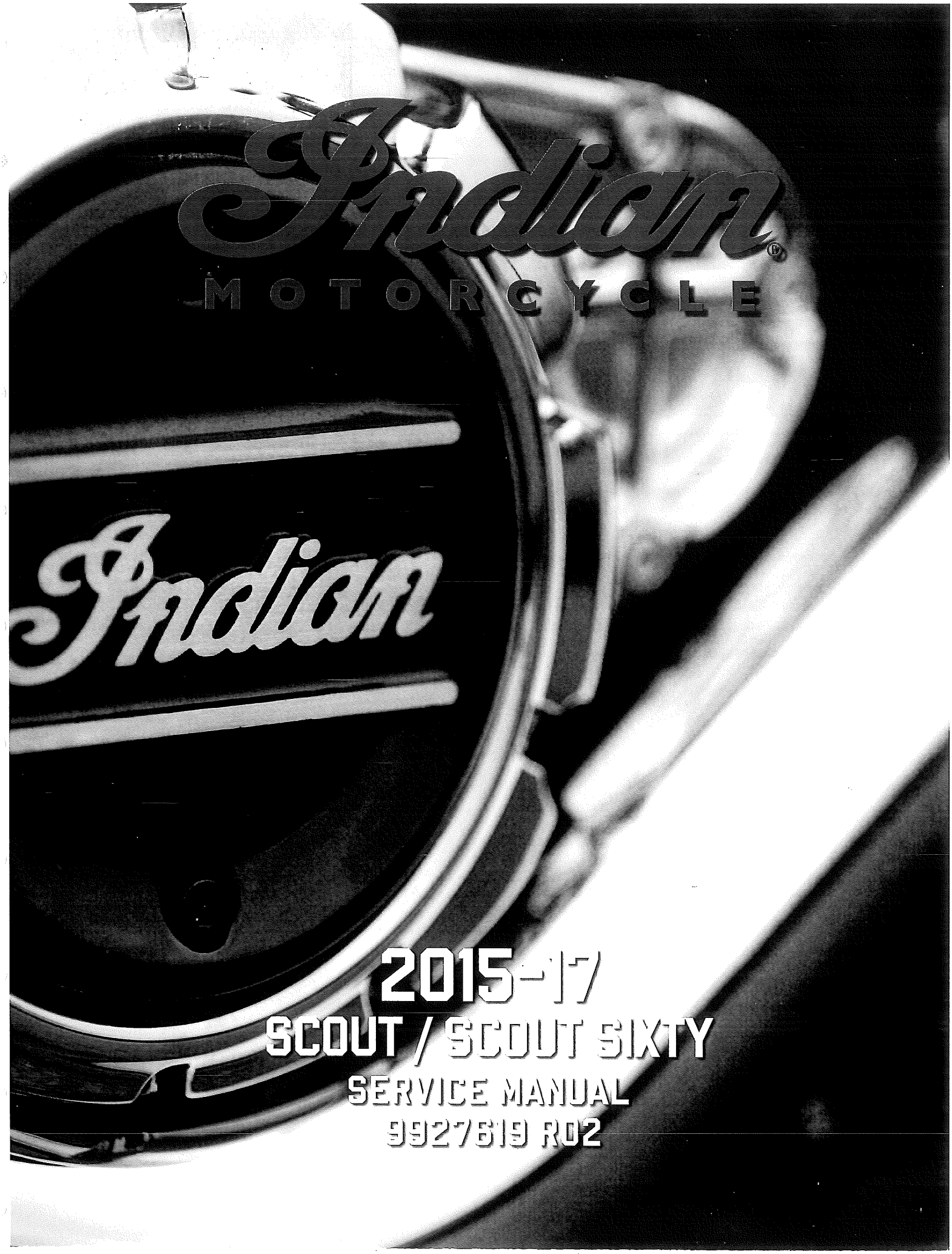

2015-17
SCOUT / SCOUT SIXTY
SERVICE MANUAL
9927619 R02

SAFETY WARNINGS

Throughout this manual, important information is brought to your attention by the following symbols:

⚠ WARNING

SAFETY ALERT WARNING indicates a potential hazard that may result in severe injury or death to the operator, bystander or person(s) inspecting or servicing the vehicle.

⚠ CAUTION

SAFETY ALERT CAUTION indicates a potential hazard that may result in minor personal injury or damage to the vehicle.

CAUTION

CAUTION indicates special precautions that must be taken to avoid vehicle damage or property damage.

NOTE

NOTE provides key information by clarifying instructions.

IMPORTANT

IMPORTANT provides key reminders during disassembly, assembly and inspection of components.

TRADEMARKS

INDIAN MOTORCYCLE ACKNOWLEDGES THE FOLLOWING PRODUCTS MENTIONED IN THIS MANUAL:

LOCTITE®, is a registered trademark of the Henkel Corporation.

DUNLOP®, is a registered trademark of the Dunlop Tire Corporation.

STA-BIL®, is a registered trademark of Gold Eagle.

NYOGEL™, is a trademark of Gold Eagle.

FLUKE ®, is registered trademark of the Fluke Corporation.

XM®, is a registered trademark of XM® Satellite Radio, Inc.

Torx®, is a registered Trademark of Textron.

Garmin®, is a registered trademark of Garmin, Ltd.

Some Indian Motorcycle factory publications can be downloaded from www. polarisindustries. com, purchased from www.purepolaris.com or by contacting the nearest Indian Motorcycle dealer.

REVISION INDEX

REV	DATE	CHANGES
R01	7/22/2016	Initial release
R02	1/18/2017	Add Master Torque Table, Add Vehicle Model Conversion Process (INT'L bikes)

2015 - 17 Indian Motorcycle Scout / Scout Sixty

Service Manual

Chapter Summary

CHAPTER 1: GENERAL / SPECIFICATIONS

CHAPTER 2: MAINTENANCE

CHAPTER 3: ENGINE / COOLING / EXHAUST

CHAPTER 4: FUEL DELIVERY / EFI

CHAPTER 5: CLUTCH / PRIMARY / SHIFT

CHAPTER 6: TRANSMISSION / CRANKSHAFT

CHAPTER 7: FRAME / BODY

CHAPTER 8: STEERING / SUSPENSION

CHAPTER 9: BRAKES

CHAPTER 10: ELECTRICAL

CHAPTER 1
GENERAL / SPECIFICATIONS

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MODEL NUMBER DESIGNATION 1.2
ENGINE NUMBER LOCATION 1.2
VEHICLE IDENTIFICATION NUMBER (VIN) DESIGNATION 1.2
VIN LOCATION 1.3
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VEHICLE INFORMATION

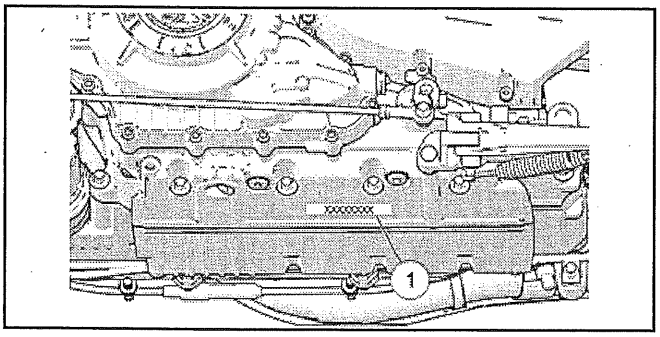
MODEL NUMBER DESIGNATION

Example: N15MSA00AA

GRP	MY	TYPE	MODEL	LINE	DISP	NET BRAKE HP	MARKET CONFIG	COLOR
1st digit	2nd/ 3rd digit	4th digit*	5th digit*	6th digit*	7th digit*	8th digit*	9th digit	10th digit
N	15	M = Mid-size	S = Scout	A = Standard	0 = 1133 cc (69 ci) V-Twin 1 = Scout Sixty - 999cc (61 ci) V-Twin	0 = 100 hp 1 = 78 hp	A = 49 State B = 50 State C = Canadian E = EU (WVTA) J = Japan (SVA)	A = Thunder Black H = Thunder Black Smoke R = Indian Red S = Black Hills Silver
* = digits that would transfer to 17 digit VIN and are used in digits 4–8 respectively. First 3 digits, 9th digit, and 10th digit are used in model number only. They are not used with the 17 digit VIN.								

ENGINE NUMBER LOCATION

The engine number ① is stamped into the bottom of the LH engine case. The stamping identifies the engine model and serial number.



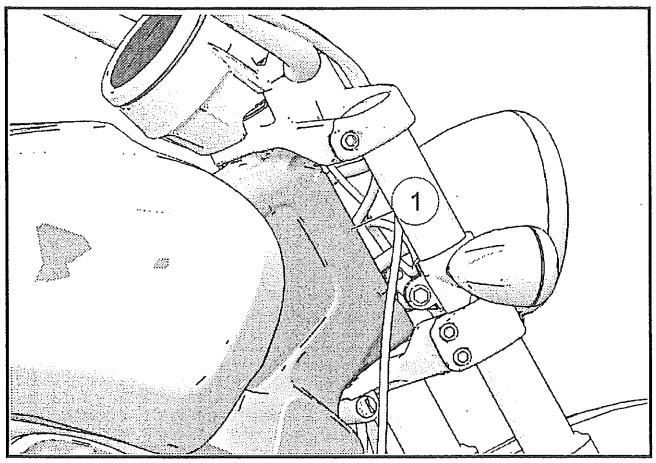
VEHICLE IDENTIFICATION NUMBER (VIN) DESIGNATION

Example: 56KTCAAA0E3000024

World Mfg. ID			Vehicle Descriptors						Vehicle Identifiers							
			Chas-sis	Type	Disp	HP	Series	Chec-k Digit	MY*	Mfg	Individual Serial No.					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
5	6	K	C	C	A	A	A	0	E	3	0	0	0	0	0	0
* Model Year: E = 2014; F = 2015; G = 2016; H = 2017																

VIN LOCATION

The vehicle identification number ① is stamped on the right side of the steering head.



MANUFACTURER LABEL

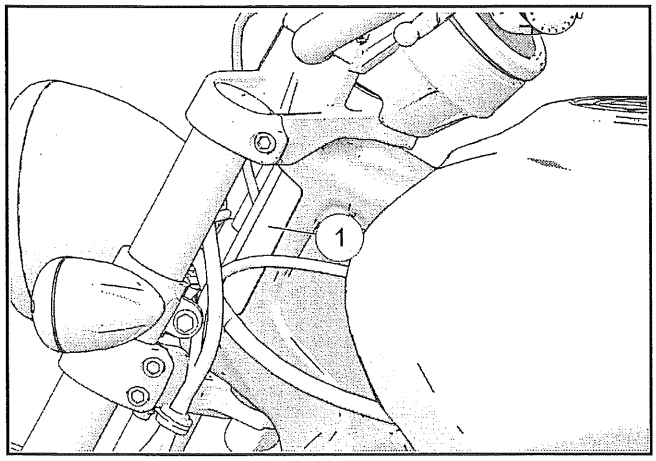
The manufacturer label ① located on the left side of the steering head contains the following information:

Vehicle Identification Number (VIN)

Gross Vehicle Weight Rating (GVWR)

Gross Axle Weight Rating (GAWR)

Tire Type and Load Information.



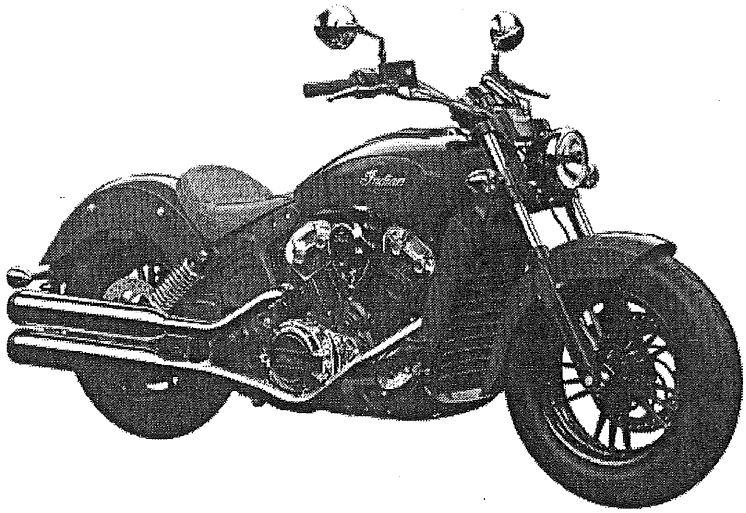
TIRE INFORMATION LABEL

See Manufacturer label for tire information. See Manufacturer Label, page 1.3.

GENERAL SPECIFICATIONS

2015 - 2017 SCOUT SPECIFICATIONS

YEAR	MODEL NUMBERS
2015 Scout	N15MSA00AA, AB, AH, AR, BA, BB, BH, BR, CA, CB, CH, CR, EA, EB, EH, ER
2016 Scout	N16MSB00AA, AJ, AL, AM, AN, AP, BA, BJ, BL, BM, BN, BP, CA, CJ, CL, CM, CN, CP
2016 Scout ABS	N16MSA00AR, BR, CR, EJ, EL, EM, EN, ER, EP
2016 Scout Sixty	N16MSB11AA, AK, AR, BA, BK, BR, CA, CK, CR, EA, EK, ER
2017 Scout	N17MSB00AA, AC, AH, AS, BA, BC, BH, BS, CA, CC, CH, CS
2017 Scout / Sixty ABS	N17MSA00A2, A3, AV, B2, B3, BV, C2, C3, CV, E2, E3, EA, EC, EH, ES, EV, K2, KA, KS, X2, X3, XA, XC, XV N17MSA11AR, AT, BR, BT, CR, CT, EA, EK, ER, ET, XA, XK, XT
2017 Scout Sixty	N17MSB11AA, AK, BA, BK, CA, CK



Chassis

Dry Weight	516 lbs (235 kg)
Wet Weight	560 lbs (255 kg)
Gross Vehicle Weight Rating	988 lbs (449 kg)
Gross Axle Weight Rating, Front	337 lbs (153 kg)
Gross Axle Weight Rating, Rear	651 lbs (296 kg)
Maximum Load	428 lbs (194 kg)
Overall Length	91.0 in (2311 mm)
Overall Width	34.6 in (880 mm)
Overall Height	47.5 in (1207 mm)
Seat Height	25.3 in (643 mm)
Ground Clearance	5.3 in (135 mm)
Total Storage Volume	N/A
Passenger Capacity	1
Wheelbase	61.5 in (1562 mm)
Rake / Trail	29° / 4.7 in (119.9 mm)

Fuel System

Fuel System	Electronic Fuel Injection (ME17)
Fuel Delivery	Electronic Fuel Pump (in tank)
Fuel Pressure	58 psi (400 kPa)
Throttle Body Bore	2.362 in (60 mm)
Fuel Capacity	3.5 gal (13.2 L)
Fuel Reserve Capacity	0.5 gal (1.9 L)
Recommended Fuel	91 Octane

Engine

Engine Number	1204691
Engine	V-Twin
Engine Configuration	Liquid Cooled V-Twin 60°
Engine Wet Weight	205 lbs (93 kg)
Engine Displacement	69 cid (1133 cc); Sixty - 61 cid (999 cc)
Engine Cooling	Liquid
Compression Ratio	10.7:1, (Sixty) - 11.0:1
Compression Pressure	210 - 230 psi (1448 - 1586 kPa)
Valve Train	DOHC, 4 Valves Per Cylinder, Graded Buckets
Bore x Stroke	3.898 in x 2.898 in (99 mm x 73.6 mm); (Sixty) - 3.661 in x 2.898 in (93 mm x 73.6 mm)
Idle Speed	1100 RPM ± 50 RPM (fully warm)
Oil Capacity	4.5 qts (4.3 L) Dry engine
Oil Type	SAE Synthetic 15W60
Lubrication System	Semi-Dry Sump
Spark Plug Type / Gap	NGK MR7F / 0.030 in (0.8 mm)
Exhaust System	Two O2 Sensors / Single three-way catalyst in each muffler

Electrical

Stator Rated Output	460 W @ 3000 RPM
Battery	12V / 12 AH / 210 CCA, Maintenance Free AGM
Headlights	Osram HB2 12V 60/55W
Tail / Brake / License	LED (non-serviceable)
Turn Signals	RY10W
Starting System	Electric Start
Ignition System	Bosch ME-17

Drivetrain

Transmission	6 Speed / Sliding Mesh; Sixty - 5 Speed / Sliding Mesh
Clutch	Wet, Multi-Plate, Coil Spring
Primary Drive	Wet, Gear Drive
Primary Reduction Ratio	1.652:1
Final Drive / Ratio	Belt / 2.357:1
Belt Type / Width	Carbon Fiber Reinforced Belt 141 Tooth, 22 mm
Gear Shift Pattern	1 Down, 5 Up (Sixty) - 1 Down, 4 Up
Transmission Gear Ratios:	
1st	2.769:1
2nd	1.882:1
3rd	1.500:1
4th	1.273:1
5th	1.125:1; Sixty - 1.036:1
6th	1.036:1; Sixty - N/A

Suspension

Front Suspension	Conventional Telescopic Fork
Front Travel	4.7 in (120 mm)
Front Tube Diameter	41 mm
Rear Shock	Monotube Dual Shocks
Rear Swingarm	Steel Weldment
Rear Travel	3.0 in (76 mm)

Wheels / Brakes

Front Tire / Size	Kenda Kruz K673F - 130/90-16 72H
Front Wheel / Size	Cast / 16 in X 3.5 in
Front Tire Air Pressure	36 PSI (248 kPa)
Front Brake	Single Solid Disc / 2 Piston Calipers
Rear Tire	Kenda Kruz K673 - 150/80-16 71H
Rear Wheel	Cast / 16 in X 3.5 in
Rear Tire Air Pressure	40 PSI (276 kPa)
Rear Brake	Single Solid Disc / 1 Piston Caliper
Brake Fluid Type	DOT 4

All specifications are for the standard Indian Scout models. Specifications may change with the addition of custom order options and / or accessories. Indian Motorcycle Company reserves the right without prior notice to discontinue at any time at its discretion any of the items herein or change specifications or designs without incurring any obligation to the customer.

VEHICLE LOADING
GROSS VEHICLE WEIGHT RATING (GVWR)

⚠ WARNING

Exceeding the gross vehicle weight rating of your motorcycle can reduce stability and handling and could cause loss of control. NEVER exceed the gross vehicle weight rating of your motorcycle.

The *maximum load capacity* of your motorcycle is the maximum weight you may add to your motorcycle *without exceeding the GVWR*. This capacity is determined by calculating the difference between your motorcycle's GVWR and wet weight.

Refer to the specification section of this manual or the Manufacturing Information / VIN label on the motorcycle frame for model-specific information. Refer to Information label section in this manual for location on the motorcycle.

When determining the weight you will be adding to your motorcycle, to ensure you do not exceed the maximum load capacity, include the following:

- operator body weight
- passenger body weight
- weight of all riders' apparel and items in or on apparel
- weight of any accessories and their contents
- weight of any additional cargo on the motorcycle

PUBLICATIONS AND TECHNICAL LITERATURE

PUBLICATION PART NUMBERS

Some Indian Motorcycle publications, such as Owner's Manuals and Parts Books may be available on-line at the Indian Motorcycle website; http://www.indianmotorcycle.com/

Service Manuals and Owner's Manuals can be purchased through any authorized Indian motorcycle dealer. The part numbers are listed in the following table.

MODEL	SERVICE MANUAL PART NUMBERS	OWNER'S MANUAL PART NUMBERS	PARTS BOOK PART NUMBERS
2015 Indian Scout Motorcycle (U.S.)	9925346	9924830	9926139
2015 Indian Scout Motorcycle (CAN)		9924831	
2015 Indian Scout Motorcycle (INT'L)		9924343	
2016 Indian Scout Motorcycle (U.S.)	9926140	9926136	9926139
2016 Indian Scout Motorcycle (CAN)		9926138	
2016 Indian Scout Motorcycle (INT'L)		9926141	
2016 Indian Scout Sixty Motorcycle (U.S.)		9926136	9926137
2016 Indian Scout Sixty Motorcycle (CAN)		9926138	
2016 Indian Scout Sixty Motorcycle (INT'L)		9926141	
2017 Indian Scout Motorcycle (U.S.)	9927619	9927436	9927434
2017 Indian Scout Motorcycle (CAN)		9927437	
2017 Indian Scout Motorcycle (INT'L)		9927438	
2017 Indian Scout Sixty Motorcycle (U.S.)		9927436	9927435
2017 Indian Scout Sixty Motorcycle (CAN)		9927437	
2017 Indian Scout Sixty Motorcycle (INT"L)		9927438	

REFINISHING
PAINT COLORS BY MODEL

2015 Scout

MODEL NUMBER	PAINT COLOR	PAINT CODE
N15MSA00AA N15MSA00BA N15MSA00CA N15MSA00EA	Thunder Black	P-266
N15MSA00AH N15MSA00BH N15MSA00CH N15MSA00EH	Thunder Black Smoke	P-463
N15MSA00AR N15MSA00BR N15MSA00CR N15MSA00ER	Indian Red	P-639
N15MSA00BS N15MSA00CS N15MSA00ES	Black Hills Silver	P-581

2016 Scout

MODEL NUMBER	PAINT COLOR	PAINT CODE
N16MSB00AA N16MSB00BA N16MSB00CA N16MSB00EA	Thunder Black (Gloss)	P-266
N16MSB00AJ N16MSB00ABJ N16MSB00CJ N16MSB00EJ	Wildfire Red	P-676
N16MSB00AS N16MSB00BS N16MSB00CS N16MSB00ES	Smoke Silver	P-581
N16MSB00AH N16MSB00BH N16MSB00CH N16MSB00EH	Smoke (Thunder) Black	P-463
N16MSA00AR N16MSA00BR N16MSA00CR N16MSA00ER	Indian Red	P-639

2016 Scout Sixty

MODEL NUMBER	PAINT COLOR	PAINT CODE
N16MSB11AA N16MSB11BA N16MSB11CA	Thunder Black (Gloss)	P-266
N16MSB11AK N16MSB11BK N16MSB11CK	Pearl White	P-566
N16MSB11AR N16MSB11BR N16MSB11CR	Indian Red	P-639

2017 Scout

MODEL NUMBER	PAINT COLOR	PAINT CODE
N17MSA00A3 N17MSA00B3 N17MSA00C3 N17MSA00E3 N17MSA00X3	Blue / Pearl White	P-1487
N17MSA00A2 N17MSA00B2 N17MSA00C2 N17MSA00E2 N17MSA00X2	Indian Red Over Black	P-1489
N17MSA00AV N17MSA00BV N17MSA00CV N17MSA00EV N17MSA00XV	Burgundy Metallic	P-629
N17MSA00EA N17MSA00KA N17MSB00AA N17MSB00BA N17MSB00CA N17MSA00XA	Thunder Black (Gloss)	P-266
N17MSA00EC N17MSB00AC N17MSB00BC N17MSB00CC N17MSA00XC	Ivory	P-646
N17MSA00ES N17MSB00AS N17MSB00BS N17MSB00CS N17MSA00KS	Smoke Silver	P-581
N17MSA00EH N17MSB00AH N17MSB00BH N17MSB00CH	Smoke (Thunder) Black	P-463
N17MSA00K2	Indian Red	P-639

2017 Scout Sixty

MODEL NUMBER	PAINT COLOR	PAINT CODE
N17MSA11AT N17MSA11BT N17MSA11CT N17MSA11ET N17MSA11XT	Silver / Black	P-1495
N17MSA11EA N17MSA11XA N17MSB11AA N17MSB11BA N17MSB11CA	Thunder Black (Gloss)	P-266
N17MSA11AR N17MSA11BR N17MSA11CR N17MSA11ER	Indian Red	P-639
N17MSA11EK N17MSA11XK N17MSB11AK N17MSB11BK N17MSB11CK	Pearl White	P-566

EMISSION INFORMATION

EMISSION CONTROL SYSTEMS

The U. S. Environmental Protection Agency and California Air Resources Board (CARB) require manufacturers to certify that their motorcycles comply with applicable exhaust emissions standards during their useful life, and that motorcycles built after January 1, 1983 comply with applicable noise emission standards for one year or 6,000 km (3,730 mi) after the time of sale to the ultimate purchaser, when operated and maintained according to the instructions provided.

EMISSION SOURCES

An internal combustion engine produces carbon monoxide and hydrocarbons during operation. Hydrocarbons must be controlled because under some conditions hydrocarbons react with sunlight to produce photochemical smog. Carbon monoxide must be controlled because it is toxic.

EXHAUST EMISSION CONTROL

Indian Motorcycles have an electronic engine management system which controls fuel delivery and ignition timing to control hydrocarbon and carbon monoxide emissions. If components are replaced that affect idle speed, no adjustments should be made to the system. The Electronic Fuel Injection (EFI) and Electronic Throttle Control (ETC) systems control idle speed.

NOISE EMISSION CONTROL

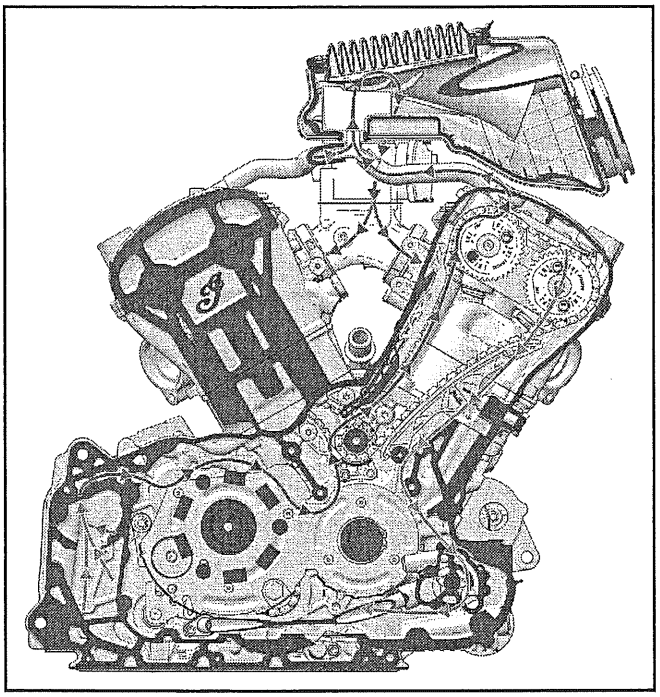
Tampering with Noise Control Systems is Prohibited. Federal law prohibits the following acts or causing thereof:

1. The removal or rendering inoperative by any person other than for purposes of maintenance, repair or replacement, any device or element of design incorporated into the motorcycle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use, or
2. The use of the motorcycle after such device or element of design has been removed or rendered inoperative.

   Among those acts presumed to constitute tampering are the acts listed below:
3. Removal of, or puncturing the muffler, baffles, header pipes or any other component which conducts exhaust gases.
4. Removal or puncturing of any part of the intake system.
5. Lack of proper maintenance.
6. Replacing any moving part of the motorcycle or parts of the exhaust / intake system with parts other than those specified by the manufacturer.

CRANKCASE EMISSION CONTROL

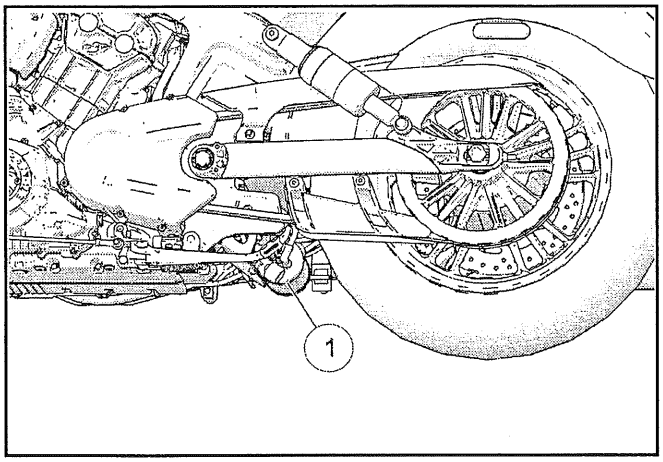
The crankcase emission control system is comprised of a closed system that routes crankcase emissions through the air cleaner into the combustion chamber.



COLOR	DESCRIPTION
Green	Engine Oil (liquid)
Red	Engine Oil (mist)
Blue	Engine Vapors

EVAPORATIVE EMISSION CONTROL (CALIFORNIA MODELS)

California models are equipped with an Evaporative Emissions Canister ①. Activated charcoal inside the canister temporarily stores fuel system vapors until the engine is started and the motorcycle is driven. The Electronic Control Module (ECM) automatically opens a Purge Control Valve under certain conditions, and engine intake vacuum draws vapors out of the canister.



SPECIAL TOOLS

USING SPECIAL TOOLS

Special tools have been designed exclusively for servicing the specialized components found on Indian Motorcycles. By using these tools, service technicians can maximize efficiency and minimize the likelihood of causing damage to the motorcycle during service.

How To Use This Book

The *Special Tools Index* located in this chapter provides a comprehensive list and pictorial representation of the special tools used throughout this service manual. The *Special Tools* section at the beginning of each chapter provides a short list of the tools required to perform procedures specific to that chapter.

TOOL ORDERING INFORMATION

Special tools may be required while servicing this vehicle. Some of the tools listed or depicted are mandatory, while other tools may be substituted with a similar tool, if available. Indian Motorcycle recommends use of the Special Tools referenced in the chapters of this service manual when servicing any Indian Motorcycle product. Dealers may order special tools through Indian Motorcycle's official tool supplier, Bosch Automotive Service Solutions, by phone at 1-800-345–2233 or on-line via your dealer website at https://polaris.service-solutions.com/

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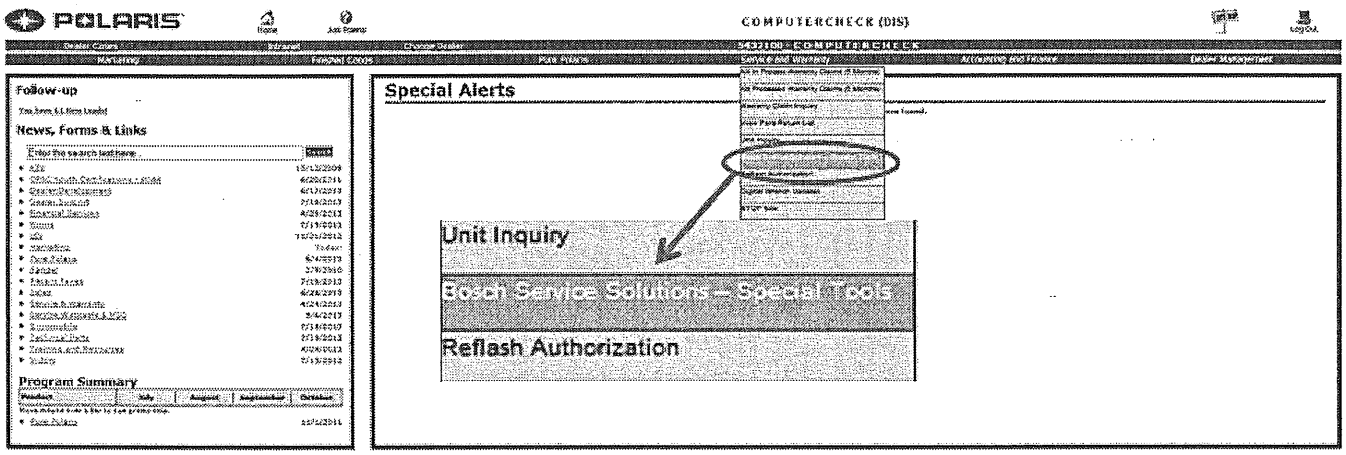
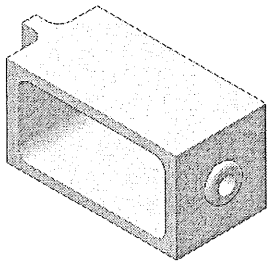
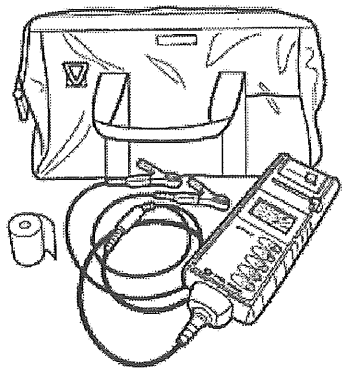


SPECIAL TOOLS INDEX

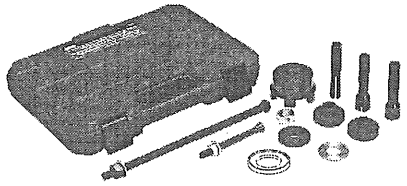
ABS Tool
PV-50104



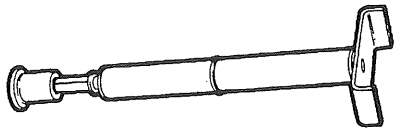
Battery Tester
PU-50296



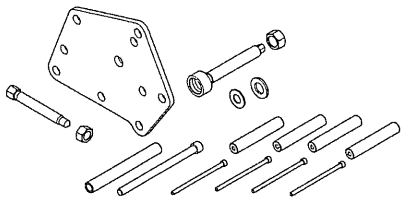
Bearing Removal Kit
PU-51324



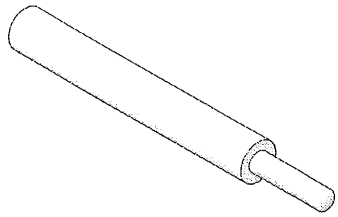
Belt Tension Meter
PV-43532



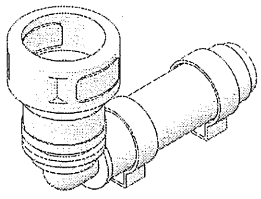
Crankcase Separator Tool
PF-51234-A



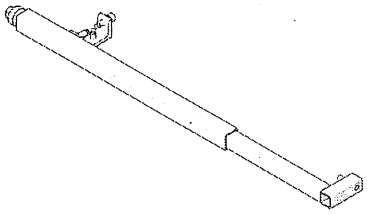
Crankshaft Locking Pin
PF-51235-A



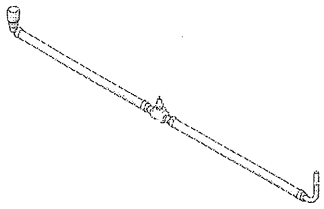
Fuel Tank Fitting Plug 12mm
PV-50567



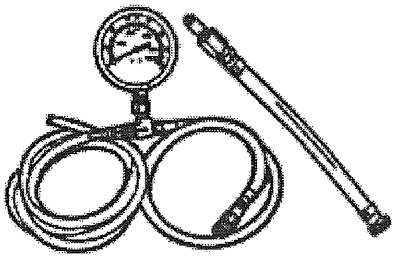
Fork Spring Compressor
PV-49463



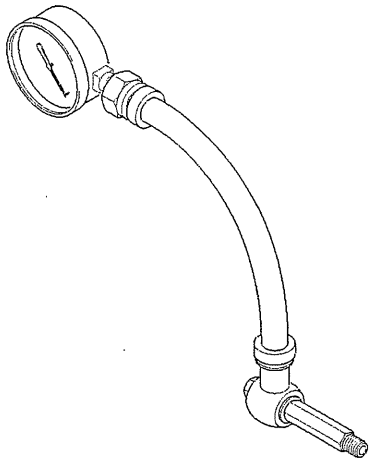
Fuel Pressure Adapter
PV-48656



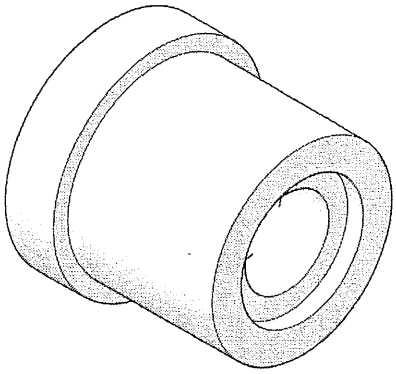
Fuel Pressure Gauge
PU-43506A



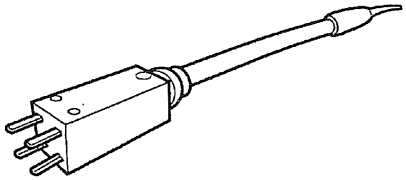
Oil Pressure Gauge
PV-43531



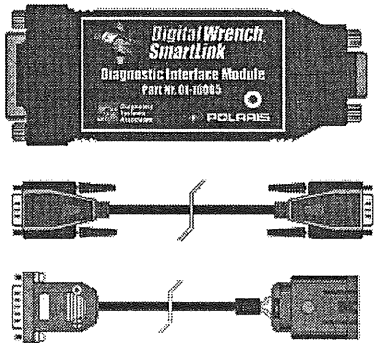
Output Shaft Seal Tool
PF-51243



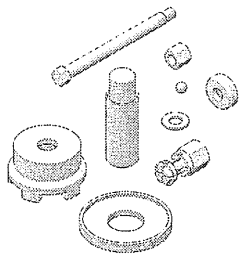
Relay Bypass Tool
PU-49466



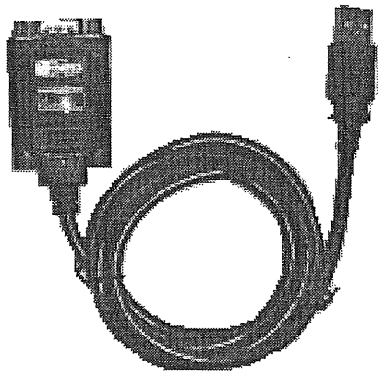
Smartlink Module Kit
PU-47471



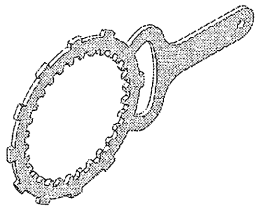
Swingarm Bushing Tool
PF-51237



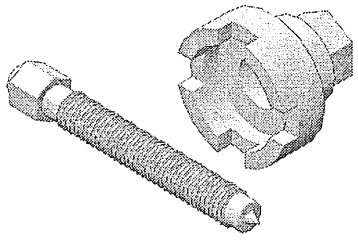
USB to Serial Adapter
PU-50621



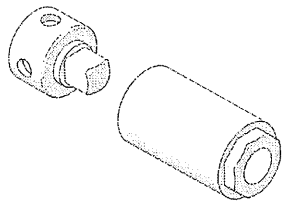
Engine Transmission Lock Tool
PF-51612



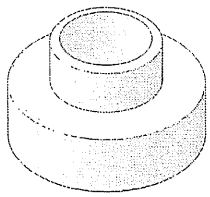
Flywheel Puller
PA-49316-A



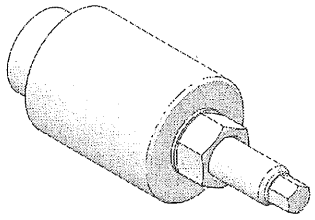
Fork Socket Adapter / Cartridge Tool
PF-51664-2



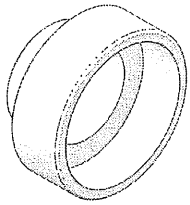
Engine Case Assembly Cup
PF-51663



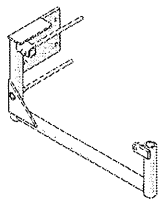
Mainshaft / Crankcase Installer
PV-45030



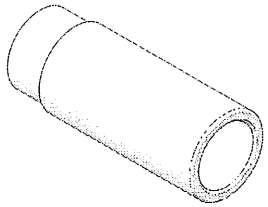
Cup Adapter
PF-51665



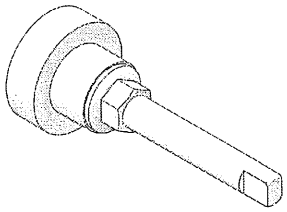
Engine Stand Adapter
PF-51609



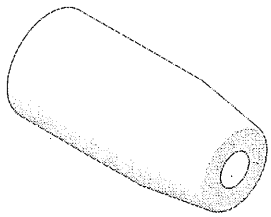
Fork Oil Seal Driver
PF-51610



Water Pump Seal Installation Tool
PF-51608



Fork Seal Installation Tool
PF-51611



REFERENCE

SCOUT MASTER TORQUE TABLE

ITEM	TORQUE
Air Filter Fasteners	**24 in-lbs (3 Nm)**
Axle (front fork)	**52 ft-lbs (70 Nm)**
Axle Nut (rear)	**65 ft-lbs (88 Nm)**
ABS Sensor Fastener (Both)	**84 in-lbs (9.5 Nm)**
Axle Pinch Fasteners	**18 ft-lbs (24 Nm)**
Backbone Bracket to Front Frame Fasteners	**19 ft-lbs (26 Nm)**
Balance Shaft Gear Fastener	**83 ft-lbs (112 Nm)**
Banjo Fastener (Front Caliper, M/C)	**16 ft-lbs (22 Nm)**
Banjo Fastener (Rear Caliper, M/C)	**16 ft-lbs (22 Nm)**
Battery Box Mount Fastener	**8 ft-lbs (11 Nm)**
Battery Box Shoulder Fasteners	**8 ft-lbs (11 Nm)**
Battery Cable to Starter Motor Nut	**62 in-lbs (7 Nm)**
Battery Bracket Hold Down Fastener	**12 ft-lbs (16 Nm)**
Battery Terminal Fasteners	**45 in-lbs (5 Nm)**
Belt Guard Fasteners (lower)	**85 in-lbs (9.6 Nm)**
Bleeder Fastener (All)	**60 in-lbs (6.8 Nm)**
Brake Disc Fasteners	**19 ft-lbs (26 Nm)**
Brake Lever Perch Fasteners	**12 ft-lbs (16 Nm)**
Brake Lever Pivot Fastener	**48 in-lbs (6 Nm)**
Brake Lever Nut	**60 in-lbs (7 Nm)**
Brake Line Bracket Fasteners (rear)	**60 in-lbs (7 Nm)**
Brake Lever Clamp Fastener	**12 ft-lbs (16 Nm)**
Brake Line P-Clamp Fastener (front)	**84 in-lbs (9.5 Nm)**

ITEM	TORQUE
Brake Line P-Clamp Fastener (rear)	**19 ft-lbs (26 Nm)**
Brake Pedal Spring Fastener	**84 in-lbs (9.5 Nm)**
Brake Pushrod Fastener	**84 in-lbs (9.5 Nm)**
Bearing Retainer Fastener	**88 in-lbs (10 Nm)**
Bearing Support Plate Fasteners	**15 ft-lbs (20 Nm)**
Bearing Support Plate Center Fastener	**52 ft-lbs (70 Nm)**
Caliper Mounting Fasteners (front)	**35 ft-lbs (47 Nm)**
Caliper Mounting Fasteners (rear)	**30 ft-lbs (41 Nm)**
Caliper Slide Fastener (rear)	**20 ft-lbs (27 Nm)**
Caliper Slide Pin (front, upper and lower)	**18 ft-lbs (24 Nm)**
Camshaft Carrier Fasteners (short & long)	**88 in-lbs (10 Nm)**
Cam Chain Gallery Fasteners	**88 in-lbs (10 Nm)**
Cam Chain Guide Fasteners (lower)	**88 in-lbs (10 Nm)**
Cam Chain Guide Fasteners (upper)	**88 in-lbs (10 Nm)**
Cam Chain Guide Fasteners (side)	**88 in-lbs (10 Nm)**
Cam Chain Tensioner	**15 ft-lbs (20 Nm)**
Cam Drive Sprocket Fastener	**52 ft-lbs (70 Nm)**
Cam Driven Sprocket Fasteners	**88 in-lbs (10 Nm)**
Clutch Cable Guide Jam Nut	**48 in-lbs (5.4 Nm)**
Clutch Lever Pivot Fastener	**60 in-lbs (6.8 Nm)**
Clutch Lever Pivot Nut	**84 in-lbs (9.5 Nm)**
Clutch Perch Clamp Fastener	**12 ft-lbs (16 Nm)**

ITEM	TORQUE
Clutch Retainer Nut	**125 ft-lbs (170 Nm)**
Connecting Rod Fasteners	**STEP 1: Tighten both fasteners to 22 ft-lbs (30 Nm) STEP 2: Tighten both fasteners an additional 90°**
Coolant Reservoir Heat Shield Fastener	**8 ft-lbs (11 Nm)**
Crankcase Fasteners	**22 ft-lbs (30 Nm)**
Cylinder Head Fastener (Primary)	**STEP 1: 21 ft-lbs (28 Nm) STEP 2: 26 ft-lbs (35 Nm) STEP 3: Plus 270 degrees**
Cylinder Head Fastener (Secondary)	**88 in-lbs (10 Nm)**
CPS (Crank Position Sensor)	**88 in-lbs (10 Nm)**
CTS (Coolant Temp Sensor)	**16 ft-lbs (22 Nm)**
Detent Roller Arm Fastener	**88 in-lbs (10 Nm)**
Dipstick Adapter Fastener	**88 in-lbs (10 Nm)**
Drive Sprocket Cover Fasteners	**85 in-lbs (9.6 Nm)**
Drive Sprocket Nut	**133 ft-lbs (180 Nm)**
Drive Sprocket Lock Plate Fasteners	**88 in-lbs (10 Nm)**
Engine Oil Drain Plugs (2)	**15 ft-lbs (20 Nm)**
Evaporative Emissions Canister Fasteners	**7 ft-lbs (9.5 Nm)**
Exhaust Clamps	**40 ft-lbs (54 Nm)**
Exhaust Mount Nut	**50 ft-lbs (68 Nm)**
Exhaust Studs	**15 ft-lbs (20 Nm)**
Frame Tube Bracket to Frame Fastener	**19 ft lbs (26 Nm)**
Frame Tube to Mid-Cast/ Frame Fasteners	**35 ft-lbs (47 Nm)**
Frame Backbone to Front Frame Fastener	**35 ft-lbs (47 Nm)**

ITEM	TORQUE
Frame to Engine Fastener (front)	**51 ft-lbs (69 Nm)**
Fender Fasteners (front)	**18 ft-lbs (24 Nm)**
Fender Fasteners (rear)	**18 ft-lbs (24 Nm)**
Flywheel Fastener	**STEP 1: Tighten fastener to 133 ft-lbs (180 Nm) STEP 2: Back out fastener 180° and re-torque to spec.**
Fork Cap	**16 ft-lbs (22 Nm)**
Fork Cartridge Fastener	**17 ft-lbs (23 Nm)**
Fork Triple Clamp Fasteners (Lower)	**18 ft-lbs (24 Nm)**
Fork Triple Clamp Fasteners (Upper)	**18 ft-lbs (24 Nm)**
Footpeg Fasteners (driver)	**35 ft-lbs (47 Nm)**
Footpeg Fasteners (passenger)	**19 ft-lbs (26 Nm)**
Footpeg Shoulder Fasteners	**50 in-lbs (68 Nm)**
Fuel Cap Fasteners	**43 in-lbs (5 Nm)**
Fuel Injector Retaining Fasteners	**88 in-lbs (10 Nm)**
Fuel Pump Fasteners	**43 in-lbs (5 Nm)**
Fuel Tank Mount Assembly Fasteners	**7 ft-lbs (9.5 Nm)**
Fuel Tank Mounting Fasteners	**18 ft-lbs (24 Nm)**
Gear Position Switch	**25 in-lbs (3 Nm)**
Handle Bar Riser Fasteners	**22 ft-lbs (30 Nm)**
Head Light Retaining Ring Fastener	**36 in-lbs (4 Nm)**
Head Light Mount Pivot Fastener	**35 ft-lbs (47 Nm)**
Head Light to Lower Triple Mount Fastener	**18 ft-lbs (24 Nm)**
Head Pipe Nuts	**12 ft-lbs (16 Nm)**
Head Pipe Hanger (rear)	**19 ft-lbs (26 Nm)**

ITEM	TORQUE
Horn to Frame Bracket Fastener	**84 in-lbs (9.5 Nm)**
Inlet tube to Oil Pump Fastener	**88 in-lbs (10 Nm)**
Ignition Coil Fasteners	**88 in-lbs (10 Nm)**
Ignition Cover Fasteners	**96 in-lbs (11 Nm)**
Ignition Cover Bracket Fasteners	**12 ft-lbs (16 Nm)**
Instrument Panel Fasteners	**22 ft-lbs (30 Nm)**
Instrument Cluster Fasteners	**22 ft-lbs (30 Nm)**
Intake Manifold Clamps	**20 in-lbs (2.3 Nm)**
Intake Manifold Boot Fasteners	**22 ft-lbs (30 Nm)**
License Plate Light Nuts	**18 in-lbs (2 Nm)**
Load / Tipover Module Mounting Fasteners	**96 in-lbs (11 Nm)**
Main Plate Mounting Fasteners	**88 in-lbs (10 Nm)**
Master Cylinder Cover Fasteners (front)	**13 in-lbs (1.5 Nm)**
Master Cylinder Cover Fasteners (rear)	**13 in-lbs (1.5 Nm)**
Master Cylinder Clevis Fastener (rear)	**84 in-lbs (9.5 Nm)**
Master Cylinder Clevis Nut (rear)	**80 in-lbs (9 Nm)**
Master Cylinder Mounting Fasteners (rear)	**84 in-lbs (9.5 Nm)**
Mid Cast Frame to Backbone Fasteners	**35 ft-lbs (47 Nm)**
Mid Frame to Engine Fasteners	**51 ft-lbs (69 Nm)**
Muffler Hanger Fasteners	**19 ft-lbs (26 Nm)**
Oil Cooler Spigot	**22 ft-lbs (30 Nm)**
Oil Filter	**115 in-lbs (13 Nm) or approximately 3/4 to 1 full turn after seal contacts the filter mount sealing surface.**

ITEM	TORQUE
Oil Pressure Switch	**88 in-lbs (10 Nm)**
Oil Pump Pickup Screen Fastener	**88 in-lbs (10 Nm)**
Oil Scavenge Inlet Screen Fastener	**88 in-lbs (10 Nm)**
Oil Pump Fasteners	**88 in-lbs (10 Nm)**
Oil Pump to Crankcase Fasteners	**88 in-lbs (10 Nm)**
Oil Pump Gear Fastener	**88 in-lbs (10 Nm)**
Oxygen Sensors	**14 ft-lbs (19 Nm)**
Pad Retaining Pin (front and rear)	**80 in-lbs (9 Nm)**
Piston Cooling Jet Fastener	**62 in-lbs (7 Nm)**
Pressure Plate Fasteners	**88 in-lbs (10 Nm)**
Primary Cover Fasteners	**9 ft-lbs (12 Nm)**
Radiator Cover Fasteners	**8 ft-lbs (11 Nm)**
Radiator Mount Fasteners	**18 ft-lbs (24 Nm)**
Regulator/Rectifier to Bracket Nuts	**84 in-lbs (9.5 Nm)**
Regulator/Rectifier Bracket to Frame Fasteners	**19 ft-lbs (26 Nm)**
Scavenge Inlet Tube Fastener	**88 in-lbs (10 Nm)**
Scavenge Oil Return Tube Fastener	**88 in-lbs (10 Nm)**
Scavenge Oil Pump Fasteners	**88 in-lbs (10 Nm)**
Shift Rod Fastener	**84 in-lbs (9.5 Nm)**
Shift Star Fastener	**88 in-lbs (10 Nm)**
Shift Rod Jam Nuts	**8 ft-lbs (11 Nm)**
Shock Fasteners (upper & lower)	**65 ft-lbs (88 Nm)**
Side-Stand Pivot Fastener	**35 ft-lbs (47 Nm)**
Side Stand Mounting Fasteners	**19 ft-lbs (26 Nm)**
Side Stand Switch	**60 in-lbs (7 Nm)**
Spark Plug	**10 ft-lbs (14 Nm)**

ITEM	TORQUE
Speed Sensor Fastener	**84 in-lbs (9.5 Nm)**
Speedometer Cover Fastener	**36 in-lbs (4 Nm)**
Stake Nuts	**125 ft-lbs (170 Nm)**
Stator Clip Fasteners	**71 in-lbs (8 Nm)**
Stator Cover Fasteners	**88 in-lbs (10 Nm)**
Stator Mounting Fasteners to Cover	**88 in-lbs (10 Nm)**
Starter Clutch Fasteners	**88 in-lbs (10 Nm)**
Starter Motor Fasteners	**88 in-lbs (10 Nm)**
Steering Head Nut	**29 ft-lbs (40 Nm)**
Steering Lock Fastener	**77 in-lbs (9 Nm)**
Steering Stem Nut (top)	**72 ft-lbs (97 Nm)**
Subframe to Midframe Fasteners (rear)	**35 ft-lbs (47 Nm)**
Swingarm Nut (LH)	**85 ft-lbs (115 Nm)**
Swingarm Pivot Tube	**5 ft-lbs (7 Nm)**
Switch Cube Fasteners (RH)	**36 in-lbs (4 Nm) Tighten Top Two Fasteners First**
Switch Cube Fasteners (LH)	**36 in-lbs (4 Nm) Tighten Top Fastener First**
Tail Light Nuts	**36 in-lbs (4 Nm)**
Thermostat Housing Fasteners	**88 in-lbs (10 Nm)**
Thermostat Cover Fasteners	**96 in-lbs (11 Nm)**
Thermostat Cover Bracket Fasteners	**96 in-lbs (11 Nm)**
Throttle Body Fasteners	**88 in-lbs (10 Nm)**
Turn Signal Fastener (front)	**36 in-lbs (4 Nm)**
Turn Signal Fastener (rear)	**36 in-lbs (4 Nm)**
TMAP Sensor Fastener	**25 in-lbs (2.8 Nm)**
Valve Cover Fasteners	**88 in-lbs (10 Nm)**
Valve Stem Nut	**44 in-lbs (5 Nm)**
Water Pump Driven Gear Fastener	**62 in-lbs (7 Nm)**

ITEM	TORQUE
Water Pump Impeller	**30 in-lbs (3 Nm)**
Water Pump Shaft Nut	**13 ft-lbs (18 Nm)**
Wind Fairing Mount Fastener (side)	**15 ft-lbs (20 Nm)**
Wind Fairing Mount Fastener (rear)	**36 in-lbs (4 Nm)**
Worm Drive Clamp	**24 in-lbs (3 Nm)**

SAE TAP DRILL SIZES

THREAD SIZE / DRILL SIZE		THREAD SIZE / DRILL SIZE	
#0-80	3/64	1/2-13	27/64
#1-64	#53	1/2-20	29/64
#1-72	#53	9/16-12	31/64
#2-56	#51	9/16-18	33/64
#2-64	#50	5/8-11	17/32
#3-48	5/64	5/8-18	37/64
#3-56	#45	3/4-10	21/32
#4-40	#43	3/4-16	11/16
#4-48	#42	7/8-9	49/64
#5-40	#38	7/8-14	13/16
#5-44	#37	1-8	7/8
#6-32	#36	1-12	59/64
#6-40	#33	1 1/8-7	63/64
#8-32	#29	1 1/8-12	1 3/64
#8-36	#29	1 1/4-7	1 7/64
#10-24	#24	1 1/4-12	1 11/64
#10-32	#21	1 1/2-6	1 11/32
#12-24	#17	1 1/2-12	1 27/64
#12-28	#15	1 3/4-5	1 9/16
1/4-20	7	1 3/4-12	1 43/64
1/4-28	3	2-4 1/2	1 25/32
5/16-18	F	2-12	1 59/64
5/16-24	I	2 1/4-4 1/2	2 1/32
3/8-16	O	2 1/2-4	2 1/4
3/8-24	Q	2 3/4-4	2 1/2
7/16-14	U	3-4	2 3/4
7/16-20	25/64		

METRIC TAP DRILL SIZES

TAP SIZE	DRILL SIZE	DECIMAL EQUIVA-LENT	NEAREST FRAC-TION
3x.50	#39	0.0995	3/32
3x.60	3/32	0.0937	3/32
4x.70	#30	0.1285	1/8
4x.75	1/8	0.125	1/8
5x.80	#19	0.166	11/64
5x.90	#20	0.161	5/32
6x1.00	#9	0.196	13/64
7x1.00	16/64	0.234	15/64
8x1.00	J	0.277	9/32
8x1.25	17/64	0.265	17/64
9x1.00	5/16	0.3125	5/16
9x1.25	5/16	0.3125	5/16
10x1.25	11/32	0.3437	11/32
10x1.50	R	0.339	11/32
11x1.50	3/8	0.375	3/8
12x1.50	13/32	0.406	13/32
12x1.75	13/32	0.406	13/32

DECIMAL EQUIVALENTS

1/64 in = .0156 in
1/32 in = .0312 in [1 mm = .0394 in]
3/64 in = .0469 in
1/16 in = .0625 in
5/64 in = .0781 in [2 mm = .0787 in]
3/32 in = .0938 in
7/64 in = .1094 in [3 mm = .1181 in]
1/8 in = .1250 in
9/64 in = .1406 in
5/32 in = .1563 in [4 mm = .1575 in]
11/64 in = .1719 in
3/16 in = .1875 in [5 mm = .1969 in]
13/64 in = .2031 in
7/32 in = .2188 in
15/64 in = .2344 in [6 mm = .2362 in]
1/4 in = .25 in
17/64 in = .2656 in [7 mm = .2756 in]
9/32 in = .2813 in
19/64 in = .2969 in
5/16 in = .3125 in [8mm= .3150 in]
21/64 in = .3281 in
11/32 in = .3438 in [9 mm =.3543 in]
23/64 in = .3594 in
3/8 in = .375 in
25/64 in = .3906 in [10 mm = .3937 in]
13/32 in = .4063 in
27/64 in = .4219 in [11 mm =.4331 in]
7/16 in = .4375 in
29/64 in = .4531 in
15/32 in = .4688 in [12 mm = .4724 in]
31/64 in = .4844 in
1/2 in = .5 in [13mm = .5118 in]
33/64 in = .5156 in
17/32 in = .5313 in
35/64 in = .5469 in [14 mm = .5512 in]
9/16 in = .5625 in
37/64 in = .5781 in [15 mm = .5906 in]
19/32 in = .5938 in
39/64 in = .6094 in
5/8 in = .625 in [16mm=. 6299 in]
41/64 in = .6406 in
21/32 in = .6563 in [17 mm = .6693 in]
43/64 in = .6719 in
11/16 in = .6875 in
45/64 in = .7031 in [18 mm = .7087 in]
23/32 in = .7188 in
47/64 in = .7344 in [19 mm = .7480 in]
3/4 in = .75 in
49/64 in = .7656 in
25/32 in = .7813 in [20 mm = .7874 in]
51/64 in = .7969 in
13/16 in = .8125 in [21 mm =. 8268 in]
53/64 in = .8281 in
27/32 in = .8438 in
55/64 in = .8594 in [22 mm = .8661 in]
7/8 in = .875 in
57/64 in = .8906 in [23 mm = .9055 in]
29/32 in = .9063 in
59/64 in = .9219 in
15/16 in = .9375 in [24 mm = .9449 in]
61/64 in = .9531 in
31/32 in = .9688 in [25 mm = .9843 in]
63/64 in = .9844 in
1 in = 1.0 in

FAHRENHEIT TO CELSIUS

°C to °F: 9 (°C + 40) ¸ 5 - 40 = °F
°F to °C: 5 (°F + 40) ¸ 9 - 40=°C

DEGREES F	DEGREES C
32	0
41	5
50	10
59	15
68	20
77	25
86	30
95	35
104	40
113	45
122	50
131	55
140	60
149	65
158	70
167	75
176	80
185	85
194	90
203	95
212	100

MEASUREMENT CONVERSION CHART

UNIT OF MEASURE	MULTIPLIED BY	COVERTS TO
ft-lbs	x 12	= in-lbs
in-lbs	x.0833	= ft-lbs
ft-lbs	x 1.356	= Nm
in-lbs	x.0115	= kg-m
Nm	x.7376	= ft-lbs
kg-m	x 7.233	= ft-lbs
kg-m	x 86.796	= in-lbs
kg-m	x 10	= Nm
in	x 25.4	= mm
mm	x.03937	= in
in	x 2.54	= cm
mile	x 1.6	= km
km	x.6214	= mile
Ounces (oz)	x 28.35	= grams (g)
Fluid Ounce	x 29.57	= CCs
grams (g)	x.035	= Ounces (oz)
cc's	x.03381	= Fluid Ounces (oz)
lbs	x.454	= kg
kg	x 2.2046	= lbs
Cubic Inches	x 16.387	= Cubic Centimeters
Cubic Centimeters	x.061	= Cubic Inches
Imperial pints	x.568	= liters (l)
liters (l)	x 1.76	= Imperial pints
Imperial quarts	x 1.137	= liters (l)
liters (l)	x.88	= Imperial quarts
Imperial quarts	x 1.201	= US quarts
US quarts	x.833	= Imperial quarts
US quarts	x.946	= liters
liters	x 1.057	= US quarts
US gallon	x 3.785	= liter
liter	x .264	= US gallon
Pounds force per square inch (psi)	x 6.895	= Kilo pascals (kPa)
Kilo pascals (kPa)	x .145	= Pounds force per square inch (psi)
Kilo pascals (kPa)	x .01	= Kilograms force per cm^2
Kilograms force per cm^2	x 98.1	= Kilo pascals (kPa)
p (3.14159) x R^2 x H (height)		= Cylinder Volume

CHAPTER 2
MAINTENANCE

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MAINTENANCE QUICK REFERENCE GUIDE
SPECIFICATIONS

General Specifications

ITEM	STANDARD	SERVICE LIMIT
Battery Type / CCA	12 Volt / 12 AH / 210 CCA	—
Brake Pad Thickness, Front	.16 in (4.0 mm)	.04 in (1.0 mm)
Brake Disc Thickness, Front	.20 in (5.0 mm)	.18 in (4.5 mm)
Brake Pad Thickness, Rear	.25 in (6.5 mm)	.04 in (1.0 mm)
Brake Disc Thickness, Rear	.20 in (5.0 mm)	.18 in (4.5 mm)
Clutch Lever Freeplay	.019 - .059" (0.5–1.5 mm)	—
Compression Pressure (Cylinder)	210 - 230 psi (1448 -1586 kPa)	Below 190 psi (1310 kPa)
Drive Belt Deflection (with 10 lbs force)	.472" (12 mm) **or** 45 - 50 Hz with Sonic Tension Meter	—
Fuel Pressure (KOEO)	58 psi (400 kPa)	51 psi (350 kPa)
Idle Speed / Fast Idle Speed	1100 RPM	±50 RPM
Oil Pressure, Lubrication @ 3000 rpm	40 PSI (275 kPa) ± 20 % Engine at operating temperature.	32 PSI (220 kPa)
Ride Height (Rear Spring Pre-Load)	See adjustment procedure outlined in this chapter	—
Spark Plug Type / Gap	NGK MR7F GAP - 0.030 in (0.80 mm)	—
Tire Pressure	Front: 36 PSI (248 kPa) Rear: 40 PSI (276 kPa)	—
Tire Tread Depth (Minimum)	—	.063 in (1.6 mm)
Valve Lash (Int. / Ex.)	0.006 in (0.152 mm) / 0.008 in (0.203 mm)	—

Torque Specifications

DESCRIPTION	TORQUE SPECIFICATIONS
Air Filter Screws - M5 x 0.8 x 16 (QTY.6)	24 in-lbs (2.7 Nm)
Axle Nut, Rear	65 ft-lbs (88 Nm)
Battery Terminal Screw	45 in-lbs (5.08 Nm)
Battery Bracket Screw	84 in-lbs (9.49 Nm)
Battery Cable to Starter Motor	63 in-lbs (7.1 Nm)
Brake Bleeder Screws (Caliper)	48 in-lbs (5.4 Nm)
Brake Lever Pivot Bolt	84 in-lbs (9.49 Nm)
Camshaft Carrier Bolls	84 in-lbs (9.49 Nm)
Clutch Cable Guide Jam Nut	48 in-lbs (5.4 Nm)
Clutch Lever Bolt	84 in-lbs (9.49 Nm)
Clutch Perch Clamp Bolt	145 in-lbs (16.38 Nm)
Drive Sprocket Nut	133 ft-lbs (180 Nm)
Drive Sprocket Nut Retainer Plate	88 in-lbs (10.0 Nm)
Fuel Tank Mounting Screws	18 ft-lbs (24.5 Nm)
Master Cylinder Cover Screws (Front)	14 in-lbs (1.6 Nm)D
Master Cylinder Cover Screws (Rear)	14 in-lbs (1.6 Nm)
Oil Drain Plugs (2)	15 ft-lbs (20.0 Nm)
Oil Filter	115 in-lbs (13 Nm) or approximately 3/4 to 1 full turn after seal contacts the filter mount sealing surface
Shift Rod Jam Nuts	96 in-lbs (10.8 Nm)
Sidestand Pivot Bolt	35 ft-lbs (47.4 Nm)
Spark Plugs	9 ft-lbs (12 Nm)

Fluid Specifications

DESCRIP-TION	FLUID TYPE	CAPACITY
Brake Hydraulic Fluid	DOT 4	—
Engine / Transmission Oil	15W60 Full Synthetic	4.5 Qts (5.2 L) Dry Engine
Fork Oil	Indian Motorcycle Fork Oil	11.3 oz (335 cc) per leg
Fuel	91 Octane (Recommend-ed)	3.5 gal (13.2 L) / Reserve 0.5 gal (1.9 L)
Coolant / Antifreeze	Polaris Extended Life 50/50	2.77 Qts (2.63 Ltrs)

INDIAN MOTORCYCLE SERVICE PRODUCTS AND LUBRICANTS

MAINTENANCE PRODUCT PART NUMBERS

PRODUCT		PART NUMBER
All Purpose Grease	14 oz	2872187
Anti-Freeze, 50/50 Extended Life (Scout)	1 quart (32 oz)	2880966
Brake Fluid, DOT 4	12 oz	2880016
Carbon Cleaner, Fuel	12 oz	2881911
Crankcase Sealant (Loctite Ultra Black 598)		Commercially Available
Fork Oil	quart	2880015
Starter Grease	2 oz	2871460
Oil Change Kit (Thunder Stroke Engines)	20W-40	2880067
Oil Change Kit (Scout)	15W-60	2880191
Synthetic 15W-60 Engine Lubricant (Scout)	quart	2880187
	55 gal drum	2880188
Semi-Synthetic 20W-40 Engine Lubricant (Thunder Stroke Engines)	quart	2880012
	55 gal drum	2880013
Synthetic Transmission oil	quart	2880014

PERIODIC MAINTENANCE INTERVAL TABLE

ENGINE	MILES (KILOMETERS)																				
	500 (800)	2500 (4000)	5000 (8000)		10000 (16000)		15000 (24000)		20000 (32000)		25000 (40000)		30000 (48000)		35000 (56000)		40000 (64000)		45000 (72000)		50000 (80000)
Air Filter	I	I	I		R		I		R		I		R		I		R		I		R
Crankcase Ventilation System	I	I	I		I		I		I		I		I		I		I		I		I
Cooling System / Radiator	I	I	I		I		I		I		I		I		I		I		I		I
Drive Belt	I	I	I		I		I		I		I		R		I		I		I		I
Engine Compression	I				I				I				I				I				I
Engine Mount Fasteners	I																				
Engine Oil*	R				R				R				R				R				R
Engine Oil Filter*	R				R				R				R				R				R
Evaporative Emission Control System (CA. Only)	I	I	I		I		I		I		I		I		I		I		I		I
Exhaust System	I	I	I		I		I		I		I		I		I		I		I		I
Fuel Filter											R										R
Fuel System	I	I	I		I		I		I		I		I		I		I		I		I
Oil Lines / Oil System Inspection	I	I	I		I		I		I		I		I		I		I		I		I
Spark Plugs	I						I						R						I		
Engine Coolant	I	I	I		I		I		I		I		I		I		I		I		R
Valve Lash Clearance									I								I				

Operation Codes:

I - Inspect (tighten, clean, adjust, correct or replace if necessary)

R - Replace/Rebuild

L - Lubricate with proper lubricant as directed

P - Perform

* - Replace at specified interval or annually. If driven in extreme conditions.

** - Replace at specified interval or every 2 years

CHASSIS	MILES (KILOMETERS)																				
	500 (800)	2500 (4000)	5000 (8000)		10000 (16000)		15000 (24000)		20000 (32000)		25000 (40000)		30000 (48000)		35000 (56000)		40000 (64000)		45000 (72000)		50000 (80000)
Battery	I	I	I		I		I		I		I		I		I		I		I		I
Brake Fluid**	I	I	I		R		I		R		I		R		I		R		I		R
Brake Pads	I	I	I		I		I		I		I		I		I		I		I		I
Clutch Lever	L		I		L		I		L		I		L		I		L		I		L
Control Cable Ends	I		I		L		I		L		I		L		I		L		I		L
Fasteners	I	I	I		I		I		I		I		I		I		I		I		I
Front Brake Lever	L	I	L		L		L		L		L		L		L		L		L		L
Front Fork Oil**	I		I		I		R		I		I		R		I		I		R		I
Front Forks and Front Axle	I	I	I		I		I		I		I		I		I		I		I		I
Gear Shift Pedal	I	I	I		I		I		I		I		I		I		I		I		I
Head Light	I	I			I				I				I				I				I
Rear Brake Pedal	I	I	I		I		I		I		I		I		I		I		I		I
Rear Shock Absorber	I	I	I		I		I		I		I		I		I		I		I		R
Rear Wheel Alignment	I	I	I		I		I		I		I		I		I		I		I		I
Road Test	P	P	P		P		P		P		P		P		P		P		P		P
Sidestand / Sidestand Safety Switch	L	I	L		I		I		I		I		I		I		I		I		I
Steering Bearings	I	I	I		I		I		I		I		I		I		I		I		I
Shock Bushings and Fasteners	I	I	I		I		I		I		I		I		I		I		I		I
Swing Arm, Rear Axle, Swing Arm Pivot, and Pivot Bearings	I	I	I		I		I		I		I		I		I		I		I		I
Tires / Wheels	I	I	I		I		I		I		I		I		I		I		I		I

Operation Codes:

I - Inspect (tighten, clean, adjust, correct or replace if necessary)

R - Replace/Rebuild

L - Lubricate with proper lubricant as directed

P - Perform

* - Replace at specified interval or annually. If driven in extreme conditions.

** - Replace at specified interval or every 2 years

GENERAL INFORMATION

SERVICE NOTES

Periodic Maintenance Overview

Inspection, adjustment and lubrication of important components are explained in the periodic maintenance chart.

Inspect, clean, lubricate, adjust and replace parts as necessary. When inspection reveals the need for replacement parts, use genuine Indian Motorcycle parts available from your Indian Motorcycle dealer.

IMPORTANT

Service and adjustments are critical. If you're not familiar with safe service and adjustment procedures, have a qualified dealer perform these operations.

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Brake Lever Reserve Tool	PV-50104
Battery Tester	PU-50296
Belt Tension Meter	PV-43532
Oil Filter Wrench	PU-50105
Shock Spanner Wrench	PV-46993

Bosch Automotive Service Solutions: 1-800-345-2233 or https://polaris.service-solutions.com/

BREAK-IN PROCEDURE

Engine break-in for Indian Motorcycles occurs in the first 500 miles (800 km) of operation. Indian Motorcycles are manufactured using the best possible materials and manufacturing techniques, but the final machining process is the break-in. During this break-in period, critical engine parts wear and polish to correct operating clearances. Read, understand and follow all break-in procedures to ensure the long-term performance and durability of the engine.

CAUTION

Failure to properly follow the engine break-in procedures outlined in this manual can result in serious damage to the engine. Follow all break-in procedures carefully. Avoid full throttle operation and other condition that may place an excessive load on the engine during the break-in period.

Observe the following precautions during the break-in period:

- Upon initial start-up, do not allow the engine to idle for long periods.
- Avoid fast starts with wide open throttle. Drive slowly until the engine warms up.
- Avoid running the engine at extremely low RPM in higher gears (lugging the engine).

Break-In Guidelines

ODOMETER	BREAK-IN PROCEDURE
0–90 Miles (0–145 km)	Do not operate for extended periods above 1/3 throttle or at any one throttle position. Vary engine speed frequently.
91–300 Miles (146–483 km)	Do not operate for extended periods above 1/2 throttle or at any one throttle position. Vary engine speed frequently.
301–500 Miles (484–805 km)	Do not operate for extended periods above 3/4 throttle.
500 Miles (805 km)	Perform the break-in maintenance procedure outlined in the Periodic Maintenance Interval Table located in this chapter.

MAINTENANCE PROCEDURES
AIR FILTER REPLACEMENT

NOTICE

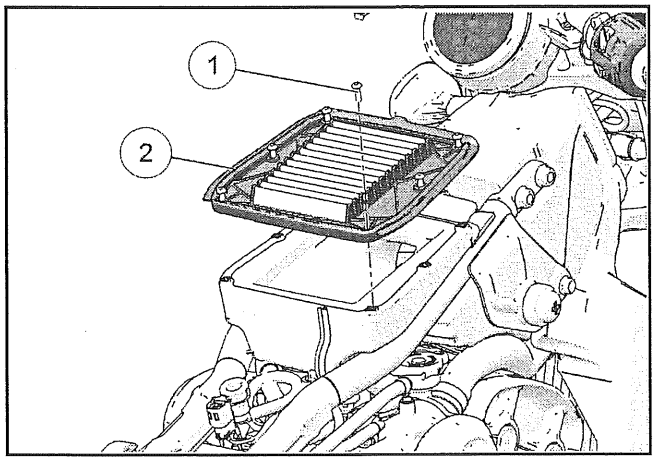
If the motorcycle is operated in wet or dusty conditions, more frequent servicing is required. The air filter element cannot be cleaned. Replace the filter when necessary.

⚠ WARNING

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Protect fuel tank finish when removing, storing, and installing tank.

Store the fuel tank in a secure location with a drain pan positioned to catch any fuel that may leak or drip from disconnected hoses or fittings.

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Remove the Fuel Tank. See Fuel Tank Removal, page 4.14.
3. Remove the six air filter fasteners ①.



4. Inspect filter element ② and replace if dirty, wet, or oil fouled.
5. Reverse steps to install filter.
6. Torque air filter fasteners ① to specification.

TORQUE

Air Filter Element Screws:
24 in-lbs (3 Nm)

⚠ CAUTION

A loose fitting cover or improperly installed filter element may allow debris to enter the engine which may cause premature engine wear.

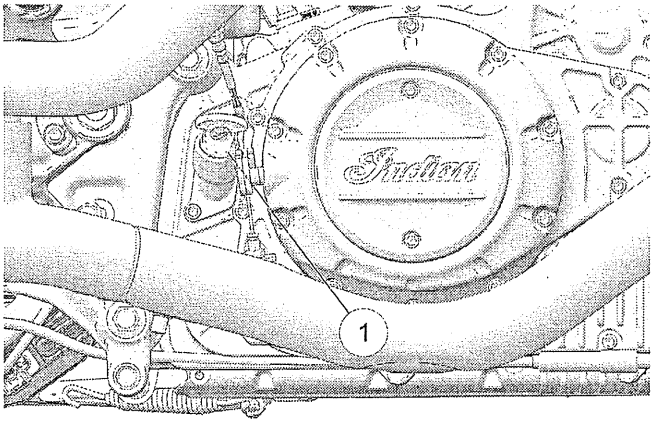
ENGINE OIL LEVEL CHECK

With the semi-dry sump lubrication system, the engine oil level on the dipstick will fluctuate, depending on the motorcycle's position and engine speed when the engine is turned off. To ensure a proper reading of the engine oil level, follow all inspection procedures closely.

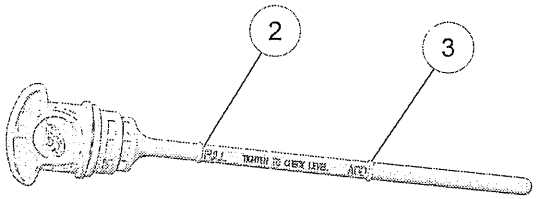
NOTICE

Engine MUST BE AT FULL OPERATING TEMPERATURE when checking oil level.

1. With the motorcycle in an upright (vertical) position, run the engine for 30 seconds.
2. Stop engine.
3. Place the machine on a level area and hold it in an upright (centered) position.
4. Remove the engine oil dipstick ① and clean off the engine oil.



5. Reinsert the dipstick and thread in until fully seated.
6. Remove the dipstick and check that the oil level is between the ADD ③ and FULL lines ②.



7. Oil level should be between the ADD and FULL lines on dipstick. If oil level is low, add Indian Motorcycle 15W60 Full Synthetic engine oil and repeat steps 3 - 6 until the reading is within the safe operation range.

CAUTION

Oil level will NOT be accurate if checked on a cold engine. DO NOT ADD oil to bring to FULL mark on a cold engine, as this can result in overfilling.

Do not overfill! The approximate volume between the FULL ② and ADD ③ marks on the dipstick is 16 oz. (.45 L).

ENGINE OIL & FILTER CHANGE

NOTE

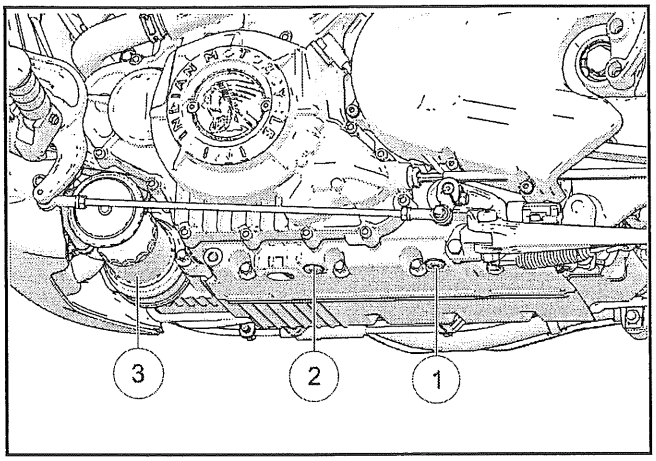
Engine MUST BE WARMED before performing the following procedure.

CAUTION

HOT COMPONENTS

Wear insulated gloves and use caution handling these parts.

1. Run engine until warm, then turn engine off.
2. Securely support the motorcycle in a vertical "centered" position.
3. Place an oil drain pan under the engine oil drain plugs ① and ②.



4. Remove the drain plugs and sealing washers.
5. Allow oil to drain completely. Dispose of oil properly.
6. Remove oil filter ③ and allow oil to drain. Dispose of oil filter properly.
7. Clean the engine oil filter mount sealing surface and surrounding area.
8. Place a small amount of oil on the new oil filter seal and spin filter on until the filter seal contacts the sealing surface. Tighten oil filter to specification.

TORQUE

Oil Filter:
115 in-lbs (13 Nm) or approximately 3/4 to 1 full turn after seal contacts the filter mount sealing surface.

9. Use new sealing washers and reinstall the drain plugs. Torque to specification.

TORQUE

Engine Oil Drain Plug:
15 ft-lbs (20 Nm)

10. Use a funnel to add 3 US quarts (2.8 Liters) of Indian Motorcycle 15W60 Full Synthetic engine oil through the engine oil dipstick hole.

NOTE

3 US quarts will bring the engine oil level at or near the "FULL" mark on the dipstick. For a new or rebuilt (dry) engine add an additional .5 US quart (.47 Liters).

11. Securely support the motorcycle in a vertical "centered" position, idle engine for approximately 30 seconds.
12. Remove oil dipstick and wipe clean, then reinsert and fully tighten dipstick. Remove dipstick and read the engine oil level. Add engine oil as required to bring oil level to the dipstick full mark. **DO NOT OVERFILL!**

IMPORTANT

Total engine oil fill volume with oil filter change will be approximately 3.0 - 4.0 US quarts (2.8 - 3.8 Liters). Total engine oil fill volume with a new or rebuilt (dry) engine will be approximately 4.5 quarts (4.25 Liters).

13. Refer to the Checking Engine Oil, page 2.10 section in this chapter for setting proper oil level.

NOTE

If the low oil pressure indicator remains illuminated longer than usual after an oil change, do not increase RPM above idle until indicator lamp goes out or engine may be damaged.

14. Check for leaks around drain plug and oil filter.

NOTE

Recycle used oil and oil filter in accordance with local regulations.

COOLING SYSTEM OVERVIEW

NOTE

Use Indian Motorcycle 50/50 Extended Life Coolant only. Do not mix coolant types.

The engine coolant level is controlled or maintained by the recovery system. The recovery system components are the recovery bottle, filler neck, pressure cap and connecting hoses.

As coolant operating temperature increases, the expanding (heated) excess coolant is forced out of the system past the pressure cap and into the recovery bottle. As engine coolant temperature decreases the contracting (cooled) coolant is drawn back from the tank past the pressure cap and into the cooling system.

NOTE

Some coolant level drop on new vehicles is normal as the system is purging itself of trapped air. Observe coolant levels often during the break-in period.

Overheating of engine could occur if air is not fully purged from the cooling system.

Indian Motorcycle 50/50 Extended Life Coolant is premixed and ready to use. Do not dilute with water.

COOLANT STRENGTH / TYPE

Test the strength of the coolant using an antifreeze hydrometer.

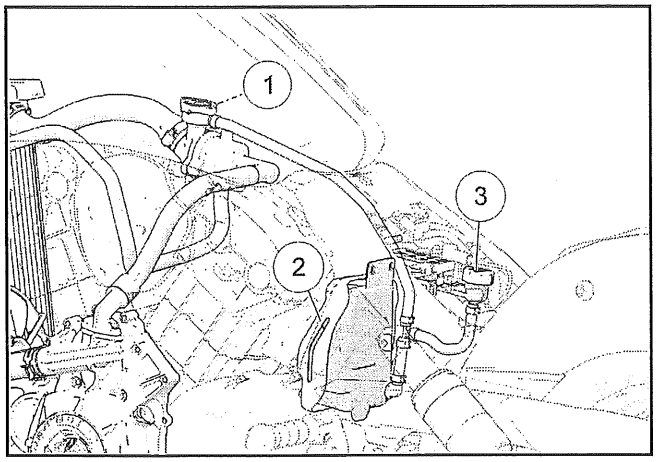
- A 50/50 mixture of extended life antifreeze and distilled water will provide the optimum cooling, corrosion protection, and antifreeze protection.
- Do not use tap water, straight antifreeze, or straight water in the system. Tap water contains minerals and impurities which build up in the system.
- Straight water or antifreeze may cause the system to freeze, corrode, or overheat.

FLUID CAPACITY

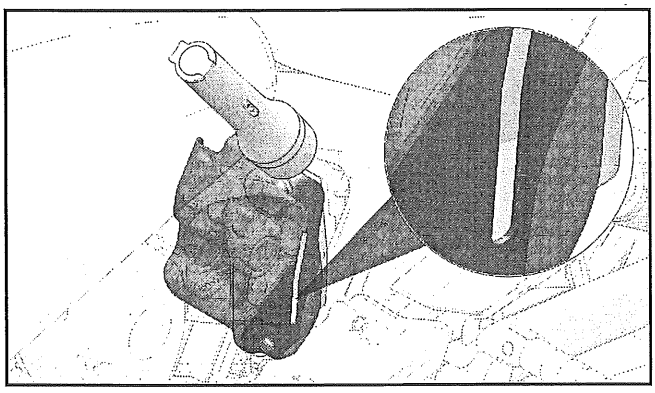
Recommended Coolant:
Indian Motorcycle 50/50 Pre-Mixed Extended Life Antifreeze
System Capacity:
2.77 qt (2.63 L)
Recovery Bottle Capacity:
.16 qt (.15 L)
(PN 8560214) (Quart)

COOLANT LEVEL INSPECTION

1. The pressure cap ① is located under the fuel tank.



2. The coolant reservoir ② is located under the driver seat. The coolant level must be maintained at the "COLD FULL" level indicated on the reservoir.
3. Position the motorcycle upright on a level surface.
4. View the coolant level in the reservoir.



5. If the coolant level is below the "COLD FULL" line, coolant will need to be added to the system.
6. Remove the driver seat. See Seat Removal / Installation, page 7.8.
7. Remove the filler cap ③ . Using a funnel, add coolant to the filler cap opening until the coolant level in the reservoir is to the "COLD FULL" line.
8. Reinstall the filler cap.
9. Reinstall the driver seat. See Seat Removal / Installation, page 7.8.

COOLING SYSTEM PRESSURE TEST

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Remove the Fuel Tank. See Fuel Tank Removal, page 4.14.

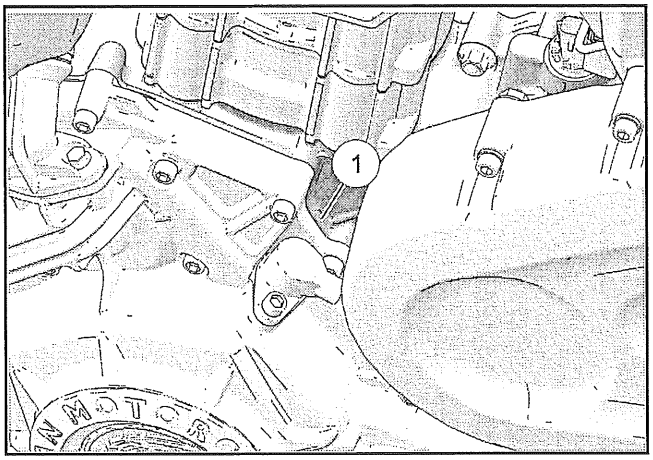
⚠ WARNING

Never remove pressure cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

3. Remove the cooling system pressure cap and test using a cooling system pressure tester. (Commercially available).
4. The system must retain 11-14 psi (75-95 kPa) for five minutes or longer. If pressure loss is evident within five minutes, check the radiator, all cooling system hoses, hose clamps and water pump for leakage.

NOTE

Coolant may be present at the water pump weep hole ① due to normal water pump function. Verify integrity of the water pump seal with a cooling system pressure test.



COOLING SYSTEM PRESSURE CAP TEST

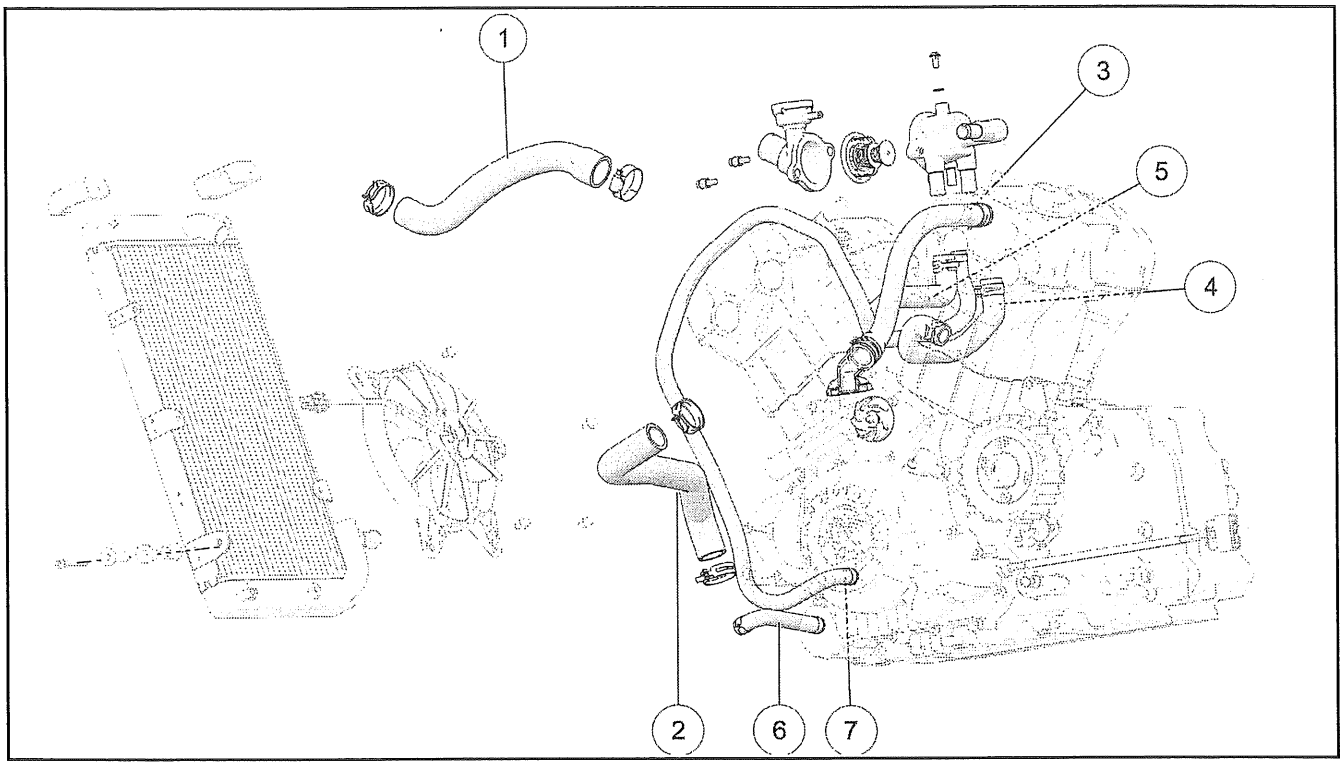
1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Remove the Fuel Tank. See Fuel Tank Removal, page 4.14.

⚠ WARNING

Never remove pressure cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

3. Remove the cooling system pressure cap and test using a cooling system pressure tester. (Commercially available).
4. The cooling system pressure cap relief pressure is 16 psi (110 kPa). Replace cap if it does not hold the required specification pressure.

COOLING SYSTEM HOSES



NUMBER	DESCRIPTION
①	Radiator Inlet Hose
②	Radiator Outlet Hose
③	Bypass Hose
④	Rear Head Outlet Hose
⑤	Front Head Outlet Hose
⑥	Cooler Return Hose (2015–16 models only)
⑦	Cooler Supply Hose

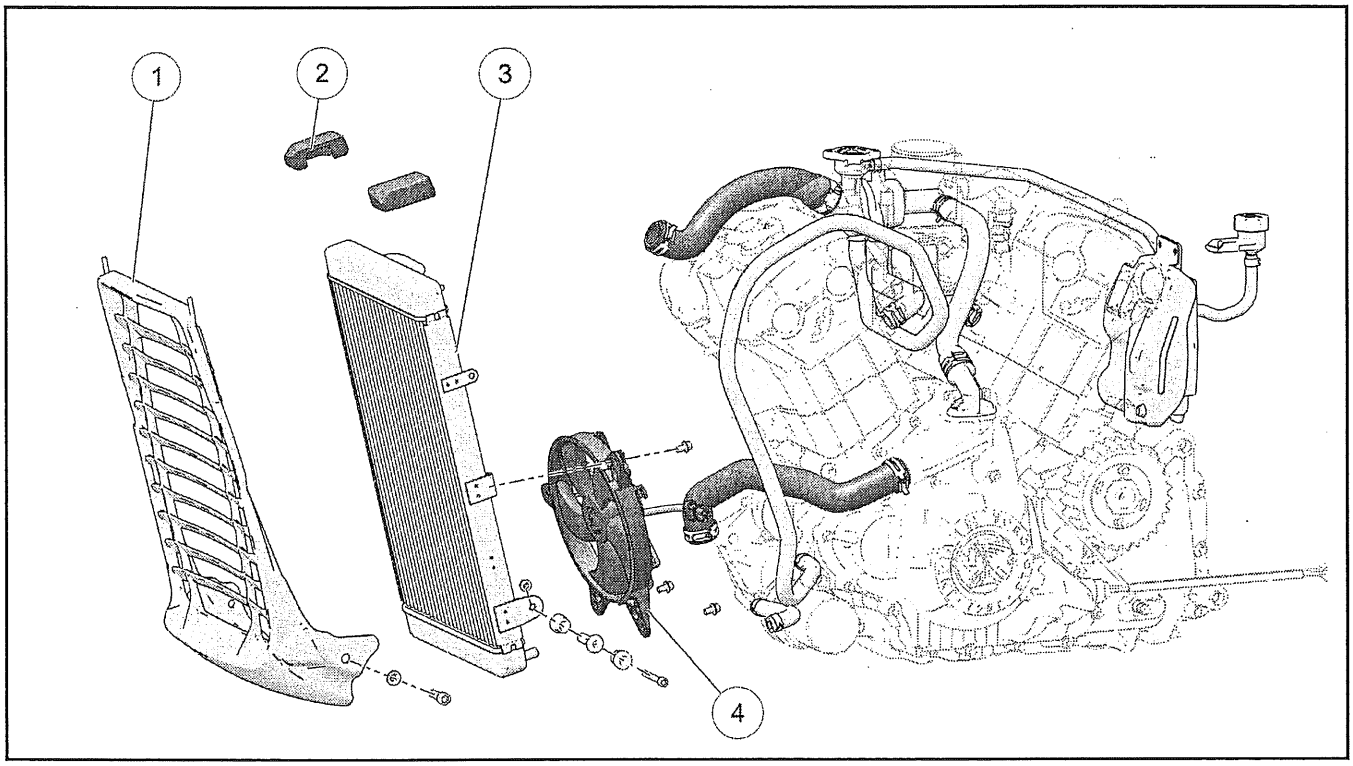
Cooling System Hoses Inspection

1. Inspect all vehicle coolant hoses for cracks, deterioration, abrasion or leaks. Replace if necessary.
2. Check tightness and condition of all hose spring clamps. Replace if necessary.

RADIATOR INSPECTION / CLEANING

CAUTION

Washing the vehicle with a high-pressure washer could damage the radiator fins and impair the radiators effectiveness. Use of a high-pressure washer is not recommended.



NUMBER	DESCRIPTION
①	Radiator Cover
②	Upper Radiator Mount
③	Radiator
④	Cooling Fan Assembly

Radiator Inspection and Cleaning

1. Check radiator air passages for restrictions or damage.
2. Carefully straighten any bent radiator fins.
3. Remove any obstructions with low pressure compressed air or low pressure water.

COOLANT DRAIN / FILL

⚠ WARNING

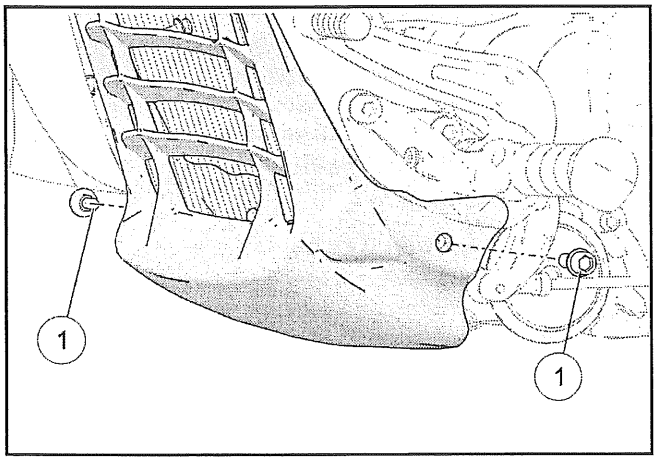
Never remove pressure cap when engine is warm or hot.
The cooling system is under pressure and serious burns may result.
Allow the engine and cooling system to cool before servicing.

Cooling System Drain

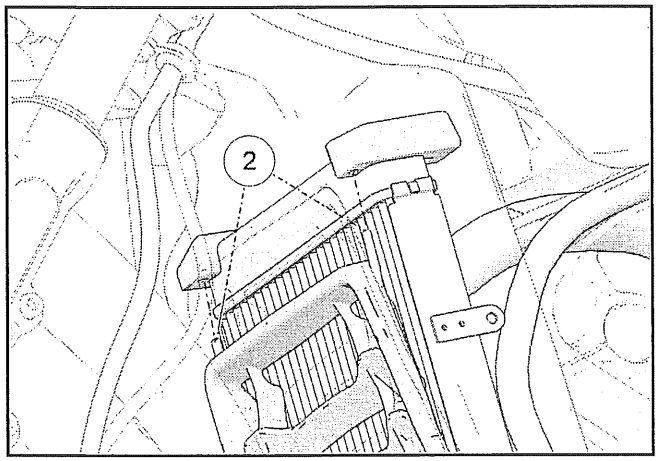
IMPORTANT

Pressure test the cooling system before and after cooling system service.

1. Remove the radiator cover fasteners ① .



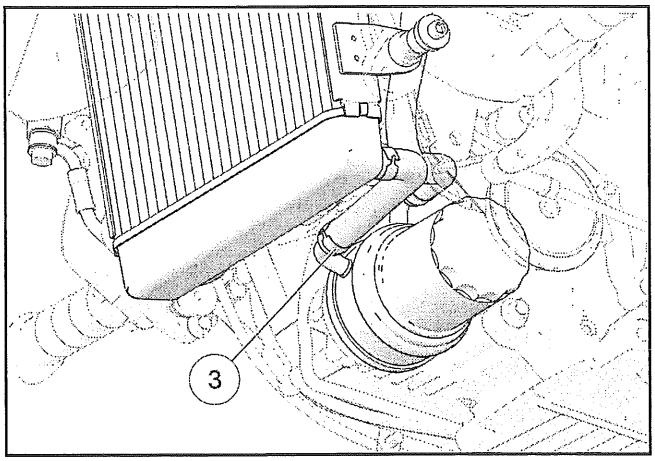
2. Slide radiator cover down to disengage posts from the upper radiator mounts ② .



3.

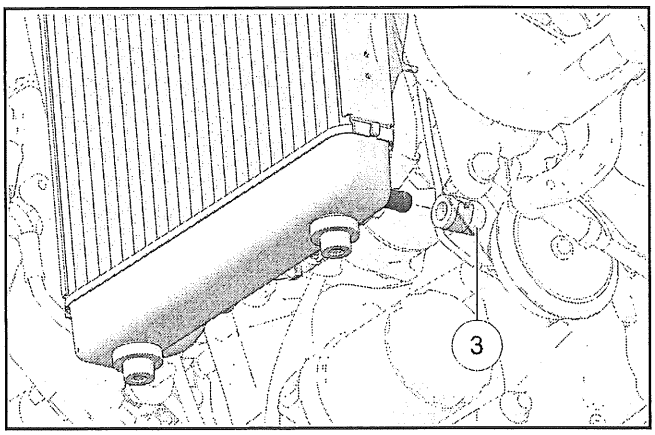
- **2015–16 Models**

  Remove the coolant return hose ③ from the oil cooler assembly to drain the coolant.



- **2017 Models**

  Remove the coolant drain plug ③ from the radiator.



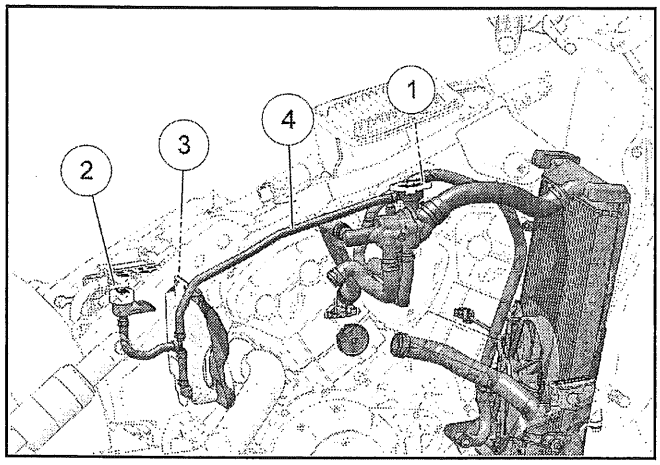
Cooling System Fill/Bleeding

NOTE

Pressure test before and after servicing the cooling system.

1. Depending on the model year, either reconnect the coolant return hose to the oil cooler or install the coolant drain plug to the radiator.
2. Install the radiator cover.
3. Remove the seat. See Seat Removal / Installation, page 7.8.
4. Remove the Fuel Tank. SeeFuel Tank Removal, page 4.14.
5. Remove cooling system pressure cap ① .

6. Use pinch pliers (commercially available) to pinch off the coolant line ④ between the coolant reservoir and thermostat housing.



7. Install a cooling system vacuum bleeder (commercially available) on the pressure cap opening to create a vacuum in the cooling system.
8. Using the vacuum bleeder draw in Indian Motorcycle Extended Life 50/50 Engine Coolant to fill the cooling system.
9. Remove the vacuum bleeder and install the pressure cap.
10. Remove the pinch pliers from the coolant line between the reservoir and thermostat housing.
11. Add Indian Motorcycle Extended Life 50/50 Engine Coolant to the reservoir fill opening ② until the coolant reservoir ③ is half full.
12. Install the fuel tank assembly. See Fuel Tank Installation, page 4.19.
13. Run the engine until the cooling fan cycles ON and OFF.
14. Recheck the coolant level in the reservoir and add to the "COLD FULL" level.
15. Repeat the fill/bleed procedure until the coolant level in the reservoir remains at the "COLD FULL" level.
16. Install the seat. See Seat Removal / Installation, page 7.8.

IDLE SPEED / FAST IDLE SPEED

NOTE

Idle speed cannot be adjusted manually, it is continuously monitored and adjusted by the ECM.

TIRE PRESSURE / SPECIFICATIONS

⚠ WARNING

Indian motorcycles are produced using the designated tires listed below as original equipment. This includes field testing to ensure stability and superior handling. The use of tires other than original equipment may cause instability. See Steering / Suspension Chapter for a review of all tire related warnings.

1. Inspect tires for weather checking, cuts, imbedded foreign objects, etc.
2. Inspect front and rear wheels for damage.
3. Measure tread depth at center of tread.
4. Measure in 3-4 places equally spaced around the tire and record the smallest measurement.

⚠ WARNING

It is dangerous to ride with a worn tire. When a tire reaches the minimum tread depth listed below, replace the tire immediately.

Minimum Tread Depth

Front Tire Minimum Tread Depth	.063 in (1.6 mm)
Rear Tire Minimum Tread Depth	.063 in (1.6 mm)

Tire Pressure Table (Cold)

NOTE

Also refer to Manufacturing Information label.

SCOUT	
FRONT: Kenda Kruz K673F - 130/90-16 72H	36 PSI (248 kPa)
REAR: Kenda Kruz K673 - 150/80-16 71H	40 PSI (276 kPa)

CLUTCH CABLE INSPECTION / LUBRICATION

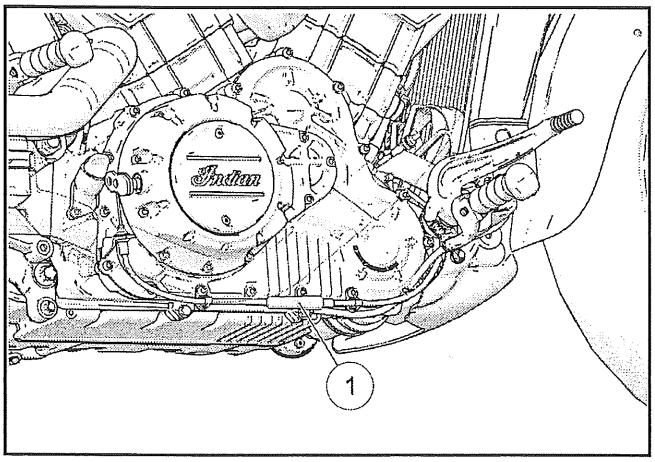
NOTE

Control cable casings are lined with a low friction sleeve and are factory lubricated for reliable operation. Periodic lubrication of cables is not required and could be detrimental to cable performance. Only cable *ends* must be periodically inspected and lubricated in accordance with the Periodic Maintenance Schedule. See Periodic Maintenance Interval Table, page 2.6.

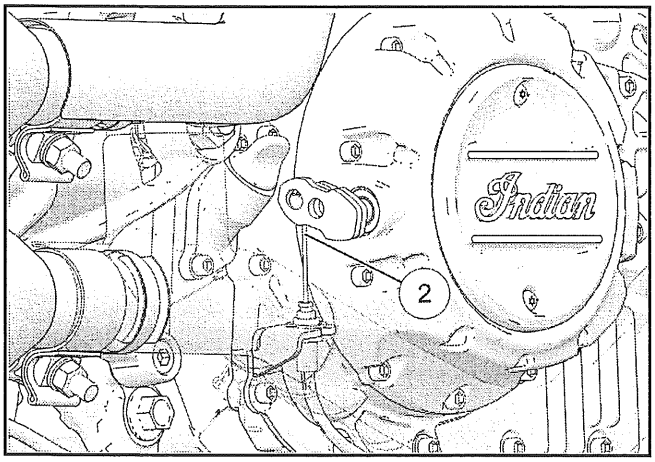
CAUTION

Inspect inner cable for fraying. Do not kink, bend or twist inner cable or cable casing during removal or installation.

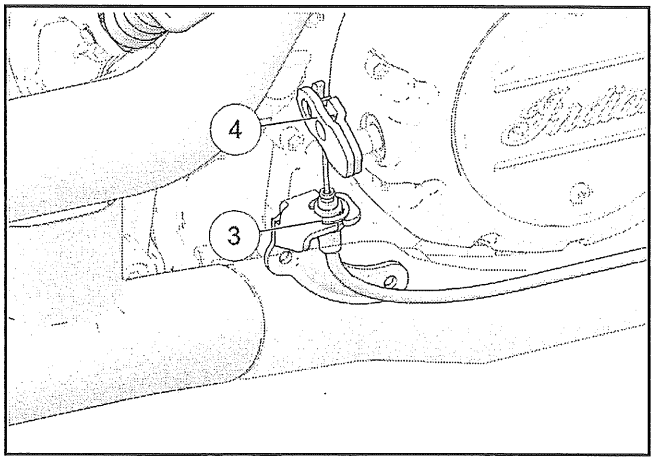
1. Inspect the clutch cable ①for proper routing, smooth movement, and damage to the external casing.



2. Inspect the lower cable end ② for damage or frayed wires.



3. Remove the jam nut ③ that retains the clutch cable in the lower cable guide. Using an adjustable wrench, rotate the clutch shaft arm ④ to release the cable housing from the mounting boss.



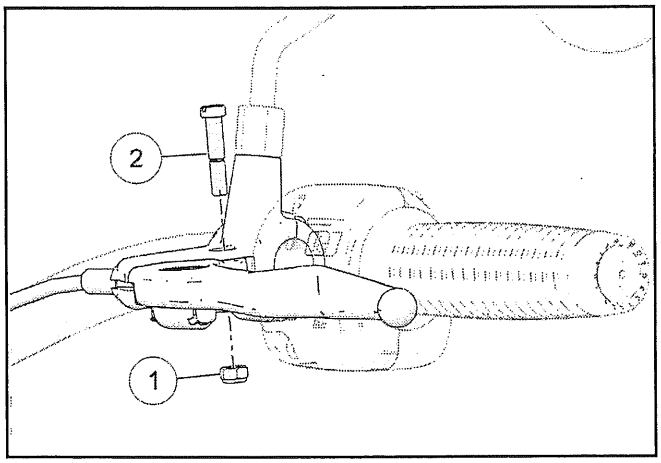
4. Apply a thin coating of all purpose grease to both cable ends.
5. Reverse steps 3 - 4 to reinstall clutch cable.
6. Tighten the lower cable guide jam nut to specification

TORQUE
Cable Guide Jam Nut: **48 in-lbs (5.4 Nm)**

7. Adjust cable free play. See Clutch Lever Free Play, page 2.20

CLUTCH LEVER LUBRICATION

1. Disconnect clutch cable at primary cover. See Clutch Cable Inspection / Lubrication, page 2.19.
2. Pull cable housing out of lever perch and remove barrel from clutch lever. Do not kink cable.
3. Remove the nut ① and push pivot bolt ② upward to remove.



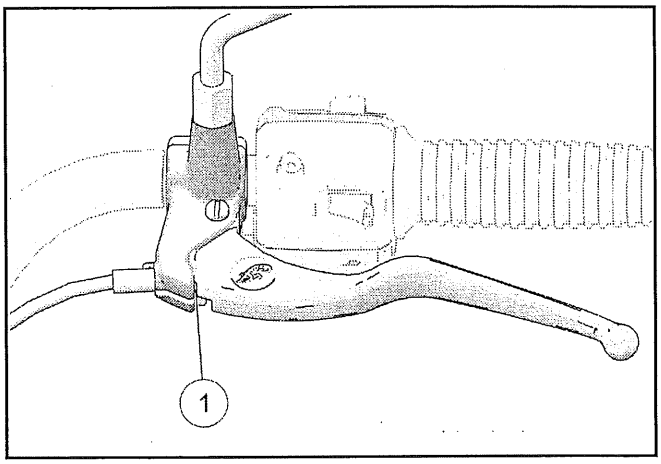
4. Inspect both ends of inner cable for frayed strands. Clean parts and apply moly paste to pivot bolt and both cable ends.
5. Assemble lever.
6. Install cable to lever. Rotate cable back through slot in perch, and push outer casing back into perch recess.
7. Install the pivot bolt and torque the nut to specification.

TORQUE
Clutch Lever Pivot Nut: **84 in-lbs (9.5 Nm)**

8. Lubricate and attach lower end of cable to clutch arm on primary cover.
9. Adjust clutch lever free play. See Clutch Lever Free Play, page 2.20.

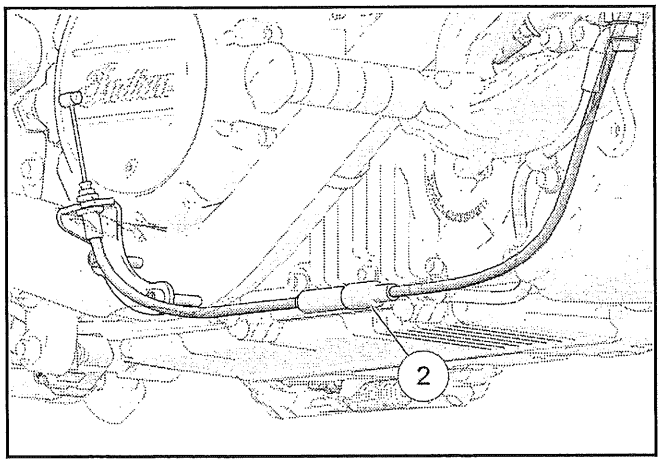
CLUTCH LEVER FREE PLAY

1. With handlebars pointing straight ahead, measure the clutch lever free play at point shown ① between lever and perch.



MEASUREMENT
Clutch Lever Free Play: **.019–.059" (0.5–1.5 mm)**

2. Compare measurement to specification. If adjustment is required, proceed to Step 3.
3. Locate the clutch cable adjuster boot ② and pull it back to expose the jam nut and barrel adjuster.



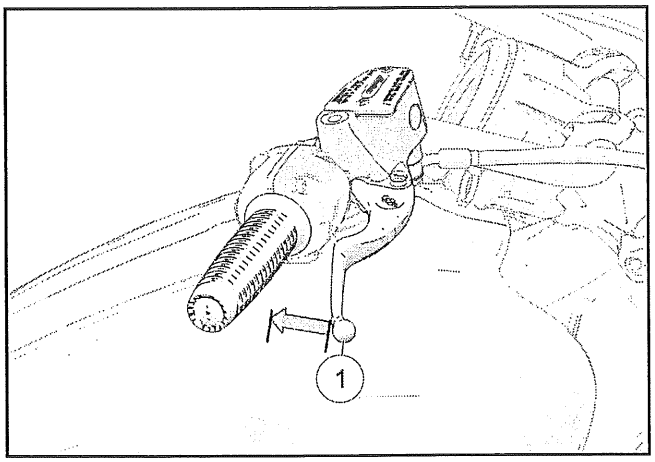
4. Hold cable and loosen the adjuster jam nut.
5. Turn cable adjuster in or out until clutch free play is correct.
6. Tighten adjuster jam nut to specification.

TORQUE
Clutch Cable Adjuster Jam Nut: **48 in-lbs (5.4 Nm)**

7. Slide adjuster boot back over adjuster assembly.

FRONT BRAKE LEVER INSPECTION

1. Pull and release the front brake lever. It should move freely and smoothly and return to its rest position quickly when released. Lubricate brake lever if binding, or if it does not return quickly and completely when released. See Front Brake Lever Lubrication, page 2.21.
2. Measure brake lever free play ①. You should feel a firm resistance in the lever within the specified length of lever travel. If brake lever travels too far before beginning to apply the brake, inspect for brake fluid leaks and bleed air from the system. See Brake Bleeding.

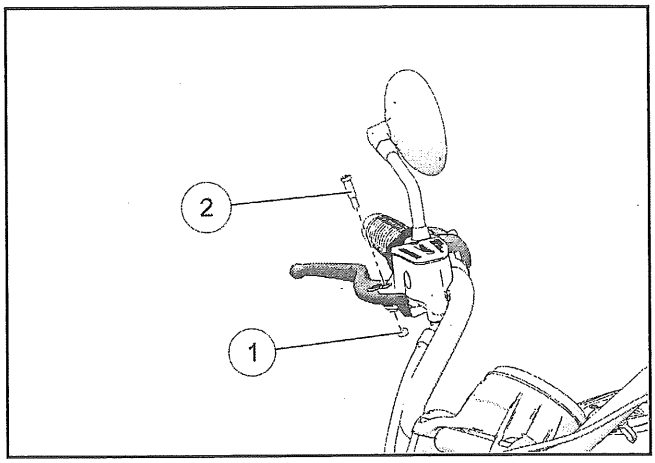


MEASUREMENT
Brake Lever Free Play: **.75 - 1.0" (19.1–25.4 mm)**

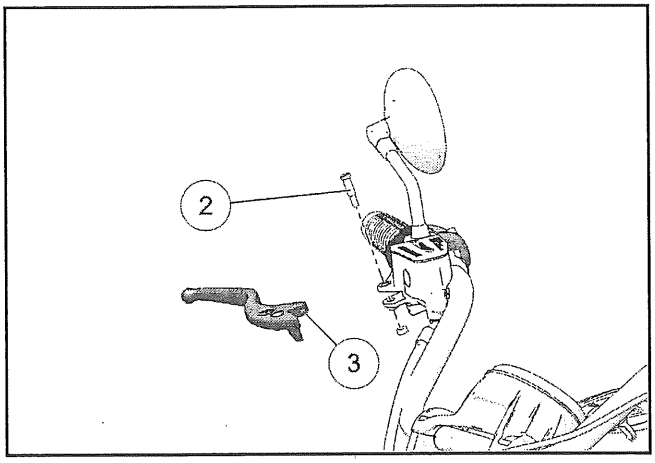
3. Safely elevate the front wheel. Verify wheel rotates freely without drag or binding when lever is released.

FRONT BRAKE LEVER LUBRICATION

1. Remove the nut ① and pivot fastener②.



2. Clean pivot bolt, lever and lever perch.
3. Remove brake lever and apply grease to pivot fastener②, lever bushing, and pushrod contact surface of lever ③ as shown.



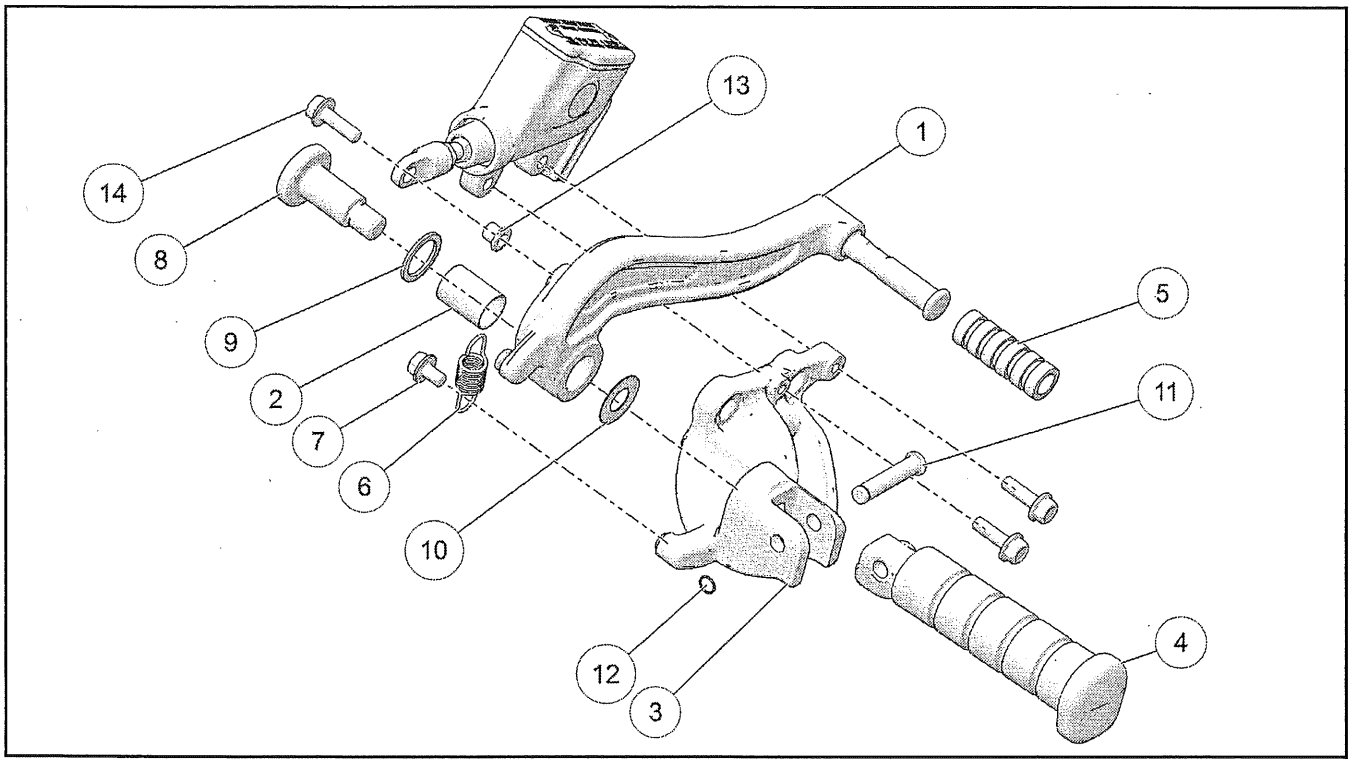
4. Assemble brake lever.
5. Torque brake lever pivot fastener nut to specification.

TORQUE
Brake Lever Pivot Fastener: **48 in-lbs (6 Nm)**

BRAKE PEDAL INSPECTION

1. Press and release the brake pedal. It should move freely and smoothly and return to the rest position quickly when released.
2. Press brake pedal and check for firm resistance. If pedal feels spongy or travels too far without resistance, inspect system for leaks and bleed brakes. See Brake Bleeding.

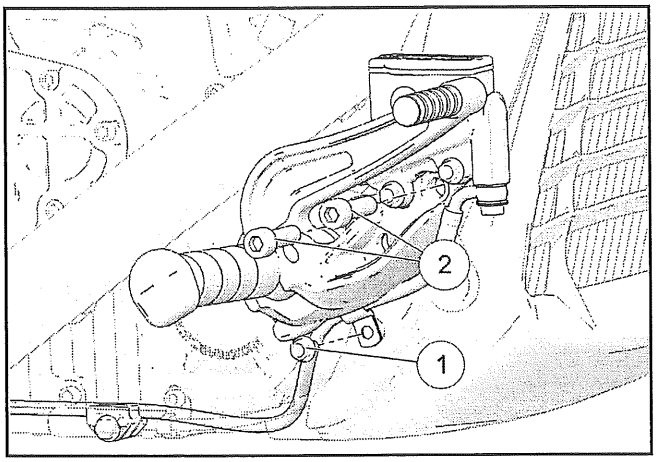
BRAKE PEDAL LUBRICATION



NUMBER	DESCRIPTION	NUMBER	DESCRIPTION
①	Brake Pedal	⑧	Shoulder Pivot Bolt
②	Brake Pedal Pivot Bearing	⑨	Wave Washer
③	Footpeg Mount	⑩	Washer
④	Footpeg	⑪	Pivot Footpeg Pin
⑤	Brake Pedal Pad	⑫	Retaining Spiral Ring
⑥	Brake Return Spring	⑬	Pivot Brake Pushrod Bushing
⑦	Screw	⑭	Brake Pushrod Screw

Lubricate brake pedal at intervals listed on periodic maintenance table. See Periodic Maintenance Interval Table, page 2.6.

1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Working on the RH side of the motorcycle, remove brake line p clamp bolt ① and foot peg mount bolts ②. Move foot peg mount/master cylinder assembly so the brake pedal pivot shoulder bolt can be accessed.



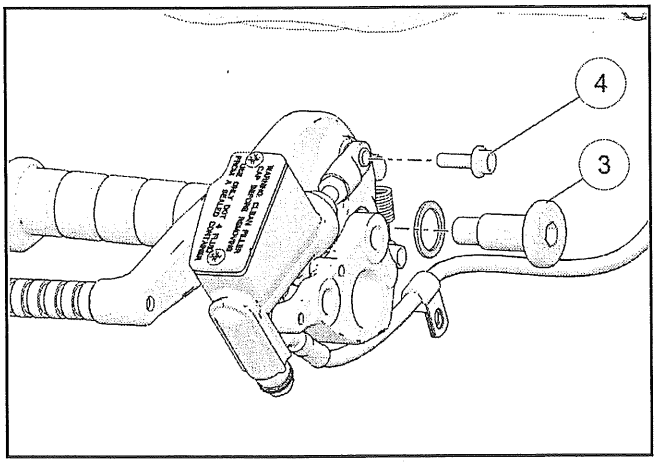
NOTE

It is not necessary to disconnect the brake line from the master cylinder to perform this procedure.

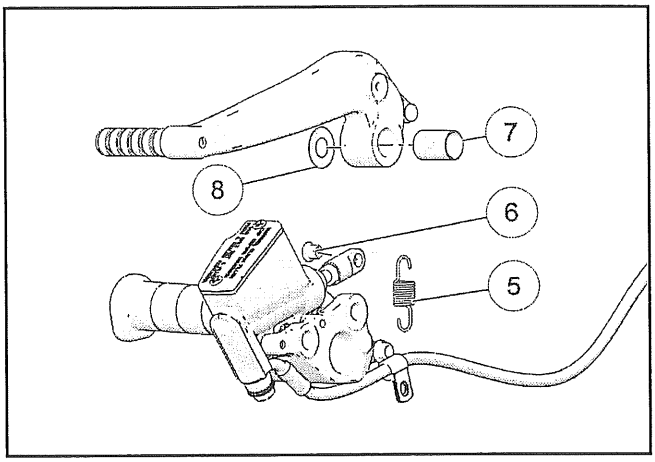
IMPORTANT

Keep the floorboard / master cylinder assembly in an upright position at all times to ensure air does not enter the brake system.

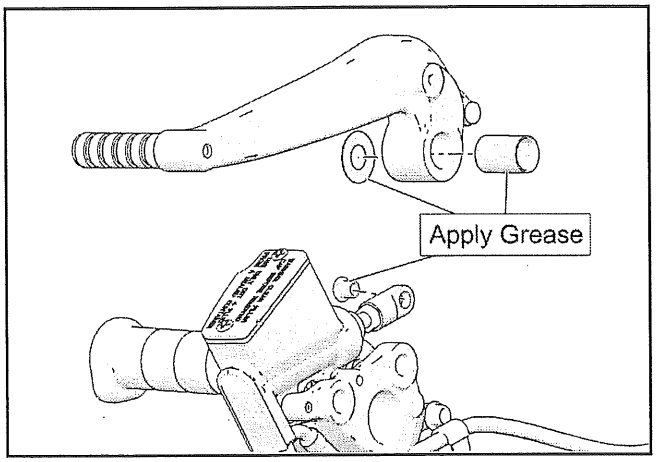
3. Remove the brake pedal pivot shoulder bolt ③ and flat washer. Remove the pushrod bolt ④ from the brake pedal.



4. Remove brake pedal return spring ⑤. Remove brake pushrod pivot bushing ⑥. Remove the brake pedal bushing ⑦ and washer ⑧.



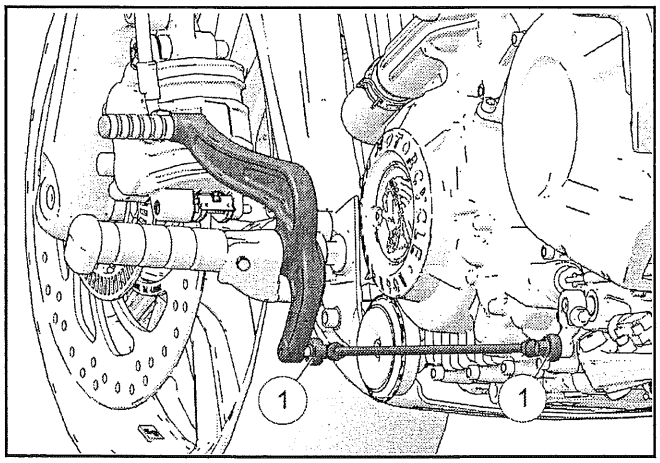
5. Clean off old lubricant and dirt from all parts.
6. Apply all-purpose grease to pushrod and pedal bushings as shown.



7. Install pedal bushing ⑦. Assemble pedal, washer ⑧, brake pedal pivot shoulder bolt ③ and flat washer to the foot peg mount.
8. Install pushrod pivot bushing and bolt.
9. Assemble foot peg support to frame. Torque mounting bolts ② and p-clamp bolt ① to specification. SeeDriver Foot Peg Removal / Installation, page 7.6.
10. Depress brake pedal to verify proper operation and pedal feel. Bleed brakes if necessary. See Brake Bleeding.

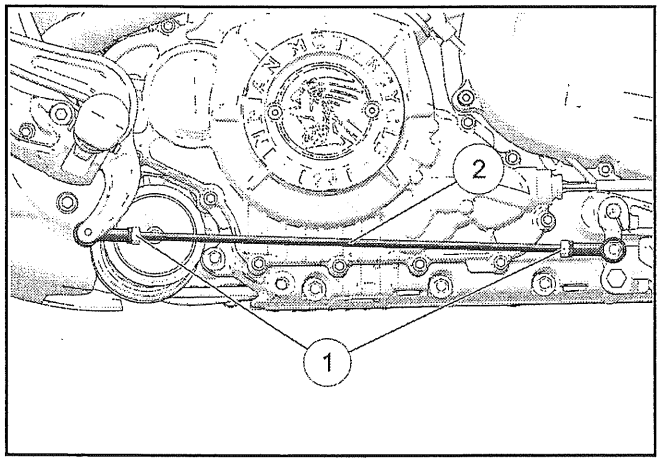
SHIFT PEDAL INSPECTION / LUBRICATION

1. Check all shift pedal and linkage fasteners to be sure they are tight. Torque fasteners to specification. See Shift Pedal Adjustment, page 2.24.
2. Lubricate shift pedal pivot bushing and all pivots ① with all-purpose lubricant.



SHIFT PEDAL ADJUSTMENT

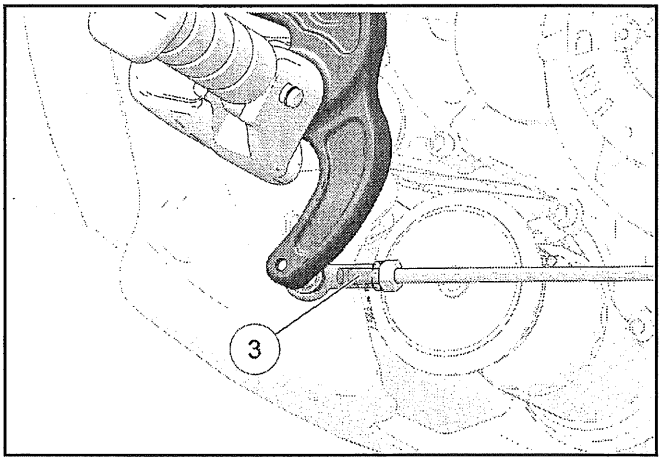
1. Loosen jam nuts ①.
2. Rotate linkage rod ② until pedal angle is correct.



3.

IMPORTANT

The shift linkage rod ③ must be threaded into each pivot end a minimum of seven complete turns.



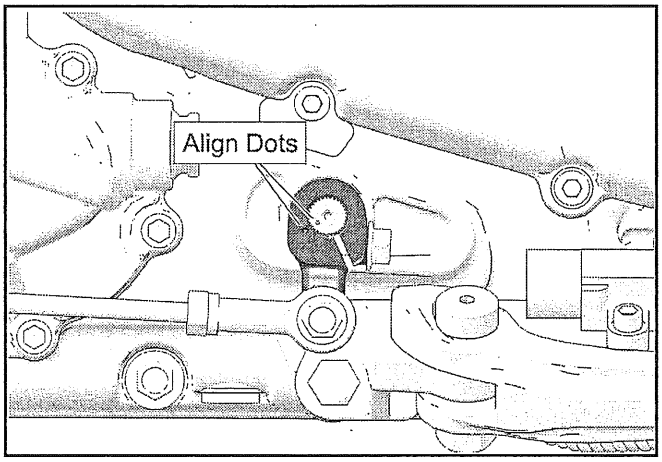
TORQUE

Shift Rod Jam Nuts:
8 ft-lbs (11 Nm)

4. Tighten jam nuts ① to specification.

CAUTION

Do not remove and reposition the shift arm on the shift shaft to adjust gear shift pedal height. Dots on shift shaft and shift arm must be aligned for gears to shift correctly.



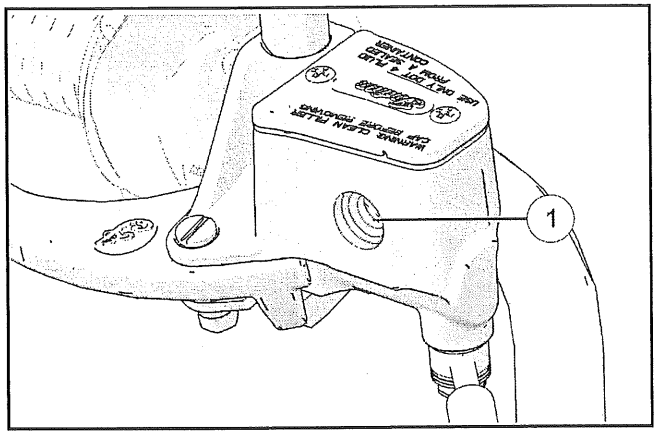
BRAKE FLUID LEVEL INSPECTION

IMPORTANT

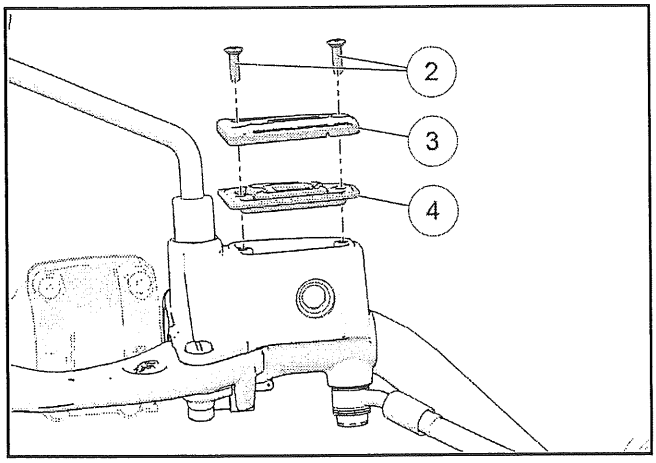
The brake fluid level in the reservoir will go down as brake pads wear. If you notice a constant or sudden lowering of the brake fluid level, inspect brake pads for wear and brake system for leaks.

Front Brake Fluid Inspection

1. Turn handlebars or adjust the motorcycle until top of reservoir is level.



2. View front brake fluid level through sight glass. The fluid should be clear and at the middle of the site glass ① or above.
3. Wipe area around reservoir cover with a clean cloth.
4. Wipe brake fluid container with a clean cloth.
5. Remove screws ②, reservoir cover ③ and diaphragm ④. If diaphragm is extended, return it to the neutral position.



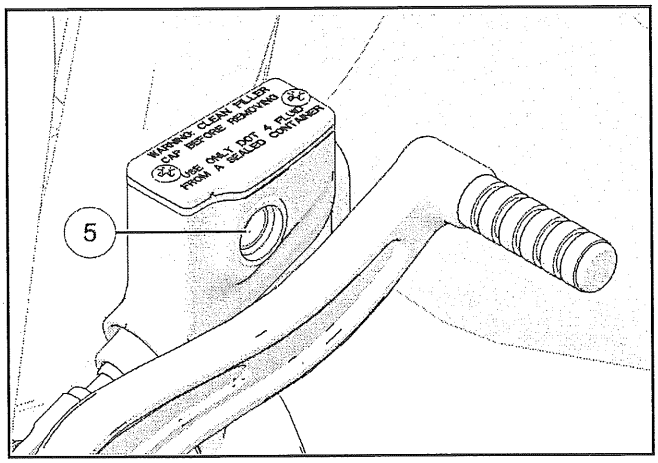
6. Carefully add enough DOT 4 brake fluid to bring level to the upper edge of the sight glass.
7. Reinstall reservoir diaphragm and cover and torque screws to specification.

TORQUE

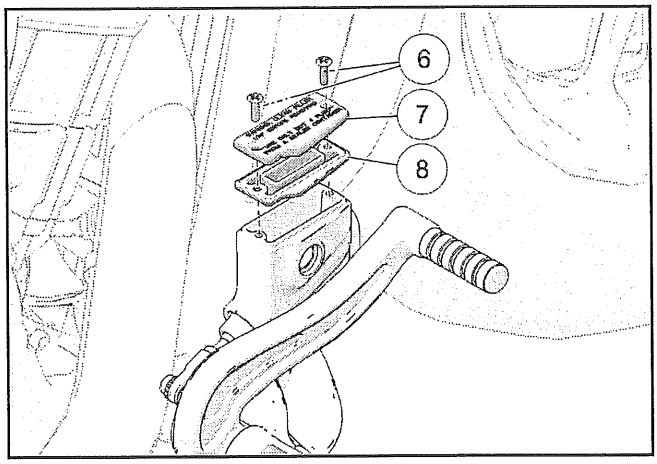
Front Master Cylinder Cover Screws:
13 in-lbs (1.5 Nm)

Rear Brake Fluid Inspection

8. Fluid level is checked at the rear brake master cylinder reservoir.
9. View fluid level through reservoir sight glass ⑤. The fluid should be clear and at or above the middle of the sight glass.



10. Wipe area around reservoir cover with a clean cloth.
11. Wipe brake fluid container with a clean cloth.
12. Remove screws ⑥, reservoir cover ⑦, and diaphragm ⑧. If diaphragm is extended, return it to the neutral position.



13. Carefully add enough DOT 4 brake fluid to bring level to the upper edge of the sight glass.

14. Install diaphragm and cover. Tighten cover screws to specification.

TORQUE

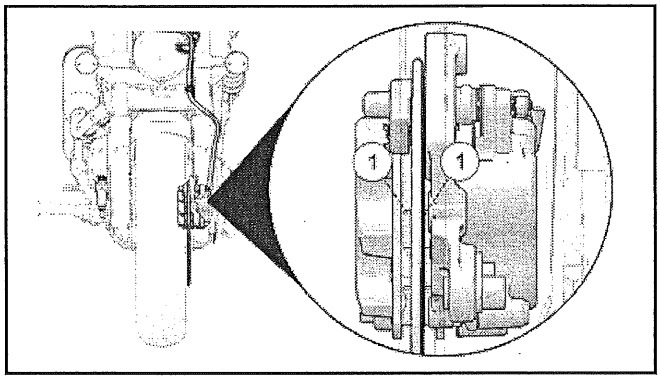
Rear Master Cylinder Cover Screws:
13 in-lbs (1.5 Nm)

FRONT BRAKE PAD INSPECTION

NOTE

Wear indicator grooves are provided on each front brake pad to allow for a visual inspection without pad removal. Inspect pads by viewing from rear of caliper.
Replace pads if worn to bottom of grooves. See Front Brake Pad Replacement (2015–16), page 9.24

1. Viewing the front brake pads from the front of the caliper, locate the wear indicator grooves ①.
2. Wear indicator grooves should be visible on both inboard and outboard brake pads.



CAUTION

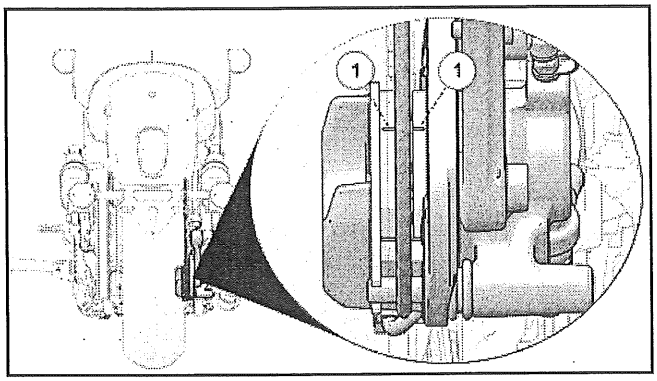
Front brake pads should always be replaced as a complete set. If it is determined that an individual brake pad has worn past the wear indicator groove, the front caliper should receive a new pad set. Failure to replace both front brake pads together may cause reduced braking performance or brake failure, resulting in a vehicle crash.

REAR BRAKE PAD INSPECTION

NOTE

Wear indicator grooves are provided on each rear brake pad to allow for a visual inspection without pad removal. Inspect pads by viewing from the rear of the motorcycle, directly behind the muffler.
Replace pads if worn to bottom of grooves. See Rear Brake Pad Replacement (2015–16), page 9.26.

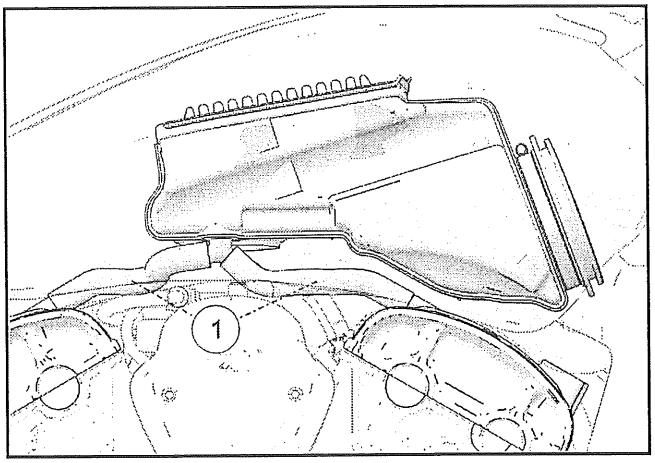
1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Viewing the rear brake pads from behind the motorcycle and below the lip of the rear fender, locate the wear indicator grooves ①.



3. Wear indicator grooves should be visible on both inboard and outboard brake pads.

CRANKCASE VENTILATION SYSTEM

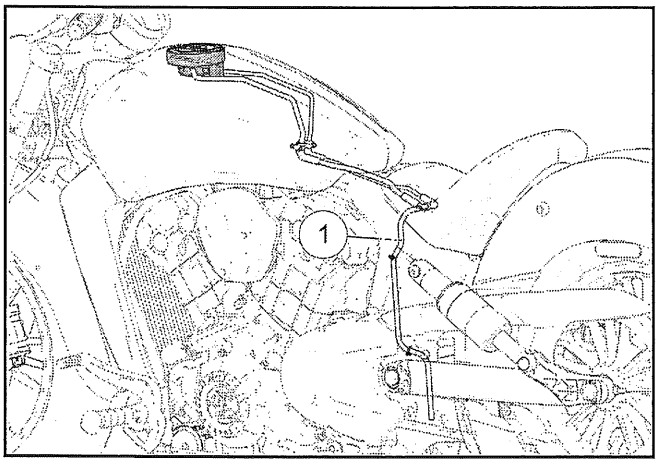
1. Inspect condition of ventilation hoses ① along the entire length and at both ends.



2. Be sure hoses are not restricted, kinked, or cracked.
3. Replace worn or damaged hoses.

FUEL TANK VENT INSPECTION (49 STATE)

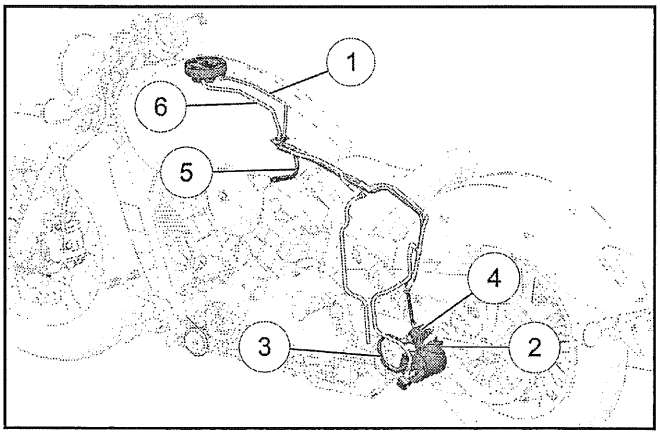
- Inspect fuel tank vent hose ① in accordance with periodic maintenance schedule and any time fuel tank has been removed and installed. Be sure the hose is clear and not pinched or kinked, and that all connections are tight.



EVAPORATIVE EMISSION CONTROL SYSTEM (CALIFORNIA MODELS)

NOTE

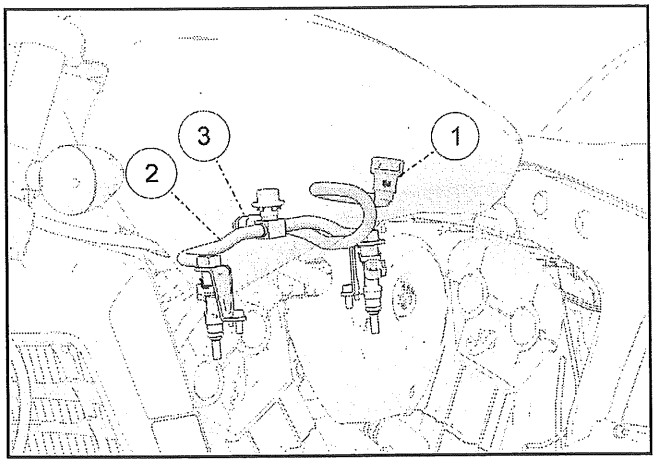
The fuel tank vent line is routed to a vapor canister where the fuel vapor is stored until specific operating parameters are met and the ECM opens the purge valve. Fuel vapor is then routed out of the vapor canister, through the purge valve and into the throttle body for combustion. Inspect all EVAP lines for abrasion or wear. Check that all connections for both vent and canister purge systems are securely attached.



NUMBER	DESCRIPTION
①	Fuel Tank Vent Hose
②	Evaporative Emissions Vapor Canister
③	Purge Hose (Canister to Purge Valve)
④	Canister Purge Valve
⑤	Purge Hose (Purge Valve to Throttle Body)
⑥	Fuel Cap Recess Drain Hose

FUEL SUPPLY HOSE / FUEL RAIL INSPECTION

1. The fuel supply hose and fuel rail are located behind the engine cover on the RH side of the motorcycle.
2. Inspect fuel supply line ① and fuel rail ② for deterioration, damage, leakage, or kinked areas. Inspect fuel supply line-to-fuel rail connection ③ for signs of leakage.



3. Replace any components that fail inspection with genuine Indian Motorcycle replacement parts.

⚠ WARNING

The fuel lines exiting fuel pump are subjected to high pressure. Replace with genuine Indian Motorcycle replacement parts to reduce the possibility of fuel line failure. Be sure fuel lines are routed properly and do not come in contact with sharp or hot objects, or anything that may cause wear or damage.

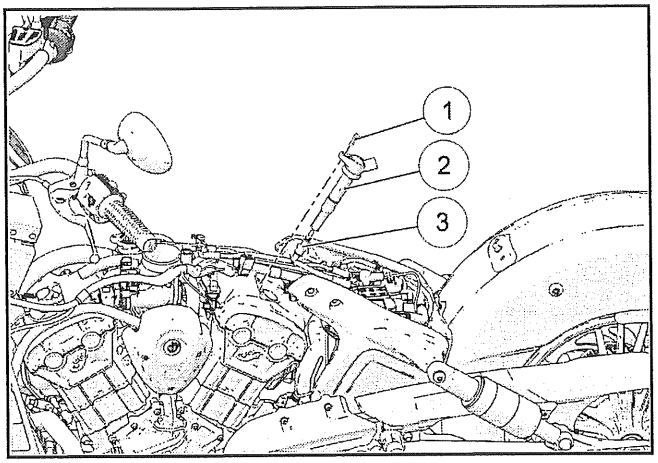
SPARK PLUG REMOVAL

⚠ WARNING

HOT COMPONENTS Wear insulated gloves and/ or allow engine and exhaust to cool before handling these parts.

NOTE

The engine should be at room temperature to perform this procedure.



1. Place the motorcycle on the side stand and allow engine to cool.
2. Remove the seat. See Seat Removal / Installation, page 7.8.
3. Remove the fuel tank. See Fuel Tank Removal, page 4.14.
4. Remove air box. SeeAir Box Removal, page 3.4.
5. Disconnect the ignition coil electrical connector.
6. Remove the ignition coil fastener ①.
7. Remove the ignition coil assembly ②.
8. Using a 6" extension and a 5/8" spark plug socket, remove spark plug ③.

NOTE

Check gap on replacement spark plug(s).

SPARK PLUG INSPECTION / GAP

⚠ WARNING

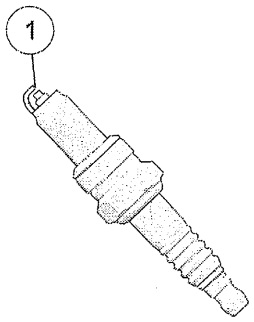
A hot engine can cause serious burns. Allow engine to cool or wear protective gloves when removing the spark plugs.

1. Remove spark plug (s). See Spark Plug Removal, page 2.29.
2. Inspect electrodes for wear and carbon buildup. Look for a sharp outer edge with no rounding or erosion of the electrodes.
3. Clean with electrical contact cleaner or a glass bead spark plug cleaner only.

CAUTION

A wire brush or coated abrasive (sandpaper) should not be used to clean electrodes.

4. Measure electrode gap with a wire gauge ①. Adjust gap if necessary by carefully bending the grounding electrode until the specified gap is achieved.



Spark Plug Type: **NGK MR7F**

Spark Plug Gap: **0.030 in (0.80 mm)**

SPARK PLUG INSTALLATION

1. Inspect spark plug gap with a wire gauge. If gap adjustment is necessary, bend ground electrode carefully using a spark plug gap tool.

Spark Plug Type: **NGK MR7F**

Spark Plug Gap: **0.030 in (0.80 mm)**

2. Apply anti-seize compound sparingly to spark plug threads, avoiding the bottom 2 - 3 threads.
3. Torque spark plugs to specification.

TORQUE

Spark Plug:
10 ft-lbs (14 Nm)

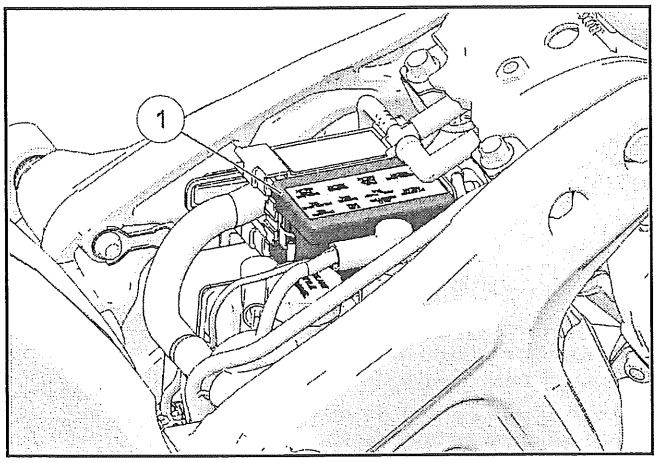
CAUTION

Do not over tighten spark plugs. Damage to the cylinder head or spark plug may result.

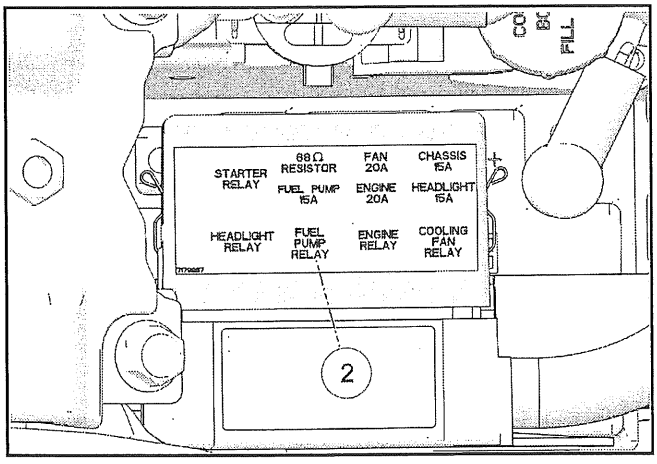
4. Install ignition coil(s). See Ignition Coil Removal / Installation, page 10.35.
5. Install air box assembly. See Air Box Installation, page 3.5
6. Install fuel tank assembly. See Fuel Tank Installation, page 4.19
7. Install seat assembly. See Seat Removal / Installation, page 7.8

ENGINE COMPRESSION TEST

1. Warm engine to operating temperature.
2. Shift transmission into neutral and stop engine.
3. Remove the seat. SeeSeat Removal / Installation, page 7.8.
4. Remove the fuel tank. SeeFuel Tank Removal, page 4.14
5. Remove the air box assembly. See Air Box Removal, page 3.4.
6. Remove ignition coils. SeeIgnition Coil Removal / Installation, page 10.35.
7. Remove the fuse box cover ① .



8. Remove the Fuel Pump Relay ② to disable fuel pump.



9. Remove spark plug from cylinder to be tested. See Spark Plug Removal, page 2.29.
10. Install compression tester in the spark plug hole following manufacturers instructions.
11. Crank engine until needle on compression gauge stops rising (about 5 seconds).
12. Repeat procedure for other cylinder.

Specification - Scout

STD: 210 - 230 psi (1448 - 1586 kPa)

SERVICE LIMIT: Below 190 psi (1310 kPa)

High engine compression may indicate:

- Carbon deposits in combustion chamber
- Engine modification
- Faulty Gauge

Low engine compression may indicate:

- Slow starter motor cranking speed
- Carbon or foreign material on valve seat
- Worn or damaged piston and/or piston rings
- Leaking exhaust or intake valves
- Leaking head gasket
- Valve timing incorrect
- Non-OEM camshafts or faulty gauge

If cylinder compression is below specification, perform a cylinder leakage test to determine where the leak is occurring. Follow the instructions provided with the leak-down tester.

ENGINE COMPRESSION TEST (WET)

If a cylinder leakage tester is not available, perform a wet cylinder compression test.

1. Pour 3-5 cc of clean engine oil into each cylinder through spark plug hole. Repeat cylinder compression test. See Engine Compression Test, page 2.31.
2. If compression increases substantially, inspect cylinder, piston, and rings.
3. If compression does not increase, inspect valves and valve seats.

BATTERY

This motorcycle is equipped with a maintenance free battery which is located under the seat. DO NOT remove cell caps or add distilled water to the battery. If the battery discharges, refer to Electrical Chapter for diagnostic information.

⚠ WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

External: Flush with water.

Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

Eyes: Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries. **KEEP CHILDREN AWAY FROM BATTERY.**

CAUTION

Whenever removing the battery, disconnect the negative (black) cable first. When reinstalling the battery, connect the negative (black) cable last.

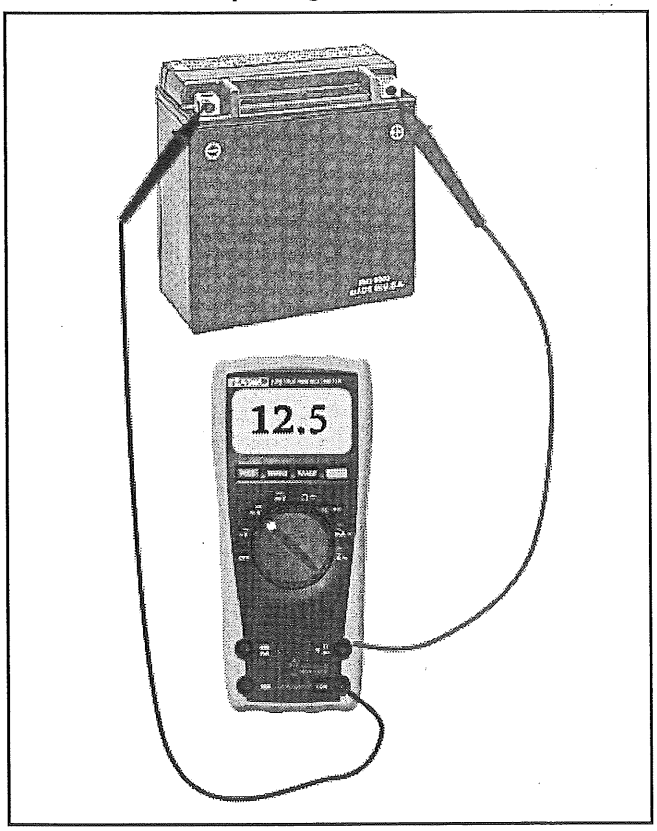
Do not remove the battery cables while the engine is running. Doing so may damage the Electronic Control Module (ECM).

Take great care NOT to reverse the battery leads when installing the battery.

BATTERY INSPECTION

Battery terminals and connections should be kept free of corrosion. If cleaning is necessary, remove the corrosion with a stiff wire brush. Wash with a solution of one tablespoon baking soda to one cup water. Rinse well with tap water and dry off with clean rags. Coat terminals with dielectric grease.

1. Visually inspect the exterior of the battery. Replace battery if housing is damaged, case is deformed, or if electrolyte is leaking.
2. To remove corrosion, remove battery from motorcycle and wash terminals with water and baking soda solution. Clean terminals, bolts, and cable ends with a brass wire brush and apply a thin film of dielectric grease.
3. Measure battery voltage.



Specification: 12.5 Volts DC minimum

4. If battery voltage is below 12.5 Volts DC, charge it thoroughly. See Battery Charging, page 2.33.
5. Replace battery if it will not accept a charge.

BATTERY CHARGING

CHARGING NEW BATTERY

1. Charge the battery at *1.8 amps for 5 to 10 hours. use a straight rate charger (not load sensing or battery tender type) for the initial charge of a new battery.*

CAUTION

Do not attempt to quick charge the battery at any time.

2. Remove battery from charger and let battery stand for 30 minutes or longer.
3. Measure voltage with a digital multi-meter. If lower than 12.5 Vdc, battery must be recharged again in accordance with step 1 and 2 above.
4. After charging battery and letting it sit for 30 minutes or more, check battery voltage again. If battery voltage is still below 12.5 Vdc, replace the battery.

CHARGING BATTERY IN SERVICE

1. Measure battery voltage with a digital multi-meter. The reading should be above 12.5 Vdc. If battery voltage is lower than 12.

CAUTION

Do not remove caps on battery while recharging. Do not attempt to inspect or add fluid to a maintenance free battery.

2. Charge battery at *1.8 amps for 5 to 10 hours.*

Battery Charging Specification: 1.8 A for 5-10 hours

3. Remove battery from charger and let it sit for 30 minutes or longer.
4. Measure battery voltage with a digital multi-meter. If battery voltage is lower than 12.5 Vdc, battery must be recharged again in accordance with step 1 and 2 above.
5. After charging battery and letting it sit for 30 minutes or more, check the battery voltage again. If battery voltage is still below 12.5 Vdc, replace battery.

NOTE

When motorcycle is not used for one (1) month or more, remove battery and store it in a cool, dry area. Inspect voltage monthly and charge according to above instructions if necessary.

BATTERY STORAGE

When the motorcycle is not used for periods of one month or longer the battery should be fully charged prior to operation. Store battery in a cool, dry place.

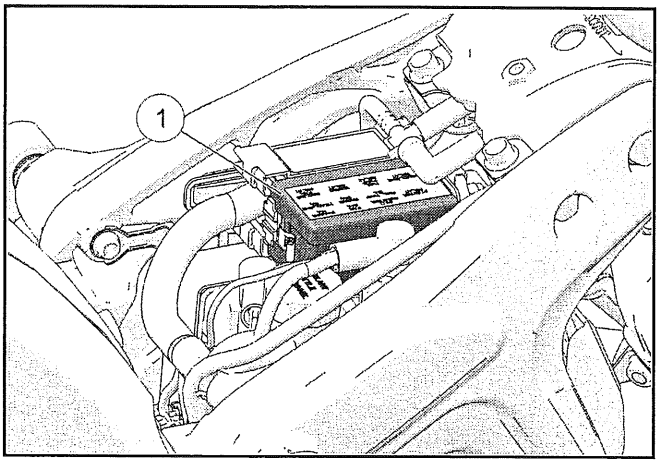
Battery should be charged monthly using a 12 volt battery charger with a maximum charge rate of 1.8 amp-hr.

⚠ WARNING

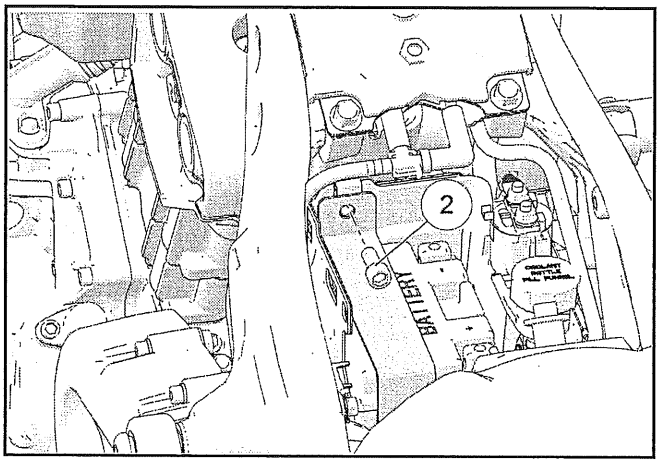
Battery charging can create explosive gasses; keep sparks, flames, cigarettes or anything that could ignite the gasses away. Provide adequate ventilation when charging in an enclosed space. Batteries contain acid that is caustic. Wear protective clothing and a face shield or protective eyewear when working with the battery. KEEP OUT OF REACH OF CHILDREN.

BATTERY REMOVAL

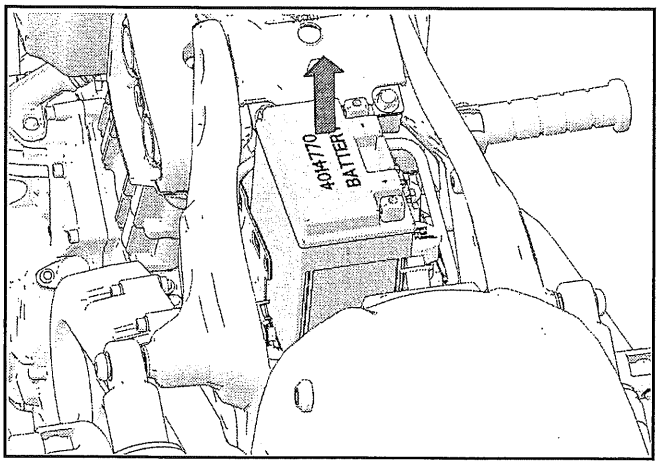
1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Release fuse panel ① and move off to the side.



3. Disconnect negative battery terminal.
4. Disconnect positive battery terminal.
5. Remove battery hold down bracket fastener ②.



6. Lift the battery out of the battery box.



BATTERY INSTALLATION

1. Install battery into battery box.
2. Install battery hold down bracket and torque fastener to specification.

TORQUE
Battery Bracket Fastener: **12 ft-lbs (16 Nm)**

3. Connect the positive battery terminal and torque fastener to specification.

TORQUE
Battery Terminal Fastener: **45 in-lbs (5 Nm)**

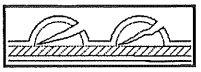
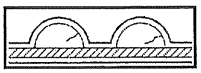
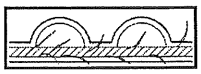
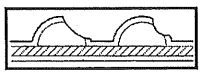
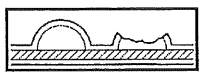
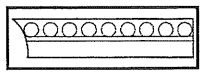
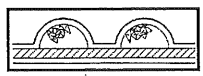
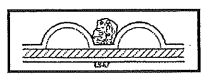
4. Connect the negative battery terminal and torque fastener to specification.

TORQUE
Battery Terminal Fastener: **45 in-lbs (5 Nm)**

5. Install fuse panel.
6. Install the seat. See Seat Removal / Installation, page 7.8.

DRIVE BELT INSPECTION

NOTE
Inspect drive belt in accordance with Periodic Maintenance Interval Chart and replace at specified intervals regardless of belt condition. See Periodic Maintenance Interval Table, page 2.6.

DRIVE BELT WEAR EXAMPLES	CONDITION	SERVICE RECOMMENDATION
	External Tooth Cracks	Replace Belt
	Internal Tooth Cracks	OK to run, but monitor condition
	Fuzzy Edge Cord	OK to run, but monitor condition
	Hook Wear	Replace Belt
	Missing Teeth	Replace Belt
	Bevel Wear (Outer Edge Only)	OK to run, but monitor condition
	Chipping (Not Serious)	OK to run, but monitor condition
	Stone Damage	Belt should be replaced if damage is on the edge of the belt

1. Periodically inspect drive belt for cuts, excessive wear, foreign substance (oil, grit), missing teeth, or any other damage.
2. If any damage is found, belt should be replaced.

NOTE
Adjust drive belt tension at intervals in accordance with the Periodic Maintenance Interval Chart. See Periodic Maintenance Interval Table, page 2.6.

3. If the drive belt or sprocket is being replaced due to damage, replace belt and both sprockets as a set if drive system has more than 5000 miles (8000 Km) of use.

DRIVE BELT SPECIFICATIONS

DRIVE BELT DEFLECTION DATA

IMPORTANT

MODEL	DEFLECTION AT 10 LBS FORCE	FREQUENCY
Scout	.472" (12 mm)	40–50 Hz

DRIVE BELT FREQUENCY TENSION DATA

NOTE

45-50 Hz with Sonic Tension Meter

DRIVE BELT TENSION

Special Tool: **Belt Tension Gauge PV-43532**

IMPORTANT

Do not adjust the belt when wet, or immediately after riding. Belt must be *dry* and the drive system must be at ambient temperature (60-80° F). This is extremely important for accuracy.

IMPORTANT

Perform this procedure to achieve proper belt tension *and* alignment. Belt tension should be set before performing the alignment procedure.

⚠ WARNING

A drive belt that is not properly tensioned can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.

⚠ WARNING

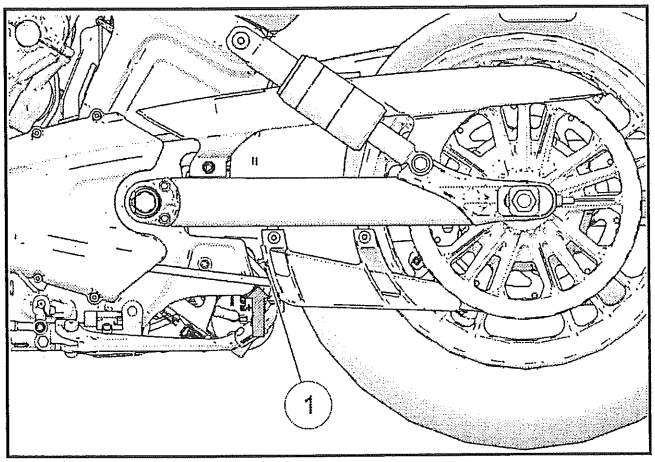
Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

1. Secure motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Shift transmission into NEUTRAL.
3. ELEVATE rear wheel off the ground when checking deflection or adjusting the belt.

   Find Tight Spot In Belt

4. Use the tire valve stem as a reference and perform the following Steps:

- Check / record belt deflection at 4 different points, 90 degrees apart. Rotate wheel in a COUNTER-CLOCKWISE rotation as viewed from belt side of motorcycle.
- Place a mark on rear wheel at the tightest point (least deflection) to use as a reference.
- Continue to rotate the wheel in normal drive direction (COUNTER-CLOCKWISE) 1-2 revolutions until your reference mark (the tightest point) is lined up with the tension setting window ① in the lower belt guard.

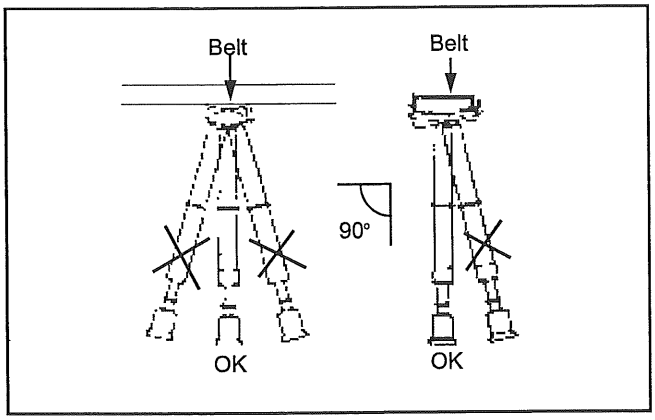


- Adjust belt deflection with wheel in this position.

5. Place tape measure or ruler next to drive belt or use the graduations on lower belt guard for reference.

6. Slide O-ring on belt tension gauge to the 10 lb. mark.

- Place belt tension gauge squarely against belt at center and keep it at a 90° angle to the belt surface.
-



7. Push up on gauge until O-ring just touches tool body. See Drive Belt Specifications, page 2.36 for drive belt deflection specifications.

8. If belt deflects more than the specified distance with 10 lbs. of force, tighten the belt. If deflection is less than specified loosen the belt. See Drive Belt Adjustment, page 2.38.

NOTE
New drive systems (new vehicle or when belt and sprockets are replaced) should be set to the tight side of the specification and inspected after the first 500 miles (800 km).

DRIVE BELT TENSION - SPECIFICATIONS

Specifications: Drive Belt

BELT DEFLECTION	
Model	Deflection @ 10 lbs force
Scout / Scout Sixty	.472" (12 mm)
SONIC TENSION DATA	
The following data is provided for use with the Gates 507C Sonic Tension Meter or an equivalent. Follow Steps 1-4 and the instructions included with your sonic tension meter.	
Required Data For Sonic Tension Meter	Specification
Span	646.98 mm
Belt Width	22 mm
Belt Mass Constant	8.4 g/mm
Tension Scout / Scout Sixty	48 Hz (± 2 Hz)

DRIVE BELT ADJUSTMENT

IMPORTANT

Perform this procedure to achieve proper belt tension and alignment. Belt tension should be set before performing the alignment procedure.

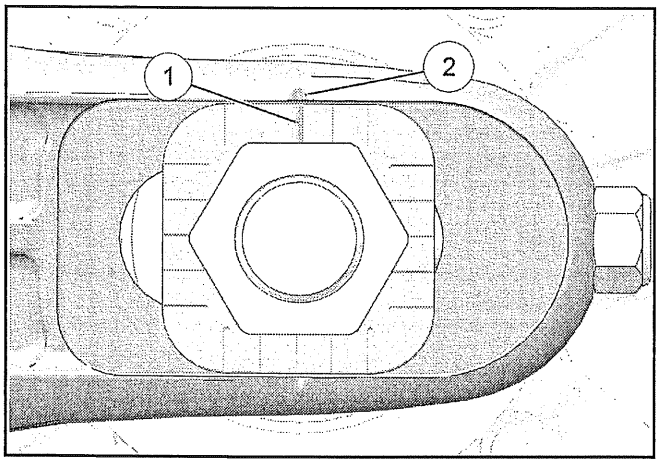
Belt Tension

⚠ WARNING

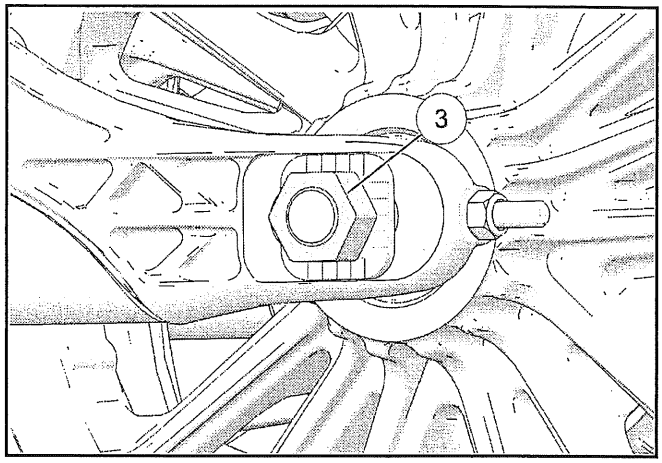
A rear axle not in alignment can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.

NOTE

Alignment marks ① and ② are used as a reference for initial wheel alignment. Alignment marks should be in approximately the same position on both left and right sides of wheel.



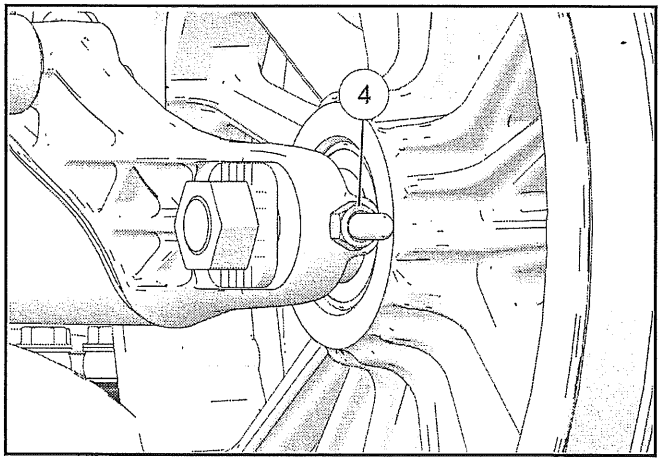
1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Make note of adjuster locations ① and ②.
3. Raise the rear of the motorcycle so the rear tire can be freely rotated.
4. Loosen axle nut ③ and retighten to the **ADJUSTMENT SPECIFICATION** during the adjustment procedure.



TORQUE

Rear Axle Nut **(ADJUSTMENT SPECIFICATION) 15 ft-lbs (20 Nm)**

5. Turn LEFT SIDE adjuster nut ④ to achieve proper belt tension. Refer to Drive Belt Tension, page 2.36



6. When belt tension is correct, check and adjust final belt alignment as follows.

Belt Alignment

⚠ WARNING

Drive belt misalignment can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.

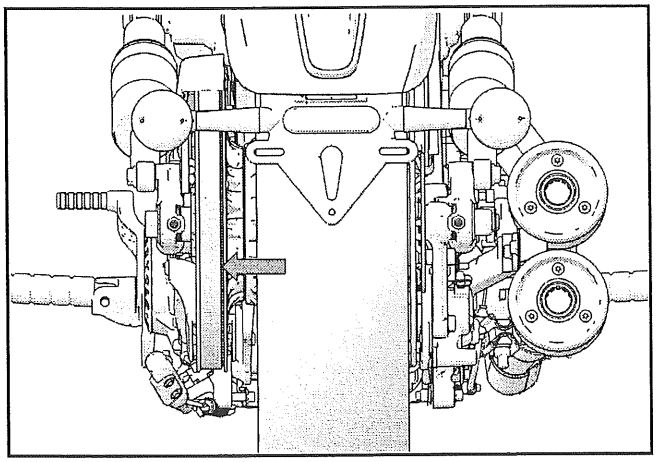
NOTE

To minimize change in belt tension, use RIGHT SIDE adjuster only to make final adjustments to belt alignment. Be sure to keep axle seated forward against axle adjusters during this procedure.

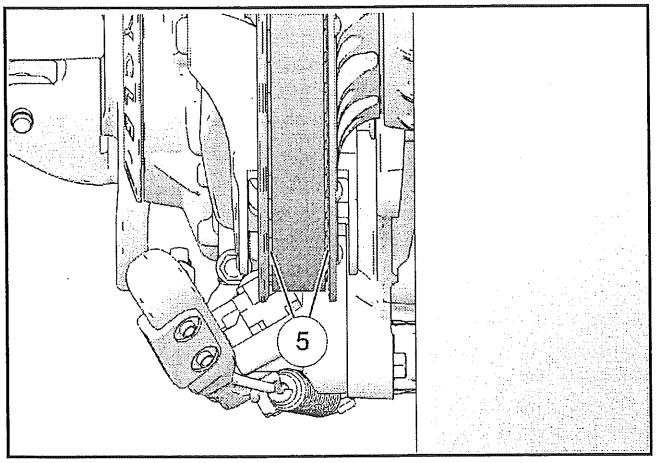
7. Rotate the wheel BACKWARD. Tighten RIGHT rear axle adjuster until belt comes off inside sprocket flange during backward wheel rotation.

IMPORTANT

The belt should track to the center of the sprocket tooth surface when properly aligned. Sprocket teeth should be visible on both sides of the drive belt.



8. Rotate the wheel in FORWARD direction and verify that sprocket teeth ⑤ are visible on both sides of the drive belt.



9. If necessary, loosen the axle nut and RIGHT SIDE adjuster until belt moves off the left flange and begins to track down the center of the driven sprocket flange during forward wheel rotation.

NOTE

It may be necessary to loosen the axle nut and tap the left end of the axle to ensure it moves forward when the adjuster is loosened. The axle nut must be retightened to the ADJUSTMENT SPECIFICATION before proceeding.

10. Rear wheel alignment is satisfactory when the drive belt remains centered on driven sprocket during forward and backward wheel rotation. Sprocket teeth should be visible from both sides of the drive belt.
11. Verify that drive belt tension is still within specification. Refer toDrive Belt Tension, page 2.36.
12. Tighten rear axle nut to **FINAL Specification**

TORQUE

Rear Axle Nut **(FINAL TIGHTENING)**
65 ft-lbs (88 Nm)

13. Pump rear brake pedal several times to reset brake pad distance.
14. Verify wheel rotates smoothly and freely without drag when brake pedal is released.

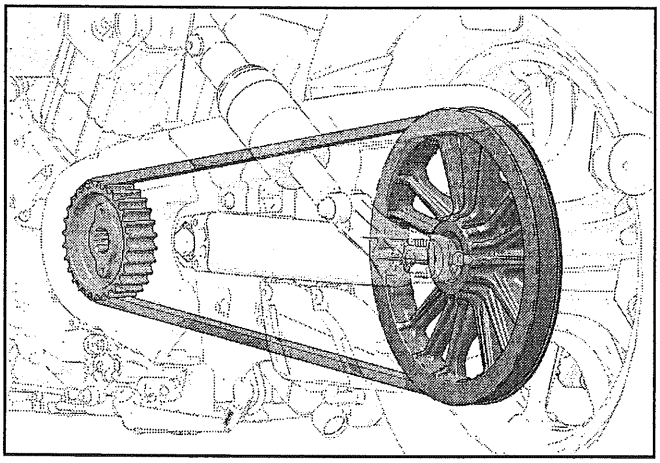
SPROCKET INSPECTION

NOTE

Drive belt and sprocket service life are maximized and drive line noise minimized by proper cleaning. Cleaning interval is approximately every tire change, or more often if operated in dirty, dusty, or high debris environments.

Inspection

1. Clean the drive belt and front and rear sprockets with a mild mixture of dish soap and warm water. Rinse and dry thoroughly.
2. Inspect front and rear sprocket teeth for wear or damage from foreign material.

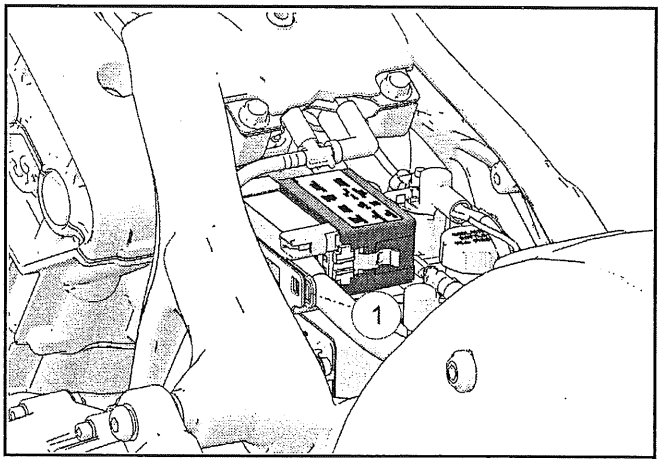


3. Closely inspect drive belt condition.

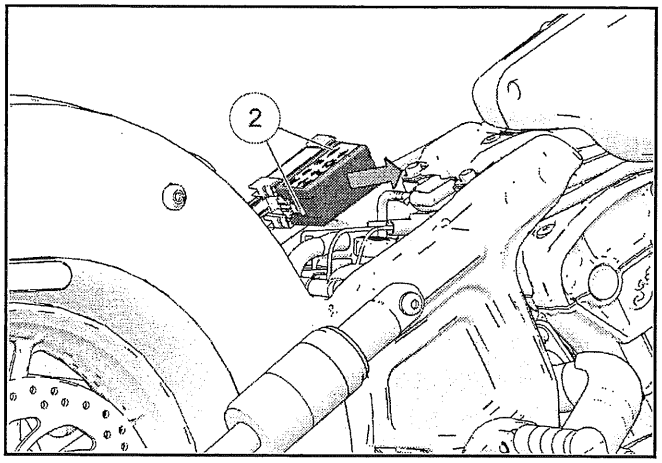
FUSE REPLACEMENT

Fuses and relays are located in the fuse box under the seat.

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Release the retainer ① and slide the fuse box rearward.



3. Release the fuse box cover clips ② and remove cover.



4. If any fuse is blown, turn off main switch. Install new fuse of specified amperage. Turn on switches and see if system operates correctly. Repeat fuse failure indicates an electrical problem.

CAUTION

Do not use fuses of a higher amperage rating than what is specified.

If the correctly rated fuse continues to blow, something is wrong and needs to be corrected. Substituting a higher amperage fuse can lead to extensive electrical system and vehicle damage.

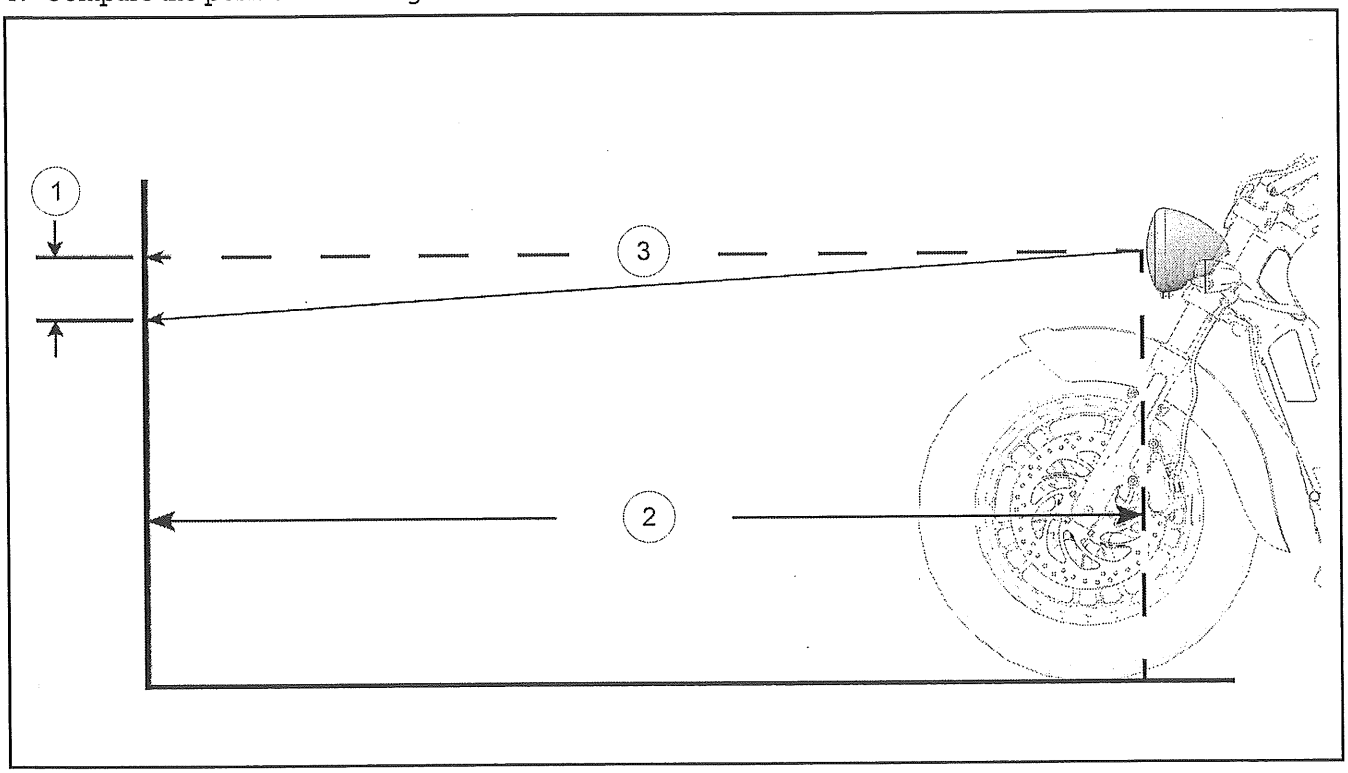
HEADLIGHT AIM INSPECTION

Adjust headlight aim when there is a change in load (rider, cargo, accessories, etc.) or after suspension adjustment.

With the headlight switched to HIGH beam, the center of highest intensity (appears as a diamond shape) should be 7.5 in (19 cm) below the height of the headlight bulb when centered straight ahead at 25 feet (7.62 m).

Follow all steps below to ensure accurate aim inspection.

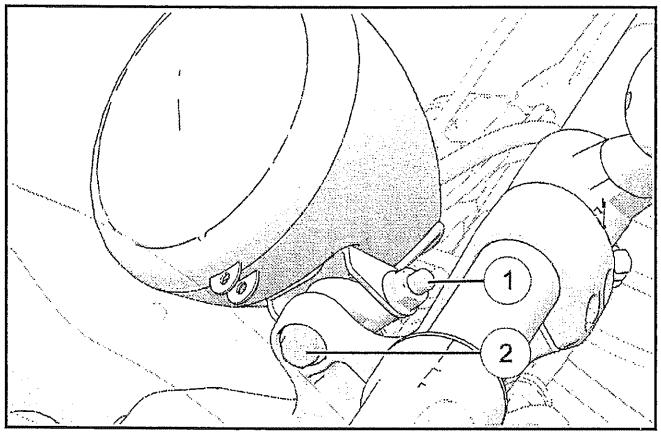
1. Check and adjust the tire pressure. See Tire Pressure / Specifications, page 2.18.
2. Verify suspension ride height is set correctly. See Rear Shock Preload Inspection, page 2.45.
3. Move the motorcycle to a clear area with a level floor and dim lighting, and place it so the top front edge of the headlight housing is 25 ft. (7.6 m) from the wall.
4. Have the rider (and passenger if normally present) straddle the motorcycle in an upright position and sit in the seat(s). Center the handlebars in a straight ahead position.
5. Turn ignition switch ON.
6. Set headlight to HIGH beam.
7. Compare the position of headlight beam on the wall to the illustration below and adjust if necessary.



NUMBER	DESCRIPTION
①	measure distance = 7.5 in (19.0 cm)
②	measure distance = 25 ft (7.6 m)
③	Headlight Center of Bulb

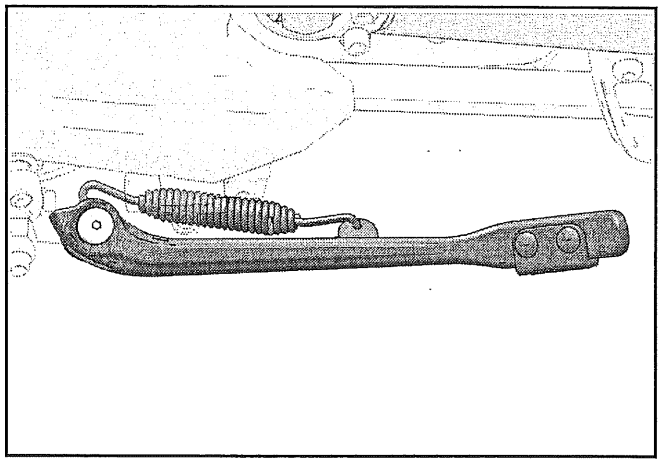
HEADLIGHT AIM ADJUSTMENT

1. To adjust the headlight vertically, loosen the headlight housing mount fastener ① and pivot the headlight housing up or down as required. To adjust the headlight horizontally, loosen the headlight mounting bolt ② and pivot the headlight side-to-side as required.



SIDE-STAND INSPECTION

1. Support the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Inspect side-stand spring for damage or loss of tension. Verify the side-stand returns to fully retracted position.



3. Inspect side-stand for smooth movement.
4. Inspect side-stand pivot fastener nut for proper torque.

TORQUE
Side-stand Pivot Fastener: **35 ft-lbs (47 Nm)**

5. Replace side-stand if it is bent. Do not attempt to straighten side-stand.

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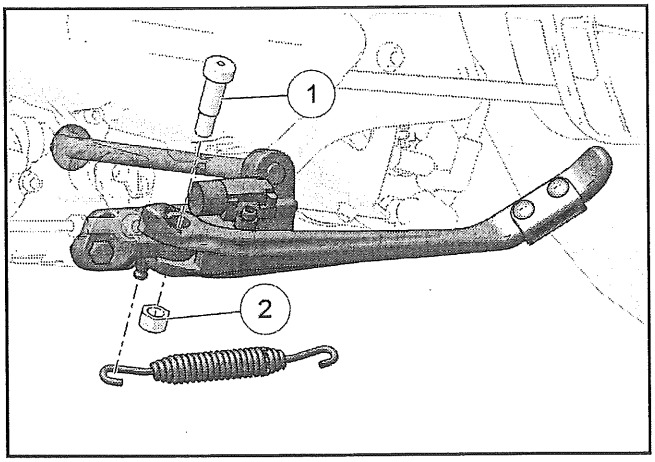
SIDE-STAND REMOVAL / INSTALLATION

⚠ WARNING

The side-stand spring is under tension. Wear eye and face protection when removing and installing the spring and side-stand. Be sure the vehicle is properly secured before you begin.

1. Side-stand will be moved between the UP (retracted) and DOWN (extended) position during removal and installation. Be sure vehicle is properly secured.
2. Remove side-stand pivot bolt ① using a 6 mm hex wrench while holding the nut ② with a 15 mm wrench.



3. Grasp side-stand firmly and move it to the UP position.
4. Pull side-stand rearward against spring tension until mounting flange on side-stand is clear of the mounting boss on the frame.
5. Relax tension and remove spring.
6. *Installation:* Attach spring to side-stand.
7. Lightly grease side-stand mounting boss on frame and the shouldered portion of the pivot bolt.
8. Place loose end of spring through hole in frame rail.
9. With side-stand in the retracted position (up), pull stand rearward against spring tension until the mounting flange on the side-stand drops onto the mounting boss on the frame.
10. Swing side-stand to the extended position to align bolt hole and install bolt and nut.
11. Torque to specification and wipe off any excess grease.

TORQUE
Side-stand Pivot Bolt: **35 ft-lbs (47 Nm)**

12. Cycle the side-stand to be sure it moves freely, and returns to the fully retracted position.

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STEERING HEAD / FRONT WHEEL INSPECTION

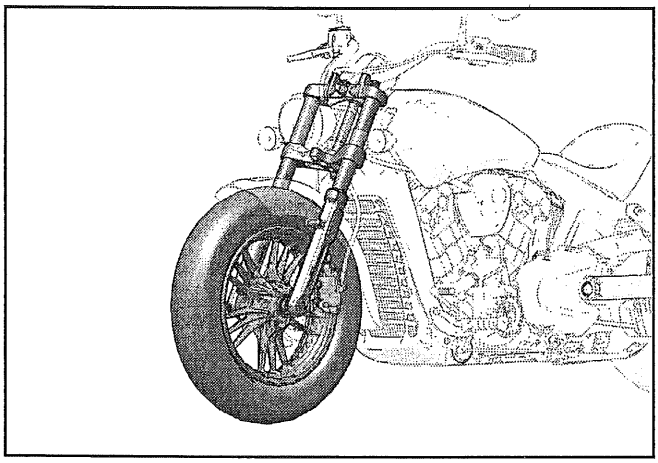
⚠ WARNING

Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

NOTE

Be sure control cables, hoses and wiring are not interfering with handle bar rotation.

1. Secure motorcycle with front wheel off the floor.
2. Turn handlebars from full left to full right and inspect for smooth, free movement. Point front wheel straight ahead, grasp fork tubes and pull/push fork tubes back and forth. If steering binds, feels rough or uneven, or if movement is detected at steering stem, adjust or replace steering head bearings as necessary.



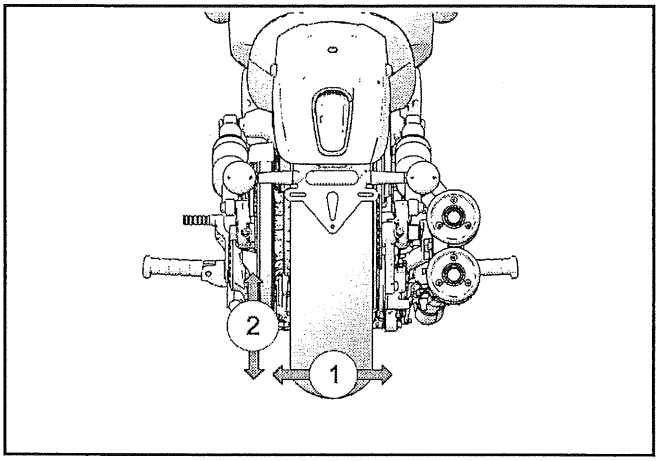
3. Rotate front wheel and inspect for smooth rotation of front wheel bearings. If roughness or unusual sounds are present, replace front wheel bearings. See Steering / Suspension Chapter.
4. Turn handle bars full right or left and hold against the fork stop. Attempt to move front wheel side-to-side. If movement is observed, inspect front axle, wheel, and bearings. See Steering / Suspension Chapter.

SWING ARM INSPECTION

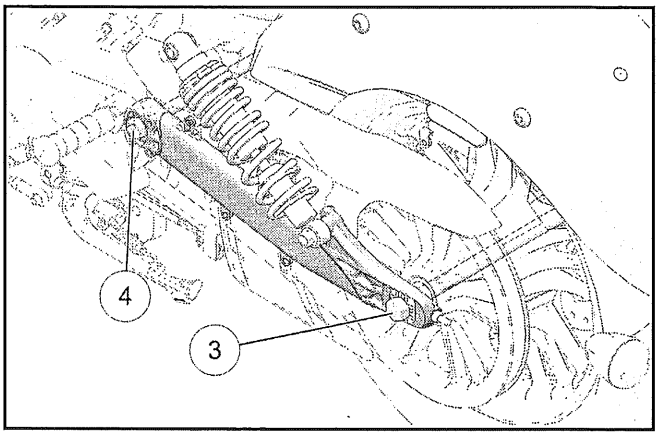
⚠ WARNING

Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

1. Sit astride the motorcycle. Compress the rear suspension several times and check for smooth and quiet operation.
2. Secure motorcycle with rear wheel elevated.
3. Inspect for worn swing arm bearings by grasping the rear wheel and attempting to move wheel side-to-side ① . Inspect for worn bearings and linkages by moving the wheel side-to-side ②.



4. If movement is detected, determine if movement is at axle area ③ or swing arm pivot area ④. Refer to wheel bearing and swing arm bearing replacement.



5. Rotate rear wheel and inspect for smooth rotation of rear wheel bearings. If roughness or unusual sounds are detected, inspect rear wheel bearings, belt tension and alignment, and brake pads.

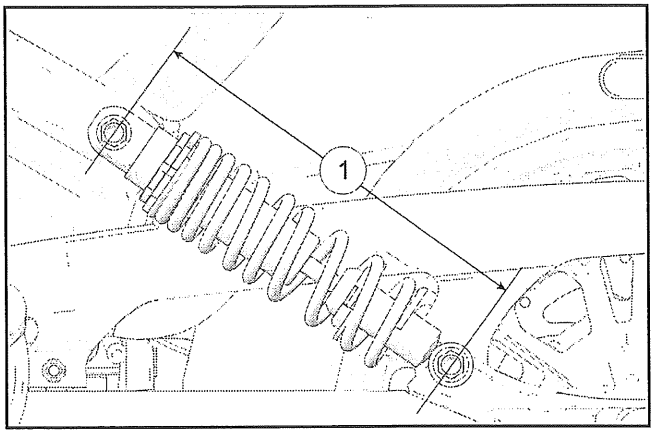
6. Inspect rear shock for leakage and all rear suspension components for damage or loose fasteners.
7. Inspect suspension pivots and shock mounts for radial movement in all pivot joints. If a joint has radial movement, remove rear shock absorber and inspect suspension pivot linkage. See Steering / Suspension Chapter.
8. Replace any worn or damaged parts.
9. Verify axle nut is tight.

TORQUE
Rear Axle Nut: **65 ft-lbs (88 Nm)**

REAR SHOCK PRELOAD INSPECTION

Periodically inspect rear shock preload. For the most comfortable ride and proper ground clearance, adjust preload if ride height is out of specification.

1. Verify that tire pressure is at specification. See Tire Pressure / Specifications, page 2.18.
2. Load the motorcycle with all intended cargo.
3. Determine shock preload ① by measuring from the upper shock mount bolt center to lower shock mount bolt.

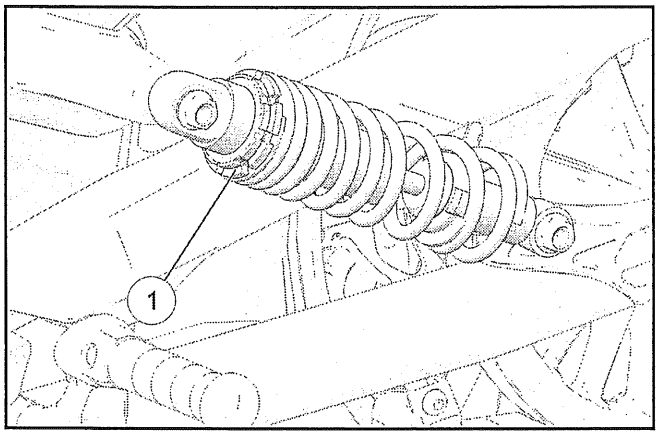


4. Adjust preload as needed to achieve suspension sag indicated in the table below. See (Rear Shock Preload Adjustment) for adjustment procedure.

SHOCK PRELOAD LENGTH	
①	282 mm (from shock mount bolts center-to-center)

REAR SHOCK PRELOAD ADJUSTMENT

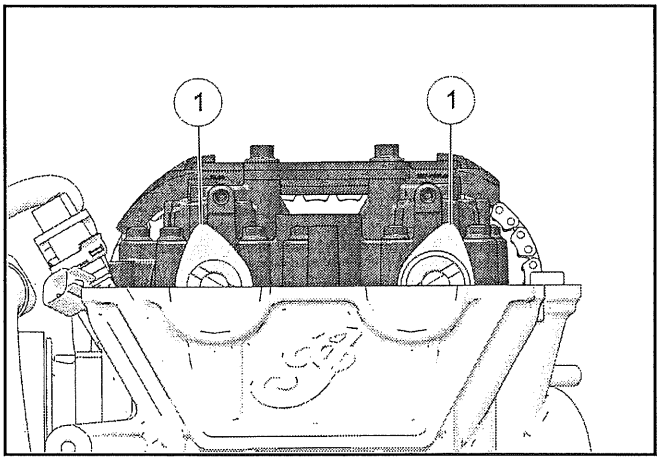
1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Using shock spanner wrench **(PV-46993)** loosen the lock nut ① by turning it counter-clockwise (as viewed from the top of the shock).
3. Spray a light lubricant on the adjuster nut where it contacts the spring.
4. Adjust shock preload by rotating the adjuster nut clockwise (as viewed from the top of the shock) to **INCREASE** preload (firm) or counter-clockwise to **DECREASE** preload (softer).



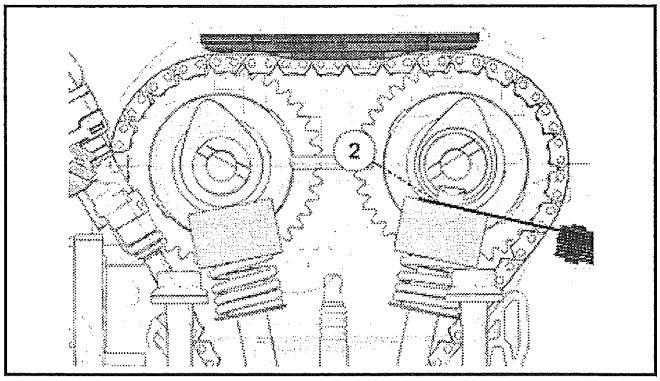
5. Recheck the preload measurement after adjusting.
6. Tighten the lock nut securely against the adjuster nut.

VALVE CLEARANCE INSPECTION

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Remove the fuel tank. See Fuel Tank Removal, page 4.14.
3. Remove air box. SeeAir Box Removal, page 3.4.
4. Remove thermostat housing cover. See Thermostat Cover Removal / Installation, page 7.11.
5. Remove valve covers. SeeValve Cover Removal, page 3.60.
6. Remove spark plugs.
7. Remove flywheel access cover.
8. Rotate the engine CCW (from flywheel side) until the cam lobes ① are facing away from valves being inspected.



9. Measure the valve clearance at location ② with a feeler gauge.



10. If the valve clearance is out of specification, proceed to "Valve Clearance Adjustment". See Valve Clearance Adjustment , page 2.47.
11. Repeat steps 8 - 10 on each of the eight valves.
12. If previously removed, apply anti-seize compound to the spark plug threads and reinstall the spark

plugs. Torque spark plugs to specification. See Spark Plug Installation, page 2.30.

13. Inspect the valve cover seal and replace if necessary.
14. Install **NEW** isolators on the valve cover bolts. Install the valve cover and the three T40 bolts. Torque cover bolts to specification. SeeValve Cover Installation, page 3.60
15. Install the ignition coil. See Ignition Coil Removal / Installation, page 10.35.
16. Install the air box. See Air Box Installation, page 3.5.
17. Install the fuel tank. See Fuel Tank Installation, page 4.19.
18. Install the seat. See Seat Removal / Installation, page 7.8.

VALVE CLEARANCE ADJUSTMENT

Procedure to adjust valve clearance as part of scheduled maintenance.

NOTE

Consult the Periodic Maintenance Interval Table for maintenance intervals.

1. If any of the valve clearance measurements are out of specification, remove the camshaft carriers and camshafts and proceed with this procedure.

Intake Camshaft - PN 3022484
Exhaust Camshaft - PN 1204693

MEASUREMENT

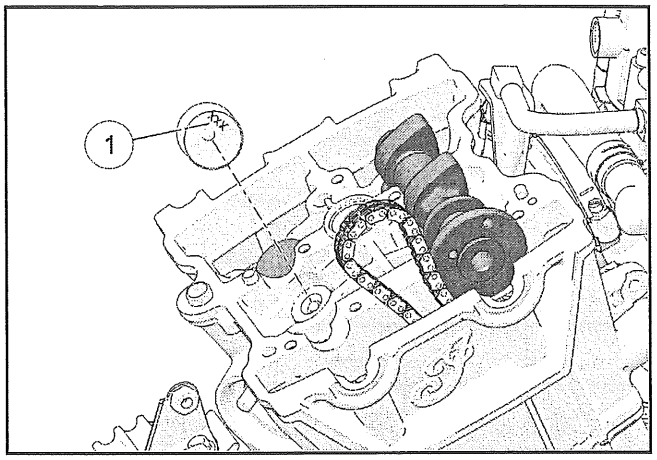
Intake Valve Clearance (cold): 0.006 in (0.152 mm)
Exhaust Valve Clearance (cold): 0.008 in (0.203 mm)

2. Remove the valve tappet from a valve that was out of specification.

NOTE

Keep mated parts together and in order with respect to their location in the cylinder head for assembly purposes. Mark each component or place them in an organized rack as you remove them.

3. Record the 3 digit number on the bottom of the tappet ① .



4. Reference the valve clearance measurement recorded for that valve, along with the 3-digit tappet number.
5. Refer to the appropriate tappet selection matrix to select the proper tappet. See Intake Valve Lash - Tappet Selection Matrix, page 3.74 orExhaust Valve Lash - Tappet Selection Matrix, page 3.75.
6. Install the proper tappet.

NOTE

Lubricate the outer portion of the valve tappet upon installation.

7. Repeat steps 2 - 6 until all necessary valves have been adjusted.
8. Reinstall the camshafts and camshaft carriers and tighten the bolts evenly to specification.

TORQUE

Camshaft Carrier Bolts:
88 in-lbs (10 Nm)

9. Measure and confirm that valve clearance is now within specification for each valve.
10. If valve clearance is not within specification, repeat this procedure.

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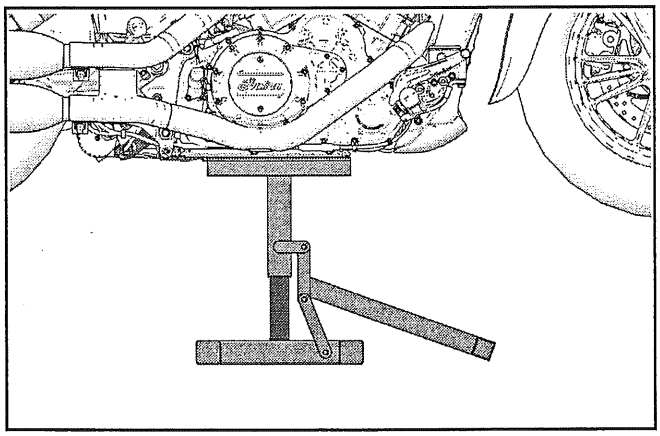
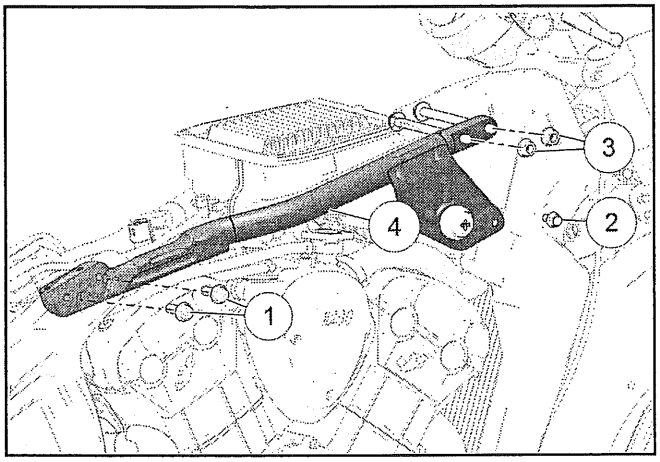
AIR CLEANER SERVICE

AIR BOX REMOVAL

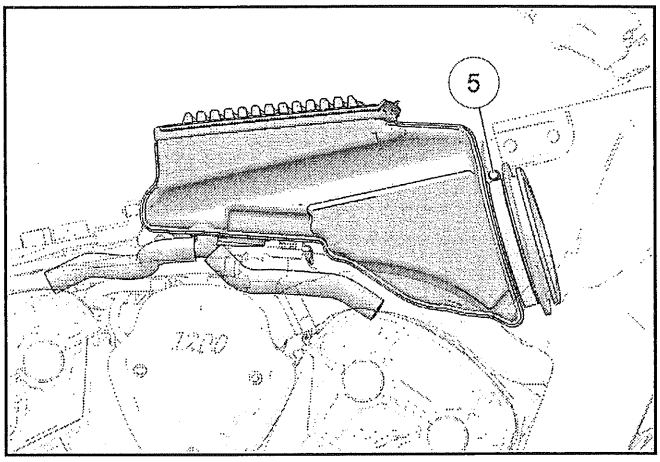
1. Secure motorcycle in an upright position and place a suitable jack under engine.



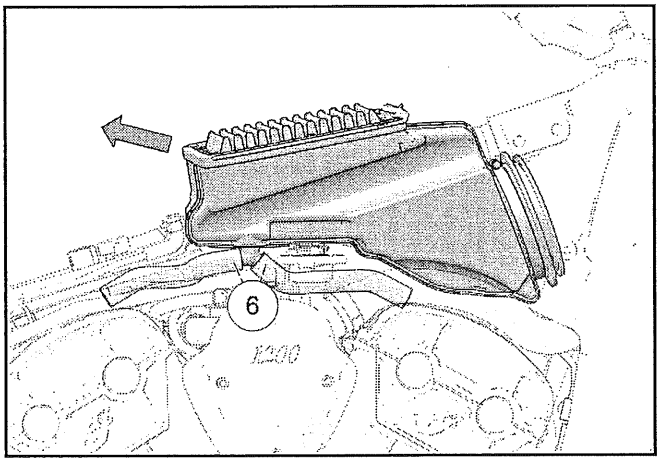
2. Remove seat. See Seat Removal. Seat Removal / Installation, page 7.8
3. Remove fuel tank. See Fuel Tank Removal. Fuel Tank Removal, page 4.14
4. Remove frame tube to mid-casting bolts ①, two nuts ③ and bolt ② retaining the right frame tube ④.



5. Remove both frame tubes.
6. Loosen the air inlet boot clamp ⑤.

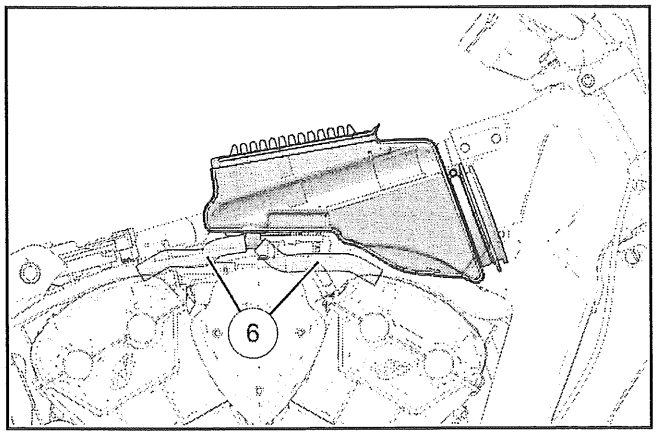


7. Disconnect the breather hoses ⑥ from the air box fitting and lift the back of the air box to remove from throttle body.

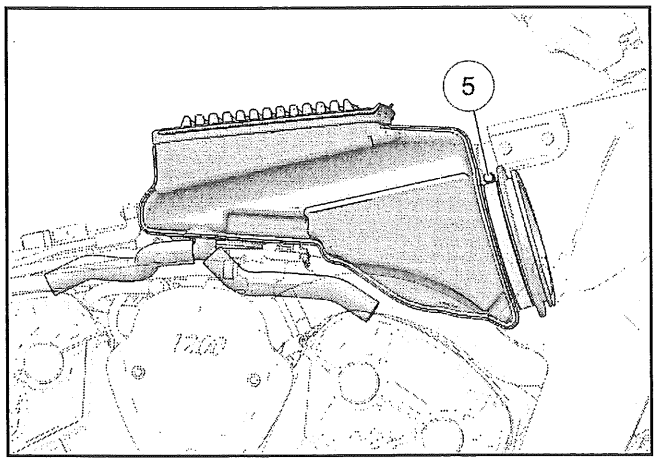


AIR BOX INSTALLATION

1. Connect the breather hoses ⑥ to the air box fitting and slide the front of the air box in place.

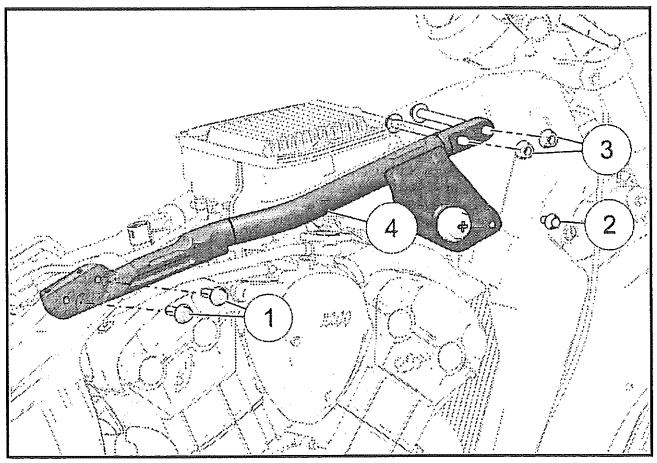


2. Tighten the clamp ⑤ securing the air box to the air inlet boot.



3. Install both frame tubes.

4. Install the frame Tube to Mid-Cast Bolts①, two nuts ③ and Bracket bolt ② retaining the right frame tube ④. Torque Fasteners to Specification.



TORQUE
Frame Tube to Mid-Cast/Frame Fasteners ① and ③: **35 ft-lbs (47 Nm)** Frame Tube Bracket to Frame Fastener ②: **19 ft lbs (26 Nm)**

5. Install fuel tank. See Fuel Tank Installation, page 4.19.

6. Install seat. See Seat Removal / Installation, page 7.8.

ENGINE REMOVAL / INSTALL

GENERAL INFORMATION

SERVICE NOTES

A floor jack or commercially available motorcycle engine lift or hoist is required for engine removal. Arrange for assistance when removing and installing the engine.

Once the engine is removed from frame, an engine stand is recommended for engine disassembly and assembly.

Engine removal and installation methods may differ slightly depending on available equipment, but always be sure the engine and chassis are securely supported at all times.

REQUIRES ENGINE REMOVAL FOR SERVICE	CAN BE SERVICED WITH ENGINE IN FRAME
Camshaft(s) / Bearings	Airbox Removal
Crankshaft & Crankshaft Component Service	Camshaft Chain / Guide / Tensioner Assembly
Cylinder Heads	Fuel Injectors / Throttle Body / Fuel Rail
Cylinders	Voltage Regulator, Stator, Rotor (Flywheel)
Lifters	Clutch
Oil Pump	Gearshift Linkage (External)
Balance Shaft	Ignition System
Piston/Cylinder	Oil Pump Drive
Pushrods	Output Shaft Seal
Transmission/All Internal Transmission Parts	Torque Compensator Assembly
Valve Covers	
Starter, Starter One-Way Clutch, Starter Torque Limit Clutch	
Crankshaft Position Sensor Timing Wheel	

SPECIAL TOOLS

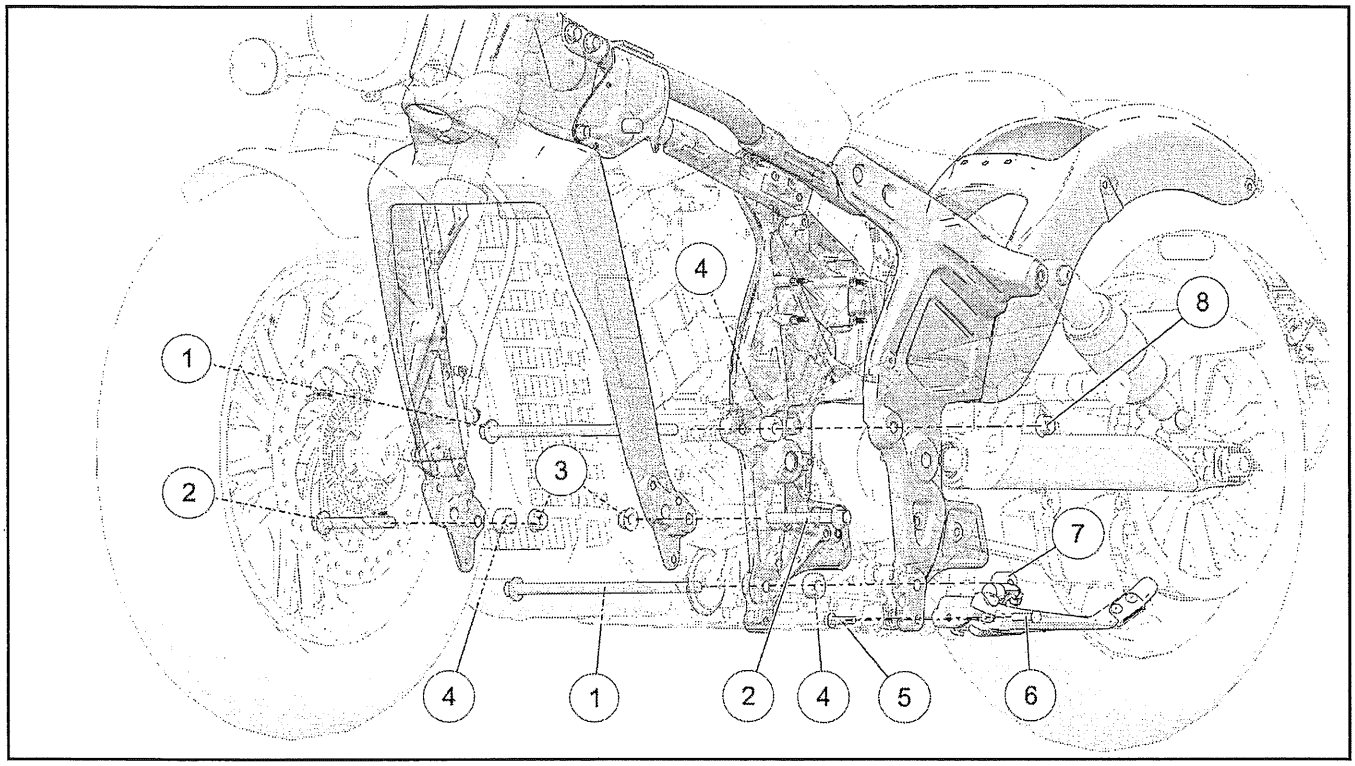
TOOL DESCRIPTION	PART NUMBER
Engine Stand Adapter	PF-51240
Motorcycle Table Lift / Wheel Vise	Commercially Available
12"x12" Platform Jack	Commercially Available
Engine Hoist (Cherry Picker)	Commercially Available
Engine Stand	Commercially Available

Bosch Automotive Service Solutions: 1–800–345–3322 or https://polaris.service-solutions.com/

SERVICE SPECIFICATIONS

ITEM	SPECIFICATIONS
Engine Dry Weight	Approximately 200 lbs (91 kg)
Oil Capacity (Dry Fill)	Approximately 4.5 Quarts (4.3 Liters)

ASSEMBLY VIEWS
ENGINE BRACKET / FASTENER COMPONENTS
ENGINE MOUNTING BRACKETS / FASTENERS



NUMBER	PART DESCRIPTION	TORQUE (IF APPLICABLE)
①	Mid Frame to Engine Fasteners	**51 ft-lbs (69 Nm)**
②	Frame to Engine Fastener (front)	**51 ft-lbs (69 Nm)**
③	Nut	-
④	Spacer	-
⑤	Side Stand Fastener	**19 ft-lbs (26 Nm)**
⑥	Side Stand Fastener	**19 ft-lbs (26 Nm)**
⑦	Sidestand Assembly Mount	-
⑧	Nut	-

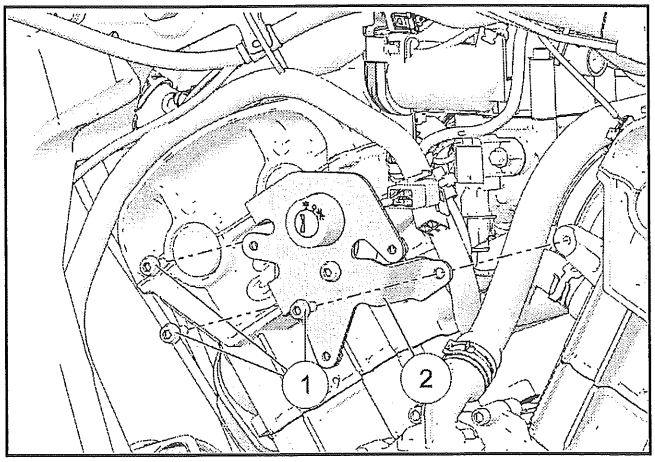
ENGINE REMOVAL

PREPARATION FOR ENGINE REMOVAL

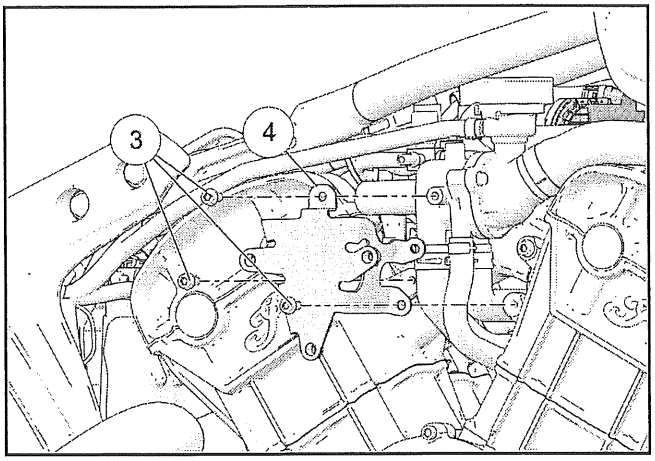
NOTE

Different methods can be used to remove the engine depending on the equipment available to the technician. All methods require the front wheel to be held securely in an upright position.

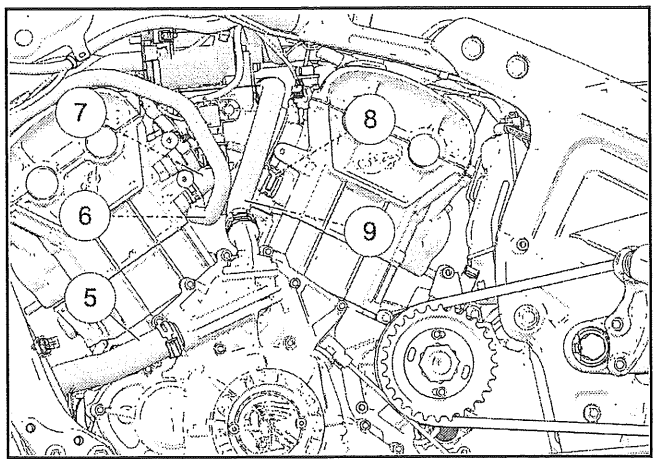
1. Support motorcycle securely in an upright position. Clamp front tire securely in a wheel vise.
2. Remove thermostat housing cover. See Thermostat Cover Removal / Installation, page 7.11.
3. Remove ignition side cover. See Ignition Cover Removal / Installation, page 7.11
4. Remove the seat. See Seat Removal / Installation, page 7.8.
5. Remove the battery. See Battery Removal, page 10.12.
6. Remove the fuel tank. See Fuel Tank Removal, page 4.14.
7. Drain the cooling system. See Coolant Drain / Fill, page 2.17.
8. Remove the radiator assembly. See Radiator Removal / Installation, page 3.35
9. Remove the mufflers. See Muffler Removal, page 3.92.
10. Remove the exhaust head pipe assembly. SeeHead Pipe Removal, page 3.94
11. Remove the sprocket cover. See Drive Sprocket Cover Removal / Installation, page 8.39.
12. Loosen axle nut and remove belt from drive sprocket. See Drive Belt Adjustment, page 2.38
13. Remove air box. See Air Box Removal, page 3.4.
14. Reinstall the frame tubes removed in previous step and torque all fasteners to specifications. See Air Box Installation, page 3.5.
15. Remove both driver foot controls. See Driver Foot Peg Removal / Installation, page 7.6
16. Remove brake line from right side of engine.
17. Disconnect clutch cable from clutch lever on engine.
18. Remove horn assembly. See Horn Removal / Installation, page 10.51.
19. Remove the ignition switch cover bracket fasteners ① and bracket ②.



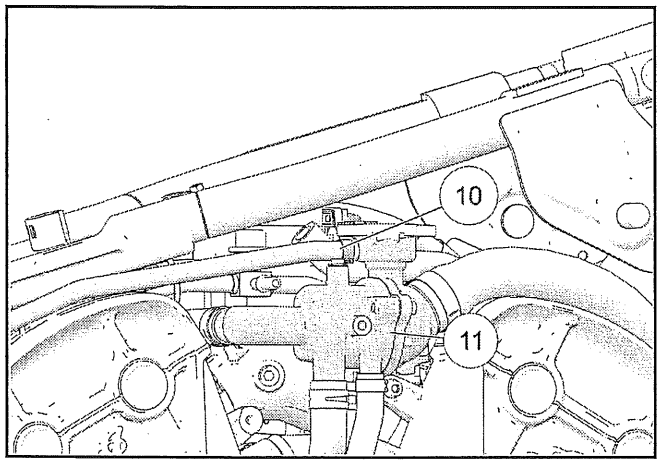
20. Remove the thermostat cover bracket fasteners ③ and bracket ④.



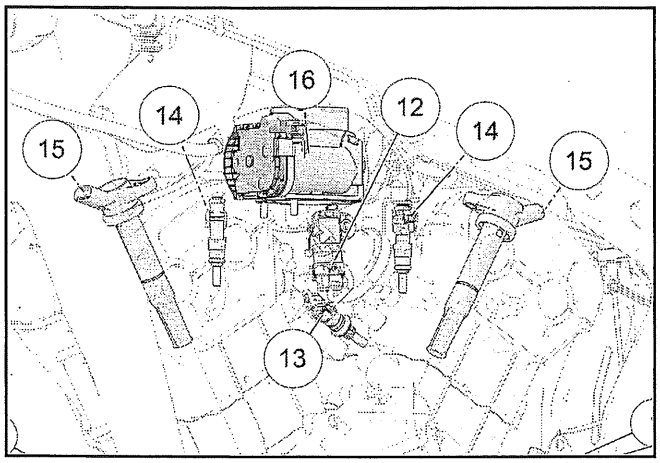
21. Disconnect the radiator outlet hose ⑤, oil cooler coolant feed hose ⑥, front head coolant outlet hose ⑦, rear head coolant outlet hose ⑧ and bypass hose ⑨ from the engine.



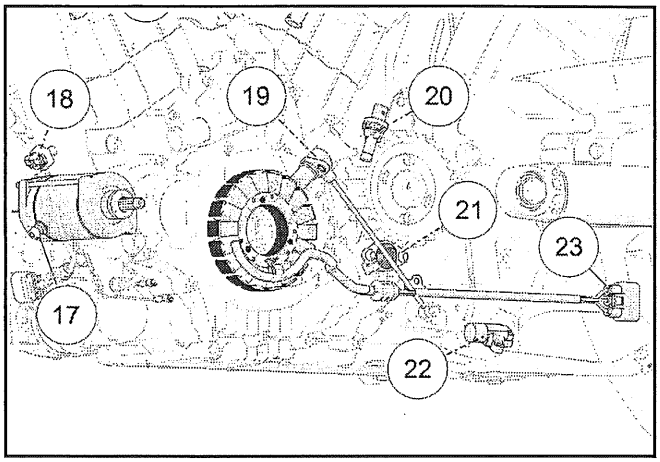
22. Disconnect the overflow reservoir hose ⑩ and remove the thermostat housing ⑪.



23. Disconnect the TMAP sensor connector ⑫.



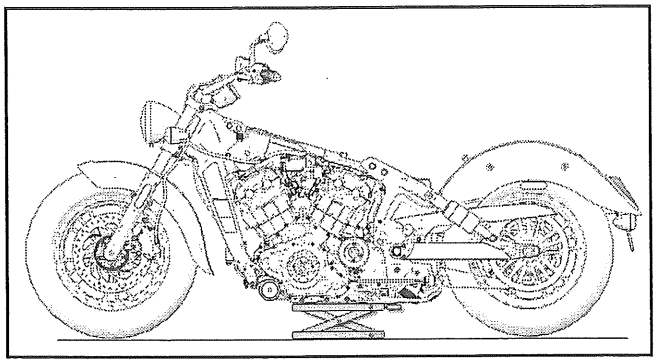
24. Disconnect the CTS sensor connector ⑬.
25. Disconnect both fuel injector connectors ⑭.
26. Disconnect both ignition coil connectors ⑮.
27. Disconnect the electronic throttle body connector ⑯.
28. Disconnect the starter motor battery cable at the terminal ⑰.



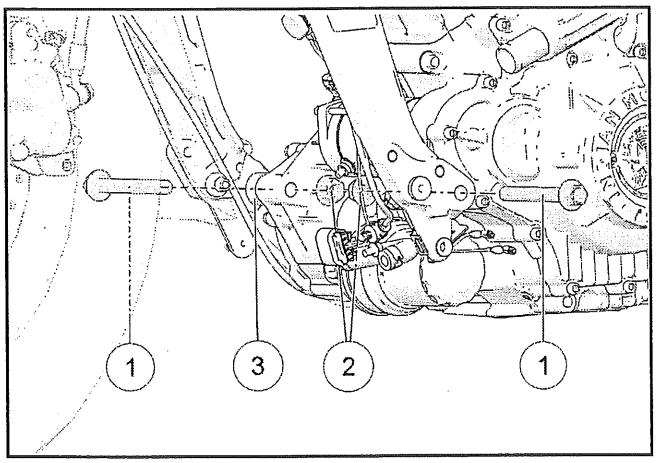
29. Disconnect the oil pressure switch connector ⑱. See Sensors - Powertrain Management, page 4.11.
30. Disconnect the crankshaft position sensor connector ⑲.
31. Disconnect the vehicle speed sensor connector ⑳.
32. Disconnect the gear position switch connector ㉑. See Sensors - Powertrain Management, page 4.11.
33. Disconnect the side stand switch connector ㉒.
34. Disconnect the stator connector.
35. Proceed to engine removal. See Removing Engine From Frame, page 3.11.

REMOVING ENGINE FROM FRAME

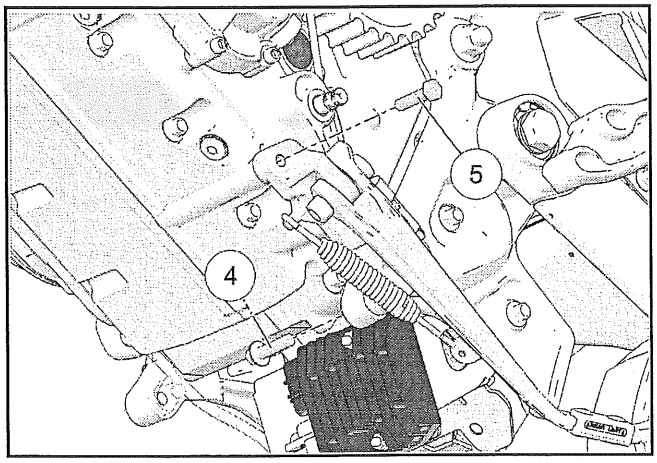
1. Perform the preliminary engine removal steps outlined in this chapter. See Preparation For Engine Removal, page 3.9.
2. Place a platform jack beneath the engine and raise enough to support engine. Note: Jack should firmly contact the engine crankcase.



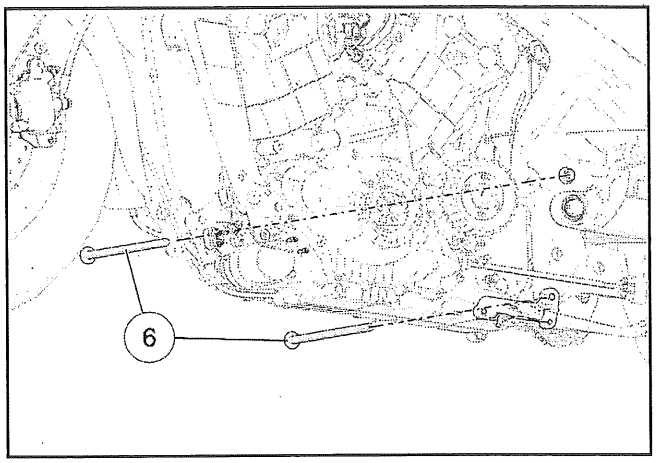
3. Remove the two front motor mount bolts ① and nuts ② from the engine case.



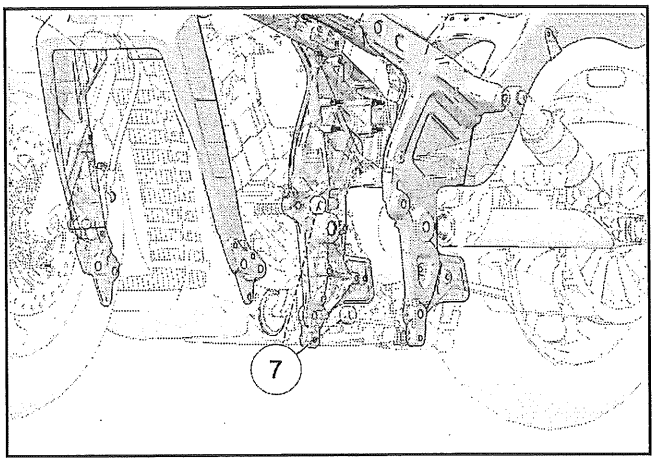
4. Retain the right side spacer ③ for reassembly.
5. Remove inner ④ and outer ⑤ side stand fasteners.



6. Verify platform jack is placed securely under engine cases.
7. Remove engine mount bolts ⑥ from right side of frame and remove side stand assembly.



8. Remove spacers ⑦ located between the right side engine case and mid frame.



9. Push engine slightly to the RH side to free up from alignment dowels. With an assistant, lower the engine from the frame and remove from vehicle.

ENGINE INSTALLATION

The following procedure is written assuming the engine has been assembled and is resting on an engine stand, ready for installation.

Refer toEngine Brackets / Fasteners, page 3.8 in this chapter for torque values and assembly views.

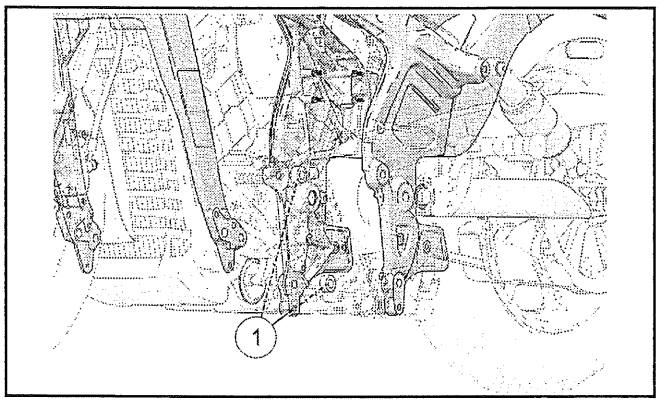
CAUTION

Arrange for assistance when installing engine. The engine must be held securely to prevent damage to engine, frame, wiring, or hoses. The engine is very heavy and could cause severe personal injury if not handled properly. Be sure engine is properly supported before proceeding.

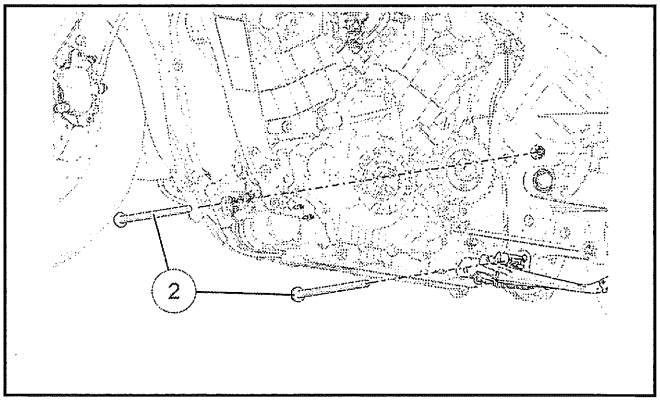
IMPORTANT

Be sure alignment dowels are in place in the RH rear engine mounts prior to installation.

1. Clean mating surfaces of frame and engine crankcase. Install alignment spacer dowels ① between right side engine case and mid frame.



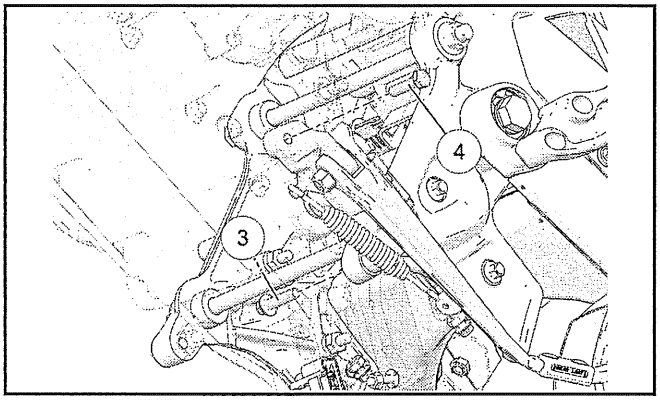
2. Secure motorcycle in an upright position with the front wheel clamped in a wheel vise.
3. Position the engine on a platform jack to the left of the motorcycle and slide into position so the engine is orientated correctly front to back.
4. Slide the engine back until the rear mounting ears are aligned with the mounting holes in the mid frame. Adjust height of engine as needed to align rear mounts and dowel pins.
5. Be sure all wiring and hoses are properly routed before installing rear spacers and mounting bolts.
6. Install the two engine mounting bolts ② into the RH frame panel with side stand assembly and tighten until the engine is fully drawn into the frame panel. **Do not torque bolts at this time.**



CAUTION

Be sure engine is aligned at the proper height and angle with the dowel pins. DO NOT force engine alignment using the mounting bolts, or the dowel pins may be damaged! Adjust engine height and angle continuously as required while drawing up the bolts.

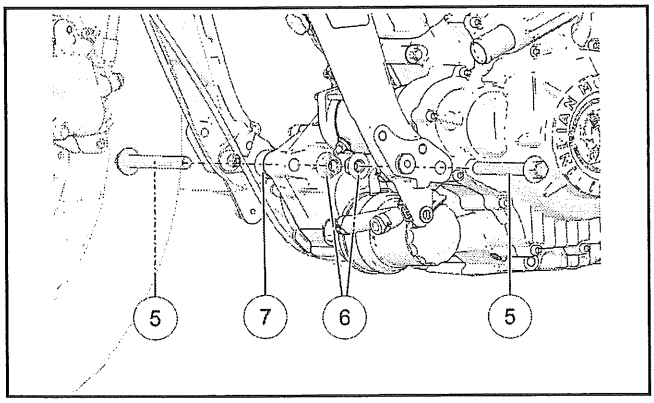
7. Install the inner ③ and outer ④ side stand fasteners. Torque fasteners to specification.



TORQUE

Side Stand Mounting Fasteners:
19 ft-lbs (26 Nm)

8. Install the two front motor mount bolts ⑤, nuts ⑥, and spacer ⑦ through frame into the engine case. Torque to specification.

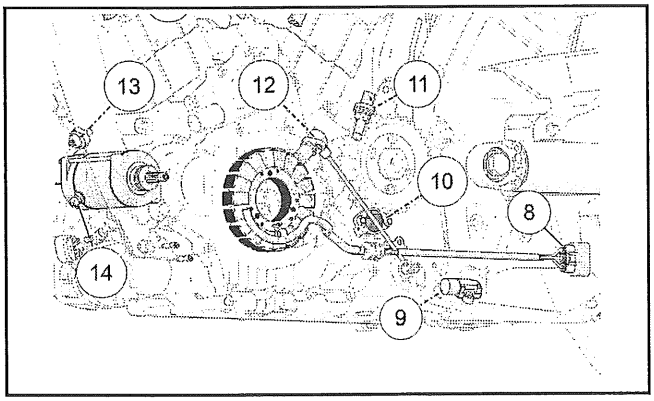


TORQUE
Frame to Engine Fastener (front): **51 ft-lbs (69 Nm)**

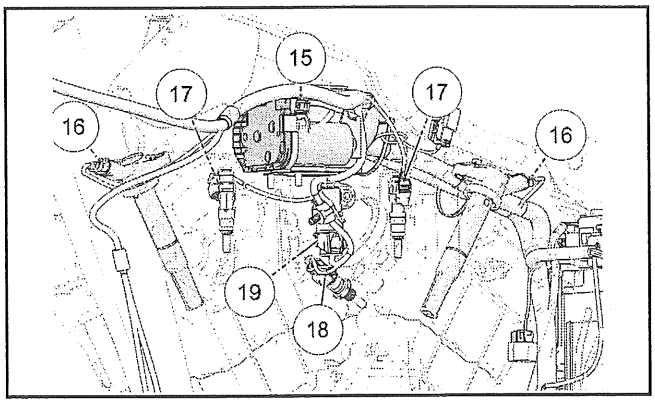
9. Torque the RH rear engine mounting bolts to specification.

TORQUE
Mid Frame to Engine Fasteners: **51 ft-lbs (69 Nm)**

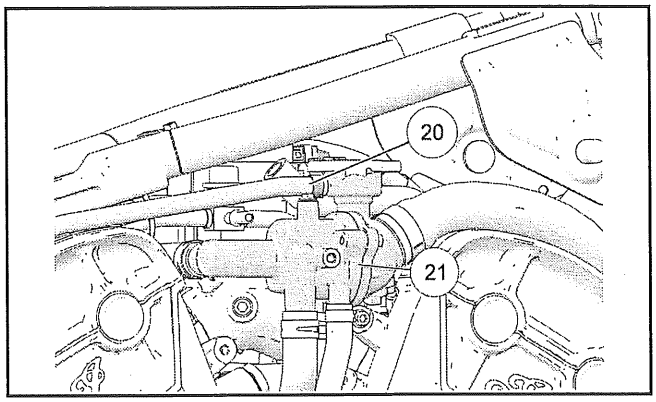
10. Connect the stator connector ⑧.



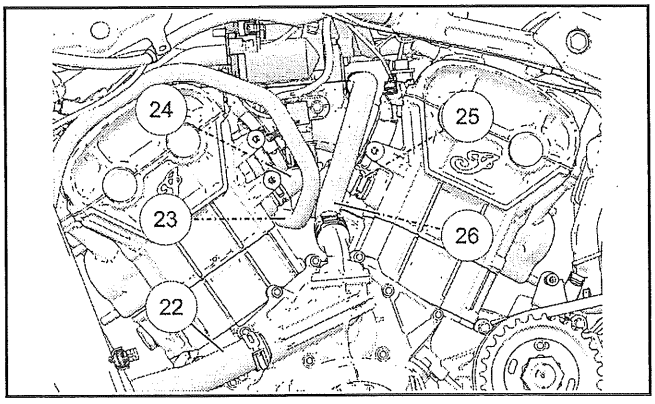
11. Connect the side stand switch connector ⑨.
12. Connect the gear position switch connector ⑩. See Sensors - Powertrain Management, page 4.11.
13. Connect the vehicle speed sensor connector ⑪.
14. Connect the crankshaft position sensor connector ⑫.
15. Connect the oil pressure switch connector ⑬. See Sensors - Powertrain Management, page 4.11.
16. Connect the starter motor battery cable at the terminal ⑭.
17. Connect the electronic throttle body connector ⑮.



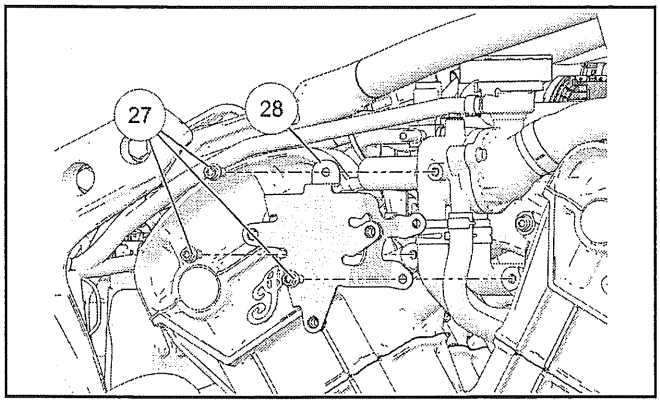
18. Connect both ignition coil connectors ⑯.
19. Connect both fuel injector connectors ⑰.
20. Connect the CTS sensor connector ⑱.
21. Connect the TMAP sensor connector ⑲.
22. Connect the overflow reservoir hose ⑳ to the thermostat housing fitting㉑.



23. Connect the radiator outlet hose ㉒, oil cooler coolant feed hose㉓, front head coolant outlet hose ㉔, rear head coolant outlet hose ㉕ and bypass hose ㉖ on the engine.



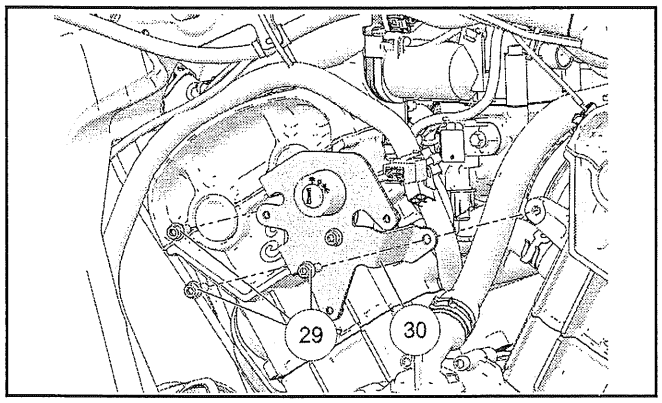
24. Install the thermostat cover bracket fasteners ㉗ and bracket ㉘. Torque fasteners to specification.



TORQUE

Thermostat Cover Bracket Fasteners:
96 in-lbs (11 Nm)

25. Install the ignition switch cover bracket fasteners ㉙ and bracket ㉚. Torque fasteners to specification.



TORQUE

Ignition Switch Cover Bracket Fasteners:
12 ft-lbs (16 Nm)

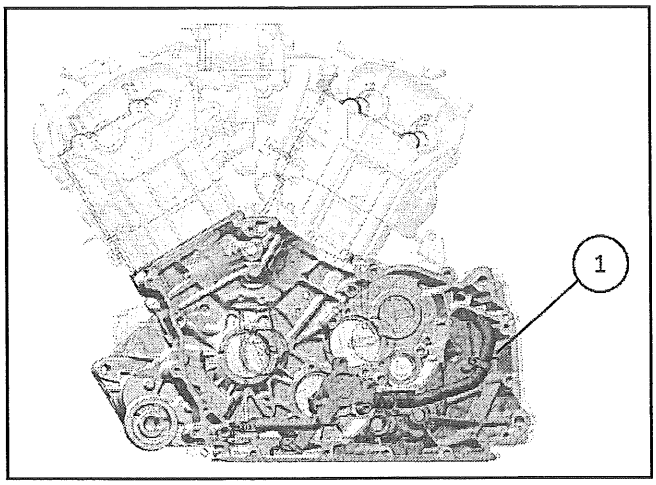
26. Install horn assembly. SeeHorn Removal / Installation, page 10.51.
27. Connect clutch cable to clutch lever on engine.
28. Install both driver foot controls. SeeDriver Foot Peg Removal / Installation, page 7.6.
29. Install air box, frame tubes and torque all fasteners to specifications. SeeAir Box Installation, page 3.5.
30. Install belt from drive sprocket and axle nut. Align the drive belt. SeeDrive Belt Adjustment, page 2.38.
31. Install the sprocket cover. SeeDrive Sprocket Cover Removal / Installation, page 8.39.
32. Install the exhaust head pipe assembly. See Head Pipe Installation, page 3.95.
33. Install the mufflers. See Muffler Installation, page 3.93.
34. Install the radiator assembly. SeeRadiator Removal / Installation, page 3.35.
35. Fill and bleed the cooling system. SeeCoolant Drain / Fill, page 2.17.
36. Install the fuel tank. SeeFuel Tank Installation, page 4.19.
37. Install the battery. SeeBattery Installation, page 10.12.
38. Install the seat. SeeSeat Removal / Installation, page 7.8.
39. Install ignition side cover. SeeIgnition Cover Removal / Installation, page 7.11.
40. Install thermostat housing cover. SeeThermostat Cover Removal / Installation, page 7.11.

LUBRICATION / COOLING

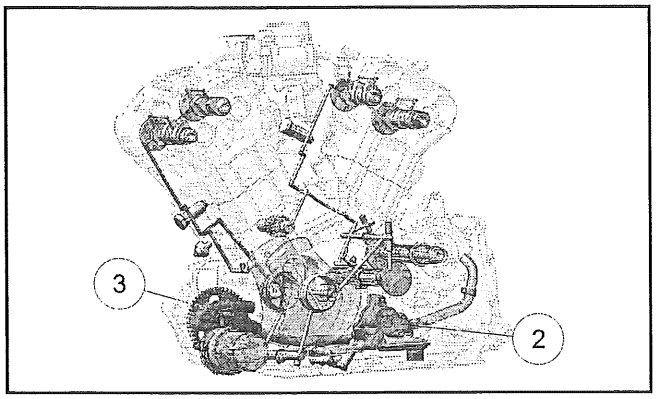
GENERAL INFORMATION

SERVICE NOTES

The Scout uses a semi-dry sump lubrication system. The engine oil is housed in a separate chamber within the engine cases ① as shown in the image below.



The engine has two separate oil pumps, a scavenge pump ② and pressure (lubrication) pump ③. The scavenge pump has two sets of internal gerotors. One set scavenges oil from the right side of the engine crankcase and the second set from the left side. The scavenge pump supplies oil to fill the oil tank area ① of the engine. The oiling system pressure relief valve is located inside the pressure oil pump.



To access the scavenge oil pump, the stator cover must be removed. To access the pressure pump, remove the right engine cover. Before disassembly, review the troubleshooting charts located in this chapter.

If the engine is making irregular noises that appear to be coming from rotating parts, check the lubrication side oil pressure. Check the oil pressure before engine disassembly, and recheck the oil pressure after a repair.

TROUBLESHOOTING

LOW OIL PRESSURE	HIGH OIL PRESSURE
Incorrect oil being used or low oil level Engine temp above test temperature range Damaged O-rings or leaks at pipes or fittings Damaged or worn oil pump or oil pump drive Pressure relief valve stuck open Damaged engine bearings/excessive engine wear. Restricted oil filter, oil filter screen or passages	Incorrect oil being used Additives added to oil to increase viscosity Engine temp below test temperature range Restricted oil passages Incorrect oil filter Pressure relief valve stuck closed

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Oil Pressure Gauge	PV-43531

Bosch Automotive Service Solutions: 1-800-345-2233 or https://polaris.service-solutions.com/

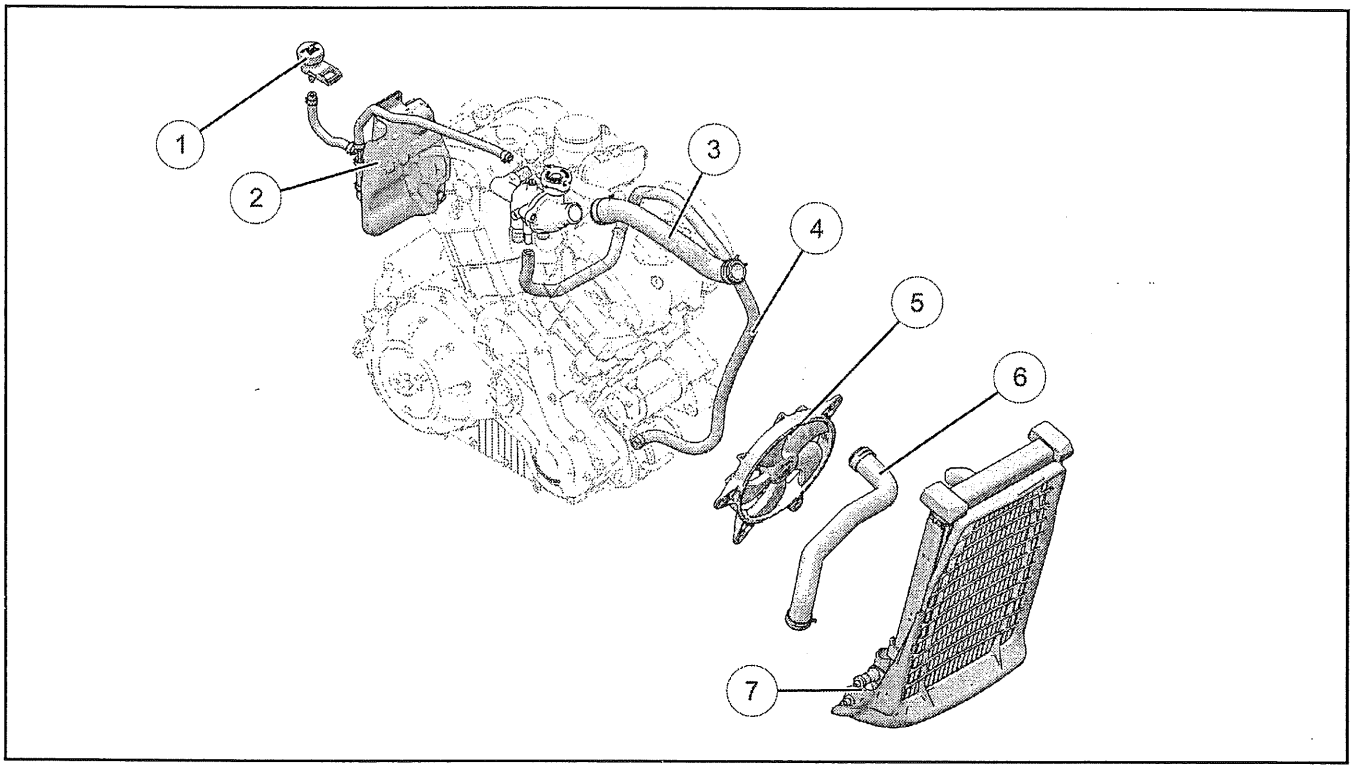
SERVICE SPECIFICATIONS

ITEM	STANDARD	SERVICE LIMIT
Engine Oil Fill Capacity (for DRY rebuilt engine)	4.5 U.S. qts (4.3 Liters)	Not Applicable
Engine Oil Capacity (for Change with Filter) Follow the oil change procedure outlined in the Maintenance Chapter.	3.0 - 3.5 U.S. qts (2.8 - 3.3 Liters)	Not Applicable
Engine Oil Capacity (for Change without Filter) Follow the oil change procedure outlined in the Maintenance Chapter.	2.9 - 3.2 U.S. qts (2.7 - 3.0 Liters)	Not Applicable
Recommended Engine Oil if Indian Motorcycle 15W60 is not available, use motorcycle oil with same specifications.	Indian Motorcycle Synthetic 15W60	Not Applicable
Oil Pressure @ 3000 rpm (supply side) **Measurements must be taken with engine at operating temperature and specified Indian Motorcycle Engine Oil**	40 psi (275 kPa) Readings should be within 20% of the specification.	MINIMUM PRESSURE: 32 psi (220 kPa)

OIL PUMP CLEARANCES (SCAVENGE)		
Pump Gerotor OD to Oil Pump Body	.003"-.007" (0.100 mm - 0.200 mm)	.011" (.300 mm)
Oil Pump End Clearance	.0019"-.003" (.050 mm - 0.100 mm)	.007" (.200 mm)
Gerotor Tip Clearance	.0031"-.007" (.080 mm -.200 mm)	.0098" (.250 mm)
OIL PUMP CLEARANCES (FEED)		
Pump Gerotor OD to Oil Pump Body	.003"-.007" (0.100 mm - 0.200 mm)	.011" (.300 mm)
Oil Pump End Clearance	.0019"-.003" (.050 mm - 0.100 mm)	.007" (.200 mm)
Gerotor Tip Clearance	.0031"-.0059" (.080 mm - .150 mm)	.007" (.200 mm

COOLING SYSTEM SPECIFICATIONS		
ITEM	**DESCRIPTION**	**SPECIFICATION / CAPACITY**
Capacity Engine Coolant / Antifreeze	Extended Life Anti-Freeze 50/50 Premixed (Yellow)	System 2.77 Qts (2.63 Ltrs) / Recovery Bottle .16 Qt (.15 Ltrs)
Thermostat	Opening Temperature	180 Degrees F (82 Degrees C)
Cooling System Pressure Cap	Relief Pressure	16 PSI
COOLING FAN OPERATION		
CONDITION	**APPROXIMATE RESISTANCE OHMS Ω**	**TEMPERATURE**
Engine Protection Misfire	120Ω	240.8 Degrees F (116 Degrees C)
Coolant Hot Lamp (On Solid)	140Ω	233.6 Degrees F (112 Degrees C)
Cooling Fan On	200Ω	204.8 Degrees F (96 Degrees C)
Cooling Fan Off	210Ω	203.0 Degrees F (95 Degrees C)
Room Temperature	2500Ω	68 Degrees F (20 Degrees C)

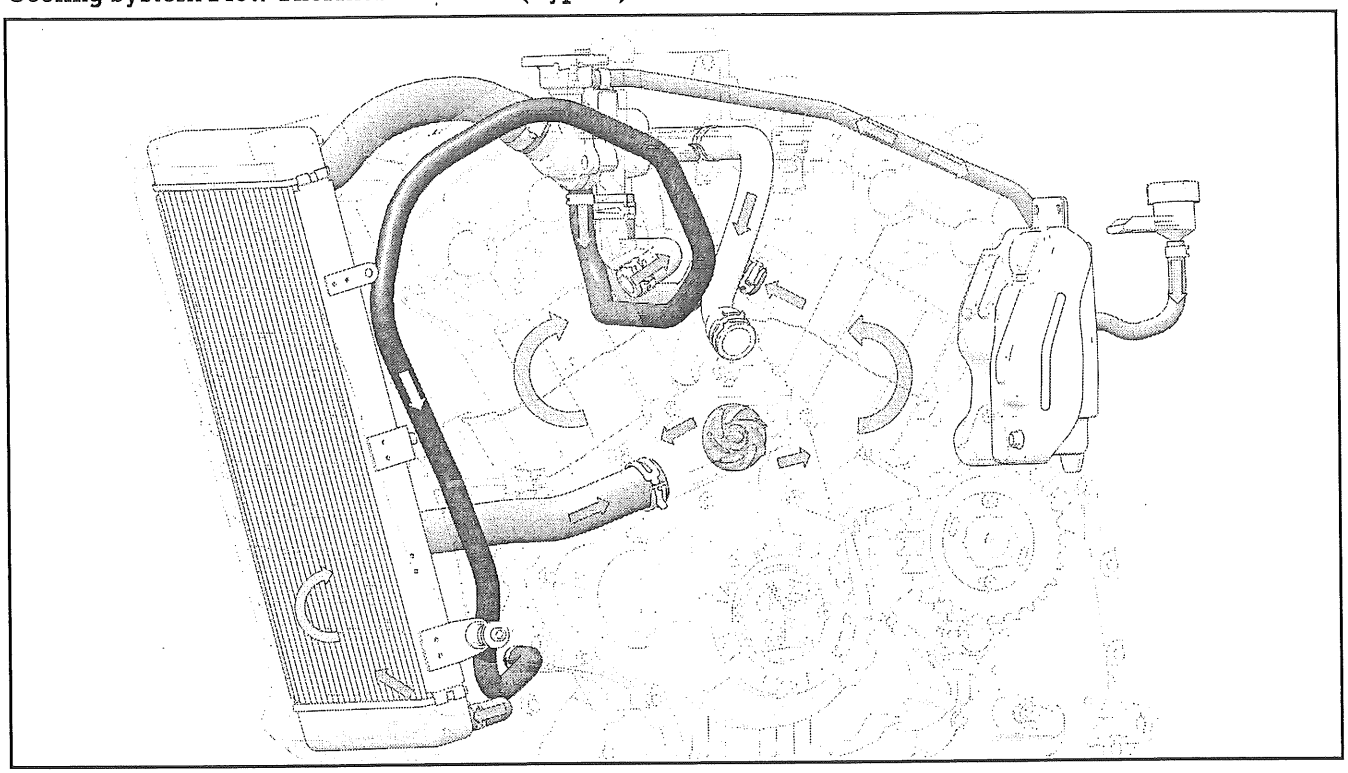
ASSEMBLY VIEWS
COOLING SYSTEM COMPONENTS



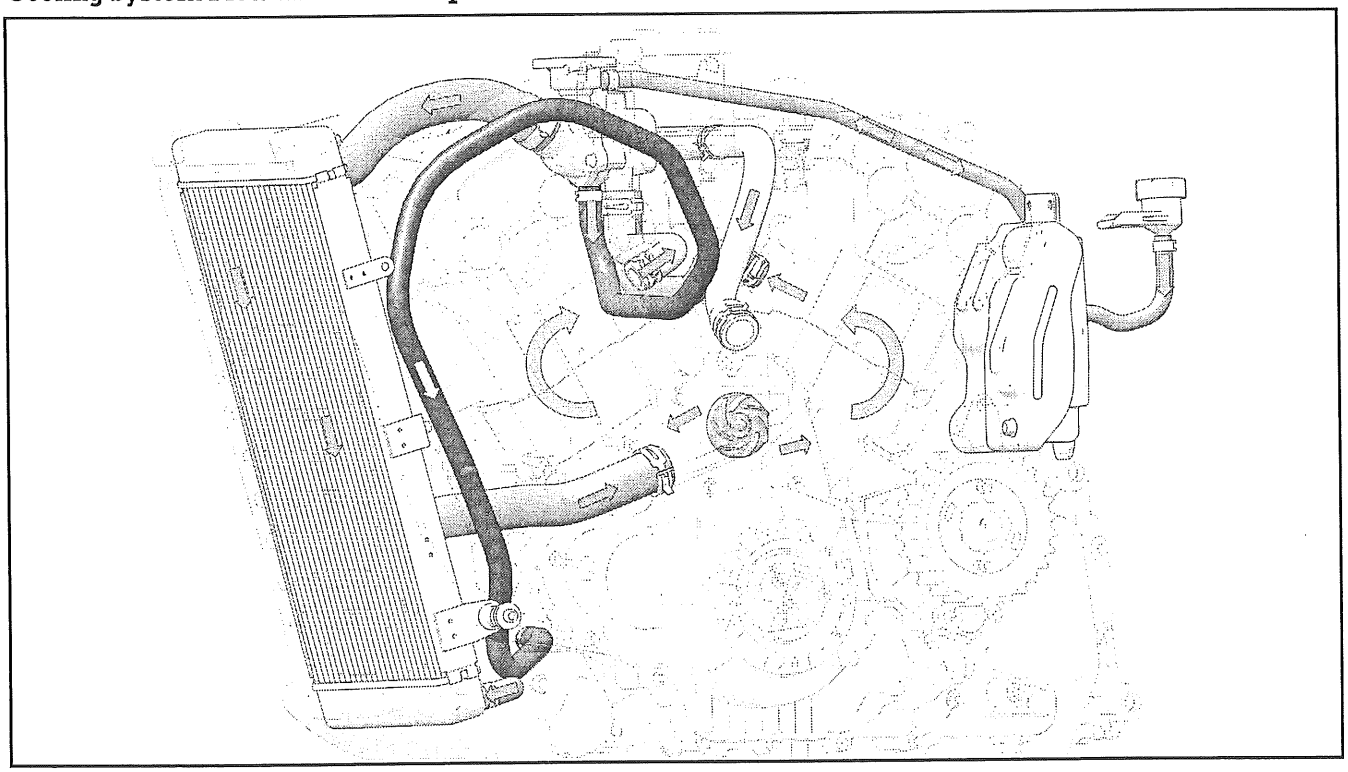
NUMBER	DESCRIPTION
①	Funnel Coolant Filler
②	Coolant Surge Tank
③	Coolant Radiator Inlet Hose
④	Coolant Oil Cooler Inlet Hose
⑤	Cooling Fan Assy
⑥	Coolant Radiator Outlet Hose
⑦	Radiator Assy

COOLANT FLOW DIAGRAM

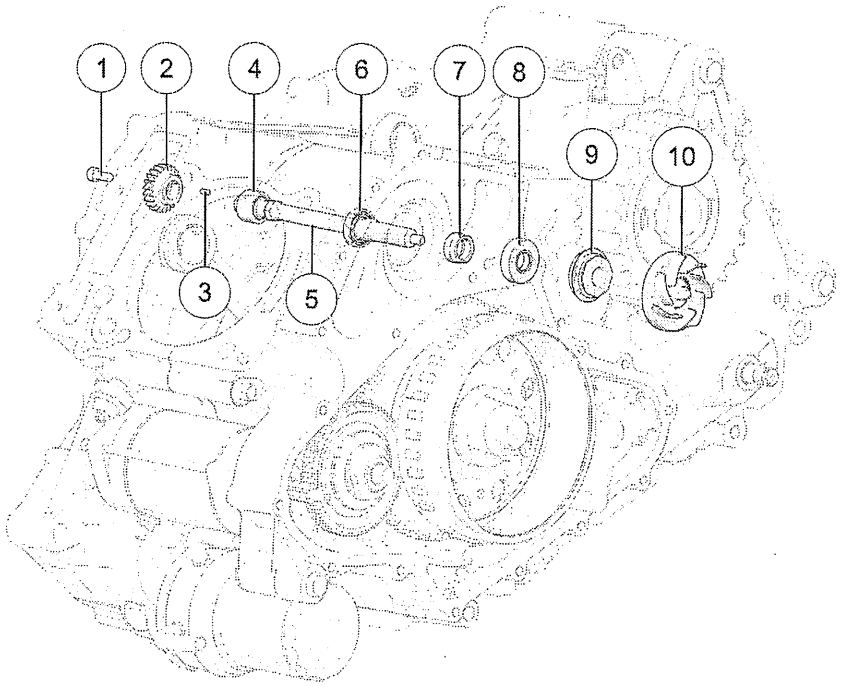
Cooling System Flow Thermostat Closed (Bypass)



Cooling System Flow Thermostat Open



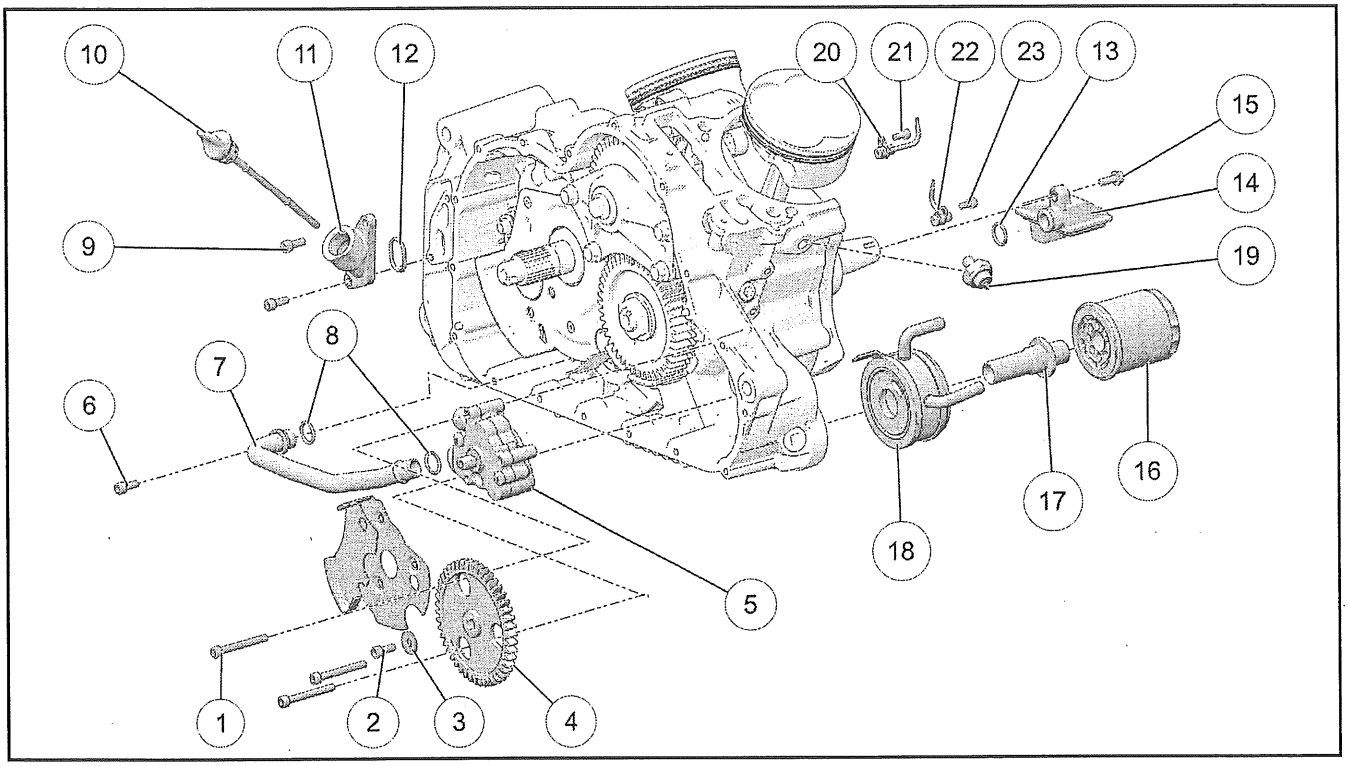
WATER PUMP COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	SCREW	-
②	WATER PUMP DRIVEN GEAR	-
③	WATER PUMP DRIVEN GEAR PIN	-
④	NEEDLE BEARING	-
⑤	WATER PUMP SHAFT	-
⑥	ROLLER BEARING	-
⑦	WATER PUMP SHAFT NUT	**13 ft-lbs (18 Nm)**
⑧	SHAFT SEAL	-
⑨	SHAFT WATER SEAL	-
⑩	WATER PUMP IMPELLER	**30 in-lbs (3 Nm)**

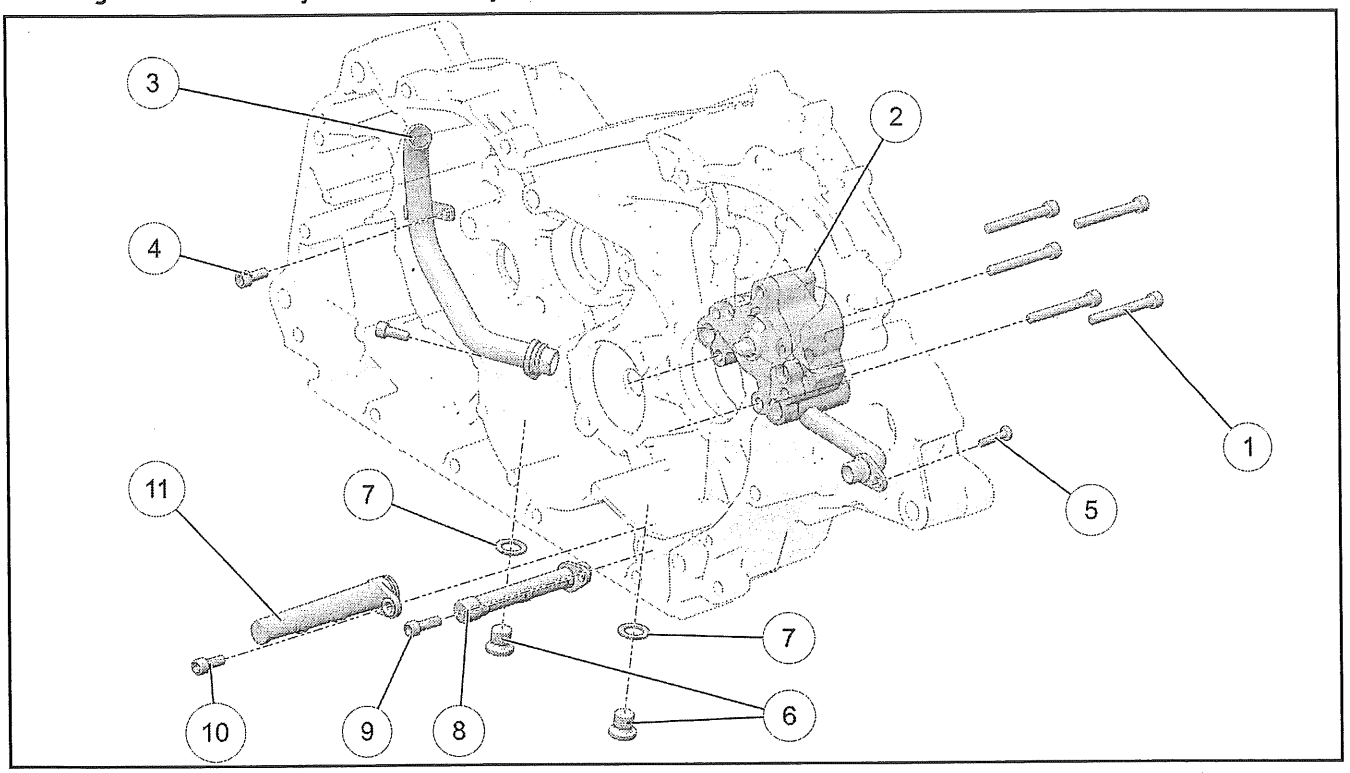
LUBRICATION SYSTEM ASSEMBLY VIEW

Pressure Lubrication System Assembly View



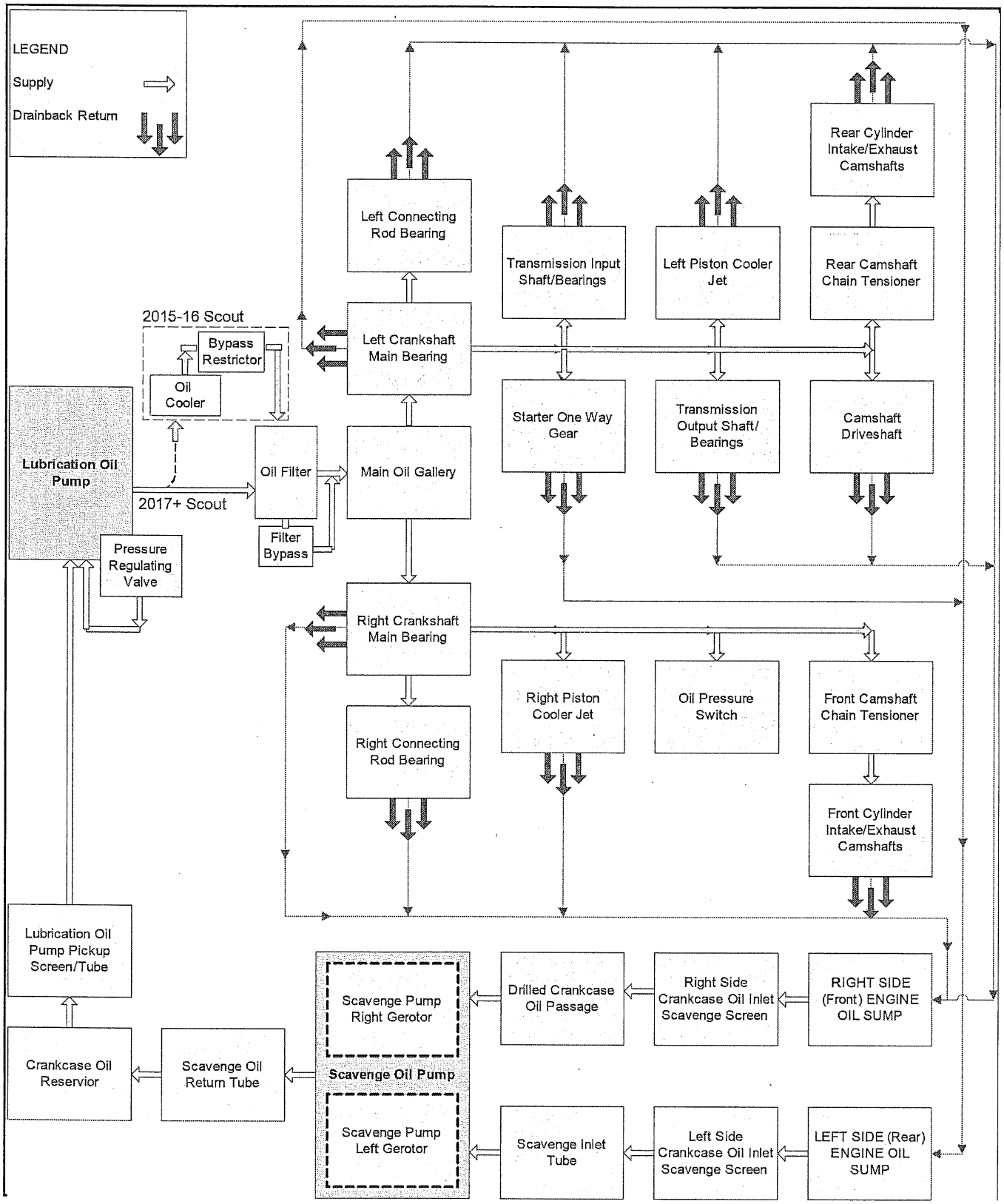
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Oil Pump to Crankcase Fasteners (QTY.3)	**88 in-lbs (10 Nm)**
②	Oil Pump Gear Fastener	**88 in-lbs (10 Nm)**
③	Oil Pump Gear Washer	–
④	Oil Pump Gear	–
⑤	Oil Pump Assembly (Pressure)	–
⑥	Inlet tube to Oil Pump Fastener	**88 in-lbs (10 Nm)**
⑦	Oil Pressure Inlet Tube	–
⑧	Oil Pressure Inlet Tube Seal (QTY 2)	–
⑨	Dipstick Adapter Fastener	**88 in-lbs (10 Nm)**
⑩	Engine Oil Level Dipstick	–
⑪	Engine Oil Dipstick Adapter	–
⑫	Engine Oil Adapter Seal	–
⑬	Oil Pump Pickup Seal	–
⑭	Oil Pump Pickup Screen	–
⑮	Oil Pump Pickup Screen Fastener	**88 in-lbs (10 Nm)**
⑯	Engine Oil Filter	**115 in-lbs (13 Nm) or approximately 3/4 to 1 full turn after seal contacts the filter mount sealing surface.**
⑰	Oil Cooler Spigot	**22 ft-lbs (30 Nm)**
⑱	Engine Oil Cooler (2015–16 models only)	–
⑲	Oil Pressure Switch	**88 in-lbs (10 Nm)**
⑳	Piston Rear Cooling Jet	–
㉑	Piston Cooling Jet Fastener	**62 in-lbs (7 Nm)**
㉒	Piston Front Cooling Jet	–
㉓	Piston Cooling Jet Fastener	**62 in-lbs (7 Nm)**

Scavenge Lubrication System Assembly View



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Scavenge Oil Pump Fasteners (QTY.3)	**88 in-lbs (10 Nm)**
②	Engine Oil Scavenge Pump	-
③	Scavenge Oil Return Tube	-
④	Scavenge Oil Return Tube Fastener	**88 in-lbs (10 Nm)**
⑤	Scavenge Inlet Tube Fastener	**88 in-lbs (10 Nm)**
⑥	Engine Oil Drain Plug	**15 ft-lbs (20 Nm)**
⑦	Oil Drain Plug Sealing Washer	-
⑧	Inlet Scavenge Engine Oil Screen	-
⑨	Oil Scavenge Inlet Screen Fastener	**88 in-lbs (10 Nm)**
⑩	Oil Scavenge Inlet Screen Fastener	**88 in-lbs (10 Nm)**
⑪	Inlet Scavenge Engine Oil Screen	-

OIL FLOW DIAGRAM



OIL PRESSURE INSPECTION

OIL PRESSURE

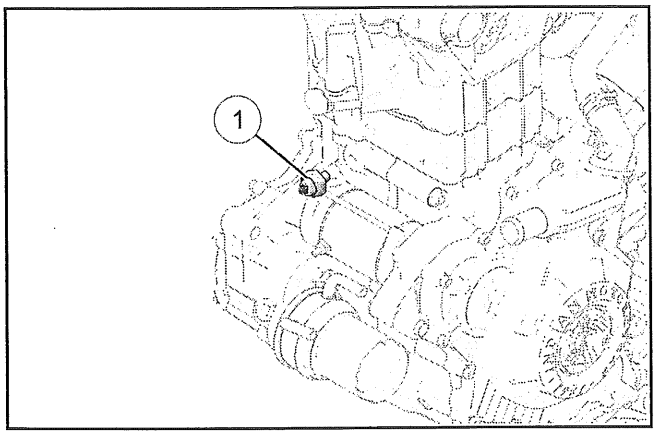
CAUTION

Use caution when working around hot engine oil.

NOTE

Oil pressure switch activates at 3 psi ± 1 psi.

1. Start the engine and run until operating temperature is reached.
2. Turn the engine OFF.
3. Remove oil pressure sensor ①.



4. Install oil pressure gauge.
5. Use the dipstick to check the engine oil level and add recommended oil, if necessary.
6. Start engine and check oil pressure at 3000 rpm.
7. Compare reading to oil system specifications.
8. If oil pressure is outside of specification, refer to troubleshootingTroubleshooting, page 3.15.
9. Once testing is completed, clean threads with Loctite Primer N, and apply thread sealant to the oil pressure switch threads and torque to specification.

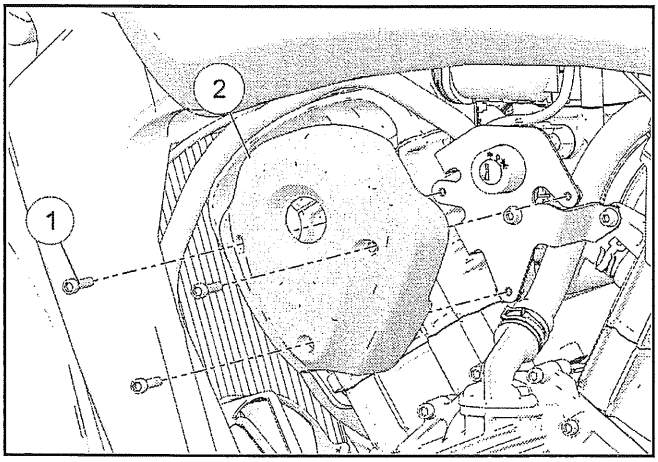
TORQUE

Oil Pressure Switch:
88 in-lbs (10 Nm)

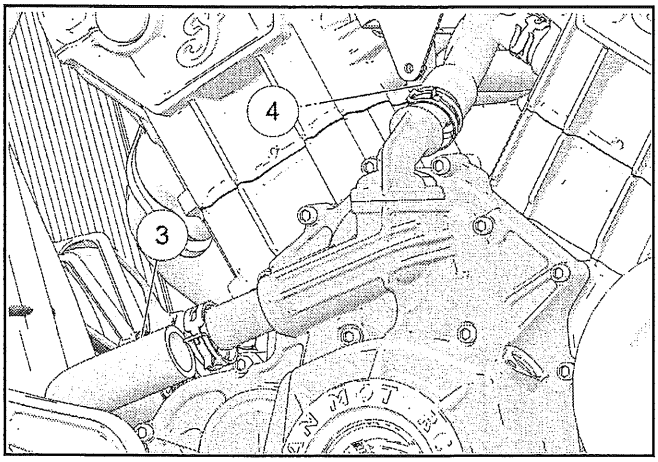
OIL PUMP SERVICE

SCAVENGE OIL PUMP REMOVAL

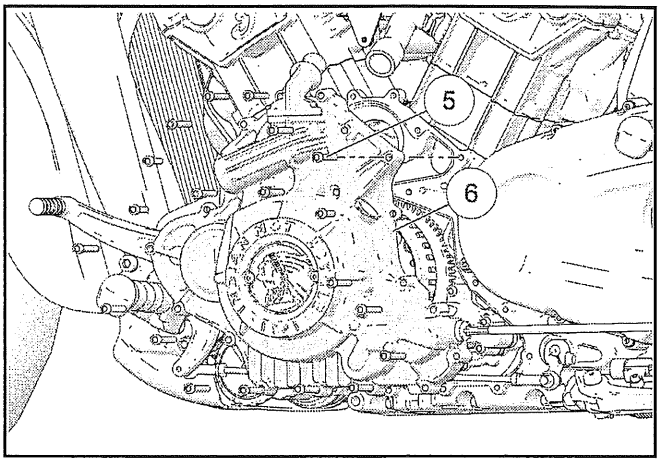
1. Drain cooling system. Coolant Drain / Fill, page 2.17
2. Remove the left side ignition cover fasteners ① and cover ②.



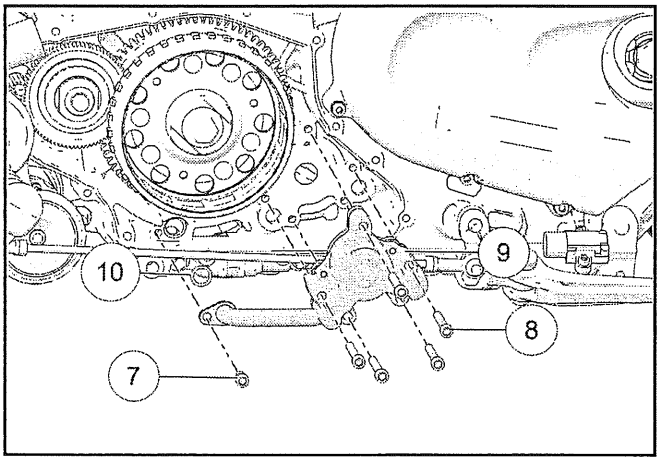
3. Disconnect the radiator outlet hose ③ from the fitting on the stator cover.



4. Disconnect coolant bypass return hose ④ from the stator cover.
5. Remove the crankshaft position sensor CPS. See Crankshaft Position Sensor Test/Replace.
6. Disconnect the stator electrical connector.
7. Remove the stator cover fasteners ⑤ and stator cover assembly ⑥.



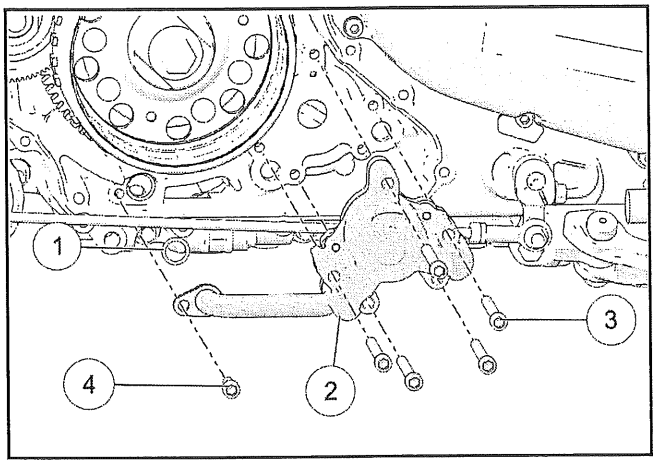
8. Remove the scavenge inlet tube fastener ⑦ and scavenge oil pump fasteners ⑧.



9. Remove scavenge oil pump assembly ⑨.
10. Remove and discard the O-ring on both sides ⑩.

SCAVENGE OIL PUMP INSTALLATION

1. Install a new o-ring ① on the inlet tube.



2. Install the oil pump ② into the crankcase and loosely install fastener ④ securing the inlet tube to the LH crankcase.
3. Align bolt holes and install oil pump fasteners③ and torque to specification.

TORQUE
Scavenge Oil Pump Fasteners: **88 in-lbs (10 Nm)**

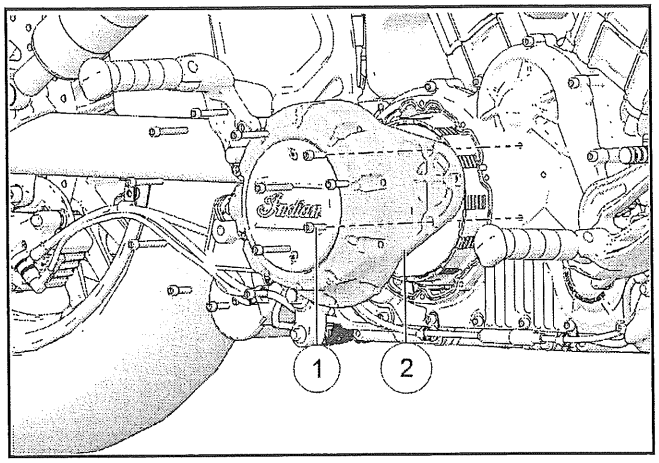
4. Torque inlet tube fastener to specification.

TORQUE
Scavenge Inlet Tube Fastener: **88 in-lbs (10 Nm)**

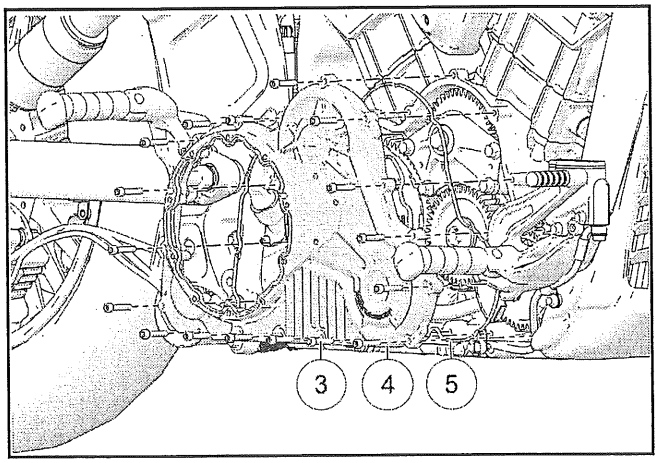
5. Install engine stator cover. SeeStator Cover Installation, page 5.21.
6. Verify engine oil pressure after assembly. See Oil Pressure, page 3.25.

PRESSURE OIL PUMP REMOVAL

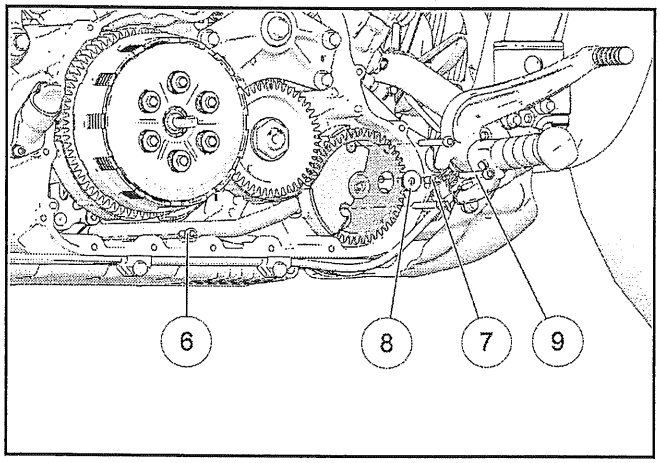
1. Remove exhaust head pipe. SeeHead Pipe Removal, page 3.94.
2. Disconnect clutch cable from engine clutch lever. SeeClutch Cable Removal / Installation, page 8.13.
3. Remove primary cover fasteners ① and cover assembly ②.



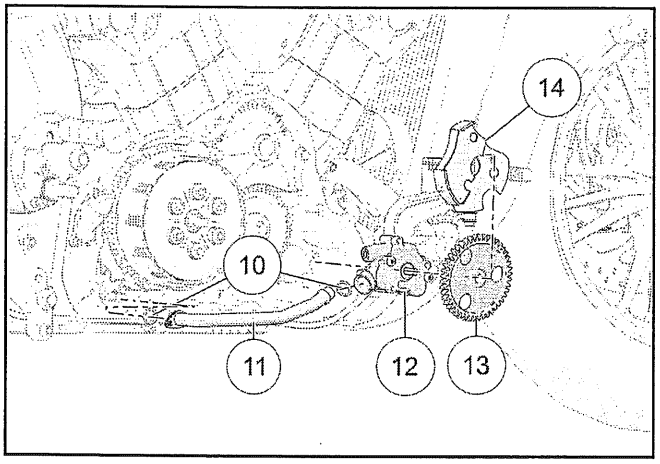
4. Remove primary drive cover fasteners ③, seal ⑤ and cover assembly ④.



5. Remove pressure pump pickup tube fastener ⑥, gear fastener ⑦, washer ⑧ and three mounting bolts ⑨.



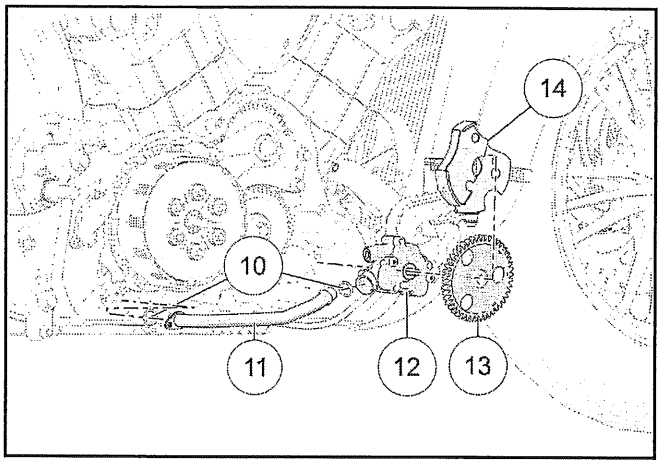
6. Remove pressure pump ⑫ and inlet tube ⑪ assembly from engine.



7. Separate inlet tube ⑪ from pressure pump ⑫ and discard inlet tube seals ⑩.
8. Separate gear shield ⑭ from oil pump gear ⑬.

PRESSURE OIL PUMP INSTALLATION

1. Assemble gear shield ⑭ and gear ⑬ onto lubrication pump ⑫.

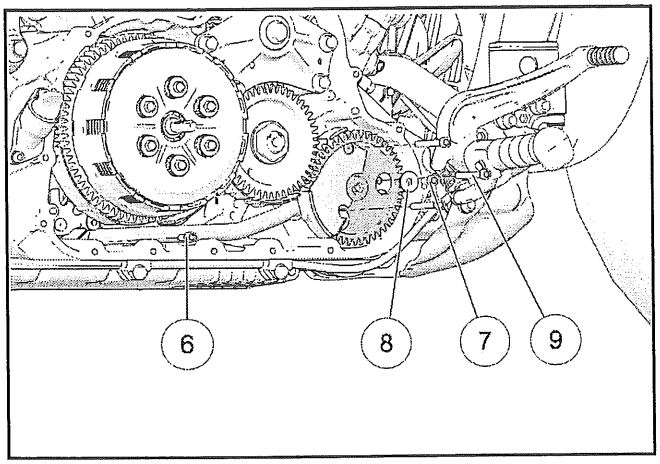


2. Lubricate new inlet tube seals ⑩ with engine oil and install the seals on the inlet tube ⑪.
3. Assemble the inlet tube to the pump and torque fastener to specification.

TORQUE
Inlet tube to Oil Pump Fastener: **88 in-lbs (10 Nm)**

4. Install the lubrication pressure pump assembly into the right crankcase with pump mounting fasteners⑨ and pickup tube screw⑥. Torque fasteners to specification.

TORQUE
Oil Pump to Crankcase Fasteners: **88 in-lbs (10 Nm)**



5. Install the oil pump gear fastener⑦ and washer ⑧ onto pump shaft. Torque fastener to specification.

TORQUE
Oil Pump Gear Fastener: **88 in-lbs (10 Nm)**

6. Install the primary drive cover assembly. See Primary Drive Cover Installation, page 5.7.

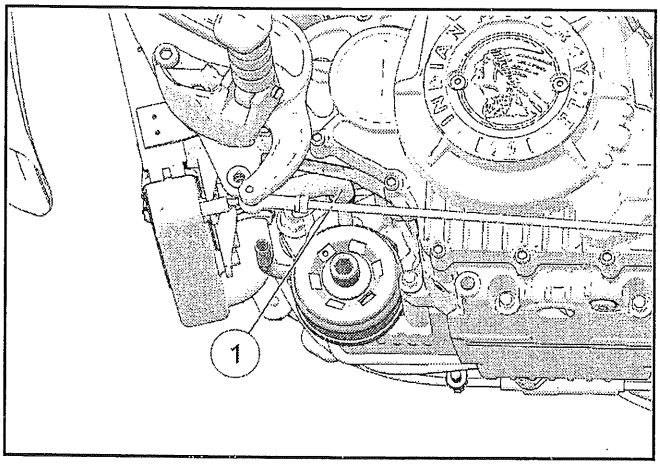
OIL COOLER SERVICE

OIL COOLER REMOVAL

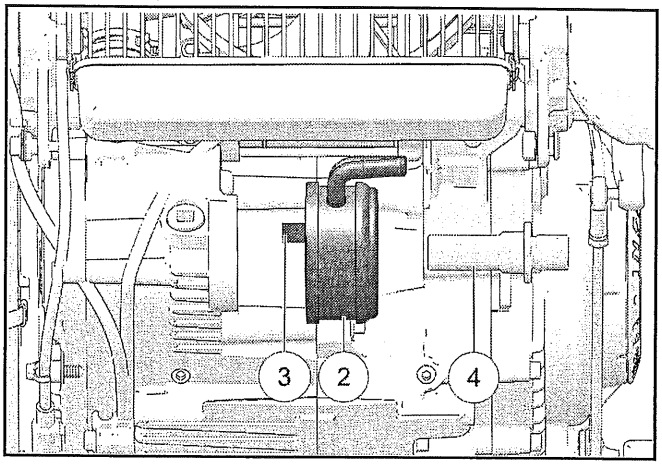
NOTE

Model year 2017 Scout and Scout Sixty models are not equipped with an oil cooler.

1. Drain the cooling system. See Coolant Drain / Fill, page 2.17.
2. Remove the horn assembly. See Horn Removal / Installation, page 10.51.
3. Disconnect the supply coolant hose ① at the oil cooler.



4. Place an oil pan beneath the oil filter adapter to catch any oil that drains out of the cooler assembly upon removal.
5. Remove oil filter assembly.
6. Hold the oil cooler assembly ② from turning to prevent distorting the locating tang ③ and remove the oil cooler mounting spigot ④.



NOTE

It may be necessary to hold the oil cooler assembly from turning to assist with removal oil cooler mounting spigot.

7. Remove the oil cooler assembly from the vehicle.

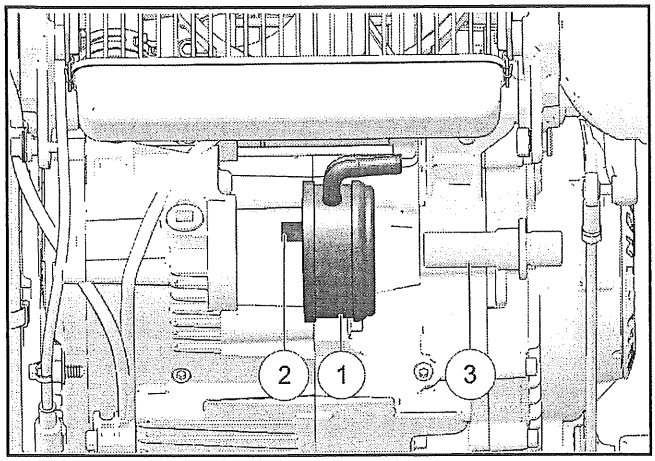
OIL COOLER INSPECTION

1. Inspect cooler, lines and all connection for leaks.
2. Inspect coolant lines for proper routing. Replace if there is any sign of abrasion or damage.
3. Inspect cooler surface for kinks or debris.
4. Inspect cooler mounting fastener for proper torque.
5. Replace any damaged components.

OIL COOLER INSTALLATION

Inspect the oil cooler sealing surfaces/seals for damage and replace if necessary.

1. Install the oil cooler assembly ① on the engine so the locating tang ② is positioned in the engine case recess.



2. Prevent the oil cooler assembly from spinning when installing the oil cooler spigot ③ and torque spigot to specification.

TORQUE
Oil Cooler Spigot: **22 ft-lbs (30 Nm)**

3. Install new oil filter.
4. Connect the supply and return coolant lines to the oil cooler.
5. Install the horn assembly. See Horn Removal / Installation, page 10.51.
6. Install the radiator cover.
7. Fill and bleed the cooling system. See Coolant Drain / Fill, page 2.17.
8. Check engine oil level. See Engine Oil Level Check, page 2.10.
9. Run the engine to cycle oil through the oil cooler and check oil level. Top off if necessary.
10. Check for engine oil or coolant leaks.

COOLING SYSTEM SERVICE

COOLANT STRENGTH / TYPE

Test the strength of the coolant using an antifreeze hydrometer.

- A 50/50 mixture of extended life antifreeze and distilled water will provide the optimum cooling, corrosion protection, and antifreeze protection.
- Do not use tap water, straight antifreeze, or straight water in the system. Tap water contains minerals and impurities which build up in the system.
- Straight water or antifreeze may cause the system to freeze, corrode, or overheat.

FLUID CAPACITY
Recommended Coolant: Indian Motorcycle 50/50 Pre-Mixed Extended Life Antifreeze System Capacity: 2.77 qt (2.63 L) Recovery Bottle Capacity: .16 qt (.15 L) (PN 8560214) (Quart)

COOLING SYSTEM PRESSURE TEST

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Remove the Fuel Tank. See Fuel Tank Removal, page 4.14.

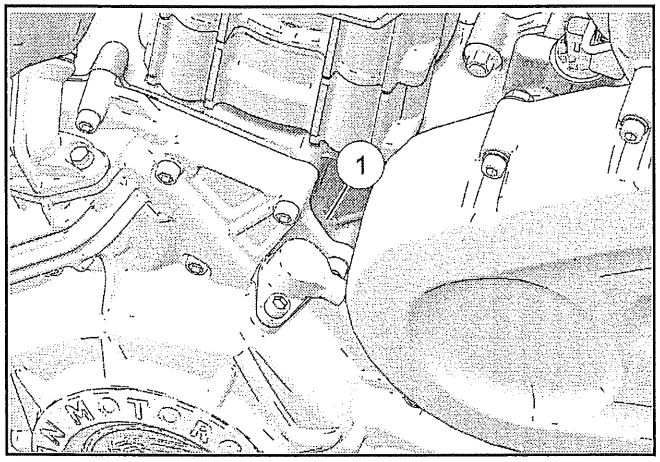
⚠ WARNING

Never remove pressure cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

3. Remove the cooling system pressure cap and test using a cooling system pressure tester. (Commercially available).
4. The system must retain 11-14 psi (75-95 kPa) for five minutes or longer. If pressure loss is evident within five minutes, check the radiator, all cooling system hoses, hose clamps and water pump for leakage.

NOTE

Coolant may be present at the water pump weep hole ① due to normal water pump function. Verify integrity of the water pump seal with a cooling system pressure test.



COOLING SYSTEM PRESSURE CAP TEST

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Remove the Fuel Tank. See Fuel Tank Removal, page 4.14.

⚠ WARNING

Never remove pressure cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

3. Remove the cooling system pressure cap and test using a cooling system pressure tester. (Commercially available).
4. The cooling system pressure cap relief pressure is 16 psi (110 kPa). Replace cap if it does not hold the required specification pressure.

COOLANT DRAIN / FILL

⚠ WARNING

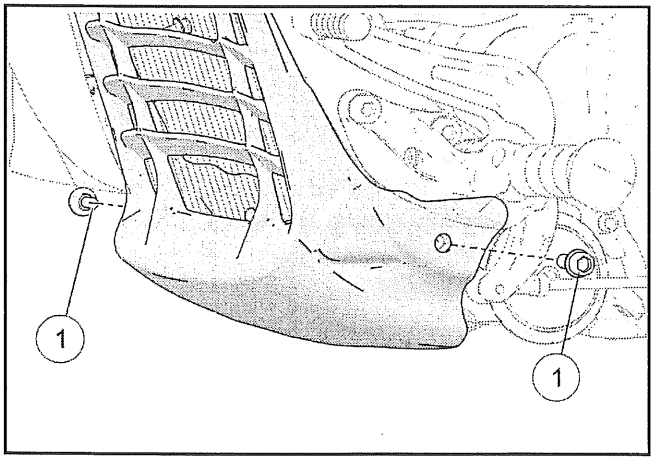
Never remove pressure cap when engine is warm or hot.
The cooling system is under pressure and serious burns may result.
Allow the engine and cooling system to cool before servicing.

Cooling System Drain

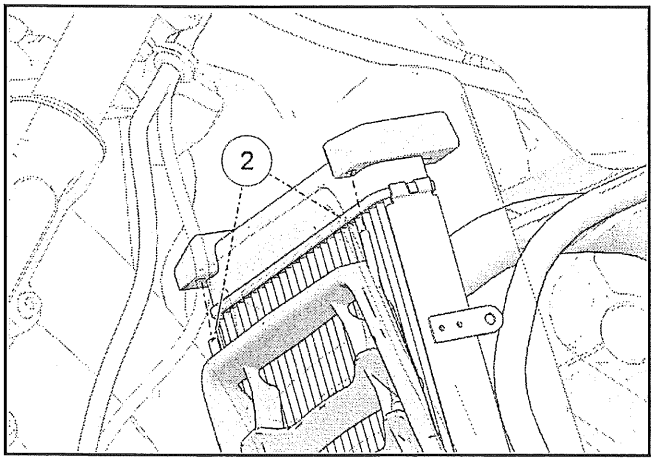
IMPORTANT

Pressure test the cooling system before and after cooling system service.

1. Remove the radiator cover fasteners ① .



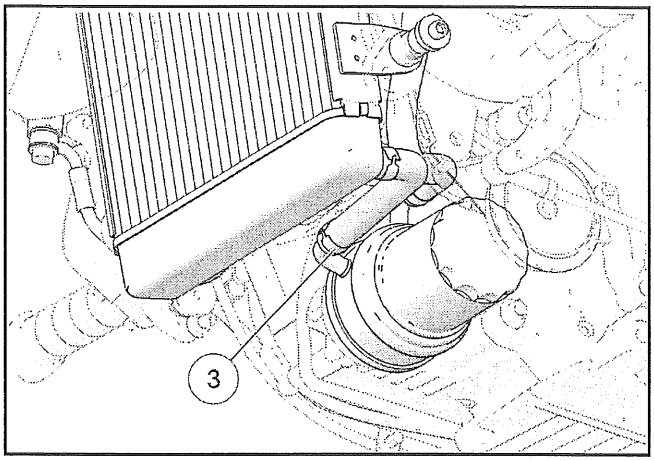
2. Slide radiator cover down to disengage posts from the upper radiator mounts ② .



3.

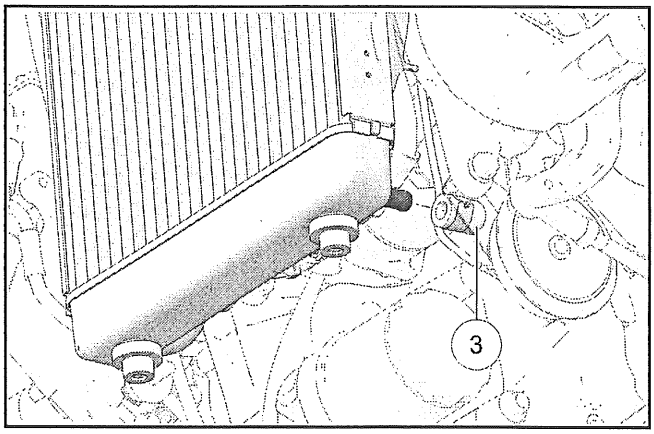
- **2015–16 Models**

  Remove the coolant return hose ③ from the oil cooler assembly to drain the coolant.



- **2017 Models**

  Remove the coolant drain plug ③ from the radiator.



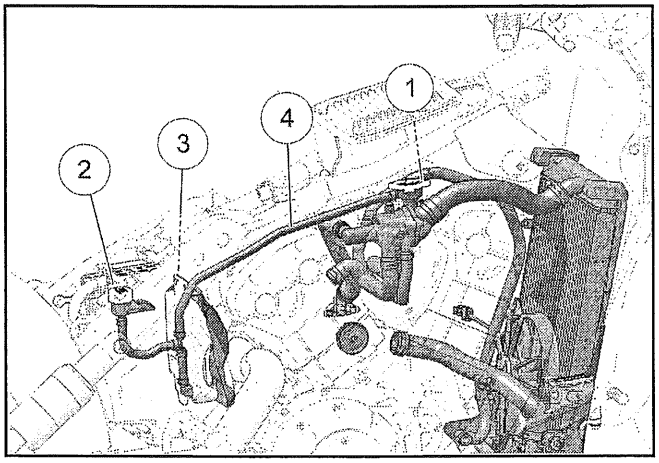
Cooling System Fill/Bleeding

NOTE

Pressure test before and after servicing the cooling system.

1. Depending on the model year, either reconnect the coolant return hose to the oil cooler or install the coolant drain plug to the radiator.
2. Install the radiator cover.
3. Remove the seat. See Seat Removal / Installation, page 7.8.
4. Remove the Fuel Tank. SeeFuel Tank Removal, page 4.14.
5. Remove cooling system pressure cap ① .

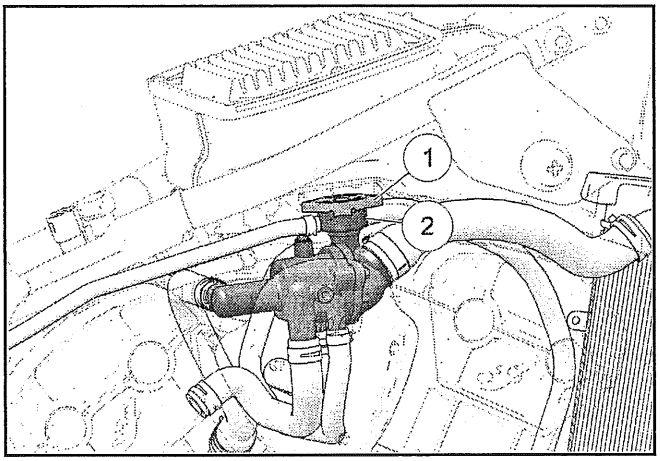
6. Use pinch pliers (commercially available) to pinch off the coolant line ④ between the coolant reservoir and thermostat housing.



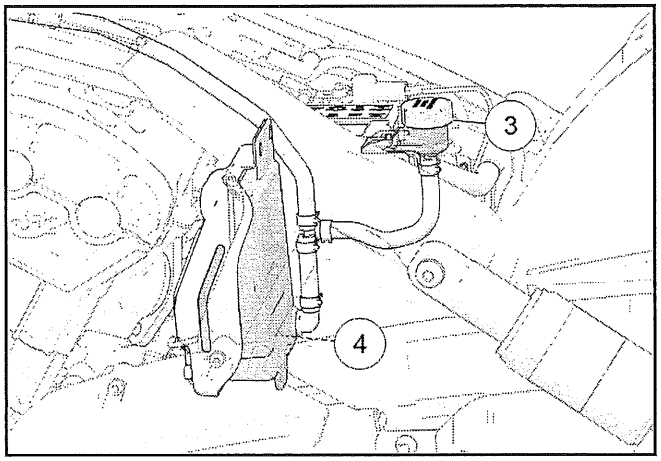
7. Install a cooling system vacuum bleeder (commercially available) on the pressure cap opening to create a vacuum in the cooling system.
8. Using the vacuum bleeder draw in Indian Motorcycle Extended Life 50/50 Engine Coolant to fill the cooling system.
9. Remove the vacuum bleeder and install the pressure cap.
10. Remove the pinch pliers from the coolant line between the reservoir and thermostat housing.
11. Add Indian Motorcycle Extended Life 50/50 Engine Coolant to the reservoir fill opening ② until the coolant reservoir ③ is half full.
12. Install the fuel tank assembly. See Fuel Tank Installation, page 4.19.
13. Run the engine until the cooling fan cycles ON and OFF.
14. Recheck the coolant level in the reservoir and add to the "COLD FULL" level.
15. Repeat the fill/bleed procedure until the coolant level in the reservoir remains at the "COLD FULL" level.
16. Install the seat. See Seat Removal / Installation, page 7.8.

COOLANT FILL / BLEEDING

1. Remove seat assembly. See Seat Removal / Installation, page 7.8.
2. Remove fuel tank assembly. See Fuel Tank Removal, page 4.14.
3. Remove the pressure cap ①.



4. Add coolant to top of filler neck ②
5. Install a commercially available vacuum bleeder to remove air from the cooling system.
6. Remove vacuum bleeder.
7. Add coolant bring level to top of the filler neck.
8. Install the pressure cap.
9. Add coolant to the filler funnel ③ until the coolant is visible in the surge tank ④.



10. Install the fuel tank. See Fuel Tank Installation, page 4.19.
11. Run engine to increase coolant temperature until the cooling fan cycles on and off.
12. Check coolant level in the surge tank and add as required.

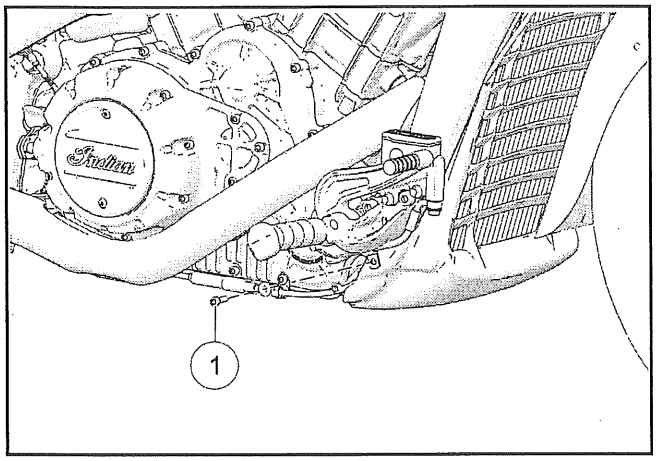
13. Install seat. See Seat Removal / Installation, page 7.8.

RADIATOR REMOVAL / INSTALLATION

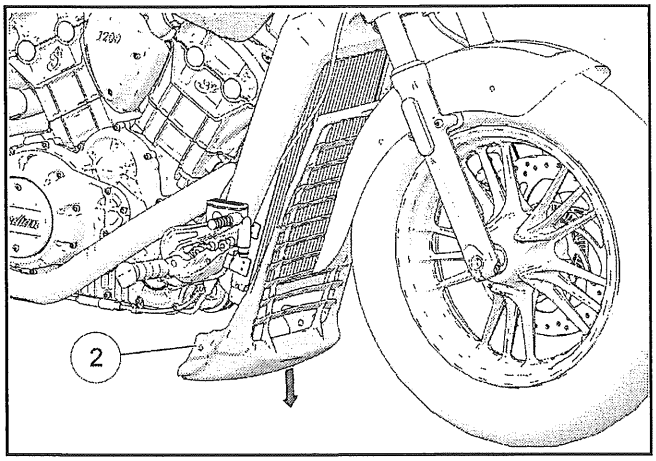
⚠ WARNING

Never remove pressure cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

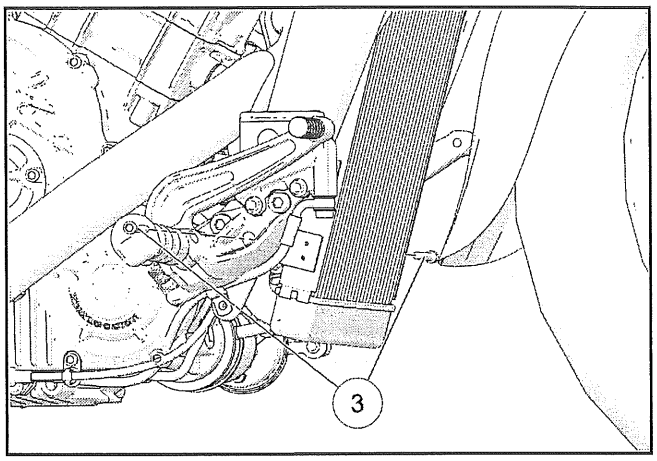
1. Place the motorcycle on the side stand and rotate the handlebars to the full left lock position.
2. Drain the cooling system. See Coolant Drain / Fill, page 3.33.
3. Remove radiator cover fasteners ① from both sides.



4. Protect the painted surface on the front fender and remove radiator cover ②.



5. Remove the radiator mount fasteners ③.



6. Disconnect the cooling fan electrical connector.
7. Remove the radiator inlet and outlet hoses.
8. Remove the coolant return hose from the radiator.
9. Remove the radiator and store in a location to prevent damage.
10. Reverse removal procedure for installation.
11. Fill cooling system. See Coolant Fill / Bleeding, page 3.34

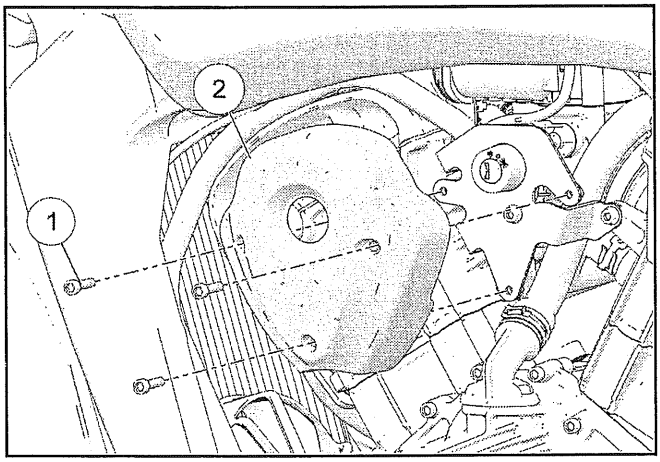
WATER PUMP

Water Pump Seal Removal and Installation

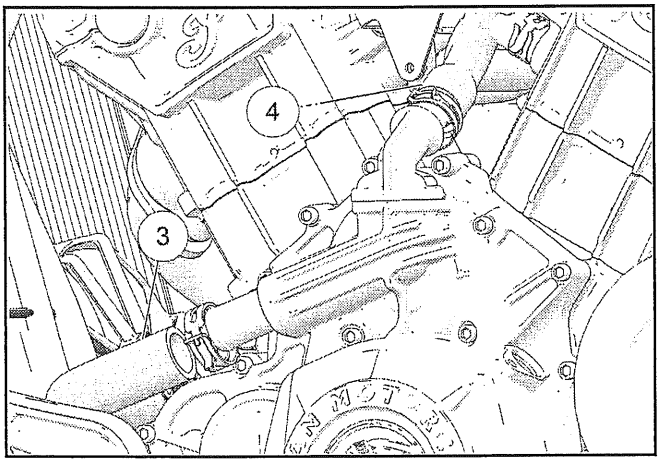
NOTE

Coolant may be present at the water pump weep hole due to normal water pump function. Verify integrity of the water pump seal with a cooling system pressure test.

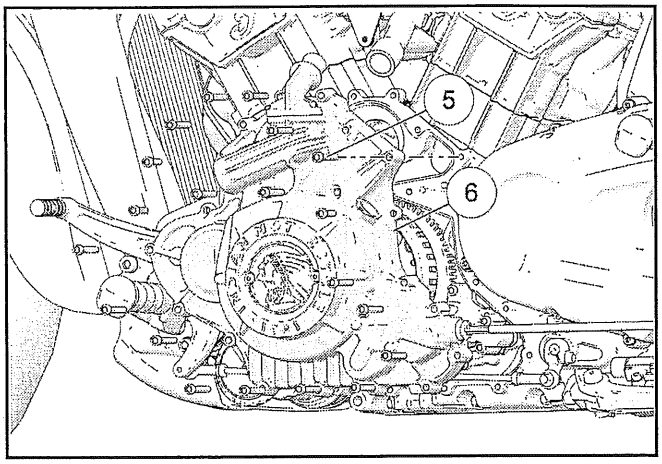
1. Drain cooling system. See Coolant Drain / Fill, page 3.33.
2. Remove Crankshaft Position Sensor from the stator cover. See Crankshaft Position Sensor, Test / Replace, page 4.38.
3. Remove the Ignition Cover fasteners ① and remove the Ignition Cover ②.



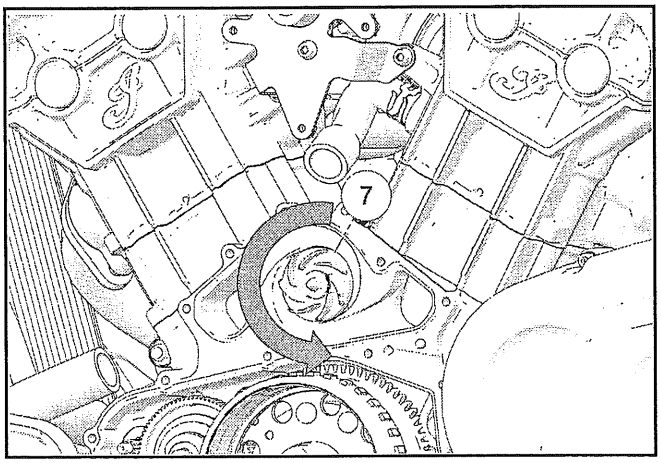
4. Disconnect the radiator outlet hose ③ at the left engine cover.



5. Disconnect the bypass hose ④ from the left engine cover.
6. Disconnect the stator harness connector.
7. Remove the stator cover fasteners ⑤ and stator cover ⑥.



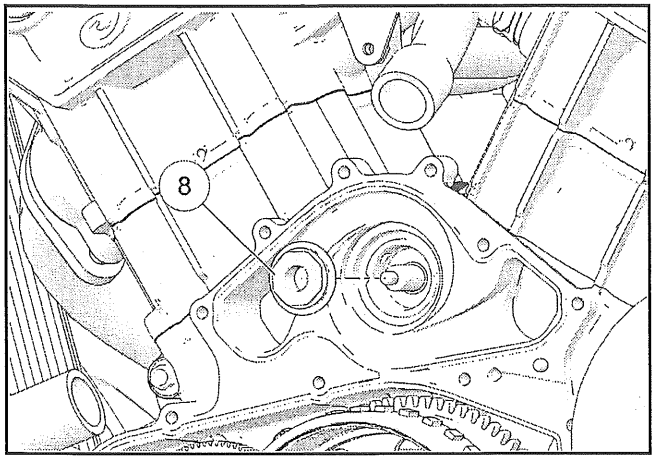
8. Remove water pump impeller ⑦.



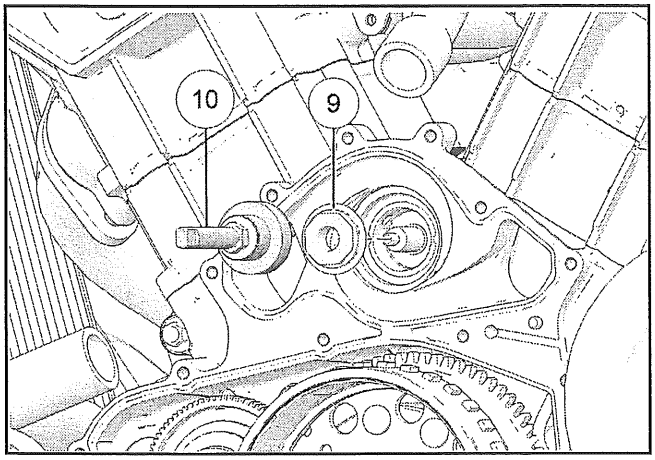
9. Remove the water pump seal assembly ⑧ with a hooked tool or equivalent taking care to not damage the water pump shaft or engine case.

NOTE

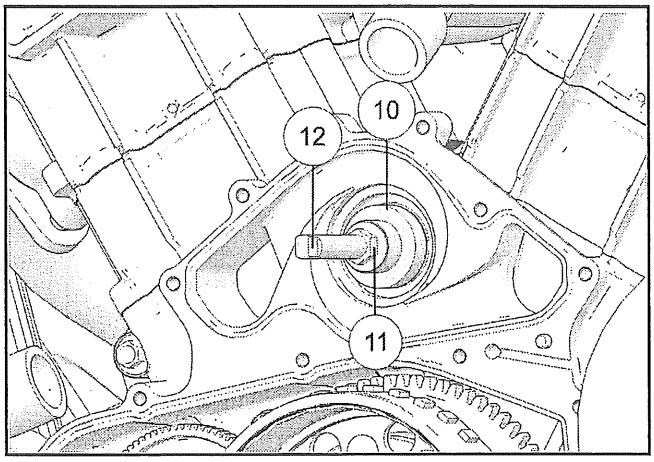
Do not damage the engine case or sealing surfaces



10. Clean the water pump seal bore and inspect the seal bore surfaces for scoring or damage.
11. Install new water pump seal ⑨ in engine case by hand. Thread water pump seal installation tool PF-51608 ⑩ on the water pump shaft.



12. Use the wrench flats ⑫ to hold the water pump seal installation tool ⑩ from turning while turning the tool wrench hex ⑪ to seat the seal in the bore.



13. Reverse the removal procedure to reassemble. Torque fasteners to specification.

TORQUE

Water Pump Impeller:
30 in-lbs (3 Nm)

TORQUE

Stator Cover Fasteners:
88 in-lbs (10 Nm)

TORQUE

Ignition Cover Fasteners:
96 in-lbs (11 Nm)

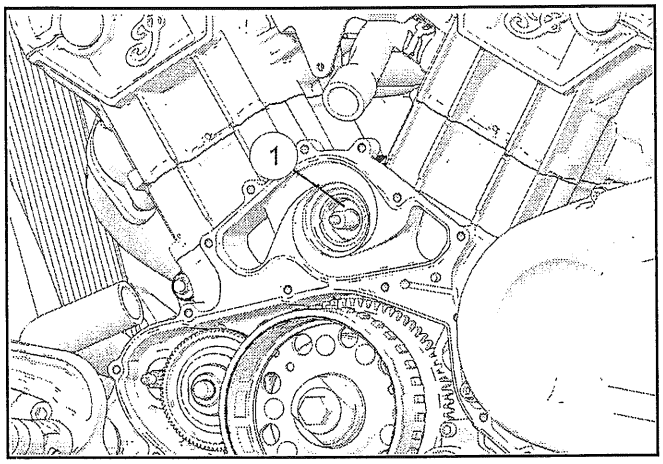
Water Pump Shaft Oil Seal

1. Remove water pump seal. Refer to **Water Pump Seal Removal and Installation.**

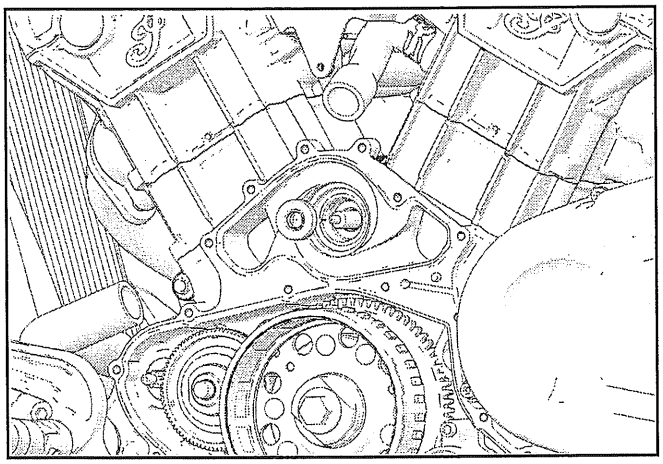
2. Remove water pump shaft oil seal ① with a hooked tool or equivalent taking care to not damage water pump shaft or engine case.

NOTE

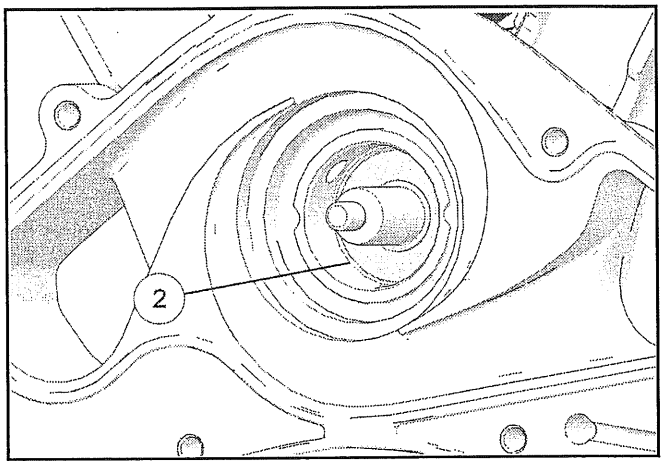
Do not damage the engine case or sealing surfaces



3. Clean the water pump oil seal bore and inspect the seal bore surfaces for scoring or damage.
4. Align the new water pump shaft oil seal in the engine case and insert with light pressure.



5. Use a suitable driver to install the seal so the outer face is flush with the step ② on the engine case.



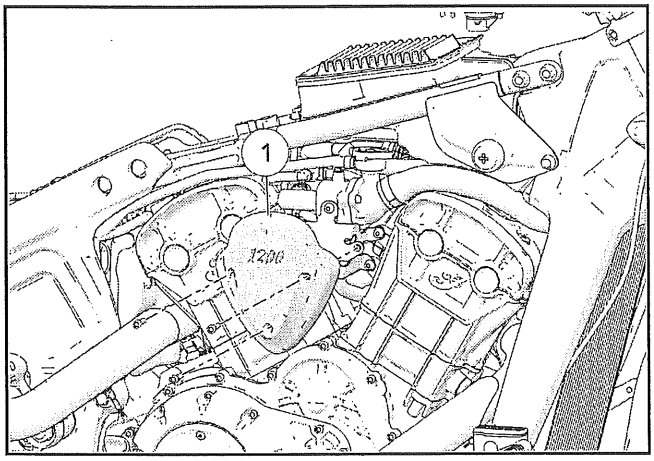
6. Install new water pump seal. Refer to **Water Pump Seal Removal and Installation.**

THERMOSTAT

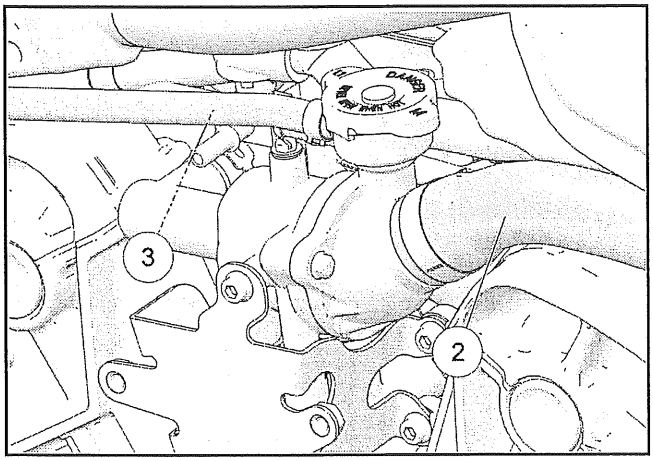
⚠ WARNING

Never remove pressure cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

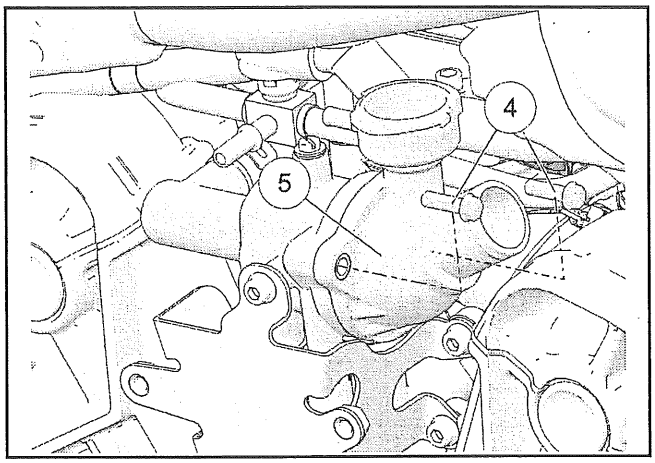
1. Place motorcycle on the side stand.
2. Remove seat. SeeSeat Removal / Installation, page 7.8.
3. Remove fuel tank assembly. SeeFuel Tank Removal, page 4.14.
4. Remove right thermostat housing cover ①. See Thermostat Cover Removal / Installation, page 7.11



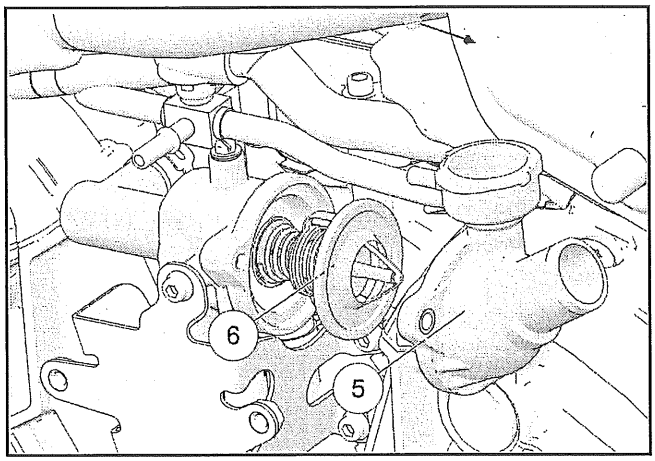
5. Drain the cooling system. See Coolant Drain / Fill, page 3.33.
6. Disconnect the radiator inlet hose ② and overflow reservoir hose ③ from the thermostat housing.



7. Remove thermostat housing fasteners ④ and thermostat housing ⑤.



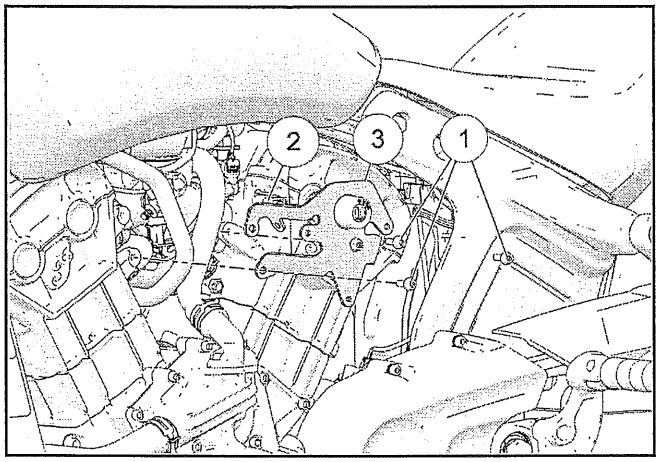
8. Remove the thermostat assembly ⑥.



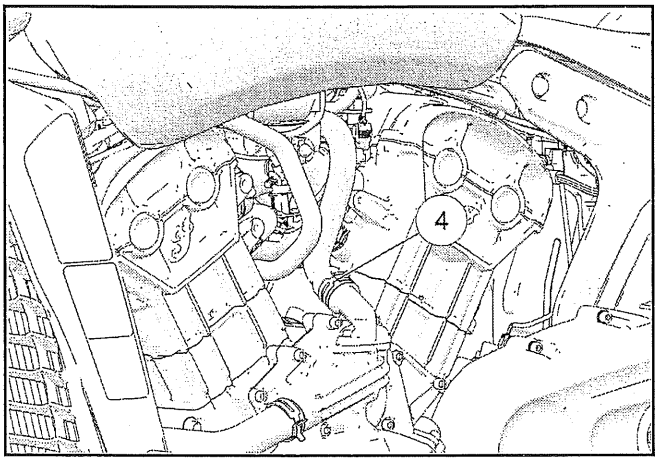
9. Reverse removal procedure for installation.
10. Fill and bleed the cooling system. SeeCoolant Drain / Fill, page 3.33.

COOLANT TEMPERATURE SENSOR

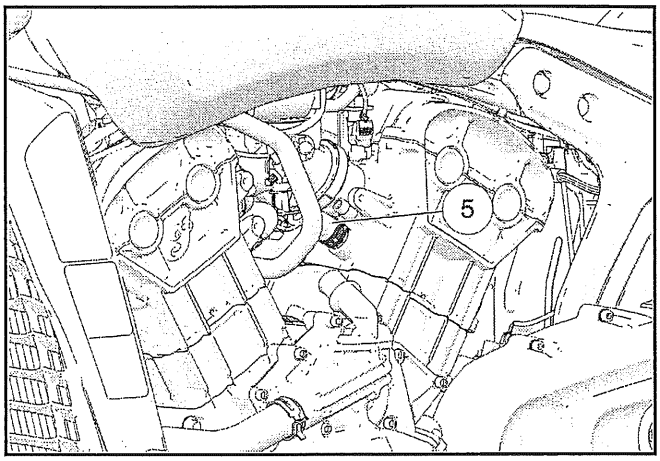
1. Drain cooling system. See Coolant Drain / Fill, page 3.33.
2. Remove ignition switch side cover. See Ignition Cover Removal / Installation, page 7.11.
3. Remove ignition switch bracket fasteners ①.



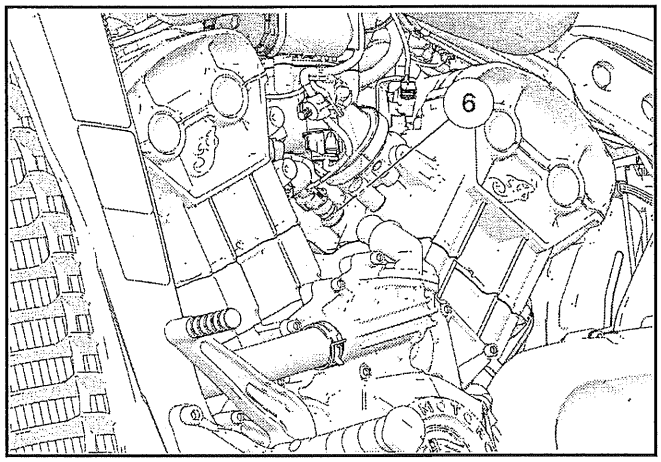
4. Disconnect the ignition switch electrical connector ② and remove the ignition switch bracket assembly ③.
5. Disconnect the coolant bypass hose ④ from the stator housing.



6. Disconnect the coolant outlet hose ⑤ from the rear cylinder head.



7. Disconnect the coolant temperature sensor electrical connector and remove the sensor ⑥ from the rear cylinder head.



8. Reverse removal procedure for installation. Torque fasteners to specification.

TORQUE
Ignition Cover Bracket Fasteners: **12 ft-lbs (16 Nm)**

TORQUE
CTS (Coolant Temp Sensor): **16 ft-lbs (22 Nm)**

TROUBLESHOOTING

Overheating

- Low coolant level
- Air in cooling system
- Wrong type/mix of coolant
- Faulty pressure cap or system leaks
- Restricted system (mud or debris in radiator fins causing restriction to air flow, passages blocked in radiator, lines, pump, or water jacket, accident damage)
- Engine running lean (fuel system restriction)
- Fuel pump output weak
- Water pump failure/ Loose impeller
- Engine Coolant Temperature Sensor failure
- Electrical malfunction
- Cooling fan inoperative or turning too slowly
- Low oil level
- Faulty hot lamp circuit
- Thermostat stuck closed or not opening completely

Temperature Too Low

- Thermostat stuck open

Leak at Water Pump Weep Hole

- Faulty water pump mechanical seal
- Worn pump shaft or pump shaft bearing

CYLINDER HEAD / VALVES

GENERAL INFORMATION

SERVICE NOTES

- This chapter covers service of the cylinder heads, camshafts, cam chains, tensioners and guides.
- Refer to Engine / Cooling / Exhaust Chapter for engine removal and installation.
- If cylinder heads are removed the cylinder base gasket must be replaced also.
- Mark and store all mating parts for correct engine assembly.
- Use Moly Assembly Paste - P/N: 2871460 or Indian Motorcycle Synthetic 15W60 Engine Oil to lubricate parts where indicated.
- Handle and store all parts in such a way that they will not be damaged or contaminated.
- Some fasteners have a pre-applied locking agent, and must be replaced if loosened or removed. Always replace fasteners that have a pre-applied locking agent or as directed in this service manual.
- There are some precision machining steps to be performed in this section. If you are not sure of your capabilities in these areas, have a competent machinist perform these operations.
- Valve guide and seat reconditioning should be performed by a technician proficient in cylinder head reconditioning techniques using high quality equipment with grinding stones. Do not attempt cylinder head repair without the proper equipment or experience in cylinder head reconditioning techniques.
- The intake and exhaust valves cannot be re-faced.
- Cleanliness of parts is critical to engine life and accurate parts inspection. Use clean solvent to clean all disassembled parts. Dry parts with compressed air and lubricate before engine inspection and engine assembly.

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Valve Spring Compressor	**Commercially Available**
Crankshaft Locking Tool	PF-51235-A

TOOL DESCRIPTION	PART NUMBER
Crankshaft Rotation Tool	PF-51239
Seal and Bearing Driver Set	PV-43558

Bosch Automotive Service Solutions: 1-800-345-2233 or https://polaris.service-solutions.com/

SERVICE SPECIFICATIONS

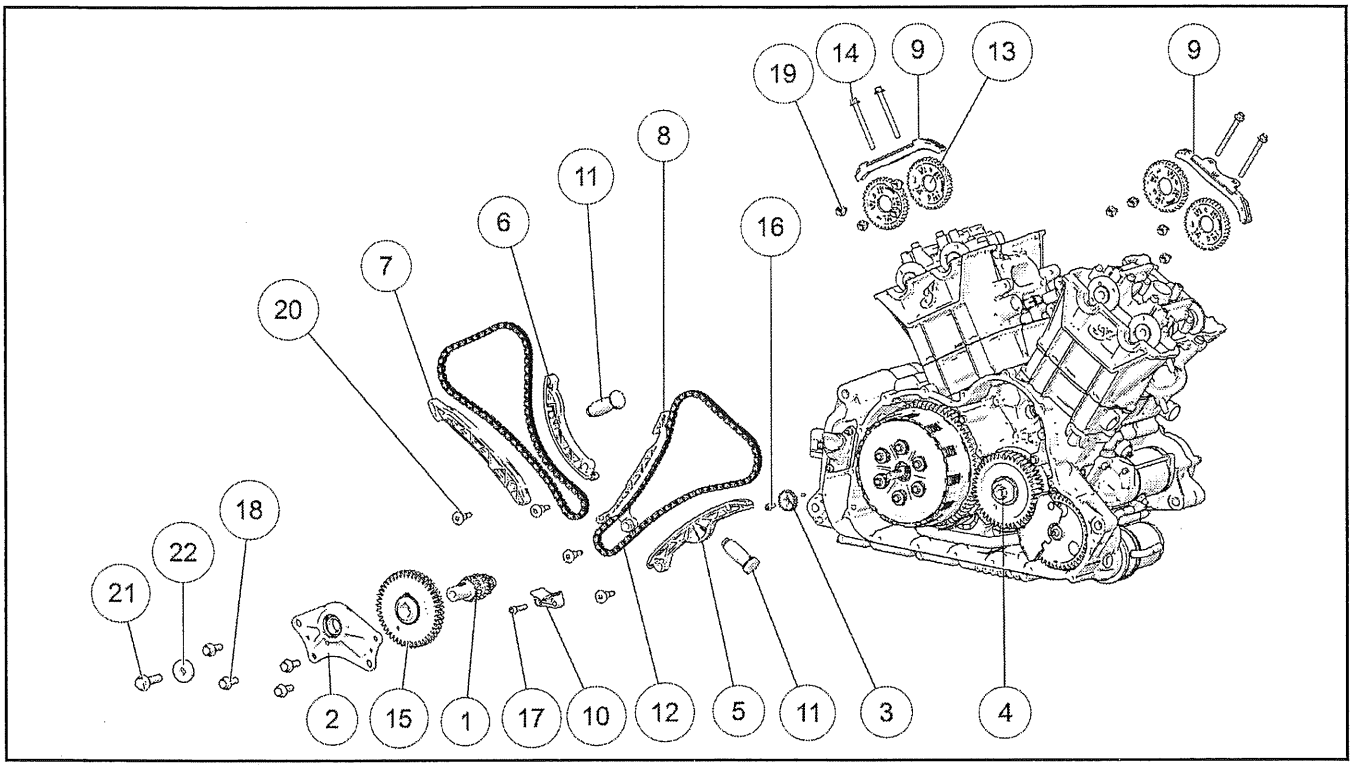
Camshaft Data

	DESCRIPTION	SPECIFICATION
CAMSHAFT DATA	Valve Train	Over Head Valve / 4 valves per cyl 2 Intake Valve / 2 Exhaust Valve
	Intake Valve Opens At 1 mm Lift	9.0° BTDC
	Intake Valve Closes At 1 mm Lift	221.0° ATDC
	Exhaust Valve Opens At 1 mm Lift	229° BTDC
	Exhaust Valve Closes At 1 mm Lift	3° ATDC
	Max Lobe Lift INTAKE EXHAUST	 .3976" (10.10 mm) .3976" (10.10 mm)
	Max Valve Lift INTAKE EXHAUST	 .3976" (10.10 mm) .3976" (10.10 mm)

Cylinder Head & Valve Train Data

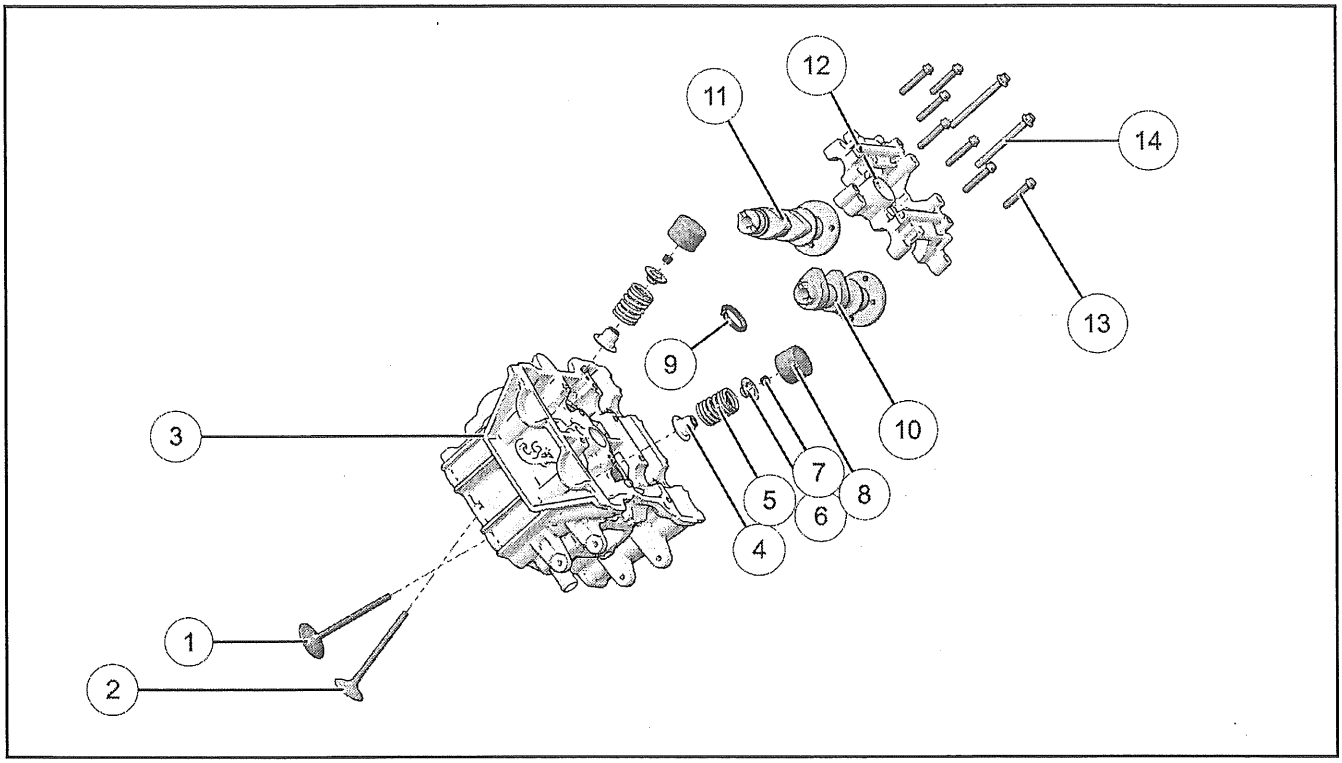
ITEM			STANDARD	SERVICE LIMIT
Cam Chain Tensioner (s)	Hydraulic / Self-Adjusting		-	-
Cam Shaft	Lobe Height	INTAKE	MIN: .9844" (25.003 mm) MAX: .9920" (25.197 mm)	.9745" (24.753 mm)
		EXHAUST	MIN: .9844" (25.003 mm) MAX: .9920" (25.197 mm)	.9745" (24.753 mm)
	Journal O.D. (Exhaust)		MIN: .9038"(22.957 mm) MAX: .9046" (22.978 mm)	.9025" (22.924 mm)
	Journal O.D. (Intake)		MIN: .9038"(22.957 mm) MAX: .9046" (22.978 mm)	.9025" (22.924 mm)
Cylinder Head	Warpage (Distortion)		-	.004" (.10 mm)
Valve, Valve Guide, Valve Seat	Valve Clearance	INTAKE	0.006" ± 0.001" (0.152 mm ± 0.05 mm)	-
		EXHAUST	0.008" ± 0.001" (0.023 mm ± 0.05 mm)	
	Guide Height from Valve Spring Seat (Installed)		11.4 –11.8 mm	-
	Valve Stem O.D.	INTAKE	.2155 — .2161" (5.474 – 5.489 mm)	-
		EXHAUST	.2147 — .2153" (5.453 – 5.468 mm)	
	Valve Stem Deflection (INTAKE & EXHAUST)		-	.005" (.13 mm)
	Valve Seat Width	INTAKE	.0354 - .0432" (.899 - 1.097 mm)	.0551" (1.399 mm)
		EXHAUST	.0551 - .0629" (1.399 - 1.598 mm)	.0748" (1.899 mm)
	Valve Stem Runout		-	.0005" (.013 mm)
	Valve Head Radial Runout		-	.002" (.05 mm)
Valve Spring	Free Length (INTAKE & EXHAUST)		1.9330" (49.1 mm)	1.9094" (48.5 mm)
	Intake Valve Maximum Lift		.3976" (10.1 mm)	-
	Exhaust Valve Maximum Lift		.3976" (10.1 mm)	-
	Spring Installed Height		1.3543" (34.4 mm)	-

ASSEMBLY VIEWS
CAM CHAINS COMPONENTS



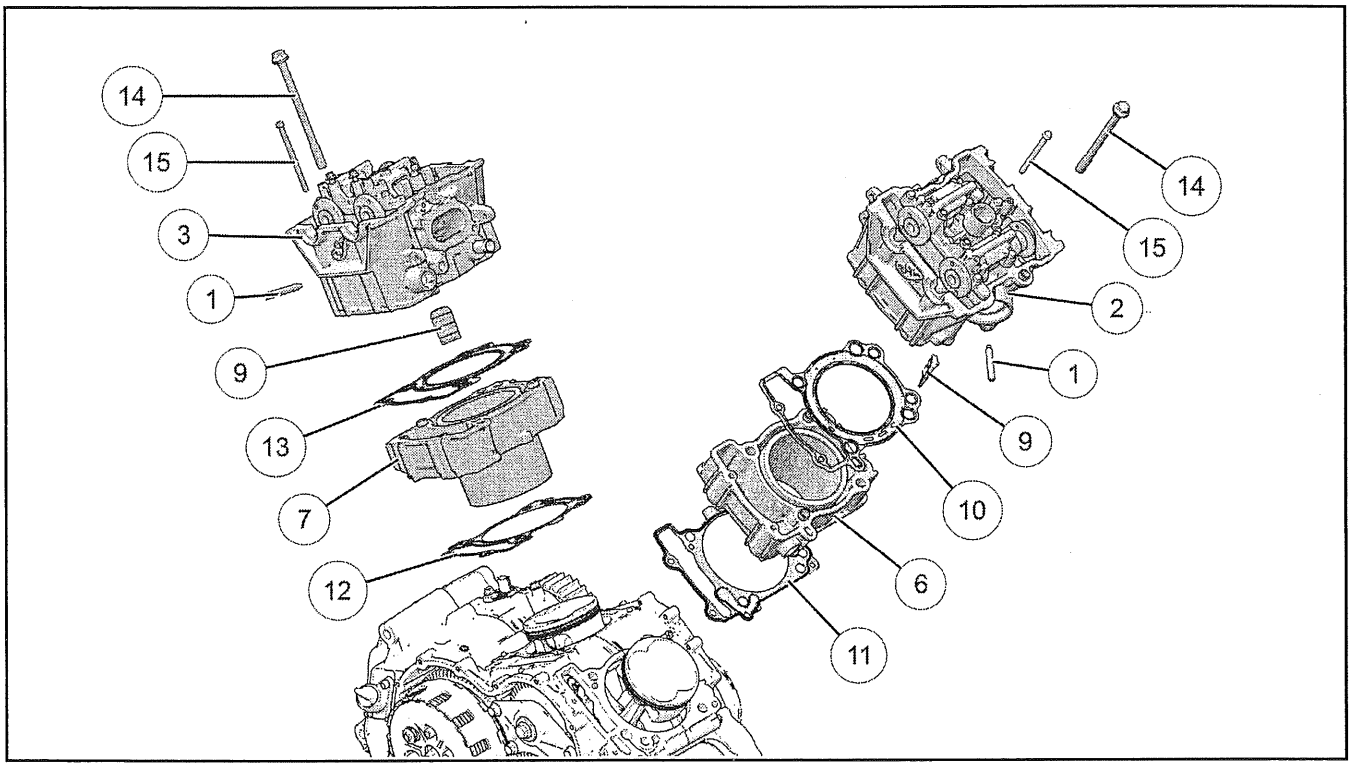
NUMBER	DESCRIPTION	NUMBER	DESCRIPTION
①	Cam Drive Shaft Assembly	⑫	Cam Chain
②	Bearing Support Plate	⑬	Cam Driven Sprocket
③	Water Pump Driven Gear	⑭	Cam Chain Guide Bolt
④	Shaft Assembly	⑮	Cam Idler Assembly Gear
⑤	Cam Chain Tensioner Front Guide	⑯	Screw
⑥	Cam Chain Tensioner Rear Guide	⑰	Screw
⑦	Cam Chain Fixed Rear Guide	⑱	Bolt
⑧	Cam Chain Fixed Front Guide	⑲	Screw
⑨	Cam Chain Fixed Cover Guide	⑳	Shoulder Bolt
⑩	Cam Chain Lower Guide	㉑	Screw
⑪	Cam Chain Hydraulic Tensioner	㉒	Washer

CYLINDER HEAD / CAMSHAFTS COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Intake Valve (QTY.2 per head)	-
②	Exhaust Valve (QTY.2 per head)	-
③	Cylinder Head Assembly (Front shown)	-
④	Spring Seat w/seal (QTY.4 per head)	-
⑤	Valve Spring (QTY.4 per head)	-
⑥	Valve Retainer (QTY.4 per head)	-
⑦	Valve Keeper (QTY. 8 per head)	-
⑧	Valve Tappet	-
⑨	Cam Carrier Seal (QTY.1 per head)	-
⑩	Intake Camshaft (QTY.1 per head)	-
⑪	Exhaust Camshaft (QTY.1 per head)	-
⑫	Camshaft Carrier	-
⑬	Short Cam Carrier Bolt (Short)	**88 in-lbs (10 Nm)**
⑭	Long Cam Carrier Bolt (Long)	**88 in-lbs (10 Nm)**

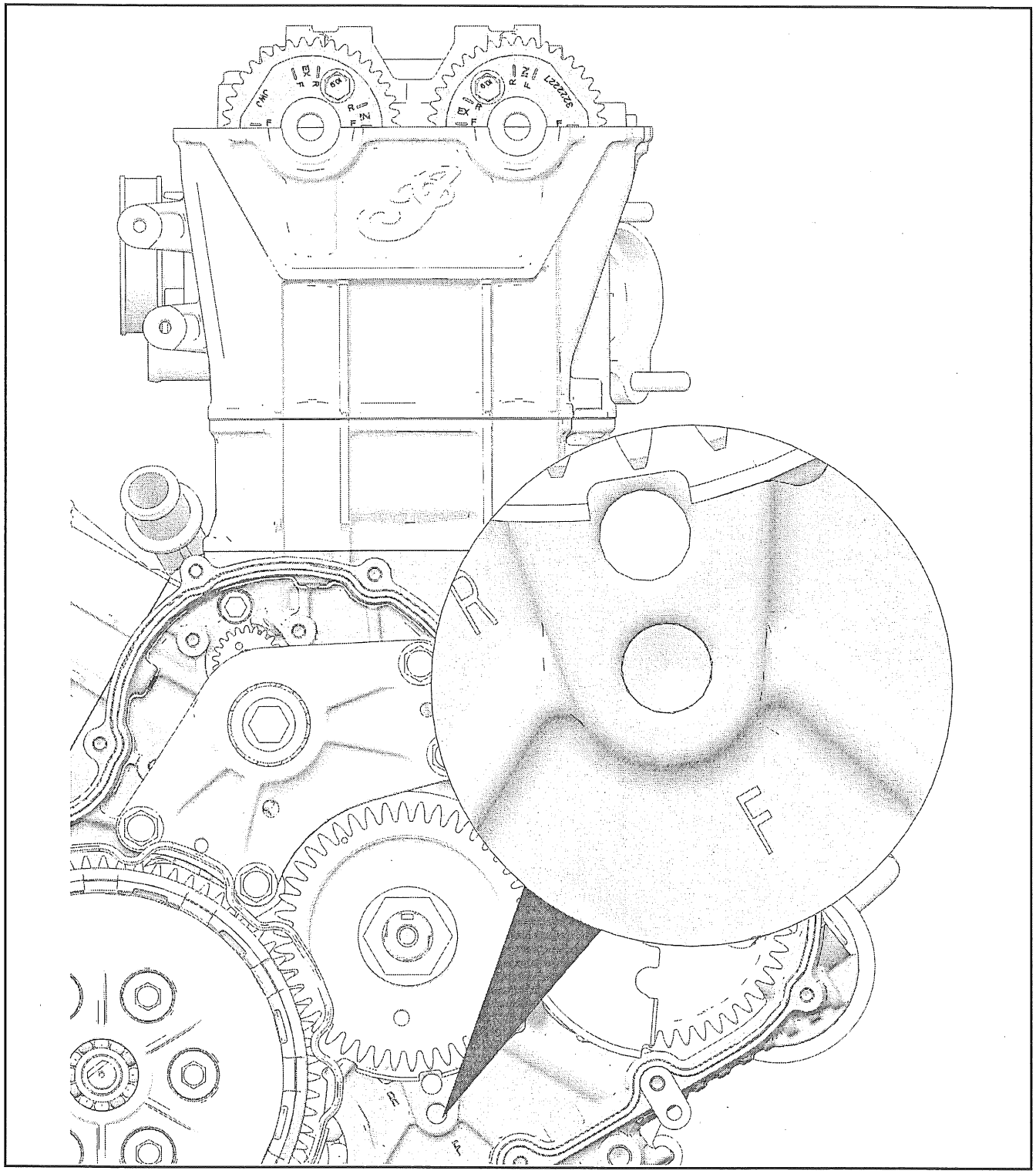
CYLINDER HEAD COMPONENTS



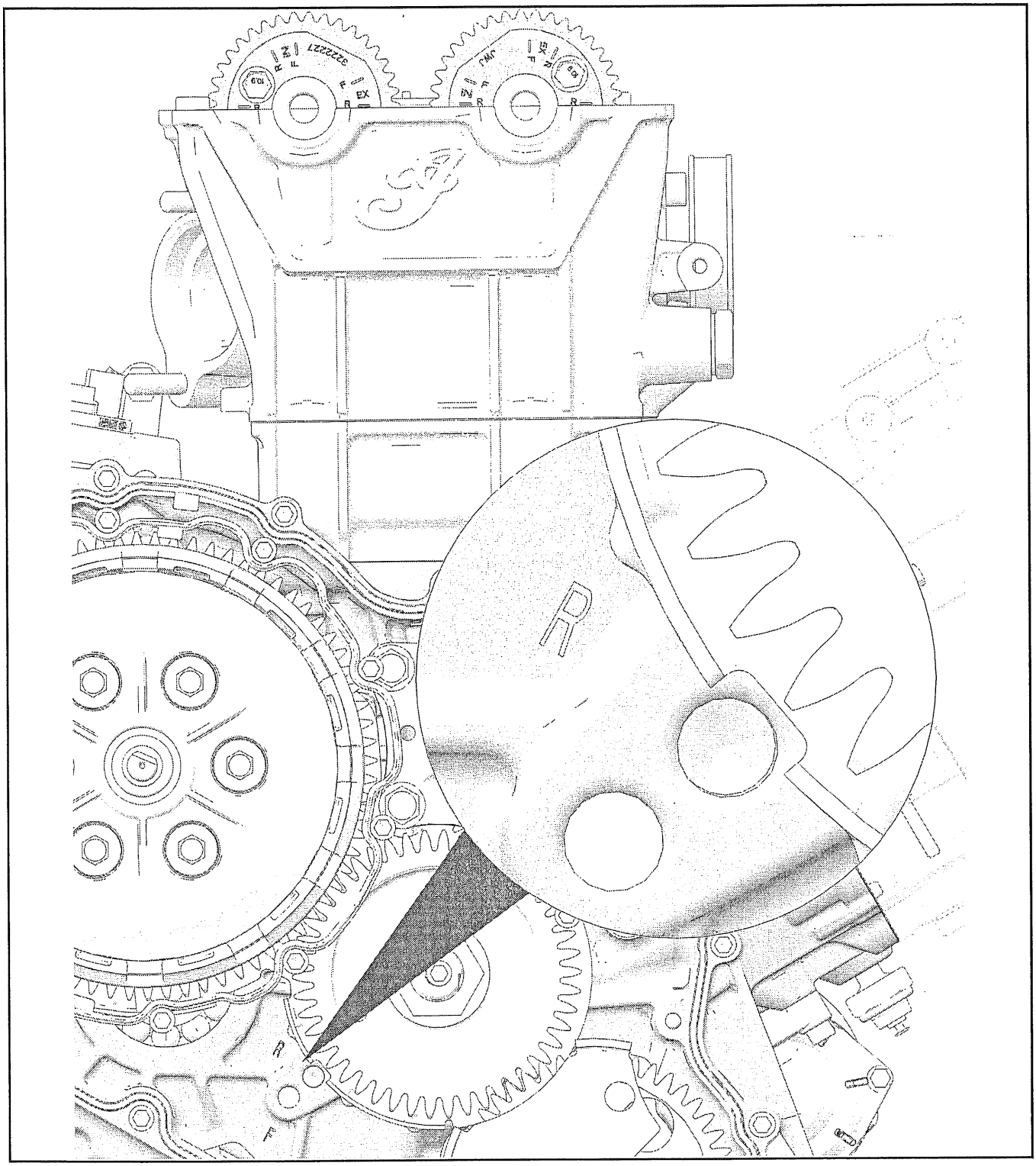
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Exhaust Stud	-
②	Front Cylinder Head ASM	-
③	Rear Cylinder Head ASM	-
⑥	Front Cylinder Head	-
⑦	Rear Cylinder Head	-
⑨	Coolant Diverter	-
⑩	Front Head Gasket	-
⑪	Front Base Gasket	-
⑫	Rear Base Gasket	-
⑬	Rear Head Gasket	-
⑭	Cylinder Head Fastener (Primary)	**STEP 1: 21 ft-lbs (28 Nm)** **STEP 2: 26 ft-lbs (35 Nm)** **STEP 3: Plus 270 degrees**
⑮	Cylinder Head Fastener (Secondary)	**88 in-lbs (10 Nm)**

CAMSHAFT TIMING MARKS

Camshaft Timing Front Cylinder



Camshaft Timing Rear Cylinder



CAM CHAIN SERVICE

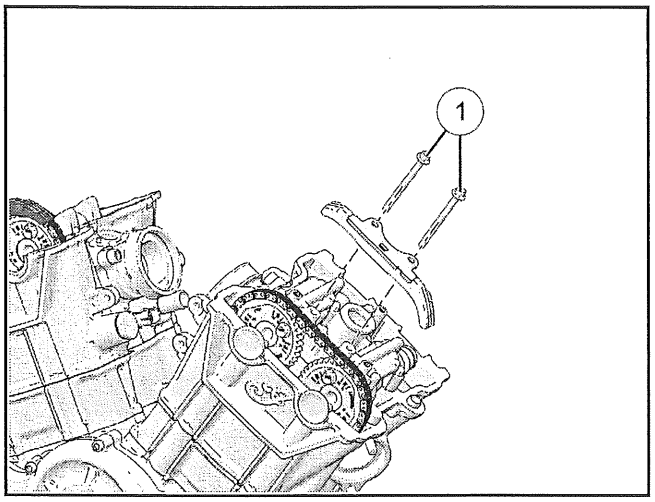
CAM CHAIN SERVICE NOTES

Read the following tips to ease the removal, installation and timing procedures when servicing the cam chain and / or cylinder head assembly.

- Drain the engine oil prior to servicing the cam chain.
- If the cam chain(s) or cylinder head(s) will be removed, loosen all camshaft sprocket bolts prior to removing tensioners. Loosen exposed camshaft sprocket bolts 1/2 turn, rotate crankshaft to expose remaining bolts and loosen 1/2 turn.
- ALWAYS rotate the crankshaft CLOCKWISE by turning the primary drive gear stake nut. Use a 1 1/4" wrench.
- Rotate the front piston to TDC on the compression stroke and lock the crankshaft prior to servicing the cam chain(s) / cylinder head(s). See Locking the Crankshaft for Service, page 6.6.
- DO NOT rotate the crankshaft if one or both of the cam chain tensioners has been removed.

CAM CHAIN GUIDE (UPPER), REMOVAL

1. Remove valve cover(s). See Valve Cover Removal, page 3.60.
2. Remove screws ① and lift guide off of cylinder head.



CAM CHAIN TENSIONER REMOVAL

CAUTION

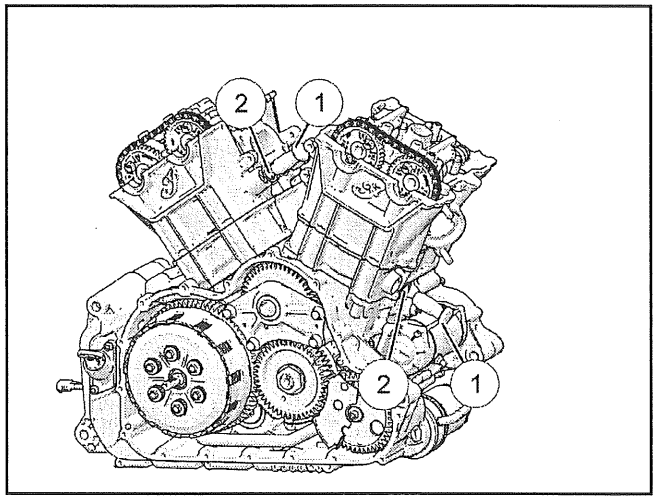
Do not rotate engine with tensioner(s) removed.

IMPORTANT

Protection has been built into the cam chain guide system to prevent the chain from jumping time with the tensioner(s) removed if the engine remains static. This does not guarantee the chain will not jump time with tensioner(s) removed. Do NOT rotate the crankshaft with tensioner(s) removed or the chain may jump time. Two methods of tensioner removal are provided below. **Method 1 (recommended)** is the only way to guarantee the cam chain timing is correct upon reassembly. **Method 2** *may* result in incorrect valve timing and engine damage if the chain jumps time.

Method 1 (Recommended)

1. Remove valve covers. See Valve Cover Removal, page 3.60.
2. Lock the crankshaft for service with the front piston at TDC on the compression stroke. SeeLocking the Crankshaft for Service, page 6.6.
3. Remove the cam chain tensioners ① and sealing washers ②.

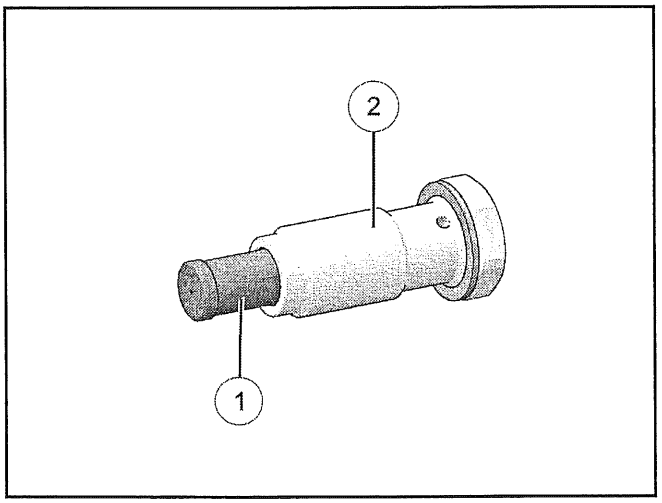


Method 2

1. Remove cam chain tensioners and sealing washers.

CAM CHAIN TENSIONER INSPECTION

1. Visually inspect inner plunger ① for damage, scoring or burns.
2. Lubricate inner plunger with engine oil. Move plunger in and out of outer plunger ② to check for smooth movement without binding.
3. Verify the oil passage opening is free from debris.
4. Replace tensioner assembly if worn or damaged.

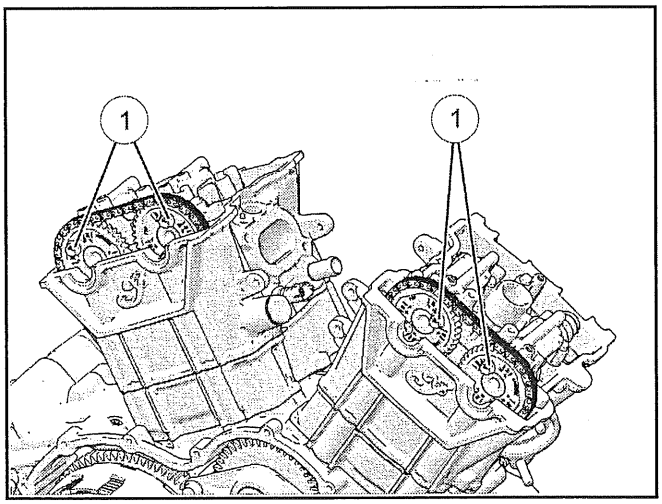


CAMSHAFT SPROCKET REMOVAL

1. Place motorcycle in an upright position with front wheel clamped in a wheel vise.
2. Drain engine oil and dispose of properly.
3. Remove valve cover(s). See Valve Cover Removal, page 3.60.
4. Remove the primary cover. See Primary Drive Cover Removal, page 5.7.
5. Remove upper cam chain guide(s). See Cam Chain Guide (upper), Removal, page 3.49.
6. Rotate the crankshaft to expose sprocket bolts ① and loosen 1/2 turn.

NOTE

Use a piece of nylon webbing or rope to create an interference between the crank drive gear and clutch gear, thus locking the crankshaft while loosening sprocket bolts.



7. Repeat step 6 for remaining camshaft sprocket bolts.
8. Rotate crankshaft so the front piston is TDC on the compression stroke and lock in position. See Locking the Crankshaft for Service, page 6.6.
9. Remove the cam chain tensioner (s). See Cam Chain Tensioner Removal, page 3.49.

CAUTION

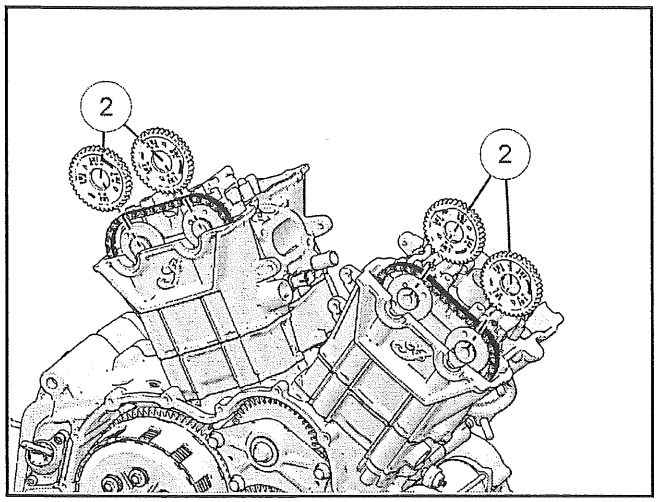
Do not rotate the crankshaft with tensioner(s) removed. Engine damage may occur.

10. Remove the camshaft sprocket bolts completely.

NOTE

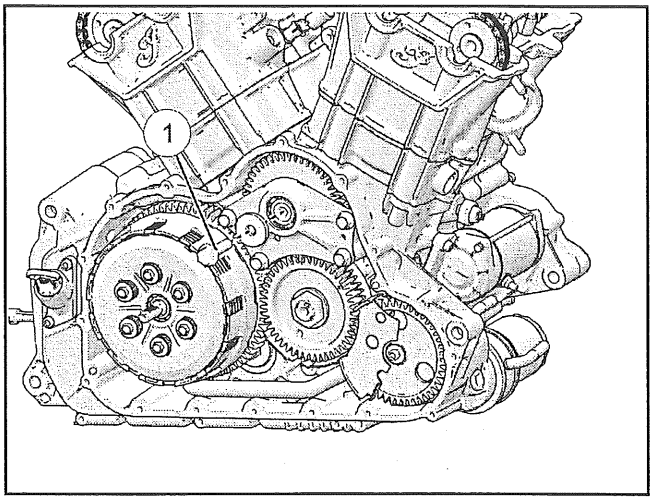
It will be necessary to use a thin 10mm spanner to remove the sprocket bolts that are not exposed. The bolts cannot be completely removed until the sprocket is out of the cylinder head.

11. Remove sprocket(s) ② from camshaft(s) using care not to drop the chain into the cam chain gallery.

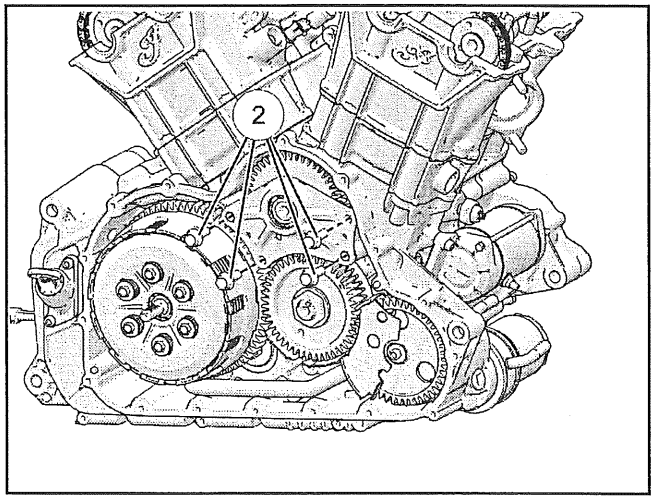


CAM DRIVE SPROCKET REMOVAL

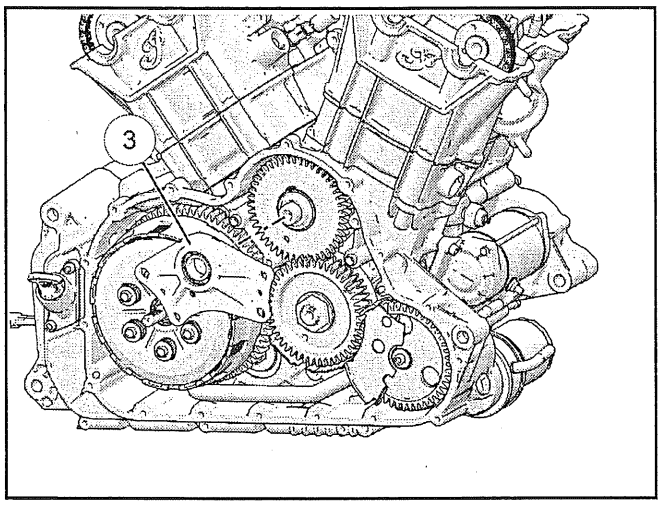
1. Lock the crankshaft for service. See Locking the Crankshaft for Service, page 6.6.
2. Remove bolt and washer ① securing cam drive gear to cam drive shaft.



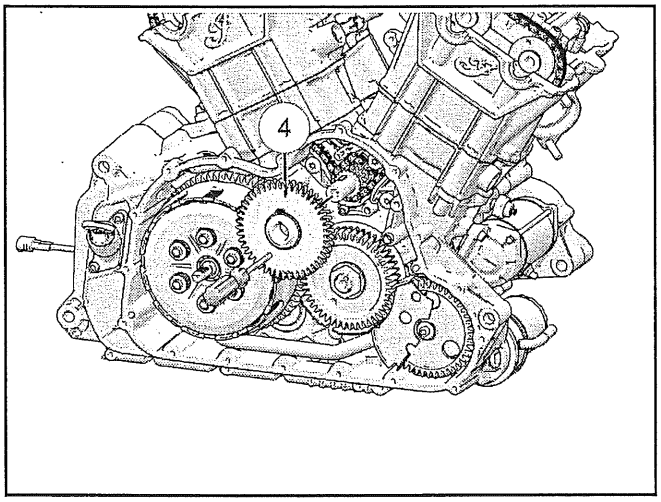
3. Remove four bolts ② securing the cam drive carrier to the crankcase.



4. Remove the cam drive carrier ③ from the crankcase assembly.

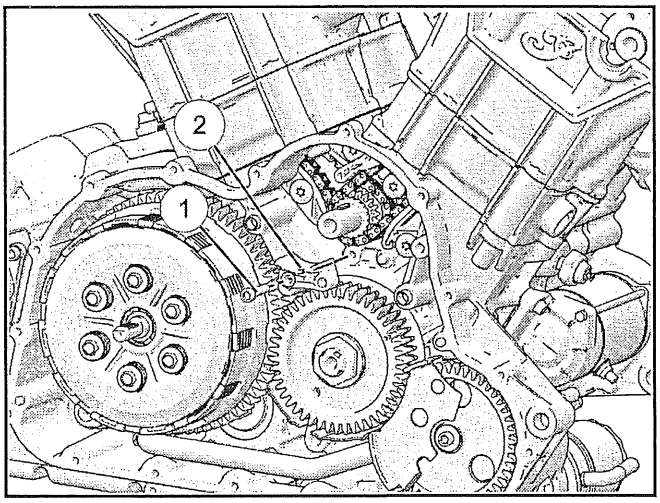


5. Using a pin punch or similar tool, release the preload from the split gear teeth and slide the cam drive gear ④ off of the cam drive shaft.

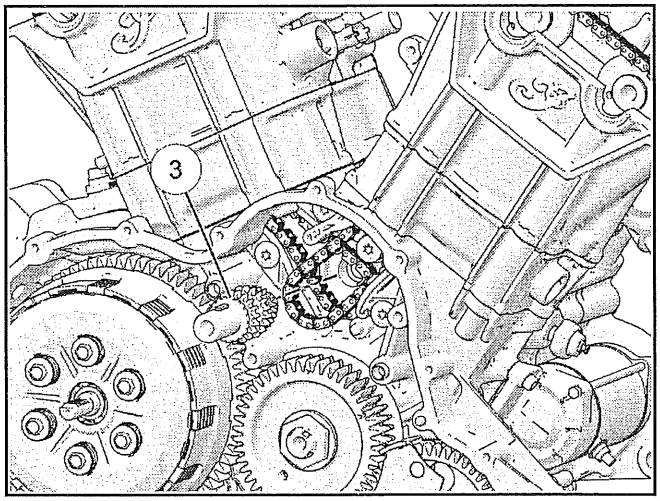


CAM DRIVE SHAFT REMOVAL

1. Remove the camshaft sprockets. See Camshaft Sprocket Removal, page 3.50.
2. Remove the cam drive sprocket. See Cam Drive Sprocket Removal, page 3.51.
3. Remove the screw ① securing the cam chain guide ② from the crankcase assembly.

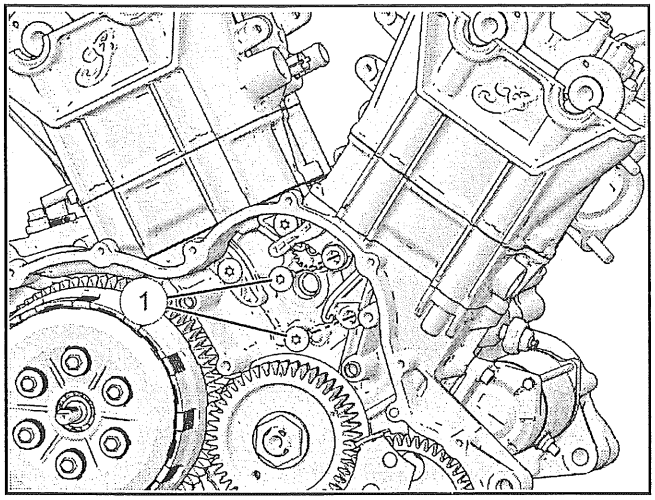


4. Slack the cam chains enough to remove the cam drive shaft ③ and slide out of bearing bore to remove.

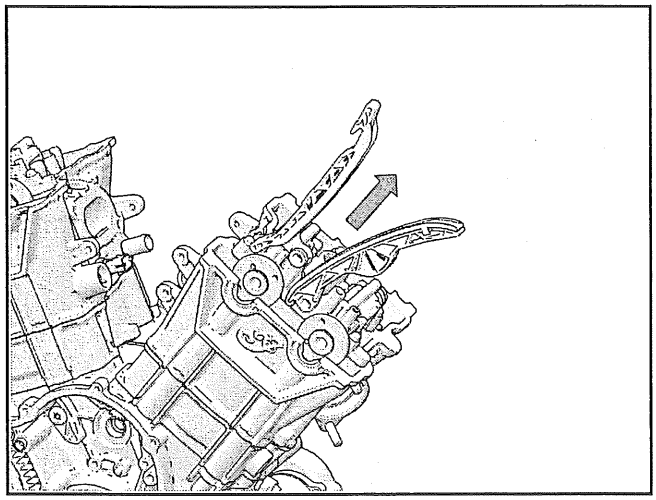


CAM CHAIN GUIDE (LOWER), REMOVAL

1. Remove camshaft sprockets. See Camshaft Sprocket Removal, page 3.50.
2. Start with the front cylinder and remove bolts ① from the guides.



3. Remove the guide (s) through the top of the cylinder head.



4. Repeat steps 1 and 2 for the rear cam chain guides.

CAM CHAIN REMOVAL

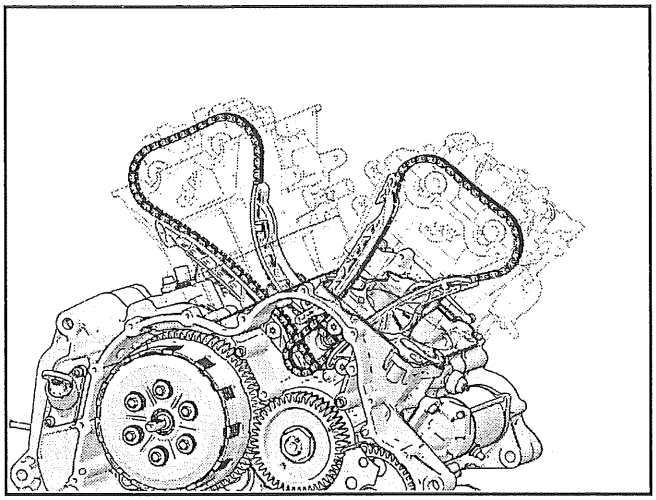
1. Remove the cam drive shaft. See Cam Drive Shaft Removal, page 3.52.
2. Remove lower cam chain guides. See Cam Chain Guide (lower) Removal, page 3.53.
3. Lift cam chain(s) out of engine.

CAM CHAIN INSTALLATION

CAUTION

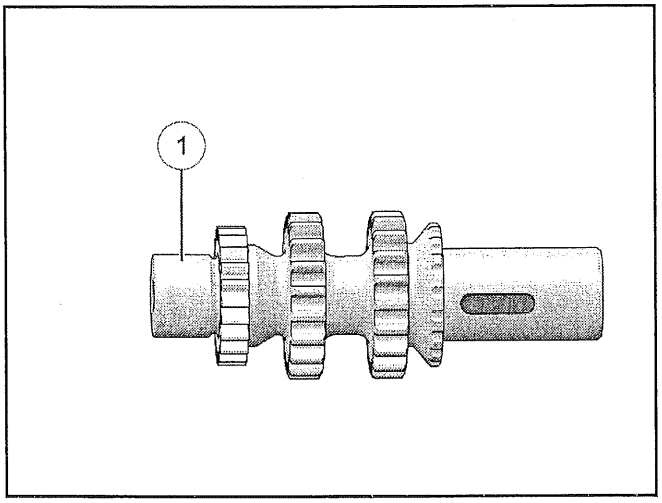
The engine used in Indian Scout models is an INTERFERENCE ENGINE. If the camshafts and crankshaft must be turned independently of each other to set valve timing, the camshafts must be set to TDC prior to rotating the crankshaft. Failure to do this may cause the pistons to contact the valves resulting in engine damage.

1. Feed the cam chain (s) in through the top of the cylinder head (s) keeping the front chain on the outside (right side) of the rear chain.
2. Lay the chains over the camshaft hubs or hang them in position using string to keep them from falling into the crankcase.



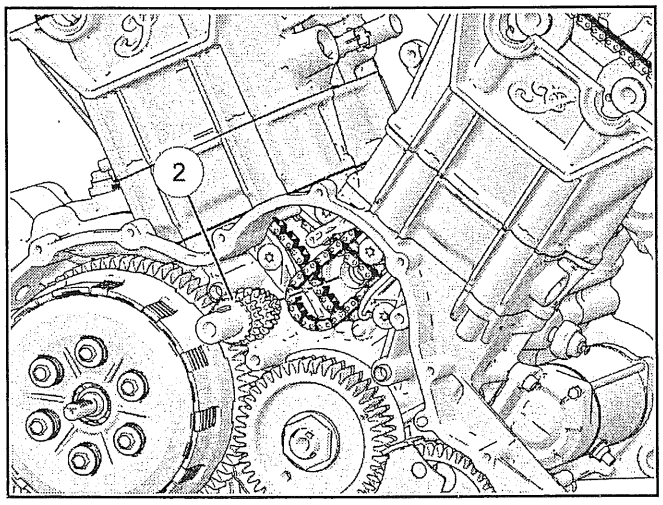
CAM DRIVE SHAFT INSTALLATION

1. Apply a thin coat of assembly lube to the bearing end of the cam drive shaft ①.

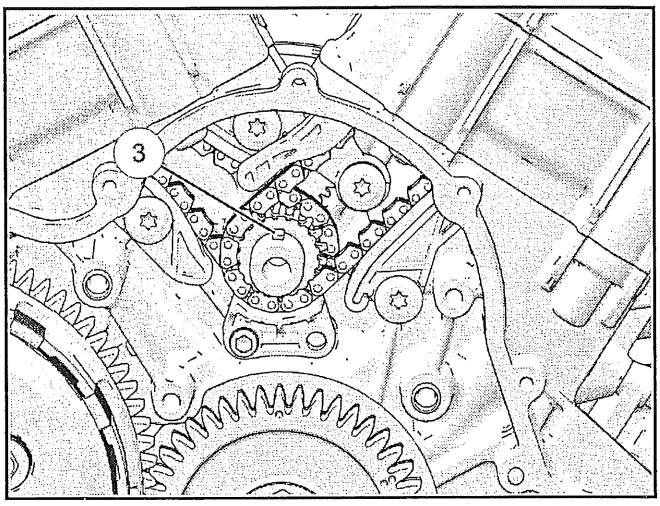


2. Install the cam drive shaft ②:

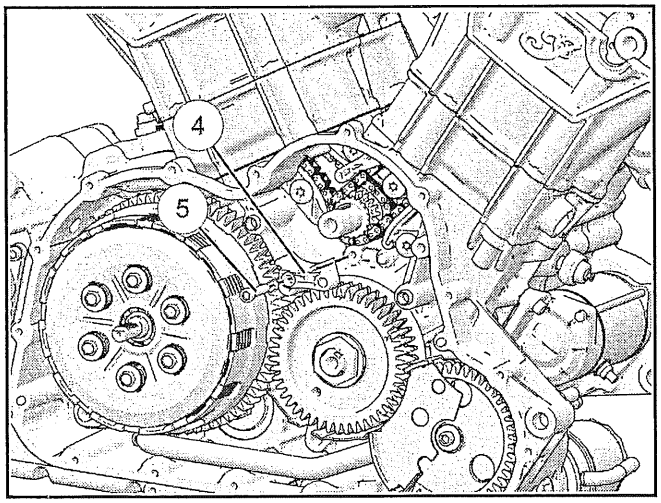
- Loop cam chains around respective sprockets
- Engage water pump gear teeth with cam drive shaft
- Slide cam drive shaft into bearing bore until fully seated



3. Turn the cam drive shaft so the woodruff key is pointing at 12 o'clock.



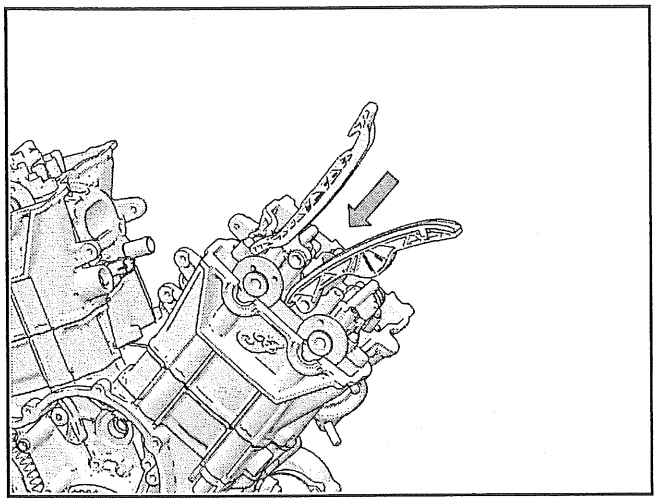
4. Install the cam chain guide and spacer ③ and torque screw ④ to specification.



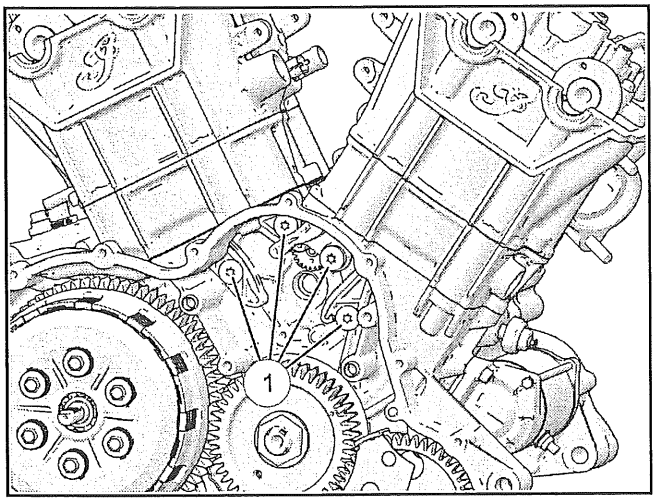
TORQUE
Cam Chain Guide Fasteners (side): **88 in-lbs (10 Nm)**

CAM CHAIN GUIDE (LOWER), INSTALLATION

1. Inspect the guides to verify the guide face isn't cracked or grooved from the chain. Replace guides if damaged.
2. Lower the guides into position through the top of the cylinder head(s).



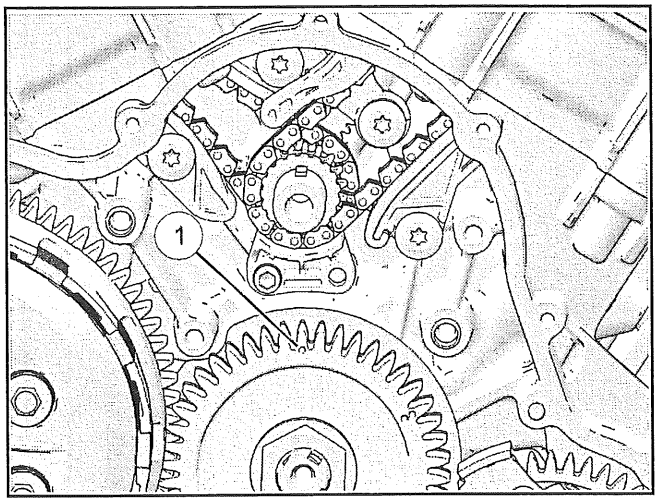
3. Starting with the rear cylinder, hand-tighten the screws ① until seated and torque to specification.



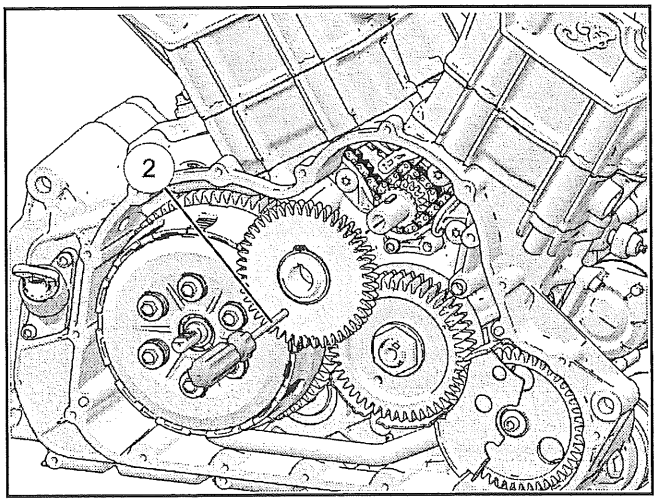
TORQUE
Cam Chain Guide Screws (lower): **88 in-lbs (10 Nm)**

CAM DRIVE SPROCKET INSTALLATION

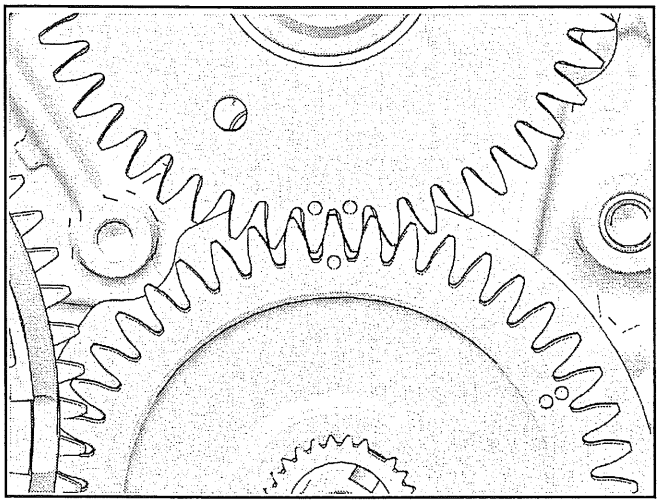
1. Rotate the primary drive gear so the timing mark① is pointing at 12 o'clock.



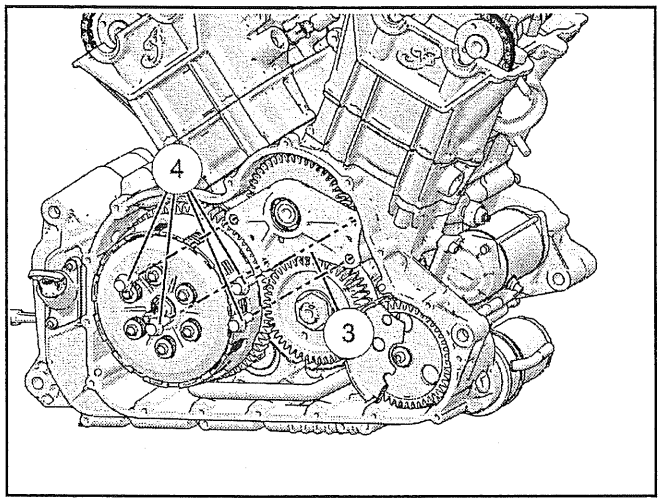
2. Lock the crankshaft in position for service. See Locking the Crankshaft for Service, page 6.6.
3. Using a small screw driver ② or equivalent, preload the gear teeth of the cam drive sprocket.



4. Align the timing marks on the primary gear and cam drive sprocket as shown and slide the cam sprocket onto the cam drive shaft.

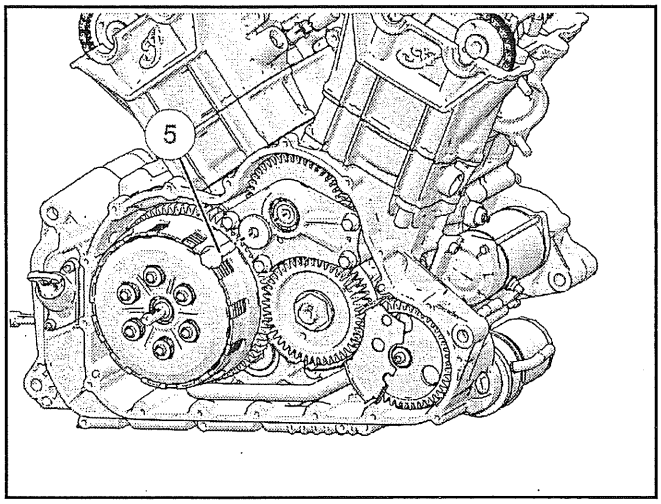


5. Slide the cam bearing support plate ③ into position and hand tighten the four fasteners ④ until seated. Torque fasteners to specification.



TORQUE
Bearing Support Plate Fasteners: **15 ft-lbs (20 Nm)**

6. Install the bearing support plate center fastener ⑤ and washer. Torque to specification.



TORQUE
Bearing Support Plate Center Fastener: **52 ft-lbs (70 Nm)**

CAMSHAFT SPROCKET INSTALLATION / TIMING PROCEDURE

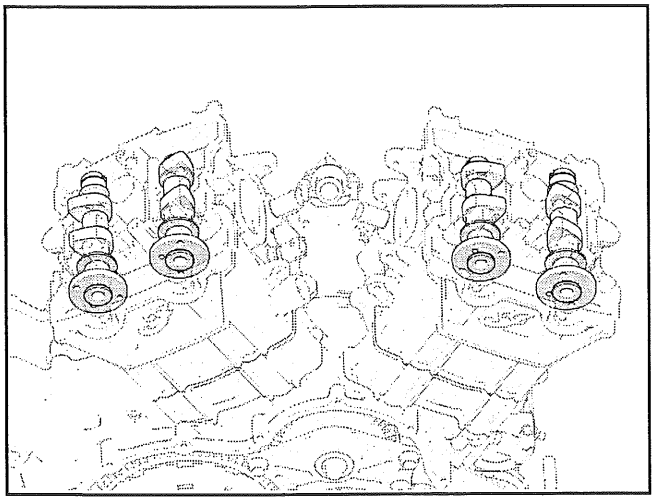
IMPORTANT

Camshaft sprockets are interchangeable (identical for all camshafts) and drilled offset so that they cannot be installed incorrectly.
Letters / Timing Marks on sprockets will appear right-side up if timed correctly and the respective cylinder is at TDC.
See Camshaft Timing Marks, page 3.47 for camshaft timing marks.

CAUTION

DO NOT rotate crankshaft / primary drive gear counterclockwise while timing the camshafts.

1. Lock the crankshaft so that the front piston is at TDC. SeeLocking the Crankshaft for Service, page 6.6 .
2. Rotate camshafts so the lobes are positioned as indicated in the image below.



3. Starting with the front cylinder, install the INTAKE sprocket to the camshaft. Torque screws ① to specification.

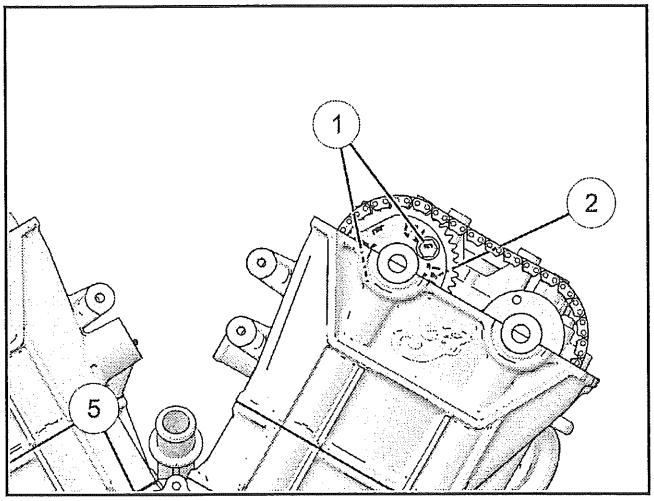
NOTE

Threaded holes in camshaft hubs must be free from oil and debris.

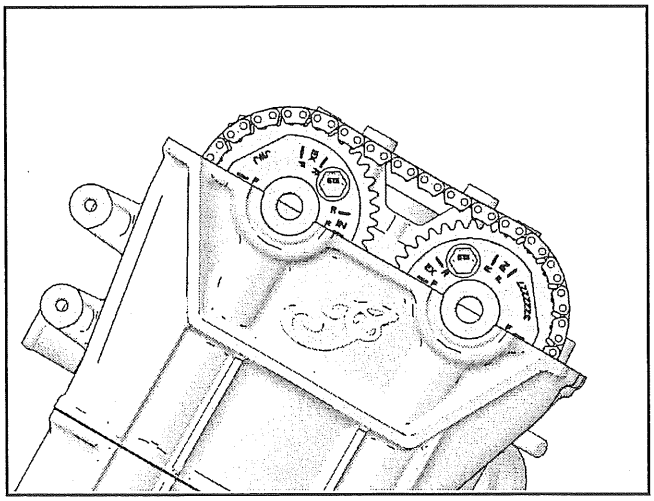
TORQUE

Cam Driven Sprocket Fasteners (All):
88 in-lbs (10 Nm)

4. Take up the slack on the intake side of the cam chain and lay it over the INTAKE sprocket. Verify that the timing marks ② line up with the chain installed and slack removed.



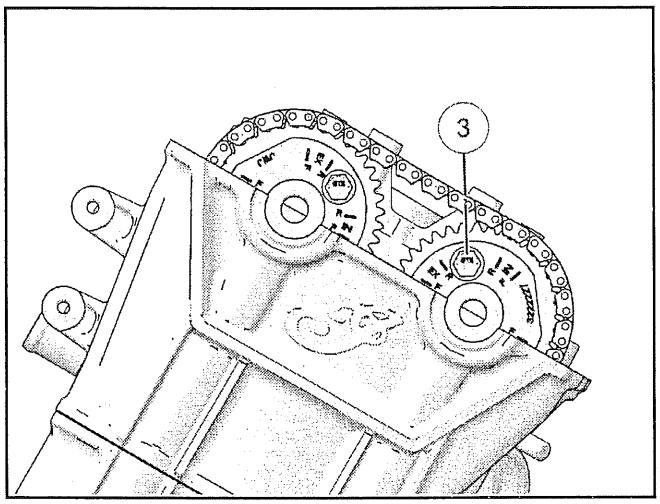
5. Engage the cam chain with the EXHAUST sprocket teeth and fit the sprocket to the camshaft hub. Verify the timing marks on both sprockets align with the machined valve cover gasket surface when slack is removed from the intake side of the chain.



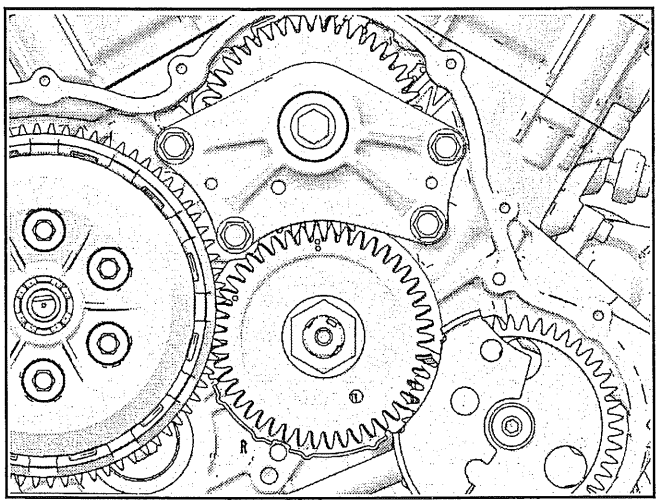
6. Rotate the EXHAUST camshaft until the screw holes line up and install one screw ③ into the exposed hole and torque to specification.

TORQUE

Cam Driven Sprocket Fasteners (All):
88 in-lbs (10 Nm)



7. Install the front cam chain tensioner and torque to specification. See Cam Chain Tensioner Installation, page 3.59.
8. Supporting the rear cam chain, remove the crankshaft locking pin, rotate the crankshaft 300° (CLOCKWISE) and re-lock the crankshaft with the rear piston in the TDC position. See Locking the Crankshaft for Service, page 6.6.
9. The timing mark on the primary drive gear will be at approximately 10 o'clock. Note: Disregard location of double dots on the crankshaft gear.



10. Working on the rear cylinder, install the INTAKE sprocket to the camshaft. Torque screws ④ to specification.

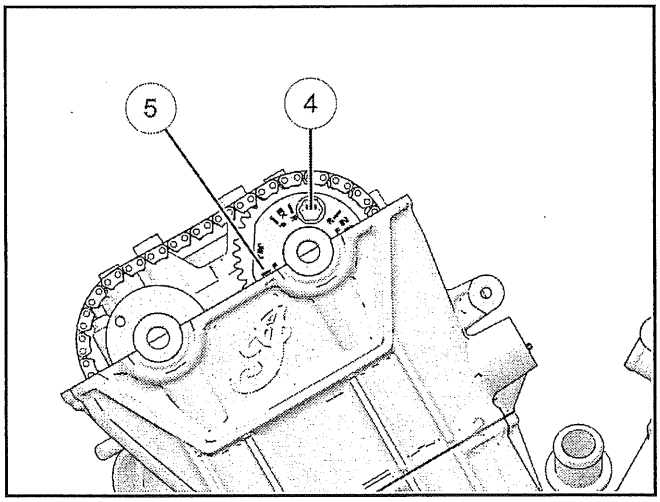
NOTE

Threaded holes in camshaft hubs must be free from oil and debris.

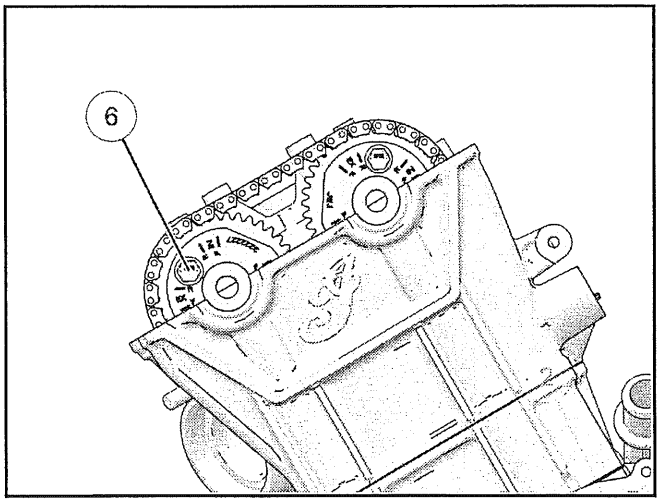
TORQUE

Cam Driven Sprocket Fasteners (All):
88 in-lbs (10 Nm)

11. Take up the slack on the intake side of the cam chain and lay it over the INTAKE sprocket. Verify that the timing marks ⑤ line up with the chain installed and slack removed.

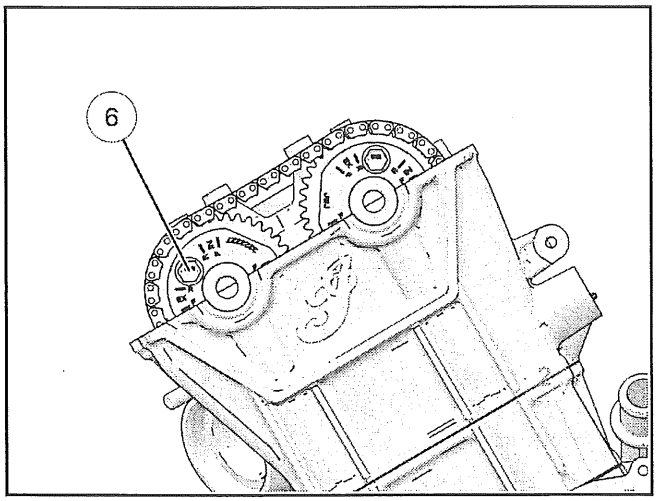


12. Engage the cam chain with the EXHAUST sprocket teeth and fit the sprocket to the camshaft hub. Verify the timing marks on both sprockets align with the machined valve cover gasket surface when slack is removed from the intake side of the chain.



13. Rotate the EXHAUST camshaft until the screw holes line up and install one screw ⑥ into the exposed hole and torque to specification.

TORQUE
Cam Driven Sprocket Fasteners (All): **88 in-lbs (10 Nm)**



14. Install the rear cam chain tensioner and torque to specification. SeeCam Chain Tensioner Installation, page 3.59 .
15. Rotate the crankshaft and install the remaining camshaft sprocket screws. Torque to specification.

TORQUE
Cam Driven Sprocket Fasteners (All): **88 in-lbs (10 Nm)**

16. Rotate the crankshaft several times and stop on TDC of both cylinders to verify that the timing marks still match up and that the engine turns freely.

CAM CHAIN TENSIONER INSTALLATION

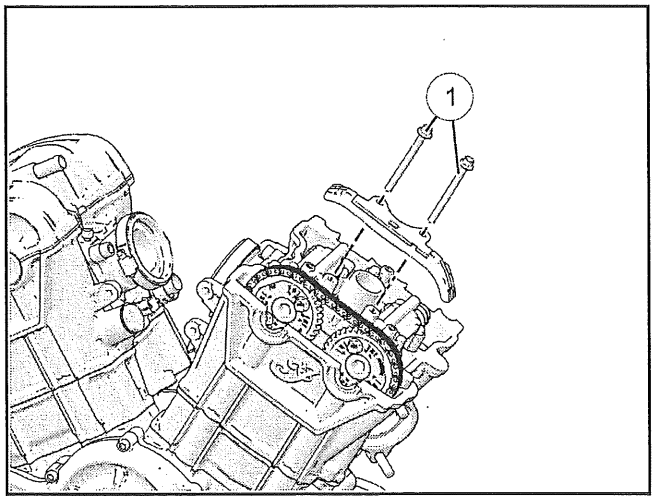
1. Verify that the engine is at TDC and the timing marks are properly aligned. SeeCamshaft Timing Marks, page 3.47.
2. Install the tensioner (s) with new sealing washers and torque to specification.
3. Install tensioner bolt and torque to specification.

TORQUE
Cam Chain Tensioner: **15 ft-lbs (20 Nm)**

CAM CHAIN GUIDE (UPPER), INSTALLATION

1. Install guide (s) and torque screws ① to specification.

TORQUE
Cam Chain Guide Fasteners (upper): **88 in-lbs (10 Nm)**

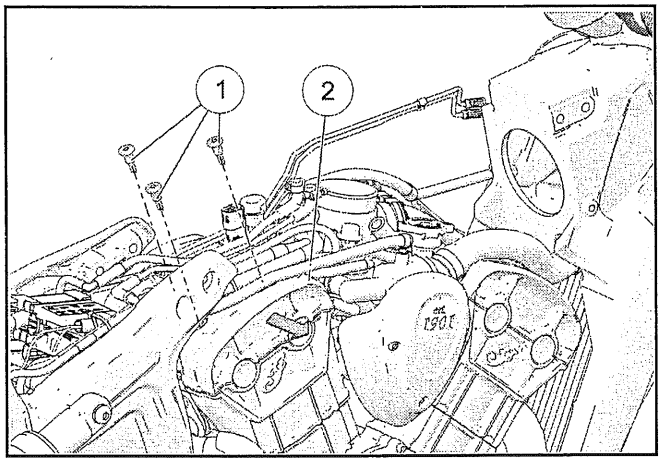


2. Install valve cover(s). See Valve Cover Installation, page 3.60.

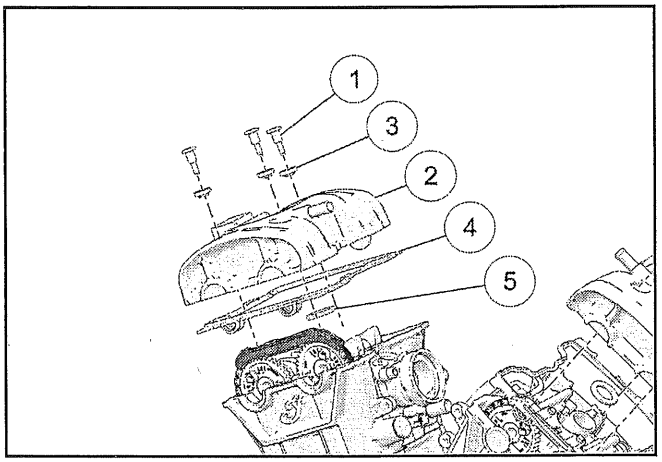
CYLINDER HEAD SERVICE

VALVE COVER REMOVAL

1. Secure the vehicle in an upright position.
2. Remove the seat. See Seat Removal / Installation, page 7.8.
3. Remove the fuel tank. See Fuel Tank Removal, page 4.14.
4. Remove air box. SeeAir Box Removal, page 3.4.
5. Use a T40 Torx to remove the three valve cover screws ①.

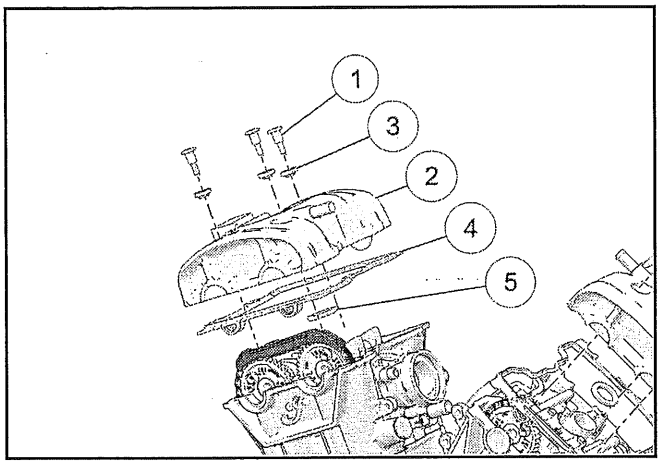


6. Remove the valve cover ② and gaskets.
7. Discard and replace the valve cover isolators ③, gasket seal ④, and the spark plug tube seal ⑤.

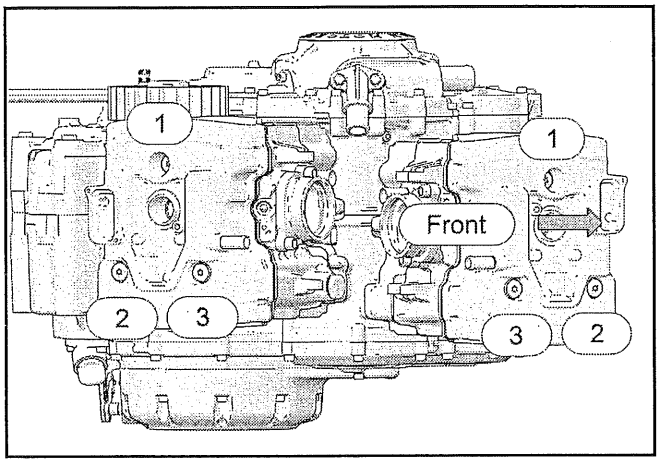


VALVE COVER INSTALLATION

1. Assemble new cover gasket ④ on the valve cover.



2. Assemble spark plug tube seal ⑤ on cylinder head.
3. Install valve cover ② on cylinder head with new isolators ③ and hand tighten the valve cover fasteners ①.
4. Reference the torque sequence and torque valve cover screws to specification.



TORQUE
Valve Cover Fasteners: **88 in-lbs (10 Nm)**

5. Install ignition coils. See Ignition Coil Removal / Installation, page 10.35.
6. Install airbox. SeeAir Box Installation, page 3.5.
7. Install fuel tank. SeeFuel Tank Installation, page 4.19.
8. Install the seat. See Seat Removal / Installation, page 7.8.

VALVE CLEARANCE ASSEMBLY

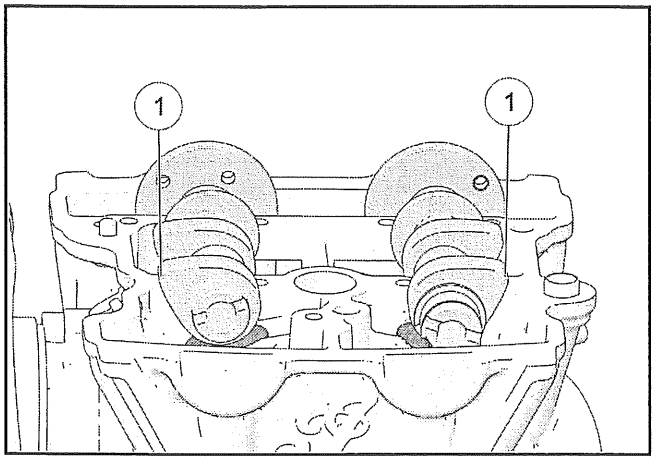
NOTE

Always inspect valve clearance prior to camshaft installation or final engine assembly.

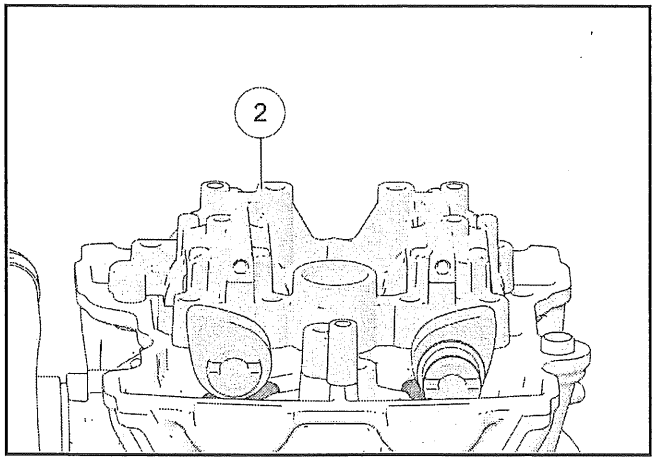
1. Reference the camshaft intake and exhaust markings made during disassembly. If installing new camshafts or if camshafts were not marked, reference the part number stamped on the camshaft ends.

Intake Camshaft - PN 3022484Exhaust Camshaft - PN 1204693

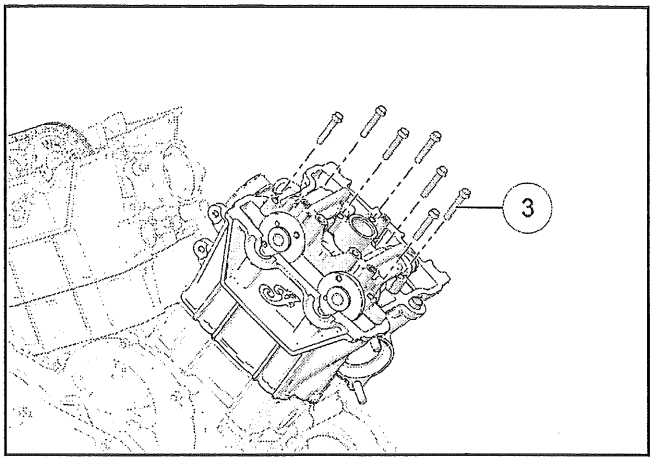
2. Lubricate the camshaft bearing journal surfaces with Indian Motorcycle engine oil prior to installation.
3. Carefully install the camshafts into the cylinder head. The camshaft lobes ① should be positioned as shown.



4. Carefully install the camshaft carrier ② onto the camshafts.



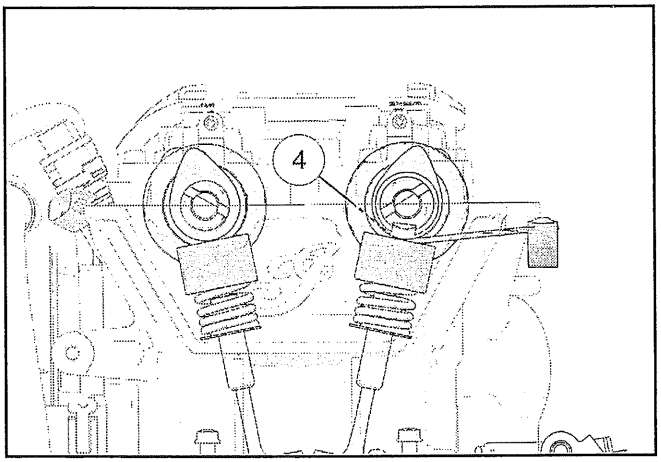
5. Install the camshaft carrier bolts ③ and tighten the bolts evenly to specification.



TORQUE

Camshaft Carrier Fasteners (short & long):
88 in-lbs (10 Nm)

6. Rotate the camshaft until the cam lobe above the valve being inspected is facing up.
7. Measure the valve clearance using a thickness (feeler) gauge ④. Record the measurement if clearance is out of specification.



8. Repeat steps 6 and 7 until all eight valves have been inspected.

MEASUREMENT

Intake Valve Clearance (cold): **0.006" ± 0.001"**
(0.152 mm ± 0.05 mm)
Exhaust Valve Clearance (cold): **0.008" ± 0.001"**
(0.203 mm ± 0.05 mm)

9. If any of the valve clearance measurements are out of specification, remove the camshaft carriers and camshafts and proceed with this procedure.

NOTE

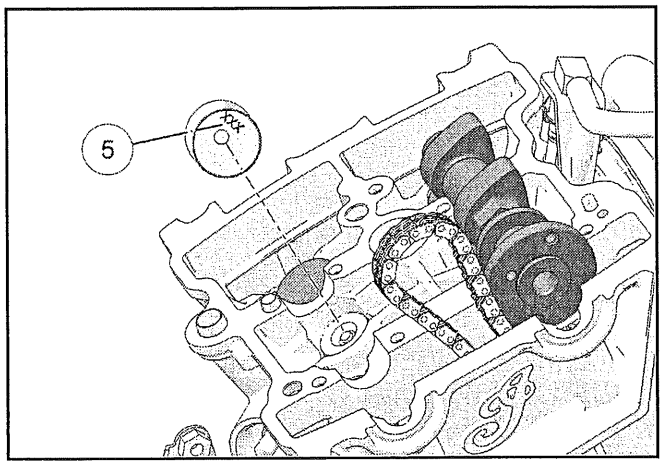
If all valve clearance measurements are within specification proceed to Camshaft Sprocket Installation / Timing Procedure, page 3.57.

10. Remove the valve tappet from a valve that was out of specification.

NOTE

Keep mated parts together and in order with respect to their location in the cylinder head for assembly purposes. Mark each component or place them in an organized rack as you remove them.

11. Record the 3 digit number ⑤ on the bottom of the tappet.



12. Reference the valve clearance measurement recorded for that valve, along with the 3-digit tappet number.
13. Refer to the appropriate tappet selection matrix (Intake or Exhaust) on the following pages and select the proper tappet.
14. Install the proper tappet.

NOTE

Lubricate the outer portion of the valve tappet upon installation.

15. Repeat steps 10-14 until all necessary valves have been adjusted.
16. Reinstall the camshafts and camshaft carriers and tighten the bolts evenly to specification.

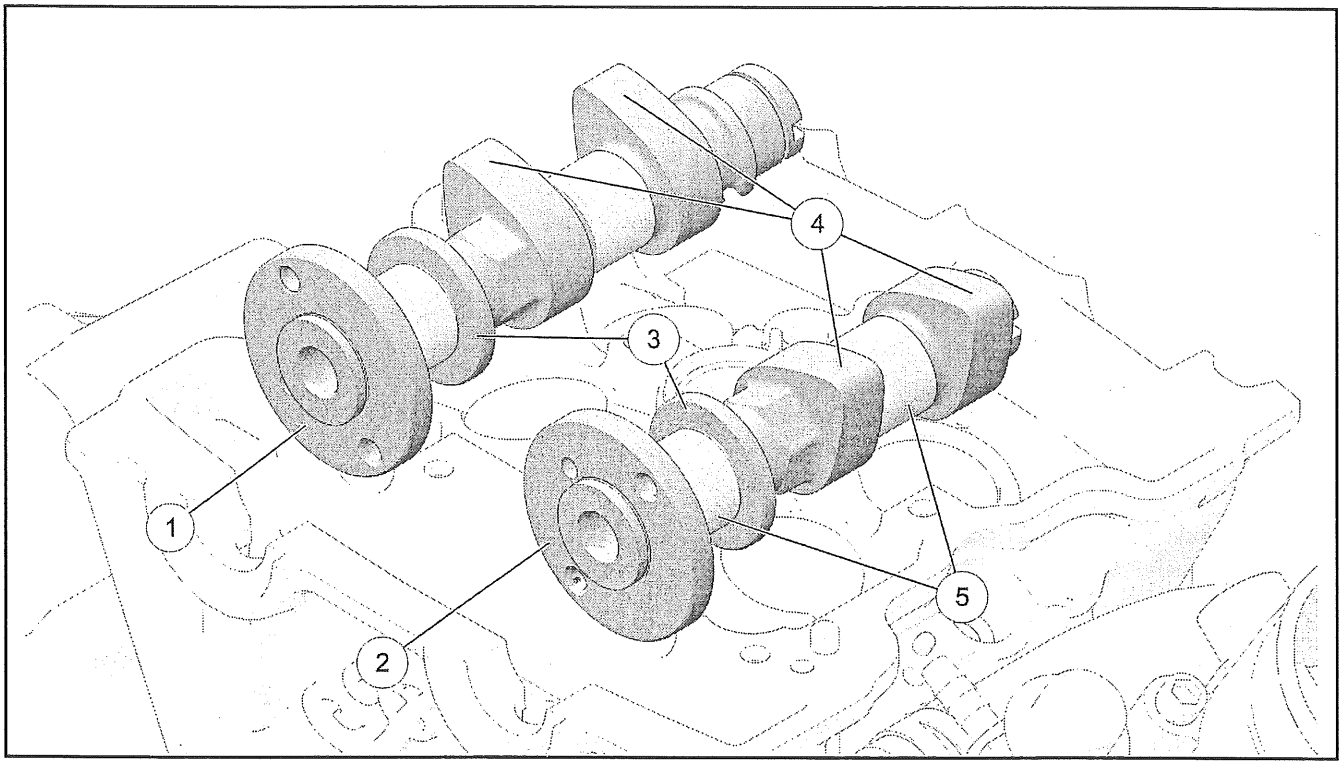
TORQUE

Camshaft Carrier Fasteners (short & long):
88 in-lbs (10 Nm)

17. Measure and confirm that valve clearance is now within specification for each valve.
18. If valve clearance is not within specification, repeat this procedure.
19. If all valve clearance measurements are now within specification, remove the camshaft carriers and proceed to Camshaft Sprocket Installation / Timing Procedure, page 3.57.

CAMSHAFT INSPECTION

For the following camshaft inspection procedure, refer to the camshaft service specifications section. See Service Specifications, page 3.42.



NUMBER	DESCRIPTION
①	Exhaust Camshaft
②	Intake Camshaft
③	Thrust Face
④	Cam Lobes
⑤	Bearing Journals

1. Visually inspect camshaft journal surfaces for scoring or signs of insufficient lubrication. Replace camshaft if heavy scoring or damage is noted.
2. Inspect height of each cam lobe for INTAKE and EXHAUST camshafts.
3. Measure O.D. of each camshaft journal for INTAKE and EXHAUST camshafts.
4. Inspect the camshaft hub face for damage or surface roughness.
5. Inspect decompression device (EXHAUST camshaft only).
6. Inspect camshaft thrust face(s) for uneven wear and scoring.
7. Wash the camshaft in solvent.
8. Oil the camshaft.

CYLINDER HEAD REMOVAL

CAUTION

Cylinder and Cylinder Head assemblies may have extremely sharp machined surfaces. Gloves should be worn whenever handling these components to prevent personal injury.

IMPORTANT

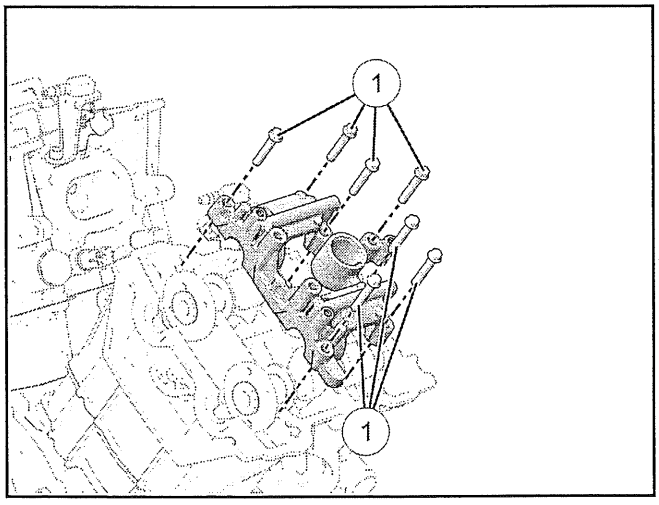
Removing the cylinder head(s) releases pressure on the cylinder base gasket(s). Cylinder base gasket(s) should always be replaced in conjunction with cylinder head removal / service.

1. Remove engine from frame and place on an engine stand. See Removing Engine From Frame, page 3.11
2. Remove the intake manifold assembly. See Intake Manifold Removal / Installation, page 4.12

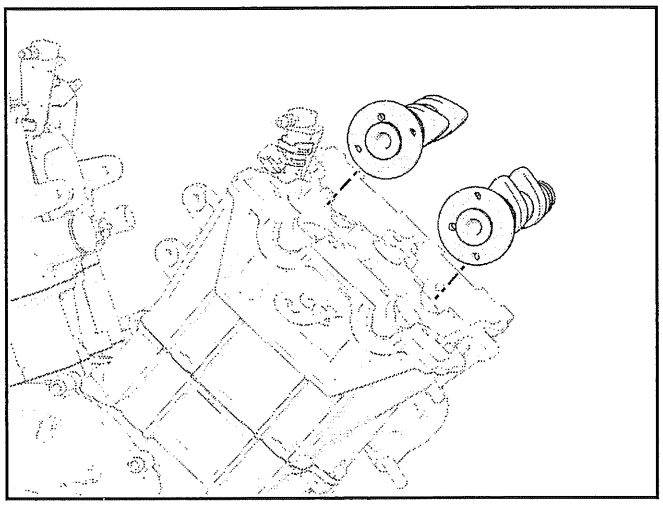
NOTE

Repeat STEPS 3 - 11 for each cylinder head being serviced. Cylinder heads can be removed individually.

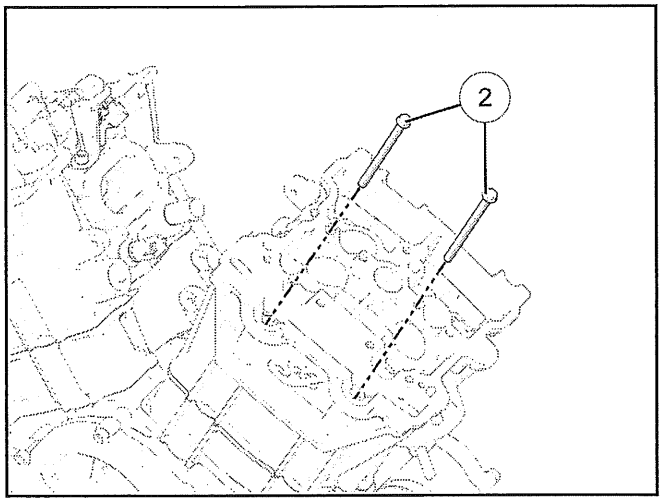
3. Remove the ignition coil from the cylinder(s) being serviced. See Ignition Coil Removal / Installation, page 10.35
4. Remove the camshaft sprockets. See Cam Drive Sprocket Removal, page 3.51
5. Remove the lower cam chain guides. See Cam Chain Guide (lower) Removal, page 3.53
6. Carefully lower the cam chain into the cam chain gallery.
7. Remove the seven remaining screws ① and the camshaft carrier.



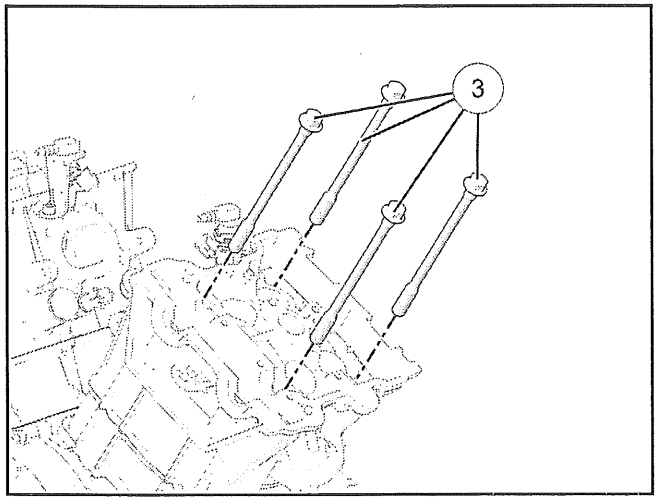
8. Paying attention to location / orientation, remove camshafts from cylinder head.



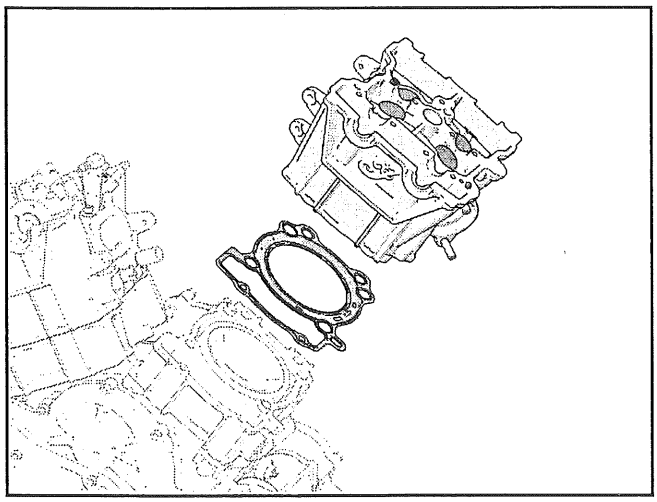
9. Using a long extension, remove the two screws ② from inside the cam chain gallery.



10. Alternately loosen and remove cylinder head bolts ③.



11. Remove the cylinder head assembly and cylinder head gasket by carefully lifting off of cylinder.



CYLINDER HEAD DISASSEMBLY

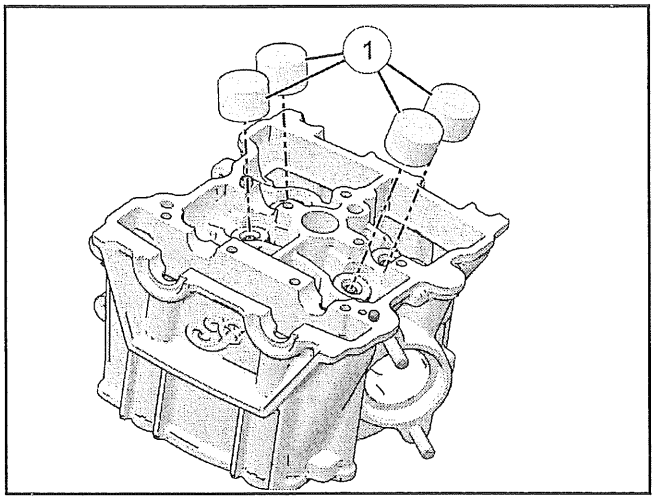
CAUTION

Wear eye protection while removing valve springs.

NOTE

Keep mated parts together for assembly.

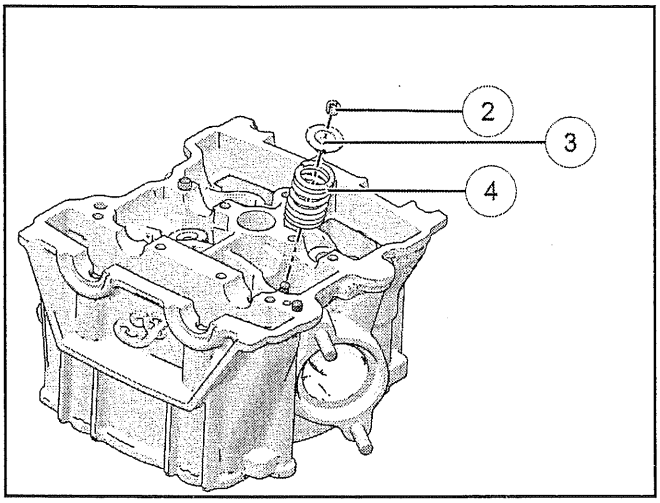
1. Remove the cylinder head (s) to be serviced. See Cylinder Head Removal, page 3.64.
2. Remove the tappets ① by lifting out of the bore.



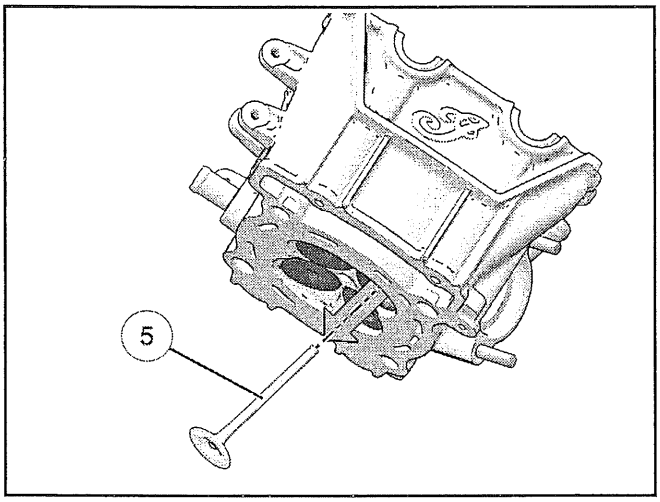
NOTE

If tappets will be reused, wipe excess oil off using solvent and a clean towel. Mark each tappet with a marker so it can be matched to it's respective bore upon reassembly.

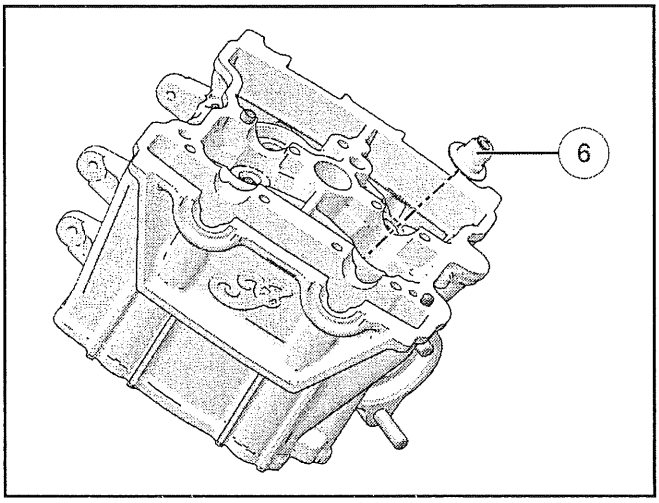
3. Using valve spring compressor **PV-1253** remove keepers ②, upper spring retainer ③ and valve spring ④ from valves.



4. Slide valve ⑤ out through the bottom of the cylinder head.



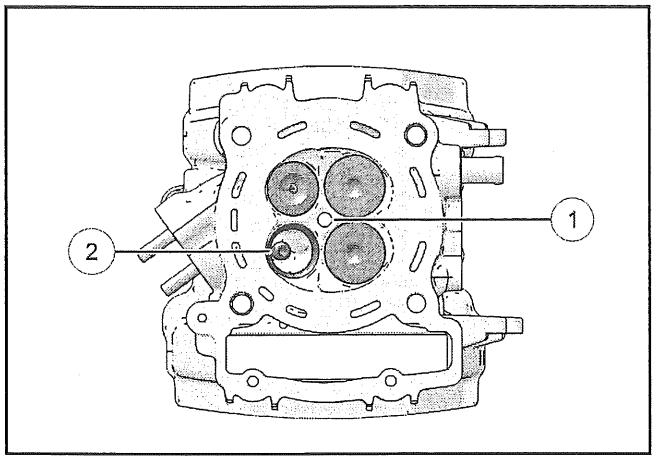
5. Remove and discard the spring seat / valve stem seal assembly ⑥.



6. Clean carbon deposits from combustion chamber.
7. Clean gasket surfaces.

CYLINDER HEAD INSPECTION

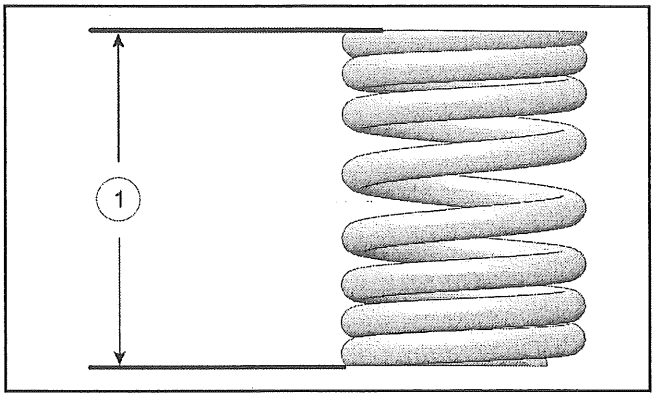
1. Visually inspect cylinder head for cracks or damage. Pay close attention to the areas around spark plug ① and valve seats ②.



2. Inspect cylinder head for distortion with a straight edge and feeler gauge. Check in different directions and locations on the cylinder head. For cylinder head service limits, see Service Specifications, page 3.42.

VALVE SPRING FREE LENGTH INSPECTION

- Measure free length of valve springs. Replace springs that do not meet specification. See Service Specifications, page 3.42.



ITEM	STANDARD LENGTH
①	1.93 in (49.1 mm)

NOTE

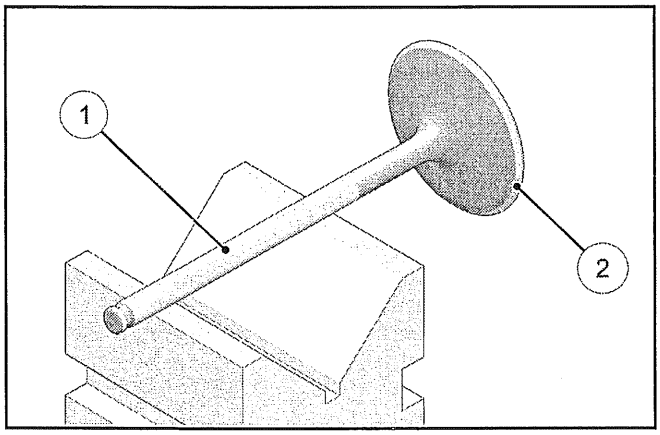
Intake and exhaust springs are identical.

VALVE INSPECTION

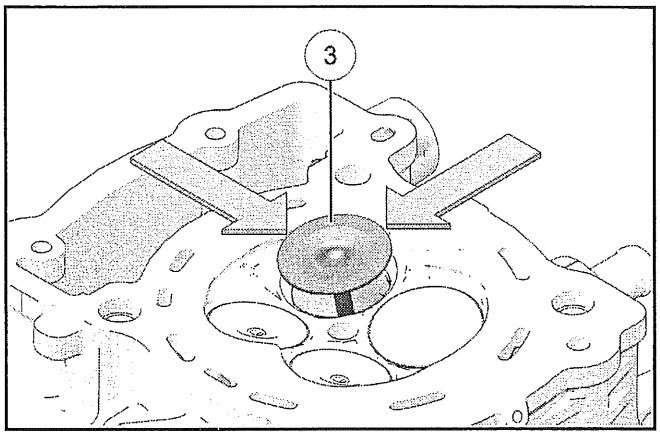
NOTE

Valve service specifications can be found at the beginning of this chapter. See Service Specifications, page 3.42.

1. Place valves on V-blocks as shown and measure valve stem runout ① using a runout gauge or similar tool.
2. Inspect the valve face for damage from burning, pitting or uneven contact.
3. Place valves on V-block as shown and inspect valve head radial runout ②.



4. Insert valves into their original locations in cylinder head.
5. Inspect that each valve moves up and down smoothly without binding in guide.
6. Measure valve stem deflection ③ for all valves to determine if valve or valve guide requires replacement.



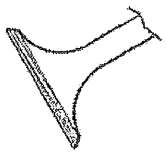
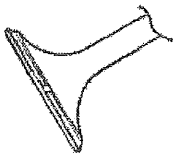
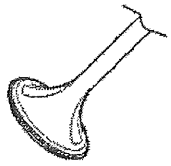
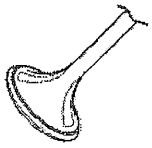
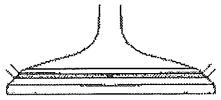
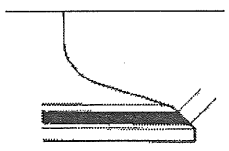
A. Raise valve 10mm (0.400") off of seat.

B. Position dial indicator as shown. Measure deflection in two directions perpendicular to each other (X & Y axis).

C. If valve deflection exceeds service limit measure valve stem diameter.

7. Replace valve and repeat step 6 if valve stem O.D. measures outside standard range. If valve stem deflection exceeds service limits with a new valve installed, valve guide must be replaced.
8. Installation of new valve guides and/or new valves requires valve seat reconditioning. This work should be performed by an experienced technician properly equipped to perform cylinder head reconditioning.

VALVE INSPECTION - QUICK REFERENCE

CONDITION	ILLUSTRATION	POSSIBLE CAUSE	CORRECTIVE ACTION
Uneven seat width		Bent valve stem, worn valve guide	Replace valve and reface seat
Damaged valve face		Burnt, pitted, foreign material damage	Replace valve and reface seat
Contact area too high		Wear, settling of valve seat	Lower with 30° stone
Contact area too low		Wear, settling of valve seat	Raise with 60° stone
Contact area too wide		Wear, settling of valve seat	Narrow with both 30° stone and 60° stone
Contact area too narrow			Use 45° stone
Contact area free of pitting and damage, centered in seat, proper width.		Correct	None

VALVE GUIDE REMOVAL / INSTALLATION

CAUTION

Replacement of valve guides requires an oven, special equipment and experience to do the job correctly. If you are unsure of your ability to do the repair professionally it is best to sublet the labor to a competent machinist. Valve seat reconditioning is required when valve guides are replaced.

1. Support cylinder head and place valve guide remover into valve guide from the combustion chamber side.
2. Drive or press old valve guides out of cylinder head.

CAUTION

The cylinder head can be easily damaged if the procedure is done carelessly.

3. Apply 90 weight oil to outside of new valve guides.
4. Drive or press new guides from rocker arm side of head.
5. Measure valve guide height from spring seat:

MEASUREMENT

Guide Height from Valve Spring Seat (Installed):
Intake: **11.74 - 11.14 mm**
Exhaust: **11.14 –10.54 mm**

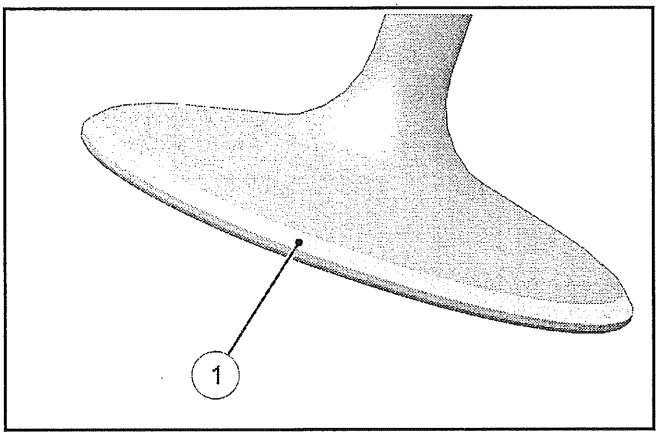
6. Ream new valve guides to size to obtain specified stem-to-guide clearance. Ream from combustion chamber side of head.
7. Clean cylinder head thoroughly with clean solvent.
8. Inspect and recondition valve seats.

VALVE SEAT INSPECTION

NOTE

Valves cannot be ground. If valve face is burned or badly worn, replace the valve.

1. Remove carbon deposits from valves and seats.
2. Inspect valve face for burning, pitting or uneven contact.
3. Apply a light coating of machinist's layout fluid or paste to valve face.
4. Install valve into valve guide.
5. Tap valve several times to make a clear impression on the valve face. Do not rotate valve.
6. Remove valve and measure contact area ①. See Service Specifications, page 3.42.



7. If valve seat is incorrect, recondition as needed.

VALVE SEAT RECONDITIONING

NOTE

Valve seat reconditioning should be performed by a technician proficient in cylinder head reconditioning techniques using grinding stones. The use of carbide cutters is not recommended. Follow recommendations of the manufacturer of the valve seat reconditioning equipment being used. Do not grind seats more than necessary to provide proper seat width and contact point on valve face.

CYLINDER HEAD ASSEMBLY

CAUTION
Wear eye protection during assembly.

1. Lubricate valve stems with assembly lube.
2. Install valve in head *before* installing seal. Hold valve against seat wipe off the portion that extends above the guide.
3. Apply Indian Motorcycle engine oil to valve guide seal and install seal on valve, rotating the seal as you install it.
4. Press seal firmly in place on top of guide. Be careful not to dislodge spring from seal.
5. Install valve spring and upper retainer.

CAUTION
Do not compress valve springs more than necessary to install keepers. Support cylinder head so valves will not be damaged.

6. Compress valve springs using a valve spring compressor and adapter.
7. Apply a small amount of grease to both sides of a valve keeper.
8. Insert both valve keepers in place on valve.
9. Remove spring compressor.
10. Repeat previous steps for remaining valves.
11. Be sure all keepers are fully seated in groove.

CYLINDER HEAD INSTALLATION

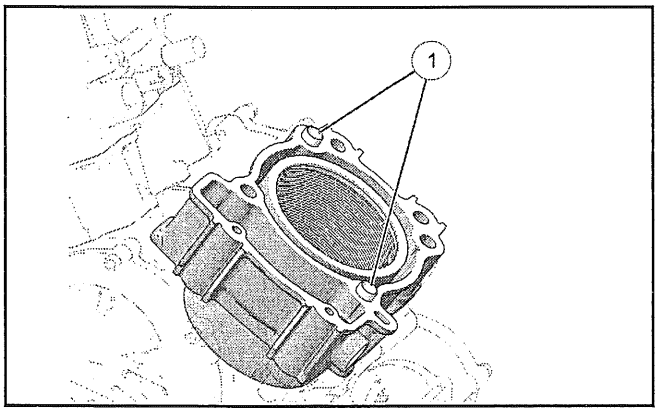
CAUTION

Torque-to-Yield cylinder head bolts can only be reused / re-torqued once following removal. Attempts to reuse bolts beyond one re-torque may result in lower sealing pressure and potential oil / coolant leaks.

NOTE

The base gasket seal is broken when the cylinder head is removed and must be replaced. See Cylinder Installation, page 3.88.

1. Verify that locating dowels ① are in position on the cylinder deck.

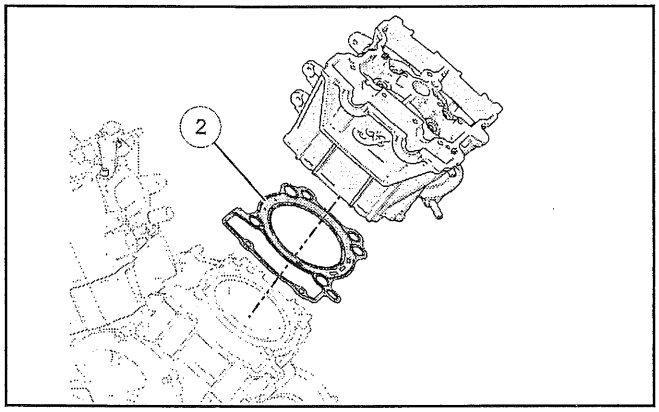


2. Thoroughly clean cylinder and cylinder head mating surfaces.

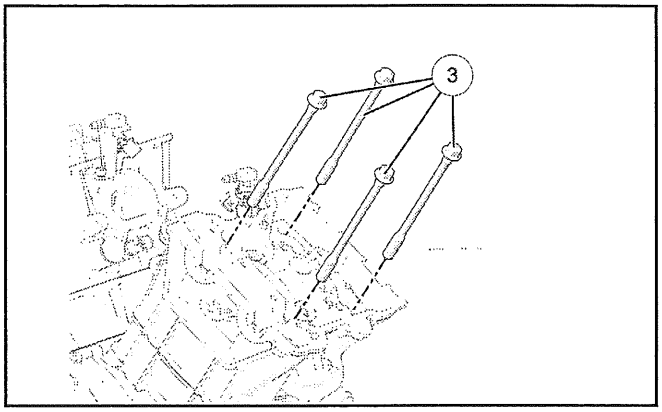
NOTE

Gaskets and gasket sealing surfaces must be free of oil and grease during assembly.

3. Install a new head gasket ②.
4. Set cylinder head in place on cylinder and press down over the locating dowels until fully seated.



5. Apply a thin coat of Indian Motorcycle engine oil to the cylinder head bolt threads and install fasteners③ finger-tight.

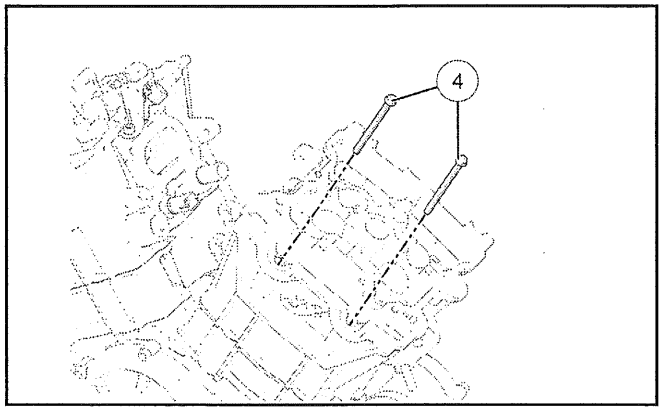


6. Torque cylinder head fasteners in an "X" pattern following the specified sequence:

TORQUE

Cylinder Head Fasteners:
STEP 1: 21 ft-lbs (28 Nm)STEP 2: 26 ft-lbs (35 Nm)
STEP 3: Plus 270 degrees

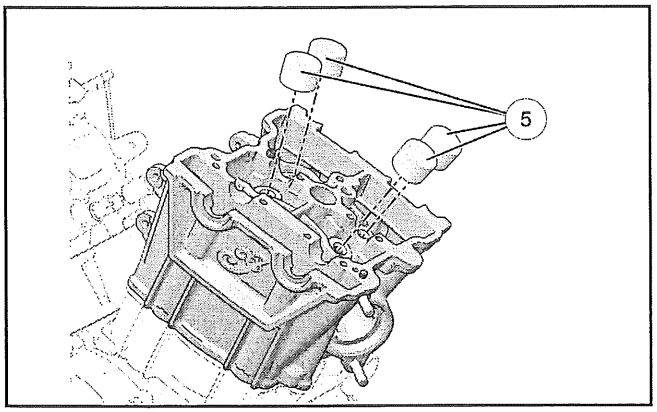
7. Install fasteners ④ into cam chain gallery and torque to specification.



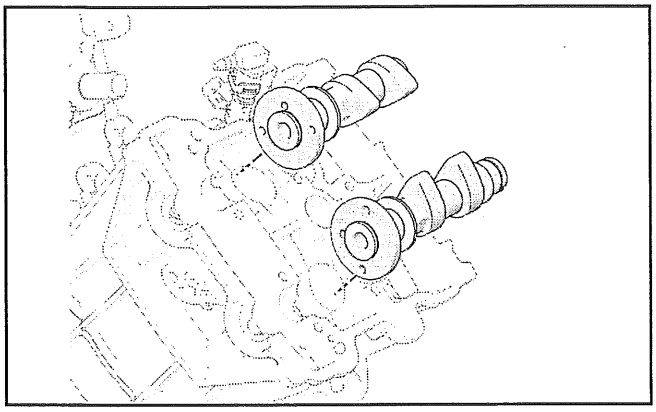
TORQUE

Cam Chain Gallery Fasteners:
88 in-lbs (10 Nm)

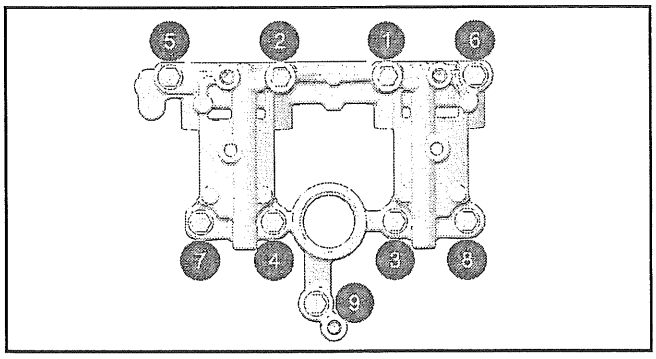
8. Apply a thin coat of Indian Motorcycle engine oil to each of the tappets ⑤ and install them in the same position from which they were removed.



9. Lubricate camshaft lobes and bearing journals with Indian Motorcycle engine oil and install into cylinder head.



10. Insert the spark plug seal into the cam carrier and install carrier onto cylinder head.
11. Temporarily install the upper cam chain guide and torque the carrier fasteners per the specified sequence.



TORQUE
Camshaft Carrier Fasteners (short & long): **88 in-lbs (10 Nm)**

12. Check valve lash and adjust if necessary. See Valve Clearance Assembly, page 3.61.
13. Remove upper cam chain guide.
14. Install cam chain. See Camshaft Sprocket Installation / Timing Procedure, page 3.57.
15. Install upper cam chain guide and re-torque per STEP 11.
16. Install valve cover(s). See Valve Cover Installation, page 3.60.
17. Install intake manifold. See Intake Manifold Removal / Installation, page 4.12.
18. Install engine in frame. See Engine Installation, page 3.12.

INTAKE VALVE LASH - TAPPET SELECTION MATRIX

Tappet Thickness: Example 440 equals thickness of 4.40 mm. Part Number: 5138477-XXX (X's represent 3 digits on tappet)

MEASUREMENT
Intake Valve Clearance (cold): .006 ± .002" (0.150 ± .05 mm)

| Intake Valve Clearance Before Adjusting (mm) | Existing Valve Lash Tappet Marking (3 digits on tappet) | | |

EXHAUST VALVE LASH - TAPPET SELECTION MATRIX

Example:

Tappet Thickness: Example 440 equals thickness of 4.40 mm. Part Number: 5138477-XXX (X's represent 3 digits on tappet)

MEASUREMENT
Exhaust Valve Clearance (cold): .008 ± .002" (0.200 ± .50 mm)

| Exhaust Valve Clearance Before Adjusting (mm) | Existing Valve Lash Tappet Marking (3 digits on tappet) | | |

TROUBLESHOOTING CYLINDER HEAD AND VALVE TRAIN

NOTE

Cylinder head, valve train and piston/cylinder problems are usually detected by an engine compression test. Other problems associated with this area of the engine are external fluid leaks, excessive oil consumption or abnormal noises.

The troubleshooting tables that follow list *possible* causes of engine mechanical problems. Always thoroughly investigate before disassembling an engine.

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
Hard Starting / Won't Start	Low Compression	Worn Valve Guide(s)	Replace Valve Guide(s)
		Poor Seating of Valve(s)	Repair or Replace
		Broken Valve Spring(s)	Replace
		Spark Plug Not Seated	Torque to Specification
		Incorrect Valve Timing	Repair / Retest
		Valve Stuck Open	Repair / Retest
		Cylinder Head Gasket Leak	Repair / Retest
		Slow Starter Motor	Refer to Electrical Chapter
		Worn Rings, Piston, or Cylinder	Refer to Engine / Cooling / Exhaust Chapter
		Valve Clearance out of Specification	Adjust Valve(s)
		Ignition Problem	Refer to Electrical Chapter
		Fuel Problem	Refer to Fuel Delivery / EFI Chapter
Electric Starter Straining to Turn Engine Over	High Compression	Excessive carbon build-up in combustion chamber	De-carbon Combustion Chamber
	Excessive Starter Load	Internal Engine / Drive Components Seized or Binding	Determine Cause of Seizure or Binding
Poor idle Quality (Engine Related)	Low Compression	Valve Clearance out of Specification	Adjust Valve(s)
		Poor Seating of Valve(s)	Repair or Replace
	Excessive Oil in Combustion Chamber	Valve Guides	Replace
		Worn Rings, Piston, or Cylinder	Refer to Engine / Cooling / Exhaust Chapter
		Engine Oil Overfilled	Correct Engine Oil Level
Engine Noise	Valve Train Area	Loose or Tight Valve(s)	Adjust Valve(s)
		Broken or Weak Valve Spring(s)	Replace
		Worn Camshaft or Tappet	Replace
		Chain Tensioner and / or Guide Worn	Replace
		Cam Bearings Worn or Damaged	Replace
	Piston / Cylinder Area	Worn Pistons and / or Cylinders	Replace

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
		Worn Wrist Pin, Wrist Pin Bore and / or Connecting Rod	Replace
		Worn Piston Rings or Piston Ring Lands	Replace
	General	Exhaust Leak	Reseal Exhaust
	Timing Chain Area	Chain / Sprocket Worn	Replace
		Chain Tensioner and / or Guide Worn	Replace
	Bottom End Area	Main Bearings	Refer to Transmission / Crankshaft Chapter
		Rod Bearings	Refer to Transmission / Crankshaft Chapter
		Loose Side Clearance	Refer to Transmission / Crankshaft Chapter
	Transmission Area	Bearings	Refer to Transmission / Crankshaft Chapter
Poor High-Speed Running	Air Intake Problem	-	Refer to Fuel Delivery / EFI Chapter
	Fuel Injection Problem	-	Refer to Fuel Delivery / EFI Chapter
	Ignition Problem	-	Refer to Electrical Chapter
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Travel	Worn Camshaft / Tappet	Replace
	Valves Opening and Closing at Wrong Time	Incorrect Valve Timing	Correct
Lack of Power in all RPM Ranges	Low Compression	Worn Piston, Rings, Cylinder, Poor Valve Seating	Repair / Replace
	Valve Timing Incorrect	Cam Chain and Sprockets	Correct
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Lift	Worn Camshaft / Tappets	Replace
	Ignition / Fuel Injection System	-	Refer to Fuel Delivery / EFI Chapter (EFI) or Electrical Chapter (Ignition)
	Oiling Problem	Oil Overfilled	Correct Engine Oil Level

CYLINDER / PISTON

GENERAL INFORMATION

SERVICE NOTES

NOTE
Clean the machine thoroughly before removing engine from frame.

- This section covers service of the cylinder, piston and rings. The engine must be removed from the frame to perform the procedures in this section. Refer to Engine / Cooling / Exhaust Chapter for engine removal and installation.
- Mark and store all mated parts for assembly. Assemble engine by putting used parts that pass inspection back in the same location.
- Machined mating surfaces are very delicate. Handle and store all parts in such a way that the mating surfaces will not be damaged.
- Many parts require assembly lubrication. Follow the assembly lubrication procedures carefully.
- There are many precision measuring steps in this section. If you are not sure of your capabilities in these areas, have a competent machinist perform the precision part inspection operations.
- Cleanliness of parts is critical to engine life and proper parts inspection. Use clean solvent and hot, soapy water to clean parts. Dry with compressed air before inspection and engine assembly. Coat parts with fresh lubricant to prevent oxidation after cleaning.

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Piston Ring Compressor	PV-43570-A
Engine Lock Tool - Transmission	PF-51612
Engine Lock Tool - Crankshaft	PF-51235-A
Cylinder Bore Gauge	PV-3017
Engine Case Splitting Tool	PF-51234-A
Straightedge, Feeler Gauge	Commercially Available

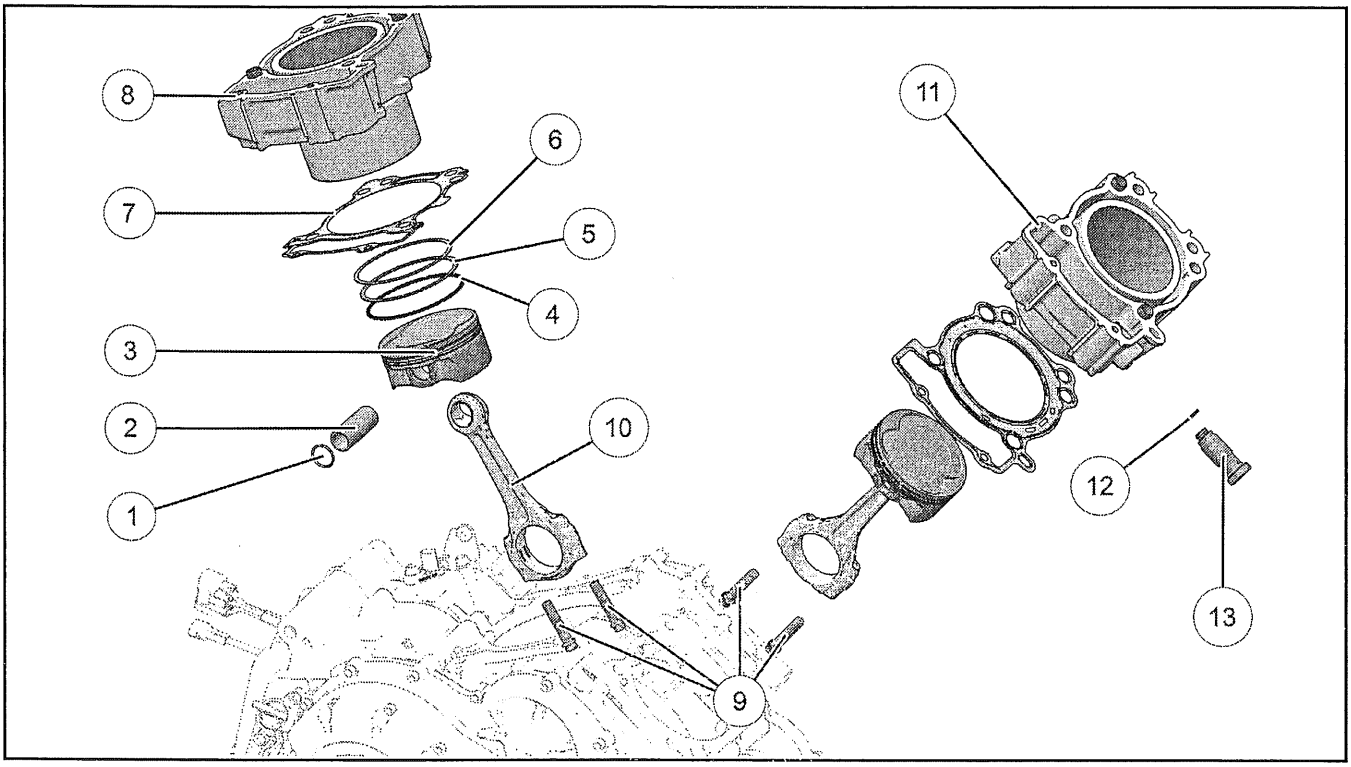
Bosch Automotive Service Solutions: 1-800-345-3322 or https://polaris.service-solutions.com/

SERVICE SPECIFICATIONS

ITEM		STANDARD	SERVICE LIMIT
Cylinder	I.D.	98.992 - 99.008 (3.8973 - 3.8979")	Check taper and out-of-round
	Out of Round	Measure 50 mm down from head surface	0.05 mm (.002")
	Taper		0.05 mm (.002")
	Gasket Surface Warpage	-	.1mm max. (.0039")
Piston	Piston Mark Direction	Piston orientation is determined by arrow on piston crown. Position BOTH pistons so arrows point to front of engine.	
	Piston O.D. (Nominal) (Measured 12 mm up from bottom of skirt, 90 degrees to pin)	98.933 - 98.947 mm (3.8949 - 3.8955")	Replace if piston-to-cylinder clearance is excessive with good cylinder
	Piston Pin Hole I.D.	22.004 - 22.010 mm (.8663 - .8665")	22.047 mm (.8679")
	Piston Pin O.D.	21.995 - 22.000 mm (.8659 - .8661")	21.96 mm (.864")
	Piston to Cylinder	.045 - .075 mm (.0017 - .0029")	.15 mm (.006")
	Piston to Piston Pin	.004 - .015 mm	.030 mm
Piston Ring Clearances	Ring End Gap - Top (Installed) Ring End Gap - 2nd (Installed)Ring End Gap - 3rd (Oil Control Rails) (Installed)	.15 - .31 mm (.006 - .012") .25 - .50 mm (.009 - .019") .25 - 1.02 mm (.009 - .040")	.80 mm (.031") 1.11 mm (.043") .80 mm (.031")
	Piston Ring Marks	-	DOT mark must face UP on all rings.
Piston Ring to Ring Land	Top Ring (1.2mm ring thickness)	.03 - .095 mm (.0001 - .0037")	.15 mm (.0059")
	2nd Ring (1.2mm ring thickness)	.02 - .066 mm (.0007 - .0025")	.10 mm (.0039")
	Oil Control Ring	.03 - .13 mm (.001 - .0051")	.25 mm (.0098")

ASSEMBLY VIEWS

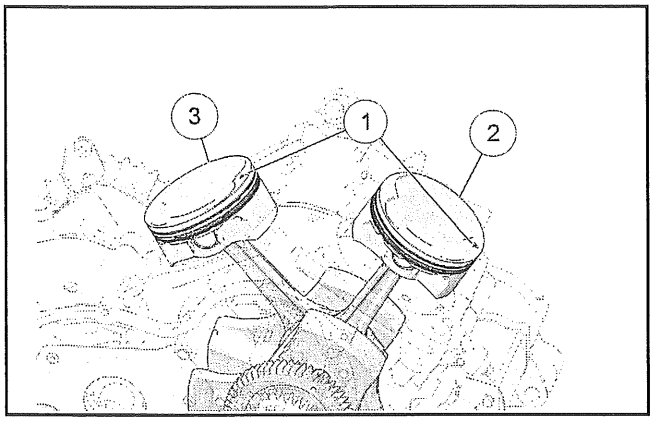
CYLINDER / PISTON COMPONENTS

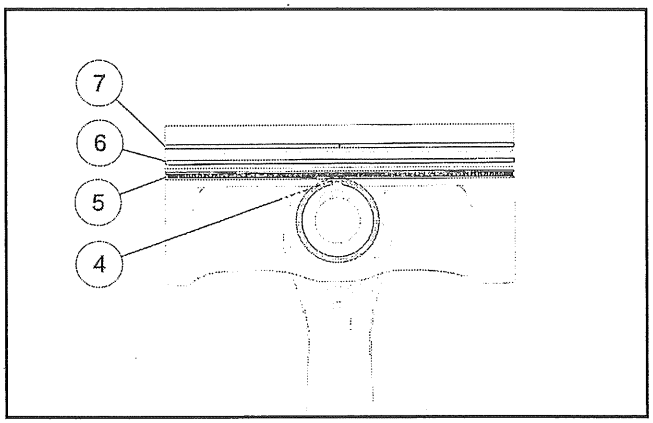


NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Piston Circlip	-
②	Piston Wrist Pin	-
③	Piston	-
④	Oil Control Ring / Expander	-
⑤	Compression Ring #2	-
⑥	Compression Ring #1	-
⑦	Cylinder Base Gasket	-
⑧	Rear Cylinder	-
⑨	Connecting Rod Bolt (Single Use Fastener)	**STEP 1: Tighten both fasteners to 22 ft-lbs (30 Nm) STEP 2: Tighten both fasteners an additional 90°**
⑩	Connecting Rod	-
⑪	Front Cylinder	-
⑫	Sealing Washer (Front Cyl. Only)	-
⑬	Cam Chain Tensioner (Front Cyl. Only)	-

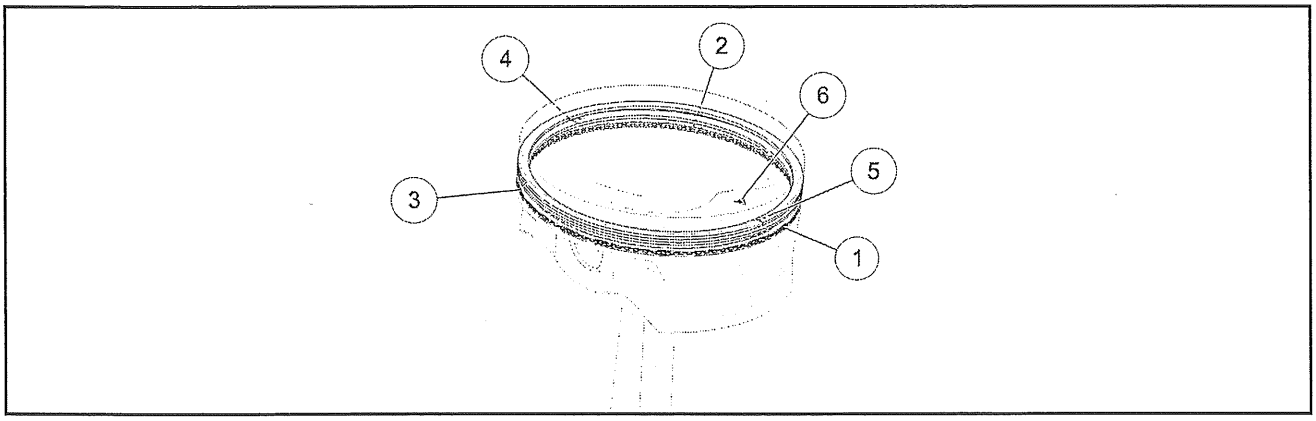
CYLINDER / PISTON SERVICE

PISTON RING PROFILE AND ORIENTATION





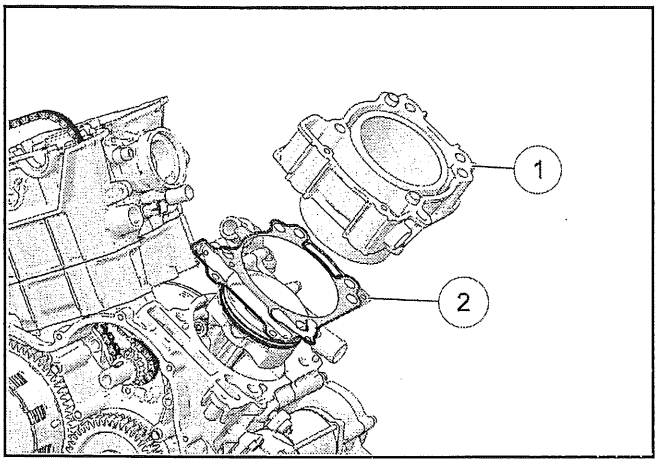
NUMBER	DESCRIPTION
①	Arrows on piston crown indicating installation direction. Both arrows point toward the front of the engine.
②	Front piston is installed closest to the primary drive side of the engine.
③	Rear piston is installed closest to the mag side of the engine.
④	Wrist pin circlip. Install the circlip with the gap positioned at 12 o'clock.
⑤	Oil Control Ring
⑥	Compression Ring No. 2
⑦	Compression Ring No. 1



NUMBER	DESCRIPTION
①	Lower Oil Ring Rail End Gap
②	Oil Ring Spring Expander End Gap
③	Upper Oil Ring Rail End Gap
④	Second Compression Ring End Gap
⑤	Top Compression Ring End Gap
⑥	Piston Marking Faces Front of Engine

CYLINDER REMOVAL

1. Remove cylinder head (s). See Cylinder Head Removal, page 3.64.
2. Remove cylinder(s) ①. Support pistons to prevent damage. Place shop towels around piston/rings to prevent damage.



3. Remove cylinder base gasket ②.
4. Clean gasket surfaces of cylinders thoroughly.

CAUTION

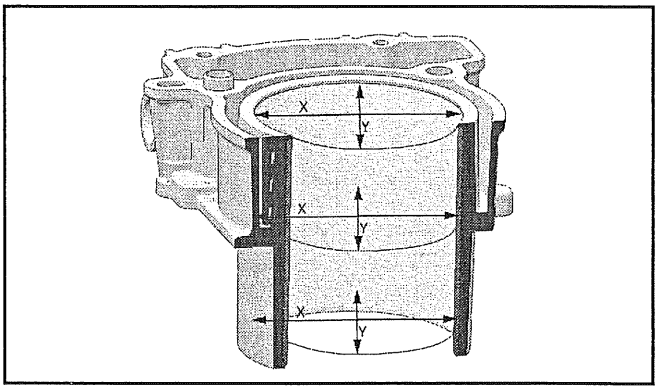
Careless handling of cylinder, pistons or rings may cause irreparable damage. Do not damage gasket surfaces during cleaning.

CYLINDER INSPECTION

1. Visually inspect cylinder bores for scratches and wear.
2. Inspect gasket surfaces for scratches or other damage that may cause an oil leak.

CYLINDER BORE MEASUREMENT

1. Measure each cylinder bore in 6 places to determine:



NOTE

Bottom measurement should be taken 2.6 in (66 mm) up from base.

- Cylinder Bore Inside Diameter
- Cylinder Taper
- Out of Round

2. Use maximum measurement to determine wear.
3. Use the worksheet provided to record measurements and calculate the clearance.

PISTON TO CYLINDER CLEARANCE WORKSHEET

FRONT CYLINDER	RECORDED MEASUREMENT	SPECIFICATION
Top "X"		Taper Service Limit: .05mm (.002")
Middle "X"		
Bottom "X"		
Top "Y"		
Middle "Y"		
Bottom "Y"		
Difference between largest "Y" measurement and smallest "Y" measurement	Taper for "Y" axis:	
Difference between largest "X" measurement and smallest "X" measurement	Taper for "X" axis:	
Largest difference between any "X" axis measurement and "Y" axis measurement	Cylinder Out-of-Round:	Out-of-Round Service Limit: .05mm (.002")
Piston Skirt Measurement		
Difference between largest "X" axis measurement and piston measurement	Piston-to-Cylinder Clearance*	Piston-to-Cylinder Clearance Service Limit: .15 mm (.006")

REAR CYLINDER	RECORDED MEASUREMENT	SPECIFICATION
Top "X"		Taper Service Limit: .05mm (.002")
Middle "X"		
Bottom "X"		
Top "Y"		
Middle "Y"		
Bottom "Y"		
Difference between largest "Y" measurement and smallest "Y" measurement	Taper for "Y" axis:	
Difference between largest "X" measurement and smallest "X" measurement	Taper for "X" axis:	
Largest difference between any "X" axis measurement and "Y" axis measurement	Cylinder Out-of-Round:	Out-of-Round Service Limit: .05mm (.002")
Piston Skirt Measurement		
Difference between largest "X" axis measurement and piston measurement	Piston-to-Cylinder Clearance*	Piston-to-Cylinder Clearance Service Limit: .15 mm (.006")

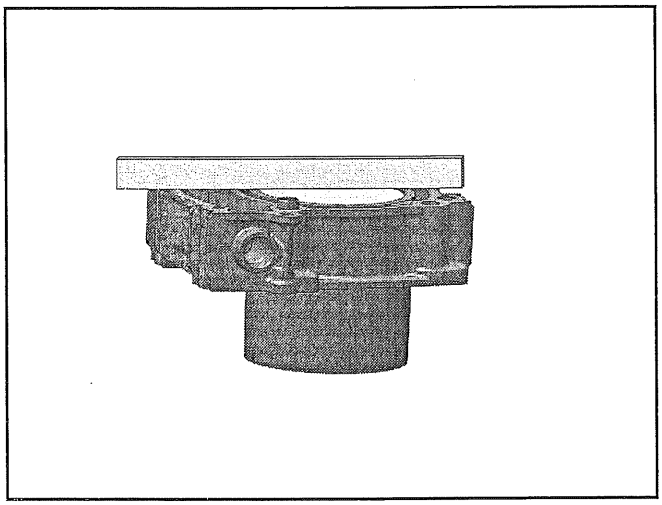
Compare recorded measurement to specifications. If measured value exceeds service limit replace the appropriate part.

NOTE

If the piston-to-cylinder clearance exceeds the service limit, *measure a new piston and re-calculate the clearance.* If the piston-to-cylinder clearance exceeds the service limits with a new piston, the cylinder can be replaced or serviced to accommodate oversize piston/rings by a qualified machine shop.

CYLINDER WARPAGE MEASUREMENT

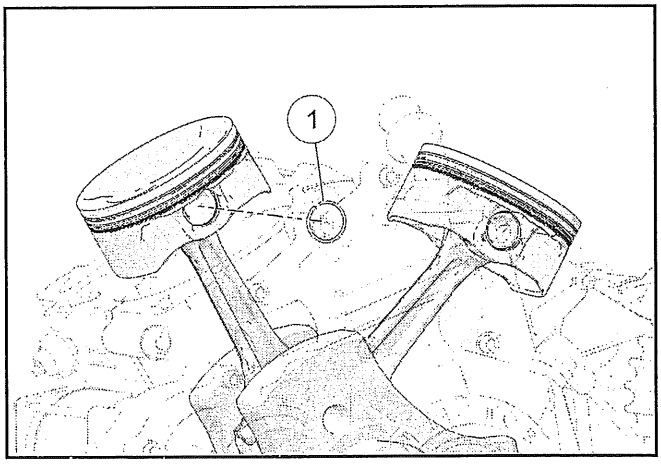
1. Inspect cylinder for warpage at cylinder head surface and base gasket surface.



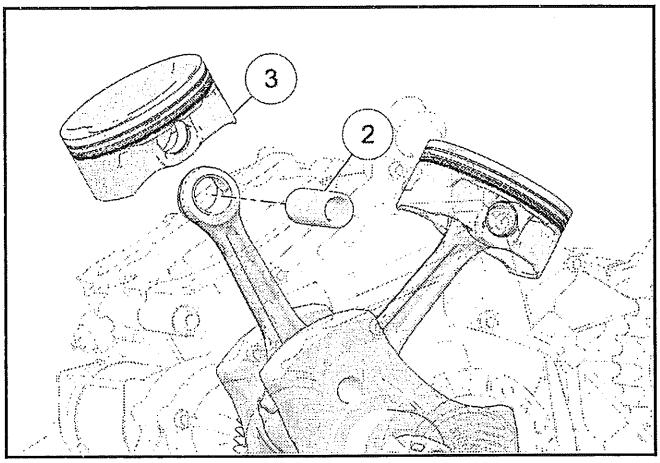
2. Place a straight edge diagonally across cylinder mating surfaces in several positions. Attempt to slide a .05mm (.002") feeler gauge under the straight edge in each position.
3. Replace cylinder if warped beyond the service limit.

PISTON & PISTON RING REMOVAL

1. Cover crankcase with a clean shop towel to prevent piston circlip from falling into the crankcase.
2. Remove the left piston pin circlip ①.



3. Push piston pin ② out to left side of engine and remove the piston ③.



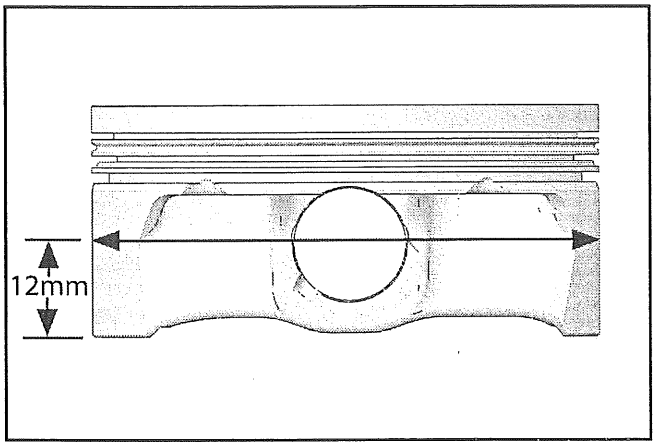
4. Rotate rings in piston grooves. Rings should rotate freely in grooves.
5. Clean carbon deposits from piston.
6. Spread rings only wide enough to remove them from piston. Spreading rings too wide will damage them.
7. Clean piston ring grooves. Break or cut a piston ring in half. File or grind one edge square and remove all burrs. Use this piston ring to carefully clean piston ring grooves.

NOTE

A soft wire brush may be used to only clean the top of the piston. Do not use a wire brush to clean the sides of piston or the piston ring grooves.

PISTON & PISTON RING INSPECTION

1. Visually inspect piston for cracks, excessive wear, scoring, etc.
2. Measure piston skirt O.D. (90° to pin and 12 mm from bottom of piston skirt). Replace piston if worn beyond the service limit. See Service Specifications, page 3.79.

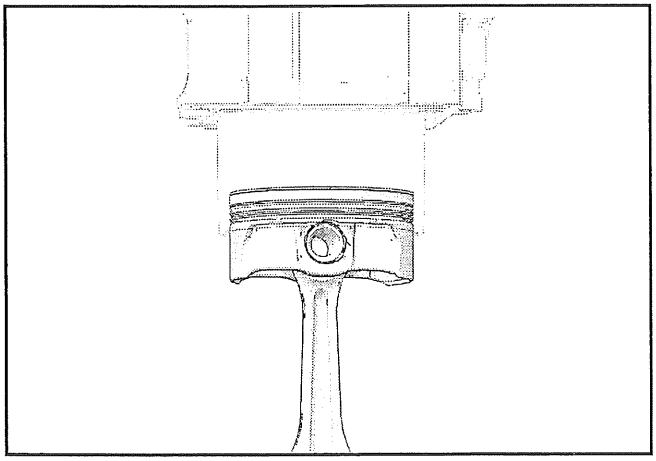


3. Calculate Piston to Cylinder Clearance. Subtract piston O.D. from cylinder bore I.D. and compare to specifications. See Service Specifications, page 3.79.
4. Replace parts that do not meet specification.

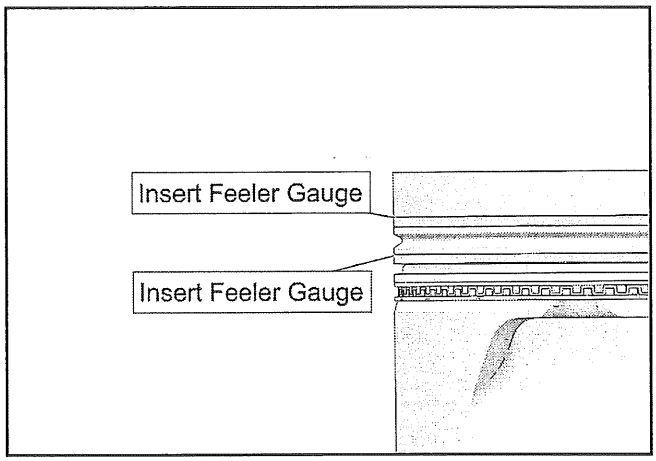
NOTE

If piston-to-cylinder clearance exceeds service limit, *measure a new piston and re-calculate clearance*. If piston-to-cylinder clearance exceeds service limits with a new piston, cylinder must be replaced.

5. Use a piston to push each ring squarely into cylinder bore from bottom (push rings 25-50 mm into cylinder).



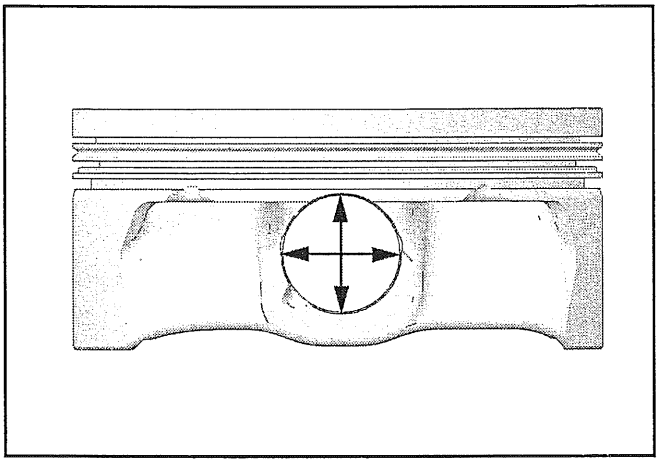
6. Measure installed ring end gap with a feeler gauge and compare to specifications. See Service Specifications, page 3.79.
7. Install rings onto a clean piston. Push rings in until they are flush with piston. Using a feeler gauge, measure side clearances for the 1st & 2nd rings.



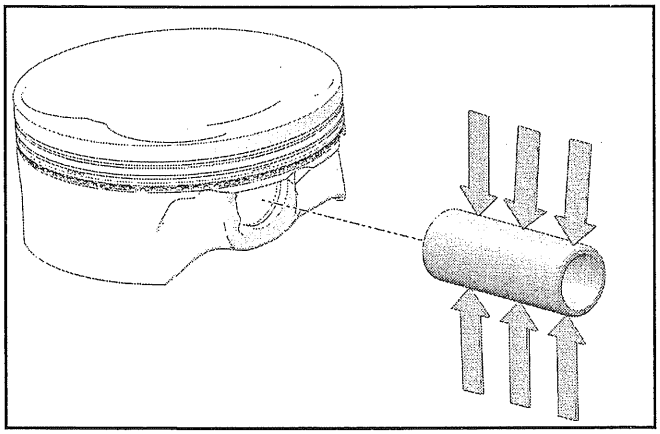
8. Replace parts that exceed service limit.

PISTON PIN / PIN BORE INSPECTION

1. Measure piston pin hole I.D. (as shown) as close to the circlip groove as possible with a telescoping gauge. Record the smallest measurement.

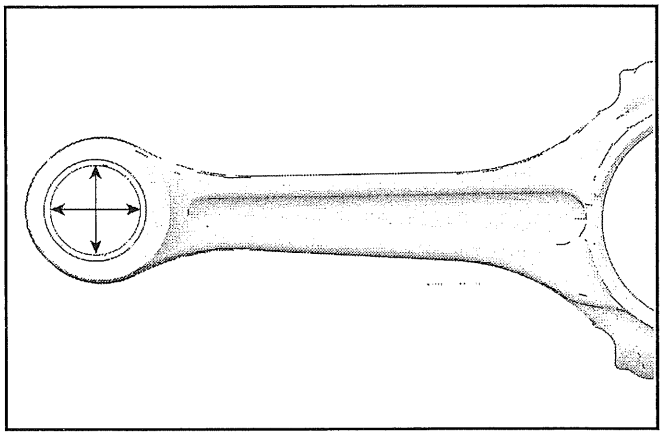


2. Measure piston pin O.D. at three locations. Record largest measurement.



3. Calculate piston pin-to-piston clearance. Subtract pin O.D. from pin hole I.D.

4. Measure connecting rod small end I. D. at two locations.



5. Calculate connecting rod-to-piston pin clearance by subtracting pin O.D from rod hole I.D.
6. Compare measurements to specifications and replace any worn parts. See Service Specifications, page 3.79.

PISTON RING INSTALLATION

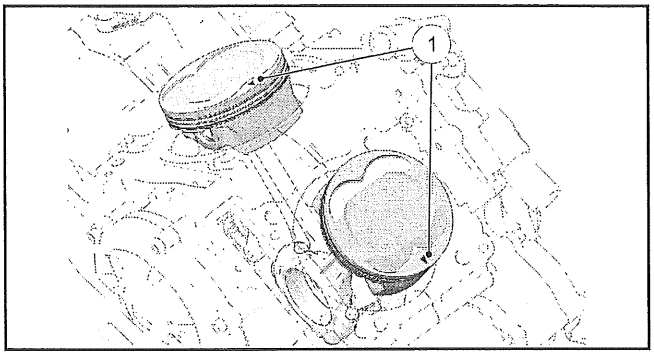
CAUTION

The rings may be damaged if they are over expanded during installation.

1. Lubricate all rings with engine oil.
2. Carefully install oil control ring expander with end gap located as shown. See Piston Ring Profile And Orientation, page 3.81.
3. Install top and bottom rails with end gap located as shown. See Piston Ring Profile And Orientation, page 3.81
4. Install top ring and second ring with pip markings facing UP.
5. Compress each ring by hand and rotate to be sure they rotate freely in grooves.
6. Locate ring end gaps as shown below in relation to arrow on piston crown. See Piston Ring Profile And Orientation, page 3.81.

PISTON INSTALLATION

The pistons are marked with an arrow on the crown ①. Install pistons on connecting rods with arrow as shown, facing the FRONT of the engine.

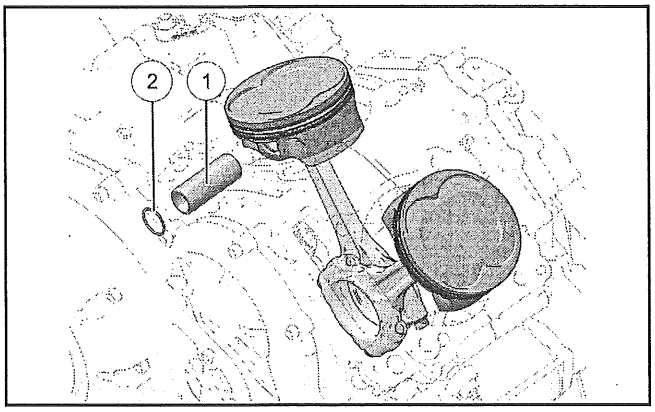


1. Place a clean shop towel over crankcase to prevent foreign material from entering crankcase.
2. Install a new circlip on one side of the piston with end gap facing UP (12:00 position).

CAUTION

Never reuse piston pin circlips.

3. Lubricate piston pin and I. D. of connecting rod small end with engine oil or moly lube.
4. Install piston over connecting rod with arrow on piston crown facing FRONT of engine.
5. Push piston pin ① through rod and piston pin hole until it is stopped by circlip.
6. Install remaining circlip ② with end gap facing up (12:00 position.)



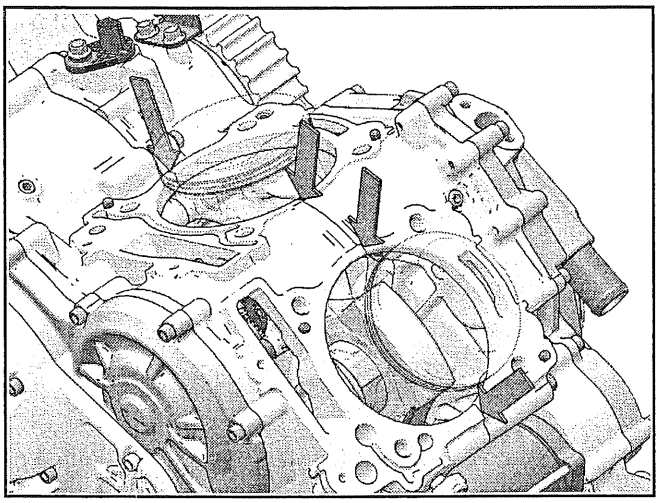
7. Make sure both piston circlips are seated properly in the groove.

CYLINDER INSTALLATION

NOTE

Be sure all top end parts are ready for assembly. Sealant on crankcase parting line must not be allowed to dry before top end is assembled and torqued.

1. First wash cylinders with clean solvent, then with hot soapy water.
2. Rinse the cylinders with clear water and immediately dry with compressed air. Cylinder bore should be wiped with a clean white shop towel and engine oil.
3. Apply a light coat of engine oil to piston and rings.
4. Ensure cylinder alignment dowel pins are in place and gasket surfaces are clean and oil-free.
5. Apply a small amount of crankcase sealant to the crankcase parting lines on base gasket surface as shown.



6. Install new cylinder base gaskets onto crankcase.

NOTE

Inspect all sealing surfaces carefully for scratches or imperfections. DO NOT allow oil or grease to contact gaskets or sealing surfaces during the assembly process.

7. Apply a small amount of engine oil to inside surfaces of a piston ring compressor band.
8. Install piston ring compressor over rings and compress rings into ring grooves.

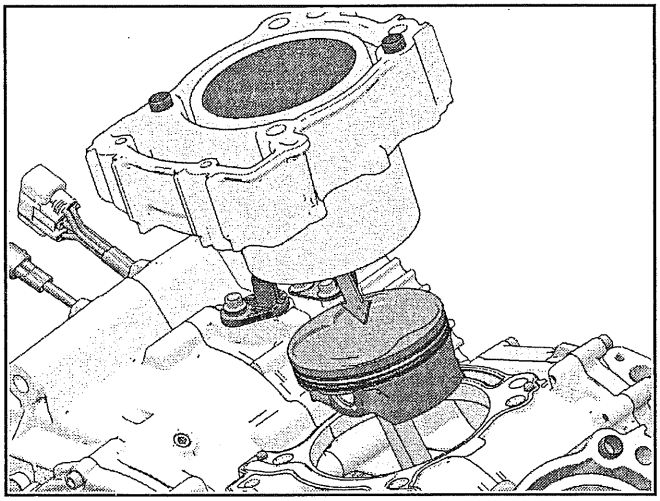
CAUTION

Be sure compressor band end gap does not align with any ring end gap when compressing the rings.

NOTE

Install cylinders in their original locations. **Cylinder with cam chain tensioner is the front cylinder.**

9. Remove protective covering from crankcase.
10. Carefully install cylinder (s) over piston/ring assembly. Do not force cylinder over piston. Monitor rings carefully. If a piston ring becomes dislodged from the ring compressor; remove cylinder, inspect ring carefully for damage.



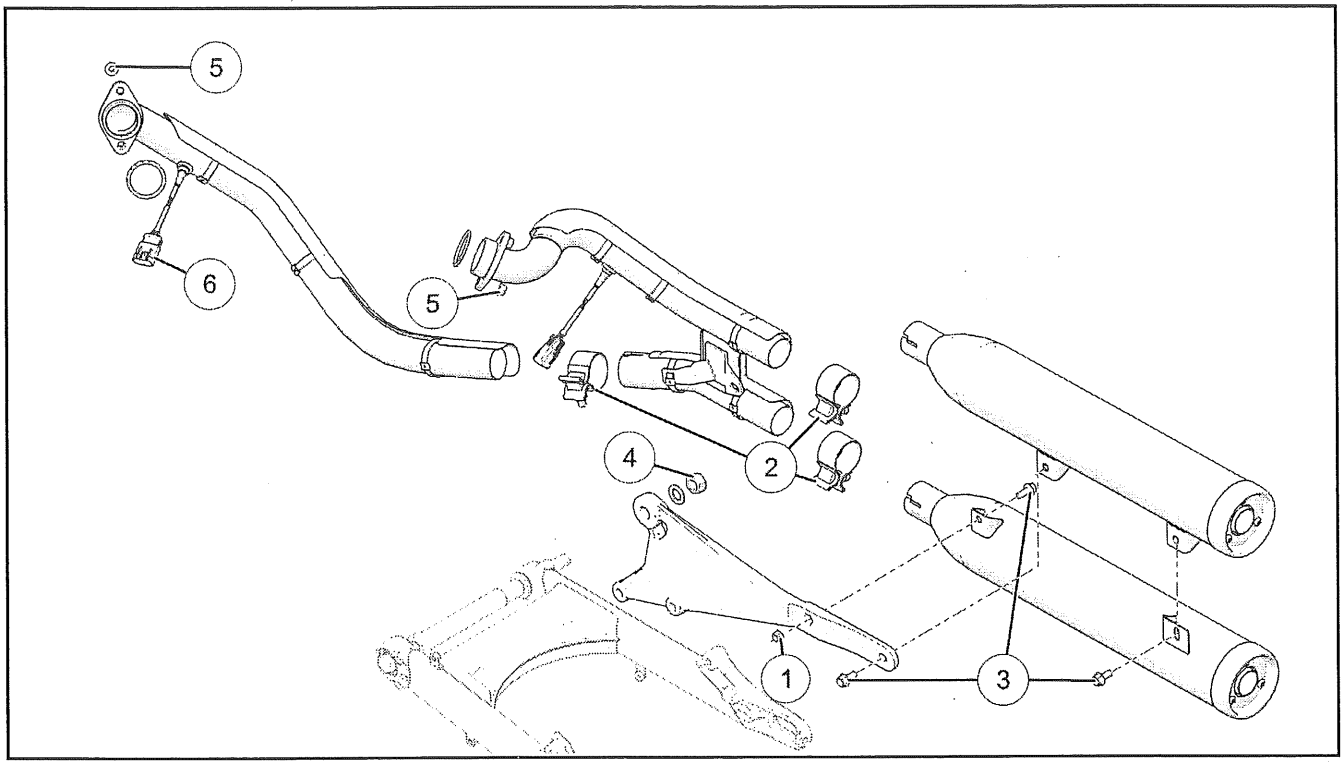
11. Remove piston ring compressor when rings are fully captive in cylinder.
12. Slide cylinder down over piston until seated to base gasket and crankcase surface.
13. Repeat for other cylinder.
14. Install cylinder head (s). See Cylinder Head Installation, page 3.72.

CYLINDER / PISTON TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
Hard Starting / Won't Start	Low Compression	Worn Valve Guide(s)	Replace Valve Guide(s)
		Poor Seating of Valve(s)	Repair or Replace
		Broken Valve Spring(s)	Replace
		Spark Plug Not Seated	Torque to Specification
		Incorrect Valve Timing	Repair / Retest
		Valve Stuck Open	Repair / Retest
		Cylinder Head Gasket Leak	Repair / Retest
		Slow Starter Motor	Refer to Electrical Chapter
		Worn Rings, Piston, or Cylinder	Refer to Engine / Cooling / Exhaust Chapter
		Valve Clearance out of adjustment	Inspect / Adjust as necessary
		Ignition Problem	Refer to Electrical Chapter
		Fuel Problem	Refer to Fuel Delivery / EFI Chapter
Electric Starter Straining to Turn Engine Over	High Compression	Excessive carbon build-up in combustion chamber	De-carbon Combustion Chamber
	Excessive Starter Load	Internal Engine / Drive Components Seized or Binding	Determine Cause of Seizure or Binding
Poor idle Quality (Engine Related)	Low Compression	Valve Clearance out of adjustment	Inspect / Adjust as necessary
		Poor Seating of Valve(s)	Repair or Replace
	Excessive Oil in Combustion Chamber	Valve Guides or worn valve stem seals	Replace
		Worn Rings, Piston, or Cylinder	Refer to Engine / Cooling / Exhaust Chapter
		Engine Oil Overfilled	Correct Engine Oil Level
Engine Noise	Valve Train Area	Valve Clearance out of adjustment	Inspect / Adjust as necessary
		Broken or Weak Valve Spring(s)	Replace
		Worn Camshaft or Rocker Arm	Replace
		Camshaft Bearing Damage / Wear	Inspect / Repair
		Cam Sprockets Worn	Replace
	Piston / Cylinder Area	Worn Pistons and / or Cylinders	Replace

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
		Worn Wrist Pin, Wrist Pin Bore and / or Connecting Rod	Replace
		Worn Piston Rings or Piston Ring Lands	Replace
	General	Exhaust Leak	Reseal Exhaust
	Timing Chain Area	Chain / Sprocket Worn	Replace
		Chain Tensioner and / or Guide Worn	Replace
	Bottom End Area	Main Bearings	Refer to Transmission / Crankshaft Chapter
		Rod Bearings	Refer to Transmission / Crankshaft Chapter
		Loose Side Clearance	Refer to Transmission / Crankshaft Chapter
	Transmission Area	Bearings	Refer to Transmission / Crankshaft Chapter
Poor High-Speed Running	Air Intake Problem	-	Refer to Fuel Delivery / EFI Chapter
	Fuel Injection Problem	-	Refer to Fuel Delivery / EFI Chapter
	Ignition Problem	-	Refer to Electrical Chapter
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Travel	Worn Camshaft / Tappets	Replace
	Valves Opening and Closing at Wrong Time	Incorrect Valve Timing	Correct
Lack of Power in all RPM Ranges	Low Compression	Worn Piston, Rings, Cylinder, Poor Valve Seating	Repair / Replace
	Valve Timing Incorrect	Cam Chain and Sprockets	Correct
		Damaged Cam Gears	Replace
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Lift	Worn Camshaft / Tappets	Replace
	Ignition / Fuel Injection System	—	Refer to Fuel Delivery / EFI Chapter (EFI) or Electrical Chapter (Ignition)
	Oiling Problem	Oil Overfilled	Correct Engine Oil Level

EXHAUST
ASSEMBLY VIEWS
EXHAUST SYSTEM COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Muffler Hanger Nut	**19 ft-lbs (26 Nm)**
②	Exhaust Clamps	**40 ft-lbs (54 Nm)**
③	Muffler Hanger Fasteners	**19 ft-lbs (26 Nm)**
④	Exhaust Mount Nut	**50 ft-lbs (68 Nm)**
⑤	Head Pipe Nuts	**12 ft-lbs (16 Nm)**
⑥	Oxygen Sensors	**14 ft-lbs (19 Nm)**

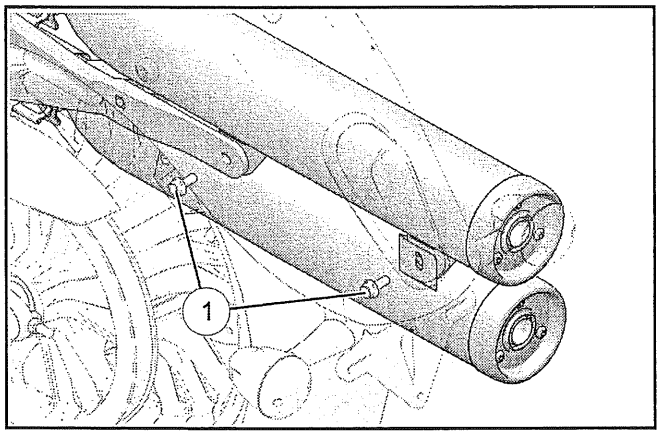
EXHAUST SERVICE

MUFFLER REMOVAL

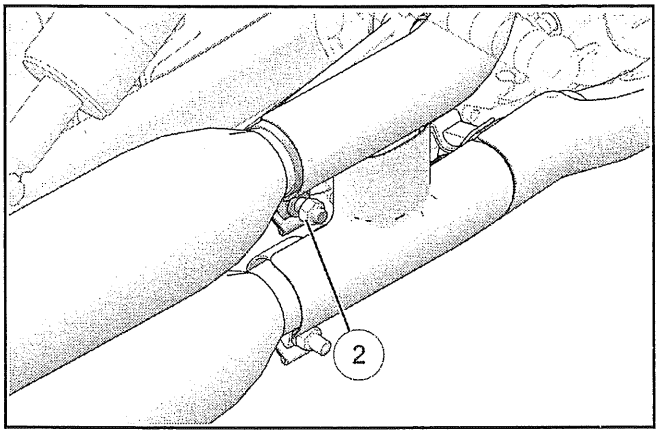
⚠ WARNING

Engine and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wear insulated protective clothing or wait for components to cool sufficiently before working on the machine.

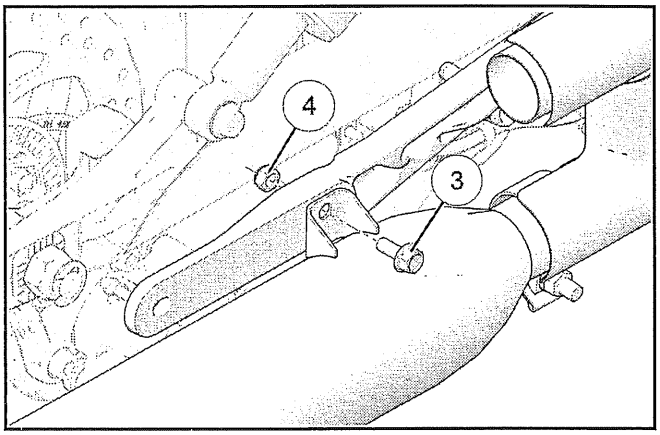
1. Remove upper muffler Support Bolts ① located on the back side of mufflers.



2. Loosen the upper Muffler Clamp ② between the head pipe and upper muffler. Remove Upper Muffler.

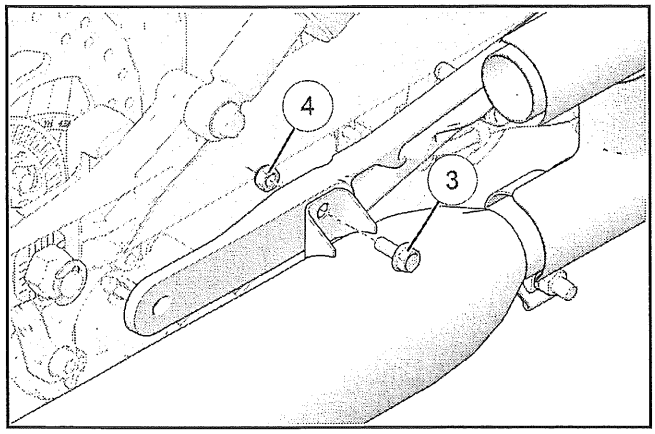


3. Remove the Bottom Muffler Bolt and Nut ④. Loosen lower muffler clamp & remove muffler.

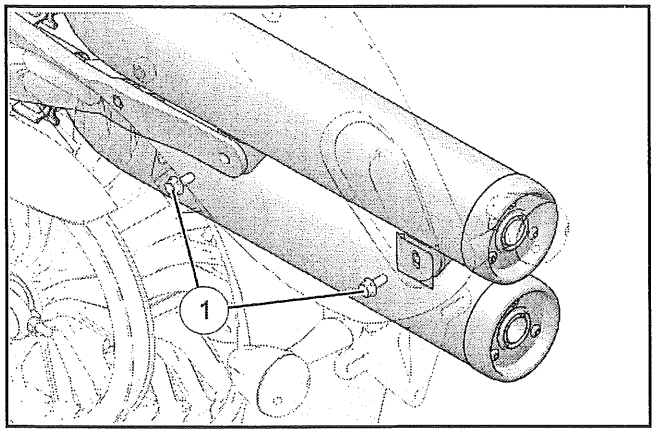


MUFFLER INSTALLATION

1. Slide the Bottom Muffler into position so Bolt ③ and Nut ④ can be installed. Slide Bottom Muffler Clamp onto Head Pipe. Hand tighten.



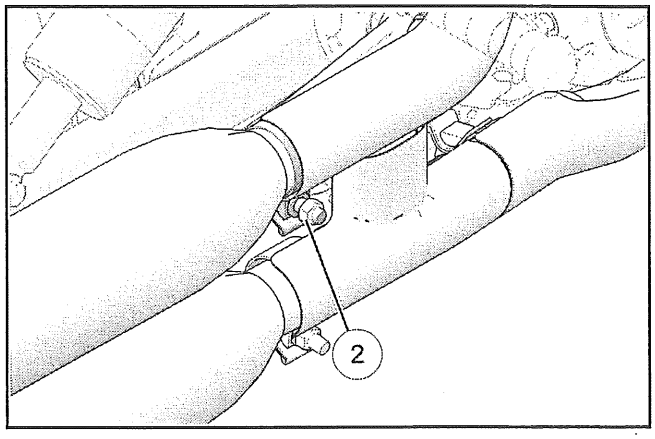
2. Slide the Top Muffler into position. Install Top Muffler Support Bolts ①. Slide Upper Muffler Clamp onto Head Pipe. Hand tighten.



3. Torque top and bottom Muffler Hanger Fasteners to specification.

TORQUE
Muffler Hanger Fasteners: **19 ft-lbs (26 Nm)**

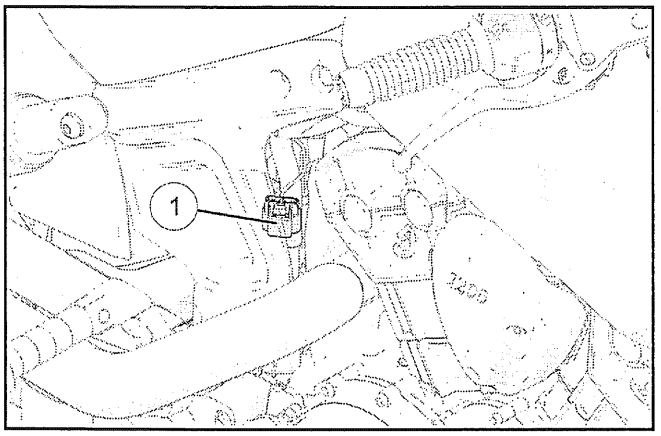
4. Torque upper and lower Exhaust Clamps ② to specification.



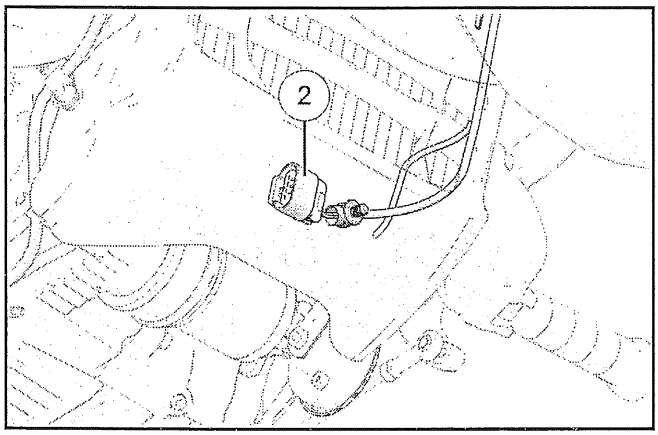
TORQUE
Exhaust Clamps: **40 ft-lbs (54 Nm)**

HEAD PIPE REMOVAL

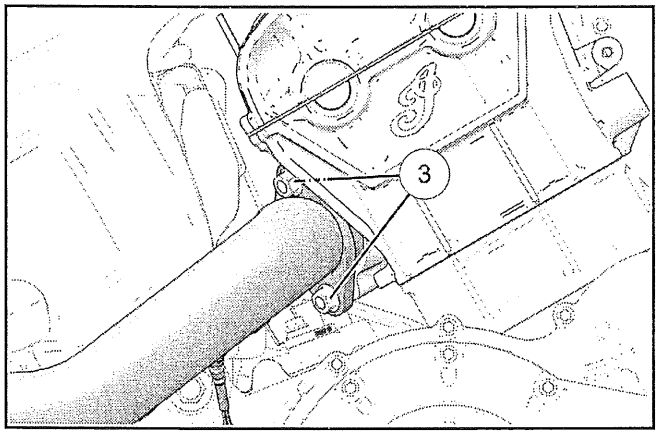
1. Remove mufflers. SeeMuffler Removal, page 3.92.
2. Disconnect rear Oxygen Sensor ①.



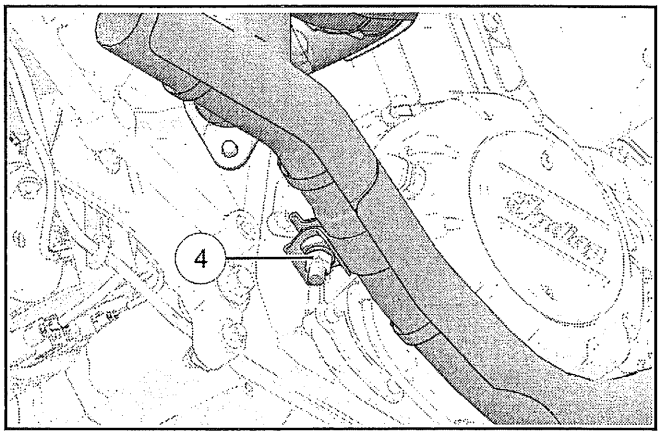
3. Cut zip tie located underneath radiator and disconnect front Oxygen Sensor ②.



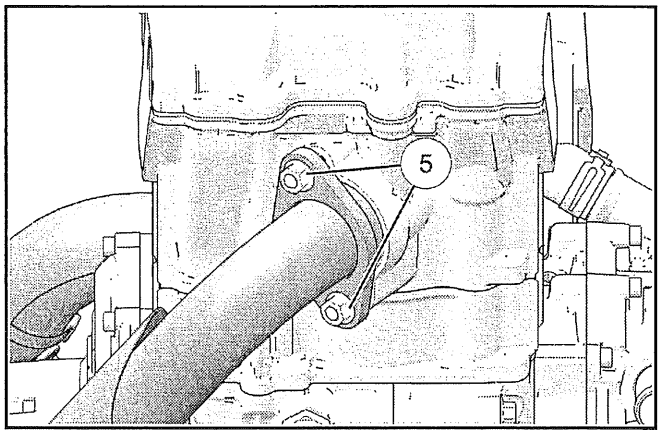
4. Remove two Rear Head Pipe Nuts ③.



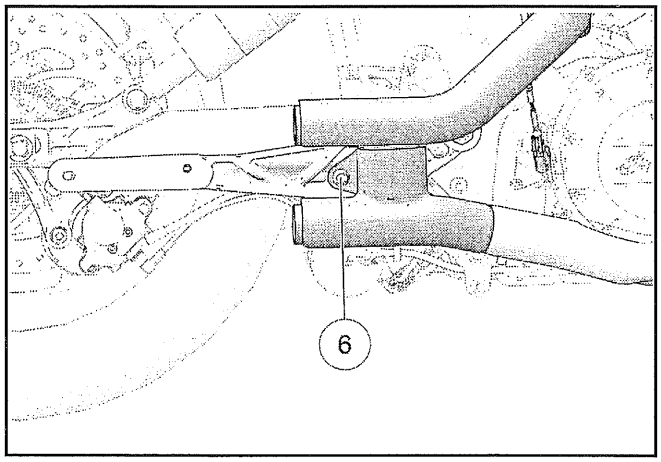
5. Loosen Front to Rear Head Pipe Clamp ④.



6. Remove two Front Head Pipe Nuts ⑤.

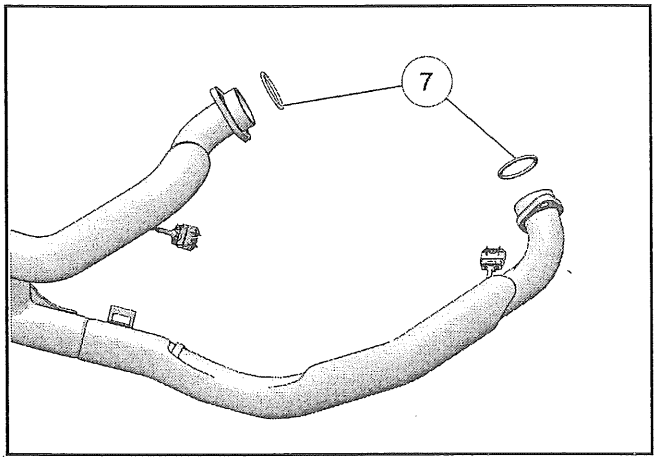


7. Remove head pipe to bracket fastener ⑥.



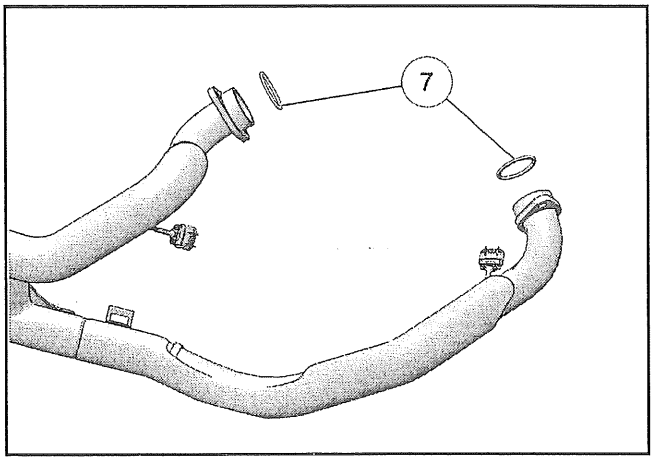
8. Remove rear exhaust tube from engine bolts first, then swing the Head Pipe assembly forward allowing room to remove front Head Pipe from the engine.

9. Remove old exhaust Gaskets ⑦ from front and rear exhaust tube.

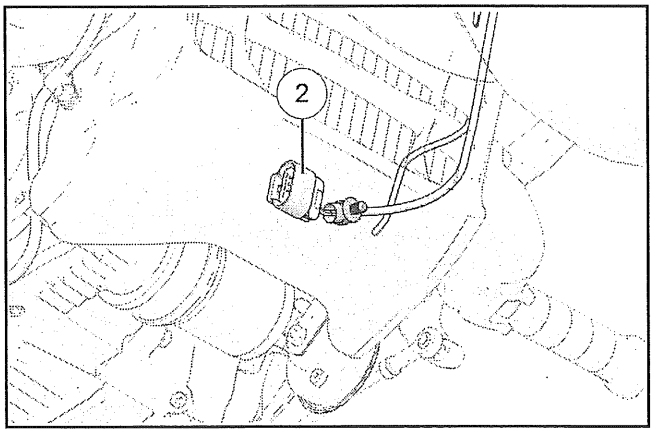


HEAD PIPE INSTALLATION

1. Install new exhaust Gaskets ⑦ on front and rear exhaust tube.



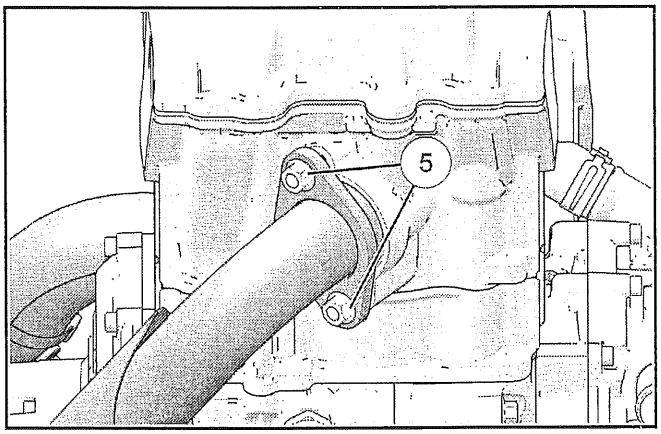
2. Connect Front Oxygen Sensor ②.



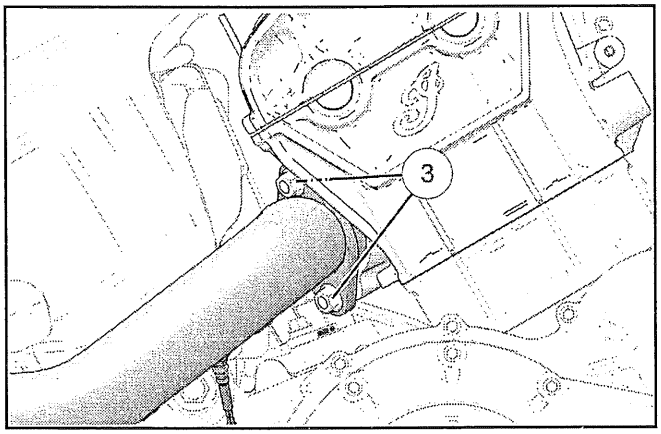
NOTE

Install new zip tie securing Front Exhaust Sensor to frame

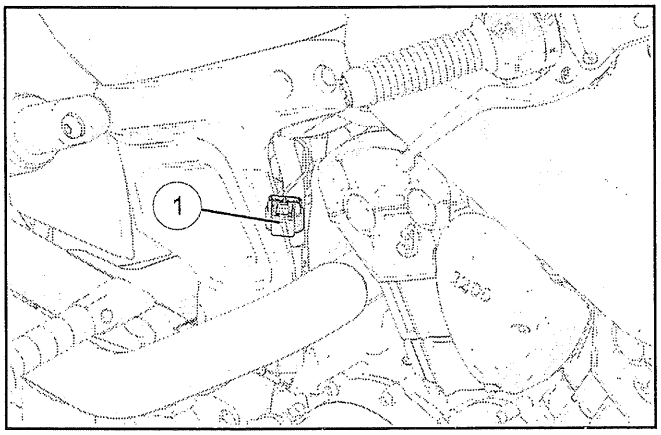
3. Install Front Head Pipe to engine and secure Head Pipe Nuts ⑤.



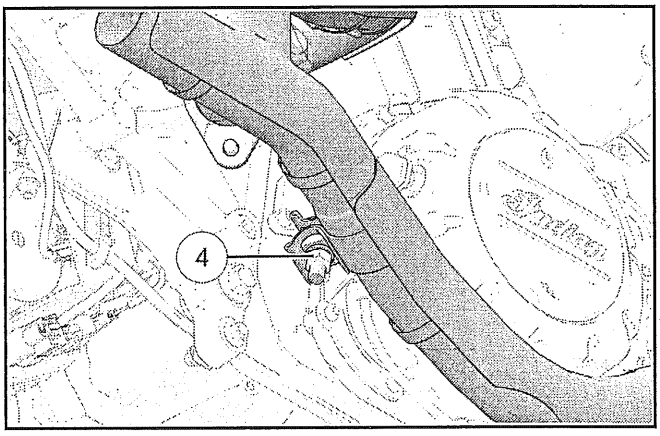
4. Install Rear Head Pipe to engine and secure with two Head Pipe Nuts ③.



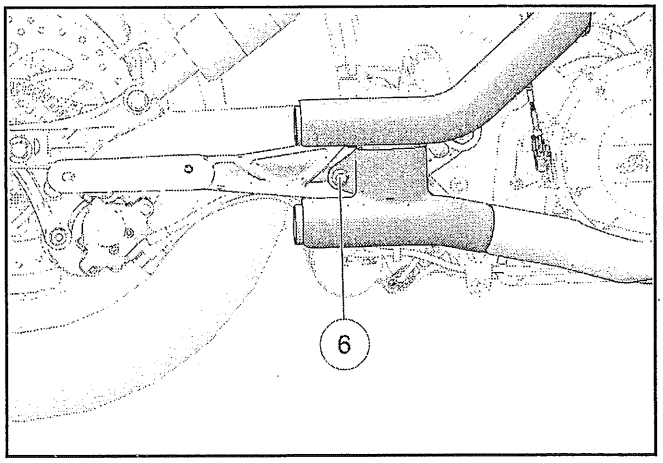
5. Connect Rear Oxygen Sensor ①.



6. Tighten Front to Read Head Pipe clamp ④.



7. Install head pipe to the muffler hanger fastener ⑥.



8. Torque fittings to specifications.

TORQUE
Head Pipe Nuts: **12 ft-lbs (16 Nm)**
Exhaust Clamps: **40 ft-lbs (54 Nm)**
Muffler Hanger Fastener: **19 ft-lbs (26 Nm)**

CHAPTER 4
FUEL DELIVERY / EFI

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GENERAL INFORMATION

SERVICE NOTES

Many hazards are present when working on or around the fuel injection system. Read and pay close attention to the following warnings and cautions when working on any component in this section.

⚠ WARNING

Gasoline is extremely flammable and is explosive under certain conditions. Work in a well ventilated area. Open flames, sparks and cigarettes must be kept away from gasoline.

⚠ WARNING

Careless handing of the control cables can result in twisting or bending of the cables. This can cause the cables to stick or bind, resulting in loss of vehicle control.

⚠ WARNING

The engine exhaust from this product contains chemicals known to cause cancer, birth defects or other reproductive harm.

⚠ WARNING

The engine and exhaust system become very hot during operation and remains hot for a period of time after the engine is shut off. Wear insulated protection for hands and arms or wait until the engine and exhaust system have cooled before performing service work.

⚠ WARNING

Always stop the engine and refuel outdoors or in a well ventilated area.

⚠ WARNING

If you get gasoline in your eyes or if you swallow gasoline, see your doctor immediately. Never try to syphon gasoline using mouth suction.

⚠ WARNING

Never start the engine or let it run in an enclosed area. Engine exhaust fumes are poisonous and can cause loss of consciousness and death in a short time.

⚠ WARNING

The battery should always be disconnected before working on the fuel system.

When replacing fuel lines, always use genuine Indian Motorcycle replacement parts. This will ensure top performance, function and durability.

Fuel lines remain under pressure at all times. Use caution when disconnecting lines for service.

Disconnect the fuel pump electrical connector to disable fuel pump and crank engine to release pressure. Always depressurize the fuel system prior to service.

Cover the fuel hose connections with a clean, absorbent towel to minimize spillage while disconnecting.

Don't overlook the basics while troubleshooting the fuel system:

- Except where noted, views of connectors are from WIRE side of the connector.
- A battery in a low state of charge can cause problems. Be sure battery is in good condition and fully charged.
- Air leaks in intake tract / air box - check for air leaks and repair to avoid misdiagnosing the EFI system.
- Contaminated or improper fuel.
- Restricted fuel flow / filters (low fuel pressure).
- Fuel tank vent line pinched or obstructed.
- Faulty spark plug(s).
- Corroded, disconnected, or incorrectly connected wiring.
- Poor ground connections - be sure all grounds are clean and tight.
- Exhaust system restriction or improper exhaust.
- Engine mechanical condition.

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Electrical Tester Kit	PV-43536
Fuel Pressure Adapter	PV-48656
Fuel Pressure Gauge	PU-43506-A
Relay Bypass	PU-49466
Smartlink Module Kit	PU-47471
USB to Serial Adapter	PU-50621

Bosch Automotive Service Solutions: 1-800-345-2233 or https://polaris.service-solutions.com/

SERVICE SPECIFICATIONS

ITEM	SPECIFICATIONS
Fuel Pump Pressure	3.51 BAR (350 kPa) (51 psi)
Idle Speed	800 rpm ± 50 rpm
Fuel Pump Amp Draw (Normal Operation)	3 - 5 Amps
Recommended Octane	91 Octane Minimum
Injector Resistance	11.4 - 12.6 Ohms

SERVICE PRECAUTIONS
EFI SYSTEM PRECAUTIONS

NOTE

While electronic fuel injection is durable and reliable, the components can be damaged or problems may occur if the following precautions are not taken.

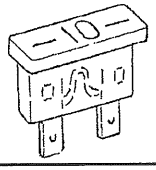
It is not advisable to "jump start" the machine with another battery. Although problems are unlikely to occur if everything is done carefully, the electrical component could be damaged.

Never disconnect the battery while the engine is running.

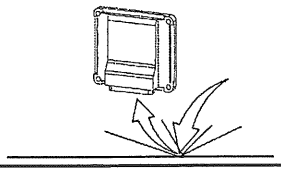
When connecting and disconnecting the battery cables refer to Electrical Chapter for complete battery connection and charging information. See Battery Installation, page 10.12.

Make sure that the ignition is powered down before connecting and disconnecting connections. Best practice is to disconnect the battery before connecting or disconnecting the electrical connections.

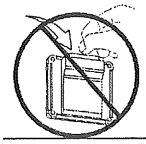
Fuses and circuit breakers protect critical electrical components and circuits. Never replace the fuse with a larger value fuse or "jumper" the fuse with wire, aluminum foil or any other means. Always investigate the cause of the problem and repair before replacing the fuse.



The ECM and sensors are sensitive pieces of electronic equipment. Dropping or hitting them may cause irreparable damage.



Static electricity can damage the electronic controllers beyond repair. The human body can easily store enough static electricity to damage sensitive electronic components. Before working with any components of the Fuel Injection system, ground yourself to dissipate any static charge. Also take care not to touch any of terminal pins on the ECM.



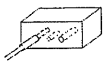
Do not touch ECM connector pins

Anti-static wrist strap PV-43541

NOTE

Some tests require probing of the ECM wiring harness connector. Do not touch or probe the exposed pins on the ECM. Static electricity from your body or the meter can easily damage the ECM.

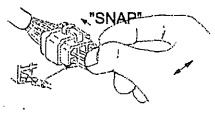
Always use the proper adapter from the Connector Test Adapter Kit when probing the terminals. Most of the connectors are sealed and cannot be back probed. Be extremely careful not damage the connectors by forcing meter probes into the connectors.



Use proper test adapters on connector pins

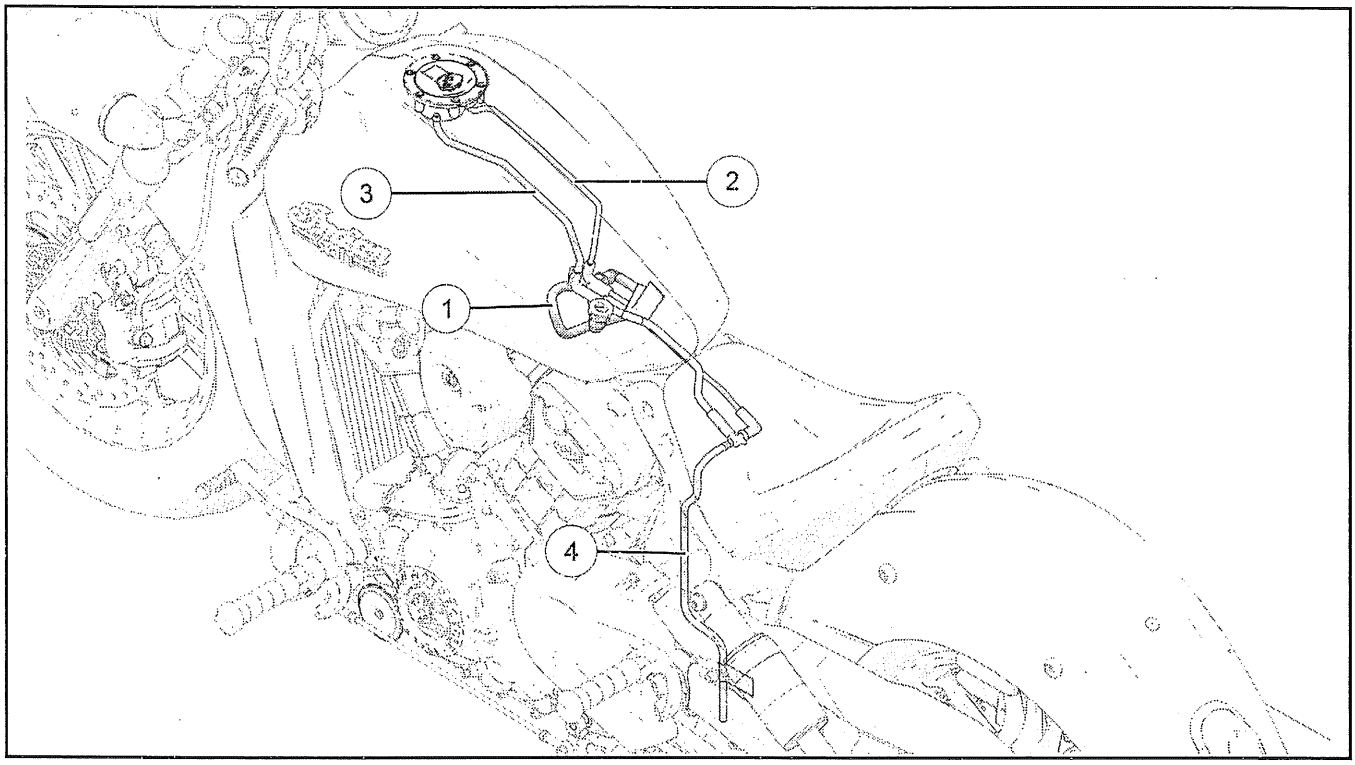
Connector test adapter kit PV-43526

Poor connections are the most common cause of Electronic Fuel Injection malfunctions. Inspect connector and wiring connections carefully during troubleshooting.



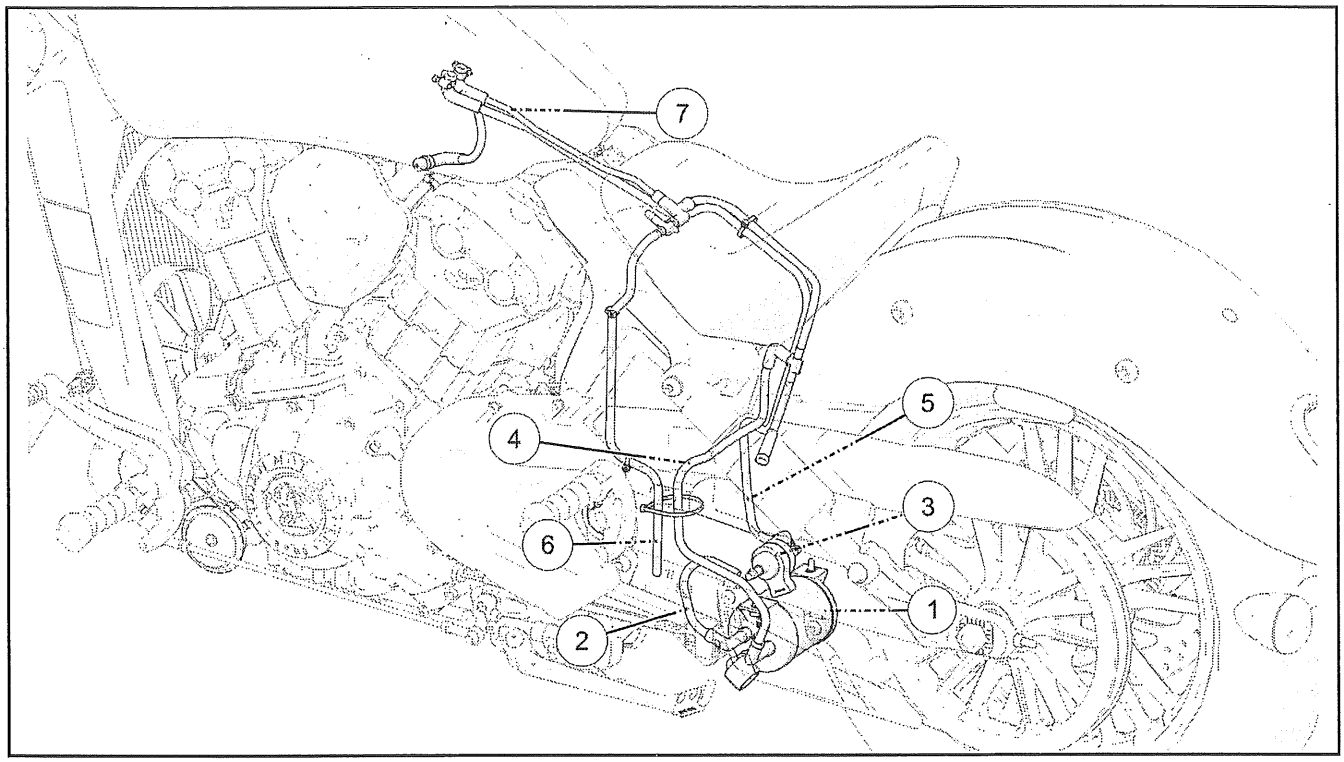
Carefully inspect the connections of the failed circuit before doing any other troubleshooting steps. Wire terminals should be corrosion free and fully seated into the connectors. Connector should snap together and lock.

ASSEMBLY VIEWS
FUEL LINE ROUTING (49 STATE MODELS)



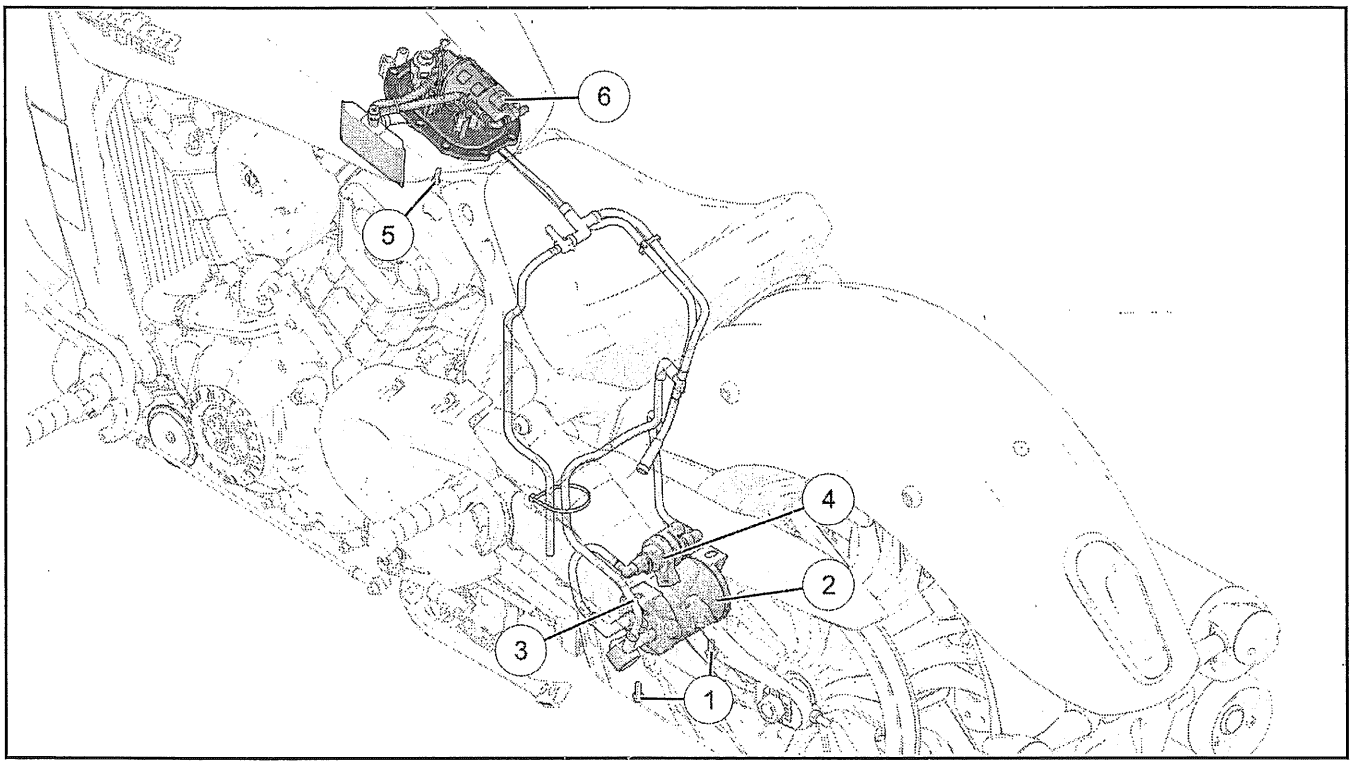
NUMBER	DESCRIPTION
①	Fuel Supply Line (Pump to Fuel Rail)
②	Upper Vapor Vent Line (from tank)
③	Fuel Cap Drain Line (from fuel cap recess)
④	Lower Vapor Vent Line (to atmosphere)

FUEL LINE ROUTING (CA)



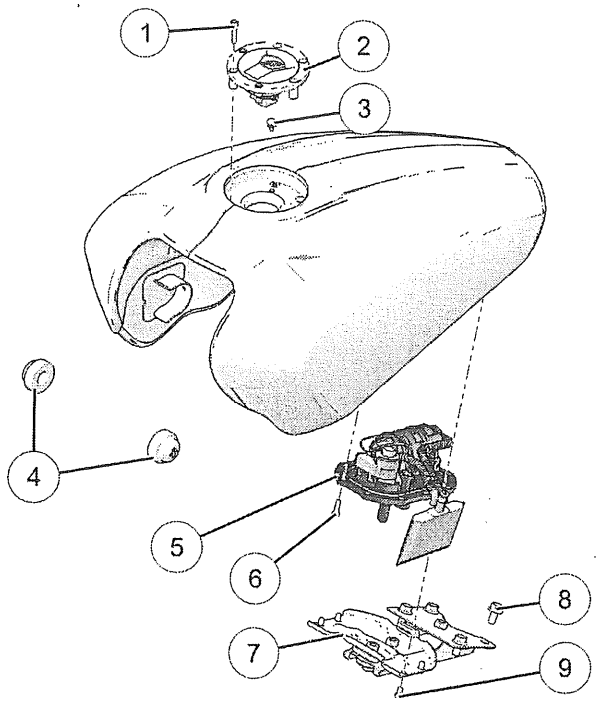
NUMBER	DESCRIPTION
①	Evaporative Emissions Canister
②	Lower Vapor Supply Line (from canister)
③	Canister Purge Valve
④	Lower Vapor Vent Line (to canister)
⑤	Upper Vapor Supply Line (to tank)
⑥	Upper Vapor Vent Line (from tank)
⑦	Fuel Supply Line (Pump to Fuel Rail)

FUEL SYSTEM COMPONENTS



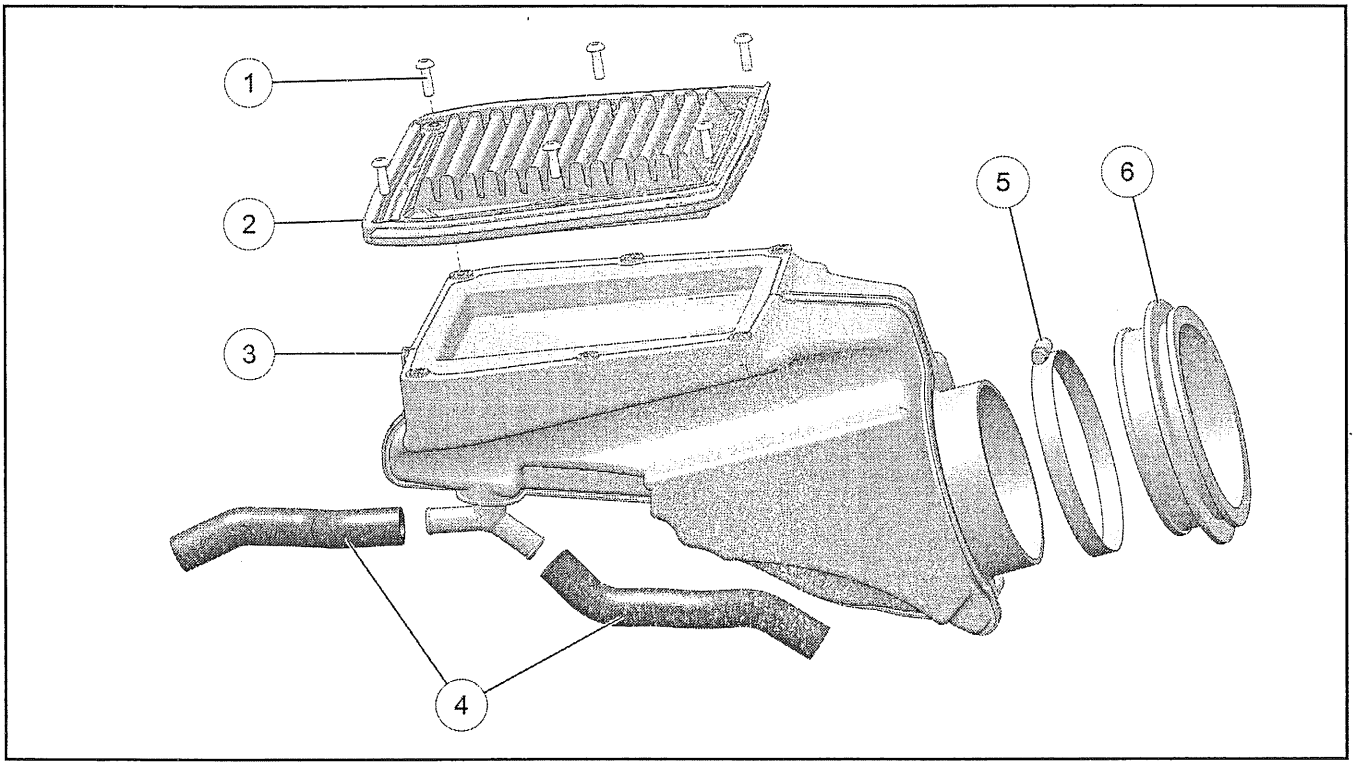
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Evaporative Emissions Canister Fasteners (QTY.2)	**7 ft-lbs (9.5 Nm)**
②	Evaporative Emissions Canister (CA & INTL Models ONLY)	—
③	Purge Line (CA Models ONLY)	—
④	Purge Valve (CA Models ONLY)	—
⑤	Fuel Pump Fasteners (QTY.10)	**43 in-lbs (5 Nm)**
⑥	Fuel Pump	—

FUEL TANK COMPONENTS



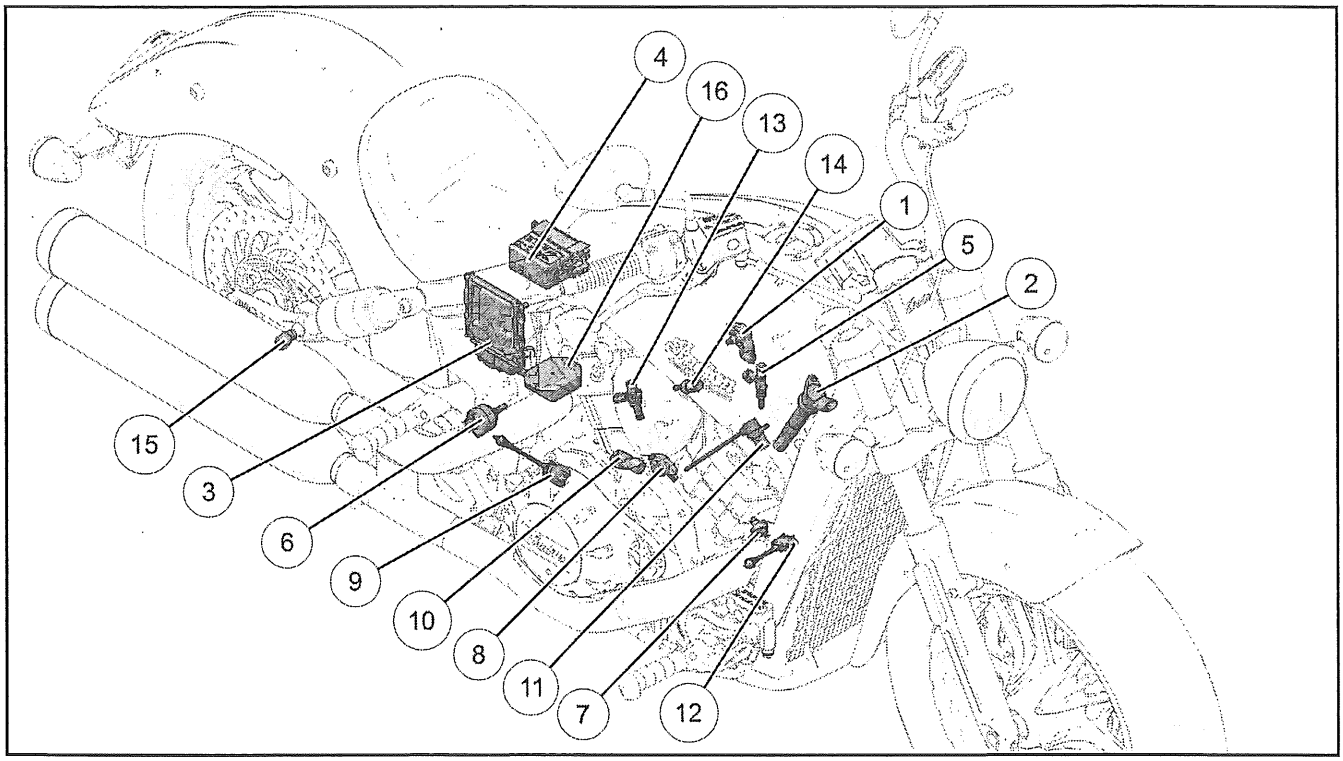
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Fuel Cap Fasteners (QTY.4)	**43 in-lbs (5 Nm)**
②	Fuel Cap	–
③	Vent Adapter	–
④	Tank Isolator	–
⑤	Fuel Pump	–
⑥	Fuel Pump Fasteners	**43 in-lbs (5 Nm)**
⑦	Tank Mount Assembly	–
⑧	Fuel Tank Mounting Fasteners (QTY.4)	**18 ft-lbs (24 Nm)**
⑨	Fuel Tank Mount Assembly Fasteners (QTY.4)	**7 ft-lbs (9.5 Nm)**

AIR BOX COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Air Filter Fasteners (QTY.6)	**24 in-lbs (3 Nm)**
②	Air Filter	–
③	Airbox Assembly	–
④	Breather Engine Hose	–
⑤	Worm Drive Clamp	–
⑥	Airbox Frame Seal	–

SENSORS - POWERTRAIN MANAGEMENT COMPONENTS

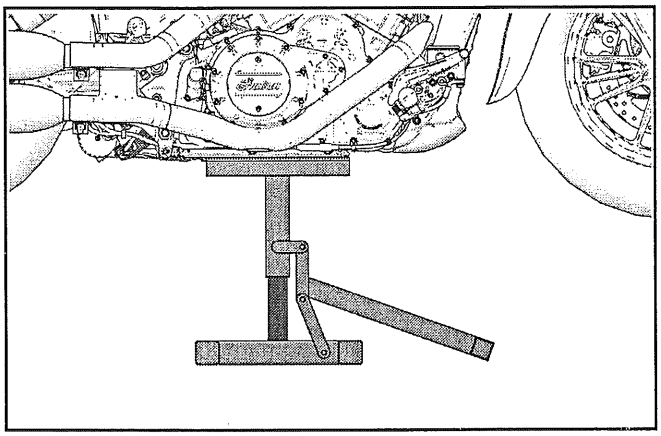


NUMBER	SENSOR / LOCATION	TORQUE (IF APPLICABLE)
①	TMAP - Sensor Fastener	**25 in-lbs (2.8 Nm)**
②	Ignition Coil Fasteners	**88 in-lbs (10 Nm)**
③	ECM (Engine Control Module)	—
④	Fuse Box NOTE: Master 40 Amp Fuse located behind battery box	—
⑤	Fuel Injectors	—
⑥	Canister Purge Valve (CA models only)	—
⑦	Oil Pressure Switch	**88 in-lbs (10 Nm)**
⑧	Gear Position Switch	**25 in-lbs (3 Nm)**
⑨	Oxygen Sensor, Rear	**14 ft-lbs (19 Nm)**
⑩	Side Stand Switch	**60 in-lbs (7 Nm)**
⑪	CPS (Crank Position Sensor)	**88 in-lbs (10 Nm)**
⑫	Oxygen Sensor, Front	**14 ft-lbs (19 Nm)**
⑬	Speed Sensor Fastener	**84 in-lbs (9.5 Nm)**
⑭	CTS (Coolant Temperature Sensor)	**16 ft-lbs (22 Nm)**
⑮	ABS (Anti-Lock Brake) Module - **INTERNATIONAL MODELS ONLY**	—
⑯	Load / Tip Over Module - Located below battery box.	—

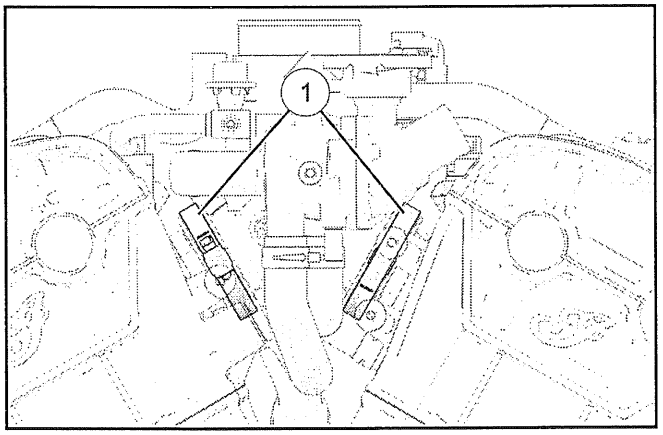
FUEL DELIVERY SERVICE

INTAKE MANIFOLD REMOVAL / INSTALLATION

1. Place a suitable jack under motorcycle frame/ engine.



2. Remove the seat. SeeSeat Removal / Installation, page 7.8.
3. Remove the fuel tank. See Fuel Tank Removal, page 4.14.
4. Remove the air box and throttle body assembly. See Air Box Removal, page 3.4.
5. Remove the fuel injectors and fuel rail assembly. See Fuel Injector Removal / Installation, page 4.37.
6. Loosen the two clamps ① securing the intake manifold to the rubber boots at the front and rear cylinders.



7. Remove the two bolts securing the intake boots to the cylinder head.

INSTALLATION is performed by reversing the removal procedure.

8. Torque the intake manifold clamps and boots to specification.

TORQUE
Intake Manifold Clamps: **20 in-lbs (2.3 Nm)**

TORQUE
Intake Manifold Boot Fasteners: **22 ft-lbs (30 Nm)**

FUEL PUMP PRESSURE INSPECTION

⚠ WARNING
Gasoline is extremely flammable. Work in a well ventilated area. Open flames, sparks and cigarettes must be kept away from gasoline. KEEP GASOLINE OUT OF THE REACH OF CHILDREN!

CAUTION
Wear safety glasses or a face shield when working around the fuel system to protect your eyes.

1. Depressurize fuel system and disconnect fuel line at fuel rail. SeeFuel System Depressurization, page 4.13 .
2. Install fuel pressure gauge **PU-43506-A** and fuel pressure gauge adapter **PV-48656**.
3. Start engine and record fuel pressure (or press the power switch ON and cycle the Engine Stop switch to read pressure when pump cycles for 2-3 seconds).

Minimum Fuel pressure
3.51 BAR (351 kPa) (51 psi)

4. Turn ignition switch off. Disconnect gauge adapter and re-connect fuel line (Fuel Tank Installation, page 4.19).

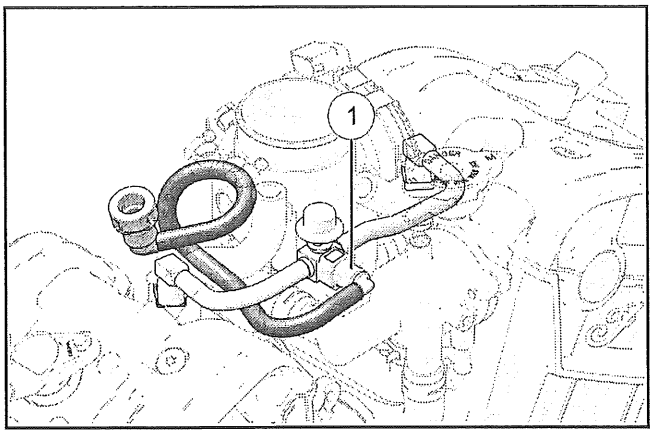
FUEL PRESSURE TROUBLESHOOTING	
FUEL PRESSURE TOO LOW: INSPECT	FUEL PRESSURE TOO HIGH: INSPECT
* Low fuel level (add fuel) * Pump not running (Fuel pump or circuit malfunction) * Restricted fitting, fuel supply line, or gauge adapter hose * Fuel line kinked or restricted (from tank fitting to rail) * Fuel line leaking (leaking air in or fuel out) * Vent restriction * Plugged fuel pickup filter (located in fuel tank) * Pressure regulator malfunction (located on pump) *Fuel pump malfunction (Pump should run for about 2-3 seconds the instant that the key switch and Engine Stop switch are turned ON.	* Plugged fuel return (in tank on pressure regulator) * Pressure regulator malfunction (located on pump).

FUEL SYSTEM DEPRESSURIZATION

⚠ WARNING

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Wear eye protection.

1. Wrap a clean shop towel around fuel line fitting ①.
2. Squeeze both release buttons (one on each side of fitting) and hold. Gently slide fitting straight off fuel rail.



3. Cover fuel fittings to keep debris out.

4

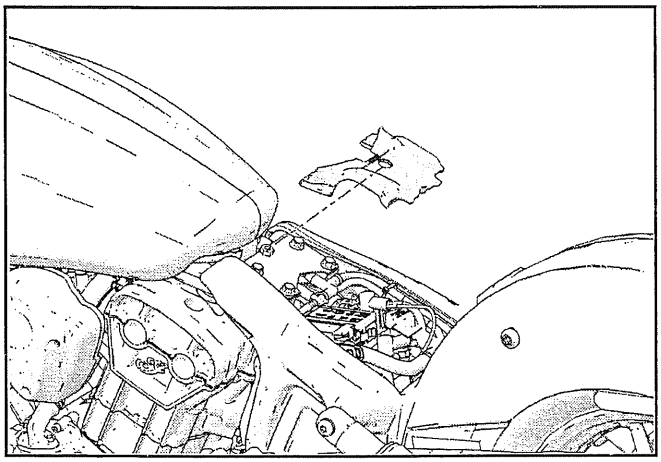
FUEL TANK REMOVAL

⚠ WARNING

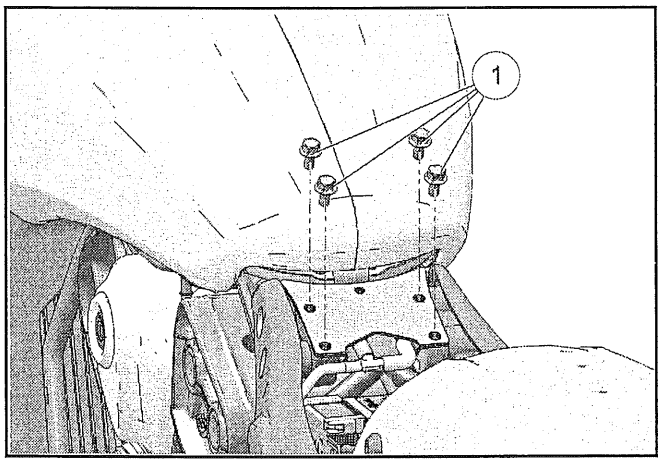
Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Protect fuel tank finish when removing, storing, and installing tank.

Be prepared to place the fuel tank in a secure location with a drain pan positioned to catch any fuel that may leak or drip from disconnected hoses or fittings.

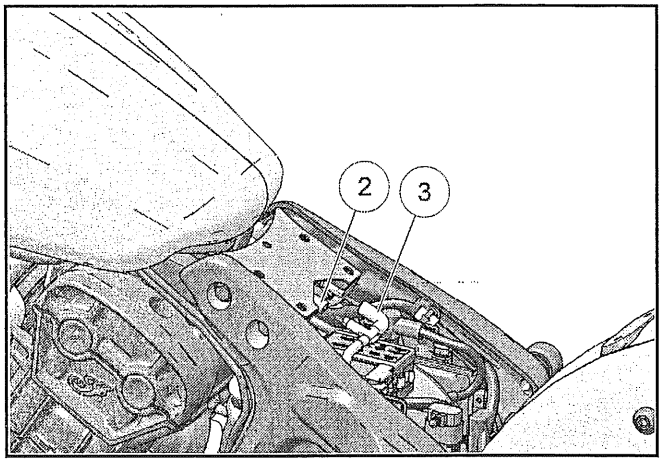
1. Remove seat. See Seat Removal / Installation, page 7.8.
2. Remove the fuel tank filler pad.



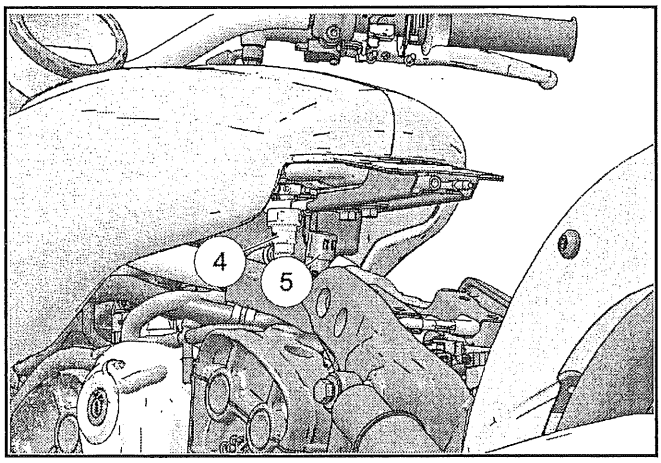
3. Remove the four bolts ① at the rear of the fuel tank.



4. Disconnect the fuel tank vent line ② and fuel cap recess drain line ③ at the rear of fuel tank.

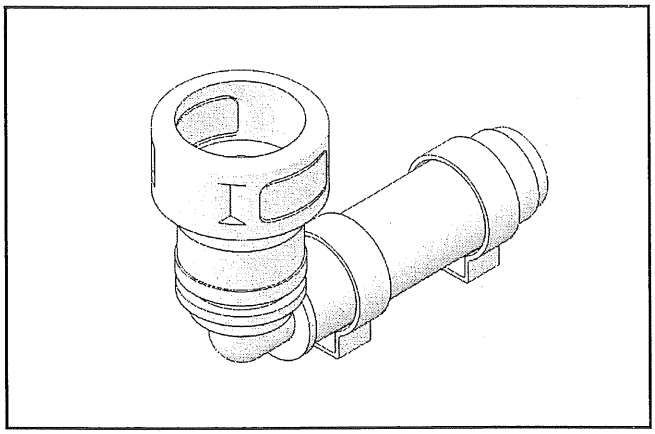


5. Place the handlebars in the straight ahead position. Place a protective cloth on front of the fuel tank to prevent damage. Lift the rear of the tank approximately 2". to access the fuel supply line connector and fuel pump electrical connector ⑤.

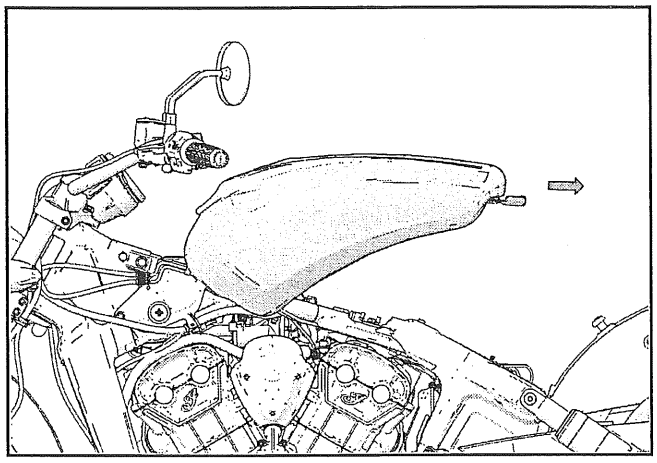


6. Support the tank and disconnect fuel pump electrical connector.
7. Wrap a shop towel around the fuel fitting and disconnect the fuel supply line connector from the fuel pump by squeezing release tabs on both sides of the fitting.

8. Install Special Tool PV-50567 Fuel Tank Fitting Plug onto the fuel pump fitting to the protect the fitting and prevent fuel from seeping out of the tank.



9. Lift the rear of the fuel tank and slide rearward to release from the front isolators.



10. Lift the fuel tank off the motorcycle and place on a suitable flat surface to prevent tank damage.

FUEL PUMP REMOVAL

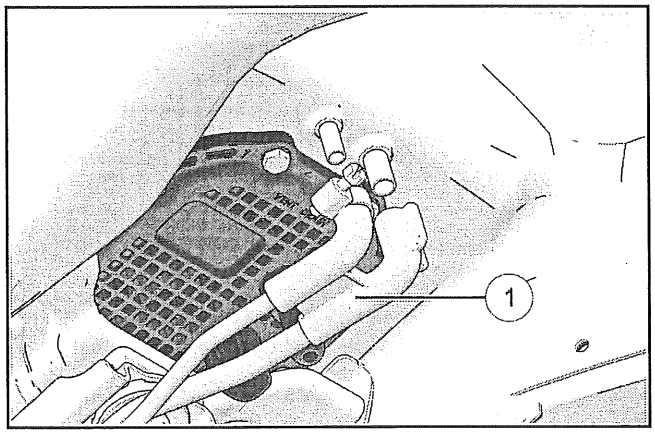
⚠ WARNING

Replace all mounting screws and pump seal O-ring any time pump is removed for service or fuel filter maintenance. Do not kink or bend fuel pickup hose upon removal. Review gasoline warnings outlined in the beginning of this chapter.

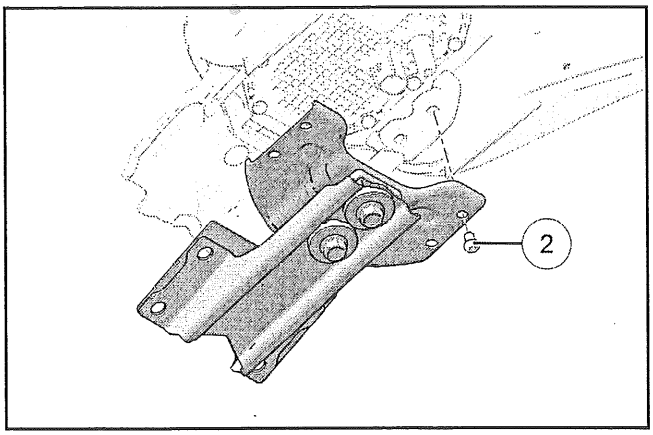
CAUTION

Be careful when performing this procedure to avoid damaging the fuel pump, electrical wiring, or hoses. Always inspect wires and hoses closely for damage after removing the fuel pump.

1. Remove the fuel tank. SeeFuel Tank Removal, page 4.14.
2. Disconnect fuel vent/drain hoses ①.

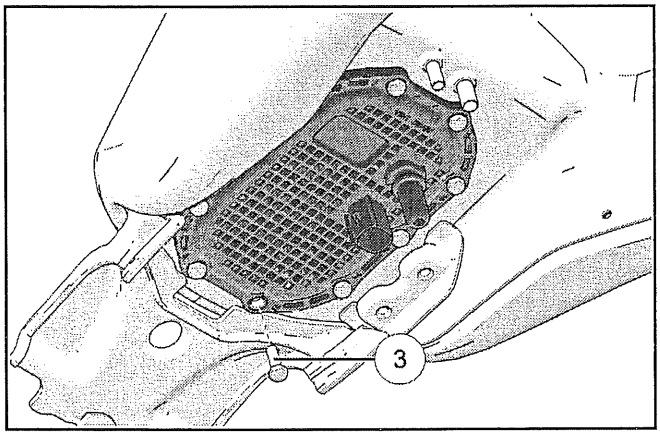


3. Remove tank mount assembly by removing four bolts ②.



4

4. Remove fuel pump bolts ③.



5. Lift the fuel pump assembly and carefully remove from fuel tank.

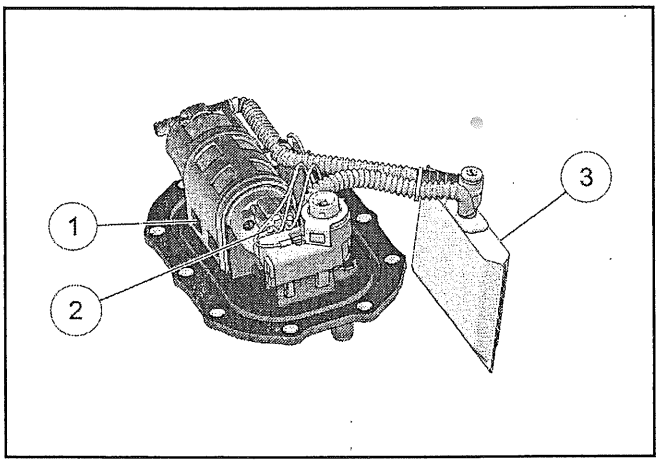
FUEL FILTER REPLACEMENT

IMPORTANT

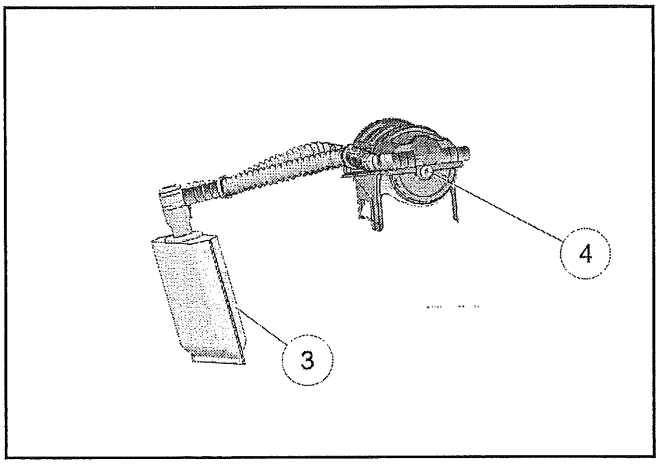
The fuel filter element should be replaced every 25,000 miles (40,234 km).

Removal

1. Remove fuel pump from the fuel tank. See Fuel Pump Removal, page 4.15.
2. Insert a small screwdriver and gently pry the retaining tabs ① to release it from the snap detent on both sides of the pump cage.



3. Slide the pump and filter assembly ③ to release it from the flange assembly.
4. Disconnect the fuel pump electrical connector ②.
5. Remove the filter element retaining ring ④.



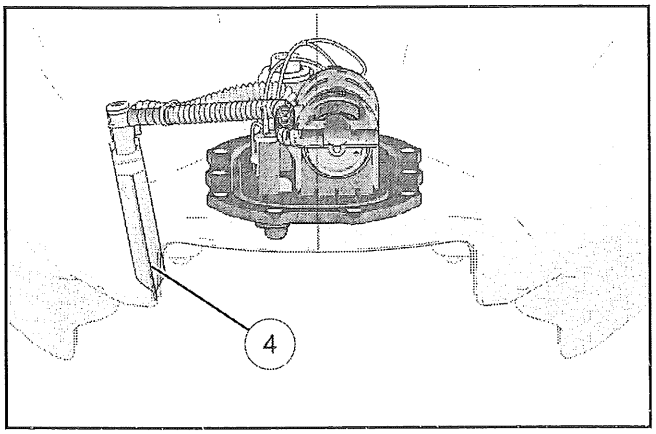
6. Insert a large flat blade screwdriver and pry near the filter tee fitting to separate the filter element assembly from the pump motor. Use caution not to break or permanently deform the plastic.
7. Remove the filter element and seal. Remove motor from remaining assembly.
8. Install new filter / motor cage assembly to the pump assembly.
9. Reinstall the retaining ring and seat with a small deep well socket.
10. Remove seal from outlet of fuel pump and replace with new seal.
11. Install the pump cage onto the flange assembly. Be careful not to severely bend or kink wire exiting the thermistor.
12. Connect the fuel pump connector.
13. Install the pump assembly into the fuel tank.

FUEL TANK VENT INSPECTION

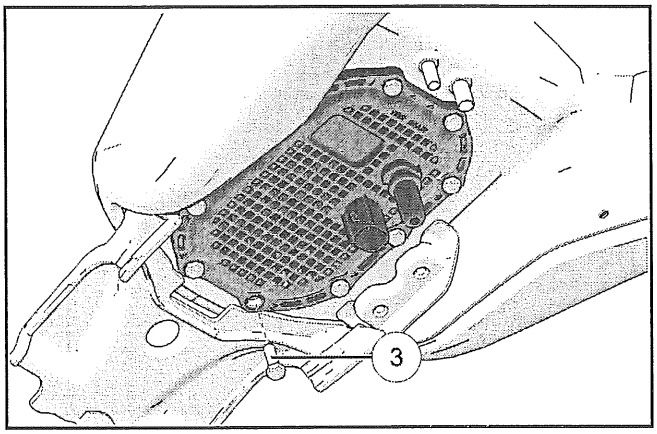
1. Refer to Maintenance Chapter for tank vent inspection and hose routing information. See Fuel Tank Vent Inspection (49 State), page 2.28.

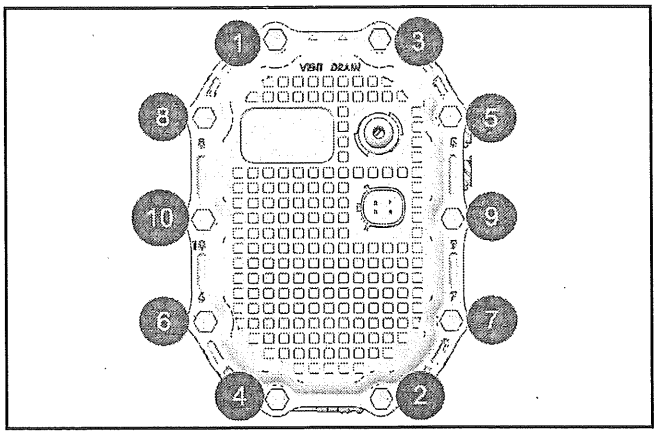
FUEL PUMP INSTALLATION

1. Install fuel pump assembly into bottom of gas tank. Insert fuel filter ④ first before pushing the rest of the fuel pump into fuel tank. Verify the filter is positioned correctly in the tank cavity before installing the pump fasteners.



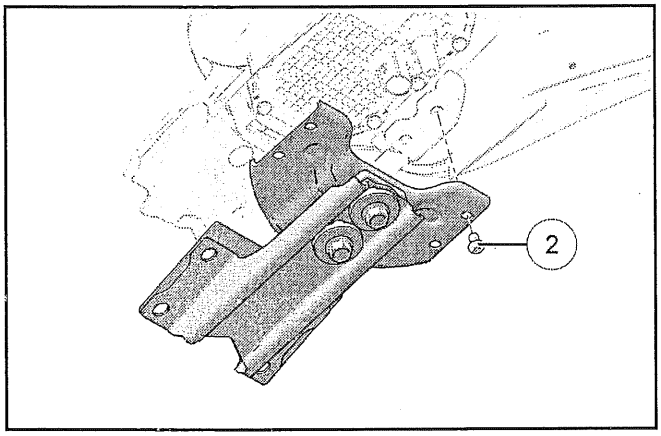
2. Install fuel pump fasteners ③ and tighten to specification following the torque sequence shown.





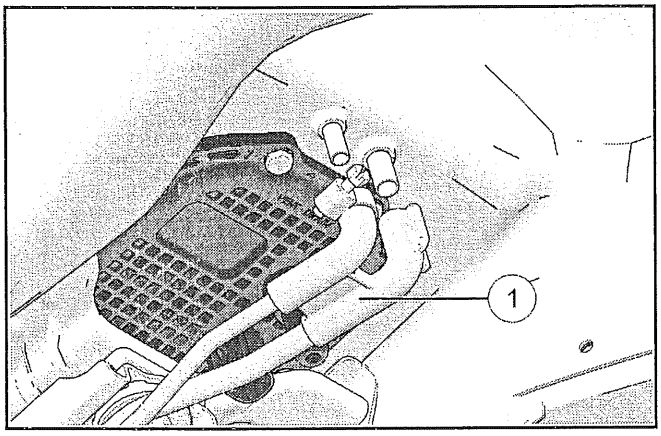
TORQUE
Fuel Pump Fasteners: **43 in-lbs (5 Nm)**

3. Install tank mount assembly using four bolts ②. Torque to specification.



TORQUE
Fuel Tank Mount Assembly Fasteners: **7 ft-lbs (9.5 Nm)**

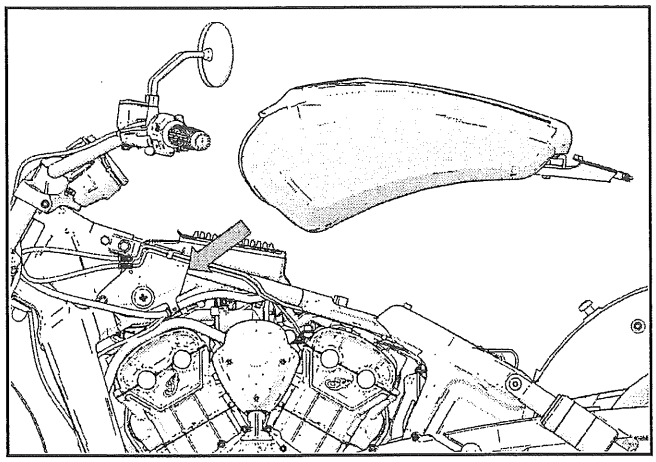
4. Connect fuel vent/drain hoses ①.



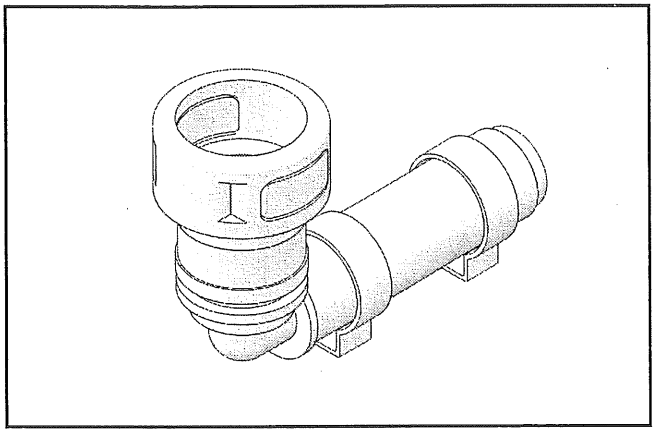
5. Install the fuel tank. See Fuel Tank Installation, page 4.19
6. Prime the fuel system and verify fuel pump operation. See Priming the Fuel System, page 4.23.

FUEL TANK INSTALLATION

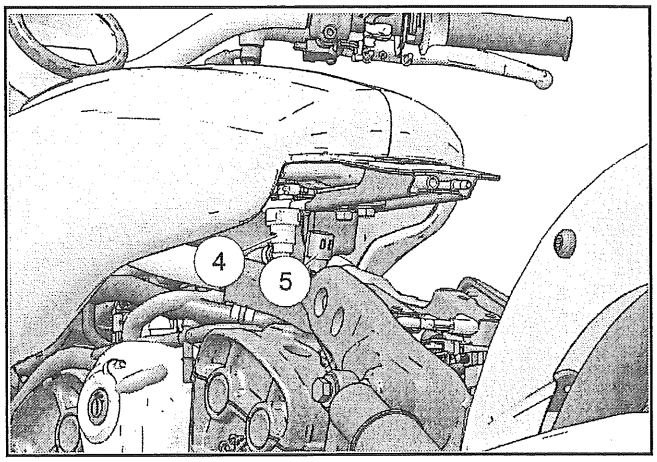
1. Secure the handlebars in the straight ahead position.
2. Apply alcohol, soapy water solution, or rubber lubricant to the isolators and carefully lower the fuel tank onto the tank isolators.



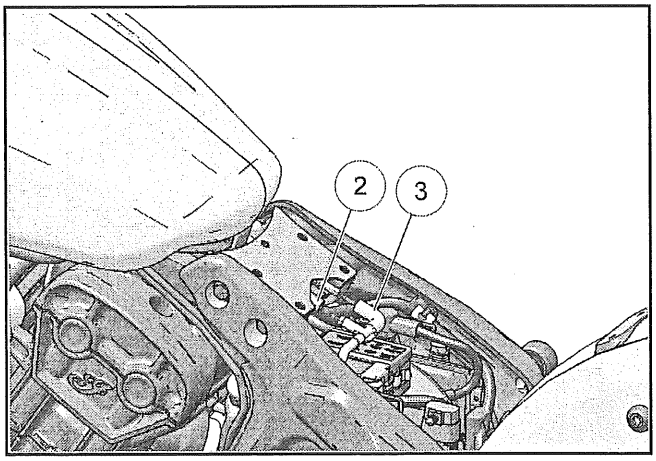
3. Remove Special Tool PV-50567 Fuel Tank Fitting Plug from the fuel pump.



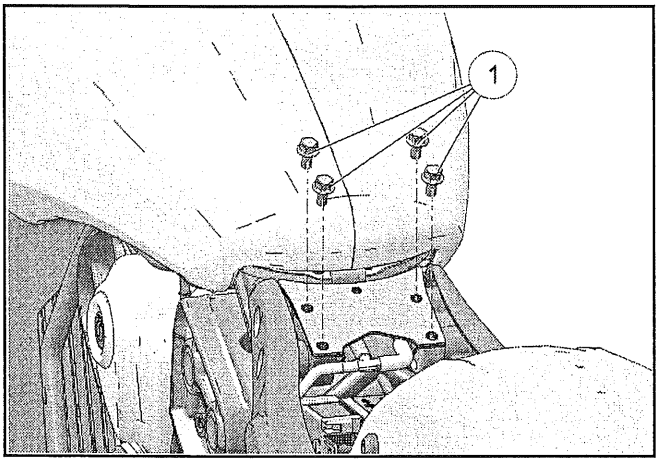
4. Connect the fuel supply line to the fuel pump ④ and fuel pump electrical connector ⑤ to the fuel tank.



5. Verify the fuel line is routed and slide tank forward until fully seated on forward isolators.
6. Connect the fuel tank vent line ② and the fuel cap recess drain line ③. Install rubber tank filler panel prior to fully lowering the rear of the tank.



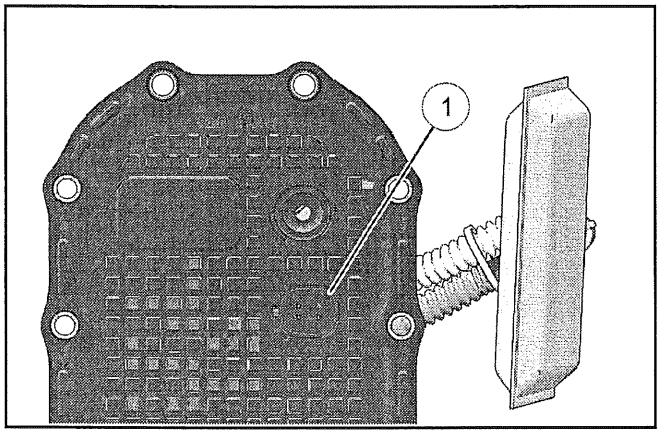
7. Install the fuel tank mounting bolts ① and torque to specification.



TORQUE
Fuel Tank Mounting Fasteners: **18 ft-lbs (24 Nm)**

FUEL LEVEL SENSOR RESISTANCE TEST

OVERVIEW OF OPERATION: The fuel level sensor is located inside the fuel tank on the fuel pump assembly①.

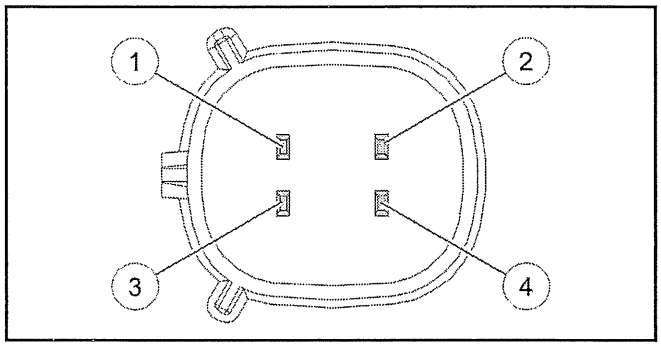


The sensor is a thermistor with inverse temperature characteristics (as temperature increases, sensor resistance decreases). When the fuel level falls below the sensor, temperature increases, lowering the resistance to provide a ground path for the Low Fuel lamp bulb which is powered when the ignition key is on. The lamp will start to glow dimly when the fuel level falls below the sensor, and will brighten as the fuel level continues to fall (low resistance).

With fuel tank empty and key ON the lamp will take approximately 30 seconds to 1 minute to reach full intensity (depending upon temperature). The sensor can be tested using a digital multimeter. Resistance readings obtained with tank installed will be in proportion to the amount of fuel in the tank (the temperature of the thermistor). The sensor wires are located in the 4-pin connector with the fuel pump wires, at rear of fuel tank.

If fuel level readings are inaccurate when the motorcycle is powered up, or if the fuel gauge isn't indicating fuel level at all, perform the following test and refer to resistance values located at the end of this procedure.

1. Remove the fuel pump. See Fuel Pump Removal, page 4.15.
2. Set multimeter to measure resistance. Attach suitable test probe adaptors to meter leads (**from kit PV-43526**).
3. On the *fuel pump* side of the connector, measure resistance across the sensor and compare to the table.



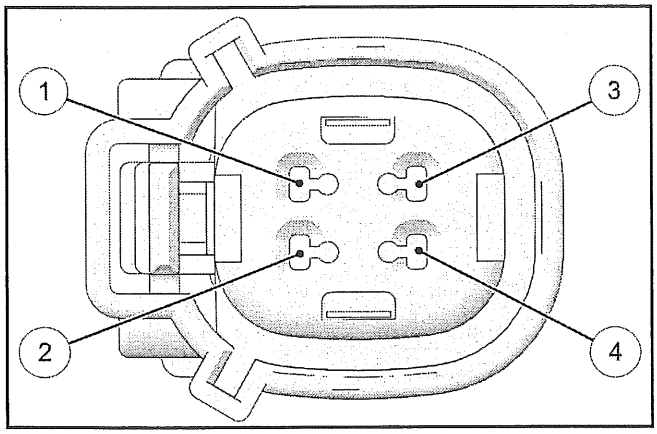
ITE-M	COLOR	ASSIGNMENT
①	White	Fuel Pump (-)
②	Yellow	Fuel Pump (+)
③	Black	Thermistor (-)
④	Red	Thermistor (+)

SENSOR TEMPERATURE	APPROXIMATE RESISTANCE LIMITS
23° C	1000 ± 15% Ω
50° C	190 ± 15% Ω

FUEL PUMP SUPPLY VOLTAGE TEST

Before performing this test, verify that battery is fully charged and in good operating condition.

1. Remove the seat assembly. See Seat Removal / Installation, page 7.8.
2. Remove the fuel tank assembly. See Fuel Tank Removal, page 4.14Fuel Tank Removal.
3. Disconnect the fuel pump / level sensor electrical connector.
4. Connect meter across terminals 2 & 4 on the *wire harness* side of connector.



ITEM	WIRE COLOR	FUNCTION
①	BK/BU	Fuel Level Sensor Signal Return
②	BK	Fuel Pump Ground
③	BK/DG	Fuel Sender Output
④	VT/YE	Fuel Pump Power

5. Turn the ignition switch to the "ON" position to power up the motorcycle electrical system.
6. Turn Engine Stop switch to RUN and read DC voltage on meter when switch is first turned on. Voltage reading should be close to battery voltage for 2-3 seconds after switching Engine Stop switch to RUN.
7. If low or no voltage is delivered to the fuel pump, verify ground wire (Pin 2, BK/DG) has good continuity to battery (-) post.
8. If ground is OK, check Gray wire from fuel pump relay terminal B4 to ECM Pin #142 . The Gray wire receives a momentary ground from the ECM (for 2-3 seconds) and activates the fuel pump relay which supplies power to the pump on the VT/YE wire.
9. Trace both power and ground circuits to determine fault if battery voltage is not present for 2-3 seconds after ignition switch and STOP / RUN switch are turned on.
10. When a CPS signal is received by the ECM (engine is cranking or running) the ECM maintains the ground on Pin # 142 (Gray wire), keeping the pump powered.

FUEL PUMP CURRENT DRAW TEST

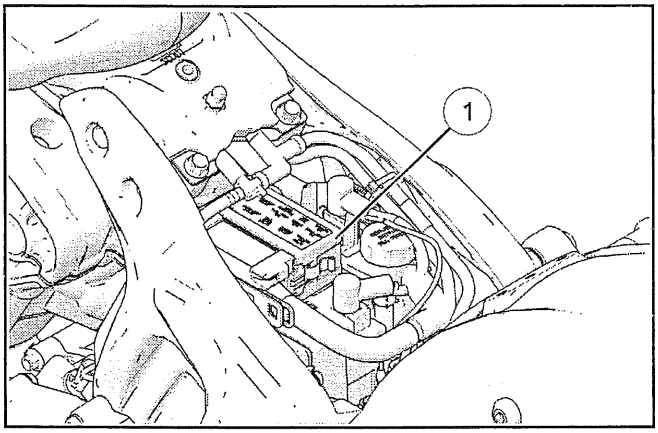
NOTE

Fuel pump current draw is an indicator of pump condition. Perform draw test if fuel pump operation is suspect, or if fuel pump fuse is found open (blown).

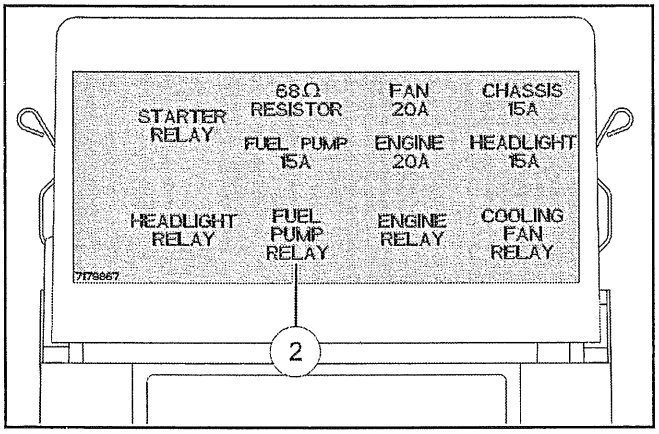
NOTE

When meter leads are inserted the pump will run, and current draw will be displayed on the meter, even with key and stop switch off. Fuel tank must be completely installed and have enough fuel in it to cover the fuel pickup screens for an accurate test.

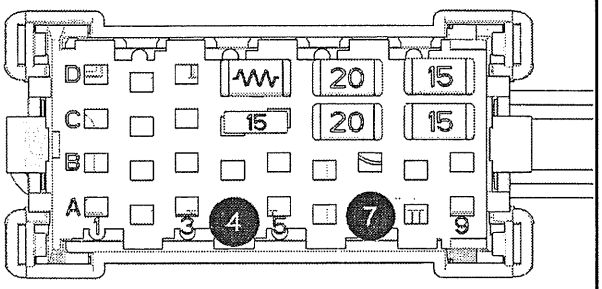
1. Remove the seat. See Seat Removal / Installation, page 7.8
2. Remove fuse box cover ①.



3. Remove Fuel Pump Relay ② by pulling straight upward.



4. Set meter to DC Amps. Be sure red meter lead is in the 10A jack, and black meter lead is in common (-) jack.
5. Insert red meter lead in pin socket B5 (7) and black meter lead in pin socket A4 (4) of relay block.



6. Read fuel pump current draw on meter and compare to specification.
7. Inspect fuel pump circuit wiring or replace fuel pump if current draw exceeds specification.

SPECIFICATION: Fuel Pump Current Draw
Maximum: 6 DC Amps

PRIMING THE FUEL SYSTEM

Prime procedure should be performed:

- If a new fuel pump is installed or if tank is run completely dry.
- Whenever fuel system is serviced (fuel line is disconnected).
- Whenever battery disconnected.

1. Fill the fuel tank.
2. Turn Engine Stop switch OFF.
3. Turn the ignition switch to ON.
4. Turn stop switch to RUN.
5. Allow switch to remain in RUN position until pump stops running (about 2-3 seconds).
6. Turn stop switch OFF.
7. Turn the ignition switch to OFF.
8. *WAIT* approximately 10 seconds.
9. Repeat Steps 4-8 about 4 times to complete the priming procedure.

NOTE
Fuel level in tank must be high enough to submerge pickup screen on fuel pump.

EFI SERVICE

FUEL INJECTION SYSTEM - OVERVIEW OF OPERATION

The Electronic Fuel Injection (EFI) system functions to provide the engine with precisely metered fuel under varying loads and conditions.

The Engine Control Module or "ECM", is located adjacent to the battery box. It is programmed to provide the correct fuel/air mixture and ignition timing based on several sensor input signals (engine load, temp, altitude, manifold pressure etc.). The ECM also provides grounds or voltage to other *EFI related* circuits of the electrical and fuel delivery systems.

An Electronic Throttle Control (ETC) system takes the place of a conventional, cable-operated throttle body. The ETC controls throttle blade angle and provides rate-of-change feedback to the ECM.

The ETC also serves as a plausibility check for the Temperature Manifold Absolute Pressure (TMAP) sensor. The MAP portion of the TMAP sensor is the primary air flow and load sensing device.

An electric fuel pump, mounted inside the fuel tank supplies fuel pressure to the injectors continuously when the engine is running or cranking. A pressure regulator incorporated on the pump keeps fuel pressure steady at approximately 4 Bar (400 kPa / 58 PSI). The fuel pump cycles "ON" for 2-3 seconds when the motorcycle is powered up and the Engine Stop switch is turned ON to pressurize the system for start-up.

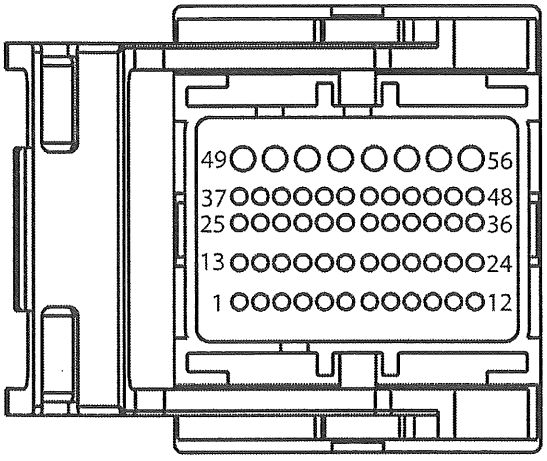
The fuel injectors inject fuel when they are grounded by drivers inside the ECM. The duration of an injector pulse (length of time the injector circuit is grounded) is controlled by the ECM. Pulse duration determines the amount of fuel delivered to the engine (longer cycles = more fuel). The ECM selects the correct fuel injector pulse by calculating the airflow from the MAP sensor measurement and referencing a three dimensional "map" for the desired air-to-fuel ratio (AFR). The ECM calculates an injection time based on the measured airflow and desired AFR.

Although TMAP and engine RPM are the most influential inputs for selecting a map reference point, the ECM also evaluates feedback from minor sensors in the system, to obtain a more accurate "picture" of the fuel needs at any given moment.

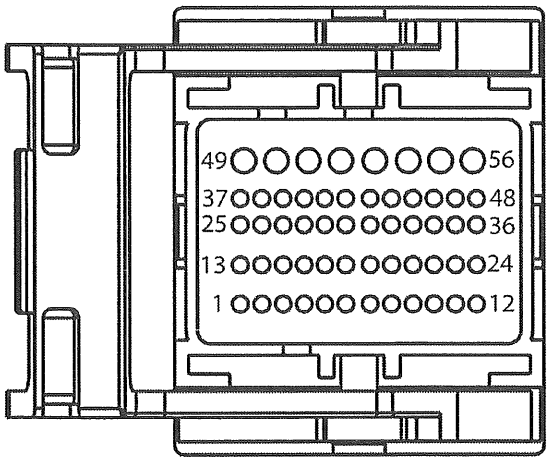
The fuel control system is closed loop. When the engine is at a warm idle and typical cruising engine speeds and loads, the ECM will operate in "closed loop fuel control" mode. The oxygen sensors in each head pipe provides feedback to the ECM and the injection time will be adjusted for each cylinder to achieve the target AFR.

The locations of sensors and other EFI system related components are outlined in this chapter. See Sensors - Powertrain Management, page 4.11.

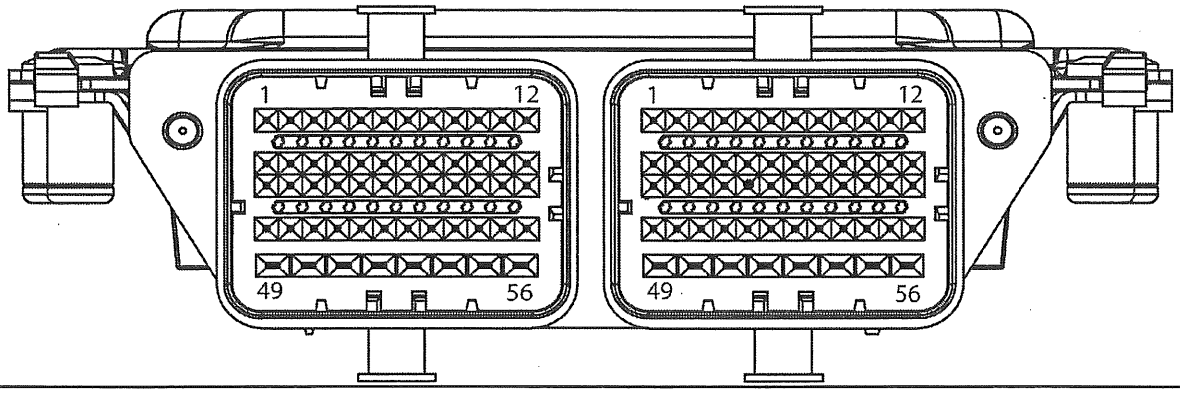
ECM CONNECTOR MAP



ECM 1



ECM 2



PIN ECM 1	COLOR	FUNCTION	PIN ECM 2	COLOR	FUNCTION
1	-	NOT USED	1	BK	CPS NEGATIVE SIGNAL
2	-	NOT USED	2	GY/DB	FRONT HEATED O2 SENSOR SIGNAL 2
3	YE/BK	PPS 2 RETURN	3	OG/YE	TPS 1 OUTPUT
4	BN/GN	TMAP SENSOR RETURN	4	BN/YE	TIPOVER SENSOR SIGNAL RETURN
5	BN/WH	TPS SIGNAL RETURN	5	BG/WH	REAR HEATED O2 SENSOR RETURN 2
6	WH/BK	PPS 1 RETURN	6	BK/BU	FUEL LEVEL SENSOR SIGNAL RETURN
7	YE/WH	START SWITCH OUTPUT (TO ECM)	7	BG	REAR HEATED O2 SENSOR RETURN 1
8	VT/OG	RIGHT TURN SIGNAL SWITCH OUTPUT (TO ECM)	8	OG/BK	ENGINE COOLANT TEMP SENSOR RETURN
9	-	NOT USED	9	-	NOT USED
10	-	NOT USED	10	WH/RD	PPS 1 - +5 VOLT REF
11	YE/GN	PPS 2 OUTPUT	11	-	NOT USED
12	-	NOT USED	12	DB	LEFT FRONT TS LAMP OUTPUT

PIN ECM 1	COLOR	FUNCTION	PIN ECM 2	COLOR	FUNCTION
13	-	NOT USED	13	RD	CPS SIGNAL POSITIVE
14	-	NOT USED	14	-	NOT USED
15	GY/BK	ENGINE RELAY CNTL	15	OG/DB	ENGINE COOLANT TEMP SENSOR SIGNAL OUTPUT
16	PK	ECM SWITCHED POWER INPUT	16	-	NOT USED
17	-	NOT USED	17	BK/YE	BRAKE PRESSURE SWITCH OUTPUT (TO ECM)
18	-	NOT USED	18	OG/WH	TIPOVER SENSOR SIGNAL
19	DB/YE	CLUTCH SWT OUTPUT (TO ECM)	19	OG/BN	TMAP SENSOR SIGNAL OUTPUT
20	VT/WH	LEFT TURN SIGNAL SWITCH OUTPUT (TO ECM)	20	VT/RD	TPS 2 SIGNAL
21	WH/GN	PPS SIGNAL 1 OUTPUT	21	-	NOT USED
22	-	NOT USED	22	-	NOT USED
23	RD/BK	RUN / STOP SWITCH (ECM INPUT)	23	BN/PK	TMAP SENSOR B+ POWER
24	YE/VT	FRONT BRK SWT OUTPUT (TO ECM)	24	DB/RD	RIGHT FRONT TS LAMP OUTPUT
25	YE/RD	PPS 2 - 5 VOLT REF	25	-	NOT USED
26	BN/GN	TIPOVER SNR - 5 VOLT REF	26	-	NOT USED
27	-	NOT USED	27	OG/DG	TMAP INTAKE AIR TEMP SENSOR SIGNAL OUTPUT
28	-	NOT USED	28	-	NOT USED
29	-	NOT USED	29	-	NOT USED
30	-	NOT USED	30	GY/RD	REAR HEATED O2 SENSOR OUTPUT 1
31	BK/OG	COOLING FAN RELAY CONTROL	31	-	NOT USED
32	YE	CAN HIGH	32	DG/BN	VEHICLE SPEED SENSOR OUTPUT
33	-	NOT USED	33	BK/PK	NEUTRAL SWITCH OUTPUT (TO ECM)
34	-	NOT USED	34	-	NOT USED
35	-	NOT USED	35	DB/BK	CANISTER PURGE VALVE (CPV) CONTROL
36	-	NOT USED	36	DB	LEFT REAR TS LAMP GROUND OUTPUT
37	-	NOT USED	37	-	NOT USED
38	BN/DB	TPS - +3.3 VOLT REF	38	-	NOT USED
39	-	NOT USED	39	GY/YE	FRONT HEATED O2 SENSOR CONTROL 2
40	DG/DB	HEADLIGHT RELAY CONTROL	40		SECONDARY AIR GROUND OUTPUT
41	WH/YE	STARTER SOLENOID RELAY CNTL	41	-	NOT USED
42	GY	FUEL PUMP RELAY CNTL	42	-	NOT USED
43	-	NOT USED	43	WH/GY	FRONT FUEL INJECTOR DRIVER 2
44	DG	CAN LOW	44	WH/DB	REAR FUEL INJECTOR DRIVER 1
45	-	NOT USED	45	-	NOT USED
46	-	NOT USED	46	GY/WH	REAR HEATED O2 SENSOR CONTROL 1
47	-	NOT USED	47	BK/WH	ECM ELECTRONIC GROUND
48	-	NOT USED	48	DB/RD	RIGHT REAR TS LAMP GROUND OUTPUT
49	-	NOT USED	49	-	NOT USED
50	-	NOT USED	50	BK/WH	ECM GROUND 1
51	PK/DB	STOP LAMP POWER OUTPUT	51	PK/RD	ETC MOTOR (+)
52	-	NOT USED	52	YE	ETC MOTOR (-)
53	BK/WH	ECM GROUND 2	53	-	NOT USED
54	BK/WH	ECM GROUND 3	54	WH	FRONT COIL SIGNAL 2
55	VT/PK	ECM SWITCHED POWER 3	55	-	NOT USED
56	VT-PK	ECM SWITCHED PWR 2	56	WH	REAR COIL SIGNAL 1

DIAGNOSTIC TROUBLE CODES

SPN	FMI	COMPONENT	CONDITION	MIL	CODE
29	3	Accelerator Position 2	Voltage Too High	ON	P1228
	4		Voltage Too Low	ON	P1227
	2		Not Plausible	ON	P1225
51	3	Throttle Position Sensor 1	Voltage Too High	ON	P0123
	4		Voltage Too Low	ON	P0122
	2		Signal Out of Range (Not Plausible)	ON	P0121
	0		Voltage Above Critical Level	ON	P1123
	1		Voltage Below Critical Level	ON	P1122
	10		Abnormal Rate of Change	ON	P0120
	13		Calibration / Adaption Failure	ON	P1120
84	0	Vehicle Speed Signal	Vehicle Speed Too High	ON	P0500
				ON	C1057
	1		Vehicle Speed Too Low	ON	P0502
	2		Data Erratic or Intermittent (or Missing)	ON	P0503
				ON	C1058
	8		Sensor Frequency Outside Normal Range	ON	P0501
	9		Abnormal Update Rate	ON	P160A
	19		Received Vehicle Speed has error	ON	C1069
				ON	P106B
91	3	Accelerator Position 1	Voltage Too High	ON	P0228
	4		Voltage Too Low	ON	P0227
	2		Not Plausible	ON	P0225
96	3	Fuel Level Signal	Voltage Too High	ON	P0463
	4		Voltage Too Low	ON	P0462
	16		Above Normal Operating Range	ON	P1462
	18		Below Normal Operating Range	ON	P1463
	2		Signal Fault	ON	P0461
98	3	Engine Oil Level Sensor Switch	Pressure Too High	ON	P1527
	4		Pressure Too Low	ON	P1526
	17		Oil Level Low	OFF	P250F
102	3	Manifold Absolute Pressure Sensor	Voltage Too High	ON	P0108
	4		Voltage Too Low	ON	P0107
	2		Signal Out of Range	ON	P0106
	10		Abnormal Rate of Change	ON	P0109
	7		Pneumatic Fault	ON	P1106
105	3	Intake Air Temperature Sensor	Voltage Too High	ON	P0113
	4		Voltage Too Low	ON	P0112
	10		Abnormal Rate of Change	ON	P0114
	2		Signal Out of Range	ON	P0111
110	3	Engine Temperature Sensor	Voltage Too High	ON	P0118
	4		Voltage Too Low	ON	P0117
	2		Signal Out of Range	ON	P0116
	10		Abnormal Rate of Change	ON	P0119
	16		Temperature Too High	OFF	P0217
	0		Engine Overheat Shutdown	OFF	P1217
	15		Temperature Above Normal Range	OFF	P1116
	17		Temperature Too Low	ON	P0128
168	3	System Power (Battery Potential / Power Input)	Voltage Too High	OFF	P0563
				ON	C1063

SPN	FMI	COMPONENT	CONDITION	MIL	CODE
	4		Voltage Too Low	OFF	P0562
				ON	C1064
	0		Voltage Above Critical Level	ON	P1562
	16		Voltage Above Warning Level	ON	P1564
	1		Voltage Below Critical Level	ON	P1563
	18		Voltage Below Warning Level	OFF	P1565
190	0	Engine Speed	Speed Exceeded Max Limit	ON	P0219
	0		Engine Speed Too High	OFF	C1059
	1		Engine Speed Too Low	OFF	C1060
	2		Data Erratic or Intermittent (or Missing)	OFF	C1061
	7		CVT Threshold Exceeded	ON	P1219
	31		Error in Engine Speed Computation	ON	P121C
	19		Received Engine Speed has Error	OFF	C1066
523	3	Gear Sensor Signal	Voltage Too High	ON	P0917
	4		Voltage Too Low	ON	P0916
	9		Abnormal Update Rate	ON	P1914
	2		Signal Fault	ON	P0914
527	31	Cruise Control Panel Switches	Switch/Switches Stuck	ON	P153D
596	31	Cruise Control Enable Switch	Switch Stuck	ON	P1590
598	2	Clutch Switch Signal	Signal Fault	ON	P0704
599	31	Cruise Control Set/Decel Switch	Switch Stuck	ON	P1591
601	31	Cruise Control Resume/Accel Switch	Switch Stuck	ON	P1592
628	12	ECU Memory	EEPROM Read / Write Failure	ON	P1602
636	8	Crankshaft Position Sensor	Circuit Fault	ON	P0336
	2		Plausibility Fault	ON	P0335
651	5	Injector 1 (Front)	Driver Circuit Open/Grounded	ON	P0261
	3		Driver Circuit Short to B+	ON	P0262
	4		Driver Circuit Grounded	ON	P1262
652	5	Injector 2 (Rear)	Driver Circuit Open/Grounded	ON	P0264
	3		Driver Circuit Short to B+	ON	P0265
	4		Driver Circuit Grounded	ON	P1265
677	5	Starter Solenoid Driver Circuit	Driver Circuit Open/Grounded	ON	P0615
	3		Driver Circuit Short to B+	ON	P0617
	4		Driver Circuit Grounded	ON	P0616
731	4	Knock Sensor 1	Voltage Too Low	ON	P0327
904	5	Wheel Speed Sensor (Front)	Open / Short	ON	C1030
	2		Input Abnormal / Signal Failure	ON	C1031
907	2	Wheel Speed Sensor (Rear)	Plausibility Fault	ON	C103D
	3		Short to B+	ON	C113D
	4		Open/Short to GND	ON	C123D
	5		Open/Short	ON	C1036
	8		Abnormal Frequency	ON	C133D
	14		Incorrect Sensor / Improper Mounting	ON	C143D
1023	5	Trip Sudden Decelerations	Open / Short	ON	C1045
1071	5	Fan Relay Driver	Driver Circuit Open/Grounded	ON	P1481
	3		Driver Circuit Short to B+	ON	P1482
	4		Driver Circuit Grounded	ON	P1483
1268	5	Ignition Coil Primary Driver 1	Driver Circuit Open/Grounded	ON	P1351
	3		Driver Circuit Short to B+	ON	P1353
	4		Driver Circuit Grounded	ON	P1361
1269	5	Ignition Coil Primary Driver 2	Driver Circuit Open/Grounded	ON	P1352

SPN	FMI	COMPONENT	CONDITION	MIL	CODE
	3		Driver Circuit Short to B+	ON	P1354
	4		Driver Circuit Grounded	ON	P1362
1347	5	Fuel Pump Driver Circuit	Driver Circuit Open/Grounded	ON	P0230
	3		Driver Circuit Short to B+	ON	P0232
	4		Driver Circuit Grounded	ON	P0231
2348	5	High Beam Lamp	Open Circuit / Short to B+	ON	C107E
	6		Grounded Circuit	ON	C107F
2350	5	Low Beam Lamp	Open Circuit / Short to B+	ON	C107B
	6		Grounded Circuit	ON	C107C
2367	5	Left Turn Indicator Driver Circuit	Driver Circuit Open/Grounded	OFF	P1714
	3		Driver Circuit Short to B+	OFF	P1715
	4		Driver Circuit Grounded	OFF	P1716
2369	5	Right Turn Indicator Driver Circuit	Driver Circuit Open/Grounded	OFF	P1710
	3		Driver Circuit Short to B+	OFF	P1711
	4		Driver Circuit Grounded	OFF	P1712
3056	2	Oxygen Sensor 1 (Front)	Signal Fault	ON	P0130
	12		Bad Component	ON	P113A
	3		Voltage High	ON	P0132
	4		Voltage Low	ON	P0131
3597	3	ECU Output Supply Voltage 1	Voltage Too High	ON	P16A2
	4		Voltage Too Low	ON	P16A1
	0		Voltage Above Critical Level	ON	P16A3
	16		Voltage Above Warning Level	ON	P16A5
	1		Voltage Below Critical Level	ON	P16A6
	18		Voltage Below Warning Level	ON	P16A7
3598	3	ECU Output Supply Voltage 2	Voltage Too High	ON	P16A9
	4		Voltage Too Low	ON	P16A8
	0		Voltage Above Critical Level	ON	P16AA
	16		Voltage Above Warning Level	ON	P16AB
	1		Voltage Below Critical Level	ON	P16AC
	18		Voltage Below Warning Level	ON	P16AD
3599	3	ECU Output Supply Voltage 3	Voltage Too High	ON	P17AA
	4		Voltage Too Low	ON	P17AB
	0		Voltage Above Critical Level	ON	P17AC
	16		Voltage Above Warning Level	ON	P17AD
	1		Voltage Below Critical Level	ON	P17AE
	18		Voltage Below Warning Level	ON	P17AF
5582	9	Static Roll Angle	Abnormal Update Rate	ON	P1062
65613	2	ETC Accelerator Position Sensor Outputs 1 & 2 Correlation	Correlation Fault	ON	P1135
65590	7	Cylinder Not Identified	Misfire Detected	ON	P1062
65591	7	Cylinder 1	Misfire Detected	ON	P0314
65592	7	Cylinder 2	Misfire Detected	ON	P0301
52036	31	Upstream O2 Sensor Signals Swapped	Condition Exits	ON	P1416
520198	3	Throttle Position Sensor 2	Voltage Too High	ON	P0223
	4		Voltage Too Low	ON	P0222
	0		Voltage Above Critical Level	ON	P1223
	1		Voltage Below Critical Level	ON	P1222
	2		Signal Out of Range (Not Plausible)	ON	P0221
	10		Abnormal Rate of Change	ON	P0220
	13		Calibration / Adaption Failure	ON	P1220

SPN	FMI	COMPONENT	CONDITION	MIL	CODE
520200	2	Tipover Sensor	Signal Fault	ON	P1501
	3		Voltage High	ON	P1503
	4		Voltage Low	ON	P1502
	14		Condition Exists (tip over condition detected)	ON	P1504
520202	5	Canister Purge Valve	Driver Circuit Open/Grounded	ON	P0444
	3		Driver Circuit Short to B+	ON	P0443
	4		Driver Circuit Grounded	ON	P0445
520204	17	Fuel Correction	System Too Lean 1 (Front) (Pre)	ON	P0171
	15		System Too Rich 1 (Front) (Pre)	ON	P0172
520205	17	Fuel Correction	System Too Lean 2 (Rear) (Post)	ON	P0174
	15		System Too Rich 2 (Rear) (Post)	ON	P0175
520208	5	Chassis/Acc Relay	Driver Circuit Open/Grounded	ON	P1611
	3		Driver Circuit Short to B+	ON	P1614
	4		Driver Circuit Grounded	ON	P1613
520209	2	Oxygen Sensor Heater 1 (pre) (front)	Plausibility Fault	ON	P0135
	5		Driver Circuit Open/Grounded	ON	P0030
	3		Driver Circuit Short to B+	ON	P0032
	4		Driver Circuit Grounded	ON	P0031
520210	2	Oxygen Sensor Heater 2 (post) (rear)	Plausibility Fault	ON	P0141
	5		Driver Circuit Open/Grounded	ON	P0036
	3		Driver Circuit Short to B+	ON	P0038
	4		Driver Circuit Grounded	ON	P0037
520250	7	ABS Pulsar (front)	COG Chip	ON	C1022
520251	7	ABS Pulsar (rear)	COG Chip	ON	C1023
520252	5	ABS Solenoid (RRI)	Open / Short	ON	C1024
520253	5	ABS Solenoid (RRO)	Open / Short	ON	C1025
520254	5	ABS Solenoid (FFI)	Open/Short	ON	C1026
520255	5	ABS Solenoid (FFO)	Open/Short	ON	C1027
520256	5	ABS Solenoid (RFI)	Open/Short	ON	C1028
520257	5	ABS Solenoid (RFO)	Open/Short	ON	C1029
520258	11	ABS Actuator (front)	Wheel Lock (or VSS failure) ABS On	ON	C1032
520259	11	ABS Actuator (rear)	Wheel Lock (or VSS failure) ABS On	ON	C1033
520260	8	ABS Motor	Motor Lock	ON	C0020
	3		Off Stick	ON	C1020
	4		On Stick	ON	C1021
520314	11	ABS Actuator (rear)	Wheel Lock (or VSS failure) ABS Off	ON	C103B
520261	7	ABS Fail Safe Relay	On/Off Stick	ON	C1034
520262	4	ABS Source Voltage	Drop	ON	C1038
	3		Raise	ON	C1039
520263	31	ABS Tire	Irregular Tire Size	ON	C1040
520264	12	ABS ECU	ECU Error	ON	C1041
520265	7	ABS Module	Incomplete Evacuation and Fill	ON	C1042
520267	31	Kickstand Switch	Condition Exists (engine disabled due to extended kickstand)	ON	P181C
520275	31	Accelerator Position/Brake Position Interaction	Condition Exists	ON	P150A
520276	12	Throttle Position Sensor (1 or 2 Indeterminable)	Neither Position Sensor Passed Test	ON	P150B
	2		Position Sensor Correlation Fault (One okay, one failed)	ON	P150C
520277	3	Throttle Body Control - Power Stage	Maximum	ON	P150D
	4		Minimum	ON	P150E

SPN	FMI	COMPONENT	CONDITION	MIL	CODE
	2		Not Plausible	ON	P151A
	8		Signal Error	ON	P151B
	31		Deactivated power stages due to 5V sensor supply error	ON	P153F
520278	31	Throttle Body Control - Return Spring Check Failed	Condition Exists	ON	P151C
520279	31	Throttle Body Control - Adaption Aborted	Condition Exists	ON	P151D
520280	31	Throttle Body Control - Limp Home Position Check Failed	Condition Exists	ON	P151E
520281	31	Throttle Body Control - Mechanical Stop Adaptation Failure	Condition Exists	ON	P15A
520282	31	Throttle Body Control	Condition Exists	ON	P152B
520283	3	Throttle Body Control	Maximum	ON	P152C
	4		Minimum	ON	P152D
	2		Outside of Pedal Range(Level 1)	ON	P152F
520284	31	Throttle Body Control - Position Deviation Fault	Condition Exists	ON	P152E
520285	2	Brake Switch (1 or 2 Indeterminable)	Brake Switch Correlation Fault	ON	P153E
520286	31	ECU Monitoring Error	Condition Exists	ON	P1540
520287	31	ECU Monitoring Error (Level 3)	Condition Exists	ON	P1541
520288	31	ECU Monitoring of Injection Cut Off(Level 1)	Condition Exists	ON	P1542
520289	31	ECU Monitoring of Injection Cut Off(Level 2)	Condition Exists	ON	P1543
520290	31	Controller Option Settings not Programmed	Condition Exists	ON	P1544
520291	5	Left Fog Lamp	Open Circuit / Short to B+	ON	C1075
	6		Grounded Circuit	ON	C1076
520292	5	Right Fog Lamp	Open Circuit / Short to B+	ON	C1078
	6		Grounded Circuit	ON	C1079
520293	5	Horn	Open Circuit / Short to B+	ON	C122A
	6		Grounded Circuit	ON	C122B
520294	5	Windshield Motor Driver	Open Circuit / Short to B+	ON	C1222
	6		Grounded Circuit	ON	C1223
520295	2	Windshield Motor Switch	Both inputs are closed	ON	C1225
520296	12	Accelerometer	Bad Component	ON	C1125
520297	31	System On Button	Switch Stuck	ON	C1530
520298	5	Heated Grips	Open Circuit / Short to B+	ON	C1047
	6		Grounded Circuit	ON	C1048
520299	5	Power Lock Motor	Open Circuit / Short to B+	ON	C1226
	6		Grounded Circuit	ON	C1227
520300	12	Tire Pressure Sensor (Front)	Battery Voltage too Low (Replace)	OFF	C1083
	17		Pressure to Low	OFF	C1084
	9		Abnormal Update Rate	OFF	C1085
520302	12	Tire Pressure Sensor (Rear)	Battery Voltage too Low (Replace)	OFF	C1088
	17		Pressure to Low	OFF	C1089
	9		Abnormal Update Rate	OFF	C1090
520304	12	Key Fob	Battery Voltage too Low (Replace)	OFF	P1633
520305	31	Throttle Body Control - requested throttle angle not plausible	Condition Exists	ON	P1530
520311	31	ECU Fault – Hardware Disruption	Condition Exists	ON	P1537
520312	31	Power Lock Motor Switch	Switch Stuck	ON	C1229
520313	11	ABS Actuator (front)	Wheel Lock (or VSS failure) ABS Off	ON	C103A
520320	5	Brake Light	Open Circuit	ON	P1593
	3		Shorted to Battery	ON	P1594
	4		Shorted to Ground	ON	P1595

SPN	FMI	COMPONENT	CONDITION	MIL	CODE
520321	5	Tail Light	Open Circuit	ON	P1596
	3		Shorted to Battery	ON	P1597
	4		Shorted to Ground	ON	P1598
520322	3	Front Brake Switch	Voltage Too High	ON	P1599
	4		Voltage Too Low	ON	P159A
	2		Signal Fault	ON	P159B
520323	3	Rear Brake Switch	Voltage Too High	ON	P159C
	4		Voltage Too Low	ON	P159D
	2		Signal Fault	ON	P159E
520329	9	Operator Switch Status (pOSS1)	Abnormal Update Rate	ON	P1063
520330	13	Immobilizer	Out of Calibration	ON	P1064
	9		Abnormal Update Rate	ON	P106A
520331	3	Knock Sensor Positive Line	Voltage Too High	ON	P1327
	4		Voltage Too Low	ON	P1328
520332	3	Knock Sensor Negative Line	Voltage Too High	ON	P132A
	4		Voltage Too Low	ON	P132B
520333	2	Oxygen Sensor (Pre) (BANK 2)	Signal Fault	ON	P1136
	12		Bad Component	ON	P1139
	3		Voltage High	ON	P1137
	4		Voltage Low	ON	P1138
520336	31	ECU Monitoring (Pedal Map Mismatch)	Condition Exists	ON	P1545
520338	31	Gross Air Leak	Condition Exists	ON	P2279
520342	15	Idle Fuel Correction Bank 1	Data Valid But Above Normal Operating Range - Least Severe Level (System Too Rich)	ON	P116C
	17		Data Valid But Above Normal Operating Range - Least Severe Level (System Too Lean)	ON	P116D
520343	15	Idle Fuel Correction Bank 2	Data Valid But Above Normal Operating Range - Least Severe Level (System Too Rich)	ON	P116E
	17		Data Valid But Below Normal Operating Range - Least Severe Level (System Too Lean)	ON	P116F
520344	15	Adaptive Fuel Correction Bank 1	Data Valid But Above Normal Operating Range - Least Severe Level (System Too Rich)	ON	P0170
	17		Data Valid But Below Normal Operating Range - Least Severe Level (System Too Lean)	ON	P1170
520345	15	Adaptive Fuel Correction Bank 2	Data Valid But Below Normal Operating Range - Least Severe Level (System Too Rich)	ON	P0173
	17		Data Valid But Below Normal Operating Range - Least Severe Level (System Too Lean)	ON	P1173
524046	31	Start Button	Switch Stuck	ON	C1512
524079	31	Cruise Control Input Checksum	Checksum does not match	ON	U0405
524080	31	Cruise Control Input Message Counter	Counter not incremented	ON	U1405
524083	5	Secondary Air Control Valve	Open Circuit	ON	P1075
	3		Shorted to Battery	ON	P1076
	4		Shorted to Ground	ON	P1077

SENSOR DIAGNOSTICS

If a sensor fails or reads outside a "normal" range, a "pre-programmed" (default) value is substituted by the ECM until sensor reading returns to normal.

Sensor values can be viewed in Digital Wrench on the "Sensor Data Grid Or Graphs" screen. Since the sensor reading may either be actual feedback from the sensor OR a default value set by the ECM in the event of a fault in the sensor or wiring, it is important to verify the condition of the sensor.

The Malfunction Indicator Light (MIL) may or may not illuminate to alert the rider of a possible problem, depending on which system fault has occurred. The first step following illumination of the MIL is to perform a visual inspection to see if a cause can be determined.

Connect Digital Wrench to see what codes are present in memory, and focus your diagnostics on that sensor and the related wiring for that circuit. Refer to wiring diagrams and system break-out diagrams to narrow a problem search.

If multiple codes are set, refer to the wiring diagram and focus your efforts on wiring and connections common to each of the sensors, such as a power supply or common ground. Multiple sensor failure is extremely unlikely.

Many sensor tests described in this section are performed at the ECM wire connector. This method ensures that the data from a sensor is reaching the ECM. Sensor tests can be performed at the sensor if easily accessible, but the wiring between the sensor and the two 56-pin ECM connectors should always be closely examined and the path between the sensor and ECM verified if the sensor itself passes the test.

Poor or corroded connections are the most common cause of system faults. Always check the integrity of the male pins and female receptacles of the connectors in the affected circuit. These may include the sensor connector, the ECM connector, and any wiring between the two, such as jumper harnesses where applicable.

ECM PINOUT TESTING

NOTE

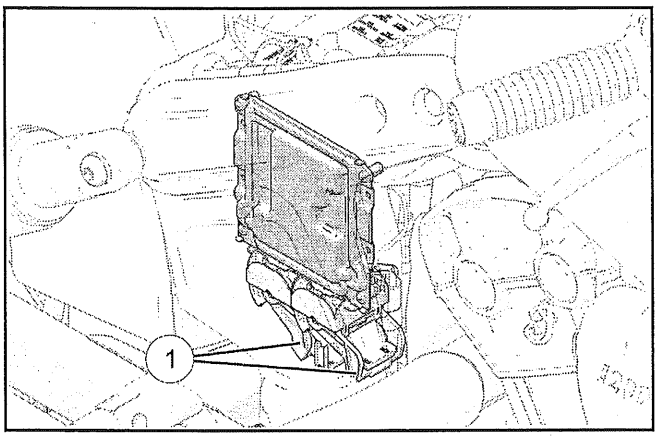
Tests in this section may require reading resistance and voltages at ECM connector. Once ECM connector has been removed from the ECM:

- Do not touch pins on ECM. Static electricity from your body can damage the ECM.
- Do not attempt to perform tests on the ECM unit.
- Always use the appropriate test connector from the Electrical Connector Test Adapter Kit (PV-43526) or an appropriate test probe that will not damage (expand) the connector pin socket.
- DO NOT attempt to use standard meter probes or other devices to probe connector pin sockets as this could expand a terminal socket or damage the connector, create a problem where none existed before, and complicate the diagnostic process.
- Sensor tests on the following pages can often be performed at the sensor connector itself or at the ECM connector based on accessibility of the connector or wiring.
- If a sensor tests within the specified range (OK), then test the circuit wiring. This usually originates at the ECM connectors, but may include other connections.

ECM CONNECTOR REMOVAL

1. To disconnect the two 56-pin ECM connectors:

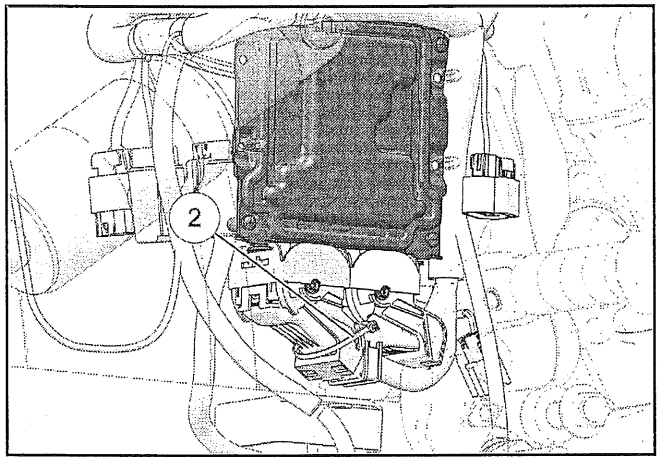
- Locate the ECM connectors ①.



- Remove the panduit strap securing the connector lock lever (if equipped).
- Slide the lock lever toward the rear of the vehicle until connector is disengaged from the ECM.
- Lift the connector straight off of the ECM.

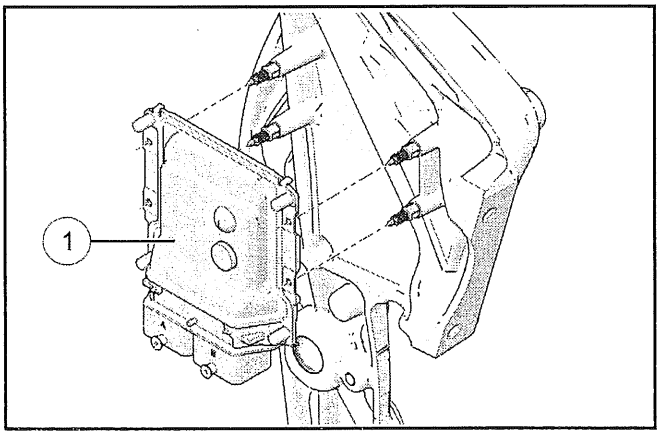
ECM Connector Installation

2. Carefully align the ECM connector *straight* with the flange on the ECM. (Do not tip or rotate the connector into the ECM).
3. Gently apply straight inward pressure on the connector while sliding the lock lever back toward the connector until the lever stops and the connector is fully seated.
4. Secure a new panduit strap ② around the ECM rear connector lock lever and harness.



ECM REMOVAL / INSTALLATION

1. Remove the battery box. See Battery Box Removal, page 10.13.
2. Disconnect the ECM connectors. See ECM Connector Removal, page 4.34.
3. Remove the ECM ① from the 4 posts securing it to the frame.

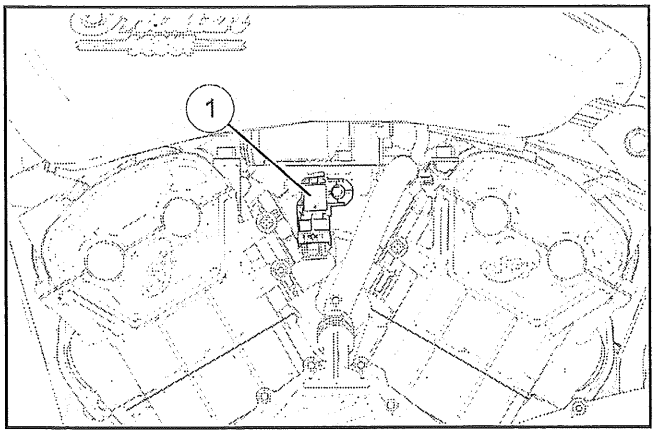


4. **Reverse the removal procedure to install.**

TEMPERATURE MANIFOLD ABSOLUTE PRESSURE SENSOR (TMAP) REPLACEMENT

Operation Overview

Mounted on the intake manifold, the TMAP sensor ① performs two functions in one unit.



Air passing through the intake is measured by the TMAP and relayed to the ECM. These signals, comprised of separate air temperature and manifold absolute pressure readings, are processed by the ECM and compared to its programming for determining the fuel and ignition requirements during operation. The TMAP sensor provides the ECM with engine load data.

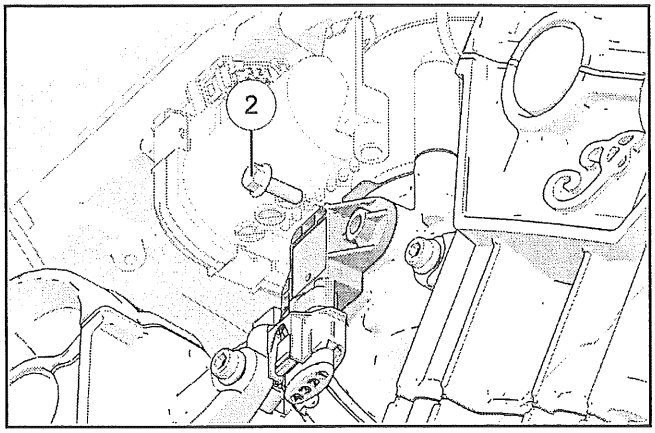
TMAP Sensor Test

The TMAP sensor is a non-serviceable item. If it is faulty, it must be replaced

IMPORTANT
This sensor should only be tested using Digital Wrench Diagnostic Software.

TMAP Sensor Replacement

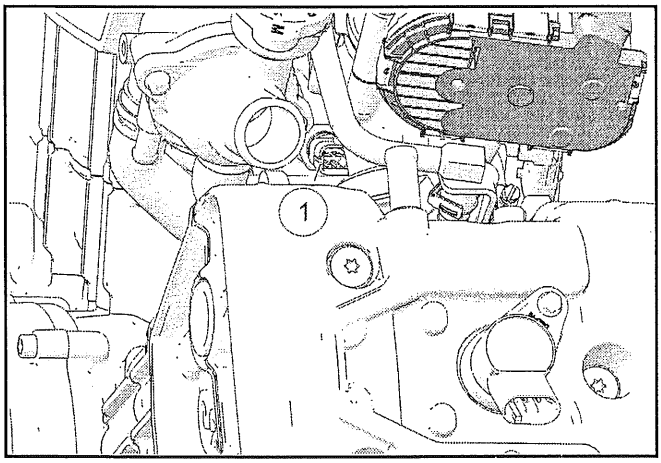
1. Remove the ignition coil assembly and associated bracket. See Ignition Coil Removal / Installation, page 10.35.
2. Disconnect vehicle harness from TMAP sensor.
3. Remove TMAP sensor screw ② and remove sensor from the intake manifold.



4. **INSTALLATION is performed by reversing the removal procedure.**
5. Torque TMAP sensor screw to specification.

TORQUE
TMAP Sensor Fastener: **25 in-lbs (2.8 Nm)**

COOLANT TEMPERATURE SENSOR, TEST / REPLACE



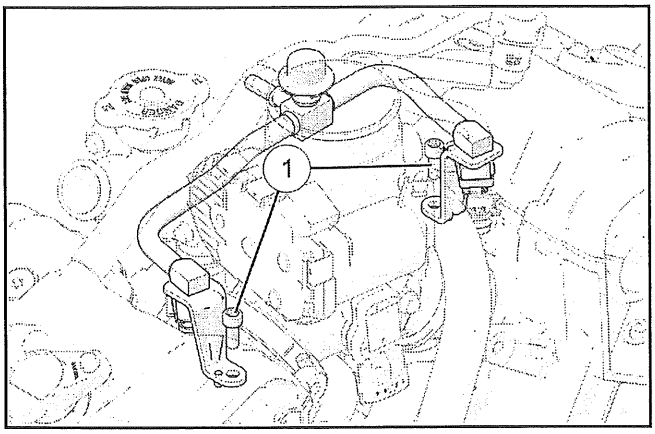
CHT TEST OVERVIEW		
INDICATES	INSPECT	LOCATION
Voltage received at ECM from CTS sensor is outside of parameters.	Resistance readings through sensor and wiring at ECM 2 connector (ECM disconnected). This will test will inspect the wiring, connectors, and CHT sensor resistance.	Under rear cylinder intake port.

1. Disconnect ECM #2 connector. See ECM Connector Removal, page 4.34.
2. Attach test lead adapters to meter leads.
3. Set multimeter to measure resistance.
4. Measure resistance between pin 208 and pin 215 of the ECM #2 connector and compare to specification. See ECM Connector MAP, page 4.25.
5. If resistance is out of specified range, disconnect sensor and measure the resistance through each wire from ECM connector to the sensor connector. Resistance should be less than 1 Ohm (good continuity).
6. If Step 5 continuity is good, measure the resistance through the sensor and compare to specification.

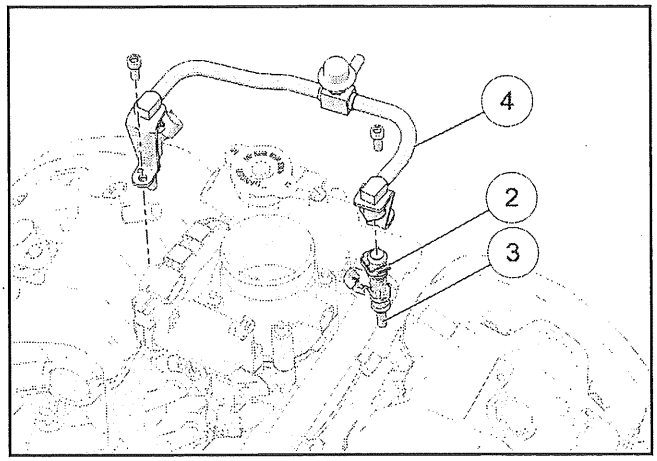
COMPONENT	METER SETTING	TEST CONNECTIONS	SPECIFICATIONS (±10%)
COOLANT TEMPERATURE SENSOR	OHMS	Pin #208 to #215	30.5 K Ohms +/- 13% @ 25° C (77° F)

FUEL INJECTOR REMOVAL / INSTALLATION

1. Remove the seat assembly. SeeSeat Removal / Installation, page 7.8
2. Remove fuel tank. See Fuel Tank Removal, page 4.14.
3. Remove the air box. See Air Box Removal, page 3.4.
4. Remove the ignition coil(s) assembly. See Ignition Coil Removal / Installation, page 10.35.
5. Disconnect electrical connectors from fuel injectors.
6. Remove fuel rail screws ①.



7. If still attached, disconnect the fuel supply line from the fuel rail quick connect.
8. Lift fuel rail off injectors to remove it. Cover injector ends and fuel rail quick connect with plastic wrap rail to prevent contamination.
9. Clean the area around injectors with compressed air to prevent foreign material from entering the engine. Pull injectors out of cylinder heads, keeping them in order (front and rear) for assembly.
10. **INSTALLATION is the reverse of the removal procedure.**
11. Install new o-ring on each fuel injector and lubricate with engine oil.
12. Install the injector retainer ② onto the injector ③ as illustrated.



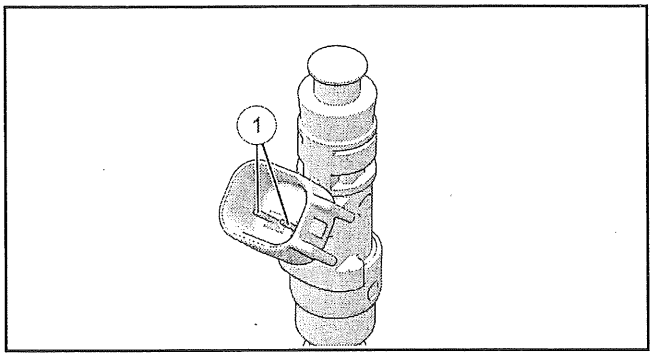
13. Insert the assembled injector into the fuel rail ④.
14. Install the fuel rail assembly to the engine.
15. Install and torque the fuel injector fasteners to specification.

TORQUE
Fuel Injector Retaining Fasteners: **88 in-lbs (10 Nm)**

FUEL INJECTOR RESISTANCE TEST

IMPORTANT
Take note of front and rear fuel injector harness connectors before disconnecting them.

The fuel injectors are non-serviceable. If diagnosis indicates a problem with either injector, test the resistance of the fuel injector (s) by measuring between the two pin terminals ①.

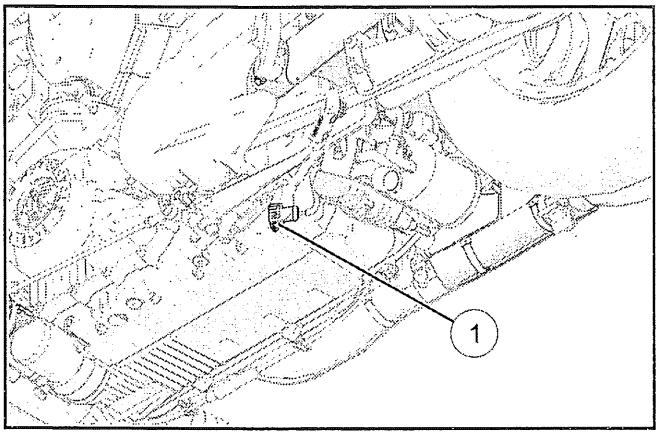


Fuel Injector Resistance Specification:
11.4 Ω - 12.6 Ω

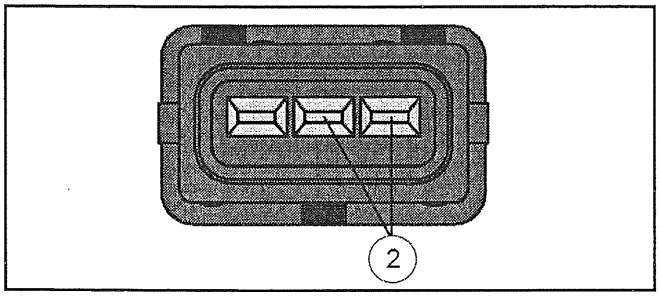
CRANKSHAFT POSITION SENSOR, TEST / REPLACE

Crankshaft Position Sensor CPS Test

1. Locate the CPS connector ① under the Belt Guard, and disconnect.



2. Connect an ohmmeter between the pin terminals ② and compare resistance readings to specification below.

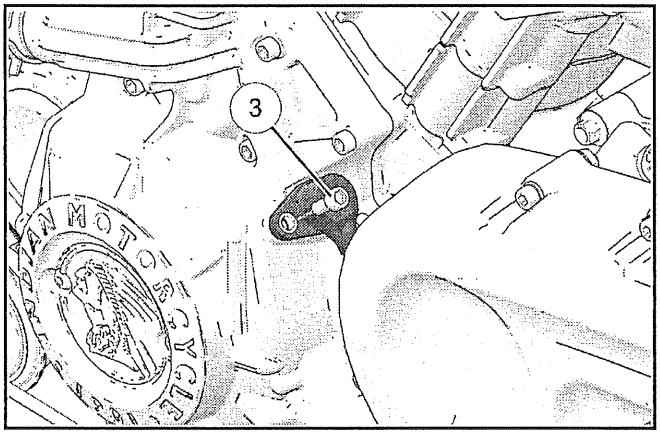


3. If resistance is correct, check to see that the sensor is mounted properly and that the tone wheel has not been damaged and is securely mounted to the crankshaft assembly.

Crankshaft Position Sensor: **860 Ohms @ 20°C (68°F)**

CPS Replacement

1. Remove regulator / rectifier assembly and bracket. See Rectifier / Regulator Replacement, page 10.33.
2. Disconnect the CPS sensor from the vehicle harness and release flying lead from plastic darts and cable ties.
3. Remove the screw ③ securing the CPS sensor to the engine case and remove sensor.



4. **Installation is performed by reversing the removal procedure.**

IMPORTANT

Apply rubber lubricant to the CPS sensor o-ring to ease installation.

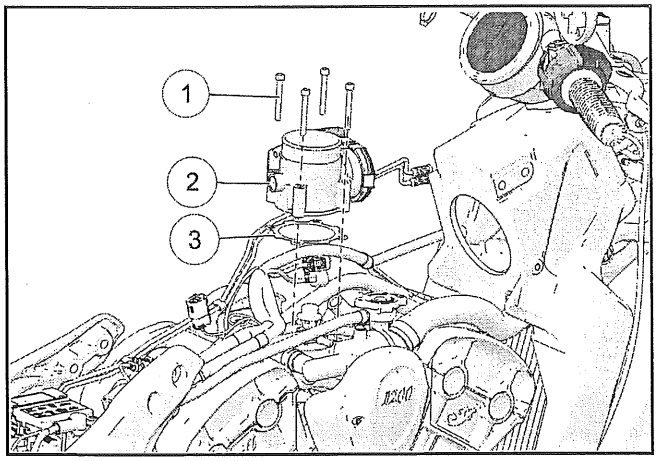
5. Torque the CPS retaining fastener to specification.

TORQUE

CPS (Crank Position Sensor) Retaining Fastener:
88 in-lbs (10 Nm)

THROTTLE BODY (ETC) REMOVAL / INSTALLATION

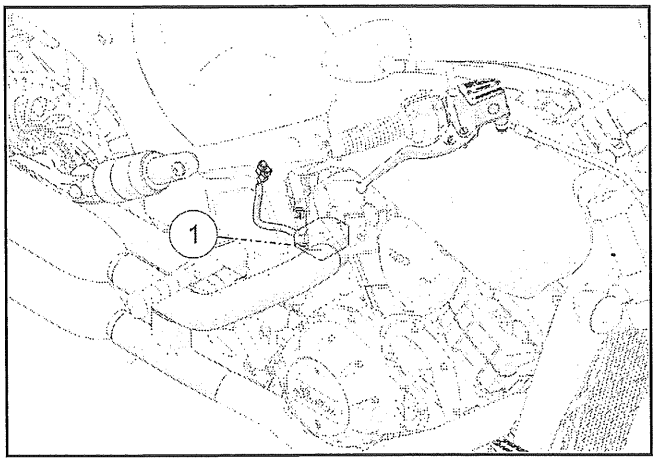
1. Remove seat assembly. See Seat Removal / Installation, page 7.8.
2. Remove fuel tank. See Fuel Tank Removal, page 4.14
3. Remove air box assembly. See Air Box Removal, page 3.4.
4. Disconnect the electronic throttle body connector.
5. Remove four electronic throttle body fasteners ①.



6. Remove electronic throttle control ② and replace gasket ③.
7. Reverse procedure for installation.
8. Torque the throttle body fasteners to specification.

TORQUE
Throttle Body Fasteners: **88 in-lbs (10 Nm)**

LOAD / TIP OVER MODULE



The Load / Tip Over Module ① adds load to standard high-current hand control switches for terminal cleaning and to provide ECM interface signal integrity. The Tip Over Sensor incorporated into this module interrupts the ignition/fuel supply which prevents engine operation after a tip over event.

See Electrical Chapter (Chassis Electrical) for additional information.

CYLINDER MISFIRE DETECTION

The ECU monitors crankshaft speed via the crankshaft position sensor. A misfire will cause a fluctuation in crankshaft speed. A code will set and flash the check engine light after an engine misfire threshold/rate is detected that is above a pre-determined limit. This threshold varies based on engine speed.

One or more of the following codes will be set if a misfire occurs:

- P0301 (SPN 65591/FMI 7) Misfire Detected, Cylinder 1 (Front)
- P0302 (SPN 65592/FMI 7) Misfire Detected, Cylinder 2 (Rear)
- P0314 (SPN 65590/FMI 7) Misfire Confirmed

If a misfire is detected, the following events will occur:

- The check engine indicator lamp will begin to flash and fuel will be cut to the affected cylinder(s). The check engine indicator lamp will continue to flash until the ignition switch has been moved to the off position. Restarting the engine will clear the flashing indicator and restore fuel to both cylinders.
- If a 2nd misfire occurs, the check engine indicator lamp will resume flashing and fuel will once again be cut to the affected cylinder(s).
- After the 3rd misfire, P0314 misfire fault is determined & set, the check engine light will remain on and fuel will be cut to the affected cylinder(s). If this occurs, follow the troubleshooting section below.

In cases where cylinder misfire is intermittent, or has been repaired in the field (e.g. loose spark plug wire has been reattached), Misfire Detection utilizes a self-healing feature to allow continued operation. Following the 1st or 2nd misfire event, when the ignition is cycled OFF and ON again, the misfire code becomes historic and the MIL turns off. When P0314 is set, after the 3rd misfire event, the MIL will stay on for 3 fault free drive cycles before turning off.

If the MIL turned on solid due to P0314, it will stay on until the misfire condition has been removed and 3 fault free drive cycles have occurred.

NOTE

DRIVE CYCLE:

A drive cycle consists of cycling the ignition from OFF to ON, then start the engine and run at idle for a period of approximately 4 minutes. Finally, turn off the ignition for approximately 2 1/2 minutes.

If it does not turn off, diagnose by verifying the following items:

TROUBLESHOOTING

- Ignition Coil and connections are good
- Spark plugs wires are secure
- The correct spark plugs are installed and the plugs are not fouled
- Crankshaft Position Sensor tests good
- Wiring to the Crankshaft Position Sensor, ECU and Ignition Coil are not damaged. Chassis ground is clean and tight
- Fuel pressure is within specification
- Fresh/good quality fuel is in the fuel tank
- Engine mechanical is good (leak down, timing)

IMPORTANT

Once the systems is repaired and functioning normally, connect to Digital Wrench to clear active and historic codes. Retest to verify the condition is no longer present.

DIGITAL WRENCH

DIGITAL WRENCH DIAGNOSTIC SOFTWARE OVERVIEW

NOTE

Refer to Section 2, 3 and 4 in the Instruction Manual provided in the Digital Wrench Diagnostic Kit to install the Digital Wrench diagnostic software on your computer.

The Digital Wrench diagnostic software allows the technician to perform the following tests and observations:

- View or clear trouble codes
- Analyze real-time engine data
- Reflash ECU calibration files
- Perform guided diagnostic procedures
- Create customer service account records
- Perform output state control tests (some models)

DIAGNOSTIC SOFTWARE VERSION

Always use the most current version of the Digital Wrench software to ensure you have the latest updates or enhancements. New reprogramming files and guided diagnostic procedures are added to these updates as they become available.

ECM REPLACEMENT

Although the need for ECM replacement is unlikely, a specific replacement procedure is required to ensure that all essential data contained within the original ECU is transferred to the replacement ECU.

Refer to procedure and carefully follow all instructions provided in Digital Wrench.

GUIDED DIAGNOSTIC AVAILABLE

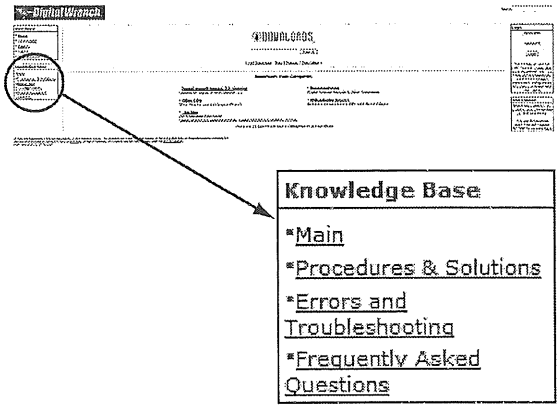
Guided diagnostics are available within Digital Wrench for most supported Diagnostic Trouble Codes (DTCs). That is, any fault that will turn on the 'Check Engine' indicator.

In addition, guided diagnostics are also available for many other electrical sub systems.

Diagnostic procedures are added to subsequent versions of Digital Wrench as they become available. Check your release version often and upgrade when available to be sure you are using the most current software available.

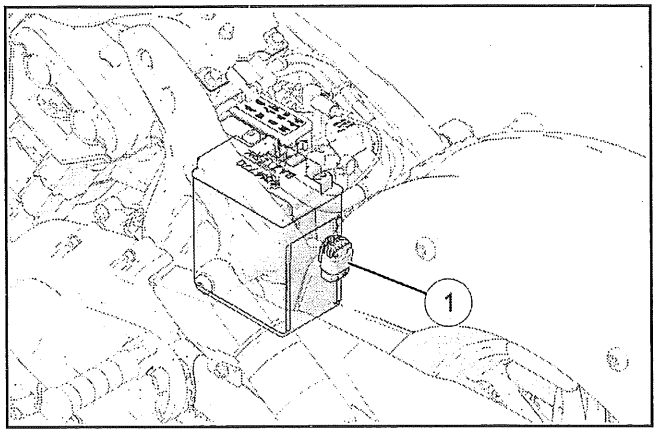
DIGITAL WRENCH COMMUNICATION ERRORS

If you experience problems connecting to a vehicle or any other Digital Wrench related problem, visit the Digital Wrench Knowledge Base for the most current troubleshooting information, FAQs, downloads and software updates at: *http://polaris.diagsys.com/.*



DIGITAL WRENCH DIAGNOSTIC CONNECTOR

The diagnostic connector ① is located behind the battery.



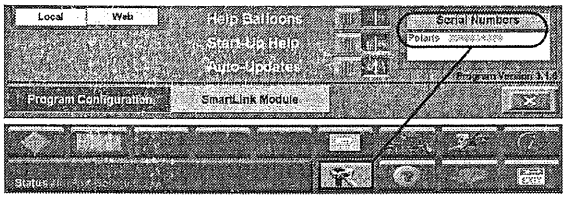
Follow these steps to connect the diagnostic interface cable to the vehicle:

1. Assemble the SmartLink Module and attach the PC Interface Cable to your laptop.
2. Unplug the Digital Wrench connector from it's protective receptacle.
3. Connect the Vehicle Interface Cable to the Digital Wrench diagnostic connector.
4. Press the ON button to power up the motorcycle electrical system and switch the STOP / RUN switch to the RUN position.

5. Select the appropriate vehicle and wait for the status to display 'Connected' in the lower left corner of the screen.
6. Once connected, proceed with using Digital Wrench.

DIGITAL WRENCH SERIAL NUMBER LOCATION

Open the configuration screen by clicking on the wrench icon. The serial number is located on the right side of the screen.



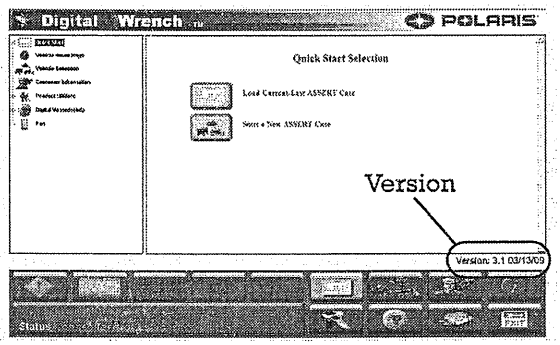
DIGITAL WRENCH VERSION AND UPDATE ID

Knowing what Digital Wrench version and update is installed will help determine which updates are required.

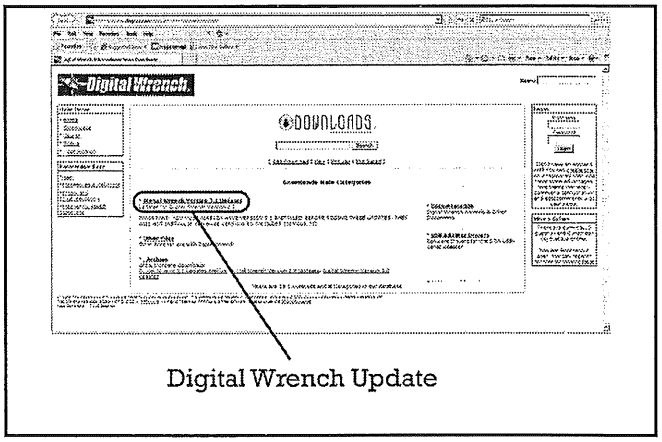
NOTE

Versions and updates are subject to change.

1. Open the Digital Wrench software. Locate the version ID shown on the lower right side of the Digital Wrench start-up screen.



2. Proceed to *http://polaris. diagsys. com* to see if a newer update is available.



3. If a newer update is available, it should be downloaded before using Digital Wrench.

NOTE

Always operate with the latest update.

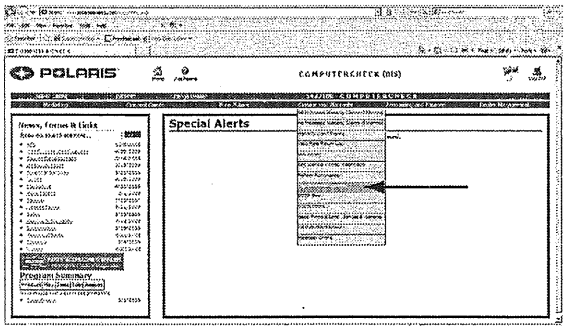
DIGITAL WRENCH UPDATES

Updates are released for Digital Wrench via the Internet at: *http://polaris. diagsys. com*. The Digital Wrench website can also be accessed through the dealer website at: *www.polarisdealers.com*.

NOTE

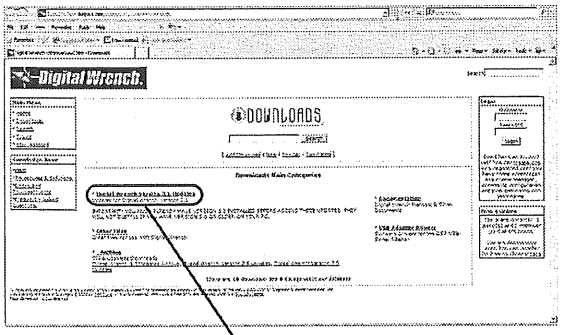
Only authorized Indian Motorcycle dealers and distributors can access the dealer website.

1. Log on to *www.polarisdealers.com*.
2. Locate the **Service and Warranty** drop-down menu.
3. Click on **Digital Wrench Updates**.



4. The Digital Wrench portal website should appear in a new web browser.

5. Click on **Digital Wrench Version Updates.**

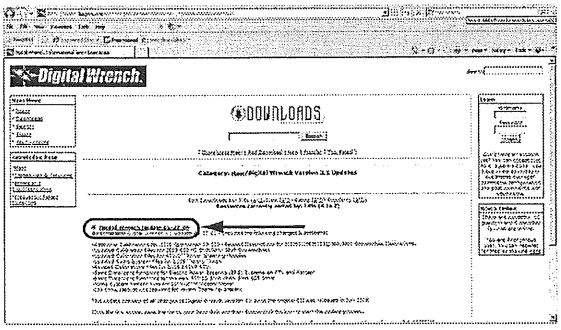


Digital Wrench Update

NOTE

You must already have the current version installed before adding an update. Updates will not install if you are using an older version loaded on your PC.

6. If the update file date listed is newer than your current version and update, download the file.

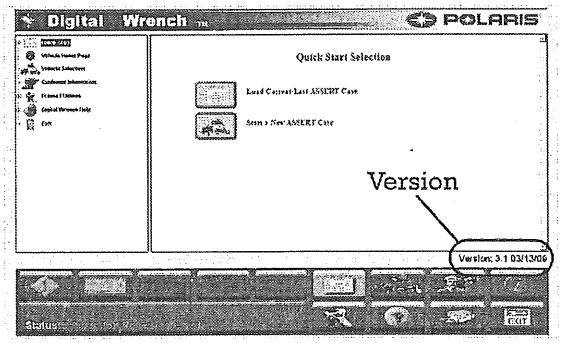


7. Click on the link shown above, save the file to your hard disk and then double-click the icon to start the update process.

NOTE

Do not "run" or "open" the file from where they are. Select "save" and download them to your PC before running the install.

8. When the update is complete, the version shown on the right side of the Digital Wrench start-up screen should match the update you just downloaded.

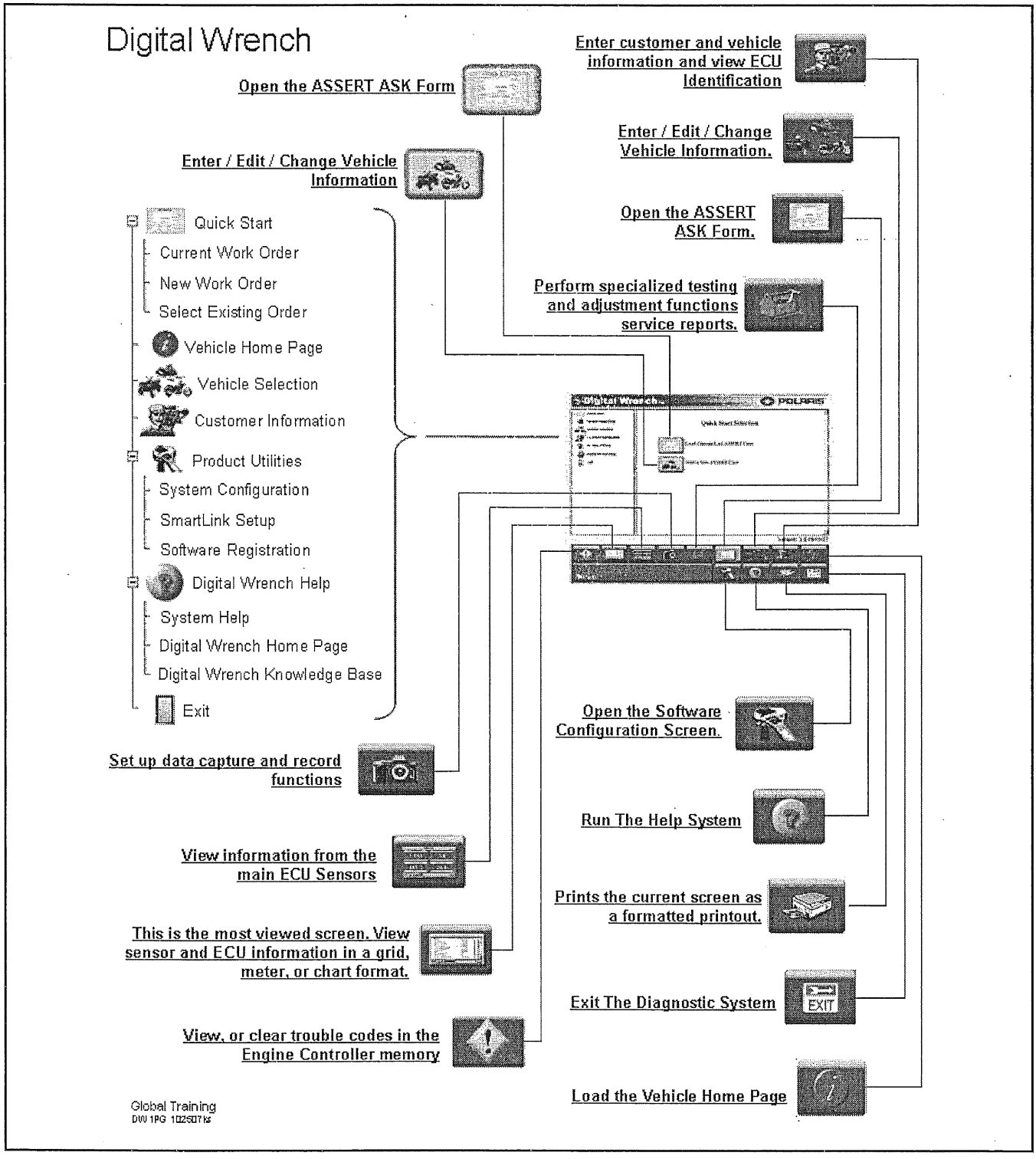


NOTE

Versions and updates are subject to change.

4

DIGITAL WRENCH FEATURE MAP



ENGINE CONTROLLER REPROGRAMMING (REFLASH)

Process Overview

The reprogramming feature is in the Special Tests menu on the Digital Wrench screen. Start Digital Wrench and click on the Special Tests menu icon (red tool box). A technician should be familiar with the process and with computer operation in general before attempting to reprogram an ECM.

The Digital Wrench Engine Controller Reprogramming (or "Reflash") feature allows reprogramming of the ECM fuel and ignition map. To successfully reprogram the ECM, an Authorization Key must be obtained by entering a Request Code in the box provided on the Reflash Authorization site. The Request Code is automatically generated by Digital Wrench during the reprogramming process. The Reflash Authorization site is located under the **Service and Warranty** drop down menu on the dealer website at: *www.polarisdealers.com*.

NOTE

Failure to follow the reprogramming instructions completely and correctly can result in an engine that does not run! Replacement ECMs are programmed as "no-start" and require a reflash for them to work.

Reprogramming (Reflash) Tips:

- BATTERY VOLTAGE: The majority of problems with reprogramming can be attributed to a low battery. Be sure the battery voltage (no load) is at least 13 volts and at least 12.5 volts with the key 'ON'. Connect a battery charger if necessary to bring voltage level above minimum. Fully charge the battery before you attempt to reprogram.
- DEDICATED LAPTOP: Best results are obtained using a laptop computer that is "dedicated to Digital Wrench". A laptop that is used by a variety of people and in several applications around the dealership is more likely to cause a reprogramming problem than one dedicated to Digital Wrench diagnostics only.
- OBTAINING THE LATEST UPDATE: Reprogramming updates are provided periodically and contain the most recent calibrations.
- CLOSE NON-ESSENTIAL PROGRAMS: It is recommended that you DO NOT install non-essential programs on a Service Department laptop. Camera detection software, Virus Scanners, Tool Bars, etc. may clog up memory if running in the background and make it harder for the diagnostic software to operate.
- KNOW THE PROCESS: If you are not familiar with the entire reprogramming process, review the HELP section of the diagnostic software before you attempt reprogramming. Click on the **?** on the tool bar or press F11. The information in the on-line help is the most current and complete information available. This should be your first step until you are familiar with the process.
- COMMUNICATION PROBLEMS: If you have had problems communicating with a vehicle while performing diagnostic functions, do not attempt reprogramming until the cause has been identified and fixed. Check all connections, and be sure battery voltage is as specified.
- Proceed to *http://polaris.diagsys.com* for specific information and FAQs on how to troubleshoot communication problems.
- DON'T DISTURB THE PC: While reprogramming is in progress, don't move the mouse and don't touch the keyboard. The process only takes a few minutes, and is best left alone until complete.

Reprogramming (Reflash) Procedure:

If you are not familiar with the reprogramming process, review the "Reprogramming (Reflash) Tips" before you begin. Follow the on-screen instructions as you progress through the steps. If you encounter a problem, always check the On-Line help for current tips and information.

1. Verify the most current update has been downloaded and loaded into Digital Wrench.
2. Connect SmartLink Module cables to PC and vehicle.
3. Open the Digital Wrench program.
4. Select the model year, product line and vehicle description by selecting the "Change Vehicle Type" icon.
5. Select the "Special Tests" icon.
6. Select "Engine Controller Reprogramming".
7. Select the file you want to load into the ECU then click the "Continue" icon to proceed to the Integrity Check and obtain a Request Code.

8. Copy (CTRL +C) the Request Code that will be required on the dealer website in the next step. DO NOT CLOSE Digital Wrench or the Request Code will be invalid.

NOTE

All characters are letters; there are no numbers in a request code.

NOTE

Request Codes and Authorization Keys must be entered EXACTLY as they appear on the screen.

9. Go to *www. polarisdealers. com* and click on "ReFlash Authorization" from the "Service and Warranty" drop-down menu.
10. Enter or paste (CTRL +V) the Request Code into the box.
11. Select the same file type from the list that you selected previously while in Digital Wrench. Enter the VIN along with the customer's name and address. When completed, click the Authorize button *once* to proceed.
12. An "Authorization Key" will appear in the upper left corner of the screen. Copy (CTRL+C) this key exactly as it appears.
13. Enter or paste (CTRL+V) the Authorization Key in the box located on the Digital Wrench screen. Click the 'Continue' button and follow instructions provided on the screen to complete reprogramming procedure.
14. At this point the reflash process will begin. Do not touch the vehicle or PC during the process.
15. Once the ECU reprogramming procedure is complete, click the 'Finish' button on the screen. Verify the reflash was a success by starting the vehicle.

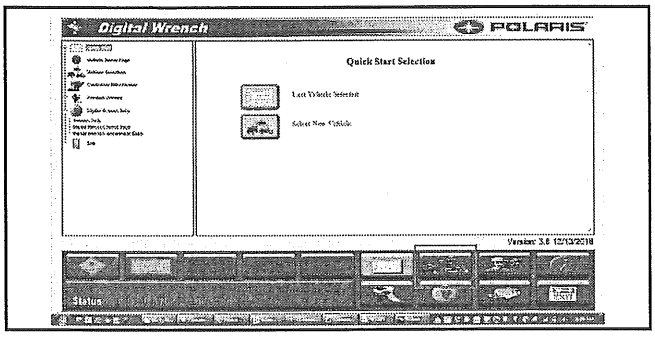
VEHICLE MODEL CONVERSION PROCESS (INT'L MODELS ONLY)

OVERVIEW

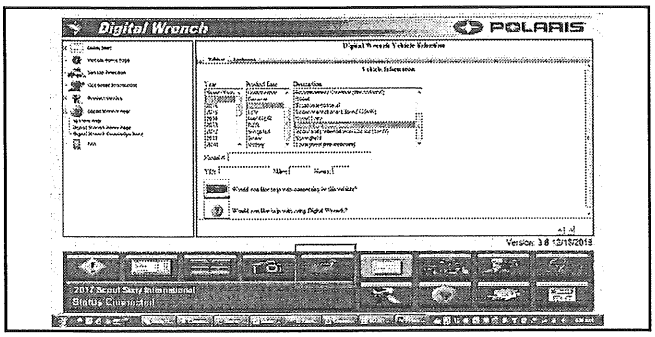
The following process will allow the use of Digital Wrench to convert select international Indian Motorcycle models to meet L3e-A2 power limited requirements in some international countries. Upon completion of this process, the vehicle will be assigned a new model number, new calibration, and a Declaration of Conversion that must be presented in order to register the vehicle in addition to the Certificate of Conformity. The same procedure may also be used to convert a vehicle back to the standard L3e-A3 full power configuration.

If you are not familiar with the reprogramming process, review *"Reprogramming (Reflash) Tips"* before you begin. See Engine Controller Reprogramming (Reflash), page 4.45. A valid internet connection is required throughout this procedure. Verify your internet connection is working before beginning.

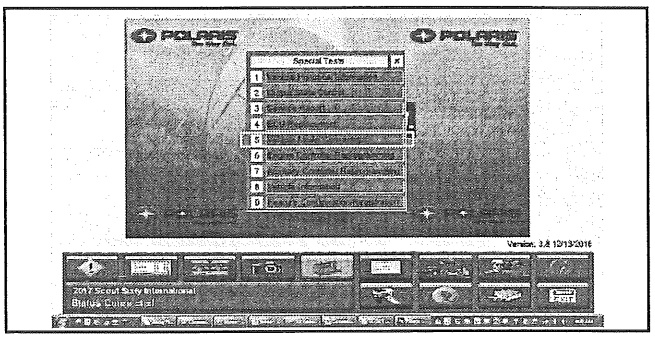
1. Verify the most current update has been downloaded and loaded into Digital Wrench.
2. Connect SmartLink Module cables to PC and vehicle. Open the Digital Wrench program.
3. Open the Digital Wrench program.
4. Select the "Change Vehicle" icon and select model year, product line and vehicle description.



5. Select the "Special Tests" icon (red tool box).



6. Select "Vehicle Model Conversion".



NOTE

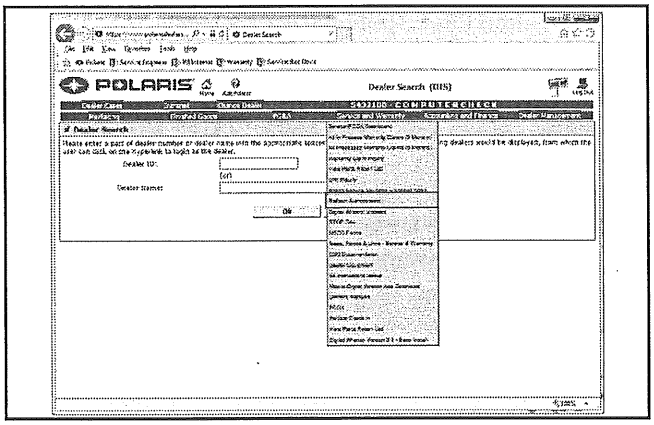
If the "Vehicle Model Conversion" option is not listed, this feature is not available for the selected model.

7. Select "Continue" to confirm and proceed with model conversion.
8. Select "Continue" to confirm intended model and calibration and proceed.
9. Copy (CTRL +C) the Request Code that will be required on the dealer website in the next step. DO NOT CLOSE Digital Wrench or the Request Code will be invalid.

NOTE

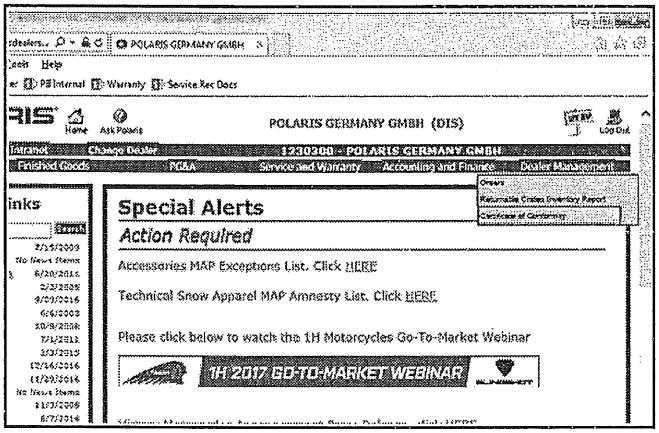
All characters are letters; there are no numbers in a request code.NOTE: Request Codes and Authorization Keys must be entered EXACTLY as they appear on the screen.

10. Login to www. polarisdealers. com or intl. polarisdealers. com and click on "Reflash Authorization" from the "Service and Warranty" drop-down menu.



11. Enter or paste (CTRL+V) the Request Code into the box.

12. Select the same file type from the list that you selected previously while in Digital Wrench. Enter the VIN along with the customer's name and address. When completed, click the Authorize button once to proceed.
13. An "Authorization Key" will appear in the upper left corner of the screen. Copy (CTRL+C) this key exactly as it appears.
14. Enter or paste (CTRL+V) the Authorization Key in the box located on the Digital Wrench screen.
15. Click the "Continue" button.
16. At this point the reflash process will begin. Do not touch the vehicle or PC during the process.
17. Once the ECU reprogramming procedure is complete, select the "Finish" button.
18. Select the "Return" button.
19. Login to www. polarisdealers. com and click on "Certificate of Conformity" from the "Dealer Management" drop-down menu.



20. Select "Document Management".
21. Select applicable product group from the drop down menu and click "Search Certificates".
22. Enter VIN, select language, and select number of seats from drop down menu. Select "Search".
23. Select the check box and click "Print Selected Revisions".
24. Select "Print" to print the applicable Certificate of Conformity and Declaration of Conversion.
25. Return to Digital Wrench and select "Continue".
26. Select "Continue" to return to vehicle selection screen.
27. Select model year, product line and vehicle description for converted model and confirm the status is displayed as "Connected" in the lower left of the screen.
28. Verify the reflash was successful by starting the vehicle.

TROUBLESHOOTING
FUEL SYSTEM TROUBLESHOOTING PART 1

PROBLEM	POSSIBLE CAUSE	AFFECTED PART(S)	REPAIR RECOMMENDED
Engine turns over with electric starter, but won't start	Compression too low	See engine section	
	No spark at spark plugs	See ignition system	
	No fuel reaching intake tract	Out of fuel Blown Fuse Plugged fuel filters / lines Fuel pump not working Fuel pressure regulator Faulty fuel pump relay Open wiring / connector Faulty connection at ECM	Add Fuel Replace Clean/Replace Test / Replace Test / Replace Test / Replace Inspect / Repair Inspect / Repair
	Excessively rich or lean fuel mixture	Fuel pump Fuel pressure regulator Crank Position Sensor Low Battery TMAP sensor CHT sensor Fuel Injector	Test / Replace Test / Replace Test / Replace Test / Replace Test / Replace Test / Replace Test / Replace
	Spark at wrong time or no spark. Fuel delivery timing incorrect.	Timing Wheel or CPS installed incorrectly, damaged, or dirty; faulty CPS	Install correctly, inspect for proper air gap (gap is preset but cover, sensor, and timing wheel must be clean and in good condition).
Poor idle	Excessively rich or lean fuel mixture	Air Leaks Air restriction in IAC Fuel Pump Fuel injector / Fuel Rail obstructed or leaking Air Filter Wrong Fuel / Old Fuel Crank Position Sensor	Inspect IAC system Inspect IAC hoses and fittings Inspect fuel pressure Replace Replace Inspect / Replace Inspect / Replace
Poor Running in Higher RPM Range	Air intake restriction Oil Overfilled Ignition problems Low Battery Voltage Loose, corroded, or wet connector(s) Valve train problems	Air filter Ignition Coil(s) / plug wires Battery ECM and wiring harness Valve springs, valve, head	Inspect Refer to ignition section. Charge or replace Unplug connections - inspect Inspect cylinder head & valves

FUEL SYSTEM TROUBLESHOOTING PART 2

PROBLEM	POSSIBLE CAUSE	AFFECTED PART(S)	REPAIR RECOMMENDED
Engine Stalls	Fuel Pump Problem	Low battery voltage Faulty fuel pump No signal from ECM Wiring problem	Battery/Charging system Check fuel pressure Repair Wiring Repair/Chk Pump Relay
	Excessive rich or lean fuel/air mixture	TMAP Sensor Plugged fuel filter Fuel pump (pressure) Fuel pressure regulator Vacuum leak Wiring problem Air Filter Low battery voltage	Repair / Replace Replace Test / Replace Test / Replace Pump Assembly Repair / Replace hoses Repair Replace Ck battery & charging system
	Control Circuit/ Sensors not functioning correctly	Fuel pressure regulator TPS Engine speed sensor Fuel pump relay Rotor Fuse ECM Relay Low battery voltage ECM	Test Pressure / Replace Test / Replace Test / Replace Test / Replace Inspect / Install correctly Replace Replace Inspect Charging system
	Valve train problems or Compression low	Refer to Engine / Cooling / Exhaust Chapter (Cylinder Head / Valves)	
Backfiring	Low Battery Voltage Ignition Problem Air leaks Restricted air intake or throttle body	Battery Spark plug fouled, poor wire connection for ignition or fuel injection, loose pin in multi-pin connector for ECM or wiring harness Inlet and Exhaust Intake tract / Throttle body	Refer to battery section Replace plugs / diagnose Inspect wiring connections Disconnect and check pin connections Seal intake or exhaust leaks Clean air inlet tract and throttle body

FUEL SYSTEM TROUBLESHOOTING PART 3

PROBLEM	POSSIBLE CAUSE	AFFECTED PART(S)	REPAIR RECOMMENDED
Poor Running in upper rpm ranges	Control Circuit/ Sensors not functioning correctly	CPS ETC Air temperature sensor Manifold Absolute Pressure sensor Intermittent wiring /connector problem ECM	Test / Replace Test / Replace Test / Replace Test / Replace Repair/Replace Test / Replace
	Fuel delivery incorrect	Plugged or kinked fuel and/or vent hoses Fuel pump Fuel regulator Fuel filter Battery/Charging System Fuel Injector plugged Contaminated fuel (water, additives, etc.) Inadequate octane Defective ETC Low battery voltage	Repair/Replace Test / Replace Test Pressure / Replace Test / Replace Charge/Replace Clean/Replace Clean/Replace Use correct fuel Test / Replace Charging system
	Air intake restriction	Dirty Air Cleaner Intake restriction	Clean Repair
	Air Leak	ETC gasket surfaces Intake manifold ETC	Repair/Replace Repair/Replace Repair/Replace
Engine lacks power	Engine component problems Ignition problems Overfilled with oil	See Engine / Cooling / Exhaust Chapters See Electrical Chapter (Ignition System) See Maintenance Chapter	
	Improper fuel delivery	Plugged fuel injector Dirty air cleaner Vacuum leaks Fuel pump Fuel pressure regulator Air temperature sensor TMAP sensor Plugged vent hose Low battery voltage ECM	Repair / Replace Replace Repair Test / Replace Test / Replace Test / Replace Test / Replace Clear Test batt./Charging system

FUEL SYSTEM TROUBLESHOOTING PART 4

PROBLEM	POSSIBLE CAUSE	AFFECTED PART(S)	REPAIR RECOMMENDED
Engine overheats	Internal Engine Parts Lubrication & Cooling system Low or incorrect oil Brakes dragging Drive belt too tight Ignition timing incorrect Spark plug(s) Low battery voltage	Cooling System Engine Oil Brake systems Drive Belt Ignition Coils Faulty ECM Charging System Faulty Battery Faulty Wiring	Refer to Engine / Cooling / Exhaust Chapter Refer to Engine / Cooling / Exhaust Chapter Refer to Brakes Chapter Refer to Steering / Suspension Chapter Refer to Electrical Chapter Replace Test / Repair Replace Repair
	Lean Air/Fuel mixture	Fuel pressure regulator Air leak Fuel injector plugged CTS Vent hose plugged / kinked Air leak at throttle body to manifold seal	Repair/Replace Repair Clean/Replace Test / Replace Repair Test / Repair
Won't Accept New Calibration	Non-Current Calibration File Set Low Battery Voltage Attempting Re-Flash Without Proper VIN, Calibration I.D. number, or calibration authorization code		Go to Dealer website and download the most current Indian Motorcycle Calibration File Set Attach Battery Charger During Re-Flash, and Re-Charge Battery When Re-Flash Is Completed Enter Authorization Code Sent With Accessory Kit

CHAPTER 5
CLUTCH / PRIMARY / SHIFT

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STATOR COVER REMOVAL 5.21
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TROUBLESHOOTING CLUTCH / PRIMARY / SHIFT 5.24

GENERAL INFORMATION

SERVICE INFORMATION

- Clutch and external transmission shift linkage service can be accomplished with the engine in the frame.
- Internal transmission or internal shifting mechanism service requires engine removal and crankcase separation.
- Oil additives of any kind are not recommended by Indian Motorcycle. Using oil additives or oil of the wrong viscosity can have a detrimental affect on clutch performance, operation, and service life.
- Burnt clutch plates are not an indication of defective clutch plates. Burnt clutch plates indicate that a problem exists within the clutch system, the clutch has been used improperly, or plates were contaminated by improper oil or additives.
- Indian Motorcycle 15W/60 motorcycle oil is recommended for all operating temperatures. If Indian Motorcycle 15W/60 oil is not available, a high quality 15W/60 motorcycle oil suitable for use in wet clutch transmissions can be used.
- Lubricate parts during assembly as described in the procedures.
- Corroded or sticking shift linkage pivot points can cause abnormal shifting. Replace any linkage components that are damaged or do not move freely, and lubricate at regular intervals.

SPECIAL TOOLS

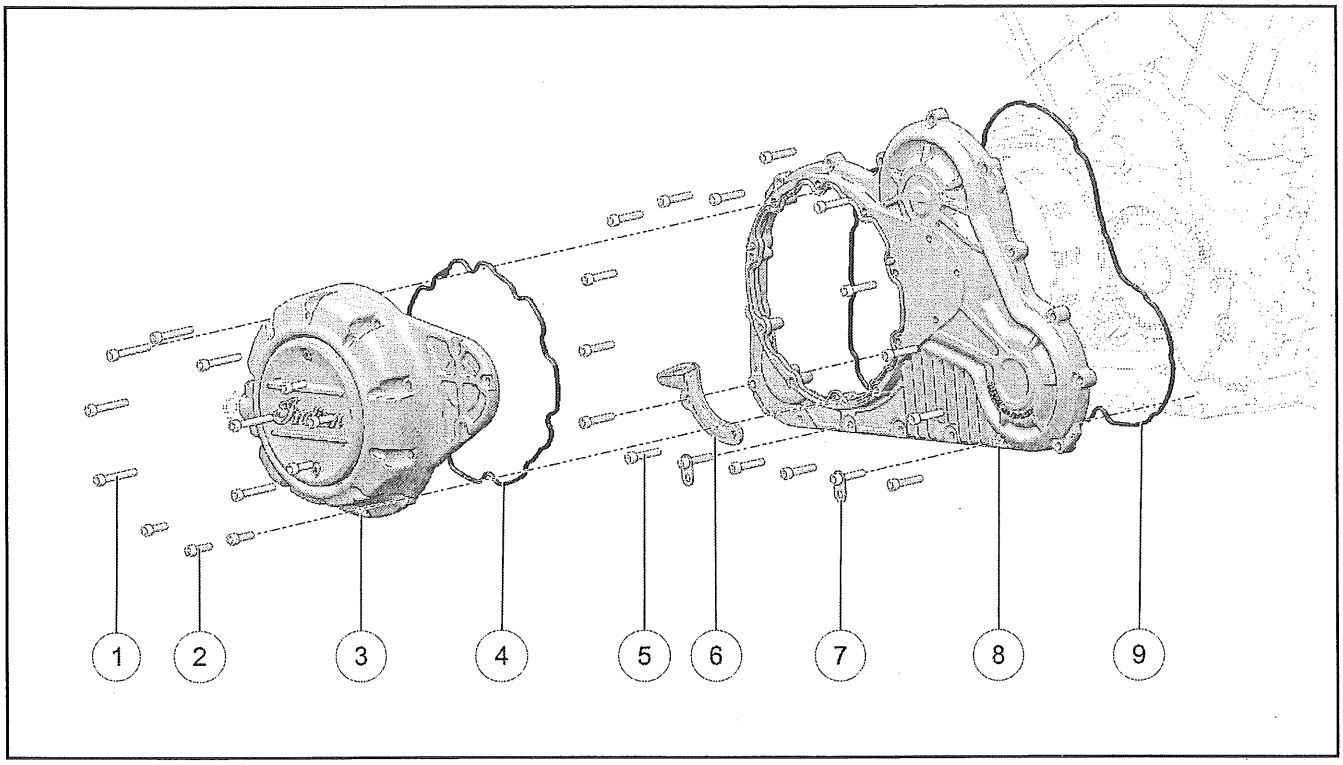
TOOL DESCRIPTION	PART NUMBER
Case Splitting / Assembly Tool	PF-51234-A
Engine Lock Tool - Transmission	PF-51612
Engine Lock Tool - Crankshaft	PF-51235-A
Engine Stand Adapter	PF-51609
Moly Assembly Paste	2871460

Bosch Automotive Service Solutions: 1– 800– 328– 6657 or https://polaris.service-solutions.com/

SERVICE SPECIFICATIONS

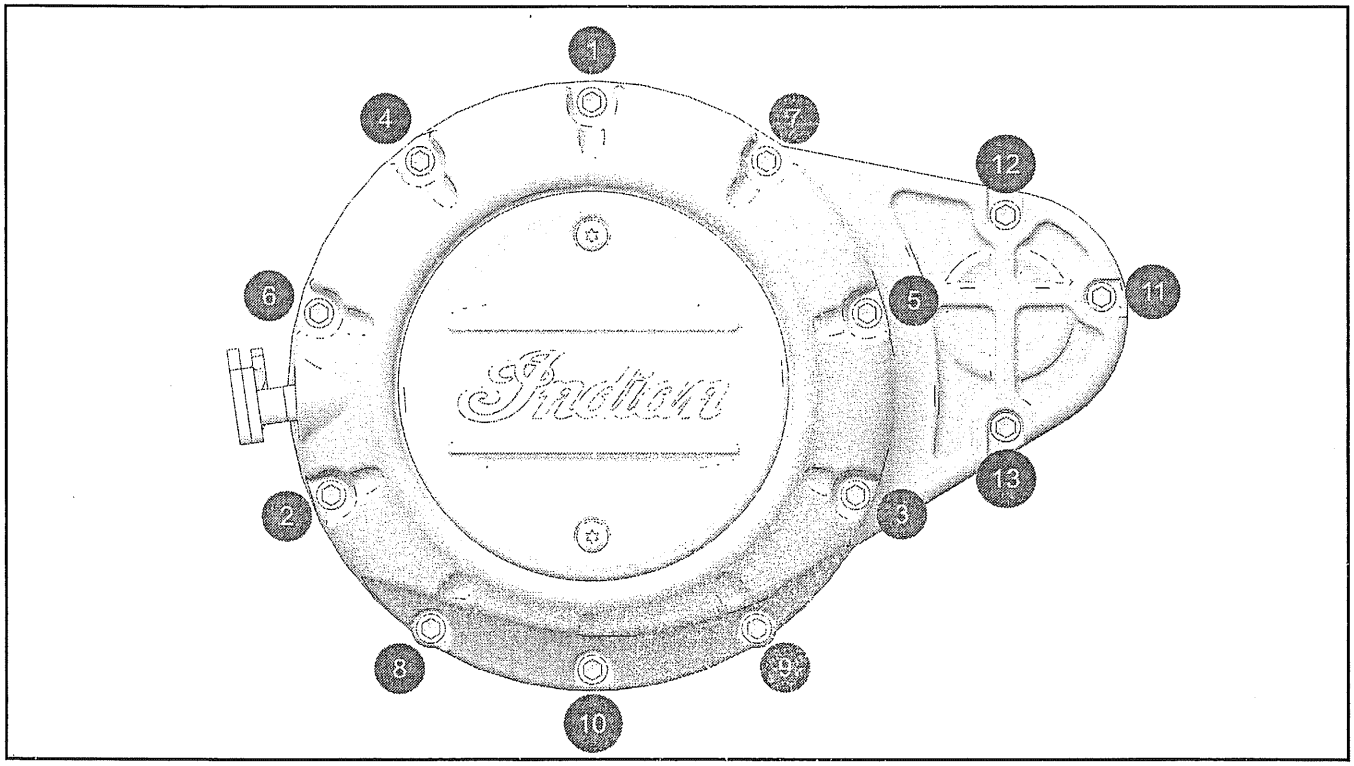
ITEM		SPECIFICATIONS
Clutch / Gear Shift / Linkage	Clutch Type	Wet, Multi-Disk
	Clutch Operating Mechanism	Manual / Cable Operated
	Primary Reduction Ratio	1.674 : 1
	Transmission Shift Mechanism	Manually Operated, Spring Centered
	Gearshift Pattern	1-N-2-3-4-5-6
	Clutch Spring (Coil Type, QTY.6)	Spring Height - Free: 55.3 mm / Installed 30.6 mm
	Clutch Lever Free Play (Cable)	.50-1.50 mm (.019 - .059")

ASSEMBLY VIEWS
PRIMARY COVER COMPONENTS

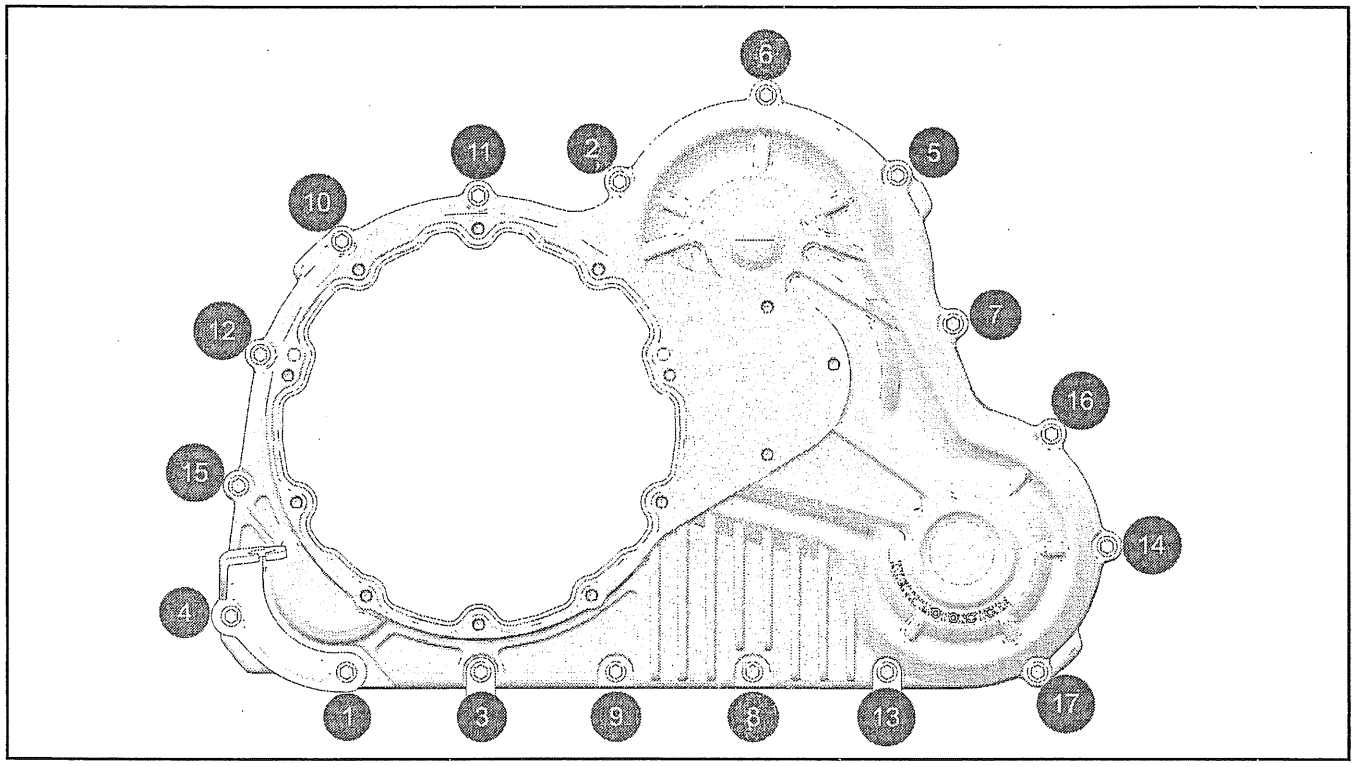


NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Primary Cover Fasteners (QTY.7)	**9 ft-lbs (12 Nm)**
②	Primary Cover Fasteners (QTY.6)	**9 ft-lbs (12 Nm)**
③	Primary Cover	-
④	Primary Cover Gasket	-
⑤	Primary Gear Cover Fasteners	**9 ft-lbs (12 Nm)**
⑥	Clutch Cable Retaining Bracket	-
⑦	Cable Mount Bracket	-
⑧	Primary Drive Cover	-
⑨	Primary Drive Cover Gasket	-

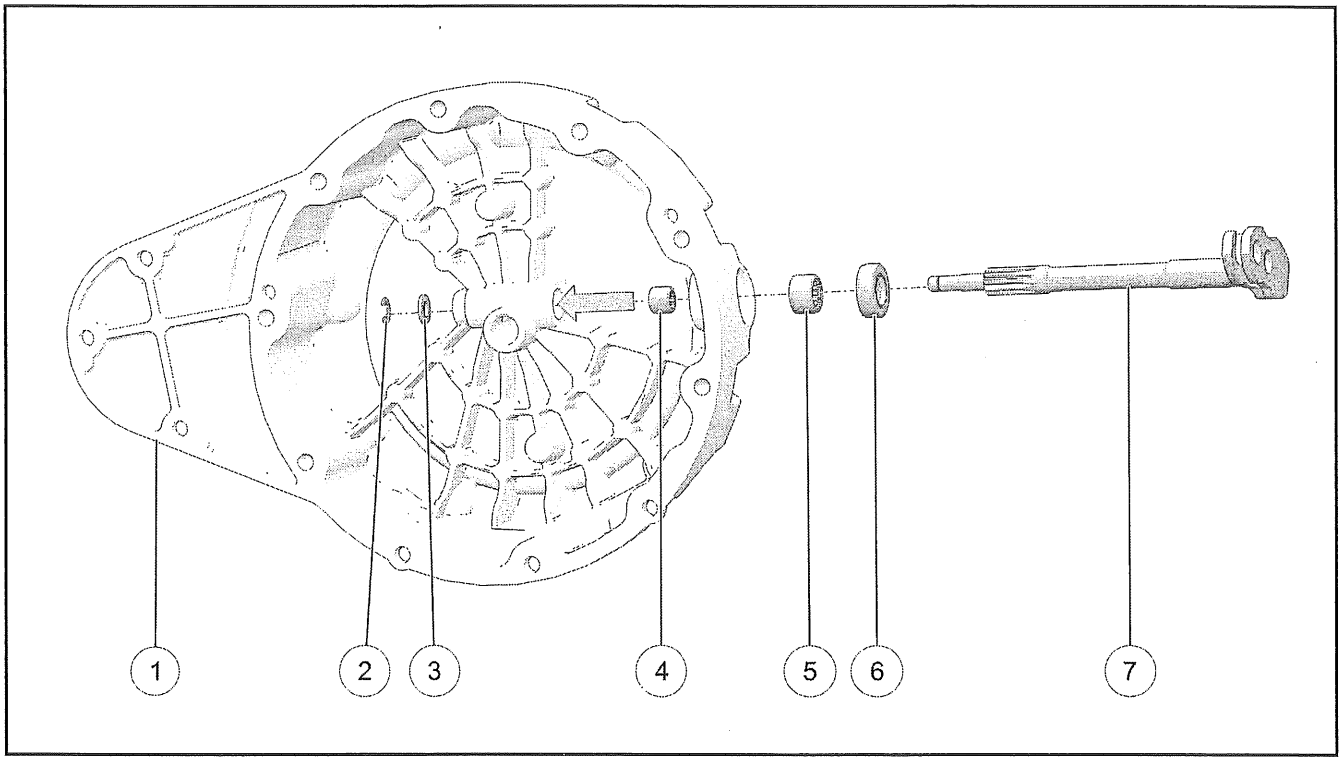
Primary Cover Torque Sequence



Primary Drive Cover Torque Sequence

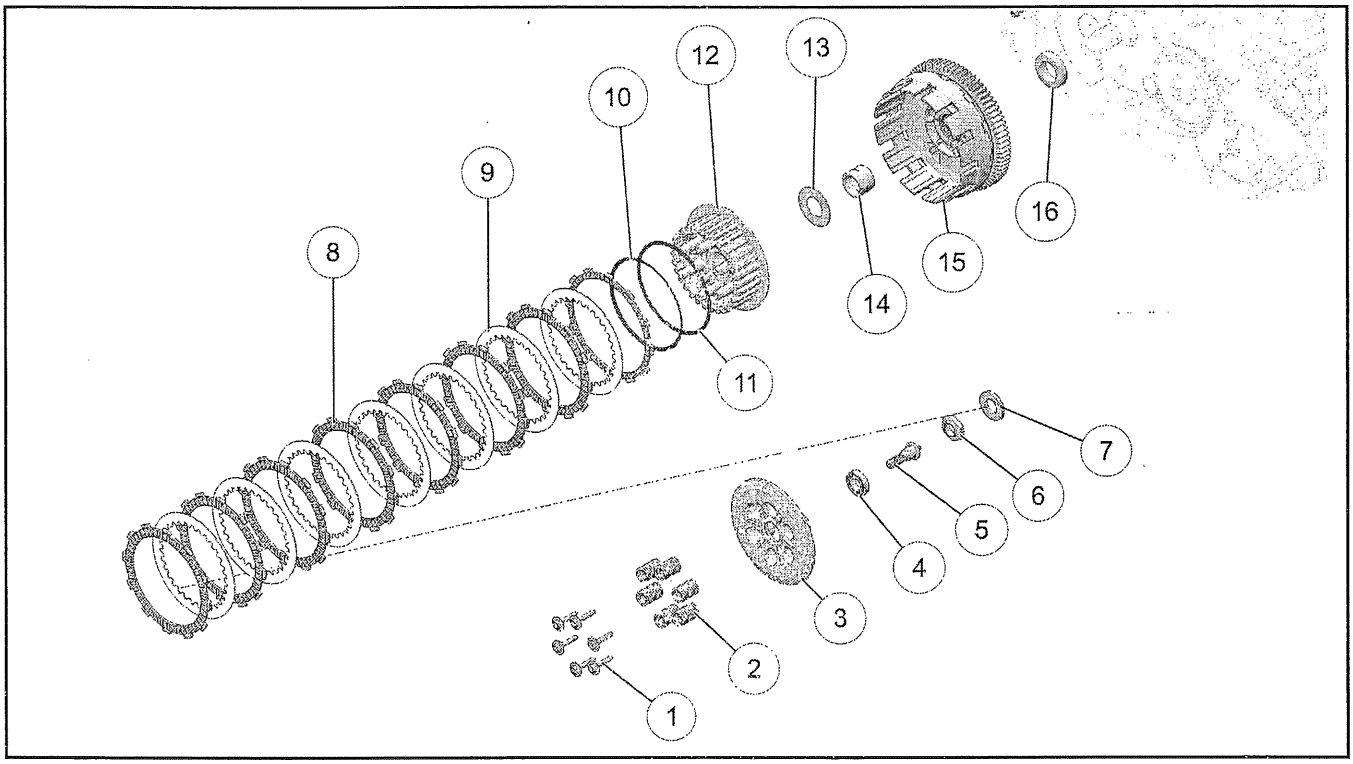


CLUTCH PINION SHAFT COMPONENTS



NUMBER	DESCRIPTION
①	Primary Cover
②	External E-Clip
③	Washer
④	Pinion Shaft End Bearing
⑤	Shaft Bearing (Clutch Pinion Shaft)
⑥	Shaft Seal
⑦	Clutch Pinion Shaft

CLUTCH COMPONENTS

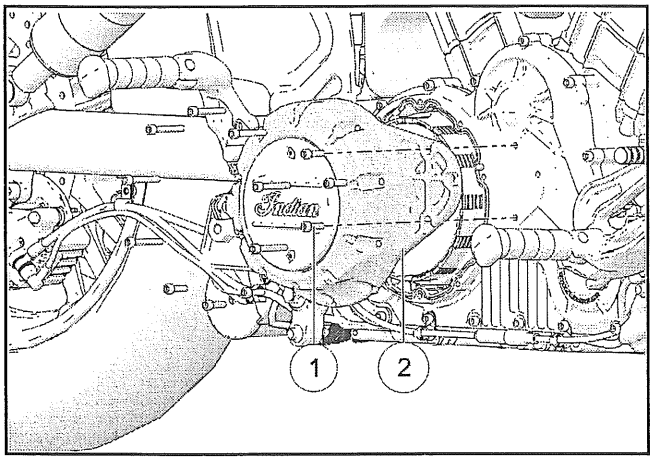


NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Pressure Plate Fasteners (QTY.6)	**88 in-lbs (10 Nm)**
②	Clutch Spring (QTY.6)	-
③	Clutch Pressure Plate	-
④	Clutch Lifter Bearing	-
⑤	Clutch Rack Lifter	-
⑥	Clutch Retainer Nut (Staking)	**125 ft-lbs (170 Nm)**
⑦	Flat Washer	-
⑧	Clutch Friction Disc	-
⑨	Clutch Steel Disc	-
⑩	Judder Spring	-
⑪	Judder Spring Seat	-
⑫	Inner Clutch Hub	-
⑬	Clutch Washer	-
⑭	Bearing Collar	-
⑮	Outer Basket Assembly	-
⑯	Clutch Spacer	-

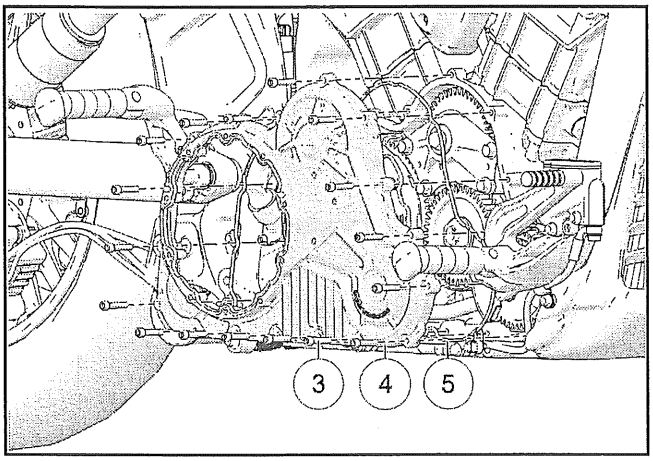
SERVICE PROCEDURES

PRIMARY DRIVE COVER REMOVAL

1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Drain oil from engine. See Engine Oil / Filter Change, page 2.11.
3. Remove the exhaust system. See Head Pipe Removal, page 3.94.
4. Disconnect clutch cable from engine clutch lever. See Clutch Cable Removal / Installation, page 8.13Clutch Cable Removal.
5. Remove clutch cover fasteners ① and cover assembly ②.

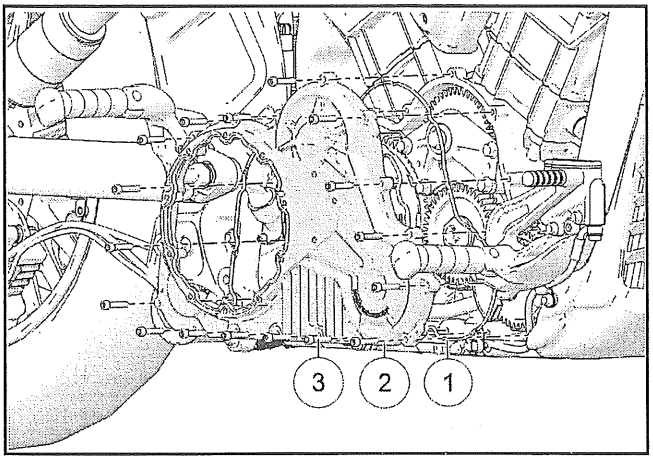


6. Remove primary drive cover fasteners ③, seal ⑤ and cover assembly ④.



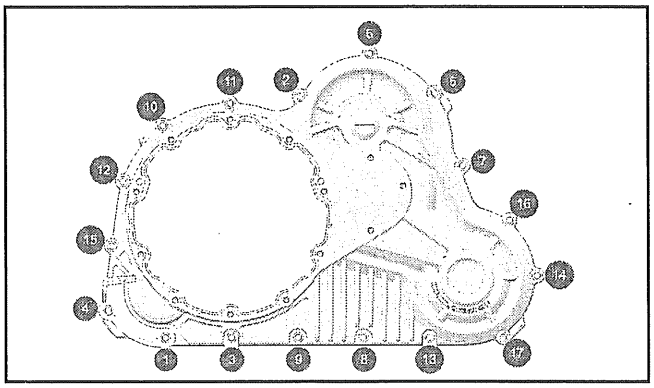
PRIMARY DRIVE COVER INSTALLATION

1. Clean gasket surfaces of crankcase and cover.
2. Install a new primary cover gasket ① with flat side towards primary cover ②.



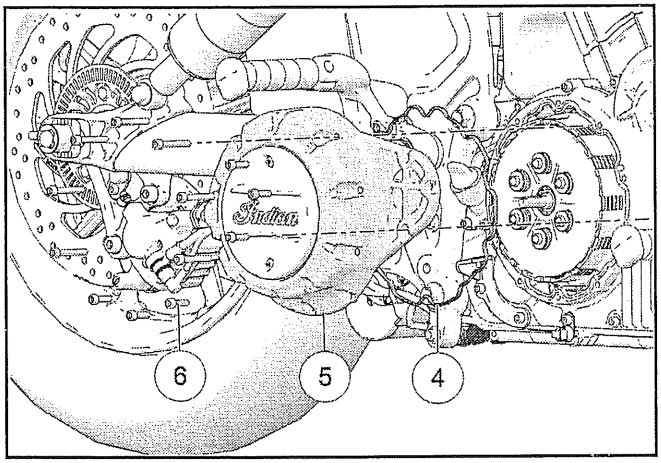
3. Torque the primary cover fasteners ③ to specification following the torque sequence.

TORQUE
Primary Drive Cover Fasteners: **9 ft-lbs (12 Nm)**



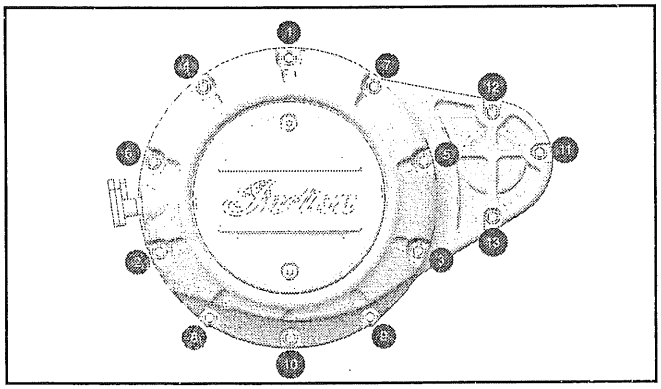
4. Clean clutch cover and primary drive cover gasket mating surfaces.

5. Install new clutch cover gasket with flat side facing clutch cover ⑤.



6. Install clutch cover fasteners ⑥ and torque in sequence to specification.

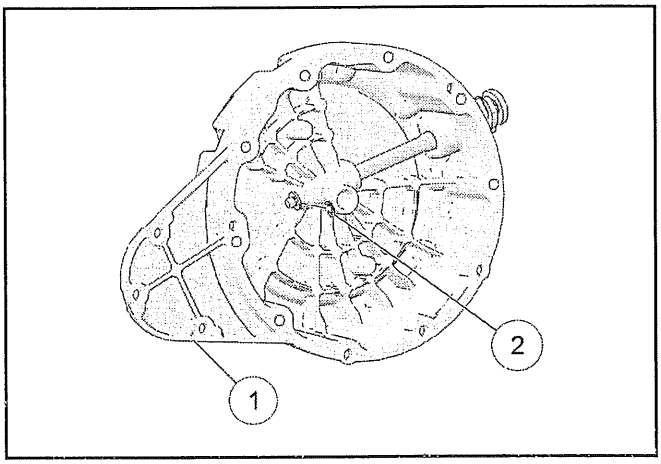
TORQUE
Primary Cover Fasteners: **9 ft-lbs (12 Nm)**



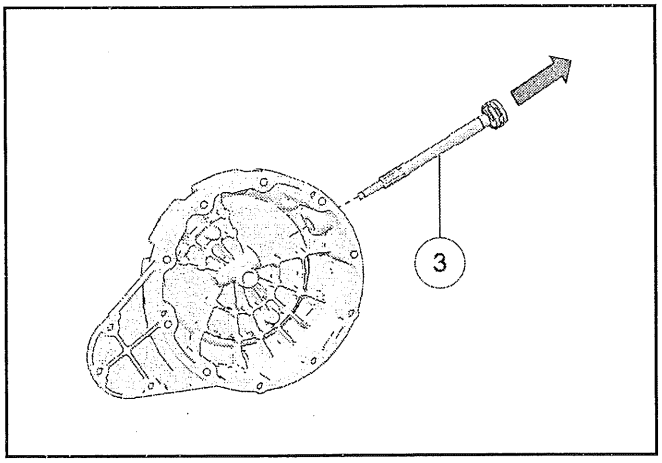
7. Connect the clutch cable. See Clutch Cable Removal / Installation, page 8.13.
8. Install exhaust system. See Head Pipe Installation, page 3.95.
9. Check engine oil level. See Engine Oil Level Check, page 2.10.

CLUTCH PINION SHAFT REMOVAL

1. Remove the Primary Cover ①. See Primary Drive Cover Removal, page 5.7.
2. Remove the E-clip ② and washer from the end of the clutch pinion shaft as shown.



3. Slide the pinion shaft ③ out of the primary cover.

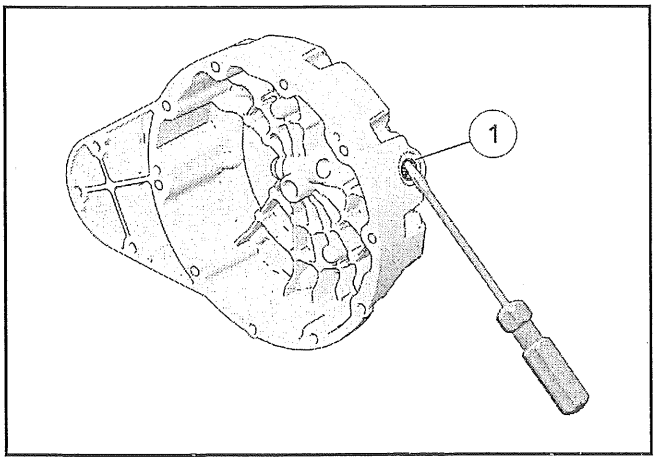


CLUTCH PINION SHAFT BEARING INSPECTION

1. Apply engine oil to the bearings.
2. Temporarily install pinion shaft into primary cover.
3. Turn shaft by hand. Replace bearings that feel rough, notched, or loose.

CLUTCH PINION SHAFT SEAL REMOVAL / INSTALLATION

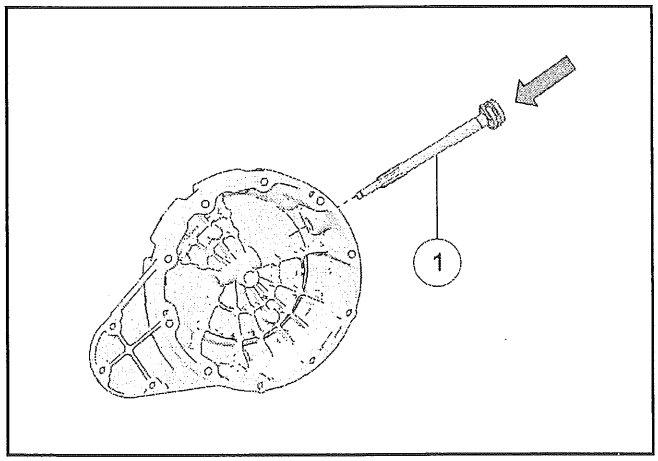
1. Remove clutch pinion shaft. See Clutch Pinion Shaft Removal, page 5.8.
2. Protect cosmetic surfaces and carefully pry seal ① out of primary cover.



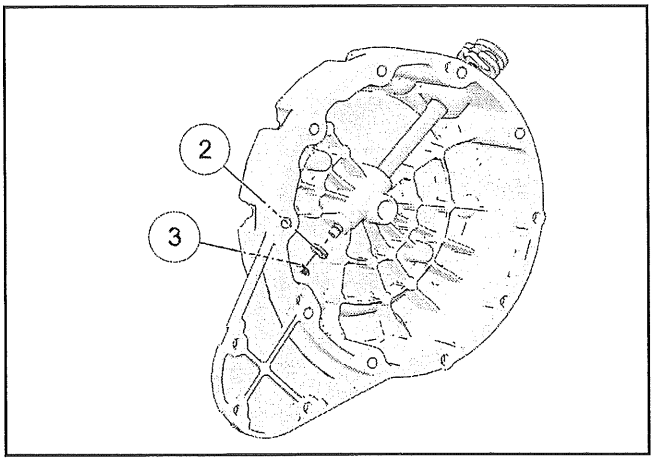
3. Lubricate outer edge of new seal with engine oil and sealing lip with grease.
4. Drive seal into place with a suitable driver.

CLUTCH PINION SHAFT INSTALLATION

1. Lubricate and install clutch pinion shaft ① until fully seated in bearings.

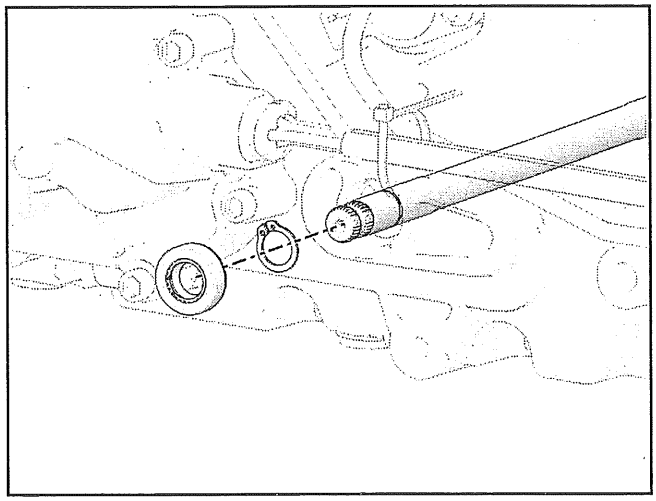


2. Install washer ② and E-clip ③.



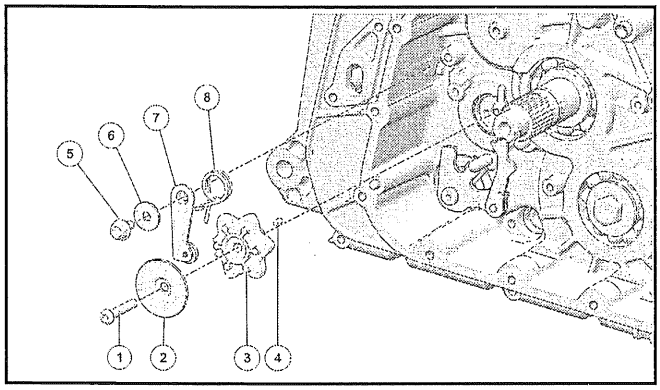
SHIFT RATCHET REMOVAL / INSPECTION

1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Shift transmission into neutral.
3. Remove shift pedal linkage from shift shaft.
4. Gently pry oil seal out of shift shaft bore and remove external circlip as shown.



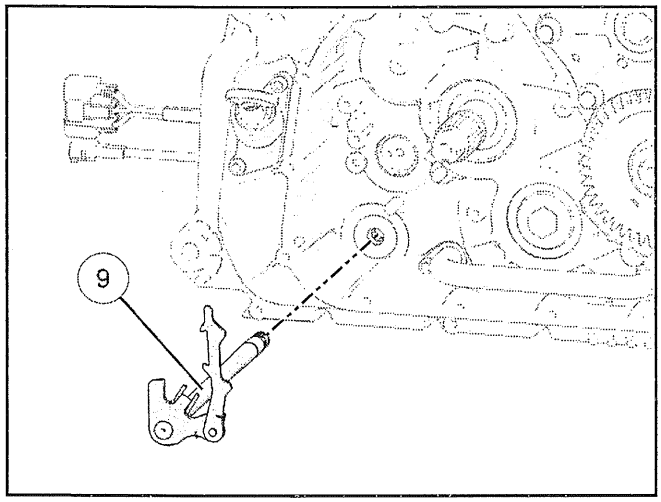
5. Remove primary cover. See Primary Drive Cover Removal, page 5.7.
6. Remove primary drive cover. See Primary Drive Cover Removal.
7. Remove clutch assembly. See Clutch Removal, page 5.13.

8. Using a 4 mm hex wrench, remove the screw ① securing the shift star ② to the shift drum and remove shift star ③. Secure locating pin ④ for reassembly.

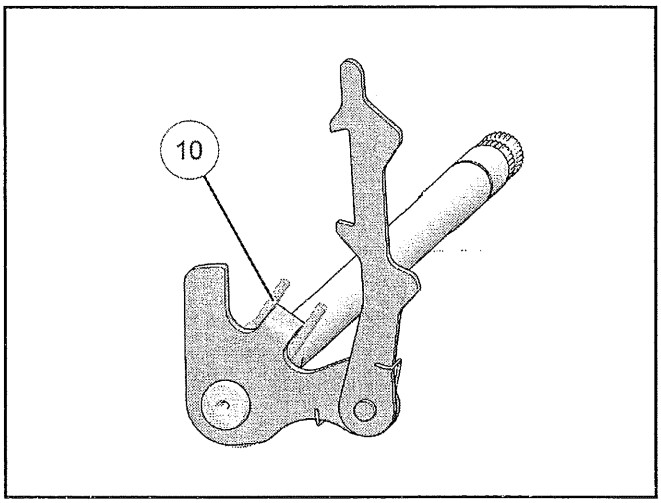


9. Rotate the detent lever ⑦ so the spring ⑧ is relaxed. Using a 10 mm socket, remove the bolt ⑤ and washer ⑥ securing the detent lever to the engine case.

10. Pull the shift shaft and spring assembly ⑨ out of the bore.



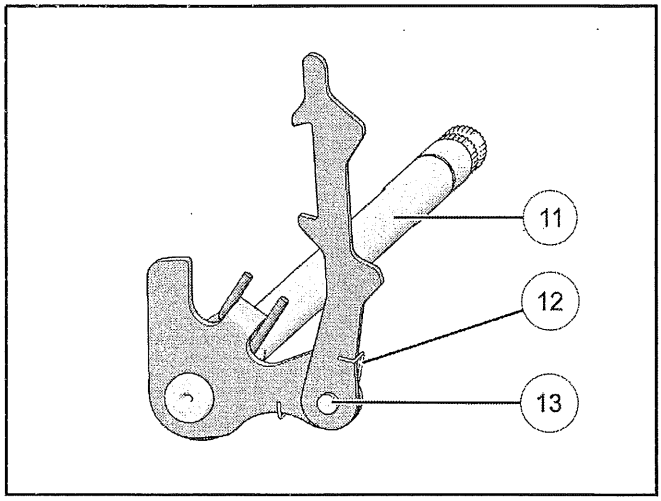
11. Inspect shift shaft return spring ⑩ for cracks or loss of tension. The spring should have enough tension to keep the shift shaft centered.



12. Inspect shift shaft ⑪ for wear or damage.

13. Inspect ratchet arm return spring ⑫ for tension. The spring should apply enough tension on the shift ratchet mechanism to keep it engaged with the shift star.

14. Inspect fit of rivet ⑬ on shift ratchet assembly. It should allow for free movement, but not be excessively loose.



15. Inspect shift star for wear.

16. Inspect detent roller arm for wear or damage.

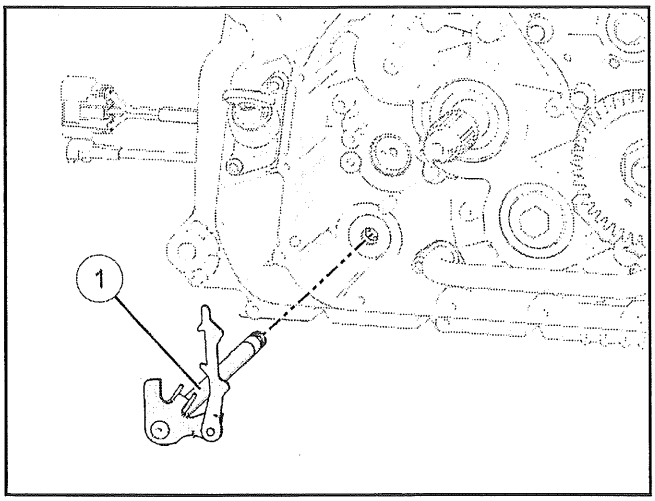
17. Inspect detent roller arm spring for cracks or fatigue.

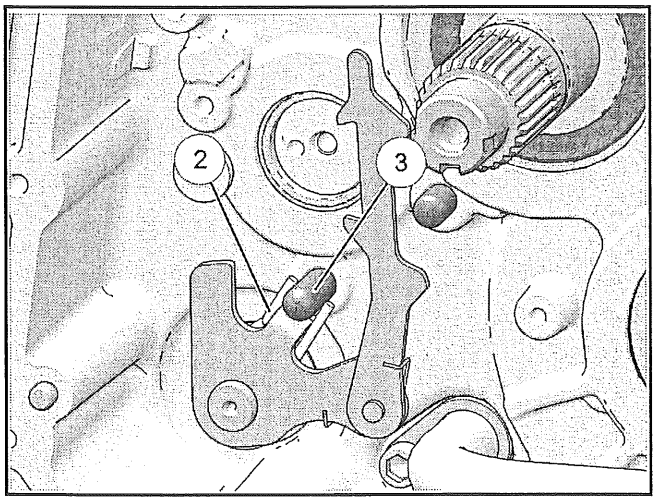
SHIFT RATCHET INSTALLATION

1. Lubricate the shift shaft ① with engine oil and slide into bore until fully seated.

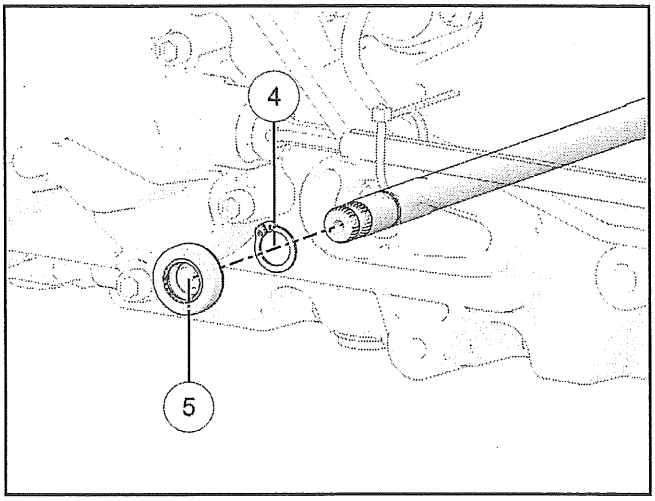
IMPORTANT

Verify that the return spring ② has properly engaged the dowel ③ as shown.

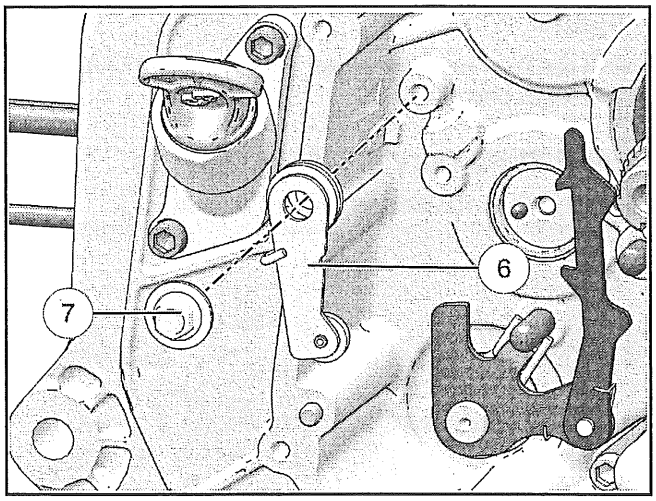




2. Install circlip ④ and press new oil seal ⑤ into position until flush with crankcase.



3. Install the detent roller arm and spring assembly ⑥. Torque fastener ⑦ to specification.



TORQUE

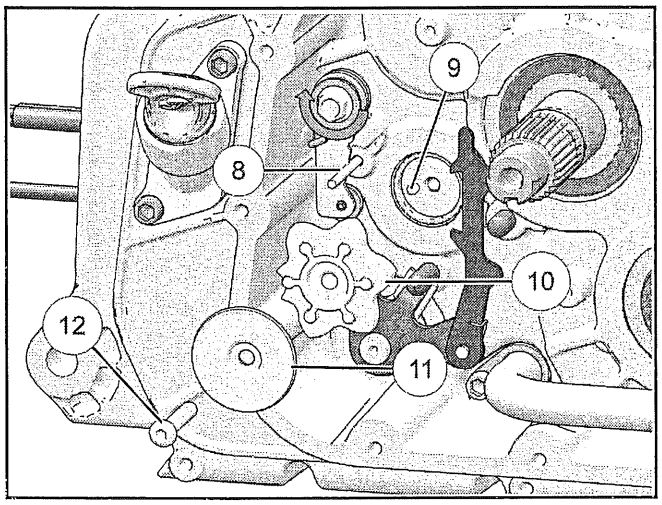
Detent Roller Arm Fastener:
88 in-lbs (10 Nm)

4. Rotate the detent roller arm against the spring and install a suitable locking pin ⑧ to hold it in position.
5. Verify that the shift star dowel ⑨ is in place in the shift drum and install the shift star ⑩.
6. Install the shift star washer ⑪ and fastener ⑫ and torque to specification.

TORQUE

Shift Star Fastener:
88 in-lbs (10 Nm)

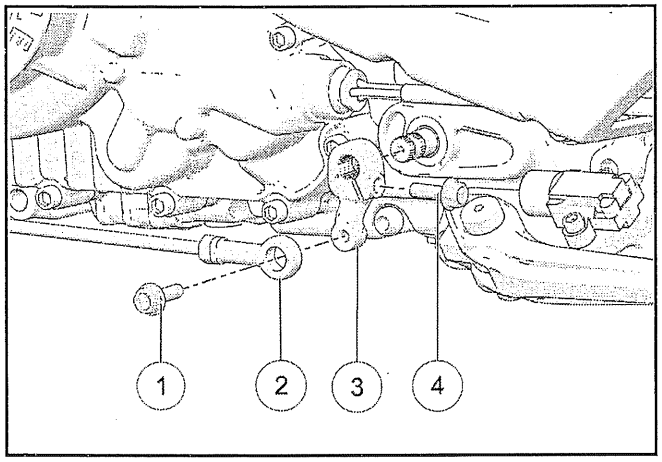
7. Remove locking pin ⑧ to release the detent roller arm.



8. Install the shift arm.
9. Install clutch assembly. See Clutch Installation, page 5.19.
10. Install the primary cover. See Primary Drive Cover Installation, page 5.7.

SHIFT ARM REMOVAL / INSTALLATION

1. Remove shift pedal linkage from shift shaft.



SHIFT SHAFT SEAL REPLACEMENT

1. Remove shift shaft assembly. See Shift Ratchet Removal / Inspection, page 5.9.
2.

NOTE

The Shift Shaft Seal requires removal as part of the shift shaft removal procedure.

Apply assembly lube to inner & outer surfaces of new bearing.

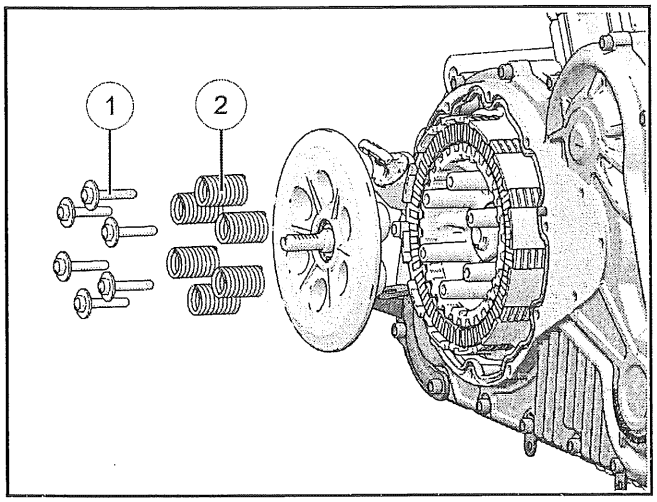
Moly assembly paste PN: 2871460

3. Apply a small amount of grease to lip of seal and apply engine oil to outside of seal.
4. Drive seal into place with a seal driver slightly smaller than the O.D. of seal.
5. Install primary cover. See Primary Drive Cover Installation, page 5.7.
6. After installing primary cover, be sure shift shaft returns freely to the centered position after rotating up or down.

CLUTCH SERVICE

CLUTCH RACK REMOVAL / INSTALLATION

1. Remove the clutch cover. See Primary Drive Cover Removal, page 5.7.
2. Remove the six pressure plate screws ① and coil springs ②.

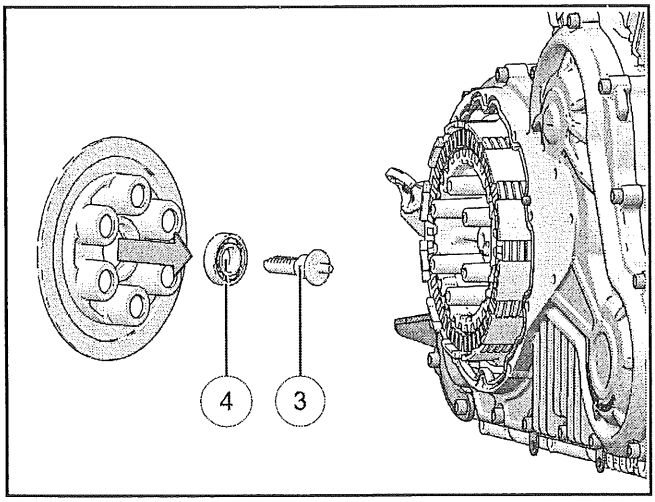


3. Lift the pressure plate off of the clutch basket assembly to access the clutch rack from the back side of the plate.

NOTE

It is not necessary to remove the clutch plates to service the rack assembly.

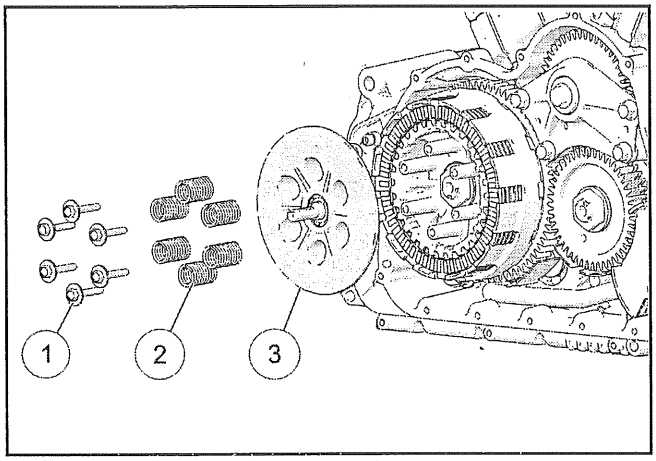
4. Remove the slip-fit clutch rack ③ from the back side of the clutch rack bearing.
5. Using a suitable bearing driver or press, remove the clutch rack bearing ④ from the back side of the pressure plate.



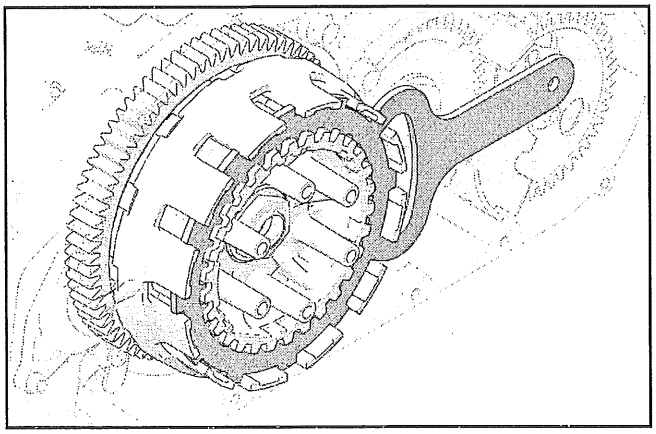
6. **INSTALLATION:** Reverse the removal procedure to install.

CLUTCH REMOVAL

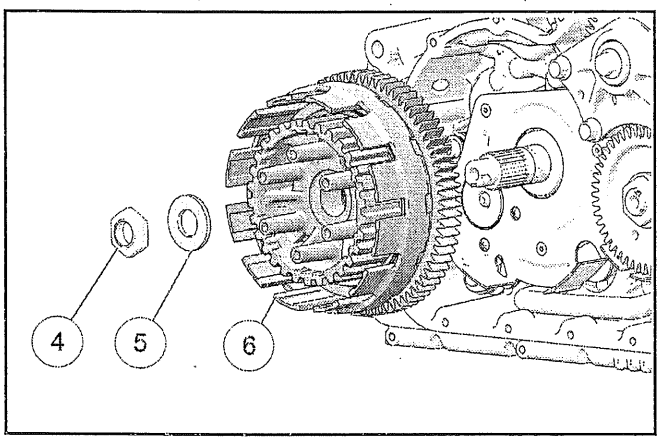
1. Remove primary cover. See Primary Drive Cover Removal, page 5.7.
2. Remove bolts ①, springs ② and pressure plate ③.



3. Remove all friction and separator plates.
4. Prevent input shaft from turning by placing Engine Transmission Lock Tool PF-51612 inside clutch and securing handle.



5. Remove clutch nut ④ and flat washer ⑤. Discard the stake nut.



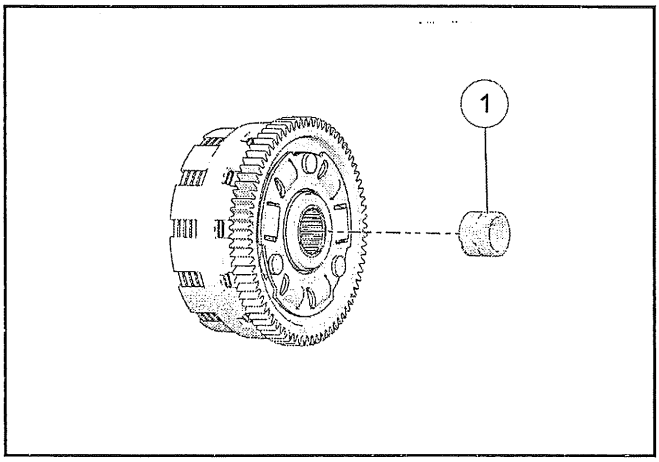
6. Remove clutch assembly ⑥ from clutch shaft.
7. A new stake nut must be installed upon assembly.

CLUTCH DISASSEMBLY

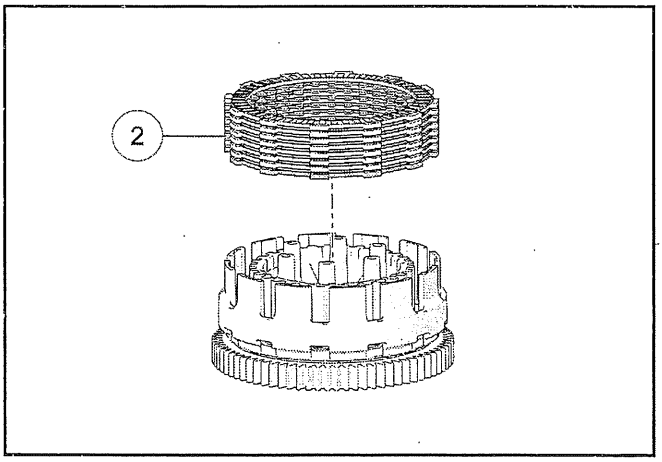
⚠ CAUTION

Clutch is under spring pressure.
WEAR EYE PROTECTION.

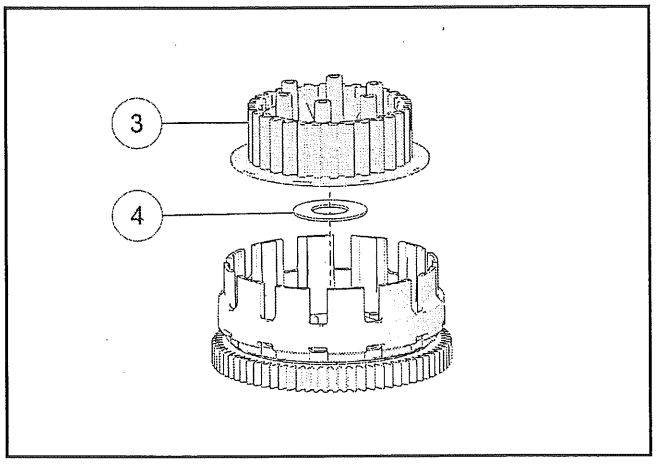
1. Remove the clutch. See Clutch Removal, page 5.13.
2. Remove the sleeve ① from the back side of the clutch assembly.



3. Lift the clutch assembly ② out of the basket and set aside.



4. Remove the inner hub ③ and thrust washer ④.

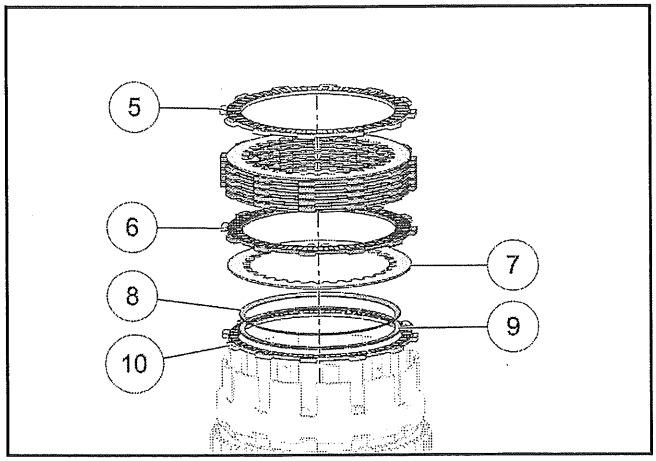


NOTE

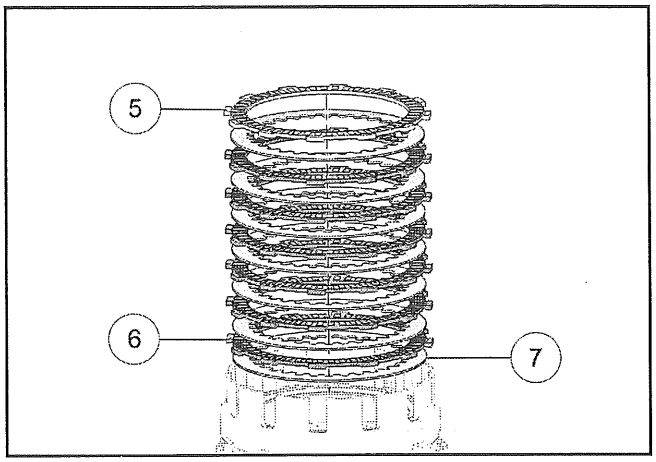
The clutch assembly consists of three different types of friction plates and one type of separator plate. See Clutch Assembly, page 5.6.

NUMBER	DESCRIPTION	QTY
⑤	Friction Plate A	1
⑥	Friction Plate B	6
⑦	Separator Plate A	7
⑧	Judder Clutch Seat	1
⑨	Judder Clutch Spring	1
⑩	Friction Plate C	1

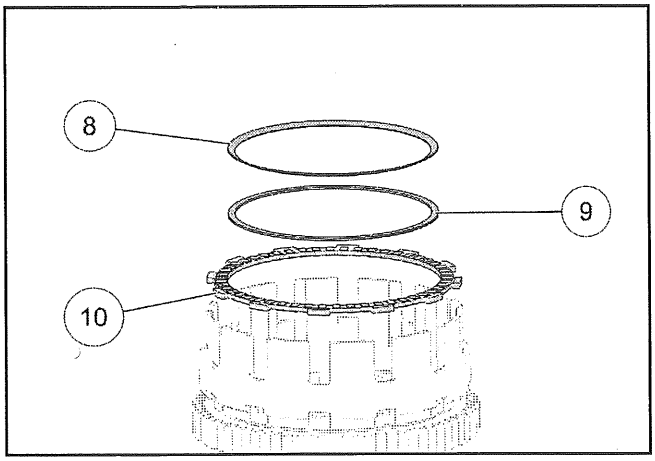
5. Remove Friction Plate ⑤.



6. Then alternately remove Friction Plates B ⑥ and Separator Plates C ⑦.



7. Remove Friction Plate C ⑩, Judder Spring ⑧ and Judder Spring Seat ⑨.

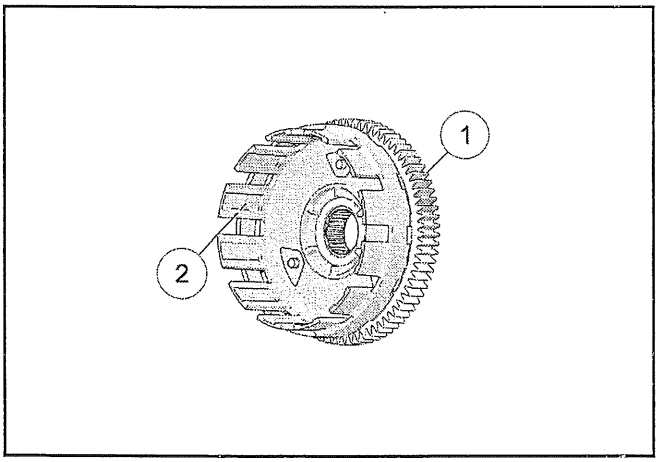


CLUTCH INSPECTION

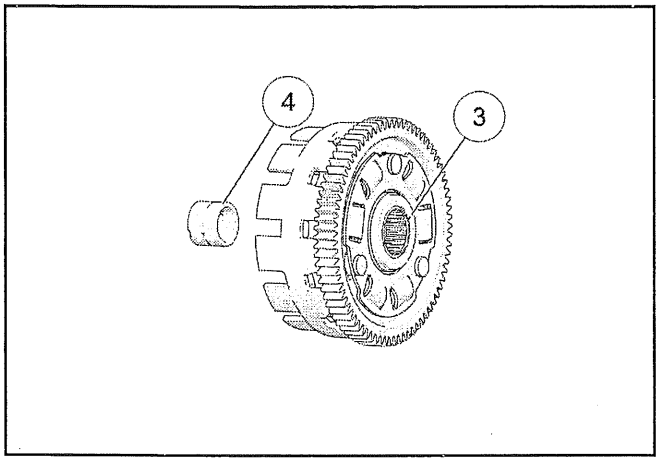
1. Clean clutch plates, inner hub, and outer basket.

Clutch Basket

2. Inspect clutch gear teeth ① for wear, cracks or damage.
3. Inspect inside surfaces ② of basket for cracks or wear (grooves) from clutch plates.

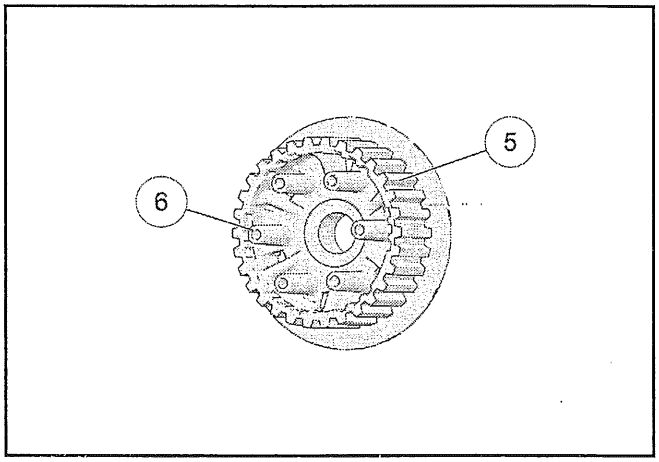


4. Replace parts that fail inspection
5. Rotate basket bearing ③. Check for smooth rotation. Inner race should have no detectable radial movement.
6. Lubricate bearing ③ and collar ④ with engine oil.



Clutch Hub

7. Inspect surface of steel plate guides ⑤ on outer edge of hub for wear, grooves, or damage. Check all posts ⑥ for cracks or damage.



8. Visually inspect friction and steel plates for wear or damage on both surfaces. Replace plates as a set if any plate is worn or damaged.
9. Replace steel plates if grooved, distorted or discolored. Inspect plates for distortion by placing each plate on a precision flat surface. Insert a feeler gauge between plate and flat surface in several places.

MEASUREMENT
Clutch Steel Plate Warp Service Limit: **.008 in (.20 mm)**

10. Measure thickness of friction plates in several places. Thickness should be the same at each place. Replace plates that fail inspection.

MEASUREMENT
Friction Plate Thickness (Minimum): **.126 in (3.2 mm)**

Clutch Pressure Plate

11. Inspect pressure plate for cracks, scoring, or wear on friction surface.

Clutch Springs

12. Inspect clutch springs for cracks or distortion.

Clutch Release Rack and Bearing

NOTE
Clutch rack is serviceable as an assembly only.

13. Inspect clutch rack for broken or damaged teeth.

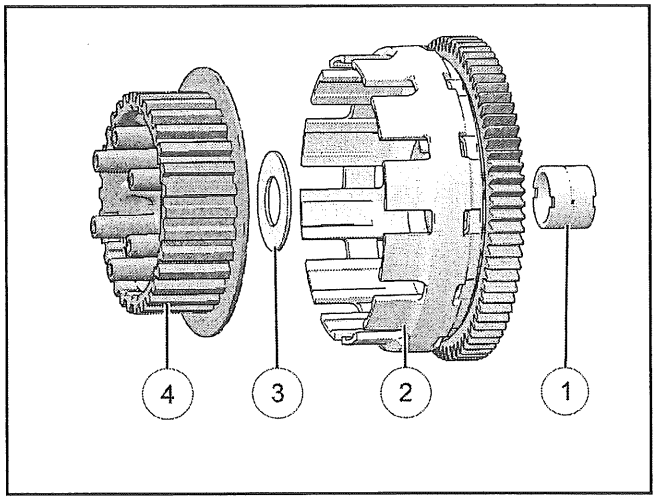
14. Inspect lifter bearing visually for any signs or wear or discoloration. Rotate bearing inner race with your finger and check for smooth movement and no play.
15. Replace clutch rack assembly if necessary.

CLUTCH ASSEMBLY

NOTE

Apply a thin coat of engine oil to all clutch components prior to assembly.

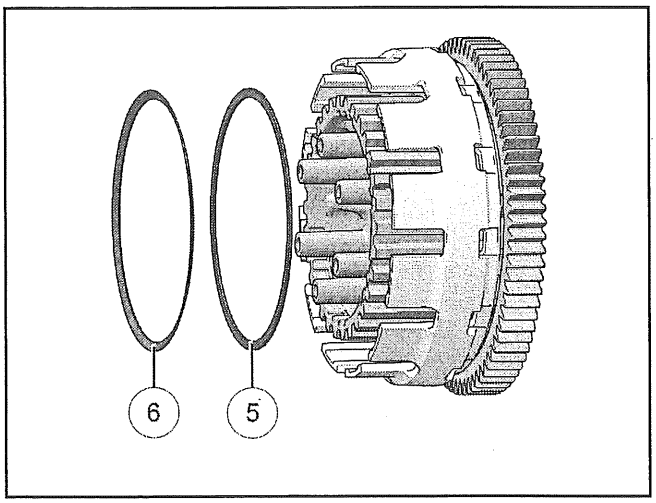
1. Install the bearing collar ① into the clutch basket ② followed by the thrust washer ③ and clutch hub ④.



2. Apply engine oil to judder spring seat ⑤ and spring ⑥.
3. Install judder spring seat (flat ring), then judder spring.

NOTE

Judder spring must be installed with concave side facing UP (toward outside of clutch). The tallest edge of spring will be outermost.

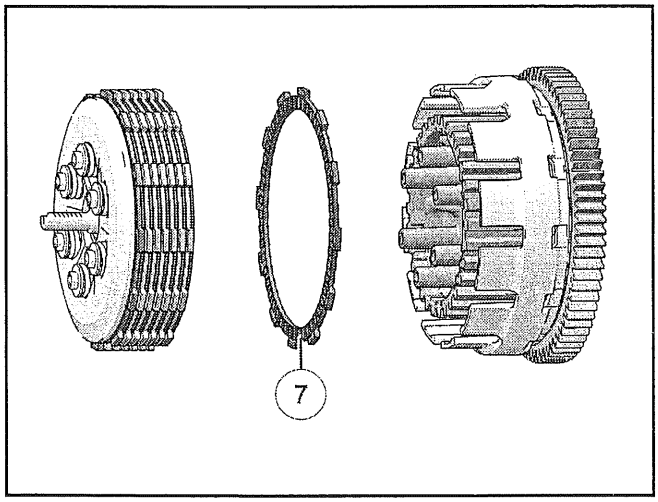


4.

NOTE

Refer to the Clutch Assembly View outlined in this chapter for clutch plate orientation. See Clutch Assembly, page 5.6.

Apply engine oil to Friction Plate C ⑦ and install.



NOTE

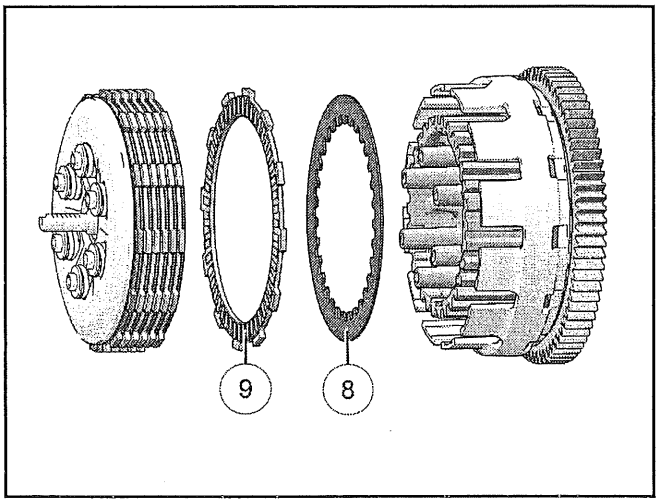
Friction Plate C has an inner diameter that is larger than the other friction plates, allowing it to fit around the judder spring.

5. Place an oiled Separator Plate B ⑧ into clutch basket followed by Friction Plate B ⑨.

NOTE

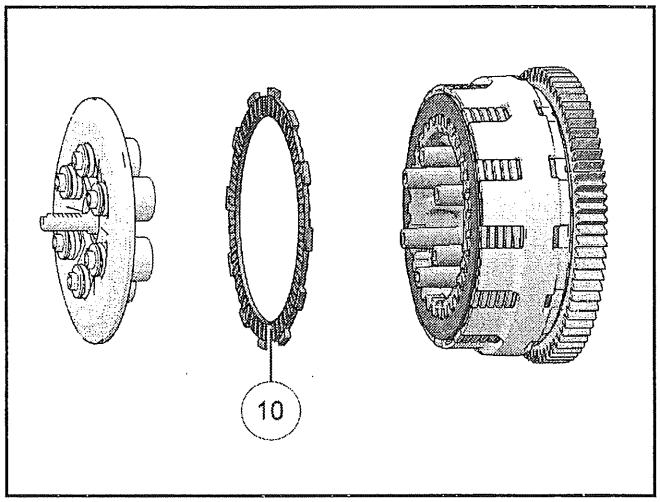
If friction plates are new, soak them in clean engine oil for a few minutes before installing.

6. Continue stacking oiled clutch plates into clutch basket alternating Friction Plate B ⑨ and Separator Plate B ⑧.



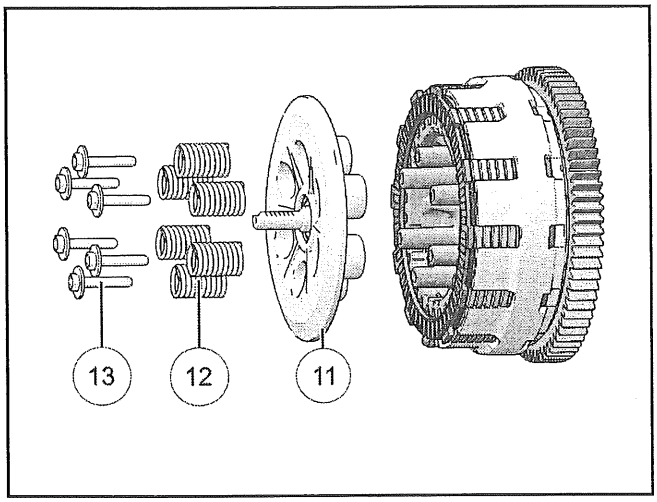
7. Install Separator Plate A ⑧ followed by Friction Plate B ⑨ and Separator Plate A ⑧.

8. Install the final Friction Plate A ⑩.



9. Apply engine oil to hub bearing.

10. Install the pressure plate ⑪ and clutch springs ⑫ and fasteners ⑬. **Alternately tighten the clutch spring screws in a star pattern until fully seated.**



11. Torque pressure plate fasteners to specification.

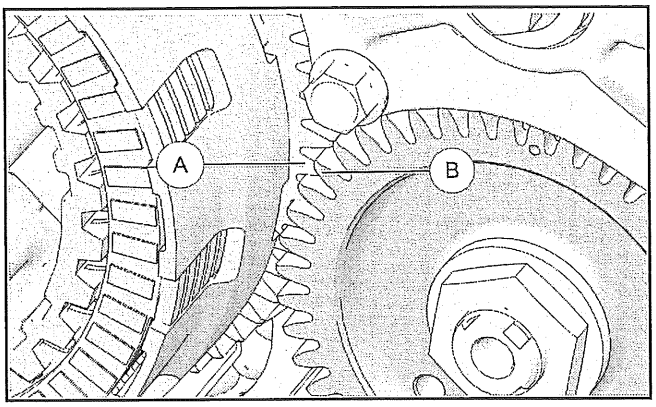
TORQUE
Pressure Plate Fasteners: **88 in-lbs (10 Nm)**

CLUTCH INSTALLATION

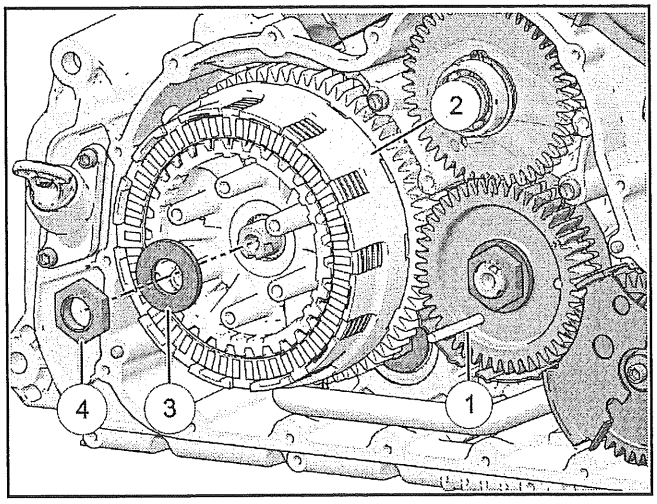
1. Remove the pressure plate from the clutch assembly and set aside.
2. Using a pin punch or similar tool ①, preload the teeth of the primary drive split gear and hold in place.
3. Slide the clutch assembly ② onto the transmission input shaft until fully seated. Note: Crankshaft bearing damage will occur if the clutch assembly is not fully seated.
4.

IMPORTANT
Clutch assembly installation inspection.

Verify the outer face of the clutch gear Ⓐ is inset from the primary drive split gear Ⓑ.



5. Install washer ③ and a new stake nut ④.



6. Lock the crankshaft. See Locking the Crankshaft for Service, page 6.6.
7. Torque the stake nut to specification.

TORQUE
Stake Nuts: **125 ft-lbs (170 Nm)**

8. Install clutch pressure plate assembly and torque fasteners to specification.

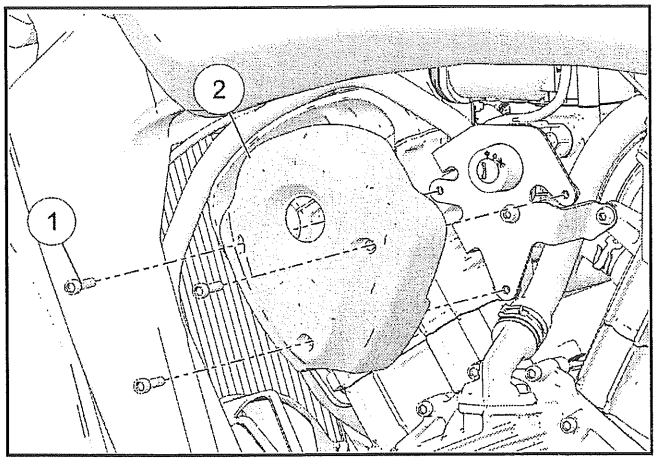
TORQUE
Pressure Plate Fasteners: **88 in-lbs (10 Nm)**

9. Install primary cover. See Primary Drive Cover Installation, page 5.7.
10. Check engine oil and fill to proper level.

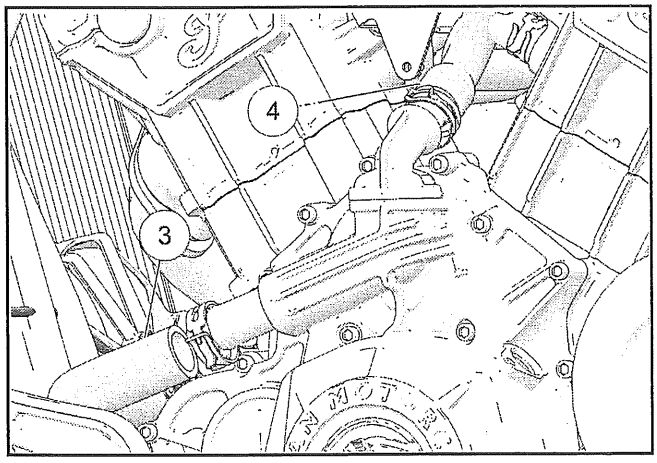
FLYWHEEL SERVICE

STATOR COVER REMOVAL

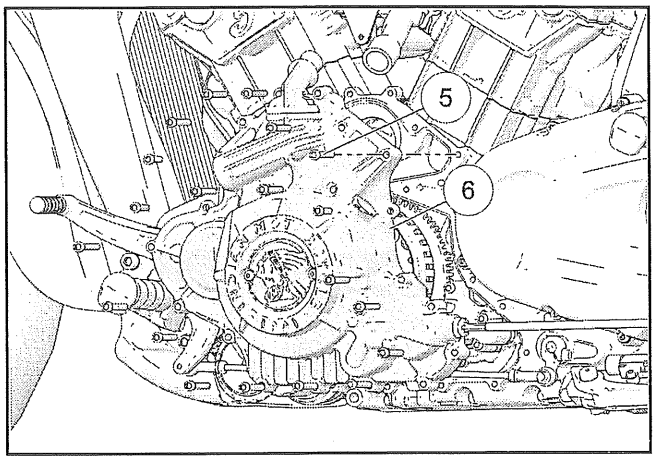
1. Drain cooling system. See Coolant Drain / Fill, page 3.33.
2. Remove Crankshaft Position Sensor from the stator cover. See Crankshaft Position Sensor, Test / Replace, page 4.38.
3. Remove Ignition Cover fasteners ① and remove the Ignition Cover ②.



4. Disconnect the radiator outlet hose ③ at the left engine cover.

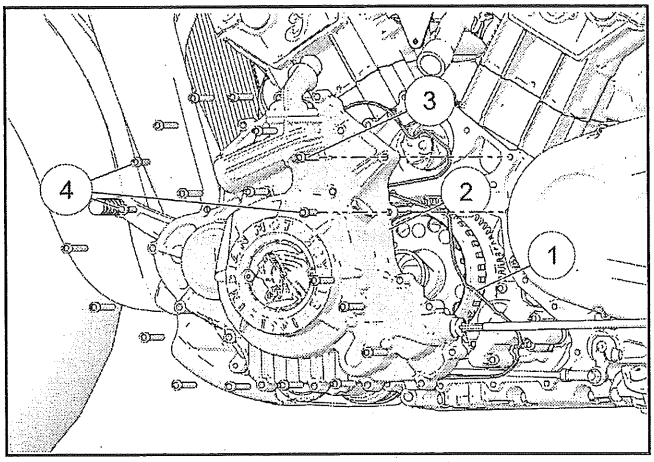


5. Disconnect the bypass hose ④ at the left engine cover.
6. Disconnect the stator harness connector.
7. Remove the stator cover fasteners ⑤ and stator cover ⑥.

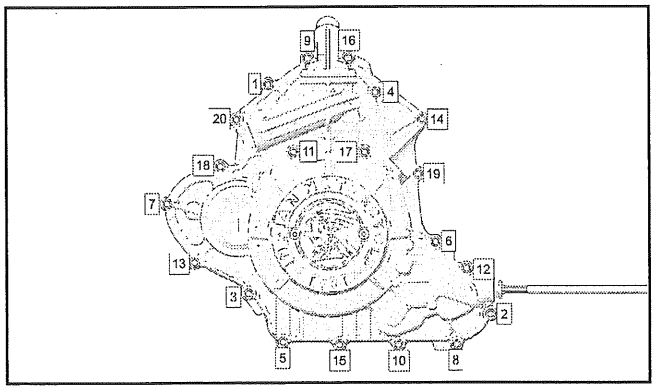


STATOR COVER INSTALLATION

1. Assemble new gasket ① on stator cover ② with the gasket flat surface facing the engine.



2. Install fasteners ③ and ④ in the locations illustrated.
3. Install remaining stator cover fasteners and torque all fasteners in sequence to specifications.



TORQUE
Stator Cover Fasteners: **88 in-lbs (10 Nm)**

4. Connect coolant hoses to stator cover.
5. Install the crankshaft position sensor and torque fastener to specifications.

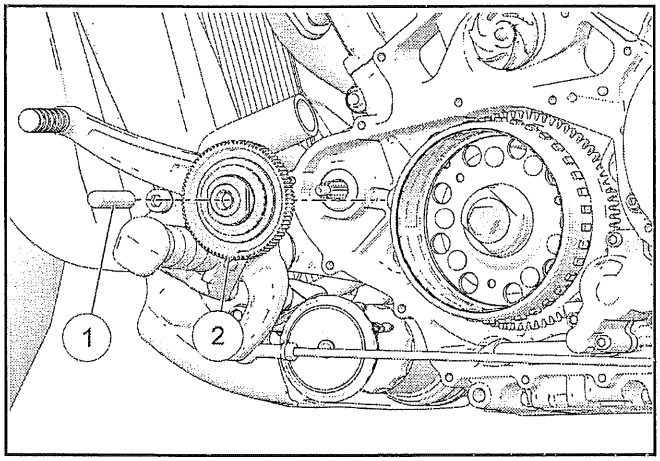
TORQUE
CPS (Crankshaft Position Sensor) Fastener: **88 in-lbs (10 Nm)**

6. Connect the stator connector.
7. Fill the cooling system with 50/50 Premix Extended Life Coolant. See Coolant Fill / Bleeding, page 3.34

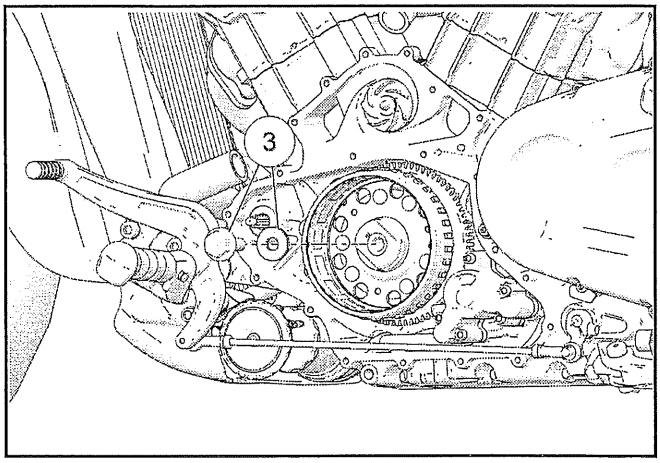
FLYWHEEL REMOVAL

⚠ WARNING
The flywheel contains powerful magnets. Use caution when lifting stator cover off of flywheel to avoid personal injury.

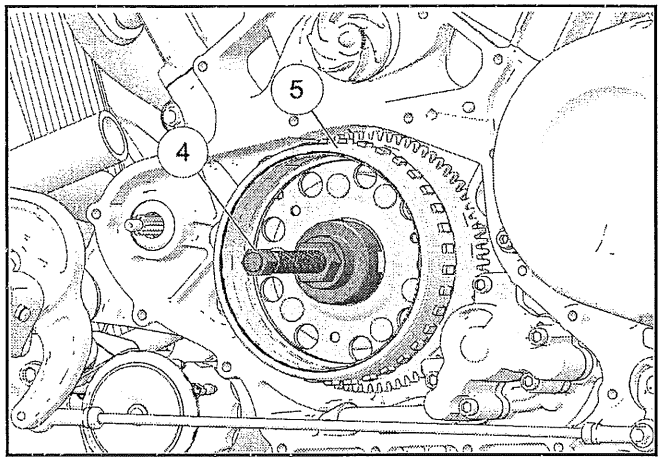
1. Remove stator cover. See Stator Cover Removal, page 5.21.
2. Remove the torque limiter gear pin ① and torque limiter assembly ②.



3. Remove flywheel bolt and washer ③.



4. Install flywheel remove tool PA-49316-A ④ on the flywheel ⑤ and tighten puller to remove flywheel assembly.



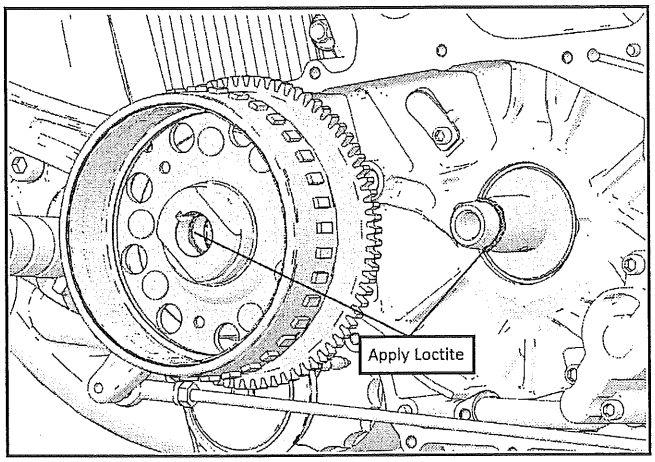
5. Grasp flywheel assembly and lift off the crankshaft.

FLYWHEEL INSTALLATION

NOTE

The flywheel contains powerful magnets. Use caution when installing flywheel onto crankshaft to avoid personal injury.

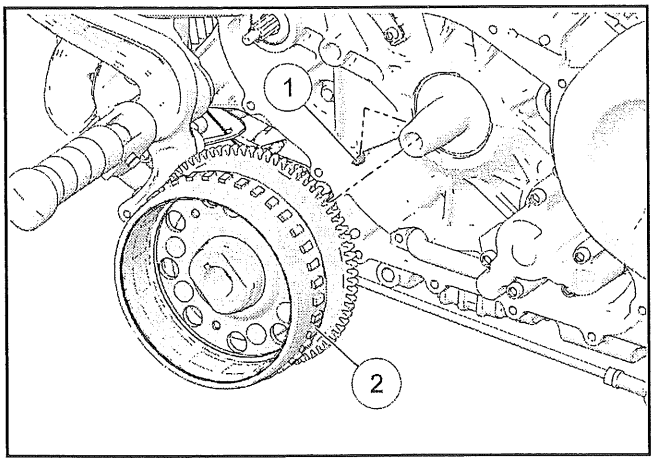
1. Clean flywheel and crankshaft taper thoroughly with isopropyl alcohol or similar.
2. Inspect crankshaft taper surface and replace if damaged.
3. Apply a bead of Loctite® 641 (Yellow) to the internal flywheel taper and crankshaft external taper surfaces. Refer to image below.



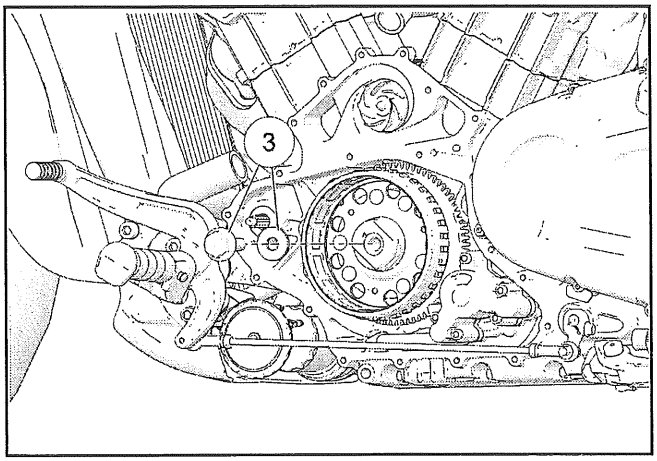
IMPORTANT

Do not allow Loctite® to contact the starter gear bearing.

4. Install woodruff key ① and install flywheel assembly ② onto crankshaft.



5. Install flywheel fastener with washer ③ and torque to specification.



TORQUE

Flywheel Fastener:
STEP 1: Tighten fastener to 133 ft-lbs (180 Nm)
STEP 2: Back out fastener 180° and re-torque to spec.

6. Install stator cover assembly. See Stator Cover Installation, page 5.21
7. Check engine oil level. See Engine Oil Level Check, page 2.10.

5

TROUBLESHOOTING CLUTCH / PRIMARY / SHIFT

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
Clutch Lever Pulls Excessively Hard	Clutch lever pivot, bushings need lubrication	Clutch lever pivot points	Lubricate
	Drive plates catching on primary driven gear basket	Clutch primary driven gear / clutch plates	Replace necessary parts
	Clutch rack bearing damage	Clutch rack	Replace
	Clutch pinion shaft bearing binding	Pinion shaft bearings	Replace
Clutch Slips	Clutch springs weak	Clutch springs	Replace
	Pressure plate worn or distorted	Pressure plate	Replace
	Clutch plates worn, warped or distorted	Clutch Friction / Separator Plates	Replace plates as necessary
	Clutch rack mechanism sticking	Clutch rack mechanism	Replace
	Engine oil level low	Oil level	Correct oil level
	Oil additives present in oil or used previously	Oil quality	Replace oil & filter (clutch plates may need to be replaced
Dragging clutch (doesn't disengage completely, creeping)	Clutch lever, pivot, cable, or lifter arm sticking	Lever, pivots, bushings, bearings, cable	Inspect
	Oil additives present in oil or used previously	Oil quality	Replace oil & filter (clutch plates may need to be replaced
	Oil level too high	Oil level	Correct oil level
	Oil viscosity too high	Oil quality	Replace oil & filter
	Pressure plate worn, warped or distorted	Pressure plate	Replace
	Clutch plate(s) worn, warped or distorted	Driven plates and / or drive plates	Replace
	Weak clutch springs	Clutch springs	Replace

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
Transmission Will Not Shift	Broken shift drum	Shift drum	Replace shift drum
	Bent shift forks	Shift fork	Replace shift forks
	Worn shift drum	Shift drum	Replace shift drum
	Broken gears	Transmission gears	Replace broken gear(s)
	Damaged/broken bearings	Transmission, shift cam bearings	Replace bearings that fail inspection
	Worn gear shift pawl ratchet mechanism	Shift pawl mechanism	Replace parts that fail inspection
	Broken or dislodged shift shaft return spring	Shift shaft return spring	Repair or replace
	Roller detent arm stuck	Roller detent arm	Repair or replace parts
	Bent shift shaft (internal)	Shift shaft	Repair or replace
	External shift linkage binding or damaged	External shift linkage	Repair or replace
	Bent or distorted shift forks	Shift fork	Replace
	Bent or distorted shift fork rails	Shift fork rail	Replace
	Broken transmission components	Transmission components	Repair or replace
Transmission Hard to Shift	Improper clutch operation	Clutch	Inspect, repair
	Incorrect oil viscosity	Oil quality	Replace engine oil
	Incorrect clutch cable adjustment	-	Adjust
	Shift shaft damaged	Shift shaft components	Repair or replace
	Sticking pivot point, bent external shift linkage	External shift linkage	Repair or replace
	Bent or distorted shift forks	Shift forks	Replace
	Damaged shift drum grooves	Shift drum	Repair or replace
	Shift detent plunger stuck	Shift detent plunger	Repair or replace
	Bent/binding shift fork rails	Shift fork rails	Repair or replace
Transmission Jumps Out of Gear	Broken / loose stop pin	Shift stop pin	Replace
	Worn shift drum or shift drum ratchet	Shift drum or shift linkage	Replace
	Broken shift return spring	Shift return spring	Replace
	Damaged shift drum grooves	Shift drum	Replace
	Bent or worn shift forks	Shift forks	Replace
	Bent/binding shift fork rails	Shift fork rails	Replace
	Worn engagement dogs on transmission gears	Transmission gears	Replace
Transmission Noise	Drive belt tension incorrect	Drive belt	Adjust or replace
	Clutch plates bind or drag when clutch is disengaged	Clutch plates / hubs	Adjust / repair / replace
	Gear/bearing wear/damage	Transmission components	Inspect / replace

NOTES

CHAPTER 6
TRANSMISSION / CRANKSHAFT

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- SERVICE SPECIFICATIONS 6.4
- LOCKING THE CRANKSHAFT FOR SERVICE 6.6

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TROUBLESHOOTING TRANSMISSION / CRANKSHAFT 6.42

GENERAL INFORMATION

SERVICE NOTES

- Remove engine from frame to service internal transmission and/or crankshaft components. SeePreparation For Engine Removal, page 3.9 .
- The crankcase must be separated to access internal transmission components and crankshaft.
- Label and store parts neatly to speed the assembly process and ensure that matched parts like connecting rods, camshafts and bearings and pushrods can be installed in their original location
- Crankshaft main bearing replacement requires line boring. This procedure requires full machine shop capabilities and specialized knowledge. It is recommended that a qualified machine shop perform this procedure if it becomes necessary or replace the crankcase assembly
- Crankshafts and connecting rods are color coded for manufacturing tolerances with a white or red paint mark (or stamped "R" or W").
- All torque specifications are "dry" unless specified for oil or locking agent. Refer to exploded views
- When locking agents are required, use Loctite® Primer N to clean fastener before applying locking agent Primer N reduces cure time of thread locking agent in addition to preparing the surfaces

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Case Splitting / Assembly Tool	PF-51234-A
Clutch Holding Tool	PF-51612
Crankshaft Locking Pin	PF-52135-A
Drive Sprocket Seal Installer	PF-51243

Bosch Automotive Service Solutions: 1-800-345-2233 or https://polaris.service-solutions.com/

SERVICE SPECIFICATIONS

Connecting Rod / Crankshaft Specifications

ITEM	PART SPECIFIC	STANDARD	SERVICE LIMIT
Connecting Rod	Connecting Rod to Crankshaft Side Clearance	.22 - .42 mm (.0087 - .0165")	.65 mm (.025")
	Connecting Rod Bearing to Crankshaft Oil Clearance	.0254 - .0635 mm (.001 - .0025")	.11 mm (.0043")
	Connecting Rod Small End I.D.	22.01 - 22.02 mm (.8665 - .8670")	22.09 mm (.8694")
	Connecting Rod Width	21.01 - 21.11 mm (.8271 - .8310")	20.76 mm (.8173")
	Connecting Rod Big End I. D. (White)	54.992 - 55.000 mm (2.1650 - 2.1653")	55.030 mm (2.1665")
	Connecting Rod Big End I. D. (Red)	55.000 - 55.008 mm (2.1653 - 2.1656")	55.038 mm (2.1668")
Crankshaft Main Bearing / Rod Journals	Connecting Rod Journal Width	42.42 - 42.50 mm (1.670 - 1.673")	43.46 mm (1.627")
	Crankshaft Rod Journal O. D. (White)	51.9920 - 51.9999 mm (2.0469 - 2.0472")	51.9620 mm (2.0457")
	Crankshaft Rod Journal O. D. (Red)	52.0000 - 52.0080 mm (1.8888 - 1.8891")	51.970 mm (2.0460")
	Main Bearing Oil Clearance	Left .013 - .060 mm (.0005 - .0023") Right .014 - .061mm (.0005 - .0024")	.10 mm (.004")
	Left Main Bearing Journal O.D.	59.9523 - 59.9703 mm (2.3603 - 2.3610")	59.9323 mm (2.3595")
	Right Main Bearing Journal O.D.	64.9523 - 64.9703 mm (2.5571 - 2.5578")	64.9273 mm (2.5561")
	Crankshaft End Play	.05 - .30 mm (.0019 - .0118")	-
Balance Shaft	Journal O.D., Left (Primary Side) / Journal O.D., Right (Cam Side)	24.980 - 24.992 mm / 24.969 - 24.979 mm	-

Transmission Specifications

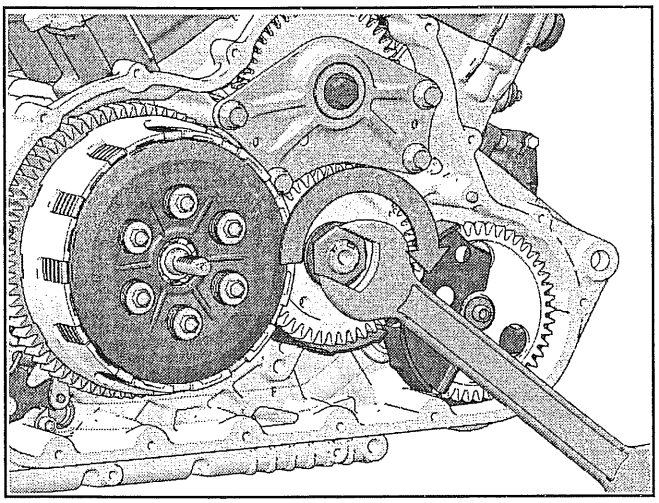
ITEM	PART SPECIFIC	STANDARD	SERVICE LIMIT
Shift Fork	Shift Fork I.D. (Rail)	12.00 - 12.026 mm (.4725 - .4732")	12.05 mm (.4744")
	Shift Fork Pin O.D.	6.036 - 6.136 mm (.2376 - .2416")	6.02 mm (.2370")
Shift Fork Rail	Shift Fork Rail O.D.	11.948 - 11.972 mm (.4704 - .4713")	11.92 mm (.4693")
	Shift Fork Rail Runout	-	.025 mm (.001")
Shift Drum	Shift Drum Groove	-	Replace drum if any wear is evident

ITEM		SPECIFICATIONS
Drive Train (General)	Transmission	6 Speed / Sliding Mesh
	Primary Reduction Ratio	1.674: 1
	Final Reduction Ratio	2.357: 1
Drive Train (Gear Ratios)	Gear Ratio: 1st Gear	2.769: 1
	Gear Ratio: 2nd Gear	1.882: 1
	Gear Ratio: 3rd Gear	1.500: 1
	Gear Ratio: 4th Gear	1.273: 1
	Gear Ratio: 5th Gear	1.125: 1
	Gear Ratio: 6th Gear (Overdrive)	1.036: 1

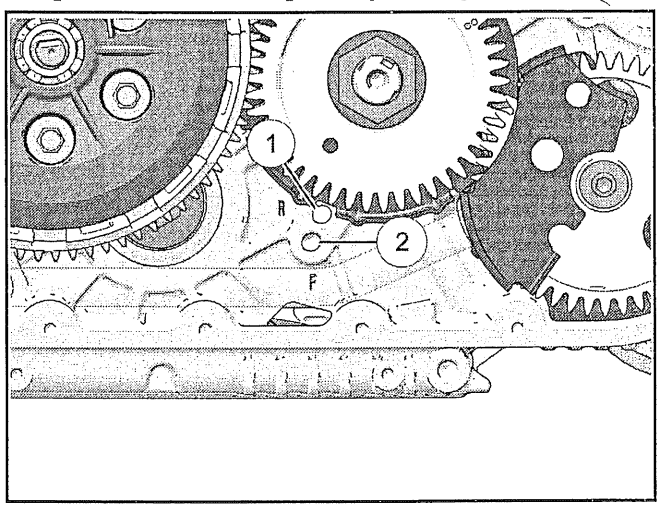
LOCKING THE CRANKSHAFT FOR SERVICE

This procedure describes how to lock the crankshaft in the Top Dead Center (TDC) position for the front *or* rear pistons using the Crankshaft Locking Tool: **PF-51235-A** or equivalent (5/16" punch).

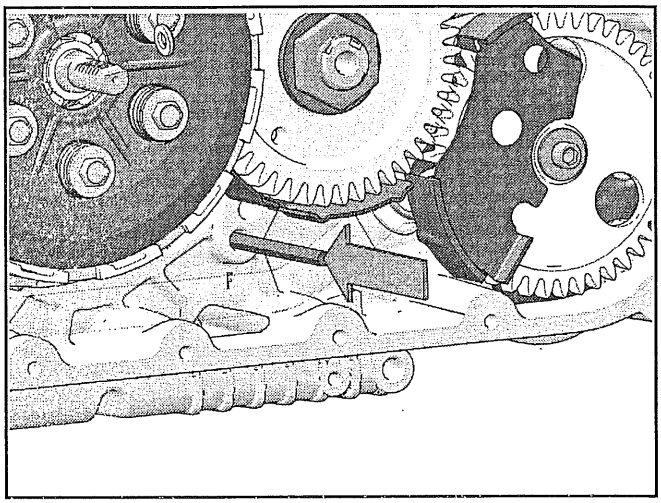
1. Remove the spark plugs. See Spark Plug Removal, page 2.29.
2. Remove the clutch and primary drive covers. See Primary Drive Cover Removal, page 5.7.
3. Using a 32mm wrench or socket, rotate the crankshaft clockwise (primary side) until the front piston is at TDC. See the Camshaft Timing Marks, page 3.47 illustration for details.



4. Locate the two holes (① and ② in the illustration), marked "R" for rear piston and "F" for front piston, beneath the primary drive gear.



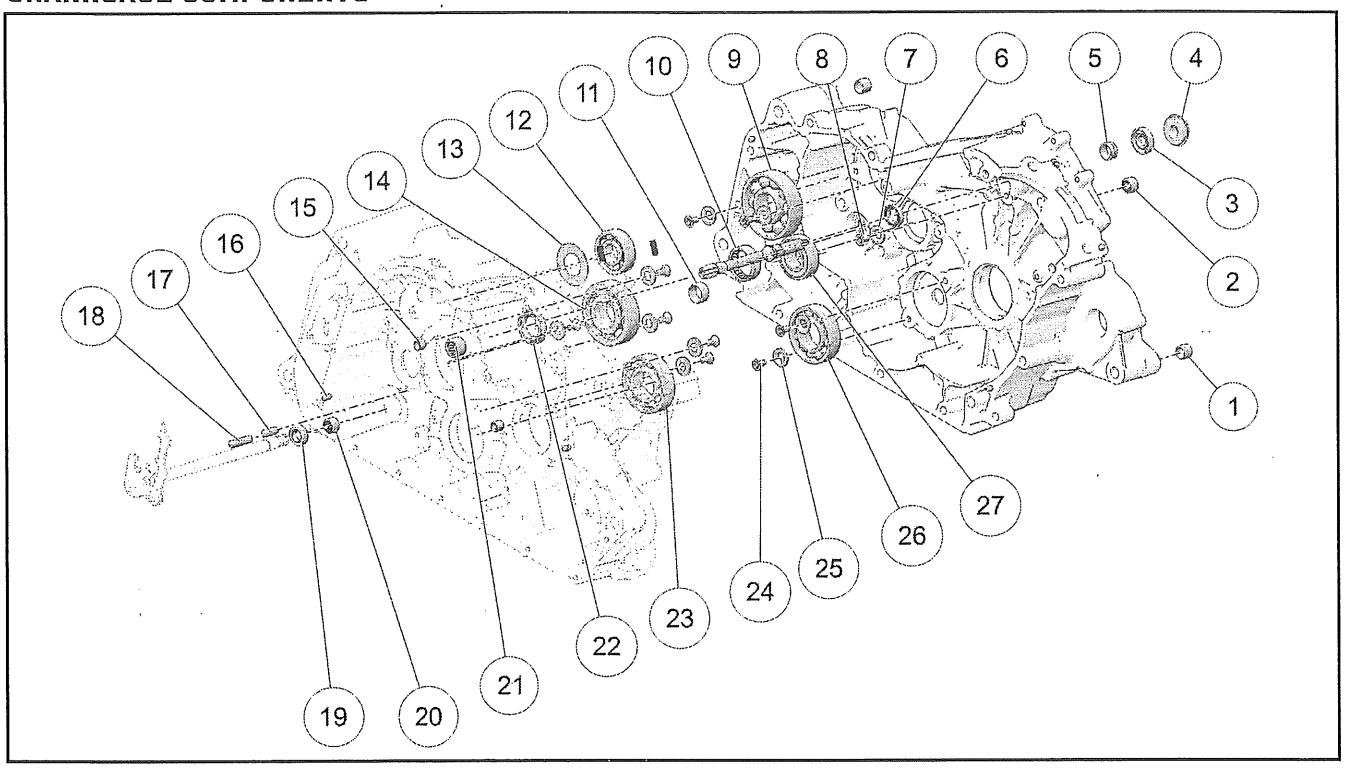
5. Lock the crankshaft by inserting the Crankshaft Locking tool **(PF-51235-A)** or equivalent into the desired locking hole.



NOTE

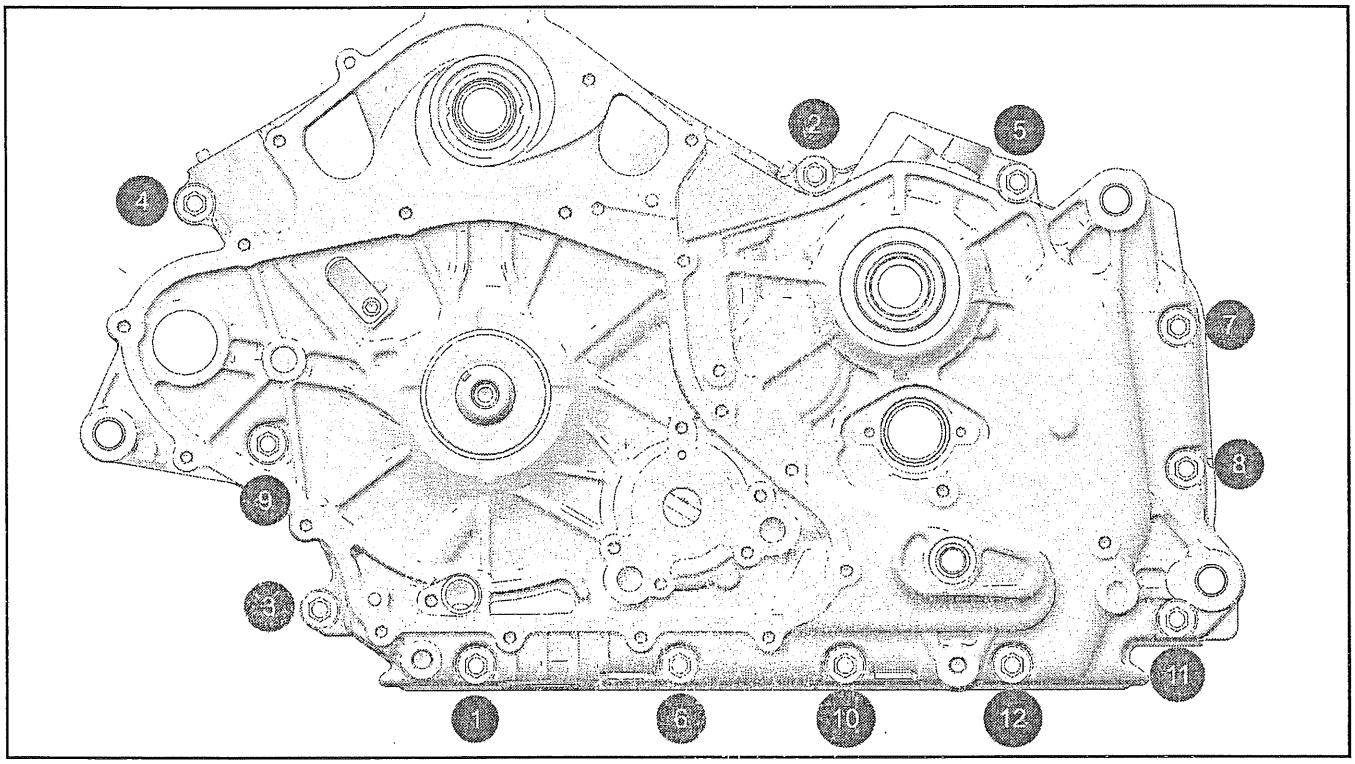
It may be necessary to rotate the crankshaft slight forward or back to properly align holes.

ASSEMBLY VIEWS
CRANKCASE COMPONENTS



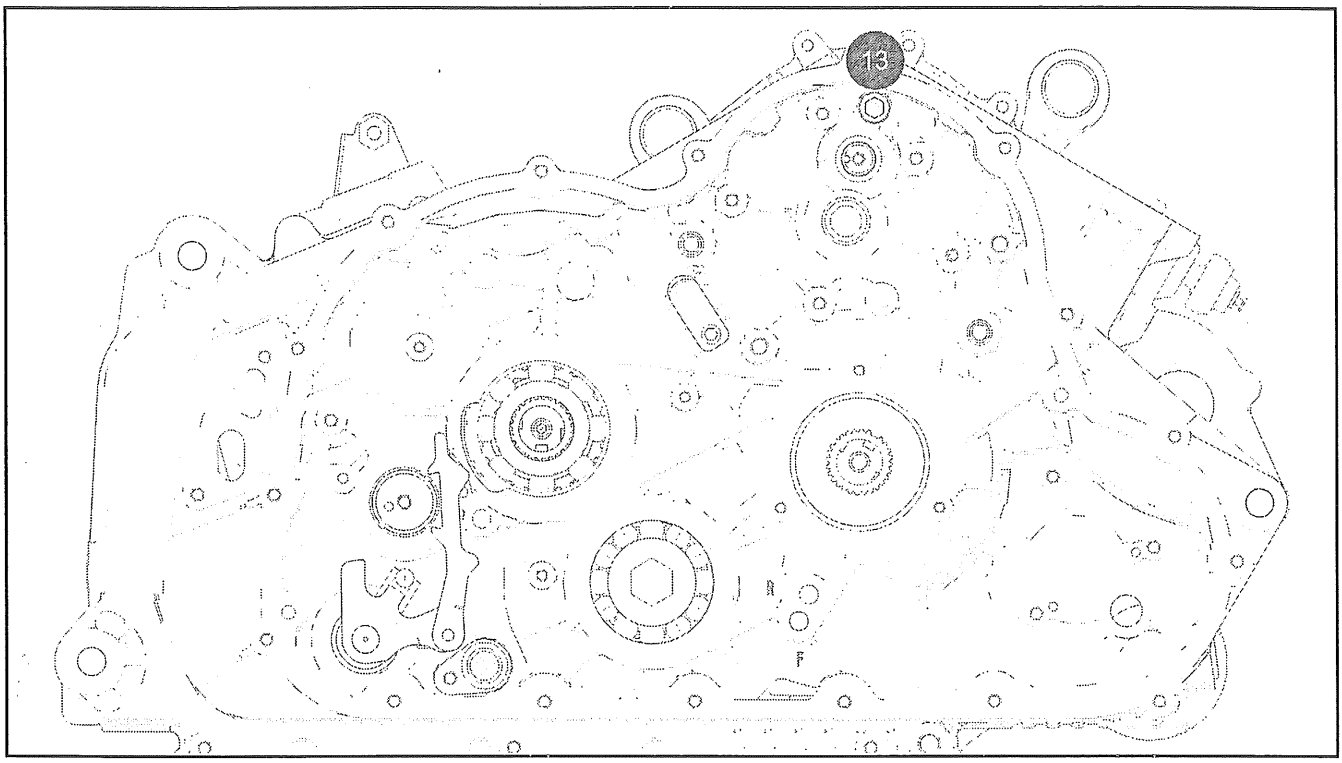
#	DESCRIPTION	TORQUE	#	DESCRIPTION	TORQUE
①	Dowel	-	⑮	Hollow Dowel	-
②	Needle Shift Shaft Bearing	-	⑯	Alignment Pin	-
③	Shaft Water Pump Oil Seal	-	⑰	Solid Pin	-
④	Water Pump Seal	-	⑱	Solid Pin	-
⑤	Water Pump Shaft Nut	**13 ft-lbs (18 Nm)**	⑲	Shift Shaft Seal	-
⑥	Water Pump Shaft Bearing	-	⑳	Needle Shift Shaft Bearing	-
⑦	Bearing Retainer Plate	-	㉑	Needle Water Pump Shaft Bearing	-
⑧	Bearing Retainer Fastener	**88 in-lbs (10 Nm)**	㉒	Ball Shift Drum Bearing	-
⑨	Ball Transmission Output Shaft Bearing	-	㉓	Ball Balance Shaft Right Bearing	-
⑩	Needle Shift Drum Bearing	-	㉔	Bearing Retainer Fastener	**88 in-lbs (10 Nm)**
⑪	Cam Idler Bearing	-	㉕	Bearing Retainer	-
⑫	Ball Transmission Output Shaft Bearing	-	㉖	Ball Balance Shaft Left Bearing	-
⑬	Oil Deflector Plate	-	㉗	Ball Transmission Input Shaft Bearing	-
⑭	Ball Transmission Input Shaft Bearing	-			

CRANKCASE TORQUE PATTERN



NOTE

Left crankcase bolts ②, ③ and ⑤ in tightening sequence are M8 x 1.25 x 40 all other bolts are M8 x 1.25 x 75.



NOTE

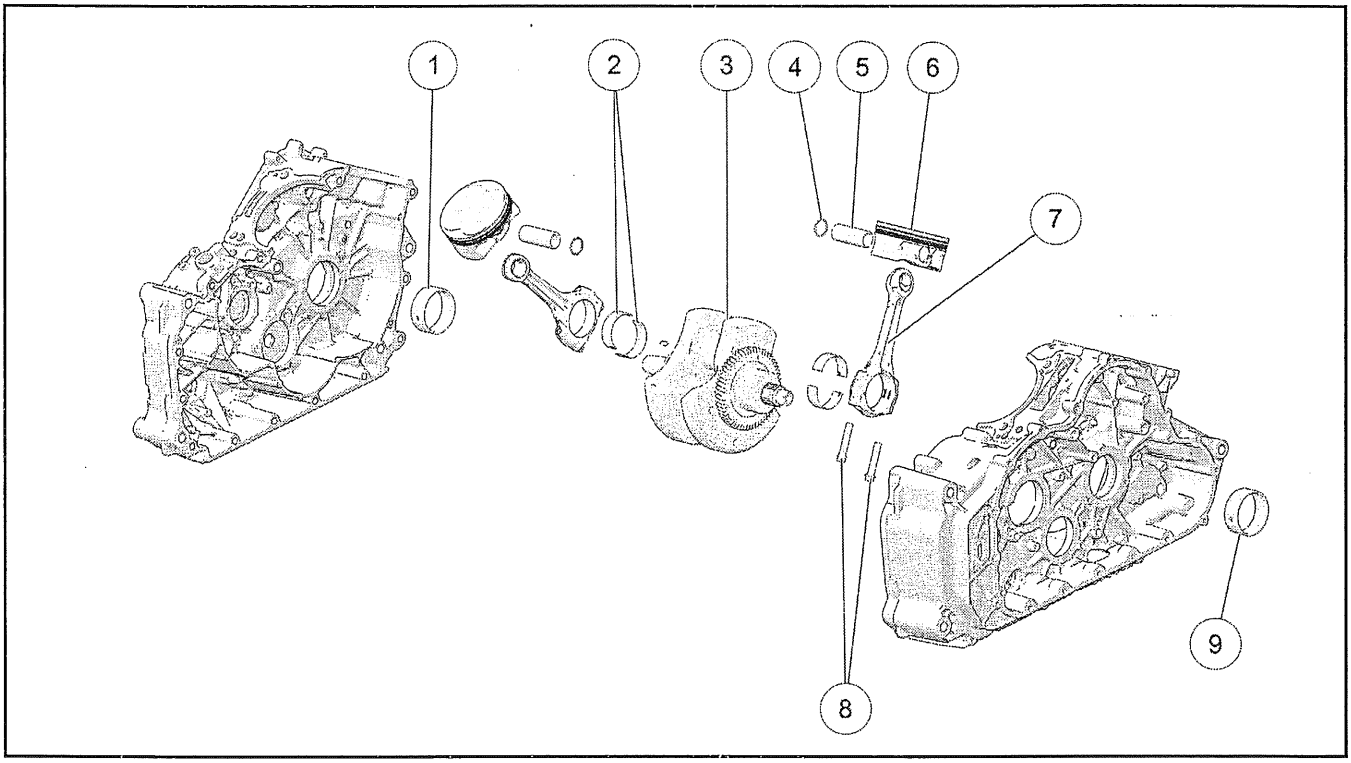
Right crankcase bolt ⑬ in the tightening sequence is a M8 x 1.25 x 60.

Torque case bolts to specification following the torque sequence.

TORQUE

Crankcase Fasteners:
22 ft-lbs (30 Nm)

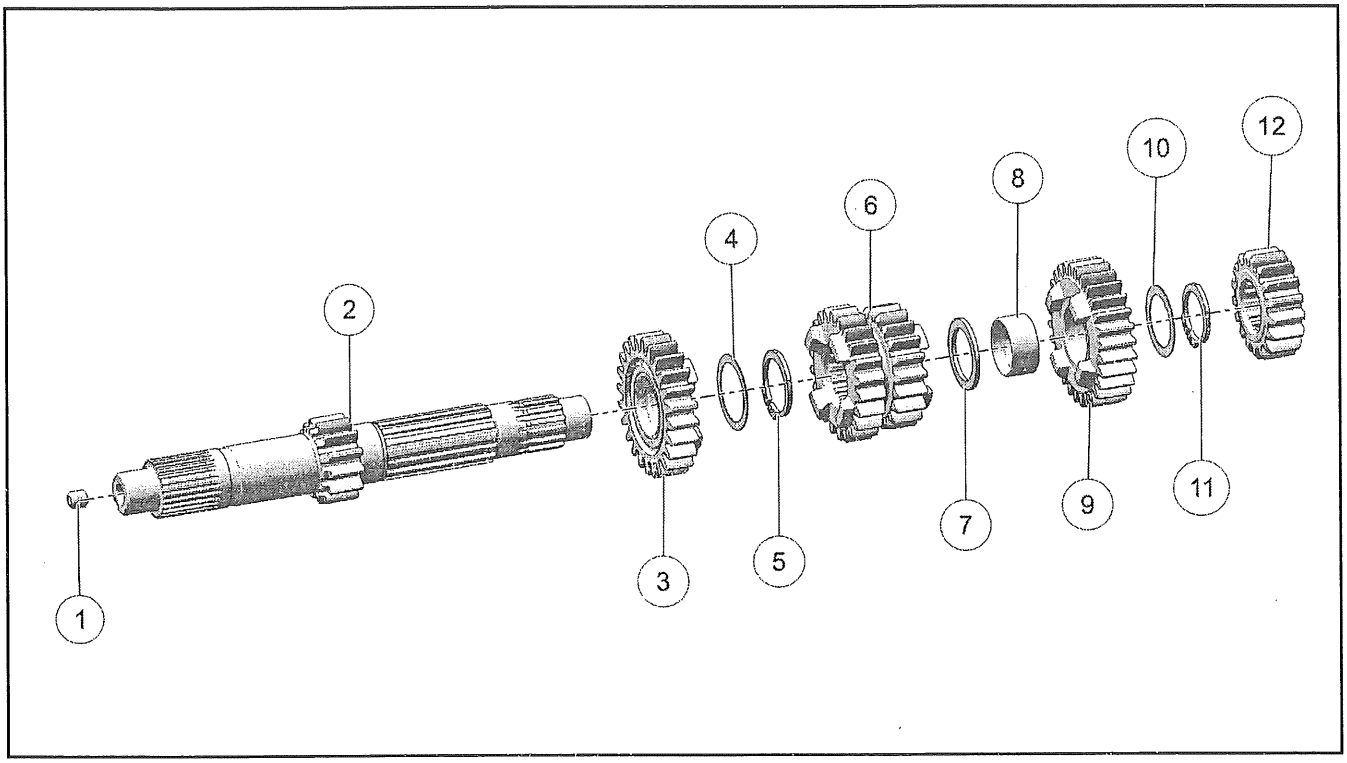
CRANKSHAFT COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Crankshaft Main (LH) Bearing — Non-Serviceable	—
②	Connecting Rod Bearings (big end)	—
③	Crankshaft Assembly	—
④	Wrist Pin Circlip	—
⑤	Piston Wrist Pin	—
⑥	Piston Assembly	—
⑦	Connecting Rod Assembly	—
⑧	Connecting Rod Fasteners (QTY.4)	**STEP 1: Tighten both fasteners to 22 ft-lbs (30 Nm)** **STEP 2: Tighten both fasteners an additional 90°**
⑨	Crankshaft Main (RH) Bearing — Non-Serviceable	—

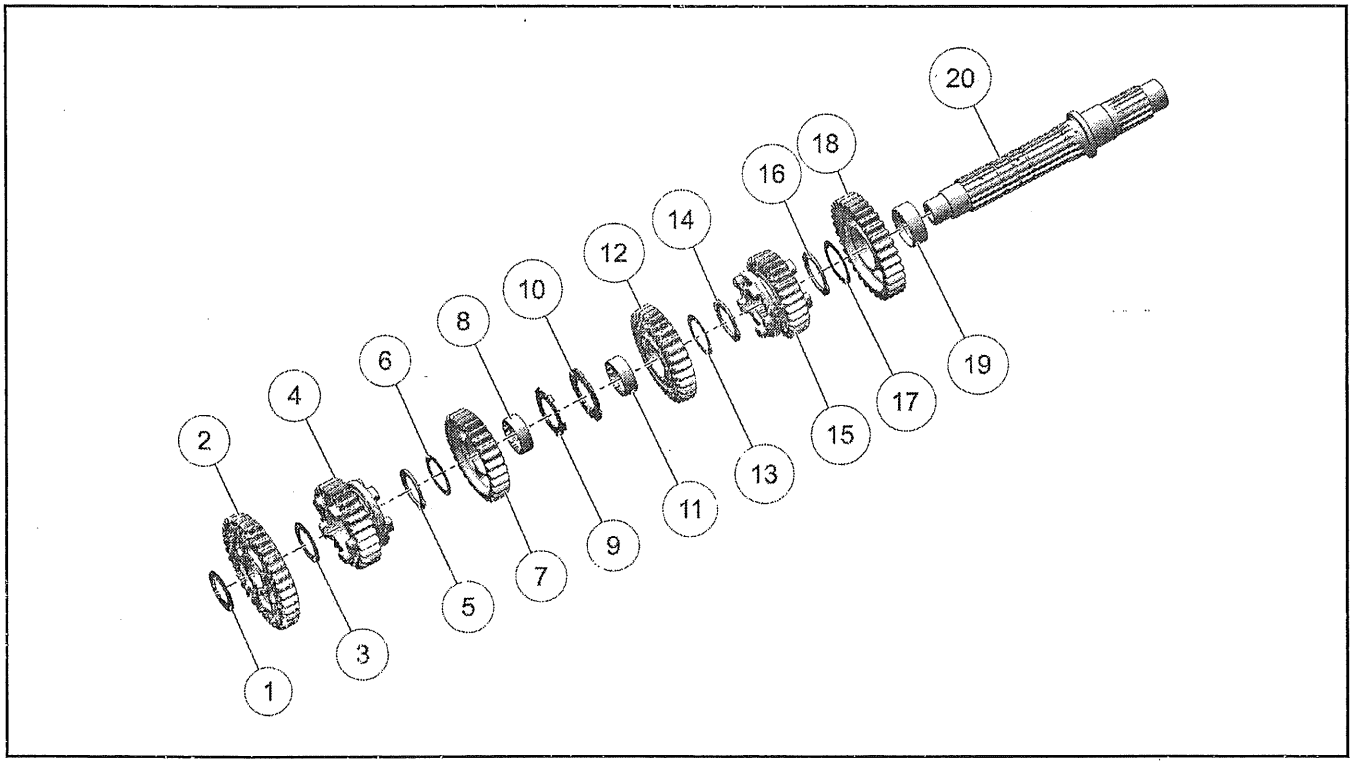
TRANSMISSION, 6 SPEED

Input Shaft



NUMBER	DESCRIPTION
①	Input Shaft Plug
②	Transmission Input Shaft
③	5th Input Gear
④	Flat Washer
⑤	Retaining Ring
⑥	3rd & 4th Input Gear
⑦	Washer
⑧	Plain Bushing
⑨	6th Input Gear
⑩	Washer
⑪	Retaining Ring
⑫	2nd Input Gear

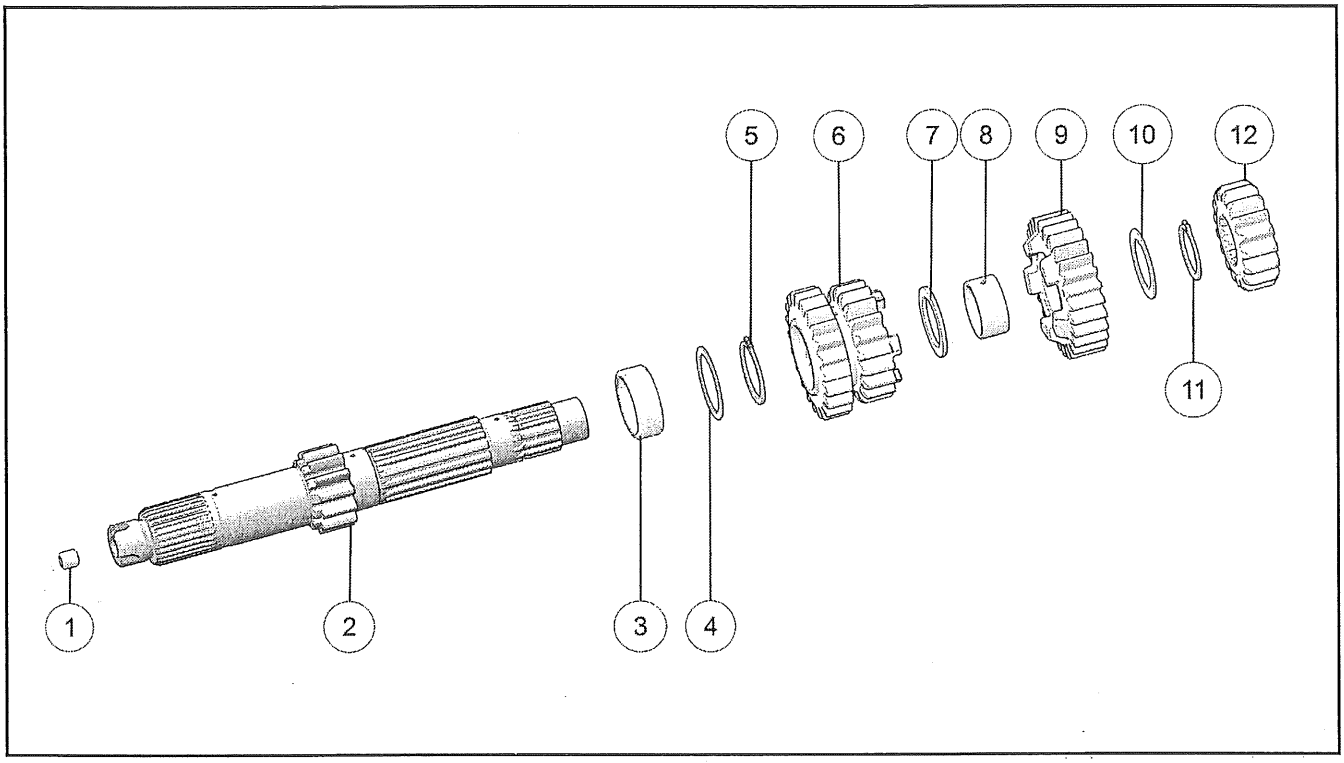
Output Shaft



NUMBER	DESCRIPTION	NUMBER	DESCRIPTION
①	Flat Washer	⑪	Splined Bushing
②	1st Output Gear	⑫	3rd Output Gear
③	Flat Washer	⑬	Flat Washer
④	5th Output Gear	⑭	Retaining Ring
⑤	Retaining Ring	⑮	6th Output Gear
⑥	Flat Washer	⑯	Retaining Ring
⑦	4th Output Gear	⑰	Lock 1T Washer
⑧	Splined Bushing	⑱	2nd Input Gear
⑨	Lock 15T Washer	⑲	Plain Bushing
⑩	Thrust 15T Washer	⑳	Transmission Output Shaft

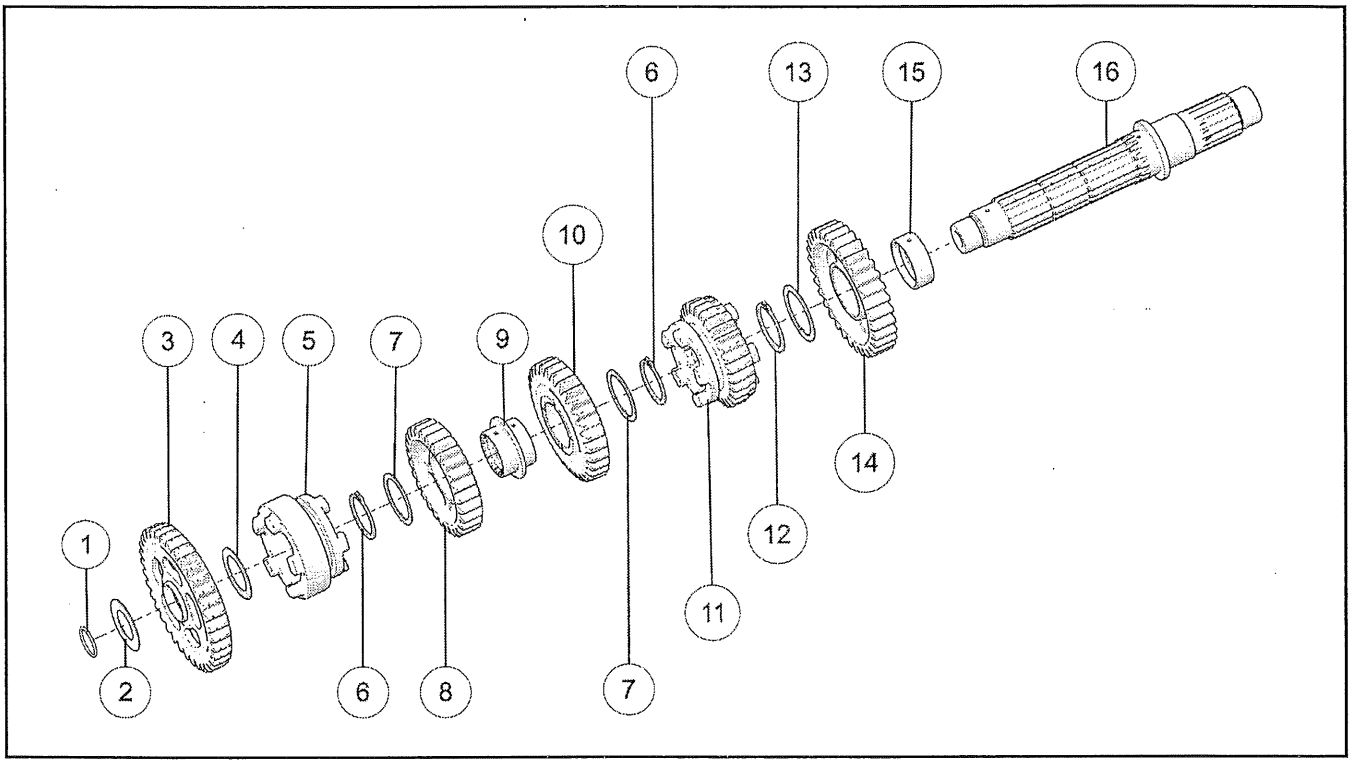
TRANSMISSION, 5 SPEED (SCOUT SIXTY)

Input Shaft



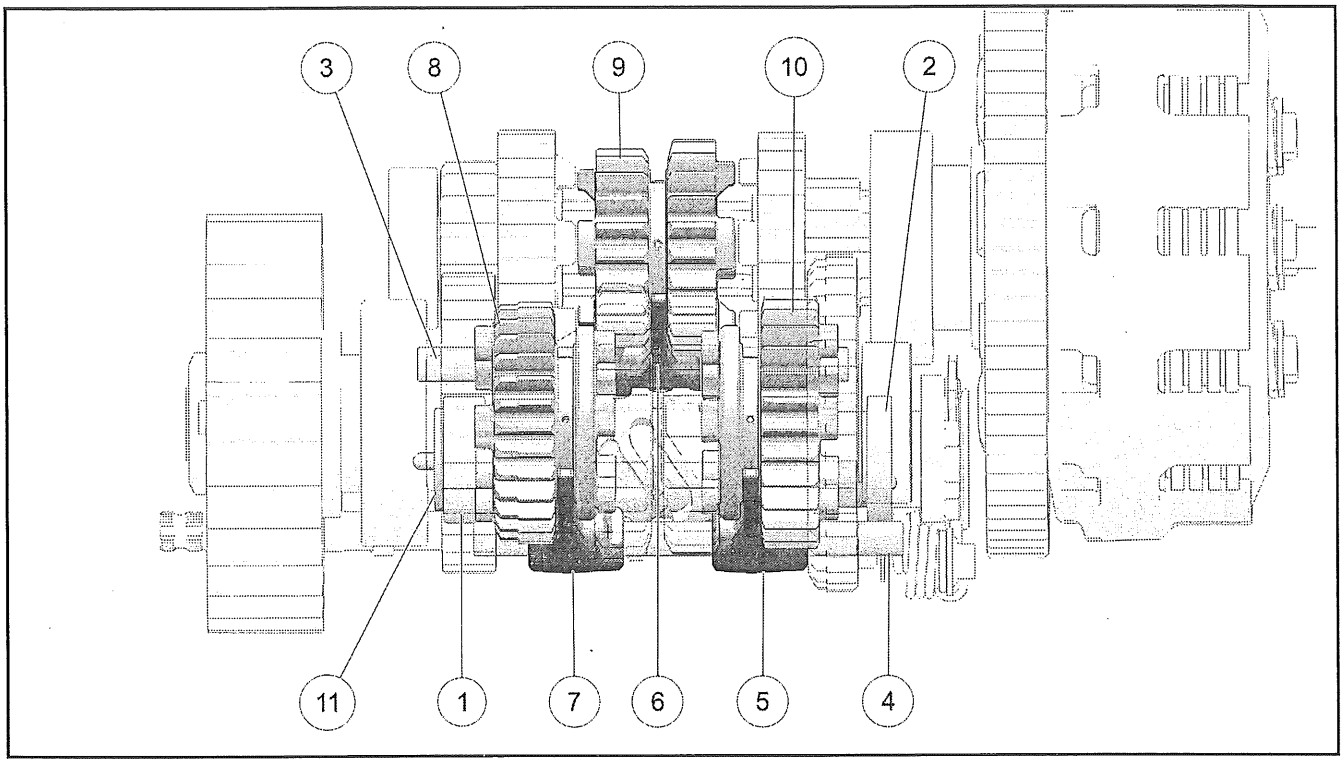
NUMBER	DESCRIPTION
①	Input Shaft Plug
②	Transmission Input Shaft and 1st Gear
③	Input Shaft Spacer
④	Flat Washer
⑤	Retaining Ring (External 28mm)
⑥	3rd & 4th Input Gear
⑦	Washer
⑧	Plain Bushing
⑨	6th Input Gear
⑩	Washer
⑪	Retaining Ring
⑫	2nd Input Gear

Output Shaft



NUMBER	DESCRIPTION
①	O-ring
②	Flat Washer
③	1st Output Gear
④	Flat Washer
⑤	Dog Ring 5spd
⑥	Retaining Ring
⑦	Flat Washer
⑧	4th Output Gear
⑨	Splined Bushing
⑩	3rd Output Gear
⑪	6th Output Gear
⑫	Retaining Ring
⑬	Flat Washer 1TH
⑭	2nd Output Gear
⑮	Plain Bushing
⑯	Transmission Output Shaft

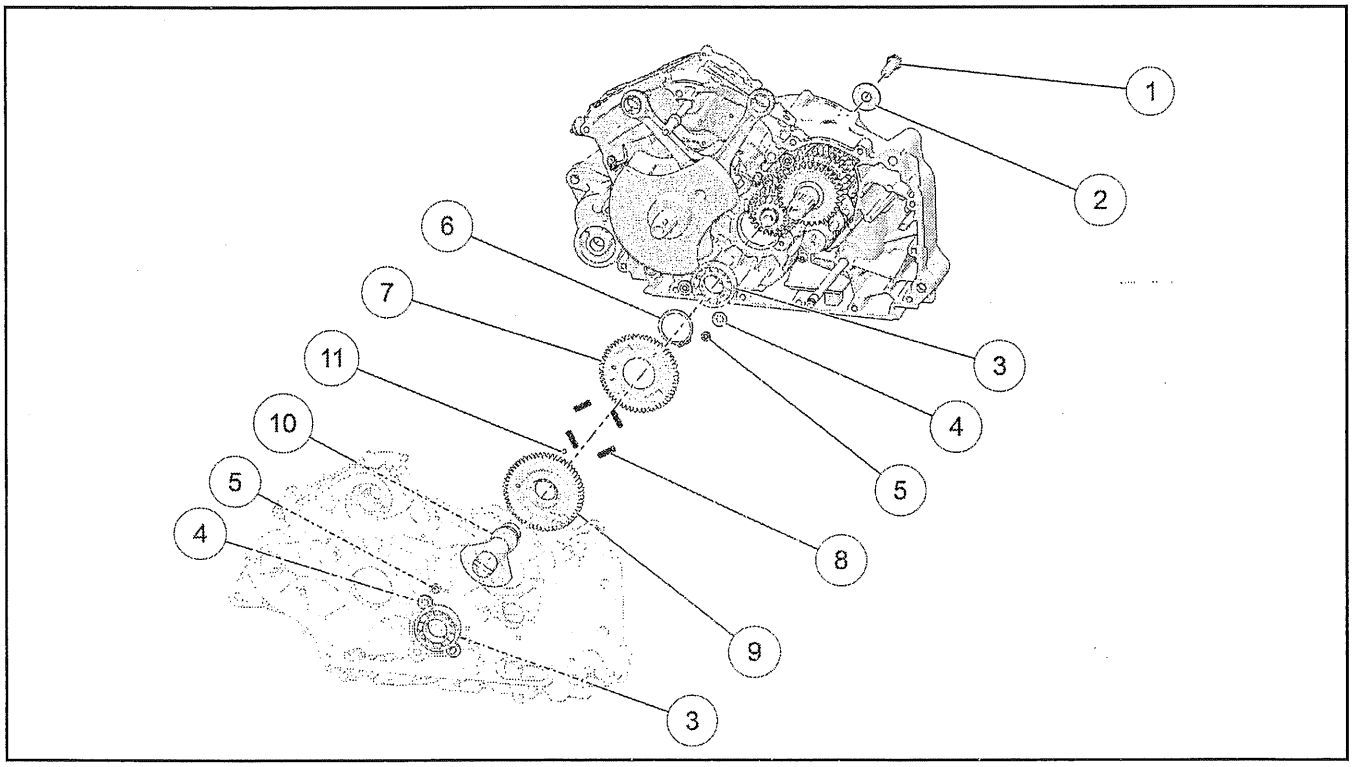
SHIFT DRUM / SHIFT FORK



NUMBER	DESCRIPTION
①	Bearing, Shift Drum - Drive Sprocket Side
②	Bearing, Shift Drum - Primary Side
③	Shift Rail
④	Shift Rail
⑤	Shift Fork, 1st and 4th
⑥	Shift Fork, 5th & 6th
⑦	Shift Fork, 2nd & 3rd
⑧	Gear, 6th Output
⑨	Gear, 3rd & 4th Input
⑩	Gear, 5th Output
⑪	Shift Drum

BALANCE SHAFT

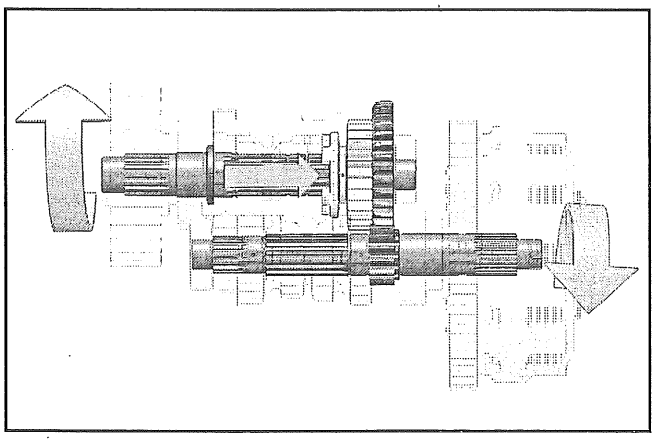
Balance shaft service requires engine removal and crankcase separation.



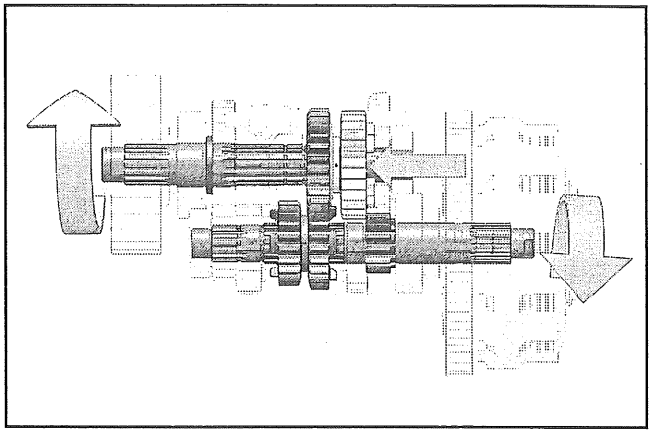
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Balance Shaft Gear Fastener (QTY.1)	**83 ft-lbs (112 Nm)**
②	Washer	-
③	Balance Shaft Bearings	-
④	Bearing Retainer Plate Washer	-
⑤	Bearing Retainer Plate Screws (QTY.3)	-
⑥	Balance shaft Snap-Ring (Inner) - Non-Serviceable	-
⑦	Balance Shaft Gear (Inner) - Non-Servicable	-
⑧	Pre-Load Springs - Non-Serviceable	-
⑨	Balance Shaft Gear (Outer) - Non-Serviceable	-
⑩	Balance Shaft	-
⑪	Balance Shaft Retaining Key	-

GEAR TRAIN

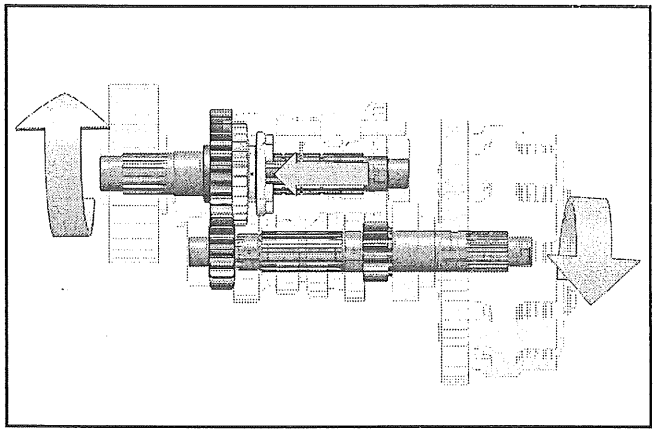
1st Gear



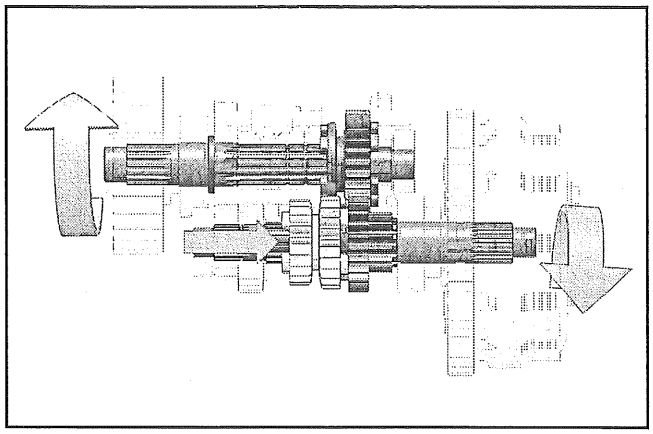
4th Gear



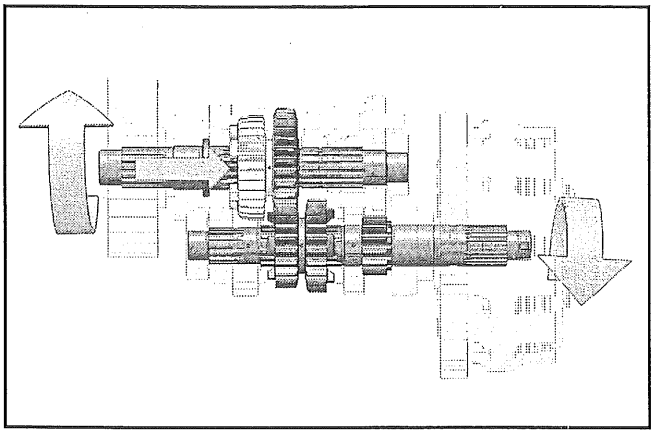
2nd Gear



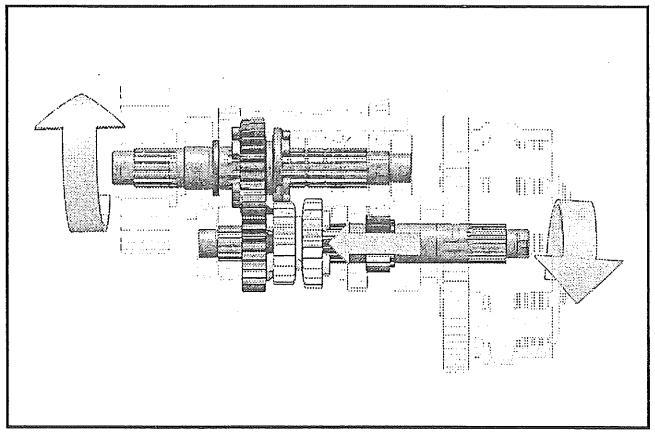
5th Gear



3rd Gear



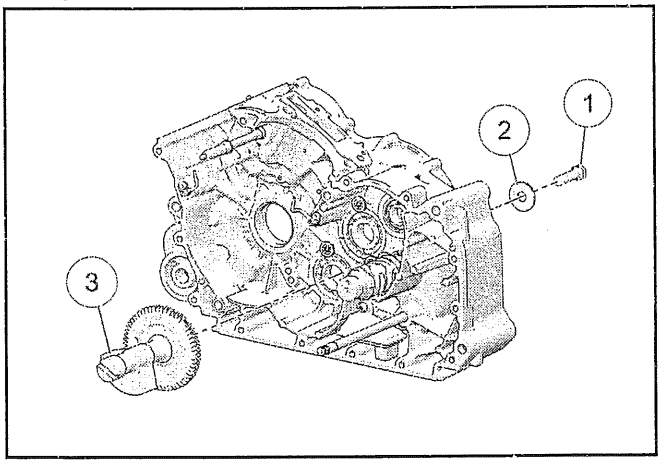
6th Gear



BALANCE SHAFT SERVICE

BALANCE SHAFT REMOVAL

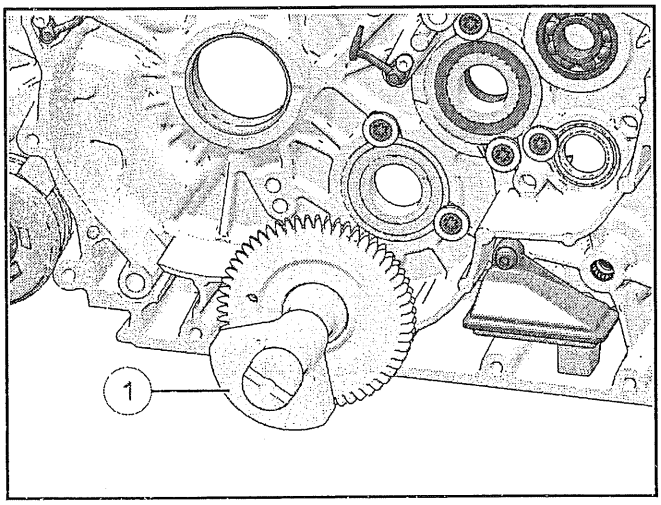
1. Remove the engine from the chassis. See Preparation For Engine Removal, page 3.9.
2. Separate the engine cases. SeeCrankcase Separation, page 6.22.
3. Remove crankshaft assembly. SeeCrankshaft Removal, page 6.27.
4. Remove transmission input and output shaft assemblies. SeeTransmission Removal, page 6.24.
5. Remove balance shaft retaining bolt ① and washer ②.



6. Grasp balance shaft assembly ③ and remove from right engine case assembly.
7. Inspect sprocket teeth for wear or damage.
8. Check balance shaft for runout, or twisting.
9. Rotate right and left balance shaft bearings by hand while observing bearing rotation. Bearings should run smooth and quiet and shaft should be a snug fit in bearings.
10. Visually inspect bearings for damage.

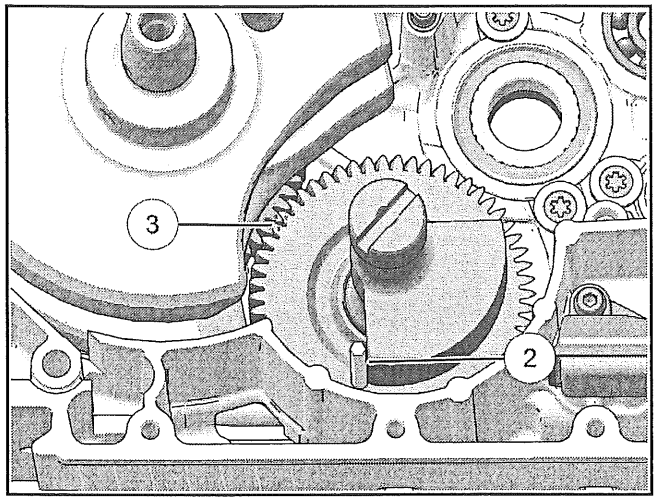
BALANCE SHAFT INSTALLATION

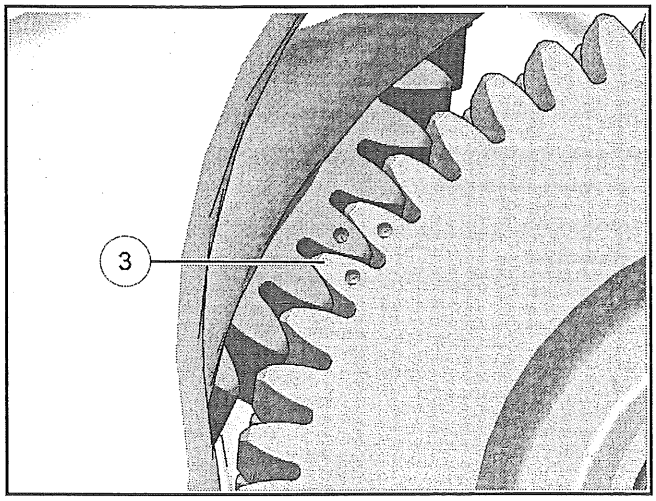
1. Lubricate balance shaft bearings with engine oil.
2. Install the balance shaft assembly ① until fully seated in bearing bore.



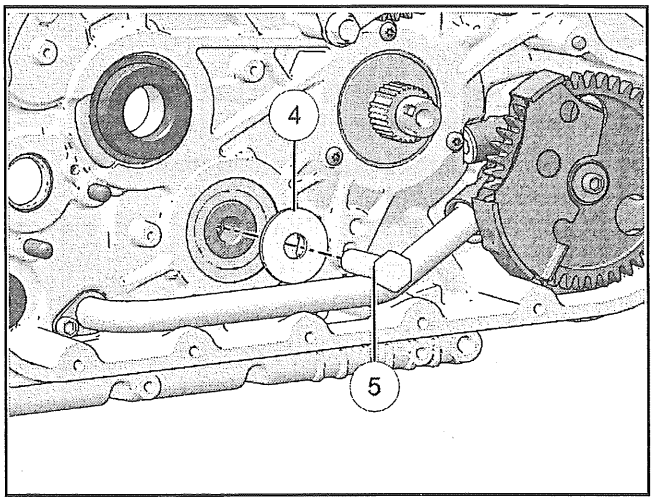
3. Preload the teeth of the split-gear on the balance shaft and lock in place with a pin punch or similar tool ②.

4. Fit the crankshaft assembly into the engine case and align the timing marks ③ on the crank and balance shaft gears as shown.





5. Install the balance shaft washer ④ and bolt ⑤. Torque to specification.



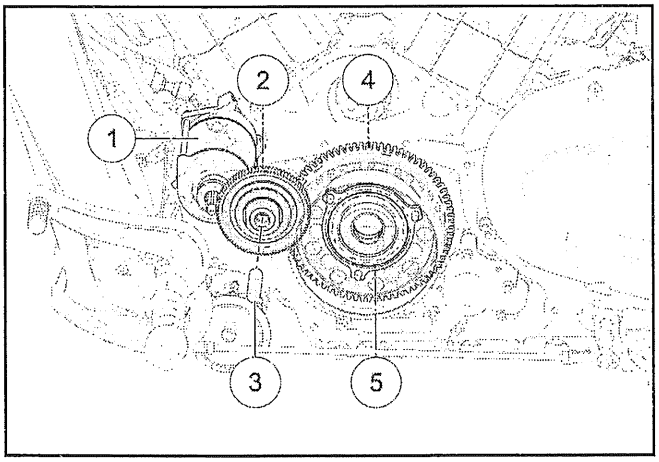
TORQUE
Balance Shaft Gear Fastener: **83 ft-lbs (112 Nm)**

6. Install the transmission and output shaft assemblies. See Transmission Installation, page 6.38.
7. Assemble the crankcase. See Crankcase Assembly, page 6.39.
8. Rotate the engine to verify smooth operation and install in motorcycle chassis.

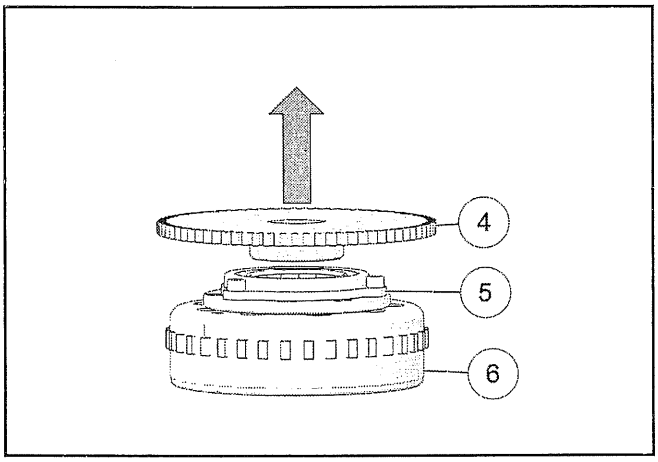
STARTER DRIVE SERVICE

STARTER DRIVE REMOVAL

1. Remove the stator cover. See Stator Cover Removal, page 5.21.
2. Disconnect negative battery cable at battery to prevent starter motor ① from operating.
3. Slide pin ③ out of the torque limiting gear ② and remove from the engine.

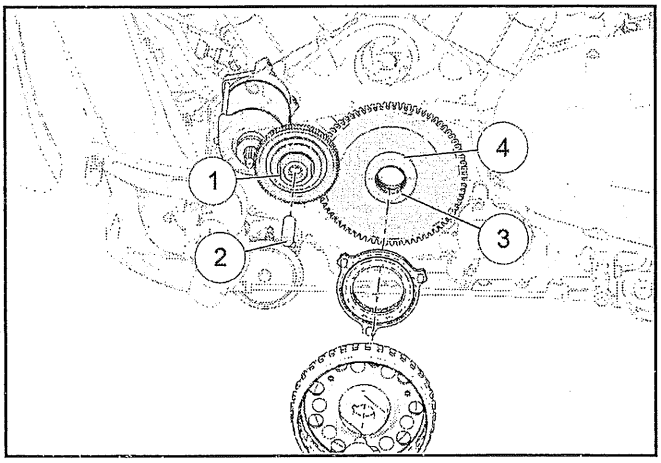


4. Remove the flywheel assembly to access the starter crank drive gear ④ and one-way clutch ⑤. SeeFlywheel Removal, page 5.22
5. Lift and rotate the starter crank drive gear ④ to remove from one-way clutch ⑤ on flywheel ⑥.

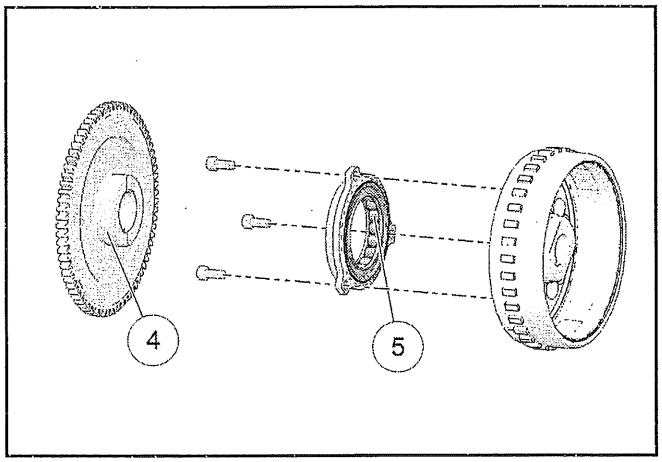


STARTER DRIVE INSPECTION

1. Inspect gear teeth for chips, cracks or excessive wear.
2. Inspect shaft surfaces ② and bushing surface in torque limiting gear ① for excessive wear and scoring.



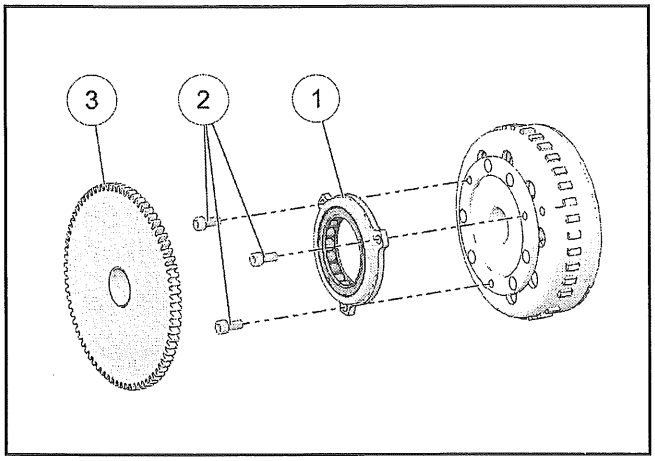
3. Inspect bushing ③ in starter drive crank gear.
4. Inspect one-way clutch hub surfaces ④ for wear, scoring or damage.
5. Inspect one-way clutch cams ⑤ for wear, scoring or damage.



6. Replace any worn or damaged components.

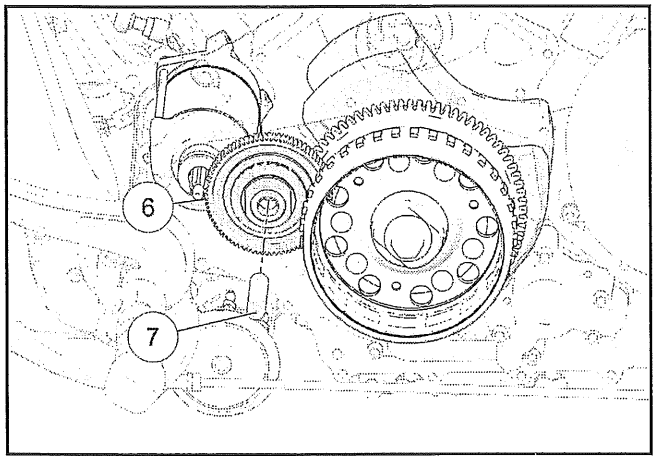
STARTER DRIVE INSTALLATION

1. Install one-way clutch assembly ① onto the flywheel and torque fasteners ② to specification..



TORQUE
Starter Clutch Fasteners: **88 in-lbs (10 Nm)**

2. Insert the starter drive gear ③ into the one-way clutch ①.
3. For proper flywheel installation perform steps 1–5 in Flywheel Installation, page 5.23.
4. Install the starter torque limiter gear ⑥ and insert shaft ⑦ into the crankcase bore.



5. Install the stator cover. See Stator Cover Installation, page 5.21.
6. Check engine oil and fill to proper level. See Engine Oil Level Check, page 2.10.

CRANKSHAFT SERVICE

CRANKCASE SEPARATION

1. Drain engine oil. See Engine Oil / Filter Change, page 2.11.
2. Drain cooling system. See Coolant Drain / Fill, page 3.33.
3. Remove engine from frame. SeePreparation For Engine Removal, page 3.9 .
4. Mount engine securely on an engine stand using Engine Stand Adapter tool **PF-51609**.
5. Remove the cam chains/chain guides. See Cam Chain Removal, page 3.53.
6. Remove cylinder heads. See Cylinder Head Removal, page 3.64.
7. Remove cylinders. See Cylinder Removal, page 3.82.
8. Remove primary cover. See Primary Drive Cover Removal, page 5.7.
9. Remove clutch assembly. See Clutch Removal, page 5.13.
10. Remove flywheel. See Flywheel Removal, page 5.22.
11. Remove stator cover. See Stator Cover Removal, page 5.21.
12. Remove the starter drive. See Starter Drive Removal, page 6.20.
13. Remove the balance shaft driven gear and drive gear. See Balance Shaft Removal, page 6.18.
14. Remove the drive sprocket. See Drive Sprocket Removal, page 8.39.
15. Remove the oil filter. See Engine Oil & Filter Change, page 2.11Engine Oil & Filter Change, page 2.11.
16. Remove the oil cooler adapter assembly.
17. Remove the shifter shaft assembly. See Shift Shaft Removal.

NOTE

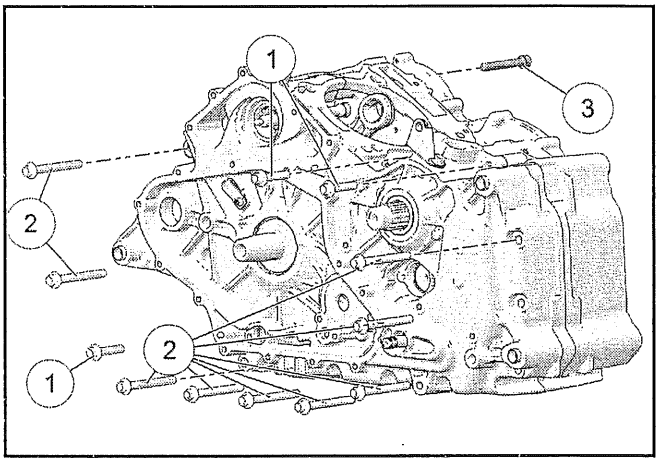
Severe damage to the engine cases and shift shaft assembly may occur if attempting to separate cases with shift shaft installed.

18. Remove the speed sensor. See Speed Sensor Removal.
19. Remove the gear position switch. See Sensors - Powertrain Management, page 4.11.

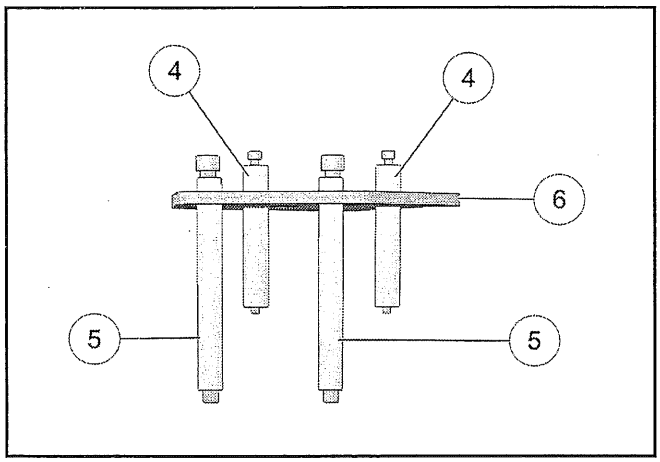
NOTE

Collect the two switch contact pins and springs from the end of the shift drum so they do not get lost.

20. Remove three (Qty 3) M8x1.25x40 engine case bolts ①.

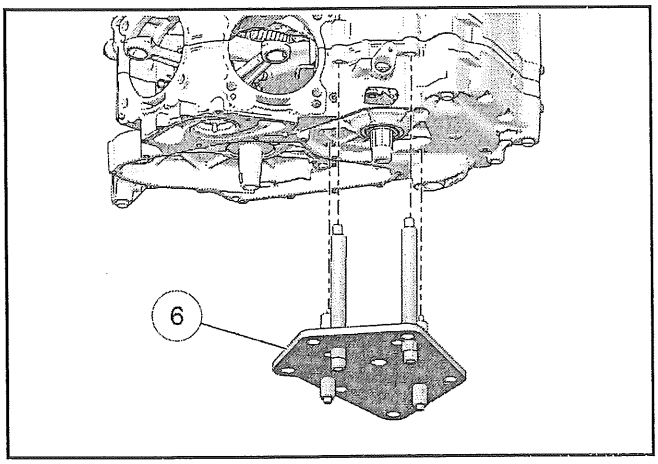


21. Remove nine (Qty 9) M8x1.25x75 engine case bolts ②.
22. Remove one (Qty 1) M8x1.25x60 engine case bolt ③ from primary drive side of engine case.
23. Place the Engine Case Splitting / Assembly tool **PF-51234-A** on a flat surface and assemble the M6 threaded spacers ④ and M12 threaded spacers ⑤ into the main plate ⑥ as shown. **Use only holes marked with the letter B.**

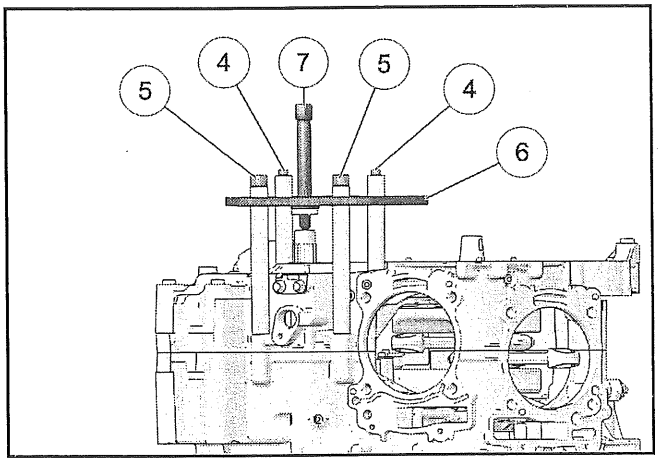


24. Rotate the engine stand so the engine is lying flat with the output shaft pointing UP.

25. Position the main plate assembly ⑥ onto the engine case as shown. Note: The threaded spacers should line up with the corresponding engine case bolt holes.



26. Install the case splitting adapter ⑦ through the center hole in the main plate and thread into nut and washer until 1-2 threads are exposed on the other side.

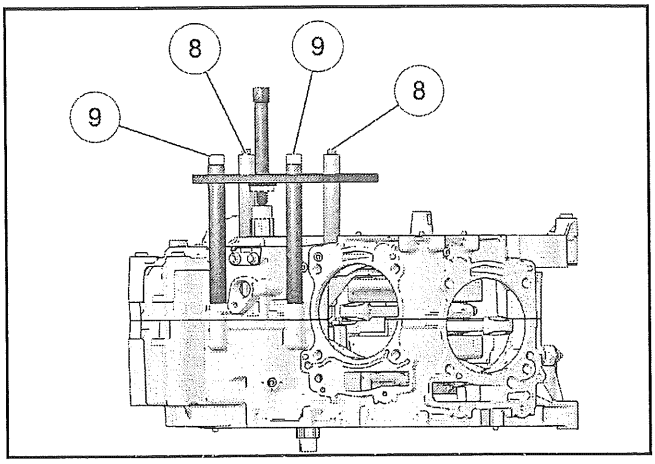


27. **Main plate adjustment: Turn threaded spacers in or out to raise, lower and level the main plate.**

IMPORTANT

- Plate surface should be parallel to the surface of the engine crankcase.
- Plate height is correct when the plate is resting on the washer and the case splitting adapter contacts the transmission output shaft.
- All threaded spacers must be in contact with engine case prior to bolting on the plate assembly.

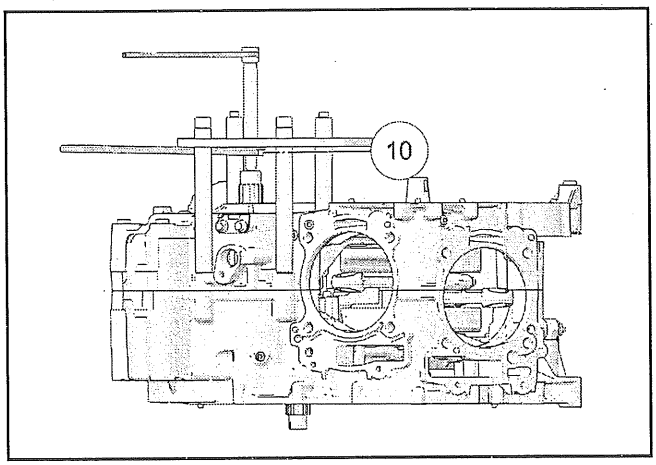
28. Install M6 bolts ⑧ and M12 bolt ⑨ into threaded spacers and torque to specification.



TORQUE

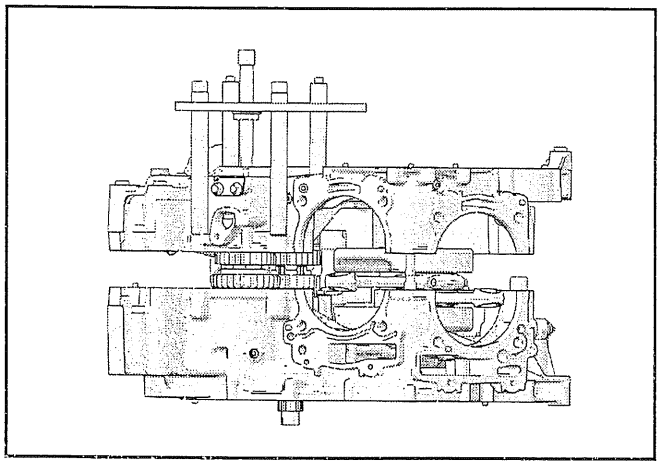
Main Plate Mounting Fasteners (All):
88 in-lbs (10 Nm)

29. Holding nut ⑩ stationary with an open ended wrench, turn the case splitting adapter ⑦ clockwise until the engine cases begin to part. **STOP.**



30. Using a soft-faced mallet, work around the seam of the engine cases tapping lightly to release the sealed bond.

31. Alternately turn the case splitting tool in until resistance is felt, then work around the upper case with a mallet until the cases are completely apart.

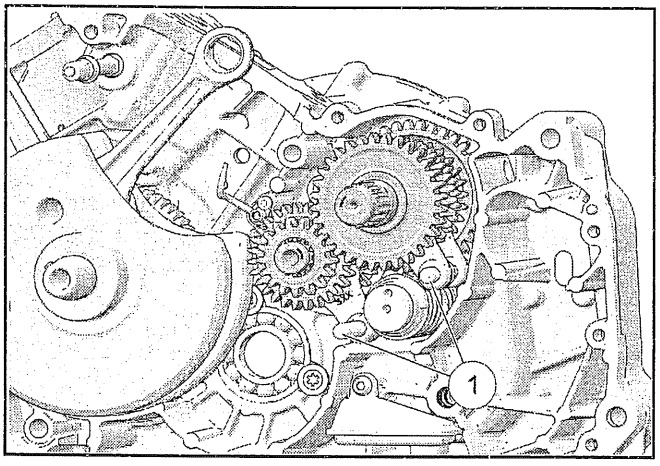


TRANSMISSION REMOVAL

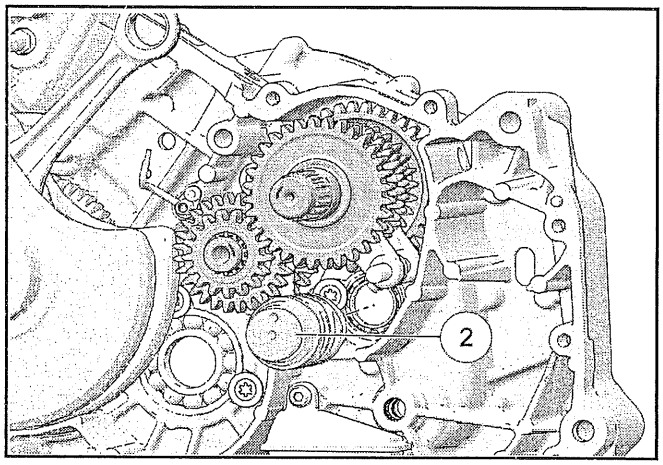
⚠ CAUTION

Gloves should be worn at all times while working on the transmission assembly to avoid personal injury.

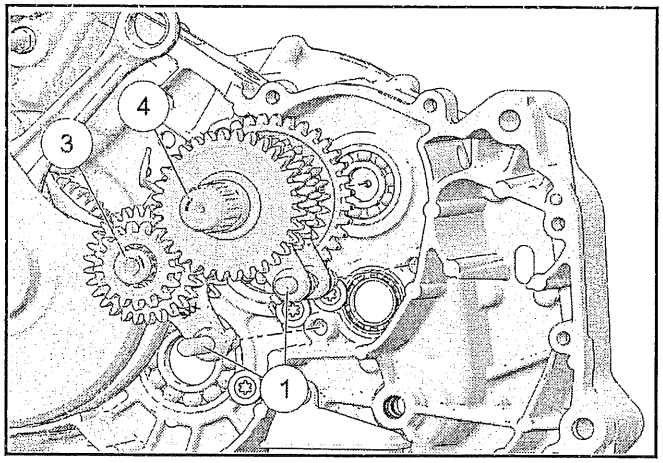
1. Remove the shift ratchet assembly. See Shift Ratchet Removal / Inspection, page 5.9.
2. Separate engine cases. See Crankcase Separation, page 6.22.
3. Lift both of the shift fork rails ① out of the crankcase just enough so the ends clear the crankcase bores. Rotate rails and forks away from the shift drum.



4. Lift the shift drum ② out of the bearing.

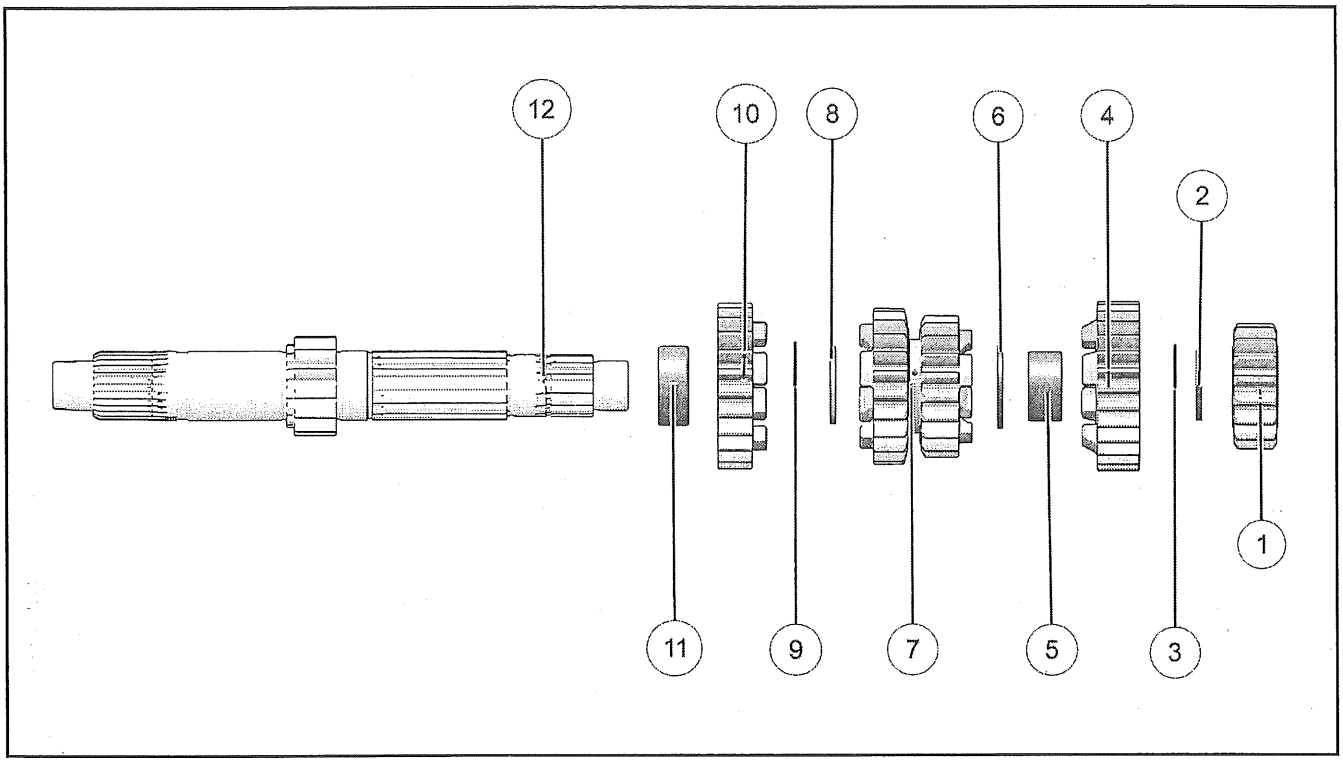


5. **As an assembly**, lift the input shaft ③, output shaft ④, shift forks and shift fork rails ① out of the engine case.



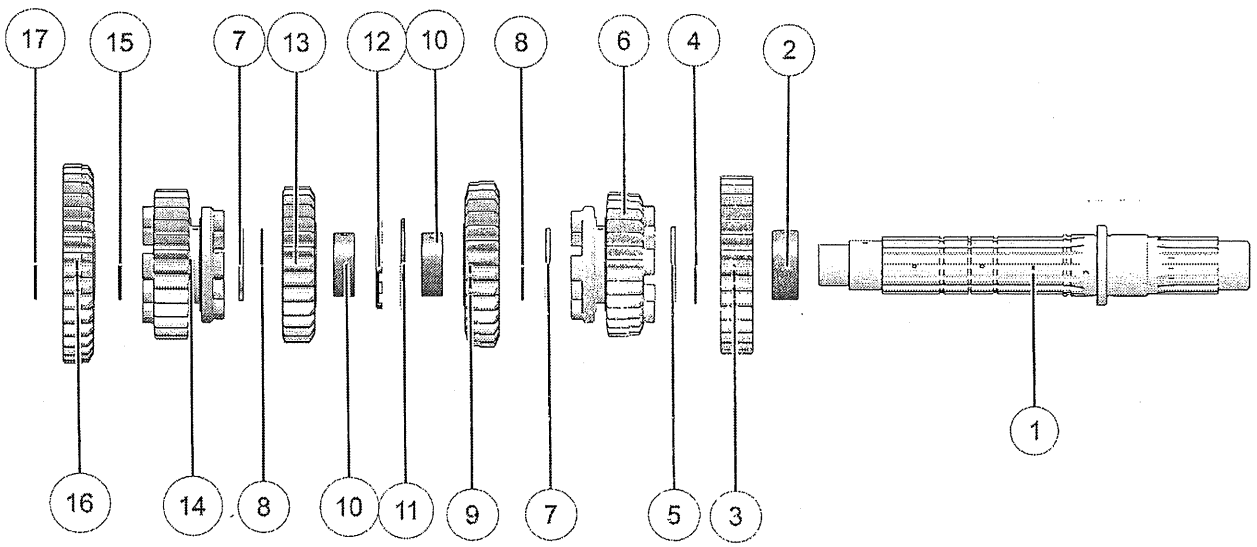
TRANSMISSION INSPECTION

Input Shaft



NUMBER	MEASUREMENT LOCATION	DIAMETER SPECIFICATION
①	Gear, 2nd - Input	-
②	Retaining Ring, External	-
③	Shim - 25 x 34 x 0.5	-
④	Gear, 6th - Input	28.000 - 28.021 mm
⑤	Bushing	I.D. - 25.02 - 25.04 mm / O.D. - 27.96 -27.98 mm
⑥	Shim - 25 x 34 x 2	-
⑦	Gear, 3rd & 4th - Input	-
⑧	Retaining Ring, External	-
⑨	Washer, Flat - 28 x 35	-
⑩	Gear, 5th - Input	-
⑪	Bushing	28.015 - 28.035 mm
⑫	Shaft, Input & 1st Gear	-

Output Shaft



NUMBER	MEASUREMENT LOCATION	DIAMETER SPECIFICATION
①	Shaft, Output	-
②	Bushing	I.D. - 30.02 - 30.04 mm / O.D. - 33.96-33.98 mm
③	Gear, 2nd - Output	34.000 - 34.025 mm
④	Washer, Toothed - 30 x 38	-
⑤	Retaining Ring, External	-
⑥	Gear, 6th, Output	-
⑦	Retaining Ring, External	-
⑧	Washer, Toothed - 28 x 35	-
⑨	Gear, 3rd - Output	31.015 - 31.030 mm
⑩	Bushing, Splined	O.D. - 30.975-31.005 mm
⑪	Washer, Thrust - 15 Tooth	-
⑫	Washer, Lock - 15 Tooth	-
⑬	Gear, 4th - Output	31.015 - 31.030 mm
⑭	Gear, 5th - Output	-
⑮	Washer, Flat - 24 x 35	-
⑯	Gear, 1st - Output	24.015 - 24.0.35 mm
⑰	Washer, Flat	-

NOTE

Refer to the Assembly View section in this chapter for component locations and exploded diagrams. See Transmission 6 Speed , page 6.11.
Refer to the Service Specifications section in this chapter for complete transmission specifications. See Service Specifications, page 6.4.

Shafts

1. Measure outside diameter of shafts and bearing areas for wear and concentricity. Look closely at splines for wear. Inspect ends of shafts for signs of wear:
   - Dull finish
   - Discoloration
   - Rough or uneven surface
   - Measurement outside of specification

   Gears
2. Visually inspect:
   - Gear internal splines
   - Gear teeth
   - Gear dogs for rounding, cracks, chips
   - Gear dog slots for rounding
   - Bearing surfaces
   - Shift fork grooves

   Check each gear for damage, cracks, wear (rounding of dogs or surfaces), or discoloration.

Shift Forks, Shift Fork Rails

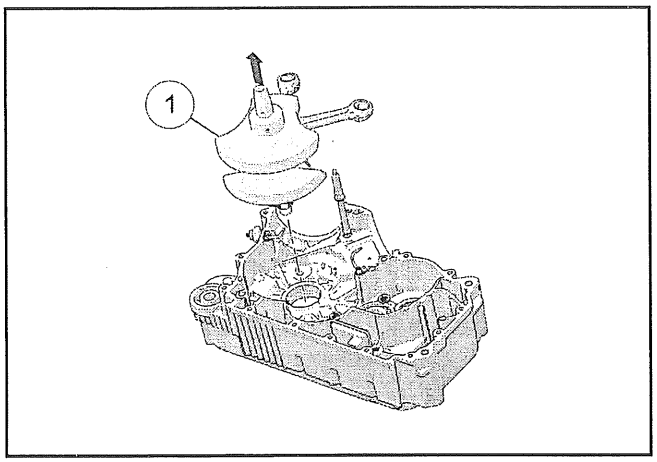
3. Inspect all contact surfaces of each shift fork. Replace a shift fork if any part is discolored (overheated), unusually scored, warped, or worn beyond service limit.
4. Inspect each shift fork pin for wear or damage and compare to specifications.
5. Inspect shift fork rails for wear, scoring, or runout.
6. Measure shift fork rail O.D. for wear in 3 or 4 places along the length. The rail O.D. should be consistent over the entire length.
7. Slide rails into crankcase holes and check for a good snug fit.
8. Visually inspect the shift drum bearing in the left crankcase for wear or damage. The bearing must be fully seated in the case and held in position by the retaining plate. Replace the bearing if it is loose in the bore, or if any side play is detected.
9. Temporarily install shift drum into bearing and rotate, checking for smooth bearing operation.

Shift Drum

10. Inspect shift drum grooves for wear. Pay close attention to corners of grooves where forks change direction.
11. Inspect surface of shift drum star for excessive wear or damage.
12. Inspect right side shift drum bearing.
13. Temporarily install shift drum in right hand case bearing and inspect fit. Spin drum to check for smooth bearing operation.

CRANKSHAFT REMOVAL

1. Separate RH crankcase from LH case. See Crankcase Separation, page 6.22.
2. Lift crankshaft assembly ① straight up until clear of right side engine case.

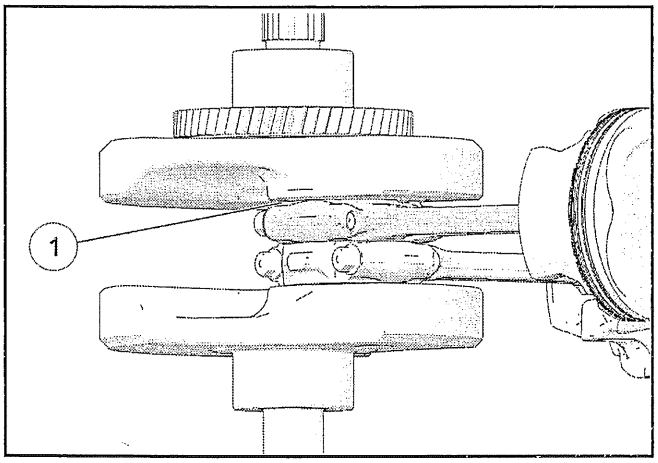


NOTE

Connecting rod bearings and main bearings are easily damaged. Be careful not to cause damage to these parts when servicing items within the crankcase.

CONNECTING ROD SIDE CLEARANCE INSPECTION

1. Move connecting rods to one side of crankshaft. Insert a feeler gauge ① between one connecting rod and the crankshaft. Compare measurement to specification outlined in this chapter. See Service Specifications, page 6.4.



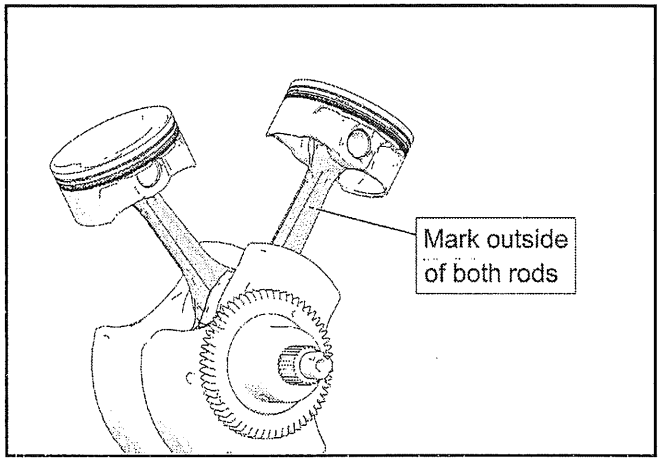
2. If clearance recorded exceeds service limit, the crankshaft, connecting rod or both must be inspected and worn parts replaced. See Crankshaft Inspection, page 6.34.

CONNECTING ROD REMOVAL / IDENTIFICATION

NOTE

The connecting rod caps are marked with paint from the factory, however it is recommended that an additional reference mark be added for clarity. **Caps are matched to rods and MUST be installed with the proper orientation left to right and front to back.** DO NOT strike or stamp the connecting rod.

1. Use a permanent marker to mark orientation of connecting rods and rod bearing caps. **These parts MUST be installed in their original locations.** EXAMPLE: Right connecting rod must be assembled on the right side with the bearing cap that was removed from it. The bearing cap and connecting rod must be assembled in the same direction as it was removed using the **same bolt.**
2. Mark the outside of both connecting rods prior to removal so they can be assembled in the same direction in relation to the crankshaft.



3. Remove connecting rod bolts and connecting rod bearing caps.

NOTE

It may be necessary to lightly tap the caps with a plastic mallet to loosen them.

CAUTION

The mating surface of connecting rod and cap is rough in appearance, which is a normal condition due to the manufacturing process. If rod caps are installed *incorrectly* and tightened, the precision mating surfaces will be damaged. Replace the connecting rod assembly if mating surfaces are damaged.

CONNECTING ROD INSPECTION (BIG END)

IMPORTANT

Connecting rod bolts can only be reused three times. Failure to replace bolts after completing three torque sequences may result in severe engine damage. Each time a bolt has been torqued to specification, it should be marked with a center punch.

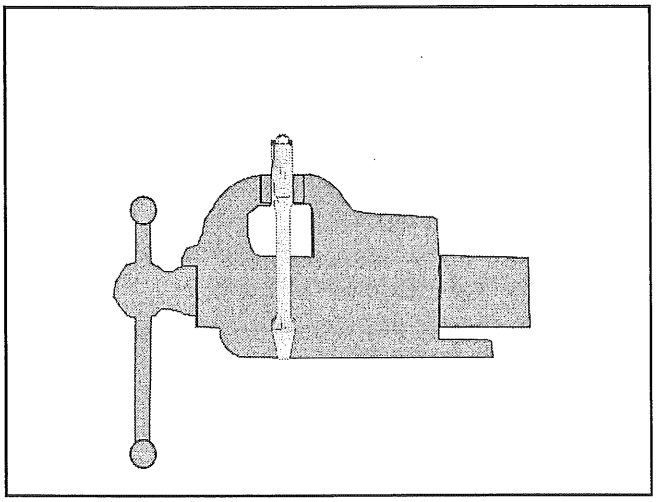
EXAMPLE:

- 1st Torque: Manufacturer installation of connecting rod bolts.
- 2nd Torque: Torque for inspection per this procedure.
- 3rd Torque: Reinstallation following inspection. **Discard bolts the next time they are removed.**

1. Refer to Piston Pin / Pin Bore Inspection, page 3.86 for connecting rod small end inspection.

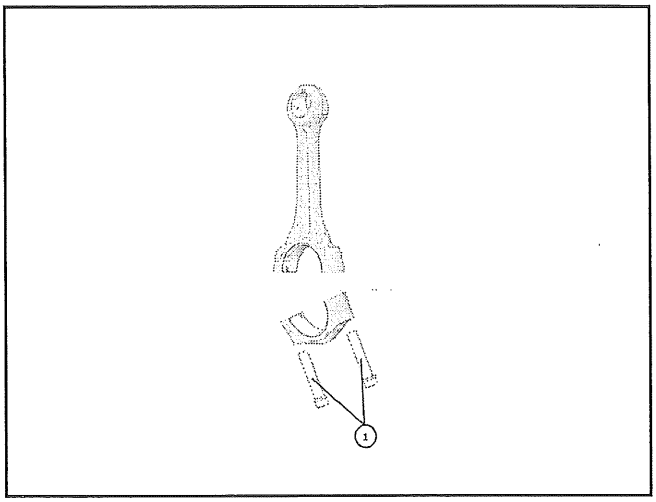
CAUTION

Be sure to match connecting rod caps with their respective rod and orient the cap properly before installing the cap. Secure the big end of rods in a vise equipped with soft, protective jaws before torquing rod bolts.



2. Remove bearings and install caps on connecting rods. Be sure mating surfaces ① of rod and cap are clean.

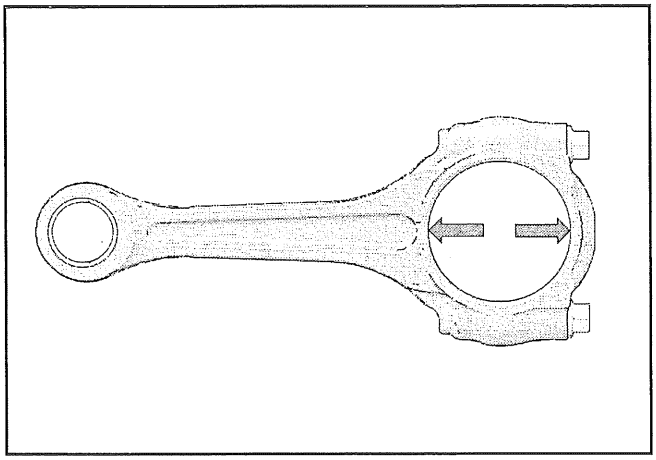
3. Apply engine oil to threads of rod bolts. Torque bolts to specification.



TORQUE

Connecting Rod Fasteners:
STEP 1: Tighten both fasteners to 22 ft-lbs (30 Nm)
STEP 2: Tighten both fasteners an additional 90°

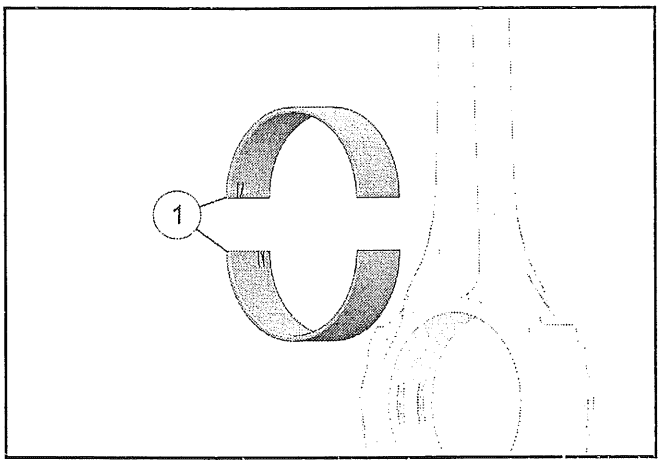
4. Measure I. D. of connecting rod big end for size and out of round and compare to specification. See Service Specifications, page 6.4.



5. Visually inspect connecting rod upper and lower ends for scoring, damage, or excessive wear.

CONNECTING ROD BEARING INSPECTION

1. Inspect bearing inserts ① for unusual wear, peeling, scoring, damage etc. Replace as a set if damage is noted. Inspect bearing clearance and refer to Bearing Selection Chart. See Connecting Rod Bearing Selection, page 6.31.

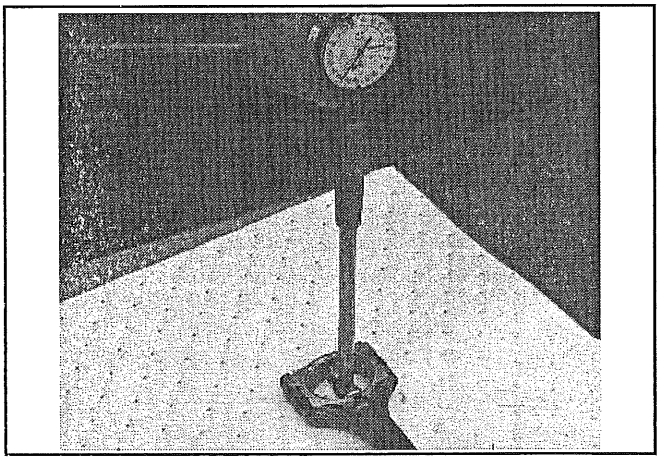


CONNECTING ROD BEARING CLEARANCE INSPECTION

1. Assemble the connecting rod cap with bearings and torque to specification.

TORQUE
Connecting Rod Fasteners: **STEP 1: Tighten both fasteners to 22 ft-lbs (30 Nm)** **STEP 2: Tighten both fasteners an additional 90°**

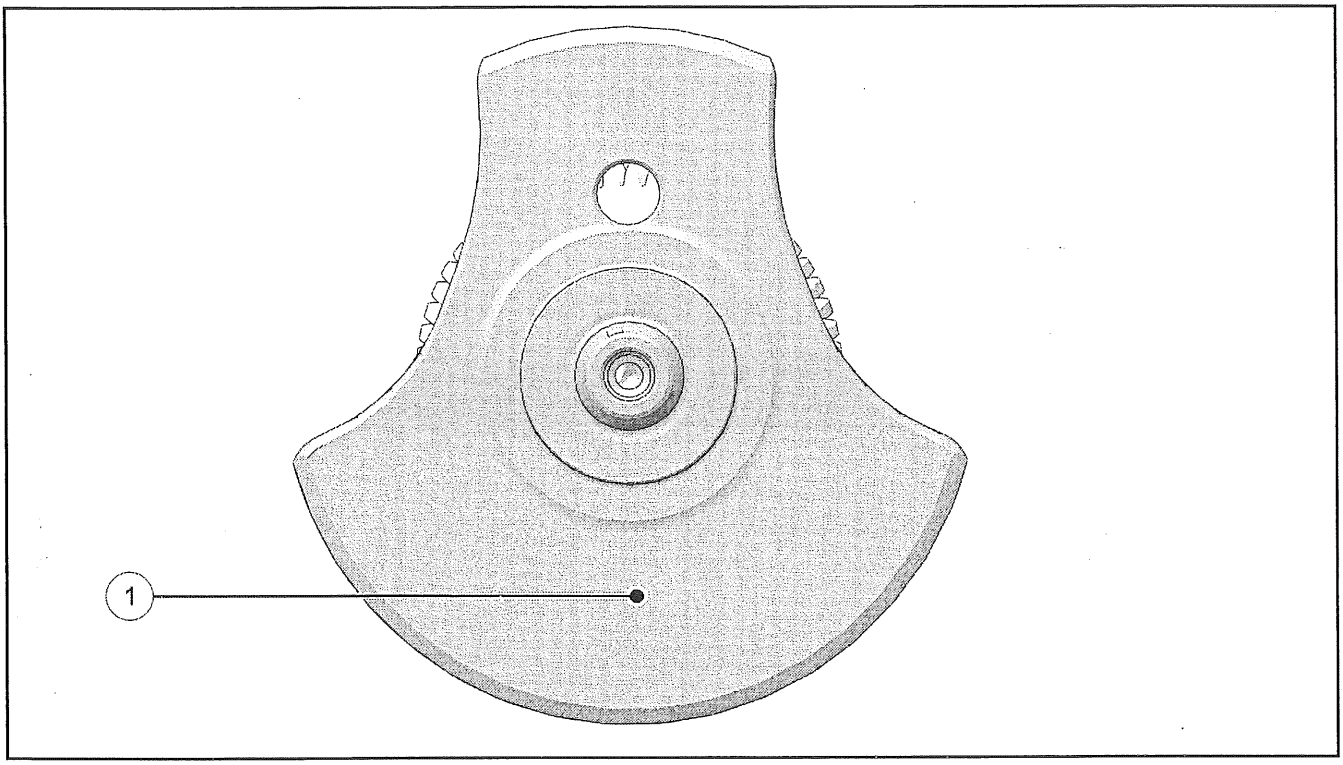
2. Measure the connecting rod big end bearing I.D. with a dial bore gauge and record.



3. Measure the connecting rod journal on crankshaft and record.
4. Subtract the journal diameter from the connecting rod bearing diameter to calculate oil clearance and compare to specification. See Service Specifications, page 6.4.
5. If service limits are exceeded, install new rod bearings and recheck oil clearance.
6. If service limits are still exceeded, determine if crankshaft or connecting rods need to be replaced.

CONNECTING ROD BEARING SELECTION

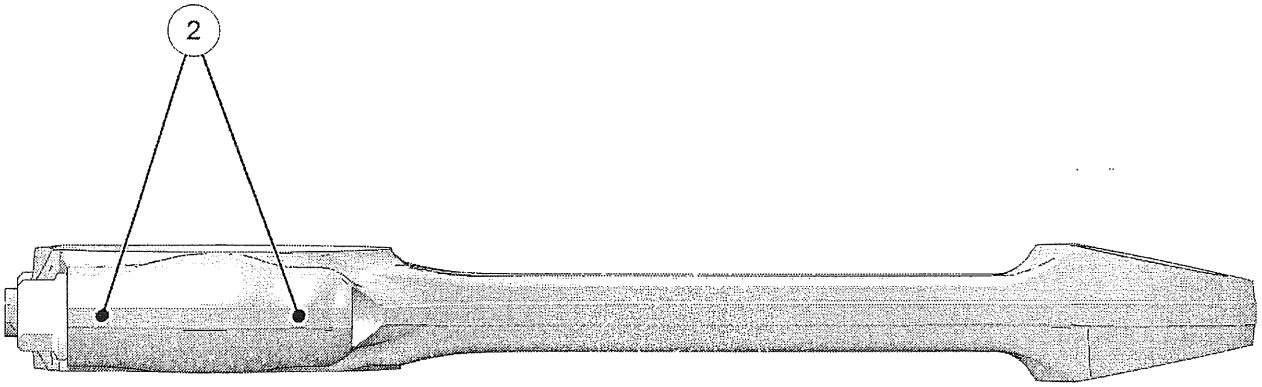
1. Two different dimension crankshafts were used. Identify the crankshaft by part number and use the corresponding chart for bearing selection.



① reads:
"R" or "W"
Date Code
Part Number
Engineering Data

2. There are 3 sizes of connecting rod bearings available: Black, Orange and Blue (see chart below).
3. To determine which bearing to use, look at the color code on the left crankshaft counterweight "R" for Red or "W" for White. The letter will be etched onto the outer surface of the counterweight.

4. The color code on the connecting rod is laser etched onto the big end side of the connecting rod. There will be an "R" for Red or "W" for White.



② reads:
Last Digit
"W" = WHITE
"R" = RED
Example: 12345W

5. Refer to the chart below to select the proper bearing insert.

   FOR EXAMPLE: If the CONNECTING ROD grade is RED and the CRANKSHAFT stamp is W (white) (or not stamped), use BLACK bearing inserts.

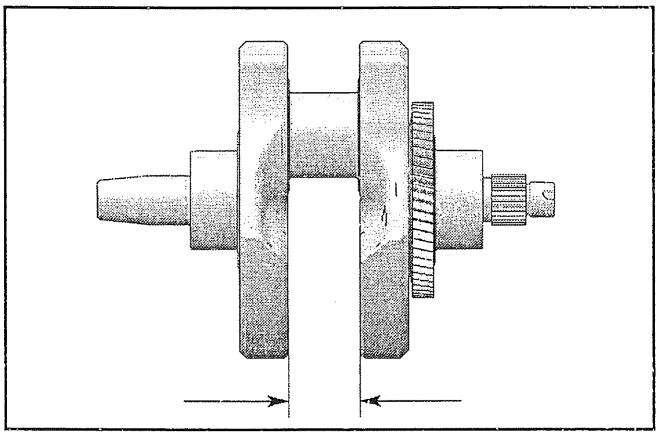
CONNECTING ROD BEARING SELECTION CHART FOR CRANKSHAFT PN 1204692			
Connecting Rod Color	**Crankshaft Color**	**Bearing Color** (P/N 3514804-**XXX**)	**Bearing Thickness**
WHITE Paint Mark ("W" Stamp)	RED ("R" Stamp)	Blue (**- 027**)	1.409 - 1.415 mm
WHITE Paint Mark ("W" Stamp)	WHITE ("W" Stamp or not marked)	Blue (**- 027**)	
RED Paint Mark ("R" Stamp)	RED ("R" Stamp)	Blue (**- 027**)	
RED Paint Mark ("R" Stamp)	WHITE ("W" Stamp or not marked)	Orange (**- 159**)	1.413 - 1.419 mm

CONNECTING ROD BEARING SELECTION CHART FOR CRANKSHAFT PN 1205267			
Connecting Rod Color	**Crankshaft Color**	**Bearing Color** (P/N 3514804-**XXX**)	**Bearing Thickness**
WHITE Paint Mark ("W" Stamp)	RED ("R" Stamp)	Blue (**- 027**)	1.409 - 1.415 mm
WHITE Paint Mark ("W" Stamp)	WHITE ("W" Stamp or not marked)	Orange (**- 159**)	1.413 - 1.419 mm
RED Paint Mark ("R" Stamp)	RED ("R" Stamp)	Orange (**- 159**)	
RED Paint Mark ("R" Stamp)	WHITE ("W" Stamp or not marked)	Black (Std)(**- 067**)	1.417 - 1.423 mm

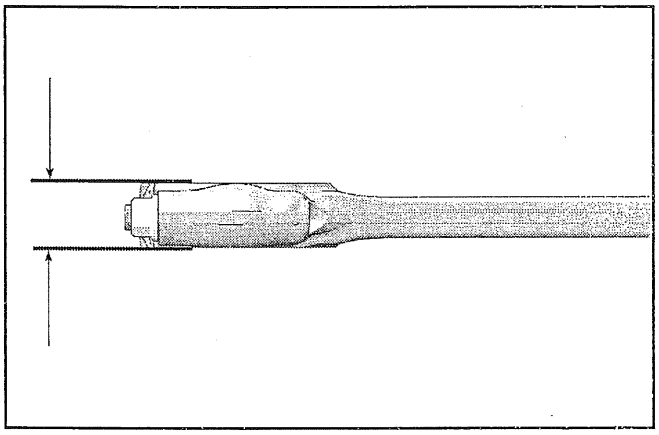
CRANKSHAFT INSPECTION

Record all measurements and compare to specifications. Replace crankshaft if any measurement is worn beyond the service limit. See Service Specifications, page 6.4.

1. Measure the width of the rod bearing journal.



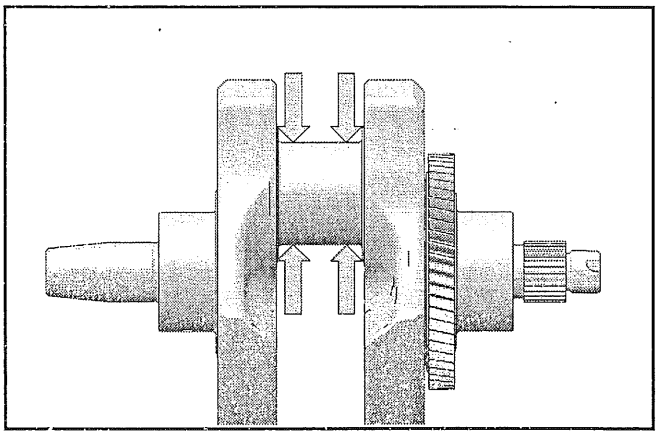
2. Measure width of connecting rods at big end.



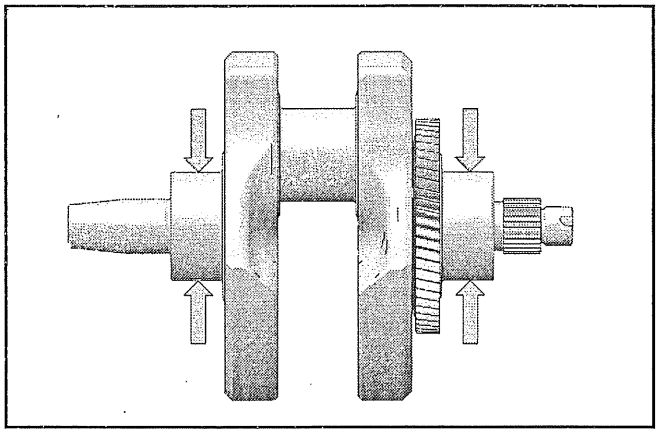
3. Visually inspect all bearing journals for scoring, damage or excessive wear.

4. Crankshaft and connecting rods are identified by color. Be sure to compare measurements to specifications for the proper color (or non-marked) connecting rod or crankshaft.

   Measure O. D. of crankshaft rod journal in four places and compare to specifications.



5. Measure O.D. of main bearing journals.



CONNECTING ROD INSTALLATION

1. Make sure proper bearing clearance is achieved by using the correct colored bearing insert for a given color combination of connecting rod and crankshaft.
2. Clean all oil off connecting rod, connecting rod cap and bearing inserts.
3. Install bearing inserts into connecting rods and caps. First, install bearing tab into groove, then press the rest of the bearing into place.

NOTE

Procedure during disassembly called for marking of connecting rods and caps. Ensure that each part is installed in original location including rod cap bolts.

4. Apply assembly lube to connecting rod bearings and crank pin.
5. Install rods and caps onto the crankshaft, observing the paint mark on the connecting rods. **The paint mark must face away from the center of the crankshaft.** Be sure the identifier marks made previously are aligned.
6. Tighten rod fasteners:

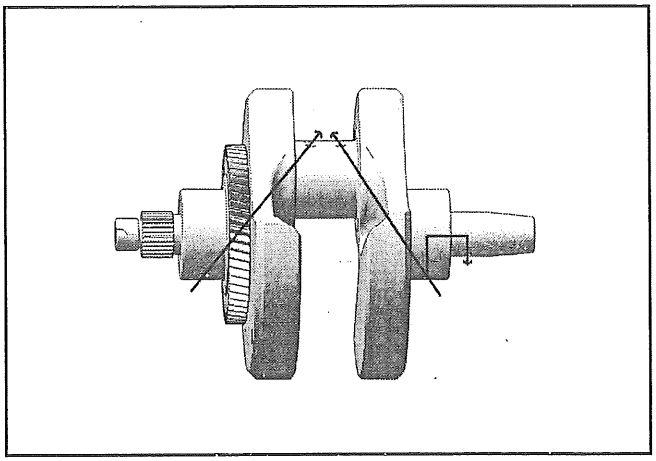
TORQUE

Connecting Rod Fasteners:
STEP 1: Tighten both fasteners to 22 ft-lbs (30 Nm)
STEP 2: Tighten both fasteners an additional 90°

7. Check that the connecting rods rotate smoothly and freely on crankshaft journal.

CRANKSHAFT CLEANING

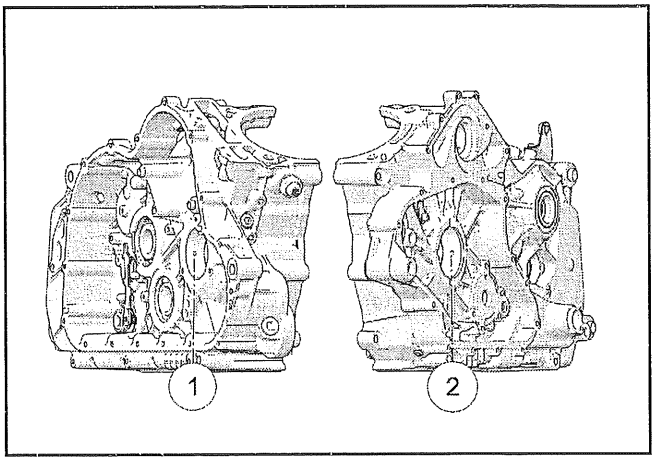
1. Pass cleaning solvent through the oil passages to ensure that passages are clear.



2. After cleaning passages, verify crankshaft journals and oil passage openings are free of debris.

MAIN BEARING INSPECTION

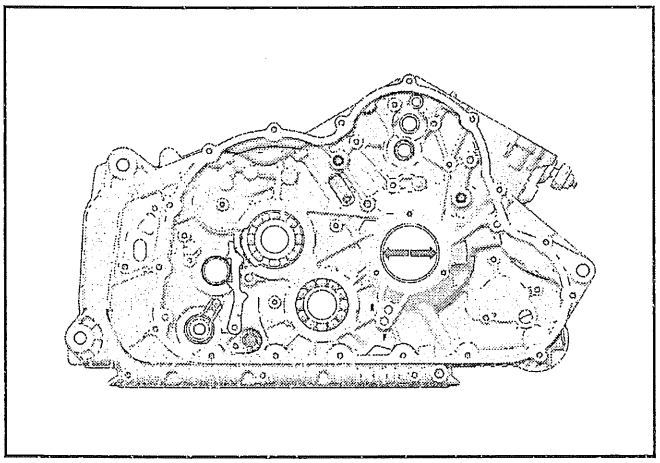
1. Inspect crankcase main bearing surfaces for wear, peeling, scoring, or damage.
2. Inspect alignment of bearing lubrication hole in right crankcase half ① and left case half ②. Holes must be aligned with their respective oil passage in crankcase.



6

MAIN BEARING OIL CLEARANCE INSPECTION

1. Measure main bearing I.D. and concentricity with a dial bore gauge for right and left side. Compare to specification. Subtract crankshaft main journal diameter from main bearing diameter to calculate oil clearance. See Service Specifications, page 6.4.



2. If crankshaft dimensions are within tolerances and oil clearances are incorrect, the crankcase set must be replaced.

NOTE

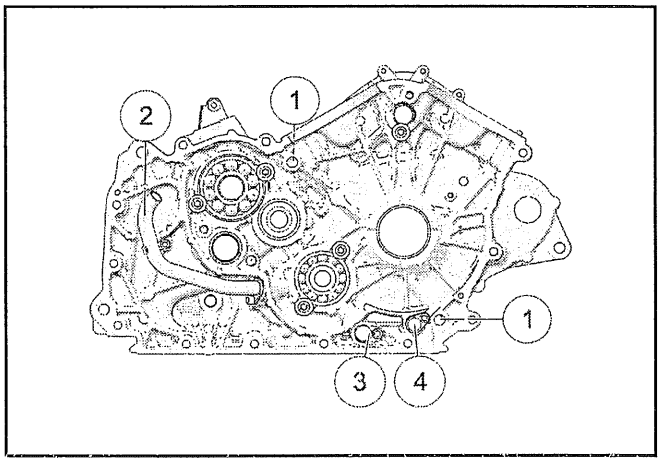
Replace crankcase halves as a set.

LEFT CRANKCASE ASSEMBLY

Prepare LEFT crankcase for assembly:

Refer to crankcase assembly view for locations and torque values. See Crankcase Components, page 6.7.

1. Clean crankcase and oil passages ① thoroughly. Rinse and dry with compressed air.



2. Install new ball bearings in crankcase as required.
   - Apply a film of lithium grease to outer race of bearings to prevent galling upon installation
   - Press on outer race of bearings using an arbor press and a suitable arbor that is slightly smaller than bearing outside diameter
   - DO NOT press on inner race of ball bearings
3. Install bearing retainers as required and torque to specification.
4. Install the scavenge return tube ② with a new o-ring.
5. Install rear scavenge oil inlet screen assembly ③ with a new o-ring. See Lubrication System, page 3.21.
6. Install front scavenge oil inlet screen assembly ④ with a new o-ring .

TORQUE

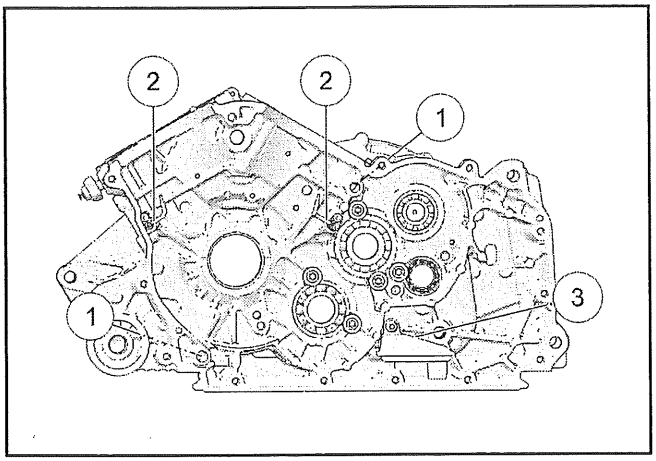
Scavenge Inlet Tube Fastener:
88 in-lbs (10 Nm)

RIGHT CRANKCASE ASSEMBLY

Prepare RIGHT crankcase for assembly:

Refer to crankcase assembly view for locations and torque specification. See Crankcase Components, page 6.7.

1. Clean crankcase oil passages ① thoroughly. Rinse and dry with compressed air.



2. Install new bearings in crankcase as required.

- Apply a film of lithium grease to outer race of bearings to prevent galling upon installation.
- Press on outer race of bearings using an arbor press and a suitable arbor that is slightly smaller than bearing outside diameter.
- DO NOT press on inner race of ball bearings.

3. Install bearing retainers as required and torque to specification.

TORQUE
Bearing Retainer Fastener: **88 in-lbs (10 Nm)**

4. Install piston cooling jets ② with a new o-ring and torque to specification.

TORQUE
Piston Cooling Jet Fastener: **62 in-lbs (7 Nm)**

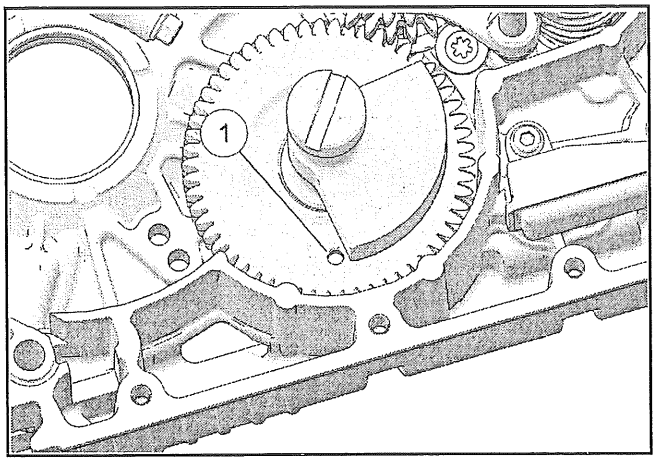
5. Install pressure lubrication pump oil pickup screen ③ with a new o-ring and torque fastener to specification.

TORQUE
Oil Pump Pickup Screen Fastener: **88 in-lbs (10 Nm)**

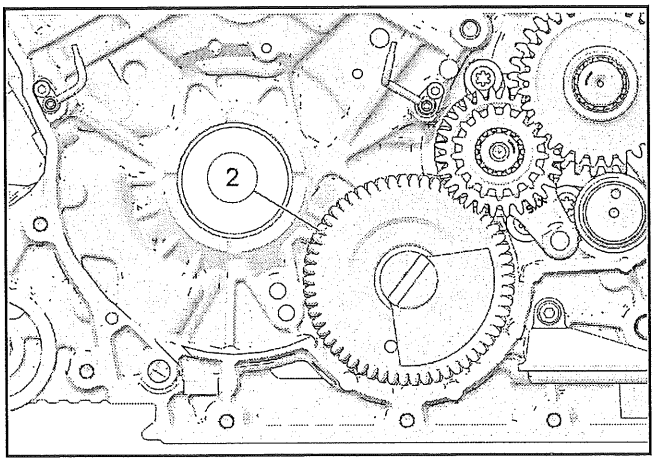
CRANKSHAFT INSTALLATION

NOTE
Install left engine case onto an engine stand.

1. Insert a punch or other suitable object into the opening ① to align the balance shaft split gear teeth.

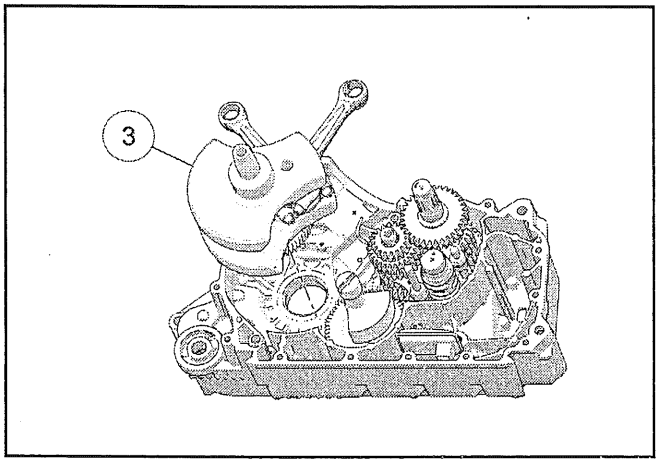


2. Rotate the balance shaft so the timing marks ② are facing the main bearing bore.

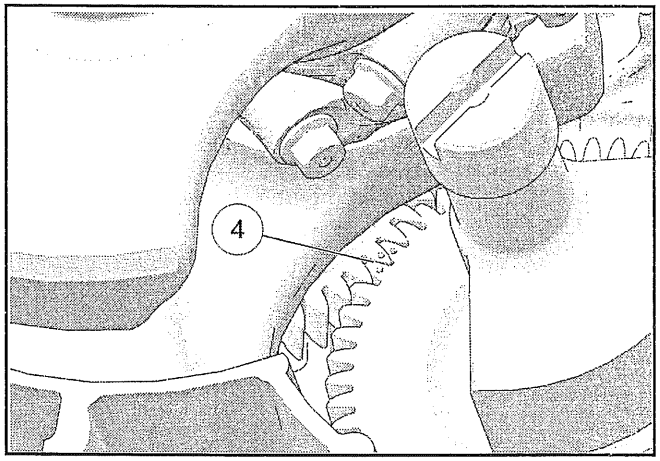


3. Apply assembly paste to main bearings.
4. Hold crankshaft over right crankcase and position rods so that left side rod is in cutout for rear cylinder and right side rod is in cutout for the front cylinder.

5. Place crankshaft ③ into right crankcase half.



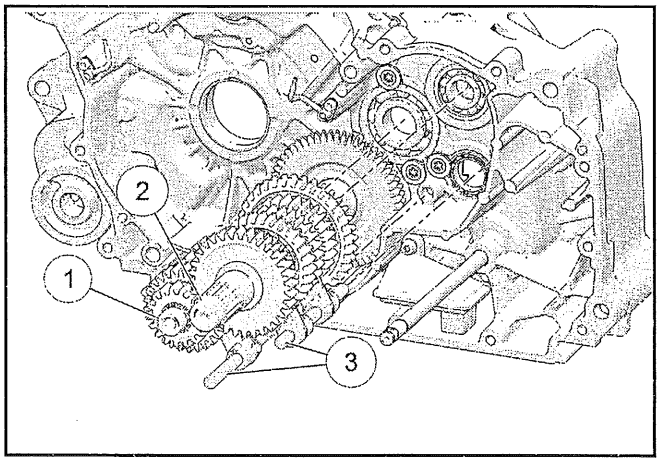
6. Align crankshaft and balance shaft timing marks ④.



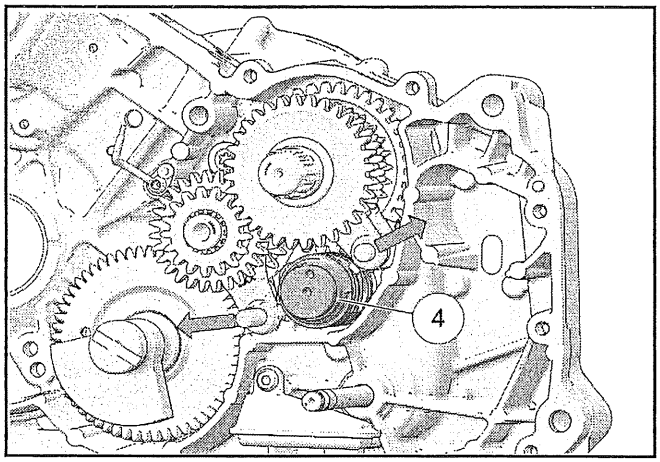
7. Remove the split alignment tool installed as part of step 1.

TRANSMISSION INSTALLATION

1. Install balance shaft if previously removed. See Balance Shaft Installation, page 6.18.
2. If transmission shaft bearings were replaced, be sure all bearing retainer plate screws are installed and tightened to specification. See Crankcase Components, page 6.7.
3. Working on a flat surface, assemble the input shaft ① and output shaft ② so the gears are properly meshed.



4. Install shift rails ③ into shift forks and assemble to input and output shafts.
5. Lubricate parts with engine oil. Apply assembly lube to ends of transmission shafts.
6. Install input shaft ① and output shaft ②, shift forks and rails ③ into the right crankcase. Verify both shafts are fully seated and rotate freely.
7. Rotate shift rails away from shift drum bore and install shift drum ④.

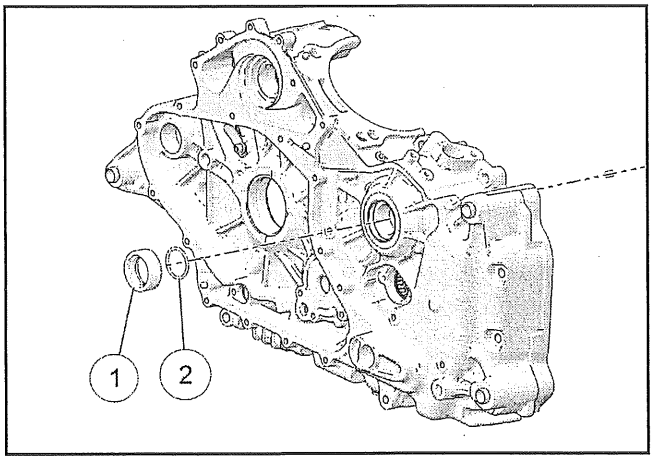


8. Rotate shift drum to align proper grooves with forks.
9. Move shift fork pins into drum grooves and seat rails.

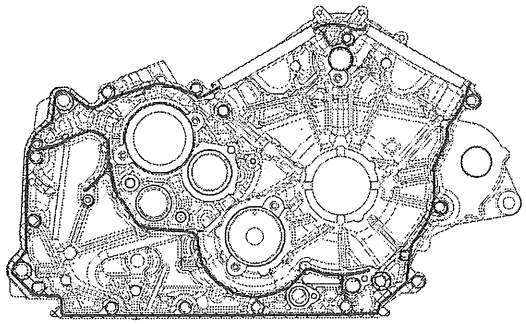
10. Install crankshaft. See Crankshaft Installation, page 6.37.
11. Assemble crankcase. See Crankcase Assembly, page 6.39.

CRANKCASE ASSEMBLY

1. Clean crankcase mating surfaces to remove all grease, oil, and old sealant.
2. Check to be sure all shafts are seated properly (crankshaft, balance shaft, shift drum, shift forks, input shaft, output shaft).
3. Check to be sure that alignment dowel pins and oil pipes, etc. are in place.
4. Remove the drive sprocket spacer ① and o-ring ② from the LH crankcase prior to installation.



5. Apply a light even bead of Loctite™ Ultra Black 598 to entire case sealing surface.



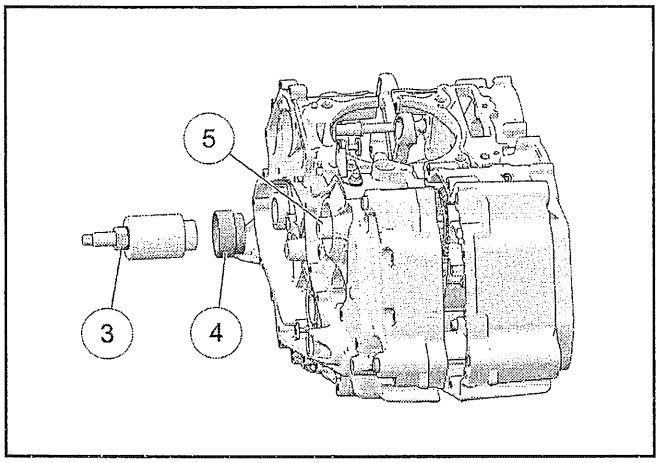
CRANKCASE SPLITLINE SEALANT PATH

6. Spread sealant into a thin even layer on entire case mating surface. Be sure all areas are covered.

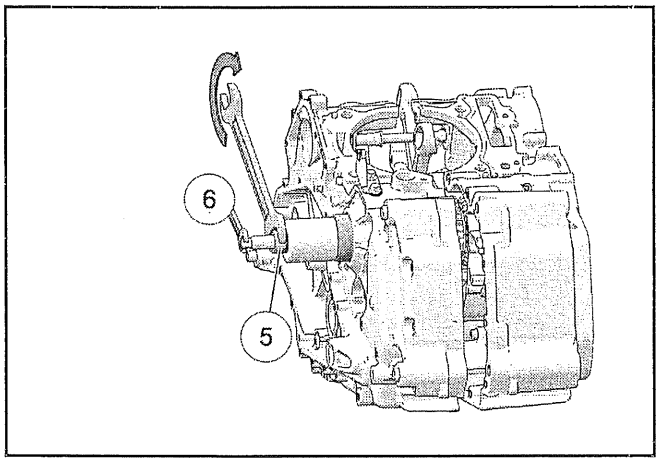
IMPORTANT

DO NOT ALLOW SEALANT TO DRY. CONTINUE ASSEMBLY UNTIL CASES ARE SEALED AND ALL BOLTS ARE TIGHT.

7. Lower the LH case onto the RH case and install mainshaft / crankcase installer PV-45030 ③ and engine case assembly cup PF-51663 ④ onto the transmission output shaft.



8. Pull crankcase together by tightening nut ⑤ and holding tool ⑥ tapping on crankcase with a soft mallet.



NOTE

The cases will mate before the output shaft is drawn fully into bearing.

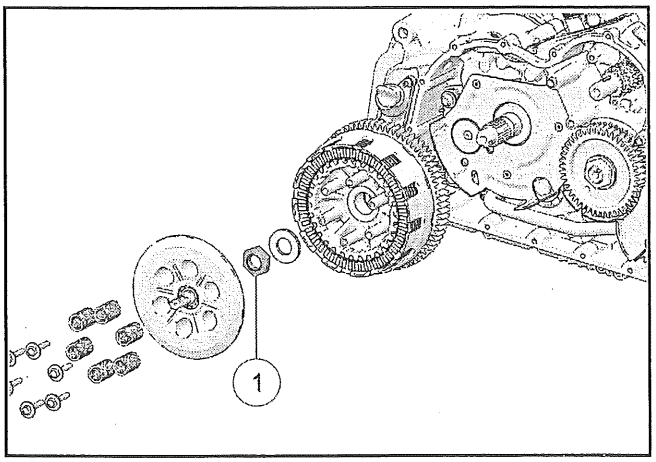
IMPORTANT

Continue to turn nut and tap case until sealant squeezes out along the entire perimeter and resistance is felt when turning nut.

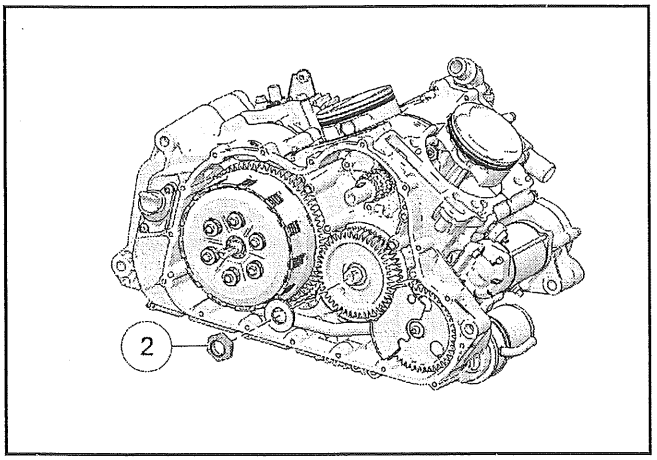
9. Remove the tools from the output shaft.
10. Install crankcase bolts and torque to specification. See Crankcase Bolt Length and Torque Pattern, page .
11. Install a new output seal in LH crankcase using seal installer **PF-51243**.
12. Install the o-ring and drive sprocket spacer removed in STEP 4 with tapered edge toward the o-ring.
13. Install the gear position switch. See Sensors - Powertrain Management, page 4.11.
14. Install the drive sprocket. See Drive Sprocket Installation, page 8.42.
15. Install the balance shaft driven gear and drive gear. See Balance Shaft Installation, page 6.18.
16. Install the scavenge oil pump. SeeScavenge Oil Pump Installation, page 3.27
17. Install the pressure lubrication oil pump. SeePressure Oil Pump Installation , page 3.28
18. Install the starter drive. See Starter Drive Installation, page 6.21.
19. Install the cam chains. See Cam Chain Installation, page 3.53.
20. Install the flywheel. See Flywheel Installation, page 5.23.
21. Install the clutch assembly. See Clutch Installation, page 5.19.
22. Install cylinders. See Cylinder Installation, page 3.88.
23. Install cylinder heads. See Cylinder Head Installation, page 3.72.
24. Install the primary cover. See Primary Drive Cover Installation, page 5.7.
25. Install the stator cover. SeeStator Cover Installation, page 5.21
26. Install engine in frame. See Engine Installation, page 3.12.

STAKE NUT INSTALLATION

- A stake nut is located on the clutch side of the transmission input shaft ①.



- Another stake nut is located on the crankshaft drive gear end ②.



- It is important that they are torqued and staked correctly for proper function

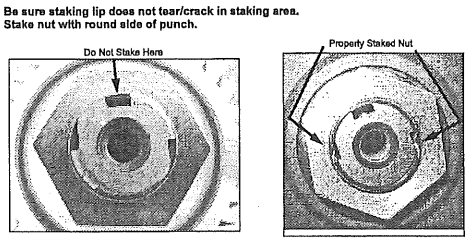
IMPORTANT
Do not reuse or reinstall any previously used stake nut. A new stake nut needs to be installed every time the nut is removed or loosened.

Use the following procedure to install the stake nuts correctly:

1. Clean threads on shaft so there is no oil or contaminants.
2. Thread NEW stake nut onto shaft finger tight.
3. Torque stake nut to specification.

TORQUE
Stake Nut: **125 ft-lbs (170 Nm)**

4. Stake the stake nut as shown below using round side of punch. Do not crack or tear staking lip. Do not use a sharp chisel to stake the nut.



6

TROUBLESHOOTING
TROUBLESHOOTING TRANSMISSION / CRANKSHAFT

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
Transmission Will Not Shift	Broken Shift Cam	Shift Cam	Replace shift cam
	Bent Shift Forks	Shift Fork	Replace shift fork(s)
	Worn Gearshift Pawl	Shift Cam	Replace shift cam
	Broken Gears	Transmission Gears	Replace necessary parts
	Damaged/Broken Bearings	Transmission, Shift Cam Bearings	Replace necessary parts
	Worn Gear Shift Ratchet Mechanism	Shifter Ratchet	Refer to Clutch / Primary / Shift Chapter
	Broken or out-of-place spring on shift ratchet	Shift Ratchet Spring	Refer to Clutch / Primary / Shift Chapter
	Shift Detent Ratchet Stuck	Shift Ratchet	Repair as necessary
	Seized Pivot Point, Bent External Shift Linkage	External Shift Linkage	Repair as necessary
	Bent or Distorted Shift Fork Rails	Shift Fork Rails	Replace Shift Fork Rails
	Debris From Broken Parts Locking Transmission	Transmission Components	Repair as necessary
Excessive Noise Related to Bottom End of Engine	Worn Main Bearings	Crankshaft and/or Crankshaft Bearings	Repair as necessary
	Worn Connecting Rod Bearings	Connecting Rod Bearings and/or Connecting Rod and/or Rod Bearings	Repair as necessary
	Worn Connecting Rod Small End Bushing	Connecting Rod, Connecting Rod Bushing, Piston Pin, Piston	Repair as necessary
	Worn, seized, chipped or broken gear teeth	Transmission Gears	Repair as necessary
	Worn, seized, chipped or broken Transmission Bearings	Transmission Bearings	Repair as necessary
	Originates from Primary Cover	Clutch, Oil Pump Drive	Repair as necessary
	Oil Pump	Oil Pump, Oil Pump Drive	Refer to Engine / Cooling / Exhaust Chapter (Lubrication / Cooling)
	Cam Drive	Cam Chain, Cam Sprocket	Refer to Engine / Cooling / Exhaust Chapter (Cylinder Head / Valves)

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
Transmission Hard to Shift	Improper Clutch Operation	Clutch	Refer to Clutch / Primary / Shift Chapter
	Incorrect Oil Viscosity	Engine oil and filter	Refer to Maintenance Chapter
	Incorrect Clutch Adjustment	Clutch Adjustment	Refer to Clutch / Primary / Shift Chapter
	Bent, Rubbing, Sticky, Broken Shift Shaft	Shifter Ratchet Assembly	Refer to Clutch / Primary / Shift Chapter
	Sticking Pivot Point, Bent External Shift Linkage	External Shift Linkage	Repair or replace components as necessary
	Bent or Distorted Shift Forks	Shift Forks	Replace bent shift fork
	Damaged Shift Drum Grooves	Shift Drum	Replace damaged shift drum
	Shift Ratchet Bent / Stuck	Shift Ratchet	Repair as necessary
	Bent or Distorted Shift Fork Rails	Shift Fork Rails	Replace Shift Fork Rails
Transmission Jumps Out of Gear	Broken Shift Stop Pin	Shift Stop Pin	Replace stop pin
	Worn Shift Drum Pawls or Shifter Ratchet	Shift Drum or Shift Linkage	Replace damaged shift drum or shifter ratchet
	Broken Shift Ratchet Spring	Shift Ratchet Spring	Replace spring
	Damaged Shift Drum Grooves	Shift Drum	Replace shift drum
	Bent, Worn, Distorted Shift Forks	Shift Forks	Replace shift forks
	Bent or Distorted Shift Fork Rails	Shift Fork Rails	Replace shift fork rails
	Worn Engagement Dogs on Transmission Gears	Transmission Gears	Replace necessary parts

NOTES

CHAPTER 7
FRAME / BODY

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SPECIAL TOOLS 7.2
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FENDER COMPONENTS 7.3
FRAME COMPONENTS 7.4
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FOOT PEGS PASSENGER REMOVAL / INSTALLATION 7.7
SEAT REMOVAL / INSTALLATION 7.8
FRONT FENDER REMOVAL 7.9
FRONT FENDER INSTALLATION 7.9
REAR FENDER REMOVAL 7.10
REAR FENDER INSTALLATION 7.10
INSTRUMENT PANEL REMOVAL / INSTALLATION 7.11
IGNITION COVER REMOVAL / INSTALLATION 7.11
THERMOSTAT COVER REMOVAL / INSTALLATION 7.11
FRAME REMOVAL / INSTALLATION 7.12

GENERAL INFORMATION

SERVICE NOTES

This section covers the removal and installation of frame and body components, assemblies and systems. Pay close attention to assembly procedures and torque specifications.

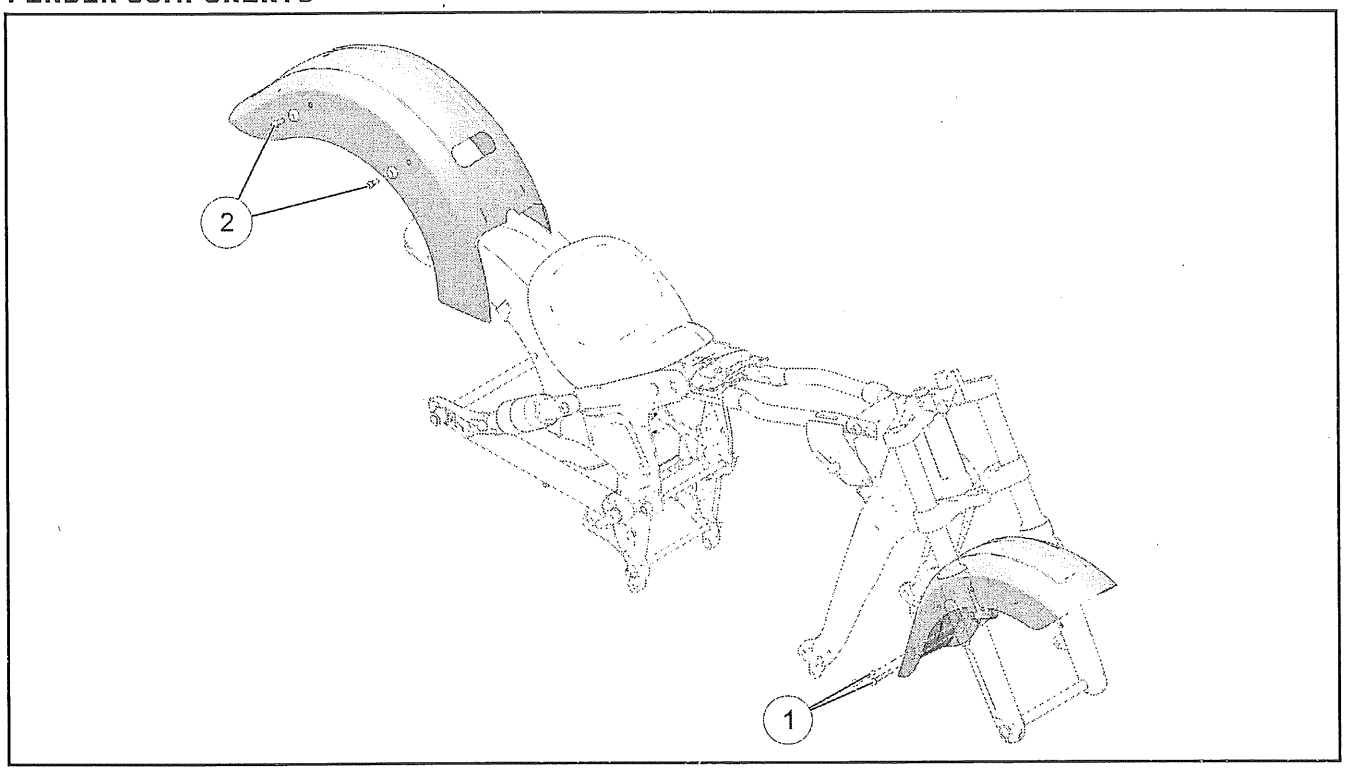
Cables, hoses and tie straps that have been removed during disassembly must be replaced per factory standards during assembly. Caution should be used when tightening body panels. Any deformation on the panel around the fastener is an indication that the fastener is too tight. Do not over tighten body components in order to avoid damage.

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
PV-49955	Body Panel Tool Kit

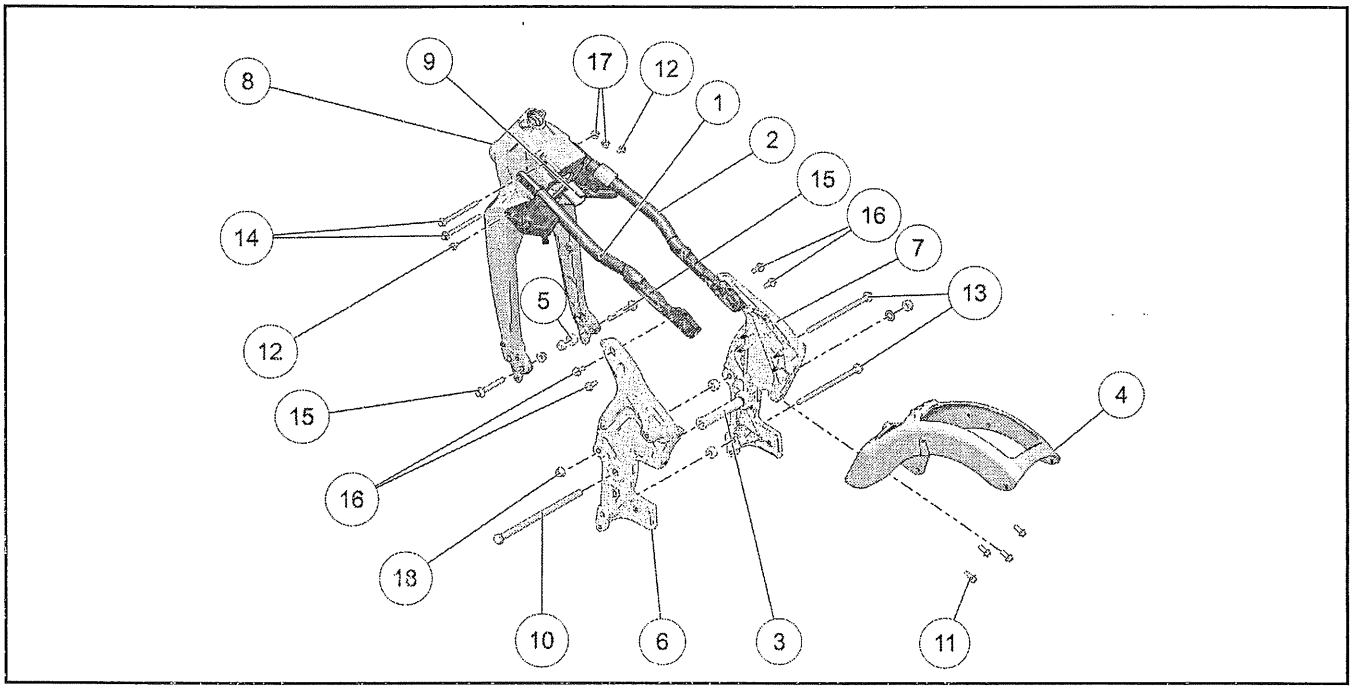
Bosch Automotive Service Solutions: 1-800-345-2233 or https://polaris.service-solutions.com/

ASSEMBLY VIEWS
FENDER COMPONENTS



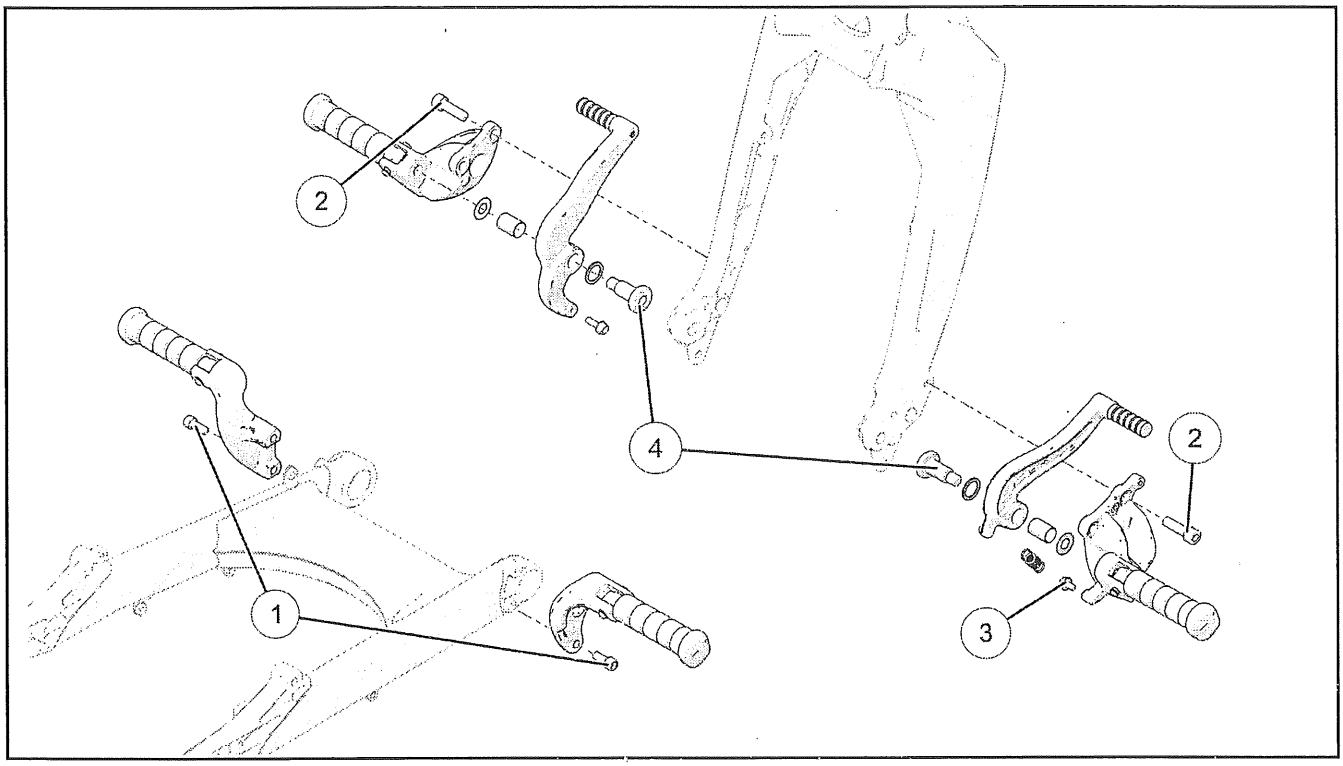
NUMBER	DESCRIPTION	TORQUE
①	Fender Fasteners (front) (QTY.4)	**18 ft-lbs (24 Nm)**
②	Fender Fasteners (rear) (QTY.4)	**18 ft-lbs (24 Nm)**

FRAME COMPONENTS



NUMBER	DESCRIPTION	TORQUE	TORQUE SEQUENCE
①	Frame Weld Backbone	-	-
②	Frame Weld Backbone	-	-
③	Swingarm Pivot	**5 ft-lbs (7 Nm)**	3rd
④	Rear Subframe	-	-
⑤	Spacer	-	-
⑥	Mid Frame LH	-	-
⑦	Mid Frame RH	-	-
⑧	Front Frame	-	-
⑨	Air Box Frame Foam	-	-
⑩	Swingarm Pivot Bolt	-	-
⑪	Subframe to Midframe Fastener (rear)	**35 ft-lbs (47 Nm)**	4th
⑫	Backbone Bracket to Front Frame Fastener	**19 ft-lbs (26 Nm)**	13th (Right) 14th (Left)
⑬	Mid Frame to Engine Fasteners	**51 ft-lbs (69 Nm)**	1st (Lower) 2nd (Upper)
⑭	Frame Backbone to Front Frame Fastener	**35 ft-lbs (47 Nm)**	-
⑮	Frame to Engine Fastener (front)	**51 ft-lbs (69 Nm)**	5th (Left) 6th (Right)
⑯	Mid Cast Frame to Backbone Fastener	**35 ft-lbs (47 Nm)**	7th (Left Front) 8th (Left Rear) 9th (Right Front) 10th (Right Rear)
⑰	Backbone to Front Frame Nut	-	11th (Right Front) 12th (Right Rear)
⑱	Nut (QTY.3)	-	-

FOOT PEG COMPONENTS



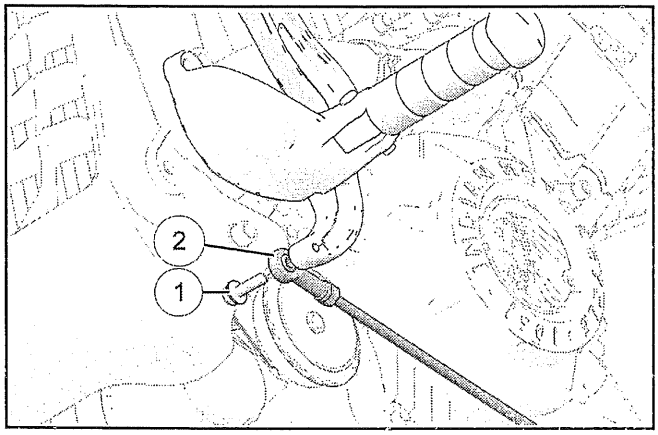
NUMBER	DESCRIPTION	TORQUE
①	Footpeg Fasteners (passenger)	**19 ft-lbs (26 Nm)**
②	Footpeg Fasteners (driver)	**35 ft-lbs (47 Nm)**
③	Brake Pedal Spring Fastener	**84 in-lbs (9.5 Nm)**
④	Footpeg Shoulder Fasteners	**50 in-lbs (68 Nm)**

BODY / FRAME SERVICE

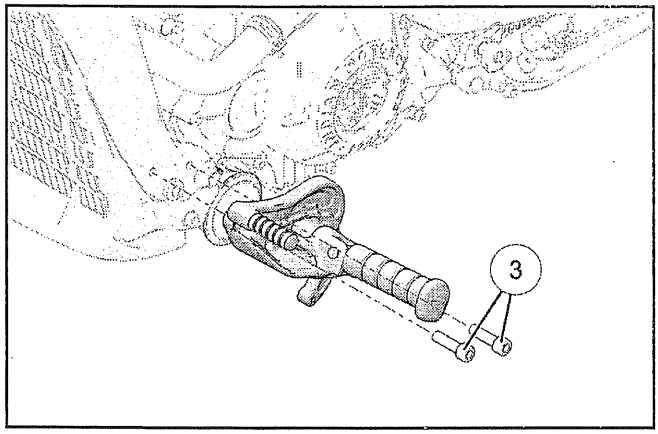
DRIVER FOOT PEG REMOVAL / INSTALLATION

LEFT FOOT PEG

1. Remove Shift Rod Bolt ① from Shift Rod ②.



2. Remove two bolts ③ securing foot peg bracket to frame.



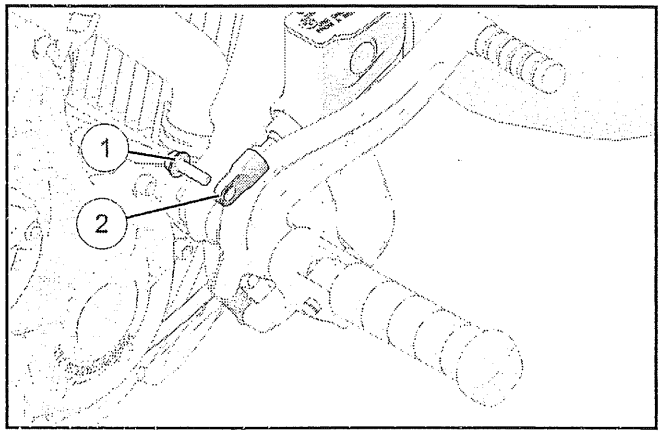
3. **INSTALLATION is performed by reversing the removal procedure.**
4. Torque driver foot peg bracket bolts to specification.

TORQUE
Footpeg Fasteners (driver): **35 ft-lbs (47 Nm)**

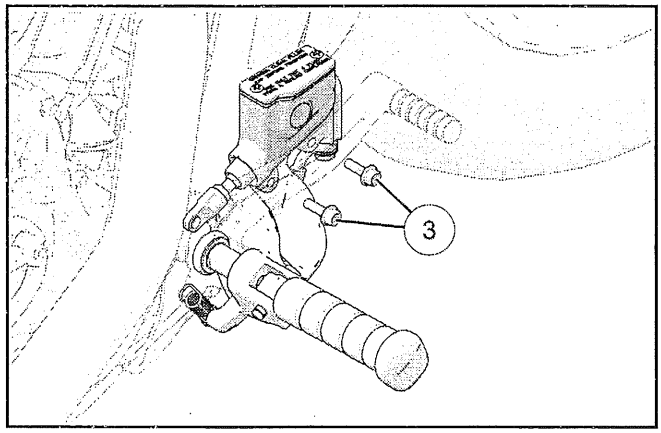
TORQUE
Shift Rod Fastener: **84 in-lbs (9.5 Nm)**

RIGHT FOOT PEG

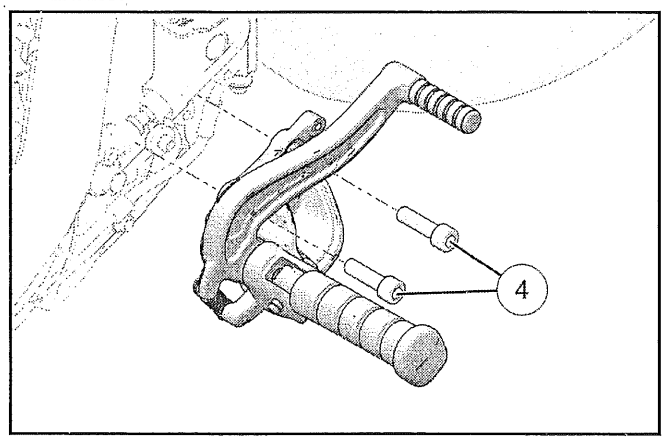
1. Remove bolt ① retaining the master cylinder clevis ② to pedal.



2. Remove two Master Cylinder Bolts ③.



3. Remove two bolts ④ securing foot peg bracket to frame.



4. **INSTALLATION is performed by reversing the removal procedure.**
5. Torque driver foot peg bolts to specification.

TORQUE
Footpeg Fasteners (driver): **35 ft-lbs (47 Nm)**

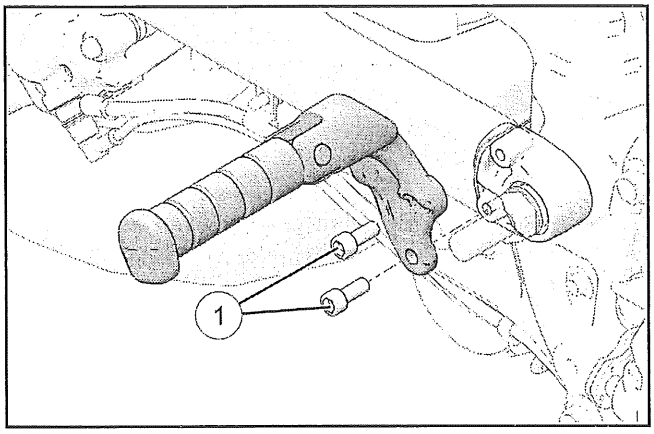
TORQUE
Master Cylinder Mounting Fasteners (rear): **84 in-lbs (9.5 Nm)**

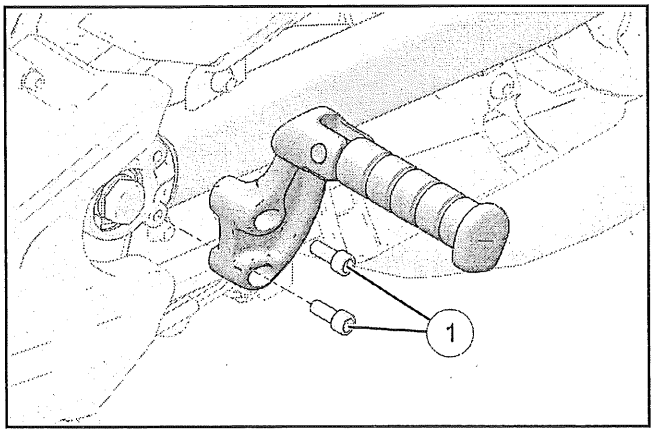
TORQUE
Master Cylinder Clevis Fastener (rear): **84 in-lbs (9.5 Nm)**

FOOT PEGS PASSENGER REMOVAL / INSTALLATION

NOTE
Remove Exhaust to access left foot peg.

1. Remove bolts ① securing foot peg bracket to frame.
2. Remove foot peg / bracket as an assembly.



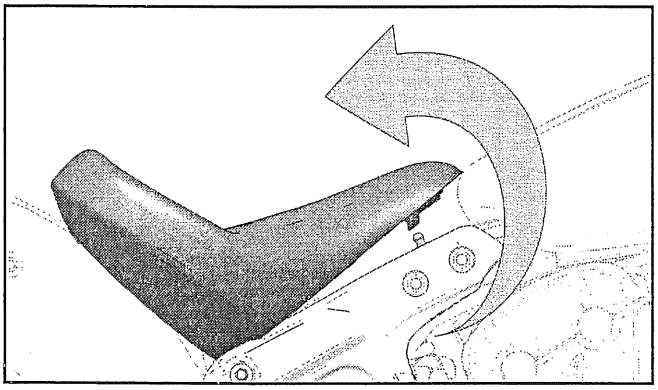


3. **INSTALLATION is performed by reversing the removal procedure.**
4. Torque passenger foot peg bracket bolts ① to specification.

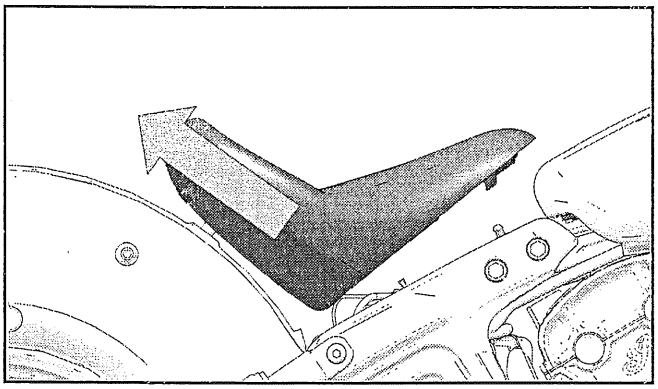
TORQUE
Passenger Foot Peg Bolts: **19 ft-lbs (26 Nm)**

SEAT REMOVAL / INSTALLATION

1. Lift up on the seat front to disengage the front of the seat from the frame post.



2. Lift the seat and pull rearward to disengage the seat from the mount holding the back of the seat to the frame.



3. **INSTALLATION is performed by reversing the removal procedure.**

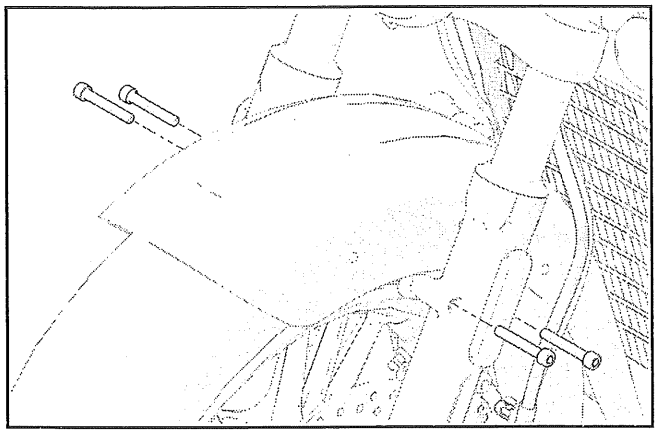
FRONT FENDER REMOVAL

Motorcycle should be parked on a level surface resting on the side stand.

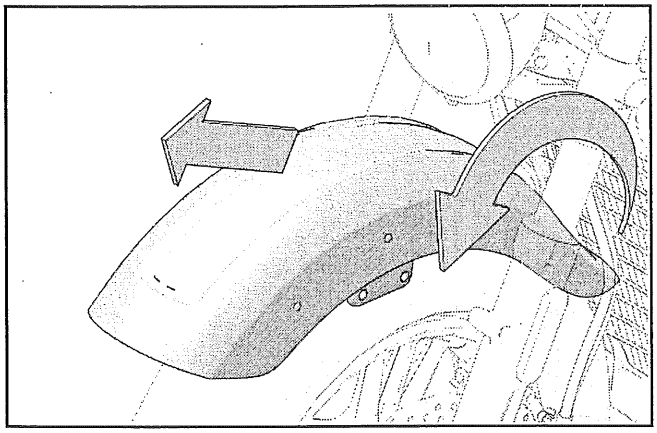
CAUTION

Use care not to scratch or damage painted surfaces during fender removal and / or installation.

1. Remove two fender mount bolts from each fork slider leg.



2. Stand in front of the motorcycle facing the front fender and squeeze the sides together while "rolling" the fender out from between the fork legs.



Once fender has been removed from the motorcycle, make sure the fender is stored safely until it is reinstalled.

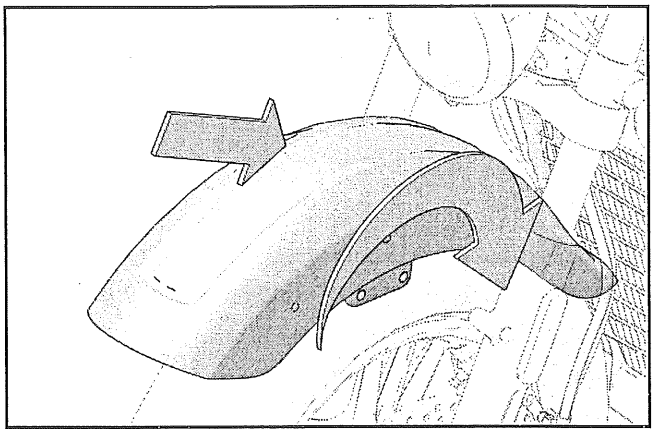
FRONT FENDER INSTALLATION

Motorcycle should be parked on a level surface resting on the side stand.

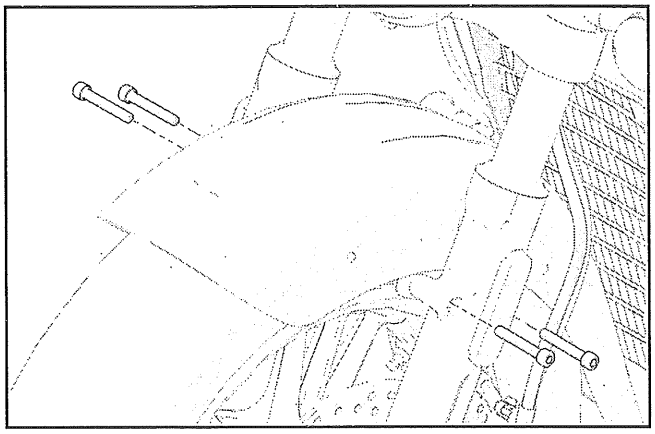
CAUTION

Use care not to scratch or damage painted surfaces during fender removal and / or installation.

1. Gently squeeze the sides of the front fender and "roll" the fender into position between the fork legs so the bolt holes line up.



2. Install the two bolts on each side of the fender and torque to specification.



TORQUE

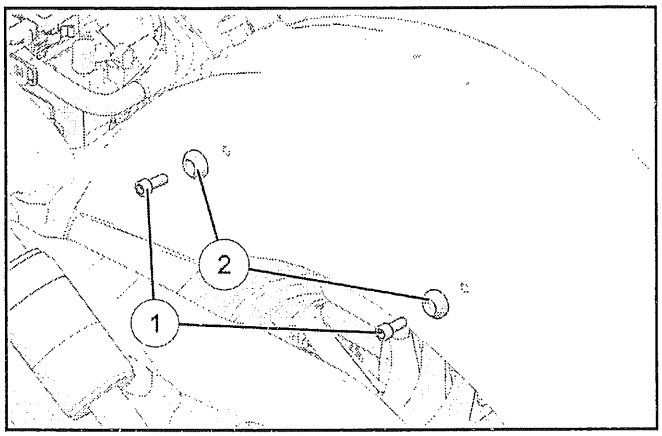
Fender Fasteners (front):
18 ft-lbs (24 Nm)

3. Turn the handlebar all the way to the left and right to verify proper operation and freedom of movement.

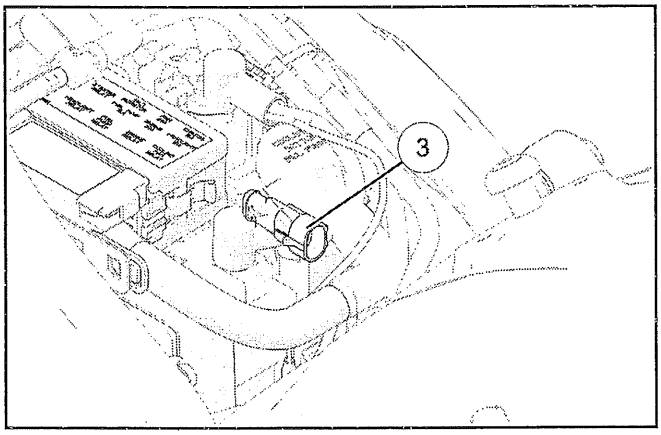
7

REAR FENDER REMOVAL

1. Remove seat. See Seat Removal / Installation, page 7.8
2. Remove two bolts ① and fender washers ② from both sides of the fender.



3. Locate the rear lighting harness connector ③ and disconnect.



4. Lift the fender off of the motorcycle.

CAUTION

Be careful not to damage painted surfaces.

REAR FENDER INSTALLATION

CAUTION

Use care not to scratch or damage painted surfaces during fender removal and / or installation.

1. Route the rear harness along the rear fender and secure with cable ties.
2. Place the rear fender assembly onto the motorcycle so the bolt holes line up and install screws and ① fender washers② to finger tightness.
3. Plug the rear harness lighting connector ③ into the chassis harness.
4. Torque fender fasteners to specification.

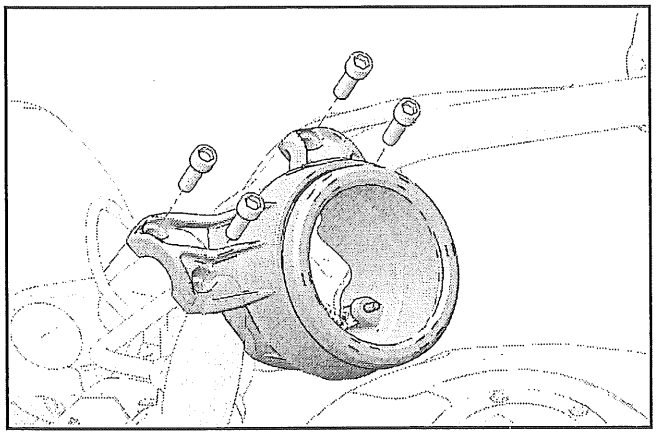
TORQUE

Fender Fasteners (rear):
18 ft-lbs (24 Nm)

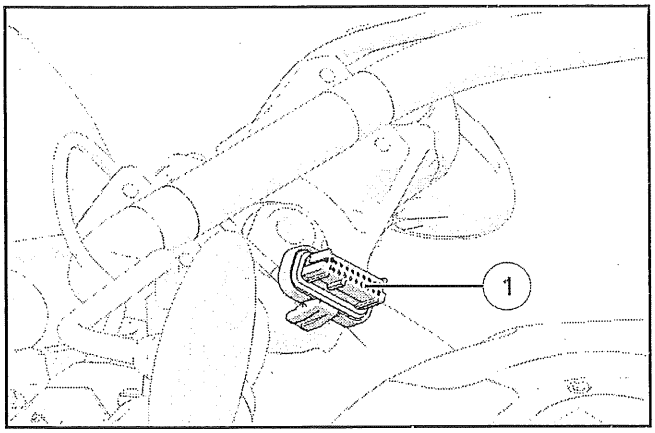
5. Install seat. See Seat Removal / Installation, page 7.8

INSTRUMENT PANEL REMOVAL / INSTALLATION

1. Remove four handle bar screws securing the instrument panel to the handle bars.



2. Lift instrument panel and disconnect the single multi-plug connector①.

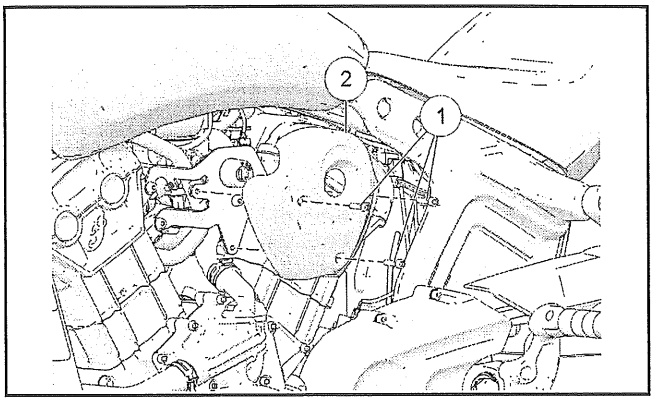


3. **INSTALLATION is performed by reversing the removal procedure.**

TORQUE
Instrument Panel Fasteners: **22 ft-lbs (30 Nm)**

IGNITION COVER REMOVAL / INSTALLATION

1. Remove ignition side cover fasteners ①.

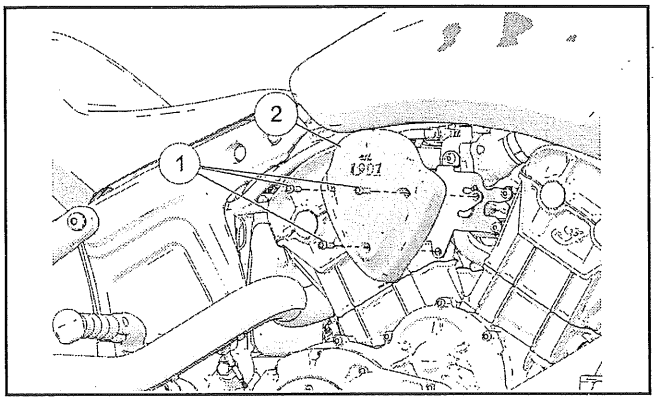


2. Remove ignition side cover ②.
3. Installation is reverse of removal. Torque fasteners to specification.

TORQUE
Ignition Cover Fasteners: **96 in-lbs (11 Nm)**

THERMOSTAT COVER REMOVAL / INSTALLATION

1. Remove the thermostat cover fasteners ①.



2. Remove the thermostat cover ②.
3. Installation is reverse of removal.
4. Torque fasteners to specification.

TORQUE
Thermostat Cover Fasteners: **96 in-lbs (11 Nm)**

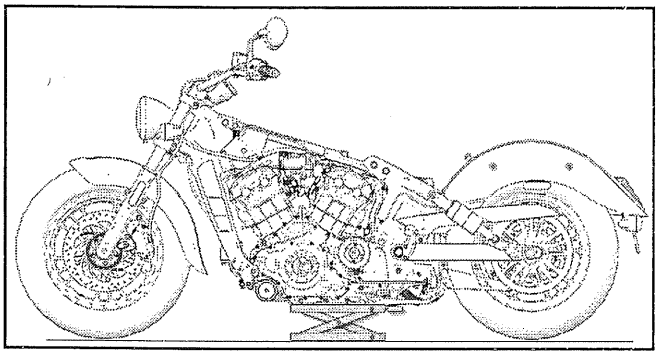
FRAME REMOVAL / INSTALLATION

⚠ WARNING

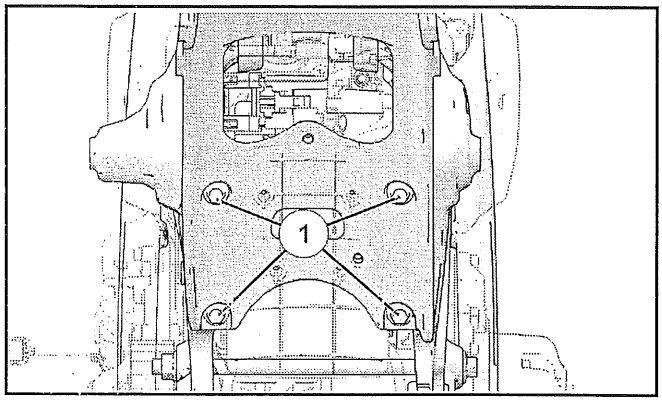
Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death could occur if the motorcycle tips or falls.

REMOVAL

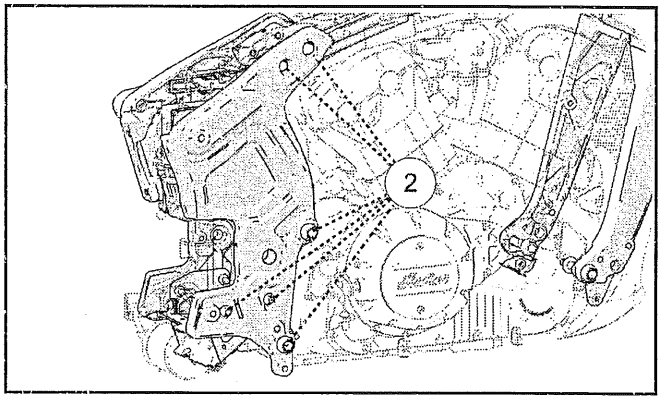
1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove the seat assembly. See Seat Removal / Installation, page 7.8.
3. Disconnect the negative cable from the battery.
4. Remove the fuel tank. See Fuel Tank Removal, page 4.14.
5. Remove the battery box. See Battery Box Removal, page 10.13.
6. Remove the driver foot controls. SeeDriver Foot Peg Removal / Installation, page 7.6.
7. Remove passenger foot pegs (if equipped). See Foot Pegs Passenger Removal / Installation, page 7.7.
8. Remove the head pipe assembly. See Head Pipe Removal, page 3.94.
9. Support the engine with a platform jack.



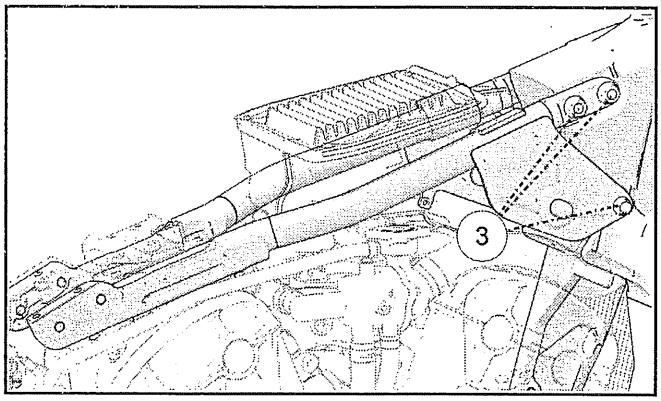
10. Remove the rear fender. SeeRear Fender Removal, page 7.10.
11. Remove the rear swingarm. See Swingarm Removal, page 8.51.
12. Remove any electrical harness clips to the frame.
13. Remove the rear subframe fasteners ① and subframe assembly.



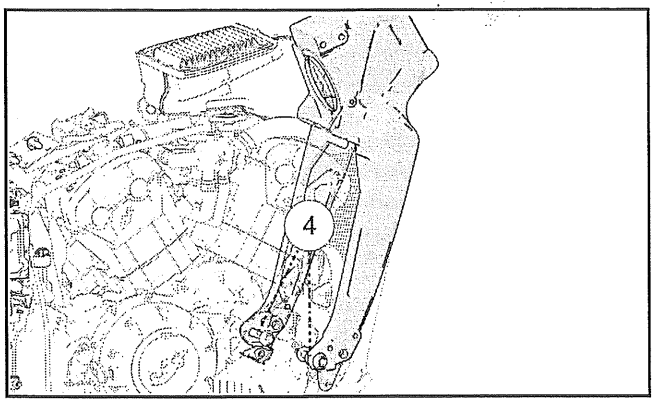
14. Remove the RH and LH mid cast frame fasteners ②.



15. Remove front triple clamps and forks. See Triple Clamp Removal, page 8.27.
16. Remove radiator assembly. See Radiator Removal / Installation, page 3.35.
17. Remove the fasteners ③ holding the RH and LH backbone to the front frame.



18. Remove the lower fasteners ④ holding the front frame to the vehicle and remove front frame.

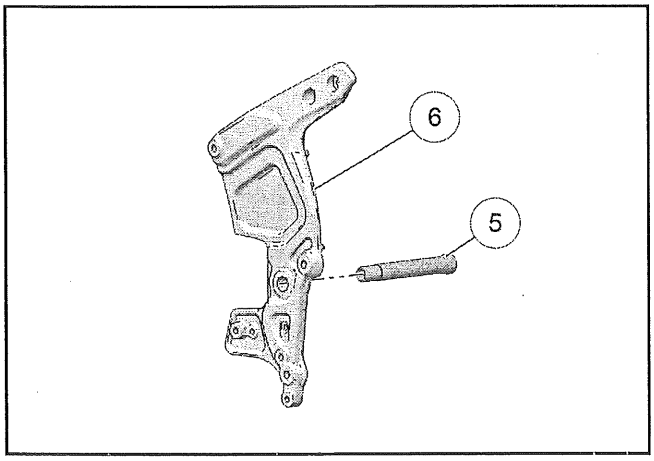


INSTALLATION

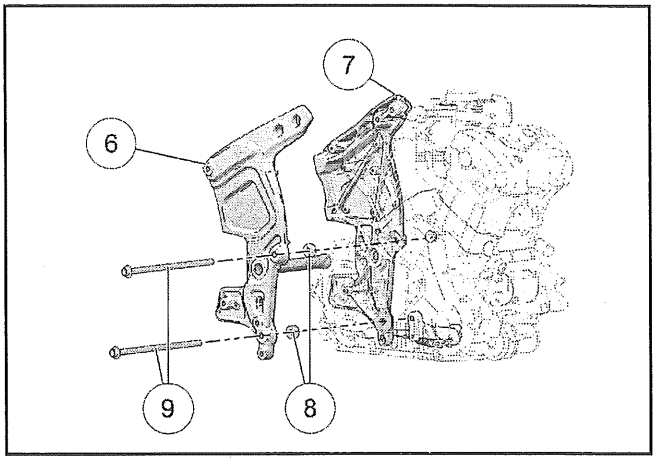
NOTE

Frame fasteners must be torqued in sequence. See Torque Specifications, page .

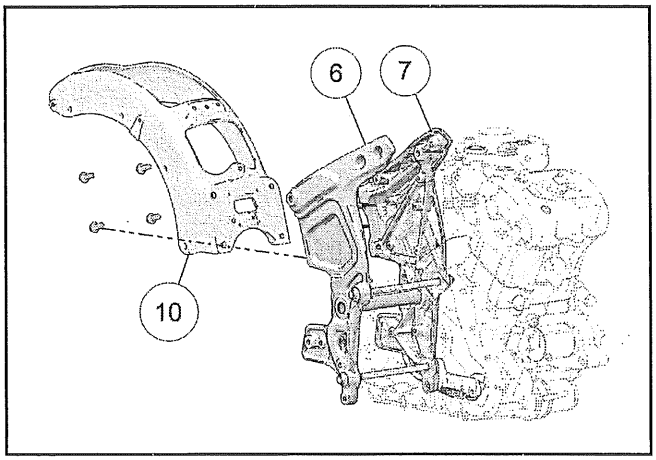
1. Thread the swing arm pivot ⑤ completely into the RH mid frame ⑥.



2. Assemble RH mid frame ⑥, LH midframe ⑦, spacers ⑧ on the engine with mounting bolts ⑨ to hand tightness.

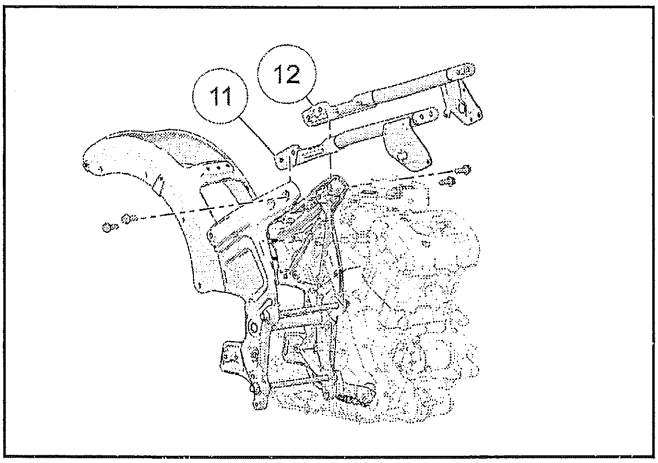


3. Assemble the rear subframe ⑩ to the midcast frames.

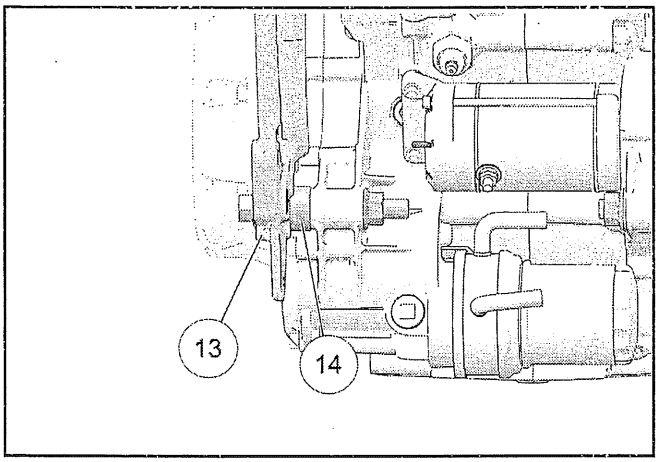


4. Install the airbox if previously removed. See Air Box Removal, page 3.4.

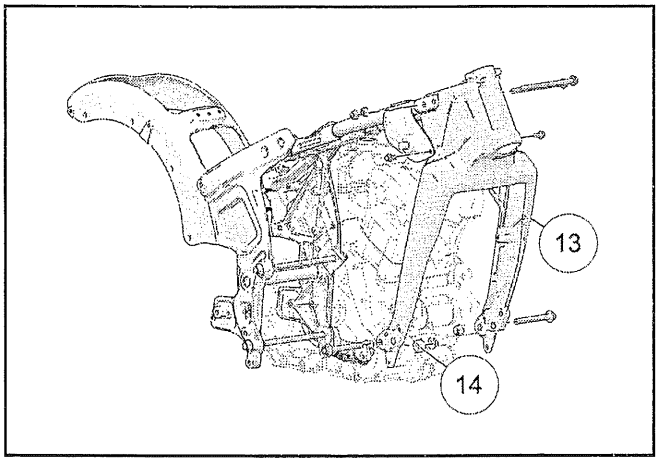
5. Install RH frame backbone ⑪ and LH frame backbone ⑫ on the midcast frames.



6. Position the spacer ⑭ between the front frame assembly ⑬ and engine case.



7. Install the front frame assembly ⑬ to the frame backbones and engine case.

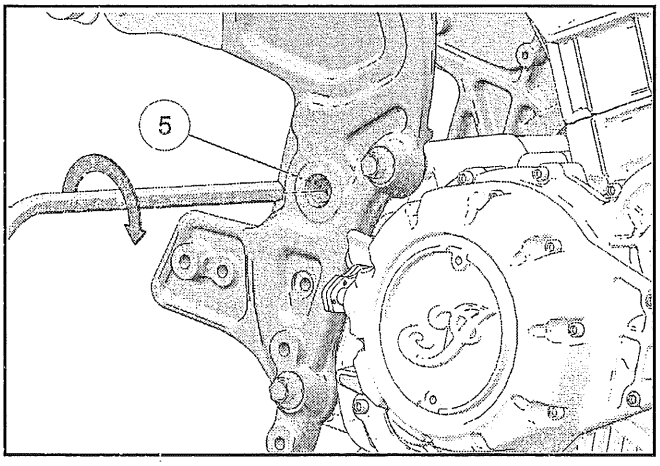


8. Torque fasteners to specification. See Frame Components, page 7.4.

TORQUE

Frame to Engine Fastener (front):
51 ft-lbs (69 Nm)
Frame Backbone to Front Frame Fastener:
35 ft-lbs (47 Nm)
Mid Frame to Engine Fasteners:
51 ft-lbs (69 Nm)
Subframe to Midframe Fastener (rear):
35 ft-lbs (47 Nm)

9. Torque swingarm pivot ⑤ outward (clockwise) to 5 ft-lbs (6.7 Nm) to seat tube against LH midcast frame.



10. Install swingarm assembly. SeeSwingarm Installation, page 8.53.
11. Install rear fender. See Rear Fender Installation, page 7.10.
12. Install the radiator assembly. See Radiator Removal / Installation, page 3.35.
13. Install the triple clamps. SeeTriple Clamp Installation / Steering Head Bearing Adjustment, page 8.29.
14. Install the forks. SeeFront Fork Installation, page 8.26.
15. Install the head pipe assembly. SeeHead Pipe Installation, page 3.95.
16. Install mufflers. See Muffler Installation, page 3.93.
17. Install the driver foot controls. See Driver Foot Peg Removal / Installation, page 7.6
18. Install passenger foot pegs if equipped. See Footpeg Passenger Removal / Installation, page 7.7Foot Pegs Passenger Removal / Installation, page 7.7.
19. Install battery box. SeeBattery Box Installation, page 10.13.
20. Install the fuel tank. SeeFuel Tank Installation, page 4.19.

21. Connect battery cables.
22. Install seat assembly. See Seat Removal / Installation, page 7.8.

NOTES

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STEERING / SUSPENSION

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FRONT WHEEL / SUSPENSION

GENERAL INFORMATION

SERVICE NOTES

⚠ WARNING

Indian Motorcycles are produced using the designated tires listed as original equipment. This includes field testing to ensure stability and superior handling. The use of tires other than original equipment may cause instability which could lead to a crash, resulting in serious injury or death. Use *only* the recommended tires inflated to the recommended tire pressures based on load conditions as listed on the tire information label.Tubeless tires are used on certain Indian Motorcycle models. Operating the motorcycle with damaged rims creates a safety hazard including air pressure loss, steering imbalance and/or reduced steering control. Do not attempt to repair or straighten damaged rims.

CAUTION

Work performed to the front end of the motorcycle usually involves supporting the machine with the front end elevated. Take precautions so that the motorcycle is securely supported when the front tire is off the ground. This reduces the possibility of personal injury or damage to the motorcycle.

Leaking front fork seals are a safety hazard and should be replaced immediately if a leak is found. Fork oil could contaminate front brake components which could reduce stopping ability of the motorcycle. Contaminated brake discs or pads greatly reduce available stopping force & increase stopping distance. Brake discs can be cleaned using commercially available brake cleaner. NEVER attempt to clean contaminated brake pads. Replace pads as a set.

- Refer to Maintenance Chapter for **MAINTENANCE** of front end components.
- Refer to Steering / Suspension Chapter for **TIRE REMOVAL, REPAIR, & BALANCING**
- Refer to Brakes Chapter for **BRAKE SYSTEM** service and repairs.

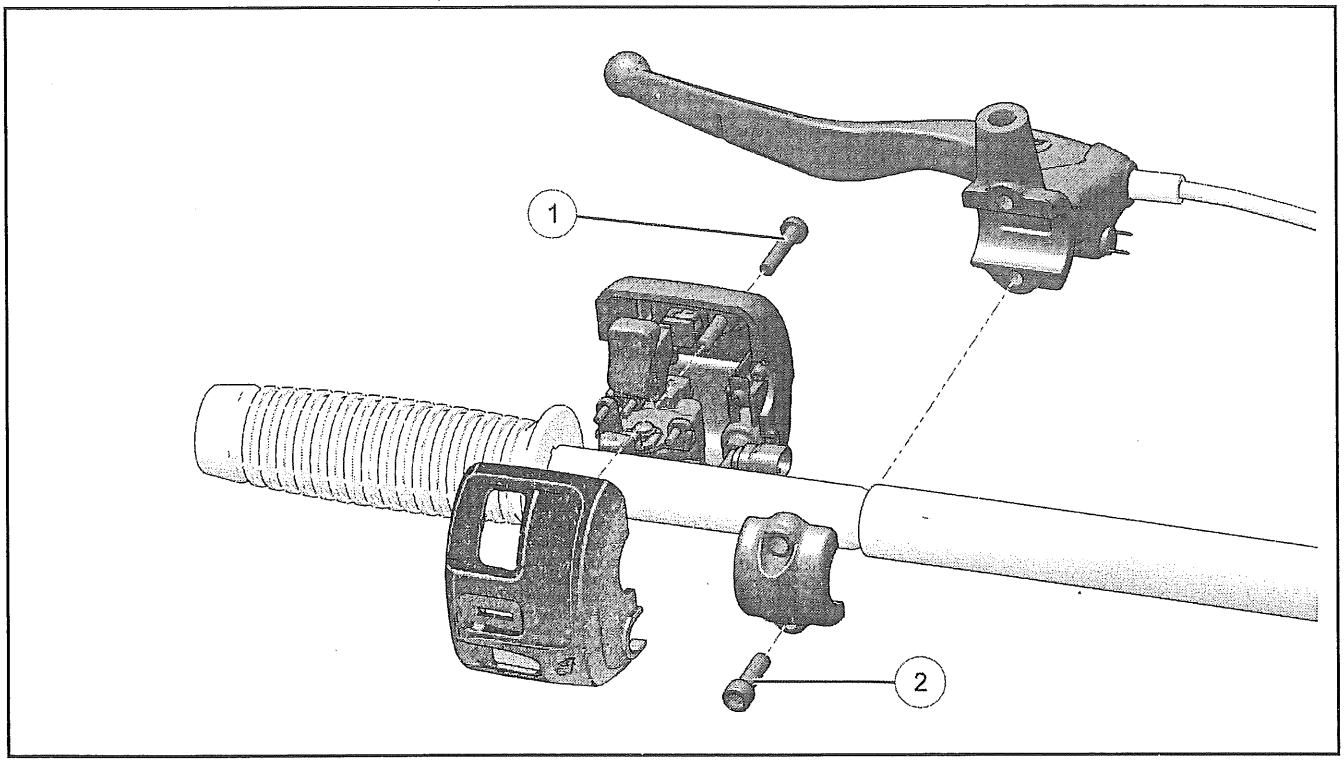
SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Fork Spring Compressor	PV-49463
Fork Spring Compressor Adapter / Cartridge Tool	PF-51664–2
Fork Oil Seal Driver	PF-51610
Fork Seal Installation Tool	PF-51611
Wheel / Stem Bearing Removal / Installation Kit	PF-51324
Spanner Socket (Steering Stem)	PV-43508

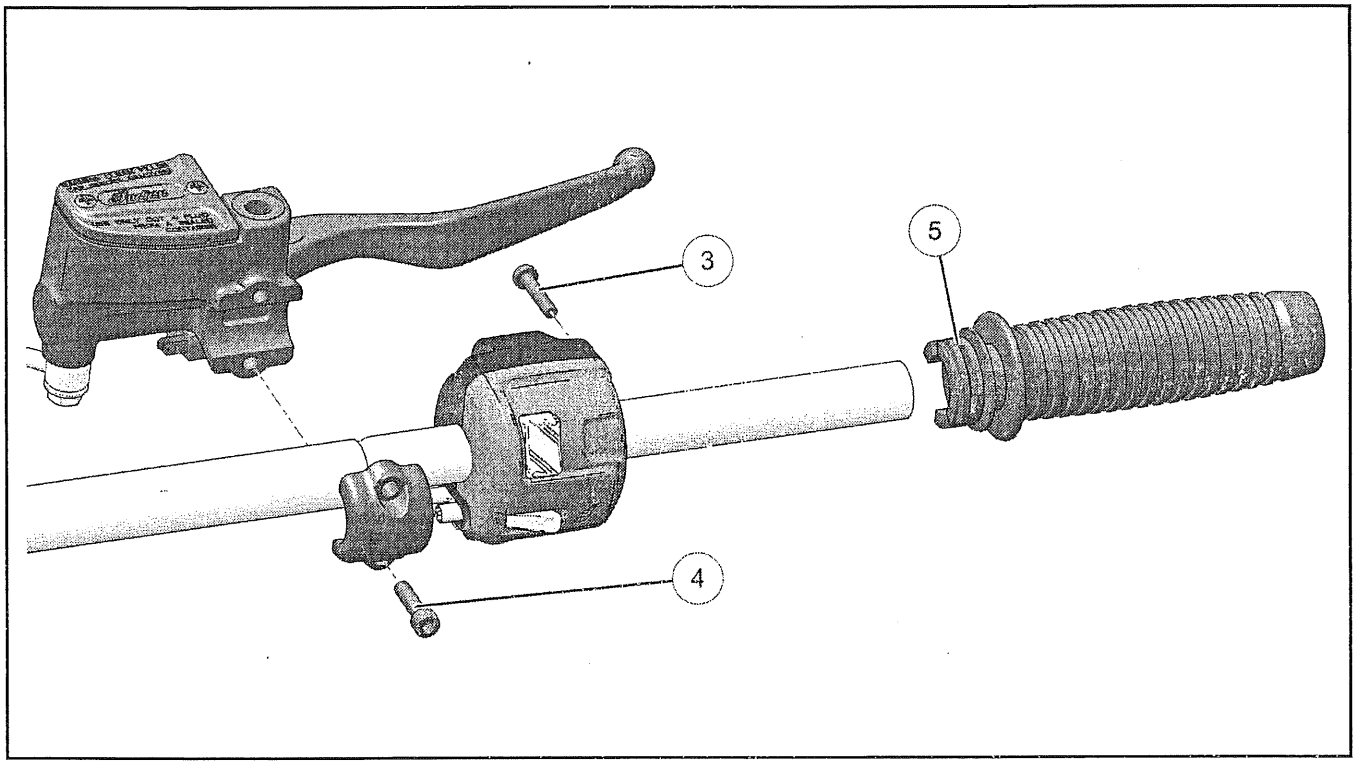
SERVICE SPECIFICATIONS

ITEM		STANDARD	SERVICE
Axle Runout		-	.20 mm (.008 in.)
Front Wheel Runout (Cast and Spoked Type) 3.5" x 16"	Axial	.50 mm (.020 in.)	2.0 mm (.080 in.)
	Radial	.50 mm (.020 in.)	2.0 mm (.080 in.)
Fork Tube Diameter		41 mm (1.61in.)	Not Applicable
Fork Tube Runout		-	.20 mm (.008 in.)
Fork Oil Type		Indian Motorcycle Fork Oil (PN: 2880015)	
Fork Spring Pre-Load		42 mm (1.65 in.)	Not Applicable
Fork Spring Rate		5.0 N/mm - 12.0 N/mm (0.042 - 0.106 lb/in)	Not Applicable
Fork Spring Free Length		457.9 mm (18.02 in.)	-
Fork Oil Capacity (per leg, dry)	Oil level must be measured and adjusted to specification.	335cc	Set Level

ASSEMBLY VIEWS
CONTROLS

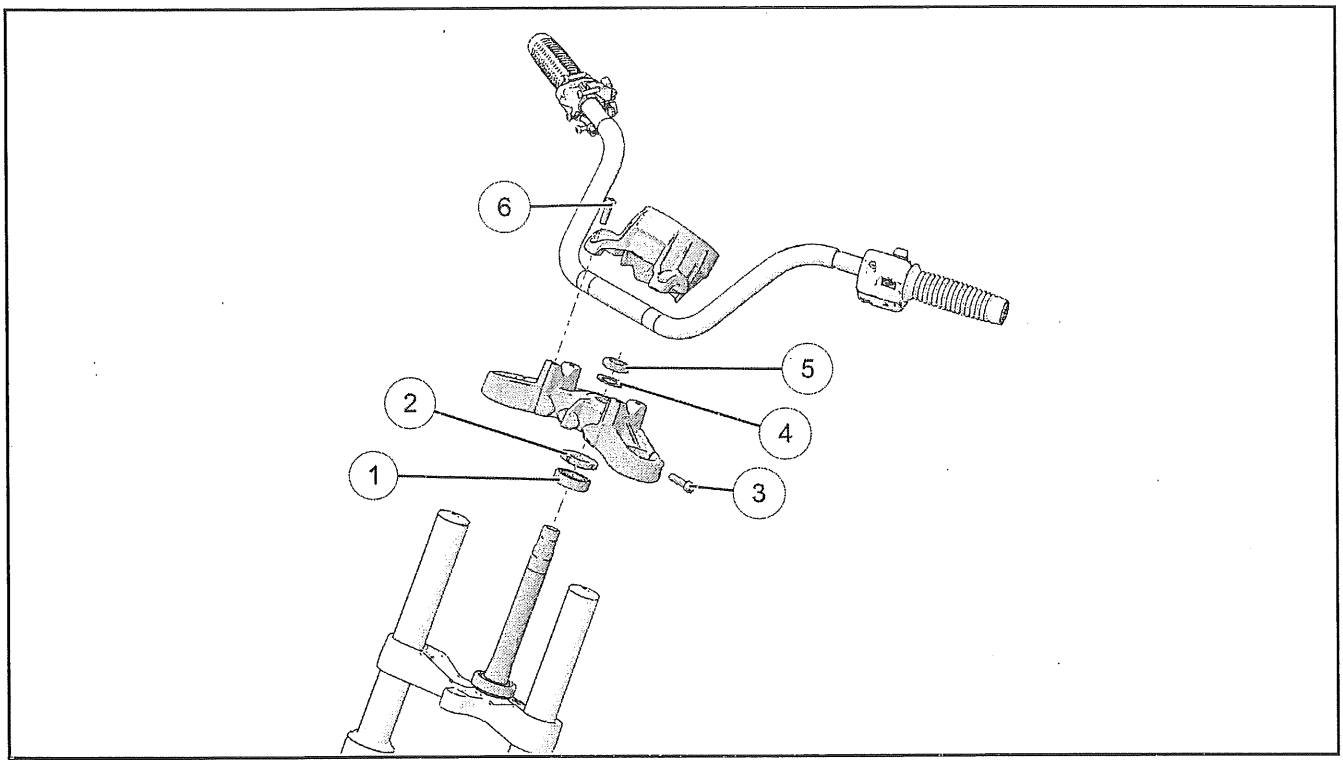


NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Switch Cube Fasteners (LH)	**36 in-lbs (4 Nm)** **Tighten Top Fastener First**
②	Clutch Perch Clamp Fastener	**12 ft-lbs (16 Nm)**



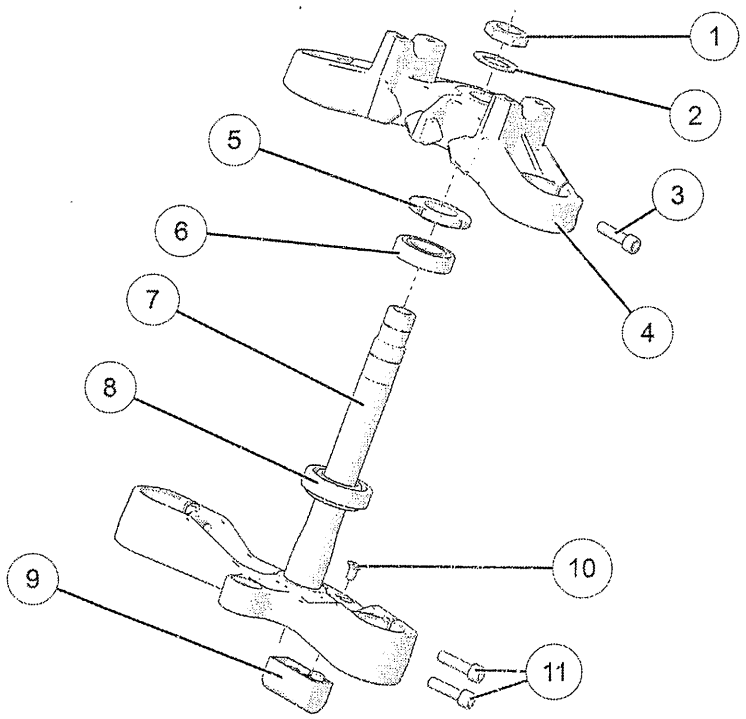
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)	NOTES
③	Switch Cube Fasteners (RH)	**36 in-lbs (4 Nm)** **Tighten Top Two Fasteners First**	-
④	Brake Lever Clamp Fastener	**12 ft-lbs (16 Nm)**	-
⑤	Throttle Grip	-	Ridge goes toward rider.

HANDLEBAR COMPONENTS



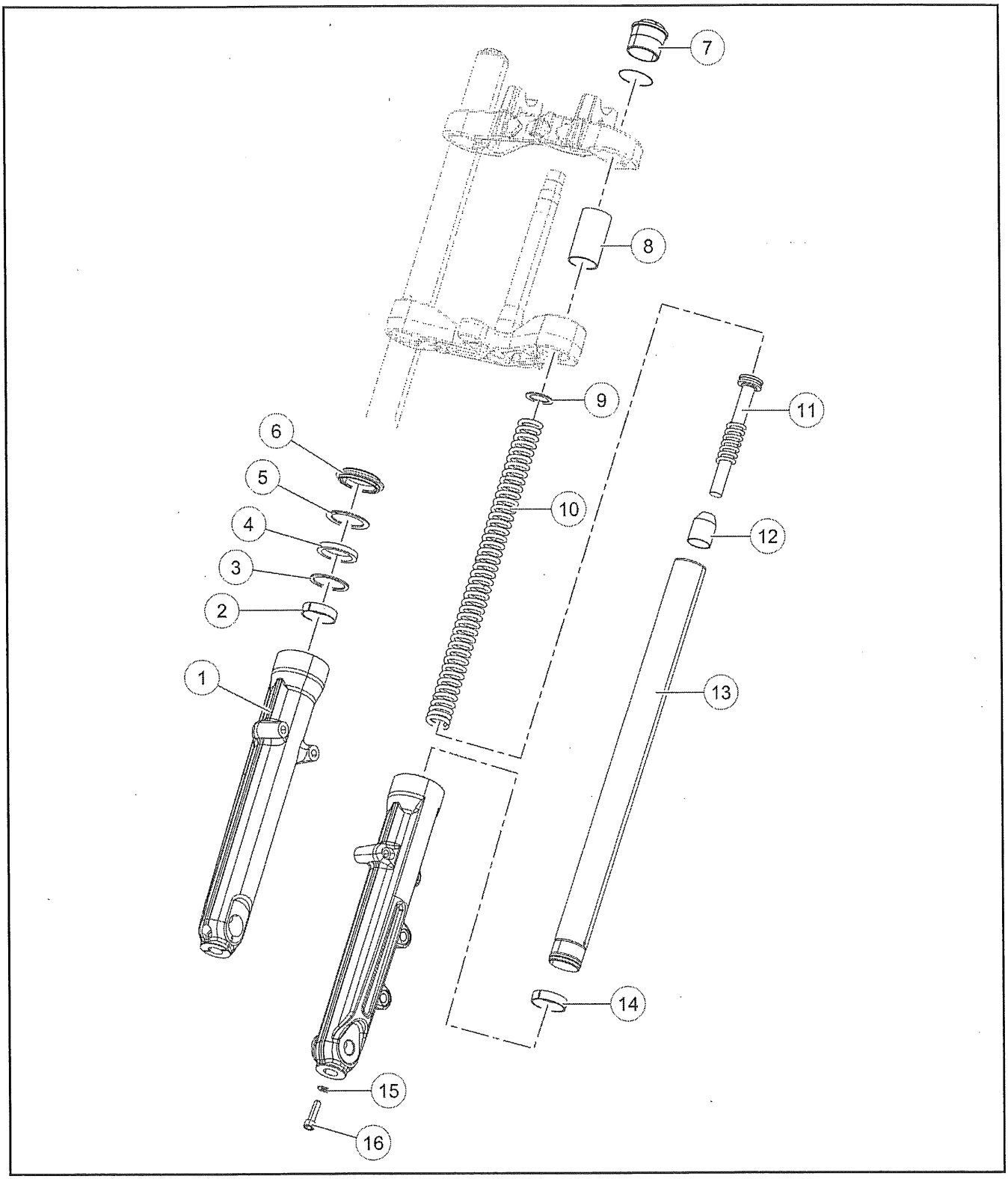
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Ball Bearing	-
②	Steering Head Nut	**29 ft-lbs (40 Nm)** See Tightening Procedure Outlined in this Chapter
③	Fork Triple Clamp Fasteners (Upper)	**18 ft-lbs (24 Nm)** See Tightening Procedure Outlined in this Chapter
④	Washer	-
⑤	Steering Stem Nut (top)	**72 ft-lbs (97 Nm)** See Tightening Procedure Outlined in this Chapter
⑥	Instrument Cluster Fasteners	**22 ft-lbs (30 Nm)** Tighten Front Bolts First, then Rear

TRIPLE CLAMP COMPONENTS



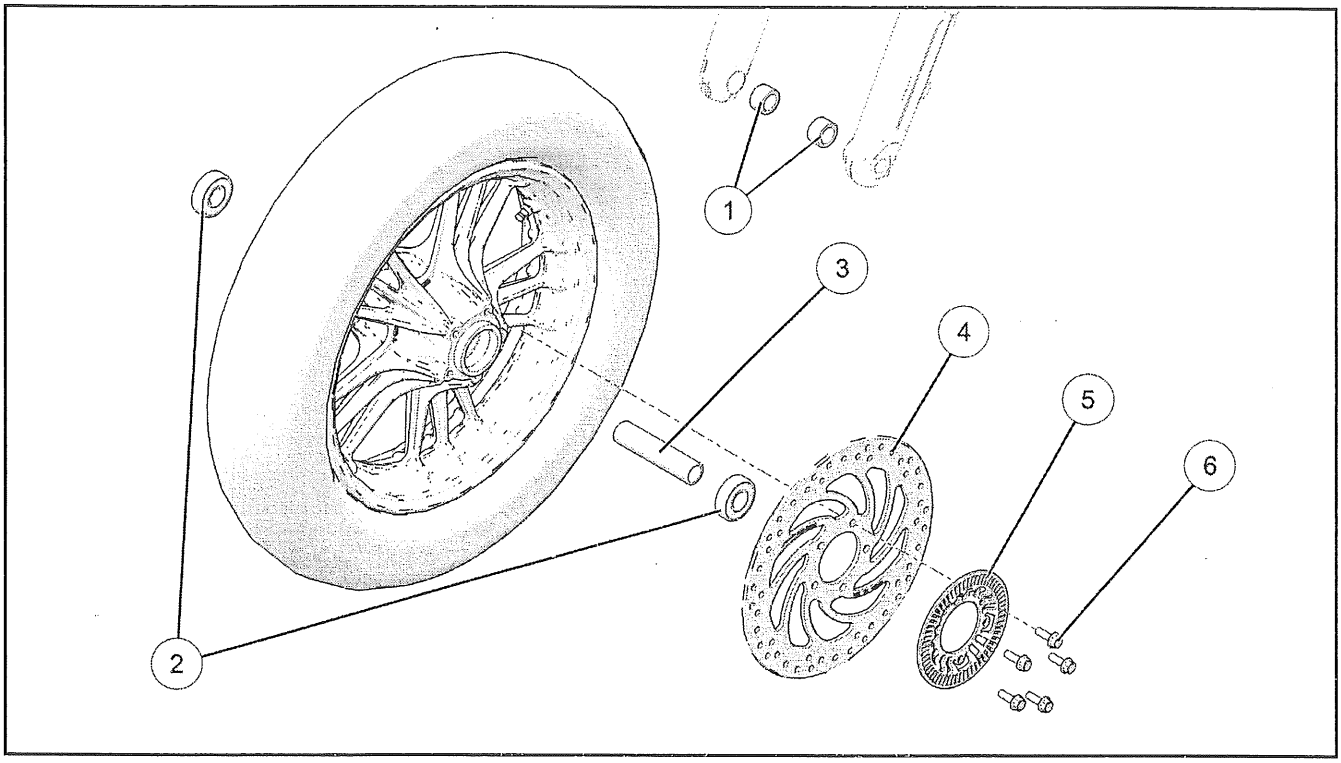
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Steering Stem Nut (top)	**72 ft-lbs (97 Nm)** See Tightening Procedure Outlined in this Chapter
②	Washer	-
③	Fork Triple Clamp Fasteners (Upper)	**18 ft-lbs (24 Nm)** See Tightening Procedure Outlined in this Chapter
④	Upper Triple Clamp	-
⑤	Steering Head Nut	**29 ft-lbs (40 Nm)** See Tightening Procedure Outlined in this Chapter
⑥	Ball Bearing	-
⑦	Lower Bracket ASM	-
⑧	Sealed Bearing	-
⑨	Steering Lock	-
⑩	Steering Lock Fastener	**77 in-lbs (9 Nm)**
⑪	Fork Triple Clamp Fasteners (Lower)	**18 ft-lbs (24 Nm)** See Tightening Procedure Outlined in this Chapter

FRONT FORK COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Fork Leg Assembly	-
②	Slide, Metal	-
③	Washer	-
④	Oil Seal	-
⑤	Snap Ring	-
⑥	Dust Seal	-
⑦	Fork Cap	**16 ft-lbs (22 Nm)**
⑧	Spacer	-
⑨	Washer	-
⑩	Spring	-
⑪	Cylinder Assembly	-
⑫	Oil Lock	-
⑬	Inner Fork Tube	-
⑭	Bushing	-
⑮	Packing	-
⑯	Fork Cartridge Fastener	**17 ft-lbs (23 Nm)**

FRONT WHEEL COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Outer Bearing Spacer	-
②	Wheel Bearing	-
③	Inner Bearing Spacer	-
④	Brake Disc	-
⑤	Ring Tone ABS	-
⑥	Brake Disc Fasteners (QTY.5)	**19 ft-lbs (26 Nm)**

SERVICE PROCEDURES

HANDLEBAR REMOVAL / INSTALLATION

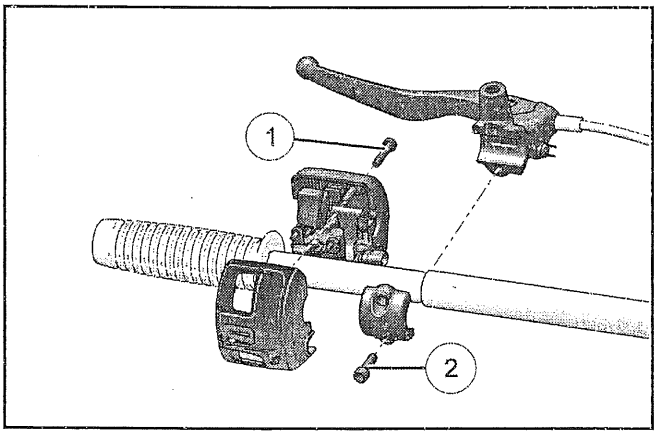
⚠ WARNING

Clutch cable must be routed, installed, and adjusted correctly to function properly. Note how cable is routed and secured before removing the cable. Permanent cable damage may result if the inner cable is bent or twisted during installation. If the cable is incorrectly routed, installed, or adjusted, serious injury or death may occur.

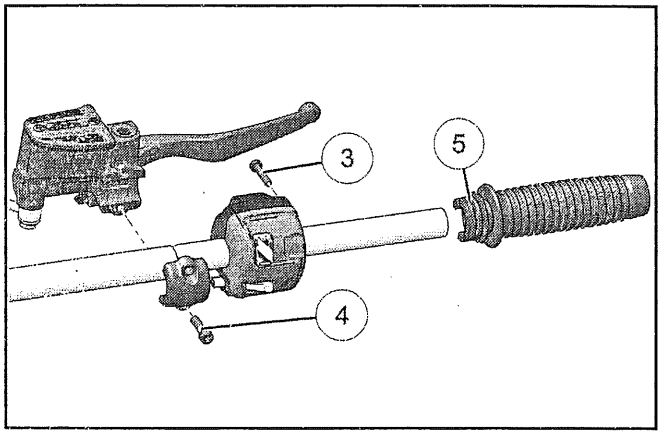
CAUTION

Cover painted or chrome parts to prevent damage. Use care to protect fuel tank and front fender. Tank removal is recommended. Secure, set aside, or support parts as they are removed.

1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise
2. Remove left hand Switch Cube screws ①.
3. Remove Clutch Lever perch screws ②.



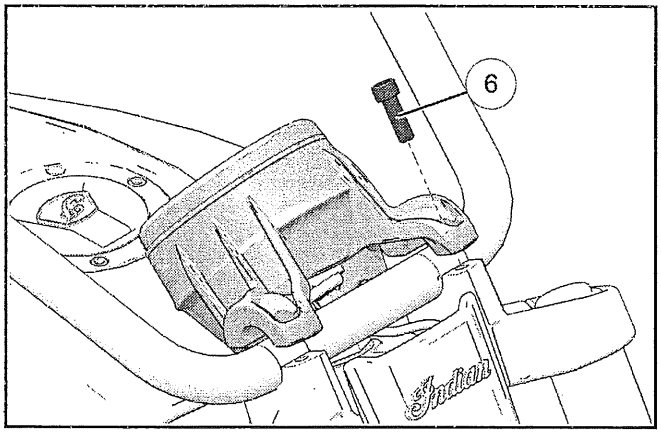
4. Remove Right hand Switch Cube screws ③. Remove Switch Cube.
5. Remove Master Cylinder screws ④. Place Brake assembly in position that allows hose not to be stressed.
6. Remove Throttle Grip ⑤.



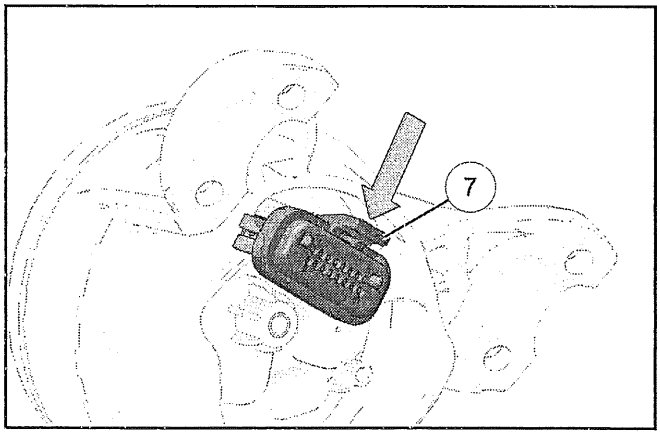
CAUTION

Keep brake reservoir in an upright position to prevent air from entering the system. Bleeding is required if air enters the system.

7. Remove four instrument cluster fasteners ⑥.



8. Press tab ⑦ down to remove the connector from instrument cluster.



9. Lift handlebars out of upper triple clamp.

NOTE

Make an index mark on the handlebar along the parting line of the riser cap to ensure proper handlebar position upon reassembly.

10. Installation is performed by reversing the removal procedure.
11. Line up the handlebar index mark made in STEP 9 and torque instrument cluster, starting with the front bolts, to specification.

TORQUE

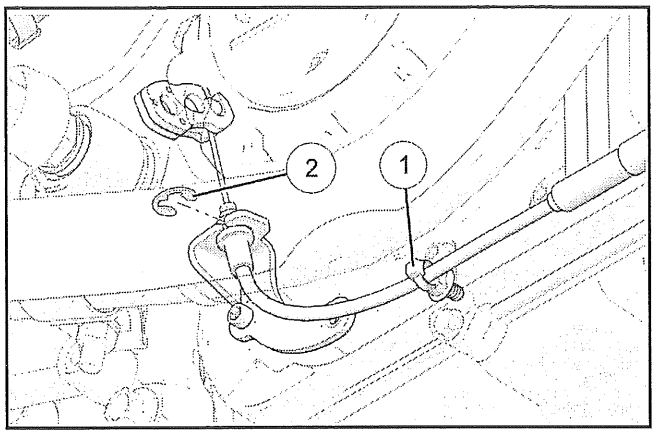
Instrument Cluster Fasteners:
22 ft-lbs (30 Nm) Tighten Front Bolts First, then Rear

CLUTCH CABLE REMOVAL / INSTALLATION

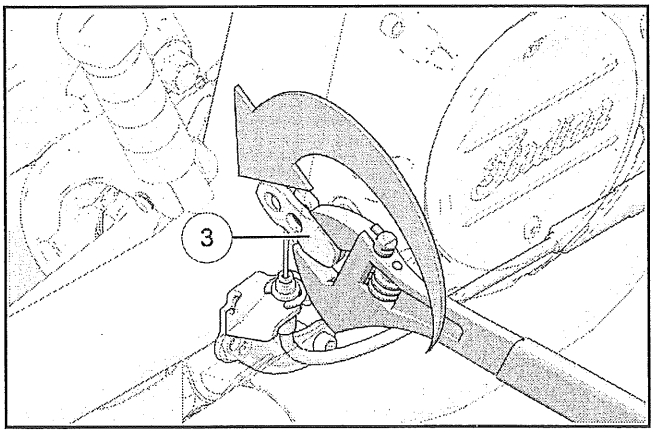
1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.

Clutch Cable Removal

2. Remove the cable routing clip ① and the clutch cable jam nut ②.



3. Protect the clutch release arm ③ with a shop towel. Using an adjustable wrench, rotate the release arm inward. Disconnect clutch cable from release arm.



4. Withdraw the clutch cable from the mounting boss located on the primary cover.
5. At the handlebar, pull the clutch cable casing straight out until clear of lever perch and rotate cable outward to align inner cable wire with slot in lever.
6. Pull lever slightly until slotted opening in lever is clear of perch and slide cable barrel end down and out of lever.
7. Note routing of clutch cable through frame.
8. Remove the clutch cable.

1. **Clutch Cable Installation**

CAUTION

Do not kink, bend, or twist the inner cable or outer cable casing during installation

2. Route clutch cable in the same manner as removed.
3. Apply multi-purpose grease to the lever end of the cable and install it in the clutch lever at the handlebar.
4. Install the casing in the lever perch at the handlebar.
5. Install cable in the mounting boss located on the primary cover.
6. At the release arm end of the cable, pull the inner cable until fully extended. Be sure the upper end of the cable casing is seated in the lever perch at handlebar end.
7. Apply multi-purpose grease to the lower barrel end of the cable.
8. Rotate the release arm inward (as in STEP 3) until cable can be installed in release arm.
9. Adjust clutch cable free play. See Clutch Lever Free Play, page 2.20.

FRONT WHEEL REMOVAL / INSTALLATION

⚠ WARNING

This procedure requires raising and supporting the motorcycle so that the front wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.

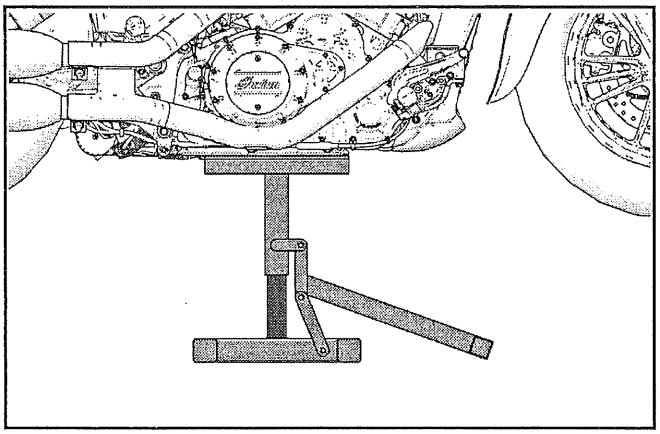
CAUTION

Do not twist the brake hose or brake line. Do not allow calipers to hang from the brake hose. Secure calipers in such a way to avoid hose damage.

CAUTION

CALIFORNIA MODELS: Remove the charcoal canister prior to raising motorcycle wheels off the ground. As the swingarm lowers it can contact the canister hose fittings and damage them.

1. Secure the motorcycle in an upright position with tie-down straps and a platform jack positioned beneath the engine cases.



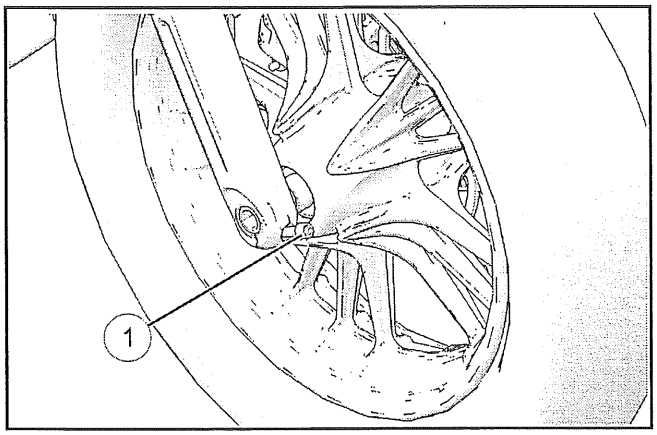
NOTE

Do not operate the front brake lever with the calipers or wheel removed.

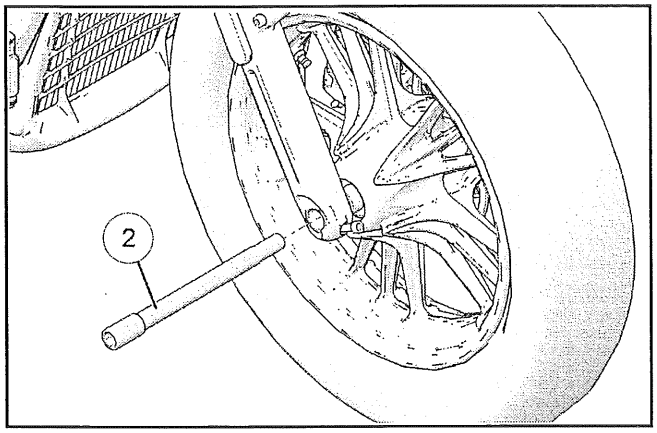
Removal

2. Remove the front fender. See Front Fender Removal, page 7.9.

3. Loosen axle pinch bolts ① on lower right fork leg.



4. Support wheel and remove axle ②. Spacers are loosely retained by the dust seals, but may fall out after wheel has been removed.



Installation

5. Install front wheel and spacers into fork.
6. Install the axle and torque to specification.

TORQUE
Axle (front fork): **52 ft-lbs (70 Nm)**

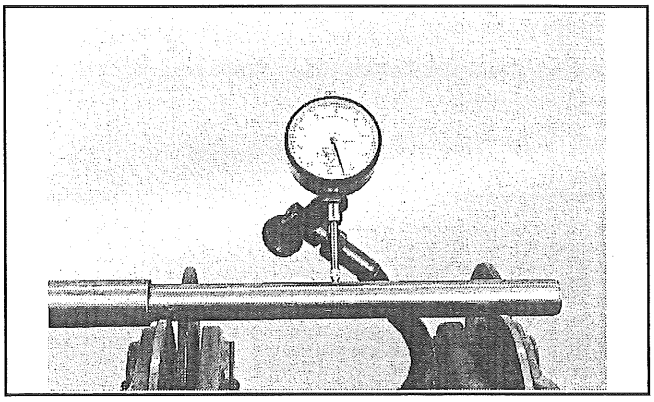
7. Cycle the front suspension. Tighten axle pinch bolts to specification.

TORQUE
Axle Pinch Fasteners: **18 ft-lbs (24 Nm)Tighten each screw once after initial torque**

8. Install front fender. See Front Fender Installation, page 7.9.

FRONT AXLE INSPECTION

1. Place axle in V-blocks and inspect runout. Compare to specifications in this chapter. See Service Specifications, page 8.4.



2. Replace axle if it fails inspection. Do not attempt to straighten a bent axle.

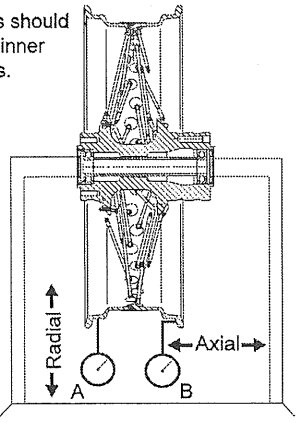
FRONT WHEEL INSPECTION

1. Install front wheel in truing stand.

NOTE
Bearings must be in good condition to accurately measure runout.

2. Set up a dial indicator to measure radial runout (up and down) (A) and compare to specifications. See Service Specifications, page 8.4.
3. Position dial indicator to measure axial runout (side to side) (B) and compare to specifications. See Service Specifications, page 8.4.

Measurements should be taken from inner wheel surfaces.

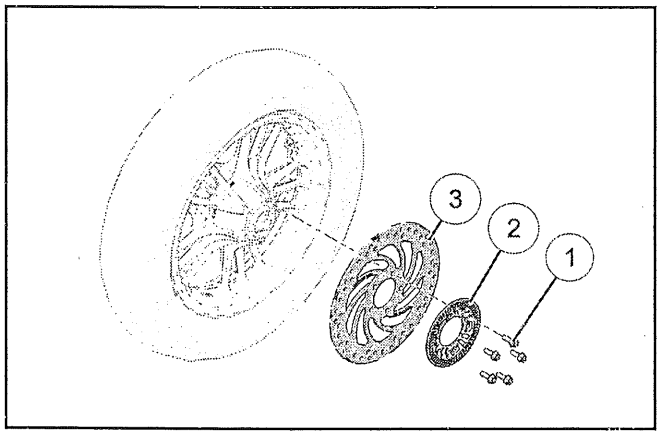


4. Visually inspect wheel for cracks.
5. Replace wheel if it fails visual or measured inspection. Do not attempt to straighten cast or wheels.

8

BRAKE DISC REMOVAL / INSTALLATION

1. Remove front wheel. See Front Wheel Removal / Installation, page 8.14.
2. Position wheel with brake disc and ABS tone ring (if equipped) facing up.
3. Remove and discard brake disc / tone ring screws ①.
4. Remove tone ring ② and brake disc ③ from wheel.



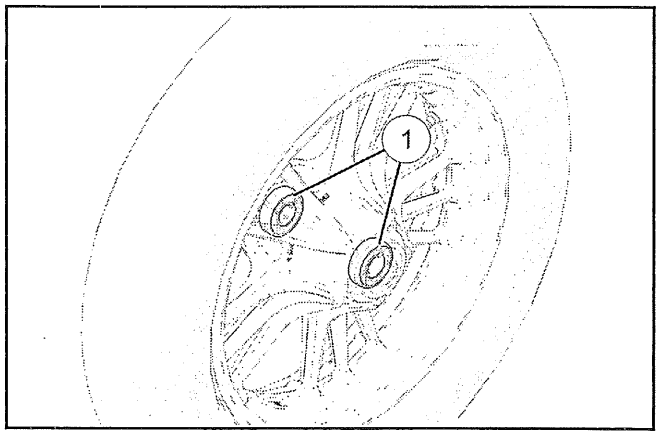
5. **Installation is performed by reversing the removal procedure. Use new brake disc fasteners for installation**
6. Torque *new* brake disc fasteners to specification in a star pattern.

TORQUE
Brake Disc Fasteners: **19 ft-lbs (26 Nm)**

FRONT WHEEL BEARING INSPECTION

NOTE
Inspect bearings installed in the wheel. Do not remove to inspect. Bearings cannot be repacked. Replace both wheel bearings if one or both fail inspection, or if either bearing was removed.

1. Visually inspect bearing seals ① on each side for wear or damage.



2. Check bearings by turning inner race by hand.

- Look for signs of discoloration, scoring, galling, or contamination from moisture or dirt. Replace bearings if any of the above are present.
- Turn the inner race of the bearings. The bearings should turn smoothly and quietly. The inner race should be firm with minimal side to side movement and no detectable up and down movement.

3. Discard bearings that fail any of the above inspections.

CAUTION
Do not reuse bearings after removing them from the wheel. Removal damages the bearings internally.

4. Inspect bearing fit into wheel hub. The outer race of the bearing must fit tightly into the bore. You should not be able to move it (or remove it) by hand. Replace the wheel if outer race of a new bearing does not fit tightly in the bore.

FRONT WHEEL BEARING REPLACEMENT

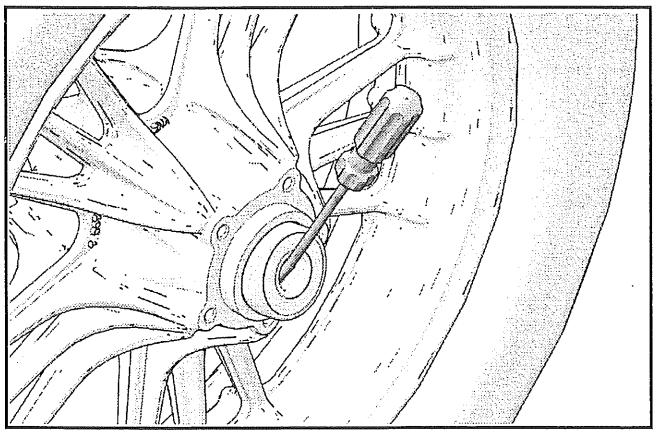
CAUTION

Do not reuse bearings that have been removed.

NOTE

This procedure requires the Wheel Bearing Removal / Installation Kit **(PF-51324)**. Refer to special tool manufacturer instructions for proper use of tool.

1. Remove front wheel. See Front Wheel Removal / Installation, page 8.14.
2. Remove brake discs. See Brake Disc Removal / Installation, page 8.16.
3. Carefully remove both seals using a suitable seal removal tool and discard. Be careful not to scratch the seal bore.



4. Refer to special tool manufacturer instructions to remove bearing from LH side of hub.
5. Remove bearing.
6. Remove spacer.
7. Extract or drive bearing from RH side of hub.
8. **Installation:** Use the Wheel Bearing Removal / Installation Kit **PF-51324)** to install new wheel bearings. Refer to special tool manufacturer instructions for proper use of tool.
9. Install *new* wheel bearing into the RH side of hub followed by the inner bearing spacer.
10. Install *new* wheel bearing into the LH side of hub.
11. Install *new* seals and existing outer bearing spacers into each side of the wheel hub.
12. Install the brake discs. See Brake Disc Removal / Installation, page 8.16.
13. Install the front wheel. See Front Wheel Removal / Installation, page 8.14.

FRONT FORK REMOVAL

⚠ WARNING

This procedure requires raising and supporting the motorcycle so that the front wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.

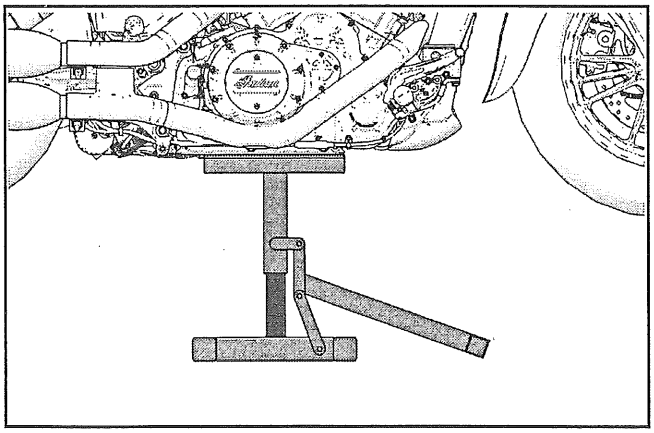
CAUTION

Do not twist the brake hose or brake line. Do not allow calipers to hang from the brake hose. Secure calipers in such a way to avoid hose damage.

CAUTION

CALIFORNIA MODELS: Remove the charcoal canister prior to raising motorcycle wheels off the ground. As the swingarm lowers, it can contact the canister hose fittings and damage them.

1. Remove front fender. See Front Fender Removal, page 7.9.
2. Secure the motorcycle in an upright position with tie-down straps and a platform jack positioned beneath the engine cases.

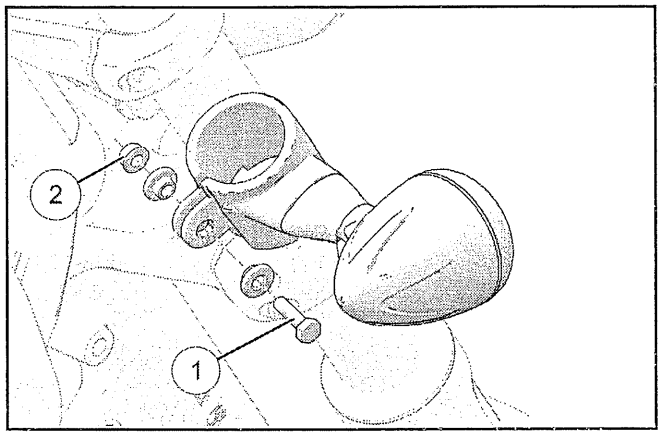


NOTE

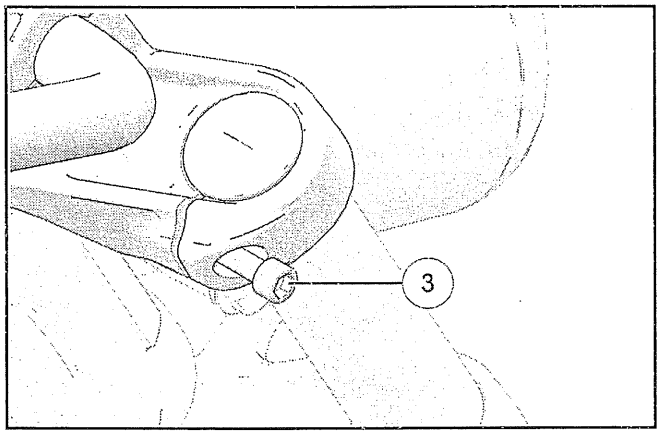
Do not operate the front brake lever with the calipers or wheel removed.

3. Remove front brake calipers and support them so they do not hang by brake hoses. See Front Caliper Service (2015–16), page 9.31.

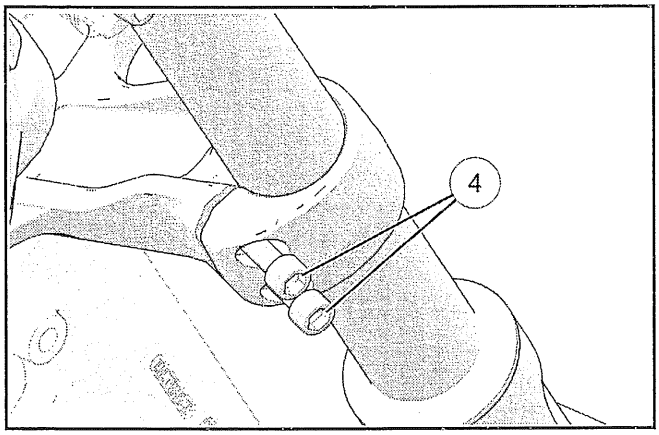
4. Remove front wheel. See Front Wheel Removal / Installation, page 8.14.
5. Remove turn signal assembly by removing bolt ① and nut ②.



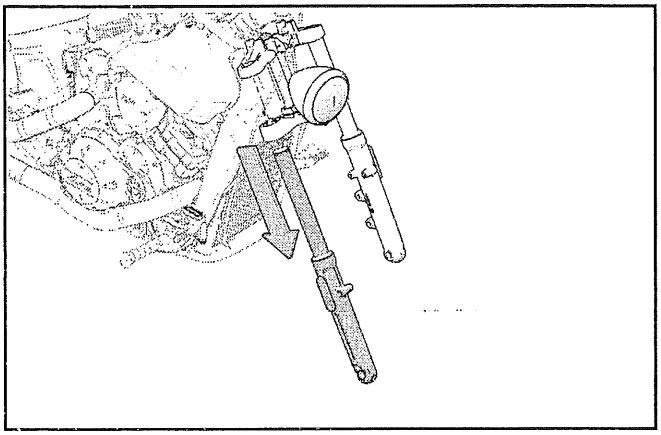
6. Loosen top triple clamp pinch bolt ③.



7. Loosen lower triple clamp pinch bolts ④.



8. Slide fork leg down and remove.



FRONT FORK DISASSEMBLY

NOTE

The following procedure requires the use of Fork Spring Compressor (PV-49463) and Fork Spring Compressor Adapter/Cartridge Tool (PF-51664-2).

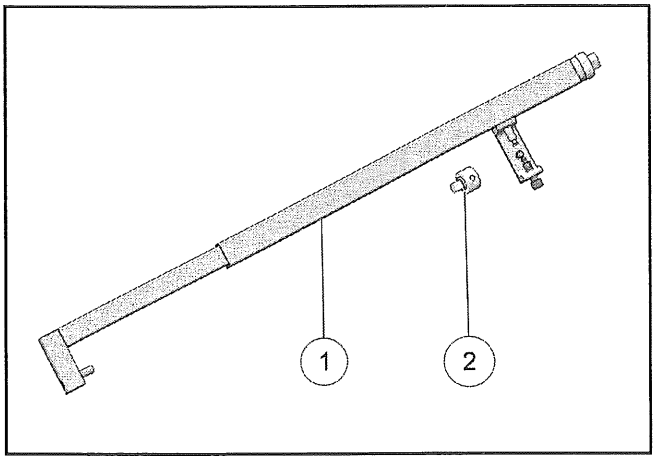
NOTE

Refer to appropriate Front Fork Exploded View. Clean fork tubes before disassembly.

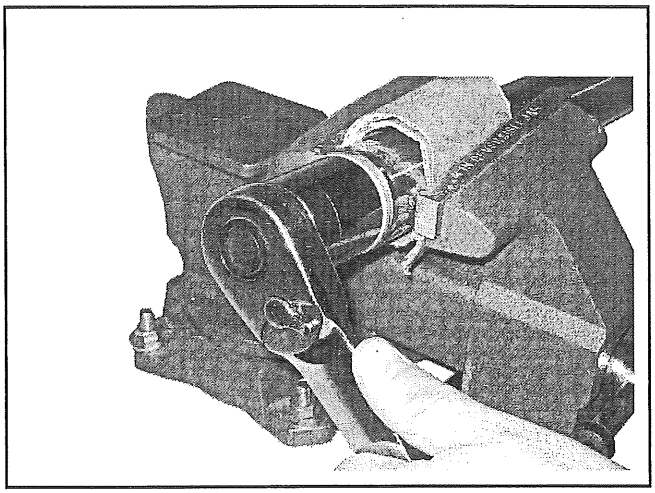
NOTE

Two types of fork caps have been used an "early" and "late" design. The "early" design cap is flat on top with M37x1.5 threads and the "late" design cap has a raised circle in the center with M35 x 1.5 threads. The caps and fork tubes are not interchangeable between designs.

1. Secure Fork Spring Compressor **(PV-49463)** ① vertically in a vise with drive bolt UP.



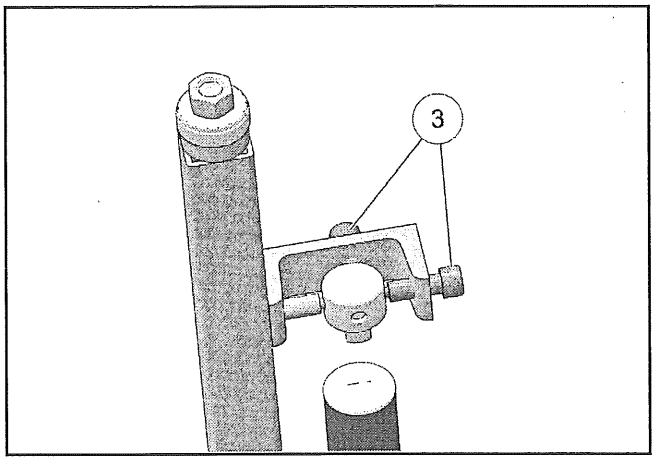
2. Place fork in soft jawed vise and loosen fork cap approximately 1 turn. Do not remove the cap. Remove fork from vise.



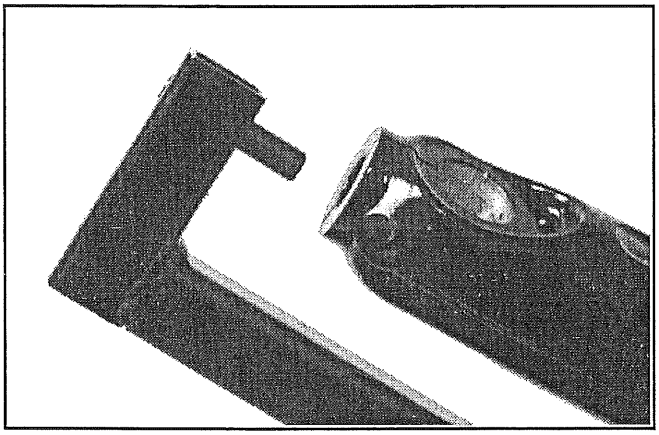
⚠ WARNING

Wear eye / face protection. Be sure spring is engaged properly with pegs of tool as you compress the spring in the following steps.

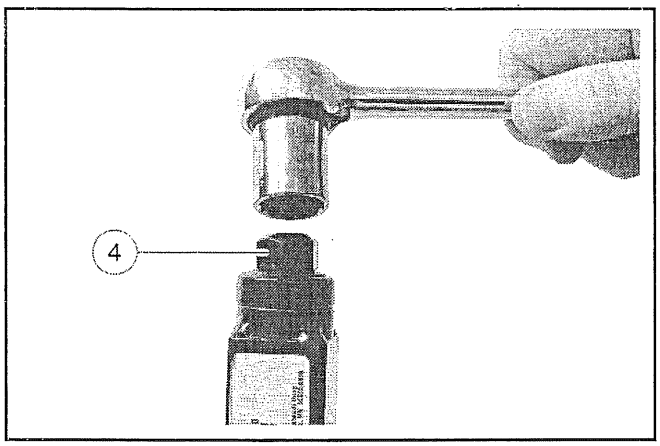
3. Mount special socket adapter **(PF-51664-1)** ② and 30mm socket in spring compressor **(PV-49463)**. Center socket adapter **(PF-51664-1)** in holding fixture with all thumb screws ③.



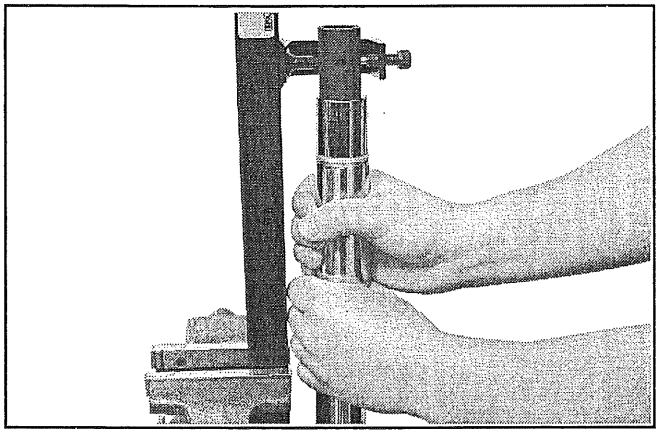
4. Place fork tube in spring compressor tool with hole in bottom of fork slider over peg on bottom of tool.



5. Place special tool **(PV-49463)** in soft jawed vise with the drive bolt ④ facing up. Adjust length of spring compressor by turning drive bolt (4) as required until fork cap is captive in socket.

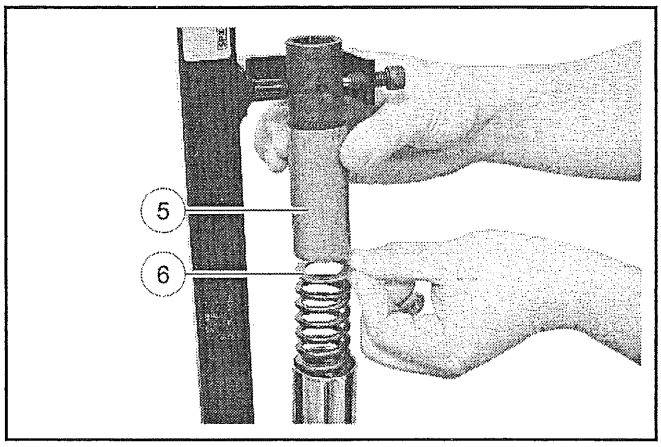


6. Rotate fork tube until cap is unscrewed completely from fork tube.

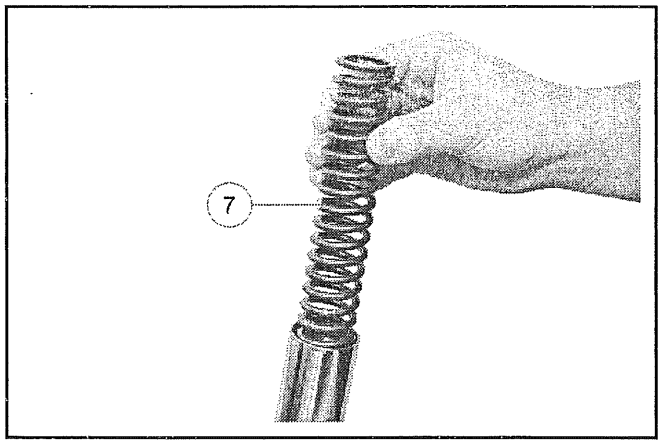


7. Back off spring compressor and remove special socket along with Cap assembly.

8. Remove Spacer ⑤ and Washer ⑥ from top of spring.

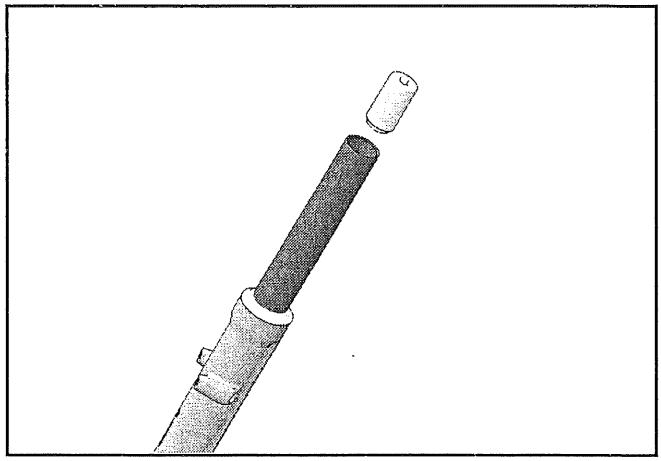


9. Remove Spring ⑦ from fork tube.

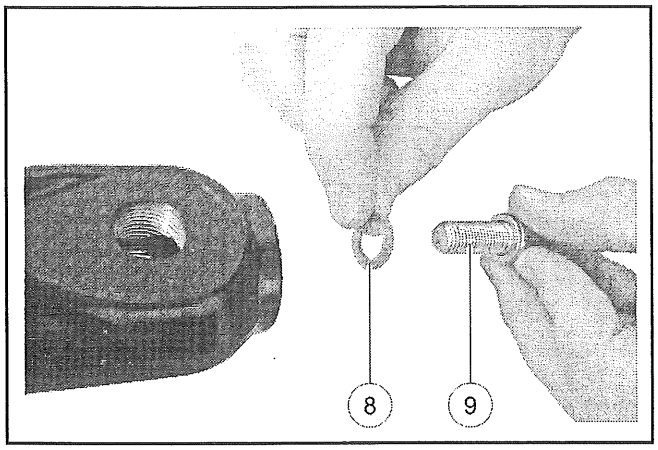


10. Pour fork oil out of tube assembly.

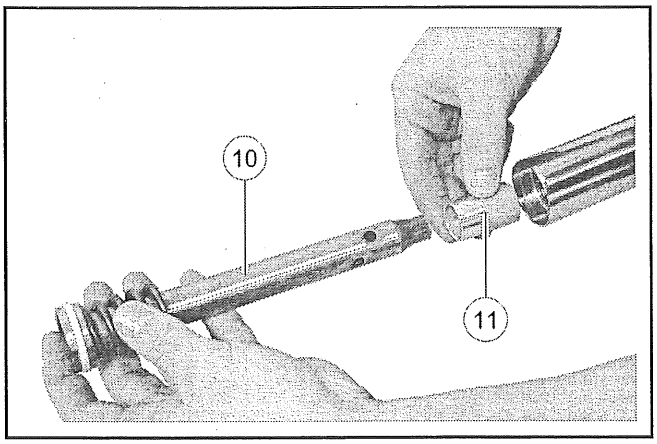
11. Remove fork cartridge by inserting Fork Cartridge Tool **(PF-51664-2)** with a 3/8" extension into fork tube.



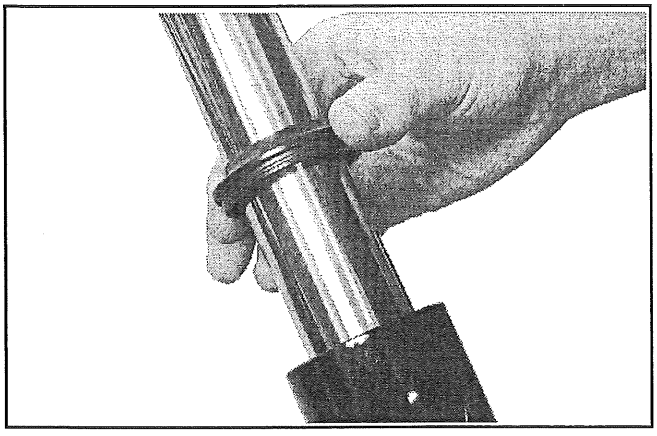
12. Prevent Fork Cartridge Tool **(PF-51664-2)** from turning and remove cylinder screw ⑨ from bottom of fork. Using a pick tool, remove crush washer ⑧.



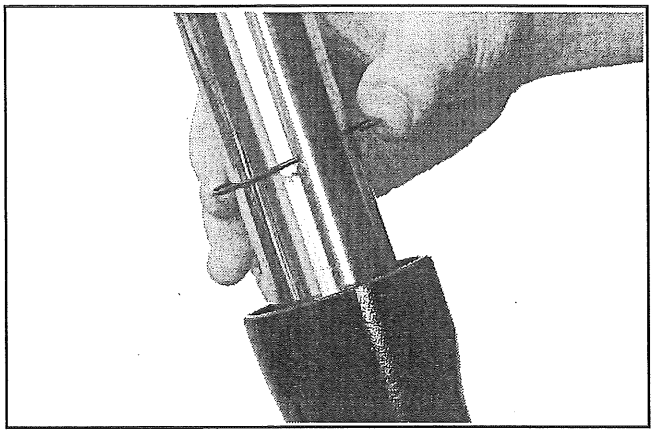
13. Tip fork upside down and slide Cylinder Assembly ⑩ out of fork tube along with Oil Lock ⑪.



14. Carefully lift dust seal out of outer fork tube with a small flat screwdriver.

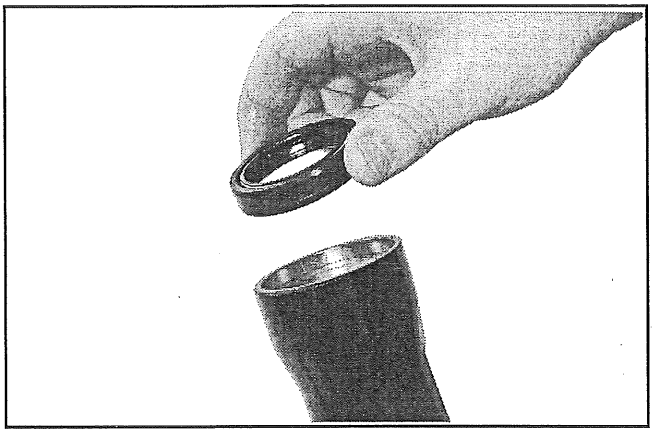


15. Remove seal retaining ring. Use care not to scratch the surface of the inner fork tube.

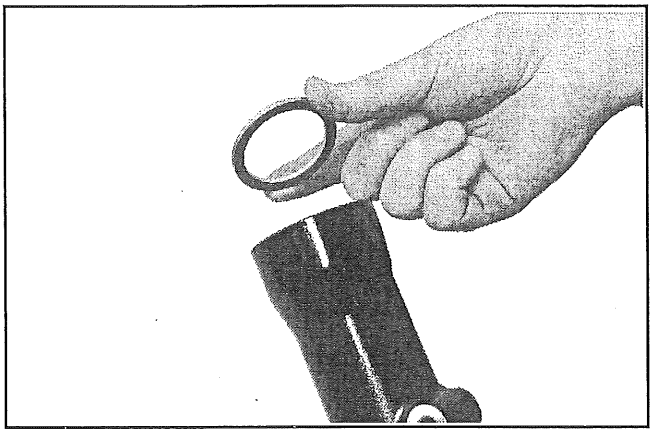


16. Push inner and outer tube together, then pull apart quickly to produce a slide hammer motion to remove the inner tube.

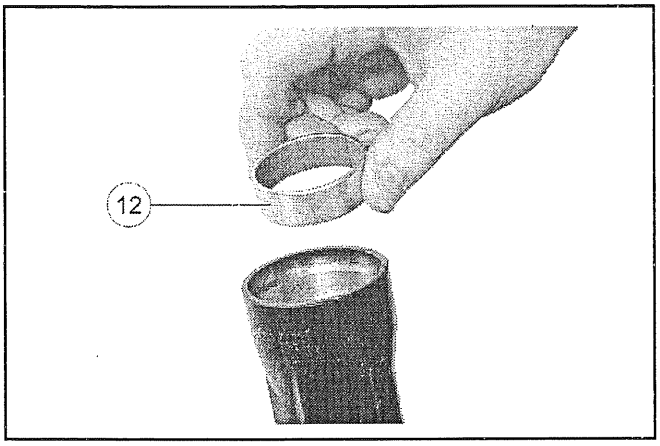
17. Remove Oil Seal.



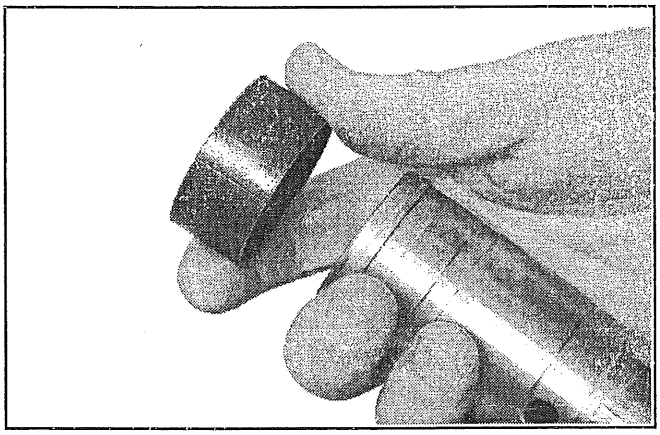
18. Remove Washer.



19. Remove Slide ⑫.

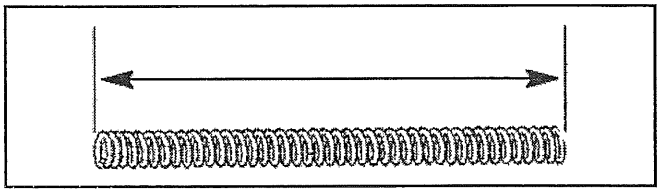


20. Remove the lower bushing from the inner tube.



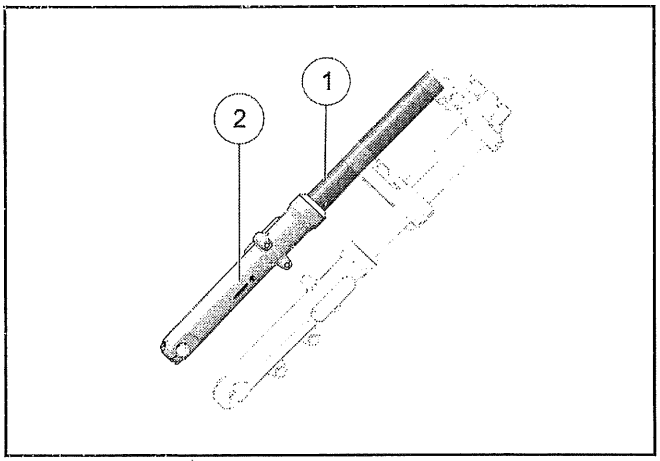
FRONT FORK INSPECTION

1. Measure fork spring free length and compare to specifications on Service Specifications, page 8.4.

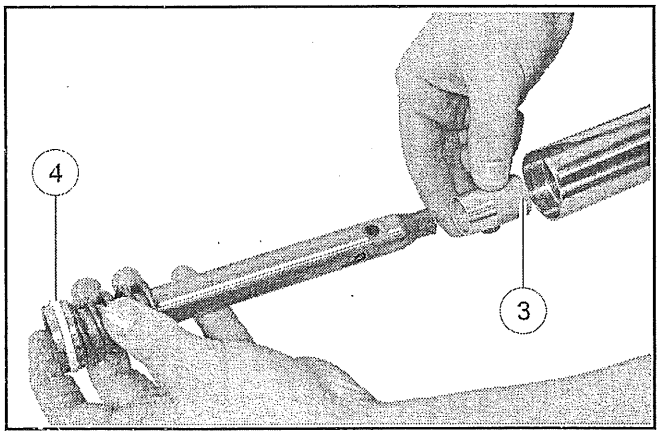


2. Inspect fork stanchion tube ① for scoring, heavy scratches, dents due to rocks or other road debris, or excessive wear. Replace tube (s) if deep scratches, pitting, or dents are found.

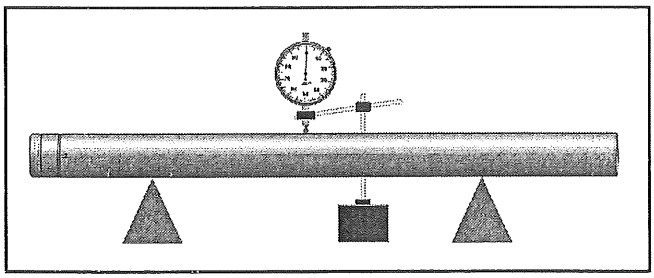
3. Inspect slider ② for dents or other indentations due to rocks or other road debris or damage. If damage is found on exterior of slider, insert fork tube into slider and move the tube through the complete travel range. Check for resistance or binding in the damaged area. If binding or resistance is evident, replace the slider.



4. Inspect oil lock valve ③ for scoring, excessive or abnormal wear.



5. Visually inspect the damper rod piston ring ④. Replace component if scoring, deep scratches and/or excessive wear is noted.
6. Place fork tube in V-blocks and measure runout. Replace the tube if runout exceeds service limit listed at Service Specifications, page 8.4.



⚠ WARNING

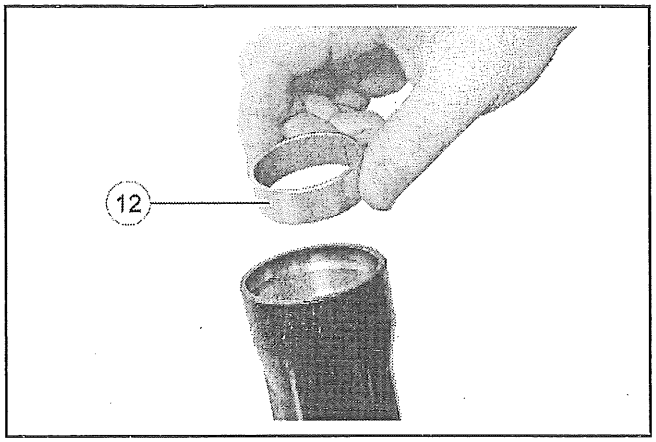
Do not attempt to straighten bent fork tubes. Doing so will weaken the tube and make the motorcycle unsafe to operate.

FRONT FORK ASSEMBLY

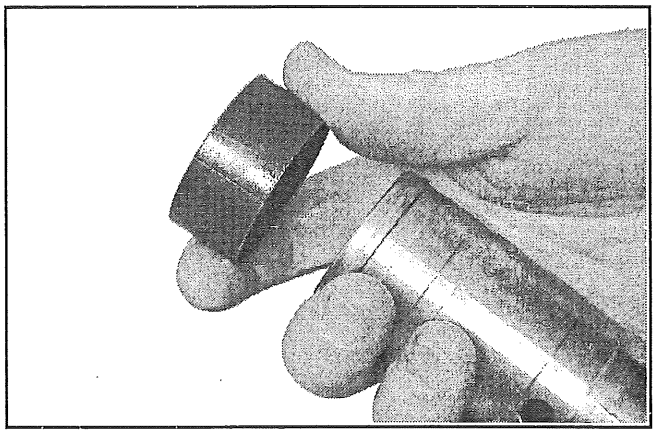
NOTE

Clean all parts prior to assembly.

1. Lubricate and install new bushing ⑫ into fork slider.



2. Lubricate and install a new lower bushing on inner fork tube.

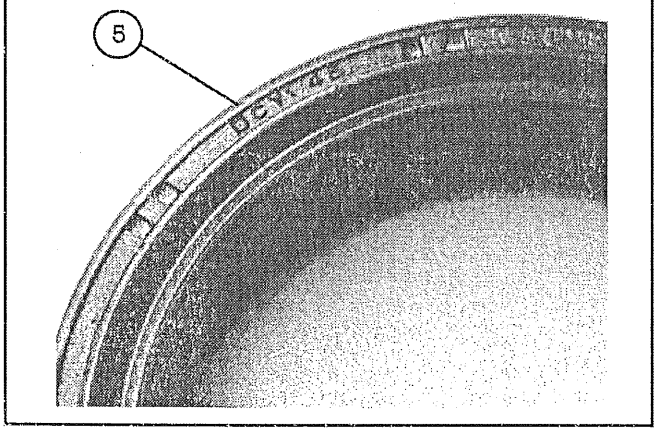


8

3. Apply a light film of fork oil to outside edge and inside seal lips of new oil seal.

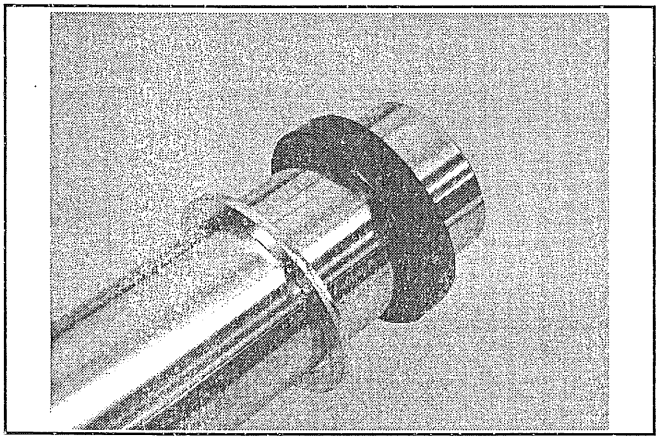
NOTE

Install oil seal with markings facing UP (toward top of tube and retaining ring).



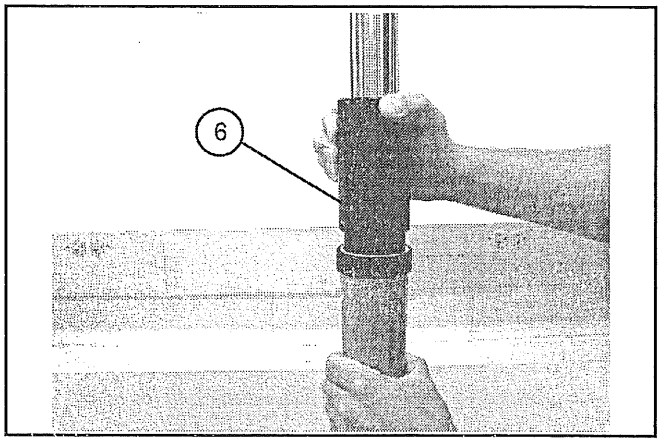
4. Install Fork Seal Installation Tool **(PF-51611)** on fork tube.

5. Lubricate the surface of the inner fork tube and slide backing washer and new oil seal onto fork tube.

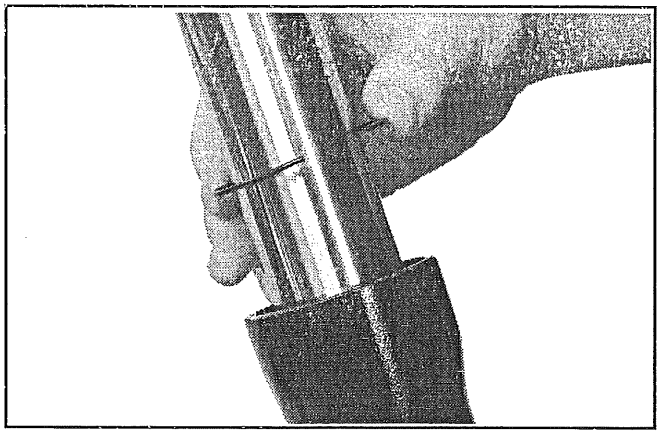


6. Insert fork tube in fork leg.

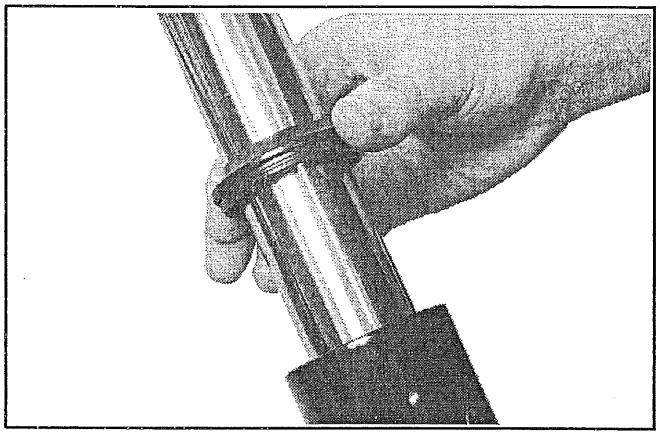
7. Use the Fork Seal Tool **(PF-51610)** ⑥ to install oil seal until seated. Be sure top edge of seal is past (below) retaining ring groove.



8. Install a new retaining ring ⑦ fork tube.



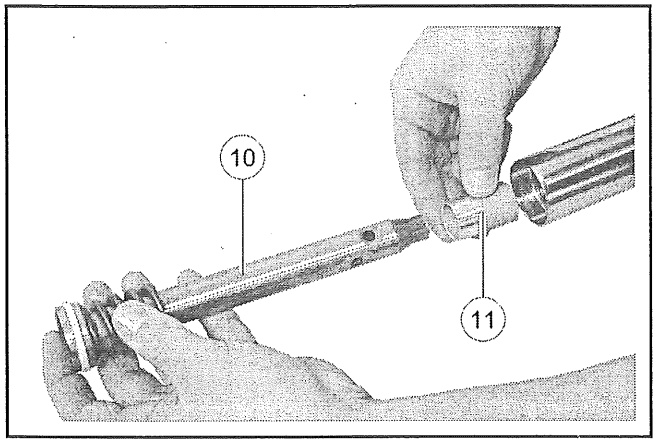
9. Wipe away any excess grease or oil. Install dust seal (use opposite end of Fork Seal Tool **(PF-51610)** until fully seated in outer tube.



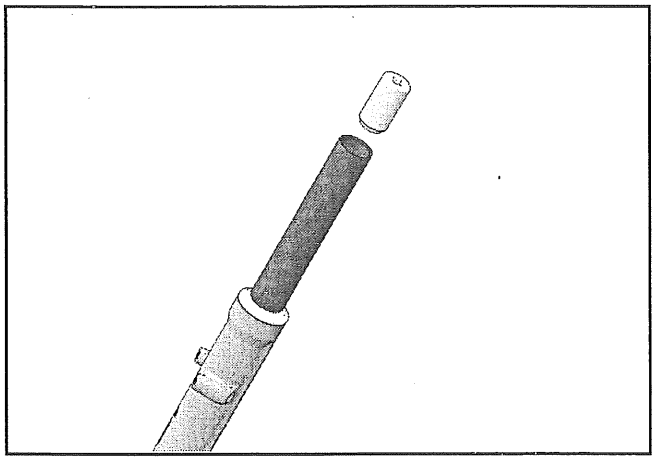
Cylinder Installation

10. Be sure screw threads in bottom of Cylinder Assembly are clean and not damaged.

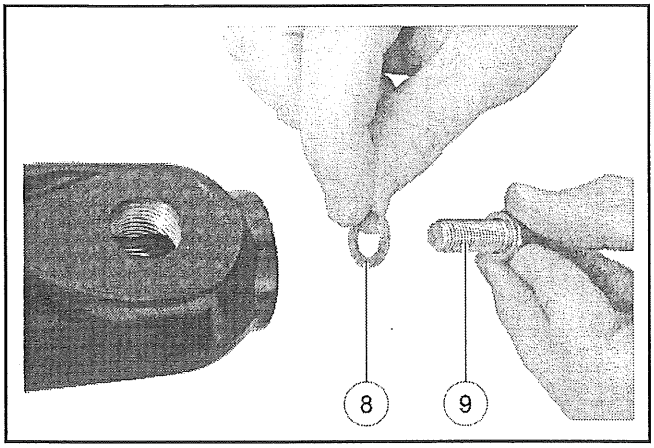
11. Place Cylinder Assembly ⑩ along with Oil Lock ⑪ into fork slider. Carefully align bottom of Oil Lock with recess in bottom of fork.



12. Prevent fork cartridge cylinder from turning by inserting Fork Cartridge Tool **(PF-51664-2)** with a 3/8" extension into fork tube.



13. Install a new cylinder screw ⑨ and a new crush washer ⑧.

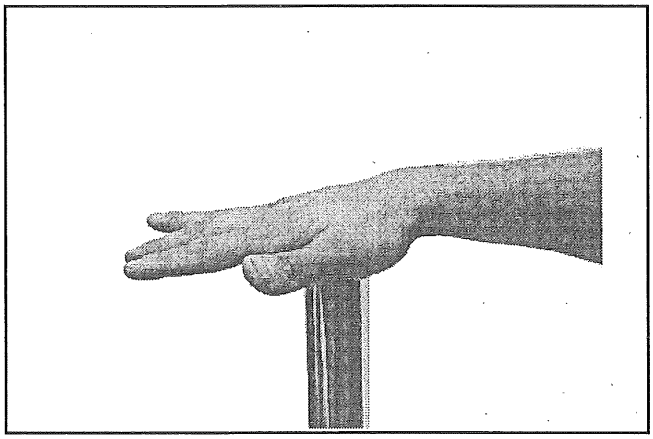


14. Torque cylinder screw to specification.

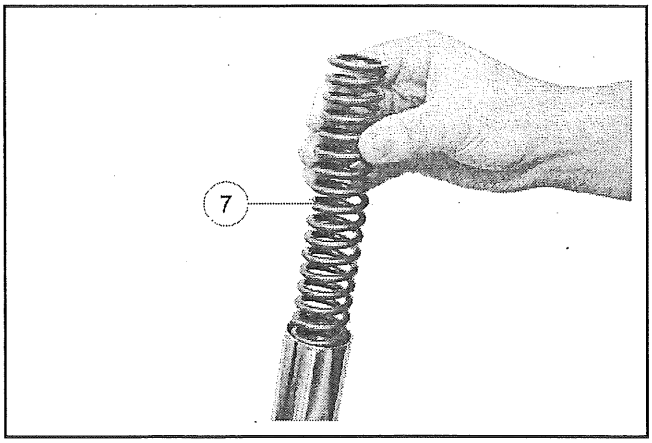
TORQUE
Fork Cartridge Fastener: **17 ft-lbs (23 Nm)**

Oil Filling / Cartridge Air Bleeding

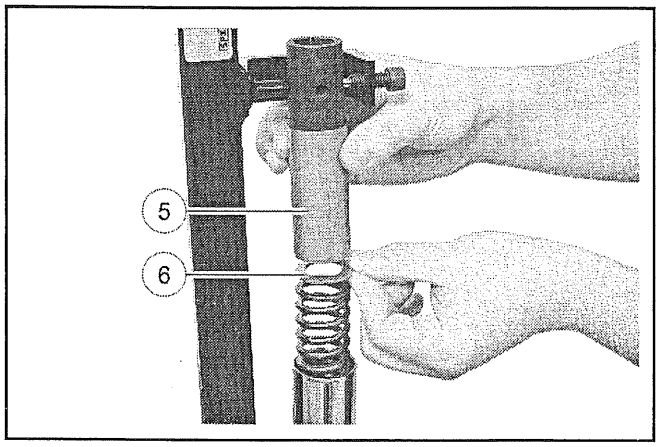
15. Set fork leg upright.
16. Lift tube to top of travel range.
17. Tip fork leg at an angle to reduce air bubbles. Slowly add 335cc of Indian Motorcycle fork oil.
18. Seal top of tube with your hand and push downward against air pressure. Hold for 10– 15 seconds. This will help force trapped air from cartridge and tube.



19. Mount fork assembly upright in a soft jawed vise by brake caliper mounts on slider.
20. Install Spring ⑦ into fork tube.

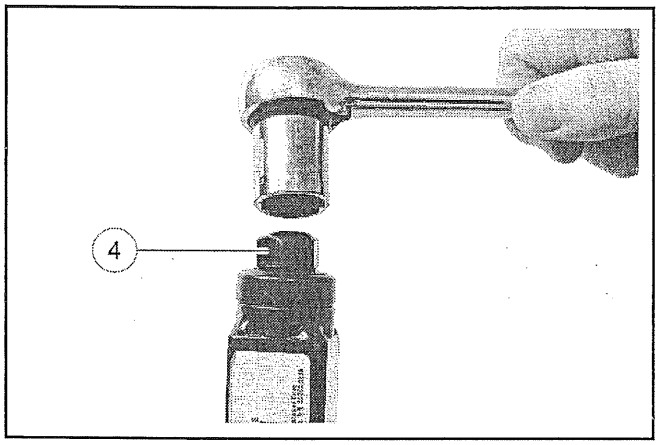


21. Place Washer ⑥ and Spacer ⑤ on top of spring. Place Fork Cap on Spacer.

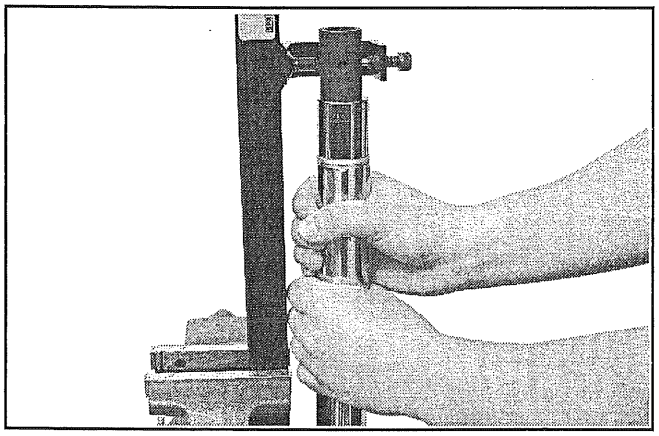


22. Install fork spring socket adapter **(PF-51664-2)** in compressor as outlined for disassembly.

23. Slowly compress fork tube assembly with drive nut ④ until fork cap enters the outer tube, and threads start to make contact.



24. Rotate outer tube to start cap. Use care to avoid thread damage.



25. After cap thread is started, continue to turn tube and adjust spring compressor pressure as required until cap is fully seated against top of outer tube.

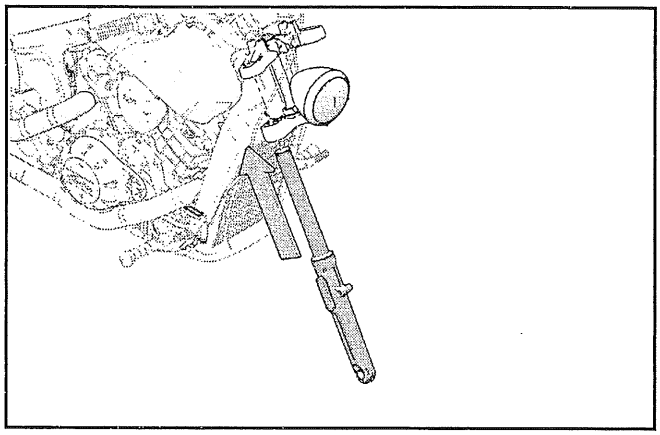
26. Tighten fork cap to outer tube. Torque to specification.

TORQUE
Fork Cap: **16 ft-lbs (22 Nm)**

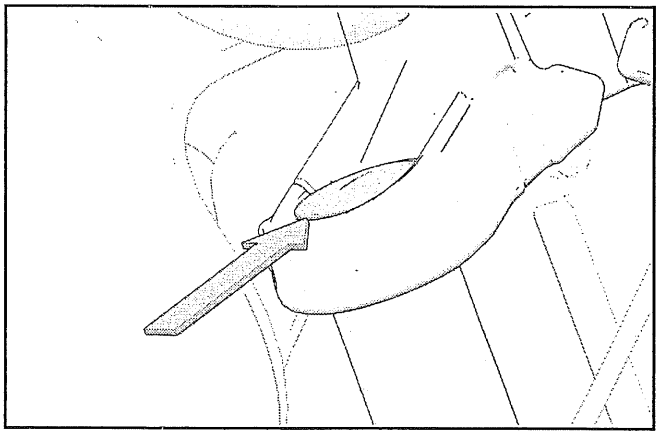
FRONT FORK INSTALLATION

NOTE
Clean the fork tubes and the clamping surfaces of the triple clamps to remove any oil or grease prior to installation.

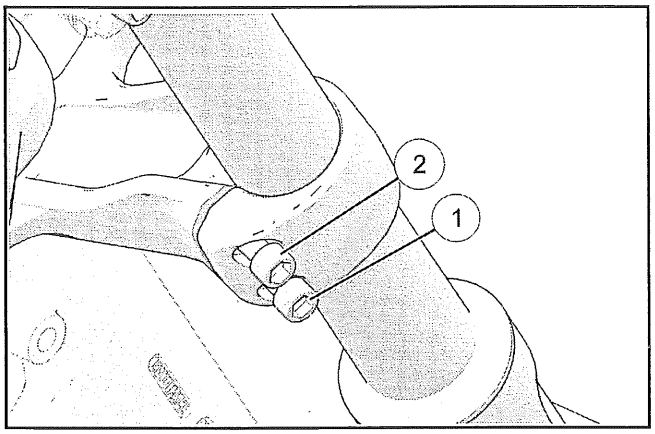
1. Install one fork tube assembly into lower triple clamp.



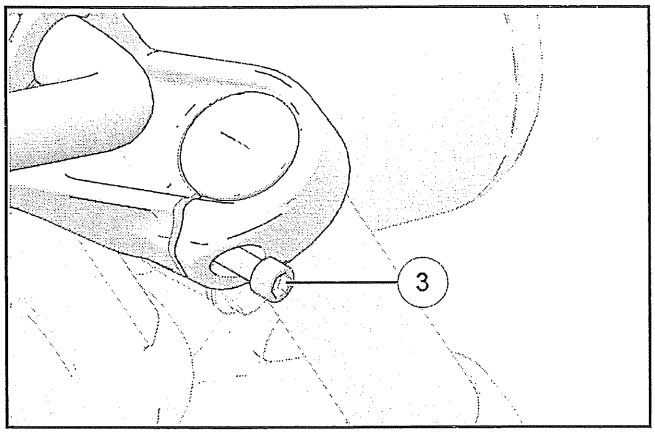
2. Continue to slide tube through lower triple clamp and into upper triple clamp. Stop when the top of the fork cap is flush with the top of the upper triple clamp.



3. Torque the bottom bolt on the lower triple clamp ①.
4. Torque the top bolt on the lower triple clamp ②.



5. REPEAT steps 3 – 4.
6. Torque the upper triple clamp bolt ③.



TORQUE

Fork Triple Clamp Fasteners (Lower):
18 ft-lbs (24 Nm)

TORQUE

Fork Triple Clamp Fasteners (Upper):
18 ft-lbs (24 Nm)

7. Repeat steps 1 through 6 for the other fork tube.
8. Install brake line guides (if removed).
9. Install front wheel. See Front Wheel Removal / Installation, page 8.14.
10. Install brake caliper. See Front Caliper Service (2015–16), page 9.31.
11. Install front fender. See Front Fender Installation, page 7.9.
12. Inspect all bolts for proper torque. Inspect hoses and wiring for proper routing.
13. Lower front end of motorcycle to the ground and test front suspension / fork operation.

TRIPLE CLAMP REMOVAL

⚠ WARNING

This procedure requires raising and supporting the motorcycle so that the front wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.

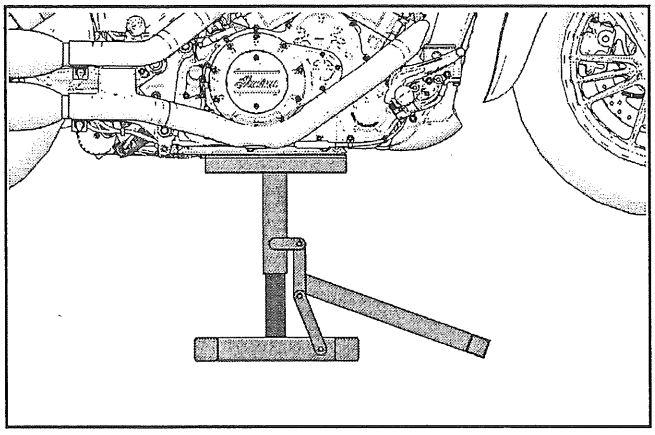
CAUTION

Do not twist the brake hose or brake line. Do not allow calipers to hang from the brake hose. Secure calipers in such a way to avoid hose damage.

CAUTION

CALIFORNIA MODELS: Remove the charcoal canister prior to raising motorcycle wheels off the ground. As the swingarm lowers it can contact the canister hose fittings and damage them.

1. Secure the motorcycle in an upright position with tie-down straps and a platform jack positioned beneath the engine cases.

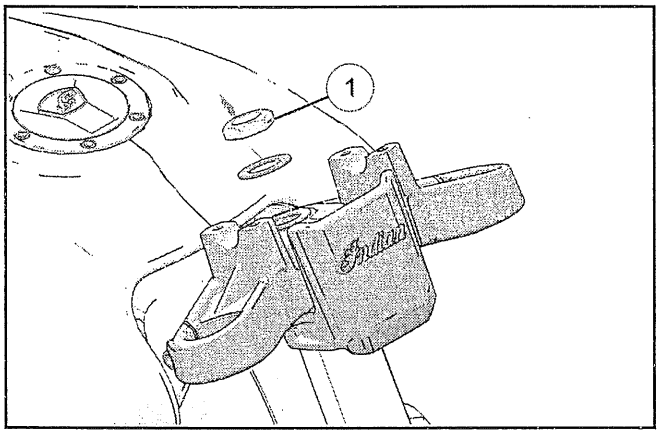


NOTE

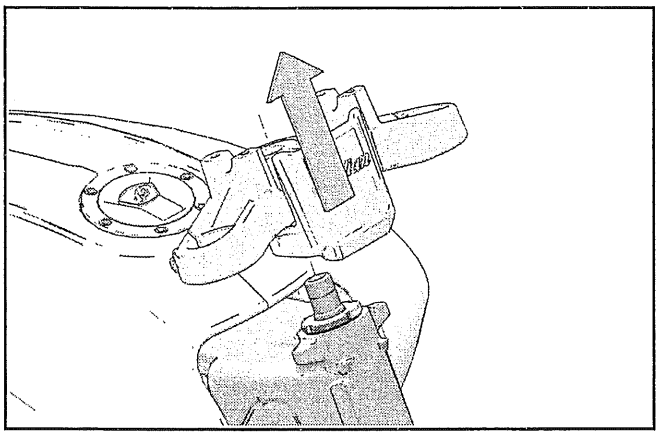
Do not operate the front brake lever with the calipers or wheel removed.

2. Remove the front fender. See Front Fender Removal, page 7.9.

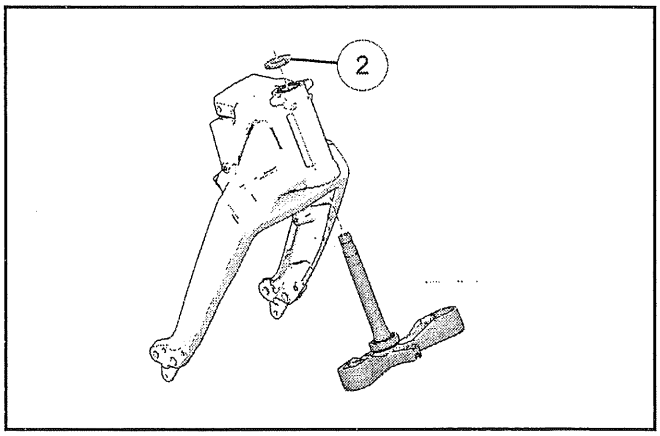
3. Remove front wheel. See Front Wheel Removal / Installation, page 8.14.
4. Remove Speedometer assembly.
5. Remove Headlight assembly.
6. Remove the handlebar / riser assembly. See Handlebar Removal / Installation, page 8.12.
7. Remove fork tubes. See Front Fork Removal, page 8.17.
8. Remove brake line guides from upper and lower triple clamp.
9. Remove center nut ① and washer on upper triple clamp.



10. Slide upper triple clamp off steering stem.



11. Remove stem adjuster nut ② with a suitable spanner socket.



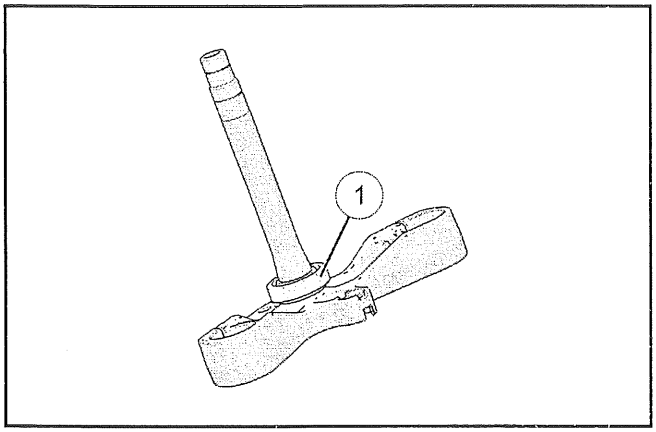
NOTE

Support lower triple clamp while removing the adjuster nut.

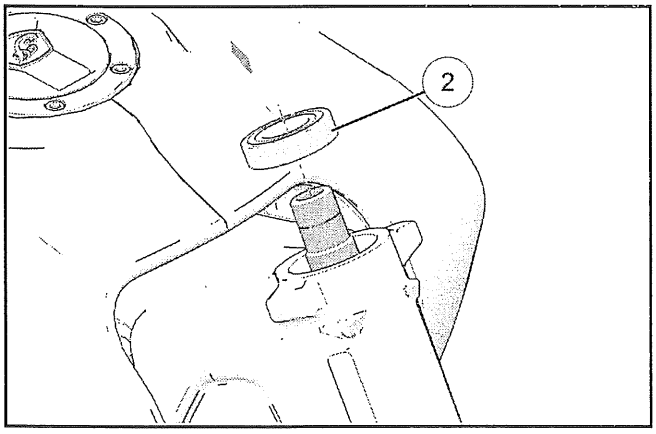
12. Remove lower triple clamp, with steering stem, and lower bearing (outer race will remain in head tube).
13. Inspect bearings and bearing races.

TRIPLE CLAMP INSTALLATION / STEERING HEAD BEARING ADJUSTMENT

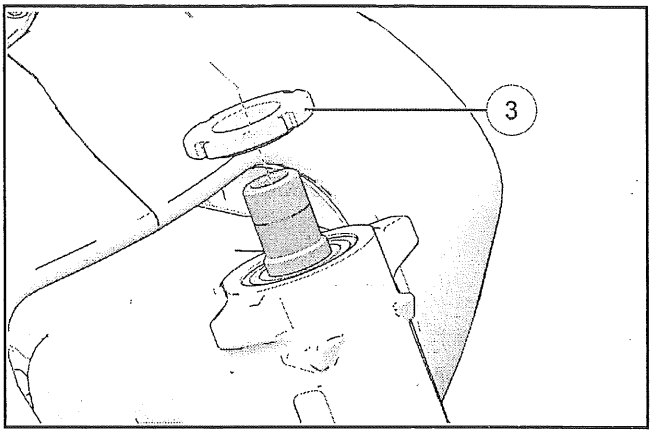
1. Inspect both top and bottom bearing races for pitting, dents, or worn surface. Replace bearings and races as a set if they are worn or damaged.
2. Be sure lower stem bearing ① is seated against step on lower triple clamp. Apply all purpose grease to bearing and install lower triple clamp / stem to frame.



3. Grease and install upper bearing ② onto stem and push it down until seated in upper bearing race.



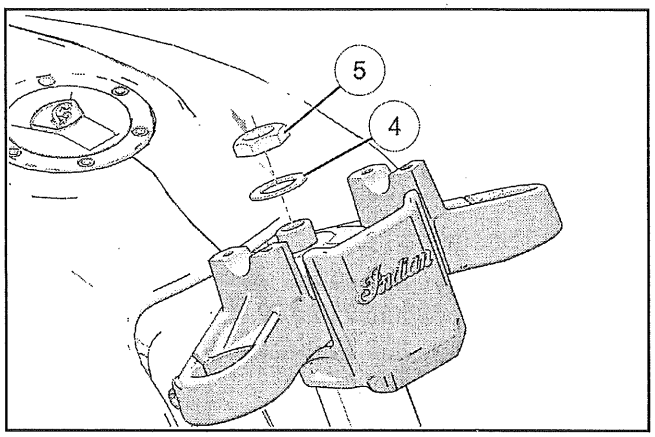
4. Screw adjuster nut ③ (shoulder side down) onto the steering stem until it is finger tight.



5. Turn triple clamp assembly fully to the right.
6. Torque steering head nut to specification using suitable spanner wrench.

TORQUE
Steering Head Nut: **29 ft-lbs (40 Nm)**

7. Place a mark on the frame in alignment with one of the slots on the adjuster nut.
8. Turn lower triple clamp from lock to lock five times and *return to full right* position.
9. Loosen adjuster nut 90 degrees (1/4 turn) so the reference mark on frame is aligned with the next one of the four slots on the stem nut.
10. Set upper triple clamp in place on stem. Install washer ④ and nut ⑤ and tighten top nut until it is finger tight.



NOTE
Nut will be torqued after fork tubes are installed.

11. Slide fork tubes through lower triple clamp and into upper triple clamp. Align top edge of fork cap with top edge of upper triple clamp and hold in position.
12. Tighten top triple clamp pinch bolt enough to hold tubes in place. Leave lower triple clamp pinch bolts *loose*.
13. Torque the top steering stem nut to specification.

TORQUE
Steering Stem Nut (top): **72 ft-lbs (97 Nm)**

NOTE
CHECK STEERING STEM BEARINGS at this time. Pull firmly on fork tubes with a front-to-rear motion. If movement can be felt in steering bearings, disassemble and go back to STEP 10. Tighten steering stem adjuster nut an additional 5 degrees, and reassemble following STEPS 10–15. Repeat this procedure until no play can be felt.

14. Verify fork tube height in upper triple clamp. The top of the fork cap should be flush with the top of the upper triple clamp.
15. Torque the upper triple clamp pinch bolts (both sides) to specification.

TORQUE
Fork Triple Clamp Fasteners (Upper): **18 ft-lbs (24 Nm)**

16. Torque bottom bolts on lower triple clamp to specification.
17. Torque top bolts on lower triple clamp to specification.

TORQUE
Fork Triple Clamp Fasteners (Lower): **18 ft-lbs (24 Nm)**

18. Repeat STEPS 15–17.
19. Install handlebar assembly. See Handlebar Removal / Installation, page 8.12.
20. Install front wheel. See Front Wheel Removal / Installation, page 8.14.
21. Verify all fasteners are installed and properly torqued.

TROUBLESHOOTING FRONT WHEEL / SUSPENSION

PROBLEM	POSSIBLE CAUSE	REPAIR RECOMMENDED
Heavy Steering	Steering Stem Nut Over Tightened	Torque to specification
	Damaged Steering Stem Bearings or Races	Replace
	Bent Steering Stem	Replace
	Front Tire Damaged or Worn	Replace
	Low Tire Pressure	Inflate to specification
Pulls to One Side or Wanders	Damaged Steering Stem Bearings or Races	Replace
	Steering Stem Nut Over Tightened or Under Tightened	Torque to specification
	Low Tire Pressure	Inflate to specification
	Rear Wheel Not Aligned Correctly	Align
	Bent Front Axle	Replace
	Damaged or Excessively Worn Front Tire / Incorrect Tire	Replace
	Damaged Wheel Bearings	Replace
	Damaged Swing Arm Bearings	Replace
	Loose Swing Arm Pivot Nut	Torque to specification
	Bent Frame or Swingarm	Replace
Handlebars Oscillate (Wobble)	Bent Front Axle	Replace
	Wheel Has Excessive Runout	True (Spoked) / Replace (Cast)
	Tire Mounted Incorrectly	Check Mounting and Balance
	Damaged Tire / Worn Tire	Replace
	Loose Steering Stem Nut	Torque to specification
	Incorrect Tire	Replace
	Incorrect Tire Pressure	Correct
Noise Coming From Front Suspension	Worn Fork Bushings	Rebuild Forks
	Low Fork Fluid	Determine Cause / Replace Fork Oil
	Loose Fasteners	Torque to specification
	Loose Steering Stem Bearings	Determine Cause / Correct
Front Wheel Oscillates (Wobbles)	Bent Front Rim	Replace
	Damaged Front Wheel Bearings	Replace
	Damaged or Incorrect Tire	Replace
Front Wheel Oscillates (Wobbles)	Loose Axle	Torque to specification

PROBLEM	POSSIBLE CAUSE	REPAIR RECOMMENDED
	Fork Tube Height Unequal	Install Correctly
	Fork Oil Level Unequal	Set Correctly
	Fork Spring Free Length Different Between Right & Left	Replace
	Wheel Assembly Out-of-Balance	Balance
	Low Tire Pressure	Inflate to specification
Front Suspension Too Soft	Weak Fork Springs	Replace
	Low Fork Oil Level	Determine Cause/Replace Fork Oil
	Wrong Weight Fork Oil	Replace
	Contaminated and/or Deteriorated Fork Oil	Replace
	Low Tire Pressure	Set Correctly
Front Suspension Too Hard	Tire Pressure Too High	Set Correctly
	Bent Fork Tubes	Replace
	Wrong Weight Fork Oil	Replace
	Too Much Fork Oil	Set Correctly
	Plugged Oil Passages	Rebuild Front Forks
	Damaged Sliders	Replace
	Forks Binding	Correct
Wheel Turns Hard	Damaged Wheel Bearings	Replace
	Front Axle Bent	Replace
	Brake Dragging (Hydraulic or Mechanical Problem)	Repair as Necessary
	Brake Dragging (Bent Disc)	Replace
	Improper Assembly After Repairs	Correct as Necessary

REAR WHEEL / SUSPENSION

GENERAL INFORMATION

SERVICE NOTES

⚠ WARNING

This motorcycle was produced with the designated tires as original equipment. The testing to ensure stability and superior handling was done using the OEM tires. Using non-OEM tires could result in poor motorcycle stability and handling, which can lead to a crash resulting in serious injury or death. Use only the recommended tires inflated to the recommended tire pressures.

Tubeless tires are used on certain Indian Motorcycle models. Operating the motorcycle with damaged rims creates a safety hazard including air pressure loss, steering imbalance and/or reduced steering control. Do not attempt to repair or straighten damaged cast or spoked rims. Always use genuine Indian Motorcycle parts or equivalent so that quality is not compromised. The use of tire valves and valve cores other than original equipment replacement Indian Motorcycle parts could cause tire deflation which may lead to loss of control, resulting in injury or death. Do not allow any motorcycle to leave your service area without tire valve caps securely installed.

- The rear shock absorber is serviceable.
- Refer to Maintenance Chapter for maintenance of rear wheel & suspension components, and suspension ride height adjustment.

SPECIAL TOOLS

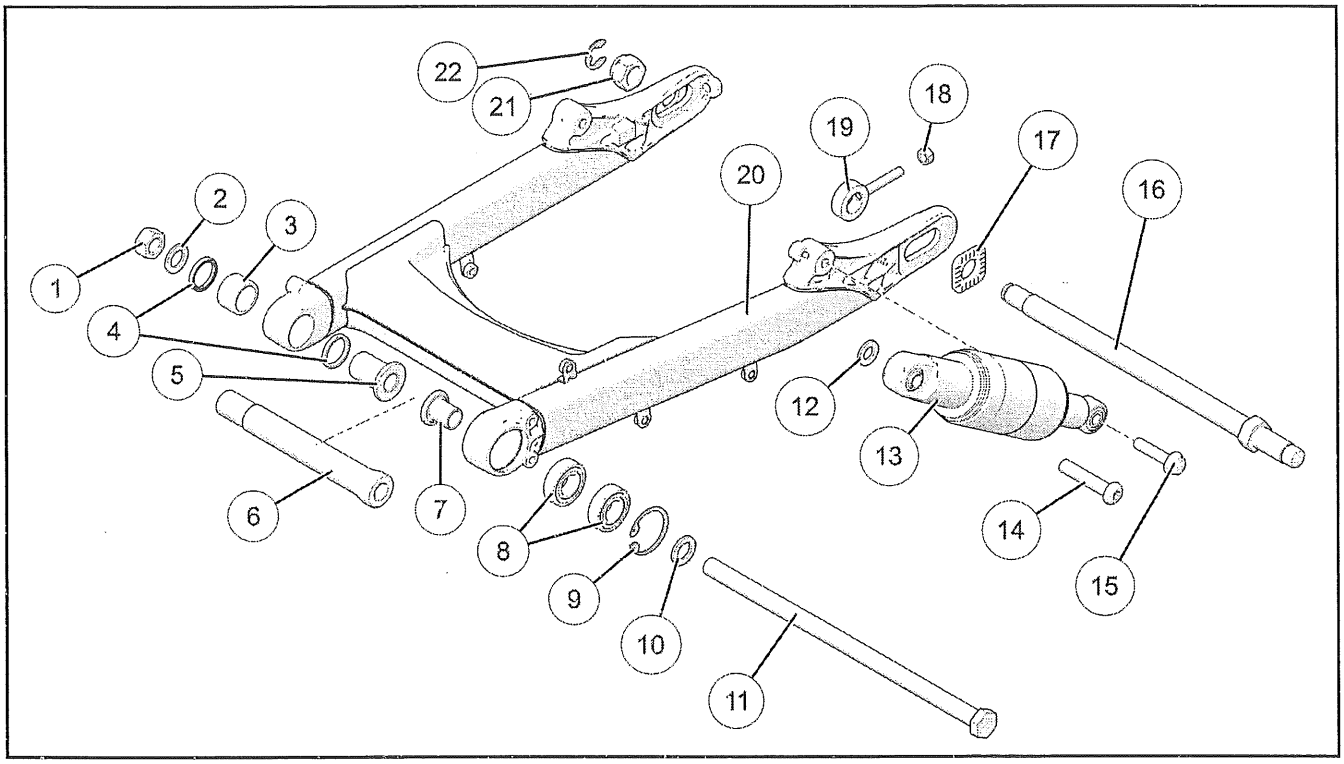
SPECIAL TOOL	PART NUMBER
Swing-arm Bushing Tool	PF-51237
Shock Spanner Wrench	PV-46993
Bearing Removal / Installation Kit	PU-51324
Platform Jack	Commercially Available

SERVICE SPECIFICATIONS

ITEM		STANDARD	SERVICE LIMIT
Axle Runout		-	.20 mm (.008")
Rear Wheel Runout	Axial / Radial	.80 mm (.030 inch)	2.0 mm (.080")
Rear Wheel Size / Type	All Models	16" x 3.5" Cast	–
Rear Wheel Travel	All Models	3.0" (76.2 mm)	–
Shock Spring Free Length	All Models	8.0" (203.2 mm)	–
Shock Spring Installed Length (Standard)	All Models	Perform Ride Height Adjustment	–
Suspension Ride Height	All Models	Refer to Maintenance Chapter for Ride Height Measurement procedure	–
Spring Rate	All Models	400 lbs / in	–
Swing Arm Pivot Shaft Runout		Not Applicable	.20 mm (.008")
Swing Arm Pivot Shaft O.D.		LH Ball Bearing Journal: 19.965–19.99 mm / RH Needle Bearing Journal: 24.95–25.00 mm	–
Swing Arm Needle Bearing Bore O.D. (RH)		31.946–31.972 mm	–
Swing Arm Ball Bearing Bore O.D. (LH)		41.967–41.992 mm	–
Wheel bearing O.D. (approx)		51.987–52.00 mm	–
Wheel bearing I.D. (approx)		19.998–20.00 mm	–

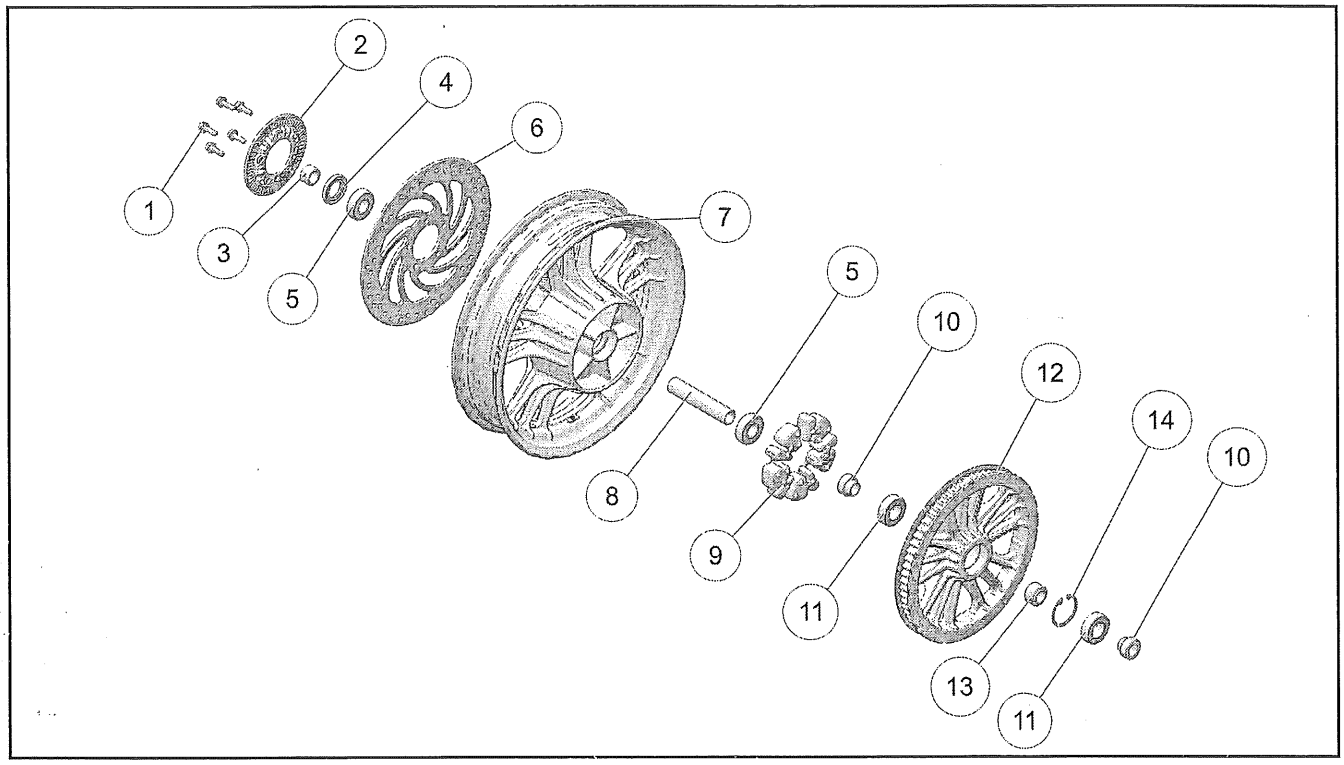
ASSEMBLY VIEWS

REAR SUSPENSION COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Swingarm Nut (LH)	**85 ft-lbs (115 Nm)**
②	Washer	-
③	Needle Roller Bearing	-
④	Seal	-
⑤	Swing Arm Bushing	-
⑥	Swing Arm Pivot	-
⑦	Swing Arm Bushing (Ball bearing)	-
⑧	Ball Bearing	-
⑨	Retaining Ring	-
⑩	Washer	-
⑪	Fastener	-
⑫	Washer	-
⑬	Shock ASM	-
⑭	Shock Fastener (upper)	**65 ft-lbs (88 Nm)**
⑮	Shock Fastener (lower)	**65 ft-lbs (88 Nm)**
⑯	Rear Axle	-
⑰	Indicator Plate	-
⑱	Axle Adjustment Nuts	-
⑲	Axle Adjuster	-
⑳	Swing Arm ASM	-
㉑	Axle Nut (rear)	**65 ft-lbs (88 Nm)**
㉒	E-Clip Ring	-

REAR WHEEL COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Brake Disc Fastener	**19 ft-lbs (26 Nm)**
②	ABS Ring (If Equipped)	-
③	Axle Spacer	-
④	Bearing Seal	-
⑤	Wheel Bearing	-
⑥	Brake Rotor	-
⑦	Rear Wheel	-
⑧	Bearing Spacer	-
⑨	Damper	-
⑩	Outer Bearing Spacer	-
⑪	Bearing	-
⑫	Sprocket	-
⑬	Sprocket Bearing Spacer	-
⑭	Retaining Ring	-

DRIVE BELT SERVICE

DRIVE BELT INSPECTION

1. Inspect belt tension and adjust if necessary. See Drive Belt Inspection, page 2.35.
2. If one or more component is damaged, replace belt and both sprockets as a set if the drive system has been in service for 5000 miles or more (8000 Km).

DRIVE BELT REMOVAL

NOTE

If belt is to be reinstalled, mark direction of rotation on the outer surface of belt. Reinstall belt in same direction as it was removed.

⚠ WARNING

A mis-aligned rear axle can cause drive line noise and damage the drive belt, which could cause belt failure and loss of control of the motorcycle.

⚠ WARNING

Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

1. Loosen rear axle and axle adjusters. See Rear Wheel Removal / Installation, page 8.45.
2. Remove left rear shock. Shock Absorber Removal, page 8.48
3. Remove drive sprocket cover. See Drive Sprocket Cover Removal / Installation, page 8.39.
4. Remove belt from drive sprocket.

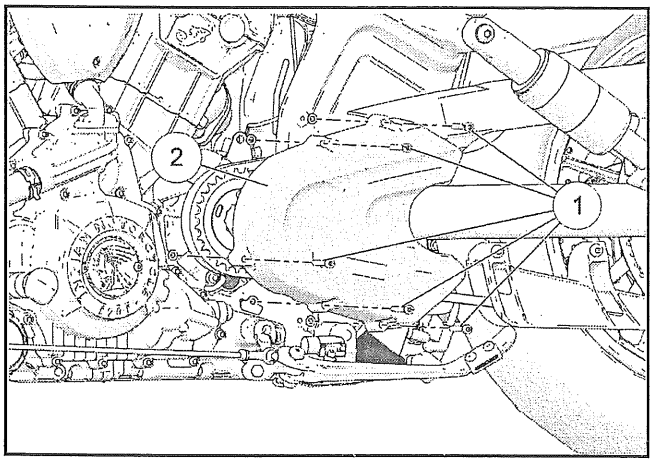
DRIVE BELT INSTALLATION

1. Inspect sprockets and verify sprocket fasteners are tight.
2. Install drive belt with the Indian Motorcycle script situated so that it reads correctly when viewed from the LH side of the motorcycle.
3. Install the drive sprocket cover. See Drive Sprocket Cover Removal / Installation, page 8.39.
4. Install shock absorber. SeeShock Absorber Installation, page 8.50.
5. Install the rear wheel. See Rear Wheel Removal / Installation, page 8.45.
6. Set drive belt alignment and tension. See Drive Belt Adjustment, page 2.38.

DRIVE SPROCKET SERVICE

DRIVE SPROCKET COVER REMOVAL / INSTALLATION

1. Remove bolts ① and drive sprocket cover ②.

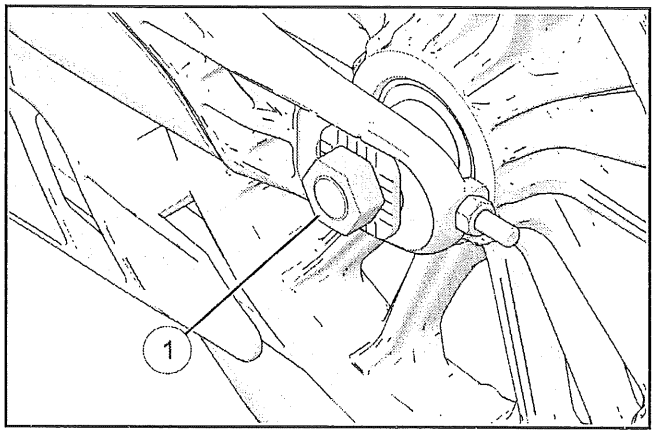


2. To install the drive sprocket cover, reverse the removal procedure.
3. Torque drive sprocket cover fasteners to specification.

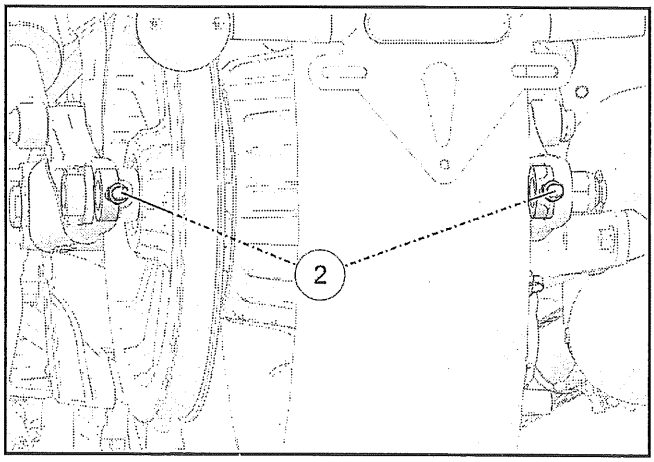
TORQUE
Drive Sprocket Cover Fasteners: **85 in-lbs (9.6 Nm)**

DRIVE SPROCKET REMOVAL

1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove the drive sprocket cover. SeeDrive Sprocket Cover Removal / Installation, page 8.39.
3. Loosen rear axle nut ① so that wheel assembly can be moved forward to slacken drive belt.

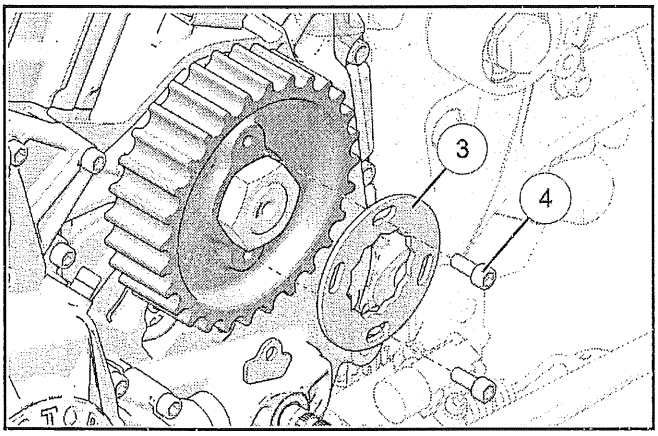


4. Loosen both axle adjuster nuts ② evenly to move wheel forward until belt is loose.

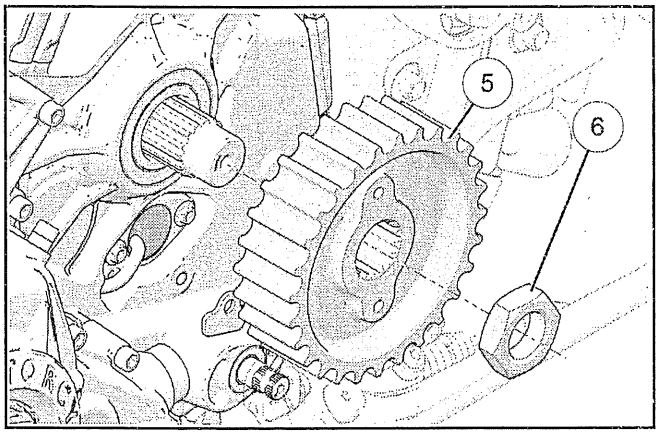


5. Pull belt off drive sprocket.

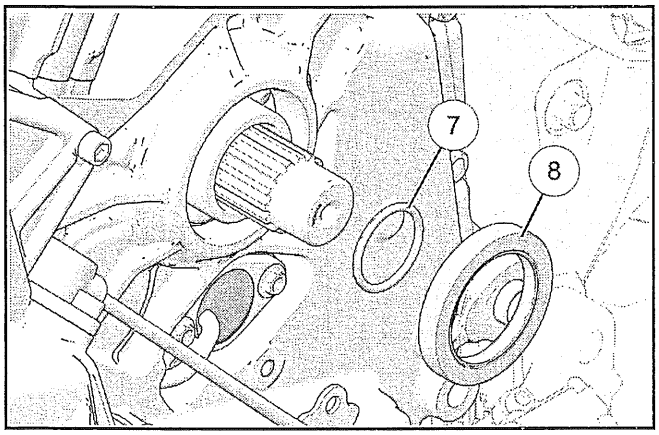
6. Remove two locking plate screws ④ and locking plate ③.



7. Remove drive sprocket ⑤ and drive sprocket retaining nut ⑥. See Locking the Crankshaft for Service, page 6.6.

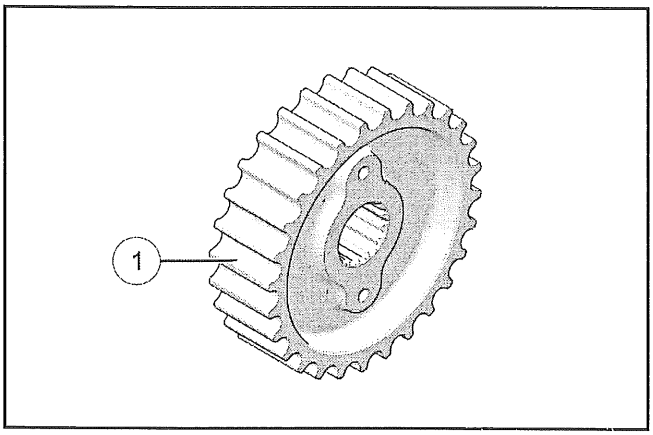


8. Remove O-ring ⑦ and spacer ⑧ and from output shaft.

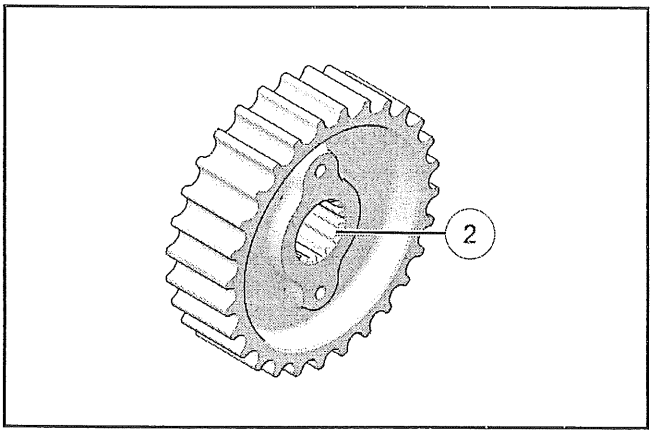


DRIVE SPROCKET INSPECTION

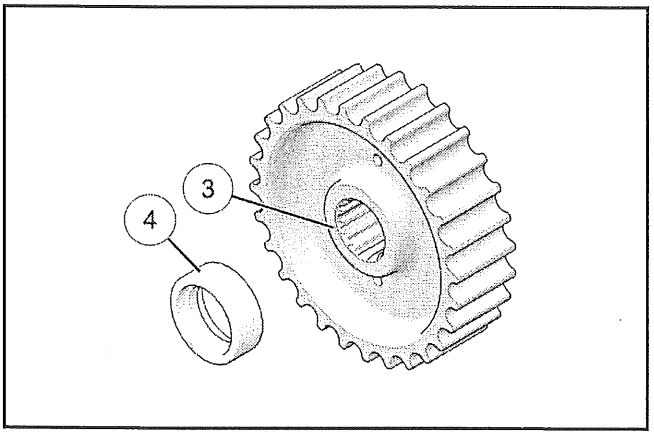
1. Visually inspect sprocket teeth ① for excessive wear and damage.



2. Inspect splines ② for a tight fit on output shaft splines.



3. Inspect the back surface of sprocket hub ③ where it contacts the seal sleeve. Replace if worn or if surface is rough.
4. Inspect the machined sealing surface of the spacer sleeve ④. Replace the spacer sleeve if it is grooved or otherwise damaged.



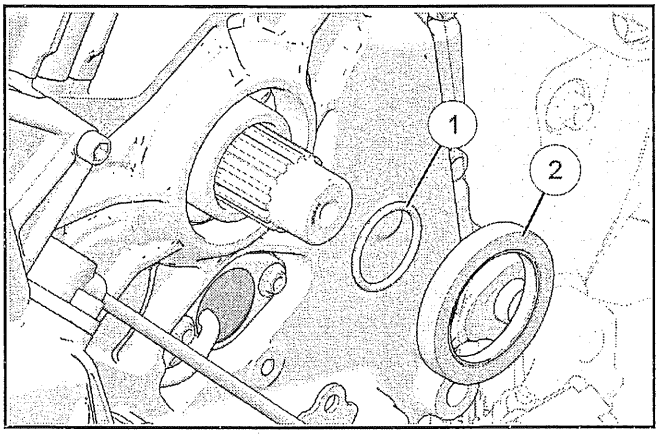
5. Sprockets and belt normally exhibit a polished appearance due to normal operation. Belt replacement is not required unless uncharacteristic damage is noted, or if the mileage service interval is reached. Belt or sprocket damage is usually due to debris trapped between belt and sprocket, or from improper maintenance and adjustment.

DRIVE SPROCKET INSTALLATION

NOTE

If replacing the output shaft seal, it will be necessary to use the Output Shaft Seal Tool **(PF-51243)** for proper installation.

1. Place new output shaft seal over the output shaft and drive into position using the Output Shaft Seal Tool **(PF-51243)**.
2. Apply grease to a new O-ring ① and install on output shaft.
3. Install seal sleeve ② with the chamfer on inside diameter of sleeve facing in, toward O-ring.



4. Clean shaft threads and sprocket nut to remove all previous thread locking agent.
5. Apply a light film of anti-seize compound to splines of shaft. Place belt onto front sprocket, place sprocket over splines of output shaft.
6. Apply Loctite™ 262 to threads of shaft and nut.
7. Install drive sprocket nut and torque to specification.

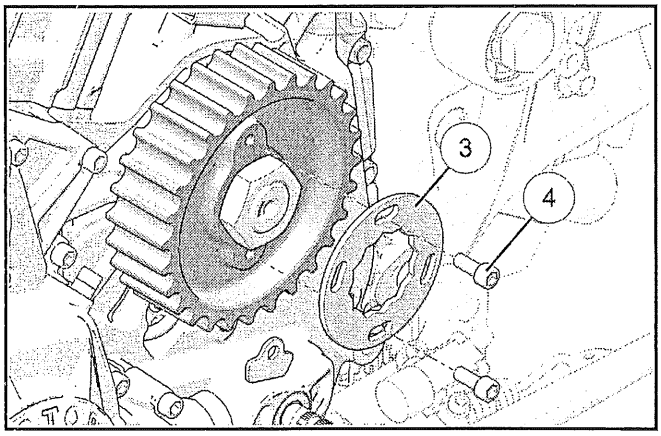
NOTE

Install Clutch Shaft Holding Tool **(PF-51232)** on clutch shaft prior to tightening sprocket nut.

TORQUE

Drive Sprocket Nut:
133 ft-lbs (180 Nm)

8. Install lock plate ③ and tighten screws ④ until lightly seated on plate.



NOTE

The lock plate can be installed in many positions and either side of the plate can be used. If the plate still does not align, tighten sprocket nut slightly and try to fit the lock plate again.

9. Rotate the plate CLOCKWISE until it stops and hold it firmly against the nut.
10. Torque lock plate fasteners to specification.

TORQUE

Drive Sprocket Lock Plate Fasteners:
88 in-lbs (10 Nm)

11. Remove the clutch shaft holding tool and install the clutch assembly. See Clutch Installation, page 5.19.
12. Install the drive sprocket cover. See Drive Sprocket Cover Removal / Installation, page 8.39.
13. Adjust belt tension and wheel alignment. See Drive Belt Adjustment, page 2.38.

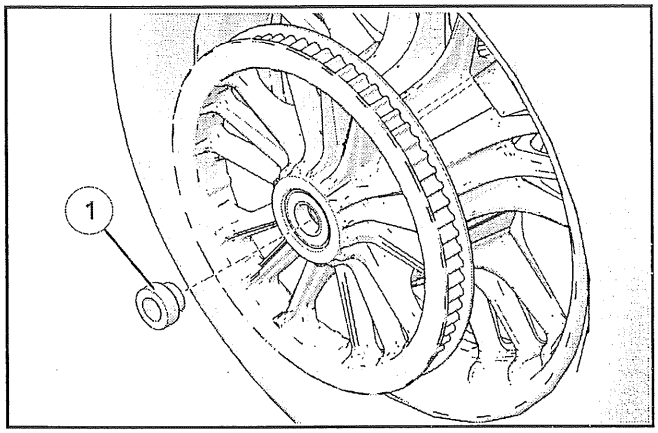
DRIVEN SPROCKET SERVICE

DRIVEN SPROCKET REMOVAL

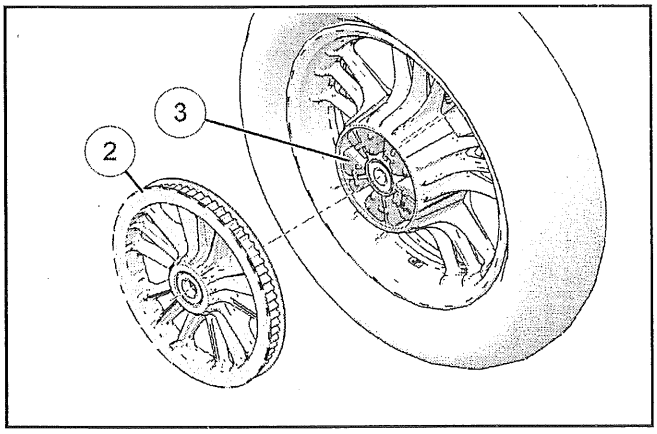
CAUTION

Protect brake disc surface while working on wheel.

1. Remove rear wheel. See Rear Wheel Removal / Installation, page 8.45.
2. Remove the LH wheel spacer ① from the driven sprocket roller bearing.

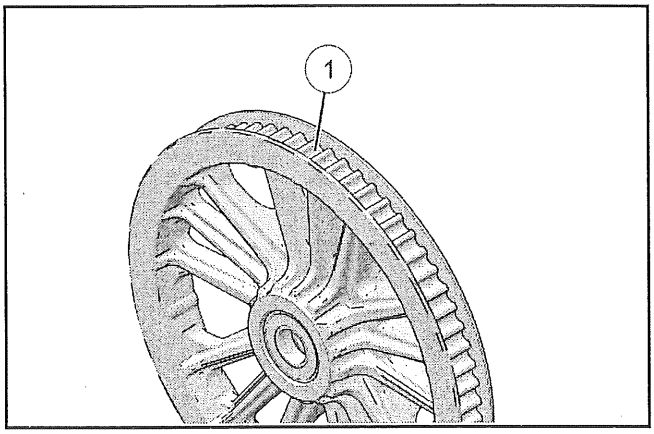


3. Lift the driven sprocket assembly ② off of the drive damper ③.

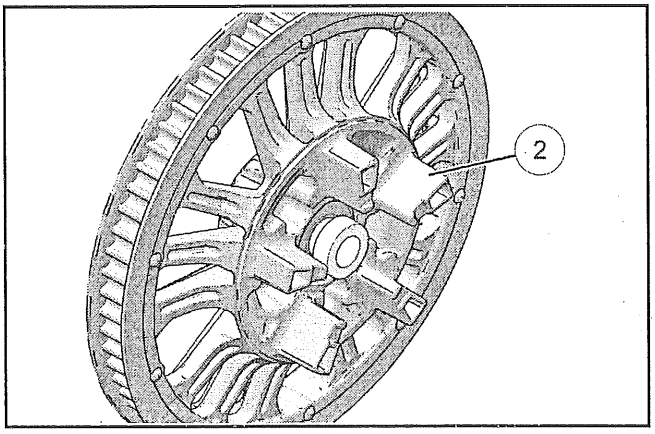


DRIVEN SPROCKET INSPECTION

1. Visually inspect sprocket teeth ① for excessive wear and damage from foreign material or road debris.



2. Inspect the back side of the sprocket where it engages the damper ② for wear, galling or roughness. Surface must be smooth, with no burrs or surface irregularities.



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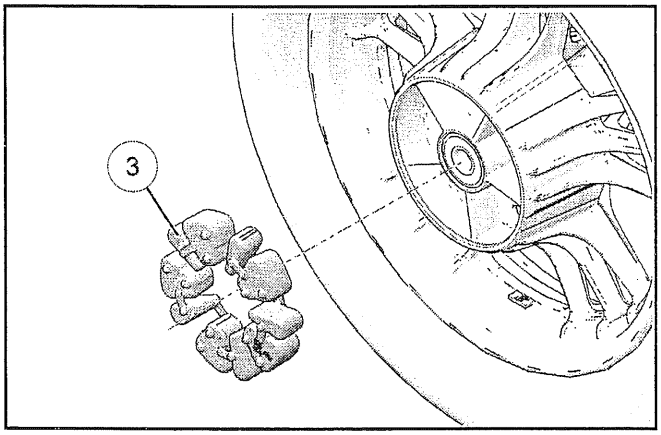
3. Visually inspect the cushion drive damper ③ for cracks or deformation. Replace damper if damage is found.

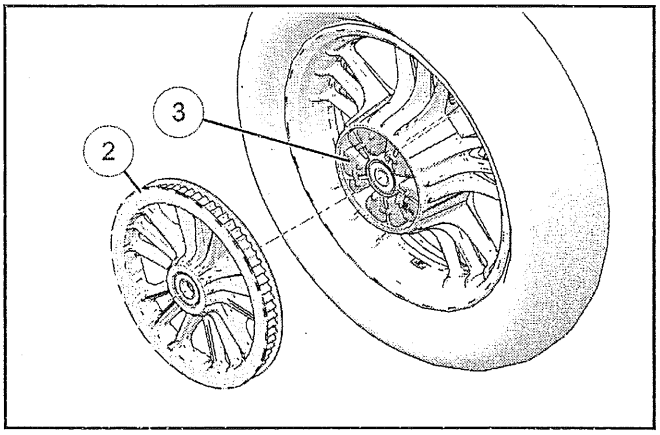


NOTE

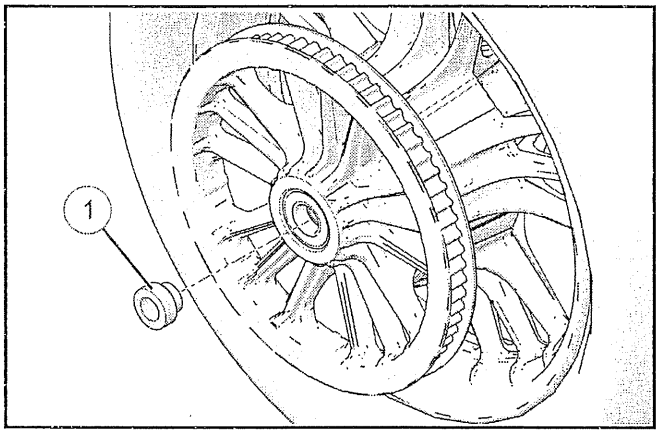
If the drive system has been in service for 5000 miles or more, replace both front and rear sprockets along with the belt if any one item is damaged or worn beyond a normal polished appearance.

DRIVEN SPROCKET INSTALLATION

1. Install cushion damper ③ into wheel hub.
2. Install sprocket assembly ② onto wheel hub making sure the cushion damper is properly engaged.



3. Install the LH wheel spacer ① into the sprocket roller bearing.



REAR WHEEL SERVICE

REAR WHEEL REMOVAL / INSTALLATION

⚠ WARNING

Rear wheel removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear tire is off the ground. Severe personal injury or death can occur if the motorcycle tips or falls.

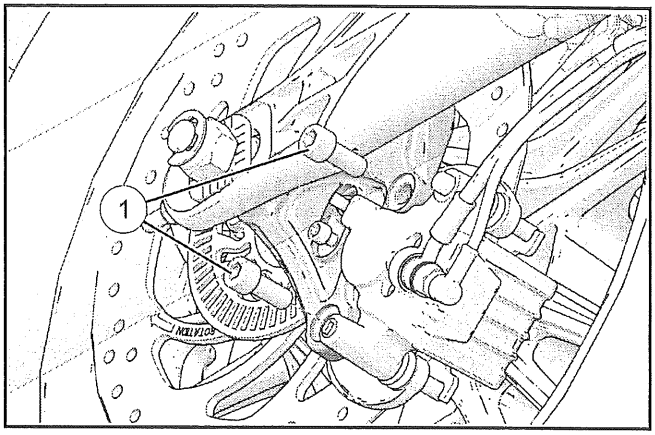
⚠ WARNING

Make sure the exhaust system has cooled to room temperature before elevating the motorcycle. The drive belt may be damaged if it comes into contact with HOT exhaust components.

⚠ WARNING

If working on a motorcycle equipped with a charcoal canister (EVAP), remove the canister prior to elevating the rear of the motorcycle to prevent damage to the canister hose fittings.

1. Place the motorcycle in an upright position on a lift table with the front wheel clamped in a wheel vise.
2. Remove saddlebags, if equipped.
3. Position a platform jack beneath the engine cases and raise until the rear tire is barely in contact with the ground.
4. Remove two caliper mounting bolts ① and remove caliper.



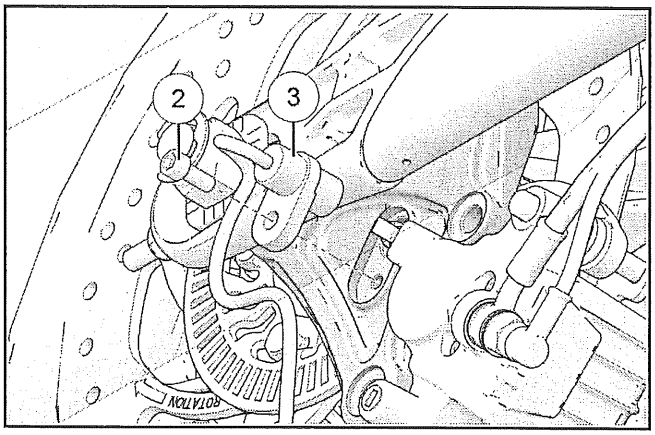
CAUTION

Do not hang rear brake caliper from the brake line. Do not twist the brake line or damage may result.

NOTE

Do not apply rear brake pedal after the brake caliper has been removed.

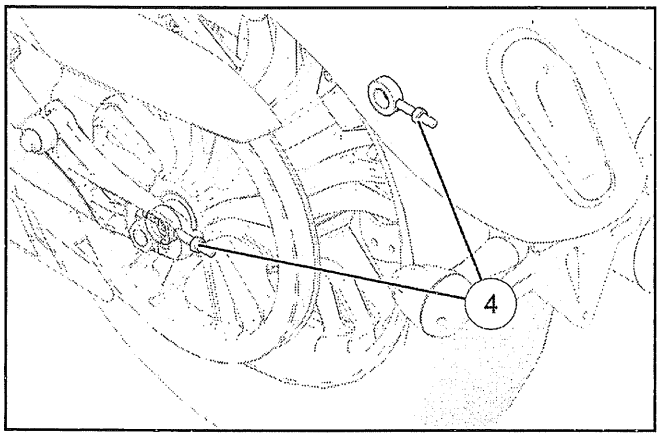
5. Remove rear ABS wheel speed sensor mounting bolt ② and sensor ③, if applicable.



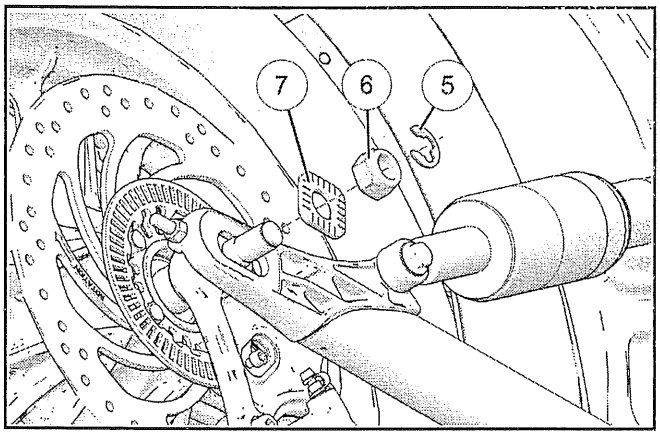
NOTE

Move sensor aside so that it is not damaged.

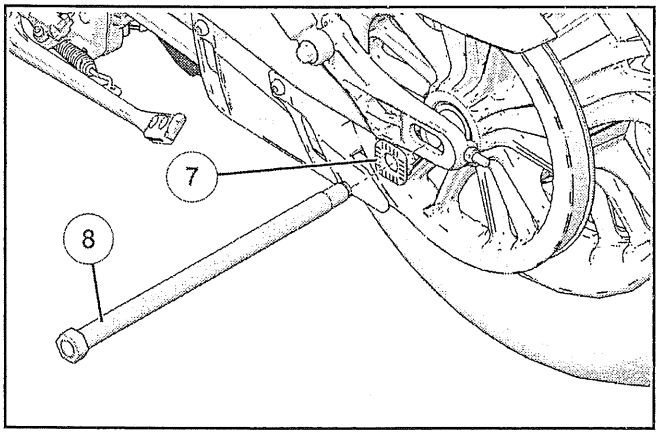
6. Loosen right and left axle adjusters ④.



7. Remove clip ⑤, rear axle nut ⑥ and washer ⑦ from side of swingarm.



8. Remove washer ⑦ and axle ⑧ from swing arm.



9. Push wheel forward and slide drive belt to the LEFT side off of the rear sprocket.
10. Remove rear wheel assembly by sliding it to the rear of the motorcycle.
11. **Installation is performed by reversing the removal procedure.**
12. Torque fasteners to specification.

TORQUE
Axle Nut (rear): **65 ft-lbs (88 Nm)**

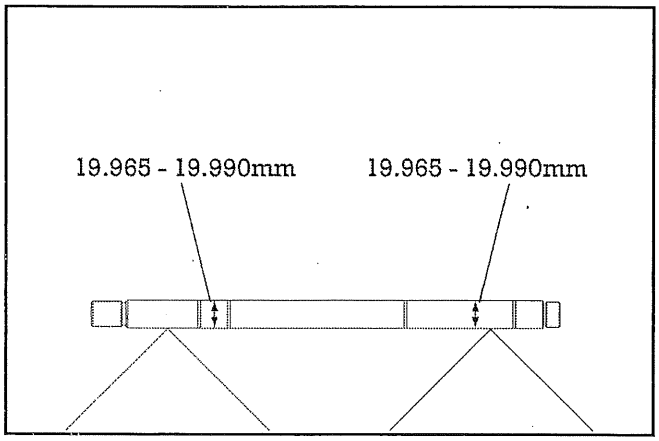
TORQUE
Speed Sensor Fastener: **84 in-lbs (9.5 Nm)**

TORQUE
Caliper Mounting Fasteners (rear): **30 ft-lbs (41 Nm)**

Set drive belt tension and alignment. See Drive Belt Tension, page 2.36 and Drive Belt Adjustment, page 2.38.

REAR AXLE INSPECTION

1. Install rear axle in V-blocks and measure runout and compare to service limit. See Service Specifications, page 8.34.
2. Axle diameter should be measured on bearing surfaces.



REAR WHEEL INSPECTION

NOTE
Wheel bearings must be in good condition.

1. Set up a dial indicator to measure axial and radial runout of the wheel and compare to service limit. See Visual Inspection / Runout, page 8.68.
2. Visually inspect wheel for cracks or other damage.
3. Replace wheel if it fails visual or measured inspection.

REAR WHEEL BEARING INSPECTION

NOTE

If possible, also inspect wheel bearings before removing the wheel from the vehicle. Do not remove bearings from wheel to inspect. Bearings cannot be repacked. Replace both bearings if one or both fail inspection, or if either bearing was removed.

1. Visually inspect integral bearing seal for damage.
2. Inspect bearing fit in wheel hub. The outer race of the bearing must fit tightly into the bore. You should not be able to move outer race by hand.
3. Slide axle into wheel and check for smooth rotation and tight fit.

NOTE

Due to extremely close tolerances, the bearings must be inspected visually, and by feel. Look for signs of discoloration, scoring, galling, or contamination from moisture or dirt. Replace bearings if any of the above are present. Turn the inner race of the bearings. The bearings should turn smoothly and quietly. The inner race should be firm with minimal side to side movement and no detectable up and down movement.

WHEEL BEARING REPLACEMENT

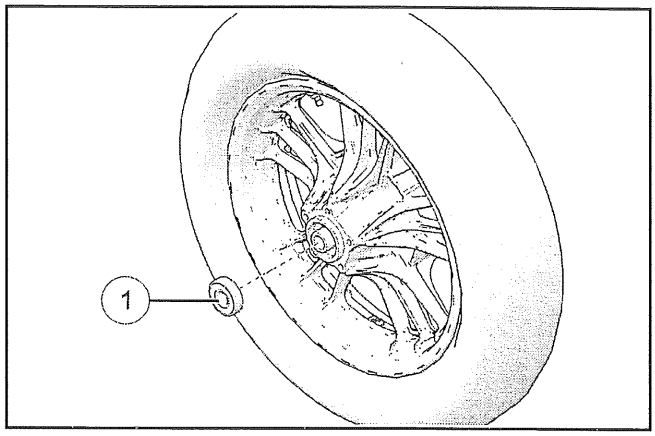
CAUTION

Do not reuse bearings that have been removed.

NOTE

This procedure requires the Wheel Bearing Removal / Installation Kit **(PF-51324)**. Refer to special tool manufacturer instructions for proper use of tool.

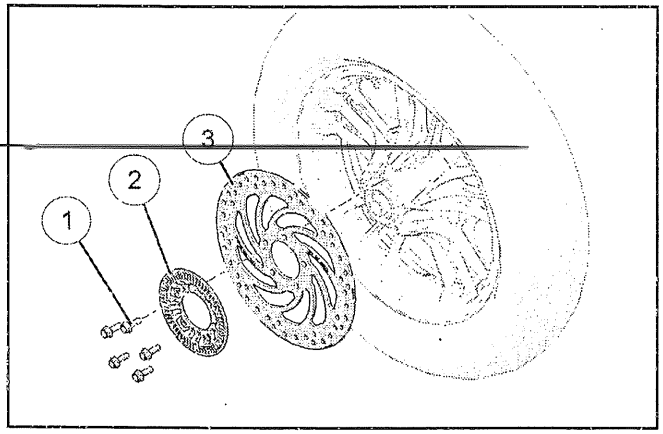
1. Remove rear wheel. See Rear Wheel Removal / Installation, page 8.45.
2. Remove driven sprocket. See Driven Sprocket Removal, page 8.43.
3. Remove brake disc. See Brake Disc Removal / Installation, page 8.48.
4. Carefully pry seal ① out of RH side of hub.



5. Refer to special tool manufacturer instructions to remove bearing from brake disc side of hub.
6. Remove bearing.
7. Remove spacer.
8. Extract or drive bearing from sprocket side.
9. **Installation:** Use the Wheel Bearing Removal / Installation Kit **PF-51324)** to install new wheel bearings. Refer to special tool manufacturer instructions for proper use of tool.
10. Install new seal into the RH side of hub.
11. Install the brake disc. See Brake Disc Removal / Installation, page 8.48.
12. Install driven sprocket. See Driven Sprocket Installation, page 8.44.
13. Install the rear wheel. See Rear Wheel Removal / Installation, page 8.45.

BRAKE DISC REMOVAL / INSTALLATION

1. Remove the rear wheel. See Rear Wheel Removal / Installation, page 8.45.
2. Remove the driven sprocket and cushion damper. See Driven Sprocket Removal, page 8.43.
3. Position wheel with brake disc facing up.
4. Remove and discard ABS tone ring (if applicable) / brake disc screws ①.
5. Remove the ABS tone ring (if applicable) ② and brake disc ③.



6. **Installation is performed by reversing the removal procedure.**
7. Torque brake disc bolts to specification in a star pattern. Ensure rotation arrows on rotor are noted and followed.

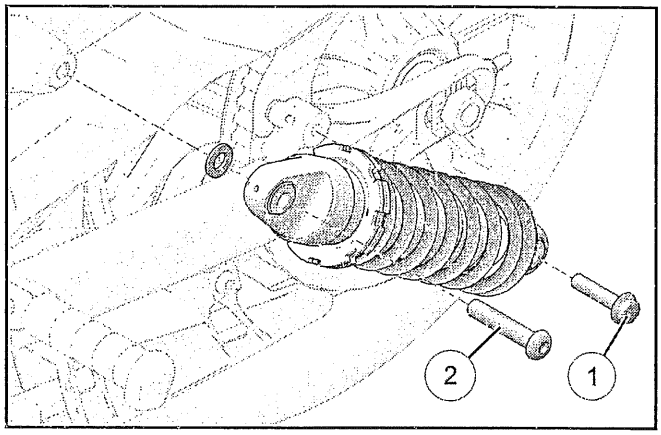
TORQUE
Brake Disc Fasteners: **19 ft-lbs (26 Nm)**

SHOCK ABSORBER REMOVAL

⚠ WARNING

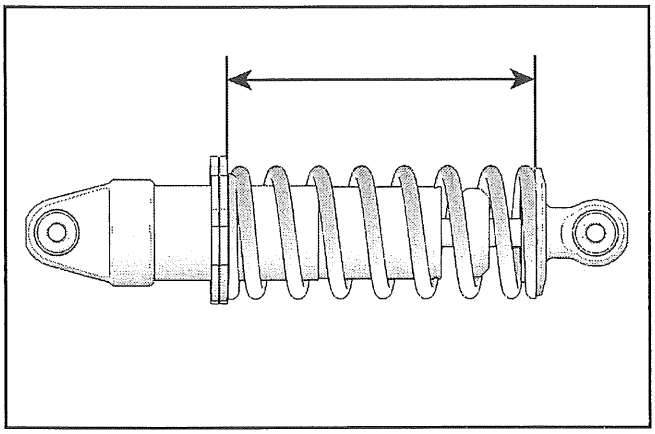
Shock absorber removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear tire is off the ground. Severe personal injury or death can occur if the motorcycle tips or falls.

1. With the rear wheel properly supported, remove the lower shock fastener ① and upper shock fastener ② and remove shock absorber.

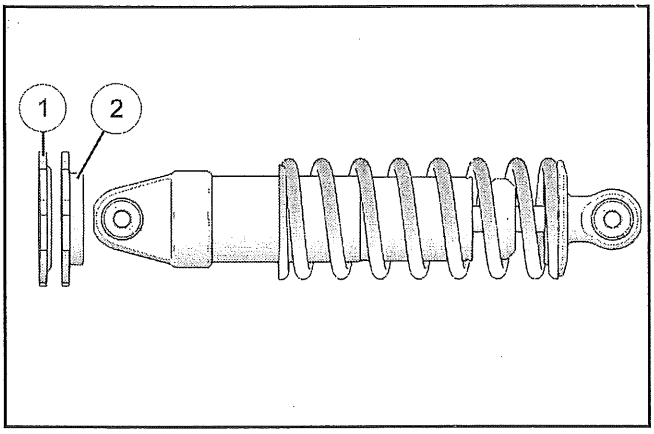


SHOCK ABSORBER INSPECTION

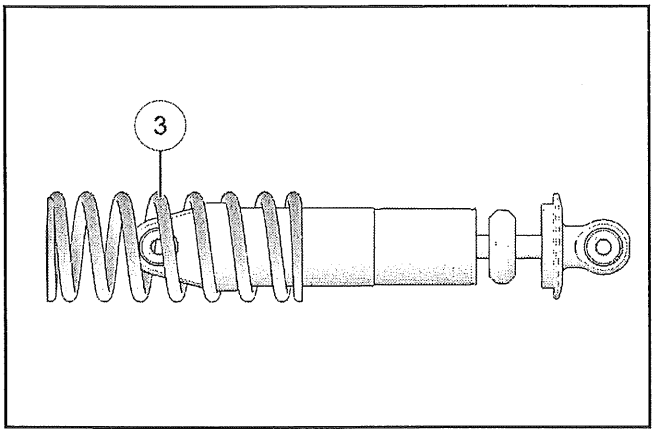
1. Measure spring installed height and record so ride height adjustment can be returned to rider's preference.



2. Loosen spring collars ① and ② completely to relieve spring tension.

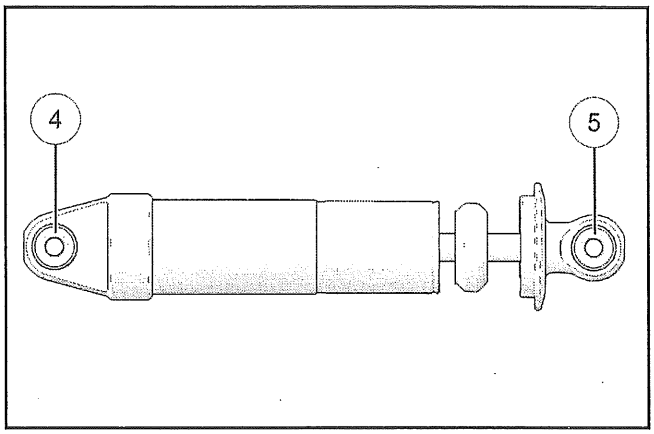


3. Slide spring ③ off of shock.



4. Thoroughly clean the shock spring.

5. Inspect eyelets and ⑤ for cracks, damage or loose fitting eyelet. Replace shock if either eyelet is cracked.

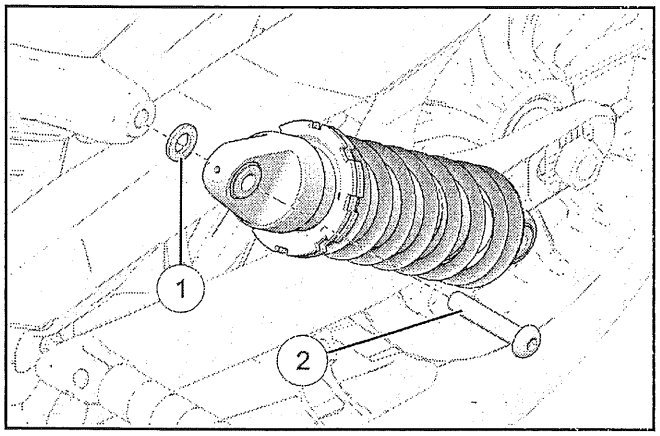


6. With shock upright, move damper rod through entire travel range. Damper rod should move smoothly with consistent damping through the entire travel range, and return to the fully extended position when released.

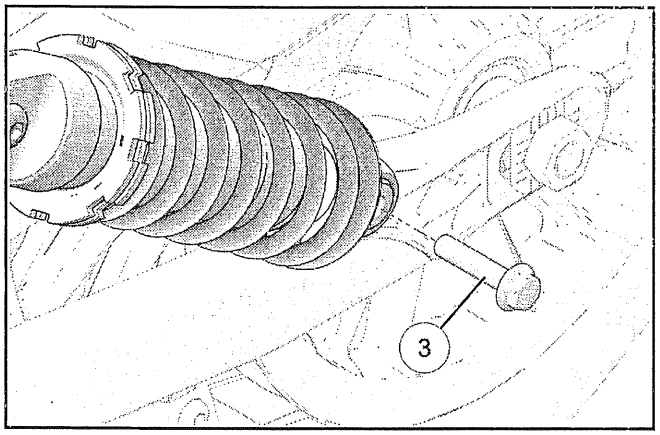
7. Inspect shock spring for cracks or distortion. Measure free length and compare to specification. See Service Specifications, page 8.34.

SHOCK ABSORBER INSTALLATION

1. Lift shock into position and install top shock washer ① and fastener ② finger tight.



2. Install the lower shock fastener ③ finger tight.



3. Torque upper and lower shock fasteners to specification.

TORQUE
Shock Fasteners (upper & lower): **65 ft-lbs (88 Nm)**

SWINGARM SERVICE

SWINGARM REMOVAL

⚠ WARNING

Swingarm removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear tire is off the ground. Severe personal injury or death can occur if the motorcycle tips or falls.

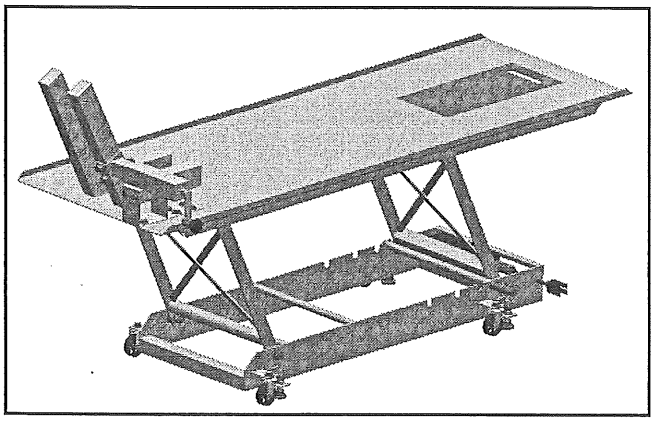
⚠ WARNING

Make sure the exhaust system has cooled to room temperature before elevating the motorcycle. The drive belt may be damaged if it comes into contact with HOT exhaust components.

⚠ WARNING

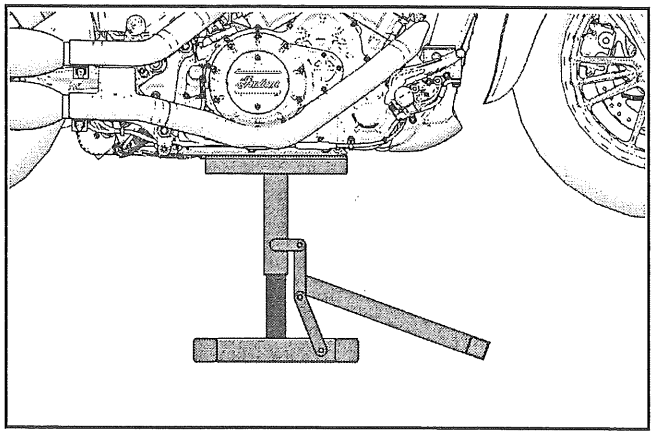
If working on a motorcycle equipped with a charcoal canister (EVAP), remove the canister prior to elevating the rear of the motorcycle to prevent damage to the canister hose fittings.

1. Place the motorcycle in an upright position on a lift table with the front wheel clamped in a wheel vise.



2. Remove exhaust assembly. See Muffler Removal, page 3.92.

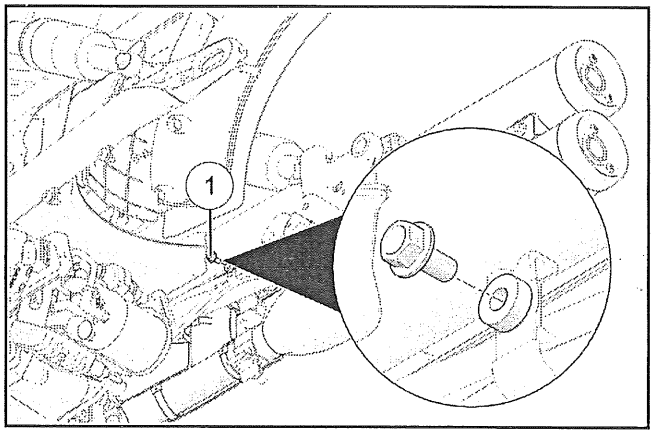
3. Position a platform jack beneath the engine cases and raise until it contacts the engine.



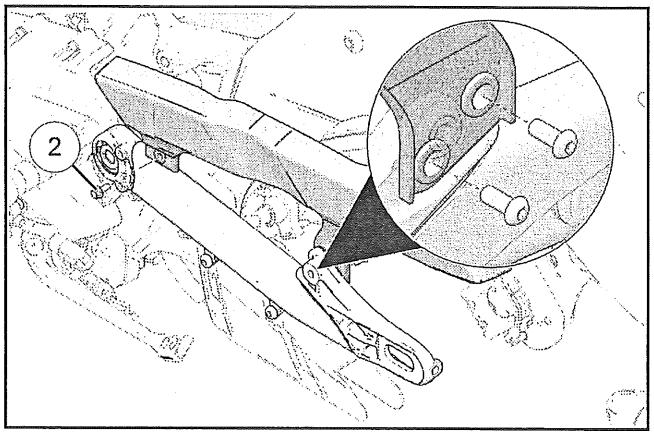
4. Remove rear wheel assembly. See Rear Wheel Removal / Installation, page 8.45.

5. Remove rear shocks. Shock Absorber Removal, page 8.48

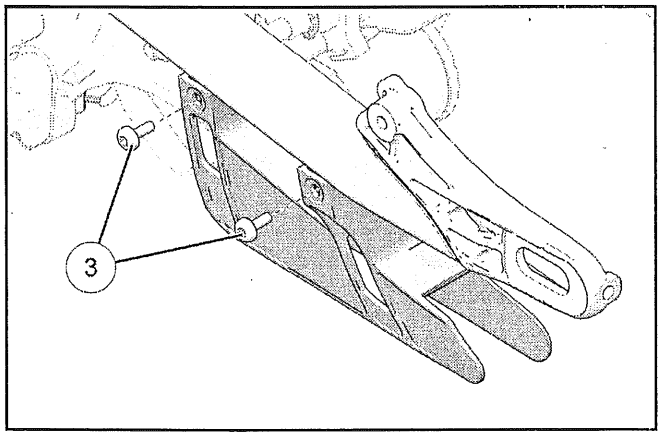
6. Remove the rear brake hose rear p-clamp bolt ① located on the left inner surface of the swingarm.



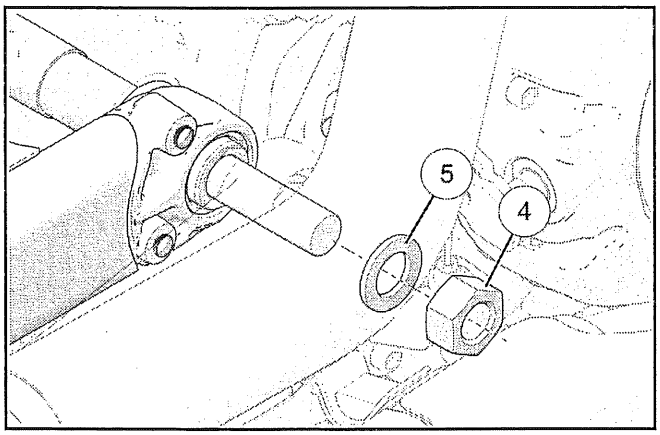
7. Remove upper belt guard bolt ② from front and two bolts from the back side of guard.



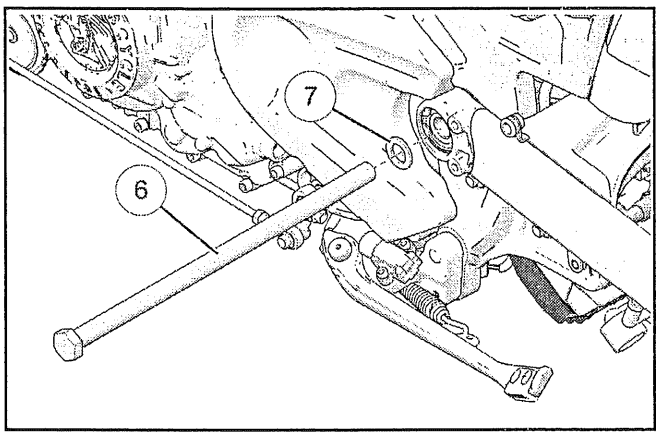
8. Remove lower belt guide bolts ③.



9. Remove swingarm nut ④ and washer ⑤ from the right side of the swingarm pivot shaft.



10. Thread the swingarm shaft ⑥ and remove washer ⑦ from the left side of the frame.

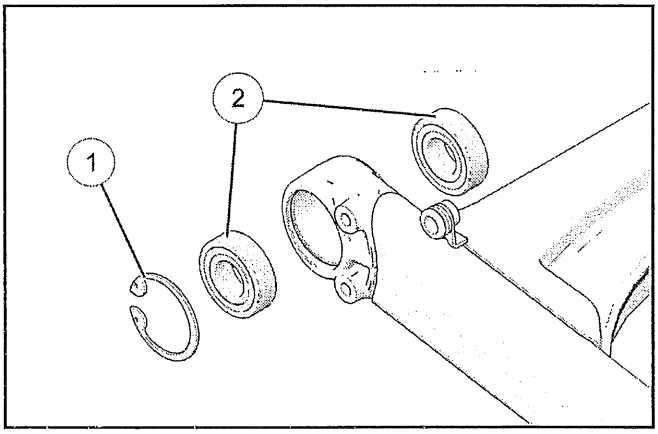


11. Support and remove the swingarm assembly towards the rear of the motorcycle.

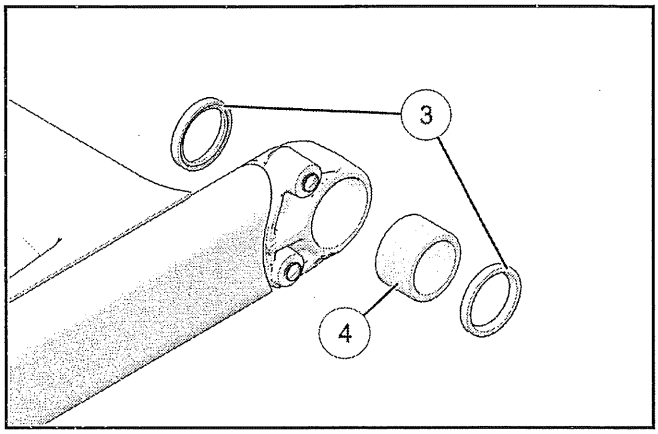
SWINGARM BUSHING / BEARING REPLACEMENT

REMOVAL

1. Remove swingarm assembly from motorcycle. See Swingarm Removal, page 8.51.
2. Remove shock absorber assembly from swingarm. See Shock Absorber Removal, page 8.48.
3. Remove the internal snap-ring ① followed by the bearings ② from the LH side of the swingarm.



4. Working from the RH side of the swingarm, gently pry the seals ③ out of the bearing bore.



5. Remove needle roller bearing ④.
6. Inspect bearing bores for any galling or damage.

INSTALLATION

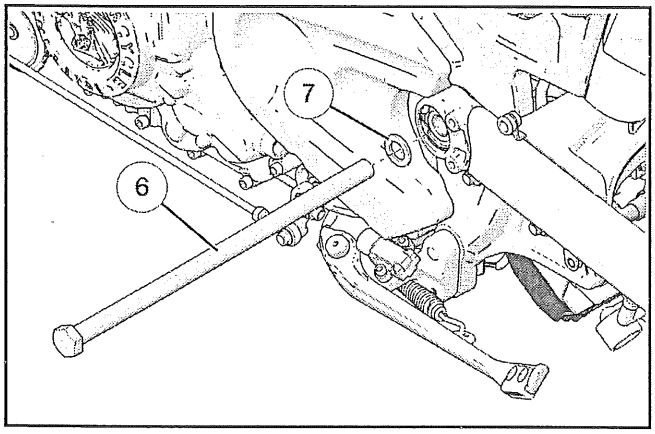
1. Working on the LH side of the swingarm, press or drive *new* bearings ② into the bearing bore using a suitable bearing driver.
2. Install internal snap-ring ①.
3. Using the bearing driver drive a new needle bearing ④ into the RH side of the swingarm until fully seated.
4. Press new *outer* seals ③ into the bearing bore until seated.

5. Install shock absorber assembly. See Shock Absorber Installation, page 8.50.
6. Install swingarm assembly. See Swingarm Installation, page 8.53.

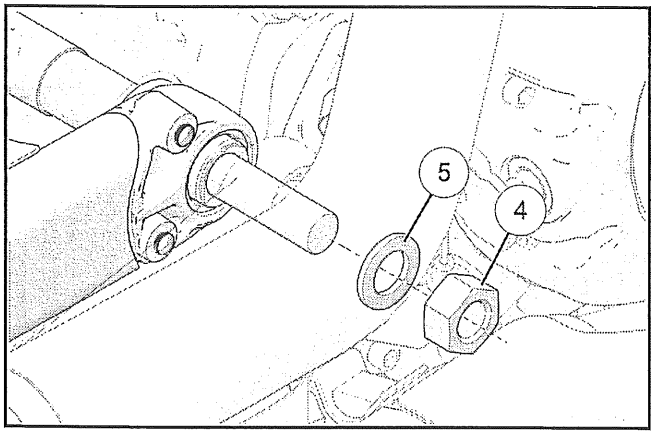
SWINGARM INSTALLATION

Drive belt must be installed on the drive sprocket prior to installing the swingarm.

1. Clean inside of the swingarm shaft bores in both sides of the frame midcastings.
2. Grease swingarm pivot shaft.
3. Lift the swingarm into position in the frame.
4. Install washer ⑦ on swingarm shaft. Slide the swingarm shaft ⑥ into the left side of the frame.

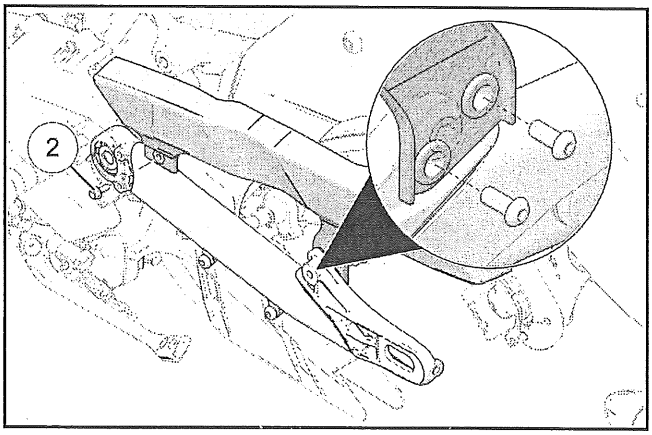


5. Install the swingarm shaft washer ⑤ and nut ④ onto the end of the swingarm shaft. Torque nut to specification.

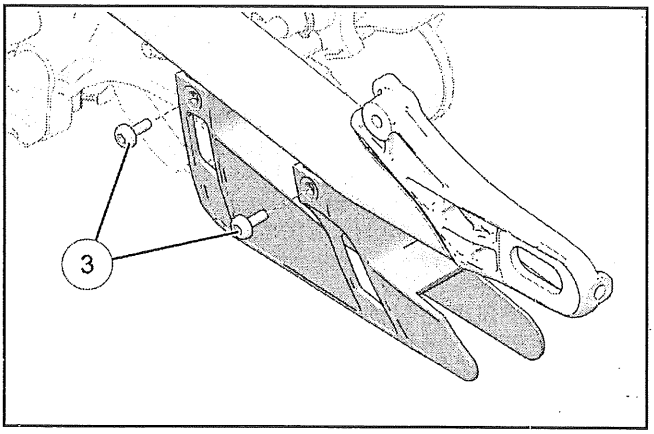


TORQUE
Swingarm Nut (LH): **85 ft-lbs (115 Nm)**

6. Install upper belt guard and torque fasteners ② two screws on the back side of guard to specification.



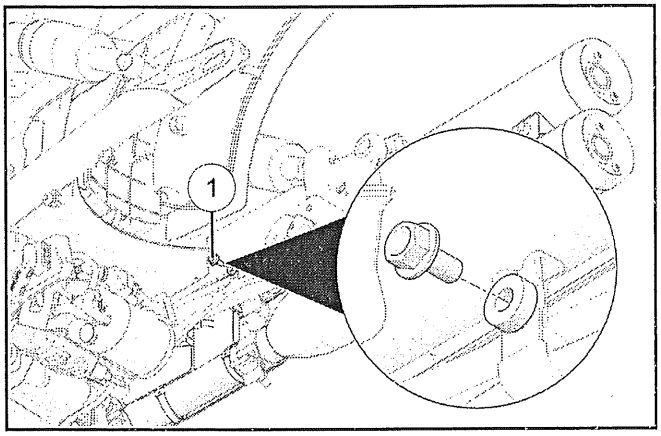
7. Install lower belt guard and torque fasteners ③ to specification.



TORQUE
Belt Guard Fasteners (lower): **85 in-lbs (9.6 Nm)**

8. Install rear shocks. Shock Absorber Installation, page 8.50

9. Install the rear brake hose rear p-clamp bolt ① located on the left inner surface of the swingarm.



10. Install the rear wheel. See Rear Wheel Removal / Installation, page 8.45.
11. Make sure that the following applies:
    - The rear wheel turns freely, without any interference between the belt guard, the tire, and the swingarm.
    - Brake line is properly routed and secured.
    - The left and right axle adjusters are aligned properly (wheel is in alignment).
    - The rear brake functions properly.
    - All fasteners have been tightened correctly.
    - There is adequate clearance between swingarm and exhaust mufflers and mounting.
    - The swingarm is not loose, it doesn't wobble from side to side, and it doesn't move up and down more than 1/32 of an inch when pushed and pulled firmly.
12. Install the seat. See Seat Removal / Installation, page 7.8.
13. If equipped, install the charcoal canister. See Evaporative Emission Control System (CA Models), page 2.28.
14. Adjust ride height as required. SeeRear Shock Preload Inspection, page 2.45.
15. Test ride motorcycle to be sure rear suspension operates smoothly without binding or abnormal noises.

TROUBLESHOOTING REAR WHEEL / SUSPENSION

PROBLEM	POSSIBLE CAUSE	REPAIR RECOMMENDED
Rear Wheel Feels "Loose" or Wobbles	Loose fasteners	Torque to specification
	Distorted (bent) rear wheel	Replace wheel
	Worn or damaged wheel bearings	Replace wheel bearings
	Worn or damaged swing arm bushings.	Replace swing arm bushings
	Damaged or incorrect rear tire	Replace rear tire
	Unbalanced rear wheel assembly	Balance tire/wheel
	Low tire pressure	Inflate to specification
	Loose swing arm, axle or suspension fasteners	Torque to specification
	Shock bushing failure	Replace shock bushings
Rear Suspension Too Hard	Incorrect preload adjustment	Adjust to rider & load
	Damaged shock absorber	Replace / Rebuild shock
	Damaged or corroded suspension mount bushing	Correct as necessary
	Damaged or corroded swingarm bushings	Replace
	High tire pressure	Deflate to specification
	Drive belt adjustment too tight	Adjust drive belt tension
Rear Suspension Too Soft	Incorrect preload adjustment	Adjust to rider & load
	Damaged shock absorber	Rebuild or replace shock
	Weak shock spring	Replace shock spring
	Excessive load placed on motorcycle	Reduce load weight
	Low tire pressure	Inflate to specification
Rear Suspension Noisy	Loose fasteners	Torque to specification
	Worn wheel bearings	Replace
	Worn swing arm bushings	Replace
	Damaged shock absorber	Replace as necessary
	Worn shock bushings	Replace shock bushings
Wheel Drags (Turns Hard)	Incorrect drive belt adjustment	Adjust drive belt tension
	Brake problem	Diagnose and Service
	Loose fasteners	Torque to specification
	Bent rear axle	Replace
	Damaged wheel bearings	Replace
	Tire contact with object or chassis	Determine point of contact and correct

TROUBLESHOOTING FINAL DRIVE

PROBLEM	POSSIBLE CAUSE	POSSIBLE REPAIR NEEDED
Belt Shows Excessive Wear On One Side	Out-of-Alignment	Align rear wheel
Belt Squeal	Out-of-Alignment	Align rear wheel
Belt Whine / Noise	Out-of-Alignment Belt Damage Incorrect Belt Tension	Align rear wheel Inspect Belt Adjust Tension
Broken Sprocket Teeth	Foreign material damage / Loose drive belt or sprocket	Replace parts or repair as necessary
Broken or Torn Cogs on Belt	Foreign material damage / Loose drive belt or sprocket	Replace parts as necessary
Belt Jumps Sprocket Teeth	Worn, damaged or out of adjustment belt or sprockets	Replace parts as necessary
	Belt Loose	Adjust Belt
Excessive Wear, Binding Suspension	Belt Tight	Adjust Belt
Broken Belt	Belt weakened by foreign material damage. Belt run excessively tight or loose.	Replace Belt, Replace Sprockets

TIRES

GENERAL INFORMATION

SERVICE NOTES

⚠ WARNING

If a consumer wishes to replace the Original Equipment Manufacturer (OEM) tires with another brand of tire, Indian Motorcycle recommends contacting the tech-line of the tire manufacturer being considered to ensure compatibility. Indian Motorcycle makes no other recommendation other than the OEM tires. Tires other than OEM may or may not adversely affect the handling characteristics of the motorcycle or may not have adequate tire clearance.

⚠ WARNING

The use of tires other than original equipment may cause instability which can lead to a crash resulting in serious injury or death. Use *only* the recommended tires inflated to the recommended tire pressures. Operating the motorcycle with damaged rims creates a safety hazard including air pressure loss, steering imbalance and/or reduced steering control. Do not attempt to repair or straighten damaged rims.

⚠ WARNING

Do not attempt to repair tires that have:

- Punctures with a diameter of greater than 6mm (0.240").
- Cuts with a length of greater than 6mm (0.240").
- Any punctures or cuts on the sidewall of the tire.
- Tread depth of less than 1.6mm (.063") for the front tire.
- Tread depth of less than 1.6mm (.063") for the rear tire.
- Ply separation.
- Tread separation.
- Severe tread cupping.
- Cuts, gouges or scratches on the sealing surface of the bead.
- Flat spots on the tread.
- Bubbles, separation or any unusual damage to the inner liner of the tire.
- Chemical sealants or balance additives added to the tire.

⚠ WARNING

All repairs must be made from inside the tire.

No form of temporary repair should ever be attempted. Secondary damage caused by a penetrating object may not be detected and tire or tube deflation may occur at a later date.

When a tire reaches the minimum tread depth listed below, replace the tire immediately.

CAUTION

Overloading and under-inflation lead to premature tire wear. Do not deviate from the specifications for loading or inflation.

SERVICE SPECIFICATIONS

Refer to Steering / Suspension Chapter (Front Wheel and Suspension) for front wheel specifications.

Refer to Steering / Suspension Chapter (Rear Wheel and Suspension) for rear wheel specifications.

Tire Specifications

POSITION	TIRE TYPE / SIZE	TIRE PRESSURE	MINIMUM TREAD DEPTH
Front	Kenda Kruz K673F - 130/90-16 72H	36 PSI (248 kPa)	1/16 in (1.6 mm)
Rear	Kenda Kruz K673 - 150/80-16 71H	40 PSI (276 kPa)	1/16 in (1.6 mm)

TIRE INSPECTION

TIRE WEAR PATTERNS

Tire Wear Patterns

SYMPTOM	CAUSE
Wear on Left Side	Riding on Crowned Roads
Edges Worn	Under-inflation or Excessive Loads
Excess Wear in the Middle of Tire	Over-inflation or Tire Abuse
Cracks in Tread Grooves	Under-inflation, Excessive Loads, Suspension Bottoming
Tread Block Cupping (Usually Front Tire -See Below)	Normal Braking Wear

OZONE CRACKING

Ozone cracking usually shows up on the sidewalls of tires and is caused by sunlight, electric motor emissions, smog, or other environmental factors. Ozone cracking does not pose a problem unless the cracks reach the cords. If this occurs, moisture may penetrate the carcass of the tire causing cord separation. Tires showing signs of severe ozone cracking (cords visible at the bottom of the cracks) must be replaced.

FRONT TIRE CUPPING

Front of tread block worn more than rear of tread block:

- The cupping of front tires is somewhat normal.
- Rear tires are subjected to forces in both directions. The forces of braking and acceleration result in even tire wear.
- Front tires are subjected only to the forces of braking. When the brakes are applied, tire deflection is increased and wear occurs in only one direction.
- Incorrect tire pressure is the number one cause of excessive tire cupping. Too little tire pressure causes the tire to over-deflect which increases the amount of scrubbing and causes more tire cupping.
- Binding or improperly assembled front forks can also contribute to excessive tire cupping. If the front forks do not react as they should the tire acts as the sole suspension component and tread deflection increases.

TIRE SERVICE

TIRE CHANGING

There are three generally acceptable methods to dismount and mount a motorcycle tire to its rim. For each of the three methods, there are countless variations.

The three general methods are:

- Pneumatic or electrically operated tire machine
- Manually operated tire machine
- Manual manipulation of tire irons

Indian Motorcycle permits and recommends all three of the general methods, but realizes that careless or improper work habits can damage both the tire and rim no matter which method is used. With any of the methods, care must still be taken to avoid damaging the rim, tire, inner tube (if applicable), brake disk, or sprocket.

The pneumatic or electrically operated tire machine is preferred because it is the most efficient method to dismount and mount tires.

The manually operated tire machine is the next preferred method. It can be just as efficient as a power assisted tire machine but with some of the machines it may be necessary to remove the belt driven sprocket in order to gain sufficient clearance for tire removal.

Manual manipulation is the least preferred method since it will generally not deliver the same efficiency as the other methods and greater care needs to be taken when performed. Care must be taken when using tire irons to not damage or stress the tire bead, Also, the opposite bead needs to be in drop center of wheel during mounting and dismounting of the tire.

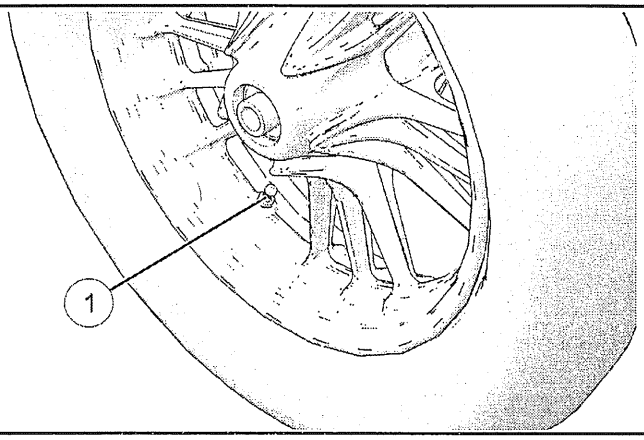
Be very careful not to damage the rim, tire, inner tube, brake disk, or sprocket regardless of which method is used.

TIRE REMOVAL

NOTE

This procedure is written assuming that a pneumatic, electric, or manually operated rim-clamp type tire machine is being used.

1. Remove wheel / tire assembly from motorcycle. See **Steering / Suspension Chapter for front wheel removal** and **rear wheel removal.**
2. Remove valve core ① from valve stem and let all air escape.



3. Mount the wheel assembly onto a tire bead breaker and break the bead starting at the valve stem and continue around the circumference of the rim as necessary.
4. Flip the wheel assembly over and repeat STEP 3 on the other side.

IMPORTANT

Take great care not to bend or otherwise damage the brake disc and/or belt driven sprocket. If the bead breaker being used interferes with either the brake disk and/or belt driven sprocket, remove the disc or sprocket as required.

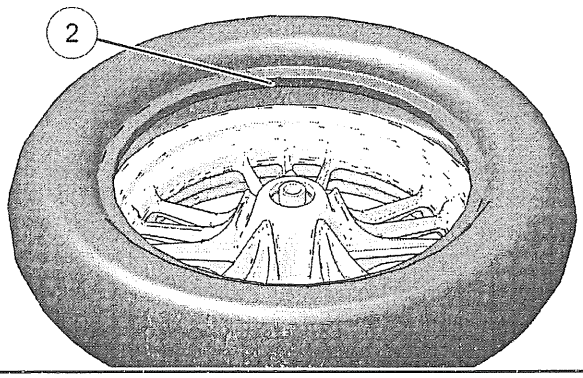
5.

NOTE

Refer to manufacturer's instructions for proper tire changer operation.

Mount the tire and wheel assembly on the tire machine per the manufacturers instructions.

6. Carefully work around the circumference of the upper bead ② with the tire lever until it is completely off of the rim.



7. Lift the lower tire bead up until the tire lever can be positioned and the tire completely removed.
8. Work around the circumference of the rim until the tire can be lifted free of the rim.

TIRE INSTALLATION

NOTE

This procedure is written assuming that a pneumatic, electric, or manually operated rim-clamp type tire machine is being used.

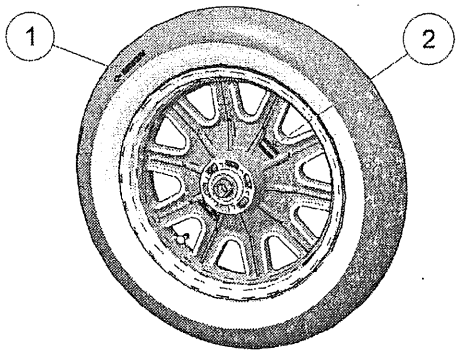
NOTE

Balance Dots

Indian Motorcycle does not recommend the use of liquid balancer/sealers. These are a form of temporary repair which may adversely affect ply material and mask secondary damage caused by the penetrating object. Reliance upon sealants can result in sudden tire failure and accident.

Directional Arrows

Tires ① have directional arrows that must be observed when installing tires to rims ②.



The wheel assemblies must be free of foreign debris that would affect balancing. Carefully inspect the wheel bearings, seals and axle for damage or corrosion.

1. Lubricate both tire beads with rubber lubricant.

⚠ WARNING

Never apply grease, oil, gasoline, spray type lubricants or anything other than rubber lubricant or a neutral soap and water solution to the tire bead. Doing so can damage the tire.

2.

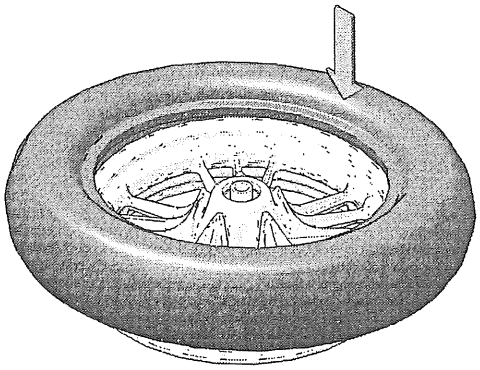
NOTE

Refer to manufacturer's instructions for proper tire changer operation.

Mount the tire and wheel assembly on the tire machine per the manufacturers instructions.

3. Orient tire correctly as to the directional arrows.

4. Push tire on to rim until one bead is installed. It shouldn't be necessary to use tire irons to put one side of the tire onto the rim. Remember to keep bead(s) in the drop center of the wheel whenever possible.



NOTE

Confirm tire is positioned correctly by observing directional arrows.

5. Lubricate the tire bead.
6. With your hands, push as much of the remaining tire bead as possible into the rim, pinching both upper and lower beads into the drop center.
7. When no more of tire can be installed by hand, press down on portion of tire in front of you with your knee to keep the top bead in the drop center.
8. Install the tire lever and work around the remaining circumference of the wheel until the bead is fully installed onto the rim.

NOTE

Be sure both beads are forced as far as possible into the drop center of the rim.

9. Install valve core if it was removed.
10. Line up balance dot.
11. Confirm that the directional arrows are pointing in the correct direction.
12. Bounce tire on the floor several times while rotating tire. This will expand tire bead outward slightly which will make tire inflation easier.
13. Inflate tire observing the precautions listed below.

Tire Inflation & Precautions

- Wear approved eye protection
- Lubricate the tire beads with a tire mounting lubricant before inflation.
- Lock assembly on mounting machine or place in safety cage before inflating to seat beads
- Use extension gauge and hose with slip-on air chuck.
- Stand back with no part of your body within the perimeter of the assembled tire and rim.
- Inflate with core in valve stem
- Never inflate above 42 psi to seat beads
- If beads do not seat by 42 psi. Deflate and repeat procedures. Never use a volatile substance or rubber "donut" to aid bead seating.

14. Inspect the line molded onto the tire side walls. It must be the same distance from the rim all the way around the tire. If the distance varies it indicates that tire is not seated properly.
15. If tire is not seated correctly, deflate and unseat the tire, lubricate the tire beads and repeat inflation procedure.

16. Install wheel assembly onto balance stand and spin. Observe the wheel assembly while it is spinning to make sure the tire is seated properly.
17. Adjust tire pressures to specifications.
18. Balance tire / wheel assembly.

⚠ WARNING

FOR REPAIRED TIRES: Speed should not exceed 50 MPH for the first 24 hours after repair and repaired tire should never be used over 80 MPH. Inspect inflation pressure after tire cools for at least three hours following run-in.

FOR NEW TIRES: Replacement of OEM tires or replacement with differently constructed tires will not immediately produce improved reactions the same as the original tires when new. When new tires are installed, they should not be subjected to maximum power or hard cornering until a reasonable "scrub" period of approximately 100 miles has been covered. This will permit the rider to become accustomed to "feel" of new tires or tire combination, and achieve optimum road grip.

Inspect and adjust tire inflation pressure after tire cools down for at least three hours following "run-in".

TIRE BALANCING

⚠ WARNING

It is essential that the wheel assembly be balanced before use and rebalanced each time the tire is removed. Wheel balance affects stability, handling and overall safety of the motorcycle.

The use of liquid balancer/sealer is not recommended.

This procedure will outline balancing wheel assembly in a gravity balance stand. If a pendulum or spin type balancer is being used, reference the manufacturer's instructions that came with the equipment.

1. Mount wheel assembly in a commercially available balance stand.
2. Remove all balance weights. Clean tire and rim thoroughly.

NOTE

While it is possible to balance a wheel assembly with axle and grease-free wheel bearings as the pivot point, it is not recommended. Use an inspection stand that has knife edge bearings and its own axle.

3. Spin the wheel assembly. Allow it to stop on its own and mark the highest (lightest) part of the wheel.
4. Repeat the spinning process to verify the heaviest part of the wheel.
5. Place balance weights at the lightest portion of wheel in small increments.
6. After each addition of weight, spin the wheel assembly and allow it to stop by itself.
7. When correct amount of weight has been added to wheel, it will no longer stop in the same location and the wheel assembly is balanced.

CAUTION

Do not add more than 85 grams (3.0 oz.) of weight to the front or rear wheel.

If more than the recommended weight is necessary to balance the wheel, dismount the tire and rotate it 90° without regard to the yellow balance dot, and re-balance the wheel / tire.

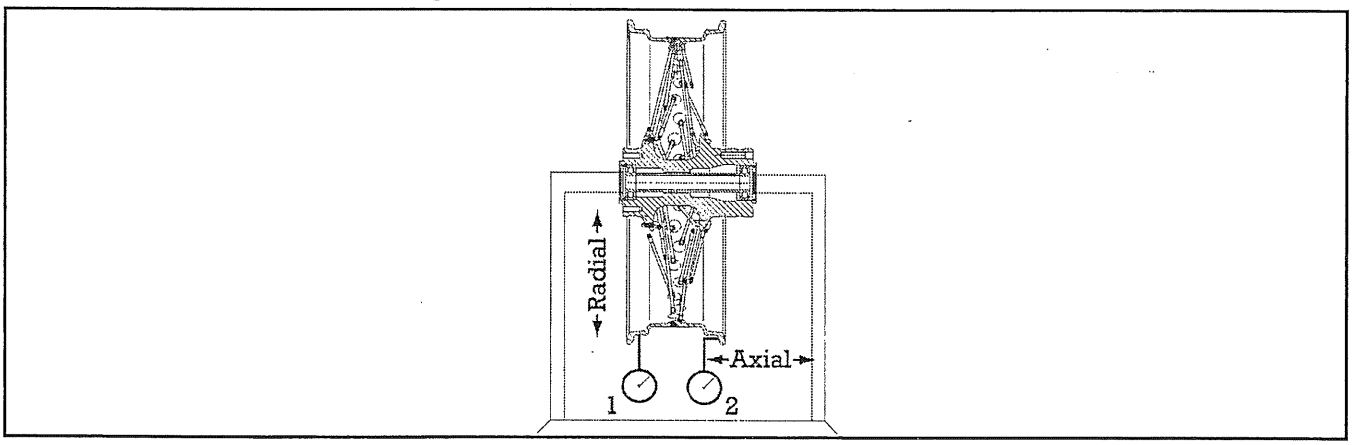
Adhesive Weight P/N 1521682

8. Install wheel / tire assembly onto motorcycle. See **Steering / Suspension Chapter for front wheel installation** and **rear wheel installation**.

WHEEL INSPECTION

VISUAL INSPECTION / RUNOUT

1. Clean the rim of all rubber particles and corrosion.
2. Inspect wheel for cracks and/or distortion.
3. Inspect bead seating area for scratches, distortion, or damage that could prevent proper sealing.
4. Measure wheel for radial runout ①.
5. Measure wheel for axial runout ②.



NOTE

Measure runout on tire bead sealing surface of wheel. Be sure surface is clean.

6. Compare measurements of axial and radial runout to specifications. See Service Specifications, page 8.57. Replace wheel if any measurement exceeds Service Limit.
7. Clean the sealing surfaces of the rim thoroughly. Use a soft brush (nylon) soap and water if necessary.

⚠ WARNING

Do not scratch or damage sealing surfaces of rim. Loss of air pressure can cause a loss of control and an accident, resulting in serious injury or death.

TIRE REPAIR PRECAUTIONS

⚠ WARNING

Only permanent plug-patch repairs of small tread area punctures from **inside** the dismounted tire are recommended. Never perform an exterior repair and never use an inner tube as a substitute for a proper repair. Speed should not exceed 50 MPH for the first 24 hours after repair and the repaired tire should never be used over 80 MPH. Inspect inflation pressure after tire cools for at least three hours following initial operation.

VALVE STEM

VALVE STEM INSPECTION

1. Remove the valve stem cap and spray the valve stem down with a mild soap and water solution.
2. Observe the area around the base of the valve stem and valve core area. If any bubbles form over a 1–2 minute period, the valve stem or inner tube should be replaced.
3. Inspect valve stem for cracks or visible damage and replace if necessary.

NOTE

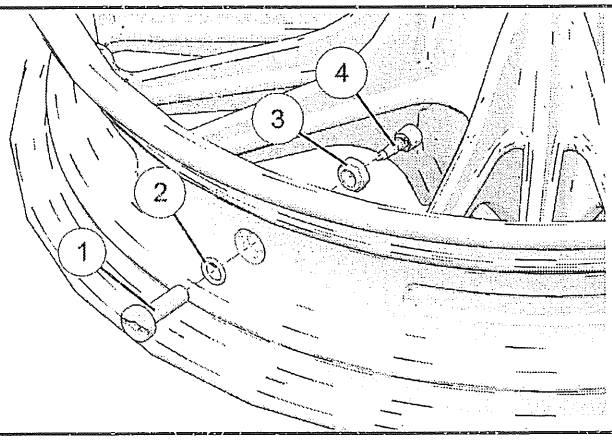
Valve stem replacement is recommended when tire is being replaced.

VALVE STEM INSTALLATION - METAL

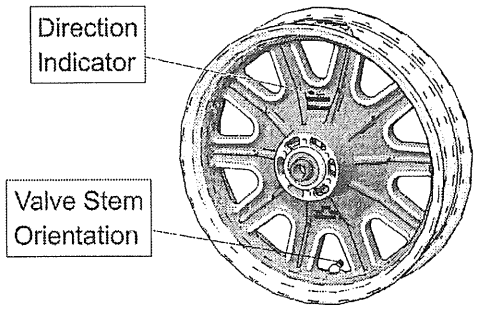
IMPORTANT

The Scout model uses directional tires and wheels. Pay close attention to markings to ensure proper tire and valve stem orientation.

1. Remove tire from wheel. SeeTire Removal, page 8.62 .
2. Remove valve stem ①, o-ring ②, nut ③ and valve stem ④.



3. Clean gasket or o-ring sealing surface of rim.
4. Place new valve stem (with seal washer or O-ring installed) through hole in rim and position it so the stem is perpendicular from wheel center and, valve opening facing away from surface containing direction indicator.



8

5. Hold stem and tighten nut to specification.

TORQUE
Valve Stem Nut: **44 in-lbs (5 Nm)**

6. Install tire. See Tire Installation, page 8.64.

TROUBLESHOOTING TIRES

PROBLEM	POSSIBLE CAUSE	REPAIR RECOMMENDED
Rear Wheel (Wobbles)	Bent rim	Replace
	Worn or damaged wheel bearings	Replace as a set
	Worn or damaged swing arm bushings.	Replace as a set
	Damaged or incorrect tire	Replace rear tire
	Wheel assembly out-of-balance	Balance wheel
	Low tire pressure	Inflate to specification
	Loose swing arm, axle or suspension fasteners.	Torque to specification
Handlebars Oscillate (Wobble)	Bent front axle	Replace
	Worn or damaged wheel bearings	Replace as a set
	Tire mounted incorrectly	Inspect and re-mount tire
	Damaged tire	Replace
	Loose steering stem nut	Adjust to specification
	Incorrect tire	Replace
	Incorrect tire pressure	Inflate to specification
Front Wheel Oscillates (Wobbles)	Bent rim	Replace
	Worn or damaged wheel bearings	Replace as a set
	Damaged or incorrect tire	Replace
	Loose axle or axle pinch fasteners	Torque to specification
	Right and left fork not installed at same height	Repair
	Fork oil level incorrect	Fill to specification
	Fork spring free length different between right & left	Replace spring that does not meet specification
	Wheel assembly out-of-balance	Balance wheel

NOTES

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BRAKES

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GENERAL INFORMATION

SERVICE NOTES

Use only genuine Indian Motorcycle replacement parts when servicing the brake system. Clean all system components prior to disassembly, including the fluid reservoir cover (s) to reduce the chance of debris entering the system during repair or maintenance work. Start with a clean work area away from dust, water or other contamination. Cleanliness is very important for proper brake system maintenance and repair. Follow procedure outlined in this manual carefully, including fastener torques and the application of special lubricant in required areas. Special lubricants are included with service kits.

⚠ WARNING

Contaminated brake discs or pads greatly reduce the amount of stopping force available & increase stopping distance. Brake discs can be cleaned using a commercially available brake disc cleaner. Follow the manufacturer instructions printed on the container. NEVER attempt to clean contaminated brake pads. Always replace pads as a set.

⚠ WARNING

The brake system uses ethylene-glycol based fluid (DOT 4). Do not use or mix with different types of fluid such as silicone-based (DOT 5) or any petroleum-based fluid.Do not let water or moisture enter the master cylinder when refilling. Water significantly lowers the boiling point of the fluid and can result in poor braking.Do not use brake fluid taken from old, used or unsealed containers. Never reuse brake fluid.Keep brake fluid containers completely sealed and out of reach of children.Brake hoses should be replaced whenever the exterior shows signs of deterioration or damage. Brake hoses should be replaced every four (4) years regardless of their exterior condition.Bleed the brake system any time it is disassembled or when the brake action is spongy.Always inspect the operation of the brakes before riding the motorcycle.Replace sealing washers whenever brake lines are removed.Always remove the master cylinder fluid reservoir cover and inspect the fluid level when brake pads are replaced.

NOTE

Brake fluid and some types of brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level and clean before removing the cap.

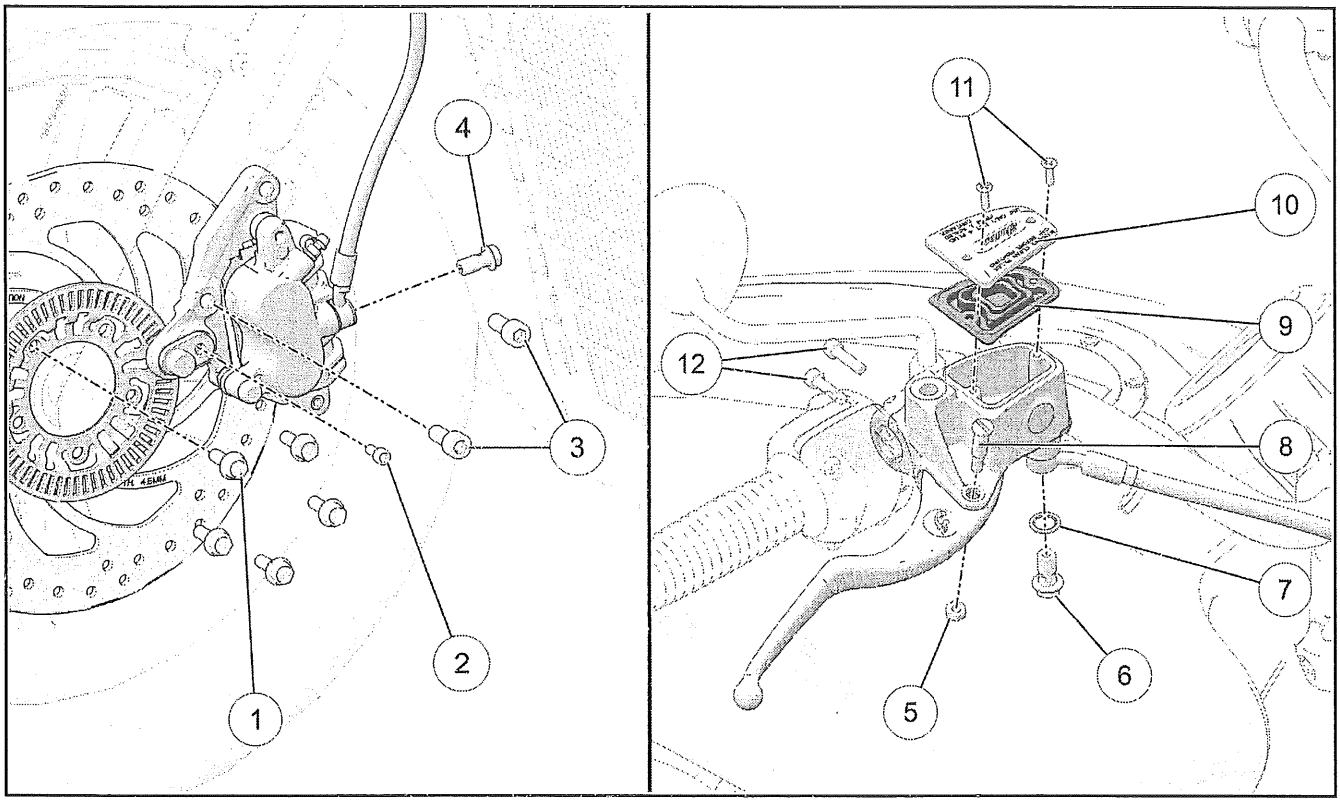
SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
ABS Tool (Lever Reserve)	PV-50104
Vacuum Brake Bleeder	Commercially Available

SERVICE SPECIFICATIONS

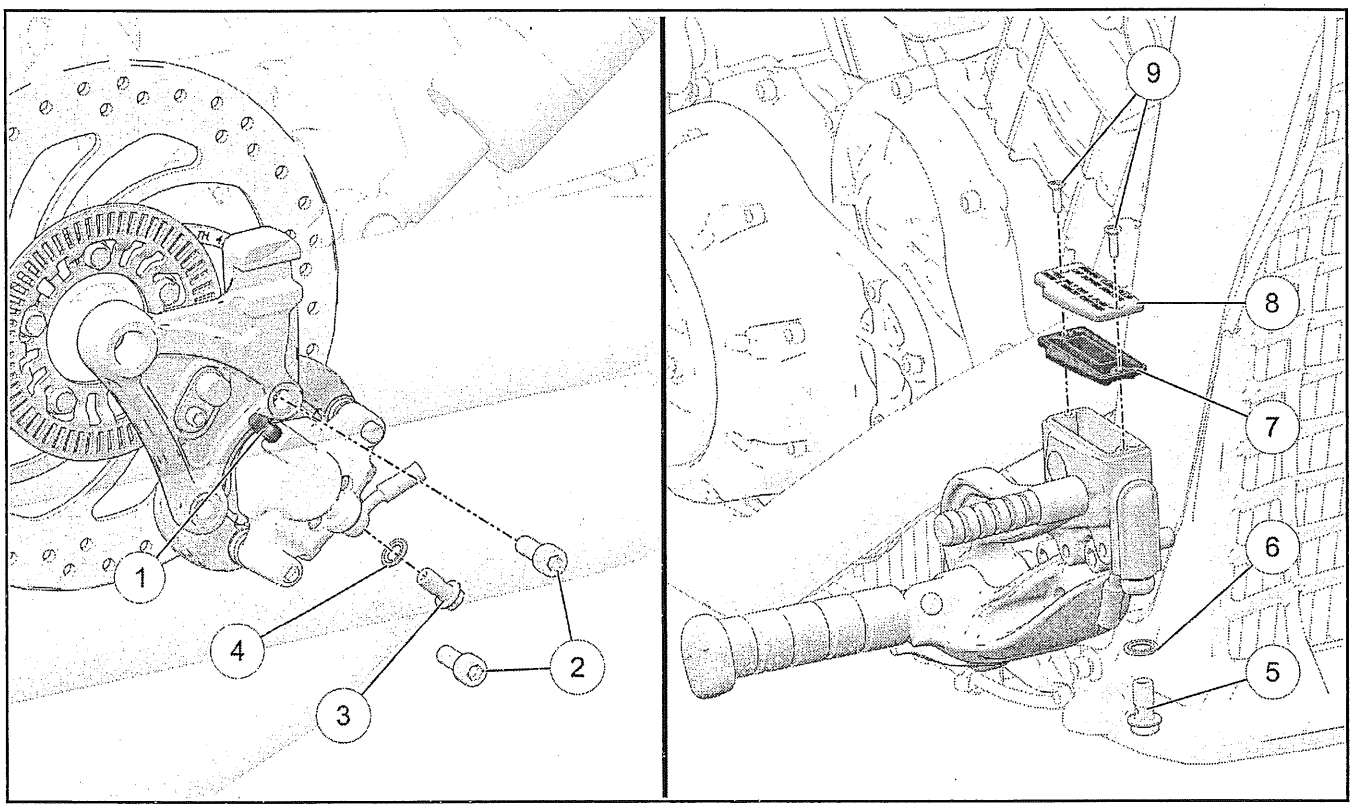
ITEM	STAN-DARD	SERVICE LIMIT
Specified Brake Fluid	DOT 4	Replace every 24 months or 10,000 miles (16,000 km)
Brake Disc Thickness, Front	5 mm	4.5 mm (.177") (Min)
Brake Disc Thickness, Rear	5mm	4.5 mm (.177") (Min)
Brake Disc Runout	-	.30 mm (.012") (Max)
Brake Pad Wear Limit (Front & Rear)	-	When wear limit groove is no longer visible
Brake Pedal Free Play (Pedal Clearance)	No Ad-just-ment	-
Brake Lever Freeplay (Front)	No Ad-just-ment	-

ASSEMBLY VIEWS
FRONT BRAKE SYSTEM COMPONENTS



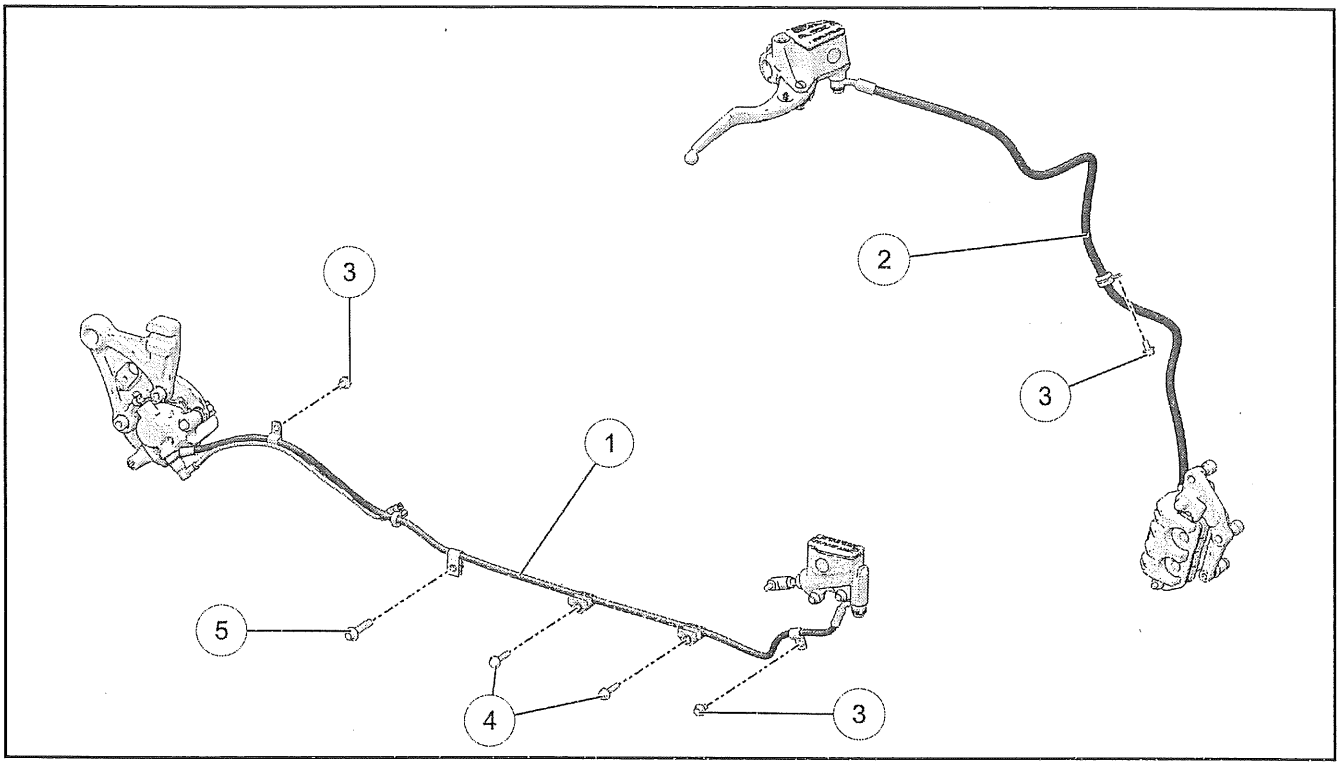
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Brake Disc Fasteners (front)	**19 ft-lbs (26 Nm)**
②	ABS Sensor Fastener	**84 in-lbs (9.5 Nm)**
③	Caliper Mounting Fasteners (front)	**35 ft-lbs (47 Nm)**
④	Banjo Fastener (Front Caliper, M/C)	**16 ft-lbs (22 Nm)**
⑤	Brake Lever Nut	**60 in-lbs (7 Nm)**
⑥	Master Cylinder Banjo Fastener	**16 ft-lbs (22 Nm)**
⑦	Sealing Washer	-
⑧	Brake Lever Pivot Fastener	**48 in-lbs (6 Nm)**
⑨	Rubber Diaphragm	-
⑩	Front Master Cylinder Cover	-
⑪	Master Cylinder Cover Fastener (front)	**13 in-lbs (1.5 Nm)**
⑫	Brake Lever Perch Fasteners	**12 ft-lbs (16 Nm)**

REAR BRAKE SYSTEM COMPONENTS



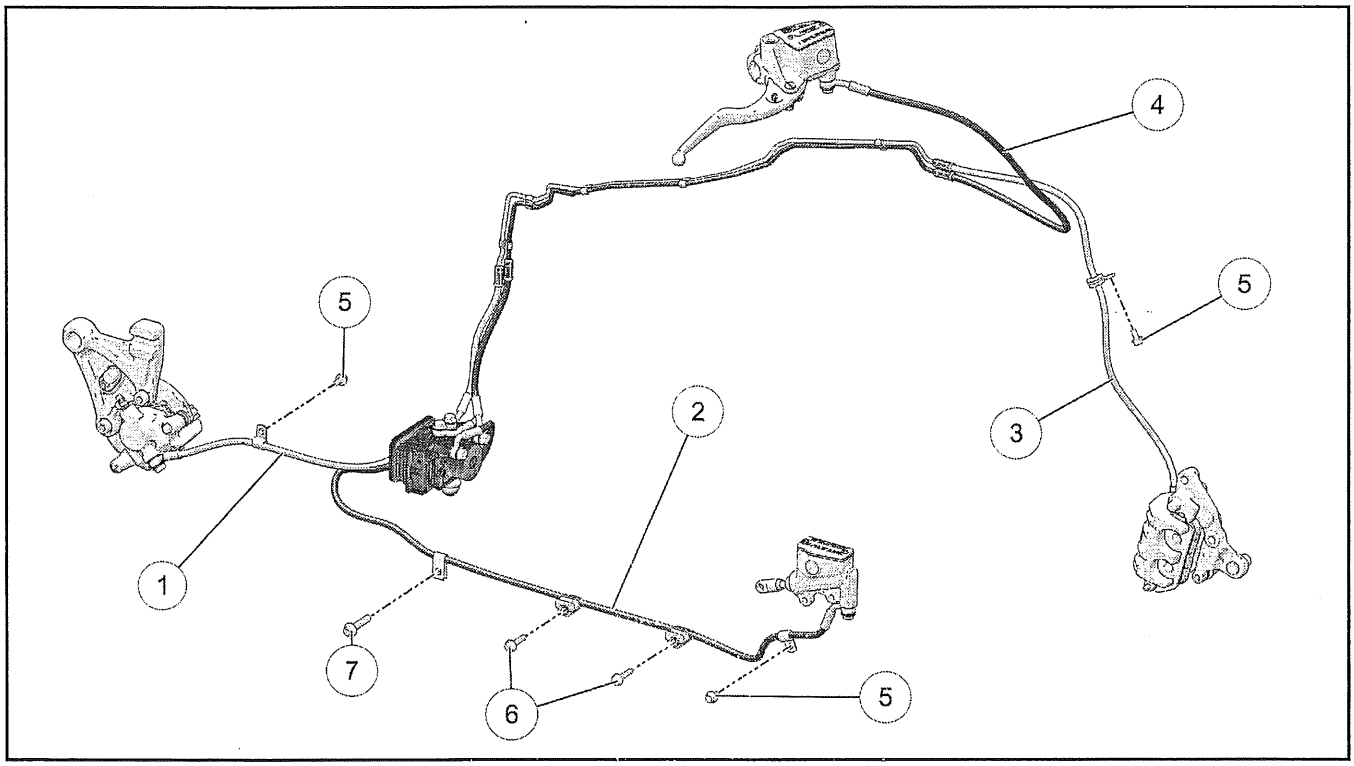
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Bleeder Fastener	**60 in-lbs (6.8 Nm)**
②	Caliper Mounting Fasteners (rear)	**30 ft-lbs (41 Nm)**
③	Banjo Fastener	**16 ft-lbs (22 Nm)**
④	Sealing Washer	-
⑤	Banjo Fastener	**16 ft-lbs (22 Nm)**
⑥	Sealing Washer	-
⑦	Rubber Diaphragm	-
⑧	Master Cylinder Cover (rear)	-
⑨	Master Cylinder Cover Fasteners (rear)	**13 in-lbs (1.5 Nm)**

BRAKE LINE ROUTING COMPONENTS



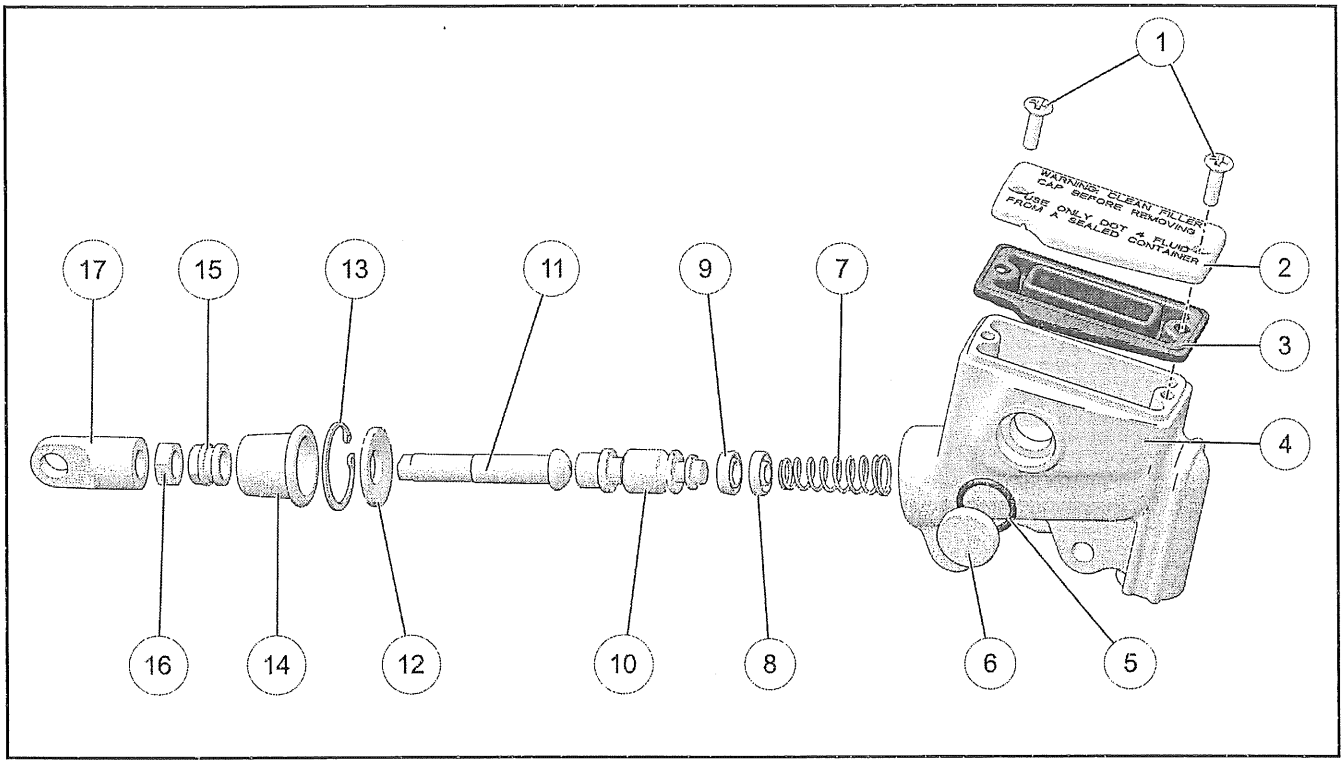
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Rear Brake Line (Rear Caliper to Master Cylinder)	-
②	Front Brake Line (Front Caliper to Handlebar)	-
③	Brake Line P-Clamp Fastener (front)	**84 in-lbs (9.5 Nm)**
④	Brake Line Bracket Fasteners (rear)	**60 in-lbs (7 Nm)**
⑤	Brake Line P-Clamp Fastener (rear)	**19 ft-lbs (26 Nm)**

ABS Models



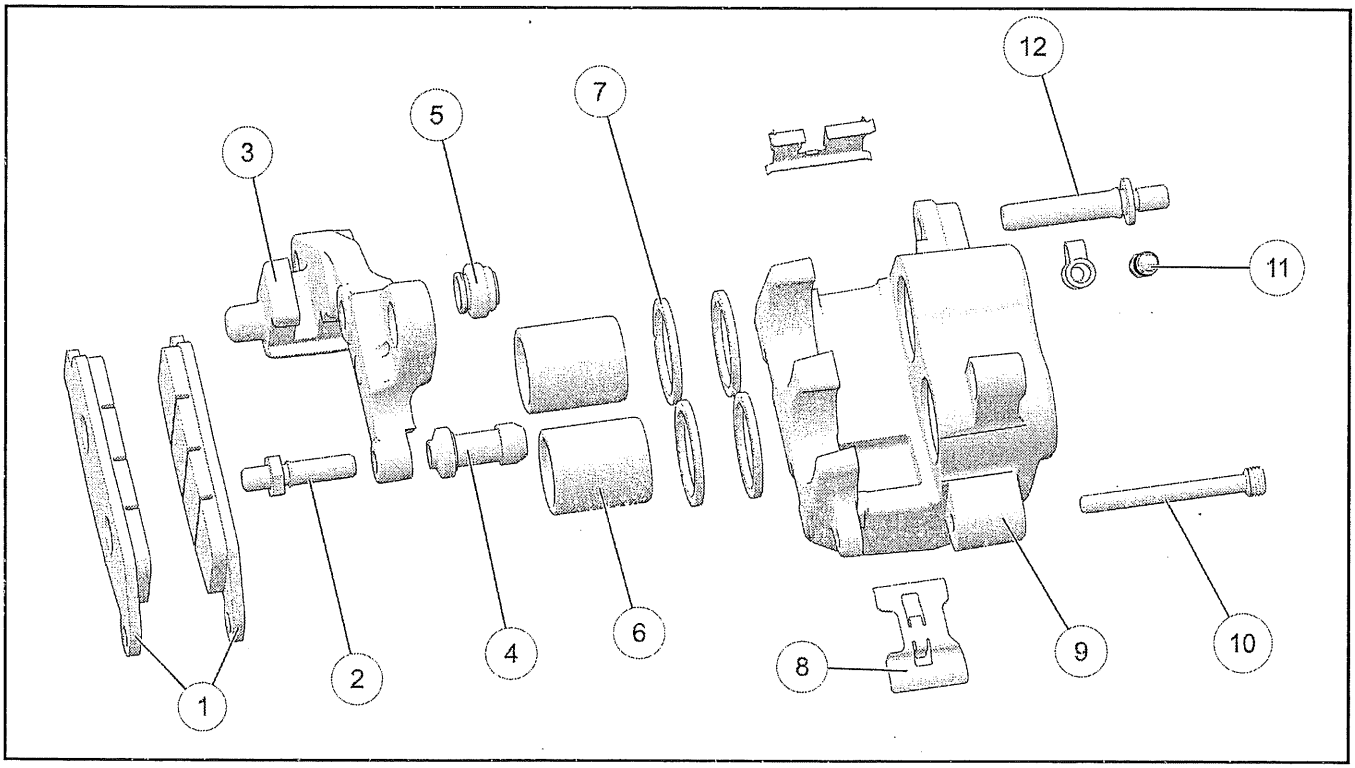
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Rear Brake Line (Rear Caliper to ABS Module)	-
②	Rear Brake Line (Rear Master Cylinder to ABS Module)	-
③	Front Brake Line (Front Caliper to ABS Module)	-
④	Front Brake Line (Handlebar to ABS Module)	-
⑤	Brake Line P-Clamp Fastener (front)	**84 in-lbs (9.5 Nm)**
⑥	Brake Line Bracket Fasteners (rear)	**60 in-lbs (7 Nm)**
⑦	Brake Line P-Clamp Fastener (rear)	**19 ft-lbs (26 Nm)**

REAR MASTER CYLINDER COMPONENTS



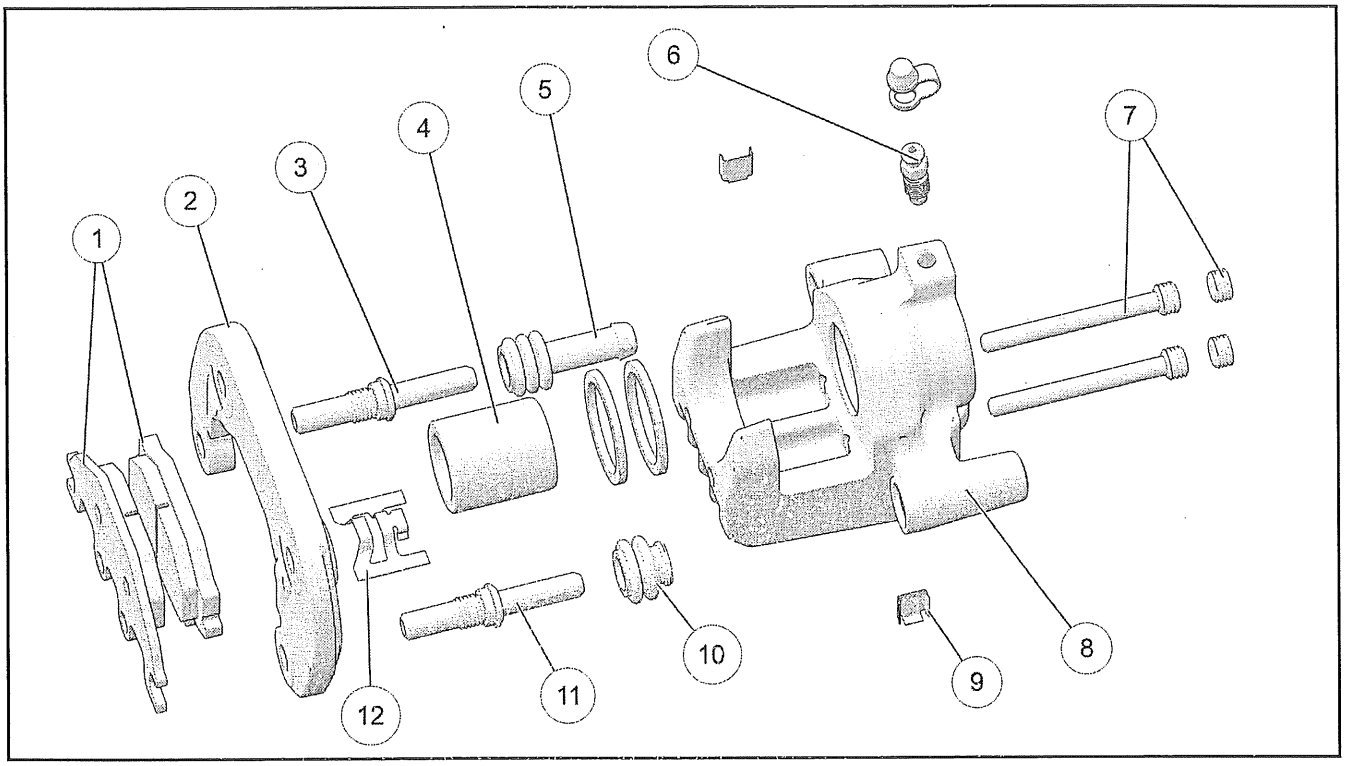
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Master Cylinder Cover Fasteners (rear)	**13 in-lbs (1.5 Nm)**
②	Master Cylinder Cover (rear)	-
③	Rubber Diaphragm	-
④	Master Cylinder Reservoir (rear)	-
⑤	Sight Glass O-Ring	-
⑥	Sight Glass	-
⑦	Spring	-
⑧	P Cup	-
⑨	S Cup	-
⑩	Pushrod	-
⑪	Piston	-
⑫	Piston Washer	-
⑬	Piston Snap Ring	-
⑭	Dust Boot	-
⑮	Pushrod Nut	-
⑯	Master Cylinder Clevis Nut (rear)	**80 in-lbs (9 Nm)**
⑰	Clevis	-

FRONT BRAKE CALIPER COMPONENTS (2015–16)



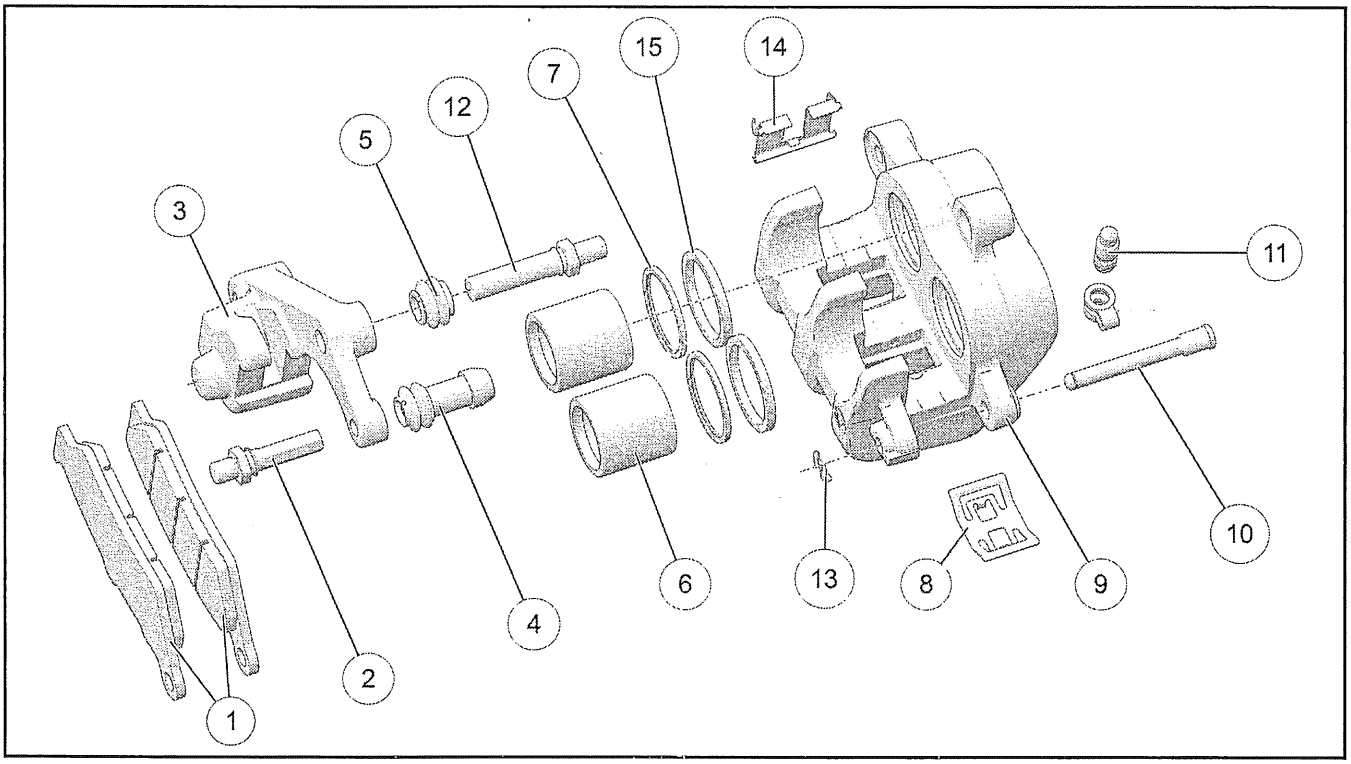
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Brake Pads	-
②	Caliper Slide Pin (lower)	**18 ft-lbs (24 Nm)**
③	Bracket	-
④	Lower Dust Boot	-
⑤	Upper Dust Boot	-
⑥	Piston	-
⑦	Piston Seal	-
⑧	Pad Spring	-
⑨	Caliper Body	-
⑩	Pad Retaining Pin	**80 in-lbs (9 Nm)**
⑪	Bleeder Fastener	**60 in-lbs (6.8 Nm)**
⑫	Caliper Slide Pin (upper)	**18 ft-lbs (24 Nm)**

REAR BRAKE CALIPER COMPONENTS (2015-16)



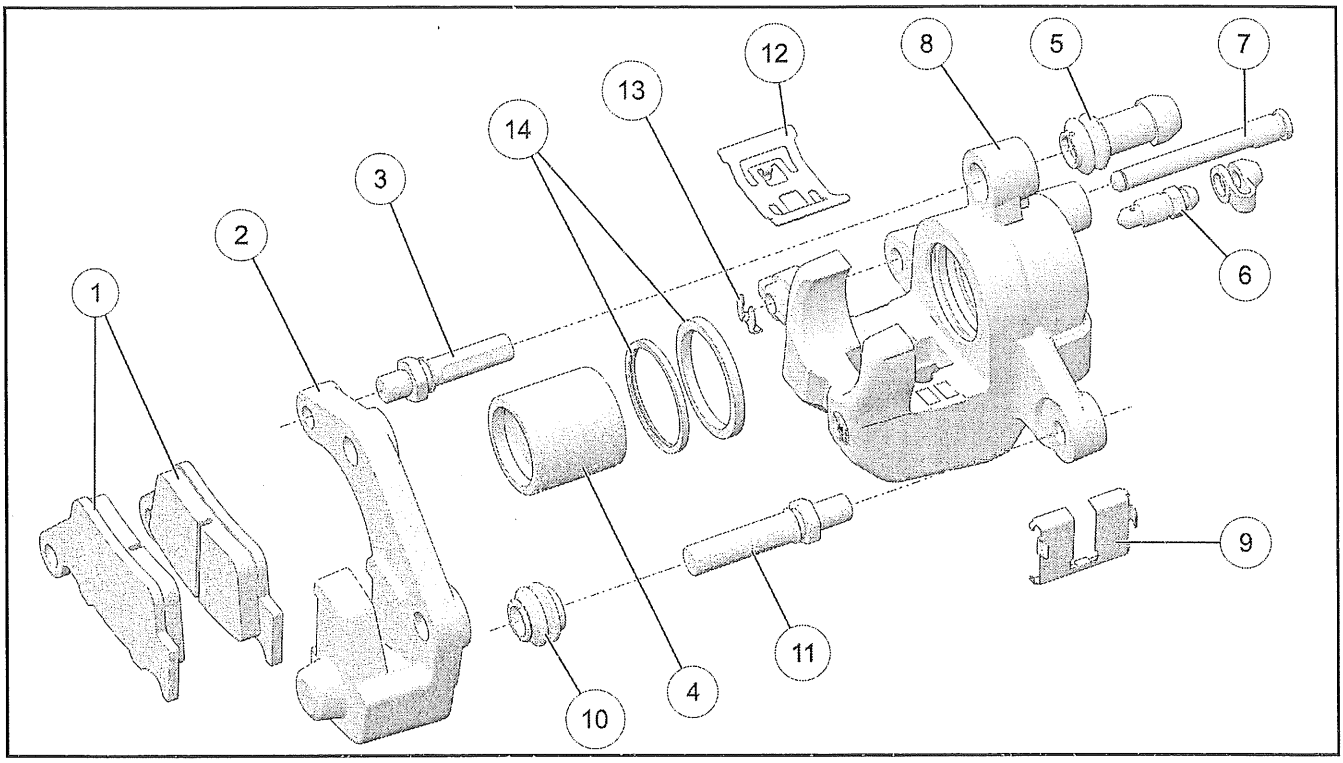
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Brake Pads	-
②	Mount Bracket	-
③	Guide Pin	-
④	Piston	-
⑤	Dust Seal	-
⑥	Bleeder Fastener	**60 in-lbs (6.8 Nm)**
⑦	Pad Retaining Pin	**80 in-lbs (9 Nm)**
⑧	Caliper Body	-
⑨	Pad Wear Clip	-
⑩	Dust Seal	-
⑪	Guide Pin	-
⑫	Pad Spring	-

FRONT BRAKE CALIPER COMPONENTS (2017)



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Brake Pads	-
②	Caliper Slide Pin (lower)	**18 ft-lbs (24 Nm)**
③	Bracket	-
④	Lower Dust Boot	-
⑤	Upper Dust Boot	-
⑥	Piston	-
⑦	Dust Seal	-
⑧	Pad Spring	-
⑨	Caliper Body	-
⑩	Pad Retaining Pin	**80 in-lbs (9 Nm)**
⑪	Bleeder Fastener	**60 in-lbs (6.8 Nm)**
⑫	Caliper Slide Pin (upper)	**18 ft-lbs (24 Nm)**
⑬	Clip	-
⑭	Wear Pad	-
⑮	Square Seal	-

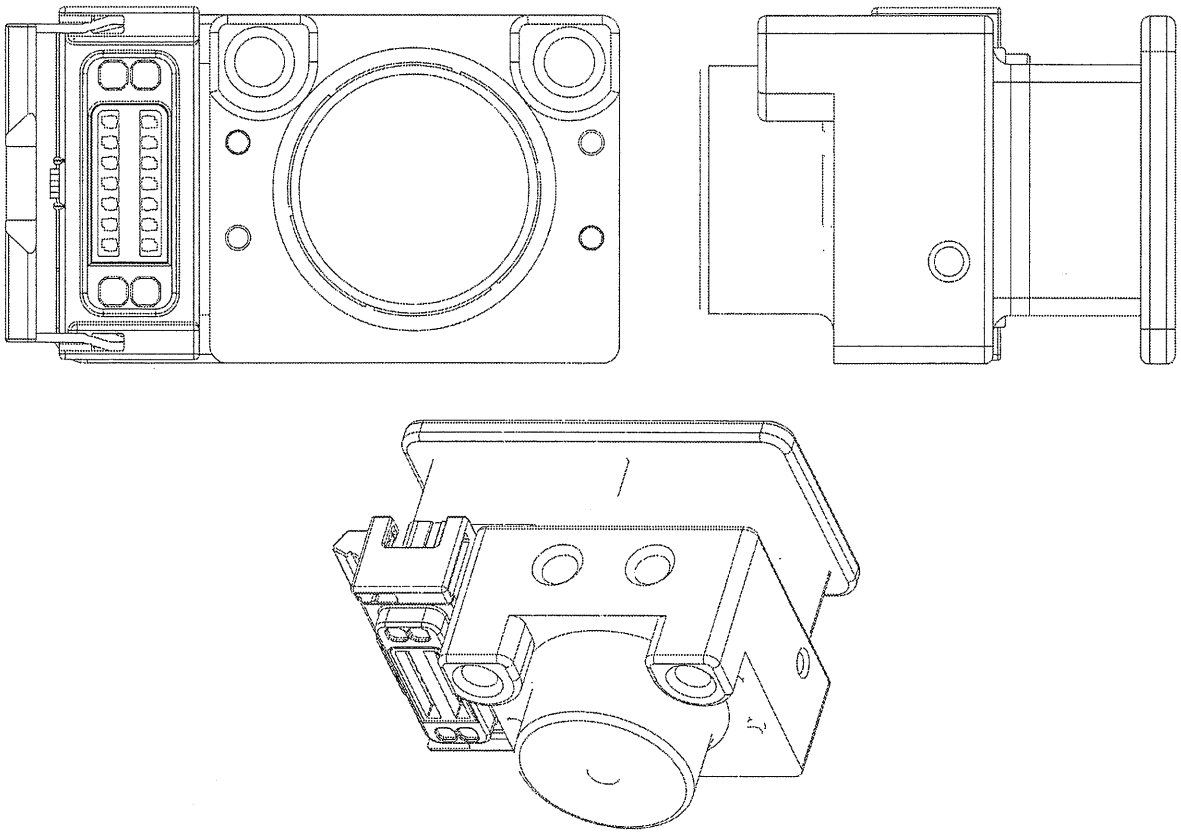
REAR BRAKE CALIPER COMPONENTS (2017)



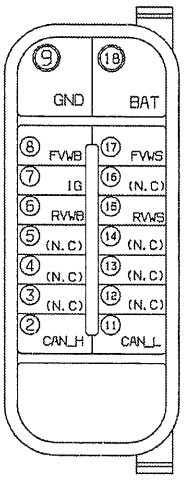
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Brake Pads	-
②	Mount Bracket	-
③	Caliper Slide Pin (lower)	**18 ft-lbs (24 Nm)**
④	Piston	-
⑤	Lower Dust Boot	-
⑥	Bleeder Fastener	**60 in-lbs (6.8 Nm)**
⑦	Pad Retaining Pin	**80 in-lbs (9 Nm)**
⑧	Caliper Body	-
⑨	Pad Wear Clip	-
⑩	Upper Dust Boot	-
⑪	Caliper Slide Pin (upper)	**18 ft-lbs (24 Nm)**
⑫	Pad Spring	-
⑬	Clip	-
⑭	Piston Seal	-

ABS MODULE

ABS Module / Assembly View

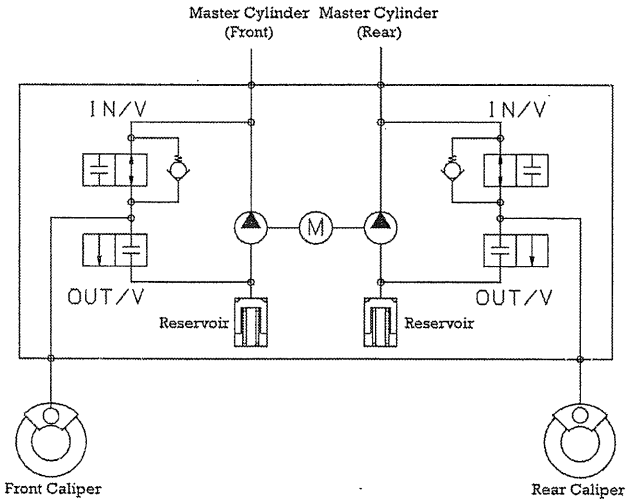


Terminal Layout
(Module Side)



CAN H: CAN HIGH
RVWB: REAR VELOCITY WHEEL BATTERY
IG: IGNITION
FVWB: FRONT VELOCITY WHEEL BATTERY
GND: GROUND
CAN L: CAN LOW
NC: NOT CONNECTED
RVWS: REAR WHEEL SPEED SENSOR
FVWS: FRONT WHEEL SPEED SENSOR
BAT: BATTERY

Hydraulic Circuit Diagram



ANTILOCK BRAKE SYSTEM (ABS) INFORMATION

ABS SYSTEM SAFETY PRECAUTIONS

Before working on an Indian Motorcycle equipped with anti-lock brakes, review and understand all general brake system, brake fluid, and ABS specific precautions and system information. Do not attempt maintenance or repair of the anti-lock brake system without the proper tools.

⚠ WARNING

Proper brake system bleeding is extremely important to ensure adequate lever reserve in the system. Always perform the Brake Lever Reserve test described in this manual after bleeding the anti-lock brake system.

- Operating with non-recommended tires or improper tire pressure may reduce the effectiveness of the anti-lock brake system.
- Always install the recommended size and type of tires specified for the vehicle.
- Always maintain the recommended tire pressure.
- Indian Motorcycle DOT 4 Brake Fluid is recommended. Change every 10,000 miles (16,000 km) or 2 years, whichever comes first.
- The anti-lock brake system will not prevent wheel lock-up, loss of traction, or loss of control *under all conditions.* Always adhere to all safe motorcycle riding practices as recommended.
- It is not unusual to leave tire marks on the road surface during a hard braking event.
- The anti-lock braking system does not compensate for or reduce the risk associated with:
- excessive speed
- reduced traction on rough, uneven or loose surfaces
- poor judgement
- *improper operation*

ABS GENERAL INFORMATION

The Anti-Lock Brake System is a safety feature designed to prevent wheel lock-up and improve control of the motorcycle during extreme braking events, including:

- Panic braking
- Slick surface braking (such as wet road surfaces)
- Surface transitions (from asphalt to oily asphalt or cobblestone, etc.)

Here are a few general points to note about ABS:

- The anti-lock brake system cannot be turned OFF.
- The ABS indicator lamp (located on the Instrument Cluster) always illuminates when the key is in the ON position and remains on until the anti-lock system activates, which occurs when vehicle speed exceeds 6 mph (10 kph).
- If the lamp is not illuminated when the key is ON, connect Digital Wrench and perform an ABS System inspection to determine the cause.
- When the ABS lamp is illuminated, the anti-lock brakes will not activate, but the conventional brake system will continue to operate normally.
- If the lamp continues to illuminate after the vehicle speed exceeds 6 mph (10 kph), the system is not functioning. Connect Digital Wrench and perform an ABS System inspection to determine the cause.
- When the anti-lock brakes engage during a braking event, the rider will feel pulsing at the brake lever or pedal. *Continue to apply steady pressure to the brakes for the best stopping performance.*
- The wheel speed sensor-to-pulse ring air gap is adjustable. Shims can be added or removed to bring the air-gap into specification. See adjustment procedure outlined in this chapter.
- The ABS system *can* be reprogrammed.
- The ABS light is controlled via CAN BUS.
- Wheel speed sensors provide feedback for anti-lock brake operation.
- If fuse is open or removed, the ABS light will remain ON after 6 mph (10 kph). ABS will not be active. Normal (conventional) braking will be available provided the system components (master cylinder, lines, calipers, etc.) are in working order.

ABS SYSTEM COMPONENTS

The following parts *function* in the same manner as the same component in a non-ABS system, although parts are not necessarily interchangeable. Always refer to the appropriate ABS parts information when replacing a component or component parts.

- Front Brake Calipers
- Rear Brake Caliper
- Front Master Cylinder
- Rear Master Cylinder
- Brake Light Switch
- Brake Lines

In addition to the brake system components listed above, the following are exclusive to ABS equipped vehicles:

- Wheel Speed Sensors (Front located on front caliper; Rear mounted on rear caliper bracket)
- Wheel Speed Sensor Pulse Rings (Front and Rear mounted to wheel with 5 disc bolts)
- ABS Module Assembly
- ABS Related Wiring
- ABS Indicator Lamp

ABS OVERVIEW OF OPERATION

The ABS system is active and available when vehicle speed exceeds 6 mph (10 kph).

The system uses two independent Hall-Effect *Wheel Speed Sensors*. One sensor is mounted to the front caliper and one is mounted to the rear brake caliper bracket. Two *Pulse Rings* are also used, one mounted to the left front brake disc hub and one to the rear brake disc hub, which rotate with the wheels. When the vehicle is in motion, the multiple reluctor segments on each pulse ring pass by the center pole of the respective wheel speed sensor, generating an electrical pulse signal in the sensor which is sent to the *ABS Module* which is located in front of the rear wheel.

The ABS Module interprets wheel speed signal pulses to determine speed, rate-of-change, and front / rear wheel speed differential to determine if wheel lock-up is about to occur. When wheel lock-up is imminent during a braking event, the ABS Module controls the operation of solenoids and a pressure pump (located inside the *ABS Module)* to regulate the amount of line pressure and cycles (length of time) applied to the caliper pistons and brake pads. This pressure / time modulation can often be felt at the brake lever or the brake pedal during an ABS braking event and is a normal condition. Note that the brake fluid is not diverted inside the module and does not "flow" in the system any more than occurs in a conventional (non-ABS) brake system.

If the surface coefficient changes (such as moving from wet pavement to dry pavement) the ABS system will recalculate (in a matter of milliseconds) and adjust pressure output to caliper(s) as required.

In the event of a system fault, the ECM turns on the ABS indicator lamp (via the CAN BUS) and leaves it on even after vehicle speed exceeds 6 mph (10 kph) activation speed.

If a system fault occurs, the light will remain on (and ABS will not be active) until the ignition key is turned to OFF position and back to ON.

The ABS Module Assembly is serviceable only as an assembly. The module itself is not rebuildable.

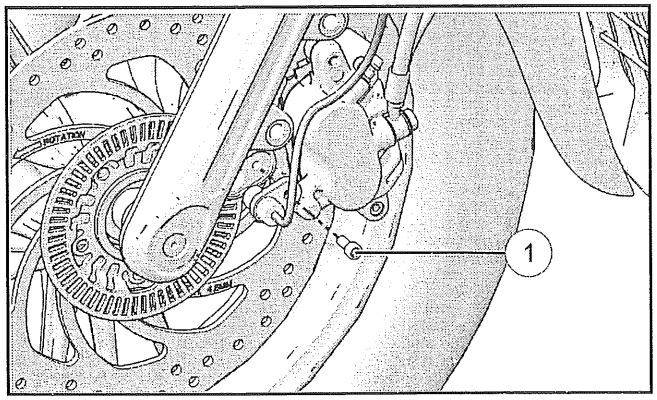
Disconnect negative (-) battery cable from battery before servicing ABS brake lines or system components.

ABS SYSTEM SERVICE

WHEEL SPEED SENSOR REPLACEMENT

Removal - Front

1. Remove bolt ① securing the Wheel Speed Sensor to bracket.



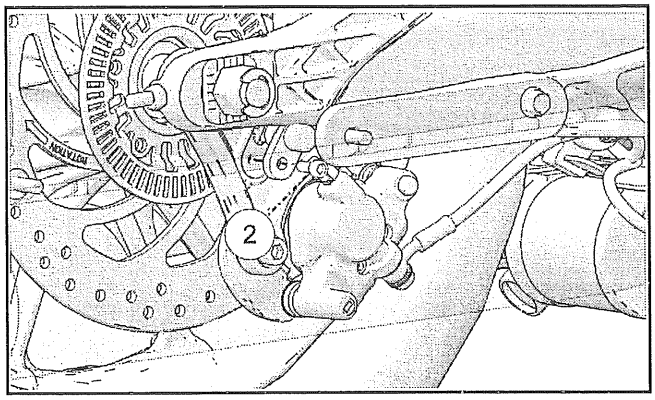
2. Withdraw speed sensor and remove any existing shims.
3. Noting their position, clip cable ties securing the harness to the motorcycle.
4. Locate connector inside the headlight and disconnect the wheel speed sensor.

Installation - Front

5. Reverse procedure to install.
6. Verify speed sensor air gap is within specification. Perform adjustment procedure if necessary. See Wheel Speed Sensor Air Gap Adjustment, page 9.18.

Removal - Rear

7. Remove bolt ② securing the Wheel Speed Sensor to the bracket.



8. Withdraw speed sensor and remove any existing shims.
9. Noting their position, clip the cable ties securing the speed sensor harness to the rear brake line.
10. Locate connector below the ABS module and above the voltage regulator. Disconnect the wheel speed sensor.

Installation - Rear

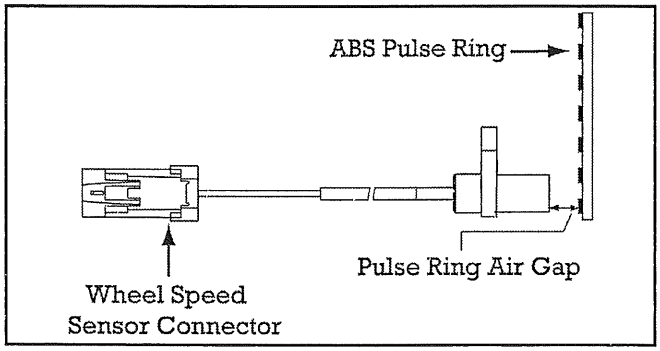
11. Reverse procedure to install.
12. Verify speed sensor air gap is within specification. Perform adjustment procedure if necessary. See Wheel Speed Sensor Air Gap Adjustment, page 9.18.

WHEEL SPEED SENSOR AIR GAP ADJUSTMENT

NOTE

Wheel Speed Sensor air gap is adjusted by adding and removing shims. Shims are added to increase gap and removed to decrease gap. No more than 3 shims (per Wheel Speed Sensor) should be used at one time.

1. Using a suitable feeler gauge, measure the air gap between the ABS Pulse Ring and the Wheel Speed Sensor.

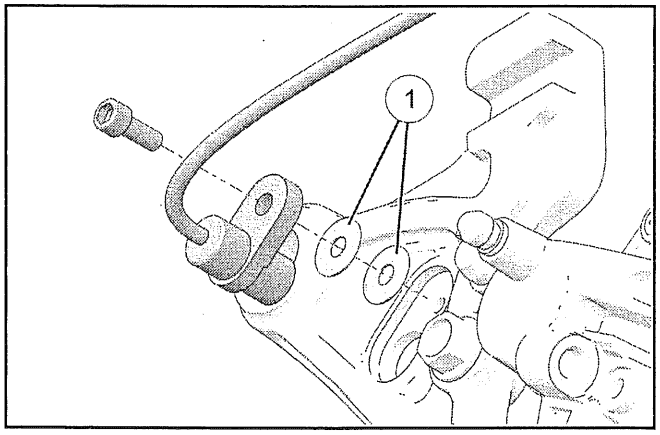


2. If the Wheel Speed Sensor air gap is out of specification, proceed to step 3.

MEASUREMENT

Wheel Speed Sensor Air Gap (Max)
0.079 in (2.00 mm)

3. Remove Wheel Speed Sensor from bracket.
4. Withdraw the speed sensor and remove any existing shims.
5. Based on air gap measurement, add or remove shims ① to achieve the specified air gap.



MEASUREMENT

WSS Shim Thickness:
0.019 in (0.5 mm)

6. Reinstall Wheel Speed Sensor and torque to specification.

TORQUE

Speed Sensor Fastener:
84 in-lbs (9.5 Nm)

ABS MODULE REPLACEMENT

NOTE

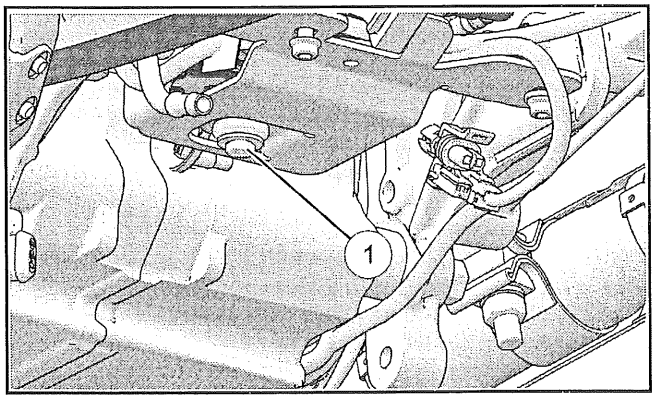
Do not disassemble the ABS module. The ABS module is serviceable only as a sealed (pre-bled) assembly. If ABS module has failed internally, replace complete assembly.

⚠ WARNING

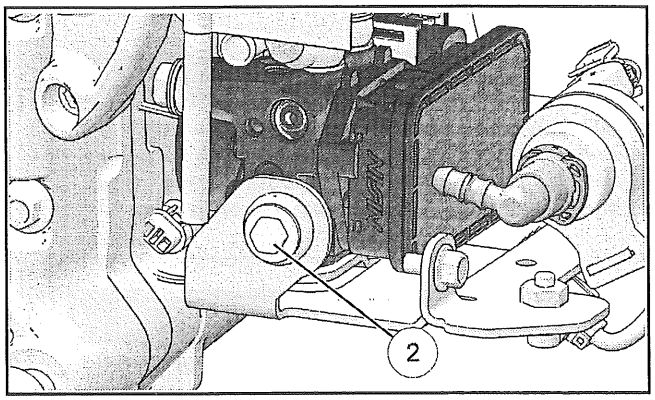
The hydraulic brake system MUST be completely bled following removal or replacement of the ABS module. Follow the brake bleeding procedure outlined in this chapter after ABS module service.

Removal

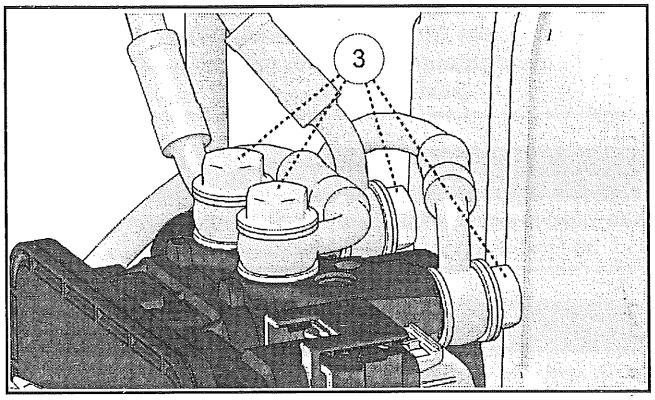
1. Disconnect the negative battery cable.
2. Position motorcycle in an upright position with the front wheel clamped in a wheel vise.
3. **California Models ONLY:** Remove the evaporative emissions charcoal canister, if equipped. Refer to , page 1.12.
4. Remove the swingarm assembly. Refer to , page 8.51 procedure.
5. Remove the voltage regulator. Refer to Regulator / Rectifier Replacement, page 10.33procedure.
6. Remove the fastener ① securing the bottom ABS Module mount.



7. Remove the fastener ② securing the side ABS Module mount.



8. Disconnect the electrical connectors from the ABS Module.
9. Disconnect hydraulic lines ③ from ABS module and cap off lines to prevent contamination.



10. Remove ABS module.

Installation

11. Reverse procedure to install.
12. Bleed brake system as outlined in this chapter.
13. Attach Digital Wrench and check for ABS trouble codes.

ABS BRAKE SYSTEM BLEEDING

BRAKE FLUID REPLACEMENT / BLEEDING PRECAUTIONS

⚠ WARNING

Contaminated brake discs or brake pads greatly reduce braking performance and increase stopping distance. Do not attempt to clean contaminated pads. Replace them. Clean the brake disc with brake cleaner.

⚠ WARNING

This brake system requires ethylene-glycol based fluid (DOT 4). Do not use or mix different types of fluid such as silicone-based or petroleum-based.

⚠ WARNING

Do not use brake fluid taken from old, used or unsealed containers. Never reuse brake fluid. Brake fluid can accumulate moisture, reducing it's performance.

⚠ WARNING

Brake fluid is poisonous. Keep brake fluid tightly sealed and out of reach of children.

⚠ WARNING

A soft, spongy feeling in the brake lever and/or brake pedal could indicate a hazardous condition in the brake system. Do not operate the motorcycle until the failure in the brake system is corrected.

⚠ WARNING

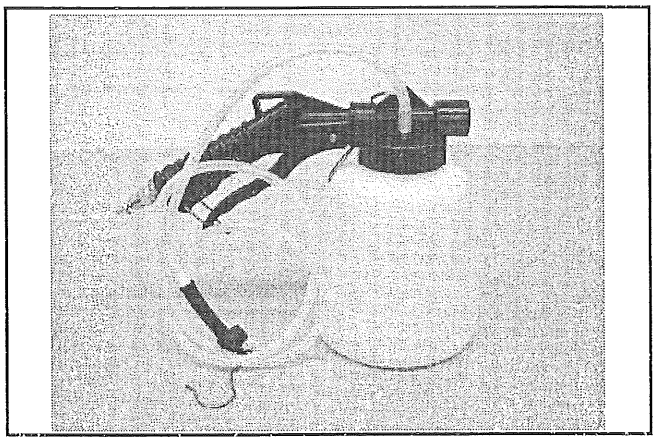
An unsafe condition exists when air is trapped in the hydraulic brake system. Air in the brake hydraulic system acts like a soft spring and absorbs a large percentage of the pressure developed by the master cylinder. Without this pressure, the braking system cannot develop full braking force to allow for safe, controlled stops. It is extremely important to bleed the brakes properly after any brake system work has been performed or when inspection reveals spongy brakes.

Keep these points in mind when bleeding hydraulic brakes:

- The master cylinder reservoirs have limited capacities. It is easy to empty them during the bleeding procedure. This introduces air into the system which you are trying to purge. Watch the reservoir closely and add fluid when necessary to keep the level above the LOW mark and prevent air from re-entering the system.
- Apply only light to moderate pressure to the lever or pedal when bleeding the brake system. Extreme pressure or rapid movement will cause a surge of fluid through the small orifices of the brake system when the bleeder screw is opened and could introduce air into the system by means of cavitation.
- Small amounts of air can become trapped in the banjo bolt fittings at the master cylinder(s) and junction points of brake lines. These fittings can be purged of air by following a standard bleeding procedure at these fittings (instead of the bleed screw on caliper) if necessary to speed the bleeding process. This is usually only needed if system was completely drained of fluid. Bleed each line connection, starting with the fitting closest to the master cylinder, working toward the caliper, and ending with the bleed screw.
- Always torque banjo bolts and other brake system fasteners and components to specified torque.
- Always install NEW genuine Indian Motorcycle replacement parts and rubber parts upon assembly. Apply special lubricant where indicated (included in service kits).

ABS BRAKE VACUUM BLEEDER

A vacuum bleeder is recommended for ABS system bleeding and can also be used to bleed conventional (non-ABS) brake systems. One style of bleeder is shown below.



ABS FLUID CHANGE

Review Brake Fluid Replacement and Bleeding Precautions before working with brake fluid.

NOTE

When bleeding or flushing the system, monitor fluid level in master cylinder reservoir constantly. DO NOT allow fluid level to fall below the LOW level.

Use only DOT 4 brake fluid from a sealed container.

NOTE

EMPTY LINES - If system is dry or very low on fluid due to parts replacement or disassembly, fill reservoir and pump lever or pedal slowly through stroke range until air bubbles no longer rise through the fluid into the reservoir.

FLUSHING THE SYSTEM - Brake systems should be flushed every 2 years or more often if the fluid is discolored. To flush the system, follow normal brake bleeding process, and pump fluid through the system until fluid moving through the bleeder hose is clear. Do not allow reservoir level to fall below the LOW level or complete system bleeding will be required.

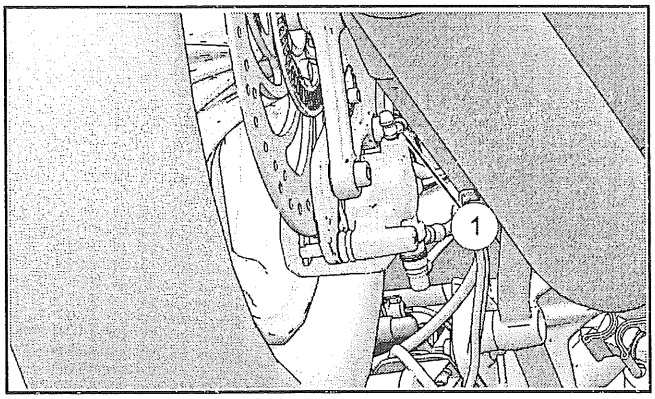
ABS REAR BRAKE BLEEDING

NOTE

The use of a vacuum bleeder is recommended. DO NOT allow fluid level in reservoir to drop below the LOW mark at any time during the bleeding procedure.

Repeat entire bleed procedure at least once.

1. Remove rubber cap from rear caliper bleed screw ① and place a box end wrench on the screw.
2. Attach a tight-fitting clear hose from the vacuum bleeder to the bleed screw and apply vacuum.



3. Fill rear brake fluid reservoir and leave cover off so fluid can be added as it is drawn through the system.
4. Open bleed screw about 1/4 turn.
5. Pump brake pedal repeatedly with smooth full strokes while adding brake fluid to the reservoir as required. For best results pump the pedal at a fairly rapid rate but avoid pumping too fast or fluid may become aerated. After about 2 cups of fluid have been run through the system, the bleeder hose should have clear, bubble-free fluid running through it.
6. Close bleeder screw and fill the brake fluid reservoir.
7. *Repeat the entire bleeding process* to be sure all air is purged from the system.
8. Torque all bleed screws to specification and install the rubber caps.

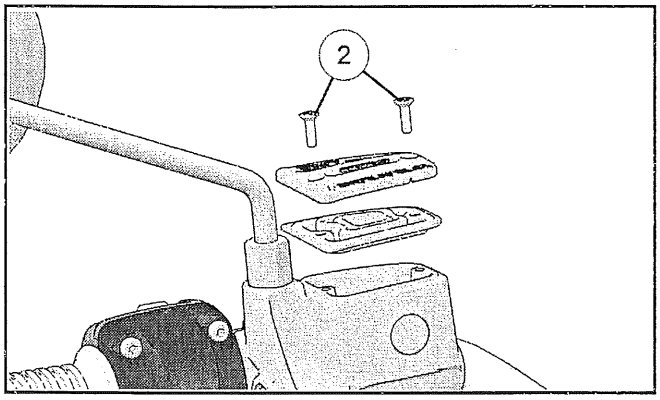
TORQUE
Caliper Bleeder Screws: **60 in-lbs (6.8 Nm)**

9. After completing the bleeding procedure a second time, inspect brake fluid level and add if necessary.

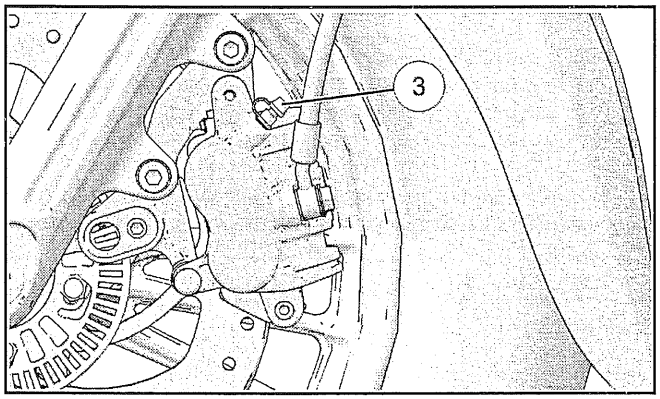
10. Clean the reservoir cover, diaphragm, and reservoir sealing surface. If diaphragm is extended, return it to normal (flat) position. Install diaphragm and cover.
11. If pedal is not firm, repeat bleeding procedure and insect brake system.

ABS FRONT BRAKE BLEEDING

1. Pull brake lever forward to ensure smooth lever operation.
2. Remove front brake fluid reservoir cover ② and leave it off so fluid can be added as it is drawn through the system.



3. Remove rubber cap from bleeder screw ③ on front caliper and place a box end wrench on the screw.



4. Attach tight fitting clear hose from vacuum bleeder to bleed screw and apply vacuum.
5. Hold lever to handlebar or hold firm pressure on lever, then open bleed screw about 1/4 turn.
6. Pump brake lever repeatedly with smooth full strokes while adding brake fluid to the reservoir as required. For best results pump the lever at a fairly rapid rate but avoid pumping too fast or fluid may become aerated. Eventually, the bleeder hose should have clear, bubble-free fluid running through it. Close the bleeder screw.
7. Fill fluid reservoir and install diaphragm and cover. Torque cover screws to specification.

TORQUE
Master Cylinder Cover Fasteners (front): **13 in-lbs (1.5 Nm)**

8. Perform Brake Lever Reserve Inspection. See Brake Lever Reserve Inspection, page 9.23.

BRAKE LEVER RESERVE INSPECTION

This procedure requires use of the Brake Lever Reserve Tool **(PV-50104)**.

1. Turn handlebars fully LEFT.
2. Place grommet of Brake Lever Reserve Inspection Tool **PV-50104** on ball end of front brake lever.
3. Connect a scale (commercially available) with a minimum of 25 kg / 50 lb capacity to end of tool.
4. Keep tool centered so it does not touch hand grip. Pull on scale to specified force.

Brake Lever Reserve Force: **42 lbs (19 kg)**

5. Have an assistant verify brake lever *does not* contact hand grip. Clearance must exist at specified pull force as shown.
6. If lever makes contact with hand grip or bar end, bleed the front brake system.
7. See troubleshooting if bleeding problems persist.

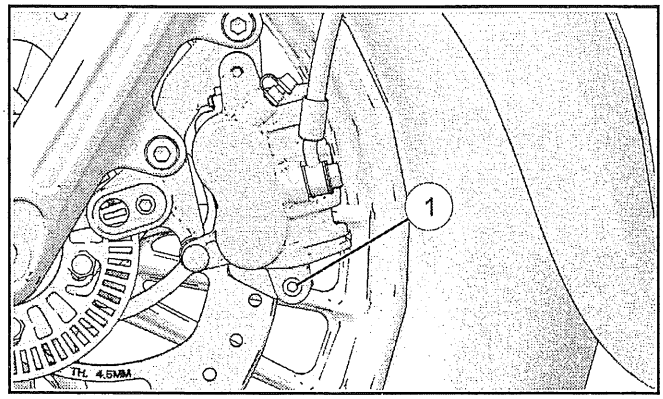
BRAKE SYSTEM SERVICE

FRONT BRAKE PAD REPLACEMENT (2015-16)

NOTE

Always replace brake pads as a set and always replace pads in both front calipers at the same time.

1. Remove the set screw, and then remove brake pad pin ①.



2. Push each pad back by hand to gain clearance for new pads.

NOTE

Brake fluid will be forced back into the reservoir when pads are pushed back. Remove reservoir cover and monitor fluid level, or attach a hose to the brake bleeder screw and open the bleed screw while pushing the pads and pistons back.

3. Remove each pad.
4. Wipe brake disc clean with a shop towel sprayed with brake cleaner (commercially available).
5. Inspect caliper piston seals for any sign of fluid leakage.
6. Install new brake pads with friction material toward disc.
7. Insert pin through caliper and through outer pad. Lay spring in place over pads and press on center while sliding pin through spring and then through inner pad.
8. Torque pad retaining pin to specification.

TORQUE

Pad Retaining Pin:
80 in-lbs (9 Nm)

9. Inspect brake fluid in reservoir and set to proper level.
10. Slowly pump lever to set brake pads against disc. Lever should be firm, not spongy. If lever is spongy, inspect pad installation, bleed brake lines and inspect brake disc.
11. Install reservoir cover and torque to specification.

TORQUE

Master Cylinder Cover Fastener (front):
13 in-lbs (1.5 Nm)

12. Operate brake lever several times until lever is firm and pressure can be felt.

⚠ WARNING

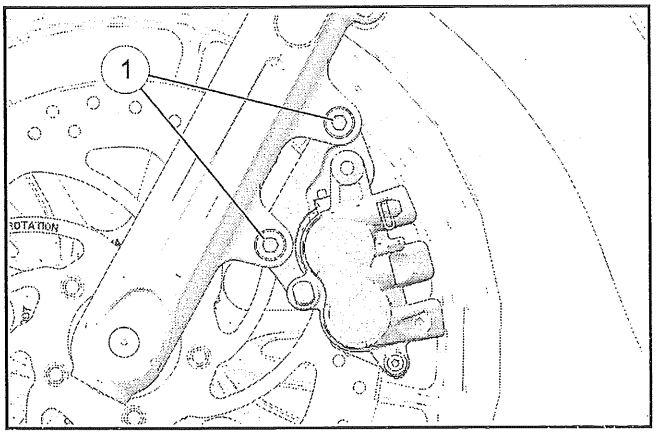
After pad installation or any brake system repair, safely elevate wheel, apply and release brake pedal or lever 2-3 times and release. Verify wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect vehicle to determine cause and then repair as necessary.

FRONT BRAKE PAD REPLACEMENT (2017)

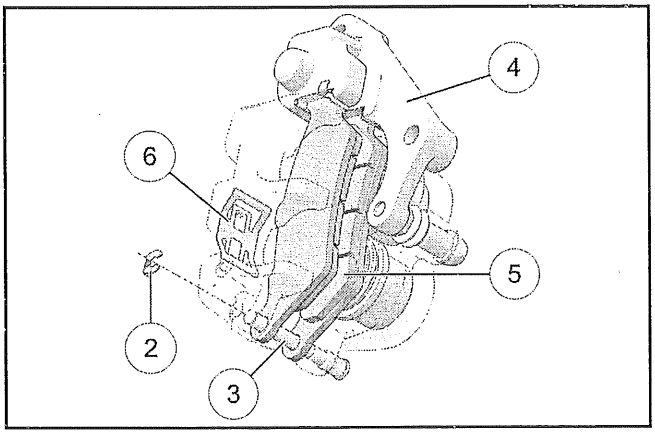
NOTE

Always replace brake pads as a set and always replace pads in both front calipers at the same time.

1. Remove the front brake caliper from the fork by removing the two fasteners ①.



2. Remove the pin clip ②, brake pad pin ③ and spring pad ⑥.



3. Pull out bracket ④ from the body.
4. Push each pad back by hand to gain clearance for new pads.

NOTE

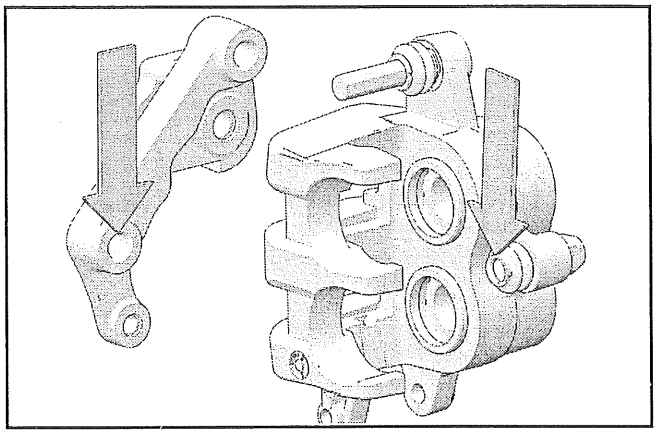
Brake fluid will be forced back into the reservoir when pads are pushed back. Remove reservoir cover and monitor fluid level while pushing the pads and pistons back.

5. Remove each pad ⑤.

NOTE

Wash the brake caliper components with new brake fluid (DOT4) before reassembly. Do not wipe the brake fluid off after washing the components.

6. Apply grease to primary and secondary pin bolt bore on the main caliper and bracket.



7. Inspect caliper piston for any sign of fluid leakage.
8. Install new brake pads with friction material toward disc.
9. Insert pads into caliper until the forward ear is engaged into the channel. Push the pads up into the caliper and insert the retaining pin through the hole in both.
10. Torque pad retaining pin to specification.

TORQUE

Pad Retaining Pin:
80 in-lbs (9 Nm)

11. Inspect brake fluid in reservoir and set to proper level.
12. Slowly pump lever to set brake pads against disc. Lever should be firm, not spongy. If lever is spongy, inspect pad installation, bleed brake lines and inspect brake disc.
13. Install reservoir cover and torque to specification.

TORQUE

Master Cylinder Cover Fastener (front):
13 in-lbs (1.5 Nm)

14. Operate brake lever several times until lever is firm and pressure can be felt.

⚠ WARNING

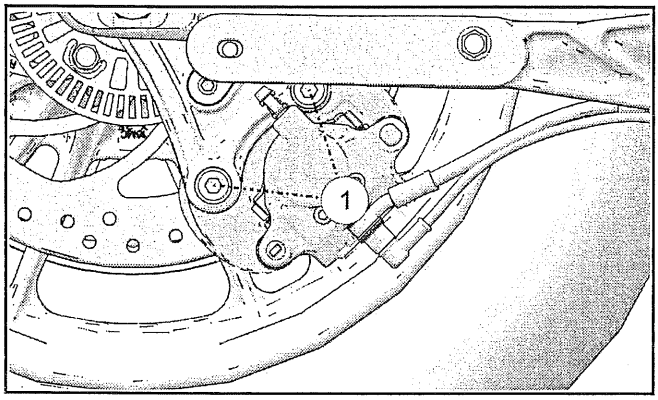
After pad installation or any brake system repair, safely elevate wheel, apply and release brake pedal or lever 2-3 times and release. Verify wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect vehicle to determine cause and then repair as necessary.

REAR BRAKE PAD REPLACEMENT (2015–16)

NOTE

Always replace brake pads as a set.

1. Remove the rear brake caliper mounting pins ① and remove the caliper.

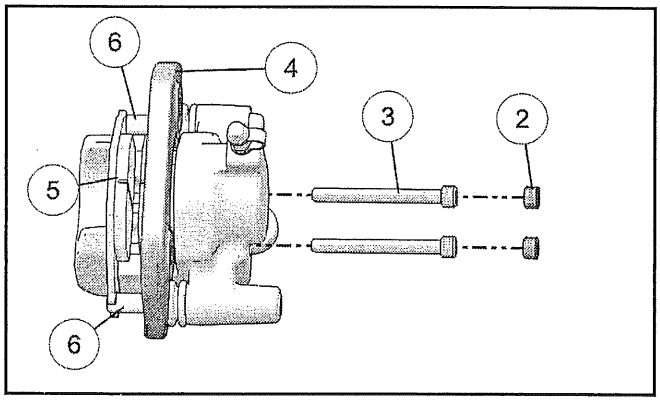


2. Push each pad back by hand to gain clearance for new pads.

NOTE

Brake fluid will be forced back into the reservoir when pads are pushed back. Remove reservoir cover and monitor fluid level, or attach a hose to the brake bleeder screw and open the bleed screw while pushing the pads and pistons back.

3. Remove the set screws ② and pad retaining pins ③. Slide the mount bracket ④ back into the caliper, and slide the pads ⑤ off the end of the guide pins ⑥. Do NOT remove the guide pins for pad removal. Note orientation of retaining spring.



4. Install new brake pads with friction material toward disc.
5. Using the guide pins, install caliper back onto bracket with mounting fasteners. Install set screws and pad pins. Torque fasteners to specification.

TORQUE

Caliper Mounting Fasteners (rear):
30 ft-lbs (41 Nm)

6. Inspect fluid level in the reservoir and adjust as necessary.
7. Pump brake pedal slowly several times to set new pads against disc, until lever is firm and pressure can be felt.
8. Bleed brake system if necessary.

⚠ WARNING

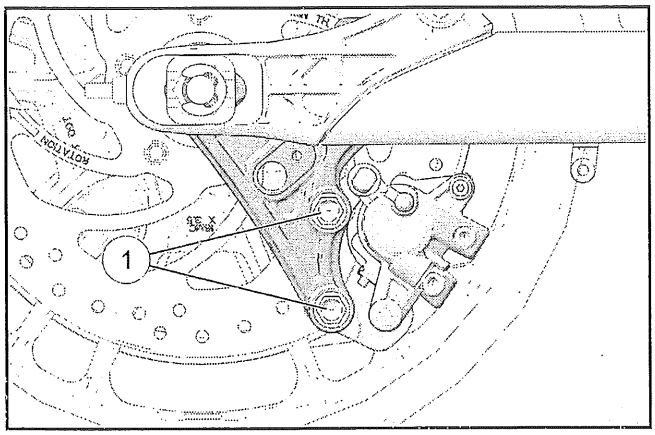
After pad installation or any brake system repair, safely elevate wheel, apply and release brake pedal or lever 2-3 times and release. Verify wheel turns freely without drag. If rear brake drag is evident, inspect pedal clearance. Do not operate the motorcycle if drag is still evident after clearance adjustment. Inspect vehicle to determine cause and repair as necessary.

REAR BRAKE PAD REPLACEMENT (2017)

NOTE

Always replace brake pads as a set.

1. Remove the rear brake caliper from the bracket by removing the two fasteners ①.

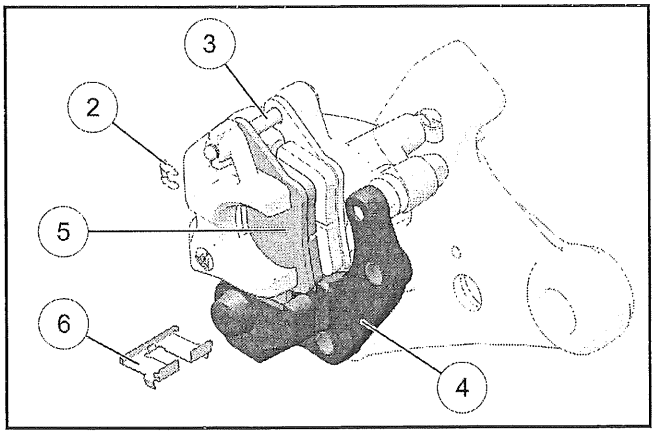


2. Push each pad back by hand to gain clearance for new pads.

NOTE

Brake fluid will be forced back into the reservoir when pads are pushed back. Remove reservoir cover and monitor fluid level, or attach a hose to the brake bleeder fastener and open the bleed fastener while pushing the pads and pistons back.

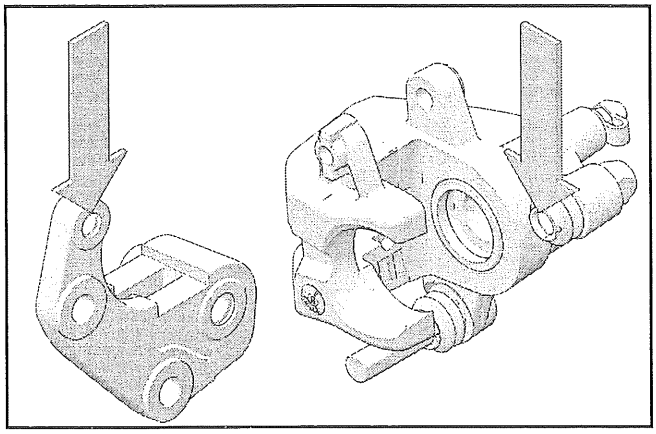
3. Remove the clip ② and pad retaining pin ③.
4. Remove the old pads ⑤ and pad spring ⑥ from the caliper.



NOTE

Wash the brake caliper components with new brake fluid (DOT4) before reassembly. Do not wipe the brake fluid off after washing the components.

5. Apply grease to primary and secondary pin bolt bore on the main caliper and bracket.



6. Install new pads with the friction material of the pads against each other. Slide the pads into the caliper until the tab is seated in the wear clip. Insert the pad retaining pin through the caliper and the hole in both brake pads. Torque fasteners to specification.

TORQUE

Pad Retaining Pin:
80 in-lbs (9 Nm)

7. Install the caliper onto the bracket, ensuring one pad is on each side of the disc. Torque fasteners to specification.

TORQUE

Caliper Mounting Fasteners (rear):
30 ft-lbs (41 Nm)

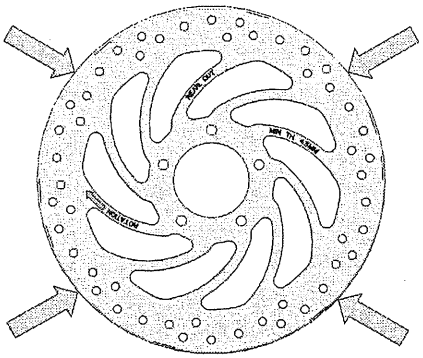
8. Inspect fluid level in the reservoir and adjust as necessary.
9. Pump brake pedal slowly several times to set new pads against disc, until pedal is firm and pressure can be felt.
10. Bleed brake system if necessary.

⚠ WARNING

After pad installation or any brake system repair, safely elevate wheel, apply and release brake pedal or lever 2-3 times and release. Verify wheel turns freely without drag. If rear brake drag is evident, inspect pedal clearance. Do not operate the motorcycle if drag is still evident after clearance adjustment. Inspect vehicle to determine cause and repair as necessary.

BRAKE DISC INSPECTION

1. Visually inspect disc for cracks or damage.
2. Measure brake disc thickness in several locations around disc with a micrometer, and along *wear surface* and compare to specifications. See , page 9.4.



NOTE

Replace the brake disc if any measurement is worn beyond the service limit.

3. With disc mounted to wheel, inspect for brake disc runout / warpage with a dial indicator and compare to specifications. See , page 9.4.

NOTE

Runout should be measured 2-4 mm in from outside edge of disc.

4. Replace brake disc if dial indicator reading displays excessive brake disc runout and other possible causes have been eliminated.

FRONT MASTER CYLINDER SERVICE

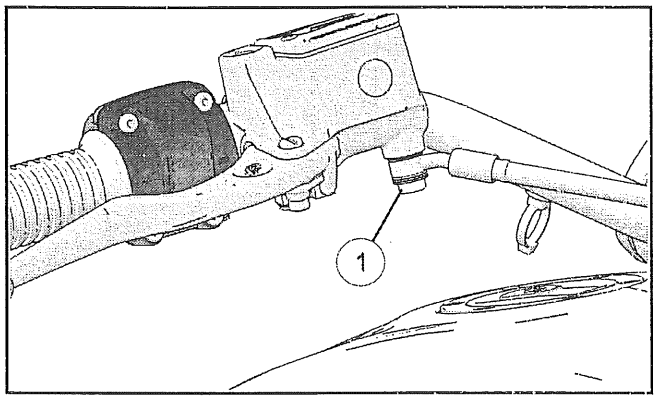
CAUTION

Brake fluid and brake cleaners could damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Be sure master cylinder reservoir is level before removing cover.

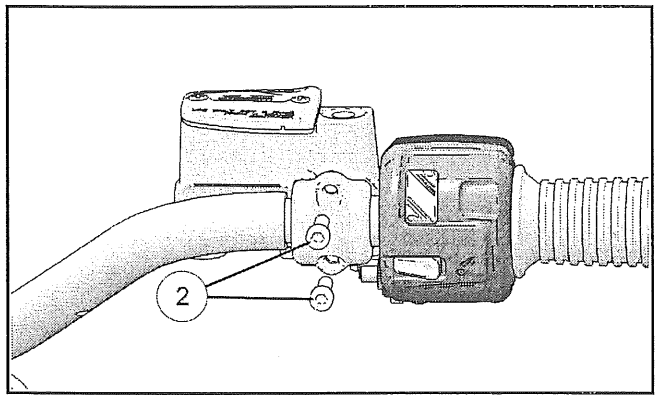
NOTE

Replace all rubber parts upon assembly.

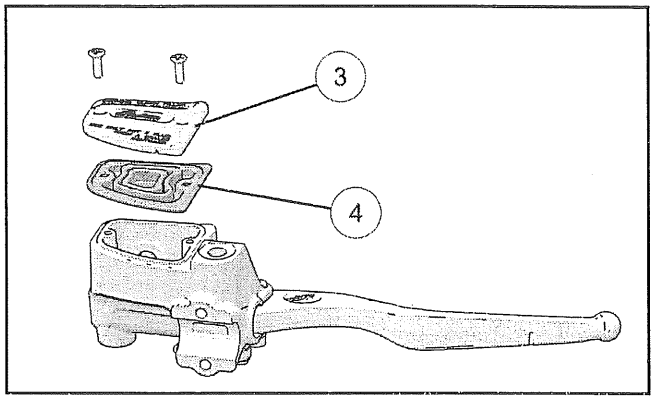
1. Clean the master cylinder. Attach a drain hose to caliper bleed screw and place the end in a suitable container. Drain brake fluid from the front brake system by slowly pumping brake lever.
2. Remove the RH side mirror from the lever perch.
3. Remove banjo bolt ① and brake line from master cylinder.



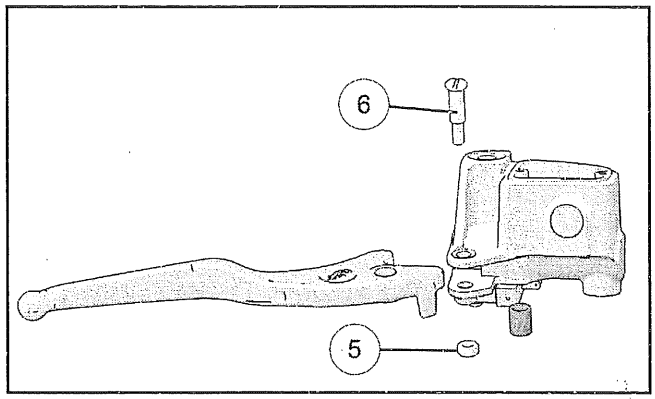
4. Remove screws ②, clamp, and master cylinder from the handlebar.



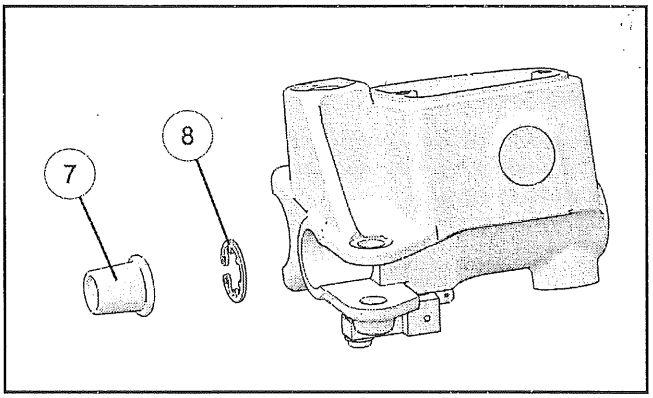
5. Remove reservoir cover ③ and diaphragm ④.



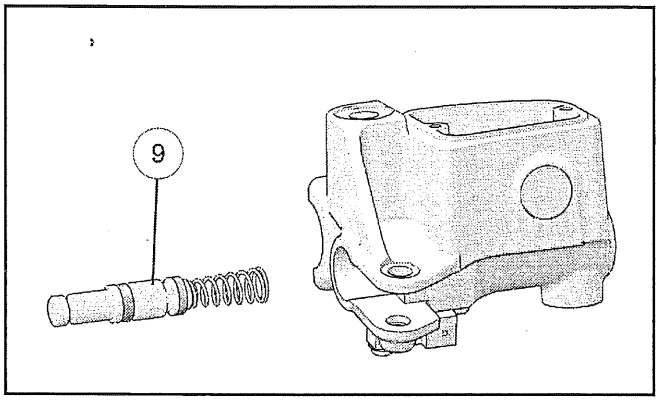
6. Remove the nut ⑤ and pivot pin ⑥ and pull lever assembly out of master cylinder.



7. Remove dust boot ⑦ and snap ring ⑧ out of master cylinder.



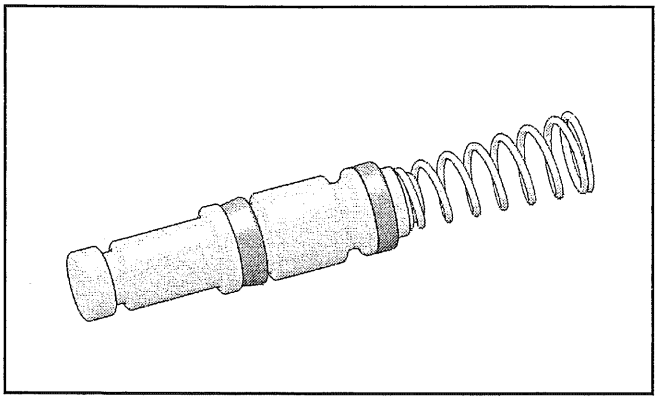
8. Slide piston ⑨ out with spring. Note spring orientation for assembly of new spring (new parts).



9. Clean master cylinder with isopropyl alcohol and dry with compressed air. DO NOT soak in alcohol for more than 30 seconds. DO NOT aim pressurized air directly at the level sight glass.
10. Inspect cylinder bore and chamfer of bore for corrosion, scratches, scoring, or pitting. Replace master cylinder if any of these conditions are evident.
11. Measure the diameter of the bore. Replace master cylinder if worn beyond the service limit.

Master Cylinder Bore Diameter Service Limit: **0.504 in (12.8 mm)**

12. Clean the compensating port and supply port with compressed air to be sure they are clean and unobstructed.
13. Apply a light film of special lubricant from piston kit to each piston seal cup.
14. Assemble the piston / spring assembly as shown. Large diameter of beveled edge on piston cups face toward spring.



15. Carefully install spring / piston assembly into master cylinder bore. Work the front piston seal carefully past the chamfer and into bore. Use care not to damage or fold the seal when working it past the chamfer.
16. Continue to install the piston until the rear seal is past the chamfer. Push and hold the piston in far enough to allow the retaining ring to be installed.
17. Be sure retaining ring is fully seated in the groove.
18. Clean the bore from the retaining ring outward, so the outer edge of the new dust boot adheres properly and will not dislodge from the bore.
19. Install new boot, seating the outer edge fully in the bore and engage outer lip of boot in piston groove.
20. Apply non-petroleum grease from kit to brake lever contact surface.
21. Install master cylinder on handlebar. Torque clamp fasteners to specification.

TORQUE
Brake Lever Perch Fasteners: **12 ft-lbs (16 Nm)**

FRONT CALIPER SERVICE (2015–16)

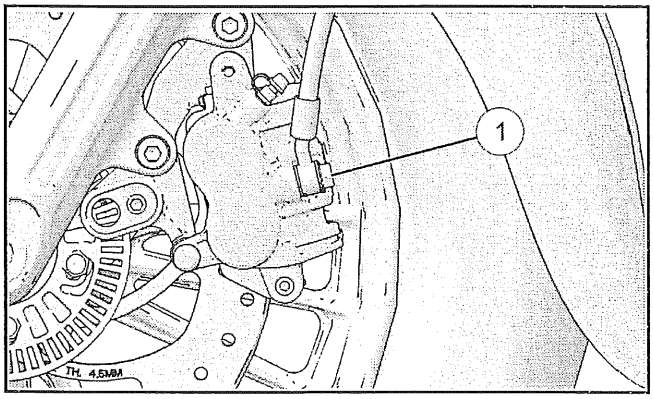
CAUTION

Brake fluid and brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level before removing the cap.

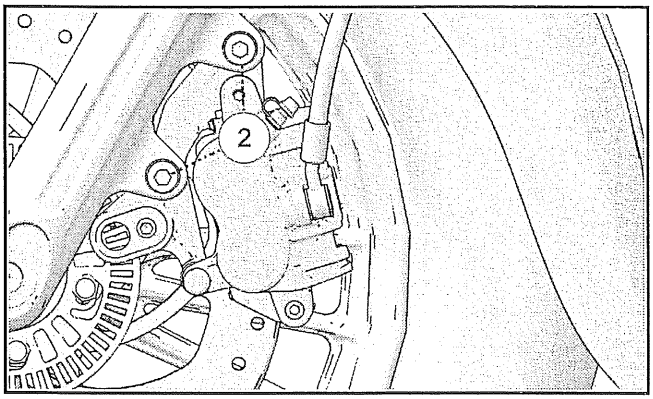
NOTE

Replace all rubber parts upon assembly. Keep parts in order for assembly. *The top and bottom pistons in the caliper are not the same size.*

1. Remove banjo bolt ①, sealing washers, and brake hose from caliper assembly and allow it to drain into a container. Cover the end of brake line to prevent debris from entering.

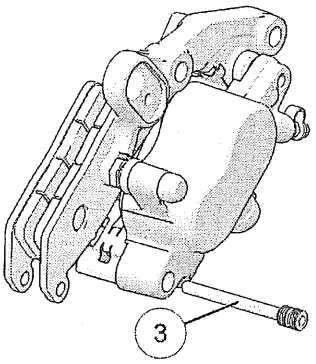


2. Remove front caliper mounting studs ② and remove the caliper.



3. Cover the brake hose connection on the caliper and clean the outer surfaces of caliper assembly with brake cleaner (commercially available) or isopropyl alcohol. Dry with compressed air.

4. Remove pad retaining pin ③ and brake pads.



NOTE

Pads contaminated with oil or grease must be replaced as a set.

5. Keep parts in order for assembly in the same bore.
6. Remove each piston with a caliper piston pliers. If a caliper piston pliers is not available, wrap the caliper in a shop towel and apply short bursts of compressed air through the brake line hole and through the transfer passage to force the pistons out of the bore.
7. Remove dust seals and piston seals. Use care not to damage the seal bores.
8. Clean all parts thoroughly with isopropyl alcohol. Be sure the seal bores are clean, removing all traces of dirt or dried brake fluid.
9. Clean piston seal and dust seal bores to remove residue that could cause the pistons to stick, resulting in brake drag.
10. Inspect each piston bore for corrosion, scratches, scoring, or pitting. Replace caliper if any of these conditions are evident.
11. Measure the diameter of each caliper bore. Replace caliper if any is worn beyond the service limit.

Front Caliper Bore Diameter
Std Bore: 1.185 in (30.2 mm)
SERVICE LIMIT: 1.193 in(30.3 mm)

12. Measure the outside diameter of each piston in two spots 90° apart, 5mm from outer edge. Repeat measurement 5mm from inner edge. Replace piston if worn beyond service limit at any measuring point.

Front Caliper Piston Outside Diameter
Std Size: 1.18 in (30.0 mm)
SERVICE LIMIT: 1.177 in (29.9 mm)

NOTE

Install all new rubber parts during assembly. Do not reuse old seals or boots.

13. Apply special lubricant from service kit to new piston seals and dust seals.
14. Apply non-petroleum grease (included in kit) to outer surface of all pistons.
15. Install piston seals and dust seals in caliper body.
16. Install pistons in their respective bores.
17. Install brake pads. Torque retaining pin and set screw to specification.

TORQUE

Pad Retaining Pin:
80 in-lbs (9 Nm)

FRONT CALIPER SERVICE (2017)

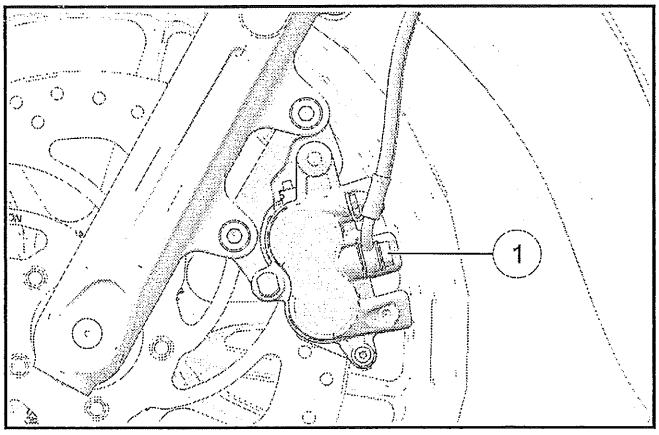
CAUTION

Brake fluid and brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level before removing the cap.

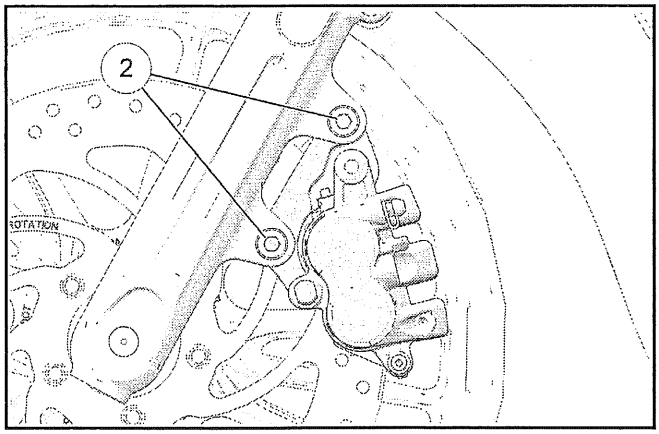
NOTE

Replace all rubber parts upon assembly. Keep parts in order for assembly. *The top and bottom pistons in the caliper are the same size.*

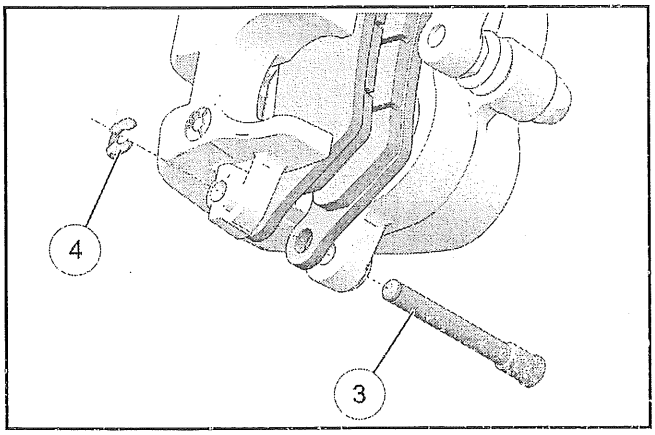
1. Remove banjo fastener ①, sealing washers, and brake hose from caliper assembly and allow it to drain into a container. Cover the end of brake line to prevent debris from entering.



2. Remove front caliper mounting fasteners ② and remove the caliper.



3. Cover the brake hose connection on the caliper and clean the outer surfaces of caliper assembly with brake cleaner (commercially available) or isopropyl alcohol. Dry with compressed air.
4. Remove clip ④, pad retaining pin ③ and brake pads.



NOTE

Pads contaminated with oil or grease must be replaced as a set.

5. Keep parts in order for assembly in the same bore.
6. Remove each piston with a caliper piston pliers. If a caliper piston pliers is not available, wrap the caliper in a shop towel and apply short bursts of compressed air through the brake line hole and through the transfer passage to force the pistons out of the bore.
7. Remove dust seals and piston seals. Use care not to damage the seal bores.
8. Clean all parts thoroughly with isopropyl alcohol. Be sure the seal bores are clean, removing all traces of dirt or dried brake fluid.
9. Clean piston seal and dust seal bores to remove residue that could cause the pistons to stick, resulting in brake drag.
10. Inspect each piston bore for corrosion, scratches, scoring, or pitting. Replace caliper if any of these conditions are evident.
11. Measure the diameter of each caliper bore. Replace caliper if any is worn beyond the service limit.

Bore Diameter
SERVICE LIMITS
Std Bore 1.182 in (30.021 mm)

12. Measure the outside diameter of each piston in two spots 90° apart, 5mm from outer edge. Repeat measurement 5mm from inner edge. Replace piston if worn beyond service limit at any measuring point.

Piston Outside Diameter
SERVICE LIMITS
Std Size: 1.1782 in (29.927 mm)

NOTE

Install all new rubber parts during assembly. Do not reuse old seals or boots.

13. Apply special lubricant from service kit to new piston seals and dust seals. If special lubricant is not available use clean DOT4 brake fluid.
14. Apply clean DOT4 brake fluid to outer surface of all pistons.
15. Install piston seals and dust seals in caliper body.
16. Install pistons in their respective bores.
17. Install retaining ring clip. Torque retaining pin to specification.

TORQUE

Pad Retaining Pin:
80 in-lbs (9 Nm)

FRONT CALIPER INSTALLATION

1. Clean mounting surfaces of caliper and fork leg.
2. Apply brake cleaner or isopropyl alcohol to a clean shop towel and wipe brake discs clean.
3. Separate brake pads and install caliper assembly over brake disc.
4. Install caliper mounting studs and torque to specification.

TORQUE

Caliper Mounting Fasteners (front):
35 ft-lbs (47 Nm)

5. Connect brake hose to caliper with banjo bolt and new sealing washers. Torque to specification.

TORQUE

Banjo Bolt (Brake Line):
16 ft-lbs (22 Nm)

6. Fill and bleed the front brake hydraulic system. See ABS Front Brake Bleeding, page 9.22.

⚠ WARNING

After pad installation or any brake system repair, safely elevate the wheel, apply and release the brake pedal or lever 2-3 times and release. Verify the wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect the vehicle to determine the cause and then repair as necessary.

REAR MASTER CYLINDER SERVICE

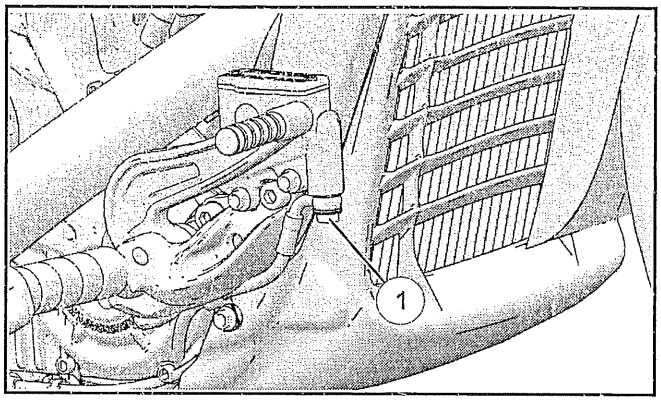
CAUTION

Brake fluid and brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level before removing the cap. Replace all rubber parts upon assembly.

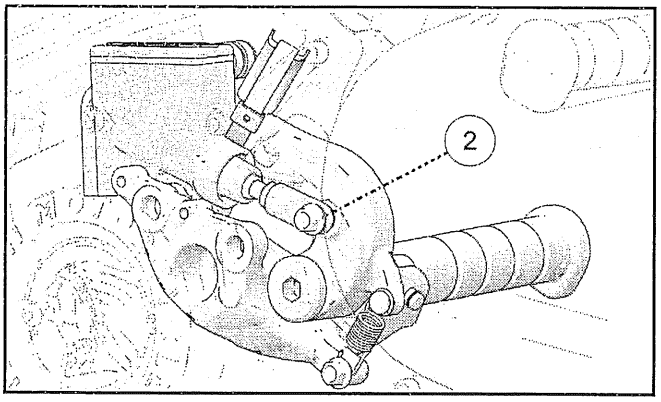
NOTE

Replace all rubber parts upon assembly.

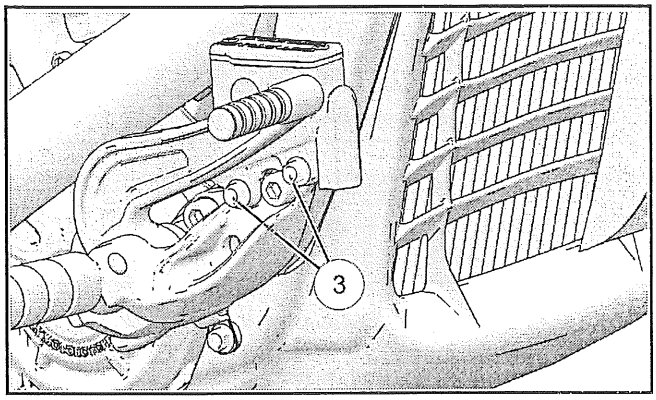
1. Remove brake line banjo bolt ①, sealing washers and brake line. Allow fluid to drain into a container.



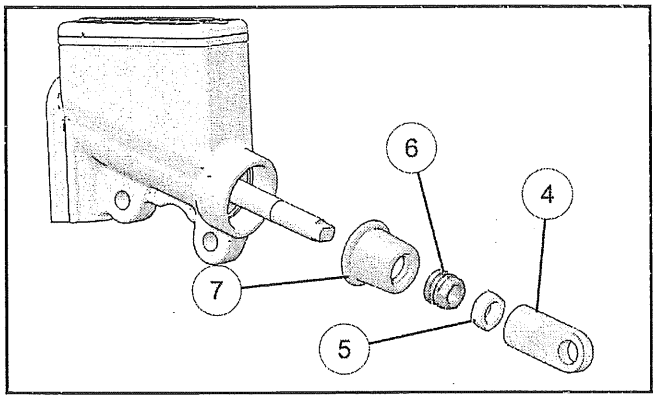
2. Remove screw ② retaining the clevis to the footpeg.



3. Remove mounting fasteners ③ from master cylinder to footpeg. Remove the master cylinder.



4. Remove clevis ④, clevis nut ⑤, pushrod nut ⑥, and dust boot ⑦.



5. Remove internal snap ring followed by piston, pushrod, cups, and spring.
6. Inspect cylinder bore and chamfer on the front of the bore for corrosion, scratches, scoring, or pitting. Replace master cylinder if any of these conditions are evident.
7. Measure the diameter of the bore. Replace master cylinder if worn beyond the service limit.

Master Cylinder Bore Diameter Service Limit:
0.504 in (12.8 mm)

8. Clean compensating port and supply port with compressed air to be sure they are clean and unobstructed.
9. Clean all parts with clean Indian Motorcycle DOT 4 brake fluid or isopropyl alcohol.
10. Replace ALL RUBBER PARTS with new.
11. Carefully assemble and install the internal master cylinder components in order.
12. Install the master cylinder and torque the jamb nut. mounting fasteners, and brake line banjo bolt to specification.

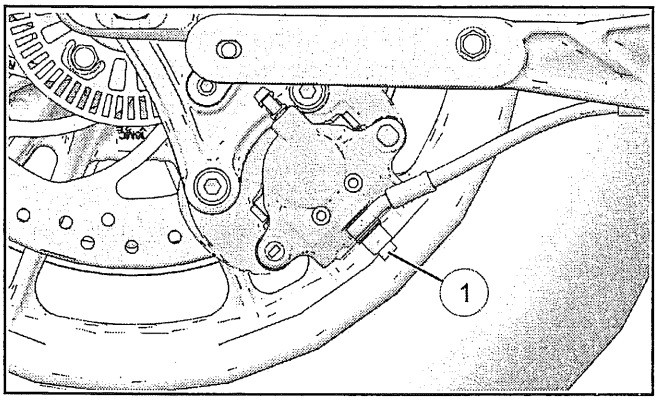
TORQUE
Master Cylinder Clevis Nut (rear): **80 in-lbs (9 Nm)**

TORQUE
Master Cylinder Mounting Fasteners: **84 in-lbs (9.5 Nm)**

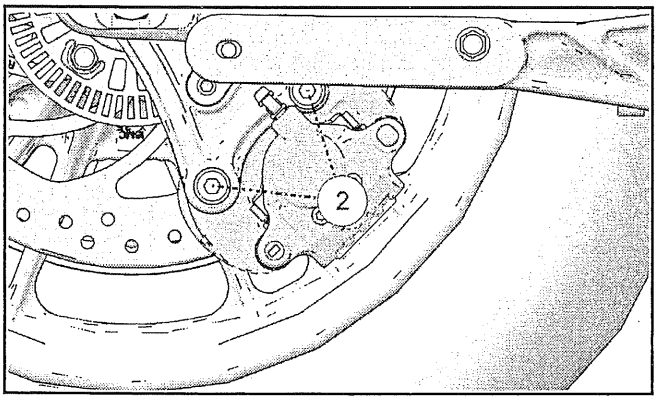
TORQUE
Banjo Fastener: **16 ft-lbs (22 Nm)**

REAR CALIPER SERVICE (2015–16)

1. Remove the brake pressure switch from the banjo bolt.
2. Remove banjo bolt ① and sealing washers from rear caliper and allow fluid to drain into a container.



3. Remove caliper bolts ② and lower caliper off of mounting bracket.



4. Remove the rear brake pads. Refer to Rear Brake Pad Replacement (2015–16), page 9.26procedure.
5. Slide caliper bracket off pins and remove spring plate.
6. Remove caliper piston.
7. Remove dust seals and piston seals. Use care not to damage the seal bores.
8. Clean caliper thoroughly with isopropyl alcohol. Dry with compressed air. Clean seal grooves thoroughly. Any residue left behind in the grooves could cause caliper pistons to stick and result in brake drag.
9. Inspect bore and surface of piston for corrosion, scratches, scoring, or pitting. Replace caliper assembly if any of these conditions are evident.
10. Measure diameter of each bore and piston. Replace caliper assembly or parts if worn beyond service limit.

Rear Caliper Bore Diameter:
Std Bore: 1.185 in (30.2 mm)
SERVICE LIMITS: 1.193 in (30.3 mm)

Rear Caliper Piston Outside Diameter:
Std Size: 1.18 in (30.0 mm)
SERVICE LIMIT: 1.177 in (29.9 mm)

11. Install all new rubber parts during assembly. Do not reuse old seals or boots. Apply special lubricant from service kit to new piston seals and dust seals.
12. Apply special assembly oil to outer surface of all pistons.
13. Install piston seals and dust seals in caliper body.
14. Install pistons in their respective bore.
15. Replace caliper pin boot on bracket and on caliper. Apply special lubricant from service kit to boots and both pins.
16. Assemble bracket to caliper. Remove excess lubricant.
17. Install spring plate and outer brake pad. Start pad pin through outer pad.
18. Install inner pad with insulator and backing plate.
19. Torque brake pad retaining pin to specification.

TORQUE
Pad Retaining Pin: **80 in-lbs (9 Nm)**

20. Be sure end tabs of pads are both fully engaged in the heel plate on bracket.
21. Install caliper to bracket and torque caliper fasteners to specification.

TORQUE
Caliper Mounting Fasteners: **30 ft-lbs (41 Nm)**

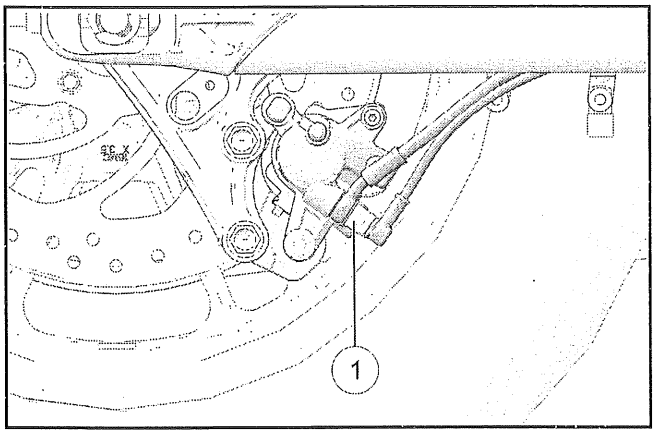
22. Install brake line with new sealing washers and torque banjo fastener to specification.

TORQUE
Banjo Fastener (Rear Caliper): **16 ft-lbs (22 Nm)**

23. Bleed brake system. See ABS Rear Brake Bleeding, page 9.21.

REAR CALIPER SERVICE (2017)

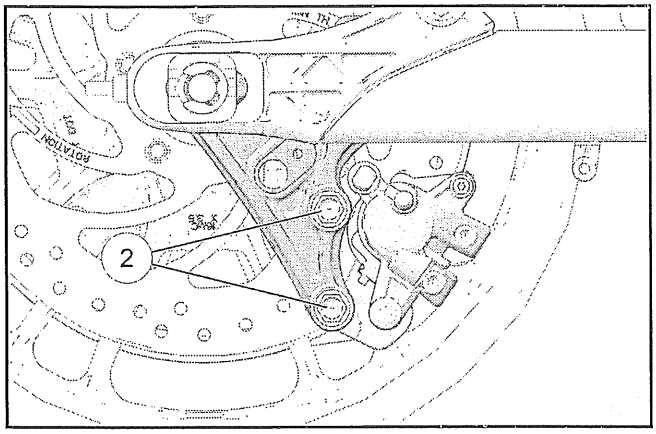
1. Unplug the pressure switch connector (above the voltage regulator) and remove the cable ties which hold the wire to the brake cable.
2. Remove banjo fastener ① and sealing washers from rear caliper and allow fluid to drain into a container.



NOTE

Make sure the wire doesn't get twisted as they remove the banjo fastener switch.

3. Remove caliper fasteners ② and lower caliper off of mounting bracket.



4. Remove the rear brake pads. Refer to Rear Brake Pad Replacement (2017), page 9.27.
5. Slide caliper bracket off pins and remove spring clip.
6. Remove caliper piston.
7. Remove dust seals and piston seals. Use care not to damage the seal bores.
8. Clean caliper thoroughly with isopropyl alcohol. Dry with compressed air. Clean seal grooves thoroughly. Any residue left behind in the grooves could cause caliper pistons to stick and result in brake drag.
9. Inspect bore and surface of piston for corrosion, scratches, scoring, or pitting. Replace caliper assembly if any of these conditions are evident.
10. Measure diameter of each bore and piston. Replace caliper assembly or parts if worn beyond service limit.

Bore Diameter:
SERVICE LIMITS
Std Bore: 1.182 in (30.021 mm)

Piston Diameter:
SERVICE LIMITS
Std Size: 1.1782 in (29.927 mm)

11. Install all new rubber parts during assembly. Do not reuse old seals or boots. Apply special lubricant from service kit to new piston seals and dust seals. If special lubricant is not available, use clean DOT4 brake fluid.
12. Apply special lubricant to outer surface of all pistons.
13. Install piston seals and dust seals in caliper body.
14. Install piston in bore.
15. Replace caliper pin boot on bracket and on caliper. Apply all purpose silicon grease to boots and both pins.
16. Assemble bracket to caliper. Remove excess lubricant. Ensure both boots are engaged on the clips.
17. Install spring clip and outer brake pad. Start pad pin through outer pad.
18. Install inner pad.
19. Torque brake pad retaining pin to specification.

TORQUE

Pad Retaining Pin:
80 in-lbs (9 Nm)

20. Install caliper to bracket and torque caliper fasteners to specification.

TORQUE

Caliper Mounting Fasteners (rear):
30 ft-lbs (41 Nm)

21. Install brake line with new sealing washers and torque banjo fastener to specification.

TORQUE
Banjo Fastener (rear): **16 ft-lbs (22 Nm)**

22. Bleed brake system. See ABS Rear Brake Bleeding, page 9.21.

⚠ WARNING
After pad installation or any brake system repair, safely elevate the wheel, apply and release the brake pedal or lever 2-3 times and release. Verify the wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect the vehicle to determine the cause and then repair as necessary.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	POSSIBLE REPAIR NEEDED
Weak Brakes or Erratic Braking Action	Fluid Leakage (External) Fluid Leakage (Internal of Master Cylinder) Worn Pads Oil Contamination of Brake Pads and/or Brake Disc Air In System Low Brake Fluid Level In Reservoir Excessive Brake Disc Runout Worn or Damaged Wheel Bearings Loose Front Axle Nut or Clamps or Loose Rear Axle Caliper Mount Surface Uneven Or Misaligned; Missing or Damaged Fasteners Clogged or Restricted Hydraulic Line Caliper Bracket Misaligned, Bent or Distorted Loose Brake Disc Brake Pads Glazed	Repair or Replace Leaking Component Replace Master Cylinder Replace Brake Pads Pads Must Be Replaced. Disc May Be Cleaned. Bleed Air From System Fill Reservoir, Bleed Brakes, Top Off Fluid Level. Replace Brake Disc. Replace Wheel Bearings. Torque Correctly Inspect / Repair Replace Line(s) Replace Bracket Install New Screws. Torque to Specification Replace Pads. Avoid Needless Heavy Braking for 100-200 miles (Burnish New Brake Pads).
Poor Brakes or No Brakes When First Applied. Brake Lever Pressure Present If Lever Is "Pumped".	Air In System Low Brake Fluid Level In Reservoir Brake Disc is Bent or Warped Caliper Misalignment External Leak Internal Leak (master cylinder) Faulty Brake Hose	Bleed Air From System Fill Reservoir, Bleed Brakes, Top Off Fluid Level. Replace Brake Disc Determine Cause and Correct Repair or Replace Damaged Component Repair or Replace Master Cylinder Inspect for Bulges / Replace
Brake Pedal or Brake Lever Pulsates	Brake Disc Bent or Warped Mounting Surface of Brake Disc Uneven / Disc Loose Caliper Mount Surface Uneven Or Misaligned; Missing or Damaged Fasteners	Replace Brake Disc Repair or Replace as Necessary Repair or Replace as Necessary
Excessive Lever or Pedal Travel / Spongy Brake Feel.	Air in System Loose Mounting Hardware Low Brake Fluid Level In Reservoir Incorrect Brake Fluid Used See "Weak / Erratic Brakes" and Poor Brakes" possible causes above.	Bleed Air From System Repair as Necessary Fill Reservoir, Bleed Brakes, Top Off Fluid Level. Flush System and Replace With Correct Fluid
Fluid Leakage	Loose Banjo Fittings Damaged Banjo Fitting Sealing Washers Cracked / Damaged Hose Worn Master Cylinder Piston, Caliper Piston(s) or Seals Diaphragm (master Cylinder reservoir) Leaking Fluid level too high (new brake pads installed without removing added fluid)	Tighten to Specified Torque Replace Replace Repair / Replace Master Cylinder or Wheel Caliper. Inspect / Replace Cover, Cap, Diaphragm or Reservoir as Required Correct fluid level

PROBLEM	POSSIBLE CAUSE	POSSIBLE REPAIR NEEDED
Brakes Drag Excessively or Self-Apply (Brakes Overheat)	Reservoir Over Filled Brake Pedal Or Lever Not Returning Completely To Rest Position Inadequate Freeplay Compensating Port Plugged Internal Corrosion of Components (Master Cylinder / Caliper) Rear Caliper: Corrosion of Sliding Parts, Bent or Damaged Parts Contaminated Brake Fluid Caliper Pistons Sticking Rider Error (Operator Riding Brakes)	Adjust Level As Necessary Inspect Linkage, Pivots and Mechanism For Cause Of Binding Or Restricted Movement; Measure Pedal Clearance / Adjust Repair or Replace Master Cylinder Replace Damaged Component Repair or Replace As Necessary Flush System, Install Correct Fluid Repair / Replace Caliper (Corrosion / Buildup of Residue In Caliper Piston Seal Grooves) Educate Operator
Brake Squeal/ Squeak	If noise is minor and inconsistent, some brake squeak / squeal is characteristic of disc brakes and usually caused by dust / dirt on pads and / or brake disc. Pad Not Secure in Caliper Aftermarket (not genuine Indian Motorcycle) Parts Worn or Damaged Wheel Bearing(s) Worn Pads / Disc	Apply non oil-based solvent to a clean shop towel and wipe dust / dirt from brake disc. Repair as Necessary. Inspect Pad Installation Install Genuine Indian Motorcycle Parts Replace Replace

CHAPTER 10
ELECTRICAL

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STARTING / CHARGING

GENERAL INFORMATION

SERVICE NOTES

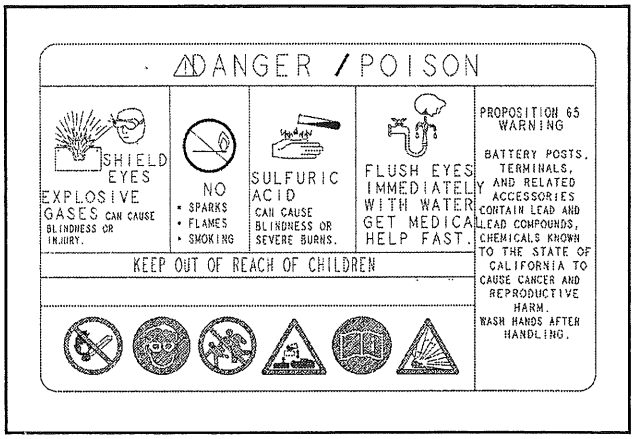
All electrical system and component service can be performed with the engine in the frame.

IMPORTANT

CAUTIONS TO OBSERVE DURING ELECTRICAL SYSTEM SERVICE

- Always turn off ignition switch before disconnecting any electrical component.
- Always verify that bullet-type connectors are free of corrosion, contamination or breaks when troubleshooting electrical problems.
- Verify that bullet-type connectors are firmly seated. Listen and/or feel for a click when connecting them.
- Ensure to release the lock on lock-type couplers before disconnecting them to avoid damaging the connector.
- Pulling on the wires when disconnecting couplers can introduce problems. Hold the connectors themselves when disconnecting them, not their associated wires.
- Inspect each male and female terminal of multi-pin connectors for corrosion, contamination, loose or bent pins.

Battery Label



WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

- **External:** Flush with water.
- **Internal:** Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.
- **Eyes:** Flush with water for 15 minutes. Call physician immediately.

Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries.KEEP BATTERIES AND BATTERY ACID OUT OF REACH OF CHILDREN.

The charging system used on the motorcycle is calibrated for the maintenance free battery that is installed as original equipment. Do not replace with a conventional lead-acid battery. Before troubleshooting the charging system, inspect the battery thoroughly. A discharged, poorly charged or faulty battery will make the readings obtained during charging system troubleshooting erroneous or difficult to interpret.

A battery will self-discharge when the motorcycle is not in use. Make sure to properly store the battery as outlined later in this section.

Maximum voltage and service life is only achieved when the battery is properly serviced initially. Make sure to follow instructions outlined later in this section.

Overcharging can be caused by a faulty battery (shorted cell). Test system with a known good battery when diagnosing an overcharge condition.

New batteries must be properly maintained as outlined in this section to ensure proper service life.

CAUTION

Even with a good battery, battery voltage can recover after charging, but under excessive loads the battery voltage will drop quickly and eventually "die". Often the charging system is suspect when it is not the cause of the problem. Always inspect for excessive loads if the battery continues to lose its charge. Items such as incorrect wattage bulbs, sticking brake light switch(s), continuous low rpm operation or leaving the lights on without the engine running for long periods of time can drain a battery even if the charging system is operating correctly.

CAUTION

WIRE ROUTING

Make sure that all wires are routed correctly away from moving parts, hot exhaust, or sharp edges.

CAUTION

FUSES

Fuses are in place to protect circuit wiring and components. Always determine the cause of an open fuse before installing a new fuse.

Do not increase the value of the fuse to correct the problem.

Do not use wire, tin foil or other substitutes for fuses.

CAUTION

ELECTRONIC COMPONENTS

Semiconductor parts used in electronic components will not withstand careless handling.

Do not drop or strike parts that contain semiconductors such as the ECM or rectifier/ regulator. Dropping electronic components can cause damage to the component.

Follow instructions supplied in this chapter, including Fuel Delivery / EFI Chapter (Fuel Injection) and Electrical Chapter (Ignition System), very carefully when working on electronic components. Failure to follow instructions may cause irreparable damage to the part being inspected.

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Battery Tester	PU-50296
Electrical Tester Kit	PV-43526
Relay Bypass	PU-49466
Smartlink Module Kit	PU-47471
USB to Serial Adapter	PU-50621

SERVICE SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

ITEM		SPECIFICATIONS
Electrical (General)	Ignition System	Distributor-less Transistorized Dual Coil Type Ignition
	Starting System	Electric
	Charging System	Permanent Magnet / 3 Phase / Full Wave Rectification
	Regulator/Rectifier	Solid State Three Phase Voltage Regulator/Rectifier
	Lighting System	12 V DC

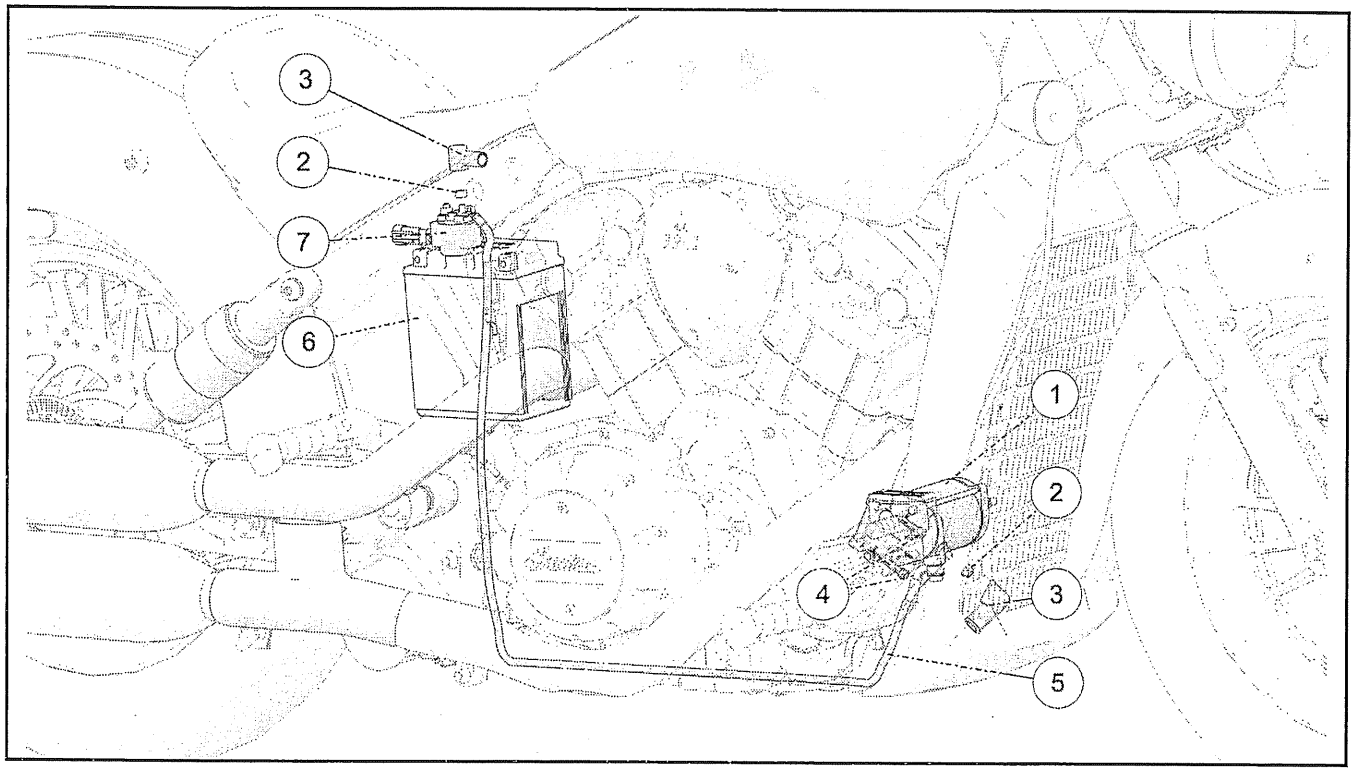
CHARGING SYSTEM SPECIFICATIONS

ITEM		SPECIFICATIONS
Alternator No Load AC Output @ 800 - 1000 RPM (Engine cool)		14A (168 Watts) @ Idle
Alternator No Load AC Output @ 2000 RPM (Engine cool)		29A (348) @ 2000 RPM
Stator Coil Resistance (@ 21°C / 70°F) (Black to each other black) (Disconnect regulator - see test.)		146 milliohms ±20%
Stator Coil Resistance To Ground (Each black wire)		Infinity (no continuity)
Regulator/Rectifier Regulated Voltage		14.3 - 14.7 V DC
Alternator Output (Amps / Watts)		32A (460 Watts) @ 6000 RPM
Battery	Type	Leoch:
	Voltage	12 Volts DC
	Nominal Capacity @ 10 Hr Rate	12 AH
	Recommended Battery Charging Current	STD: 1.20 A for 5 to 10 hrs
	Cold Cranking Amp Rating	210

STARTING SYSTEM SPECIFICATIONS

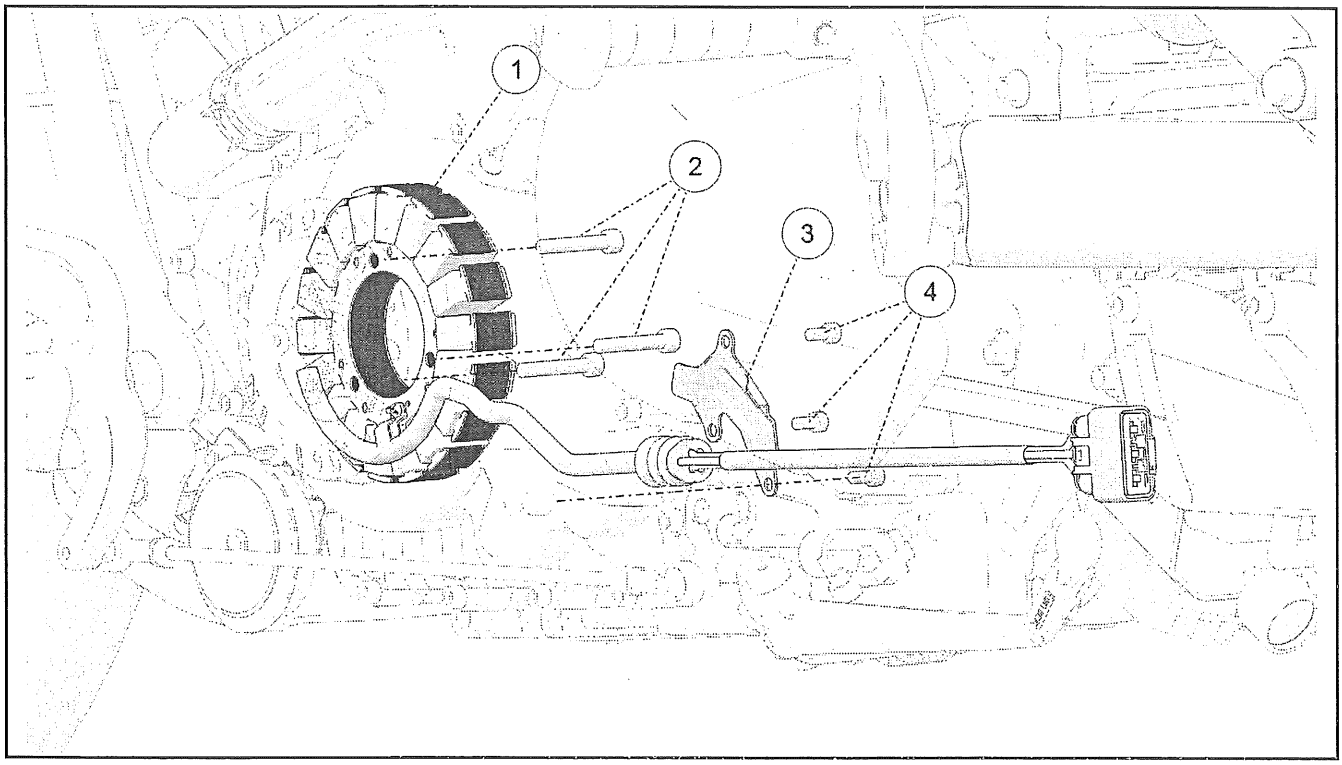
ITEM	SPECIFICATION
Battery Voltage, No Load	Above 12.5 V DC
Resistance: Between Any Two Commutator Bars	Continuity (0 Ohms)
Resistance: Commutator to Armature Shaft	Infinity (OL on Fluke™ 73)
Resistance: Battery Input Terminal to Insulated Brush	Continuity (0 Ohms)
Resistance: Bat. Input Terminal to Starter Motor Case	Infinity (OL on Fluke™ 73)
Starter Motor Operating Amp Draw	140 - 160 Amps
Starter Motor No Load Amp Draw (Bench Test)	30 - 37 Amps after initial surge
Starter Torque Limit Clutch Break-Away Torque	50 - 60 ft-lbs (70 - 80 Nm) when new

ASSEMBLY VIEWS
STARTER MOTOR / SOLENOID COMPONENTS



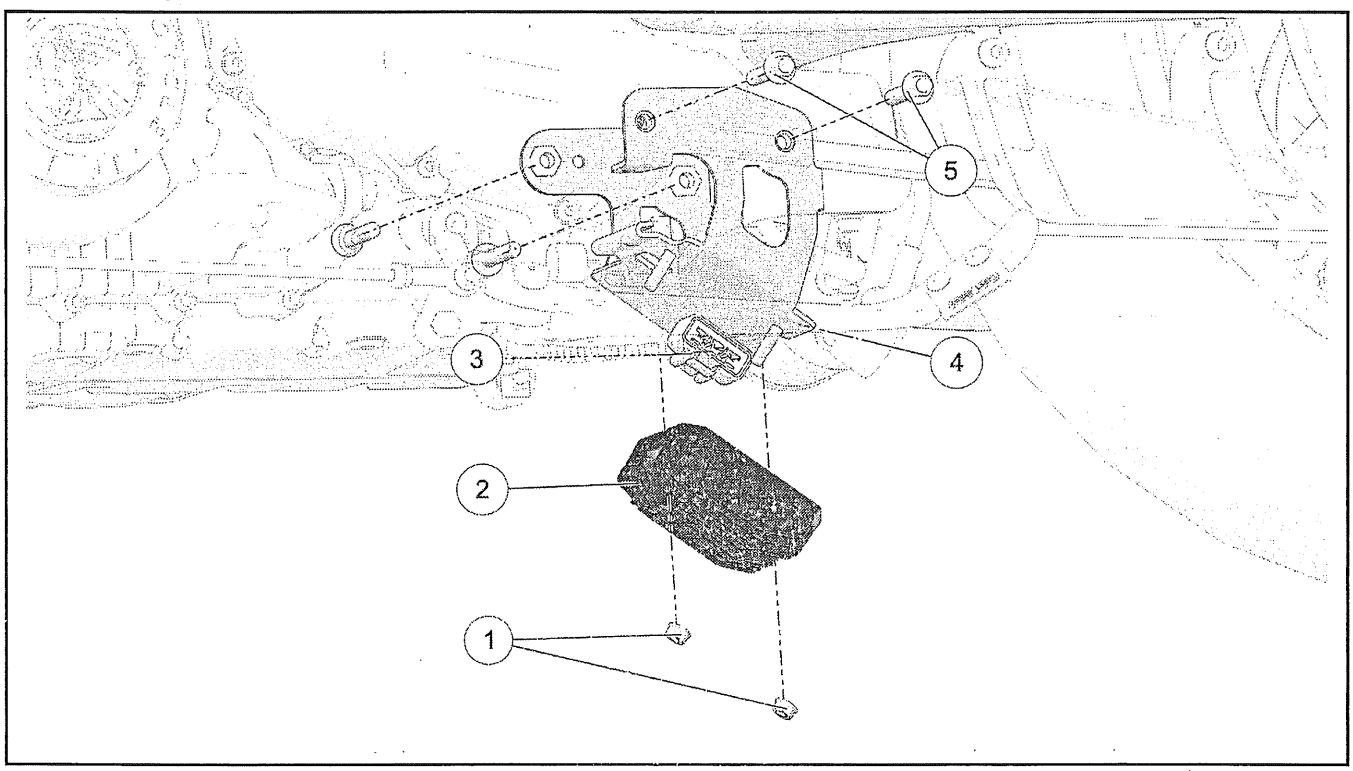
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Starter Motor	-
②	Battery Cable to Starter Motor Nut	**62 in-lbs (7 Nm)**
③	Terminal Cover	-
④	Starter Motor Fastener (QTY.2)	**88 in-lbs (10 Nm)**
⑤	Solenoid to Starter Motor Cable (B+)	-
⑥	Battery	-
⑦	Starter Solenoid	-

STATOR COMPONENTS



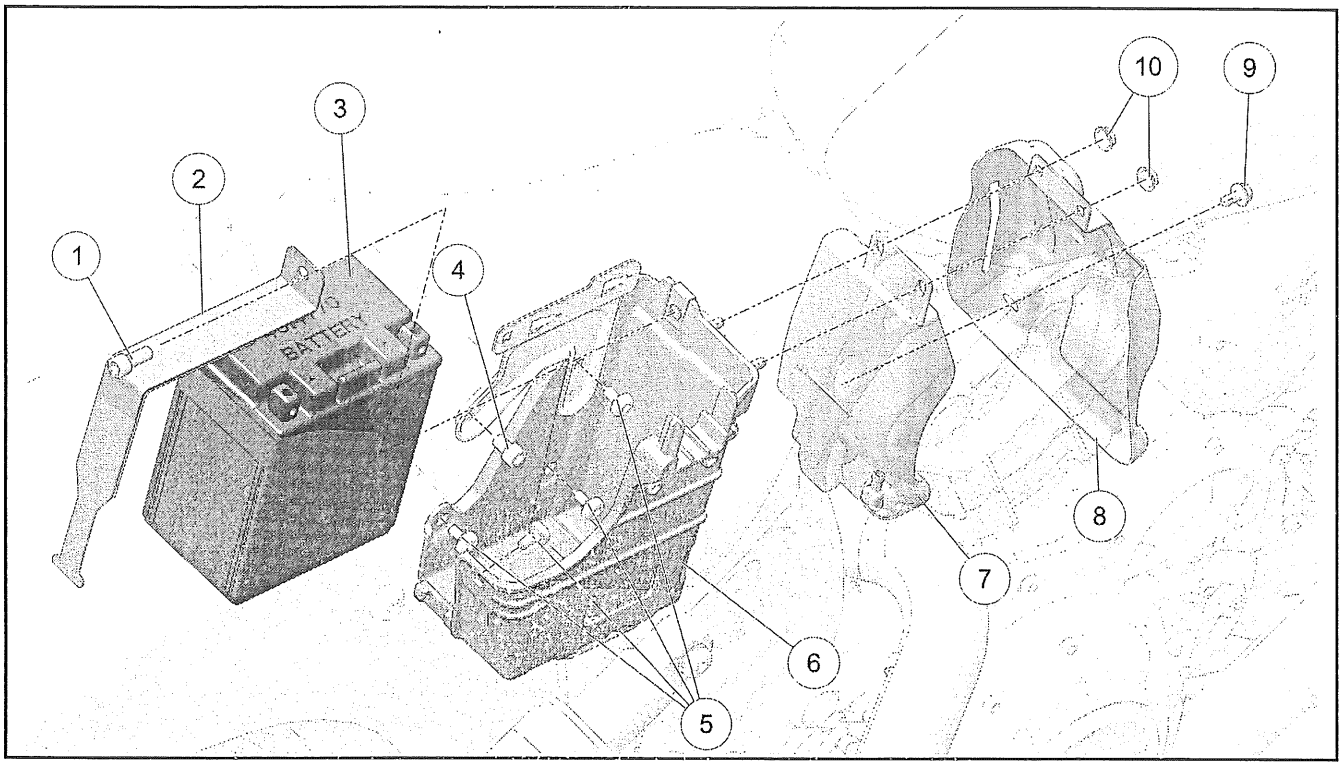
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Stator	-
②	Stator Mounting Fasteners to Cover - (QTY.3)	**88 in-lbs (10 Nm)**
③	Stator Wire Clip	-
④	Stator Clip Fasteners - (QTY.3)	**71 in-lbs (8 Nm)**

REGULATOR / RECTIFIER COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Regulator / Rectifier Nuts	**84 in-lbs (9.5 Nm)**
②	Voltage Regulator / Rectifier	-
③	Electrical Regulator / Rectifier Connector	-
④	Regulator / Rectifier Bracket	-
⑤	Regulator Bracket Fasteners - (QTY.4)	**19 ft-lbs (26 Nm)**

BATTERY BOX COMPONENTS

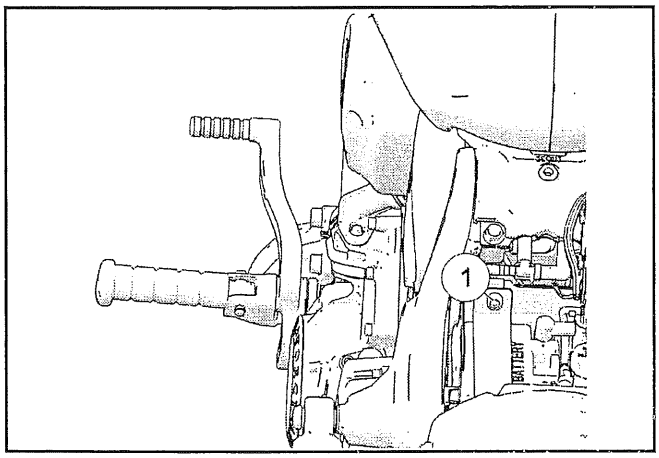


NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Battery Bracket Hold Down Fastener - (QTY.1)	**12 ft-lbs (16 Nm)**
②	Battery Hold Down Bracket	-
③	Battery	-
④	Battery Box Fastener - (QTY.1)	**8 ft-lbs (11 Nm)**
⑤	Battery Box Shoulder Fastener - (QTY.4)	**8 ft-lbs (11 Nm)**
⑥	Battery Box	-
⑦	Engine Coolant Reservoir	-
⑧	Coolant Reservoir Heat Shield	-
⑨	Coolant Reservoir Heat Shield Fastener - (QTY.1)	**8 ft-lbs (11 Nm)**
⑩	Self Threading Nuts	-

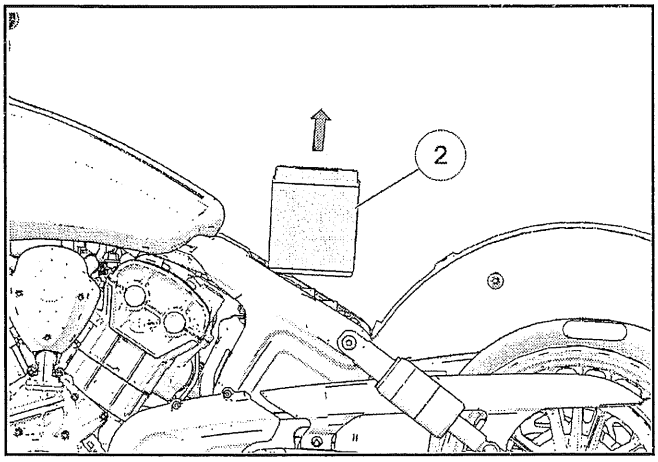
BATTERY SERVICE

BATTERY REMOVAL

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Rotate the fuse panel to access the battery.
3. Remove the battery hold down bolt ①.



4. Remove negative (-) battery terminal bolt and terminal from battery.
5. Remove positive (+) battery terminal bolt and terminal from battery ②.
6. Lift battery out of battery box.



NOTE

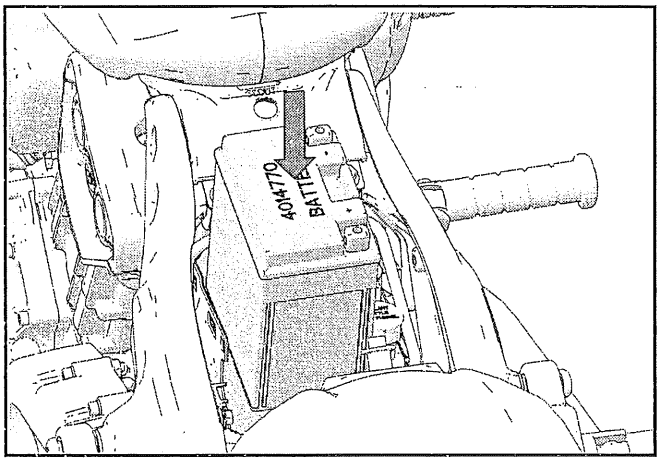
It may be necessary to push the main harness away from the battery, toward the RH side of the frame in order to remove the battery.

BATTERY INSTALLATION

NOTE

Be sure cable ends and battery terminals are clean. Apply a light film of di-electric grease to terminal bolt threads.

1. Carefully install battery with negative terminal toward front of vehicle.



2. Connect positive cable to the battery and torque to specification.
3. Connect ground (negative) cable to battery and torque to specification.

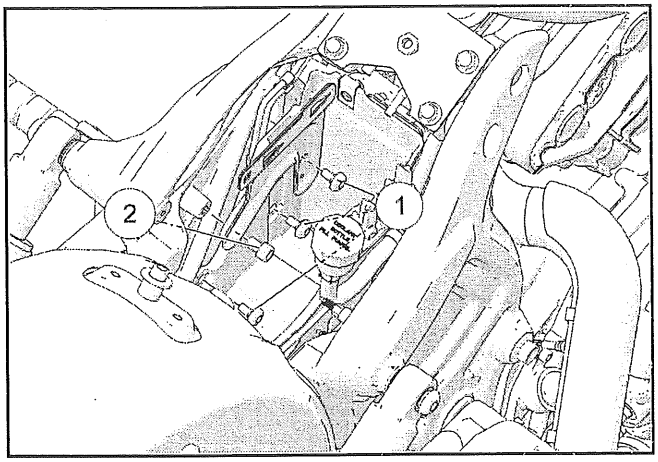
TORQUE

Battery Terminal Fasteners:
45 in-lbs (5 Nm)

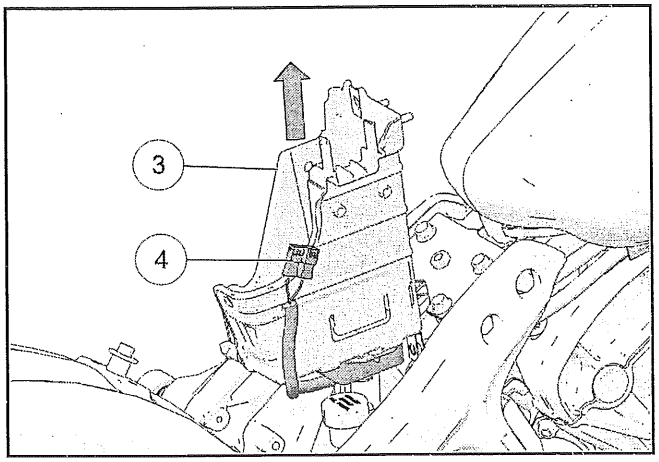
4. Apply dielectric grease over terminal areas for corrosion protection.
5. Install seat. See Seat Removal / Installation, page 7.8.

BATTERY BOX REMOVAL

1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove the seat. See Seat Removal / Installation, page 7.8.
3. Remove battery. See Battery Removal, page 10.12.
4. Lift starter solenoid and coolant filler from bracket.
5. Remove rear battery box screws ①.



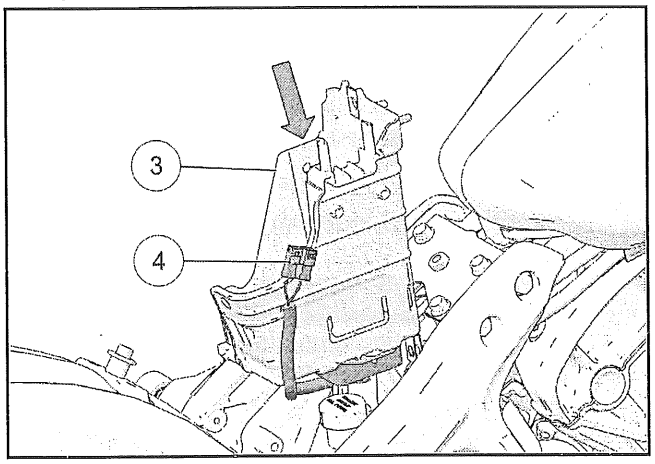
6. Remove front battery box screws ②.
7. Lift battery box ③ to disconnect the load module connectors ④.



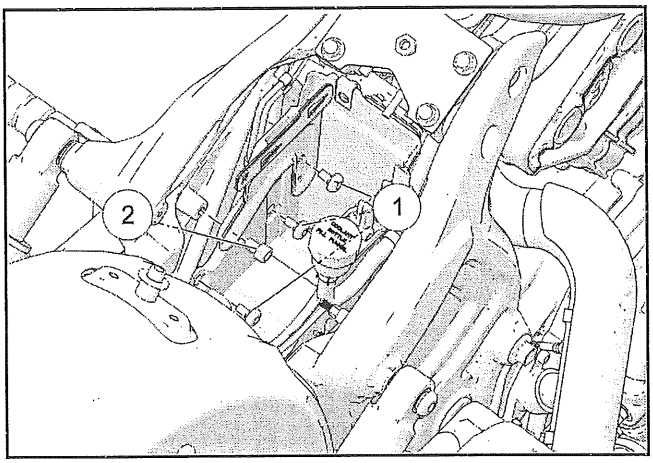
8. Remove battery box.

BATTERY BOX INSTALLATION

1. Connect the Load / Tip Over Module connectors ④.



2. Lower the battery box ③ into position and align screw holes.
3. Install the battery box shoulder fasteners ②, ① and torque to specifications.



TORQUE
Battery Box Shoulder Fasteners: **8 ft-lbs (11 Nm)**

4. Install the starter solenoid.
5. Install the coolant reservoir filler.
6. Install battery. See Battery Installation, page 10.12.
7. Install seat assembly. See Seat Removal / Installation, page 7.8

BATTERY CHARGING - NEW BATTERY

1. Charge the battery at *1.2 amps for 5 to 10 hours. use a straight rate charger (not load sensing or battery tender type) for the initial charge of a new battery.*

CAUTION

Do not attempt to quick charge the battery at any time.

2. Remove battery from charger and let it sit for 30 minutes or longer.

NOTE

Measure voltage with a digital multimeter. If lower than 12.5 V DC, battery must be recharged again in accordance with step 1 and 2 above.

3. After charging battery and letting it sit for 30 minutes or more, check battery voltage again. If battery voltage is still below 12.5 V DC, replace the battery.

BATTERY CHARGING - IN SERVICE

1. Measure battery voltage with a digital multimeter. The reading should be above 12.50 V DC. If battery voltage is lower than 12.50 V DC battery must be charged according to the instructions given below.

CAUTION

Do not remove caps on battery while recharging. Do not attempt to inspect or add fluid to a maintenance free battery.

2. Charge battery at *1.2 amps for 5 to 10 hours.*

NOTE

Specification: 1.2 A for 5-10 hours

3. Remove battery from charger and let it sit for 30 minutes or longer.
4. Measure battery voltage with a digital multimeter. If battery voltage is lower than 12.50 V DC battery must be recharged again in accordance with step 1 and 2 above.
5. After charging battery and letting it sit for 30 minutes or more, check the battery voltage again. If battery voltage is still below 12.50 V DC, replace battery.

NOTE

When motorcycle is not used for one (1) month or more, remove battery and store it in a cool, dry area. Inspect voltage monthly and charge according to above instructions if necessary.

BATTERY INSPECTION

1. Remove battery. See Battery Removal, page 10.12.
2. Inspect battery tray and hold-down bracket for damage. Be sure all foam strips are in place on battery box.
3. Inspect for cracked or broken battery case.

CAUTION

Do not remove the battery cap assembly in an attempt to inspect fluid level, specific gravity or attempt to add fluid to battery. After initial servicing, battery should remain sealed.

4. Inspect terminals for corrosion. If corrosion is found, remove battery and clean terminals with a solution of baking soda and water. Finish process by cleaning terminals (both battery and battery cables) with a wire brush.
5. Install battery. See Battery Installation, page 10.12.
6. Once connections are secured, apply a thin film of di-electric grease to terminals.
7. Install seat. See Seat Removal / Installation, page 7.8.

BATTERY TESTING

The recommended battery tester for all Indian Motorcycle batteries is special tool **PU-50296.** See Special Tools Index, page 1.15.

Conductance describes the ability of a battery to conduct current. A conductance tester functions by sending a low frequency AC signal through the battery and a portion of the current response is captured, from this output a conductance measurement is calculated. Conductance testing is more accurate than voltage, specific gravity, or load testing.

STARTER MOTOR SERVICE
SAFETY INFORMATION

⚠ WARNING

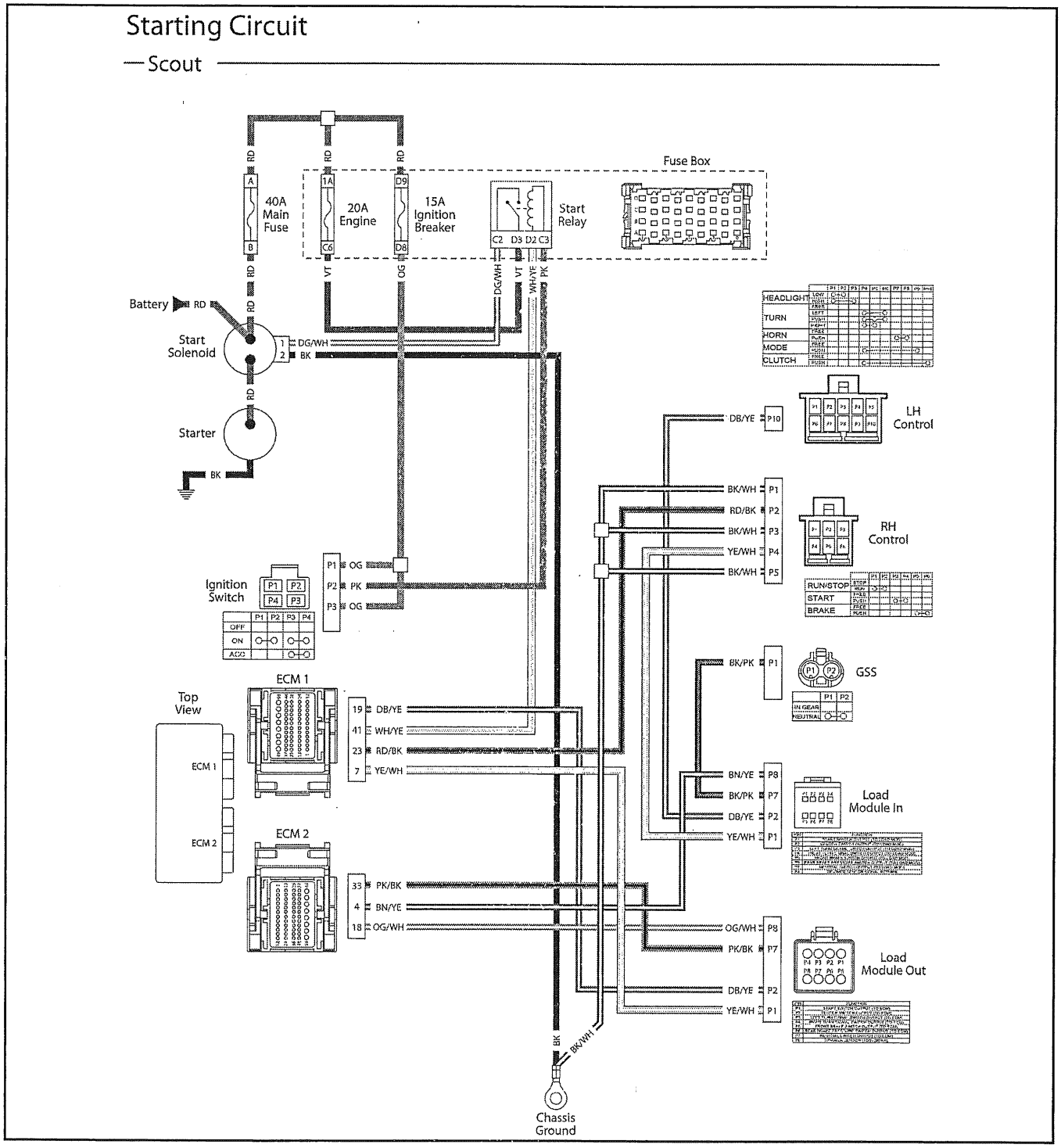
Always disconnect the battery (negative terminal first) before servicing the starter motor.

- Inspect the condition of the battery before troubleshooting the starter system. Also inspect main engine ground and battery cable connections.

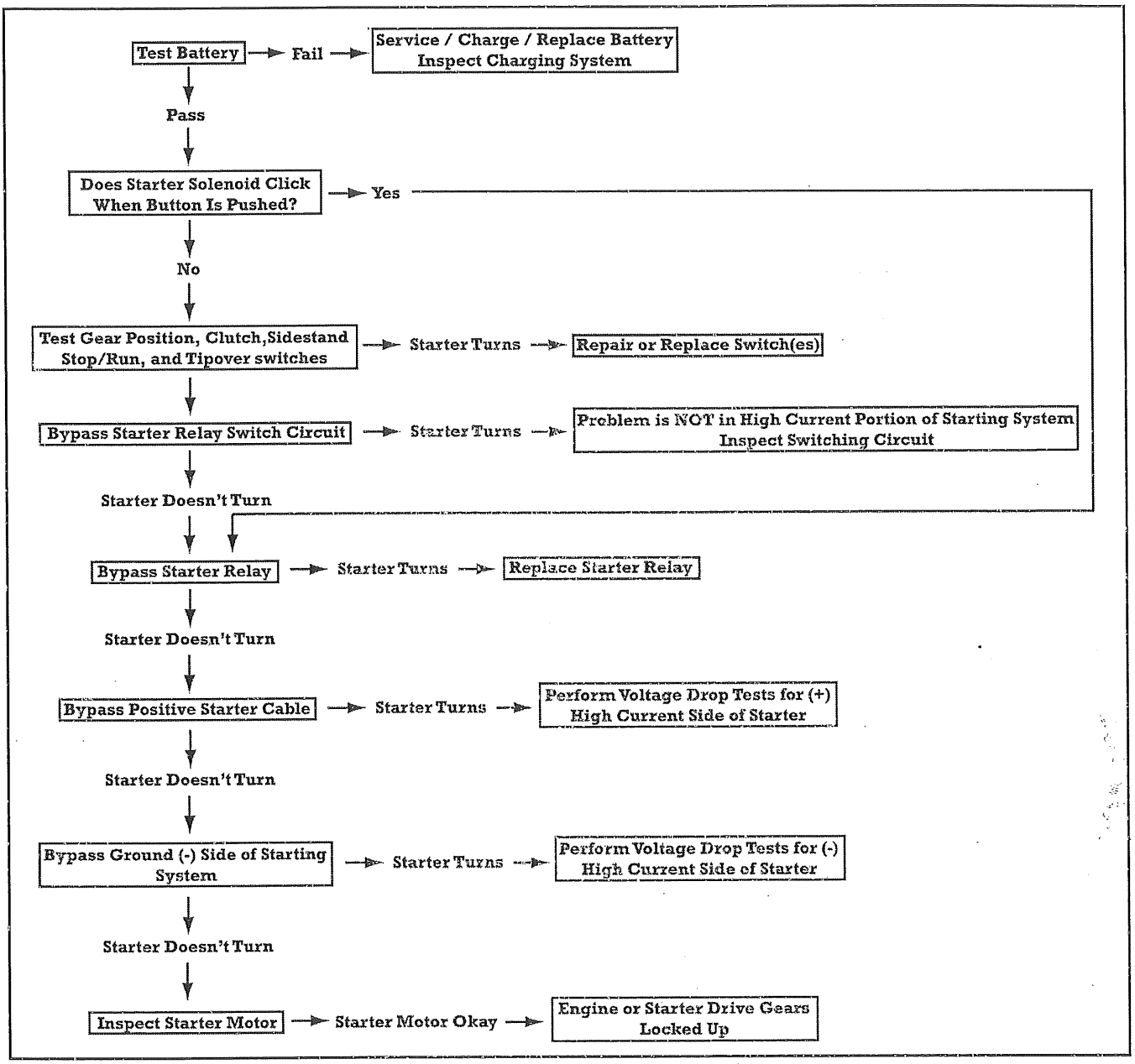
STARTING SYSTEM DIAGNOSTIC TABLE

SYMPTOM	POSSIBLE CAUSE	RECOMMENDATION
Starter motor does not turn with transmission in neutral. Turns with clutch pulled in.	Gear Position Switch or circuit malfunction.	Test Gear Position Switch.
Starter motor does not turn with transmission in gear and clutch lever pulled in. Turns with transmission in neutral.	Clutch Switch or Side Stand switch circuit malfunction.	Test Switches.
Starter motor will not turn.	Low battery voltage. Poor cable connections. Main ground loose.	See Troubleshooting Flow Chart 1
Starter motor turns slowly. Engine may or may not start.	Low battery. Faulty starter motor or drive mechanism. Engine mechanical problem.	See Troubleshooting Flow Chart 2
Starter motor turns, but engine does not turn.	Starter torque limit clutch slipping.	See Troubleshooting Flow Chart 3
Starter motor turns at normal speed, but engine does not start.	Ignition Problem Engine Problem Fuel Delivery Problem	Electrical Chapter Engine / Cooling / Exhaust Chapter Fuel Delivery / EFI Chapter

STARTER CIRCUIT DIAGRAM



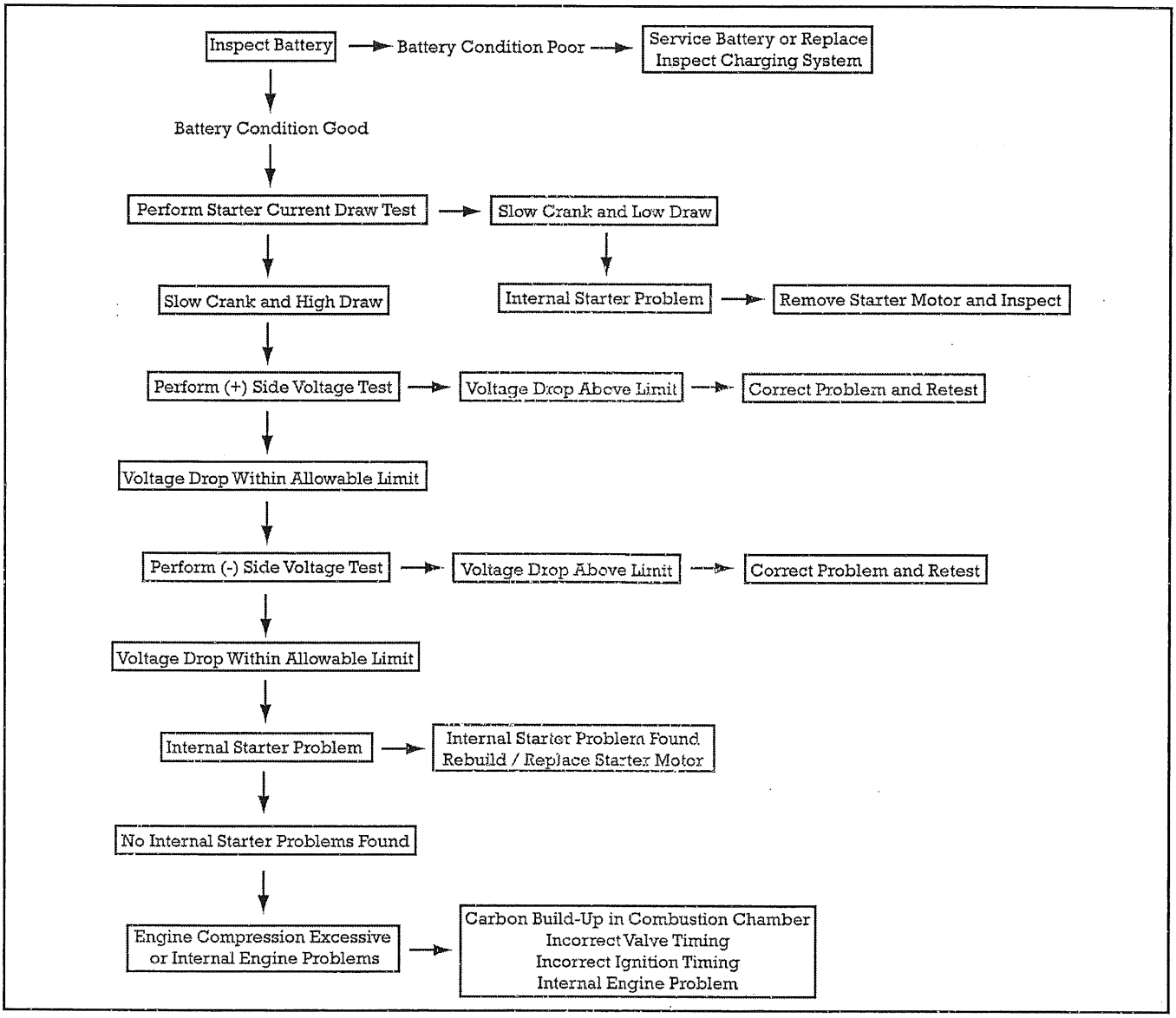
TROUBLESHOOTING FLOW CHART 1



TROUBLESHOOTING FLOW CHART 2

NOTE

These procedures require a Digital Multi Meter (DMM) and high a high current shunt, or an inductive ammeter clamp and a DMM.



TROUBLESHOOTING FLOW CHART 3

SYMPTOM	POSSIBLE CAUSE
Starter motor turns, but engine does not turn. The starter motor can be heard spinning.	Starter clutch malfunction.
	Starter torque limit clutch slipping.
	Starter gears damage.

STARTING SYSTEM TESTS

BATTERY LOAD TEST

1. Load test battery using a commercially available battery load tester. Follow the battery load tester manufacturer instructions.

NOTE

Although not as conclusive, the following test can be used to direct troubleshooting efforts if a battery load tester is not readily available.

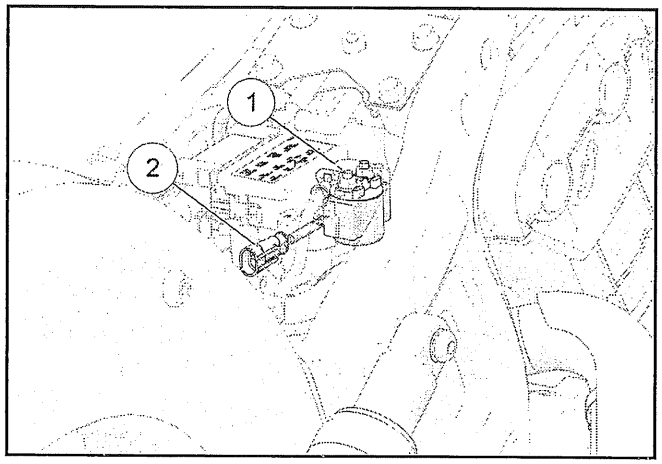
2. Charge battery until open circuit voltage is above 12.5 Volts.
3. Install battery and connect battery cables.
4. Connect digital multimeter to battery and keep it connected for duration of test.
5. Turn ignition key on and move head light high beam switch to High Beam for 1 minute (without the engine running).
6. Measure battery voltage.
7. If battery voltage has dropped below 10.5 V DC, re-charge and re-test battery or replace it.

STARTER SOLENOID GROUND CIRCUIT TEST

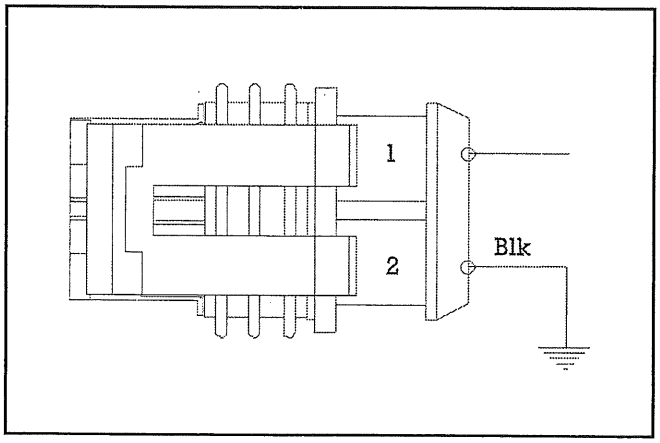
⚠ WARNING

Ensure that the motorcycle is secure and that the transmission is in neutral for the following test.

1. Shift transmission to Neutral.
2. Remove seat. See Seat Removal / Installation, page 7.8.
3. Locate the starter solenoid ① and disconnect the start solenoid connector ②.



4. Set the multi-meter to read resistance and insert meter leads into the appropriate jacks.
5. Working on the vehicle side of the harness, test continuity between terminal 2 (black wire) and chassis ground.



Resistance should be ≤ 0.5 Ω

GEAR POSITION SWITCH NEUTRAL INDICATOR TEST

Symptoms of a faulty Gear Position Switch may include:

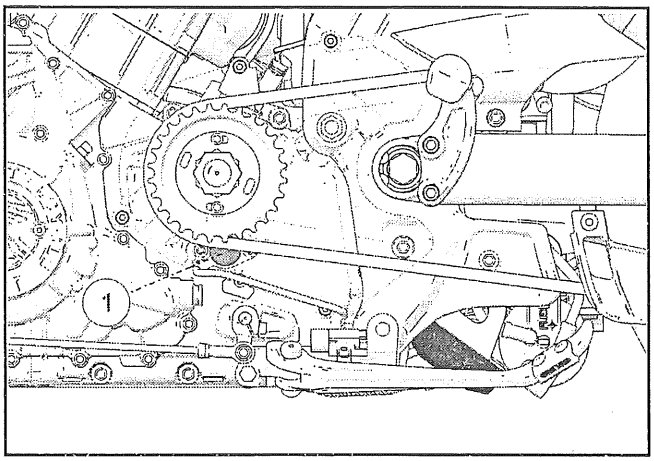
- Starter motor does not operate when transmission is in neutral,

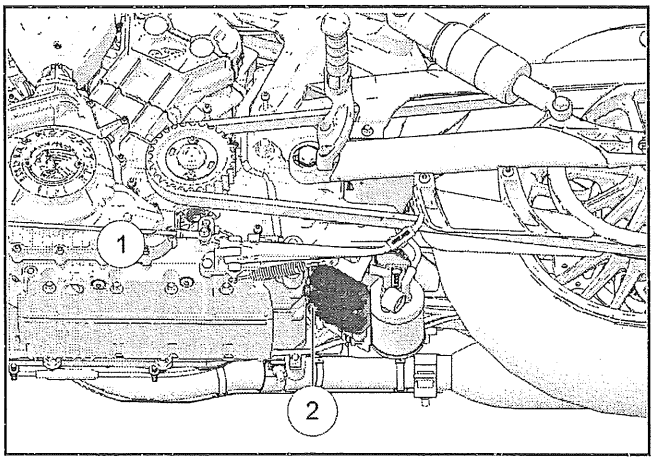
but...

- Starter motor does operate when clutch is pulled in.

1. Place the ignition switch in the RUN position to power up the electrical system.
2. Place engine stop switch in the RUN position.
3. Shift transmission into Neutral.
4. Observe neutral indicator light.
5. If indicator is not lit with transmission in neutral:

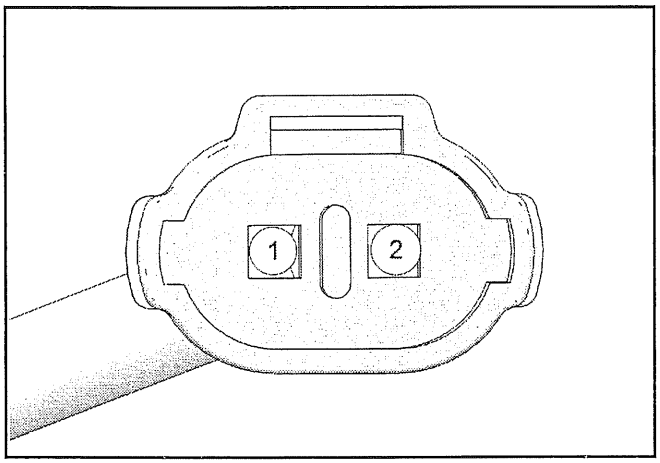
- Place the RUN/STOP switch in the STOP position and turn motorcycle power off.
- Roll the motorcycle forward and back enough to verify that it is in neutral.
- Locate the gear position switch ① wire connector ② located near the engine at the rear of the cases above the voltage regulator.





- Set the multimeter to test resistance and insert meter leads into the appropriate jacks.

- Test the gear position switch resistance between the switch connector terminal 1 and chassis ground.



- Compare reading to the resistance specification.

Gear Position Switch Neutral Resistance Specification: 1Ω±0.5Ω

6. If resistance reading is not within specified parameters, replace neutral switch or repair wiring as necessary.
7. If neutral indicator switch is working correctly and neutral indicator did not light with the transmission in neutral; inspect neutral lamp and circuit wiring for a open/short circuit.

CLUTCH SWITCH CIRCUIT TEST

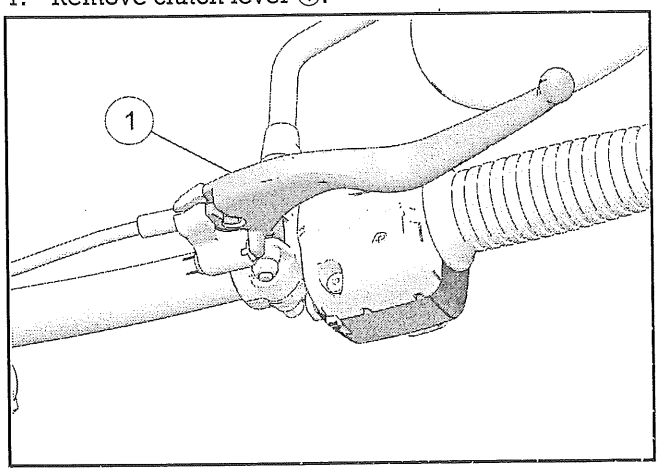
The symptom of a faulty clutch switch circuit is:

- Starter motor will not operate with transmission in gear and clutch lever pulled in. Starter *operates* with transmission in neutral. Use an ohmmeter to determine if continuity is present when the switch is closed (lever pulled in).

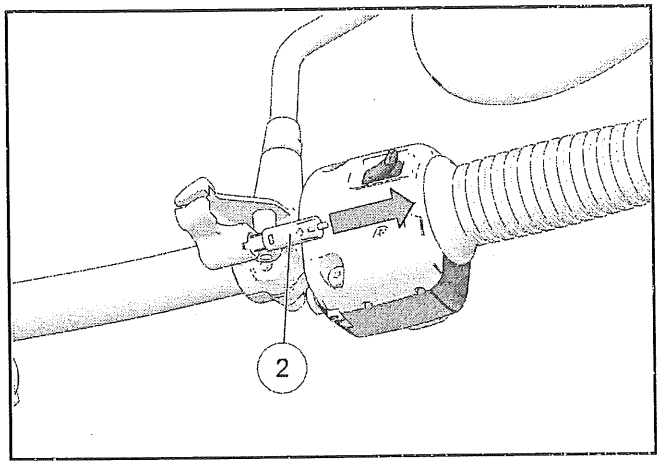
1. Transmission can be in neutral or in any gear.
2. Disconnect the clutch switch connectors.
3. Set multimeter to measure resistance and insert meter leads into appropriate jacks.
4. Connect red (+) lead of multi meter to either of the clutch switch terminals and the black meter lead to the other clutch switch terminal.
5. Operate clutch lever while observing meter display.
6. Pull clutch lever to the handlebar. Meter should display continuity or very low resistance (less than 1 ohm) when the clutch switch closes.
7. Release clutch lever, meter should display OL (open line).
8. If clutch switch does not test as described inspect clutch switch, clutch switch wiring or mounting of switch to clutch lever for fault.
9. If switch is mounted correctly and physically operates but does not open and close electrically, replace switch.

CLUTCH SWITCH REMOVAL / INSTALLATION

1. Remove clutch lever ①.



2. Disconnect the electrical connectors at the clutch switch ② and slide the switch out from the lever side.



3.

CAUTION
The clutch switch has a locating pin on the bottom side which slide into the clutch lever perch. Use caution when removing the clutch switch so the locating pin does not break off.

Gently pull the clutch switch out of the lever perch until the locating pin is free.

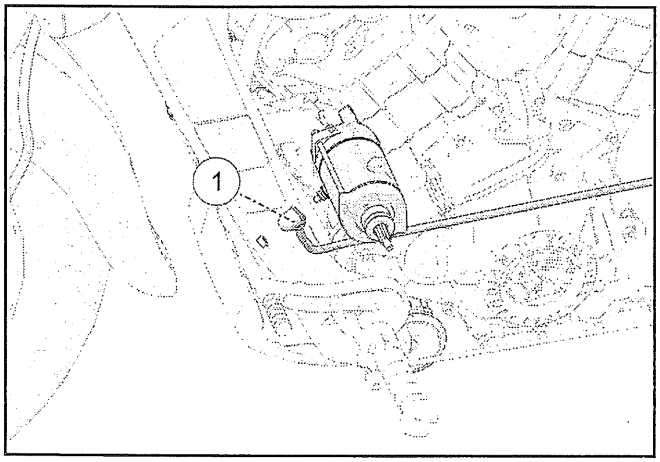
4. **Installation is performed by reversing the removal procedure.**

STARTER SOLENOID POSITIVE CIRCUIT TEST

⚠ WARNING

Secure motorcycle on the side stand and place transmission in neutral for the following test.

1. Place the transmission in neutral.
2. Disconnect positive cable ① from starter motor.



3. Set multi-meter to **DC Volts** and insert meter leads in the appropriate jacks.
4. Connect the red meter lead (+) to the positive starter cable eyelet and the black (-) meter lead to chassis ground.
5. Place key switch in RUN position to power up the electrical system and place the STOP/RUN switch in the RUN position.
6. Press starter button. The meter should display battery voltage. If voltage is more than .2 volts below battery voltage, inspect the power supply circuit.

STARTER CURRENT DRAW TEST

NOTE

This procedure requires the use of an inductive ammeter to read current draw and a volt meter to monitor battery voltage during the test.

⚠ WARNING

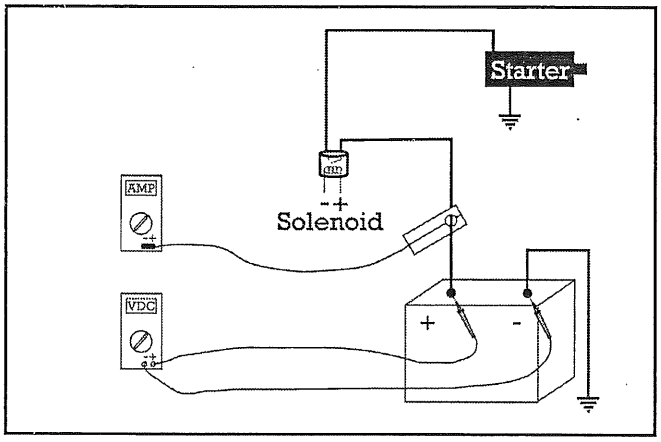
Do not allow any part of the jumper cable clamp to touch the chassis or any other ground.

CAUTION

Disable the ignition system so that the engine will not start during this test.

- Remove ignition coils and spark plugs.
- Install test spark plugs into plug caps.
- Ground spark plugs against engine.

1. Remove seat. See Seat Removal / Installation, page 7.8.
2. Inspect the battery. Charge or replace battery as necessary before proceeding.
3. Place transmission in neutral.
4. Position an inductive ammeter clamp on battery positive cable.
5. Set the multi meter to **Volts DC** scale and connect red lead of meter to positive post of battery.
6. Connect black lead of meter to negative post of battery.



7. Turn the ignition switch ON to power up the electrical system and observe ammeter. It should register negative amps. If it does not, turn the ammeter probe around.
8. Place the engine STOP/RUN switch is in the RUN position, transmission is in neutral, clutch lever pulled in and that the ignition system is disabled.

9. Press starter switch and crank starter for about 5 seconds and observe both meters and the tachometer.
10. The battery voltage should remain above 9.6 volts.
11. The amperage draw of the starter should not exceed 160 amps.

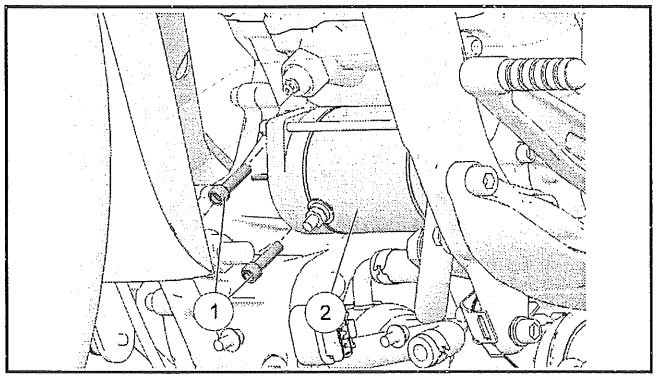
Starter current draw @ 77°F (25°C): ≤**160 Amps**

STARTER MOTOR, REMOVAL / INSTALLATION

⚠ WARNING

Ensure that the ignition switch is turned off. Remove the negative cable at the battery before removing the starter motor.

1. Disconnect negative battery cable. See Battery Removal, page 10.12.
2. Remove radiator assembly. See Radiator Removal / Installation, page 3.35.
3. Disconnect positive terminal from the starter motor.
4. Remove the two fasteners ① from rear of starter motor ②. Slide starter to the RH side of the motorcycle to release from engine case.



5. Remove starter motor.
6. **To install the starter motor, reverse the removal procedure.**
7. Torque the starter mounting bolts to specification.

TORQUE
Starter Motor Fasteners: **88 in-lbs (10 Nm)**

8. Torque the starter motor positive terminal nut to specification.

TORQUE
Battery Cable to Starter Motor Nut: **62 in-lbs (7 Nm)**

NOTE
Hold the lower terminal nut with an open ended wrench while tightening the upper nut to avoid damage.

STARTER CLUTCH REMOVAL

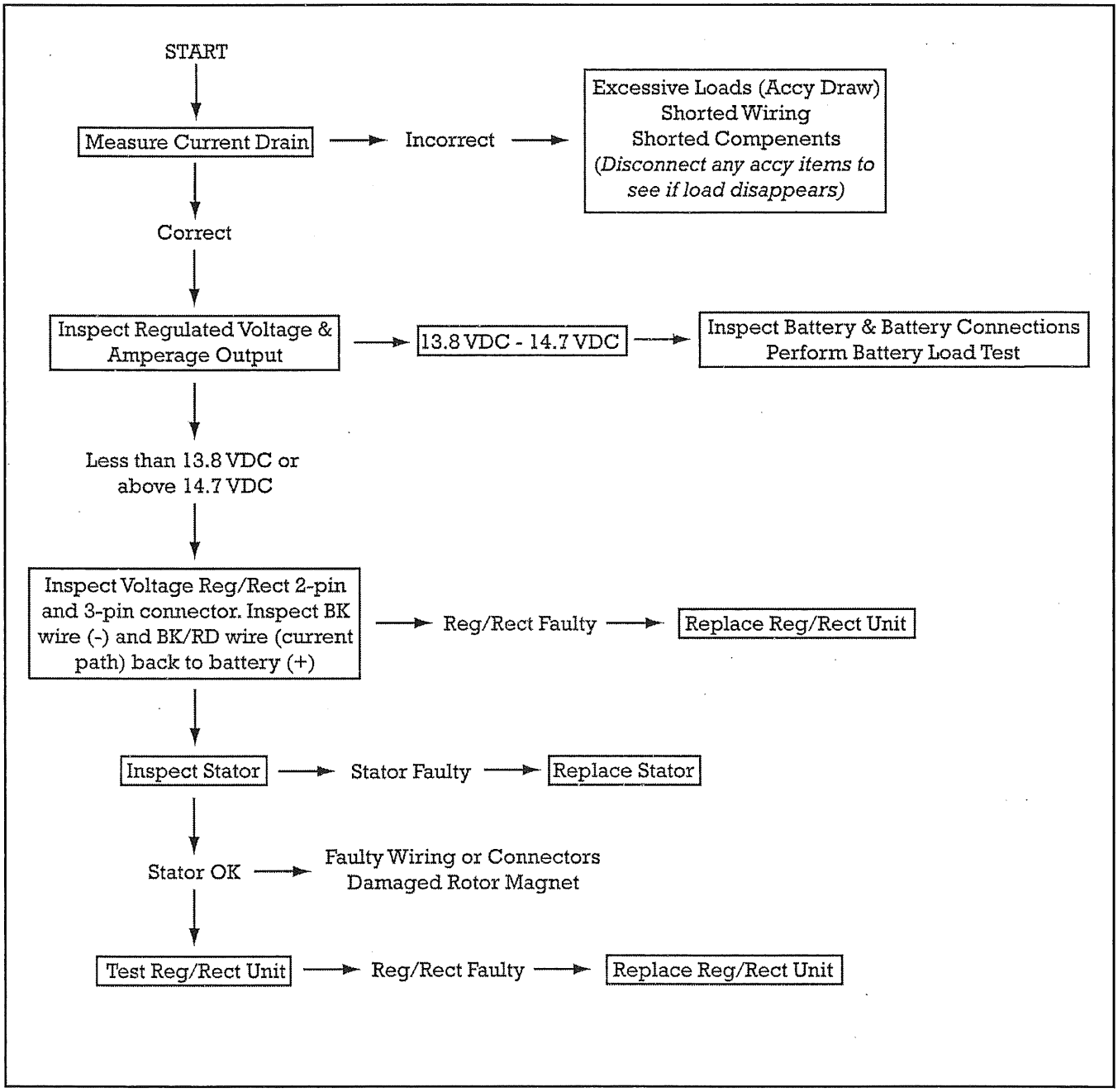
- See Starter Drive Removal, page 6.20.

CHARGING SYSTEM SERVICE

TROUBLESHOOTING, CHARGING SYSTEM

NOTE

The battery must be fully charged and in good condition to obtain accurate readings. Battery charging current is automatically reduced by the regulator / rectifier if the regulator / rectifier unit reaches a critical temperature (overheated). The system should be cool when testing DC charging output or when testing the regulator / rectifier to ensure accurate readings. Refer to test procedure for individual charging system components for more information.



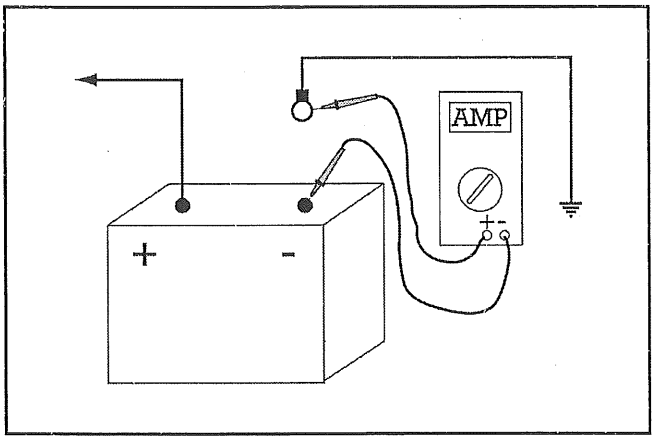
CURRENT DRAIN INSPECTION

IMPORTANT

Current drain should only be measured after all systems have timed out and gone to sleep. Leave power OFF and do not disturb for approximately **12 MINUTES** for an accurate reading.

Current drain is suspect if battery discharges when motorcycle is not in operation (short periods of storage).

1. Remove seat. See Seat Removal / Installation, page 7.8.
2. Disconnect ground cable (-) from battery.
3. Set multimeter to read milliamps (mA) and insert meter leads into appropriate jacks. Connect red meter lead to ground cable eyelet and connect black meter lead to battery negative (-) terminal.



NOTE

Do not operate electric starter or meter fuse will be damaged.

4. With ignition switch off, **and after 12 minutes have passed**, read current drain.
5. If current drain exceeds specifications inspect wiring and components for short to ground.

Parasitic Draw Specification (after 12 minutes with power OFF): 4.5 mA MAX

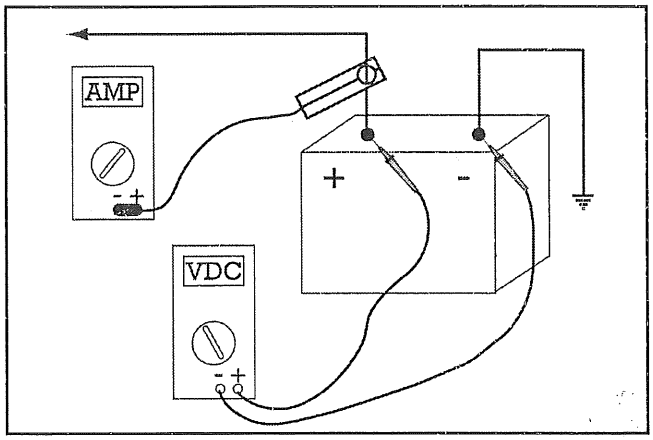
6. Locate the faulty component or wiring by disconnecting accessories, wiring connections, and fuses one-at-a-time while observing current drain. When current drain falls within specifications, focus efforts on the last circuit or component that was disconnected.

REGULATED VOLTAGE / AMPERAGE OUTPUT INSPECTION

NOTE

This procedure requires the use of an inductive ammeter to read current draw and a volt meter to monitor battery voltage during the test.

1. Remove seat. See Seat Removal / Installation, page 7.8.
2. Place the inductive ammeter over the positive (+) battery cable.
3. Set multi meter to V DC scale.
4. Connect voltmeter red (+) lead to battery red (+) lead and black (-) voltmeter lead to battery black (-) lead.



5. Start engine and warm to operating temperature.
6. At 1000 RPM or slightly above; the ammeter should reach the "break-even" point (no amperage leaving the battery) and the voltmeter should be rising toward 14 VDC.

Specification: Break-even point for charging System: 1500 RPM

7. Increase engine RPM to 2500. The ammeter should rise a slight amount, then stabilize. Volt meter should read above 14 V DC.

10

8. Use results obtained from preceding tests and the following descriptions to determine if charging system is functioning properly.

   CHARGING SYSTEM OPERATING CORRECTLY: Ammeter goes up a small amount, then stabilizes slightly above +0 amps. Volt meter rises toward 14.8 ± V DC, drops off a little and starts to stabilize.

   LOW BATTERY: Amperage continues to rise, voltage levels off as battery is absorbing voltage. Charging system may be okay. Need to charge battery fully or use a good battery and repeat test. Meters will indicate similar reading to the overcharging chart.

   CHARGING SYSTEM UNDERCHARGING: Ammeter drops to 0 or remains below 0 (negative reading) at all rpm, volt meter remains the same or goes down. Go to voltage drop inspection.

   CHARGING SYSTEM OVERCHARGING: Ammeter rises well above 0 and remains there or continues to rise. Volt meter goes well above 14.8 V DC and may continue to rise.

   EXCESSIVE LOAD: Current levels off or starts to drop, voltage continues to rise. Load may be excessive (accessories or shorted components). Determine if excessive loads are present. Disconnect accessories and re-test.

9. Turn ignition key off.
10. Remove inductive ammeter clamp.
11. Install seat. See Seat Removal / Installation, page 7.8.

STATOR AC VOLTAGE OUTPUT TEST

NOTE

Set multimeter to VAC (alternating current). Engine cold. Regulator / Rectifier disconnected (2-pin and 3-pin connector). Engine must be running. Be sure to heed the following Warnings and Cautions.

⚠ WARNING

HOT COMPONENTS: The engine and exhaust system become very hot during operation and remain hot for a period of time after the engine is shut off. Wear insulated protection for hands and arms or wait until the engine and exhaust system have cooled sufficiently before working on the machine.

⚠ WARNING

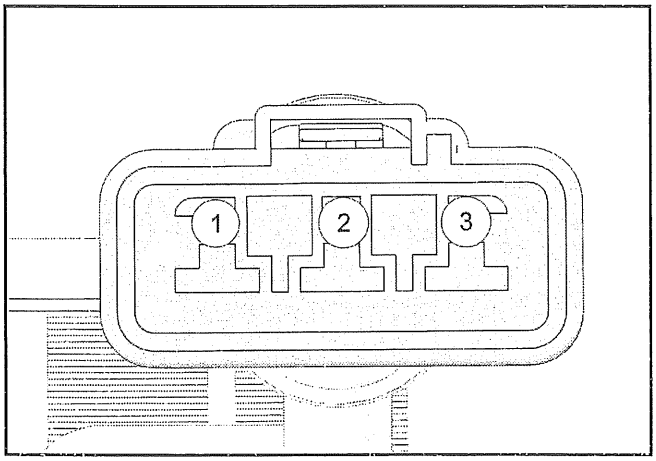
CARBON MONOXIDE: Never run an engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas that can cause loss of consciousness and may lead to death. If you must run the engine to do some repairs, do so in an open area or with an exhaust evacuation system operating.

CAUTION

VOLTAGE / ARCING: Use caution not to touch any of the connections or allow the exposed terminals to come close to any other part of the vehicle or other objects, as an arc may occur.

1. Disconnect the 3-pin stator connector.
2. Set multi meter to measure AC Volts.

3. Connect one lead of the multi meter to pin A ① and one lead to pin B ② on the 3-pin stator connector.



CAUTION

VOLTAGE / ARCING Use caution not to touch any of the connections or allow the exposed terminals to come close to any other part of the vehicle or other objects, as an arc may occur.

4. Start the engine and let it run at idle. Observe the multi meter reading.
5. The meter should indicate a minimum reading of 24 VAC at idle.
6. Repeat test for pins A ① & C ③.
7. Repeat test for pins B ② & C ③.

No load AC Volts @ 800 RPM: Approx 24 VAC

NOTE

The test results in Steps 6, 7, and 8 can read more than 24 VAC, but it is **important that the reading for each pair of wires is approximately equal.**

8. Increase RPM to 2000. Repeat Steps 4-8.
9. At 2000 RPM the reading should be at least 34 VAC.

NOTE

The test results obtained in step 10 can read more than 34 VAC, but it is important that they are all approximately equal.

No load AC Volts @ 2000 RPM: Approx 34 VAC

STATOR RESISTANCE TEST

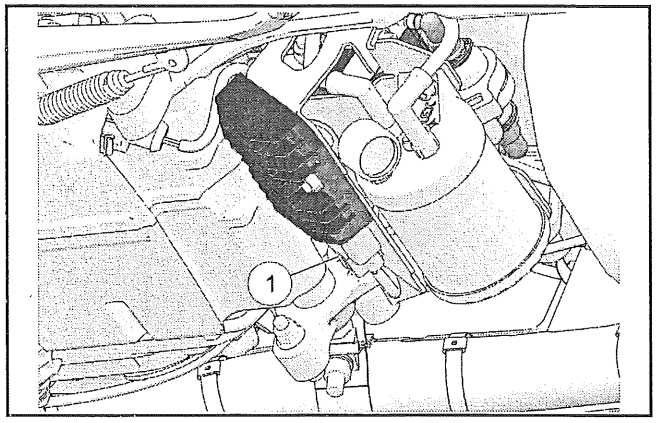
CAUTION

The *engine must not be running* while performing the following resistance test.

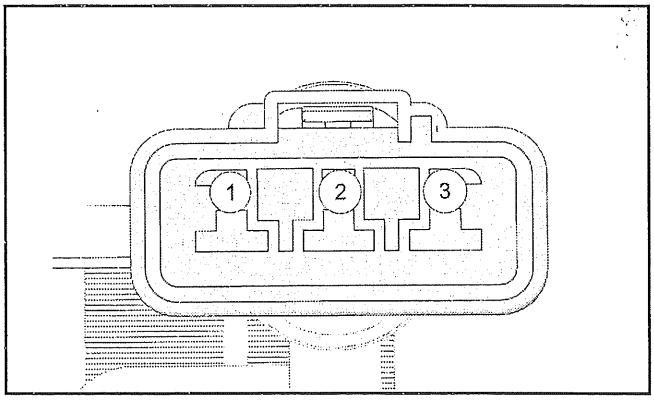
NOTE

Set multimeter to measure resistance. Engine OFF and cold. Regulator Rectifier 3-pin connector unplugged.

1. Disconnect the three pin connector ① from stator.



2. Set the multi meter to measure resistance (Ω) and insert the meter leads in to the appropriate jacks.
3. Connect one meter lead to pin A ① and the other lead to pin B ② on the stator connector. Note resistance value.



Stator Resistance: Less than 1 Ohm

4. Repeat test for pins A ① & C ③.
5. Repeat test for pins B ② & C ③.
6. If resistance values do not match specification, inspect stator and replace as necessary.

10

STATOR WINDINGS TO GROUND INSPECTION

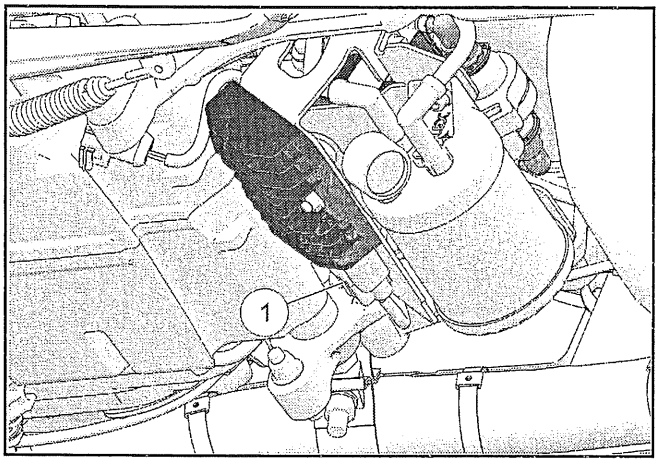
CAUTION

The *engine must not be running* while performing the following resistance test.

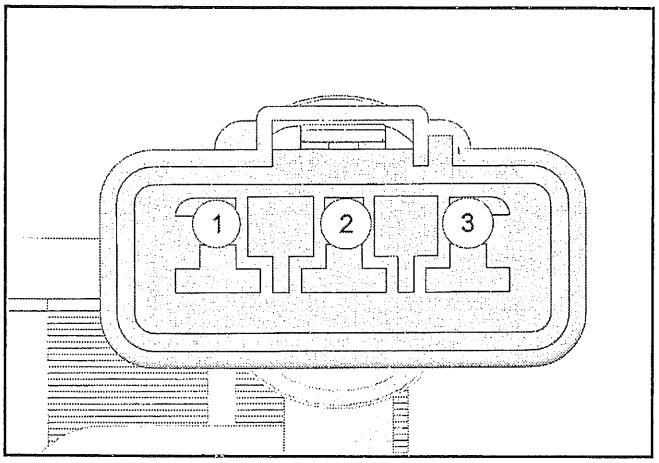
NOTE

Set multimeter to measure resistance. Engine OFF and cold. Regulator Rectifier 3-pin connector unplugged.

1. Disconnect the three pin connector ① from stator.



2. Connect one multi meter lead to pin A ① and place the other lead of the multi meter in contact with a good engine ground, observe resistance to ground reading.

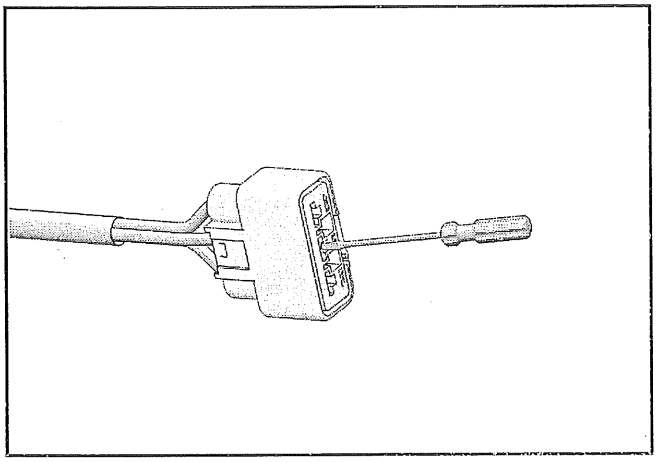


Stator to Ground (-) Continuity Specifications: Open Circuit (OL)

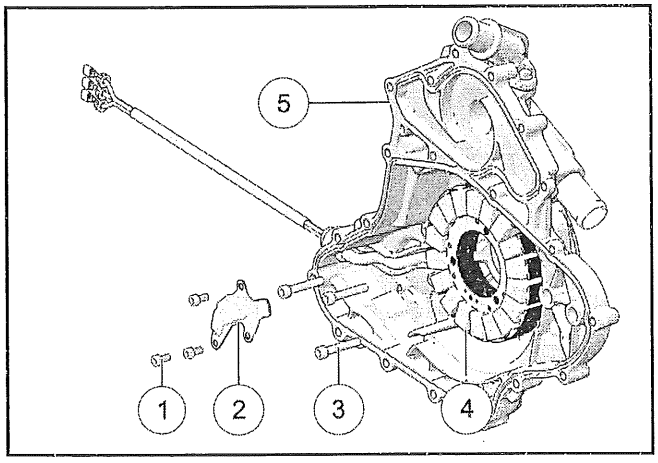
3. Repeat test for other two stator leads (② & ③) to ground.
4. There should be no connection from stator windings to ground.

STATOR REMOVAL

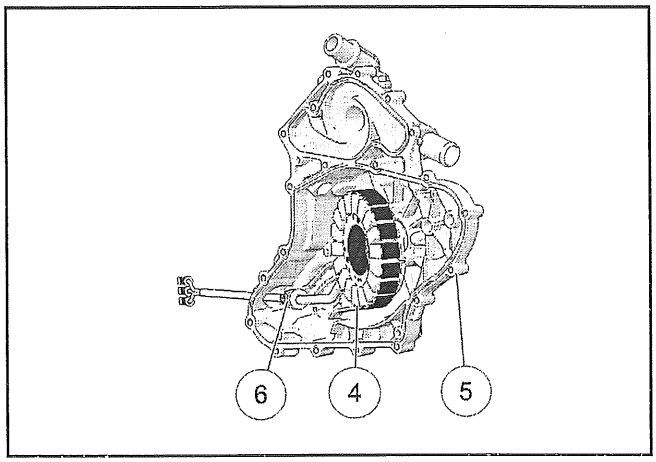
1. Remove stator cover. SeeStator Cover Removal, page 5.21.
2. Disconnect the stator connector from the regulator.
3. Using a terminal tool or pick tool, remove the three electrical terminals from the stator connector.



4. Remove fasteners ① from stator wire guide ②.



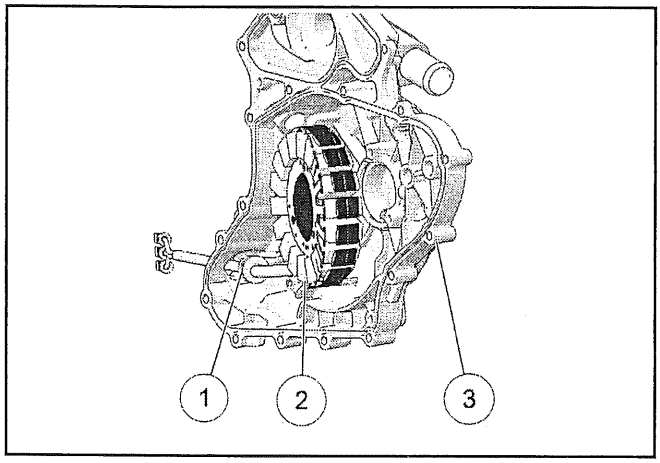
5. Remove three stator bolts ③.
6. Push the rubber harness seal ⑥ to inside of stator cover ⑤. Remove stator assembly ④.



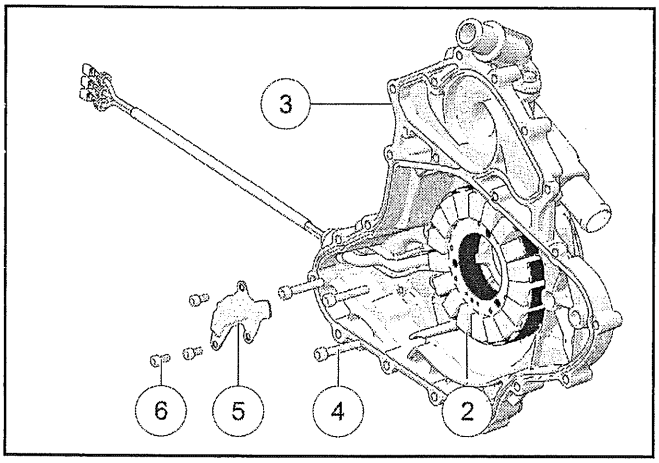
STATOR INSTALLATION

The electrical connector must be removed from the stator assembly before it can be installed in the motorcycle. See Stator Removal, page 10.31 for information on connector removal.

1. Feed the stator wires through the hole and seat the rubber harness seal ① in cover.
2. Position the stator ② inside the stator cover ③.



3. Install stator screws ④ and torque to specification.



TORQUE

Stator Mounting Fasteners to Cover:
88 in-lbs (10 Nm)

4. Install the stator wire clip ⑤ and fasteners ⑥. Torque fasteners to specification.

TORQUE

Stator Clip Fasteners:
71 in-lbs (8 Nm)

5. Insert wire terminals into stator connector housing. Note: Verify there is an audible "click" and the wires cannot be backed out.

NOTE

Wires can be installed into any position on the electrical connector. Charging performance will not be affected.

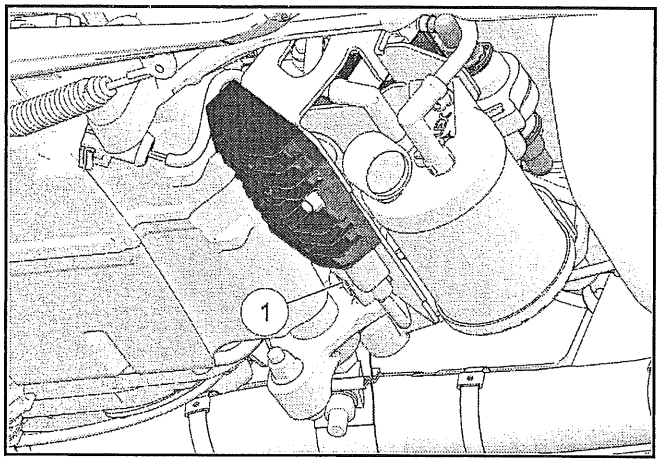
6. Connect the stator connector to the regulator / rectifier.
7. Install the stator cover. See Stator Cover Installation, page 5.21

FLYWHEEL REMOVAL

See Flywheel Removal, page 5.22.

RECTIFIER / REGULATOR CONNECTOR INSPECTION

1. Remove the regulator / rectifier assembly. See Rectifier / Regulator Replacement, page 10.33.
2. Disconnect both 2-pin and 3-pin connectors ①.



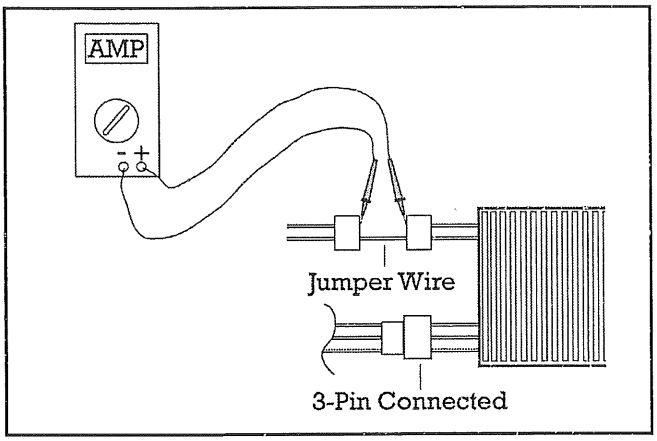
3. Inspect pins in the 3-pin and 2-pin connectors carefully. Check for corrosion, loose pins, poor connections, or evidence of overheating or other damage.
4. If the wiring and connectors are undamaged and appear to be clean and tight, inspect the battery, stator, and related wiring. Test the regulator / rectifier for diode leakage.

DIODE LEAKAGE TEST

NOTE

Engine must be OFF. Perform this test at the regulator / rectifier 2-Pin connector. Testing at any other point (between battery and battery cable for example) could include leakage not attributable to the Regulator / Rectifier unit.

1. Disconnect the 2-pin connector at voltage regulator / rectifier unit.
2. Install a jumper across the connectors as shown for the Bk wire to provide a complete ground path.
3. Connect meter as shown, with red (+) meter lead to the RD / BK wire on harness side, and the black meter lead to the RD / BK wire on the regulator / rectifier side.



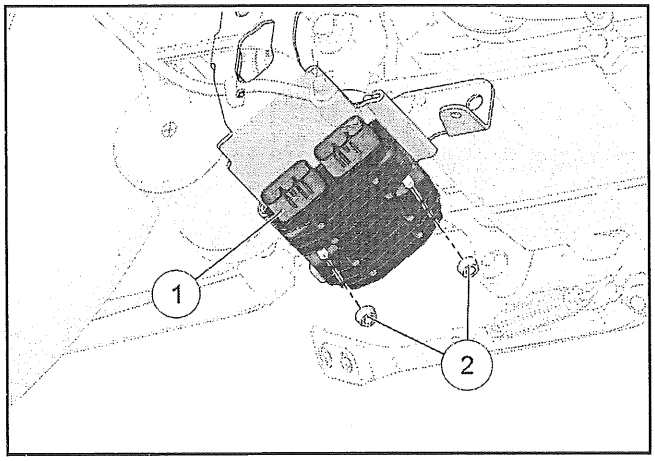
4. Compare leakage to specification below.

   Specification:

   Leakage: Less than 1.0 mA

REGULATOR / RECTIFIER REPLACEMENT

1. Disconnect the electrical connectors from the regulator / rectifier ①.



2. Remove the two nuts ② securing the regulator / rectifier to the bracket.
3. **INSTALLATION is performed by reversing the removal procedure.**
4. Torque the regulator / rectifier nuts to specification.

TORQUE
Regulator / Rectifier Nuts: **84 in-lbs (9.5 Nm)**

10

IGNITION SYSTEM

GENERAL INFORMATION

SERVICE NOTES

There are many hazards present when working on or around the ignition system. Read and pay close attention to the following warnings and cautions when working on any component in this section.

⚠ WARNING

Never run an engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas that can cause loss of consciousness and may lead to death. If you must run the engine to do some repairs, do so in an open area or with an exhaust evacuation system operating.

⚠ WARNING

The engine and exhaust system become very hot during operation and remain hot for a period of time after the engine is shut off. Wear insulated protection for hands and arms or wait until the engine and exhaust system have cooled before working on the machine.

CAUTION

Some procedures call for the engine to be run in order to warm the engine to operating temperature. If this is done the exhaust pipes can "blue" if a cooling air stream is not provided by means of a shop fan directed the exhaust system.

CAUTION

Parts containing semi-conductors can be easily damaged if handled carelessly. Do not drop or subject the electronic components to shock loads.

CAUTION

Follow the instructions closely when troubleshooting items in this section. Some electrical components can be damaged if they are connected or disconnected while the ignition is powered ON and current is present.

CAUTION

Using incorrect heat range spark plugs can damage the engine. Always follow the manufacturer's recommendations for spark plug heat range.

GENERAL PRECAUTIONS

- This ignition system is controlled electronically and no provisions are available to inspect or change ignition timing. A timing light is still valuable as a diagnostic tool.
- Poor connections are the most common cause of ignition problems. Inspect all connections and replace the spark plugs before doing extensive ignition system troubleshooting.
- Make sure the battery is fully charged and that the charging system is operating correctly.
- A signal from the Crankshaft Position Sensor must be present at the ECM for spark to occur.

SPECIAL TOOLS

SPECIAL TOOL	PART NUMBER
Electrical Tester Kit	PV-43526
Digital Multimeter	Commercially Available
Inductive Timing Light	Commercially Available

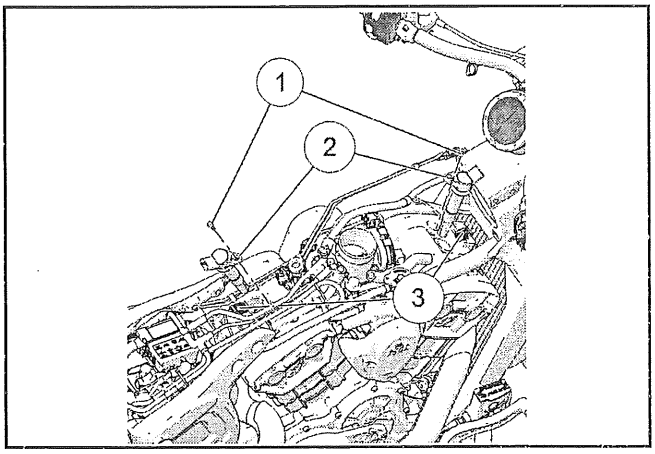
SERVICE SPECIFICATIONS

ITEM		SPECIFICATIONS
Spark Plug		NGK MR7F
Spark Plug Gap		0.030 in (0.80 mm)
Ignition Switch/ Cables Resistance Values	Primary	0.6 - 0.8 Ohms ± 20%
	Secondary	N/A
Crank Position Sensor Resistance		860 Ohms ± 10% @ 68°F (20°C)
* Spark plug end caps are not removable		

IGNITION SYSTEM SERVICE

IGNITION COIL REMOVAL / INSTALLATION

1. Place the IGNITION and RUN / STOP switch in the OFF/STOP position.
2. Remove the seat. See Seat Removal / Installation, page 7.8.
3. Remove the fuel tank. See Fuel Tank Removal, page 4.14.
4. Remove air box. SeeAir Box Removal, page 3.4.
5. Remove the ignition coil fastener ①.



6. Remove the ignition coil electrical connector ③ and lift the ignition coil ② out of the cylinder head.
7. **INSTALLATION of the ignition coil is performed by reversing the removal procedure. Torque fasteners to specification.**

TORQUE
Ignition Coil Fastener: **96 in-lbs (11 Nm)**

TROUBLESHOOTING

BASICS

Before troubleshooting the ignition system, ensure that the engine STOP/RUN switch is in the RUN position, the battery is fully charged, and system related fuses are not open (blown). Check visually for corroded, loose, or broken connections in critical areas (e. g. sensor connector). Check for loose wire pins in the individual sensor connectors and at the ECM (mounted on right side of the battery box).

Don't forget the spark plugs!

The Ignition System Troubleshooting flow chart (and the accompanying text) is designed to help you troubleshoot ignition system problems. It will not lead you to faulty or fouled spark plugs. Always inspect spark plug condition *first* (and replace if necessary) when troubleshooting ignition system problems.

Be sure that the spark plugs are the correct heat range and are the correct size specification.

⚠ WARNING

Extremely high voltage is present in the ignition system. Do not touch the ignition coils or spark plugs during test procedures.

TEST LEAD ADAPTER KIT

1. Tests in this section may include the testing of voltage and / or resistance at the connectors for various sensor and system components. Use the appropriate test adapter lead when performing these tests at connector pin(s).
2. Forcing an incorrect or oversized probe into a connector may cause inaccurate test results (due to lack of a solid mechanical connection to the terminal). It can also damage the connector being probed or the connector housing, creating another problem which greatly complicates the diagnostic process. Extreme care must be taken not to introduce problems while probing a connector.

Electrical Tester Kit: PV-43526

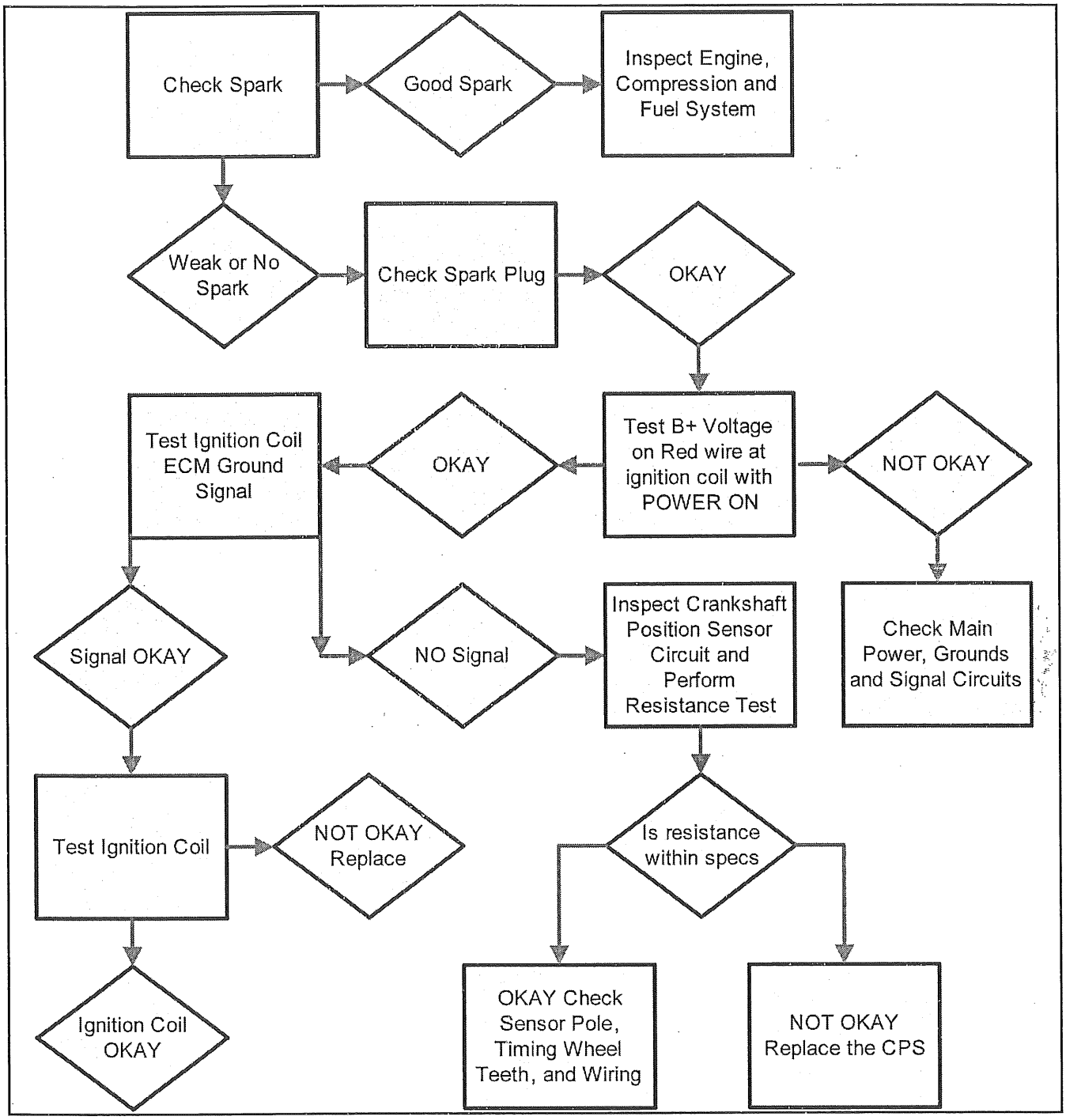
CAUTION

Once the ECM connector has been disconnected, do not touch the pins on the ECM. Static electricity from your body can damage the ECM. Do not attempt to perform tests on the ECM.

ECM CONNECTOR MAP

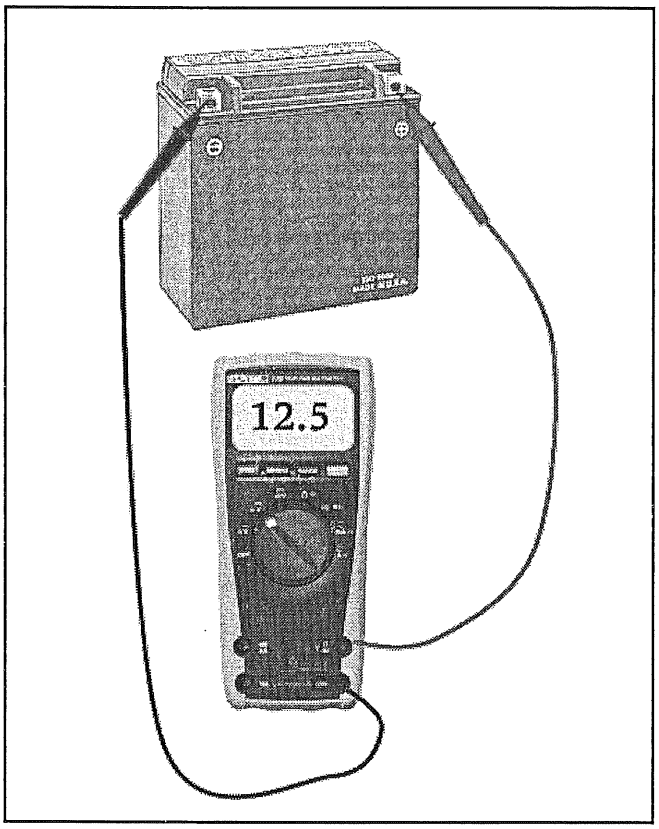
See ECM Connector MAP, page 4.25.

IGNITION SYSTEM TEST FLOWCHART



BATTERY VOLTAGE INSPECTION TEST 1

1. Remove the seat. See Seat Removal / Installation, page 7.8.
2. Set multimeter to measure DC Volts.
3. Inspect battery voltage.



4. If the battery voltage is below 12.5 V DC charge or replace the battery with a fully charged battery.

NOTE

When operating the starter with a low battery, the voltage available for the ignition coils can drop below the minimum required to produce spark.

SPARK INSPECTION TEST 2

1. Remove ignition coil(s). See Ignition Coil Removal / Installation, page 10.35.
2. Install secondary ignition cable test adapter (commercially available) between coil (s) and spark plug(s).
3. Connect timing light to secondary ignition cable test adapter.
4. Turn ignition key ON to power up the motorcycle and place the STOP/RUN switch in the RUN position.
5. Shift transmission into neutral and pull in clutch lever.
6. Depress starter button and observe timing light.
7. Determine if timing light flashes without interruption for both cylinders.
8. Consistent flashes indicate that some secondary voltage is present. The likelihood of an ignition related problem is reduced but not eliminated. Keep the following points in mind:

- There is a threshold voltage and amperage requirement for timing lights below which they will not trigger and therefore, not flash.
- Fouled spark plugs may drop secondary voltage so low that a timing light will not trigger and therefore, not flash.
- With no current flowing (open secondary side of the ignition coil) the timing light will not flash.
- A faulty high tension circuit or poor connection is one example of an open secondary.

9. Replace spark plugs, connect plug wires and re-test.
10. If timing light does not flash consistently for one or both cylinders, test ignition coil (Test 3).

IGNITION COIL POWER / GROUND SIGNAL TEST 3

Power To Ignition Coil

Battery voltage must be present at the ignition coil (Pin B) when the power button is switched on and the electrical system powered up.

1. Disconnect the electrical connector from the ignition coil. See Ignition Coil Removal / Installation, page 10.35.
2. Set the multimeter to measure VDC and insert the meter leads into the appropriate jacks.
3. Connect the black lead to ground (on the engine).
4. Connect a small thin test adapter lead to terminal 1 of the ignition coil primary connector and the red meter lead to the test adapter.
5. Turn ignition key ON to power up the motorcycle electrical system and place the STOP/RUN switch in the RUN position.
6. Battery voltage should appear on terminal 1 of the coil connector (RD wire).
7. With transmission in Neutral, crank the engine. Battery voltage should again be present on center wire.

Ignition Coil Ground Signal

The following steps will test the ECM (Ground) Signal To Ignition Coil

ECM ground signal must be present at terminal 3 of the ignition coil primary harness connector. The signal will appear as a pulse on the meter between Ground (-) and Open (OL).

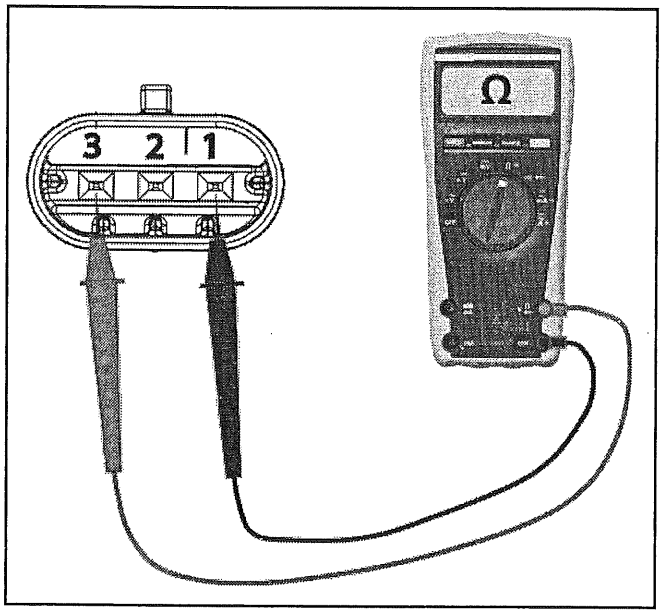
8. Set the multimeter to measure resistance (Ω).
9. Place a small thin test adapter into terminal 3 of the ignition coil connector (the WH wire) and connect one meter lead to the test adapter..
10. Ground the other lead to the engine.
11. Place transmission in Neutral.
12. Turn the ignition key ON to power up the motorcycle electrical system and place the STOP/RUN switch in the RUN position.
13. Crank the engine with the electric starter and watch the display on the multi meter. The meter display should pulse evenly while engine is cranking, indicating a ground signal is present.
14. Repeat the test on the other outside wire in the connector.

- If no pulse is present, test the Crankshaft Position Sensor.
- If the signal is present on one wire and not the other, test related wiring and connections.
- If both signals are present and there was battery voltage on the RD wire (center terminal) but still no spark, test the ignition coil windings. (Test 5).

IGNITION COIL RESISTANCE TEST 4

Ignition Coil Primary Winding

1. Remove ignition coil. See Ignition Coil Removal / Installation, page 10.35
2. Set the multi meter to measure resistance (Ω) and insert the meter leads into the appropriate jacks.
3. Measure resistance between terminal ① and terminal ③ on the coil. Compare to specification.



Primary Coil Resistance: 0.6 - 0.8 Ω

CRANKSHAFT POSITION SENSOR (CPS) RESISTANCE INSPECTION:

See CPS Test / Replace, page 4.38.

CHASSIS ELECTRICAL

GENERAL INFORMATION

SERVICE NOTES

Keep the following notes in mind when diagnosing an electrical problem:

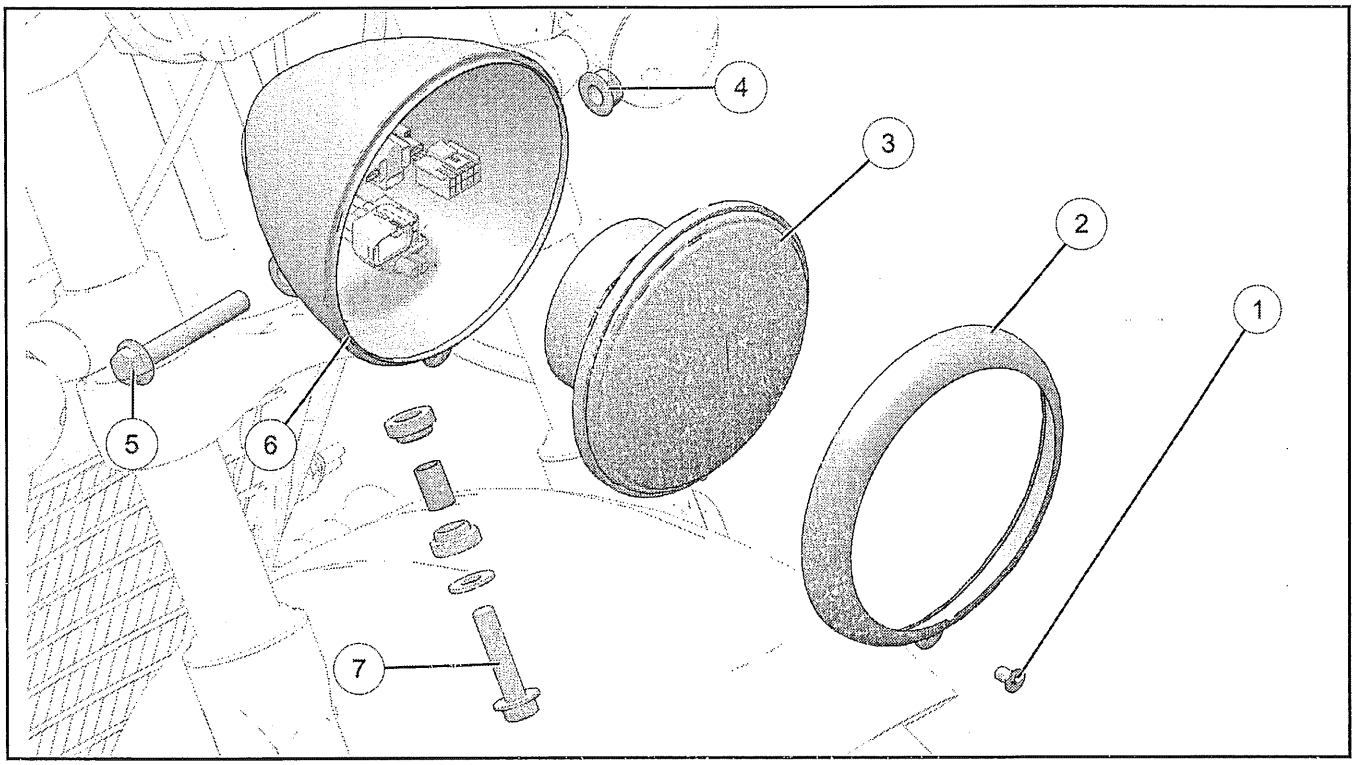
- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a resistance value under 10 Ohms, remember to subtract meter lead resistance from the reading. Connect the leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.
- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10 A jack for current readings). Refer to the Owner's Manual included with your meter for more information.
- Pay attention to the prefix on the multi-meter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate the component to be tested. Disconnect it from the wiring harness or power supply.

SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Battery Tester	PV-50296
Electrical Tester Kit	PV-43526
Smartlink Module Kit	PU-47471
USB to Serial Adapter	PU-50621

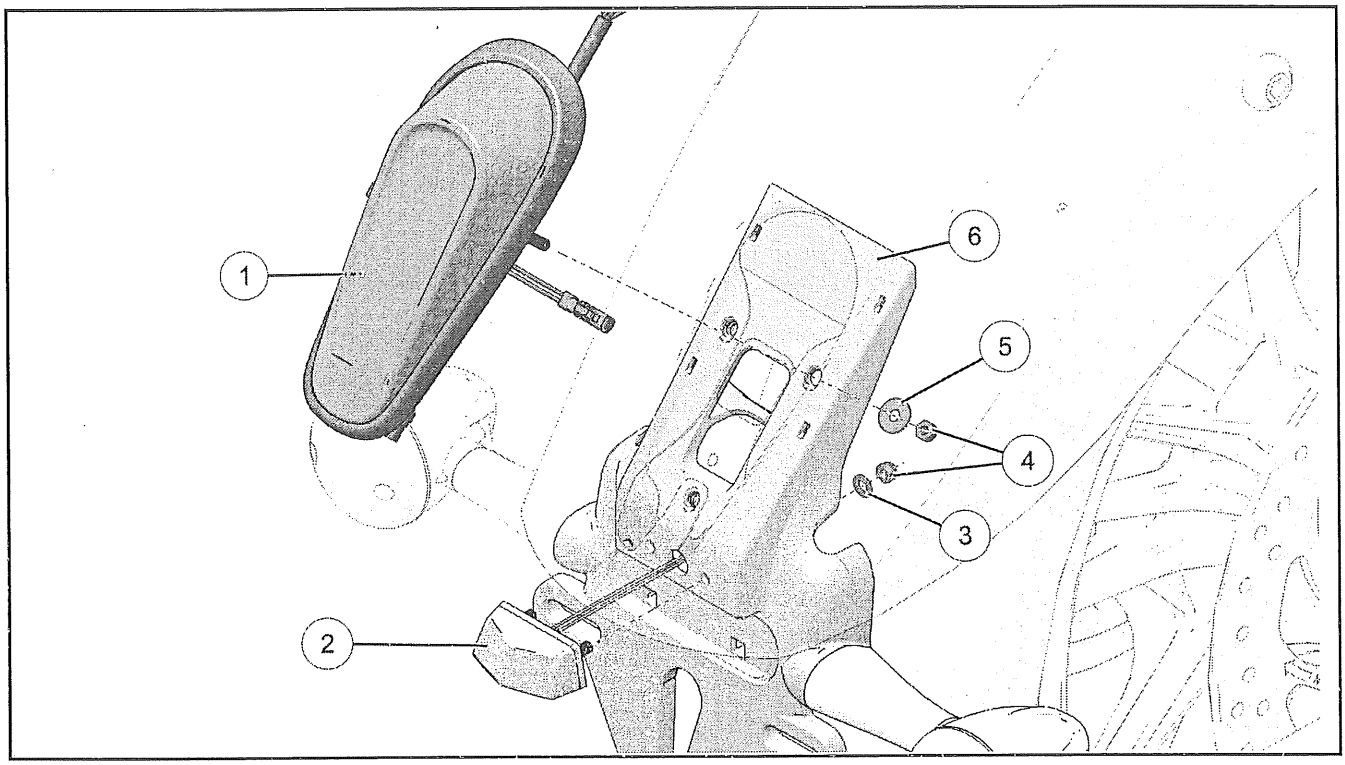
ASSEMBLY VIEWS

HEAD LIGHT COMPONENTS



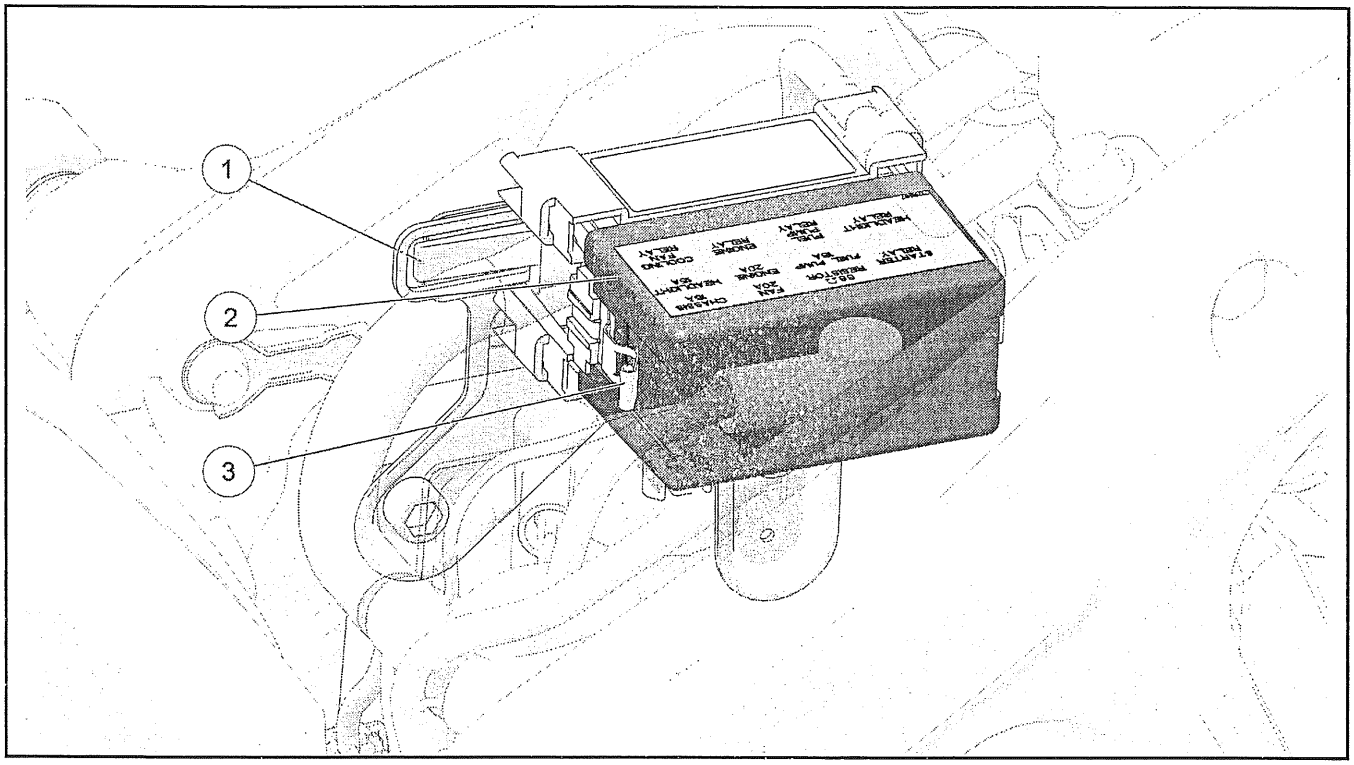
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Head Light Retaining Ring Fastener	**36 in-lbs (4 Nm)**
②	Head Light Retaining Ring	-
③	Head Light	-
④	Nut	-
⑤	Head Light Mount Pivot Fastener (Adjuster)	**35 ft-lbs (47 Nm)**
⑥	Headlight Bucket	-
⑦	Head Light to Lower Triple Mount Fastener	**18 ft-lbs (24 Nm)**

TAIL LIGHT / LICENSE PLATE LIGHT COMPONENTS



NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Taillight	-
②	License Plate Lamp	-
③	Washer (QTY. 2)	-
④	Tail Light Nut (QTY. 5)	**36 in-lbs (4 Nm)**
⑤	Washer (QTY. 3)	-
⑥	License Plate Bracket	-

FUSE BOX



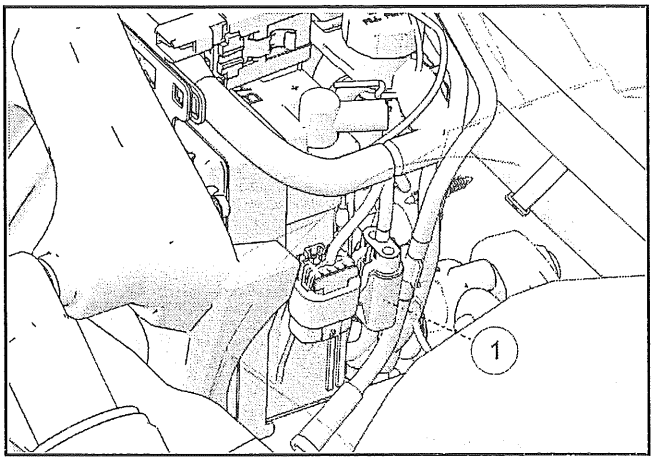
NUMBER	DESCRIPTION	TORQUE (IF APPLICABLE)
①	Fuse Box Mounting Tab	-
②	Fuse Box Cover	-
③	Fuse Box Cover Latch	-

FUSE BOX

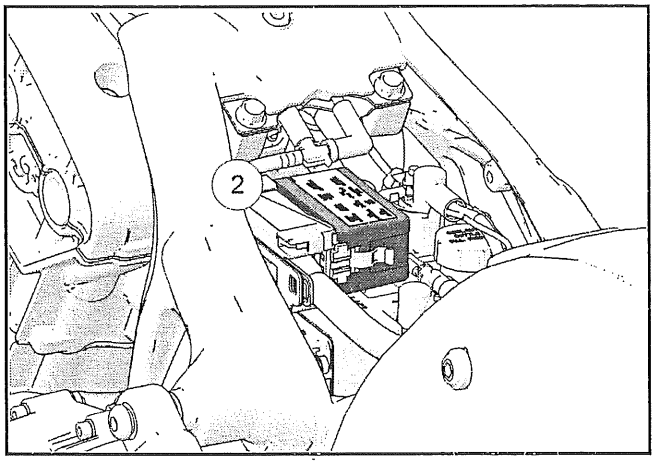
FUSE BOX LOCATION

There are two fuse locations on the motorcycle

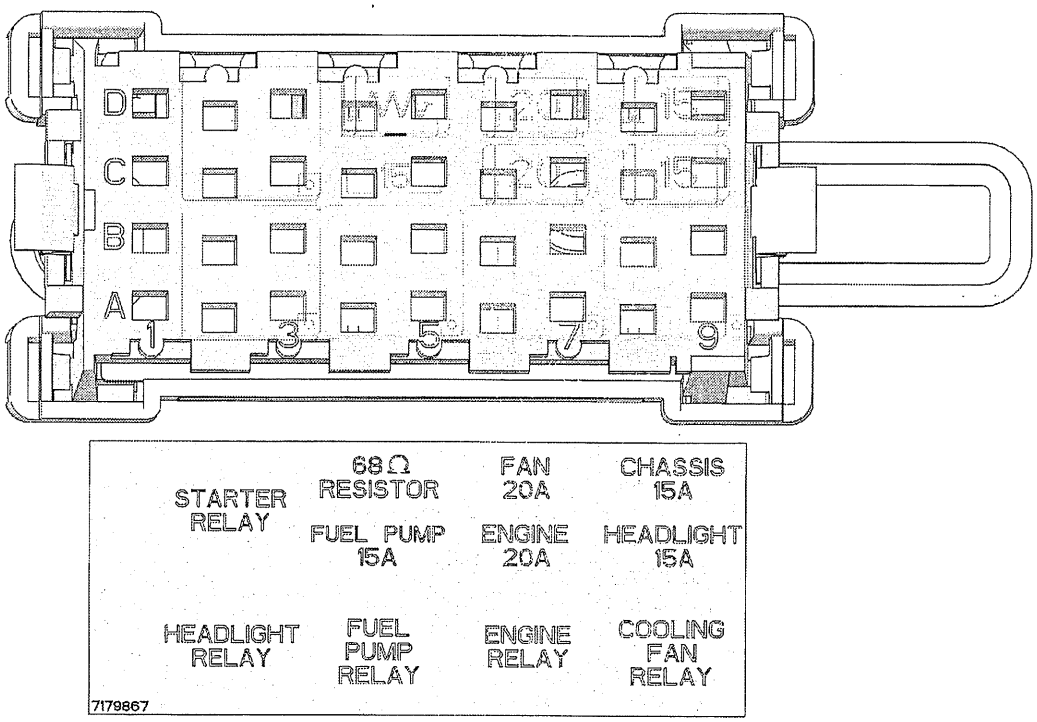
- The main fuse holder ① is located on the rear of the battery box.



- The main fuse box ② is located beneath the seat.



FUSE APPLICATION CHART



PIN	CIRCUIT DESCRIPTION	FROM	TO
A1	Not Used	-	-
A2	Headlight Relay Output	Fuse Box	LH Control
A3	Headlight Relay Coil Power	Fuse Box	Splice (IGNSW)
A4	Fuel Pump / Ignition Coil Relay Output	Fuse Box	Splice (FPPWR)
A5	Fuel Pump Relay Coil Power	Fuse Box	Splice (ENGPWR)
A6	Engine Relay Output Power	Fuse Box	Splice (ENGPWR)
A7	Engine Relay Coil Power	Fuse Box	Splice (ENGBRK)
A8	Cooling Fan Relay Output	Fuse Box	Cooling Fan
A9	Fan Relay Coil Power	Fuse Box	Splice (IGNSW)
B1	Not Used	-	-
B2	Headlight Relay Control	ECM 1	Fuse Box
B3	Headlight Circuit Breaker Output	Fuse Box C8	Fuse Box B3
B4	Fuel Pump Relay Control	ECM 1	Fuse Box B4
B5	Fuel Pump / Coil Fuse Output	Fuse Box C4	Fuse Box B5
B6	Engine Relay Control	ECM1	Fuse Box B6
B7	Engine Relay Power Input	Fuse Box B7	Splice (ENGBRK)
B8	Cooling Fan Relay Control	ECM 1	Fuse Box B8

PIN	CIRCUIT DESCRIPTION	FROM	TO
B9	Cooling Fan Circuit Breaker Power	Fuse Box D6	Fuse Box B9
C1	Not Used	-	-
C2	Starter Relay Output Power	Fuse Box C2	Start Solenoid
C3	Starter Relay Coil Power	Fuse Box C3	Splice (IGNSW)
C4	Fuel Pump / Coil Fuse Output	Fuse Box Bus 1B (Main Fuse)	Fuse Box C4
C5	Fuel Pump / Coil Fuse Input	Main Fuse	Fuse Box C5
C6	Engine Breaker Output	Fuse Box C6	Splice (ENGBRK1)
C7	Engine Breaker Input	Fuse Box C7	Splice (MFUSE)
C8	Headlight Circuit Breaker Output	Fuse Box C8	Fuse Box B3
C9	Fusebox Bus D Input	Fuse Box C9	Splice (MFUSE)
D1	Not Used	-	-
D2	Starter Solenoid Relay Control	ECM 1 (E141)	D2
D3	Starter Relay Input Power	D3	Splice (ENGBRK)
D4	Fuel Sender Resistor Output	Fuse Box D4	Splice (FUELSEND)
D5	Fuel Sender Resistor Power	Fuse Box D5	Splice (ACCR)
D6	Cooling Fan Circuit Breaker Output	Fuse Box D6	Fuse Box B9
D7	Cooling Fan Circuit Breaker Input	Splice (MFUSE)	Fuse Box D7
D8	Ignition Breaker Output	Fuse Box D8	Splice (IGNBRK)
D9	Fuse Box BUS D Input	Fuse Box D9	Splice (MFUSE)

LOAD / TIPOVER MODULE

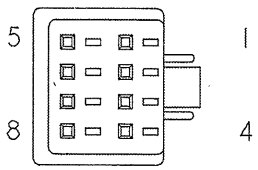
LOAD / TIP OVER MODULE CONNECTOR MAP

LOAD / TIP OVER MODULE

CONNECTOR
PIN REFERENCE

CONNECTOR #1

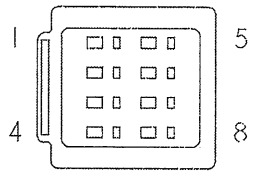
FRONT
VIEW

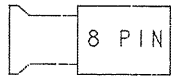


08R-JWPF-VSLE-D
RECEPTACLE HOUSING

CONNECTOR #2

FRONT
VIEW

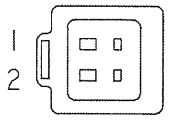


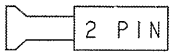


08T-JWPF-VSLE-D
TAB HOUSING

CONNECTOR #3

FRONT
VIEW





02T-JWPF-VSLE-S
TAB HOUSING

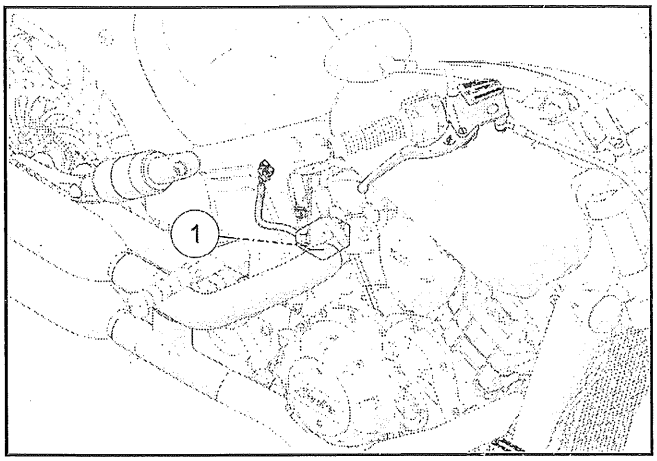
CONNECTOR PIN OUT

CONNECTOR PINOUT	FUNCTION	PCB PIN OUT	WIRE COLOR
CONNECTOR #1 8 WAY 08R-JWPF-VSLE-D			
1	START SWITCH IN (TO LOAD MOD)	1-1	TAN
2	CLUTCH SWITCH IN (TO LOAD MOD)	1-2	GREEN
3	LEFT TURN SIGNAL SWITCH IN (TO LOAD MOD)	1-3	BLUE
4	RIGHT TURN SIGNAL SWITCH IN (TO LOAD MOD)	1-4	PURPLE
5	FRONT BRAKE SWITCH IN (TO LOAD MOD)	2-1	PINK
6	REAR BRAKE PRESSURE SWITCH IN (TO LOAD MOD)	2-2	BROWN
7	NEUTRAL SWITCH IN (TO LOAD MOD)	2-3	ORANGE
8	TIP-OVER SENSOR SIGNAL RETURN (GROUND)	3-2	BLACK
CONNECTOR #2 8 WAY 08T-JWPF-VSLE-D			
1	START SWITCH OUTPUT (TO ECM)	1-5	TAN
2	CLUTCH SWITCH OUTPUT (TO ECM)	1-6	GREEN
3	LEFT TURN SIGNAL SWITCH OUTPUT (TO ECM)	1-7	BLUE
4	RIGHT TURN SIGNAL SWITCH OUTPUT (TO ECM)	1-8	PURPLE
5	FRONT BRAKE SWITCH OUTPUT (TO ECM)	2-4	PINK
6	REAR BRAKE PRESSURE SWITCH OUTPUT (TO ECM)	2-5	BROWN
7	NEUTRAL SWITCH OUTPUT (TO ECM)	2-6	ORANGE
8	TIP-OVER SENSOR (TOS) SIGNAL	3-3	WHITE
CONNECTOR #3 2 WAY 02T-JWPF-VSLE-S			
1	12+V SWITCHED LOAD MODULE POWER	3-1	YELLOW
2	TIP-OVER SENSOR +5V REF	3-4	RED

LOAD TIP OVER MODULE REMOVAL AND INSTALLATION

CAUTION

The negative battery cable MUST be disconnected before the Load / Tip Over Module can be removed.



1. Remove seat. See Seat Removal / Installation, page 7.8.
2. Remove the battery box. See Battery Box Removal, page .
3. Disconnect the three electrical multi-plugs ① from the load / tip over module and remove module.
4. **INSTALLATION is performed by reversing the removal procedure.**
5. Torque load /tipover module mounting fasteners to specification.

TORQUE

Load / Tip Over Module Mounting Fasteners:
96 in-lbs (11 Nm)

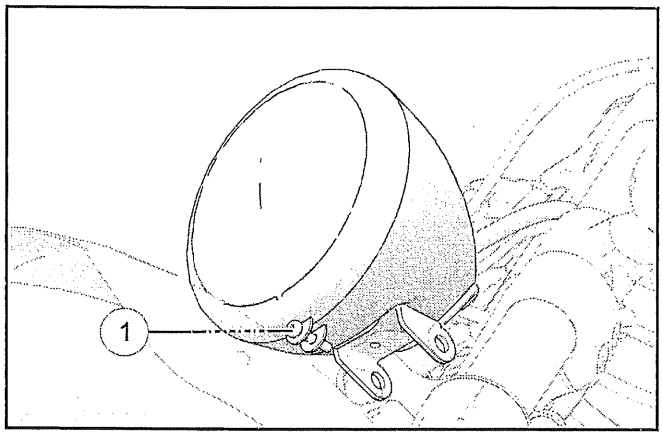
HEADLIGHT SERVICE

HEAD LIGHT BULB REPLACEMENT

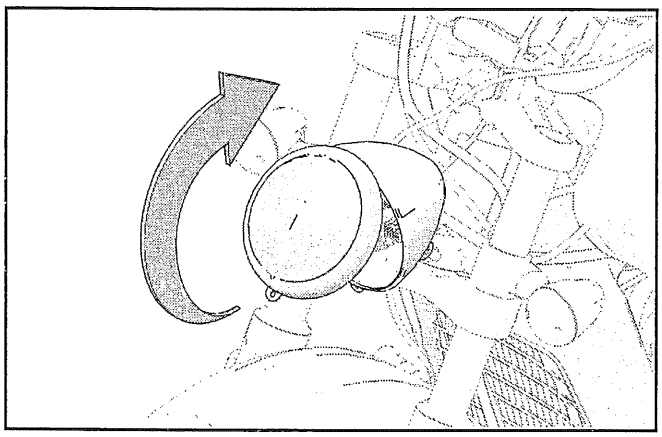
IMPORTANT

Avoid touching a halogen bulb with bare fingers. Oil from your skin leaves a residue, causing a hot spot that will shorten the life of the bulb. If a bulb is touched, clean it thoroughly with denatured alcohol.

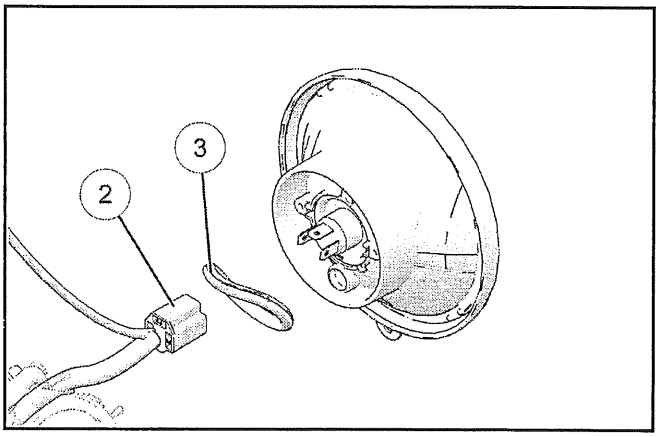
1. Remove headlight retaining screw ①.



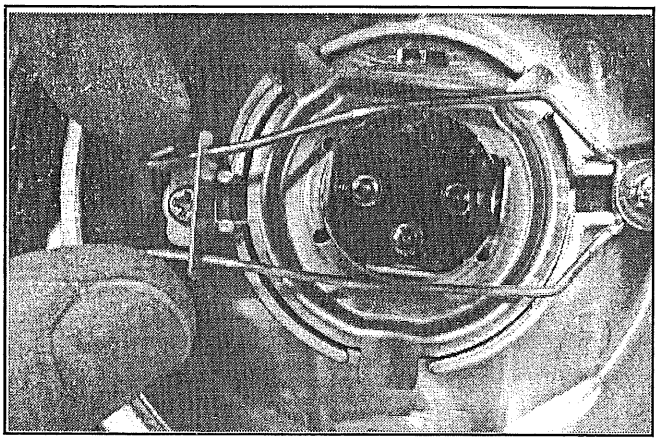
2. Lift headlight upward to remove from base.



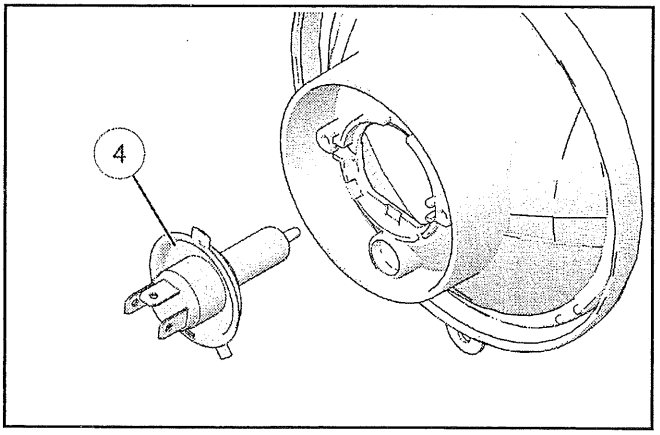
3. Disconnect wire harness ② and move rubber grommet ③ to allow access to headlight bulb.



4. Squeeze bulb retainer and move pins out of way of bulb.



5. Remove Bulb ④.



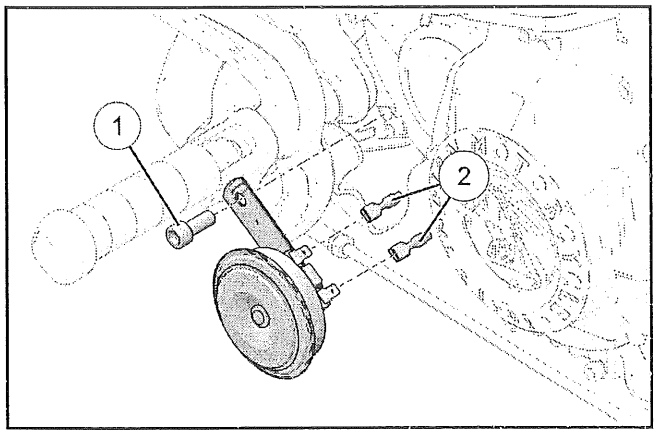
6. **INSTALLATION is performed by reversing the removal procedure.**

TORQUE
Head Light Retaining Ring Fastener: **36 in-lbs (4 Nm)**

HORN SERVICE

HORN REMOVAL / INSTALLATION

1. Remove screw ① securing the horn to the frame bracket.
2. Disconnect the horn electrical connectors ②.



3. Remove the horn.
4. **Installation is performed by reversing the removal procedure.**
5. Torque fastener to specification.

TORQUE
Horn to Frame Bracket Fastener: **84 in-lbs (9.5 Nm)**

TAIL LAMP SERVICE

LED TAIL / BRAKE LIGHT OPERATION

The multiple LED tail / brake lamp functions much like a conventional incandescent tail / brake lamp. LED lights require a regulated current supply to prevent damage, so a current regulation circuit is incorporated inside the tail lamp unit. Direct 12 volt battery power can be applied directly to the brake or tail lamp wire for testing purposes, but polarity MUST be observed or the LEDs will be permanently damaged.

Tail / Brake Light Power Supply:

When the motorcycle is powered ON, battery voltage is delivered to the TAIL / BRAKE LEDs on the BN / PINK wire from the Headlight Relay. Current through each TAIL LED (WHITE wire) is limited (inside tail lamp unit) to approximately 250 mA.

Tail / Brake Light Ground Signal:

The front and rear brake light switches provide a path to ground through the Load / Over Module to the ECM via BLACK / YELLOW wire (rear brake switch) and YELLOW / VIOLET wire (front brake switch). When the ECM receives a grounding signal from either of the brake switches, ground is provided to the tail / brake light LED, thus illuminating the light.

When the motorcycle is powered ON, the ECM provides a ground path to the tail light LED, thus illuminating the light.

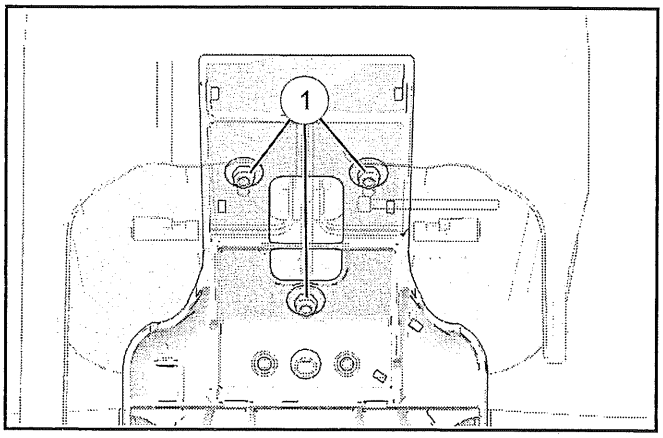
TAIL / BRAKE / LICENSE PLATE LIGHT REMOVAL / INSTALLATION

NOTE

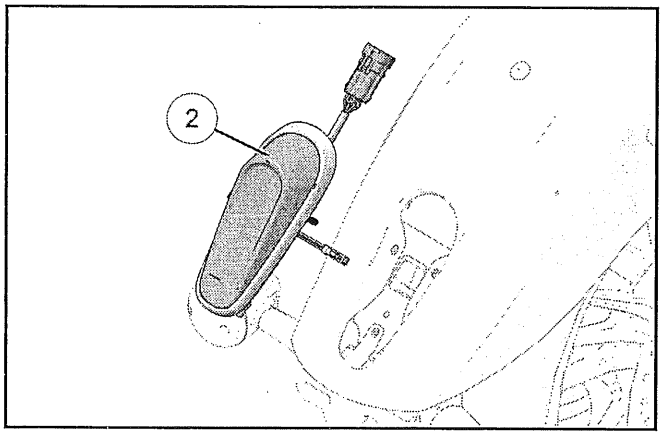
The tail and brake lights are LEDs and cannot be replaced individually. If the lights fail to function when activated, and all circuit tests indicate correct power and ground distribution, the tail /brake light must be replaced as an assembly. The license plate light can be replaced individually.

Tail / Brake Light Removal

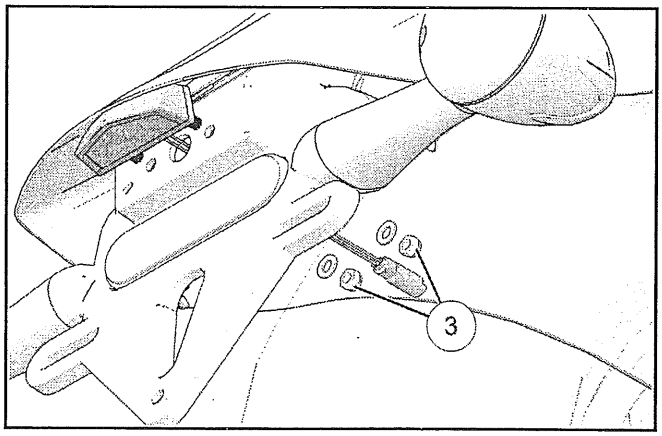
1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Working from beneath the rear fender, access the three tail light nuts ① and remove along with washers.



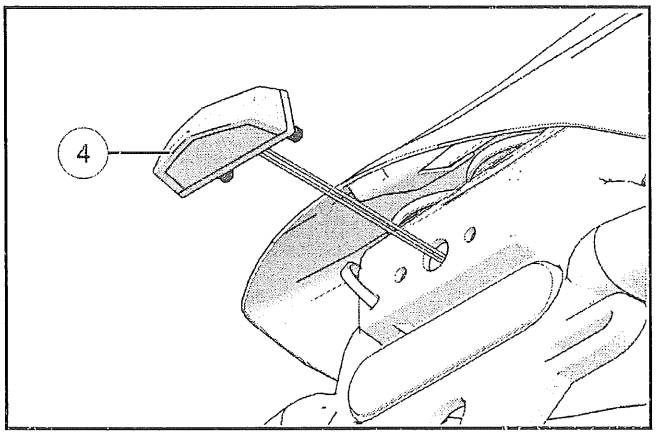
3. Lift the tail light assembly ② off of the rear fender and disconnect the electrical connectors noting their position for reassembly.



4. Remove the tail light assembly.
5. Remove nuts ③ and washers.

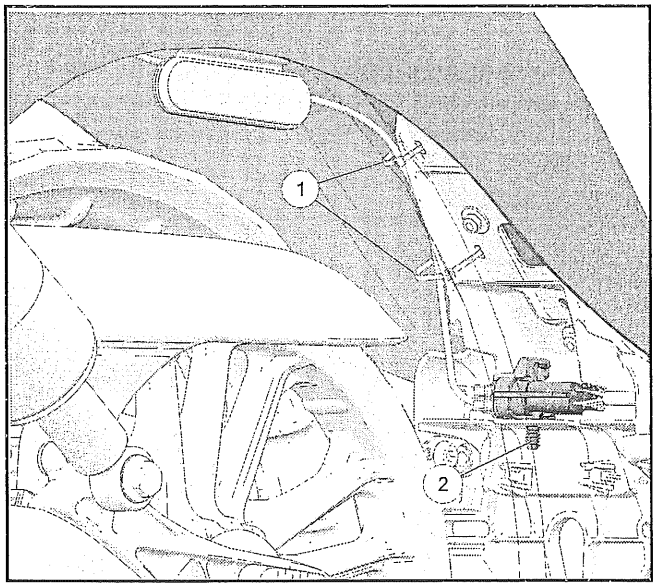


6. Remove the license plate light ④ from the license plate bracket.



Tail/Brake Light Installation

1. Install the tail light assembly.
2. Install the license plate light.
3. Verify tail lamp harness is secured with tie straps ①.
4. Verify tail lamp connector ② is positioned as illustrated.



5. Torque all fasteners to specification.

TORQUE
Tail Light Nuts: **36 in-lbs (4 Nm)**

TURN SIGNAL / HAZARD SYSTEM SERVICE

TURN SIGNAL OPERATION

Turn Signal Auto Cancel Functionality

Verify function of the following components for correct turn signal operation.

- Turn Signal Switch
- Hazard Flasher Switch
- Vehicle Speed Sensor

The Auto Cancel Turn Signal Modes

1. NORMAL MODE - Vehicle speed above 14.9 mph (24 kmh) the auto cancel software records vehicle when turn signal is activated and equates speed with a preset distance. After the preset distance is traveled the turn signal is cancelled.
2. CONTINUOUS MODE - Vehicle speed below 14.9 mph (24 kmh) the turn signals operate indefinitely until manually cancelled. This mode overrides any previous auto cancel mode.
3. 90 - DEGREE TURN MODE - Vehicle speed below 14.9 mph (24 kmh) the turn signals operate indefinitely until speed exceeds 14.9 mph (24 kmh). If vehicle speed remains above 14.9 mph (24 kmh) for approximately two complete ON-OFF flash cycles, the turn signal cancels.
4. LANE CHANGE MODE - Vehicle speed above 14.9 mph (24 kmh) by pressing and holding the turn signal switch in the desired direction for more than one ON-OFF flash cycle the turn signals will cancel immediately once the switch is released.
5. HAZARD FLASHER MODE - At any vehicle speed the hazard flashers operate indefinitely and must be manually cancelled. This mode overrides any previous auto cancel mode.

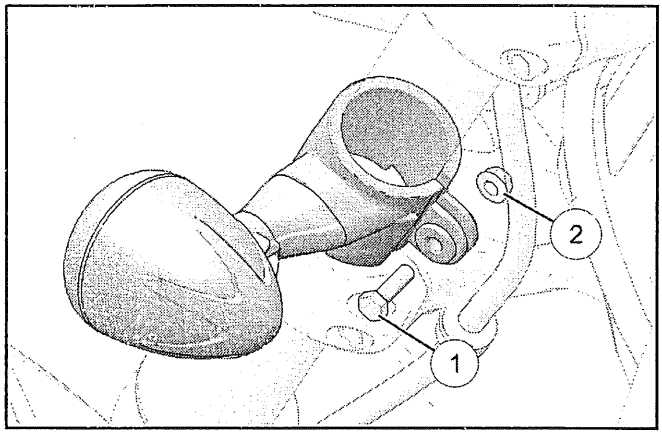
The turn signal / hazard light system does not utilize a conventional "flasher module", but instead receives a grounding signal from the ECM. Power to the turn signals is provided via the IGNITION CIRCUIT BREAKER located in the main fuse box. Turn Signal INPUTS & OUTPUTS can be located in the ECM Connector Map and Fuse Application Chart.

See ECM Connector Map, page 4.25.

See Fuse Application Chart, page 10.46.

FRONT TURN SIGNAL REMOVAL / INSTALLATION

1. Locate turn signal connectors inside the headlight and disconnect. See steps 1 and 2 of the Head Light Bulb Replacement procedure to access connectors: Headlight Bulb Replacement, page 10.50
2. Remove screw ① and nut ② to remove turn signal from front fork.

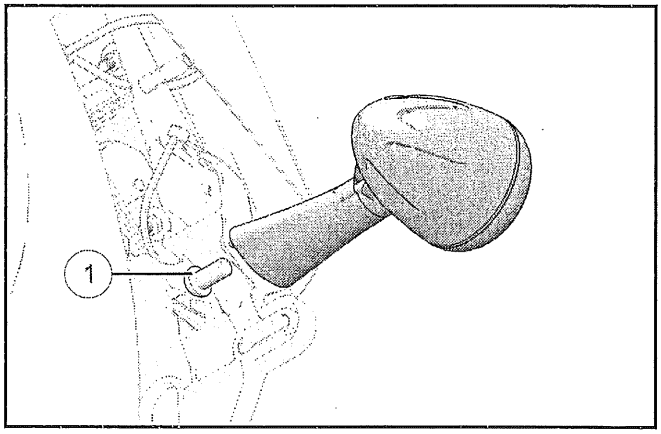


3. **Installation is performed by reversing the removal procedure. Torque all fasteners to specification.**

TORQUE
Turn Signal Fastener: **36 in-lbs (4 Nm)**

REAR TURN SIGNAL REMOVAL / INSTALLATION

1. Remove the tail light assembly. See Tail / Brake / License Plate Light Removal / Installation, page 10.52.
2. Remove bolt ①.



3. Unplug turn signal connector and withdraw the turn signal from the tail light assembly.

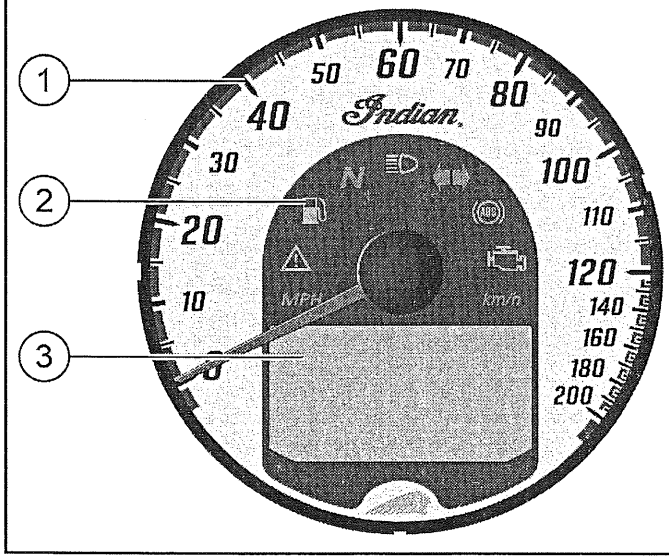
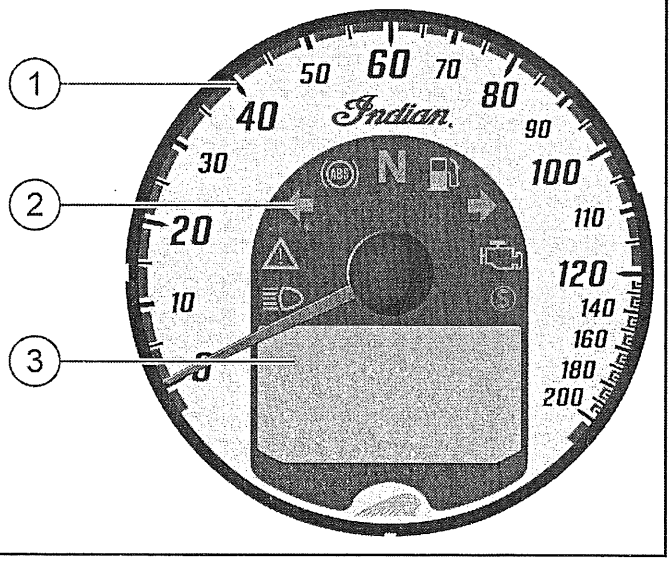
4. **Installation is performed by reversing the removal procedure. Torque all fasteners to specification.**

TORQUE
Turn Signal Fastener (rear): **36 in-lbs (4 Nm)**

INSTRUMENTATION

INSTRUMENT CLUSTER

The instrument cluster includes the speedometer, indicator lamps and Multi-Function Display (MFD).

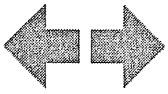
2015–16	2017
	

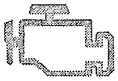
- ① Speedometer
- ② Indicator Lights
- ③ Multi-Function Display (MFD)

NOTE

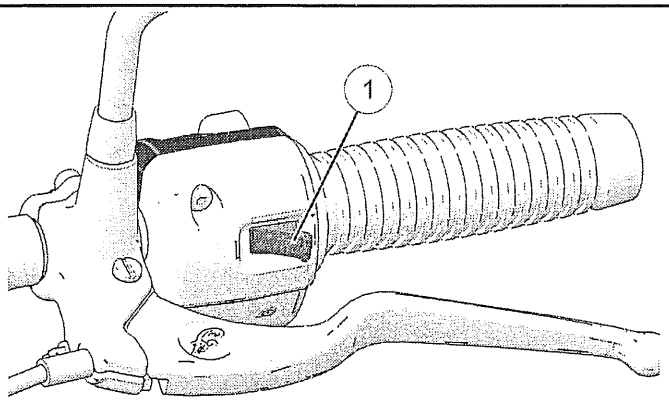
For detailed information regarding MODE selection and Multi-Function Display operation refer to the Owner's Manual.

Indicator Lights

LIGHT	INDICATES	CONDITION	MODEL YEAR
	Turn Signal	The turn signal indicator flashes when the left, right, or both turn signals (hazard) are active. *If there is a problem in the signal system, the lamps will flash at twice the normal rate.*	(2015–16)
	Low Battery Voltage / Charge Status	This lamp illuminates when battery voltage is low. Turn non-essential accessories off to conserve power. Make sure the charging system is operating properly.	(2016–17)
	Low Oil Pressure	This lamp illuminates when oil pressure drops below a safe operating pressure while the engine is running. If this lamp illuminates while the engine is running above idle speed, turn the engine off as soon as safely possible and check the oil level. *If the oil level is correct and the lamp remains on after the engine is restarted, turn the engine off immediately. See your dealer.*	

LIGHT	INDICATES	CONDITION	MODEL YEAR
	Neutral	Illuminates when the transmission is in neutral.	2015–17
	High Beam	The headlight switch is set to high beam. This indicator will flash if there is a problem with the low or high beam light.	
	Low Fuel	This indicator light appears when there are 0.5 gallons of fuel remaining in the tank.	
	Hazard Flashers	Illuminates with hazard flasher operation.	
	Check Engine	The light will remain on if the tilt sensor shuts down the engine. If abnormal sensor or engine operation is detected the light will remain on as long as the fault condition exists. Retrieve the error codes for diagnosis.	
	Anti-Lock Brakes NOT Activated	**Units with ABS ONLY:** The indicator remains on until the anti-lock system activates, which occurs when vehicle speed exceeds 6 MPH (10 km/h). When the lamp is illuminated, the anti-lock brakes will not activate, but the conventional brake system will continue to operate normally.	
Km/h	Vehicle Speed Units	When metric mode is selected, speed displays in kilometers per hour.	
MPH	Vehicle Speed Units	When standard mode is selected, speed displays in miles per hour.	
	Left Turn Signal	The turn signal indicator flashes when the left turn signal (hazard) is active. *If there is a problem in the signal system, the lamps will flash at twice the normal rate.*	(2017)
	Right Turn Signal	The turn signal indicator flashes when the right turn signal (hazard) is active. *If there is a problem in the signal system, the lamps will flash at twice the normal rate.*	
	Sidestand Indicator	Illuminates when the sidestand is in the down position.	

Multi-Function Display (MFD) The power switch must be ON to access the MFD. Use the mode switches to toggle through the modes of the MFD and to change settings in the display. The LH mode switch ① is located on the backside of the LH switch cube.



MODES AVAILABLE	
Odometer	Engine Speed
Trip Odometer 1	Clock
Trip Odometer 2	DC Voltage
Gear Indicator	

Odometer

The odometer displays total distance traveled.

Trip Odometers

The trip odometers (Trip 1 and Trip 2) display total distance traveled since being reset. To reset a trip odometer, toggle to the trip odometer, then press and hold the LEFT-TOGGLE switch until the trip odometer resets to zero.

Engine Speed

Engine Speed displays in revolution per minute (RPM).

DC Voltage

The volt meter displays battery voltage. If the engine is not running, approximate *battery* voltage displays. If the engine is running, approximate *charging* voltage displays.

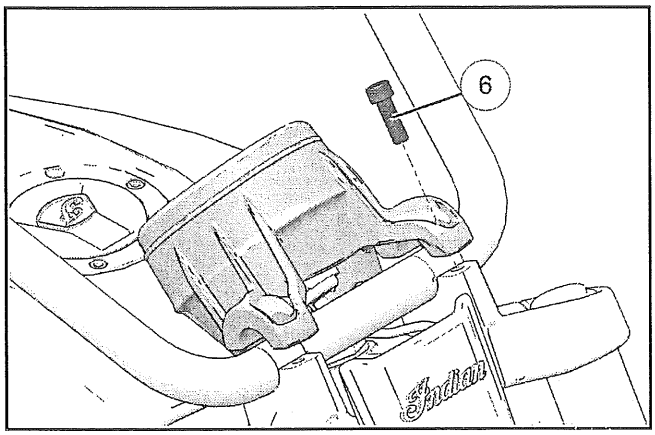
Gear Position

Gear position displays at all times while the engine is running, unless a fault occurs with the gear position sensor.

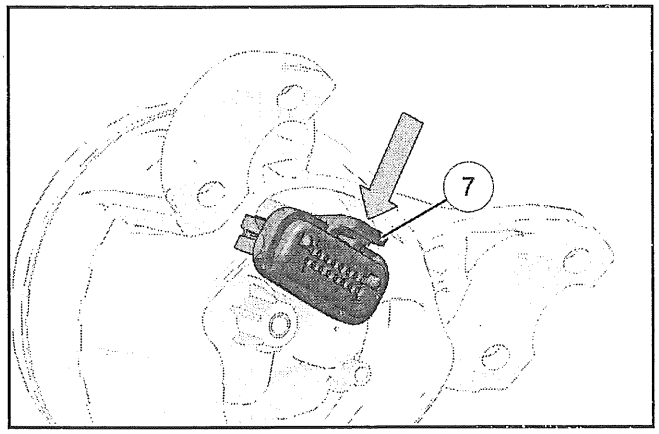
Polaris Industries Inc.

INSTRUMENT CLUSTER REMOVAL / INSTALLATION

1. Remove four speedometer screws ⑥.



2. Press tab ⑦ down to remove the connector from speedometer.



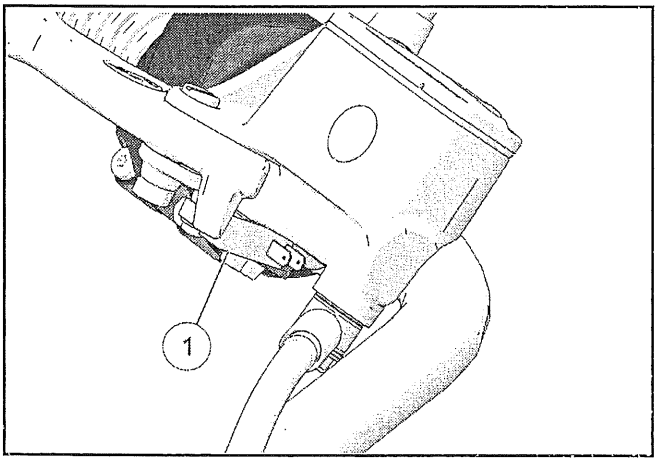
3. Installation is performed by reversing the removal procedure.

TORQUE
Instrument Cluster Mount Screws: **22 ft-lbs (30 Nm)**

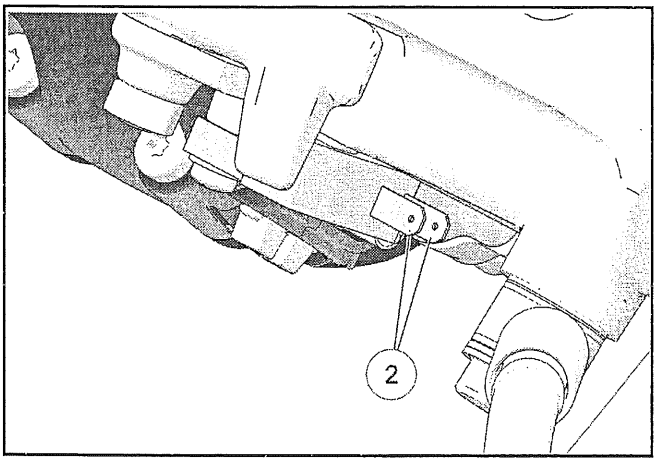
SWITCH TESTING

BRAKE LIGHT SWITCH TEST

1. Place the motorcycle in an upright position with front wheel clamped in a wheel vise.
2. Locate the brake light switch connector ① on the right control and disconnect.



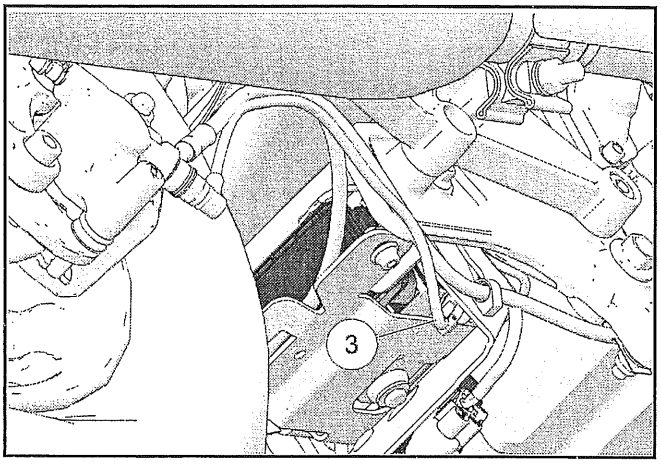
3. Set multi meter to measure resistance.
4. Connect meter leads to each terminal of the front brake switch ②.



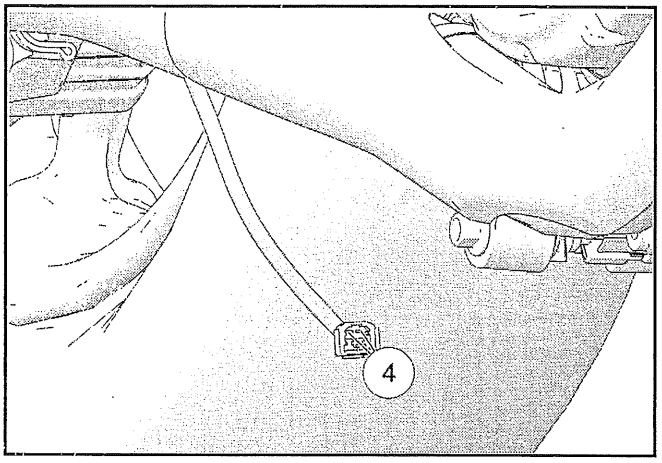
5. Apply the front brake.

Resistance Specification: **Continuity with lever depressed**

6. Locate the rear brake light switch connector ③.



7. Connect meter leads to each terminal of the rear brake switch connector ④.

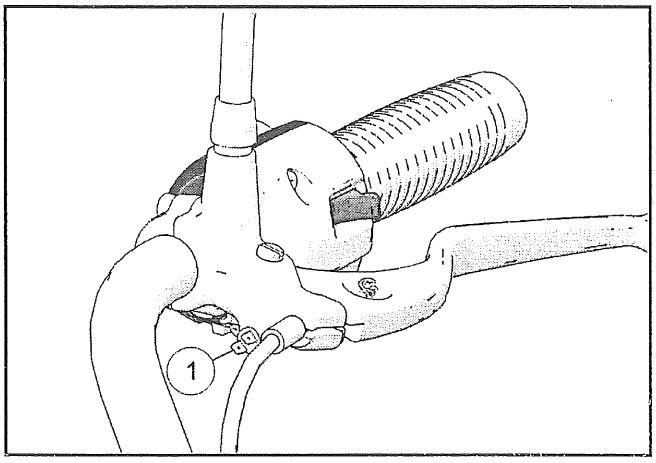


8. Apply the rear brake.

Resistance Specification: **Continuity with pedal depressed**

CLUTCH SWITCH TEST

1. Disconnect clutch switch ① electrical 2 - pin connector.



2. Measure the resistance of the switch with lever pulled to handlebar (less than 1 Ohm resistance) and with lever released (OL).

SIDE STAND SWITCH TEST

1. Inspect side stand. Be sure that when the side stand is fully retracted (UP) that the switch plunger is extended and that when the side stand is extended (down) the plunger is depressed.
2. Remove the voltage regulator bracket to access the side stand switch connector and disconnect. See Regulator / Rectifier Replacement, page 10.33.
3. Set multi meter to measure resistance and insert meter leads into appropriate jacks.
4. Place one meter lead onto each of the side stand switch terminal pins.
5. Read resistance with the side stand switch plunger depressed and extended.

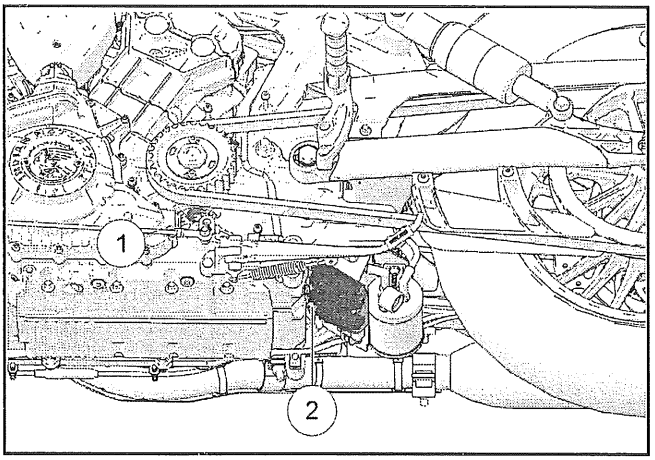
Switch Depressed (Stand DOWN): **No Continuity (OL)** Switch Extended (Stand UP): **Continuity (Less than 1Ω)**

GEAR POSITION SWITCH TEST

Normal Gear Indicator Operation

The Gear Position will display when the transmission is in gear if the motorcycle is moving when the clutch lever is released. It will also display when the transmission is in neutral.

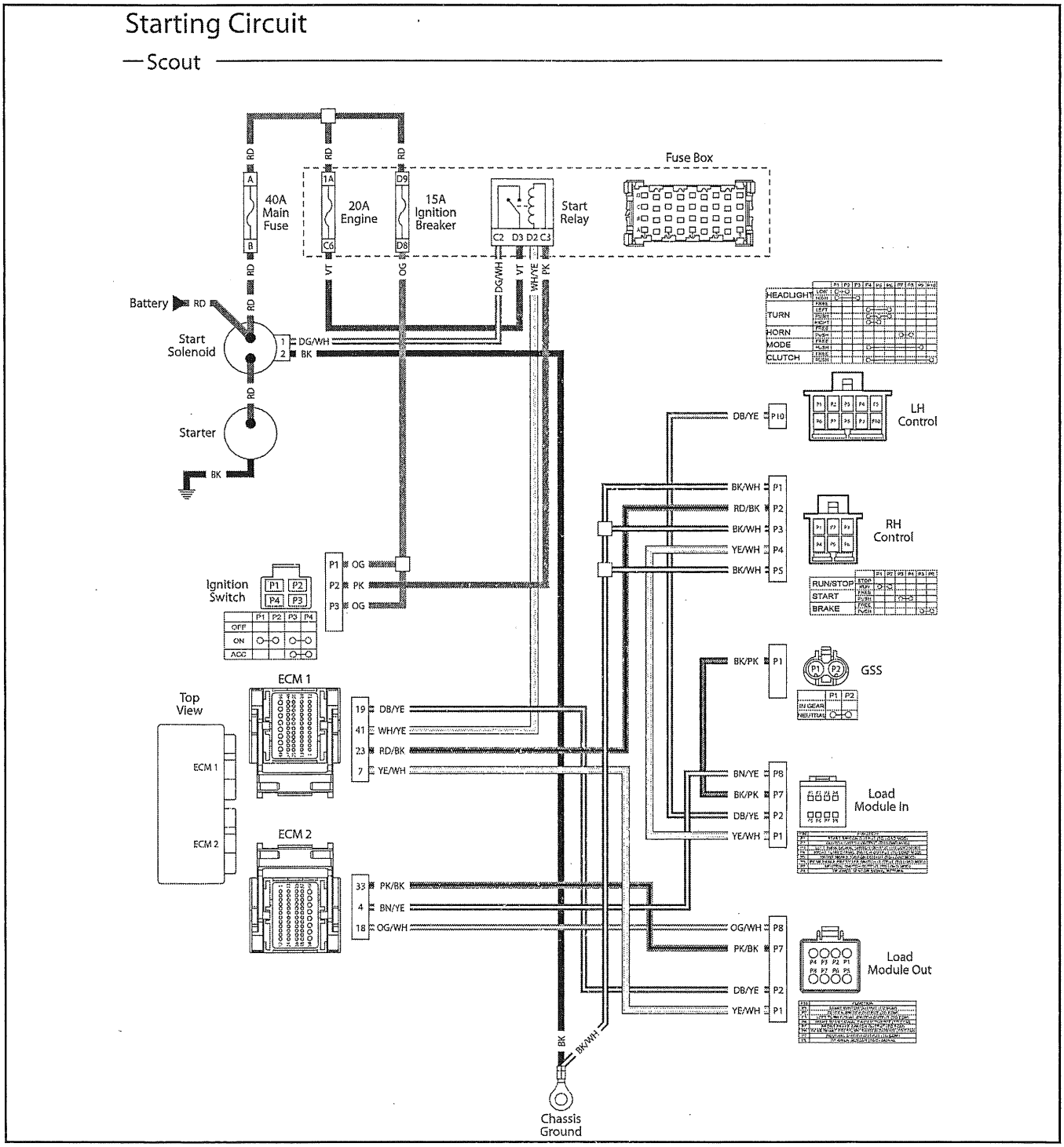
1. Disconnect the gear position switch ① electrical connector ② located at the rear of the engine above the voltage regulator.



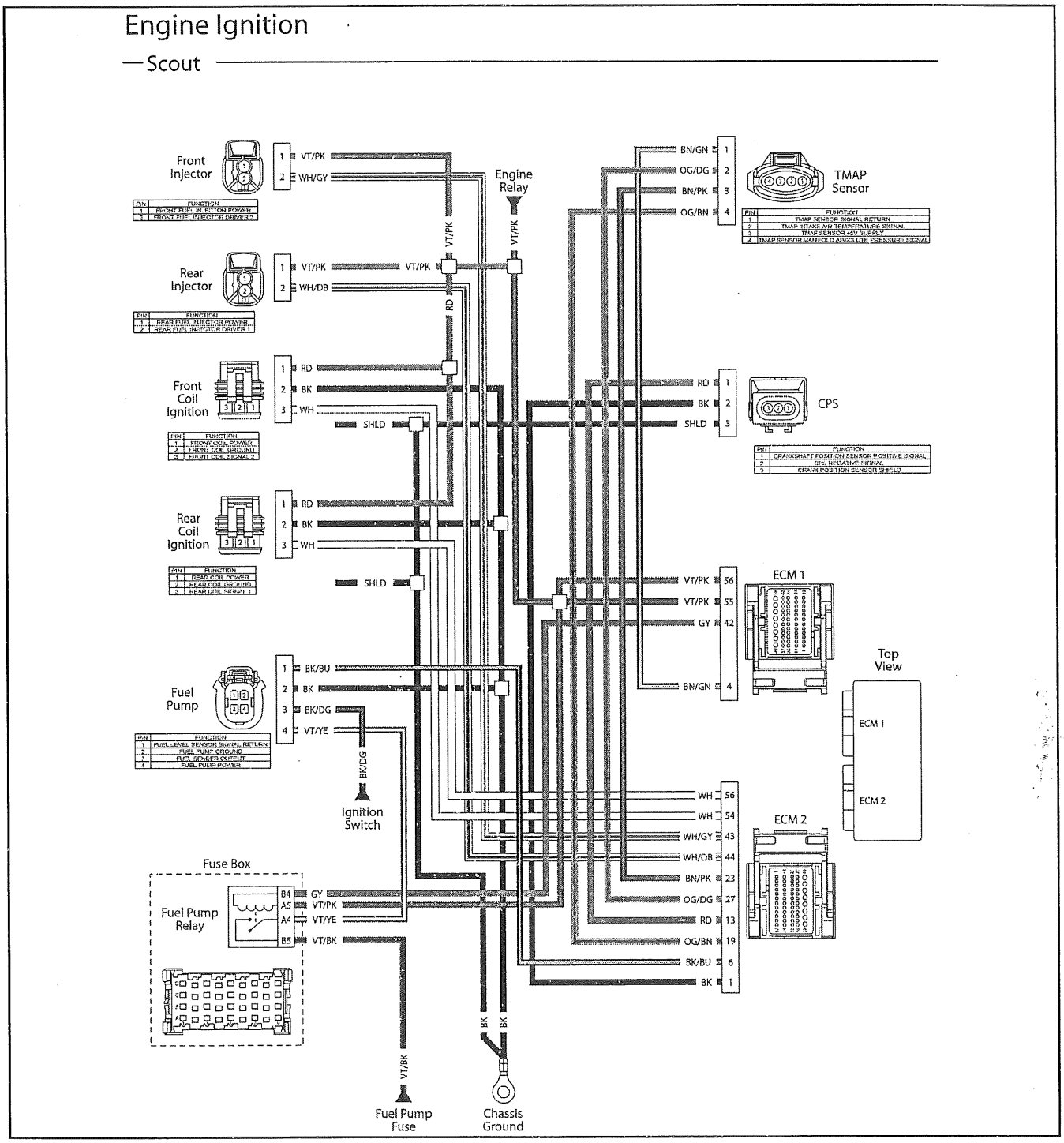
2. Set multi meter to measure resistance.
3. Connect one meter lead to each of the pins on the switch connector.
4. Watch the resistance readings as the transmission is shifted into Neutral. The meter readings be less than 1 ohm with transmission in Neutral and OL in all other gears.

BREAKOUT WIRING DIAGRAMS

STARTING CIRCUIT WIRING DIAGRAM



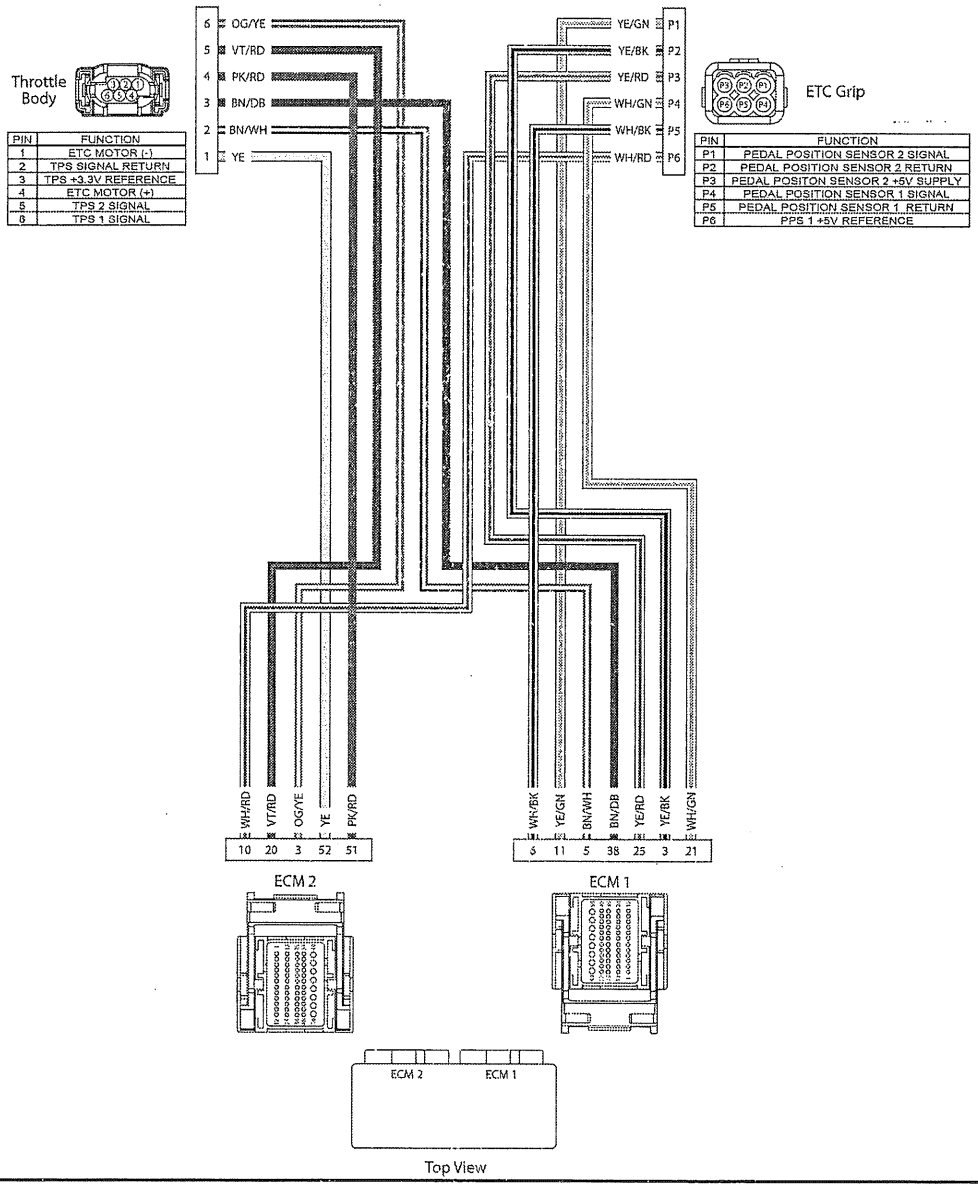
IGNITION SYSTEM WIRING DIAGRAM



THROTTLE CONTROL WIRING DIAGRAM

Engine Throttle Control

— Scout



PIN	FUNCTION
1	ETC MOTOR (-)
2	TPS SIGNAL RETURN
3	TPS +3.3V REFERENCE
4	ETC MOTOR (+)
5	TPS 2 SIGNAL
6	TPS 1 SIGNAL

PIN	FUNCTION
P1	PEDAL POSITION SENSOR 2 SIGNAL
P2	PEDAL POSITION SENSOR 2 RETURN
P3	PEDAL POSITON SENSOR 2 +5V SUPPLY
P4	PEDAL POSITION SENSOR 1 SIGNAL
P5	PEDAL POSITION SENSOR 1 RETURN
P6	PPS 1 +5V REFERENCE

2015-2017 SCOUT HARNESS-CHASSIS,SCHEMATIC

WIRE COLOR (ABBR)
BK/O
BK/WH
BK/YE
DB
LB
OG
OG/BK
OG/WH
PK
PK/BK
PK/WH
RD
RD/BK
RD/WH
VT
VT/BK
VT/WH
WH
WH/BK
WH/OG
WH/PK
WH/RD
WH/VT
WH/YE
YE
YE/BK
YE/WH

TWO WIRE COLORS ARE SHOWN WITH THE FIRST COLOR BEING THE MAIN COLOR AND THE SECOND COLOR BEING THE TRACE (EXAMPLE: RD/YE = RED WITH YELLOW TRACE

ENGINE GROUND

CHASSIS GROUND

NC = SWITCH NORMALLY CLOSED

NO = SWITCH NORMALLY OPEN

HARNESS: 2412549_Rev01-02

SHEET NO. 1 OF 2

PIN	FUNCTION
P1	HEADLIGHT HIGH BEAM POWER
P2	HEADLIGHT GROUND
P3	LOW BEAM SWITCH OUTPUT

PIN	FUNCTION
A	LICENSE PLATE LIGHT GROUND
B	STOP LAMP POWER OUTPUT
C	LICENSE PLATE LIGHT POWER
D	REAR LEFT TAIL LAMP GROUND OUTPUT
E	TAIL LIGHT POWER
F	REAR RIGHT TAIL LAMP GROUND OUTPUT

FRONT_LH_TS

FRONT_RH_TS

PSN_LAMP_POS

PSN_LAMP_NEG

HEADLIGHT

REAR_LIGHTING

BRAKE_SW

HORN_POS

HORN_NEG

LOAD_MODULE_IN

PIN	FUNCTION
P1	START SWITCH OUTPUT (TO LOAD MODE)
P2	CLUTCH SWITCH OUTPUT (TO LOAD MODE)
P3	LEFT TURN SIGNAL SWITCH OUTPUT (TO LOAD MODE)
P4	RIGHT TURN SIGNAL SWITCH OUTPUT (TO LOAD MODE)
P5	FRONT BRAKE SWITCH OUTPUT (TO LOAD MODE)
P6	REAR BRAKE PRESSURE SWITCH OUTPUT (TO LOAD MODE)
P7	NEUTRAL SWITCH OUTPUT (TO LOAD MODE)
P8	TIP-OVER SENSOR SIGNAL RETURN

LOAD_MODULE_OUT

PIN	FUNCTION
P1	IGNITION
P2	START SWITCH OUTPUT (TO ECM)
P3	CLUTCH SWITCH OUTPUT (TO ECM)
P4	LEFT TURN SIGNAL SWITCH OUTPUT (TO ECM)
P5	RIGHT TURN SIGNAL SWITCH OUTPUT (TO ECM)
P6	FRONT BRAKE SWITCH OUTPUT (TO ECM)
P7	REAR BRAKE PRESSURE SWITCH OUTPUT (TO ECM)
P8	NEUTRAL SWITCH OUTPUT (TO ECM)
P9	TIP-OVER SENSOR SIGNAL

LOAD_MODULE_PWR

LH_CONTROL

PIN	FUNCTION
P01	HEADLIGHT SWITCH POWER
P02	HEADLIGHT SWITCH OUTPUT
P03	HORN BRAKE SWITCH OUTPUT
P04	LH CONTROL SWITCH GROUND
P05	RIGHT TURN SIGNAL SWITCH OUTPUT (TO LOAD MODE)
P06	LEFT TURN SIGNAL SWITCH OUTPUT (TO LOAD MODE)
P07	HORN SWITCH POWER (MUX)
P08	HORN SWITCH OUTPUT POWER
P09	HORN SWITCH OUTPUT
P10	CLUTCH SWITCH OUTPUT (TO LOAD MODE)

		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
HEADLIGHT	LOW										
	HIGH										
	FREE										
TURN	LEFT										
	PUSH										
	RIGHT										
HORN	FREE										
	PUSH										
MODE	PUSH										
	FREE										
CLUTCH	PUSH										

RH_CONTROL

PIN	FUNCTION
P1	RUN/STOP SWITCH GROUND
P2	RUN/STOP SWITCH INPUT
P3	START SWITCH OUTPUT (TO ECM)
P4	START SWITCH OUTPUT (TO ECM)
P5	FRONT BRAKE SWITCH OUTPUT (TO LOAD MODE)

		P1	P2	P3	P4	P5	P6
RUN/STOP	STOP						
	RUN						
	FREE						
START	PUSH						
BRAKE	FREE						
	PUSH						

ETC_GRIP

PIN	FUNCTION
P1	PEDAL POSITION SENSOR 2 SIGNAL
P2	PEDAL POSITION SENSOR 2 RETURN
P3	PEDAL POSITION SENSOR 1 +5V SUPPLY
P4	PEDAL POSITION SENSOR 1 SIGNAL
P5	PEDAL POSITION SENSOR 1 RETURN
P6	PS1 1.45V REFERENCE

ACC_SW_PWR

SPEEDOMETER

PIN	FUNCTION
61	SPEEDOMETER CAN HIGH
62	SPEEDOMETER CAN LOW
63	SPEEDOMETER SWITCHED POWER
64	SPEEDOMETER CONSTANT POWER
65	SPEEDOMETER GROUND
66	HIGH BEAM INDICATOR OUTPUT
67	OIL PRESSURE SWITCH INPUT
68	MODE SWITCH OUTPUT
69	FUEL LEVEL SENSOR SIGNAL

IGNITION_SW

	P1	P2	P3	P4
OFF				
ON				
ACC				

PIN	FUNCTION
P1	IGNITION SWITCH ON INPUT
P2	IGNITION SWITCH ON OUTPUT
P3	IGNITION ACC INPUT
P4	IGNITION SWITCH ACC OUTPUT

FUEL_PUMP

PIN	FUNCTION
P1	FUEL LEVEL SENSOR SIGNAL RETURN
P2	FUEL PUMP GROUND
P3	FUEL SENDER OUTPUT
P4	FUEL PUMP POWER

DIAGNOSTIC

PIN	FUNCTION
A	DIAGNOSTIC CONNECTOR CONSTANT POWER
B	DIAGNOSTIC CONNECTOR SWITCHED POWER
C	DIAGNOSTIC CONNECTOR GROUND
D	DIAGNOSTIC CONNECTOR CAN LOW
E	DIAGNOSTIC CONNECTOR CAN HIGH

COOLING_FAN

START_SOLENOID

GSS

	P1	P2
IN GEAR		
NEUTRAL		

VSS

PIN	FUNCTION
1	VEHICLE SPEED SENSOR GROUND
2	VEHICLE SPEED SENSOR OUTPUT
3	VEHICLE SPEED SENSOR POWER

THROTTLE_BODY

PIN	FUNCTION
1	ETC MOTOR (+)
2	TPS SIGNAL RETURN
3	TPS +5.0V REFERENCE
4	THROTTLE POSITION SENSOR 2 SIGNAL
5	THROTTLE POSITION SENSOR 1 SIGNAL
6	ETC MOTOR (-)

FRONT_O2

PIN	FUNCTION
A	FRONT O2 SENSOR HEATER POWER
B	FRONT HEATED OXYGEN SENSOR (HO2) CONTROL 1
C	FRONT HEATED OXYGEN (HO2) SENSOR SIGNAL 1
D	FRONT HEATED OXYGEN (HO2) SENSOR RETURN 1

REAR_O2

PIN	FUNCTION
A	REAR O2 SENSOR HEATER POWER
B	REAR HEATED OXYGEN (HO2) SENSOR CONTROL 1
C	REAR HEATED OXYGEN (HO2) SENSOR SIGNAL 1
D	REAR HEATED OXYGEN (HO2) SENSOR RETURN 1

FRONT_INJECTOR

PIN	FUNCTION
1	FRONT FUEL INJECTOR POWER
2	FRONT FUEL INJECTOR DRIVER 1

REAR_INJECTOR

PIN	FUNCTION
1	REAR FUEL INJECTOR POWER
2	REAR FUEL INJECTOR DRIVER 1

COIL_FRONT

PIN	FUNCTION
1	FRONT COIL POWER
2	FRONT COIL GROUND
3	FRONT COIL SIGNAL 1

COIL_REAR

PIN	FUNCTION
1	REAR COIL POWER
2	REAR COIL GROUND
3	REAR COIL SIGNAL 1

TMAP

PIN	FUNCTION
1	TMAP SENSOR SIGNAL RETURN
2	TMAP INTAKE AIR TEMPERATURE SIGNAL
3	TMAP SENSOR +5V SUPPLY
4	TMAP SENSOR MANIFOLD ABSOLUTE PRESSURE SIGNAL

ECT

PIN	FUNCTION
1	ENGINE COOLANT TEMPERATURE SENSOR RETURN
2	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL

CPS

PIN	FUNCTION
1	CRANKSHAFT POSITION (CPS) SENSOR POSITIVE SIGNAL
2	CPS SENSOR SIGNAL RETURN
3	CRANK POSITION SENSOR SHIELD

PURGE

PIN	FUNCTION
1	CANISTER PURGE VALVE (CPV) CONTROL
2	PURGE VALVE POWER

OIL_PRESSURE

ECM_1

PIN	FUNCTION
1001	PEDAL POSITION SENSOR 2 RETURN
1041	TMAP SENSOR SIGNAL RETURN
1042	TPS SIGNAL RETURN
1062	PEDAL POSITION SENSOR 1 RETURN
1077	START SWITCH OUTPUT (TO ECM)
1078	RIGHT TURN SIGNAL SWITCH OUTPUT (TO ECM)
1079	PEDAL POSITION SENSOR 2 SIGNAL
1111	FUEL PUMP RELAY CONTROL
1116	ECM SWITCHED POWER INPUT
1119	CLUTCH SWITCH OUTPUT (TO ECM)
1120	LEFT TURN SIGNAL SWITCH OUTPUT (TO ECM)
1121	PEDAL POSITION SENSOR 1 SIGNAL
1124	ECM RUN/STOP SWITCH INPUT
1125	FRONT BRAKE SWITCH OUTPUT (TO ECM)

PIN	FUNCTION
1133	PEDAL POSITION SENSOR 2 +5V SUPPLY
1135	TIP-OVER SENSOR +5V REF
1137	COOLING FAN RELAY CONTROL
1138	ECM CAN HIGH
1139	TPS +5.0V REFERENCE
1140	HEADLIGHT RELAY CONTROL
1141	STARTER SOLENOID RELAY CONTROL
1142	FUEL PUMP RELAY CONTROL
1144	ECM CAN LOW
1151	STOP LAMP POWER OUTPUT
1153	ECM POWER GROUND 2
1154	ECM POWER GROUND 1
1155	ECM SWITCHED POWER 2
1156	ECM SWITCHED POWER 3

ECM_2

PIN	FUNCTION
001	CPS NEGATIVE SIGNAL
003	FRONT HEATED OXYGEN (HO2) SENSOR SIGNAL 2
003	THROTTLE POSITION SENSOR 1 SIGNAL
004	THROTTLE SENSOR SIGNAL RETURN
005	FRONT HEATED OXYGEN (HO2) SENSOR RETURN 2
006	FUEL LEVEL SENSOR SIGNAL RETURN
007	REAR HEATED OXYGEN (HO2) SENSOR SIGNAL RETURN 1
008	ENGINE COOLANT TEMPERATURE SENSOR RETURN
012	PS 1 +5V REFERENCE
013	FRONT LEFT TAIL LAMP OUTPUT
013	CRANKSHAFT POSITION SENSOR POSITIVE SIGNAL
013	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
017	REAR BRAKE PRESSURE SWITCH OUTPUT (TO ECM)
018	TIP-OVER SENSOR SIGNAL
019	TMAP SENSOR MANIFOLD ABSOLUTE PRESSURE SIGNAL
020	THROTTLE POSITION SENSOR 2 SIGNAL
022	TMAP SENSOR +5V SUPPLY
023	FRONT RIGHT TAILLAMP OUTPUT
027	TMAP INTAKE AIR TEMPERATURE SIGNAL
029	REAR HEATED OXYGEN (HO2) SENSOR SIGNAL 1
030	NEUTRAL SWITCH OUTPUT (TO ECM)
035	NEUTRAL SWITCH OUTPUT (TO ECM)
036	CANISTER PURGE VALVE (CPV) CONTROL
038	REAR LEFT TS LAMP GROUND OUTPUT
039	FRONT HEATED OXYGEN SENSOR (HO2) CONTROL 2
040	SECONDARY AIR GROUND OUTPUT
042	FRONT FUEL INJECTOR DRIVER 2
044	SECONDARY AIR SOLENOID CONTROL
045	REAR HEATED OXYGEN (HO2) SENSOR CONTROL 1
047	FAN ELECTRONIC GROUND
048	REAR RIGHT TS LAMP GROUND OUTPUT
050	ECM POWER GROUND 3
051	ETC MOTOR (+)
052	ETC MOTOR (-)
054	FRONT COIL SIGNAL 2
055	REAR COIL SIGNAL 2

ECM_1

ECM 2

TOP VIEW

(COVER REMOVED)

BATT_NEG

CHASSIS_GND

30S SERIES RELAY

HEADLIGHT RELAY

ENGINE RELAY

FUEL PUMP RELAY

FAN RELAY

STARTER RELAY

MAIN_FUSE

BATT_POS

SOLENOID

VOLT_REG

2015-2017 SCOUT ABS HARNESS-CHASSIS

WIRE COLOR LEGEND	
BK	BLACK
BL	BLUE
LB	LIGHT BLUE
DB	DARK BLUE
BR	BROWN
GY	GRAY
LG	LIGHT GREEN
DG	DARK GREEN
OG	ORANGE
PK	PINK
RD	RED
VT	VIOLET (PURPLE)
WH	WHITE
YE	YELLOW
GN	GREEN

THE WIRE COLOR CODE SHOWN WITH PARENTHESIS ARE, FOR EXAMPLE; (BK/YE) = RED WITH YELLOW TRACE.

▽ = ENGINE GROUND

▽ = CHASSIS GROUND

NC = SWITCH NORMALLY CLOSED

NO = SWITCH NORMALLY OPEN

SHEET NO. 1 OF 2

CAV#	FUNCTION
P1	HEADLIGHT HIGH BEAM POWER
P2	HEADLIGHT GROUND
P3	LOW BEAM SWITCH OUTPUT

CAV#	FUNCTION
A	LICENSE PLATE LIGHT GROUND
B	STOP LAMP POWER OUTPUT
C	LICENSE PLATE LIGHT POWER
D	REAR LEFT TL LAMP GROUND OUTPUT
E	TAIL LIGHT POWER
F	REAR RIGHT TL LAMP GROUND OUTPUT

FRONT_LH_TS
FRONT_RH_TS
PSN_LAMP_POS
PSN_LAMP_NEG
HEADLIGHT
REAR_LIGHTING
BRAKE_SW
HORN_POS
HORN_NEG

SIDESTAND_SW

CAV#	FUNCTION
P1	SIDESTAND SWITCH SIGNAL
P2	SIDESTAND SWITCH GROUND

GSS

CAV#	FUNCTION
P1	NEUTRAL SWITCH OUTPUT (TO LOAD MOD)
P2	

VSS

CAV#	FUNCTION
A	VEHICLE SPEED SENSOR GROUND
B	VEHICLE SPEED SENSOR OUTPUT
C	VEHICLE SPEED SENSOR POWER

THROTTLE_BODY

CAV#	FUNCTION
A	ETC MOTOR (+)
B	TPS SIGNAL RETURN
C	TPS +5 VDC REFERENCE
D	ETC MOTOR (-)
E	THROTTLE POSITION SENSOR 2 SIGNAL
F	THROTTLE POSITION SENSOR 1 SIGNAL

FRONT_O2

CAV#	FUNCTION
A	FRONT O2 SENSOR HEATER POWER
B	FRONT HEATED OXYGEN (HO2) SENSOR CONTROL
C	FRONT HEATED OXYGEN (HO2) SENSOR SIGNAL
D	FRONT HEATED OXYGEN (HO2) SENSOR RETURN

REAR_O2

CAV#	FUNCTION
A	REAR O2 SENSOR HEATER POWER
B	REAR HEATED OXYGEN (HO2) SENSOR CONTROL
C	REAR HEATED OXYGEN (HO2) SENSOR SIGNAL
D	REAR HEATED OXYGEN (HO2) SENSOR RETURN

FRONT_INJECTOR

CAV#	FUNCTION
A	FRONT FUEL INJECTOR POWER
B	FRONT FUEL INJECTOR DRIVER

REAR_INJECTOR

CAV#	FUNCTION
A	REAR FUEL INJECTOR POWER
B	REAR FUEL INJECTOR DRIVER

COIL_FRONT

CAV#	FUNCTION
1	FRONT COIL POWER
2	FRONT COIL GROUND
3	FRONT COIL SIGNAL 2

COIL_REAR

CAV#	FUNCTION
A	REAR COIL POWER
B	REAR COIL GROUND
C	REAR COIL SIGNAL

TMAP

CAV#	FUNCTION
A	TMAP SENSOR SIGNAL RETURN
B	TMAP INTAKE AIR TEMPERATURE SIGNAL
C	TMAP SENSOR +5V SUPPLY
D	TMAP SENSOR MANIFOLD ABSOLUTE PRESSURE SIGNAL

ECT

CAV#	FUNCTION
A	ENGINE COOLANT TEMPERATURE SENSOR RETURN
B	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL

CPS

CAV#	FUNCTION
A	CRANKSHAFT POSITION SENSOR POSITIVE SIGNAL
B	CPS NEGATIVE SIGNAL
C	CRANK POSITION SENSOR SHIELD

PURGE

CAV#	FUNCTION
1	CANISTER PURGE VALVE (PCV) CONTROL
2	PURGE VALVE POWER

OIL_PRESSURE

ECM_1

CAV#	FUNCTION
C03	PEDAL POSITION SENSOR 2 RETURN
C04	TMAP SENSOR SIGNAL RETURN
C05	TPS SIGNAL RETURN
C06	PEDAL POSITION SENSOR 1 RETURN
C07	START SWITCH OUTPUT (TO ECM)
C08	LEFT TURN SIGNAL SWITCH OUTPUT (TO ECM)
C11	PEDAL POSITION SENSOR 2 SIGNAL
C12	ECM CAN LOW
C13	ECM ENTERED POWER INPUT
C14	CLUTCH SWITCH OUTPUT (TO ECM)
C15	LEFT TURN SIGNAL SWITCH OUTPUT (TO ECM)
C21	PEDAL POSITION SENSOR 1 SIGNAL
C22	ECM IGNITION SWITCH INPUT
C24	FRONT BRAKE SWITCH OUTPUT (TO ECM)
C25	PEDAL POSITION SENSOR 2 +5V SUPPLY

CAV#	FUNCTION
P29	5V-OVER SENSOR +5V REF
C30	COOLING FAN RELAY CONTROL
C33	ECM CAN HIGH
C38	TPS +5 VDC REFERENCE
C40	HEADLIGHT RELAY CONTROL
C42	STARTER SOLENOID RELAY CONTROL
C43	FUEL PUMP RELAY CONTROL
C44	ECM GROUND 1
C45	SIDESTAND SWITCH SIGNAL
C54	STOP LAMP POWER OUTPUT
C55	ECM POWER GROUND 3
C56	ECM SWITCHED POWER 2
C56	ECM SWITCHED POWER 2

ECM_2

CAV#	FUNCTION
C01	TPS NEGATIVE SIGNAL
C02	FRONT HEATED OXYGEN (HO2) SENSOR SIGNAL 2
C09	THROTTLE POSITION SENSOR 2 SIGNAL
C10	5V-HALL SENSOR SUPPLY
C16	FRONT HEATED OXYGEN (HO2) SENSOR RETURN 2
C17	FUEL LEVEL SENSOR SIGNAL RETURN
C18	REAR HEATED OXYGEN (HO2) SENSOR RETURN 1
C19	ENGINE COOLANT TEMPERATURE SENSOR RETURN
C20	TPS +5V REFERENCE
C23	FRONT LEFT TL LAMP OUTPUT
C26	CRANKSHAFT POSITION SENSOR NEGATIVE SIGNAL
C27	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
C28	REAR BRAKE PRESSURE SWITCH OUTPUT (TO ECM)
C29	5V-OVER SENSOR +5VDC SIGNAL
C34	TMAP SENSOR MANIFOLD ABSOLUTE PRESSURE SIGNAL
C35	THROTTLE POSITION SENSOR 1 SIGNAL
C37	TMAP SENSOR +5V SUPPLY
C39	FRONT RIGHT TL LAMP OUTPUT
C41	TMAP INTAKE AIR TEMPERATURE SIGNAL
C46	REAR HEATED OXYGEN (HO2) SENSOR SIGNAL 1
C47	FRONT RIGHT TL LAMP GROUND OUTPUT
C50	NEUTRAL SWITCH OUTPUT (TO ECM)
C51	CANISTER PURGE VALVE (PCV) CONTROL
C52	REAR LEFT TL LAMP GROUND OUTPUT
C53	FRONT HEATED OXYGEN (HO2) SENSOR CONTROL 1
C57	BATTERY VOLTAGE (ELECTRONICS)
C58	REAR RIGHT TL LAMP GROUND OUTPUT
C59	ECM POWER GROUND 2
C60	ETC MOTOR (+)
C61	ETC MOTOR (-)
C64	FRONT COIL SIGNAL 2
C65	REAR COIL SIGNAL 2

SPLICE_GND4
SPLICE_GND3
SPLICE_ENGPWR
SPLICE_GND1
SPLICE_HIGH
SPLICE_GND5
SPLICE_GND6
SPLICE_ACCB
SPLICE_ACCF
SPLICE_IGNSW
SPLICE_FPPWR
SPLICE_GND2
SPLICE_CAN_L
SPLICE_CAN_H
SPLICE_MFUSE

ABS_FWSS
ABS_RWSS

CAV#	FUNCTION
B22	ABS CAN HIGH
B21	REAR WHEEL SPEED SIGNAL +
B7	ABS SWITCHED POWER
B8	FRONT WHEEL SPEED SIGNAL +
B5	ABS GROUND
B6	ABS CAN LOW
B3	REAR WHEEL SPEED SIGNAL -
B4	FRONT WHEEL SPEED SIGNAL -
B10	ABS EVOS OUTPUT

LOAD_MODULE_IN

CAV#	FUNCTION
P12	START SWITCH OUTPUT (TO LOAD MOD)
P9	CLUTCH SWITCH OUTPUT (TO LOAD MOD)
P8	LEFT TURN SIGNAL SWITCH OUTPUT (TO LOAD MOD)
P6	RIGHT TURN SIGNAL SWITCH OUTPUT (TO LOAD MOD)
P5	HORN SWITCH OUTPUT (TO LOAD MOD)
P4	REAR BRAKE PRESSURE SWITCH OUTPUT (TO LOAD MOD)
P11	NEUTRAL SWITCH OUTPUT (TO LOAD MOD)
P10	TPS-OVER SENSOR SIGNAL RETURN

LOAD_MODULE_OUT

CAV#	FUNCTION
P1	START SWITCH OUTPUT (TO ECM)
P2	CLUTCH SWITCH OUTPUT (TO ECM)
P3	LEFT TURN SIGNAL SWITCH OUTPUT (TO ECM)
P4	RIGHT HORN SIGNAL SWITCH OUTPUT (TO ECM)
P5	FRONT BRAKE SWITCH OUTPUT (TO ECM)
P6	REAR BRAKE PRESSURE SWITCH OUTPUT (TO ECM)
P7	NEUTRAL SWITCH OUTPUT (TO ECM)
P8	TPS-OVER SENSOR SIGNAL

LOAD_MODULE_PWR

LH_CONTROL

CAV#	FUNCTION
P11	HEADLIGHT SWITCH POWER
P10	HEADLIGHT SWITCH OUTPUT
P9	LOW BEAM SWITCH OUTPUT
P8/A1	LH CONTROL SWITCH GROUND
P7/A12	LEFT TURN SIGNAL SWITCH OUTPUT (TO LOAD MOD)
P6/A5	LEFT-OVER SIGNAL SWITCH OUTPUT (TO LOAD MOD)
P5/A3	HORN SWITCH POWER INPUT
P4/A2	HORN SWITCH OUTPUT POWER
P3/A4	MODE SWITCH OUTPUT
P2/A9	CLUTCH SWITCH OUTPUT (TO LOAD MOD)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
HEADLIGHT	LOW									
	HIGH									
	FREE									
TURN	LEFT									
	PUSH									
	RIGHT									
HORN	FREE									
	PUSH									
MODE	FREE									
	PUSH									
CLUTCH	FREE									
	PUSH									

RH_CONTROL

CAV#	FUNCTION
A1	IGNITION SWITCH GROUND
A2	ECM ENTERED POWER INPUT
A3	START SWITCH OUTPUT (TO LOAD MOD)
A4	FRONT BRAKE SWITCH GROUND
A5	FRONT BRAKE SWITCH OUTPUT (TO LOAD MOD)

	P1	P2	P3	P4	P5	P6
RUN/STOP	STOP					
	RUN					
START	FREE					
	PUSH					
BRAKE	FREE					
	PUSH					

ETC_GRIP

CAV#	FUNCTION
F12	PEDAL POSITION SENSOR 2 SIGNAL
F11	PEDAL POSITION SENSOR 2 RETURN
F8	PEDAL POSITION SENSOR +5V SUPPLY
F4	PEDAL POSITION SENSOR 1 SIGNAL
F3	PEDAL POSITION SENSOR 1 RETURN
F1	+5V SUPPLY

ACC_SW_PWR

SPEEDOMETER

CAV#	FUNCTION
C1	SPEEDOMETER CAN HIGH
C2	SPEEDOMETER CAN LOW
C3	SPEEDOMETER SWITCHED POWER
C4	SPEEDOMETER CONSTANT POWER
C5	SPEEDOMETER GROUND
C6	FUEL LEVEL SENSOR OUTPUT
C7	OIL PRESSURE SENSOR INPUT
C8	HOBS SWITCH OUTPUT
C13	FUEL LEVEL SENSOR SIGNAL

IGNITION_SW

CAV#	FUNCTION
P7	IGNITION SWITCH OR INPUT
P6	IGNITION SWITCH OUTPUT
P5	IGNITION ACC INPUT
P4	IGNITION SWITCH ACC OUTPUT

	P1	P2	P3	P4
OFF				
ON				
ACC				

FUEL_PUMP

CAV#	FUNCTION
A	FUEL LEVEL SENSOR SIGNAL RETURN
B	FUEL PUMP GROUND
C	FUEL SENDER OUTPUT
D	FUEL PUMP POWER

DIAGNOSTIC

CAV#	FUNCTION
A	DIAGNOSTIC CONNECTOR CONSTANT POWER
B	DIAGNOSTIC CONNECTOR SWITCHED POWER
C	DIAGNOSTIC CONNECTOR GROUND
D	DIAGNOSTIC CONNECTOR CAN LOW
E	DIAGNOSTIC CONNECTOR CAN HIGH

COOLING_FAN

START_SOLENOID

303 SERIES RELAY
HEADLIGHT RELAY
ENGINE RELAY
FUEL PUMP RELAY
FAN RELAY
STARTER RELAY

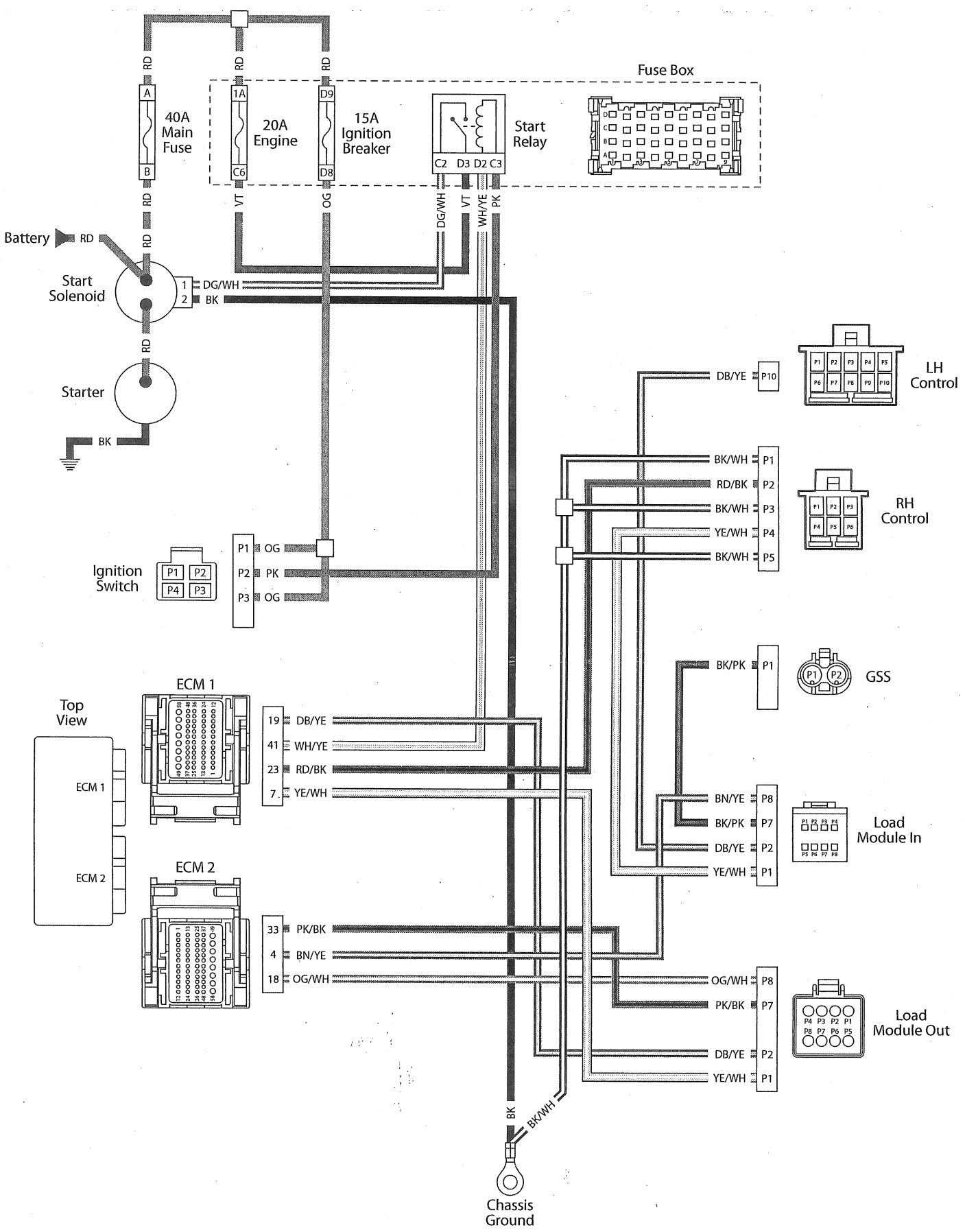
TOP VIEW
(COVER REMOVED)

ABS_FUSE
MAIN_FUSE
BATT_POS
SOLENOID
VOLT_REG

BATT_NEG
CHASSIS_GND

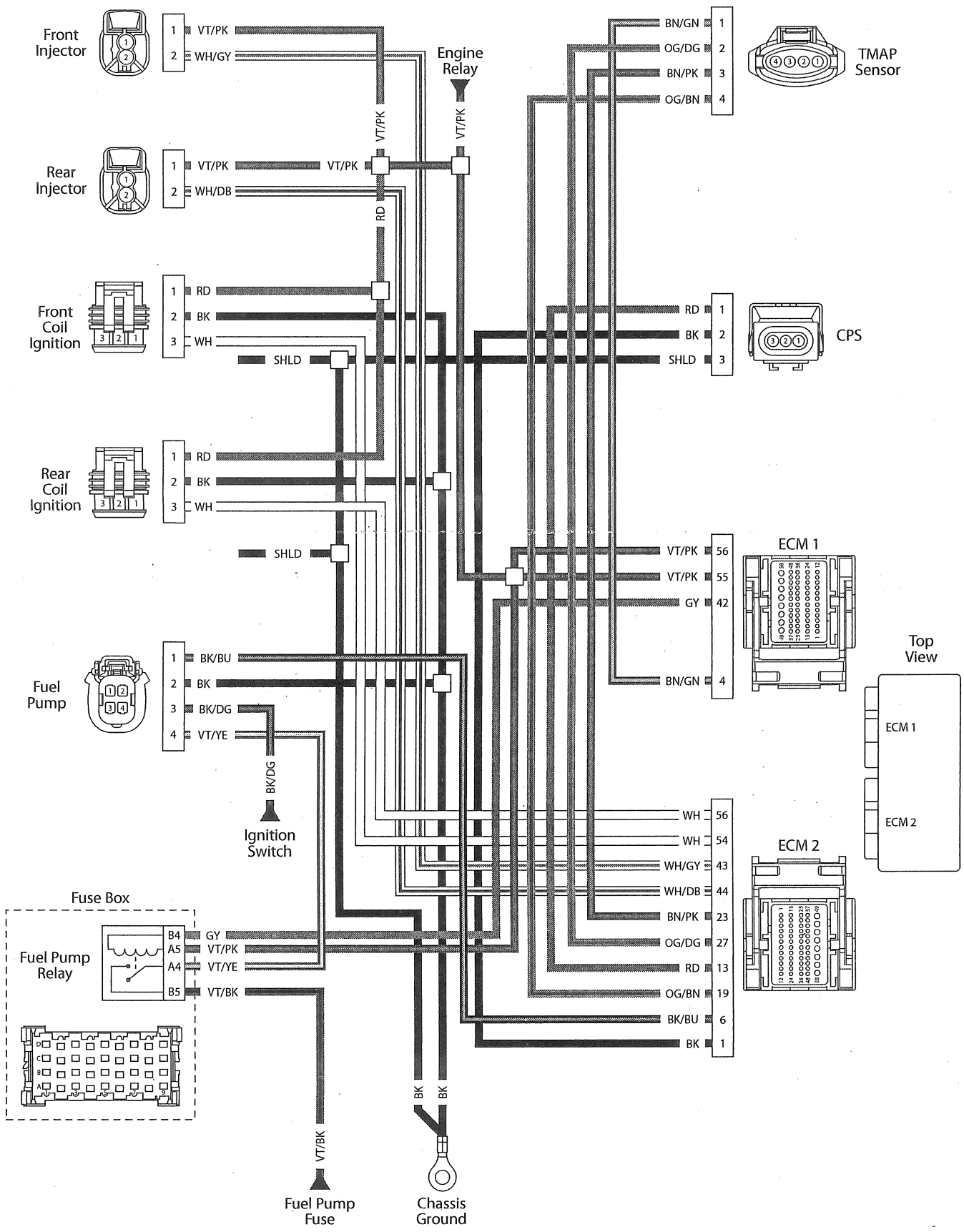
Starting Circuit

— Scout



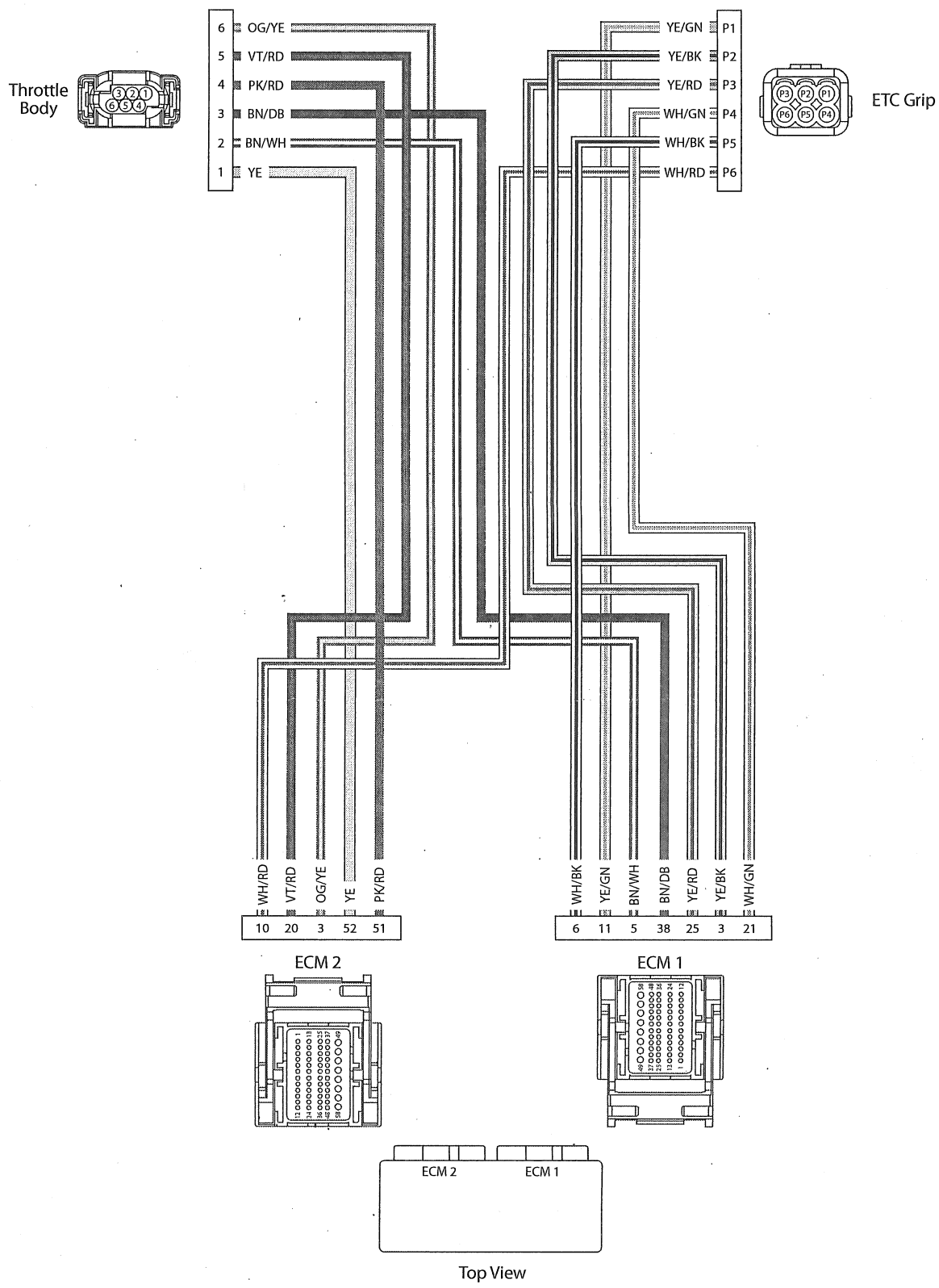
Engine Ignition

— Scout



Engine Throttle Control

— Scout



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