



2009 - 2012 Indian Motorcycle Service Manual

**Chief Classic • Chief Dark Horse • Chief Bomber
Chief Roadmaster • Chief Vintage • Chief Blackhawk Dark**



**2009-2012 Indian Motorcycle
PN 9923695**



2009-2012

INDIAN MOTORCYCLE

**CHIEF CLASSIC • CHIEF DARK HORSE • CHIEF BOMBER
CHIEF ROADMASTER • CHIEF VINTAGE • CHIEF BLACKHAWK DARK**

FOREWORD

The information printed within this publication includes the latest product information at the time of print. The most recent version of this Service Manual is available to Indian Dealers in electronic format at www.polarisdealers.com.

This manual is designed primarily for use by trained Indian service technicians in a properly equipped shop and should be kept available for reference in the shop area. All references to left and right side of the vehicle are from the operator's perspective when seated in a normal riding position.

Some procedures outlined in this manual require a sound knowledge of mechanical theory, tool use, and shop procedures in order to perform the work safely and correctly. Read the text and be familiar with the service procedures before starting the work. Certain procedures will require the use of special tools. Use only the proper tools as specified. If you have any doubt as to your ability to perform any of the procedures outlined in this service manual, contact an authorized Indian dealer for service.

Comments or suggestions about this manual should be submitted via Ask Polaris. Consumers can direct comments or suggestions to: Service Publications Department, Polaris Sales Inc., 2100 Hwy 55, Medina, Minnesota 55340.

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CHIEF CLASSIC™

CHIEF DARK HORSE™

CHIEF BOMBER™

CHIEF ROADMASTER®

CHIEF VINTAGE®

CHIEF BLACKHAWK™

BLACKHAWK DARK®

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Polaris Industries Inc. acknowledges the following products mentioned in this manual:

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SPECIFICATIONS / GAUGES

GENERAL INFORMATION

TRADEMARKS

The following are Common Law or REGISTERED trademarks of Polaris Industries Inc.:

INDIAN MOTORCYCLE; INDIAN; CHIEF; BOMBER; CLASSIC; DARK HORSE; ROADMASTER; VINTAGE BLACKHAWK; BLACKHAWK DARK; POLARIS; POLARIS THE WAY OUT.

Polaris 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, trademark of Gold Eagle

FLUKE, registered trademark of the Fluke Corporation

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

SERVICE RULES

In order to perform service work efficiently and prevent costly errors, technicians should read the text in this manual and familiarize themselves with the procedures before beginning. Notes, Cautions and Warnings have been included for clarification of text and safety concerns. Knowledge of mechanical theory, tool use and shop procedures are necessary to perform some procedures in this manual safely and correctly.

Use only genuine Indian Motorcycle service parts, including fasteners that require replacement if removed. Do NOT substitute fasteners or hardware.

Cleanliness of parts and tools as well as the work area is of primary importance. Dirt and foreign matter will cause damage to precision parts. Clean the motorcycle before beginning service. Clean all parts before installing.

If difficulty is encountered in removing or installing a component, look to see if a cause for the difficulty can be found. If it is necessary to tap the part into place, use a soft face hammer and tap lightly.

Always follow torque specifications as outlined throughout this manual. Incorrect torquing may lead to serious machine damage or in the case of steering, driveline, and chassis components, can result in loss of control during operation of the motorcycle, which may result in severe personal injury or death.

If a torquing sequence is indicated for nuts, bolts or screws of a certain component, start all fasteners and hand tighten. Following the method and sequence indicated, tighten evenly to the specified torque value. When removing nuts, bolts or screws from a component with several fasteners, loosen them all about 1/4 turn before removing them to prevent distortion of that component.

Replace all oil seals, sealing washers, gaskets, and o-rings with new ones during assembly. Be sure the mating surfaces for the gasket are clean and smooth to avoid leaks and maintain specified tolerances.

Some procedures require removal of retaining rings or clips. Removal can weaken and deform these parts, therefore, they should always be replaced with new parts. When installing new retaining rings and clips, use care not to expand or compress them beyond what is required for installation.

Some service procedures in this manual may call for lubricants and greases have been specially formulated for use with Indian motorcycles. In some applications, warranty coverage may be void if these specially formulated lubricants are not used.

Parts requiring grease should be cleaned thoroughly and fresh grease applied before reassembly. Deteriorating grease loses lubricity and may contain abrasive foreign matter. Always replace locking hardware such as lock nuts or lock washers, fasteners that have pre-applied locking agent, or any other fasteners as noted in this service manual with genuine Indian Motorcycle hardware from an authorized Indian Motorcycle dealer.

Working with batteries can be hazardous. Review all battery warnings and cautions.



SAFETY INFORMATION

1

Understanding Safety Labels & Instructions

READ AND BECOME FAMILIAR WITH ALL WARNING AND CAUTION SYMSBOLS AND STATEMENTS LISTED BELOW AND IN THE TEXT OF THIS MANUAL BEFORE YOU BEGIN WORK.

 This is the safety alert symbol. When you see this symbol on the vehicle or in this manual, be alert to the potential for personal injury. Your safety is involved!

WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

NOTICE:

Indicates a hazardous situation, which, if not avoided, could result in damage to the motorcycle.

WARNING

Gasoline is extremely flammable and explosive under certain conditions.

- Always stop the engine and refuel outdoors or in a well ventilated area
- Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored
- Do not overfill the tank. Do not fill the tank neck above the fuel tank insert. Leave air space to allow for fuel expansion
- If you get gasoline in your eyes or if you swallow gasoline, see your doctor immediately. Never try to syphon gasoline using mouth suction
- If you spill gasoline on your skin or clothing, immediately wash it off with soap and water and change clothing
- Never start the engine or let it run in an enclosed area. Engine exhaust fumes are poisonous and can cause loss of consciousness or death in a short time

WARNING

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

WARNING

Improper repairs or service can create unsafe conditions that may cause severe personal injury or death.

WARNING

The engine and exhaust components on this product become very hot during operation and remain so for a period of time after the engine is stopped.

WARNING

Never run the engine in an enclosed area without a properly functioning exhaust gas evacuation system connected to the product.

WARNING

Modifications to this motorcycle not approved by Indian Motorcycle may cause loss of performance, excessive emissions, and make the machine unsafe for use.

WARNING

Brake fluid is poisonous.
KEEP OUT OF REACH OF CHILDREN.

WARNING

Wear insulated protection for hands and arms or wait until hot components have cooled sufficiently before working on the product.

WARNING

Brake fluid is poisonous. Do not ingest or allow brake fluid to contact eyes. Always wear eye protection when working with brake fluid.

WARNING

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

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.

NOTICE

Brake fluid will damage plastic, painted and rubber parts. Protect these surfaces whenever the brake system is being serviced.



SPECIFICATIONS / GAUGES

GENERAL SPECIFICATIONS

2009 INDIAN CHIEF - Standard / Deluxe / Roadmaster / Vintage

CAPACITIES & DIMENSIONS		STANDARD	DELUXE	ROADMASTER	VINTAGE
CAPACITIES & DIMENSIONS	Oil Capacity	3.5 (3.31 ltr) Quarts w / filter at oil change			
	Fuel Capacity	5.6 US Gal (21.2 ltr)			
	Fuel Type / Octane Minimum	Premium Unleaded / 91 Octane			
	Dry Weight	728 lbs (330.2 Kg)	746 lbs (338.4 Kg)	747 lbs (339 Kg)	753 lbs (341.6 Kg)
	Wet Weight	761.6 lbs (345.5 Kg)	779.6 lbs (353.6 Kg)	780.6 lbs (354.1 Kg)	786 lbs (356 Kg)
	Gross Vehicle Weight Rating (GVWR)	1220 lbs (553 Kg)			
	Gross Axle Weight Rating FRONT AXLE	546 lbs (249 Kg)			
	Gross Axle Weight Rating REAR AXLE	671 lbs (304 Kg)			
	Maximum Load (See page 1.12 for more information)	458.4 lbs (207.5 Kg)	440.4 lbs (199.4 Kg)	439.4 lbs (198.9 Kg)	433.4 lbs (196.2 Kg)
	Overall Length	100.5 in (2553 mm)			
	Overall Width	40.5 in (1029 mm)			
	Overall Height - w/o windshield	50.5 in (1283 mm)			
	Seat Height	27.25 in (708 mm)			
	Ground Clearance	6.0 in (162 mm)			
	Passenger Capacity	0	1	1	1
	Wheelbase	68.4 in. (1737 mm)			
	Rake / Trail	34 Degrees / 5.92 in (15.01 cm)			
ENGINE	Engine Type	Powerplus V-Twin			
	Engine Configuration	45 Degree V-Twin 4-Stroke			
	Engine Displacement	105 cubic inch / 1720 cc			
	Engine Cooling System	Air / Oil			
	Compression Ratio	9:1			
	Compression Pressure	180 - 185 psi			
	Valve Train	4 valves per cylinder / Hydraulic Lifters / Non-Adjustable Push Rods			
	Bore x Stroke	3.966" x 4.25"			
	Starter	Electric			
	Fuel System	Closed Loop Sequential Port Fuel Injection			
	Exhaust System Type	2 into 1 with Catalytic Converter			
	Lubrication System	Dry Sump			
	Spark Plug Type (Gap)	Bosch 7955 / FR7DC+ (.036" / .90 mm)			
	Dry Weight (Engine Approximate)				
BRAKES	Brake Type (Front / Rear)	Disc / Disc			
	Front Brake	Dual Floating Disc / 4 Piston Calipers			
	Rear Brake	Single Floating Disc / 2 Piston Caliper			

Specifications may change with the addition of custom order options and / or accessories. Polaris Sales Inc. 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.



2009 INDIAN CHIEF - Standard / Deluxe / Roadmaster / Vintage (cont.)

1

	STANDARD	DELUXE	ROADMASTER	VINTAGE
D R I V E S Y S T E M	Transmission Type	6 Speed Constant Mesh		
	Clutch Type	Wet, Multi-Plate		
	Primary Drive Type	Wet, Chain Drive w/ Torque Compensator		
	Primary Reduction Ratio	1.32:1		
	Final Drive Type / Belt Width /	Belt Drive / 136 Tooth /		
	Gear Shift Pattern	1 Down, 5 Up		
	Internal Gear Ratios 1st	3.77:1		
	2nd	2.56:1		
	3rd	1.87:1		
	4th	1.44:1		
S U S P E N S I O N	5th	1.15:1		
	6th	1.0:1		
	Front Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)		
	Rear Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)		
	Front Tire	Black Wall - Michelin Commander 130/90R16 White Wall - Metzler Marathon ME880 130/90R16		
	Rear Tire	Black Wall - Michelin Commander 150/80R16 White Wall - Metzler Marathon ME880 150/80R16		
	Minimum Tread Depth	.063 in. (1.6mm)		
	Front Type	41 mm Conventional Telescopic Fork		
	Front Travel	4.25 in. (10.8 cm)		
	Front Tube Diameter	41 mm (1.6 in.)		
L I G H T S	Rear Shock Type	Single, Adjustable Preload		
	Rear Swingarm Type	Steel, Conventional		
	Rear Travel (inches)	2.87 in (7.3 cm)		
	Headlamp	High / Low: H-4 60/55W		
	Brake / Tail Light	1157 12V 21/5W		
	License Plate Light	C5W		
	Turn Signals	1156 12V 27W		
	Front Fender Light	LED - Must be replaced as an assembly.		
	Alternator / Battery	42A @ 13.0VDC / 12V 20AH 300CCA Sealed Glass Mat		
	Fuse Box			
F U S E S	Main	40 amp circuit breaker		
	IC B+	5A Fuse		
	IC IGN	10A Fuse		
	PARK LPS	5A Fuse		
	ECU B+	7.5A Fuse		
	ECU IGN	5A Fuse		
	KEY B+	20A Fuse		
	PCM B+	30A Fuse		
	PCM IGN	15A Fuse		

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SPECIFICATIONS / GAUGES

GENERAL SPECIFICATIONS

2010 INDIAN CHIEF - Classic / Dark Horse / Bomber / Vintage / Roadmaster

		CLASSIC	DARK HORSE	BOMBER	VINTAGE	ROADMASTER
CAPACITIES & DIMENSIONS	Oil Capacity	3.5 (3.31 ltr) Quarts w / filter at oil change				
	Fuel Capacity	5.6 US Gal (21.2 ltr)				
	Fuel Type / Octane Minimum	Premium Unleaded / 91 Octane				
	Dry Weight	728 lbs (330.2 Kg)	746 lbs (338.4 Kg)	746 lbs (338.4 Kg)	753 lbs (341.6 Kg)	747 lbs (339 Kg)
	Wet Weight	761.6 lbs (345.5 Kg)	779.6 lbs (353.6 Kg)	779.6 lbs (353.6 Kg)	786 lbs (356 Kg)	780.6 lbs (354.1 Kg)
	Gross Vehicle Weight Rating (GVWR)	1220 lbs (553 Kg)				
	Gross Axle Weight Rating FRONT AXLE	549 lbs (249 Kg)				
	Gross Axle Weight Rating REAR AXLE	671 lbs (304 Kg)				
	Maximum Load (See page 1.12 for more information)	458.4 lbs (207.5 Kg)	440.4 lbs (199.4 Kg)	440.4 lbs (199.4 Kg)	434 lbs (196.2 Kg)	439.4 lbs (198.1 Kg)
	Overall Length	100.5 in (2553 mm)				
ENGINE	Overall Width	40.5 in (1029 mm)				
	Overall Height - w/o windshield	50.5 in (1283 mm)				
	Seat Height	27.25 in (708 mm)				
	Ground Clearance	6.0 in (162 mm)				
	Passenger Capacity	0	1	1	1	1
	Wheelbase	68.4 in. (1737 mm)				
	Rake / Trail	34 Degrees / 5.92 in (15.01 cm)				
	Engine Type	Powerplus V-Twin				
	Engine Configuration	45 Degree V-Twin 4-Stroke				
	Engine Displacement	105 cubic inch / 1720 cc				
BRAKES	Engine Cooling System	Air / Oil				
	Compression Ratio	9:1				
	Compression Pressure	180 - 185 psi				
	Valve Train	4 valves per cylinder / Hydraulic Lifters / Non-Adjustable Push Rods				
	Bore x Stroke	3.966" x 4.25"				
	Starter	Electric				
	Fuel System	Closed Loop Sequential Port Fuel Injection				
	Exhaust System Type	2 into 1 with Catalytic Converter				
	Lubrication System	Dry Sump				
	Spark Plug Type (Gap)	Bosch 7955 / FR7DC+ (.036" / .90 mm)				
	Dry Weight (Engine Approximate)					
	Brake Type (Front / Rear)	Disc / Disc				
	Front Brake	Dual Floating Disc / 4 Piston Calipers				
	Rear Brake	Single Floating Disc / 2 Piston Caliper				

Specifications may change with the addition of custom order options and / or accessories. Polaris Sales Inc. 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.



2010 INDIAN CHIEF - Classic / Dark Horse / Bomber / Vintage / Roadmaster (cont.)

1

		CLASSIC	DARK HORSE	BOMBER	VINTAGE	ROADMASTER
D R I V E S Y S T E M	Transmission Type	6 Speed Constant Mesh				
	Clutch Type	Wet, Multi-Plate				
	Primary Drive Type	Wet, Chain Drive w/ Torque Compensator				
	Primary Reduction Ratio	1.32:1				
	Final Drive Type / Belt Width /	Belt Drive / 136 Tooth /				
	Gear Shift Pattern	1 Down, 5 Up				
	Internal Gear Ratios 1st	3.77:1				
	2nd	2.56:1				
	3rd	1.87:1				
	4th	1.44:1				
S U S P E N S I O N	5th	1.15:1				
	6th	1.0:1				
	Front Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)				
	Rear Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)				
	Front Tire	Black Wall - Michelin Commander 130/90R16 White Wall - Metzler Marathon ME880 130/90R16				
	Rear Tire	Black Wall - Michelin Commander 150/80R16 White Wall - Metzler Marathon ME880 150/80R16				
	Minimum Tread Depth	.063 in. (1.6mm)				
	Front Type	41 mm Conventional Telescopic Fork				
	Front Travel	4.25 in. (10.8 cm)				
	Front Tube Diameter	41 mm (1.6 in.)				
L I G H T S	Rear Shock Type	Single, Adjustable Preload				
	Rear Swingarm Type	Steel, Conventional				
	Rear Travel (inches)	2.87 in (7.3 cm)				
	Headlamp	High / Low: H-4 60/55W				
	Brake / Tail Light	1157 12V 21/5W				
	License Plate Light	C5W				
	Turn Signals	1156 12V 27W				
	Front Fender Light	LED - Must be replaced as an assembly.				
	Alternator / Battery	42A @ 13.0VDC / 12V 20AH 300CCA Sealed Glass Mat				
	Fuse Box					
F U S E S	Main	40 amp circuit breaker				
	IC B+	5A Fuse				
	IC IGN	10A Fuse				
	PARK LPS	5A Fuse				
	ECU B+	7.5A Fuse				
	ECU IGN	5A Fuse				
	KEY B+	20A Fuse				
	PCM B+	30A Fuse				
	PCM IGN	15A Fuse				

Specifications may change with the addition of custom order options and / or accessories. Polaris Sales Inc. 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.



SPECIFICATIONS / GAUGES

GENERAL SPECIFICATIONS

2011 INDIAN CHIEF - Classic / Dark Horse / Blackhawk / Vintage / Roadmaster

	CLASSIC	DARK HORSE	BLACKHAWK	VINTAGE	ROADMASTER
CAPACITIES & DIMENSIONS	Oil Capacity				
	3.5 (3.31 ltr) Quarts w / filter at oil change				
	Fuel Capacity				
	5.6 US Gal (21.2 ltr)				
	Fuel Type / Octane Minimum				
	Premium Unleaded / 91 Octane				
	Dry Weight				
	728 lbs (330.2 Kg)	746 lbs (338.4 Kg)	766 lbs (347.5 Kg)	753 lbs (341.6 Kg)	747 lbs (339 Kg)
	Wet Weight				
	761.6 lbs (345.5 Kg)	779.6 lbs (353.6 Kg)	799.6 lbs (362.7 Kg)	786 lbs (356 Kg)	780.6 lbs (354.1 Kg)
ENGINE	Gross Vehicle Weight Rating (GVWR)				
	1220 lbs (553 Kg)				
	Gross Axle Weight Rating FRONT AXLE				
	549 lbs (249 Kg)				
	Gross Axle Weight Rating REAR AXLE				
	671 lbs (304 Kg)				
	Maximum Load (See page 1.12 for more information)				
	458.4 lbs (207.5 Kg)	440.4 lbs (199.4 Kg)	420.4 lbs (190.7 Kg)	434 lbs (196.2 Kg)	439.4 lbs (198.1 Kg)
	Overall Length				
	100.5 in (2553 mm)				
BRAKES	Overall Width				
	40.5 in (1029 mm)				
	Overall Height - w/o windshield				
	50.5 in (1283 mm)				
	Seat Height				
	27.25 in (708 mm)				
	Ground Clearance				
	6.0 in (162 mm)				
	Passenger Capacity				
	0	1	1	1	1
ENGINE	Wheelbase				
	68.4 in. (1737 mm)				
	Rake / Trail				
	34 Degrees / 5.92 in (15.01 cm)				
	Engine Type				
	Powerplus V-Twin				
	Engine Configuration				
	45 Degree V-Twin 4-Stroke				
	Engine Displacement				
	105 cubic inch / 1720 cc				
BRAKES	Engine Cooling System				
	Air / Oil				
	Compression Ratio				
	9:1				
	Compression Pressure				
	180 - 185 psi				
	Valve Train				
	4 valves per cylinder / Hydraulic Lifters / Non-Adjustable Push Rods				
	Bore x Stroke				
	3.966" x 4.25"				
BRAKES	Starter				
	Electric				
	Fuel System				
	Closed Loop Sequential Port Fuel Injection				
	Exhaust System Type				
	2 into 1 with Catalytic Converter				
	Lubrication System				
	Dry Sump				
	Spark Plug Type (Gap)				
	Bosch 7955 / FR7DC+ (.036" / .90 mm)				
BRAKES	Dry Weight (Engine Approximate)				
	Brake Type (Front / Rear)				
	Disc / Disc				
	Front Brake				
	Dual Floating Disc / 4 Piston Calipers				
	Rear Brake				
	Single Floating Disc / 2 Piston Caliper				

Specifications may change with the addition of custom order options and / or accessories. Polaris Sales Inc. 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.



2011 INDIAN CHIEF - Classic / Dark Horse / Blackhawk / Vintage / Roadmaster (cont.)

1

		CLASSIC	DARK HORSE	BLACKHAWK	VINTAGE	ROADMASTER
D R I V E S Y S T E M	Transmission Type	6 Speed Constant Mesh				
	Clutch Type	Wet, Multi-Plate				
	Primary Drive Type	Wet, Chain Drive w/ Torque Compensator				
	Primary Reduction Ratio	1.32:1				
	Final Drive Type / Belt Width /	Belt Drive / 136 Tooth /				
	Gear Shift Pattern	1 Down, 5 Up				
	Internal Gear Ratios 1st	3.77:1				
	2nd	2.56:1				
	3rd	1.87:1				
	4th	1.44:1				
S U S P E N S I O N	5th	1.15:1				
	6th	1.0:1				
	Front Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)				
	Rear Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)				
	Front Tire	Black Wall - Michelin Commander 130/90R16 White Wall - Metzler Marathon ME880 130/90R16				
	Rear Tire	Black Wall - Michelin Commander 150/80R16 White Wall - Metzler Marathon ME880 150/80R16				
	Minimum Tread Depth	.063 in. (1.6mm)				
	Front Type	41 mm Conventional Telescopic Fork				
	Front Travel	4.25 in. (10.8 cm)				
	Front Tube Diameter	41 mm (1.6 in.)				
L I G H T S	Rear Shock Type	Single, Adjustable Preload				
	Rear Swingarm Type	Steel, Conventional				
	Rear Travel (inches)	2.87 in (7.3 cm)				
	Headlamp	High / Low: H-4 60/55W				
	Brake / Tail Light	1157 12V 21/5W				
	License Plate Light	C5W				
	Turn Signals	1156 12V 27W				
	Front Fender Light	LED - Must be replaced as an assembly.				
	Alternator / Battery	42A @ 13.0VDC / 12V 20AH 300CCA Sealed Glass Mat				
	Fuse Box					
F U S E S	Main	40A Maxi Fuse				
	IC B+	5A Fuse				
	IC IGN / HORN	10A Fuse				
	TURNS B+	10A Fuse				
	TURNS IGN	5A Fuse				
	PARK LPS	5A Fuse				
	ECU B+	7.5A Fuse				
	ECU IGN	5A Fuse				
	KEY B+	20A Fuse				
	BCM B+	20A Fuse				
S	BCM IGN	15A Fuse				
	AUX BATT	15A Fuse				

Specifications may change with the addition of custom order options and / or accessories. Polaris Sales Inc. 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.



SPECIFICATIONS / GAUGES

GENERAL SPECIFICATIONS

2012 INDIAN CHIEF - Classic / Dark Horse / Vintage

		CLASSIC	DARK HORSE	VINTAGE
CAPACITIES & DIMENSIONS	Oil Capacity	3.5 (3.31 ltr) Quarts w / filter at oil change		
	Fuel Capacity	5.6 US Gal (21.2 ltr)		
	Fuel Type / Octane Minimum	Premium Unleaded / 91 Octane		
	Dry Weight	728 lbs (330.2 Kg)	746 lbs (338.4 Kg)	753 lbs (341.6 Kg)
	Wet Weight	761.6 lbs (345.5 Kg)	779.6 lbs (353.6 Kg)	786 lbs (356 Kg)
	Gross Vehicle Weight Rating (GVWR)	1220 lbs (553 Kg)		
	Gross Axle Weight Rating FRONT AXLE	549 lbs (249 Kg)		
	Gross Axle Weight Rating REAR AXLE	671 lbs (304 Kg)		
	Maximum Load (See page 1.12 for more information)	458.4 lbs (207.5 Kg)	440.4 lbs (199.4 Kg)	434 lbs (196.2 Kg)
	Overall Length	100.5 in (2553 mm)		
ENGINE	Overall Width	40.5 in (1029 mm)		
	Overall Height - w/o windshield	50.5 in (1283 mm)		
	Seat Height	27.25 in (708 mm)		
	Ground Clearance	6.0 in (162 mm)		
	Passenger Capacity	0	1	1
	Wheelbase	68.4 in. (1737 mm)		
	Rake / Trail	34 Degrees / 5.92 in (15.01 cm)		
	Engine Type	Powerplus V-Twin		
	Engine Configuration	45 Degree V-Twin 4-Stroke		
	Engine Displacement	105 cubic inch / 1720 cc		
BRAKES	Engine Cooling System	Air / Oil		
	Compression Ratio	9:1		
	Compression Pressure	180 - 185 psi		
	Valve Train	4 valves per cylinder / Hydraulic Lifters / Non-Adjustable Push Rods		
	Bore x Stroke	3.966" x 4.25"		
	Starter	Electric		
	Fuel System	Closed Loop Sequential Port Fuel Injection		
	Exhaust System Type	2 into 1 with Catalytic Converter		
	Lubrication System	Dry Sump		
	Spark Plug Type (Gap)	Bosch 7955 / FR7DC+ (.036" / .90 mm)		
BRAKES	Dry Weight (Engine Approximate)			
	Brake Type (Front / Rear)	Disc / Disc		
	Front Brake	Dual Floating Disc / 4 Piston Calipers		
	Rear Brake	Single Floating Disc / 2 Piston Caliper		

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2012 INDIAN CHIEF - Classic / Dark Horse / Vintage (cont.)

	CLASSIC	DARK HORSE	VINTAGE
D R I V E S Y S T E M	Transmission Type	6 Speed Constant Mesh	
	Clutch Type	Wet, Multi-Plate	
	Primary Drive Type	Wet, Chain Drive w/ Torque Compensator	
	Primary Reduction Ratio	1.32:1	
	Final Drive Type / Belt Width /	Belt Drive / 136 Tooth /	
	Gear Shift Pattern	1 Down, 5 Up	
	Internal Gear Ratios 1st	3.77:1	
	2nd	2.56:1	
	3rd	1.87:1	
	4th	1.44:1	
S U S P E N S I O N	5th	1.15:1	
	6th	1.0:1	
	Front Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)	
	Rear Wheel (Type / Size)	Spoke or Billet / 3.50 x 16 (inch)	
	Front Tire	Black Wall - Michelin Commander 130/90R16 White Wall - Metzler Marathon ME880 130/90R16	
	Rear Tire	Black Wall - Michelin Commander 150/80R16 White Wall - Metzler Marathon ME880 150/80R16	
	Minimum Tread Depth	.063 in. (1.6mm)	
	Front Type	40.9 mm Conventional Telescopic Fork	
	Front Travel	5.69 in. (14.5 cm)	
	Front Tube Diameter	1.6 in (40.9 mm)	
L I G H T S	Rear Shock Type	Single, Adjustable Preload	
	Rear Swingarm Type	Steel, Conventional	
	Rear Travel (inches)	2.87 in (7.3 cm)	
	Headlamp	High / Low: H-4 60/55W	
	Brake / Tail Light	1157 12V 21/5W	
	License Plate Light	C5W	
	Turn Signals	1156 12V 27W	
	Front Fender Light	LED - Must be replaced as an assembly.	
	Alternator / Battery	42A @ 13.0VDC / 12V 20AH 300CCA Sealed Glass Mat	
	Fuse Box		
F U S E S	Main	40A Maxi Fuse	
	IC B+	5A Fuse	
	IC IGN / HORN	10A Fuse	
	TURNS B+	10A Fuse	
	TURNS IGN	5A Fuse	
	PARK LPS	5A Fuse	
	ECU B+	7.5A Fuse	
	ECU IGN	5A Fuse	
	KEY B+	20A Fuse	
	BCM B+	20A Fuse	
	BCM IGN	15A Fuse	
	AUX BATT	15A Fuse	

Specifications may change with the addition of custom order options and / or accessories. Polaris Sales Inc. 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.



SPECIFICATIONS / GAUGES

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 gross vehicle weight rating and the 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 (page 1.15) 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



VEHICLE INFORMATION

VEHICLE IDENTIFICATION NUMBER (VIN) 2009-2011

VIN is stamped on the right side of the frame at the down tube gusset-plate.

**SAE-assigned
World Manufacturing
Identifier**

Chassis:
C = Chief

Model Designator:
A = Bomber
B = Standard
C = Classic
D = Deluxe
H = Dark Horse
R = Road Master
V = Vintage

Market:
D = 49 State
L = California

Serial Number

5YACRA6D19K000000

Engine Size:
A = 1721 cc

Engine HP:
6 = 63-77

Check Digit
(May be a number
or a letter)

Model Year:
9 = 2009
A = 2010
B = 2011

**Plant/ Line
Code**
(Kings Mountain, NC)

MODEL NUMBER 2009-2011

See "MANUFACTURER LABEL" on page 1.15. for location on vehicle.

Model Designator:
A = Bomber
B = Standard
C = Classic
D = Deluxe
H = Dark Horse
R = Road Master
V = Vintage

Engine Size:
A = 1721 cc

Engine HP:
6 = 63-77

Series:
E = 49 State
L = California

Premium Designation

N10CVA6DXX

INDIAN

Model Year:
11 = 2011
10 = 2010
09 = 2009

Type:
C = Premium Cruiser (Standard)

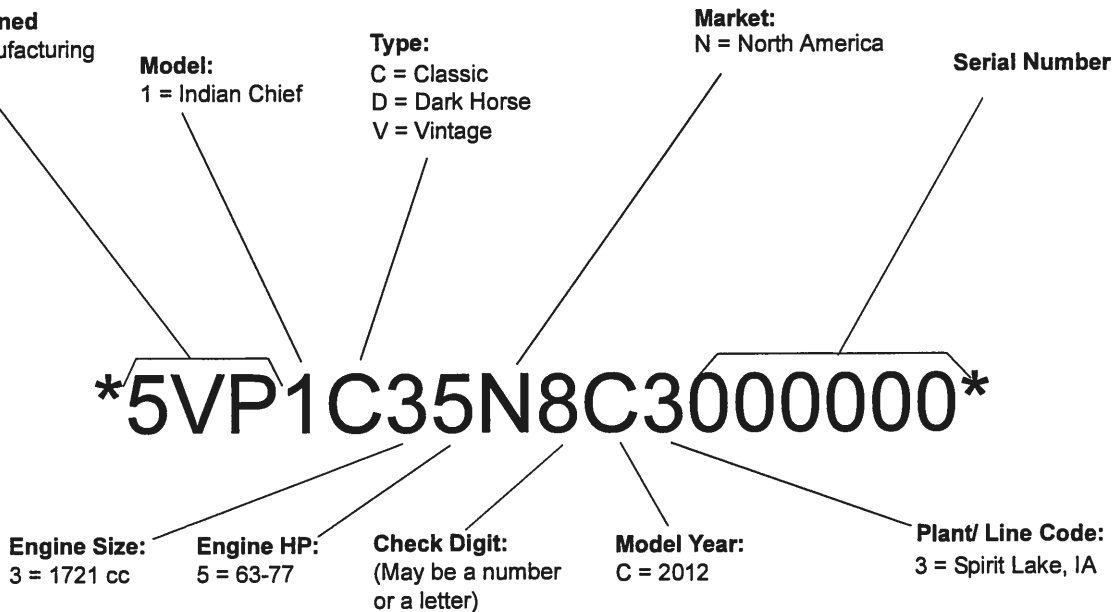
Color Indicator



SPECIFICATIONS / GAUGES

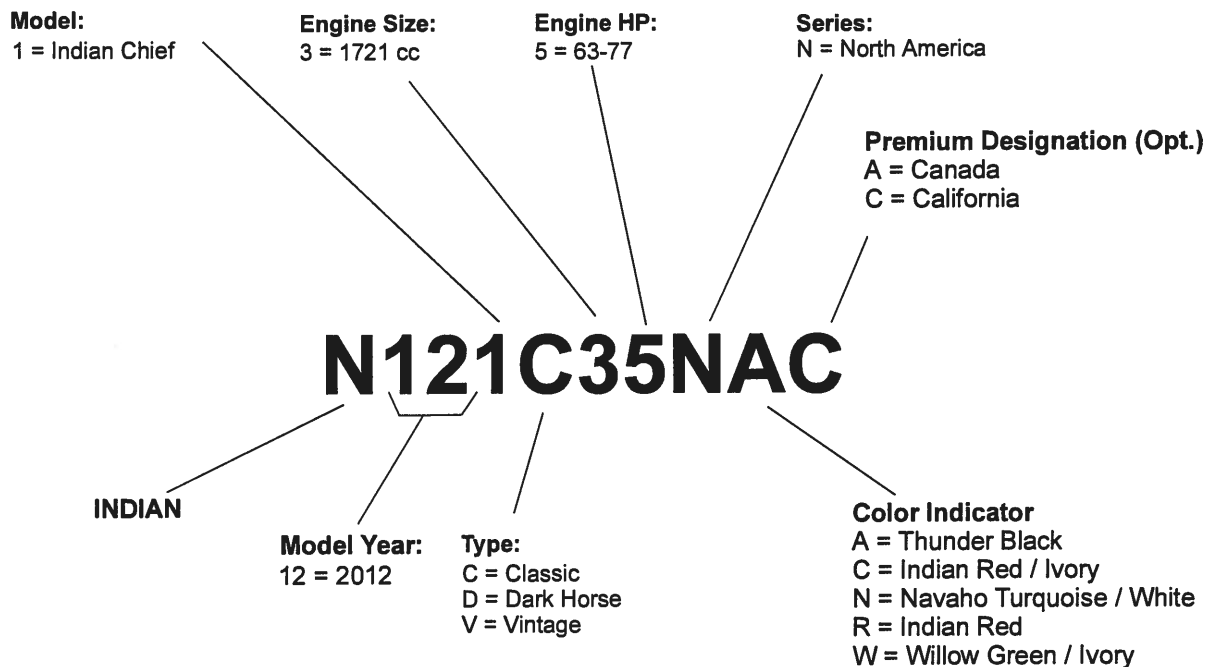
VEHICLE IDENTIFICATION NUMBER (VIN) 2012

VIN is stamped on the right side of the frame at the down tube gusset-plate.



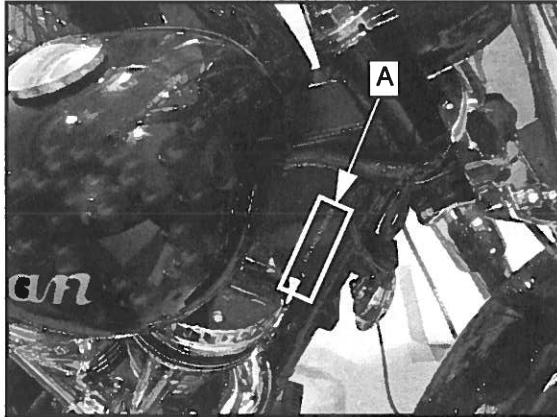
MODEL NUMBER 2012

See "MANUFACTURER LABEL" on page 1.15. for location on vehicle.



VIN NUMBER LOCATION

The vehicle identification number (A) is stamped on the right side of the frame at the down tube gusset-plate.



MANUFACTURER LABEL

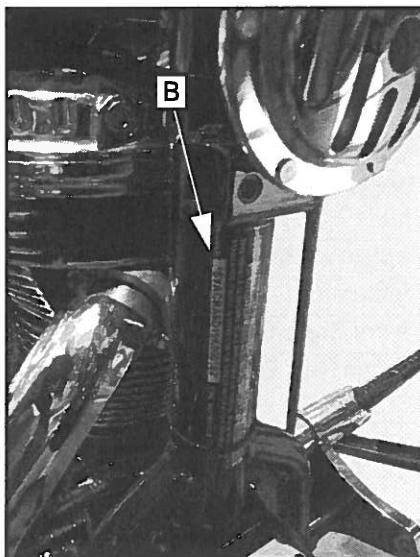
The manufacturer label (B), located on the front frame down tube, contains the following information:

VIN Number

Gross Vehicle Weight Rating (GVWR)

Gross Axle Weight Rating (GAWR)

Tire Type and Load Information.

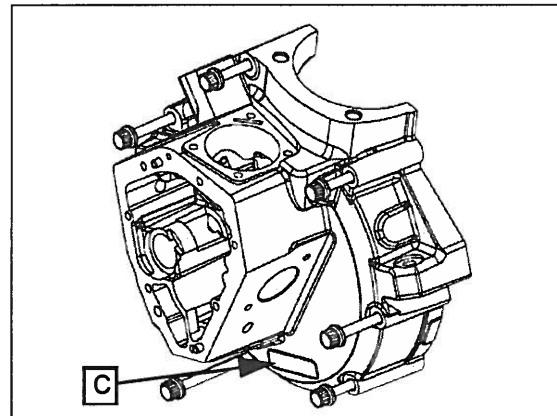


TIRE INFORMATION LABEL

2009-2012 Models: See Manufacturer label (B) for tire information.

ENGINE NUMBER LOCATION

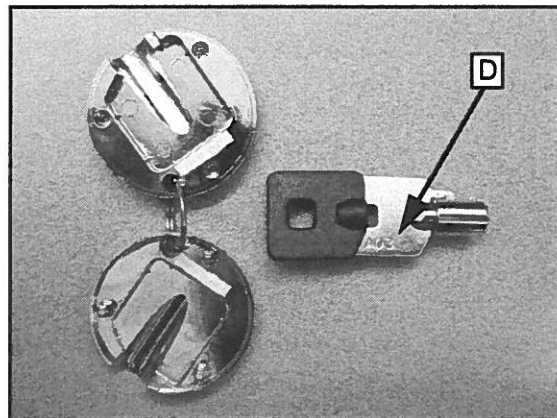
The engine number (C) is stamped into the right crankcase boss beneath the cam cover. The engine number is positioned behind the right hand frame rail with the engine installed in the frame. The stamping identifies the engine model and serial number.



KEY IDENTIFICATION NUMBER

The key identification number (D) is stamped on the key.

If it becomes necessary to replace the ignition lock key for any reason, the key will need to be disassembled in order to access the key identification number.



SPECIFICATIONS / GAUGES

PUBLICATIONS & 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 PN	Owner's Manual PN
2009-2012 Indian Motorcycles (All Models)	9923695	--
2009-2012 Indian Motorcycles (U.S.)	9923695	9923690
2009-2012 Indian Motorcycles (CAN)	9923695	9923693

REFINISHING

2009-2012 CHIEF PAINT COLORS BY MODEL

2009-2012 Indian Motorcycle Colors by Model / Year	
2009 Chief Standard	Thunder Black, Indian Red
2009 Chief Deluxe	Thunder Black, Indian Red, Winter White, Midnight Blue Metallic
2009 Chief Roadmaster	Thunder Black, Indian Red, Winter White, Midnight Blue Metallic, Smoke Silver Metallic
2009 Chief Vintage	Thunder Black, Indian Red, Willow Green, Ivory Cream, Navajo Turquoise, Winter White
2010 Chief Classic	Thunder Black, Indian Red, Dark Water Blue, Starlight Silver
2010 Chief Bomber	Warrior Silver, Warrior Green
2010 Chief Dark Horse	Thunder Black, Indian Red, Dark Water Smoke
2010 Chief Roadmaster	Thunder Black, Indian Red, Dark Water Blue, Starlight Silver, Ivory Cream.
2010 Chief Vintage	Thunder Black, Indian Red, Ivory Cream, Willow Green, Arizona Turquoise, Winter White, Maize Yellow, Plains Sky Blue
2011 Chief Classic	Thunder Black, Indian Red, Dark Water Blue, Starlight Silver
2011 Chief Dark Horse	Thunder Black, Indian Red, Dark Water Smoke
2011 Chief Blackhawk and Blackhawk Dark	Thunder Black, Ivory Cream, Indian Red
2011 Chief Roadmaster	Thunder Black, Indian Red, Dark Water Blue, Starlight Silver, Ivory Cream
2011 Chief Vintage	Thunder Black, Indian Red, Ivory Cream, Willow Green, Arizona Turquoise, Winter White, Maize Yellow, Plains Sky Blue
2012 Chief Classic	Thunder Black, Indian Red
2012 Chief Dark Horse	Thunder Black
2012 Chief Vintage	Thunder Black, Indian Red / Ivory, Navaho Turquoise / White, Indian Red, Willow Green / Ivory



2009-2012 CHIEF PAINT COLOR CODES

1

NOTE: The following paint color information is proprietary property of PPG Industries®, Inc. Please contact PPG Industries to obtain touch-up paint for your Indian Motorcycle.

2009-2012 Indian Motorcycle Colors	PPG Paint Codes (Color Formulation)
Arizona Turquoise	D753 / D797 / D754
Dark Water Blue	D977 / D958 / D952 / D754 / D960 / D740 / D966 / D759
Indian Red	D752 / D979 / D779 / D756 / D746 / D753
Ivory Cream	D753 / D980 / D967 / D750
Maize Yellow	D753 / D750 / D744 / D778 / D967
Midnight Blue Metallic	D981 / D776 / D943 / D759 / D740 / D966 / D778
Navajo Turquoise	--
Plains Blue Sky	D770 / D952 / D754 / D759 / D966 / D740 / D981
Smoked Silver Metallic (aka) Starlight Silver	D953 / D759 / D966 / D959
Thunder Black	D740
Warrior Green	D753 / D778 / D740 / D794 / D754
Warrior Silver	D767 / D740 / D754 / D959
Willow Green	D753 / D778 / D740 / D797 / D779
Winter White	D753 / D967 / D743

PAINT COLOR CARE - MATTE FINISH (SMOKE)

Indian Motorcycle's Smoke Finishes (Matte) are different than conventional high gloss finishes. The low gloss matte finish you see is produced by the clear coat. Matte paint will naturally change over time. The durability of the paint is not affected by age or this burnishing. It is simply a change in cosmetic appearance.

Smoke (Matte) finishes cannot be "buffed-out" when scratched, nicked or scuffed. Attempting to buff these finishes will result in a glossy (polished) repair not conducive to its original appearance. A polished condition can only be repaired by repainting the smoke finish using the recommended matte clear finish. Indian Motorcycle recommends that you contact your local dealer for paint repair.



SPECIFICATIONS / GAUGES

BREAK IN PERIOD

BREAK-IN PROCEDURE

The most important period in the life of a new Indian motorcycle is the period between zero and 1000 miles (1600 km). An Indian motorcycle is manufactured using the best possible materials and manufacturing techniques, but the final machining process is the break-in. During the break-in period, many parts of the engine wear and polish to correct operating clearances. Failure to comply with the break-in procedure may result in damage or premature wear to engine components. During this time, the operator should:

- Start the engine and run until normal operating temperature is achieved before riding.
- Avoid prolonged full throttle operation.
- Avoid overloading the engine at low RPM.
- Avoid operation which may result in excessive heating of the engine.

General Break-In Guidelines	
Zero (0) to 50 miles (80 km)	• Keep the engine speed below 2500 RPM in any gear. Do not lug engine. • Do not exceed 50 MPH (80 KM/H).
50 miles (80 km) to 500 miles (800 km)	• Keep the engine speed below 3500 RPM in any gear. • Vary the engine speed through all gears. • Do not operate machine at one set throttle position. • Do not exceed 55 MPH (90 KM/H).
500 miles (800 km)	• Perform the 500 mile service. See Chapter 2 for more information. • Replace the engine oil and engine oil filter
500 miles (800 km) to 1000 miles (1600 km)	• Vary the engine speed through all the gears. • Do not operate machine at one set throttle position • Do not exceed 70 MPH (115 KM/H).
1000 miles (1600 km) +	• Follow the pre-ride inspection outlined in the owner's manual.



EMISSIONS

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. Follow the Periodic Maintenance Interval Table in chapter 2 and inspect the emission control system as outlined in this manual. No adjustments can be made to the EEC system.

NOISE EMISSION CONTROL SYSTEM

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.
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:

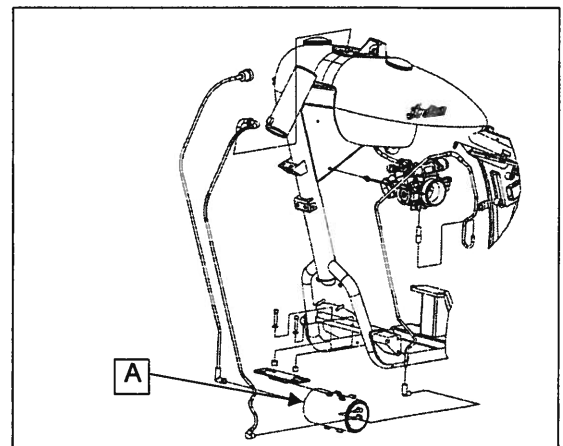
1. Removal of, or puncturing the muffler, baffles, header pipes or any other component which conducts exhaust gases.
2. Removal or puncturing of any part of the intake system.
3. Lack of proper maintenance.
4. Replacing any moving part of the motorcycle or parts of the exhaust / intake system with parts 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.

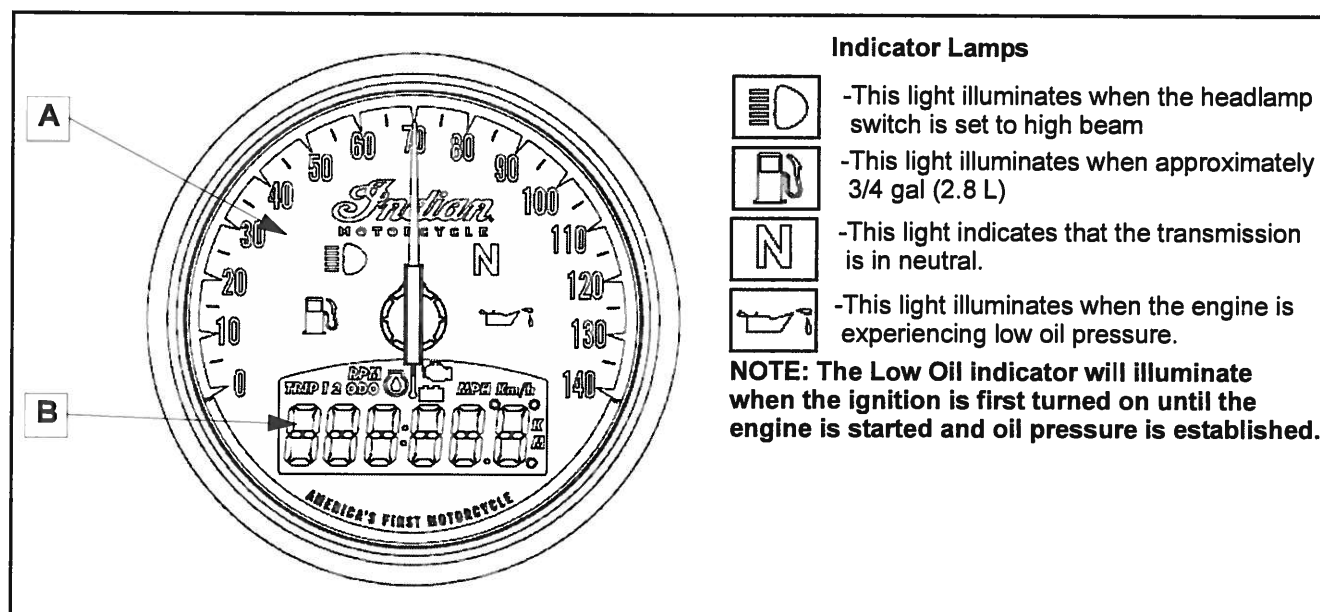
EVAPORATIVE EMISSION CONTROL

California models are equipped with an Evaporative Emissions Canister (A). Activated charcoal inside the canister temporarily stores fuel vapor from the fuel tank vent system. The fuel vapor that is stored in the charcoal canister is routed through a one-way check valve into the throttle body to be burned during combustion. Refer to Chapter 5 for system diagram and Chapter 2 for system maintenance.



SPECIFICATIONS / GAUGES

INSTRUMENTS



SPEEDOMETER (A)

The speedometer only operates when the ignition switch is in the "ON" position. The speedometer receives an input signal from the ECU. The ECU outputs the speed information to the speedometer via CAN. These outputs are displayed by the analog needle (speed indicator) or in the MFD display when SPEED mode is selected.

LOW FUEL INDICATOR (MFD)

When fuel level becomes low, approximately 3/4 of a gallon remaining, the low fuel symbol on the speedometer will illuminate and the LCD Display will switch into a Low Fuel Mileage Counter Mode that informs the rider the number of miles that have been ridden since the indicator was activated.

MULTI-FUNCTION DISPLAY or MFD (B)

The MFD allows the user to view multiple modes. Mode selection is performed by pressing the toggle switch located on the backside of the left hand switch cube.

FAULT CODE DISPLAY (MFD)

Fault codes are displayed in the MFD when a specific electrical circuit is not functioning properly.

The MFD can display the following information:

- Trip 1
- Trip 2
- RPM
- Speed
- Hour Meter
- Battery Voltage (Charge Indicator)
- Clock
- Low Fuel Mileage Counter
- Fault Codes

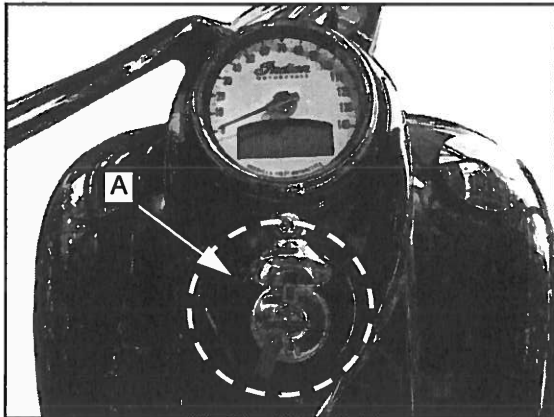
FAULT CODE DISPLAYED	DESCRIPTION
√ FPUMP	Fuel Pump
√ O2HTR	O2 Heater
√ STRTR	Starter Solenoid
√ TURNS	Turns Flasher
√ HDLT	Head Light
√ BRKLT	Brake Light
√ SPTLT	Spot Light

To clear the fault code, hold the mode button for 2 seconds.

INSTRUMENTATION / CONTROLS

IGNITION LOCK KEY

The ignition switch key (A) locks the ignition switch in the OFF position.



IGNITION SWITCH

The ignition switch has 3 positions - OFF (central position), ON (turn clockwise), and ACC (turn counter-clockwise). See table below for switch function.

Ignition Switch Function

OFF	No electrical circuits are active. Ignition switch key can be used to lock the ignition switch.
ON	All electrical circuits are energized. The taillight, fender light, and instrument lights illuminate. Note: To energize headlamp circuit on 2009 - 2011 models equipped with spot lights, switch the spot light switch to the ON position and back to the OFF position, or start the engine. ALL - With engine stop/run switch set to the RUN position you can start the engine, activate emergency flashers and turn signals.
ACC	Power is supplied to accessory circuits, fender light and tail light. Headlamp and tail lamps are OFF, and turn signals inactive.

INSTRUMENT CLUSTER

The speedometer and multi-function display (MFD) includes the items listed on the following pages. The MODE button toggles through various functions, sets the clock, and resets all functions, except the odometer.



The MODE switch is located on the left hand switch cube, behind the clutch lever.

SPEEDOMETER

The speedometer displays current motorcycle speed in miles per hour (MPH) or kilometers per hour (Km/h) (international). To change setting between MPH or Km/h, toggle the MODE switch to the odometer display. Hold the MODE button for 30 seconds to change setting.

TACHOMETER

Located in the MFD, the tachometer displays current engine speed in revolutions per minute (RPM).



SPECIFICATIONS / GAUGES

VOLT METER

The volt meter displays battery voltage being supplied to main electrical circuits when the key is in the ON position.

The meter will display approximate battery voltage when the key is ON without the engine running. With the engine running, the meter will display approximate battery charging voltage (13.0V - 13.9V).

CLOCK

The clock is located in the MFD, and is displayed with the key in the ON position.

To set the clock:

- Turn key to ON or ACC.
- Use the MODE button to toggle the display to **CLOCK**.
- Press and *hold* the MODE button until the hour segment flashes, then release the button.
- With the hour flashing, tap the MODE button to advance the hour setting until the correct hour is displayed.
- Press and *hold* the MODE button until the minute segment flashes, then release the button.
- Tap the MODE button to advance setting until the correct minute digit is displayed.
- Press and *hold* MODE to save the current time and exit the clock set mode
- Turn the key OFF. The clock is set until the battery is disconnected or discharged.

TRIP ODOMETER

The trip odometer shows total miles traveled since the trip odometer was reset. Use the MODE button to toggle between odometer and trip meter. To reset the trip meter:

- Turn the key ON and toggle to the trip meter to TRIP 1 or 2.
- *Hold* the MODE button until the trip meter resets.

ODOMETER

The odometer displays total mileage of the vehicle in miles or kilometers.

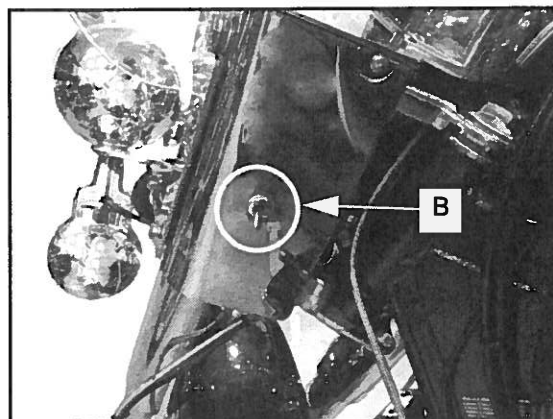
HAZARD SWITCH (Emergency Flashers)

The Hazard switch activates and de-activates emergency flashers. When emergency flashers are active, all turn signals flash.

SPOT LIGHT SWITCH

The spot light switch (B) is located on the left hand triple clamp trim cover.

The spot light switch is used to control the optional front spot lights. The spot light switch can be used to turn the headlamp on, without starting the engine, by turning the ignition switch to the ON position and toggling the spot light switch ON then OFF again.



TURN SIGNAL SWITCH

With the ignition switch in the ON position, the turn signal switch activates the turn signals.

- Push the switch left to activate left turn signals.
- Push the switch right to activate right turn signals.
- To manually cancel either turn signal, push the switch straight in toward housing while the switch is in the center position.



STARTER INTERLOCK

The motorcycle is equipped with a starter interlock switch to prevent the electric starter from operating when the transmission is in gear and the clutch is engaged (lever released).



CAUTION

Never start the motorcycle in gear with the clutch disengaged unless you are seated on the bike in a normal riding position with the front brake applied.

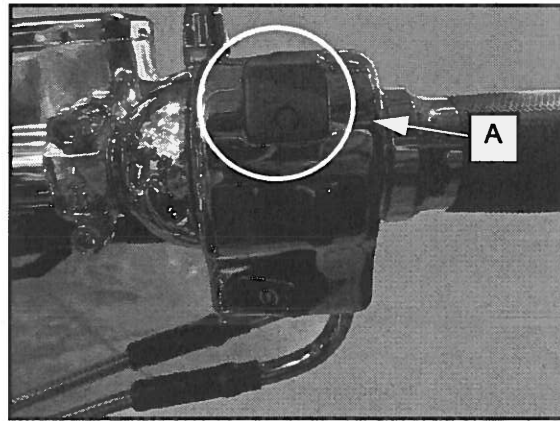
RIGHT HANDLEBAR CONTROLS

ENGINE STOP SWITCH

The engine stop/run switch (A) completes or interrupts the ignition, starter, and fuel pump circuits.

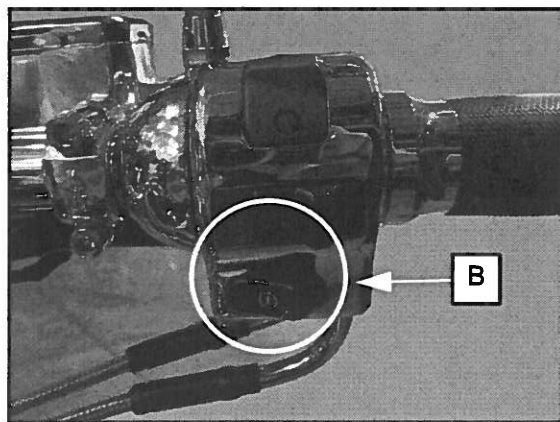
Press RUN side of engine stop/run switch (RUN position).

Press STOP side of switch to interrupt circuits and stop the engine. The engine should not start or run when the switch is in the STOP position. Use STOP/RUN switch to turn engine off under either normal or emergency conditions. Turn key OFF after the engine stops.



ENGINE STARTER BUTTON

The starter button (B) works only when STOP/RUN switch is in RUN position and the transmission is in neutral (or clutch is disengaged).



SPECIFICATIONS / GAUGES

SPECIAL SERVICE TOOLS

GENERAL / PRECISION MEASURING TOOLS

TOOL	PART NUMBER
Bearing & Seal Driver Set	PV-43558
Bore Gauge Set, 50-100mm	PV-3017
Decal, Service Bulletin Completion	7170107
Dial Caliper (Metric, 0-150mm)	PV-26900-7
Dial Caliper (Electronic Conversion. English 0-6" / Metric 0-150mm)	PV-39776
Dial Indicator, Adjustable (Metric. 10mm travel)	PV-26900-12
Dial Indicator Stand, Flexible. Magnetic Base	PV-34481
Engine Ear Listening Device	PV-39565
Feeler Gauge Set	PV-26900-8 or PV-26900-9
Outside Micrometer (0-25 & 25-50mm)	PV-3006, PV-3007
Outside Micrometer Set (0-100mm)	PV-3009
Small Hole Gauge Set	Commercially Available
Straight Edge, Precision	PV-34673
Surface Plate	Commercially Available
Telescoping Gauge Set	PU-45423
Torque Wrench (3/8" Drive 0-50 in-lb. beam type)	PV-43543
Torque Wrench (1/2" Drive 0-150 lb-ft. beam type)	PV-43552
Torque Wrench (3/8" Drive 15-100 lb-ft. click type)	PV-43564

TUNE UP & MAINTENANCE TOOLS

TOOL	PART NUMBER
Belt Tension - Sonic Tension Meter	Commercially available

ELECTRICAL TOOLS

TOOL	PART NUMBER
Ammeter Inductive Clamp for Fluke 73™ Multimeter	PV-39617
Inductive Timing Light	PV-43537
Multimeter, Fluke 73™	PV-43546
Battery Tester (must be suitable for use with AGM sealed batteries)	Commercially Available



WHEEL & TIRE TOOLS

TOOL	PART NUMBER
Air Pressure Gauge	Commercially Available Tire Pressure Gauge
Tire Bead Breaker (May be part of the tire removal equipment being used)	Commercially Available
Tire Mounting Lubricant	Commercially Available
Tire Removal Equipment	Commercially Available
Rim Protector	PV-43536
Wheel Balancing/Truing Stand	Commercially Available

TOOL ORDERING INFORMATION

Order Special Service Tools from SPX Corporation (Phone 800-328-6657 / FAX 586-578-7375) or use the link on the Indian Motorcycle Dealer Web site.

If you are not an Indian Motorcycle dealer use the phone or FAX number listed above or visit <http://polaris.spx.com/>



SPECIFICATIONS / GAUGES

REFERENCE

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	4.6mm	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		

DECIMAL EQUIVALENTS

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

METRIC TAP DRILL SIZES

Tap Size	Drill Size	Decimal Equivalent	Nearest Fraction
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



FAHRENHEIT TO CELSIUS

$^{\circ}\text{C to }^{\circ}\text{F: } 9 (^{\circ}\text{C} + 40) \div 5 - 40 = ^{\circ}\text{F}$

$^{\circ}\text{F to }^{\circ}\text{C: } 5 (^{\circ}\text{F} + 40) \div 9 - 40 = ^{\circ}\text{C}$

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
221	105
230	110
239	115

MEASUREMENT CONVERSION CHART

UNIT OF MEASURE	MULTIPLIED BY	CONVERTS TO
ft-lb	x 12	= in-lb
in-lb	x.0833	= ft-lb
ft-lb	x 1.356	= Nm
in-lb	x.0115	= kg-m
Nm	x.7376	= ft-lb
kg-m	x 7.233	= ft-lb
kg-m	x 86.796	= in-lb
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)
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)



SPECIFICATIONS / GAUGES

NOTES

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CHAPTER 2

MAINTENANCE

2

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MAINTENANCE

SERVICE SPECIFICATIONS

TUNE UP

ITEM	SPECIFICATION (2009 - 2011)
Master Cylinder Pushrod Freeplay (Rear Brake)	1-2mm (.040"-.075") Pushrod movement before brake activation
Brake Pad Friction Material Thickness (All)	1.0 mm (.039 inch) Minimum
Clutch Lever Freeplay (Hydraulic)	N/A
Compression Pressure (Cylinder)	160-190 (1103-1310 kPa)
Drive Belt Frequency (Using Sonic Tension Meter)	Frequency:47 Hz +/- 5 Hz
Idle Speed / Fast Idle Speed	NOT ADJUSTABLE (ECM / IAC valve controlled)
Oil Pressure, Lubrication @ 3000 rpm	83 kPa (12 psi) (Minimum 7 psi)
Spark Plug Type / Gap	Bosch 7955 / FR7DC+ / .9 mm (.036")
Throttle Cable Freeplay	2 - 4 mm (1/8")
Tire Pressure	Refer to tire pressure chart or manufacturers label.
Minimum Tire Tread Depth	1/16" (1.5 mm)

FLUID CHANGE

Start the engine and warm it up for several minutes. While warming up, check for oil leaks. If any leaks are found, stop the engine immediately and determine the source of the problem before starting the engine again.

TIGHTENING TORQUE	
Engine Oil Tank Drain Plug (replace o-ring)	10.8 Nm (96 in-lbs)
Primary Drive Drain Plug (replace o-ring)	10.8 Nm (96 in-lbs)
Transmission Drain Plug (integrated o-ring)	8 Nm (70 in-lbs)
2009 - 2011 Front forks (replace sealing washer)	9.3 Nm (82 in-lbs)
Oil Filter	3/4 full turn after contacting seal surface

FLUID TYPE / QUANTITY		
Engine Oil	Synthetic 20W50 Engine Oil	3.5 Qts.
Transmission Oil	Synthetic 80W90 Gear Oil	20-24 oz (600-720 cc)
2009- 2011 Fork Oil	5 Weight Fork Oil	10.5 oz (310 cc)
2012 Fork Oil	--	11.0 oz (325 cc)
Primary Drive Oil	Synthetic 80W90 Gear Oil	20-22 oz (591-650 cc)
Brake / Clutch Hydraulic Fluid	DOT 4	See Chapter 15

Use Synthetic 20W50 engine oil for all temperatures.



FASTENER TORQUE SPECIFICATIONS

MAINTENANCE ITEMS

2

DESCRIPTION	TORQUE		APPLY / NOTES
	N-m	ft-lbs (in-lbs)	
Seat (forward mounting fasteners)	9.6	(85)	
Seat (rear mounting fasteners)	1.4	(12)	
Oil / Engine Vent Line Fitting	9.6	(85)	
Air Box Cover Fasteners	13.6	10	Loctite 242
Transmission Dipstick	5.6	(50)	
Front Brake Master Cylinder Cover Screws	1.1	(10)	
Brake Master Cylinder Banjo Bolt	20.3	15	
Brake Caliper Bleeder Valve (front & rear)	3.6	(32)	
Front Caliper Banjo Bolts	20.3	15	
Caliper Covers (acorn nuts)	13.6	10	Loctite 242
Clutch Master Cylinder Cover Screws	1.1	(10)	
Clutch Master Cylinder Banjo Bolt	20.3	15	
Clutch Slave Cylinder Banjo Bolt	20.3	15	
Clutch Adjustment Nut	29.8	22	Loctite 242
Throttle Cable Jam Nut (at throttle body)	5.6	(50)	
Primary Chain Tension Adjuster Fastener	61.0	45	Loctite 242
Primary Inspection Cover Screws	11.9	(105)	Loctite 242
Clutch Inspection Cover Screws	11.9	(105)	Loctite 242
Rear Axle Nut	74.6	55	
Rear Caliper Mounting Bolts (to bracket)	54.2	40	Loctite 242
Rear Caliper Banjo Bolts	20.3	15	
Front Caliper Mounting Fasteners	54.2	40	Loctite 242
Spark Plugs	29.8	22	Anti-Seize
Swingarm Pivot Bolts	81.3	60	
Battery Terminal Bolts	8.5	(75)	
Engine Mount Fasteners	43.3	32	
Upper Triple Clamp Crown Nut	39.3	29	
Lower Triple Tree Pinch Bolts	88.1	65	Loctite 242
Front Axle Nut	74.6	55	Loctite 242
Front Wheel Axle Pinch Bolts	27.1	20	Loctite 242
Circuit Breaker Terminal Nuts	2.3	(20)	
Front Brake Rotor Fasteners 2009-2010 / 2011	24.4 / 43.3	18 / 32	Loctite 242
Rear Brake Rotor Fasteners	43.3	32	Loctite 242



MAINTENANCE

MAINTENANCE PRODUCTS

LUBRICANTS / CHEMICALS

MAINTENANCE PRODUCT PART NUMBERS

Product	Part Number
All Purpose Grease	2872187
Brake Cleaner	2872191
Brake Fluid, DOT 4	2872189
Dielectric Grease (Nyogel™)	2871329
Fuel Additive, Carbon Clean	2872190
Fuel Stabilizer	2872280
Hand Grip Adhesive (Three Bond 1501) (10ml tube)	2872575
Moly Assembly Paste	2871460
Multi-Purpose Lubricant	2872863
Vinyl and Rubber Dressing	2872194



PERIODIC MAINTENANCE

Periodic Maintenance Interval Table

2

ENGINE	ODOMETER READING MILES (Kilometers)											
Component (see operation codes below)	500 (800)	2,500 (4,023) & every 5,000 (8,000) thereafter	5000 (8,000)	10,000 (16,000)	15,000 (24,000)	20,000 (32,000)	25,000 (40,000)	30,000 (48,000)	35,000 (52,000)	40,000 (64,000)	45,000 (72,000)	50,000 (80,000)
Crankcase Ventilation System	I	I	I	I	I	I	I	I	I	I	I	I
Engine Compression	I			I		I		I		I		I
Engine Oil*	R	R	R	R	R	R	R	R	R	R	R	R
Engine Oil Filter*	R	R	R	R	R	R	R	R	R	R	R	R
Inspect Oil Lines/System	I	I	I	I	I	I	I	I	I	I	I	I
Air Filter	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
Spark Plugs	I	I	I	R	I	R	I	R	I	R	I	R

CHASSIS	ODOMETER READING MILES (Kilometers)											
Diagnostic Codes	I	I	I	I	I	I	I	I	I	I	I	I
Battery	I	I	I	I	I	I	I	I	I	I	I	I
Throttle Cable	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
Clutch 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	L	L	L	L	L	L	L	L	L
Front Brake Lever	L	I	L	L	L	L	L	L	L	L	L	L
Rear Brake Pedal	I	I	I	I	I	I	I	I	I	I	I	I
Front Fork Oil**				R		R		R		R		R
Transmission Oil*	R	I	R	R	R	R	R	R	R	R	R	R
Primary Drive Oil*	R	I	R	R	R	R	R	R	R	R	R	R
Gear Shift Pedal	I	I	I	I	I	I	I	I	I	I	I	I
Primary Chain	I	I	I	I	I	I	I	I	I	I	I	I
Clutch Endplay	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	I
Rear Wheel Alignment	I	I	I	I	I	I	I	I	I	I	I	I
Sidestand/Sidestand Pad	L	I	L	I	I	I	I	I	I	I	I	I
Front Forks and Front Axle	I	I	I	I	I	I	I	I	I	I	I	I
Steering Bearings	I	I	I	I	I	I	I	I	I	I	I	I
Suspension Linkage, Rear	I	I	I	I	I	I	I	I	I	I	I	I
Swing Arm and Rear Axle	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
Tires/Wheels	I	I	I	I	I	I	I	I	I	I	I	I
Fuel System	I	I	I	I	I	I	I	I	I	I	I	I
Fuel Filter				I		I				I		I
Electrical Equipment/Switches	I	I	I	I	I	I	I	I	I	I	I	I
Evaporative Emission Control System (CA. Only)	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

Operation Codes:

I-Inspect (tighten, clean, adjust, correct or replace if necessary)
L-Lubricate with proper lubricant

R-Replace/Rebuild

P-Perform



MAINTENANCE

*Replace at specified interval or annually
specified interval or every 2 years

**Replace at

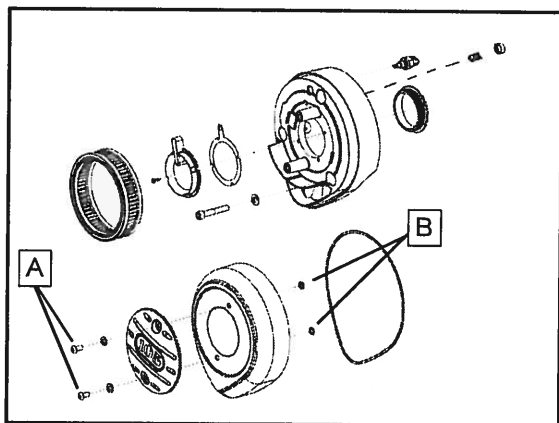
AIR FILTER

NOTE: If the motorcycle is operated in wet or dusty conditions, more frequent servicing is required.

NOTE: All 2009-2011 Indian motorcycles are equipped with a K&N® air filter as standard equipment. Utilizing a K&N Filter Care Service Kit, the air filter element can be cleaned and reused for the life of the motorcycle.

Air Filter Removal

1. Remove (2) screws (A). Remove air box cover. Collect rubber washers (B) from back side of air box cover.



2. Remove air filter element. If necessary, service air filter element per manufacturer's instructions.
3. Clean filter sealing surface on backing plate.

Air Filter Installation

1. Verify that the air box cover seal is properly seated in the groove around the outer edge of the air box backing plate.
2. Position air filter element against the air box backing plate.
3. Align air box cover trim plate to cover and insert screws (A) and washers through the air box cover. Place one rubber washer (B) over each screw.
4. Position air box cover / trim panel assembly over air filter element and align screw holes to backing plate.
5. Torque air box cover screws to specification.



Air Box Cover Screws:
10 ft-lbs (13.6 Nm)

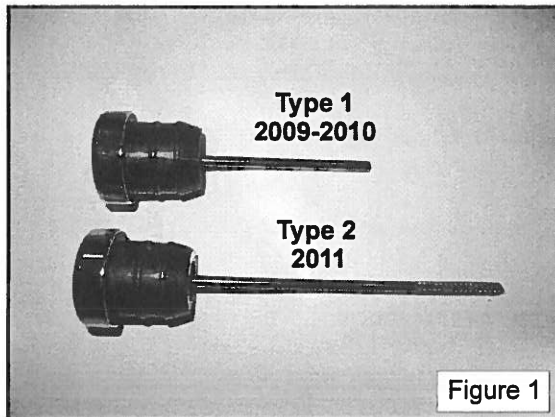
CAUTION

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



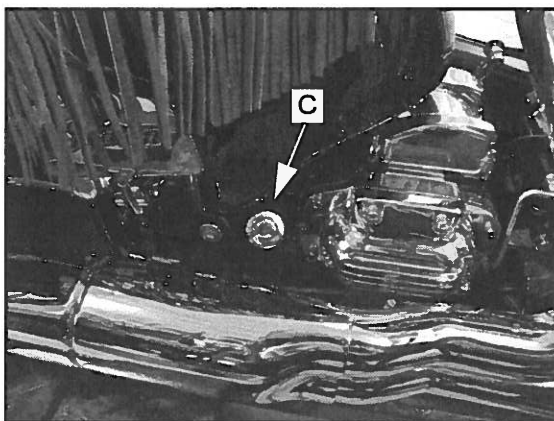
ENGINE OIL LEVEL

IMPORTANT: Two dipstick types have been utilized on Indian motorcycles built between 2009 and 2012. Although use of the Type 1 dipstick is no longer recommended, it is important to identify which dipstick is currently in use before proceeding. Engine oil level check procedures vary slightly for each dipstick type. See Figure 1 below for identification.



Type 1 & Type 2

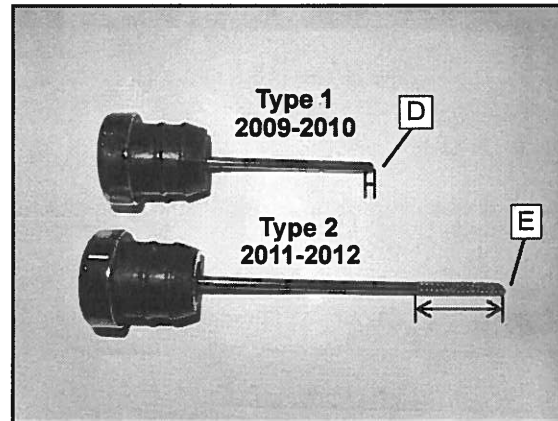
1. Warm the engine for several minutes until operating temperature is reached.
2. Stop engine and wait for 3-5 minutes.
3. Place the machine on a level area and hold it in an upright position.
4. Remove and clean the oil off of the dipstick (C).



5. Insert the dipstick into oil tank until fully seated.
6. Remove the dipstick from the oil tank and observe the oil level.

Type 1: Oil level should barely touch the end of the dipstick (D) for max fill.

Type 2: Oil level should fall anywhere within the knurled operating range (E).



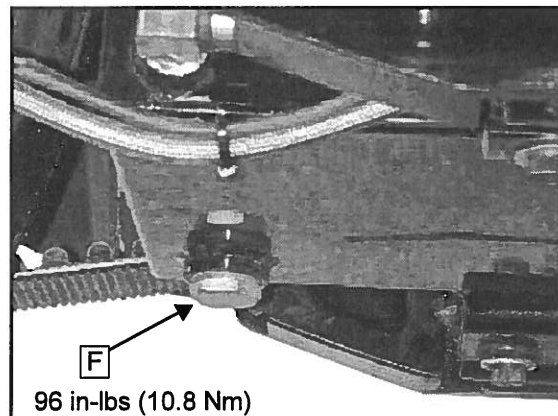
IMPORTANT: Do not overfill the oil system.

ENGINE OIL AND FILTER CHANGE

Change engine oil at intervals listed in the Periodic Maintenance Table.

Drain Engine Oil

1. Start and run engine until it reaches normal operating temperature. Stop the engine.
2. Securely support motorcycle on sidestand.
3. Place an oil drain pan under the drain plug (F).

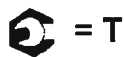


4. Remove drain plug and allow oil to drain completely.



MAINTENANCE

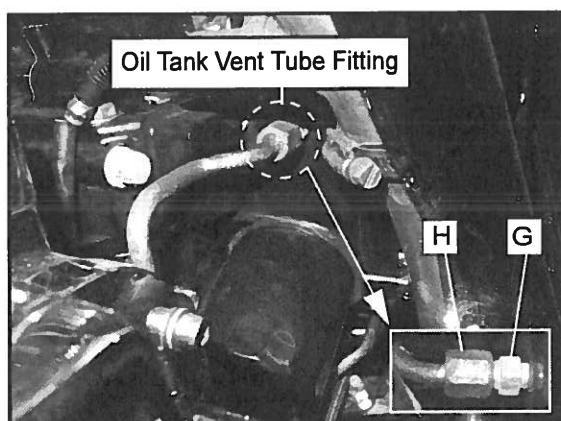
5. Replace sealing o-ring. Install drain plug and torque to specification.



Engine Oil Drain Plug Torque:
96 in-lbs (10.8 Nm)

Remove Oil Filter

1. Locate the oil tank vent tube fitting on the engine crankcase above the oil filter.
2. Using suitable line wrenches, hold the male fitting (G) in place and remove the line-side female fitting (H).



3. Move the disconnected vent tube out of the way to provide clearance for the oil filter. Remove the oil filter.
4. Clean oil filter gasket sealing surface on crankcase.

Install Oil Filter

1. Make sure new oil filter gasket is properly seated in the new oil filter, and apply a thin film of clean engine oil to the gasket. Screw new filter on until gasket contacts the filter mounting plate. Tighten filter by hand an additional 3/4 turn.
2. Reinstall the oil tank vent tube and torque fitting to specification.



Oil Tank Vent Line Nut:
96 in-lbs (10.8 Nm)

Add Oil

1. Add **approximately 3.0 quarts (2.84 liters)** of 20W50 synthetic oil through dipstick hole.
2. Reinstall dipstick. Start and run engine until it reaches normal operating temperature.

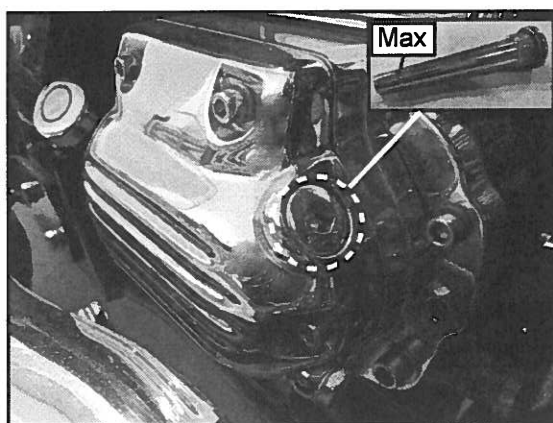
NOTE: After an oil change, the low oil pressure indicator light could remain on longer than usual. Do not rev the engine while the light is on. If light does not go out within 5 seconds of starting the engine, stop the engine immediately and investigate.

3. Stop engine and make sure there are no leaks around the drain plug and oil filter.
4. Check oil level and adjust if needed.

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

TRANSMISSION OIL LEVEL

1. Warm the transmission oil up to operating temperature by performing road test.
2. Shut engine off and park on side stand with handle bar turned towards the side stand. Allow the motorcycle to sit for 2-3 minutes while the oil settles.
3. Securely position the motorcycle in an upright and level position.
4. Remove the threaded transmission dipstick and wipe clean with an absorbent cloth.

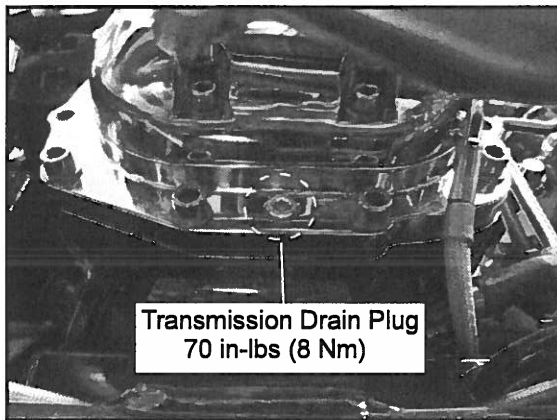


5. Thread the dipstick in completely.
6. Remove the dipstick from the transmission and observe the oil level. The transmission oil level should fall between the end of the dipstick and the Max mark.



TRANSMISSION OIL CHANGE

1. Warm the transmission oil up to operating temperature by performing road test.
2. Shut engine off and park on side stand with handle bar turned towards the side stand. Allow the motorcycle to sit for 2-3 minutes while the oil settles.
3. Securely position the motorcycle in an upright and level position.
4. Remove the transmission oil drain plug and drain oil into a suitable container.



5. Install transmission drain plug and torque to specification.

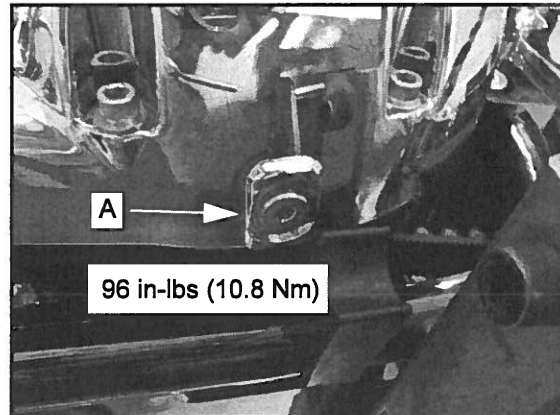
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Transmission Oil Drain Plug: 70 in-lbs (8 Nm)

6. Add approximately 20-24 oz (600-720 cc) 80W90 gear oil through the dipstick hole.
7. Thread the dipstick in completely.
8. Remove the dipstick from the transmission and observe the oil level. The transmission oil level should fall between the end of the dipstick and the Max mark.

PRIMARY DRIVE OIL CHANGE

IMPORTANT: Before changing the primary drive oil, warm the engine to normal operating temperature by riding motorcycle for 10-15 minutes.

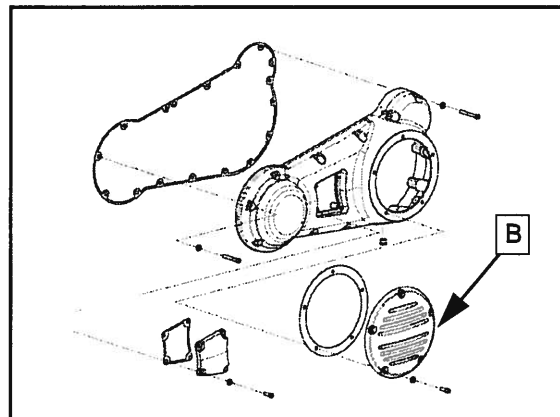
1. Remove primary drive oil drain plug (A) and drain oil into a suitable container.



2. Replace sealing o-ring on drain plug. Torque drain plug to specification.

 = T
Primary Drive Drain Plug: 96 in-lbs (10.8 Nm)

3. Remove primary drive inspection plate (B) and discard gasket.



4. Fill the primary drive housing by adding 20-22 fl.oz. (591-650 cc) synthetic 80W90 gear oil through the primary drive inspection hole.
5. Install new inspection cover gasket and inspection cover. Torque to specification.

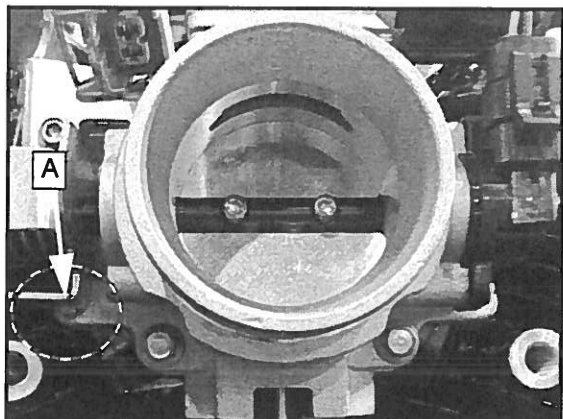
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Primary Drive Inspection Cover: 105 in-lbs (11.9 Nm)



MAINTENANCE

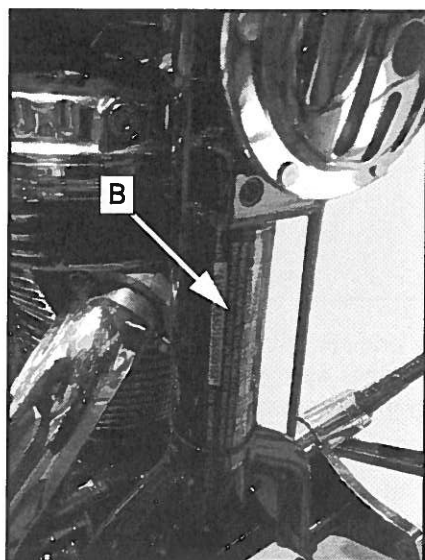
IDLE SPEED / FAST IDLE SPEED

NOTE: Idle speed is continuously monitored and adjusted by the ECM via the IAC valve. DO NOT tamper with or attempt to "adjust" the throttle plate stop screw (A)! All throttle body settings are factory pre-set. If idle is erratic or if idle speed is incorrect, refer to troubleshooting in this section to find the cause of the problem. Tampering with these screws will not correct an idle speed or control problem.



TIRE PRESSURE

NOTE: Refer to the Manufacturing Information label (B) (located on the front frame downtube) for more information. Tire pressure should be checked when tires are cool.

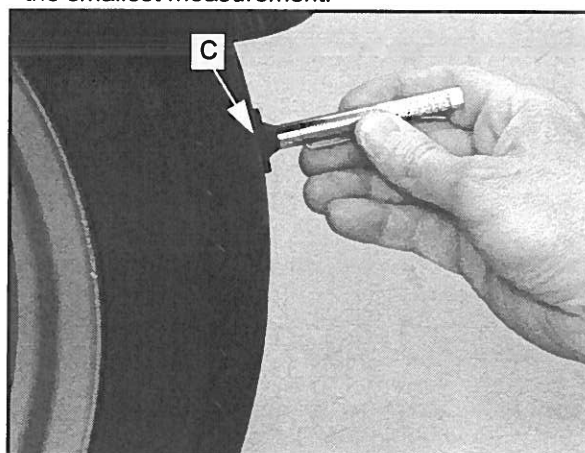


TIRE INSPECTION

WARNING

Indian motorcycles are produced using the designated tires listed above 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 Chapter 14 for a review of all tire related Warnings.

1. Inspect tires for weather checking, cuts, embedded foreign objects, abnormal wear, and surface damage.
2. Inspect front and rear wheels for damage / runout. Refer to Chapters 12 and 13 for procedure.
3. Measure tread depth at center of tread (C). 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 TIRE TREAD DEPTH

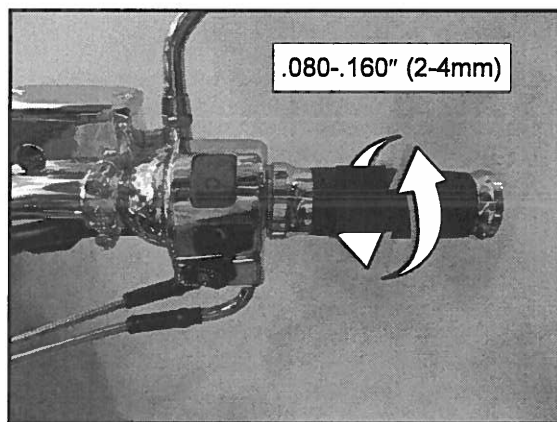
FRONT TIRE MINIMUM TREAD DEPTH	REAR TIRE MINIMUM TREAD DEPTH
1.6mm (.063") (1/16 inch)	1.6mm (.063") (1/16 inch)

THROTTLE 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.

THROTTLE CABLE FREE PLAY

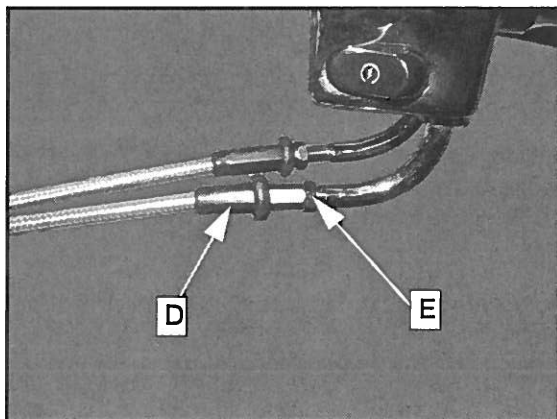
Throttle cable freeplay, the amount of control grip movement from the rest position to the point of cable resistance, should be .080-.160" (2-4 mm).



Throttle Cable Freeplay Adjustment Procedure:

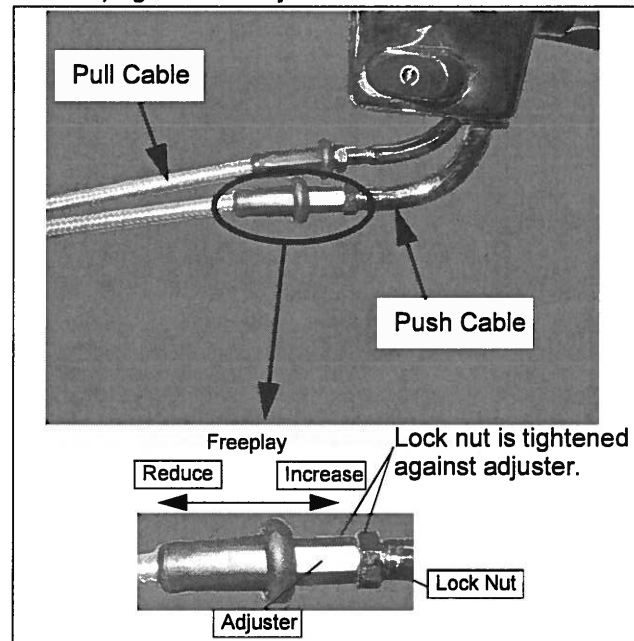
Throttle Opening Cable Adjustment

1. With engine OFF and handlebars pointed straight ahead, roll the protective covers (D) back to expose the cable adjusters. Loosen the cable lock nuts (E) as far as possible on both cables.



2. Turn both cable adjusters toward lock nuts until they lightly contact the lock nuts.
3. Turn throttle opening cable adjuster (front cable) out until freeplay is within specified range.
4. Hold adjuster in place and tighten lock securely (by hand) against the adjuster.

2



Throttle Closing Cable Adjustment

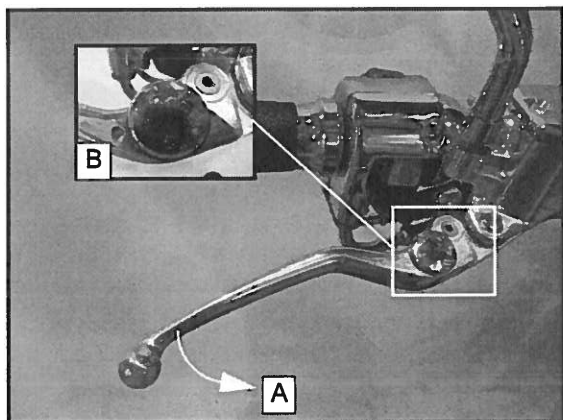
1. Hold throttle grip lightly in closed position.
2. Turn throttle closing cable (rear cable) adjuster out until slight resistance is felt at the adjuster.
3. Hold adjuster in place and tighten lock nut securely (by hand) against the adjuster.
4. Verify throttle grip moves smoothly and returns freely when released in all handlebar positions.

MAINTENANCE

FRONT BRAKE LEVER REACH

To adjust the front brake lever reach (distance to the hand grip):

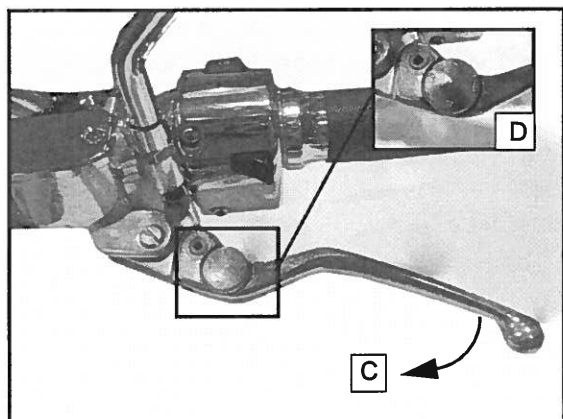
- Pull the lever away from the grip (A) and *hold*.
- To **INCREASE** lever reach distance, turn dial (B) to align a lower number with the arrow.
- To **DECREASE** lever reach distance, turn dial to align a higher number with the arrow.



CLUTCH LEVER REACH

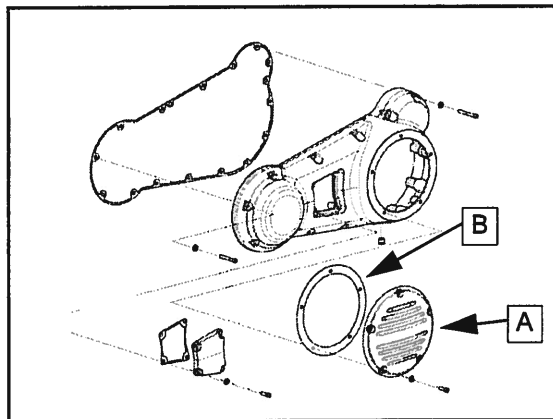
To adjust the clutch lever reach (distance to the hand grip):

- Pull the lever away from the grip (C) and *hold*.
- To **INCREASE** lever reach distance, turn dial (D) to align a lower number with the arrow.
- To **DECREASE** lever reach distance, turn dial to align a higher number with the arrow.

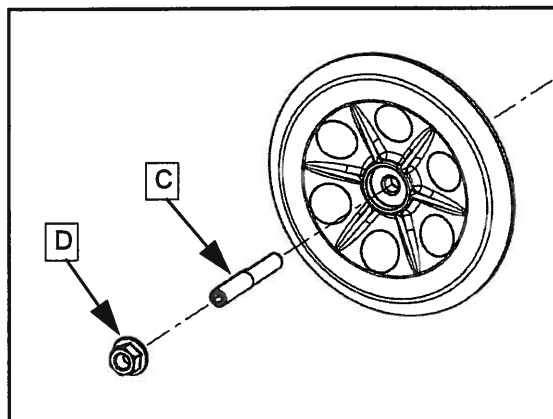


CLUTCH ADJUSTMENT

1. Secure the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Bleed the hydraulic clutch circuit (page 2.13).
3. Drain the primary drive oil (page 2.9).
4. Remove the screws securing the clutch cover (A) to the primary drive cover and discard gasket (B).



5. Hold the clutch adjuster (C) in place with a hex wrench and remove the lock nut (D).



6. Turn the push rod adjuster (C) clockwise until lightly seated and then turn adjuster back out (counter-clockwise) approximately 1 turn.
7. Apply blue Loctite™ to lock nut and reinstall lock nut finger tight.

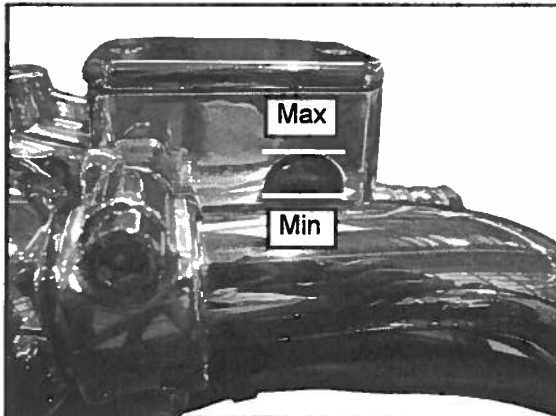
8. Hold the adjuster rod in place with a hex wrench and torque lock nut to specification.
9. Position new clutch cover gasket and clutch cover on the outer primary drive cover. Torque screws to specification



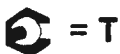
Clutch Adjuster Rod Lock Nut: **22 ft-lbs (29.8 Nm)**
Clutch Cover Screws: **105 in-lbs (11.9 Nm)**

CLUTCH FLUID LEVEL CHECK

1. Set the vehicle upright on a level surface and turn handlebars until top of clutch reservoir is level.
2. View fluid level through sight glass.



3. If level is low, check for signs of clutch fluid leaks around hoses, fittings, reservoir, and slave cylinder.
4. To add fluid, remove the reservoir cover screws, cover, and diaphragm.
5. Add DOT 4 Brake Fluid from a sealed container to proper level. Reinstall cover. Torque cover screws to specification.



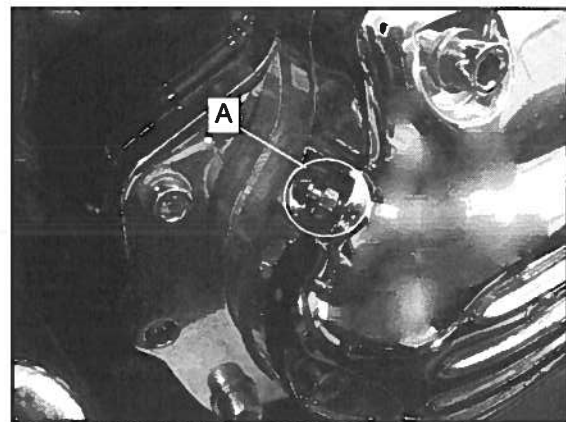
Clutch Master Cylinder Cover Screws:
10 in-lbs (1.1 Nm)

6. Wipe cap area clean to remove brake fluid.
7. Check all hoses for signs of deterioration or damage.

CLUTCH BLEEDING & FLUID CHANGE

2

1. Set the vehicle upright on a level surface and turn handlebars until top of clutch reservoir is level.
2. Remove the reservoir cover screws, cover, and diaphragm.
3. From a sealed container, add DOT 4 Brake Fluid to reservoir. Fill reservoir to the max level as viewed through the sight glass.
4. Fit a 1/4" box wrench over the bleeder screw (A) and attach a vacuum-type brake bleeder to the nipple of the bleeder screw.



5. Open the bleeder screw approximately 1/4 turn and operate the vacuum pump while observing the fluid level in the clutch reservoir.

IMPORTANT: Do not let the fluid level in the reservoir drop below the sight glass during bleeding procedure.

6. Once the fluid level reaches the MIN level in the reservoir, close the bleeder screw.
7. Refill the fluid reservoir and repeat steps 5 & 6 until the clutch lever is firm and no air bubbles are seen passing through the bleeder hose.
8. Torque bleeder screw to specification.

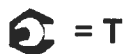


Clutch Bleed Screw:
32 in-lbs (3.6 Nm)



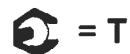
MAINTENANCE

9. Fill the fluid reservoir to the MAX level and install the reservoir diaphragm, reservoir cover and screws.
 10. Torque the clutch reservoir cover screws to specification.
8. Torque cover screws to specification.



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Clutch Master Cylinder Cover Screws:
10 in-lbs (1.1 Nm)



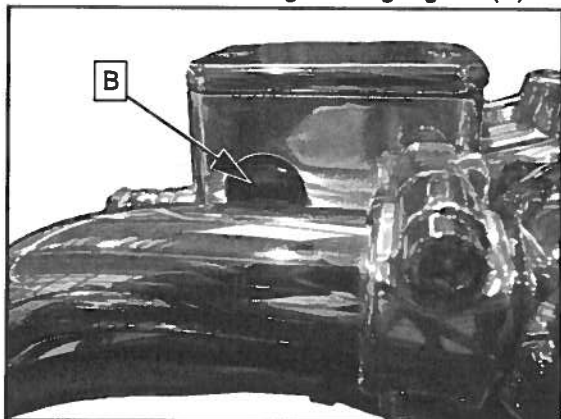
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Front Brake Master Cylinder Cover Screws:
10 in-lbs (1.1 Nm)

9. Check for deterioration of hoses.

FRONT BRAKE FLUID LEVEL

1. Set vehicle upright on a level surface and turn handlebars until top of reservoir is level.
2. View the fluid level through the sight glass (B).

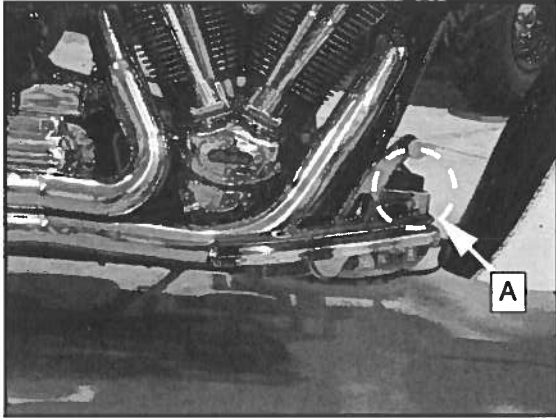


3. If level is low, check brake pads for wear (page 2.16). If pads are not worn past the service limit, inspect the brake system for leaks. Check for signs of brake fluid leaks around hoses, fittings, reservoir, and brake caliper pistons (behind brake pads).
4. To add fluid, remove the two reservoir cover screws, cover, and diaphragm.
5. Add DOT 4 Brake Fluid from a sealed container to the proper level.
6. Clean and dry the sealing surfaces of the reservoir, reservoir cover, diaphragm, and diaphragm plate with a clean lint-free cloth.
7. Reinstall diaphragm, plate, and cover.

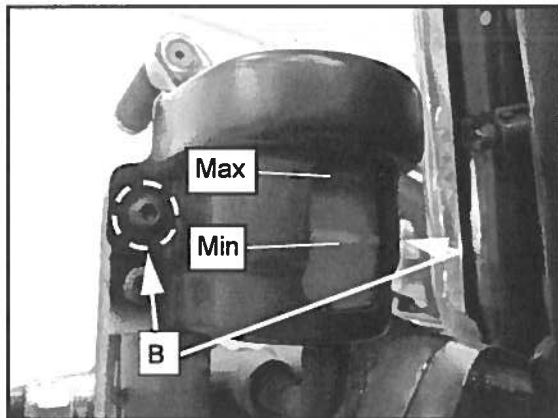


REAR BRAKE FLUID

1. The rear brake master cylinder fluid reservoir (A) is located next to the brake pedal.



2. The fluid level is checked from the backside of the master cylinder fluid reservoir.



3. If level is low, check brake pads for wear (page 2.16). If pads are not worn past the service limit, inspect the rear brake system for leaks. Check for signs of brake fluid leaks around hoses, fittings, reservoir, and brake caliper pistons (behind brake pads).

4. To add fluid, remove the two screws (B) securing the protective cover to the reservoir and remove the protective cover. Remove the reservoir cover with diaphragm by turning it counter-clockwise (as viewed from top).
5. Add DOT 4 Brake Fluid from a sealed container to bring the level between the MIN and MAX marks.
6. Clean and dry the sealing surfaces of the reservoir, reservoir cover, diaphragm, and diaphragm plate with a clean lint-free cloth.
7. Reinstall the reservoir diaphragm, cover and protective cover.

2

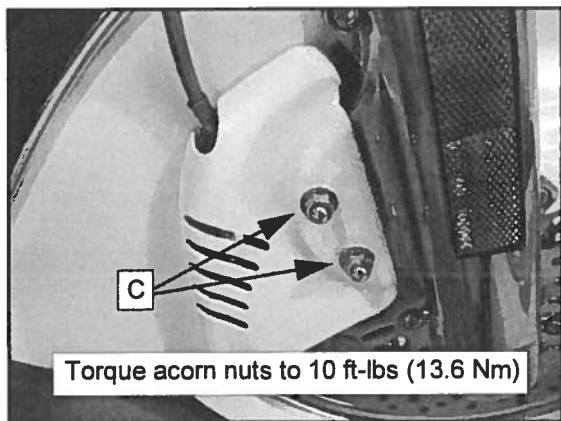


MAINTENANCE

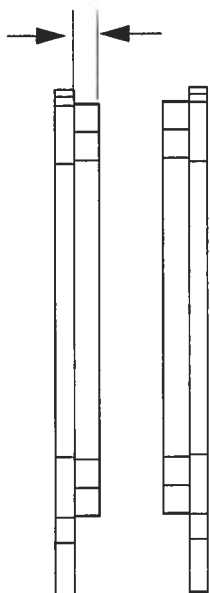
FRONT BRAKE PAD INSPECTION

NOTE: Use of an inspection mirror is recommended while performing the visual brake pad inspection.

1. Remove the two acorn nuts (C) securing the protective caliper covers.
2. Using an inspection mirror, view the brake caliper from the back side and observe the thickness of the friction material.
3. Reinstall the caliper covers.



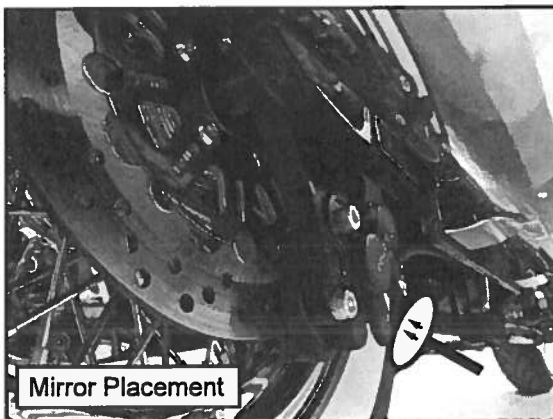
Minimum Thickness:
Front Pad: 1.0mm (.039 in.)



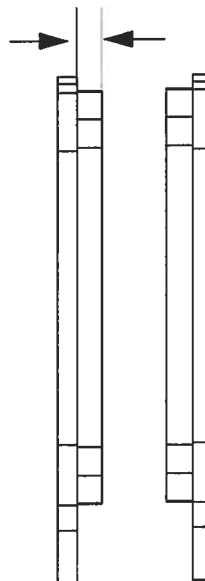
REAR BRAKE PAD INSPECTION

NOTE: Use of an inspection mirror is recommended while performing the visual brake pad inspection.

1. Set motorcycle on the side stand with the handlebar turned to the left.
2. Using an inspection mirror, view the brake caliper from the back side and observe the thickness of the friction material.

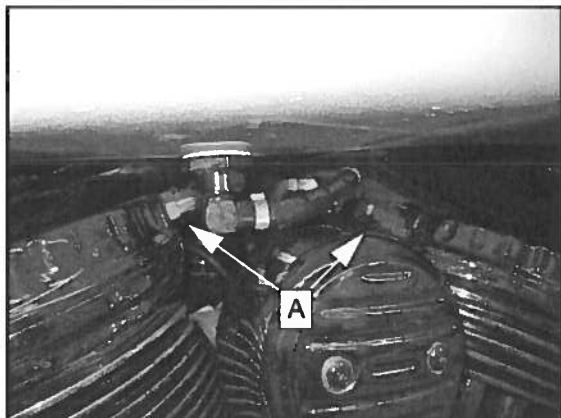


Minimum Thickness:
Rear Pad: 1.0mm (.039 in.)



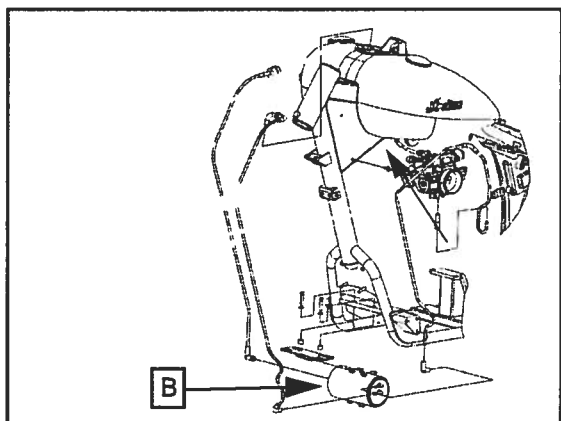
CRANKCASE VENTILATION SYSTEM

1. Standing on the right hand side of the motorcycle locate the crankcase breather hose fittings (A).
2. Inspect condition of breather hoses and hose clamps.



EVAPORATIVE EMISSION CONTROL SYSTEM (California Models)

NOTE: The fuel tank vent is routed to evaporative canister (B). Inspect all hoses for abrasion or wear and check that all connections are securely attached.



FUEL FILTER

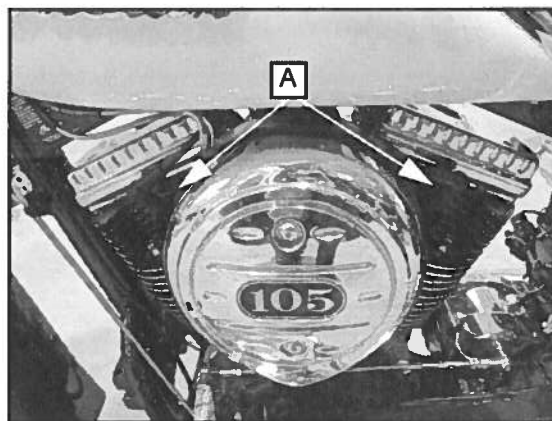
The fuel filter is attached to the electric fuel pump located inside the fuel tank. Refer to Chapter 5 for fuel system diagnostics.

SPARK PLUG REMOVAL & INSPECTION

WARNING

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

1. With the engine at room temperature, grasp the spark plug boot (A) at the base to disconnect. **DO NOT** pull on the wire or spark plug wire may be damaged.

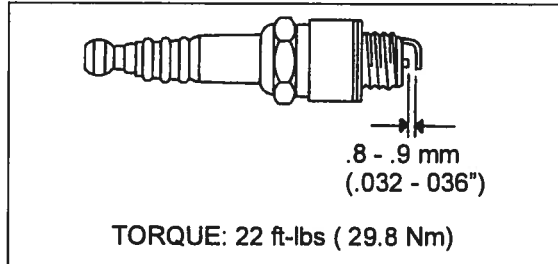


2. Clean the area around spark plug base with compressed air to remove loose debris.
3. Remove spark plugs.
4. Inspect spark plugs for:
 - Insulator damage
 - Worn electrodes
 - Deposits

MAINTENANCE

SPARK PLUG INSTALLATION

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



5. Apply anti-seize compound sparingly to spark plug threads, avoiding the bottom 2 or 3 threads.

6. Install spark plugs. Torque spark plugs to specification.

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



Spark Plugs:
22 ft-lbs (29.8 Nm)

7. Apply a light film of dielectric grease to each spark plug boot and install securely on spark plugs.

BATTERY

IMPORTANT: 2009-2011 Indian motorcycles are equipped with sealed AGM (absorbed glass mat) batteries. Use only battery chargers suitable for use with AGM battery technology. Some automotive battery chargers will damage AGM-type batteries.

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 Unit (ECM).

Take great care not to reverse the battery leads when installing the battery. Reverse power applied to the ECM will damage it instantly.

BATTERY CHARGING

Refer to Chapter 16 for battery and charging system diagnostic procedures.

BATTERY STORAGE

When the motorcycle is not used for periods of one week or longer;

- Disconnect or remove the battery from the motorcycle. Place the battery on a voltage regulated charger to maintain proper voltage. Prior to long-term storage, ensure the battery is fully charged.

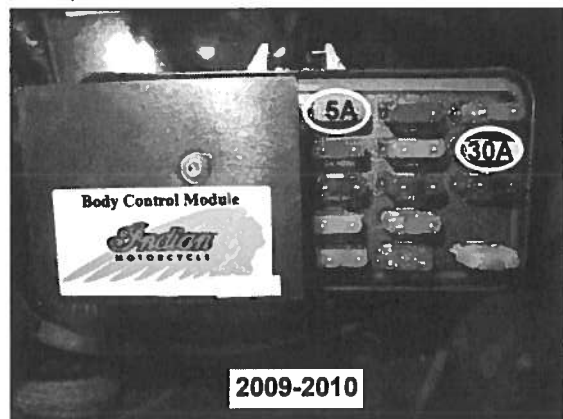
OR

- If the battery is not disconnected from the motorcycle during storage, the battery must be recharged once per week. The key-off battery draw may discharge the battery and cause long-term damage.

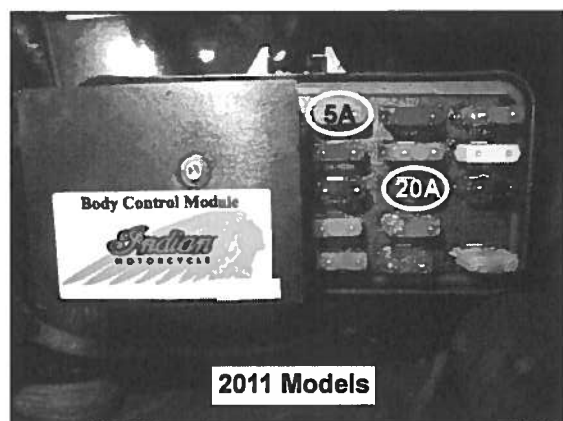


Additionally, if the battery is not disconnected from the motorcycle during storage, the following steps can be taken to reduce parasitic battery drain;

2009-2010 models, remove the 5A (IC B+) and 30A (PCM B+) fuses.



2011 models, remove the 5A (IC B+) and 20A (BCM B+) fuses.



BATTERY REMOVAL

CAUTION

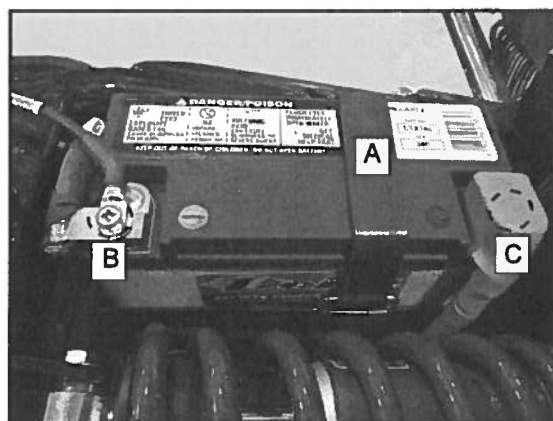
Do not disconnect the positive cable before the negative cable. Disconnecting the positive cable first increases the risk of sparks and an electric shock that could result in damage or injury.

2

1. Remove seat. (see Chapter 3).
2. Remove battery box strap (A). The strap is secured by two tabs on the battery box.
3. Remove the negative battery cable (B) first. Once removed, position negative battery cable away from the negative battery terminal.

NOTE: Model Year 2009-2010 Indian motorcycles are equipped with an auxiliary charging plug. Observe orientation on terminals prior to removing cables.

4. Remove the rubber cover from the positive (+) battery cable (C) and remove cable from battery. Position cable away from the battery terminal.



5. Remove the battery.

BATTERY INSPECTION

Battery terminals and connections should be kept free of corrosion.

1. Visually inspect the exterior of the battery. Replace battery if case damage is evident.
2. Measure battery voltage.

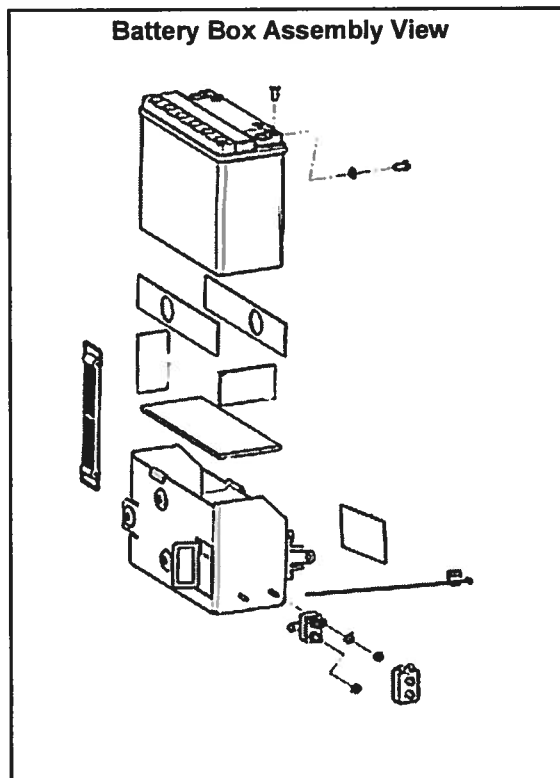
Specification: 12.5V DC minimum

3. If battery voltage is below 12.5V DC, charge it thoroughly (refer to page 16.6). Replace battery if it will not accept a charge.



MAINTENANCE

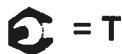
BATTERY INSTALLATION



CAUTION

Do not connect the negative cable before the positive is connected. Connecting the negative cable first increases the risk of sparks and an electric shock that could result in damage or injury.

1. Inspect battery box and strap for damage. Be sure fasteners are tight, and pads are in good condition and properly located.
2. Be sure cable ends and battery terminals are clean. Apply a light film of dielectric grease to terminal bolt threads.
3. Carefully position the battery into the battery box with the negative (-) terminal toward the front of the motorcycle.
4. Connect the positive (+) cable on the top of the battery positive post. Torque positive cable terminal bolt to specification.



Positive (+) Battery Terminal Bolt:
75 in-lbs (8.5 Nm)

5. Connect the negative (-) cables to the negative terminal. Orientate the starter ground cable beneath the frame ground cable on the negative battery terminal. Torque negative cable terminal bolt to specification.



Negative (-) Battery Terminal Bolt:
75 in-lbs (8.5 Nm)

6. Install red protective boot over + (positive) terminal.
7. Attach the battery box strap to the mounting tab on the outer right side of the box first. Stretch the strap over the battery and connect to the tab on the outer right side of the battery box.
8. Install the seat (see Chapter 3).

1. ENGINE COMPRESSION TEST

WARNING

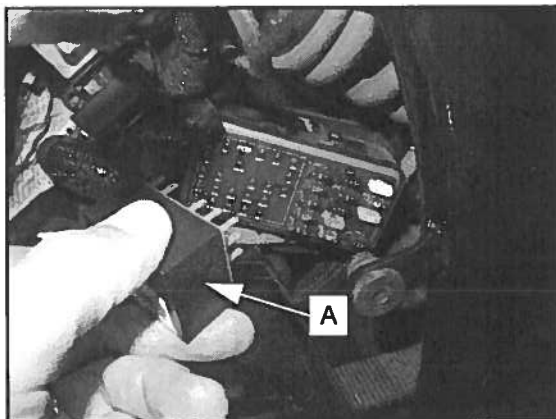
Engine components may be HOT! Wear insulated protection on your hands and arms while performing this procedure.

Battery must be fully charged prior to performing a cylinder compression test. See page 2.18 for charging information.

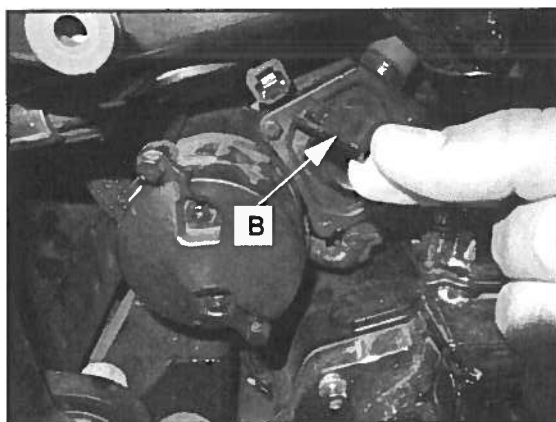
1. Warm engine to operating temperature.
2. Shift transmission into neutral and stop engine.
3. Remove seat and side covers (see Chapter 3).
4. Disconnect ignition cables from both spark plugs.
5. Remove both spark plugs from engine.
6. Install compression tester into suspect cylinder spark plug hole.



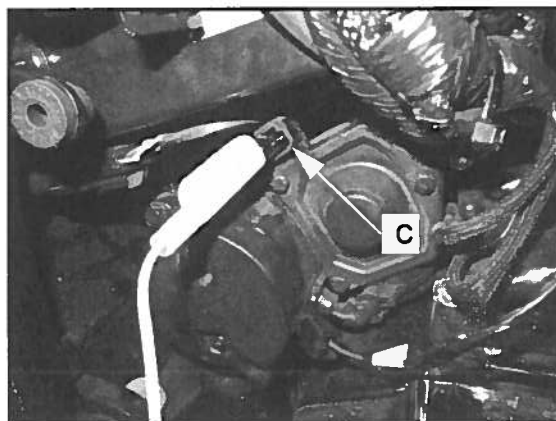
7. Locate fuse box beneath left hand side cover and remove BCM(A).



8. Locate starter motor beneath the right hand side cover and disconnect the plug (B) located at the starter solenoid.



9. Using a remote start switch, attach one of the switch leads to the starter solenoid male terminal (C) and the other lead to the positive (+) battery terminal.



10. Open throttle and activate the remote start switch to crank the engine until needle on compression gauge stops rising (about 5 seconds).

11. Repeat procedure for other cylinder. Cylinder compression should be within 10% of each other.

Engine Compression:

**STD: 160-190 psi
(1103-1310 kPa)**

**SERVICE LIMIT:
Below 160 PSI**

High engine compression may indicate:

- Carbon deposits on piston crown / cylinder head
- Engine modification
- Addition of performance parts
- Faulty gauge

Low engine compression may indicate:

- Debris / carbon on valve face or valve seat.
- Worn piston and/or piston rings
- Piston ring stuck in the piston ring groove
- Leaking valves or head gasket
- Slow starter motor cranking speed
- Valve timing incorrect
- Faulty gauge

CYLINDER LEAKAGE TEST

If compression is low, perform a cylinder leakage test to determine where leakage is occurring. Follow instructions provided with test equipment.

Cylinder Leakdown Tester: Commercially Available

ENGINE COMPRESSION TEST (WET)

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

1. Pour 3-5 cc of clean engine oil into one spark plug hole. Repeat cylinder compression test. Repeat for the other cylinder.

MAINTENANCE

2. If compression increases substantially, inspect cylinder, piston, and rings. If compression does not increase, inspect valves and valve seats.

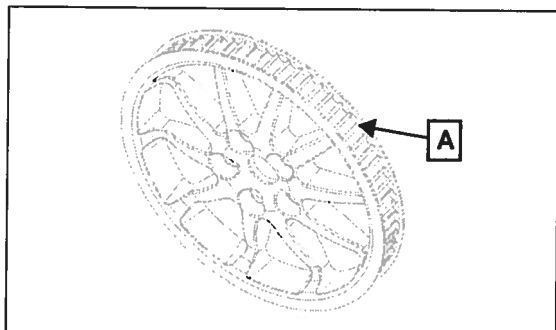
SPROCKET INSPECTION

1. Inspect front and rear sprocket teeth (Chapter 11) for wear or damage from foreign material. Closely inspect drive belt condition at the same time.

DRIVE BELT CLEANING

Drive belt and sprocket service life is 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.

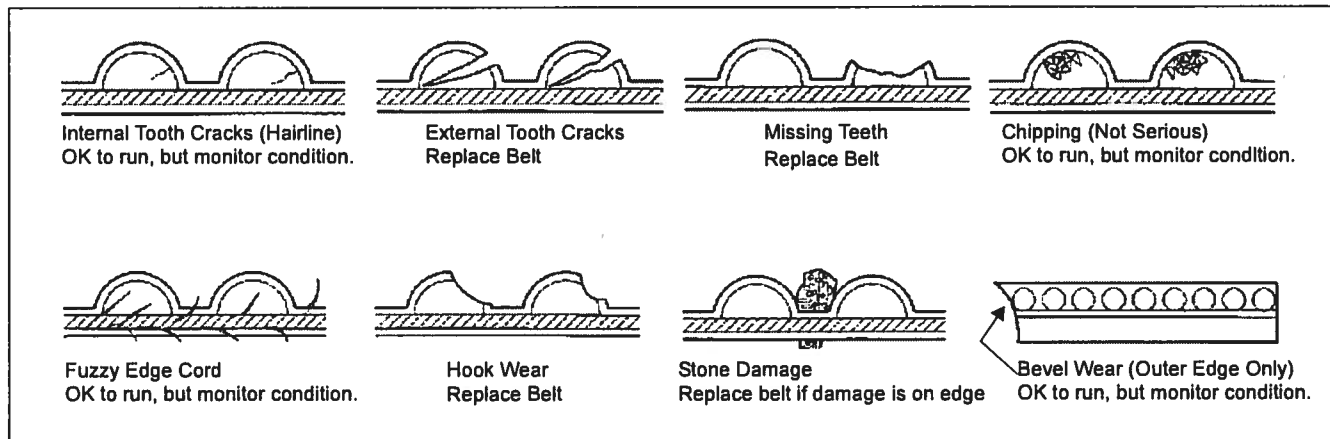
1. Mix a few drops of mild dish soap with a cup of warm water and use a soft nylon brush to clean the belt and sprocket teeth.
2. Pay close attention to corner areas (A) where road debris and belt dust can collect.



3. Rinse thoroughly with clear water and dry thoroughly.

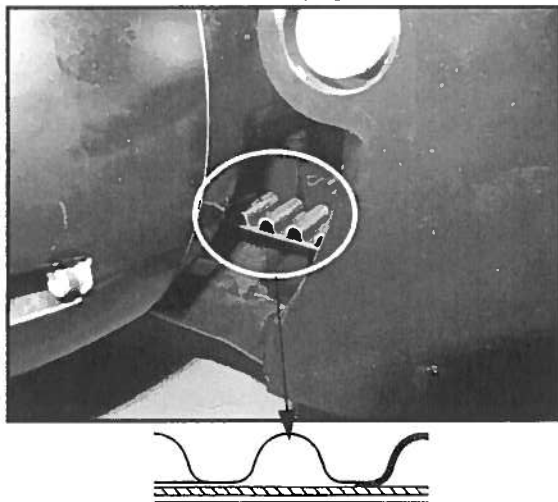
NOTE: Do not inspect or adjust drive belt tension when the belt is wet. Improper adjustment will result.

DRIVE BELT WEAR ANALYSIS



DRIVE BELT CONDITION

Replace the drive belt if it is cracked, has broken teeth, or frayed edges. No matter the condition, the drive belt should be replaced according to the Periodic Maintenance Interval Table on page 2.5.



DO NOT attempt to check belt tension if the belt has been exposed to rain or washing within a 24 hour period, or if the belt is hot from riding. Allow the belt to cool to ambient temperature before measuring belt tension. Replace drive belt and both sprockets as a set if drive belt has over 5,000 miles (8,000 km) of service at the time of damage or failure.

DRIVE BELT TENSION - 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.

⚠ CAUTION

A misaligned rear axle or incorrectly tensioned drive belt can cause excessive drive line noise and damage to the drive belt which could result in belt failure.

Special Tool: Gates® Sonic Tension Meter 507C or equivalent.

SONIC TENSION DATA

Span (mm)	607
Belt Width (mm)	28
Belt Mass (gm/m)	8.4
Target Tension	47 (+/- 5Hz)

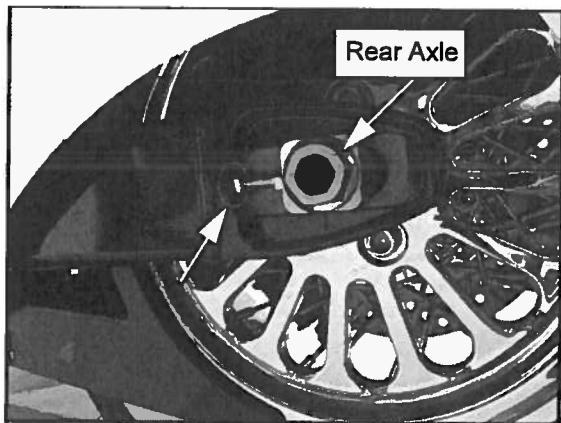
1. Secure motorcycle in an upright position by clamping the front wheel in a wheel vise.
2. Shift transmission into NEUTRAL.
3. Remove the lower belt guard.
4. Using the Sonic Tension Meter, check belt tension following the manufacturer's instructions.

MAINTENANCE

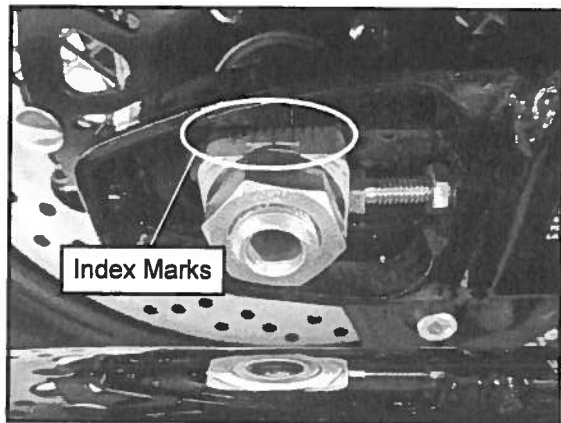
5. If Sonic Tension Meter values are out of specification proceed to the Drive Belt Tension Adjustment procedure outlined in this chapter.

DRIVE BELT TENSION / ALIGNMENT

1. Secure motorcycle in an upright position by clamping the front wheel in a wheel vise.
2. Remove the lower belt guard (see Chapter 11).
3. Using a suitable wrench, hold the axle in place (left side of swing arm) and loosen the axle nut on the right side of the swing arm.
4. Loosen the jam nuts (A) on the left and right side axle adjustment bolts.

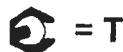


5. Using ultrasonic tension meter, adjust each axle adjustment bolt evenly until the appropriate tension is achieved at three different points on the belt.
6. Verify the rear wheel is properly aligned by comparing the index marks on the left and right side axle retaining blocks.



NOTE: Recheck belt tension if alignment changes were made.

7. Torque left and right axle adjustment jam nuts to specification.
8. Torque rear axle nut to specification.



Axle Adjustment Jam Nuts: 12 ft-lbs (16.3 Nm)
Rear Axle Nut: 55 ft-lbs (74.6 Nm)

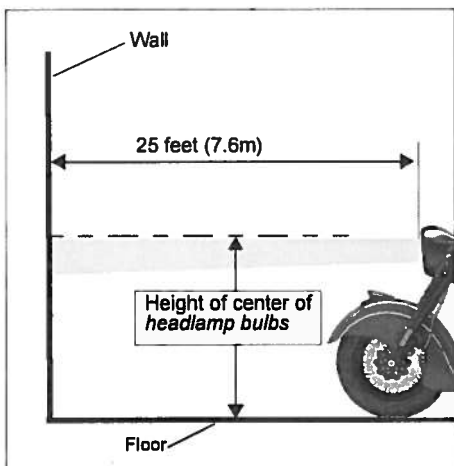
9. Install the lower belt guard.
10. Pump rear brake pedal several times to reset brake pads.
11. Rotate rear wheel to verify proper drive belt alignment and smooth operation.

HEADLAMP AIM INSPECTION

The headlamp high beam should shine straight ahead. The low beam will spread more to the right (U.S. / Canada). The top of the HIGH beam should be slightly below the height of the center of the headlamp bulbs, at a distance of 25 ft. (7.6 meters).

To check for proper headlamp aim:

1. Set tire pressure (page 2.10) and rear suspension sag.
2. Straddle motorcycle in an upright position and sit in the operator's seat.
3. Start engine to activate headlamp and select HIGH BEAM.
4. Compare to illustration and adjust if necessary.

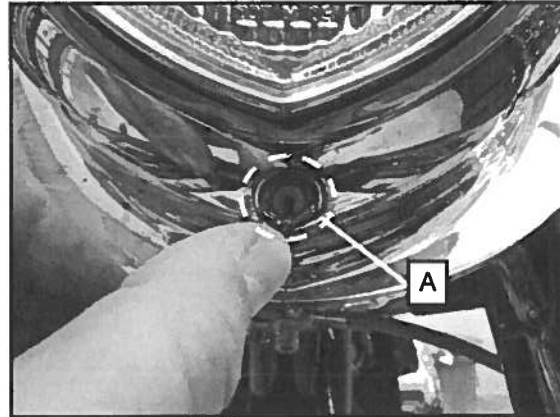


HEADLAMP AIM ADJUSTMENT

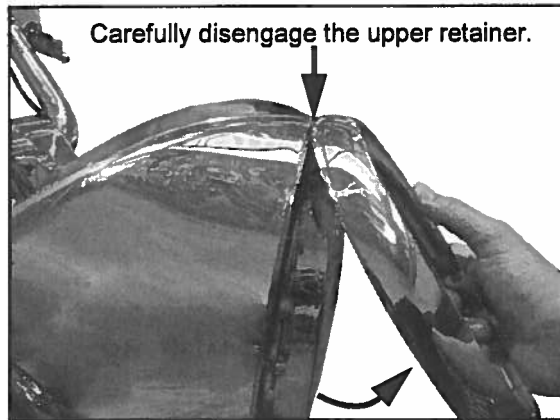
The headlamp adjustment screws are located behind the headlamp bezel.

2

1. Remove the screw (A) securing the headlamp bezel to the headlamp housing.

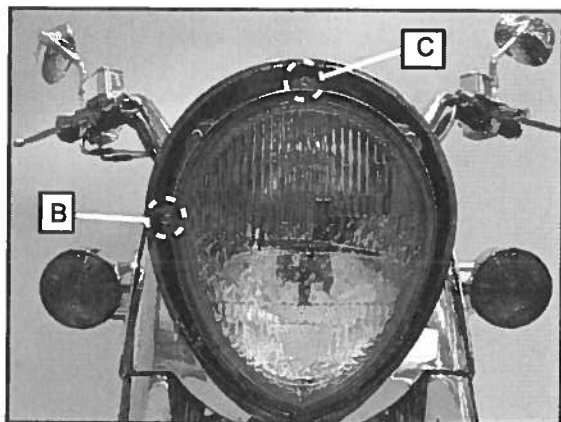


2. Lift headlamp bezel from the bottom edge and carefully disengage the upper retainer clip from the headlamp housing. Remove the headlamp bezel.



MAINTENANCE

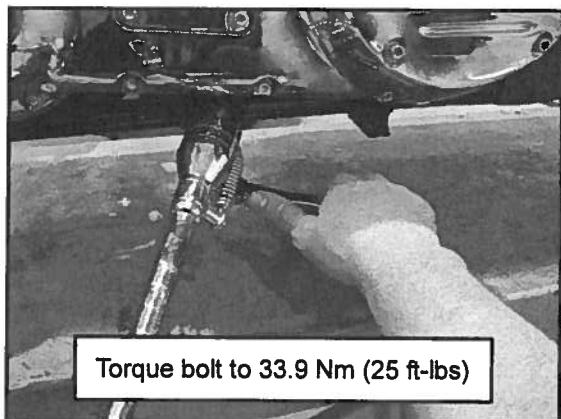
- Using a Phillips screwdriver, turn the horizontal (B) and vertical (C) adjustment screws until the headlamp is properly aimed.



- Apply Loctite® 242 to the bezel screw and reinstall the headlamp bezel.

SIDESTAND INSPECTION

- Support the motorcycle in an upright position.
- Inspect sidestand spring for damage or loss of tension. Be sure stand returns to fully retracted position.
- Inspect sidestand for smooth movement.
- Inspect sidestand pivot bolt nut for proper torque.



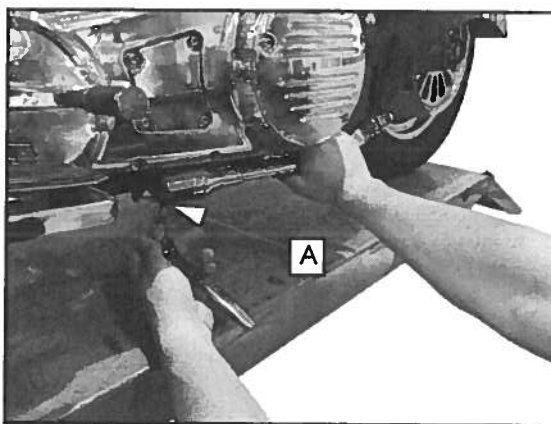
Sidestand Pivot Bolt:
25 ft-lbs (33.9 Nm)

SIDESTAND & SPRING REMOVAL

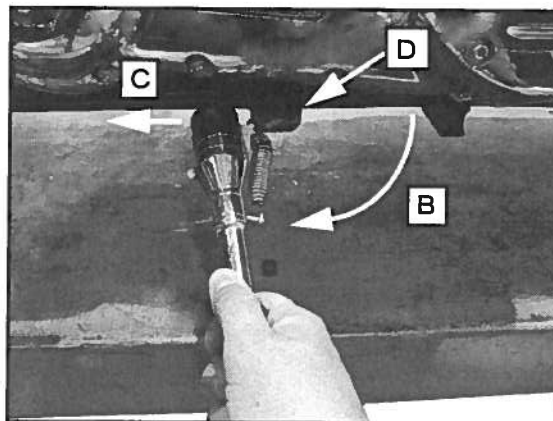
WARNING

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

- Secure the motorcycle in an upright position with the front wheel clamped in a wheel vise.
- With the sidestand securely held in the OFF (raised) position, remove the side stand pivot bolt (A).



- Slowly rotate the side stand into the ON (lowered) position (B). Carefully slide the stand forward (C) to release from welded lug (D) and relax side stand spring.



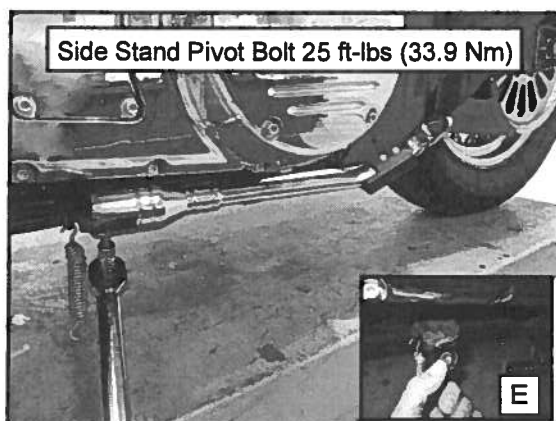
IMPORTANT: Do not lose the sidestand bushing! The Sidestand pivot bushing may fall out of frame lug once clear of the sidestand.



4. Release the side stand spring from the side stand pin only. Leave the motorcycle-side of the spring attached to the welded lug.
5. Remove sidestand and sidestand spring.

Installation:

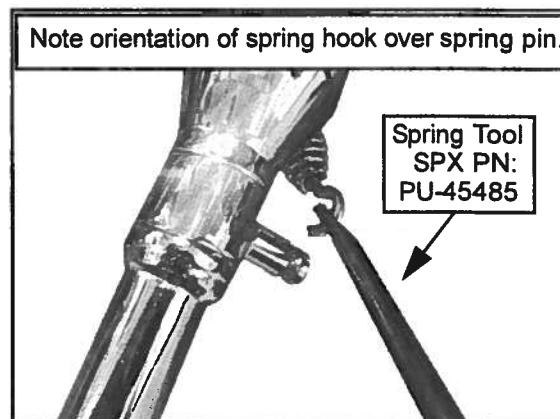
6. Attach spring to welded lug on the motorcycle frame.
7. Lightly grease sidestand mounting boss on frame rail and the shouldered portion of the pivot bolt.
8. Apply a thin film of multi-purpose grease to the side stand bushing and reinstall in welded lug (E).
9. Position replacement side stand over welded lug and reinstall side stand bolt and new lock washer. Torque side stand bolt to specification.



= T
Sidestand Pivot Bolt: 25 ft-lbs (33.9 Nm)

10. Rotate the side stand into the ON (lowered) position.

11. Using PN: PU-45485 (available through SPX) spring tool, position the side stand spring over the side stand spring pin. Make sure the spring hook fully seats in the spring pin groove.



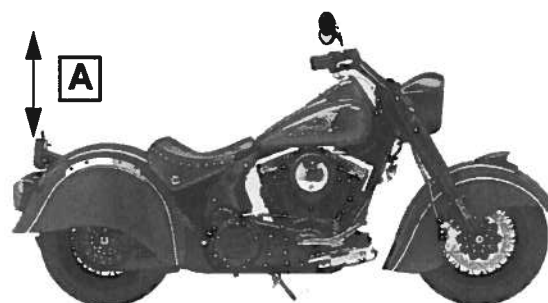
12. Cycle the sidestand to be sure it moves freely, and returns to the fully retracted position.

REAR SUSPENSION / SWINGARM 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 (A).



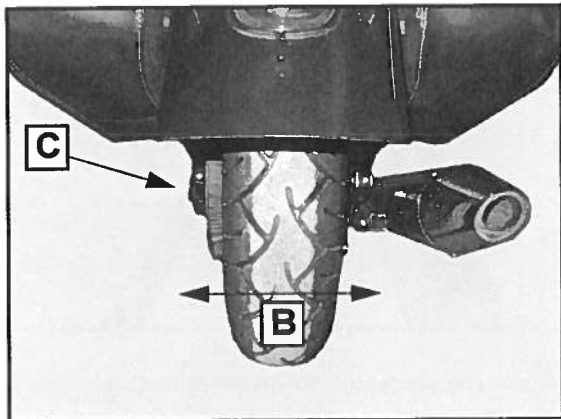
2. Verify rear axle nut and swingarm nuts are tightened to specification.

= T
Rear Axle Nut: 55 ft-lbs (74.6 Nm) Swingarm Bolts: 60 ft-lbs (81.3 Nm)



MAINTENANCE

3. Secure motorcycle with rear wheel elevated.
4. Grasp the rear wheel and push firmly side-to-side (B). If movement is detected, determine if movement is at axle area (C) or swingarm pivot area (see Fig. 1). Refer to Chapter 13 for wheel bearing and swingarm bearing replacement.
8. Inspect fasteners, bushings, and bearings on all suspension components, including shock absorber top mount (D) and lower shock absorber mount (E).



5. Rotate rear wheel and inspect for smooth rotation of rear wheel bearings. If roughness or unusual sounds are detected, inspect rear wheel bearings (Chapter 13), belt tension and alignment (page 2.24), and brake pads (page 2.16).
6. Inspect rear shock for signs of oil leakage and all rear suspension components for damage or loose fasteners.
7. Remove the seat (see Chapter 3).

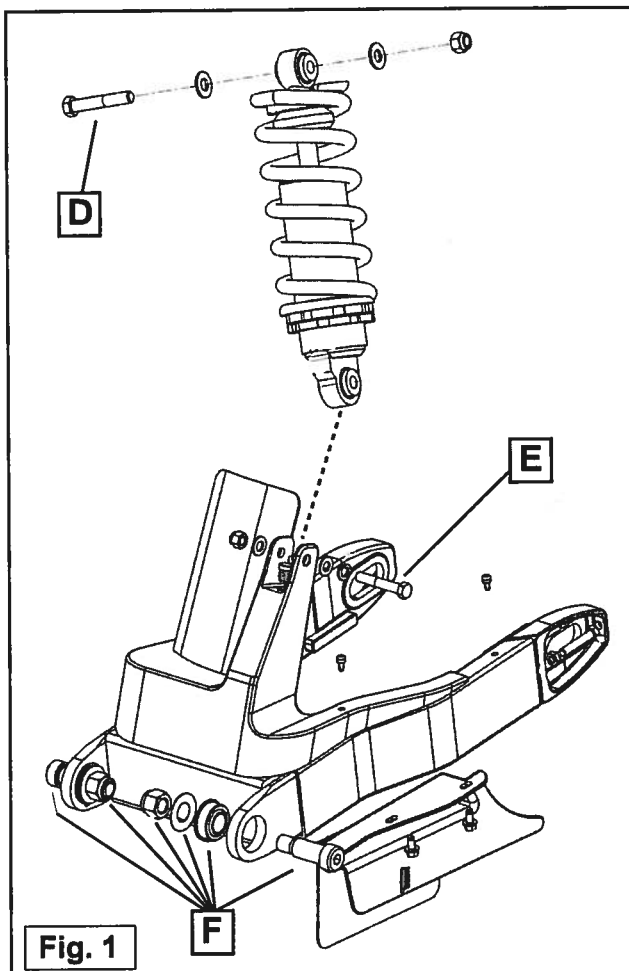


Fig. 1

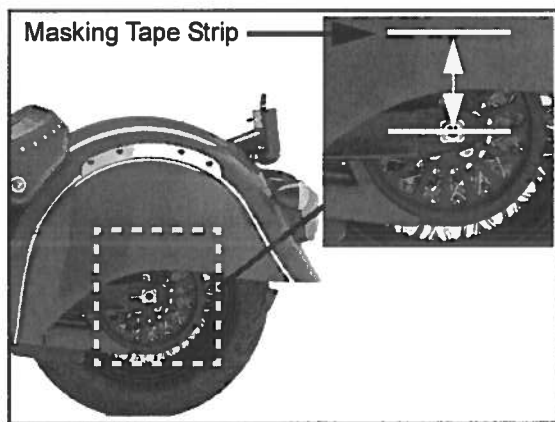
9. Inspect swingarm bearings and fasteners (F) for radial movement.
10. If radial movement or excessive play is detected at any of the pivots, or if bushings and/or bearings are cracked, worn, displaced or damaged, replace parts as required. (see Chapter 13).

REAR SUSPENSION ADJUSTMENT

To provide the most comfortable ride and proper ground clearance, adjust spring pre-load in the rear shock absorber.

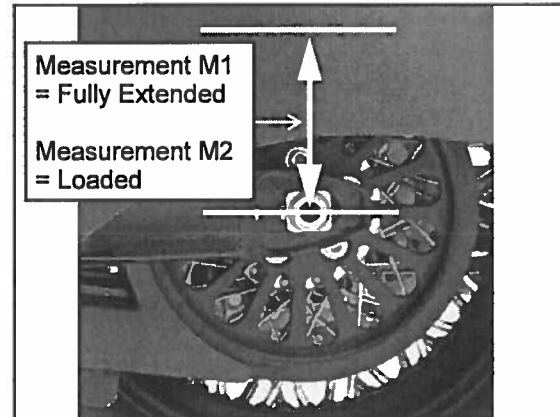
Follow these guidelines to check and adjust rear suspension preload:

1. Set front and rear tire pressures to specification.
2. Support motorcycle securely in an upright position with the front wheel clamped in a wheel vise.
3. Place a piece of masking tape on rear fender directly over rear axle approximately 3" over fender bottom.



4. Using a suitable lift, raise the motorcycle until rear shock is completely extended.
5. Measure the distance, in millimeters, from the center of the rear axle to the bottom of the masking tape. Record the results on a piece of paper and label M1.
6. Lower the motorcycle and remove the lift. Sit on the motorcycle in a normal riding position with helmet, riding gear and passenger (if applicable).
7. Have an assistant measure the distance from the center of the rear axle to the bottom of the masking tape. Record the results on a piece of paper and label M2.
8. Subtract measurement M2 from M1. The resulting calculation is the measured rider sag. **Correct rider suspension sag = 1.30 - 1.46" (33-37mm).**

9. Using PN: PV-46993 spanner (available through SPX), increase the spring preload if the sag is greater than **1.46" (37 mm)**. Decrease the spring preload if the sag is less than **1.30" (33 mm)**.



10. Repeat steps 4-8 until the measured rider sag is within specification **33-37mm (1.30 - 1.46")**.

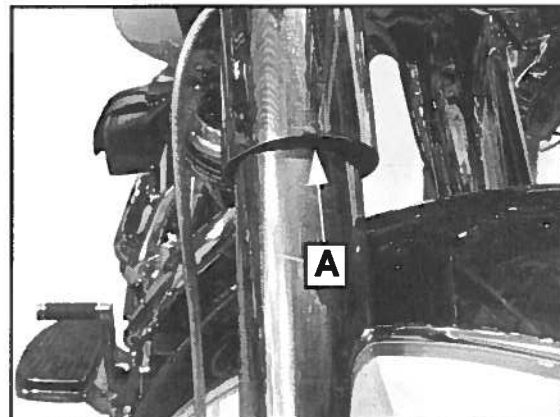
NOTE: Shock eyelet lubrication is recommended as part of routine maintenance.

FRONT SUSPENSION INSPECTION

WARNING

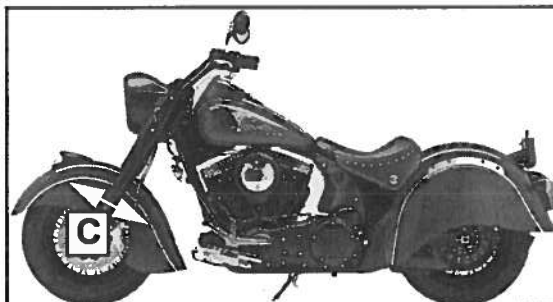
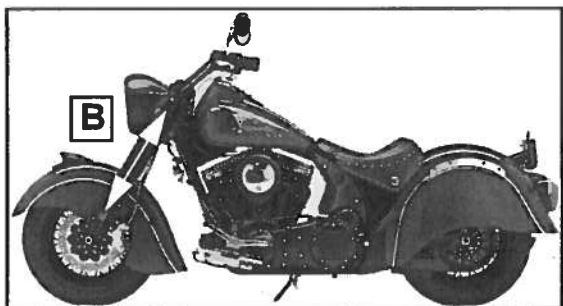
Damaged, worn, or loose suspension components may cause loss of control, increasing the chance of a crash or possible injury. Damaged, worn, or loose suspension components must be repaired before the motorcycle is operated. See Chapter 12.

1. Place motorcycle on sidestand and inspect front forks. Make sure no fork oil present on the outer fork tubes, fork seals, or around the inner tubes (A).



MAINTENANCE

2. Clean fork tubes with mild soap and water as required to remove bugs, tar, or buildup which may cause seal wear or leakage.
3. Inspect outer surfaces of inner fork tubes for scoring, scratches, and damage from foreign objects.
4. With motorcycle upright, apply front brake and pump forks through travel range several times (B). Fork operation should be smooth and quiet.
2. Turn handlebars from full left to full right and inspect for smooth, free movement.
3. Point front wheel straight ahead, grasp fork tubes and pull/push fork tubes back and forth (C).



5. Verify all fasteners are tight. Refer to Chapter 12 for front wheel and suspension torque specifications, and Chapter 15 for brake system component torque specifications.
6. Replace worn or damaged parts.

STEERING HEAD / FRONT WHEEL INSPECTION

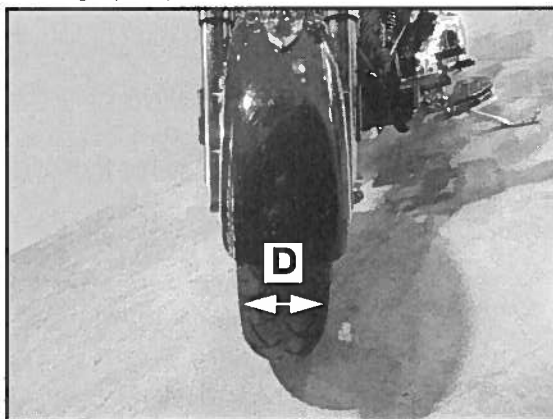
WARNING

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 elevated.

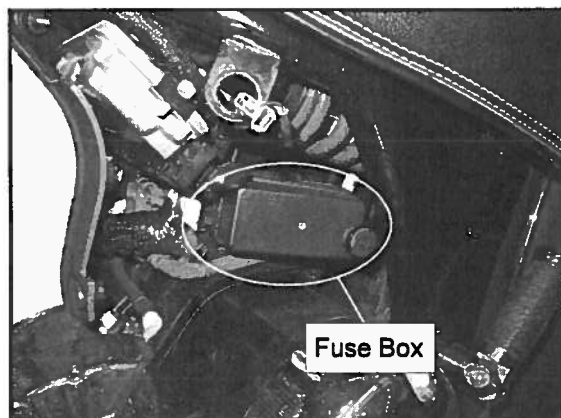
4. If steering binds, feels rough or uneven, or if movement is detected at steering stem, adjust or replace steering head bearings as necessary. Refer to Chapter 12.
5. Rotate front wheel and inspect for smooth rotation of front wheel bearings. If roughness or unusual sounds are present, replace front wheel bearings (Chapter 12).
6. Turn handle bars full right or left and hold against the fork stop. Attempt to move front wheel side-to-side (D). If movement is observed, inspect front axle, wheel, and bearings (Chapter 12).



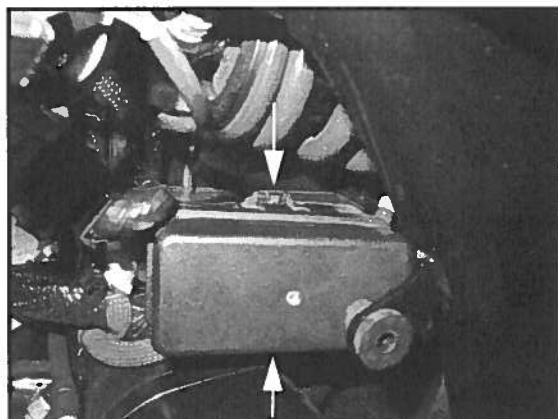
FUSE REPLACEMENT

The fuse box is located beneath the side cover on the left hand side of the motorcycle.

1. Remove the left hand side cover and locate the fuse box (see Chapter 3).



2. Squeeze the center clips together and remove the fuse box cover.



3. The fuse application and size is printed on the cover label.

CAUTION

Use only the recommended fuse to prevent electrical system damage.

FASTENERS

Inspect all fasteners on the vehicle to be sure they are tight. Refer to the appropriate chapter as required for torque specifications.

CLEANING

Before washing the motorcycle, do the following:

- Be sure exhaust has cooled completely. Cover each pipe opening with a plastic bag secured with a strong rubber band to prevent water from entering exhaust system.
- Check that the spark plugs, spark plug wire caps, oil dipstick, fuel cap, and other filler caps are properly seated.
- Avoid spraying the air box / air filter area or electrical connectors and wiring.
- Removing excess dirt with water running at low pressure. Use as little water as possible when washing near the air intake or exhaust pipe openings. Dry thoroughly before starting the engine or operating the motorcycle.
- Make sure brakes are functioning properly before operating the motorcycle.
- Do not use abrasive cleaners. Paint wear or other cosmetic damage can occur if abrasives are used.

CAUTION

Electrical components may be damaged by water. Do not allow water to contact electrical components or connectors.

CAUTION

Do not use pressurized water to wash the motorcycle. Water may seep in and deteriorate wheel bearings and seals, brake caliper assemblies, brake master cylinders, electrical connectors, steering head bearings, and transmission seals if excessive pressure is used.

CAUTION

Do not use glass cleaners, water or soil repellents, and petroleum or alcohol based cleaners on the windshield (if equipped), as these products can damage the windshield.



MAINTENANCE

WINDSHIELD CARE

Rinse windshield with water to remove loose dirt and dust.

CAUTION

Do not use glass water and soil repellents, petroleum or alcohol based cleaners as these products can damage the windshield.

CAUTION

Windshield material is polycarbonate plastic. Do not use cleaners or rain protective products meant for glass surfaces on the windshield.

STORAGE

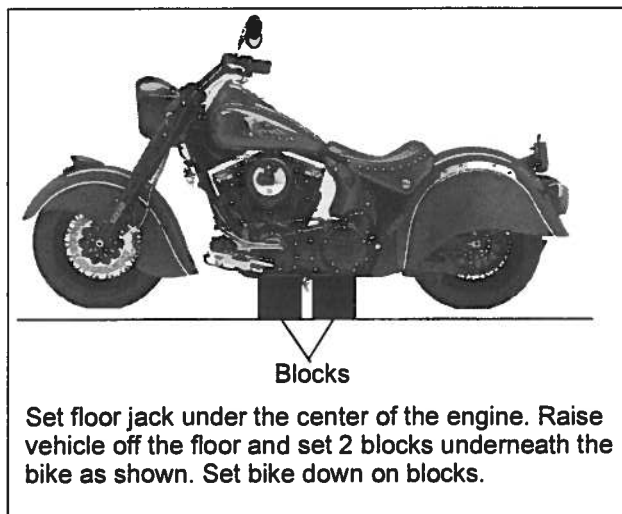
To prevent storage damage due to long-term storage (60 days or more) the following guidelines should be followed.

1. Top off fuel tank with fresh fuel and add fuel stabilizer to fuel.
2. Run motorcycle for 15 minutes or more to distribute fuel stabilizer throughout fuel system.
3. Clean motorcycle completely.
4. Dry machine thoroughly and wax all painted surfaces.
5. Change engine oil as outlined in Chapter 2.
6. Block frame to take some of the weight off of front and rear wheels.
7. Secure a plastic bag over the exhaust outlets to prevent moisture from entering the exhaust system.

IMPORTANT: Make certain exhaust system is cool prior to securing plastic.

8. Remove battery and charge it.
9. Store battery in a cool, dry area and charge it once a month.
10. Cover motorcycle with a covering made of fabric that allows for adequate ventilation. Do not use plastic or tarps, as corrosion may result.

IMPORTANT: Starting the motorcycle periodically during storage is not recommended. Water vapor is a by-product of the combustion process, and corrosion may result unless the engine is operated long enough to bring the oil and exhaust system to normal operating temperature.



CHAPTER 3

FRAME-BODY-EXHAUST

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REAR FENDER	3.11
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LICENSE PLATE BRACKET	3.13
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FRAME-BODY-EXHAUST

GENERAL INFORMATION

SAFETY - GENERAL PRECAUTIONS

This section covers the removal and installation of the frame body panels and exhaust system. Always replace exhaust system sealing gaskets when exhaust components are removed. Inspect the system for leaks after installation.

WARNING

Gasoline is extremely flammable and explosive under certain conditions.

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

Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.

Do not overfill the tank. Leave air space to allow for fuel expansion.

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

If you spill gasoline on your skin or clothing, immediately wash it off with soap and water and change clothing.

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

WARNING

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

WARNING

Improper repairs or service can create unsafe conditions that may cause serious injuries or death to your customers or others.

WARNING

Never run the engine in an enclosed area without a properly functioning exhaust gas evacuation system connected to the product.

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.

WARNING

Engine exhaust from this product contains poisonous carbon monoxide gas that can cause loss of consciousness and may lead to death.

WARNING

Modifications to this motorcycle not approved by Indian Motorcycle may cause loss of performance, and make the machine unsafe for use.

SPECIAL TOOLS

No special tools are required in this section.

3.2



REMOVAL / INSTALLATION PROCEDURES - BODY

SIDE COVER

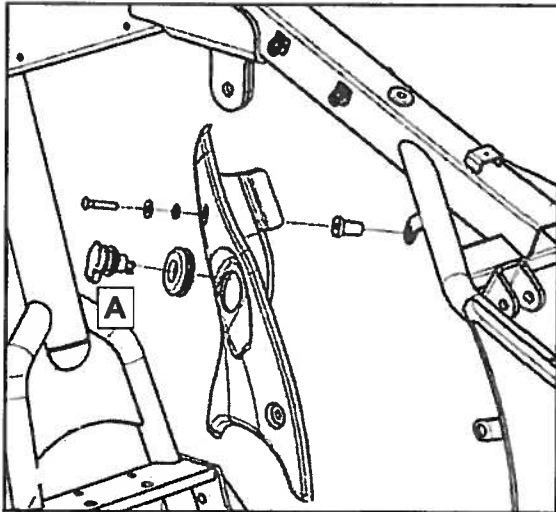
The side covers are held in place with five fasteners. Two are located at the back of each cover, securing the cover to the frame. The fifth screw is located at the center front where it is used to attach the covers together.

WARNING

The center side cover fastener is in close proximity to the exhaust system. Allow engine to cool before attempting to remove side covers or wear proper insulated equipment.

Removal

1. Remove the center front fastener. Each side cover fastener includes a button head cap screw, washer and rubber grommet shown below.



2. Remove the two right side cover fasteners, and remove the right side cover.
3. Remove the two left side cover fasteners. While removing left side cover, disconnect electrical connector from the rear power receptacle (A). The receptacle and 12V socket grommet will remain in the side cover upon removal.

Installation

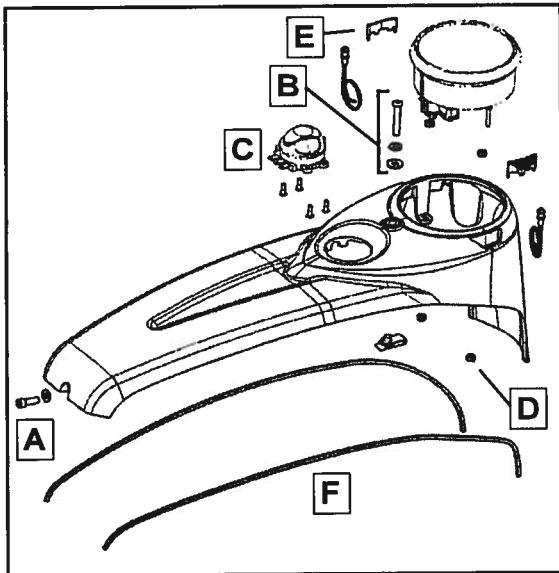
1. Position the left side cover.
2. Route the rear power receptacle electrical connector through the frame mount to obtain additional clearance to plug in electrical connector.
3. Connect electrical connector to rear power receptacle, and position rear power receptacle in the frame mount.
4. Install two left side cover fasteners, including button head cap screw, washer and rubber grommet through side cover and into the well nut retained in the frame. Install fasteners loosely at this time.
5. Position the right side cover.
6. Install the two right side cover fasteners through the side cover and into the well nut retained in the frame. Install fasteners loosely at this time.
7. Install the center front fastener through the left side cover and in the well nut retained in the right side cover.
8. Tighten all five side cover fasteners until seated and snug.

FRAME-BODY-EXHAUST

DASH

Removal

1. Remove Seat. See Chapter 3.
2. Disconnect battery. See Chapter 2.
3. Remove lower dash fastener and washer (A).
4. Remove upper dash fastener with rubber grommet and washer (B).



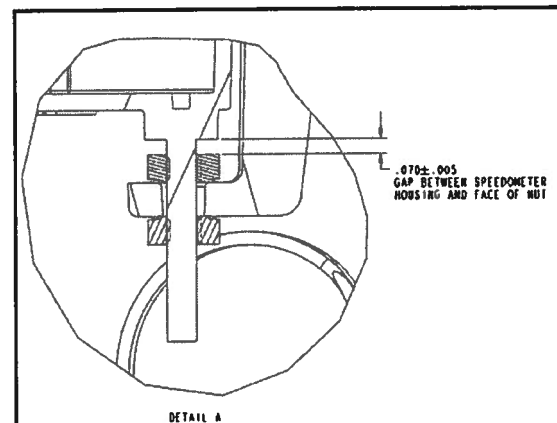
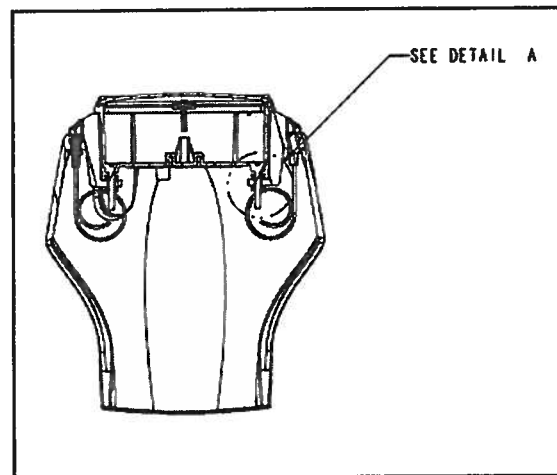
5. Gently lift the dash assembly up and disconnect 3 wire ignition switch connector, 16 wire speedometer connector, and the two turn signal indicator connectors.
6. Remove dash from motorcycle.

Disassembly

1. Remove four fasteners holding ignition switch (C above) to dash.
2. Remove two nuts (D above) holding the speedometer to dash.
3. To remove the turn signal indicator covers (E above) carefully pry out by pressing locking tabs inward toward LED signal indicators. Indicator covers are not reusable - Discard.
4. Remove turn signal indicator nuts and press the LED turn signal indicator assembly out from bottom to top.
5. Foam Dash Spacer (F above) is connected via adhesive. Use caution when removing not to cause cosmetic damage.

Assembly

1. Install new turn signal indicator assemblies using supplied nuts. Torque nuts to specification.
2. Loop turn signal wires toward the top of the speedometer and place a wire tie around the loop at the tape/shrink wrap location.
3. Leave 1.5-3 inches of wire free to allow connection.
4. Install turn signal indicator covers (E above). Ensure indicator covers are fully seated and locking tabs activate.
5. Install ignition switch (C above) from the bottom of dash and thread in four fasteners. Torque fasteners to specification.
6. Install speedometer.
7. Confirm that nuts on speedometer studs are installed with a .065"-.075" gap between the face of the nut and the speedometer housing (see below).



CAUTION

Failure to confirm gap may cause damage to speedometer during installation.

3

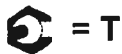
8. Install speedometer into dash until previously installed nuts contact the mounting tabs on the dash.
9. Install speedometer nuts (D above) and torque to Specification.
10. Install Foam Dash Spacer (F above) via adhesive. Confirm that installation fully covers mating surface and will protect fuel tank from cosmetic damage once installed.



Turn Signal Indicator Nuts: **20-30 in-lbs (2-3 Nm)**
 Ignition Switch Fasteners: **23-27 in-lbs (2.5-3 Nm)**
 Speedometer Nuts: **27 in-lbs (3 Nm)**

Installation

1. Carefully align the dash over the fuel tank and tilt to obtain visual locations of electrical connectors.
2. Install the 3 wire ignition switch connector (Confirm Orientation), 16 wire speedometer connector and the two turn signal indicator connectors.
3. Install dash onto tank and confirm that connectors, vent line and wire leads are free from obstructions.
4. Install upper dash fastener with flat washer and rubber grommet (B above) finger tight.
5. Install lower dash fastener with washer (A above) and finger tighten.
6. Visually confirm dash alignment.
7. Torque both dash fasteners to specification.



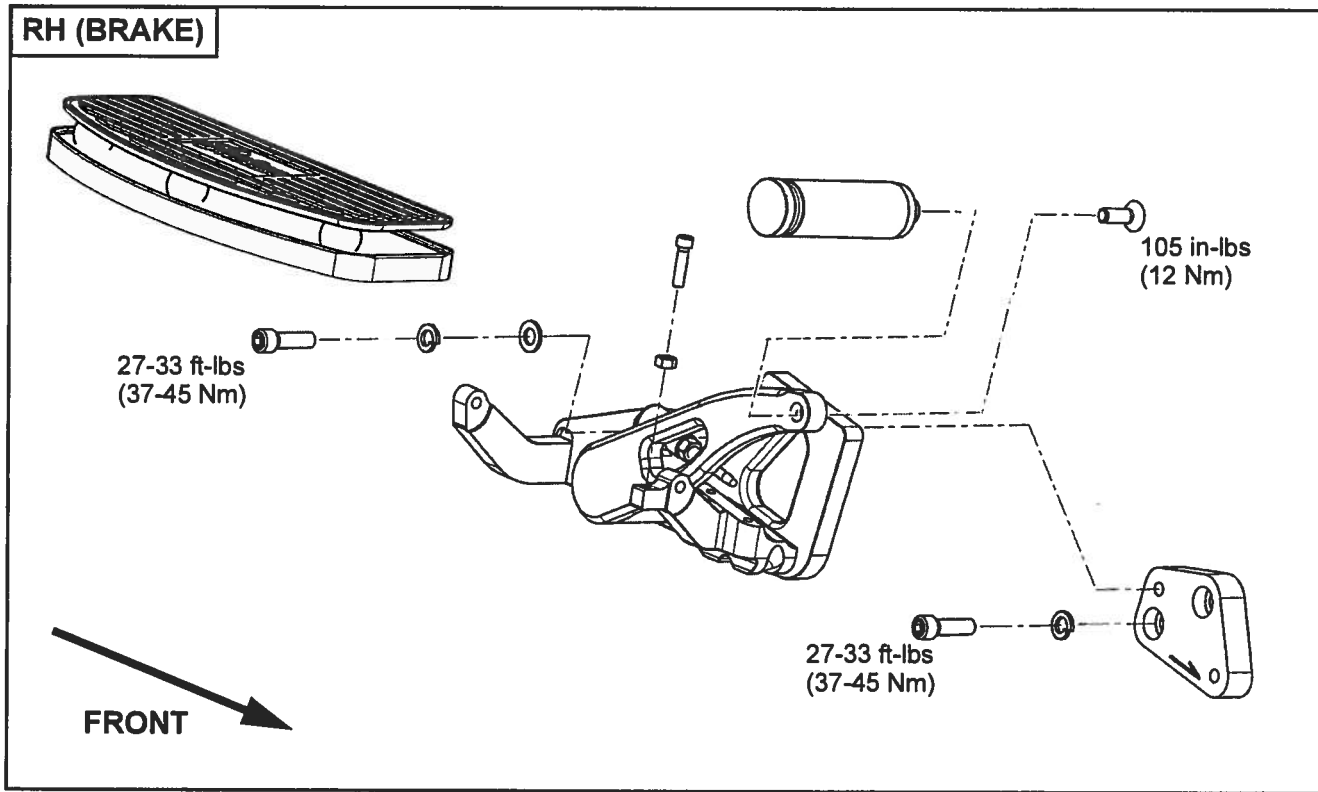
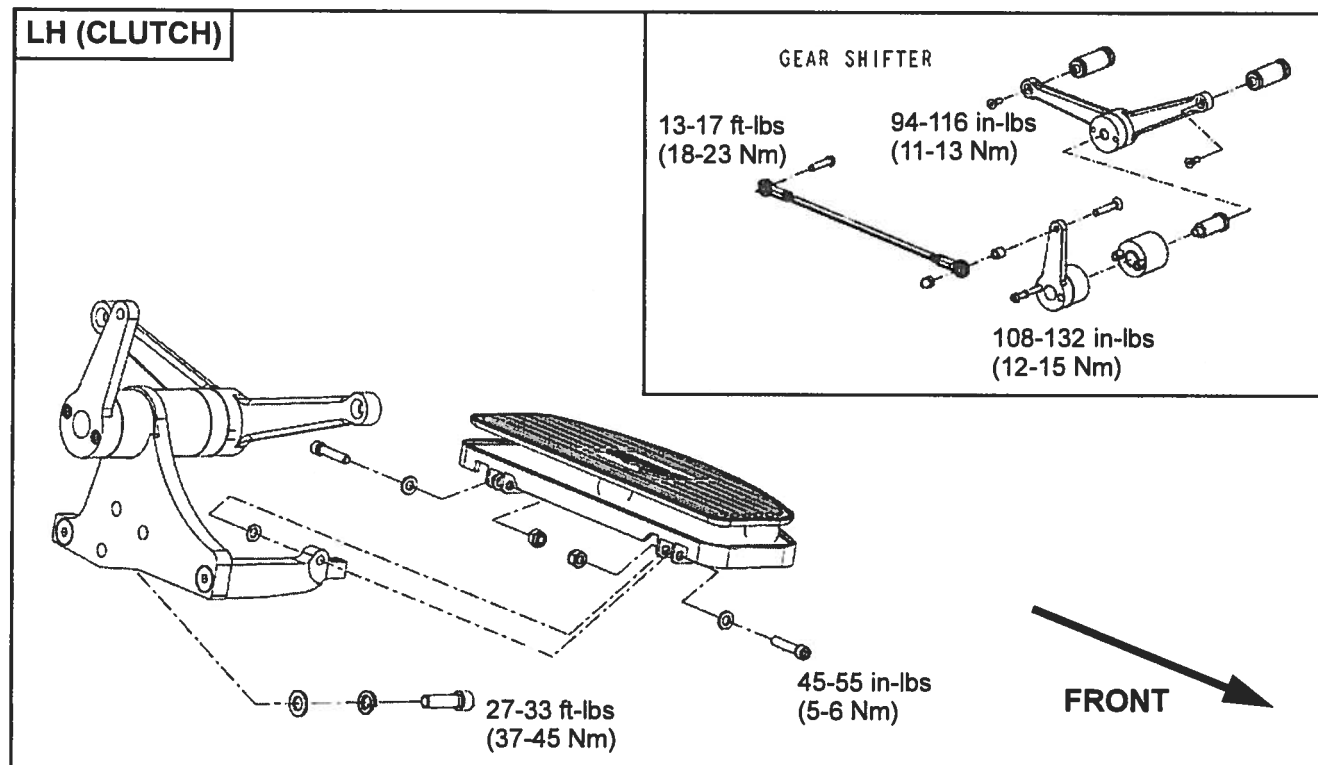
Upper Dash Fastener: **40-50 in-lbs (4.5-5.5 Nm)**
 Lower Dash Fastener: **95-115 in-lbs (11-13 Nm)**

8. Reconnect battery. See Chapter 2.
9. Install Seat. See Chapter 3.



FRAME-BODY-EXHAUST

FLOORBOARD / FOOT CONTROL MOUNTING



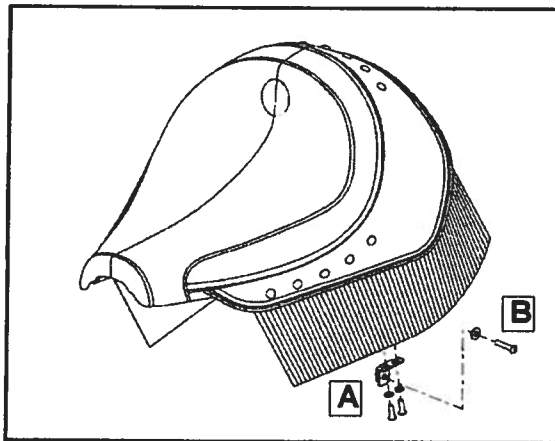
SEAT

WARNING

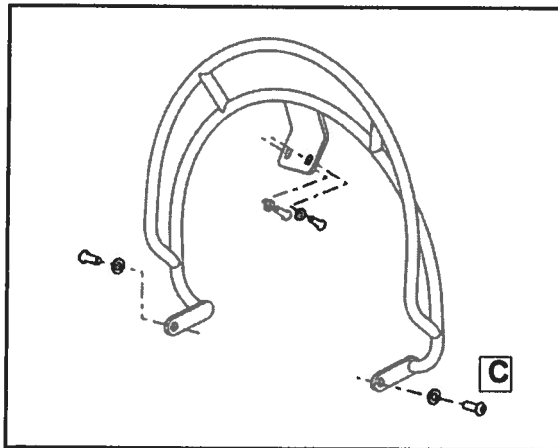
Always make sure the seat is securely fastened before riding the motorcycle. A loose seat could cause a sudden shift in riding position, causing you to lose control of the motorcycle.

Operator Seat Removal: Solo (With Grab Rail)

1. Locate the seat fastener (A) under the leather skirt of the seat. Remove seat mounting bolt and washer (B) from each side of seat.



2. If equipped with grab rail, remove grab rail mounting bolt and washer (C) from each side of the rail.



3. Lift the rear of the seat (and rail as assembly) and pull rearward to disengage front mounting tab of seat from frame mount. Use caution not to let side mount seat brackets (A above) contact rear fender.

Operator Seat Installation: Solo (With Grab Rail)

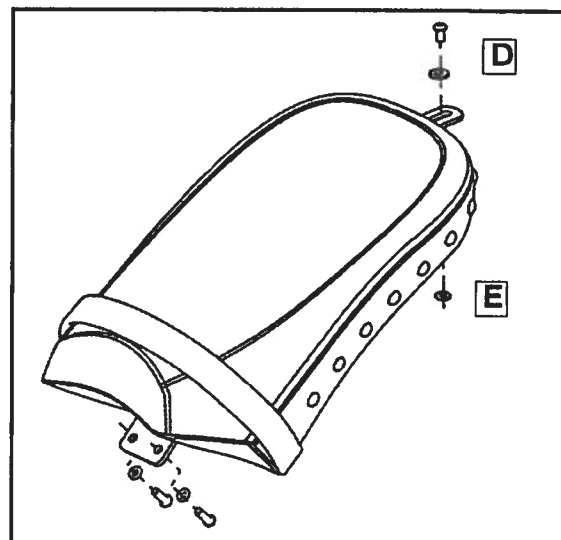
1. Position the seat (and rail as assembly) by inserting seat mounting tab from rear to front into mount on top of frame.
2. Rotate rear of seat downward and position side mount seat brackets (A above) into slots inside top rear frame tubes. Use caution not to let the side mount seat brackets contact the rear fender.
3. Align nut of side mount seat bracket with mounting hole in side of frame. On each side, thread seat mounting bolt and washer (B above) through frame and into seat bracket. Torque seat bolts to specification.
4. If equipped with grab rail, thread grab rail mounting bolt and washer (C above) through grab rail mounts, saddle bag bar mounts, and into frame. Torque grab rail mount bolts to specification.



Seat Mounting Bolt: 85 in-lbs (10 Nm)
Grab Rail Mounting Screw: 15 ft-lbs (20 Nm)

Operator Seat Removal: Solo with Passenger Pillion

1. Complete steps 1-2 of *Operator Seat Removal: Solo (With Grab Rail)*.
2. Remove pillion mounting bolt and washer (D) from pillion bracket.



FRAME-BODY-EXHAUST

3. Gently raise pillion bracket and remove rubber grommet (E above). Place a clean shop towel under the pillion bracket to prevent cosmetic damage to the rear fender during removal.
4. Lift the rear of the seat and pillion as assembly and pull rearward to disengage front mounting tab of seat from frame mount. Use caution not to let side mount seat brackets (A above) contact rear fender.

Operator Seat Installation: Solo with Passenger Pillion

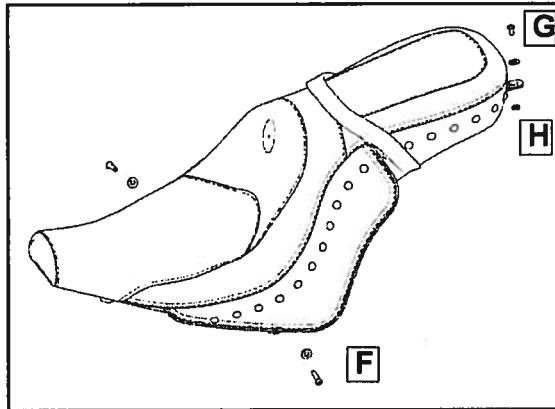
1. Position the seat and pillion as assembly by inserting seat mounting tab from rear to front into mount on top of frame.
2. Rotate rear of seat downward and position side mount seat brackets (A above) into slots inside top rear frame tubes. Use caution not to let the side mount seat brackets contact the rear fender. Place a clean shop towel under the pillion bracket to prevent cosmetic damage to the rear fender during installation.
3. Align nut of side mount seat bracket with mounting hole in side of frame. On each side, thread seat mounting bolt and washer (B above) through frame and into seat bracket. Torque seat bolts to specification.
4. If equipped with grab rail, thread grab rail mounting bolt and washer (C above) through grab rail mounts, saddle bag bar mounts, and into frame. Torque grab rail mount bolts to specification.
5. Gently raise pillion bracket and install rubber grommet (E above). Thread pillion mounting bolt and washer (D above) through pillion bracket and rubber grommet. Torque pillion mounting bolt to specification.



Seat Mounting Bolt: **85 in-lbs (10 Nm)**
Grab Rail Mounting Bolt: **15 ft-lbs (20 Nm)**
Passenger Pillion Mounting Bolt: **12 in-lbs (1.4 Nm)**

Operator Seat Removal: Dual

1. Locate the seat fastener under the leather skirt on both sides of the seat, and the rear bracket. Remove seat mounting bolt and washer (F) from each side of seat.



2. Remove rear bracket mounting bolt and washer (G above) from rear bracket. Gently raise the rear bracket and remove rubber grommet (H above). Place a clean shop towel under the rear bracket to prevent cosmetic damage to the rear fender during removal.
3. Lift the rear of the seat and pull rearward to disengage front mounting tab of seat from frame mount. Use caution not to let side mount seat brackets contact rear fender.

Operator Seat Installation: Dual

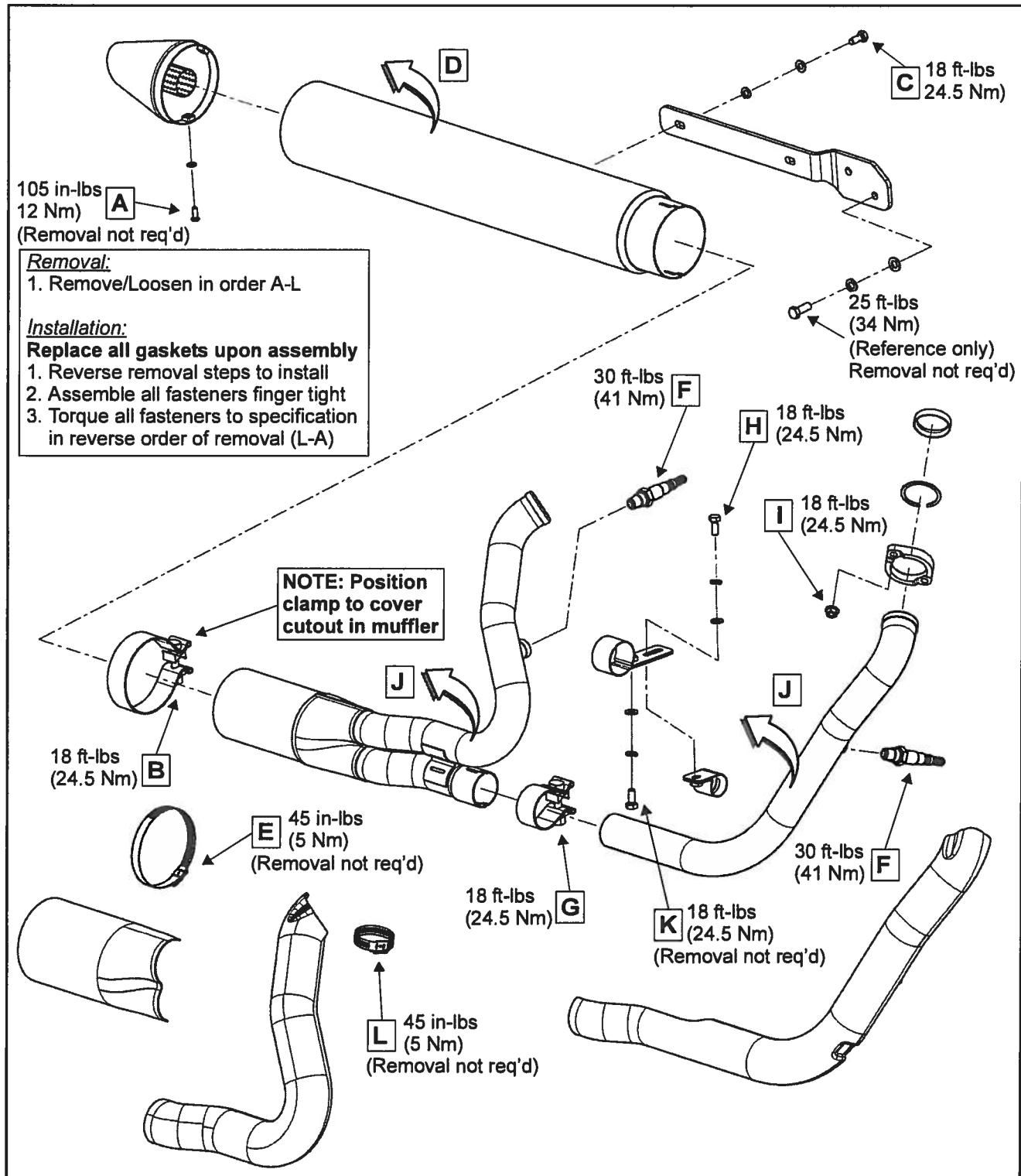
1. Position the seat by inserting seat mounting tab from rear to front into mount on top of frame.
2. Rotate rear of seat downward and position side mount seat brackets into slots inside top rear frame tubes. Use caution not to let the side mount seat brackets contact the rear fender. Place a clean shop towel under the rear bracket to prevent cosmetic damage to the rear fender during installation.
3. Align nut of side mount seat bracket with mounting hole in side of frame. On each side, thread seat mounting bolt and washer (F above) through frame and into seat bracket. Torque seat bolts to specification.
4. Gently raise rear bracket and install rubber grommet (H above). Thread rear mounting bolt and washer (G above) through rear bracket and rubber grommet. Torque rear mounting bolt to specification.



Seat Mounting Bolt: **85 in-lbs (10 Nm)**
Rear Bracket Mounting Bolt: **12 in-lbs (1.4 Nm)**

EXHAUST - MUFFLER & HEAD PIPE

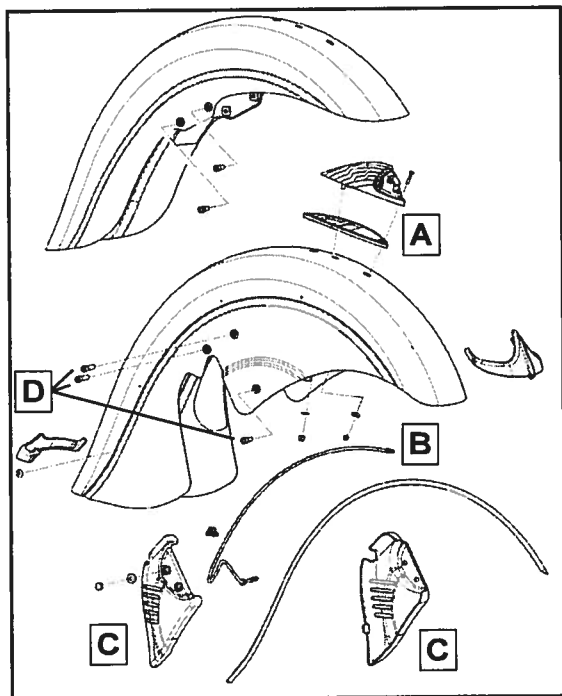
Review all **WARNINGS** on page 3.2 before working on exhaust system. Clean any oil, grease, or fingerprints from the exhaust system before starting the engine to reduce the chance of chrome discoloration.



FRAME-BODY-EXHAUST

FRONT FENDER

Removal



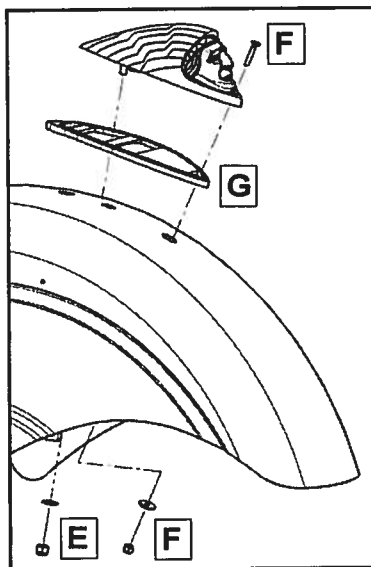
1. Unplug front fender light (A) from harness jumper connection (B) located above lower triple clamp.
2. Remove zip ties holding front fender light harness to front brake line.
3. Remove caliper covers (C) (if equipped) and front brake calipers. See Chapter 15.
4. Place suitable protective covering around the fork legs and the fender to protect the fender paint and fork legs from damage.
5. Remove front fender mounting fasteners (D) while securely holding front fender. Two technicians are recommended for steps 5 and 6.
6. Carefully remove front fender by rotating fender forward.

NOTE: If two technicians are not available for procedure, remove front wheel prior to removing front fender mounting fasteners. See Chapter 12.

NOTE: If Indian front fender light removal is necessary, proceed to steps 7-10.

7. Unplug front fender light from harness jumper located under the front fender.

8. Remove nut and washer (E) and ground wire from mounting stud underneath fender.
9. Remove nut, washer and fastener (F) holding front fender light to front fender.
10. Remove front fender light and gasket (G).



Installation

1. To install front fender, reverse removal procedure.
2. Torque all fasteners to specification.



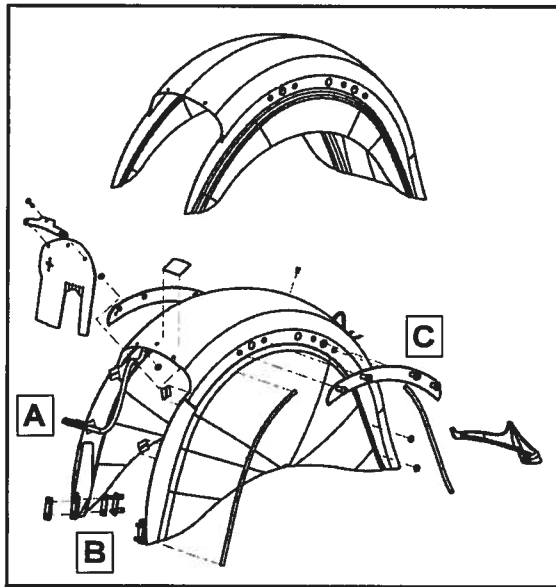
Front Fender Light fastener: 9-11 ft-lbs (12-15 Nm)
Ground Wire Retaining Nut: 22-28 ft-lbs (30-38Nm)
Fender Mount Fasteners: 16-20 ft-lbs (22-27 Nm)



REAR FENDER

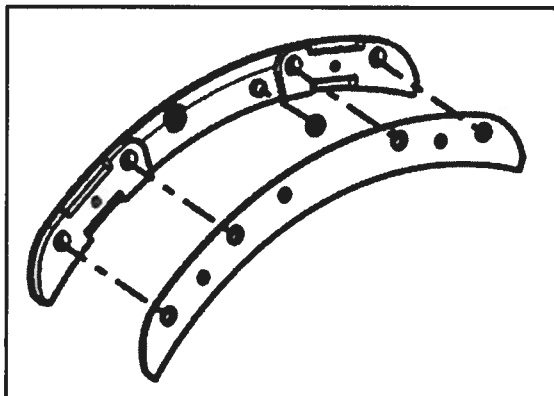
Removal

1. Remove seat. See Chapter 3.
2. Remove side covers. See Chapter 3.
3. Disconnect rear tail light electrical connector (A) underneath right side of battery box.



4. Remove saddlebags, passenger backrests or any other accessories attached to the rear of motorcycle.
5. Remove lower fender mount fasteners and mounting blocks (B above) from each side.
6. Loosen, but do not remove fasteners retaining the fender trim eyebrows (C above).

NOTE: Some models are equipped with quick detach mount eyebrows. These eyebrows would replace fender trim eyebrows (C above). See multi piece assembly below of the quick detach mount eyebrow.



7. While supporting rear fender, remove rear mount fasteners retaining rear fender trim eyebrows (C above). Remove trim eyebrows.
8. Remove rear fender by lifting up and sliding off rear frame struts.

Installation

1. To install rear fender, reverse removal procedure.
2. Install all mounting fasteners loosely before torquing. Torque all fasteners to specification beginning with lower fender mounts.



Lower Fender Mount: **95-115 in-lbs (11-13 Nm)**
Trim Eyebrow Fasteners: **23-27 ft-lbs (31-37 Nm)**



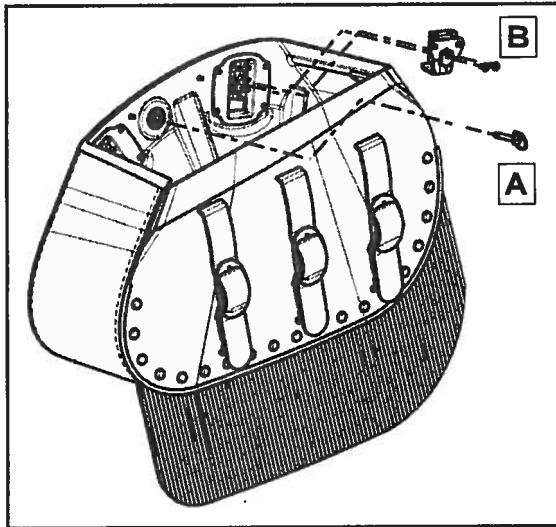
FRAME-BODY-EXHAUST

SADDLEBAGS

Saddlebags are attached with rotary latches that allow easy removal and installation.

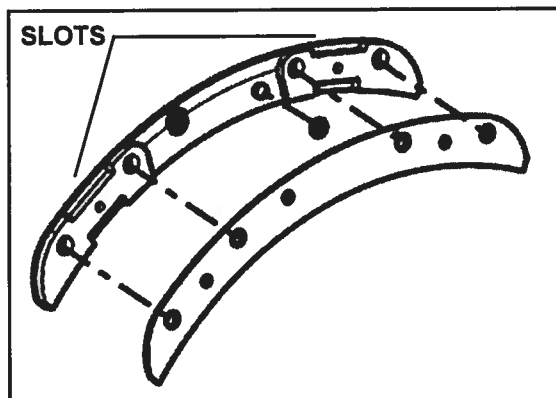
Removal

1. Obtain access to the inside of the saddlebag by unbuckling the outside clasps and lifting lid.
2. Remove ¼ turn stud (A). Twist counterclockwise and pull.
3. Turn each rotary latch (B) counterclockwise and lift locking tabs.
4. Lift and remove saddlebag from motorcycle.



Installation

1. Position saddlebag so that the two rear mounts are securely seated into the slots on the eyebrow assembly.



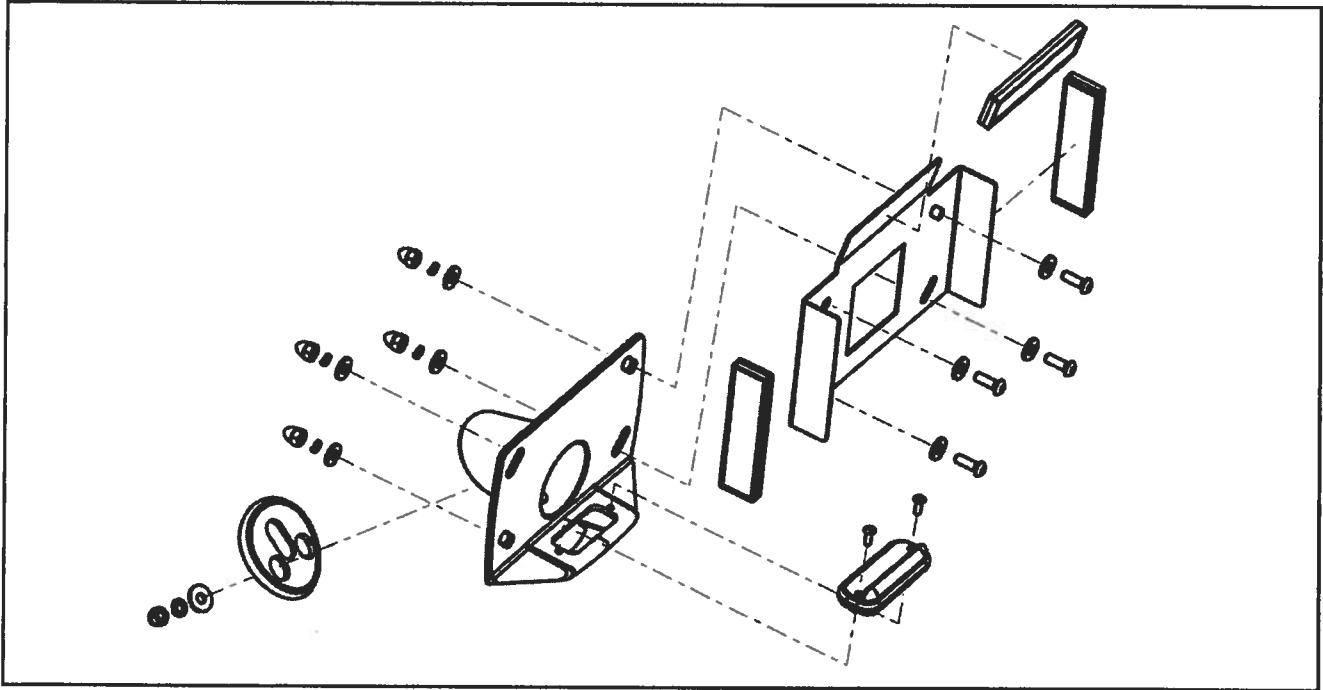
2. Lift saddlebag lids to gain access to the inside of the saddlebags.
3. Install ¼ turn stud (A above). Insert and turn clockwise.
4. Close rotary latch (B above) locking tabs. Make sure tabs are fully seated.
5. Turn rotary latch clockwise to engage rotary latch tab to eyebrow assembly.
6. Confirm bag is fully engaged and locked in by lifting upward on saddlebag.

NOTE: Saddlebag's cargo should not exceed 15 pounds per bag. Cargo weight should be distributed evenly between the two saddlebags.

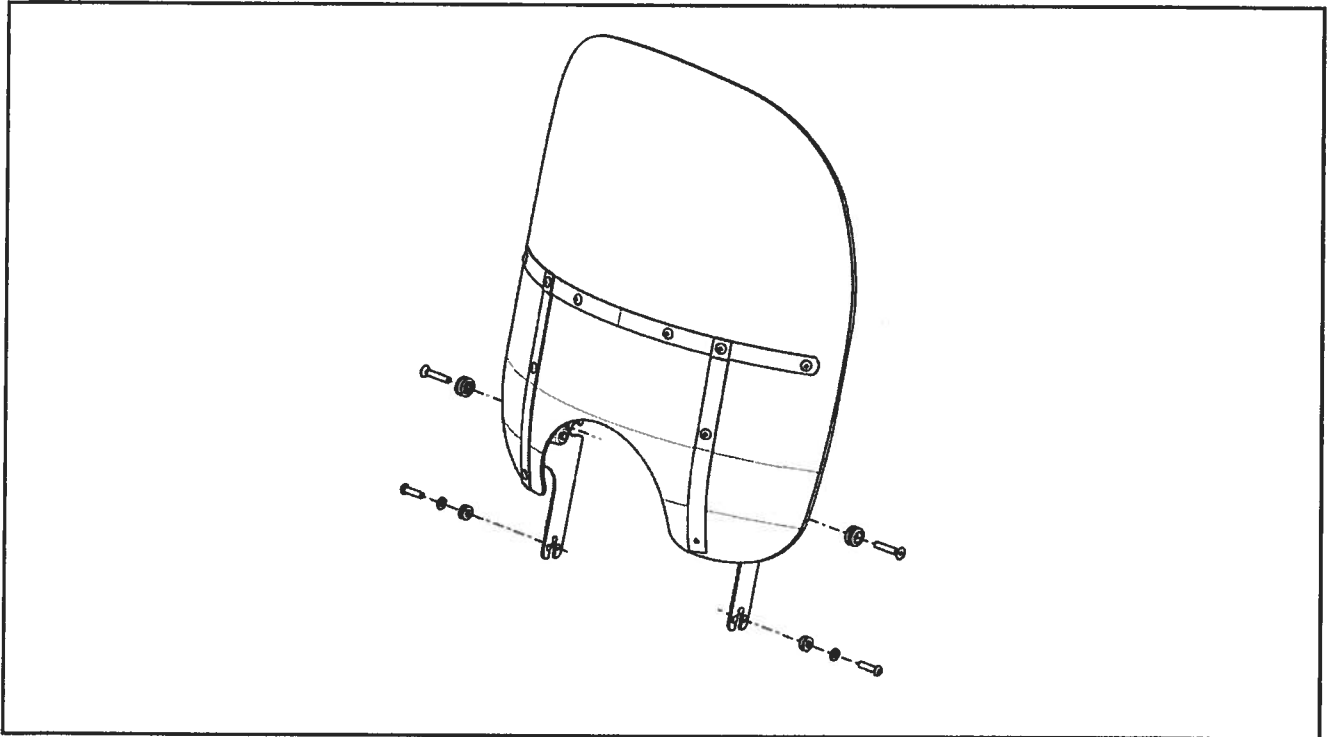


LICENSE PLATE BRACKET

3



WINDSHIELD



FRAME-BODY-EXHAUST

NOTES

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CHAPTER 4

LUBRICATION & COOLING

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TROUBLESHOOTING	4.2
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OIL PUMP DISASSEMBLY / INSPECTION	4.7
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OIL PUMP INSTALLATION	4.9



LUBRICATION & COOLING

OILING SYSTEM

OPERATION

For safety, read, understand, and follow the warnings/cautions contained in this section.

To perform some of the procedures in this section, the engine must be running.

The oil pump has two sets of internal gerotors. One set provides lubrication pressure and the second set provides the scavenge/return pressure. The oiling system pressure relief valve is also located inside the oil pump.

The oil pump may be removed without removing the engine from the frame. 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.

WARNING

DO NOT loosen any oil line connections with the engine running, or within 30 minutes of operation. Oil inside the lines could be under pressure.

WARNING

Never run an engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas that can cause loss of consciousness or death. Operate the engine in an open area or with an exhaust evacuation system connected and functioning properly.

WARNING

The engine components, oil and exhaust system become hot during operation and remain hot for a period of time after the engine is shut off. Wear eye protection and heat-resistant garments for hands and arms if working on a hot engine or wait until the components have cooled sufficiently before working on the machine.

TROUBLESHOOTING

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

SPECIAL TOOLS

Oil Line Fitting Wrench (commercially available)

Oil Line Fitting Crows Foot (commercially available)

Oil Pressure Gauge (commercially available)

SPECIFICATIONS

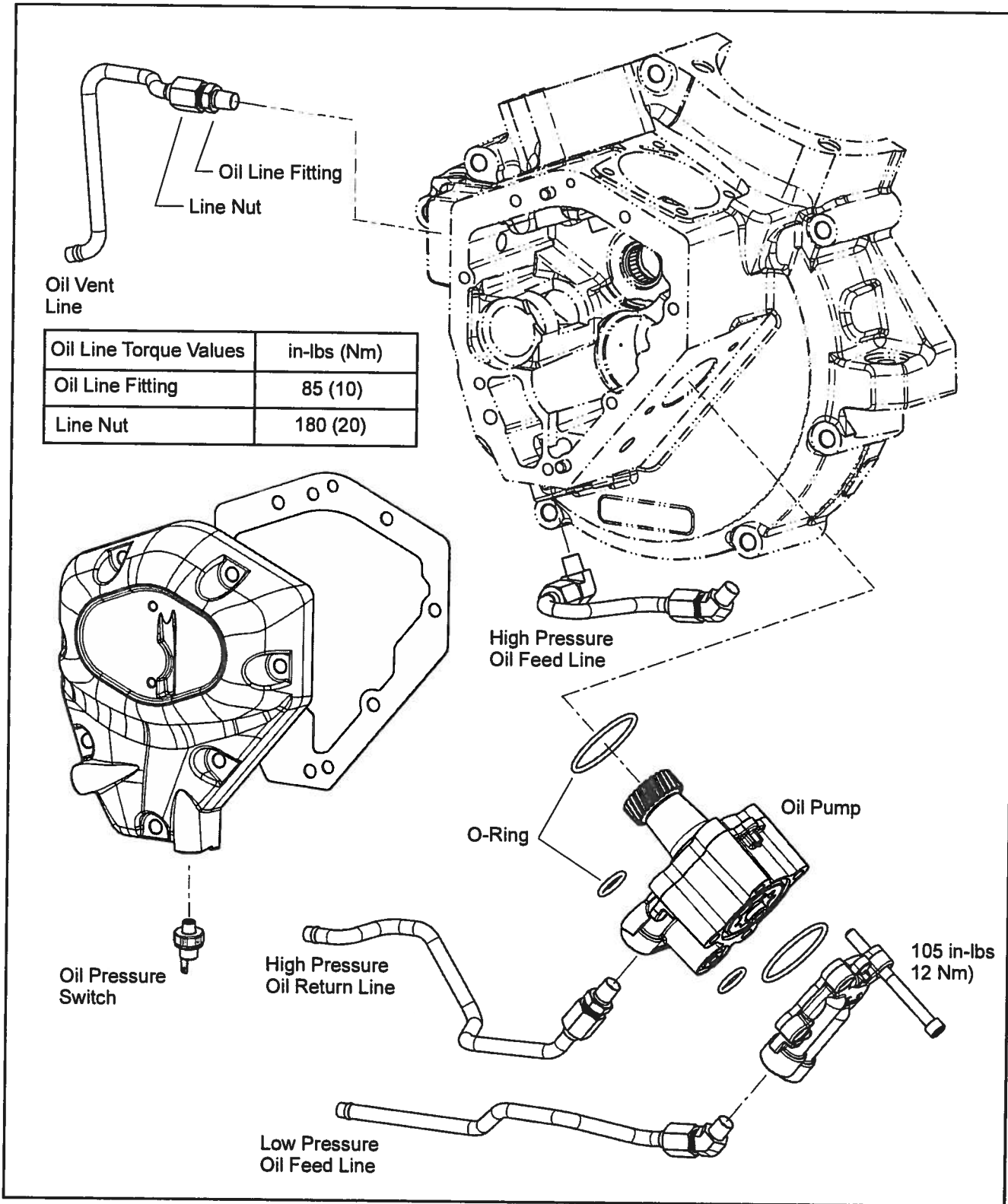
LUBRICATION & COOLING SYSTEM		
Item	Standard	Service Limit
Engine Oil Capacity (After Disassembly)	3.5 U.S. qts (3.1 Liters)	Not Applicable
Engine Oil Capacity (At Change) Fill to full line with the engine at operating temperature.	3 U.S. qts (2.8 Liters)	Not Applicable
Recommended Engine Oil If Indian 20W/50 is not available, use motorcycle oil with same specifications.	Indian Synthetic 20W/50 which meets API SM and ILSAC GF-4 specifications	Not Applicable
Oil Pressure @ 3000 rpm (Lubrication System) Measurements must be taken with engine at operating temperature and specified Indian Motorcycle Engine Oil	12 psi (83 kPa)	Readings should be within 30% of the specification. Minimum <i>Lubrication</i> Pressure 7 psi (48 kPa)
Oil Pump Clearances		
Scavenge Gerotor OD to Oil Pump Body	.15 mm-.25 mm (.006"-.010")	.381 mm (.015")
Feed Gerotor OD to Oil Pump Body	.15 mm-.25 mm (.006"-.010")	.381 mm (.015")
Oil Pump End Clearance	.036 mm-.081 mm (.0014"-.0032")	.203 mm (.008")
Gerotor Tip Clearance	.076 mm-.127 mm (.003"-.005")	.178 mm (.007")

Fastener Torque Specifications - Lubrication & Cooling		
Description	Torque Nm	Torque ft-lbs (in-lbs)
Cylinder Head Temperature Sensor - (CHT) - (Install new if removed)	15.5	11.5
Oil Pressure Sensor	9.5	(85)
Oil Drain Plug - Crankcase and Oil Tank	11	8
Oil Filter - apply oil to filter O-ring	Approximately 3/4 turn after sealing ring has contacted the engine case.	
Oil Filter Bung	20	15 (180)
Oil Line to Oil Line Fitting	20	15 (180)
Oil Line Fitting to Oil Pump	9.5	(85) and orient
Oil Pump Cover to Oil Pump	12	(105)
Oil Pump to Crankcase	12	(105)

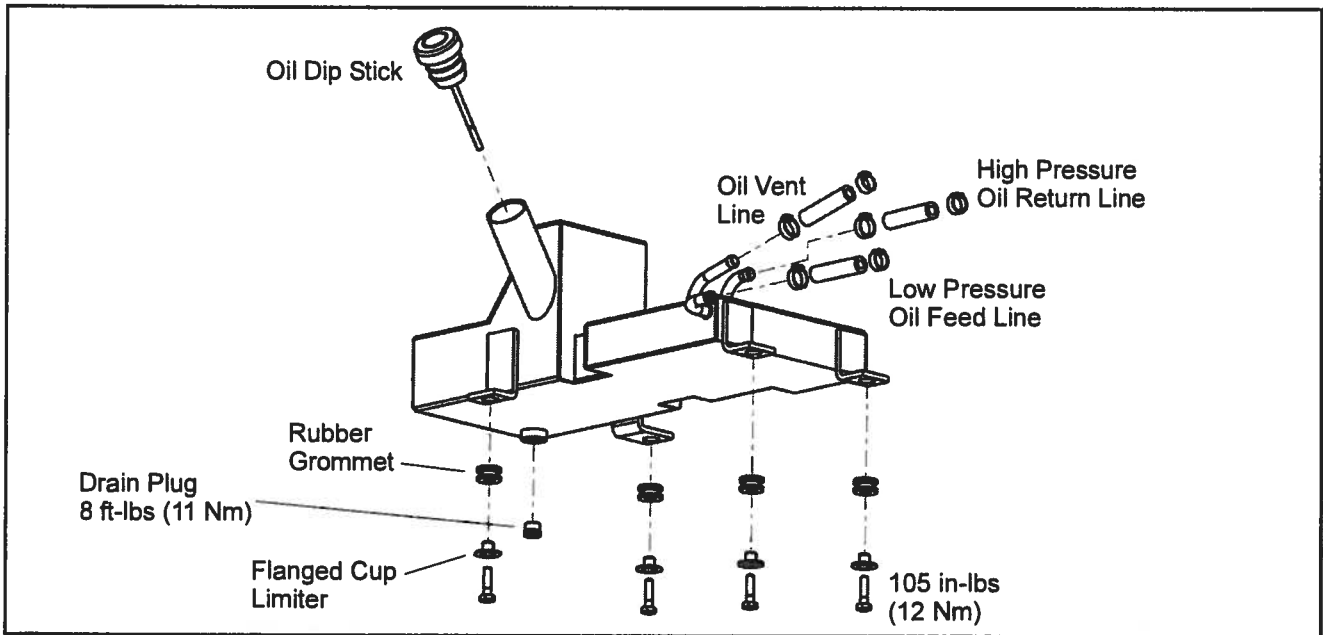


LUBRICATION & COOLING

ASSEMBLY VIEW - OIL PUMP / LINES



ASSEMBLY VIEW - OIL TANK



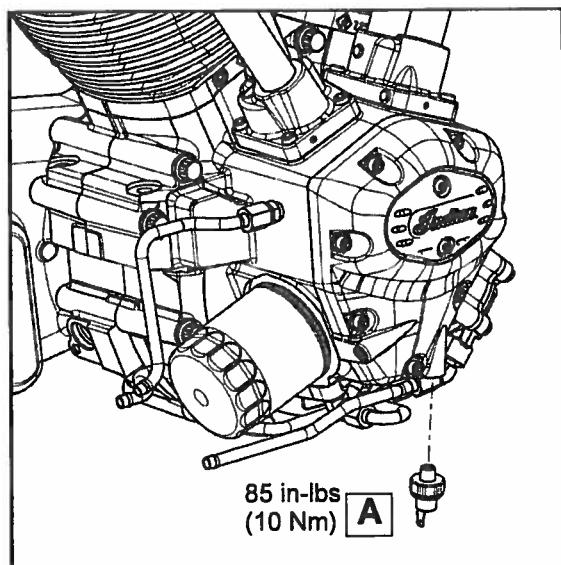
LUBRICATION & COOLING

OIL PRESSURE INSPECTION

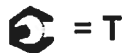
OIL PRESSURE

Use caution when working around hot engine oil. Review all WARNINGS on page 4.2.

1. Start the engine and run until operating temperature is reached.
2. Turn off the engine.
3. Remove oil pressure switch (A).
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 the troubleshooting on page 4.2.
9. Once testing is completed clean threads with Loctite™ Primer N, apply thread sealant to the oil pressure switch threads and torque to specification.



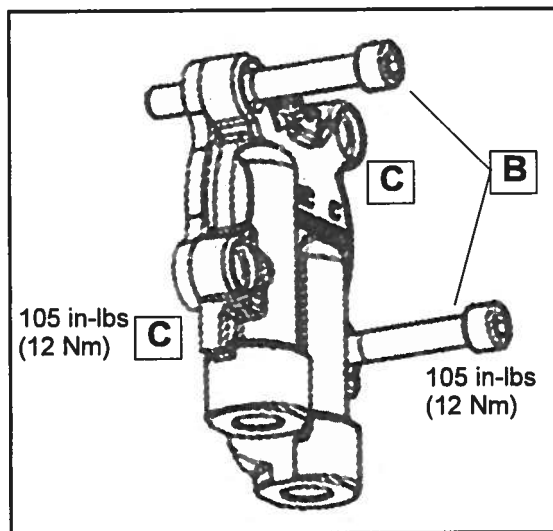
Oil Pressure Switch:
85 in-lbs (10 Nm)

NOTE: Oil pressure switch activates at 3 PSI.

OIL PUMP

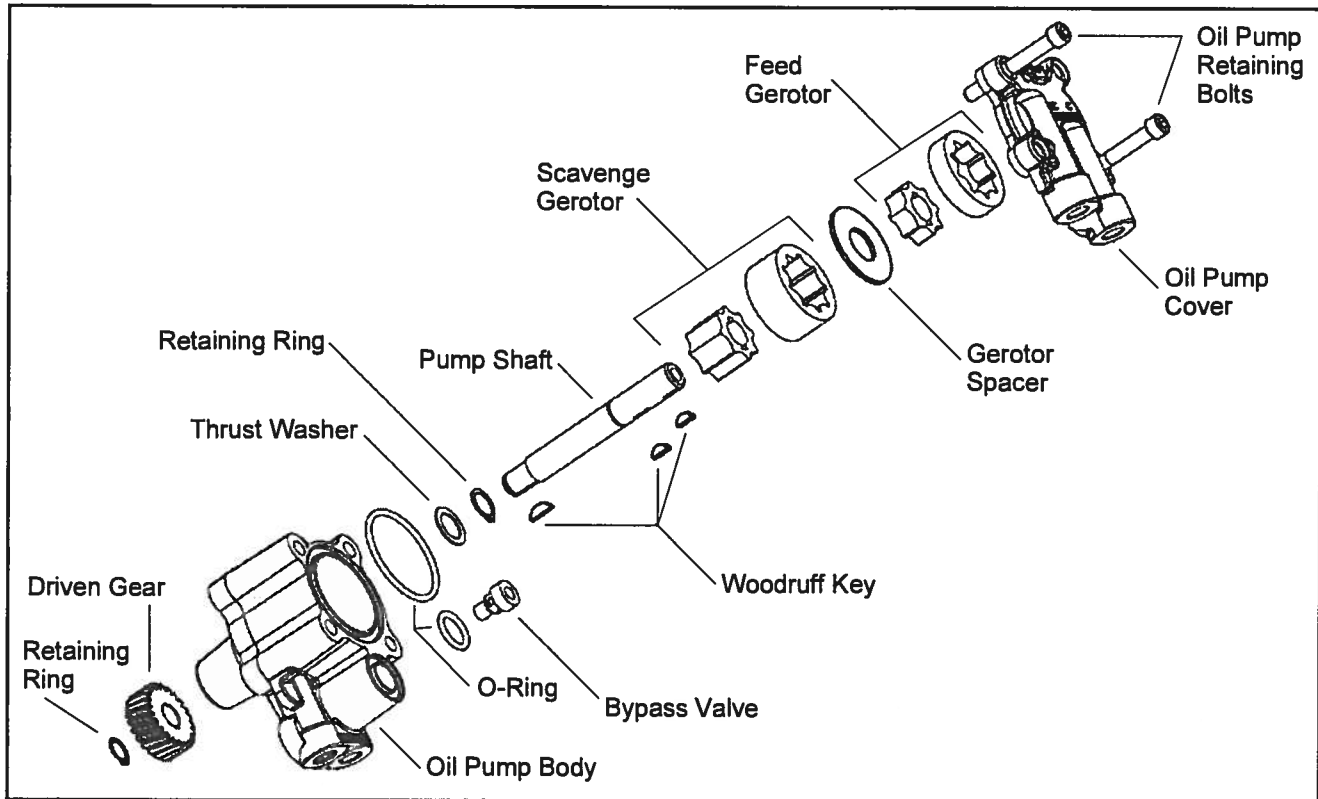
OIL PUMP REMOVAL

1. Remove right side floorboard assembly and exhaust system. See Chapter 3.
2. Remove low pressure oil feed line, high pressure oil feed line, and high pressure oil return line. Refer to Assembly View - Oil Pump / Lines for oil line designation and location.
3. Loosen the two bolts (B) retaining the oil pump cover to the oil pump body if disassembly is necessary.



4. Remove two bolts from location (C) retaining the oil pump body to the crankcase.
5. Rotate oil pump body clockwise 180° and remove from crankcase.

OIL PUMP DISASSEMBLY / INSPECTION



4

Disassembly

Refer to oil pump assembly view above for component identification and location.

1. Remove oil pump driven gear retaining ring, driven gear, and driven gear woodruff key from oil pump shaft.
2. Remove oil pump retaining bolts, securing oil pump cover to body.
3. Remove both large and small oil pump o-rings and discard. O-rings will be replaced during assembly.
4. Carefully slide out oil pump shaft and gerotor assembly out of oil pump bore.
5. Remove feed gerotor, gerotor spacer, and scavenge gerotor. Keep gerotors together as a set and oriented the same way.
6. Remove feed and scavenge gerotor woodruff keys from oil pump shaft.
7. Remove thrust washer and gerotor retaining ring.
8. Remove bypass valve

Inspection

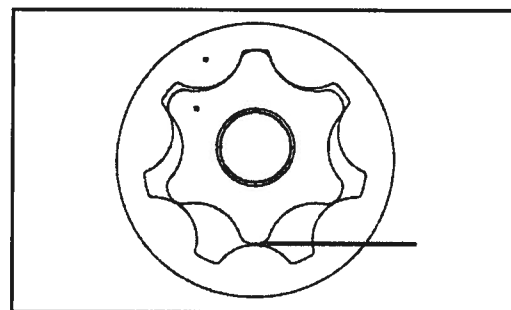
Refer to oil pump assembly view above for component identification and location.

Inspect the oil pump when lubrication oil pressure is below specification.

Keep gerotors together as a set and oriented the same way.

Refer to Oiling System Specifications for oil pump clearances.

1. Inspect gerotors and pump body for scoring.
2. Measure tip clearance of feed and scavenge gerotors as shown below.



4.7



LUBRICATION & COOLING

3. Measure clearance between oil pump body and outside diameter of scavenge gerotor.
4. Measure clearance between oil pump body and outside diameter of feed gerotor.

IMPORTANT: If any measurement is out of specification or scoring is evident, replace oil pump assembly.

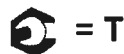
5. Measure oil pump end clearance. Place a straight-edge across the oil pump cover mounting surface and determine gap size with feeler gauge. If measurement does not meet specifications, proceed to step six.
6. If oil pump end clearance does not meet specifications, a different gerotor spacer will be needed. Using the measurement value from step five, refer to the gerotor spacer selection table to select the proper gerotor spacer part number.

GEROTOR SPACER SELECTION TABLE		
GEROTOR GAP	SPACER	CLEARANCE
0.0725 - 0.0737	11000013	0.0014 - 0.0032
0.0738 - 0.0750	11000014	0.0014 - 0.0032
0.0750 - 0.0762	11000015	0.0014 - 0.0032
0.0762 - 0.0775	11000016	0.0014 - 0.0032

OIL PUMP ASSEMBLY

Refer to oil pump assembly view above for component identification and location.

1. Install gerotor retaining ring onto groove in oil pump shaft.
2. Apply moly assembly paste to oil pump shaft, gerotors and gerotor spacer.
3. Install scavenge woodruff key.
4. Install scavenge gerotor.
5. Install gerotor spacer.
6. Install feed gerotor key.
7. Install feed gerotor.
8. Install thrust washer onto pump shaft.
9. Install pump shaft assembly in pump body.
10. Install bypass valve.
11. Install new large and small oil pump cover o-rings and oil pump cover. Install oil pump retaining bolts securing oil pump cover to body and torque to specification.



= T

Oil Pump Retaining Bolts:
105 in-lbs (12 Nm)

12. Install driven gear woodruff key, driven gear and oil pump driven gear retaining ring onto oil pump shaft.
13. Rotate driven gear two full revolutions to confirm smooth operation.

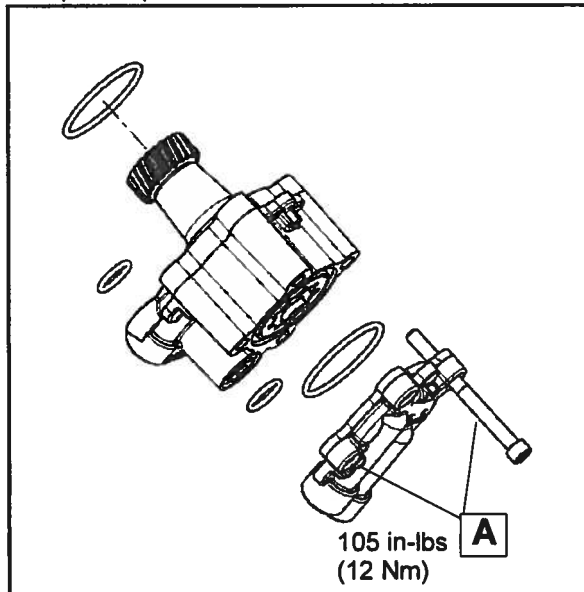
IMPORTANT: If oil pump binds, review installation orientation of the scavenge gerotor and feed gerotor.



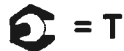
OIL PUMP INSTALLATION

Refer to oil pump / line assembly view for component identification and location.

1. Making sure oil pump o-rings are in position, insert oil pump assembly into crankcase with oil line fittings facing upwards. Once assembly is completely inserted, rotate oil pump 180° counter-clockwise so that oil line fittings now face downward.
2. Insert two oil pump retaining bolts into location (A) and torque to specification.



3. Install all oil line fittings (if removed) and torque to specification.
4. Install high pressure oil return line, high pressure oil feed line, low pressure oil feed line and oil vent line. Torque all oil line nuts to specification.



Oil Pump Retaining Bolts: **105 in-lbs (12 Nm)**
 Oil Line Fittings: **85 in-lbs (10 Nm)**
 Oil Line Nuts: **180 in-lbs (20 Nm)**

5. Install exhaust system and right side floorboard assembly. See Chapter 3.

LUBRICATION & COOLING

NOTES

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal black lines running across the width of the page. The lines are thin and consistent in thickness. There are no margins, text, or other markings on the paper.

CHAPTER 5

FUEL SYSTEM / FUEL INJECTION

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FUEL SYSTEM / FUEL INJECTION

SAFETY PRECAUTIONS

FUEL SAFETY

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 explosive under certain conditions.

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

Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.

Do not overfill the tank. Do not fill the tank above the fuel tank insert or into the filler neck. Leave air space to allow for fuel expansion.

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

If you spill gasoline on your skin or clothing, immediately wash it off with soap and water and change clothing.

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

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.

KEEP GASOLINE OUT OF THE REACH OF CHILDREN

⚠ WARNING

Careless handling 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

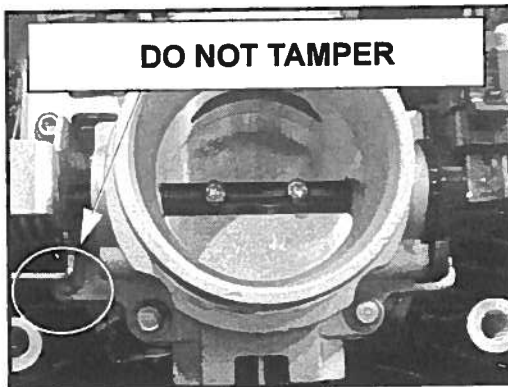
The engine exhaust from this product contains chemicals known to cause cancer, birth defects or other reproductive harm.

⚠ 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.

**DO NOT TAMPER WITH
IDLE STOP SCREW**

DO NOT TAMPER



SPECIFICATIONS

FUEL SYSTEM SPECIFICATIONS

FUEL SYSTEM	
Item	Specifications
Fuel Octane (Minimum)	91 Octane (R+M/2)
Fuel Pump Pressure	5.79 BAR (379 kPa) (55 psi)
Fuel Pump Volume	40 L / hr (10.6 gal / hr)
Idle Speed / Fast Idle	950 rpm $\pm$ 100 / Not Adjustable
Throttle Grip Free-Play	2-4 mm (1/16"-5/32")
Injector Resistance	14.5 - 15.5 Ohms

NOTE: Idle speed is continuously monitored and adjusted by the ECM via the IAC valve. DO NOT tamper with or attempt to "adjust" the idle stop screw! The idle stop screw is factory pre-set. If idle is erratic or if idle speed is incorrect, refer to troubleshooting in this section to find the cause of the problem.

SPECIAL TOOLS

FUEL SYSTEM SERVICE TOOLS

TOOL DESCRIPTION	PART NUMBER
Speedometer / Body Control Module Diagnostic Tool (Indian Motorcycle PN)	N900000000
Engine Control Module Diagnostic Tool (Indian Motorcycle PN)	N900000002
Fluke 77 Digital Multi Meter (SPX PN)	PV-43568
Vacuum Pump, hand operated	Commercially available

TROUBLESHOOTING

BASICS TROUBLESHOOTING

NOTE: The closed-loop EFI system does not require TPS calibration.

DO NOT OVERLOOK THE BASICS WHEN TROUBLESHOOTING:

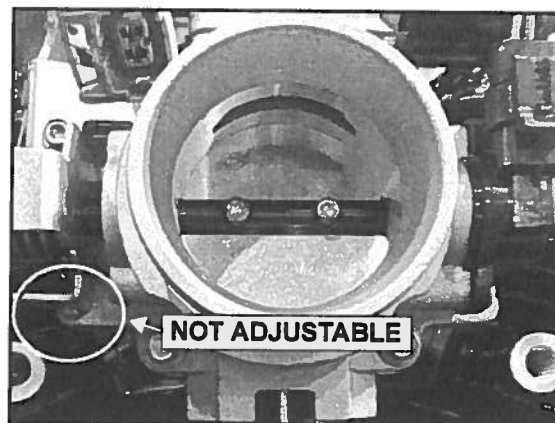
1. Battery in a low state of charge can cause problems. Be sure the battery is in good condition and fully charged.
2. Air leaks in intake tract / air box - check for air leaks and repair to avoid mis-diagnosing the EFI system.
3. Contaminated or improper fuel.
4. Restricted fuel flow / filters (low fuel pressure).
5. Fuel tank vent line pinched or obstructed.
6. Faulty spark plug(s).
7. Corroded, disconnected, or mis-connected wiring. (Mis-connected wiring after recent service).
8. Poor ground connections - be sure all are clean and tight.
9. Exhaust system restriction or improper exhaust.
10. Engine mechanical condition.

5

IDLE STOP SCREW

DO NOT TAMPER WITH THIS SCREW!

Throttle body idle stop screw is factory pre-set. Throttle body must be replaced if screw setting is changed.

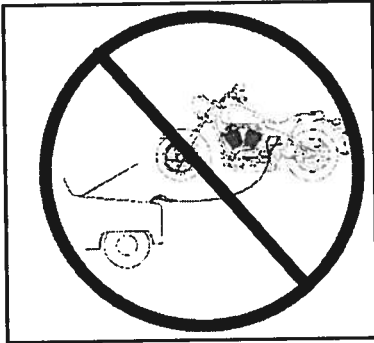


FUEL SYSTEM / FUEL INJECTION

SERVICE PRECAUTIONS

EFI SYSTEM PRECAUTIONS

NOTICE: 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 Chapter 16 for complete battery connection and charging information.
- Make sure that the ignition switch is off 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 higher amperage 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 the sensors are sensitive pieces of electronic equipment. Dropping or hitting them may cause irreparable damage.
- Static electricity can damage the ECM 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.

NOTICE: 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.

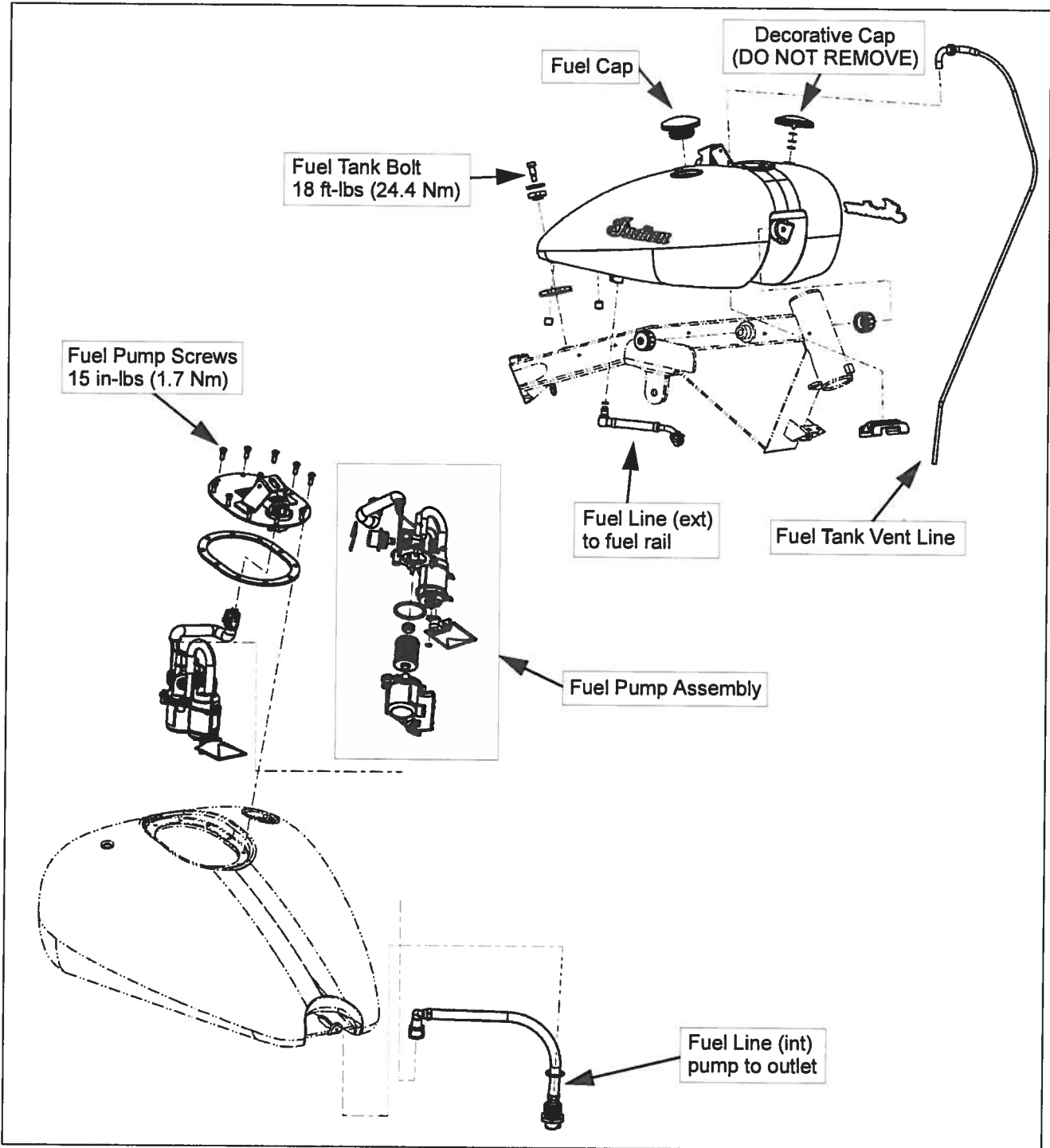
Always use a suitable adapter when probing the terminals. Most of the connectors are sealed and cannot be back probed. Be extremely careful not damage the connectors by forcing meter probes into the connectors.

Carefully inspect connections of a failed circuit before doing any other troubleshooting steps. Wire terminals must be corrosion free and fully seated. Connectors should snap together and lock.



FUEL SYSTEM ASSEMBLY VIEWS

FUEL TANK HOSE CONNECTION - 49 STATE MODELS



5

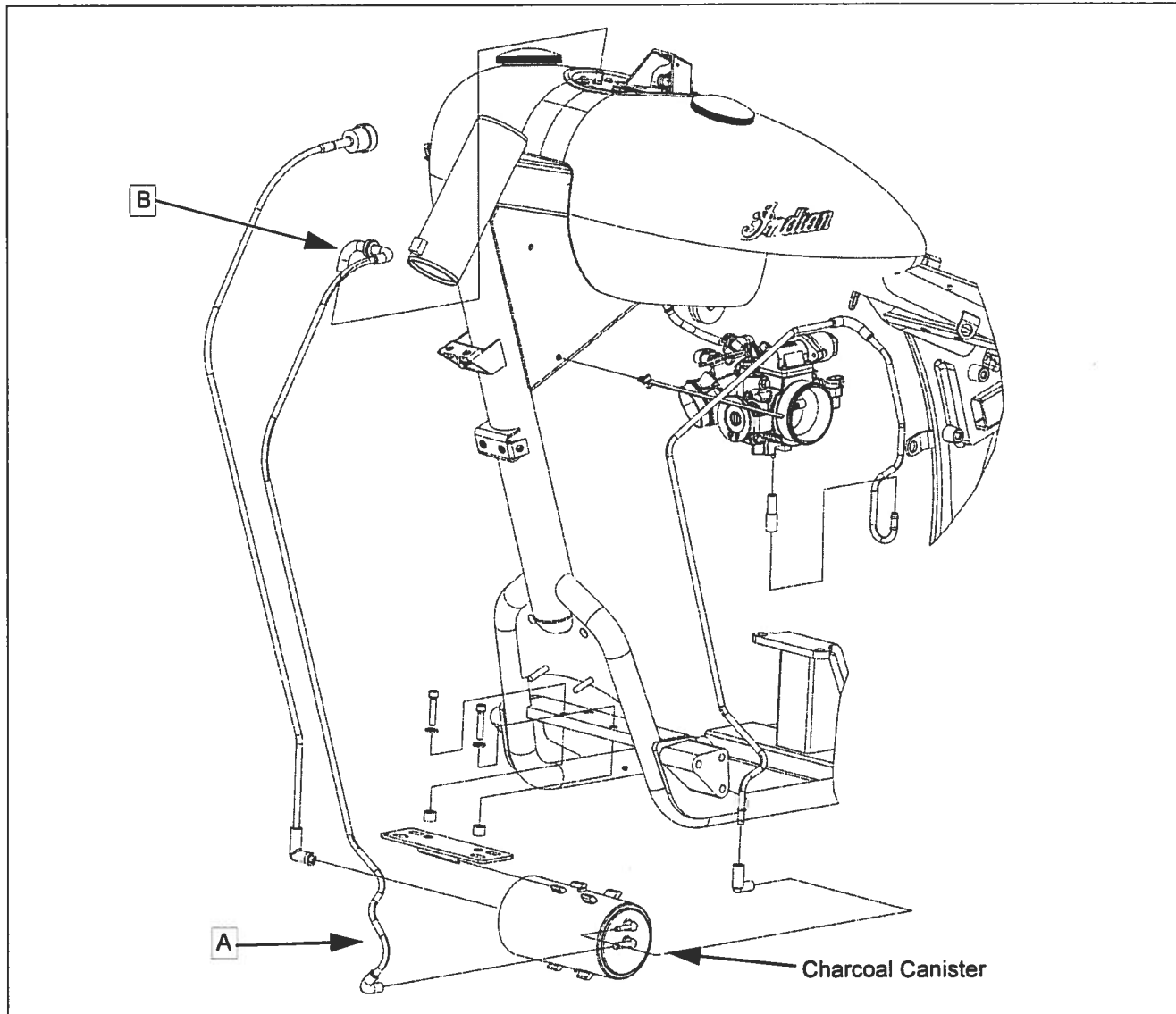
Fuel Tank Vent Inspection - 49 State

1. Access the free end of the fuel tank vent line.
2. Remove fuel cap.
3. Using a hand-operated vacuum pump, verify that the vent hose is clear between the cap and termination point.



FUEL SYSTEM / FUEL INJECTION

FUEL TANK HOSE CONNECTION - CALIFORNIA MODELS

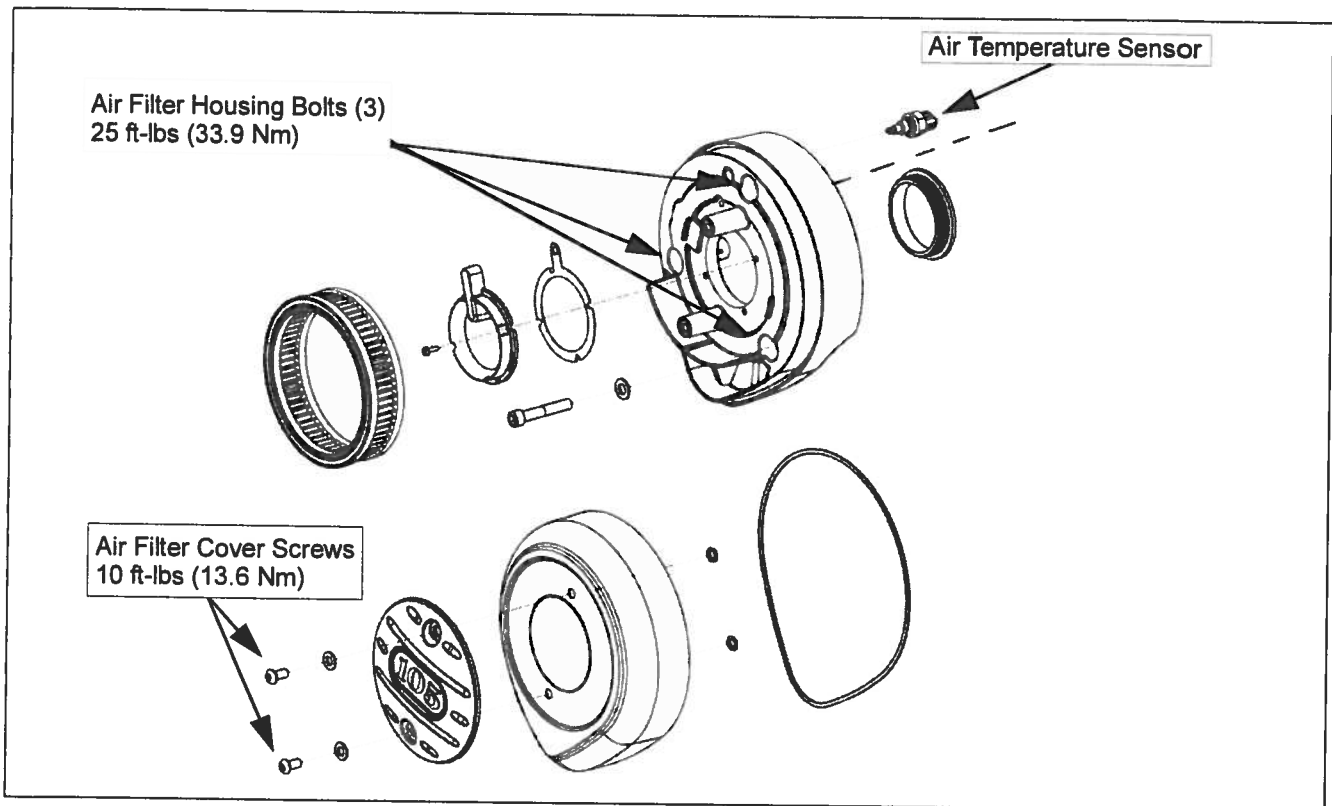


Tank Vent Inspection (California Models)

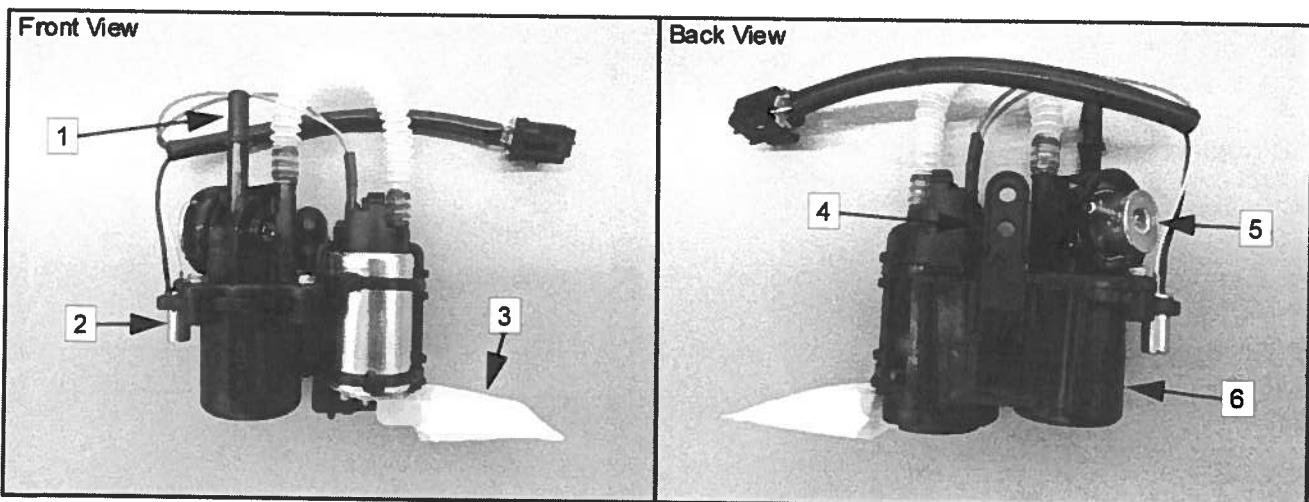
1. Access the charcoal canister and remove the fuel tank vent line (A) from the canister
2. Open fuel cap.
3. Attach a hand-operated vacuum pump to the detached vent hose fitting and apply vacuum to the vent hose. Verify that vacuum DOES NOT build as the vacuum pump is operated.

NOTE: If negative pressure builds as the vacuum pump is operated, inspect the vent hose and in-line check valve (B) for restrictions.

AIR INTAKE / BOX FRAME ASSEMBLY VIEW



FUEL PUMP / LEVEL SENSOR ASSEMBLY VIEW



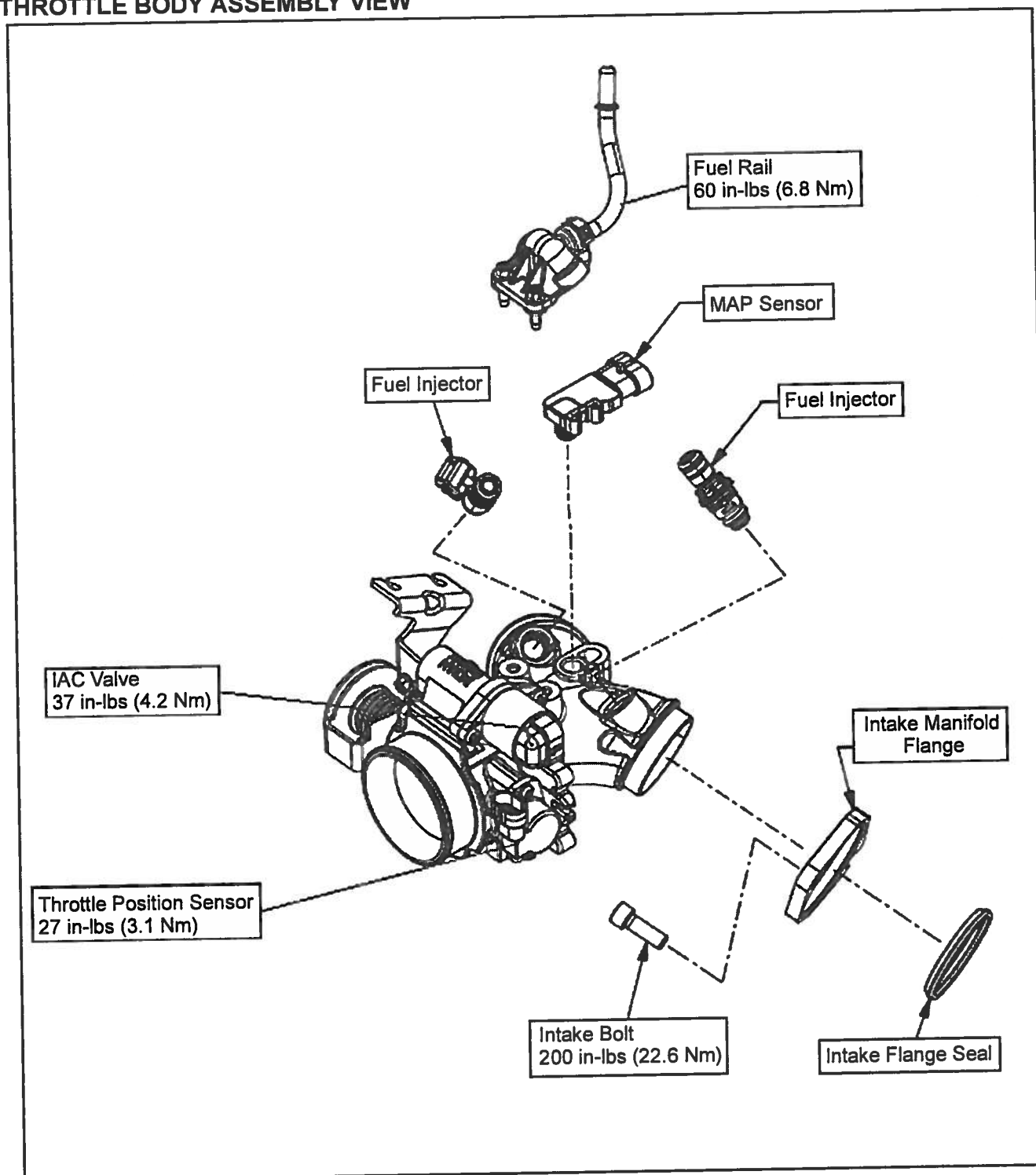
1. Fuel pump outlet.
2. Fuel level sensor (thermistor)
3. Fuel pump pre-filter.

4. Fuel pump mounting tab.
5. Fuel pressure regulator.
6. Fuel filter housing.



FUEL SYSTEM / FUEL INJECTION

THROTTLE BODY ASSEMBLY VIEW



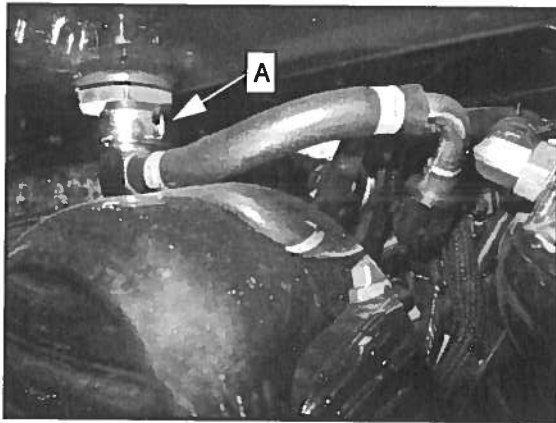
FUEL SYSTEM SERVICE

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.
2. Press the fuel line release button (A) and gently slide the quick disconnect male fitting straight off the fuel fitting. Use caution not to damage sealing O-ring attached to fuel line when disconnecting.



3. Cover fuel fittings to keep debris out of line.

PRIMING THE FUEL SYSTEM

Fuel pump prime procedure should be performed when:

- Fuel pump is replaced.
- Fuel pump/filter is serviced.
- Fuel line is disconnected.
- Fuel tank has been run completely dry.

1. Fill the fuel tank.
2. Switch the engine RUN / STOP switch to the STOP position.
3. Turn the Ignition Switch to the ON position.
4. Switch the engine RUN / STOP switch to the RUN position.
5. Allow switch to remain in "RUN" position until fuel pump stops running.

6. Turn engine RUN / STOP switch to the STOP position.
7. Repeat steps 4-6 approximately 5 times to complete the priming procedure.
8. Turn ignition key OFF when priming is complete.

NOTE: Fuel level in tank must be high enough to submerge pickup screen on the pump.

FUEL TANK VENT INSPECTION

1. Refer to page 5.5 (49 State) or 5.6 (California) for tank vent inspection and hose routing information.

5

FUEL PUMP REMOVAL

WARNING

Replace all access plate screws and access plate gasket any time the fuel pump is removed for service or maintenance. Review gasoline warning on page 5.2.

CAUTION

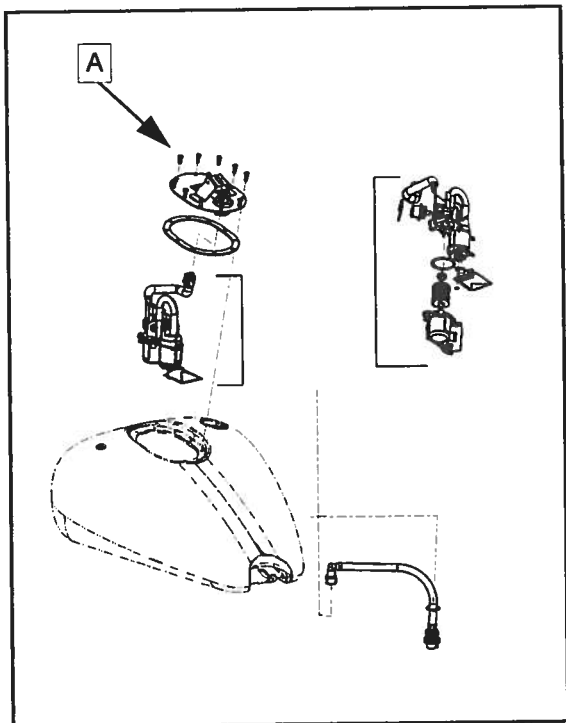
Be careful when removing the fuel pump to avoid damaging the fuel pump, electrical wiring, or hoses. Always inspect wires and hoses closely for damage after removing the pump.

1. Drain fuel from fuel tank using a vacuum or siphon pump designed for fuel systems. Observe all fuel handling precautions at the beginning of this chapter.
2. Remove seat (see Chapter 3).
3. Disconnect battery (see Chapter 2).
4. Remove dash (see Chapter 3).
5. Disconnect the electrical connector from the fuel pump.
6. Disconnect ground terminal on access plate dash bracket.

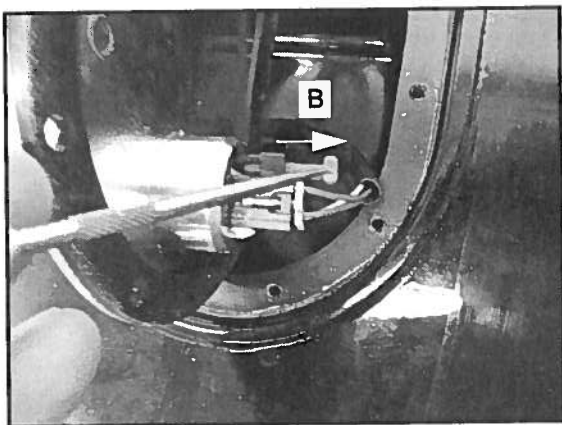


FUEL SYSTEM / FUEL INJECTION

7. Remove the 10 access plate screws (A).



8. Disconnect the internal pump wiring from access plate by first removing the RED lock tab (B) from the plug and then releasing the connector with a small screw driver.



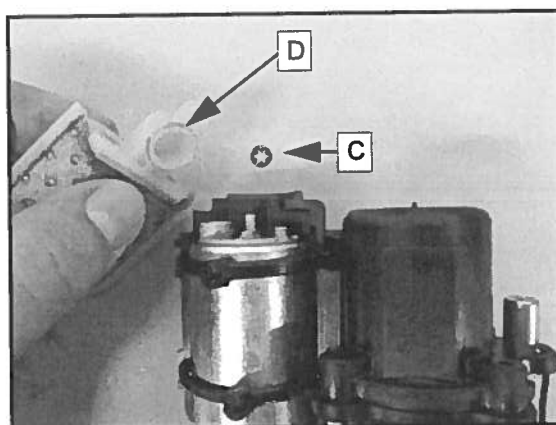
9. Disengage green retainer clip from fuel line fitting and disconnect the internal fuel line from fuel pump.
10. Through access opening of tank, release fuel pump assembly by pressing locking tab on left side of fuel tank tunnel toward fuel pump (outboard) while sliding fuel pump assembly upward off mounting rails.

11. Rotate Fuel pump assembly clockwise and carefully remove fuel pump from fuel tank. Use caution when removing fuel pump assembly to avoid damaging component.

FUEL FILTER REPLACEMENT

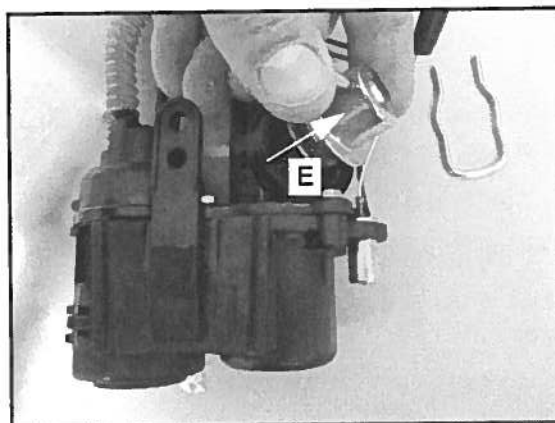
Pre-Filter (sock)

1. Remove fuel pump.
2. Using a machinist's scribe, or similar pointed tool, loosen the push nut (C) by carefully prying it off of the fuel pump post.
3. Carefully remove the pre-filter sock (D) off of the fuel pump assembly.

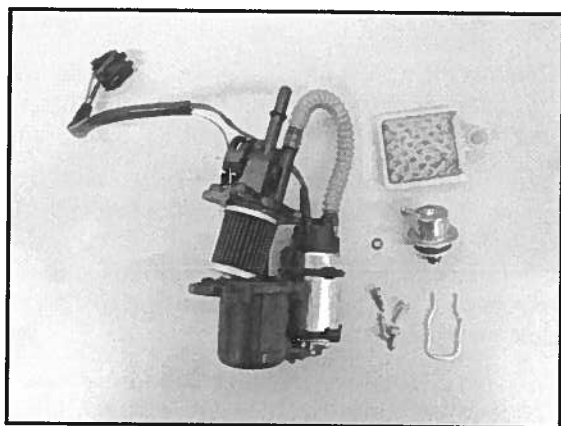


Fuel Filter (paper element)

4. Remove retaining clip from fuel pressure regulator (E) and remove regulator.



5. Remove the four screws securing the fuel filter housing to the pump assembly and withdraw the filter from the housing.



6. Reverse the procedure to reassemble the fuel pump assembly.

IMPORTANT: DO NOT overtighten the fuel filter housing screws. These are self-tapping screws and should only be tight enough to bottom out against the brass spacer in the filter cover.

FUEL PUMP INSTALLATION

NOTE: Replace all fuel pump access plate screws any time the fuel pump is removed for service.

1. From the top of the tank, carefully insert the fuel pump assembly and orientate its position (left side of the tank) so that the fuel pump's mounting tabs are inboard and the tab release is upright.
2. Align the fuel pump's mounting tabs above the fuel tank's mounting rails located on the left side of the tank tunnel.
3. Slide the fuel pump assembly down the mounting rails until the fuel pump fully seats and the locking tab engages.
4. Confirm that assembly is properly seated and locked into position by applying an upward force to the fuel pump assembly.
5. Position end of internal fuel line to inlet on fuel pump and snap fuel line connector to fuel pump. Verify positive lock of fuel line to pump.
6. Clean the mating surfaces of the fuel pump access plate and the fuel tank.
7. Reconnect the internal fuel pump connector and reinstall the RED locking tab into plug.

8. Position the access plate onto the access plate gasket and align the tank mounting holes with the gasket and access plate.

9. Thread the 10 access plate screws through access plate, gasket and into tank. Torque screws in a cross pattern to specification.



Fuel Pump Access Plate Screws:
15 in-lbs (1.7 Nm)

5

10. Fasten ground terminal to access plate.
11. Connect fuel pump electrical connector top of access plate.
12. Install dash (see Chapter 3).
13. Connect battery (see Chapter 2).
14. Install seat (see Chapter 3).
15. Prime the fuel system as described on page 5.9.

FUEL TANK REMOVAL

Refer to Fuel Tank Assembly View on page 5.5.

! WARNING

Review gasoline warnings on page 5.2. Allow engine and exhaust to cool completely before disconnecting fuels line or removing tank. Drain fuel tanks as completely as possible before performing removal.

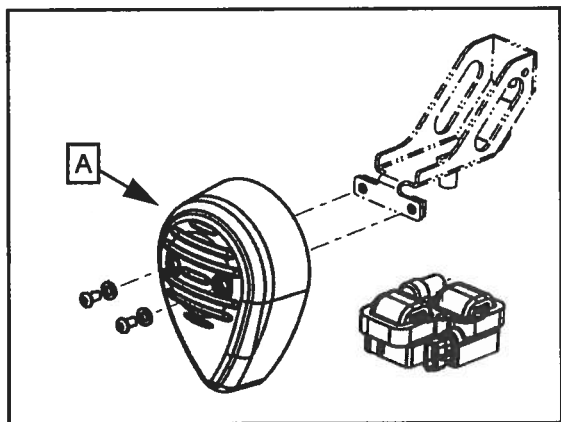
NOTE: Be prepared to place the fuel tank in a secure location after removal.

1. Secure the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove the seat (see Chapter 3).
3. Remove the dash assembly (see Chapter 3).



FUEL SYSTEM / FUEL INJECTION

4. Remove the coil cover (A) to access the quick disconnect on the external fuel line located on the right side of the unit.



5. Depressurize the fuel system (see page 5.9) and remove the external fuel line fitting from the bottom of the fuel tank.

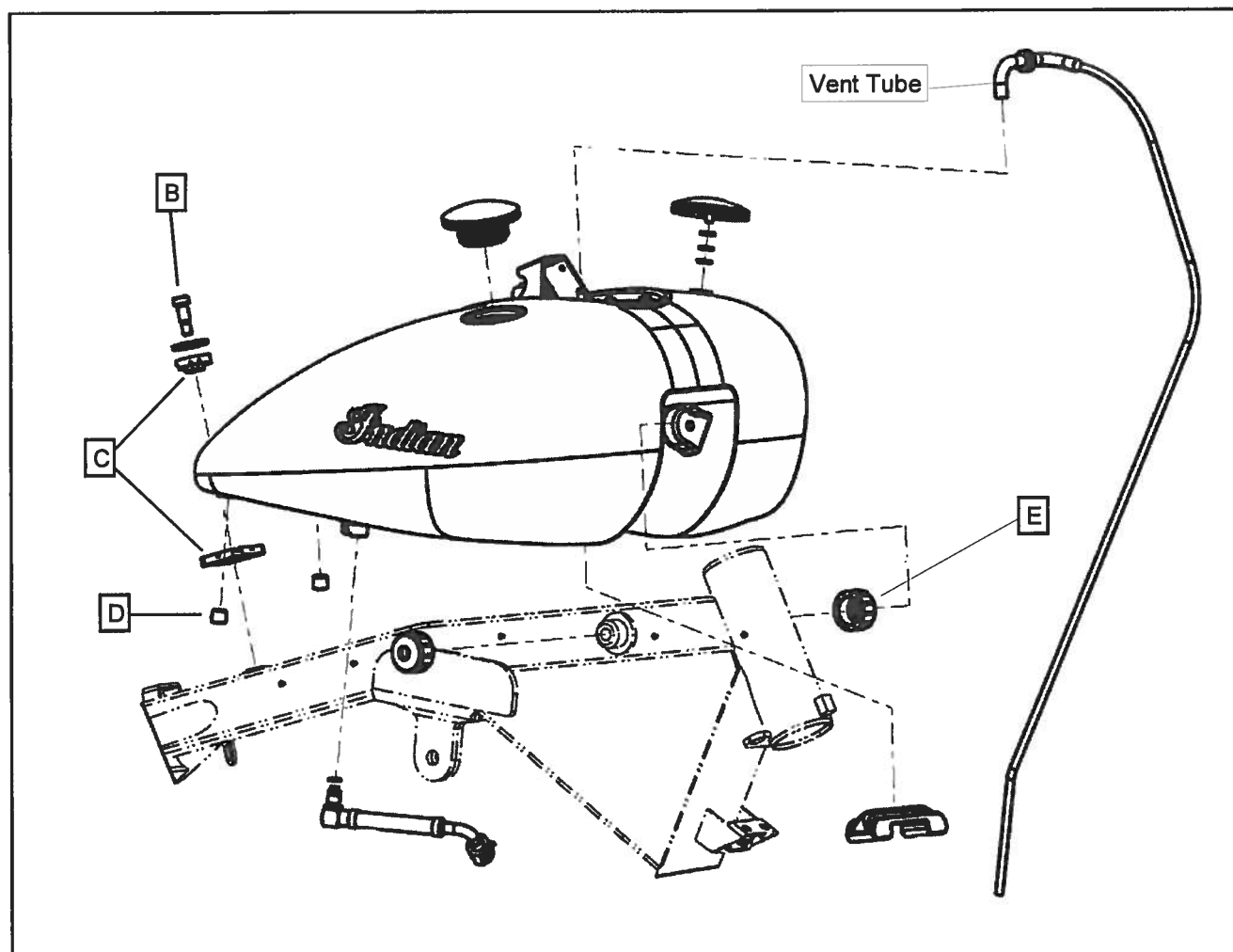
6. Disconnect the fuel vent line, fuel pump electrical connector and the fastener holding the fuel tank ground terminal located on top of the fuel pump access plate.

7. Remove the socket head fastener (B) and flat washer. Pay attention to the orientation of the tank spacers (C), and the fitment of the $\frac{1}{4}$ " Pipe plug (D) during removal.

8. Verify the handlebars are centered and place a protective cover over the front of the fuel tank.

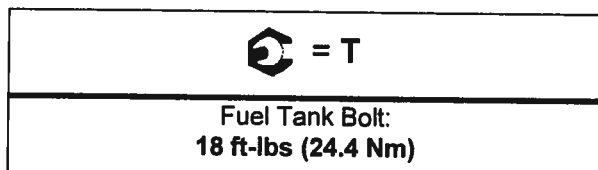
9. Lift the rear of the tank and slide toward the rear of the motorcycle. The tank will disengage from the fuel tank post grommets (E).

IMPORTANT: Store fuel tank in a secure location. Fuel can damage cosmetic surfaces. Wipe off any fuel spills immediately with a clean cloth.

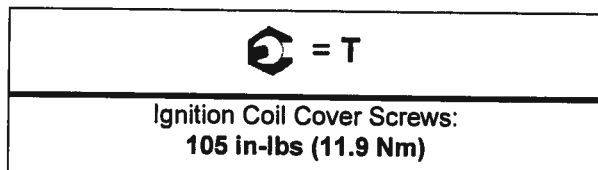


FUEL TANK INSTALLATION

1. Secure the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Apply P-80 lubricant on the fuel tank post grommets on frame backbone. Confirm that the Tunnel Spacer is positioned correctly.
3. Place protective cover over the front of the fuel tank.
4. Position the front fuel tank mounting brackets over the fuel tank post grommets. Slide the tank forward ensuring that fuel tank mounting brackets are fully seated on the fuel tank post grommets.
5. Position the lower tank spacer with ¼ " pipe plug installed onto mounting boss on top of frame backbone. Position so the grooves on the spacer face up.
6. Position upper tank spacer into mounting tab at rear of fuel tank. Orient so that the grooves in spacer face downward. Fully seat spacer into tab.
7. Rotate the tank downward and install the socket head fastener flat washer through tank spacers and into tapped hole in frame. Torque fastener to specification.

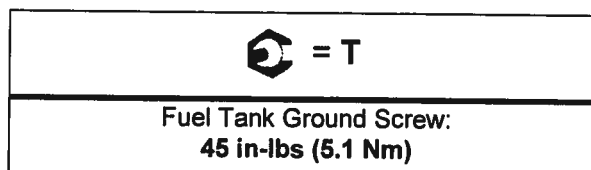


8. Attach the fuel line to the fitting on the bottom of the tank. Use caution not to damage sealing O-ring. Verify positive clamping/locking by pulling downward on fuel line after installation.
9. Install the coil cover. Install flat washers on fasteners and torque to specification.



10. Install the fuel vent line and Fuel Pump/Low Fuel electrical connector to the fuel pump access plate.

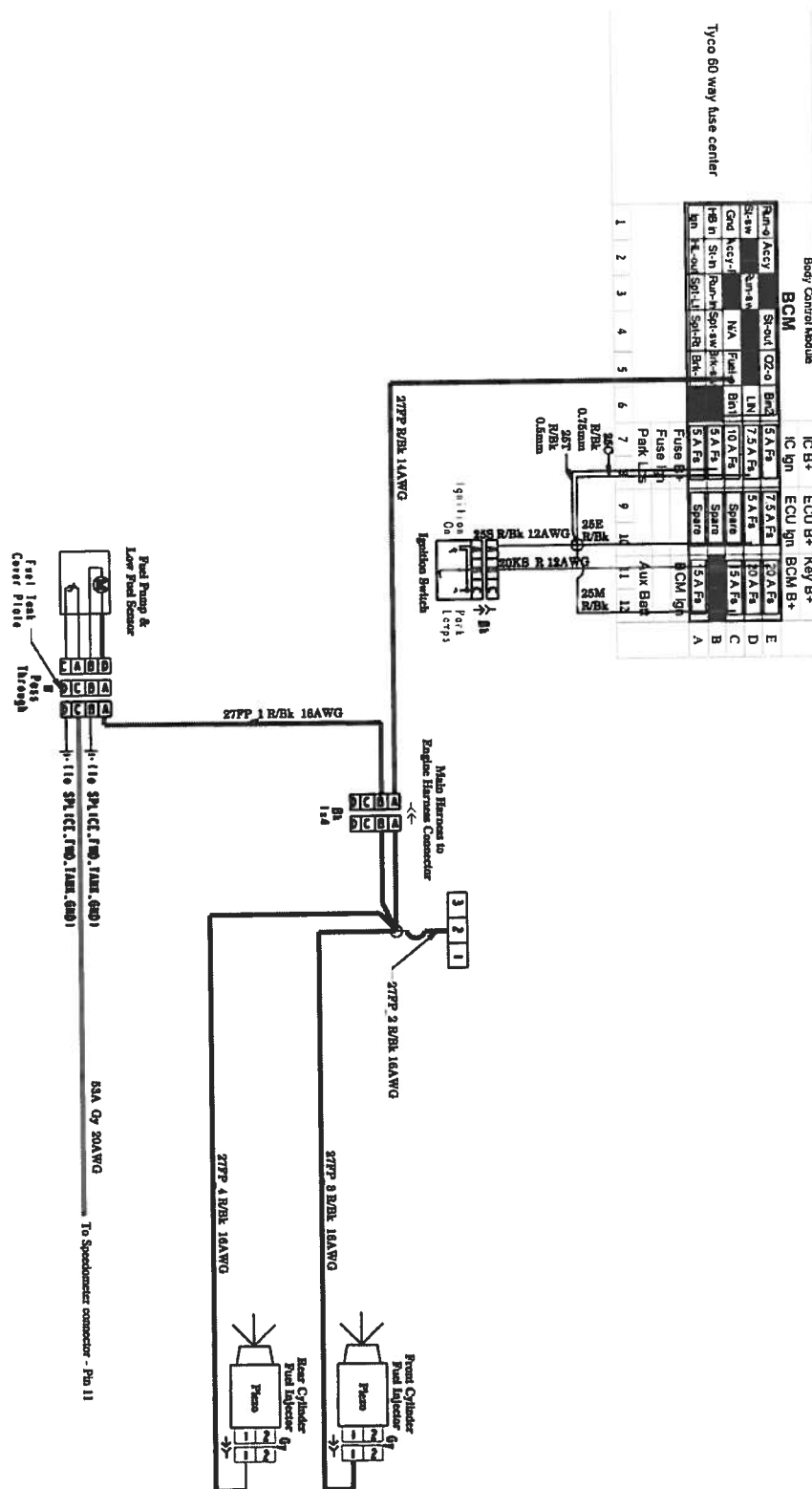
11. Attach the ground cable to the fuel pump access plate by threading the Fuel Tank Ground Screw through the ground wire terminal. Torque screw to specification.



12. Install the dash panel as an assembly (see Chapter 3).
13. Prime fuel pump as outlined on page 5.9. Inspect fuel supply line connections for leaks.
14. Install the seat (see Chapter 3).

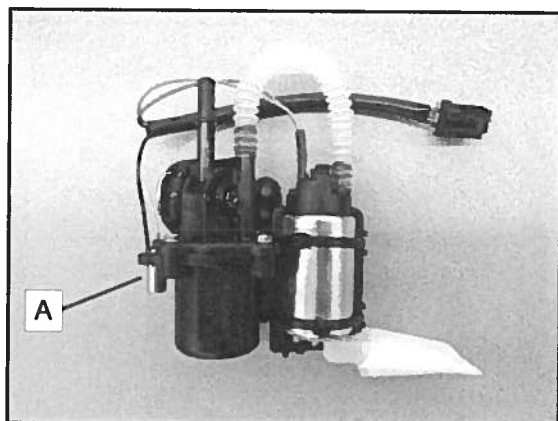
FUEL SYSTEM / FUEL INJECTION

FUEL PUMP CIRCUIT DIAGRAM



FUEL LEVEL SENSOR RESISTANCE TEST

OVERVIEW OF OPERATION: The fuel level sensor (A) is located inside the fuel tank on the fuel pump.



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 indicator lamp. The lamp will start to glow when the fuel level falls below the sensor, and will brighten as the fuel level continues to fall and resistance decreases.

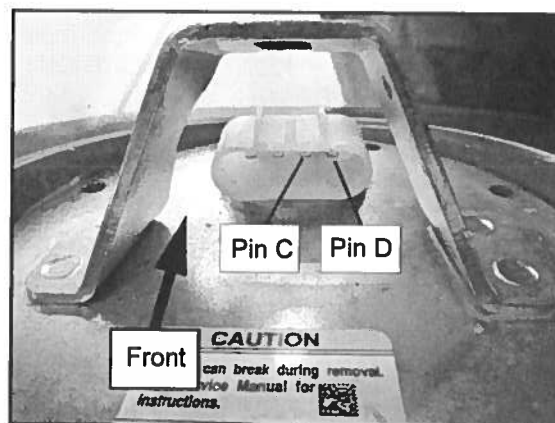
The sensor can be tested using a digital multimeter. Resistance readings obtained with tank installed will be in proportion to the amount of fuel in the tank. The sensor wires are located in the 4-pin connector, beneath the dash, in the fuel pump access plate.

Follow the steps below to test the thermistor circuit with an ohmmeter.

Fuel Level Indicator Test

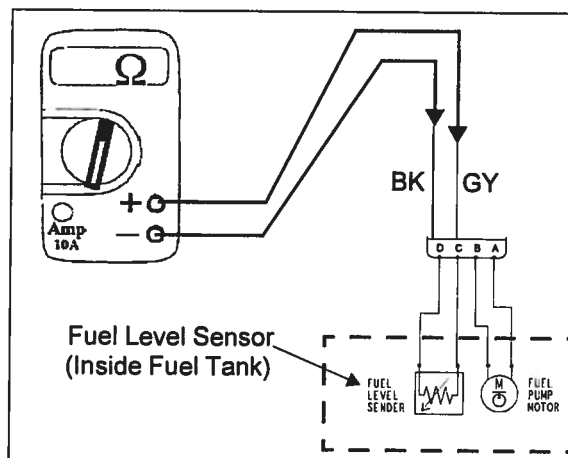
1. Turn the ignition switch OFF and secure the motorcycle in an upright position.
2. Remove the dash panel to access the fuel pump electrical connector (see Chapter 3).
3. Disconnect the fuel level sensor / fuel pump connector located in the fuel pump access panel.
4. Set multimeter to measure resistance.

5. On the access plate (sensor side) of the connector measure the resistance value across the sensor pins and compare to the table below. Fuel temperature **MUST** be close to the testing temperature listed in the table for accuracy.



5

6. Attach the meter leads to pin C and pin D of the 4-pin connector out of the fuel pump. Estimate the fuel level in the tank and compare resistance reading to the table below.



Resistance Measured From Pin C to Pin D in 4-Pin Connector	Approximate Resistance
Sensor Resistance (Room Temperature)	FULL (Sensor Arm Up) 50 Ω +/- 3 Ω
	EMPTY (Sensor Arm Down) 250 Ω +/- 5 Ω



FUEL SYSTEM / FUEL INJECTION

FUEL PUMP PRESSURE INSPECTION

WARNING

GASOLINE

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. **KEEP GASOLINE OUT OF THE REACH OF CHILDREN!**

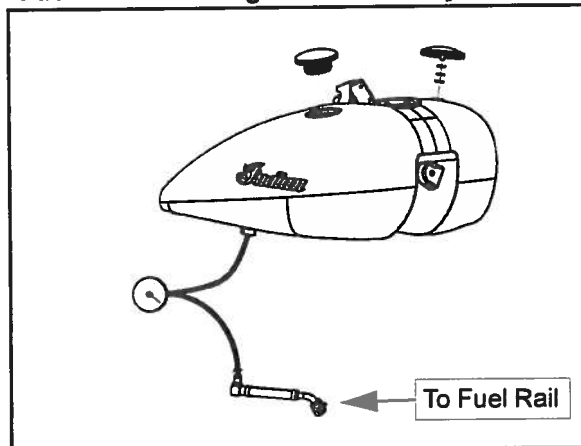
CAUTION

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

1. Remove the coil cover see page 5.11.
2. Depressurize the fuel system (page 5.9) and disconnect the fuel line at the bottom of the fuel tank.

3. Install a suitable fuel pressure gauge adapter between the fuel tank fitting and the fuel rail and attach a fuel pressure gauge.

Fuel Pressure Gauge: Commercially Available



4. Prime the fuel system (see page 5.9).
5. Start engine and record fuel pressure (or cycle ignition key and Engine Stop switch to read pressure when pump cycles for 2-3 seconds).

Fuel pressure 5.79 BAR (379 kPa) (55 psi)

6. Turn ignition switch off, depressurize the fuel system and disconnect the pressure gauge.
7. Reconnect the fuel line to the fitting on the bottom of the tank and prime the fuel system.
8. Check for leaks.

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 filter (located in fuel tank) Pressure regulator malfunction (located on pump in fuel tank) Fuel pump malfunction (Pump should run for about 2 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 in fuel tank).



IDLE AIR CONTROL (IAC)

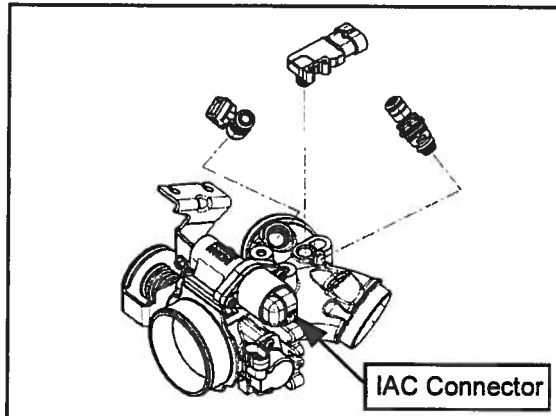
Removal

1. Remove the complete air box assembly including the back plate (see page 5.7).

NOTE: Disconnect the intake air temperature sensor from the back of the air box backing plate before removal.



2. Disconnect the IAC electrical connector from the IAC valve.



3. Remove the two screws securing the IAC valve to the throttle body and remove IAC.

Installation

1. Install idle air control into idle air control housing on throttle body assembly and align mounting holes.
2. Install IAC valve screws and torque to specification.



IAC Valve Screws:
37 in-lbs (4.2 Nm)

3. Connect idle air control electrical connector to idle air control.
4. Inspect throttle body backing plate seal. Replace if damaged.
5. Apply P-80 to throttle body backing plate seal to assist with installation of the airbox back plate.
6. Connect the intake air temperature sensor connector located on the back of the airbox back plate.
7. Position the airbox back plate onto the throttle body and over backing plate seal. Align fastener holes.

CAUTION

DO NOT pinch the intake air temperature sensor wires between the air box backing plate and the mounting boss.

8. Install the air box screws and washers and torque to specification.



Air Box Screws:
25 ft-lbs (33.9 Nm)

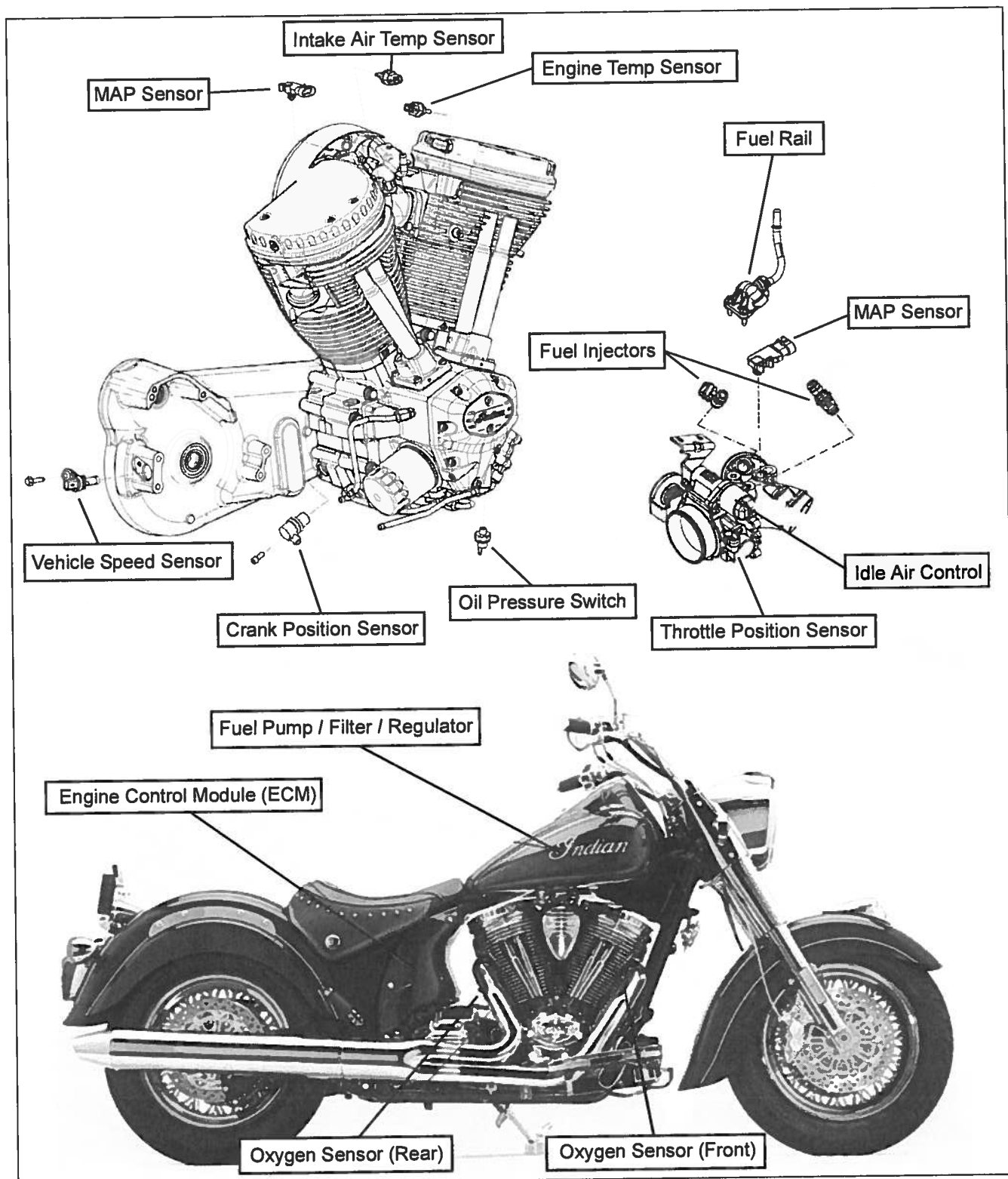
9. Install the air filter, air box cover and decorative plate. (see page 5.7)



FUEL SYSTEM / FUEL INJECTION

EFI SYSTEM COMPONENTS

FUEL INJECTION COMPONENT LOCATIONS



THROTTLE BODY REMOVAL / INSTALLATION

WARNING

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

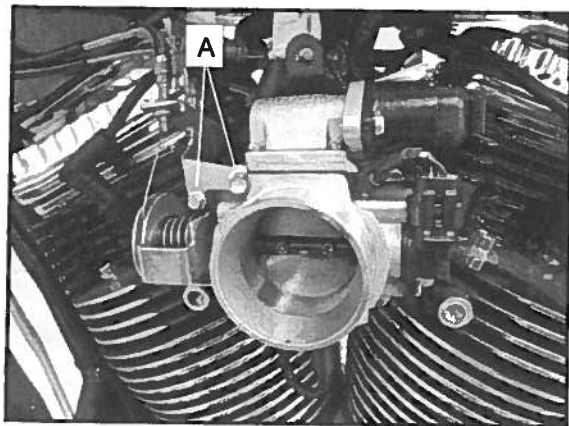
CAUTION

The fuel line should be removed from the fuel tank connector only. DO NOT remove the fuel line from the throttle body. The fuel tank connector has an automatic SHUT OFF valve to prevent fuel from draining from the tank once the line has been removed.

Removal

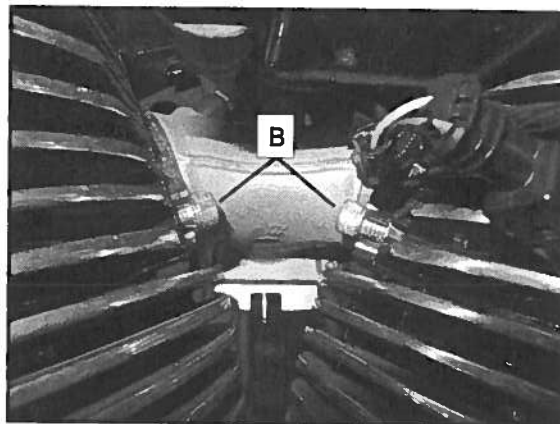
1. Secure the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove air box assembly (see page 5.7).
3. Remove ignition coil cover.
4. Depressurize the fuel system (see page 5.9) and disconnect the fuel line from the bottom of the fuel tank.
5. Remove the two screws (A) securing the throttle cable bracket to the throttle body. Disconnect cables from throttle reel.

NOTE: Observe the orientation of the throttle cable bracket spacer behind the bracket and remove from the throttle body assembly.

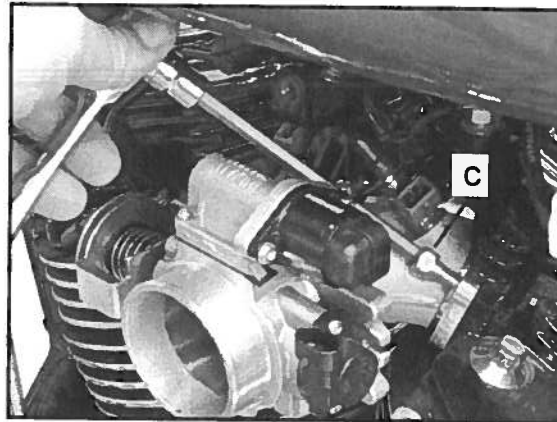


6. Noting the location of each connector, unplug the fuel injectors, MAP Sensor, Throttle Position Sensor and IAC valve from the throttle body.
7. Disconnect the vent line from the bottom of the throttle body and move aside.

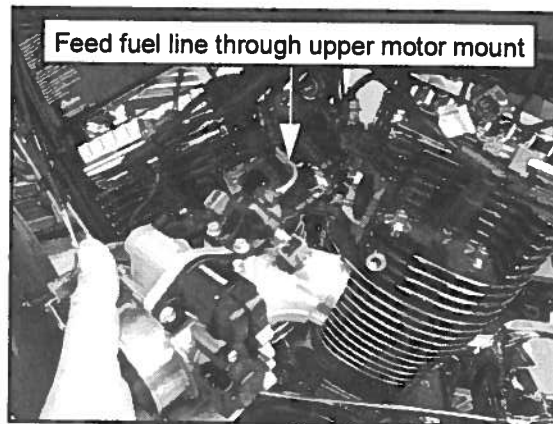
8. Using a suitable 1/4" hex head wrench, loosen (do not remove) the inboard throttle body flange bolts (B).



9. Using a long 1/4" hex head ball socket, remove the outboard throttle body flange bolts (C).



10. Paying attention to the fuel line, carefully withdraw the throttle body assembly from the motorcycle.



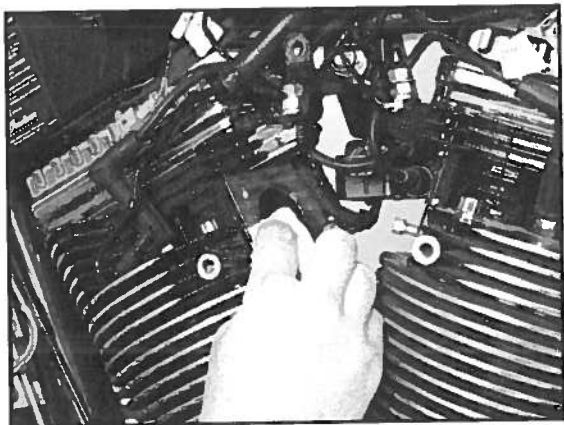
FUEL SYSTEM / FUEL INJECTION

Installation

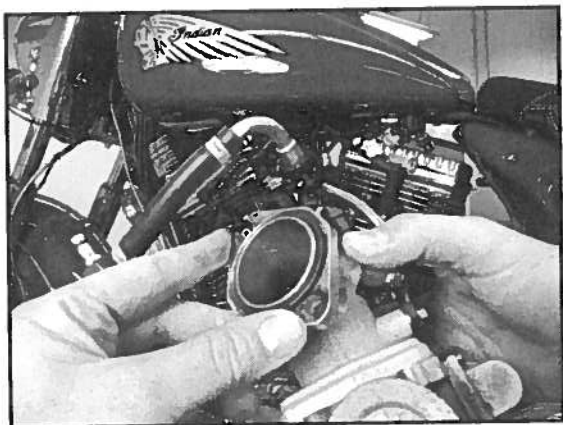
NOTE: Replace throttle body flange seals upon reassembly. Be careful not to damage, tear, or displace seals when fitting the throttle body assembly back into position.

1. Using a soft cloth, wipe any dirt or residue off of throttle body seal mating surfaces.

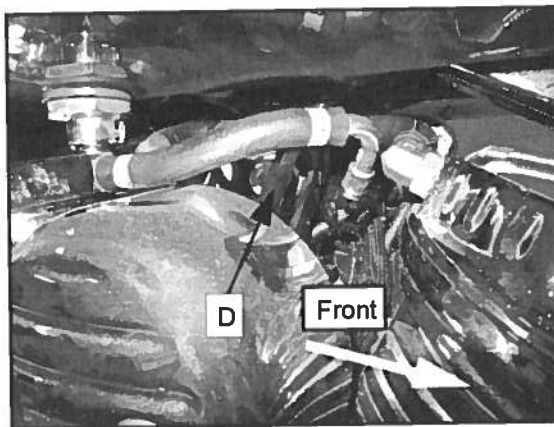
NOTE: A gasket scraper may be used to remove debris.



2. Install throttle body flange and seal assemblies onto intake runners. Make sure each flange and seal is seated against the intake runner shoulder before installation.



3. Carefully feed the fuel line between the cylinders and in front of the ignition coil bracket (D).

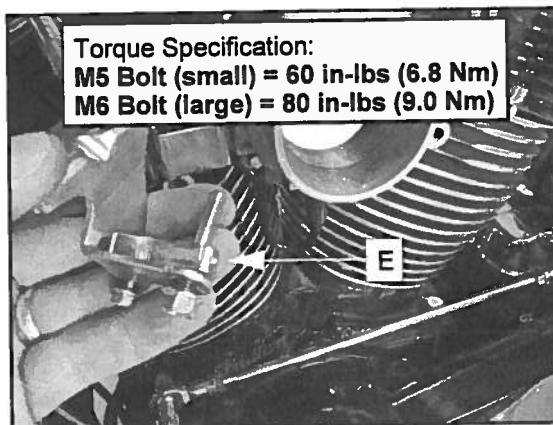


4. With the slotted throttle body flange holes lined up with the inboard bolts, engage the bolts and slide the throttle body into position.
5. Rotate each throttle body flange until the outboard bolt holes are lined up and loosely thread outboard bolts into holes.
6. Using a suitable hex head wrench, alternately torque the throttle body flange bolts to specification.



Throttle Body Flange Bolts:
200 in-lbs (22.6 Nm)

7. Plug in the electrical connectors for the fuel injectors, MAP Sensor, Throttle Position Sensor and IAC valve.
8. Connect the vent line to the fitting on the bottom of the throttle body.
9. Attach throttle cables to throttle reel, position throttle cable bracket spacer (E) against bracket, and torque bracket / spacer assembly to specification.



10. Connect fuel line to fuel tank.
11. Install ignition coil cover.
12. Install air box assembly (see page 5.7).

CAUTION

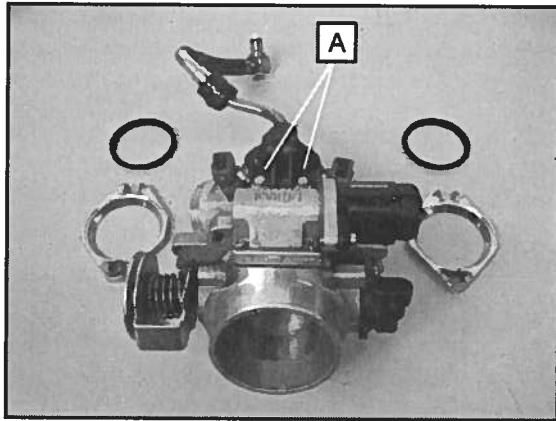
DO NOT pinch the intake air temperature sensor wires between air box and air box mounting boss when tightening air box assembly.

13. Prime the fuel system (see page 5.9) and check for leaks.

FUEL RAIL / FUEL INJECTOR REMOVAL

IMPORTANT: Fuel rail screws are secured using a factory applied patch lock. Upon removal, it is possible that these fasteners will break. Use of a commercially available heat gun may assist with the removal of these screws.

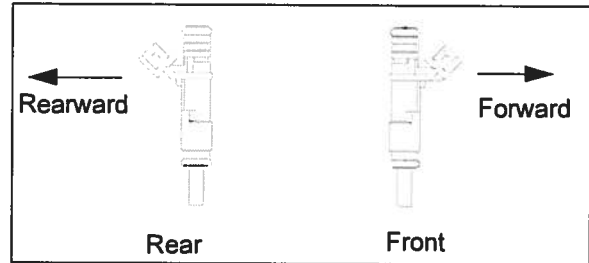
1. Remove throttle body assembly (see page 5.19).
2. Empty all fuel remaining in the throttle body / fuel line assembly into a suitable container.
3. Remove the two screws (A) securing the fuel rail to the throttle body assembly.



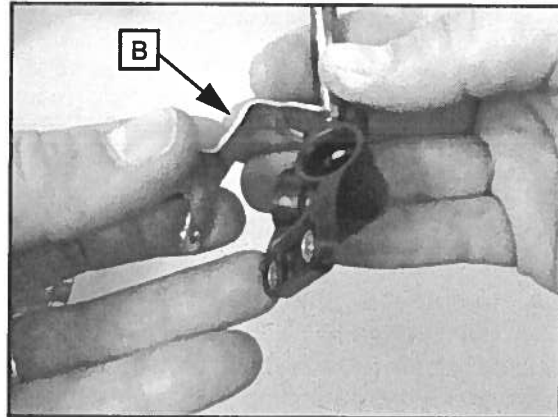
4. Hold the fuel injectors in place and remove fuel rail and fuel line retainer.
5. Cover the ends of injectors and fuel rail with plastic wrap to prevent contamination.
6. Clean the area around injectors with compressed air to prevent foreign material from entering the engine. Pull injectors out of the throttle body, keeping them in order (front and rear) for assembly.

FUEL RAIL / INJECTOR INSTALLATION

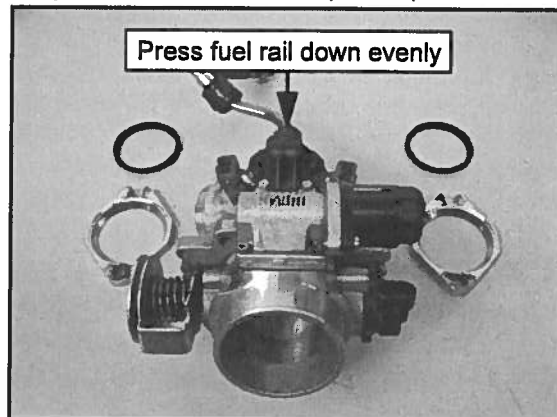
1. Install new O-rings on each injector and lubricate with engine oil.
2. Install injectors into throttle body with rear connector facing straight rearward and front facing straight forward. Press firmly to seat. Remove protective cover.



3. Fit fuel line retainer (B) into fuel rail.



4. Place fuel rail on top of injectors and install. Press rail over each injector evenly until fully seated on throttle body. Install screws and torque to specification.



Fuel Rail Screws:
60 in-lbs (6.8 Nm)

FUEL SYSTEM / FUEL INJECTION

FUEL INJECTION SYSTEM TESTING AND DIAGNOSTICS

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 inside the center fairing. It is programmed to provide the proper fuel and ignition timing based mainly on primary inputs of engine RPM, Intake Air Temperature (IAT) and Manifold Absolute Pressure (MAP) sensor inputs. The ECM evaluates other minor sensory information received from various sensors in the EFI system, and also provides grounds or voltage to other *EFI related* circuits of the electrical and fuel delivery systems.

A Throttle Position Sensor (TPS) is mounted on the throttle body. The TPS is not a primary input for air flow information in the closed loop system. It mainly provides "rate of change" feedback to the ECM (such as rapid acceleration) and also serves as a plausibility check for the MAP sensor. The MAP 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 55 PSI (5.79 Bar). The fuel pump cycles "ON" for 2-3 seconds when the ignition key and Engine Stop switch are 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 the 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).

Although MAP and engine RPM are the most influential inputs for selecting a fuel 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 locations of sensors and other EFI system related components is shown on page 5.18.

IDLE AIR CONTROL (IAC) - OVERVIEW OF OPERATION

The Idle Air Control system consists of the Engine Control Module (ECM), IAC valve, and related wiring.

The IAC valve is mounted directly to the throttle body. Its main function is to stabilize the engine's base idle speed by varying the amount of air allowed to the engine when the throttle plate is closed.

The ECM continuously monitors engine RPM, and changes the position of IAC air valves (via step motors) to maintain idle speed.

Filtered air from the air box enters the throttle body and bypasses the butterfly valve through an integrated port controlled by the IAC valve.

IAC CYCLING - Whenever the IAC wire harness is disconnected, or after ECM re-programming (re-flash) cycle the key switch on and off so the IAC valve can "learn" its position. Wait 5 seconds after turning the key ON. The system requires no scheduled maintenance. NEVER attempt to "adjust" idle speed with the idle stop screw located on the throttle body. This screw is factory pre-set. Any tampering will require throttle body replacement.

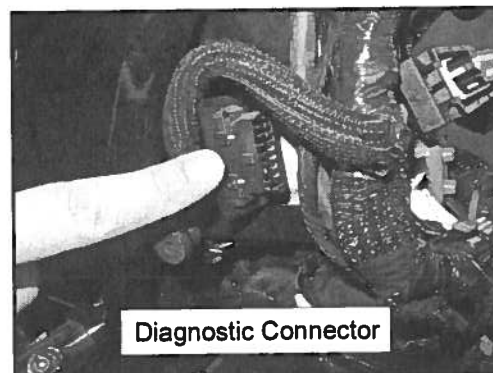
SELF-DIAGNOSTIC FEATURE

The ECM used on the Indian motorcycle stores trouble codes in memory. Trouble codes are stored by the ECM when a sensor reading is outside of the normal or "plausible" range. These codes are listed and described on page 5.25.

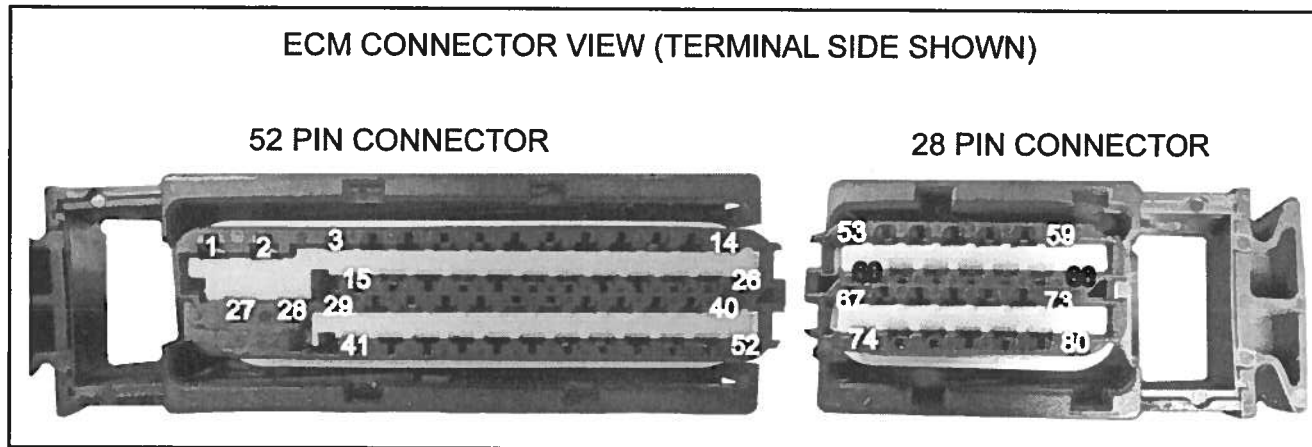
Diagnostic codes can be displayed on the speedometer or retrieved directly from the ECM using the Indian diagnostic tool. Diagnostic codes can be cleared directly from the speedometer or by using the Indian diagnostic tool.

DATA LINK CONNECTOR (DLC)

The Indian diagnostic tool Data Link Connector (DLC) is located behind the right hand side cover.



ECM CONNECTOR MAP



Wire Color Codes - BL = Blue; GY - Gray; PK = Pink; BK = Black; WH = White; RD = Red; YE = Yellow;
GR = Green; OG = Orange; BR = Brown; PL = Purple

ECM CONNECTOR MAP

(System related wire color & pin number shown. Refer to wiring diagram for complete connector diagram)

PIN	COLOR	FUNCTION	PIN	COLOR	FUNCTION	PIN	COLOR	FUNCTION
1	BK	O2 Snr Heat Cont. (GND)	28	BK	ECM Ground (GND)	55	GY	Input - Intake Air Temp.
2	BK	O2 Snr Heat Cont. (GND)	29	RD	ECM Power (+)	56		<i>not used</i>
3	BK	ECM Ground (GND)	30		<i>not used</i>	57	BL	Output - IAC Motor
4		<i>not used</i>	31	GY/WH	Output - Starter Status	58		<i>not used</i>
5		<i>not used</i>	32		<i>not used</i>	59	PK	Output - Ign. Coil, Front
6	GN	Data - CAN 2.0B Neg.	33		<i>not used</i>	60	RD/GY	5V Supply - TPS
7	YE	Data - CAN 2.0B Pos.	34	GY	Input - Clutch Switch	61	BK	Ground (-) - Sensor 1
8		<i>not used</i>	35	GY	Input - Neutral Switch	62	GY/PK	Input - Cyl. Head Temp.
9	BL	Input - Front O2 - Ref.	36		<i>not used</i>	63	BK	Shield - Cnk. Position Snr.
10		<i>not used</i>	37		<i>not used</i>	64	BR	Output - IAC Motor
11		<i>not used</i>	38		<i>not used</i>	65	PL	Output - IAC Motor
12	WH/GY	Input - Rear O2 - Signal	39		<i>not used</i>	66	RD	Output - Ign. Coil, Rear
13		<i>not used</i>	40		<i>not used</i>	67	RD	Crank Position Snr (+)
14		<i>not used</i>	41		<i>not used</i>	68	RD/GY	5V Supply - MAP
15	PK/BK	Output - ENG RUN (GND)	42		<i>not used</i>	69		<i>not used</i>
16	GY/WH	Output - Vehicle Speed	43		<i>not used</i>	70		<i>not used</i>
17		<i>not used</i>	44		<i>not used</i>	71	PK	Output - Fuel Inj., Front
18	GY	Shield - CAN 2.0B	45		<i>not used</i>	72		<i>not used</i>
19		<i>not used</i>	46		<i>not used</i>	73		<i>not used</i>
20	WH	Input - Front O2 - Signal	47	RD	Input - Ignition Switch	74		<i>not used</i>
21		<i>not used</i>	48		<i>not used</i>	75	GY	Input - MAP
22		<i>not used</i>	49		<i>not used</i>	76	GY	Input - Throttle Pos. Snr.
23		<i>not used</i>	50	GY	Input - Vehicle Spd Snr.	77		<i>not used</i>
24	BL/GR	Input - Rear O2 - Ref.	51	GY	Input - ENG RUN (GND)	78	RD	Output - Fuel Inj., Rear
25	GY	Data - K Line	52		<i>not used</i>			
26	GY/WH	Output - MIL	53	BK	Crank Position Snr (-)			
27	BK	ECM Ground (GND)	54	BK	Sensor Ground (-)			



FUEL SYSTEM / FUEL INJECTION

VIEWING AND CLEARING TROUBLE CODES

Diagnostic Trouble Codes (DTC's) are logged in the ECM memory when a sensor or other supported system fault occurs. DTC's can be viewed either at the speedometer head or by using the Indian diagnostic tool. To view the codes, do the following:

Speedometer Display

1. Turn the motorcycle ignition switch to the ON position.
2. Switch the engine Run/Stop switch to the RUN position.
3. Push the MODE button, located on left hand switch cube, to change speedometer display modes.

The speedometer can display:

- Odometer
 - Trip 1
 - Trip 2
 - Engine Hours
 - RPM
 - Battery Voltage
 - Clock
4. Toggle through the display options until the RPM mode is displayed.
 5. Hold the MODE button for 10 seconds.
 6. The speedometer screen will display "DTCS" for a 3-5 second period.
 7. If there are no codes present, the screen will display "NONE".
 8. If there is a code or codes present, a four digit code will be displayed.

Indian Diagnostic Tool

1. Remove the right hand side cover to access the diagnostic connector.
2. Connect the Indian diagnostic tool to the motorcycle and a laptop equipped with the latest Indian Motorcycle diagnostic software version.
3. To establish communication with the ECM, you must click on "Strip Chart" or "Gauges".
4. Turn the motorcycle ignition switch to the ON position.
5. Click on the "Connect" icon.

6. You will see the "connected Hz" at the bottom right of the screen.

7. DTC's can now be viewed.

Clearing Trouble Codes - Speedometer

1. Access DTC's using the speedometer MODE button.
2. Pushing the MODE button, scroll through codes until the word END appears in the speedometer display.
3. Simultaneously hold the front brake lever and press the MODE button twice while the screen displays the word END.
4. The screen will display CLEAR after code has been cleared.

FUEL INJECTION DIAGNOSTICS & ECM DATA INTERPRETATION - IMPORTANT INFORMATION

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 using the Indian diagnostic tool on the "Strip Chart or Gauges" screen. Since the sensor reading may either be actual feedback from the sensor OR a default value set by the EM in the event of a fault in the sensor or wiring, it is important to verify the condition of the sensor.

Using the speedometer or the Indian diagnostic tool, access the ECM 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 for ENG light circuits.

If multiple codes are set, refer to the wiring diagram and focus your efforts on wiring and connections common to each of the sensors. Multiple sensor failure is extremely unlikely.

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 in between the two such as jumper harnesses or the Engine-to-Chassis harness 14 pin connector where applicable.



TROUBLE CODES

P-CODE NUMBER	DESCRIPTION
P0105	Manifold Pressure (MAP sensor) circuit (resistance not in range).
P0110	Intake Air Temperature sensor circuit (resistance not in range).
P0115	Engine Temperature (front cylinder) circuit (resistance not in range).
P0120	Throttle position sensor circuit "A".
P0130	Front O2 sensor circuit (resistance for sensor not in range).
P0135	Front O2 sensor heater circuit (resistance not in range).
P0150	Rear O2 sensor circuit (resistance not in range).
P0155	Rear O2 sensor heater circuit (resistance not in range).
P0201	Injector 1 circuit open, cylinder #1.
P0202	Injector 2 circuit open, cylinder #2.
P0335	Crankshaft Position sensor circuit.
P0351	Front Ignition Coil circuit (ECM to Coil).
P0352	Rear Ignition Coil circuit (ECM to Coil).
P0500	Vehicle Speed Sensor
P0505	Idle Air Control (IAC) system fault.
P0560	Battery voltage out of range.
P0601	Internal Engine Control Module (ECM) memory <i>checksum</i> error.
P0604	Internal Control Module Random Access Memory (RAM) error.
P0605	Internal Control Module Read Only Memory (ROM) error.
P0606	ECM / PCM Processor error



FUEL SYSTEM / FUEL INJECTION

ECM HARNESS CONNECTOR TEST PRECAUTIONS

NOTICE: 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 the 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.
- DO NOT attempt to use a standard meter probe or other devices to probe the sockets in the ECM connector. Doing so could expand the terminal socket or damage the connector case, create a problem where none existed before, and complicate the diagnostic process
- Sensor tests 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 connector, but may include other connections (Engine-to-Chassis harness etc.). Be sure to check all easily accessed connectors and wiring first, to reduce diagnostic time.



FUEL SYSTEM / FUEL INJECTION

TROUBLESHOOTING

FUEL SYSTEM TROUBLESHOOTING

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 BCM 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 MAP 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 or fuel rail obstructed or leaking Air Filter Wrong Fuel / Old Fuel Crank Position Sensor	Inspect IAC system Inspect throttle body Inspect fuel pressure Replace Replace Inspect / Replace Inspect / Replace
Poor Running in Higher RPM Range	Air intake restriction 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 Inspect oil level and condition Refer to ignition section. Charge or replace Unplug connections - inspect Inspect cylinder head & valves



FUEL SYSTEM / FUEL INJECTION

FUEL SYSTEM TROUBLESHOOTING (cont.)

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
	Excessive rich or lean fuel/air mixture	MAP 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 chapter 7	
Backfiring	Low Battery Voltage Ignition Problem	Battery, spark plug fouled, poor wire connection for ignition or fuel injection, loose pin in multi-pin connector for ECM or wiring harness	Refer to battery section Replace plugs / diagnose Inspect wiring connections Disconnect and check pin connections
	Air leaks	Inlet and Exhaust	Seal intake or exhaust leaks
	Restricted air intake or throttle body	Intake tract / Throttle body	Clean air inlet tract and throttle body



FUEL SYSTEM / FUEL INJECTION

FUEL SYSTEM TROUBLESHOOTING (cont.)

PROBLEM	POSSIBLE CAUSE	AFFECTED PART(s)	REPAIR RECOMMENDED
Poor Running in upper rpm ranges	Control Circuit/Sensors not functioning correctly	Engine speed sensor	Test / Replace
		TPS	Test / Replace
		Air temperature sensor	Test / Replace
		Manifold Absolute Pressure sensor	Test / Replace
		Intermittent wiring / connector problem ECM	Repair/Replace
			Test / Replace
	Fuel delivery incorrect	Plugged or kinked fuel and/or vent hoses	Repair/Replace
		Fuel pump	Test / Replace
		Fuel regulator	Test Pressure / Replace
		Fuel filter	Test / Replace
		Battery/Charging System	Charge/Replace
		Fuel Injector plugged	Clean/Replace
		Contaminated fuel (water, additives, etc.)	Clean/Replace
		Inadequate octane	Use correct fuel
		Defective throttle valve	Replace throttle body
		Low battery voltage	Charging system
	Air intake restriction	Dirty Air Cleaner	Clean
		Intake restriction	Repair
	Air Leak	Throttle body flange seals	Repair/Replace
		Intake manifold	Repair/Replace
		Throttle body	Repair/Replace
Engine lacks power	Engine component problems	See chapter 7, 8	
	Ignition problems	See chapter 17	
	Overfilled with oil	See chapter 2	
	Improper fuel delivery	Plugged fuel injector	Replace
		TPS	Inspect / Replace
		Dirty air cleaner	Replace
		Vacuum leaks	Repair / Replace
		Fuel pump	Test / Replace
		Fuel pressure regulator	Test / Replace
		Air temperature sensor	Test / Replace
		Engine speed sensor	Test / Replace
		MAP sensor	Test / Replace
		Plugged vent hose	Charge Battery / Replace
		Low battery voltage ECM	Test batt./Charging system
			Test / Replace



FUEL SYSTEM / FUEL INJECTION

FUEL SYSTEM TROUBLESHOOTING (cont.)

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	Heat sinks full of debris Engine Oil Brake system Drive Belt Ignition Coils Faulty coolant Temperature sensor Faulty engine Speed sensor Faulty ECM Heat range incorrect Charging System Faulty Battery Faulty Wiring	Refer to chapter 4 Refer to chapter 4 Refer to chapter 3 Refer to chapter 15 Refer to chapter 3 Refer to chapter 17 Replace Replace Replace Replace Refer to charging section Replace Repair
	Lean Air/Fuel mixture	Fuel pressure regulator vacuum hose kinked or plugged Air leak Fuel injector plugged Coolant temperature sensor Vent hose plugged/ kinked Air leak at throttle body Fuel pump leaking internally	Repair/Replace Repair Clean/Replace Replace Repair Repair



CHAPTER 6

ENGINE REMOVAL & INSTALLATION

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GENERAL	6.2
SPECIAL TOOLS	6.2
ENGINE MOUNTING - TORQUE	6.2
ENGINE REMOVAL	6.3
PRECAUTIONS	6.3
REMOVAL PROCEDURE	6.3
INJECTOR REMOVAL	6.3
ENGINE INSTALLATION	6.4
PREPARATION FOR INSTALLATION	6.4
INSTALLATION PROCEDURE	6.4
POWERTRAIN ALIGNMENT	6.5
ALIGNMENT PROCEDURE	6.5



ENGINE REMOVAL & INSTALLATION

OVERVIEW - ENGINE REMOVAL

GENERAL

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.

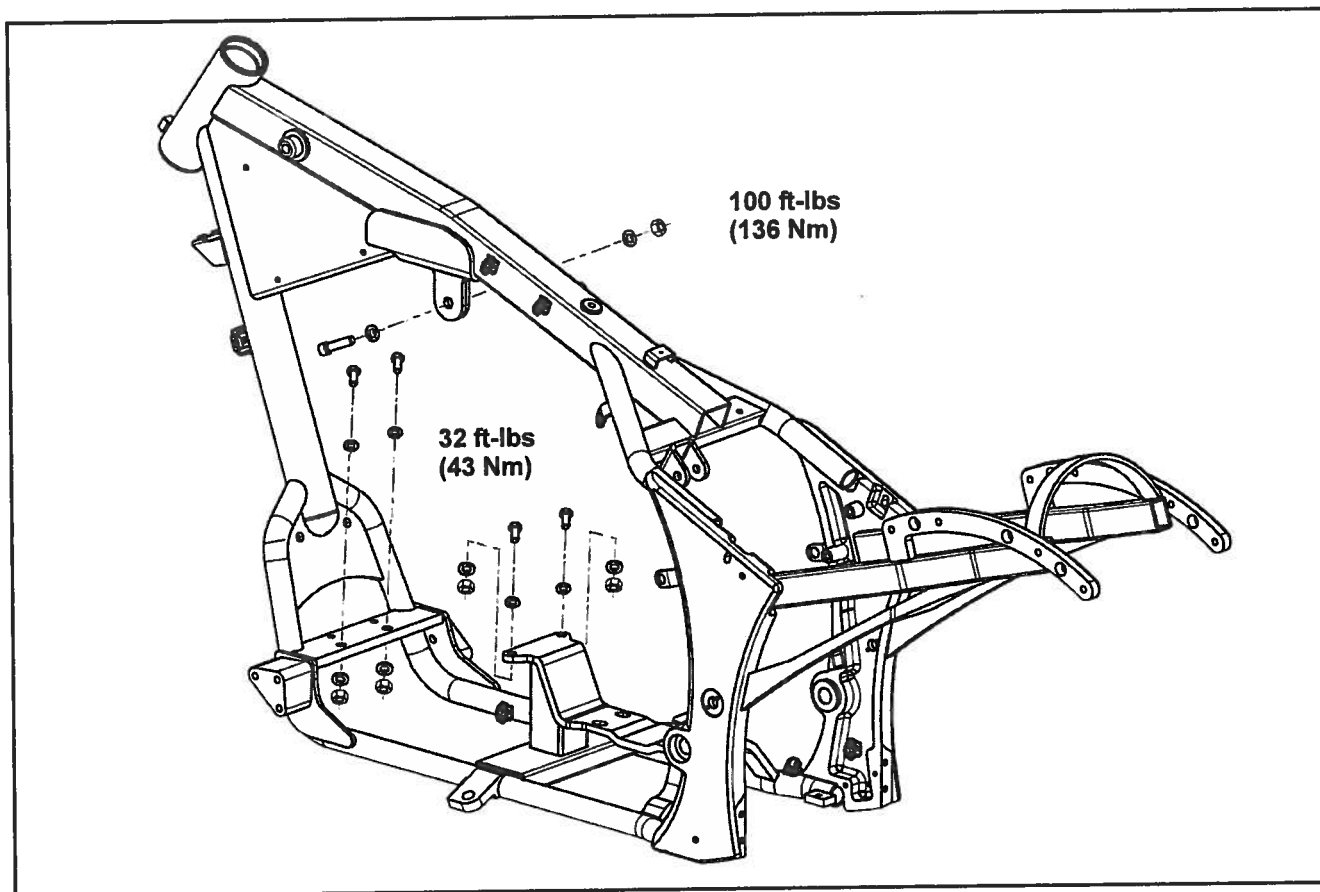
Once engine is removed from frame, an engine stand is recommended for engine disassembly and assembly.

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

SPECIAL TOOLS

- 1.) Motorcycle table lift with wheel vise (commercially available)
- 2.) Engine stand (commercially available)

ENGINE MOUNTING - TORQUE



ENGINE REMOVAL

PRECAUTIONS

- Clean engine thoroughly before removal. Cover openings during and after engine removal.
- Note routing of wires, cables and hoses.
- Protect frame down tubes and other areas from damage during engine removal with tape or protective wrap.

REMOVAL PROCEDURE



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.

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

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

1. Remove Seat, floorboards and exhaust system. See chapter three.
2. Disconnect battery.
3. Remove dash. See chapter three.
4. Remove fuel tank. See chapter five.
5. Disconnect oil lines from oil tank and oil pressure sensor connector.
6. Remove two airbox cover fasteners, airbox cover and decorative insert.
7. Remove air filter. If necessary, clean air filter in accordance with K&N® air filter cleaning instructions.
8. Remove the three fasteners retaining air box back plate to the engine. Remove the back plate from the throttle body enough so that it is possible to unplug the intake air temperature sensor from the back of the air box back plate.
9. Remove spark plug caps from spark plugs.

10. Remove coil cover by loosening the two fasteners and disconnect ignition coil electrical connector.
11. Remove the fastener retaining the coil and carefully guide front and rear spark plug wires out as the coil is removed.
12. Disconnect the MAP sensor connector, idle air control connector, throttle potentiometer connector and front/rear fuel injector connectors from the throttle body.
13. Remove jam nuts securing ground terminals to the front and rear cylinder head studs. Secure connectors/harness back and out of the way.
14. Loosen the jam nuts of both the push and pull throttle cables at the throttle body bracket. Remove both throttle cables from the bracket and cable ends from throttle body cam.
15. Loosen the two lower inboard fasteners from each respective throttle body flange. Remove the two upper outboard fasteners from each respective throttle body flange and slide throttle body out. Replace intake seals at service.
16. Remove fastener retaining upper engine mount bracket to frame.
17. Remove nuts retaining upper engine mount to front and rear cylinder heads and remove upper engine mount.
18. Remove primary cover, primary drive and inner primary. See Chapter nine.
19. Remove crank position sensor.
20. Disconnect the stator connector and ensure it has freedom of movement, as it will be removed with the engine.
21. Remove two front and two rear engine mounting bolts.
22. Carefully tilt the top of the engine outward while lifting the engine up and out of the right side of the frame. Additional assistance is recommended during this procedure.

IMPORTANT: With engine removed, note location of shims, if present.

INJECTOR REMOVAL

IMPORTANT: Debris could have collected in and around injector cavities. If injector removal is required, clean cavity and surrounding area with compressed air before removing injectors. If removed, injectors must be indexed properly to the fuel rail (aligned) to ensure proper spray pattern. See chapter five.



ENGINE REMOVAL & INSTALLATION

ENGINE INSTALLATION

PREPARATION FOR INSTALLATION

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

Refer to beginning of 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.

INSTALLATION PROCEDURE

1. Working from the right side of the motorcycle, carefully angle the lower end of the engine onto the engine mounts of the frame while tilting the top of the engine in. Additional assistance is recommended during this procedure.
2. Align engine in frame and install the two front and two rear engine bolts with flat washers. Install the four washers and flange nuts to the engine bolts and hand tighten.
3. Connect and secure stator wiring.
4. Align powertrain. See *Powertrain Alignment* in chapter six.

IMPORTANT: Failure to properly align powertrain could result in excessive vibration. Proper powertrain alignment is critical.

5. Install new intake seals onto each intake flange of throttle body. Intake seals are directional. Apply P-80® temporary lubricant to ease installation of seals.
6. Carefully engage throttle body intake flanges and loosely install lower inboard fasteners. Install upper outboard fasteners and torque to specification. Torque lower inboard fasteners to specification.
7. Install ground terminals to the front and rear cylinder head studs. Install jam nuts, orient terminals and torque to specification.



Throttle Body Intake Flange Fastener:
200 in-lbs (23 Nm)
Cylinder Head Stud Jam Nut:
105 in-lbs (12 Nm)

8. Connect the MAP sensor connector, idle air control connector, throttle potentiometer connector and front/rear fuel injector connectors from the throttle body.

NOTE: Front and rear fuel injector connectors are labeled and must be connected to the correct injector.

9. Install throttle cable tips into slots on the throttle body cam. The pull cable is routed to the outside and the push cable is routed to the inside. Position the upper jam nuts fully back to end of threaded portion of cable housing and position each throttle cable housing down through the appropriate hole in the cable mounting bracket on the throttle body. Set both cable upper jam nuts to have approximately 1/4" of exposed thread above the jam nut. Set each lower jam nut upward against cable bracket and torque to specification.
10. Set pull cable adjuster at hand control to achieve approximately 1/8" of free play from fully closed position, and torque jam nut to specification. Set and lock throttle cable hex bar adjuster to specification. Turn handlebars to full lock on each side and check for proper throttle cable operation at each position. Ensure cables are secured to LH side of steering head with tie wrap.



Throttle Cable Jam Nut at Throttle Body:
50 in-lbs (6 Nm)
Throttle Cable Jam Nut at Handlebar:
85 in-lbs (10 Nm)
Throttle Cable Hex Bar Adjuster:
50 in-lbs (6 Nm)



11. Route spark plug wires to respective spark plugs and install ignition coil. Torque the ignition coil retaining fastener to specification.

NOTE: Lower spark plug wire routes to rear cylinder spark plug. Upper wire routes to front spark plug.

12. Install ignition coil cover and torque two fasteners to specification.



Ignition Coil Fastener: **105 in-lbs (12 Nm)**
Ignition Coil Cover Fastener: **105 in-lbs (12 Nm)**

13. Inspect air box intake seal and replace if damaged. Apply P-80® temporary lubricant to air box intake seal, connect intake air temperature sensor, and carefully install air box. Ensure intake air temperature sensor wiring is not pinched and torque the three fasteners to specification.
14. Verify that the air box cover seal is flat in the groove around the outer edge of air box backing plate.
15. Position Air Filter onto the air box back plate.
16. Position the decorative insert onto air box cover. Apply Loctite 242® to air box cover fasteners. Align the mounting holes and insert the two fasteners with flat rubber washers through the insert and cover. Install assembly onto air box back plate and torque each air box cover fastener to specification.

CAUTION

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



Intake Air Temperature Sensor: **10 ft-lbs (14 Nm)**
Air Box Retaining Fasteners: **25 ft-lbs (34 Nm)**
Air Box Cover Fasteners: **10 ft-lbs (14 Nm)**

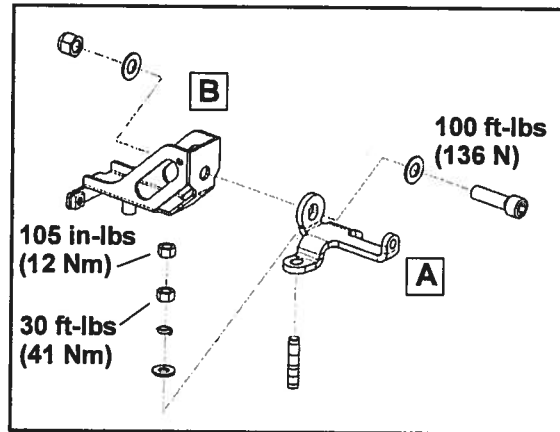
17. Connect oil lines to oil tank and oil pressure sensor.
18. Install exhaust system, floorboard assemblies and dash. See chapter three.
19. Install fuel tank. See chapter five.
20. Connect battery and install seat. See chapter three.

POWERTRAIN ALIGNMENT

ALIGNMENT PROCEDURE

IMPORTANT: Failure to properly align powertrain could result in excessive vibration. Proper powertrain alignment is critical.

1. Install upper engine mount (A) over studs on front and rear cylinder heads. Position the coil bracket (B) to right side of frame mounting tab and insert bolt and flat washer from left side of the frame through the upper engine mount, frame tab, and coil bracket. Install the second flat washer and thread nylock nut onto bolt. Do not torque at this time.
2. Install one flat washer, lock washer, and flange nut to each upper engine mount stud. Do not torque at this time.



3. Install inner primary. See chapter 9.
4. Pull engine, primary, and transmission assembly as far to the right and rearward in the frame as possible.
5. Torque two rear engine mounting bolts to specification.
6. Using a feeler gage, check clearance between the front engine mounts and frame. Tolerance should be lower than .010". If greater, mount must be shimmed according to shim table below.
7. Torque two front engine mounting bolts to specification.
8. Check clearance of the four left transmission mounts. Tolerance should be lower than .010". If greater, mount must be shimmed according to shim table below. Torque four left transmission mounting nuts in a cross pattern to specification.



ENGINE REMOVAL & INSTALLATION

9. Check clearance of the fifth, right side transmission mount. Shim according to shim table below, targeting an over-shim of .010" to compensate for compression during torquing. Torque fifth transmission mounting nut to specification.

NOTE: This is an extremely critical clearance. Not properly setting clearance may cause excessive vibration.

NOTE: Maximum three shims allowed per mount.



Shim Thickness	Shim Part Number
0.010	70400038
0.015	70487001
0.020	70400039
0.030	70487002
0.040	70487008

Target Over Shim = 0.005 - 0.015in (.010 typical)				
Measured Clearance	Shim A	Shim B	Shim C	Resulting Over Shim
0.020	0.030	0.000	0.000	0.010
0.021	0.030	0.000	0.000	0.008
0.022	0.030	0.000	0.000	0.006
0.023	0.030	0.000	0.000	0.004
0.024	0.030	0.000	0.000	0.002
0.025	0.030	0.000	0.000	0.000
0.026	0.020	0.015	0.000	0.008
0.027	0.020	0.015	0.000	0.006
0.028	0.020	0.015	0.000	0.004
0.029	0.020	0.015	0.000	0.002
0.030	0.030	0.015	0.000	0.000
0.031	0.040	0.000	0.000	0.008
0.032	0.040	0.000	0.000	0.006
0.033	0.040	0.000	0.000	0.004
0.034	0.040	0.000	0.000	0.002
0.035	0.040	0.000	0.000	0.000
0.036	0.030	0.015	0.000	0.008
0.037	0.030	0.015	0.000	0.006
0.038	0.030	0.015	0.000	0.004
0.039	0.030	0.015	0.000	0.002
0.040	0.030	0.015	0.000	0.000
0.041	0.040	0.010	0.000	0.008
0.042	0.040	0.010	0.000	0.006
0.043	0.040	0.010	0.000	0.004
0.044	0.040	0.010	0.000	0.002
0.045	0.040	0.010	0.000	0.000
0.046	0.040	0.015	0.000	0.008
0.047	0.030	0.015	0.000	0.006
0.048	0.040	0.015	0.000	0.004
0.049	0.040	0.015	0.000	0.002
0.050	0.040	0.015	0.000	0.000
0.051	0.040	0.020	0.000	0.008
0.052	0.040	0.020	0.000	0.006
0.053	0.040	0.020	0.000	0.004
0.054	0.040	0.020	0.000	0.002
0.055	0.040	0.020	0.000	0.000
0.056	0.040	0.020	0.015	0.008
0.057	0.040	0.020	0.015	0.006
0.058	0.040	0.020	0.015	0.004
0.059	0.040	0.020	0.015	0.002
0.060	0.040	0.015	0.010	0.000
0.061	0.040	0.030	0.000	0.008
0.062	0.040	0.030	0.000	0.006
0.063	0.040	0.030	0.000	0.004
0.064	0.040	0.030	0.000	0.002
0.065	0.040	0.030	0.000	0.000
0.066	0.040	0.020	0.015	0.008
0.067	0.040	0.020	0.015	0.006
0.068	0.040	0.020	0.015	0.004
0.069	0.040	0.020	0.015	0.002
0.070	0.040	0.020	0.015	0.000
0.071	0.030	0.040	0.000	0.008
0.072	0.030	0.040	0.000	0.006
0.073	0.030	0.040	0.000	0.004
0.074	0.030	0.040	0.000	0.002
0.075	0.030	0.040	0.000	0.000

10. Ensure coil mount bracket is properly aligned and torque the upper engine mount to specification.
11. Torque upper engine mount nuts at front and rear cylinder head studs to specification.



Lower Engine Mount Bolts: 32 ft-lbs (43 Nm)
 Transmission Mount Bolts: 35 ft-lbs (47 Nm)
 Upper Engine Mount Bolt: 100 ft-lbs (136 Nm)
 Engine Mount to Cylinder Studs: 30 ft-lbs (41 Nm)



CHAPTER 7

CYLINDER HEAD & VALVE TRAIN

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CYLINDER HEAD & VALVE TRAIN

GENERAL INFORMATION

IMPORTANT NOTES

- This section covers service of the rocker box, cylinder head and cam box. Servicing of these components requires engine removal.
- Refer to Chapter 6 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 Synthetic 20W/50 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.
- The intake and exhaust valves cannot be re-faced.
- Cleanliness of parts is critical to engine life and accurate parts inspection. Use cleaning solvent to clean all disassembled parts. Dry parts with compressed air and lubricate before engine inspection and engine assembly.

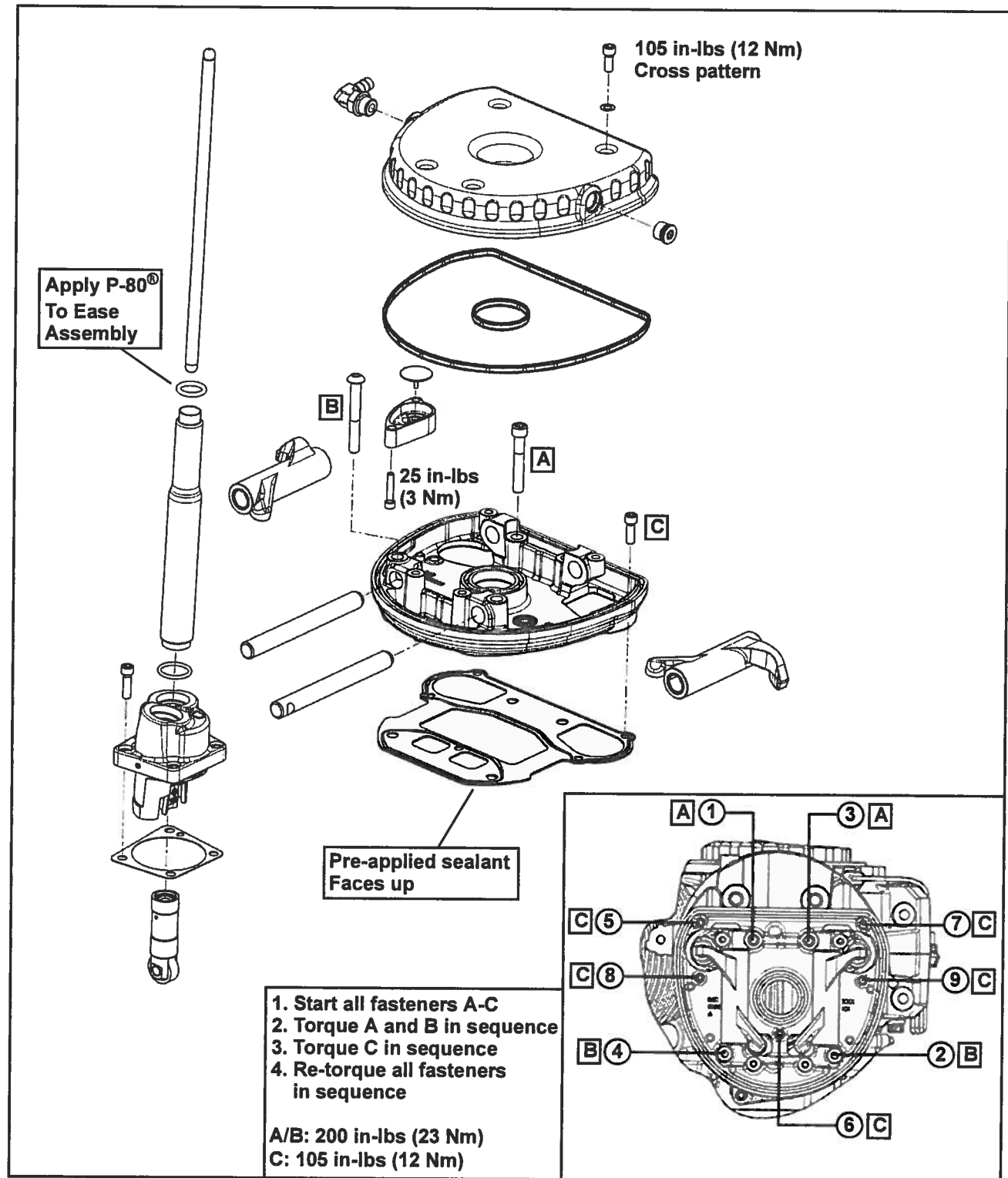
SPECIAL TOOLS

- Valve Spring Compressor - commercially available
- Pinion Gear Nut Service Tool - commercially available
- Pinion Gear Service Tool - commercially available
- Lifter Block Alignment Screws - commercially available



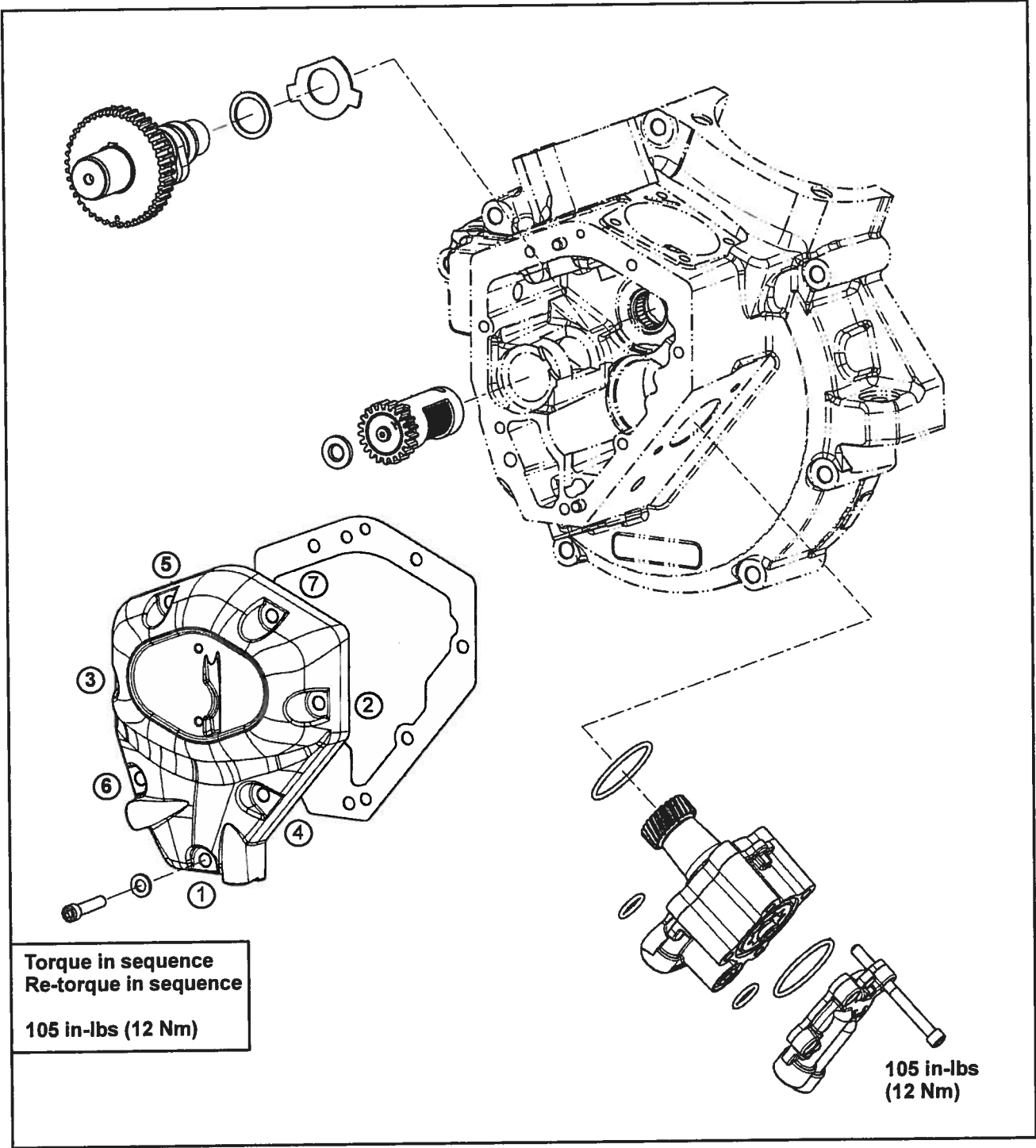
TORQUE VALUES AND ASSEMBLY VIEWS

ROCKER BOX / ROCKER BOX COVER



CYLINDER HEAD & VALVE TRAIN

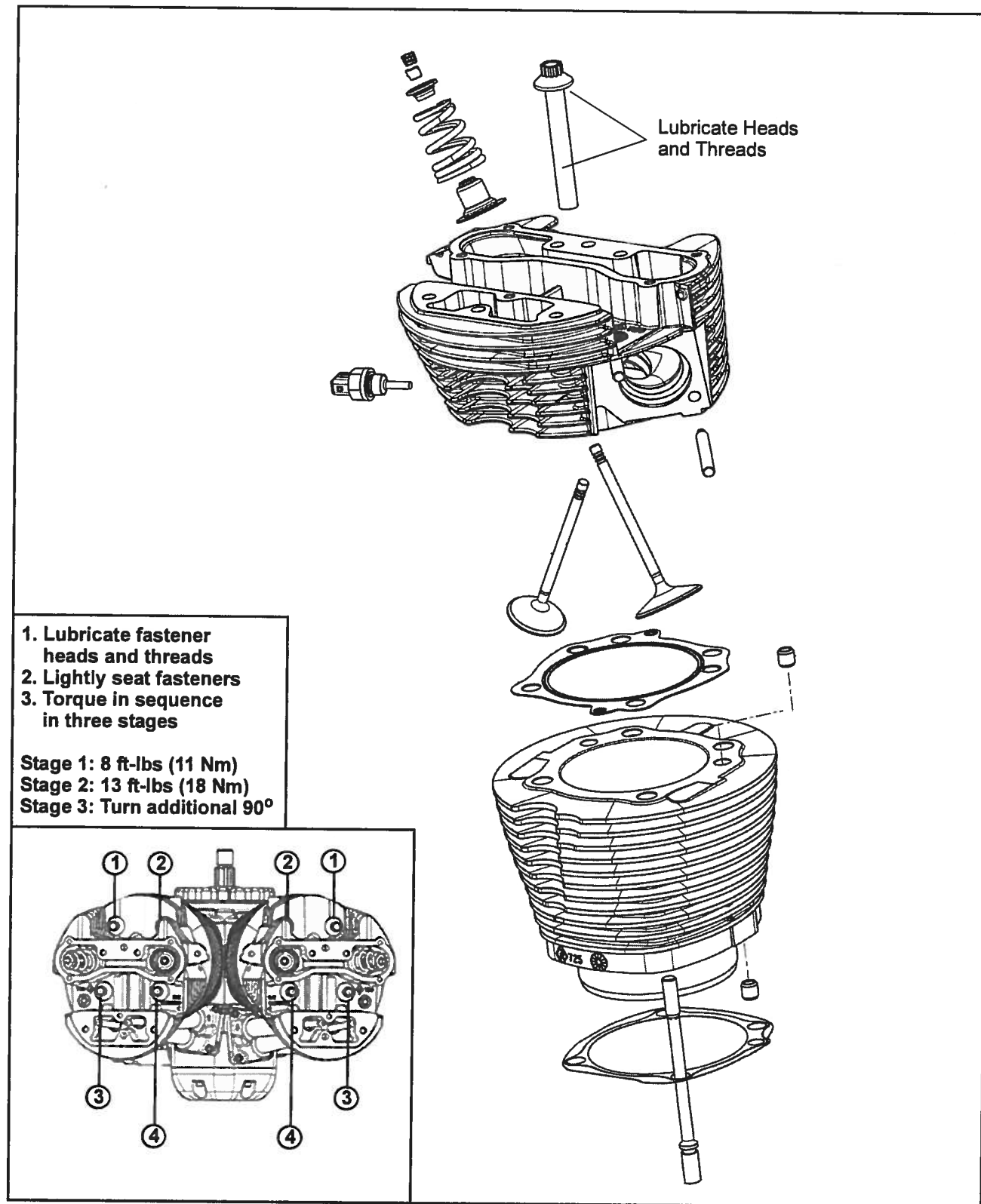
CAM BOX



CYLINDER HEAD & VALVE TRAIN

CYLINDER HEAD / VALVES

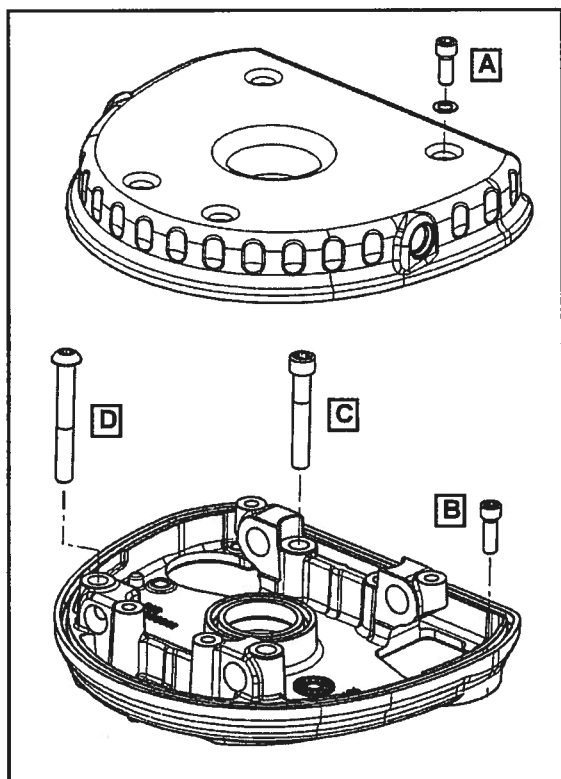
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CYLINDER HEAD & VALVE TRAIN

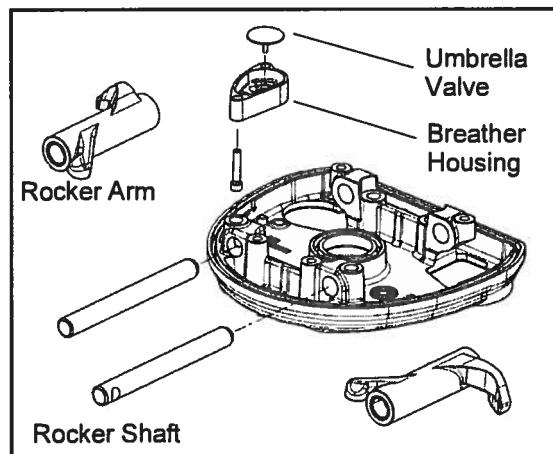
CYLINDER HEAD SERVICE

ROCKER BOX REMOVAL



1. Remove the four fasteners (A) retaining the front rocker box cover and remove cover.
2. Remove five fasteners (B) from front rocker box.
3. Evenly loosen the two fasteners (C) and the two fasteners (D) in order to gradually relieve lifter/pushrod pressure and remove rocker box.
4. Remove rocker box gasket and ensure the gasket surface is free of any residual gasket/sealing material.
5. Repeat process for rear rocker box.

ROCKER BOX DISASSEMBLY / INSPECTION



1. Remove breather housing from front rocker box cover.
2. Inspect umbrella valve for damage, replace as necessary.
3. Install breather housing onto front rocker box cover and torque two fasteners to specification.



Breather Housing Fasteners:
25 in-lbs (3 Nm)

4. Slide two rocker shafts out of rocker box and remove intake and exhaust rocker arms.
5. Inspect rocker shafts, rocker arm bushings and rocker arms for abnormal wear or damage. Replace as necessary.
6. Repeat process for rear rocker box.

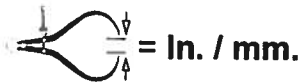


CYLINDER HEAD & VALVE TRAIN

ROCKER BOX ASSEMBLY / INSTALLATION

1. Apply Moly assembly paste to ends of rocker arms, rocker arm shafts, and rocker arm bores. Assemble rocker arms into rocker boxes with rocker arm shaft slots aligned with mounting holes in rocker arm tower. Using a feeler gauge, verify that rocker arm end play is within specification by measuring between end of rocker arm and rocker arm tower.

Moly Assembly Paste P/N: 2871460



Rocker Arm End Play:
.005 - .013 in (.127 - .330 mm)

2. Verify that rocker box sealing surfaces are clean and free from gasket material. Install new rocker box gasket to front cylinder head with pre-applied sealant facing up.
3. Install rocker box onto front cylinder head, engaging pushrods to rocker arms, and rocker arms to valve stem tips.
4. Loosely install nine rocker box retaining fasteners and verify that rocker box is centered on front cylinder head. Torque retaining fasteners to specification. Refer to rocker box assembly view for torque sequence and values.
5. Replace rocker box seal and chimney seal.
6. Install rocker box cover onto rocker box.
7. Insert four rocker box cover retaining screws with new under washer seals. Torque fasteners to specification in a cross pattern.
8. Repeat process for rear rocker box.



Rocker Box Cover Screws:
105 in-lbs (12 Nm)

CYLINDER HEAD REMOVAL / DISASSEMBLY

1. Remove front and rear rocker box assemblies. See rocker box removal.
2. Remove four pushrods noting location.
3. Evenly loosen the front cylinder head bolts and carefully remove cylinder head, leaving pushrod tubes in lifter blocks. Remove cylinder head gasket and two locating dowels. Repeat process for rear cylinder head.

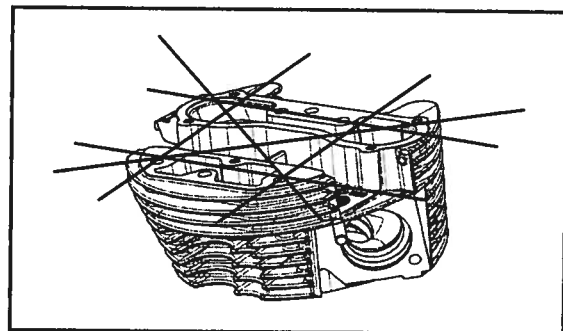
CAUTION

Wear eye protection while removing valve springs

4. Compress intake valve spring using spring compressor. Use a pencil magnet to remove valve keepers.
5. Remove retainer, valve spring, and valve. Repeat process for exhaust valve.
6. Remove and discard valve guide seals.
7. Repeat process for rear cylinder head.

CYLINDER HEAD INSPECTION

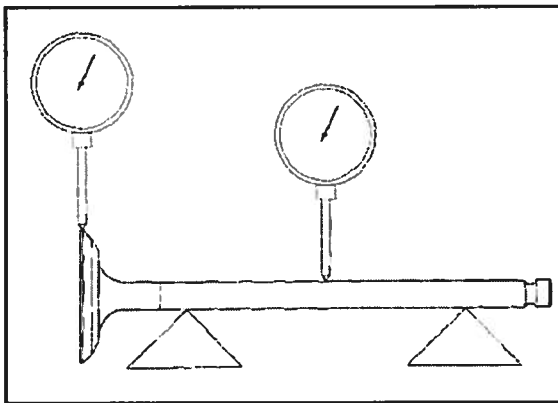
1. Visually inspect cylinder head for cracks or damage. Pay close attention to areas around spark plug and valve seats.
2. Ensure oil passages in cylinder heads are unobstructed.
3. Inspect cylinder head for distortion with a straight edge and feeler gauge. Check in different directions and locations on the cylinder head as shown. Replace cylinder head if excessive warp is found.



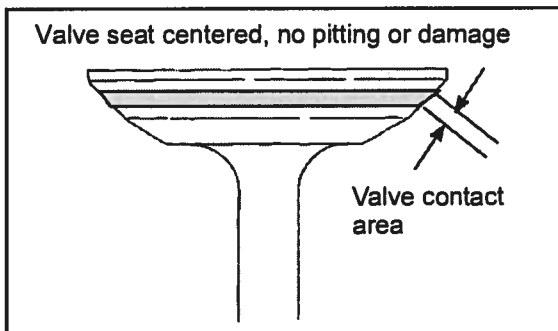
CYLINDER HEAD & VALVE TRAIN

VALVE INSPECTION

4. Inspect intake and exhaust valve faces for damage from burning, pitting, or uneven contact. Replace if damage is observed.
5. Inspect intake and exhaust valve stem runout and head radial runout as shown below. Replace valves if excessive runout condition is observed.



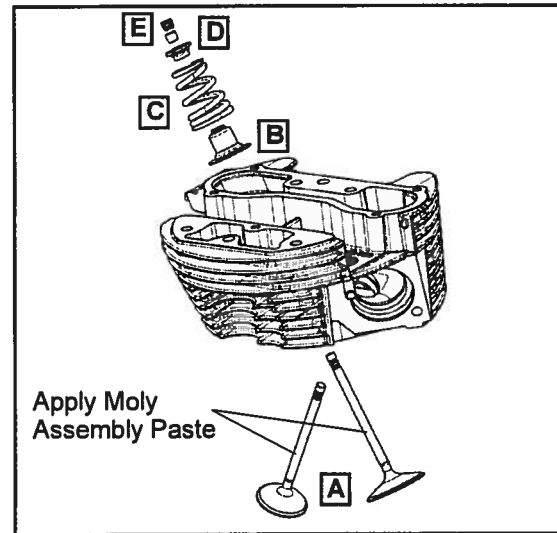
6. Apply a light coat of machinist's layout fluid or paste to valve face and install into valve guide.
7. Tap valve several times to make a clear impression on the valve face. Do not rotate valve.
8. Remove valve and inspect contact area.



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

9. Inspect intake and exhaust valve guides for cracks or excessive wear. Replace cylinder head if damage is observed.

CYLINDER HEAD ASSEMBLY



1. Apply a thin layer of Moly assembly paste to intake valve stem (A) and install through its respective valve guide. Ensure valve moves freely in valve guide.

Moly Assembly Paste P/N: 2871460

2. Prevent valve from sliding out of guide and carefully install a new valve guide seal (B) over valve stem and seat to cylinder head.
3. Install valve spring (C) over valve and install retainer (D).
4. Center retainer bore over valve stem and compress valve spring using spring compressor.

WARNING

Wear eye protection while installing valve springs

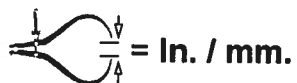
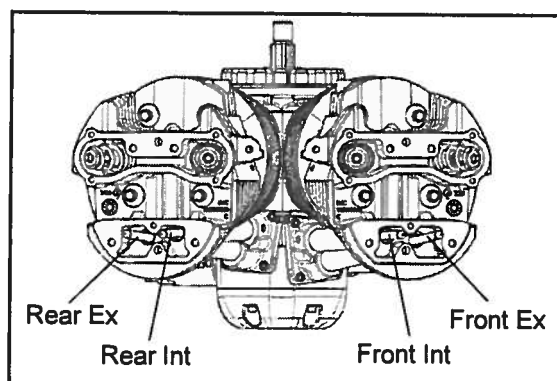
5. Align intake valve retainer with spring compression arm and keeping valve stem centered in retainer bore, fully compress spring.
6. Install keepers (E) onto valve stem and slowly release spring compression arm. Ensure keepers are fully seated in retainer. Repeat process for exhaust valve.
7. Repeat assembly process for rear cylinder head.

CYLINDER HEAD INSTALLATION

1. Install two new upper pushrod o-rings into front cylinder head pushrod tube bores.

NOTE: Apply P-80® to o-rings prior to installation.

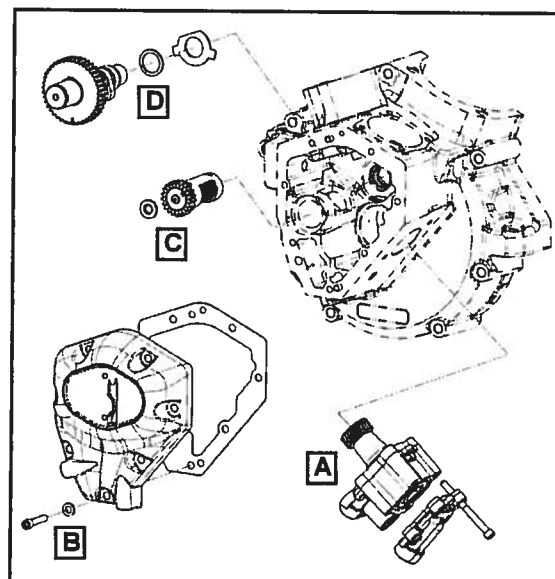
2. Reinstall two dowels into top of front cylinder and install new cylinder head gasket.
3. Carefully install front cylinder head assembly onto front cylinder, taking care to engage pushrod tubes into pushrod tube bores and o-rings, and aligning locating dowels in cylinder.
4. Lubricate the heads and threads of all four cylinder head bolts and lightly seat. Torque cylinder head bolts to specification according to sequence and values provided in *Cylinder Head/Valves*.
5. Check each pushrod tube for vertical free play to ensure proper fitment.
6. Repeat process for rear cylinder head.
7. Install pushrods into pushrod tubes they were removed from.



(BK) Front Exhaust Pushrod: 11.54 in (292.99 mm)
 (YE) Front Intake Pushrod: 11.26 in (285.88 mm)
 (BL) Rear Intake Pushrod: 11.18 in (283.85 mm)
 (PK) Rear Exhaust Pushrod: 11.38 in (289.05 mm)

8. Install front and rear rocker box assemblies. See *Rocker Box Assembly/Installation*.

CAM BOX DISASSEMBLY



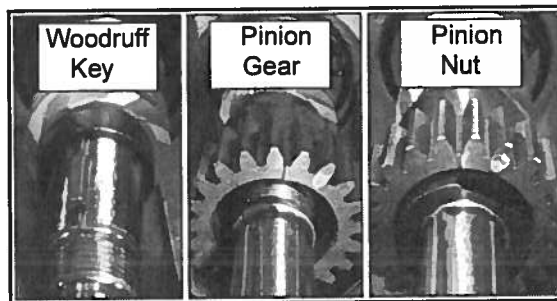
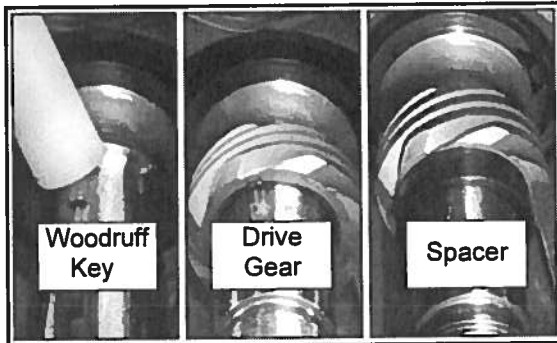
1. Remove front and rear rocker box assemblies. See *Rocker Box Removal*.
2. Remove front and rear cylinder head. See *Cylinder Head Removal/Disassembly*.
3. Remove front and rear cylinder/piston assemblies. See *Chapter 8*.
4. Remove front lifter block assembly by loosening the four fasteners. Secure lifters by placing a magnet across the lifter block opening. Repeat process for rear lifter block assembly.
5. Remove oil pump (A). See *Chapter 4*.
6. Remove oil filter.
7. Remove cam cover by loosening the seven cover retaining fasteners (B) and washers.
8. Remove breather valve shim (shim may come off with cover) and breather valve (C).
9. Remove camshaft, camshaft shim, and camshaft thrust washer (D).
10. Lock crankshaft in place and using special tool pinion gear nut service tool, remove pinion gear nut.

NOTE: Pinion gear nut is left hand thread

11. Using special tool pinion gear service tool, remove pinion gear. Remove pinion gear spacer, drive gear, and two woodruff keys.

CYLINDER HEAD & VALVE TRAIN

CAM BOX ASSEMBLY



1. Apply a light coat of Moly assembly paste to pinion shaft. Install woodruff key into the rear slot of pinion shaft.

Moly Assembly Paste P/N: 2871460

2. Install drive gear over installed key and install drive gear spacer.
3. Install second woodruff key into the outer pinion shaft slot.
4. Apply Loctite™ Primer N to pinion shaft threads and pinion nut threads to ensure they are clean and oil free. Place pinion gear onto pinion shaft over outer woodruff key. Apply two drops of red Loctite™ 262 to pinion shaft threads and start pinion gear nut. Lock crankshaft in place and torque pinion gear nut to specification using special tool pinion gear nut service tool.

NOTE: Pinion shaft has left hand threads.



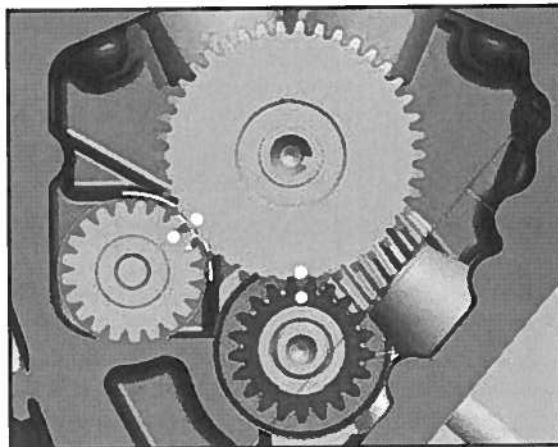
Pinion Gear Nut:
40 ft-lbs (54 Nm)

5. Ensure that oil pump mating surfaces are free of debris and oil. Install oil pump body onto crankcase with large and small o-rings in place. Secure oil pump to crankcase with two oil pump retaining bolts and torque to specification.

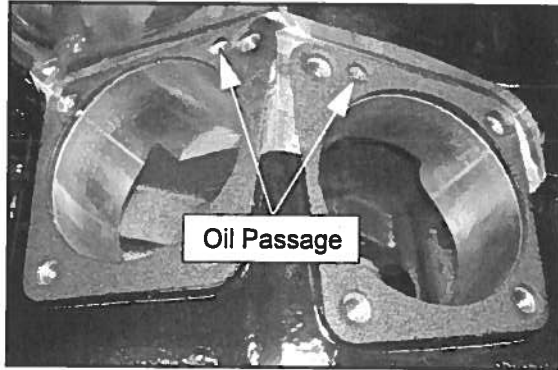


Oil Pump Retaining Bolts:
105 in-lbs (12 Nm)

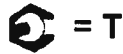
6. Apply Moly assembly paste to camshaft bearing, camshaft, camshaft shim, and camshaft thrust washer.
7. Install camshaft shim and camshaft thrust washer (orient as shown in *Cam Box Disassembly*) onto the end of camshaft.
8. Install camshaft into cam bearing being sure to align timing marks with cam drive gear. Verify cam is fully seated and that cam thrust washer is correctly oriented.
9. Apply Moly assembly paste to crankcase breather bore and OD of breather. Install breather, aligning timing mark with camshaft timing mark.



10. Apply Moly assembly paste to ID of lifter block bores and OD of lifters and install lifters into the bottom of lifter block bores.
11. Place front and rear lifter block gaskets onto their respective lifter block mating surface, ensuring lifter block oil feed slots align with oil feed holes in gaskets.



12. Using magnetic tool to hold lifters up, install front lifter block into front lifter block bore.
13. Install special tool lifter block alignment screws into front lifter block fastener bores at oil feed hole and diagonal. Install two lifter block retaining fasteners and torque to specification. Remove alignment screws and install two remaining lifter block retaining fasteners, torque to specification.



Lifter Block Retaining Fasteners:
105 in-lbs (12 Nm)

14. Repeat process for rear lifter block.
15. Apply Moly assembly paste to breather barrel shim and place on the end of breather barrel.
16. Install cam cover gasket onto crankcase locating dowels and install cam cover. Install the seven cam cover retaining fasteners and torque fasteners to specification according to sequence and values provided in *Cam Box Assembly View*.
17. Install front and rear cylinder/piston assemblies. See *Chapter 8*.
18. Install front and rear cylinder head. See *Cylinder Head Removal/Disassembly*.
19. Install front and rear rocker box assemblies. See *Rocker Box Removal*.



CYLINDER HEAD & VALVE TRAIN

TROUBLESHOOTING, CYLINDER HEAD AND VALVE TRAIN

PROBLEM	POSSIBLE CAUSE	PART(s) AFFECTED	REPAIR RECOMMENDED
Hard Starting Won't Start Excessive Lifter Noise	Low Compression	Lifter(s) locked	Replace lifter(s)
		Collapsed Hydraulic Lifter(s). Lifter Extremely Noisy.	Bleed Lifter Noise will typically stop after 10-15 minutes of high idle operation. If lifter will not bleed, replace lifter.
		Worn Valve Guide(s)	Replace Valve Guide(s).
		Poor Seating of Valve(s)	Repair or Replace
		Broken Valve Springs	Replace
		Spark Plug Not Seated	Torque to Specifications
		Incorrect Valve Timing	Repair
		Valve Stuck Open	Repair
		Cylinder Head Gasket Leak	Repair
		Slow Starter Motor	See Electrical Section
		Worn Rings, Piston, or Cylinder	See Cylinder/Piston Section
		Ignition Problem	See Ignition Section
		Fuel Problem	See F.I. Section
Electric Starter Straining to Turn Engine Over	High Compression	Excessive carbon build-up in combustion chamber.	Use "Carbon Clean" fuel system additive or disassemble engine to de-carbon combustion chamber.
Abnormal Pre-ignition	Excessive Starter Load	Internal Engine / Drive Components Seized or Binding	Determine Cause of Seizure or Binding
Poor Idle Quality	Low Compression	Collapsed Hydraulic Lifter(s). Lifter Extremely Noisy.	Air trapped in lifter. Noise will stop after 10-15 minutes of high idle operation. If air will not bleed, replace lifter.
		Poor Seating of Valve(s)	Repair or Replace
(Continued on next page)			



CYLINDER HEAD & VALVE TRAIN

PROBLEM	POSSIBLE CAUSE	PART(s) AFFECTED	REPAIR RECOMMENDED
Poor high speed running	Air Intake Problem		Refer to Chapter 5
	F.I. System Problem		Refer to Chapter 5
	Ignition Problem		Refer to Chapter 17
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Travel	Worn Camshaft/Rocker Arms	Replace
	Valves Opening & Closing at Wrong Time	Incorrect Valve Timing	Correct
Lack of power in all RPM ranges	Low Compression	Worn Piston, Rings, Cylinder	Replace
	Low Compression	Poor Valve Seating	Repair/Replace
	Valves Opening & Closing at Wrong Time	Valve Timing Incorrect	Correct
	Incorrect Valve Clearance	Hydraulic Lifter Bleeding Down	Replace
	Lifter(s) Locked	Debris in Lifter	Replace lifter(s)
	Collapsed Hydraulic Lifter(s). Lifter Extremely Noisy.	Air Trapped in Lifter. Noise will stop after 10-15 minutes of high idle operation. If lifter will not bleed, replace lifter.	Replace Lifter
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Travel	Worn Camshaft/Rocker Arms	Replace
	Ignition Problem		Refer to Chapter 5
	F.I. Problem		Refer to Chapter 5
	Air Intake Problem		Refer to Chapter 5
	Oiling Problem	Oil Overfilled	Correct
	Vacuum Leak	Mounting Surfaces, Hoses	Correct
	Oil in Combustion Chamber	Oil Overfilled	Correct
Using/Burning Oil	Oil Past Rings	Worn or Damaged Piston, Rings, Cylinder	Replace
	Oil Past Valve Guides	Worn Valve Guides	Replace
		Worn Valve Guide Seals	Replace



CYLINDER HEAD & VALVE TRAIN

NOTES

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal black lines across its entire width, typical of standard notebook paper. The background is a solid off-white color, and there are no margins, text, or other markings present.

CHAPTER 8

CYLINDER & PISTON

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CYLINDER & PISTON

CYLINDER & PISTON

GENERAL INFORMATION

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 Chapter 6 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 and mated 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.

Moly assembly paste PN: 2871460

- 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.

SPECIFICATIONS

CYLINDER & PISTON			
Item		Standard	Service Limit
Cylinder	I.D.	3.9655-3.9665" (100.723-100.749 mm)	3.970" (100.838 mm)
	Out of Round	--	0.004" (0.10 mm)
	Taper	--	0.004" (0.10 mm)
	Gasket Surface Warpage	--	0.004" (0.10 mm)
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. (15 mm up from bottom of skirt, 90 degrees to pin)	--	3.9602" (100.589 mm)
	Piston to Cylinder	0.0018-0.0032" (0.046-0.082 mm)	0.006" (0.1524 mm)
Piston Ring	Ring End Gap - Top (Installed)	0.010-0.023" (0.259-0.591 mm)	0.035" (0.889 mm)
	Ring End Gap - Second (Installed)	0.010-0.023" (0.259-0.591 mm)	0.04" (1.11 mm)
	Ring Groove Clearance - Top (Installed)	--	0.006" (0.15 mm)
	Ring Groove Clearance - Second (Installed)		0.006" (0.15 mm)

SPECIAL TOOLS

Piston ring compressor: Commercially available

Cylinder bore gauge: Commercially available

Straightedge, feeler gauge, precision measuring instruments: Commercially available

Protective sleeves for pistons / studs: Commercially available



CYLINDER REMOVAL

1. Remove front rocker box and cover. See Chapter 7.
2. Remove cylinder head. See Chapter 7.
3. Hold front cylinder down and rotate crankshaft until piston is midway up the cylinder. Carefully lift cylinder up enough so that piston pin can be accessed.
4. Place a clean shop towel in the opening around the connecting rod so that piston pin clip does not fall into the lower end of the engine and the connecting rod does not damage the crankcase.
5. While supporting the cylinder/piston assembly, remove piston pin clip and piston pin. Remove cylinder/piston assembly.
6. Remove locating dowel and base gasket. Clean gasket surfaces thoroughly.

CAUTION

Gasket surfaces could be irreparably damaged from careless handling of cylinder, pistons or rings. Use caution during the cleaning process.

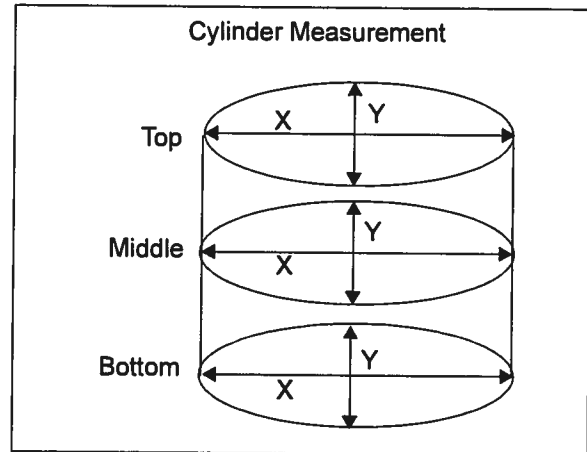
7. Repeat process for rear cylinder.

CYLINDER INSPECTION

1. Visually inspect cylinder bores for scratches and wear.
2. Inspect gasket surfaces for scratches or other damage.

CYLINDER BORE MEASUREMENT

1. Measure each cylinder bore in 6 places to determine:
 - Cylinder Bore Inside Diameter
 - Cylinder Taper and Out of Round
2. Use maximum measurement to determine wear.
3. Use the worksheet provided to record measurements and calculate clearance.



CYLINDER & PISTON

PISTON TO CYLINDER CLEARANCE WORKSHEET

Front Cylinder	Recorded Measurement	Specification
Top "X"		Taper Service Limit: 0.004" (0.10 mm)
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:	Service Limit: 0.004" (0.10 mm)
Largest difference between any "X" axis measurement and "Y" axis measurement	Cylinder Out-of-Round:	
Piston OD measurement		
Difference between largest "X" axis measurement and piston measurement	Piston-to-Cylinder Clearance*	Service Limit: 0.006" (0.1524 mm)

Rear Cylinder	Recorded Measurement	Specification
Top "X"		Taper Service Limit: 0.004" (0.10 mm)
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:	Service Limit: 0.004" (0.10 mm)
Largest difference between any "X" axis measurement and "Y" axis measurement	Cylinder Out-of-Round:	
Piston OD measurement		
Difference between largest "X" axis measurement and piston measurement	Piston-to-Cylinder Clearance*	Service Limit: 0.006" (0.1524 mm)

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

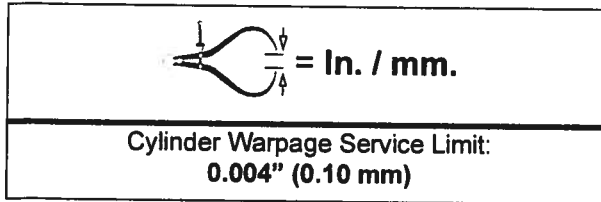
NOTE: The cylinders are Nikasil plated and cannot be reconditioned by boring or honing. If excessive surface damage, taper or out-of-round exists, the cylinder must be replaced.

*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 must be replaced.



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. Use a feeler gauge to measure the space between the straight edge and the cylinder mating surface.
3. Replace cylinder if warped beyond the service limit.



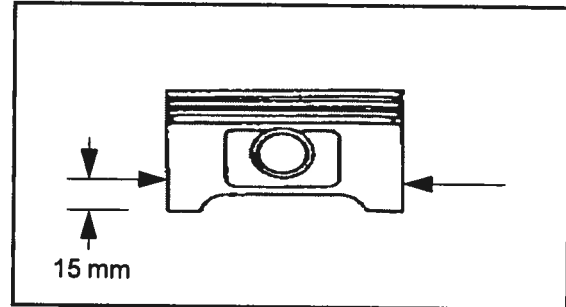
PISTON & PISTON RING REMOVAL

1. Carefully remove pistons from front and rear cylinders.
2. Rotate rings in piston grooves. Rings should rotate freely in grooves.
3. Clean carbon deposits from piston.
4. Spread rings only wide enough to remove them from piston. Spreading rings too wide will damage them.
5. Clean piston ring grooves.

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

PISTON & PISTON RING INSPECTION

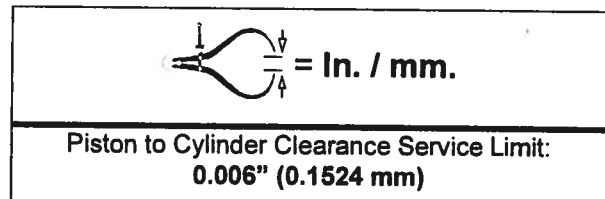
1. Visually inspect piston for cracks, excessive wear, scoring, etc.
2. Measure piston skirt O.D. at 90° to pin and 15 mm from bottom of piston skirt. Compare to specifications and replace piston if worn beyond the service limit.



3. Calculate Piston to Cylinder Clearance using the provided worksheet. Subtract piston O.D. from cylinder bore I.D. and compare to specification.

Piston to Cylinder Clearance Calculation

$$\begin{array}{r}
 \text{Cylinder I.D.} \\
 - \text{Piston O.D.} \\
 \hline
 = \text{Piston to Cylinder Clearance}
 \end{array}$$

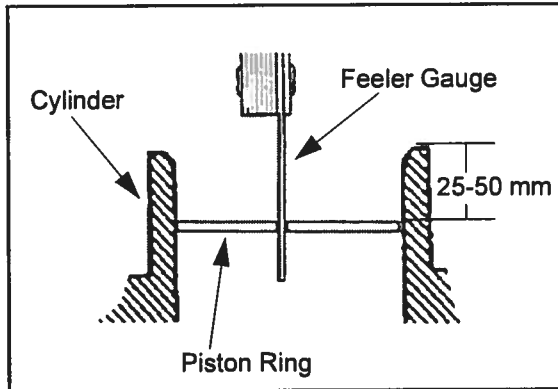


4. Replace parts that do not meet specification.

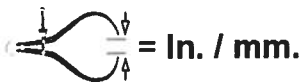
NOTE: If piston to cylinder clearance exceeds service limit, measure a new piston and re-calculate clearance. If piston to cylinder clearance exceeds service limits with a new piston, cylinder must be replaced.

CYLINDER & PISTON

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

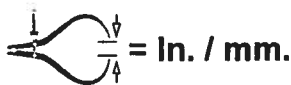
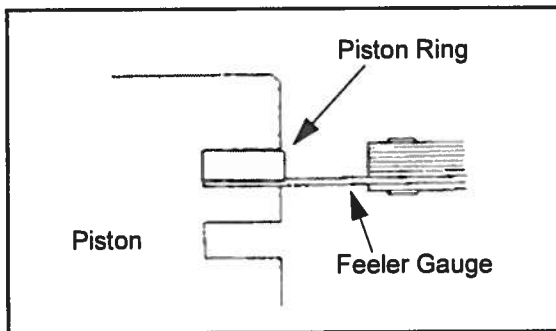


6. Measure installed ring end gap with a feeler gauge and compare to specification. If either ring exceeds the service limit, replace ring set.



Piston Ring End Gap Service Limit:
Top Ring 0.035" (0.889 mm)
Second Ring 0.04" (1.11 mm)

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. If any clearances exceed the service limit, replace piston and piston rings.



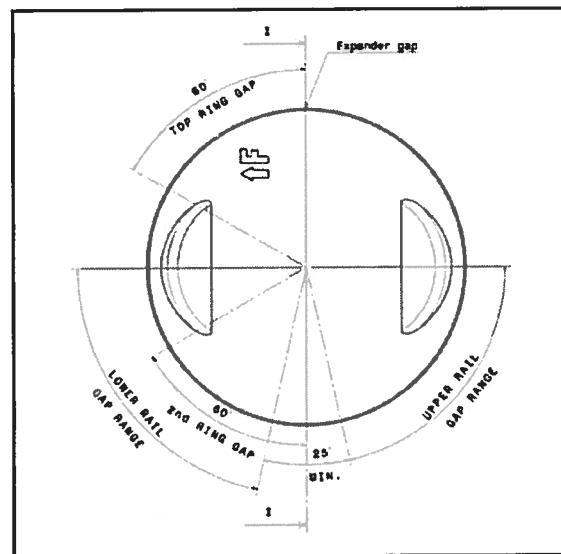
Piston Ring to Land Clearance Service Limit:
Top Ring 0.006" (0.15 mm)
Second Ring 0.006" (0.15 mm)

PISTON RING INSTALLATION

CAUTION

The rings may be damaged if they are overexpanded during installation.

1. Carefully install all three rings onto front piston.
2. Make sure that rings rotate freely in grooves.
3. Locate ring end gaps as shown below in relation to arrow on piston crown.



PISTON INSTALLATION

1. Apply a coating of fresh oil to OD of front piston, wrist pin bore, wrist pin, front cylinder bore, and ID of connecting rod wrist pin bore.
2. Using a ring compressor, install piston into cylinder ensuring that the arrow on the top of the piston will be pointing toward the front of the motorcycle once cylinder/piston assembly is installed on the motorcycle.

NOTE: Arrows on both front and rear pistons point toward front of motorcycle.

CAUTION

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

3. Place a clean shop towel over crankcase to prevent foreign material from entering crankcase.
4. Allow piston to hang out of cylinder bottom enough to access the piston pin bore.

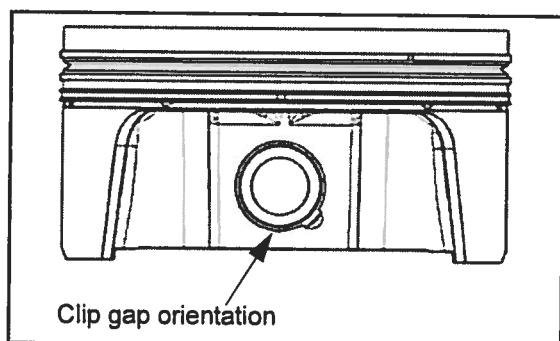
CYLINDER INSTALLATION

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. Using solvent, clean the crankcase base gasket mating surface.
2. Install two alignment dowel pins in their respective cylinder deck bores.
3. Apply a small amount of Loctite™ 5699 to the base gasket mating surface split lines and install base gasket.
4. Install front cylinder/piston assembly over cylinder studs, aligning connecting rod piston pin bore with piston wrist pin bore. Install piston pin through piston and connecting rod.
5. Orient and install piston wrist pin clip with the gap in the six o'clock position. Verify both piston wrist pin clips are correctly oriented and seated.

CAUTION

Never reuse piston pin circlips.



6. Push front cylinder down over piston seat into crankcase bore.
7. Install cylinder head. See Chapter 7.
8. Install rocker box and rocker box cover. See Chapter 7.
9. Repeat process for rear cylinder.



CYLINDER & PISTON

TROUBLESHOOTING, CYLINDER & PISTON

PROBLEM	POSSIBLE CAUSE	AFFECTED PART(s)	REPAIR RECOMMENDED
Engine Hard Starting (or) Engine Will Not Start	Low Compression	Lifter(s) Locked	Refer to Chapter 7
		Collapsed Hydraulic Lifter(s). Lifter Extremely Noisy.	Refer to Chapter 7
		Worn Valve Guide(s)	Refer to Chapter 7
		Poor Seating of Valve(s)	Refer to Chapter 7
		Broken Valve Springs	Refer to Chapter 7
Poor High Speed Performance	Valve Float	Weak Valve Springs	Refer to Chapter 7
	Insufficient Valve Travel	Worn Camshaft/Rocker Arms	Refer to Chapter 7
	Valves Opening & Closing at Wrong Time	Valve Timing Incorrect	Refer to Chapter 7
	Ignition Problem		Refer to Chapter 18
	F.I. System Problem		Refer to Chapter 5
	Air Intake Problem		Refer to Chapter 5
Lack of Power in all RPM Ranges	Incorrect Valve Clearance	Hydraulic Lifter Bleeding Down	Refer to Chapter 7
	Collapsed Hydraulic Lifter(s). Lifter Extremely Noisy.	Air trapped in lifter. Noise will stop after 10-15 minutes of high idle operation. If air will not bleed, replace lifter.	Refer to Chapter 7
	Valve Float	Weak Valve Springs	Refer to Chapter 7
	Valves Opening & Closing at Wrong Time	Valve Timing Incorrect	Refer to Chapter 7
Engine Hard Starting	Fuel Delivery Problem Ignition Problem	Low Fuel Pressure	Refer to Chapter 5
		No Spark or Weak Spark	Refer to Chapter 17
Engine Hard Starting (or) Engine Will Not Start	Low Compression	Spark Plug Not Seated	Torque Spark Plug
		Incorrect Valve Timing	Refer to Chapter 7
		Valve Stuck Open	Refer to Chapter 7
		Leaking Cylinder Head Gasket	Repair
		Slow Starter Motor	Refer to Chapter 18
		Worn cylinder, Pistons and/or Rings	Replace parts that do not meet specification
		Ignition Problem	Refer to Chapter 17
		Fuel Problem	Refer to Chapter 5



TROUBLESHOOTING (Cont.)

PROBLEM	POSSIBLE CAUSE	AFFECTED PART(s)	REPAIR RECOMMENDED
Engine Idles Poorly	Fuel Management Incorrect	Air leaks intake tract	Refer to Chapter 5
		IAC system malfunction, air leak, or restriction	Refer to Chapter 5
	Low Compression	Collapsed Hydraulic Lifter(s). Lifter Extremely Noisy	Refer to Chapter 7
		Lifter(s) Locked	Refer to Chapter 7
		Poor Seating of Valve(s)	Refer to Chapter 7
Lack of Power in all RPM Ranges	Insufficient Valve travel	Worn Camshaft/Rocker arms	Refer to Chapter 7
Lack of Power in all RPM Ranges	Low Compression	Worn Piston, Rings, Cylinder	Replace parts that are worn beyond the service limit
Leaks	Improper Assembly	Cylinder, Gaskets, Gasket Surfaces	Perform white powder test to determine leak path.
		Incorrect Fastener Torque	Assemble parts clean and free of oil, grease, or debris. Torque fasteners properly
	Damaged gasket sealing surface(s)	Cylinder/Crankcase	Repair surface or replace part
Noise	Excessive piston to cylinder clearance	Piston / Cylinder	Replace parts that are worn beyond the service limit
	Excessive piston pin clearance (to piston or connecting rod)	Piston / Pin / Connecting Rod	Replace parts that are worn beyond the service limit
	Exhaust Leak	-	Inspect seal of exhaust system at cylinder head



CHAPTER 9

CLUTCH, PRIMARY, & SHIFT LINKAGE

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CLUTCH, PRIMARY, & SHIFT LINKAGE

GENERAL

SERVICE INFORMATION

- Oil additives of any kind are not recommended by Indian Motorcycle. Using oil additives or oil of the wrong viscosity can have a detrimental effect on clutch performance, operation, and service life.
- Burnt clutch plates are NOT an indication of defective clutch plates. Burnt clutch plates indicate a problem exists within the clutch system, the clutch has been used improperly, or plates were contaminated by improper oil or additives.
- Indian Motorcycle recommends the use of Indian Motorcycle Synthetic Gear Oil in the transmission and primary. This lubricant is formulated with premium gear additives and synthetic base oil which have physical properties that meet API MT-1 API GL-5 specification.
- Lubricate parts during assembly as described in the procedures.
- Corroded or sticking lever components can cause abnormal shifting. Replace any lever components that are damaged or do not move freely, and lubricate at regular intervals.

SPECIFICATIONS

GENERAL

Item		Specifications
Clutch & Primary	Clutch Type	Wet, Multi-Disk
	Clutch Operating Mechanism	Manual / Hydraulic
	Engine Sprocket	28 Teeth
	Clutch Sprocket	37 Teeth
	Torque Compensator	Spring Loaded Cam Assembly
	Primary Reduction Ratio	1.32 : 1
	Clutch Spring	Diaphragm Type

SERVICE / MAINTENANCE

Item		Standard
Clutch & Primary	Clutch Fluid	DOT 4 Hydraulic Brake Fluid
	Primary Chain Deflection	3/8" - 1/2" (9.25 - 12.7 mm)
	Clutch Center Screw Adjustment	3/4 - 1 1/2 Turns Out
	Primary Drive Oil:	
	Service	20 - 22 Ounces (591 - 650 mL)
	Dry (Cover Removed)	29 Ounces (857 mL)

SPECIAL TOOLS

PRIMARY DRIVE SPECIAL TOOLS

Transmission Sprocket Nut Tool: N90000001

Clutch Hub Locking Tool: Commercially Available

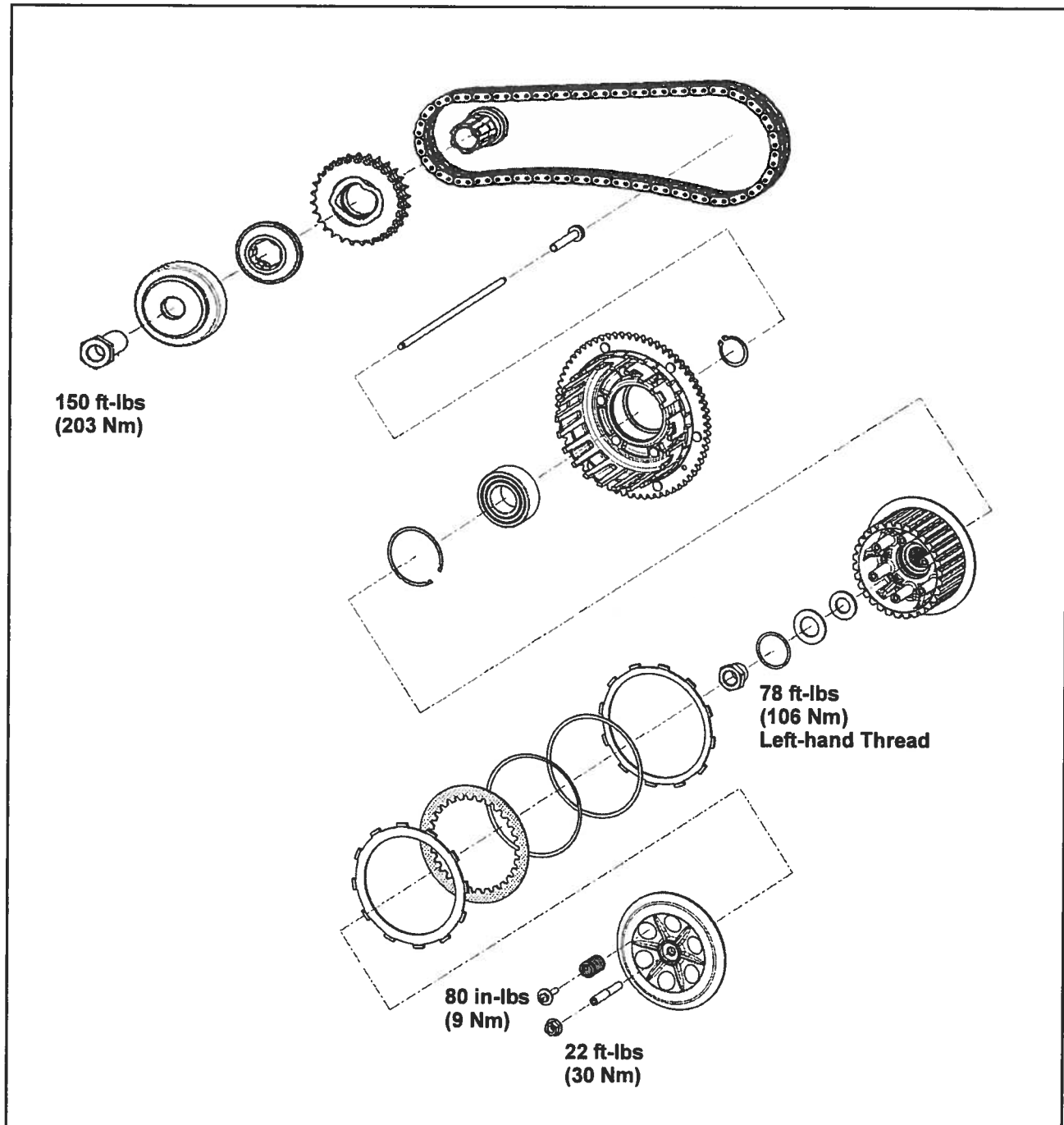
Primary Locking Tool: Commercially Available



CLUTCH, PRIMARY, & SHIFT LINKAGE

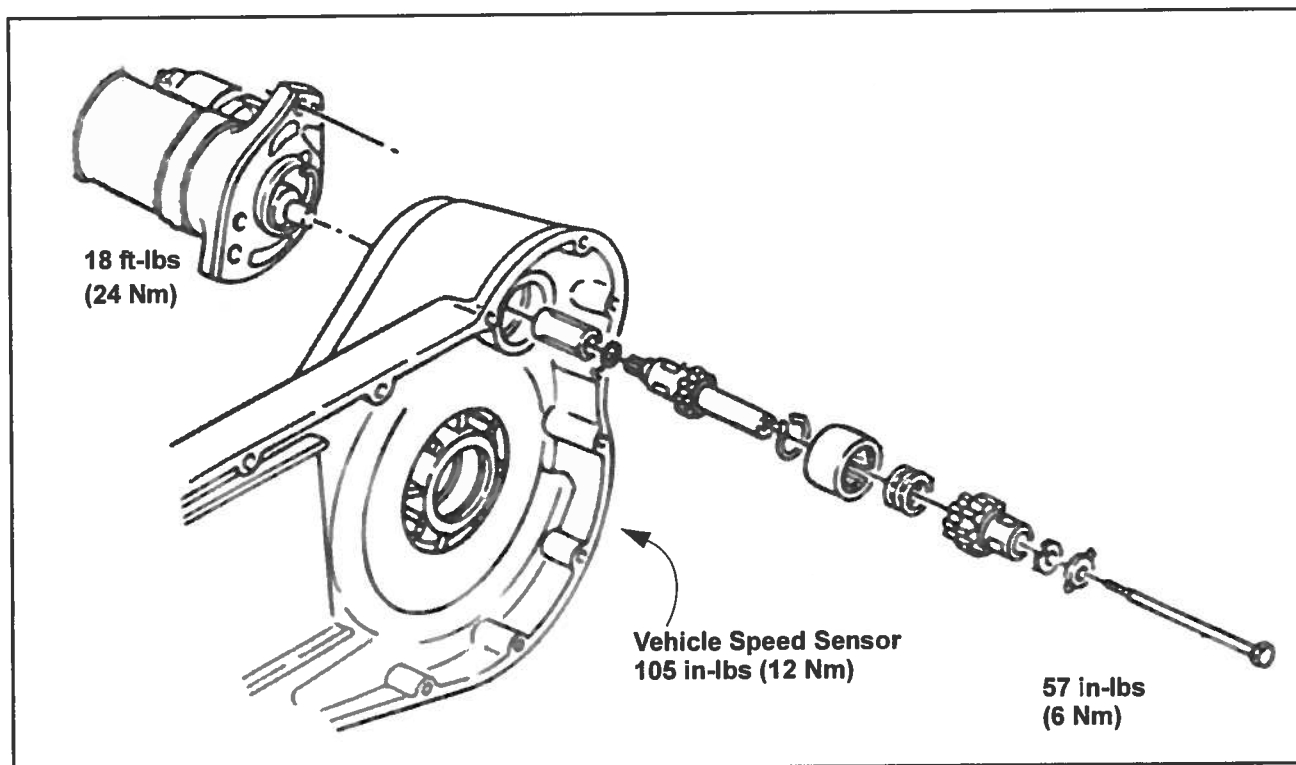
ASSEMBLY VIEWS & TORQUE VALUES

CLUTCH AND PRIMARY DRIVE



CLUTCH, PRIMARY, & SHIFT LINKAGE

JACKSHAFT

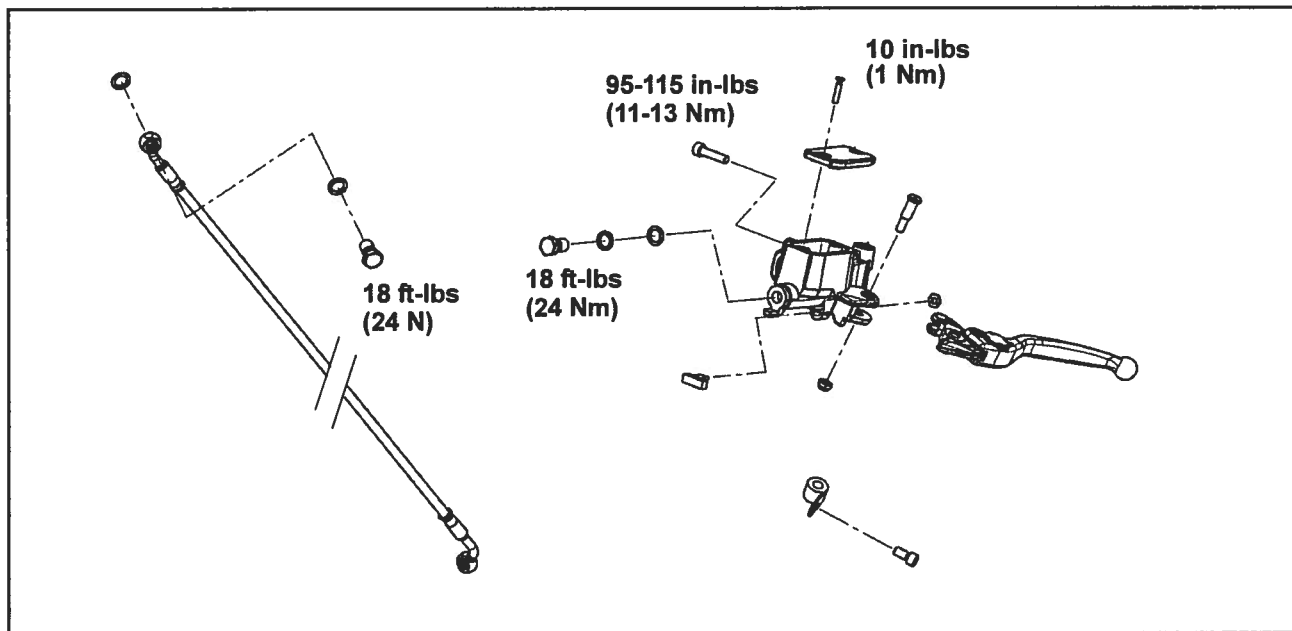


PRIMARY HOUSING / PRIMARY COVER

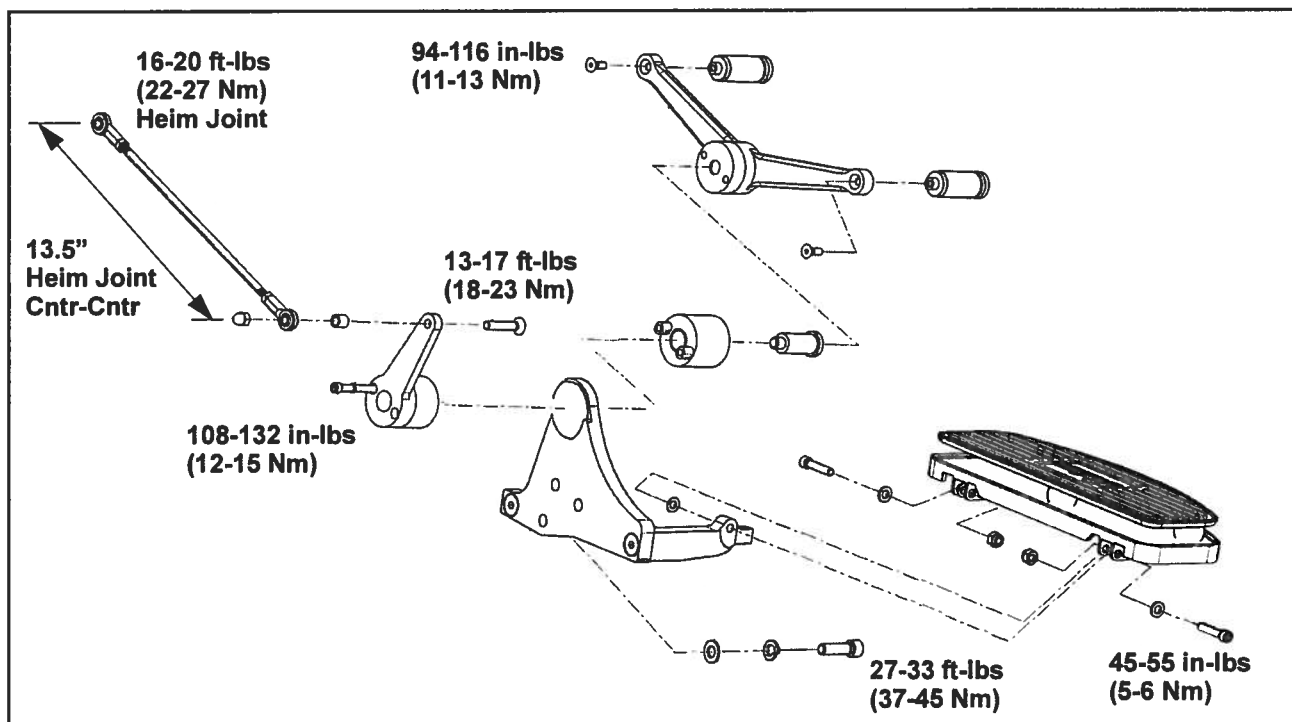


CLUTCH, PRIMARY, & SHIFT LINKAGE

CLUTCH CONTROL



SHIFT LINKAGE / FOOTREST

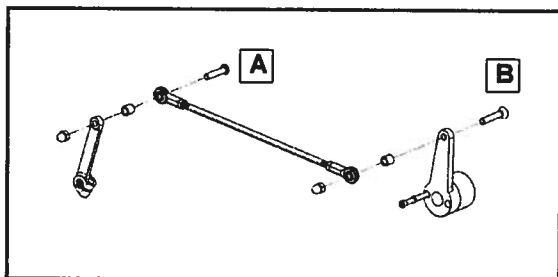


CLUTCH, PRIMARY, & SHIFT LINKAGE

SERVICE PROCEDURES

SHIFT LINKAGE REMOVAL

1. Place a clean shop towel over the primary cover to prevent damage during removal.
2. Remove fastener, spacer, and nut (A) from transmission shift arm.
3. Remove fastener, spacer, and nut (B) from shift pivot arm.

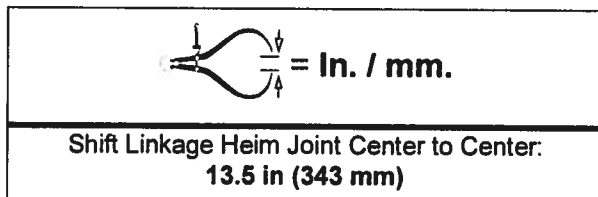


4. Remove shift linkage.

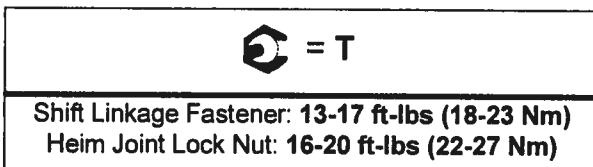
NOTE: If replacing shift linkage heim joint, see "Shift Linkage / Footrest" assembly view.

SHIFT LINKAGE INSTALLATION

1. Verify shift linkage length by measuring from center to center of heim joints. Compare to specification. Adjust if necessary.



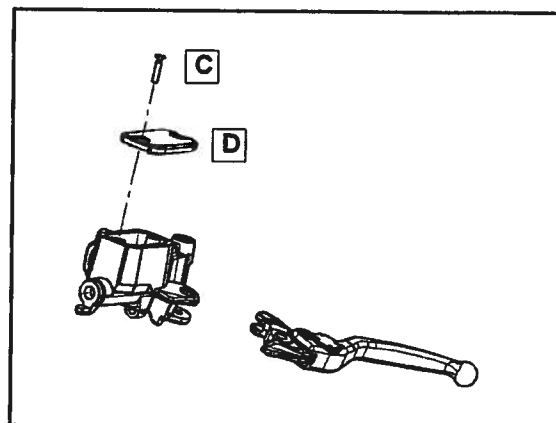
2. Position shift linkage between transmission shift arm and shift pivot arm.
3. Install fastener, spacer, and nut (B, above) into shift pivot arm. Torque to specification
4. Install fastener, spacer, and nut (A, above) into transmission shift arm. Torque to specification.



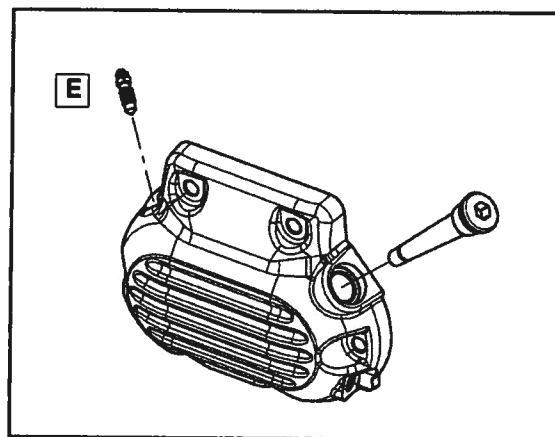
5. Verify proper linkage operation by manually shifting through range of gears.

CLUTCH FLUID CHANGE / BLEEDING

1. Secure motorcycle in an upright position.
2. Remove fastener (C) retaining master cylinder cover.
3. Remove master cylinder cover and gasket (D).



4. From a new sealed container add DOT 4 brake fluid to reservoir. Fill reservoir to max indicator mark.
5. Attach vacuum device to clutch bleed nipple (E) and open bleed nipple 1/4 turn.



6. Activate vacuum device. Monitor fluid level in reservoir. Do not allow fluid to drop below feed hole in reservoir.
7. Deactivate vacuum device when fluid level in reservoir nears the feed hole. Close bleed nipple (E, above)
8. Repeat steps 4-7 three times to ensure that system is full and free of trapped air, or that all old fluid has been flushed.
9. Temporarily install reservoir cover and gasket (D, above).



CLUTCH, PRIMARY, & SHIFT LINKAGE

10. Pump clutch lever several times to build pressure in system.

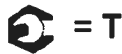
11. Hold clutch lever in and open bleed nipple fitting (E, above).

IMPORTANT: Releasing clutch lever while bleed nipple is open will introduce air into the clutch system.

12. Close bleed nipple (E, above) and release clutch lever.

13. Repeat steps 9-12 three times. After each repetition, verify that fluid in clutch master cylinder reservoir is above the minimum line.

14. Torque bleed nipple to specification.

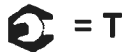


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Clutch Bleed Nipple:
32 in-lbs (4 Nm)

15. Fill clutch master cylinder reservoir until fluid level reaches maximum indicator.

16. Install reservoir cover and gasket (D, above) with fastener (C, above) and torque to specification.



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Clutch Master Cylinder Reservoir Cover Fastener:
10 in-lbs (1 Nm)

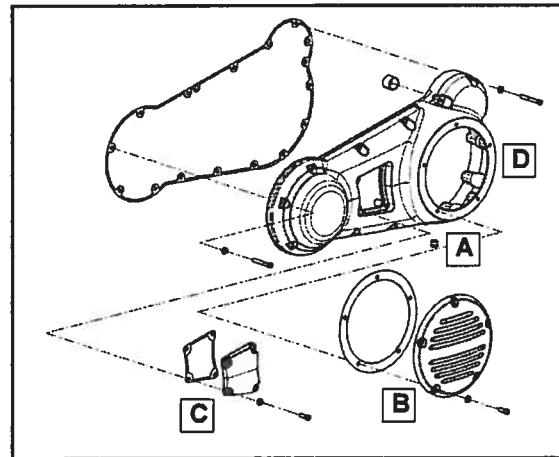
17. Pump clutch lever to ensure activation and inspect system fittings for leaks.

18. Verify proper clutch operation.

CLUTCH AND PRIMARY

PRIMARY COVER REMOVAL

1. Secure motorcycle in an upright position.
2. Remove Seat. See Chapter 3.
3. Disconnect Battery.
4. Place a drain pan under the rear of the primary cover.
5. Remove drain plug (A) and discard.
6. Remove fasteners and washers retaining clutch cover, and remove clutch cover (B). Discard clutch cover gasket.
7. Remove fasteners and washers retaining inspection cover and remove inspection cover (C). Discard inspection cover gasket.
8. Remove fasteners and washers retaining primary cover, and remove primary cover (D). Discard primary cover gasket.



NOTE: Primary cover fasteners come in two lengths. Record proper position during removal.

CLUTCH, PRIMARY, & SHIFT LINKAGE

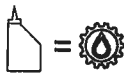
PRIMARY COVER INSTALLATION

1. Clean mating surfaces on primary cover and inner primary cover.
2. Install new primary cover gasket onto inner primary dowel pins.
3. Install primary cover onto inner primary cover. Ensure that primary gasket is properly aligned.
4. Install primary cover fasteners with washers. Refer to *Primary Housing / Primary Cover Assembly View* for torque values and sequence.
5. Install new drain plug. Torque to specification.
6. Install new clutch cover gasket and clutch cover. Install and torque fasteners in a cross pattern to specification.



Primary Cover Fasteners: **105 in-lbs (12 Nm)**
Primary Drain Plug: **8 ft-lbs (11 Nm)**
Clutch Cover Fasteners: **105 in-lbs (12 Nm)**

7. Add specified amount and grade of Indian Motorcycle Synthetic Primary Fluid through the inspection cover hole.



Indian Motorcycle Synthetic Primary Fluid
SAE 80W / 90
29 Ounces (858 mL)

8. Install new inspection cover gasket and inspection cover. Install and torque fasteners in a cross pattern to specification.

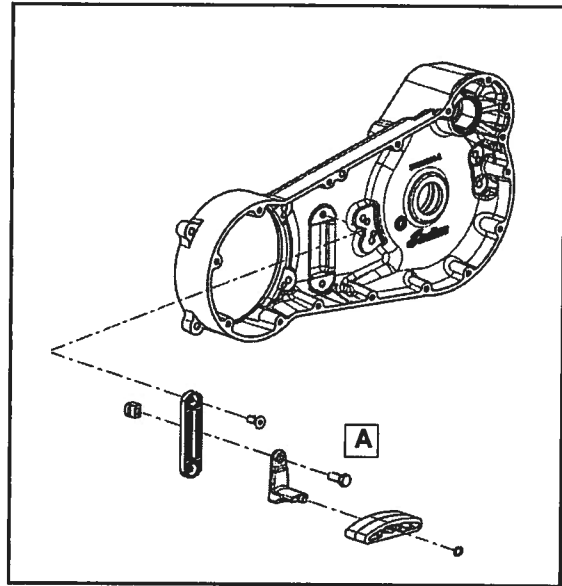


Inspection Cover Fastener:
105 in-lbs (12 Nm)

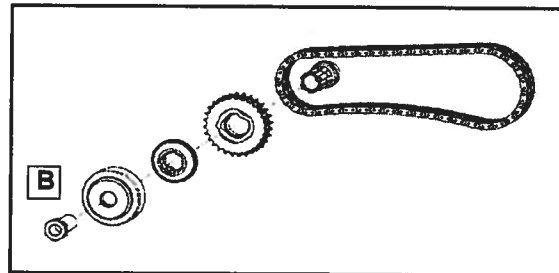
9. Connect battery.
10. Install seat. See Chapter 3.

PRIMARY DRIVE REMOVAL

1. Remove seat. See Chapter 3.
2. Disconnect battery.
3. Remove primary cover. See Primary Cover Removal.
4. Inspect the chain and sprocket for excessive wear. Replace components as necessary.
5. Inspect chain tensioner for wear or damage. Replace components as necessary.
6. Loosen the primary chain tensioner adjuster bolt (A). Slide the adjuster down to provide maximum chain slack.

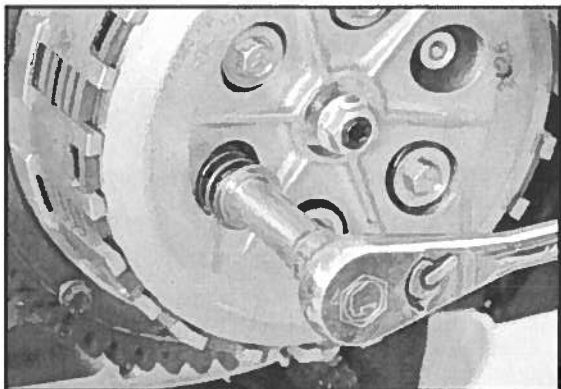


7. Remove compensator sprocket nut (B) and compensator spring cup.

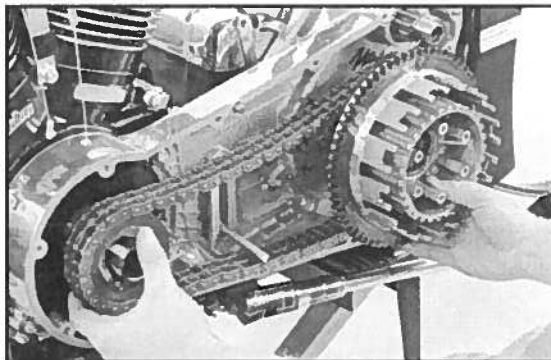


CLUTCH, PRIMARY, & SHIFT LINKAGE

8. Remove six clutch pressure plate retaining fasteners and springs.



11. Slide the clutch assembly, primary drive chain and engine sprocket off the engine crankshaft and transmission input shaft. Keep sprocket and chain evenly aligned during removal.

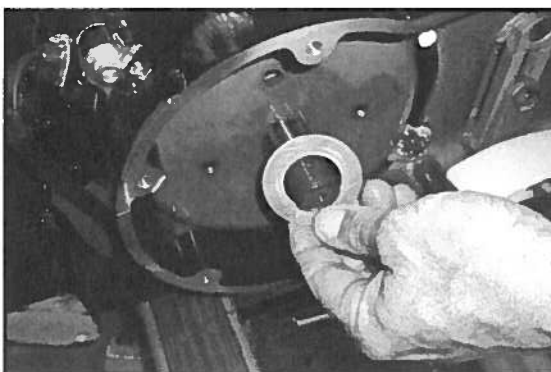
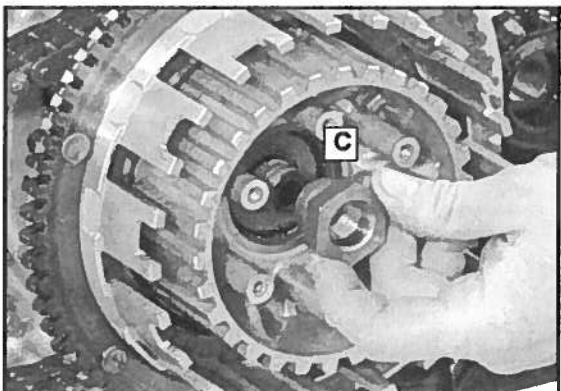


9. To gain access to the clutch hub retaining nut, remove the pressure plate from the clutch inner hub and clutch basket. Leave friction disks and separator disks installed unless performing inspection.

NOTE: Main shaft extension and spacer can remain on engine sprocket. See below.

10. Remove clutch hub retaining nut (C).

NOTE: Left hand thread - to remove nut turn clockwise.



CLUTCH, PRIMARY, & SHIFT LINKAGE

PRIMARY DRIVE INSTALLATION

1. Slide the clutch assembly, primary drive chain and engine sprocket onto the engine crankshaft and transmission input shaft. Keep sprocket and chain evenly aligned to ease installation.
2. Check primary chain alignment.
3. Apply Loctite™ to clutch hub retaining nut and install. Torque to specification.

NOTE: Left hand thread - to install nut turn counter clockwise.



Clutch Hub Retaining Nut:
78 ft-lbs (106 Nm)

4. If removed, install friction disks and separator disks.
5. Install pressure plate into the clutch inner hub and clutch basket.
6. Apply Loctite™ to the six clutch pressure plate retaining fasteners and install with springs. Torque to specification in cross pattern.
7. Adjust clutch.
8. Thoroughly clean threads of the compensator sprocket nut and apply Loctite™.
9. Install the compensator spring cup and compensator sprocket nut. Torque to specification.

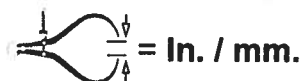
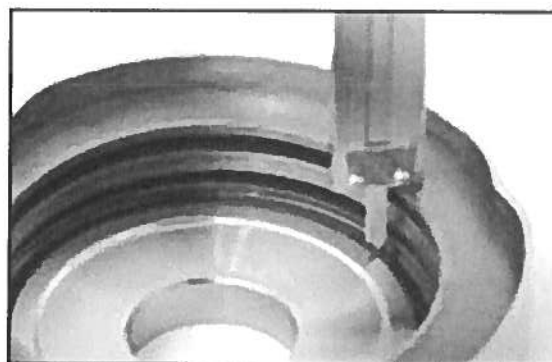


Clutch Plate Fasteners: 80 in-lbs (9 Nm)
Compensator Sprocket Nut: 150 ft-lbs (203 Nm)

10. Adjust primary chain.
11. Install primary cover.
12. Connect battery.
13. Install seat. See Chapter 3.

COMPENSATOR SPRING CUP INSPECTION

1. Check tension in the compensator spring cup. Measure unloaded spring height and compare to specification.
2. Position the vernier measuring instrument at the base of the compensator spring cup and measure to the top of the retainer. If less than specification, replace.

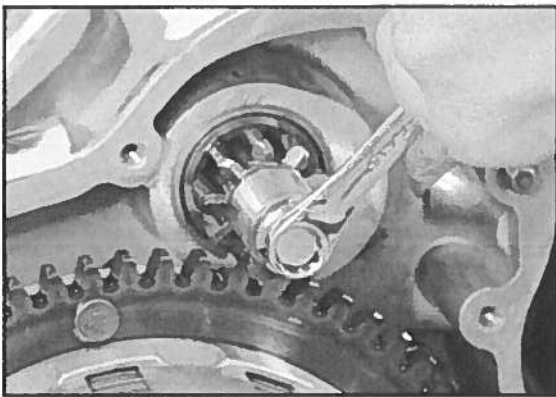


Compensator Spring Height (Unloaded):
.650 in (16.51 mm) MINIMUM

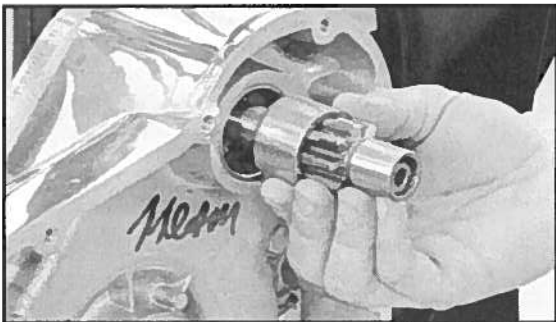
CLUTCH, PRIMARY, & SHIFT LINKAGE

JACKSHAFT REMOVAL

1. Remove seat. See Chapter 3.
2. Disconnect battery.
3. Remove primary cover.
4. Remove primary drive.
5. Bend over tab of retaining bolt lock washer to gain access to the jackshaft retaining bolt.
6. While preventing the jackshaft assembly from rotating, remove the jackshaft retaining bolt.



7. Carefully slide jackshaft assembly out of inner primary cover. Make note of orientation of assembly.



8. The jackshaft coupler connects the starter shaft to the jackshaft assembly. To gain access to the coupler remove starter.

JACKSHAFT INSTALLATION

1. Confirm orientation of jackshaft assembly and carefully slide the assembly into the inner primary cover. Rotate jackshaft assembly to engage jackshaft coupler with starter shaft.
2. While preventing the jackshaft assembly from rotating, install jackshaft retaining bolt. Torque to specification.



Jackshaft Retaining Bolt:
57 in-lbs (6 Nm)

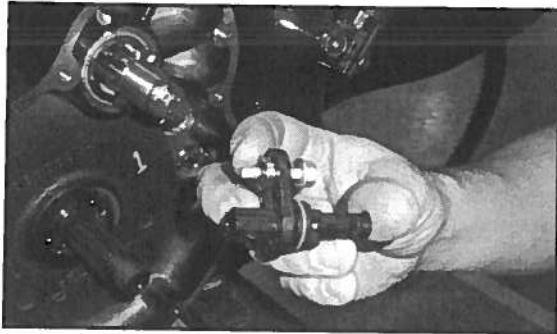
3. Bend locking tab of retaining bolt lock washer against jackshaft retaining bolt head flat.
4. Install primary drive.
5. Install primary cover.
6. Connect battery.
7. Install seat. See Chapter 3.



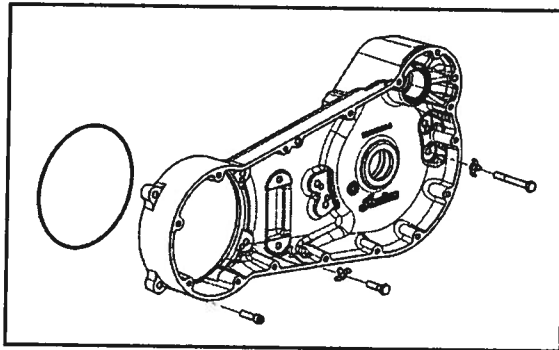
CLUTCH, PRIMARY, & SHIFT LINKAGE

INNER PRIMARY REMOVAL

1. Remove seat. See Chapter 3.
2. Disconnect battery.
3. Remove primary cover.
4. Remove primary drive.
5. Remove Jackshaft Assembly.
6. Remove Side Covers. See Chapter 3.
7. Remove Starter. See Chapter 18.
8. Disconnect the speedometer sensor electrical connector from the speedometer sensor. Located on the rear side of inner primary.
9. Remove speedometer sensor fastener and speedometer sensor.



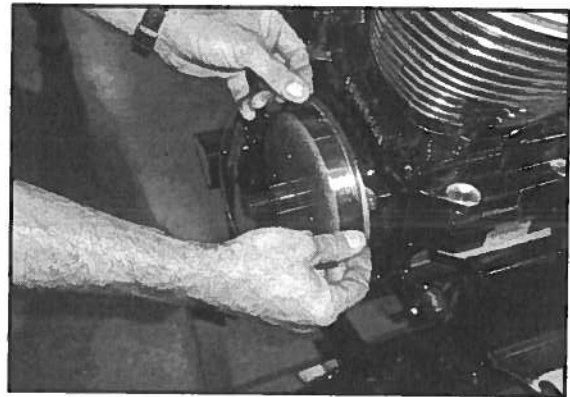
10. Bend back tabs on tabbed lock washers and remove fasteners (Qty 8) retaining inner primary.
11. Remove inner primary from transmission and engine cases.
12. Remove o-ring and discard.



INNER PRIMARY INSTALLATION

IMPORTANT: Inner primary installation procedure is associated with driveline alignment. If engine or transmission was removed after inner primary was removed. Follow Driveline alignment procedures. See Chapter 6.

1. Inspect inner primary's seals, bearing and bushing. Replace components as needed.
2. Clean engine, transmission and inner primary mating surfaces.
3. Install new O-ring onto engine mating surface.



4. Apply Loctite™ Superflex RTV 59575 to surfaces of inner primary that expose inner cavity of primary to mating surfaces of engine and transmission. See assembly view for sealant application locations.

NOTE: Once sealant has been applied, Installation and torquing of hardware must be completed within three minutes.

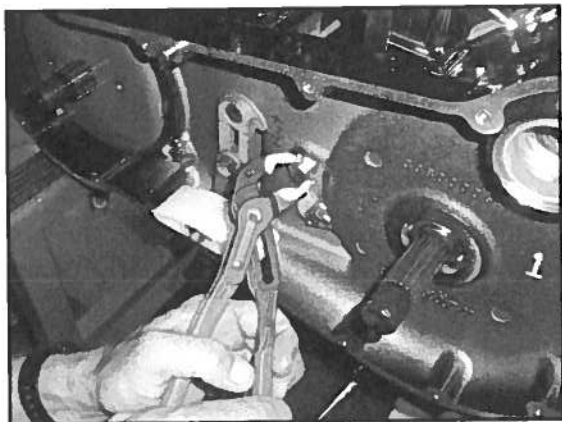
5. Position the inner primary carefully onto the transmission and engine.

NOTE: Use caution not to damage seal or o-ring during inner primary installation.

6. Once inner primary is fully seated, install tabbed lock washers and fasteners (Qty 8). Torque fasteners in sequence according to assembly view.

CLUTCH, PRIMARY, & SHIFT LINKAGE

7. Secure fasteners by bending one tab on each lock washer to the flat of the fasteners.



8. Install the Speedometer Sensor into the machined pocket in boss located on backside of the inner primary. Torque sensor fastener to specification.



Speedometer Sensor Fastener:
97 in-lbs (11 Nm)

9. Connect the speedometer sensor electrical connector from the main wiring harness to speedometer sensor.
10. Install Starter. See Chapter 18.
11. Install Jackshaft Assembly.
12. Install primary drive.
13. Install Primary Cover.
14. Install side covers. See Chapter 3.
15. Connect battery.
16. Install Seat. See Chapter 3.



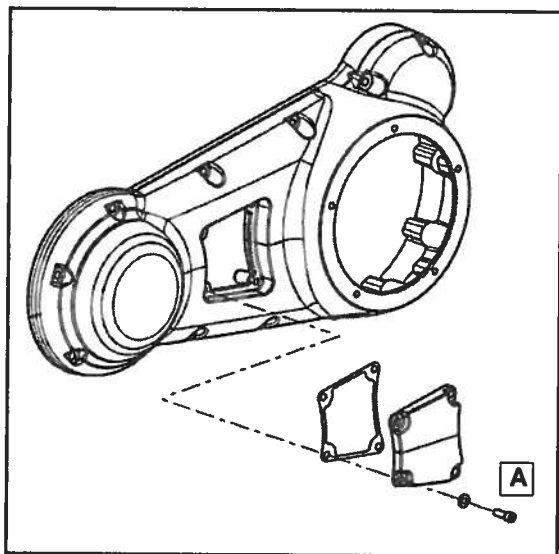
CLUTCH, PRIMARY, & SHIFT LINKAGE

PRIMARY CHAIN ADJUSTMENT

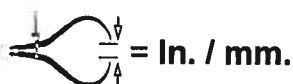
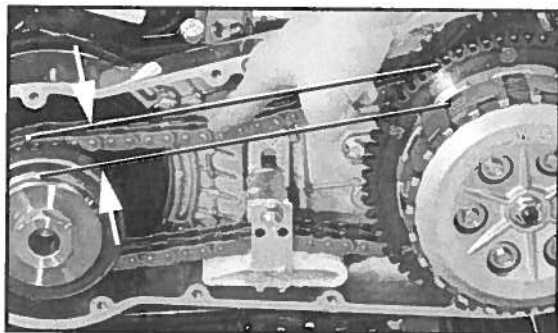
CAUTION

Excessive slack in the primary chain can cause chain rattle, knocking during acceleration/deceleration and contact between the chain and primary housing. Over-tension can cause damage to the chain, sprocket, clutch basket and main transmission bearing.

1. If primary cover is installed, remove inspection cover by removing fasteners with washers (A). Discard inspection cover gasket.

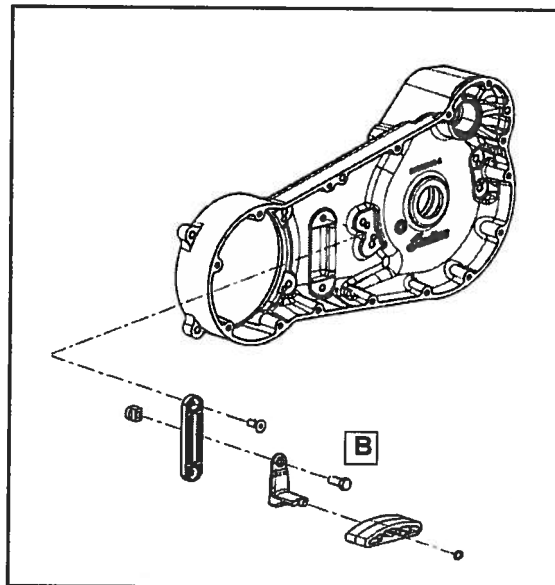


2. Through the inspection hole or while primary cover is off, measure the deflection of primary chain as shown below.



Primary Chain Deflection: 3/8-1/2 in (9.5-12.7 mm)

3. If adjustment is required, loosen chain adjuster bolt (B) and adjust primary chain adjuster shoe up or down to achieve correct deflection. Torque primary chain adjuster bolt to specification.



4. If primary cover is installed, install new inspection cover gasket and inspection cover with fasteners and washers. Torque in a cross pattern to specification.



Primary Chain Adjuster Bolt: 45 ft-lbs (61 Nm)
Inspection Cover Fasteners: 105 in-lbs (12 Nm)

CLUTCH, PRIMARY, & SHIFT LINKAGE

TROUBLESHOOTING

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PART(s) AFFECTED	REPAIR RECOMMENDED
Clutch Lever Pulls Excessively Hard	Clutch lever pivot, bushings, ferrules 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 lifter plate bearing damage	Clutch plate bearing lifter	Replace
	Damaged clutch lifter mechanism	Clutch release mechanism	Repair as necessary
Clutch Slips	Clutch spring weak	Clutch spring	Replace
	Clutch spring snap ring loose or broken	Clutch spring snap ring	Repair or replace as necessary
	Pressure plate worn, warped or distorted	Pressure plate	Replace
	Clutch plate(s) worn, warped or distorted	Driven plates or drive plates	Replace
	Clutch lifter mechanism sticking	Clutch lifter mechanism	Repair
	Engine oil level low	Oil level	Correct
	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, hard to find Neutral)	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 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 spring	Clutch springs	Replace all



CLUTCH, PRIMARY, & SHIFT LINKAGE

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



CLUTCH, PRIMARY, & SHIFT LINKAGE

NOTES

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CHAPTER 10

TRANSMISSION & CRANKSHAFT

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TRANSMISSION & CRANKSHAFT

GENERAL

SERVICE INFORMATION

- Remove engine from frame to service crankshaft components. See Chapter 6.
- The crankcase must be separated to access crankshaft. Remove:
 - Rocker box cover and rocker box
 - Cylinder heads
 - Cylinders & pistons
 - Gear shift linkage
 - Primary drive and components
- Label and store parts neatly to speed the assembly process and ensure that matched parts like connecting rods, camshaft carriers and bearings can be installed in their original location
- 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

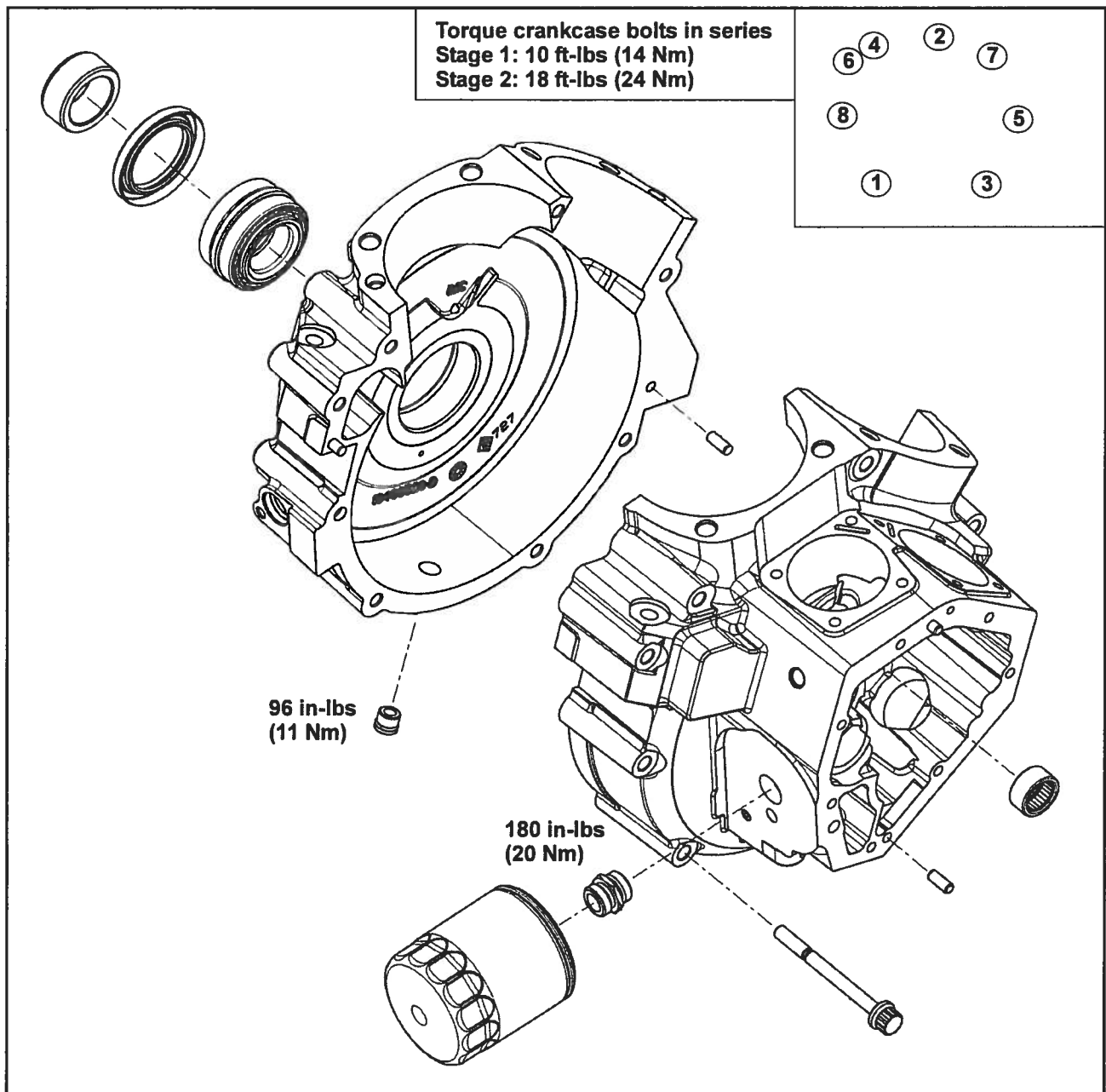
CRANKCASE / CRANKSHAFT / TRANSMISSION SPECIAL TOOLS

- Sprocket Shaft Holder: Commercially available
- Flywheel Rebuilding Jig (Commercially available)
- Crank Disassembly / Removal Tool (Commercially available)
- Seal Install Driver (Commercially available)
- Socket Tool (Commercially available)
- Crankshaft Truing Stand (Commercially available)



ASSEMBLY VIEWS & TORQUE VALUES

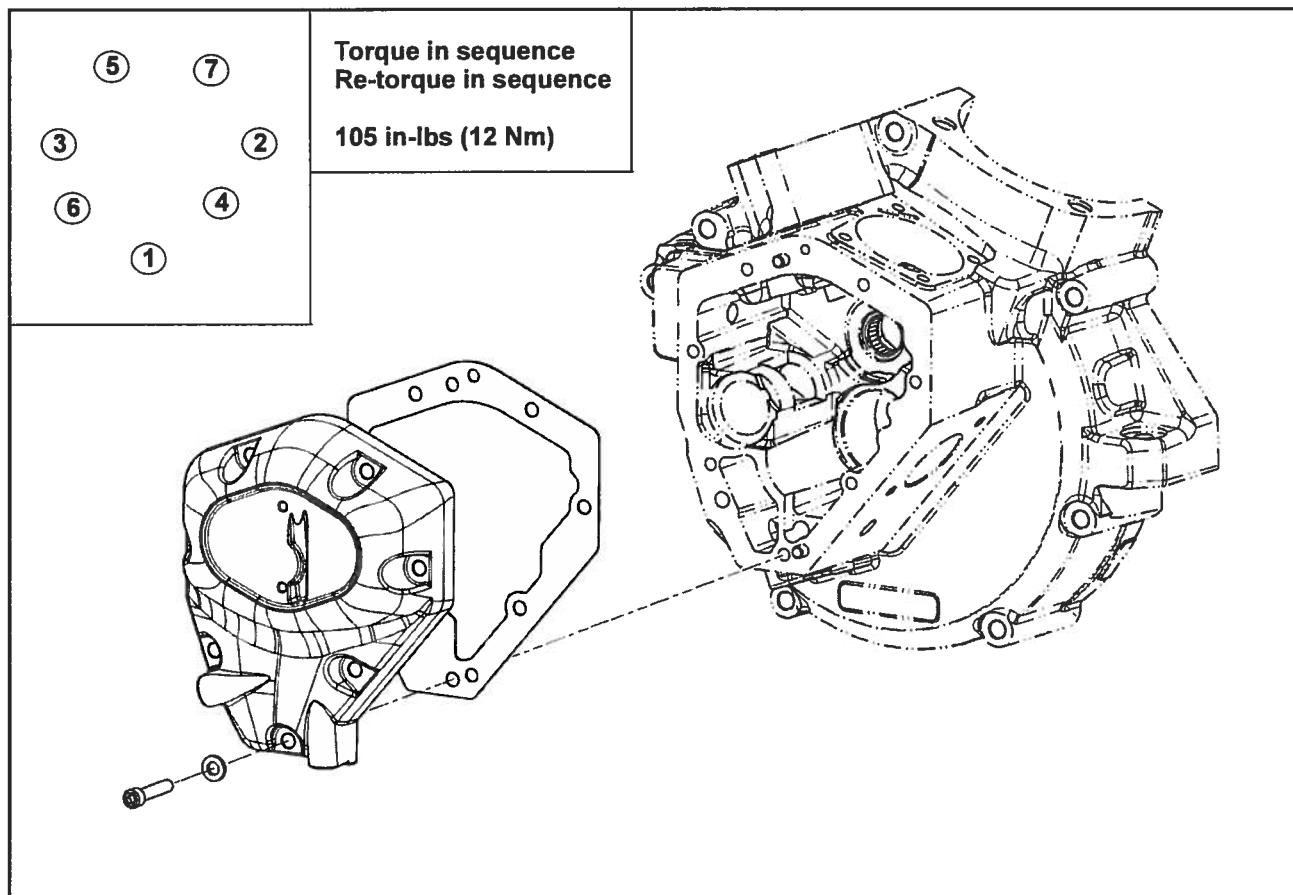
CRANKCASE



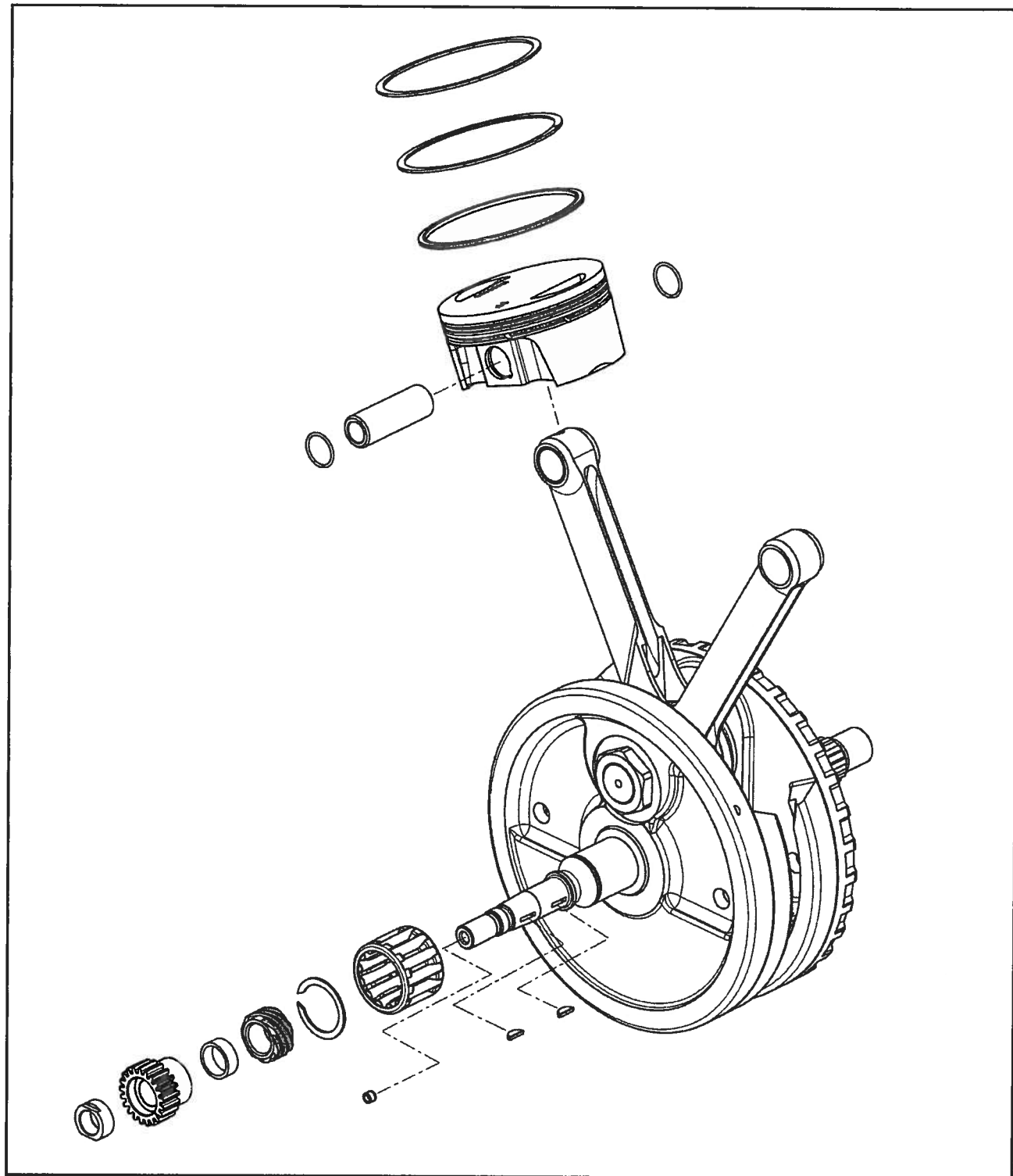
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TRANSMISSION & CRANKSHAFT

CAM COVER



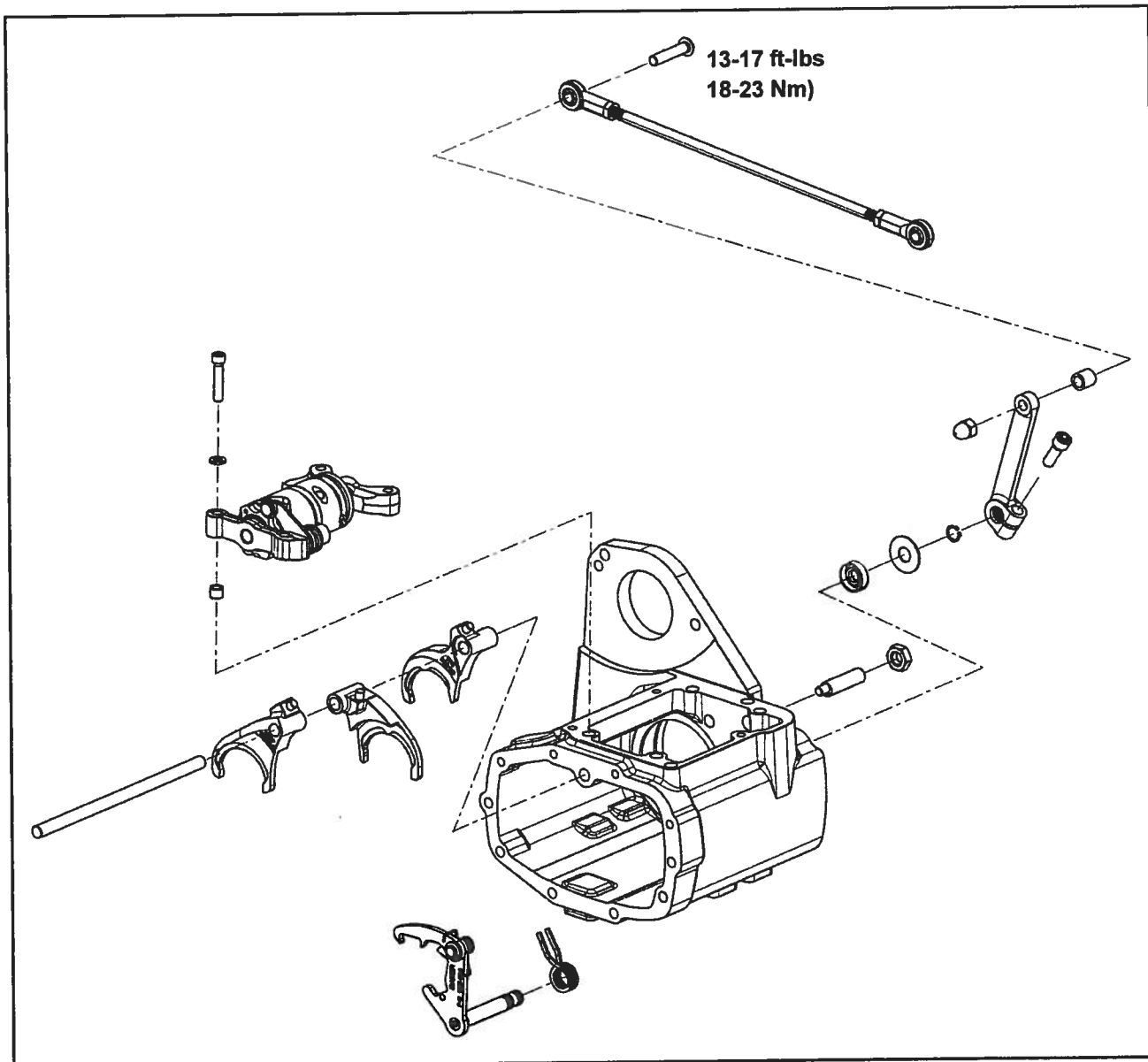
CRANKSHAFT ASSEMBLY



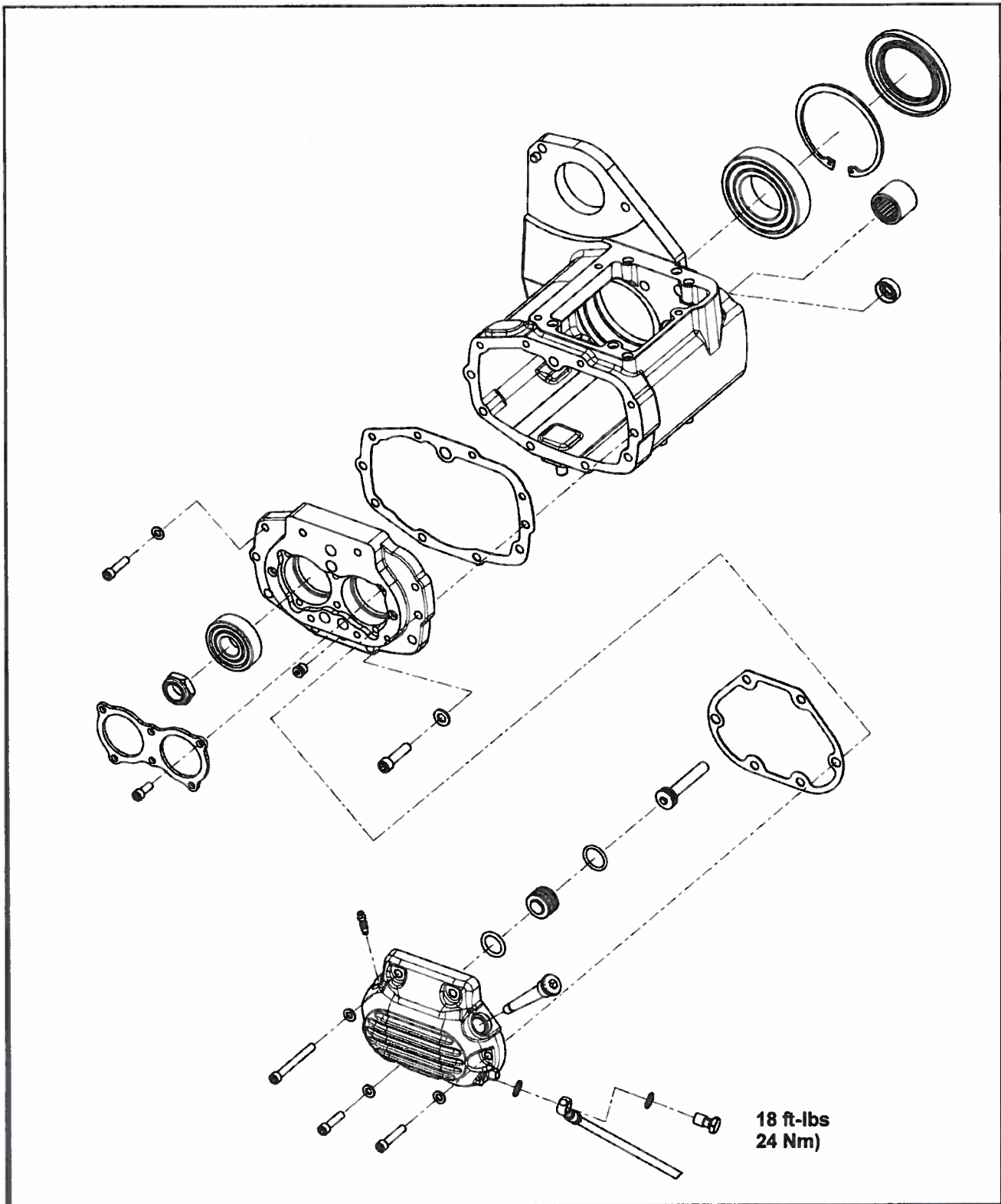
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TRANSMISSION & CRANKSHAFT

TRANSMISSION GEAR SHIFTER



TRANSMISSION BEARINGS AND COVERS

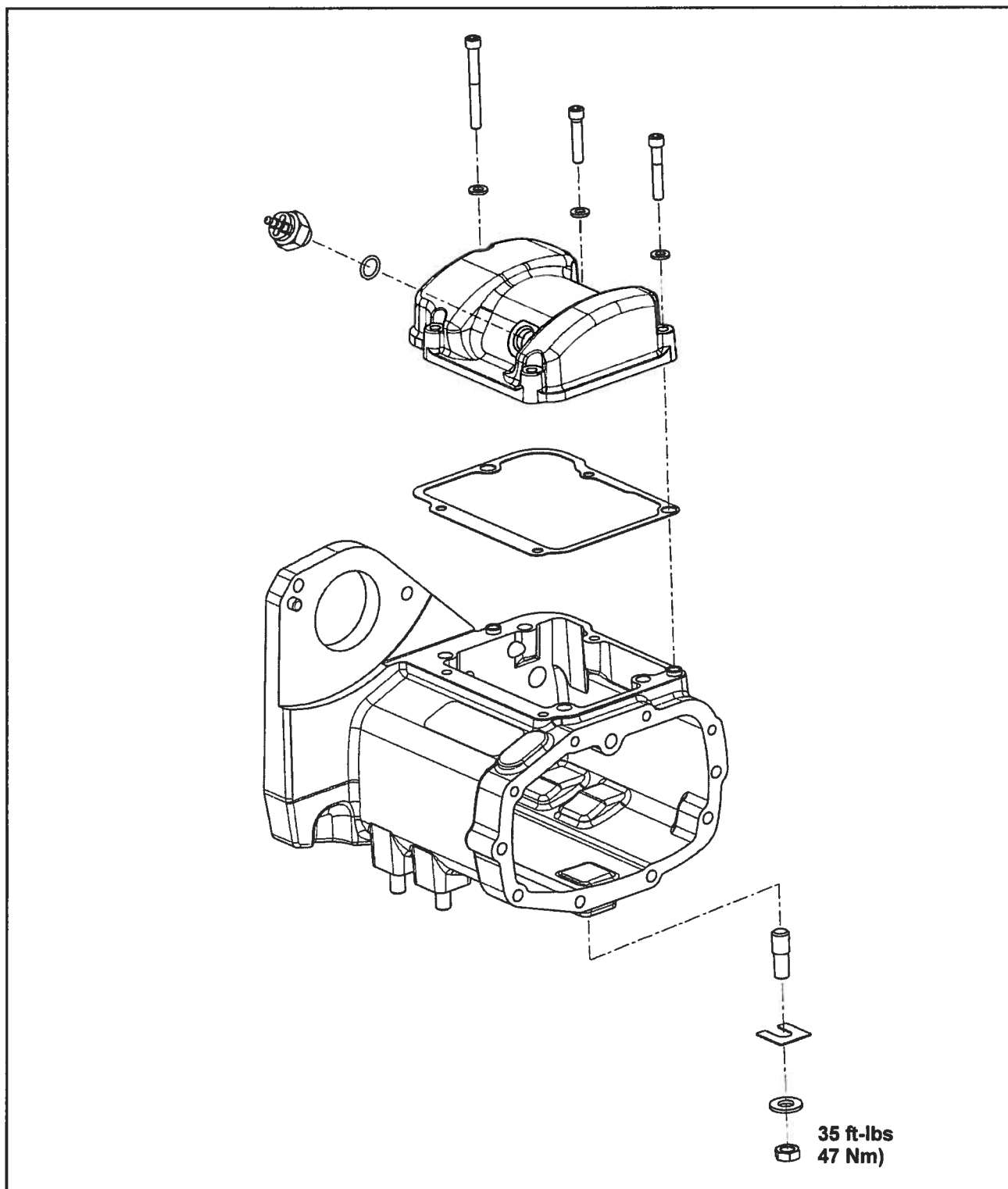


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TRANSMISSION & CRANKSHAFT

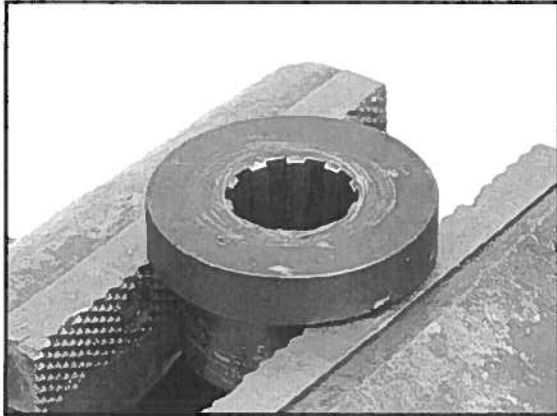
TRANSMISSION HOUSING



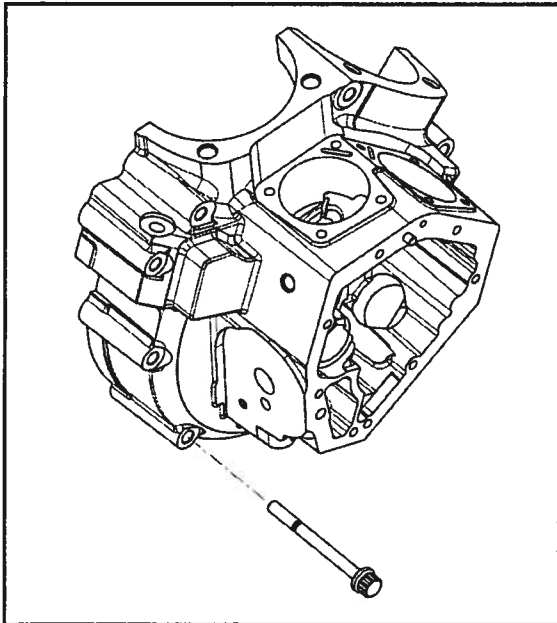
CRANKCASE

CRANKCASE SEPARATION

1. Mount sprocket shaft holder (commercially available) in a vice.

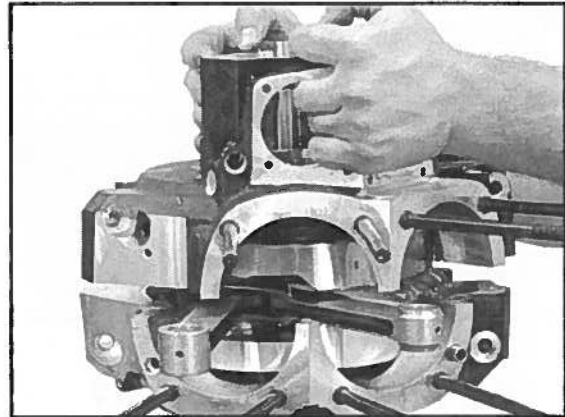


2. Place the crankcase assembly, sprocket shaft down into the sprocket shaft holder.
3. Remove crankcase bolts (Qty 8).

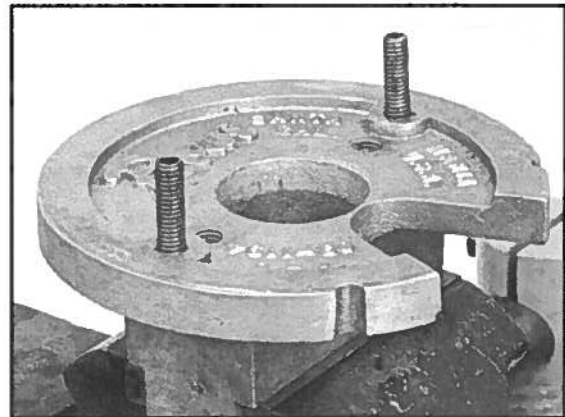


4. Using an appropriate soft-faced hammer, tap right half crank case to separate crankcase halves.

5. Remove right crankcase half.



6. Remove left crankcase assembly from sprocket shaft holder.
7. Remove sprocket shaft holder from vise and mount flywheel rebuilding jig (commercially available) in vise.

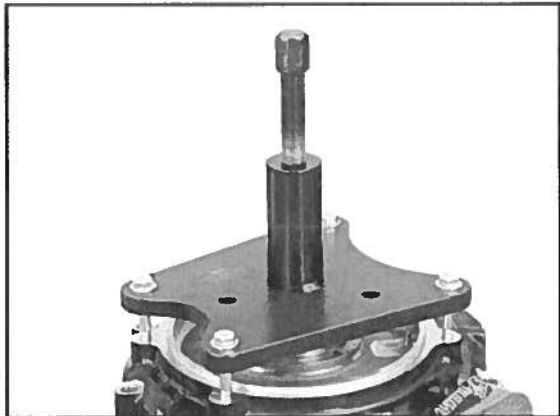


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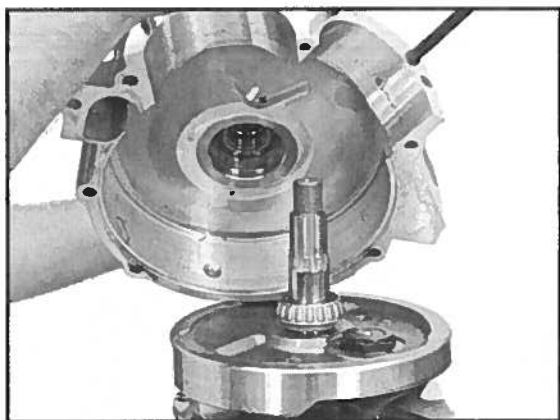
8. Mount left crankcase assembly onto flywheel rebuilding jig with pinion shaft facing down.
9. Remove left hand bearing spacer.

TRANSMISSION & CRANKSHAFT

10. Install the crank disassembly/removal tool (commercially available) onto the left case half. Follow tool instructions and separate left crankcase from crankshaft assembly.



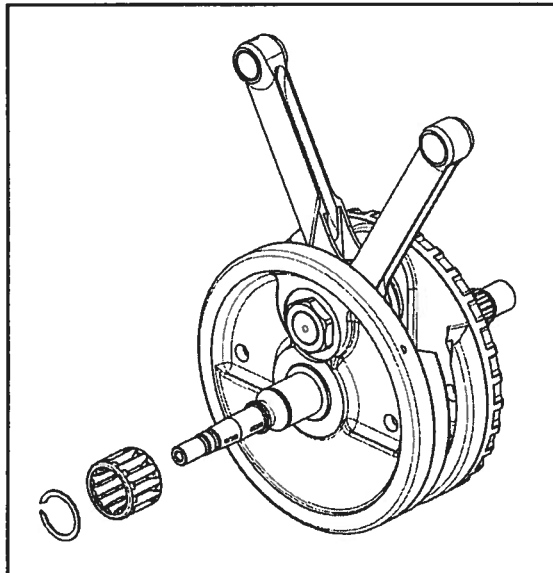
11. Remove left crankcase.



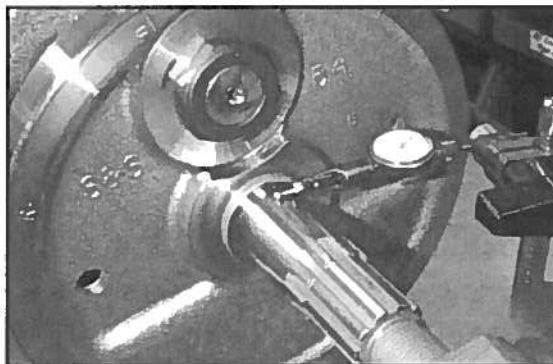
12. Using a seal puller, remove left hand bearing spacer seal from left crankcase half.

CRANKSHAFT INSPECTION

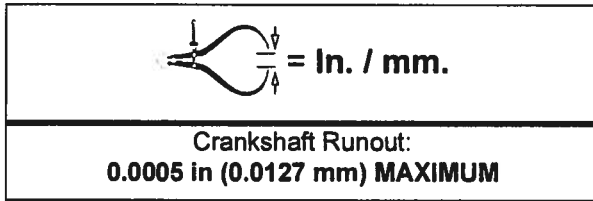
1. Remove retaining ring and discard.
2. Remove main bearing.



3. Clean crankshaft assembly with suitable solvent.
4. Place crankshaft assembly on crankshaft truing stand (commercially available). Follow instructions included with tool.
5. Place dial indicator on pinion bearing surface. Rotate crankshaft assembly. Compare reading to specification.



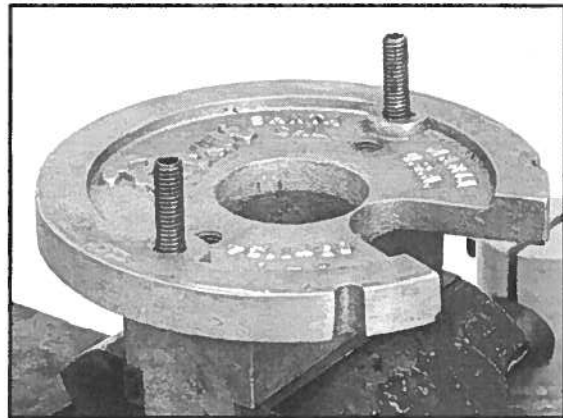
6. Place dial indicator on output shaft bearing surface. Rotate crankshaft assembly. Compare reading to specification.



7. If runout exceeds 0.0005" on either bearing surface replace crankshaft assembly.
 8. Install main bearing.
- NOTE:** If main bearing requires replacement, contact Indian Motorcycle with pinion bearing OD measurement to the ten-thousandths place.
9. Install new retaining ring.

CRANKCASE INSPECTION & ASSEMBLY

1. Clean the right and left crankcase halves in a suitable cleaning solution.
2. Remove Loctite sealant from crankcase mating surfaces. Inspect surfaces for nicks and scratches.
3. Inspect crankcase halves for cracks.
4. Inspect the crankcase alignment dowels for damage and confirm secure fit.
5. Inspect crankshaft assembly and confirm runout is within specification.
6. Mount flywheel rebuilding jig (commercially available) in vise.



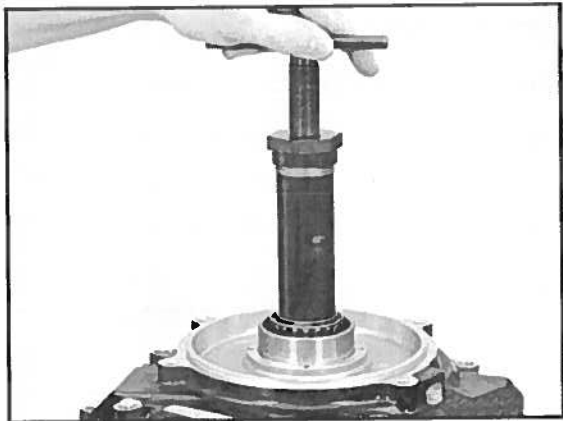
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7. Place the pinion side of crankshaft assembly in the rebuilding jig. The sprocket side of the crankshaft assembly facing up.
8. Apply assembly lube to the inside diameter of both cone bearings and to the outside diameter of the crankshaft output shaft.



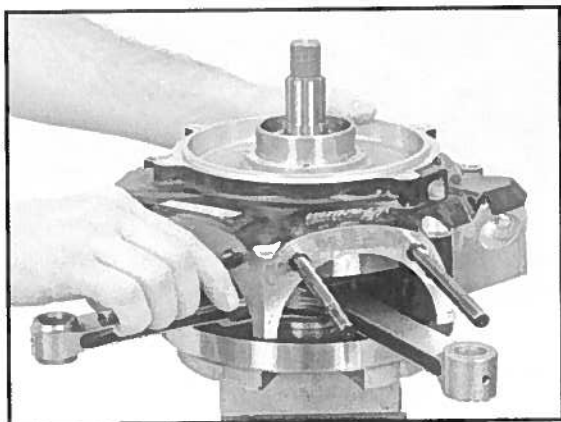
TRANSMISSION & CRANKSHAFT

9. Place one cone bearing (lettering facing crank) onto crank output shaft. Using sprocket shaft bearing installation tool (commercially available) and socket (commercially available), drive bearing on until seated. For further direction, refer to tool instructions.



10. Install cone bearing spacer on crankshaft output shaft.

11. Position left crankcase half on crankshaft output shaft. Make sure connecting rods are properly positioned in cylinder bores.

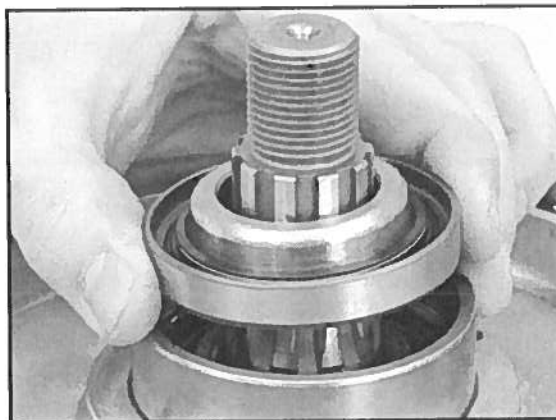


12. Install cone bearing (lettering facing up) on crankshaft output shaft.

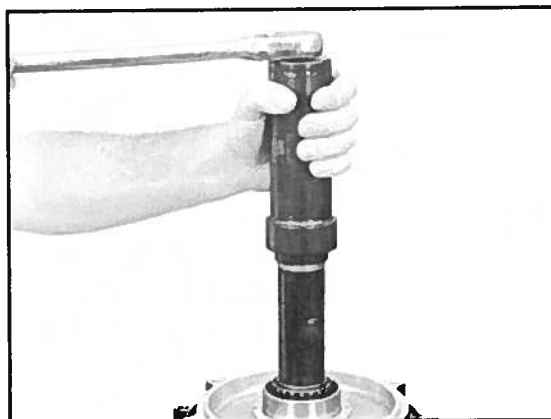
13. Using sprocket shaft bearing installation tool and socket, drive bearing on until seated against cone spacer. For further direction, refer to tool instructions.

14. Lubricate and install left hand main bearing spacer onto crankshaft output shaft.

15. Lubricate and position left hand bearing spacer seal over the left hand bearing spacer.



16. Using sprocket shaft bearing installation tool, seal install driver (commercially available), and socket, drive seal on until seated. For further direction, refer to tool instruction.



17. Remove left crankcase assembly from flywheel rebuilding jig.

18. Place the crankcase output shaft of crankcase assembly in the rebuilding jig with pinion shaft of crankcase assembly facing up.

19. Lubricate and install pinion bearing on pinion shaft.

20. Install retaining ring on pinion shaft.

21. Clean mating surface on both crankcase halves.

22. Apply Loctite™ 5699 sealant to the sealing surface of left crankcase half.

IMPORTANT: Crankcase halves must be assembled within three minutes after sealant application.

23. Position connecting rods in center of cylinder bores.
24. Position the right crankcase half on pinion shaft and align with dowel pins. Case halves should engage each other without force.
25. Apply Loctite™ 242 to threads of the eight crankcase bolts.
26. Install crankcase bolts. Torque to specification in sequence according to assembly view.



Crankcase Bolts:
Stage 1: 10 ft-lbs (14 Nm)
Stage 2: 18 ft-lbs (24 Nm)
Torque in Sequence

27. Remove excess sealant from crankcase split line.
28. Verify smooth rotation of crankshaft assembly.

CAUTION

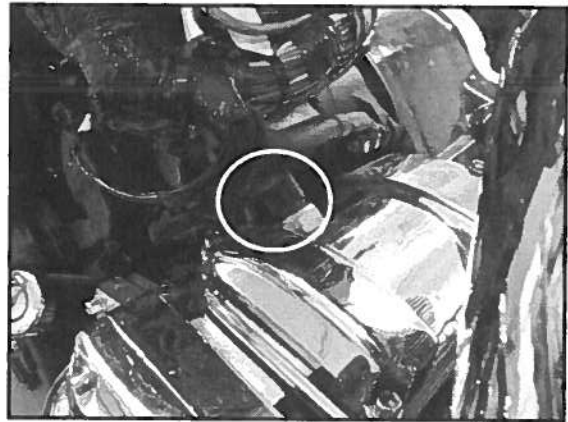
Use care during inspection not to damage crankcase bores with connecting rods.

TRANSMISSION

TRANSMISSION REMOVAL

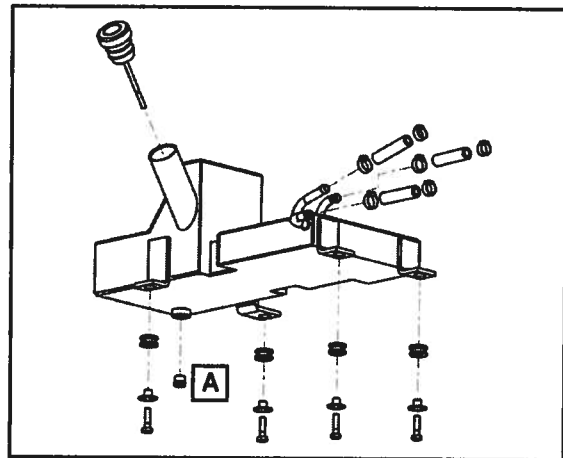
NOTE: Transmission to be serviced as an assembly.

1. Remove Seat. See Chapter 3.
2. Disconnect Battery.
3. Remove side covers and exhaust system. See Chapter 3.
4. Disconnect shift linkage from transmission shift lever.
5. Remove primary cover and clutch. See Chapter 9.
6. Remove starter. See Chapter 18.
7. Disconnect neutral switch electrical connectors.



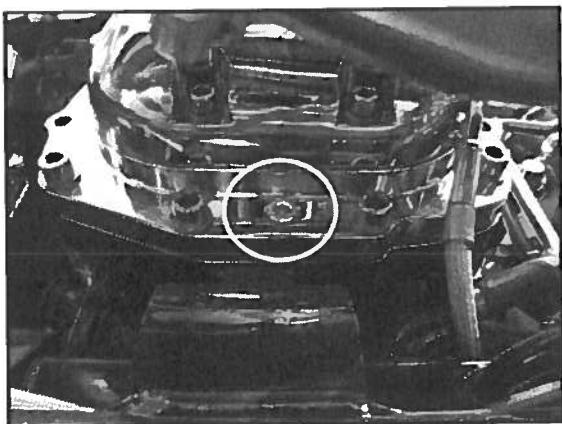
10

8. Drain oil tank by removing drain plug (A). Disconnect oil lines (Qty 3) and remove oil tank retaining fasteners (Qty 4). Lower oil tank out of the bottom of the frame.

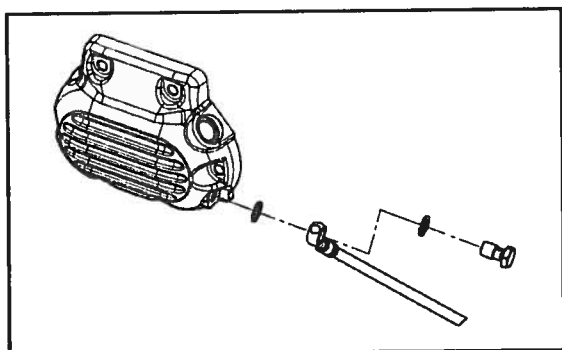


TRANSMISSION & CRANKSHAFT

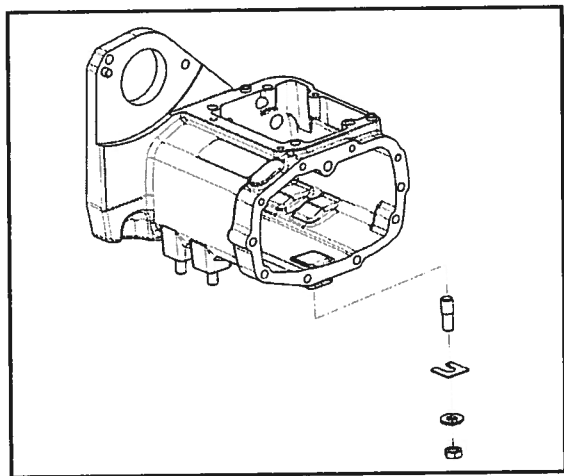
9. Place suitable drain pan under transmission and remove transmission drain plug from bottom of cover on right side of motorcycle.



10. Disconnect hydraulic clutch hose banjo fitting from transmission housing.



11. Remove Transmission mounting fasteners (Qty 5)



12. Remove Transmission from right side of motorcycle.

TRANSMISSION INSTALLATION

1. Place transmission into frame from right side of motorcycle.
2. Complete the Powertrain Alignment procedure found in Chapter 6 in order to mount the transmission in the correct orientation to the engine.
3. Connect the hydraulic clutch hose banjo fitting. Torque to specification.
4. Add fluid according to transmission oil change procedure found in Chapter 2.
5. Install oil tank and torque retaining fasteners to specification. Connect oil lines. Fill oil tank. Refer to Chapter 2 for information on oil type and capacity.
6. Connect neutral switch electrical connectors.
7. Install starter. See Chapter 18.
8. Install clutch and primary cover. See Chapter 9.
9. Connect shift linkage to transmission shift lever. Torque fastener to specification.
10. Install exhaust system and side covers. See Chapter 3.
11. Connect battery and install seat. See Chapter 3.



Clutch Banjo Fitting: **18 ft-lbs (24 Nm)**
Oil Tank Fasteners: **105 in-lbs (12 Nm)**
Shift Linkage Fastener: **13-17 ft-lbs (18-23 Nm)**



CHAPTER 11

DRIVE LINE

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DRIVE LINE

SPECIAL TOOLS

DRIVE LINE SPECIAL TOOLS

Drive Sprocket Nut Tool: N90000001

Drive Sprocket Locking Tool: Commercially available.

Torque Wrench with 250 Nm (185 lb.-ft.) range: Commercially available.

CAUTION

Some drive line repair or maintenance involves supporting the machine with the rear end elevated. Take precautions so the motorcycle is supported securely while the tire is off the ground to reduce the possibility of personal injury, or motorcycle damage.

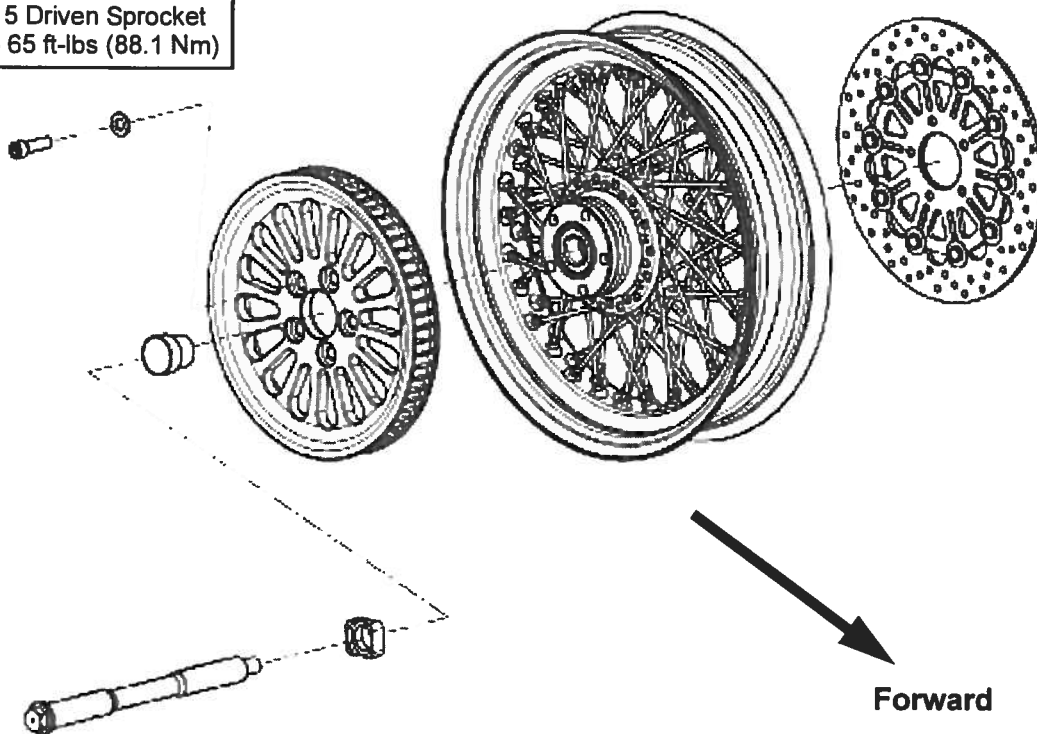
- Replace belt and sprockets as a set if the drive system has been in service for 5000 miles or more (8000 Km).
- Refer to Chapter 2 for **MAINTENANCE** of drive belt.
- Refer to Chapter 14 for **TIRE REMOVAL, REPAIR, & BALANCING**.
- Refer to Chapter 15 for **BRAKE SYSTEM** service and repairs.

ASSEMBLY VIEWS & TORQUE VALUES

REAR WHEEL FASTENER TORQUES

All surfaces and fasteners must be clean, dry, and oil free before assembly.
See Chapter 13 for Rear Wheel Removal / Installation.

Torque 5 Driven Sprocket bolts to 65 ft-lbs (88.1 Nm)



DRIVE SPROCKET FASTENER TORQUES

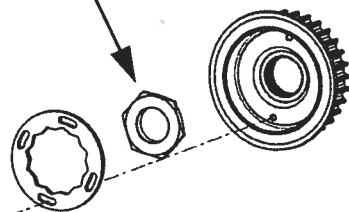
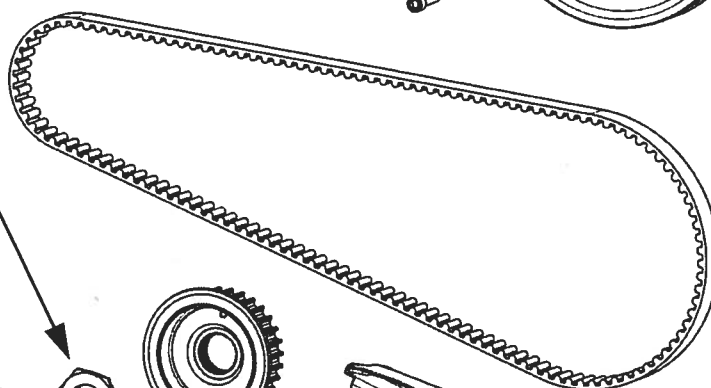
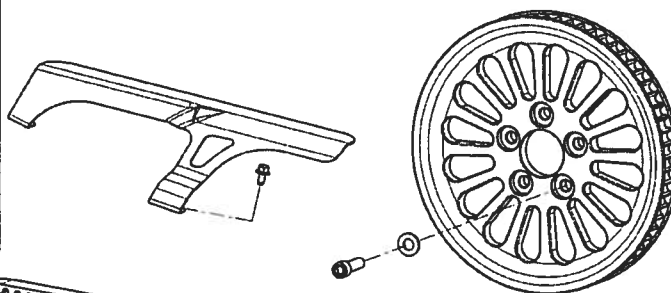
Inspect sprocket teeth and splines for wear at specified intervals. Refer to Chapter 2

See Chapter 13 for Rear Wheel Removal / Installation

NOTE: Drive Sprocket nut has left hand threads.

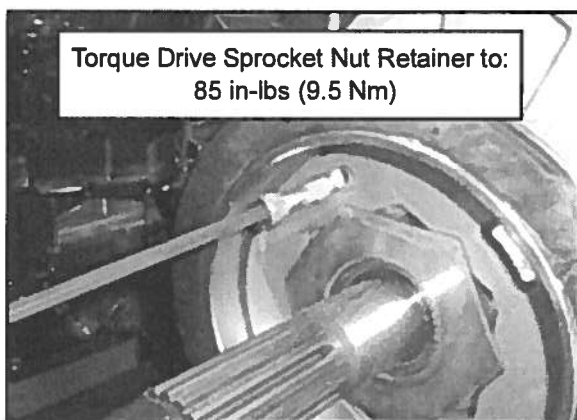
Torque Sequence:

1. 100 ft-lbs (135.58 Nm).
2. Loosen nut and retorque to 35 ft-lbs (47.5 Nm).
3. Tighten an additional 45°

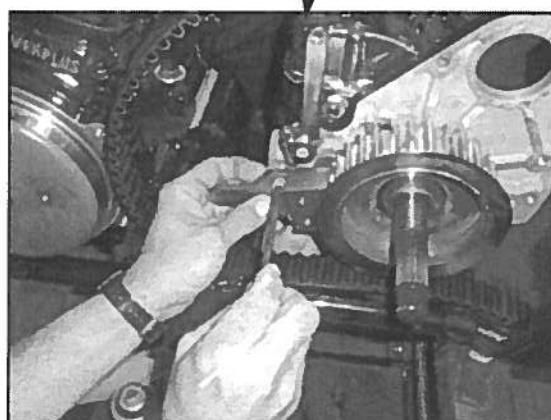


85 in-lbs (9.5 Nm)

Drive Sprocket Locking Tool
Commercially available



Torque Drive Sprocket Nut Retainer to:
85 in-lbs (9.5 Nm)



DRIVE LINE

DRIVE BELT

BELT INSPECTION

NOTE: Inspect drive belt in accordance with the Periodic Maintenance Interval Chart located in Chapter 2 of this manual. Replace drive belt at specified intervals regardless of belt condition.

1. Periodically inspect drive belt for cuts, excessive wear, foreign substance, missing teeth, or any other damage.
2. If any damage is found, the belt should be replaced.
3. Inspect drive belt tension and adjust as necessary (see Chapter 2).
4. If one or more components are damaged, replace belt and both sprockets as a set if the drive system has been in service for 5000 miles (8000 Km) or more.

BELT REMOVAL

NOTE: If you plan to remove the front sprocket, refer to Drive Sprocket Removal located in this chapter.

NOTE: If belt is to be reinstalled, always mark the 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. Secure motorcycle front wheel in a stand.
2. Place a jack underneath the engine and lift until the rear tire is not resting on the surface.
3. Remove side covers (page 3.3).
4. Remove seat (page 3.7) and disconnect battery (page 2.19).
5. Remove the muffler assembly (page 3.9)
6. Remove the lower belt guard.
7. Remove the rear fender (page 3.11).

8. Remove the rear wheel (see Chapter 13).
9. Remove cable tie securing rear brake line to lower right of swingarm.
10. Remove primary cover, primary drive, and inner primary. (see Chapter 9)
11. Remove oil tank (page 4.5).
12. Supporting swingarm, remove the lower rear shock mount hardware (see Chapter 13).
13. Remove left and right swingarm bolts and carefully remove swingarm. If applicable, note location of shims in between swingarm and frame.
14. Remove the drive belt.

BELT INSTALLATION

1. Inspect sprockets and verify sprocket fasteners are tight.
 2. Place belt onto drive sprocket.
 3. Position the left side of the swingarm through the drive belt and install swingarm into frame.
- NOTE:** If applicable, ensure shims that were removed with the swingarm are reinstalled in the same location.
4. Supporting swingarm, torque pivot bolts to specification.



Swingarm Pivot Bolts:
60 ft-lbs (81.3 Nm)

5. Grasp swingarm and check for side play and free rotational movement. If excessive side play is found, utilize shims to correct.
6. Install rear shock mount to swingarm mount and torque to specification. (32 lb. ft.)



Shock Mount to Swingarm:
32 ft-lbs (43.4 Nm)

7. Install oil tank (page 4.5).
8. Install primary cover, primary drive, and inner primary (see Chapter 9).

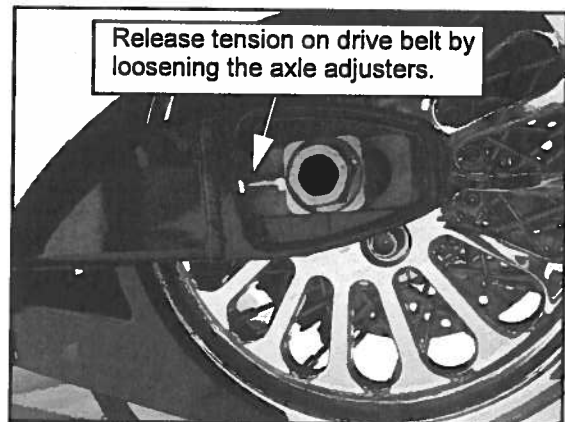


9. Install rear wheel (see Chapter 13) and replace cable tie securing rear brake line to lower right of swingarm.
10. Set drive belt tension using sonic tension meter (page 2.24).
11. Install rear fender (page 3.11).
12. Install lower belt guard.
13. Install muffler (page 3.9).
14. Install center covers.
15. Connect battery and install seat.
16. Rotate rear wheel and verify that it rotates smoothly and quietly.

DRIVE SPROCKET

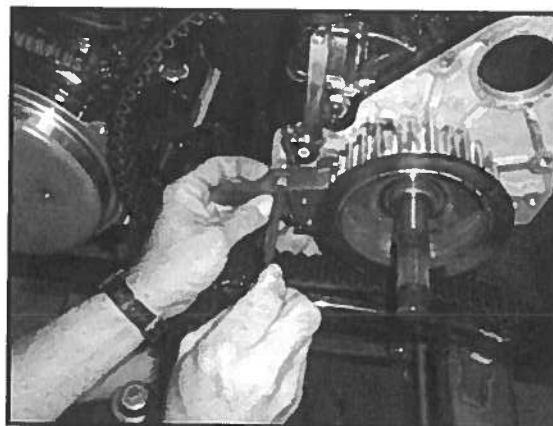
DRIVE SPROCKET REMOVAL

1. Support motorcycle securely in an upright position by clamping front tire in a wheel vise or lift bench. Using a scissor jack, lift the rear of the motorcycle off of the table.
2. Remove seat (page 3.7) and disconnect battery (page 2.19).
3. Remove side covers (page 3.3).
4. Loosen rear axle and move rear wheel forward to release tension on the drive

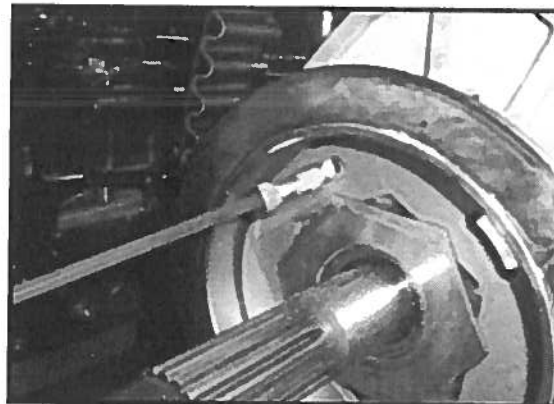


5. Remove primary cover, primary drive, and inner primary (see Chapter 9).
6. Pull belt off and to the left off of driven sprocket. Pull belt slack forward off of drive sprocket.

7. Install drive sprocket locking tool to drive sprocket.



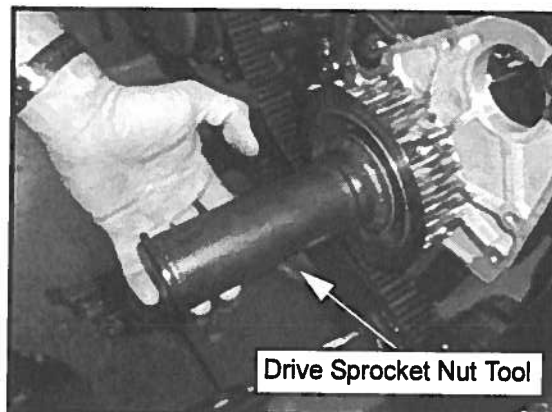
8. Remove the two sprocket lock plate screws and lock plate.



CAUTION

Drive sprocket nut has left hand threads and must be turned **CLOCKWISE** to loosen.

9. Using sprocket nut tool N90000001, remove the sprocket nut.



DRIVE LINE

10. Remove drive sprocket locking tool and drive sprocket.
11. Inspect sprocket teeth for wear or damage from foreign material.
12. If drive sprocket is damaged, replace belt and both sprockets as a set if the drive system has been in service for 5000 miles (8000 Km) or more.

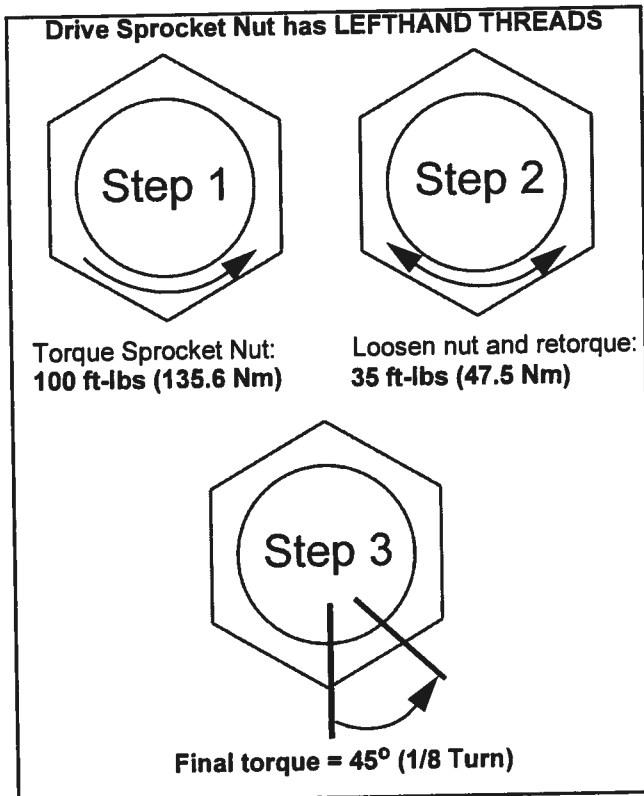
DRIVE SPROCKET INSPECTION

1. Visually inspect sprocket teeth (A) for excessive wear, foreign material damage.

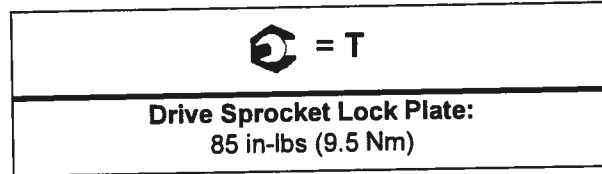
NOTE: Sprockets and belt normally exhibit a polished appearance due to normal operation. Belt replacement is not required unless uncharacteristic damage is noted, or if the mileage service interval is reached. Belt or sprocket damage is usually due to debris trapped between belt and sprocket, or from improper maintenance and adjustment.

DRIVE SPROCKET INSTALLATION

1. Install drive sprocket and drive sprocket locking tool.
2. Install the drive sprocket nut and torque to specification following the sequence outlined below.



3. Apply Loctite 242® to bolts and install the sprocket lock plate. Torque bolts to specification.



4. Install drive belt onto drive sprocket.
5. Install primary cover, primary drive, and inner primary (see Chapter 9).
6. Set drive belt tension using sonic tension meter (page 2.24).
7. Tighten rear axle nut and adjustment jam nuts.
8. Install side covers.
9. Connect battery and install seat.
10. Rotate rear wheel to verify smooth and quiet operation.

REAR SPROCKET

REAR SPROCKET REMOVAL

1. Remove rear wheel (Chapter 13).
2. Position wheel with drive sprocket facing up. Use caution not to damage brake rotor.

CAUTION

Protect brake disc surface while working on wheel.

3. Remove the five drive sprocket fasteners and five flat washers.
4. Remove the drive sprocket.



REAR SPROCKET INSPECTION

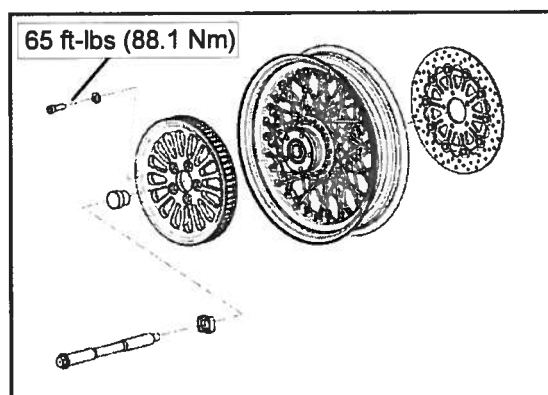
1. Visually inspect sprocket teeth for excessive wear and damage from foreign material or road debris. Inspect hub for cracks or damage.
2. Visually inspect sprocket mounting surface on wheel for wear.

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. Refer to the Periodic Maintenance Table in chapter 2 for drive system replacement interval.

3. Inspect sprocket mating surface for galling, roughness, or cracks. Surface must be flat, with no burrs or surface irregularities.

REAR SPROCKET INSTALLATION

1. Clean sprocket bolt threads in hub to remove all grease or oil residue.
2. Clean mating surfaces of wheel and sprocket.
3. Install sprocket with new bolts. Do not re-use sprocket bolts.
4. Torque bolts in a star pattern to specified torque.



Rear Sprocket Bolts:
65 ft-lbs (88.1 Nm)

5. Install rear wheel (Chapter 13).



DRIVE LINE

TROUBLESHOOTING

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	POSSIBLE REPAIR NEEDED
Belt Shows Excessive Wear On One Side	Out-of-Alignment	Align rear wheel
Belt Squeal / Noise	Belt too tight	Adjust drive belt to specified tension using a Drive Belt Tension meter.
	Out-of-Alignment	Align rear wheel
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 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 for extended period	Replace Belt, Replace Sprockets



CHAPTER 12

FRONT WHEEL / SUSPENSION

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FRONT WHEEL / SUSPENSION

GENERAL

IMPORTANT INFORMATION

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 inflation decal.

Indian motorcycles use tubeless tires on all 2009-2012 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 may contaminate the front brake components which could reduce stopping ability of the motorcycle. Contaminated brake discs or pads greatly reduce the amount of stopping force available & increase stopping distance. Brake discs can be cleaned using brake cleaner. **NEVER** attempt to clean contaminated brake pads. Replace pads as a set.

- Refer to Chapter 2 for **MAINTENANCE** of front end components.
- Refer to Chapter 14 for **TIRE REMOVAL, REPAIR, & BALANCING**.
- Refer to Chapter 15 for **BRAKE SYSTEM** service and repairs.

SPECIAL TOOLS

SPECIAL TOOLS

Fork Seal Driver	Commercially available

MAINTENANCE PRODUCTS

MAINTENANCE PRODUCTS

Hand Grip Adhesive - Three Bond 1501 (10 ml tube)	2872575
FORK OIL TYPE	
2009-2011: Indian Fork Oil	N90700007
2012: Fork Oil	2872184

Refer to Chapter 2 for a complete list of maintenance products and part numbers.

TORQUE SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

Refer to Assembly Views on page 12.4 through page 12.9 for fastener torque specifications.



FRONT WHEEL / SUSPENSION

SPECIFICATIONS

FRONT FORK SERVICE SPECIFICATIONS

2009-2011 Indian Motorcycle (all models)			
Item		Standard	Service Limit
Axle Runout		-	.20 mm (.008")
Front Wheel Runout (Spoked and Billet Type) 3.5" x 16"	Axial	.50 mm (.020")	2.0 mm (.080")
	Radial	.50 mm (.020")	2.0 mm (.080")
Tube Diameter - FORKS / TRIPLE CLAMP		41 mm	Not Applicable
Fork Tube Runout		-	.20 mm (.008")
Fork Oil Type		Indian Fork Oil PN: N90700007	
Fork Oil Capacity (per leg, dry)		10.5 oz. (310.5 cc)	Set Level See "FORK OIL DRAINING & REPLACEMENT (2009- 2011)" page 12.18

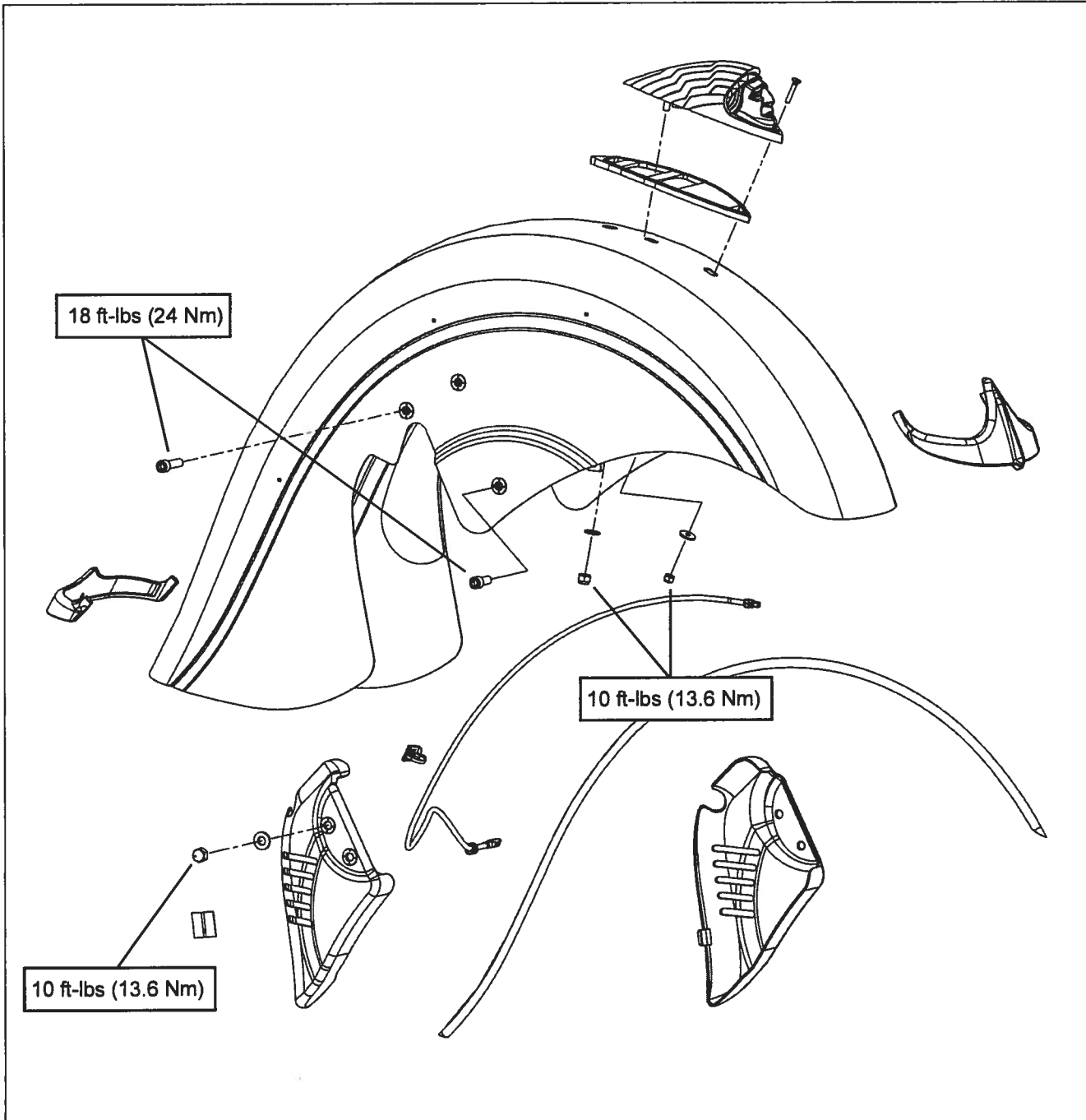
2012 Indian Motorcycle (all models)			
Item		Standard	Service Limit
Axle Runout		-	.20 mm (.008")
Front Wheel Runout (Spoked and Billet Type) 3.5" x 16"	Axial	.50 mm (.020")	2.0 mm (.080")
	Radial	.50 mm (.020")	2.0 mm (.080")
Tube Diameter - FORKS / TRIPLE CLAMP		40.9 mm	Not Applicable
Fork Tube Runout		-	.20 mm (.008")
Fork Oil Type		Fork Oil PN: 2872184	
Fork Oil Capacity (per leg, dry)		11.0 oz. (325 cc)	-



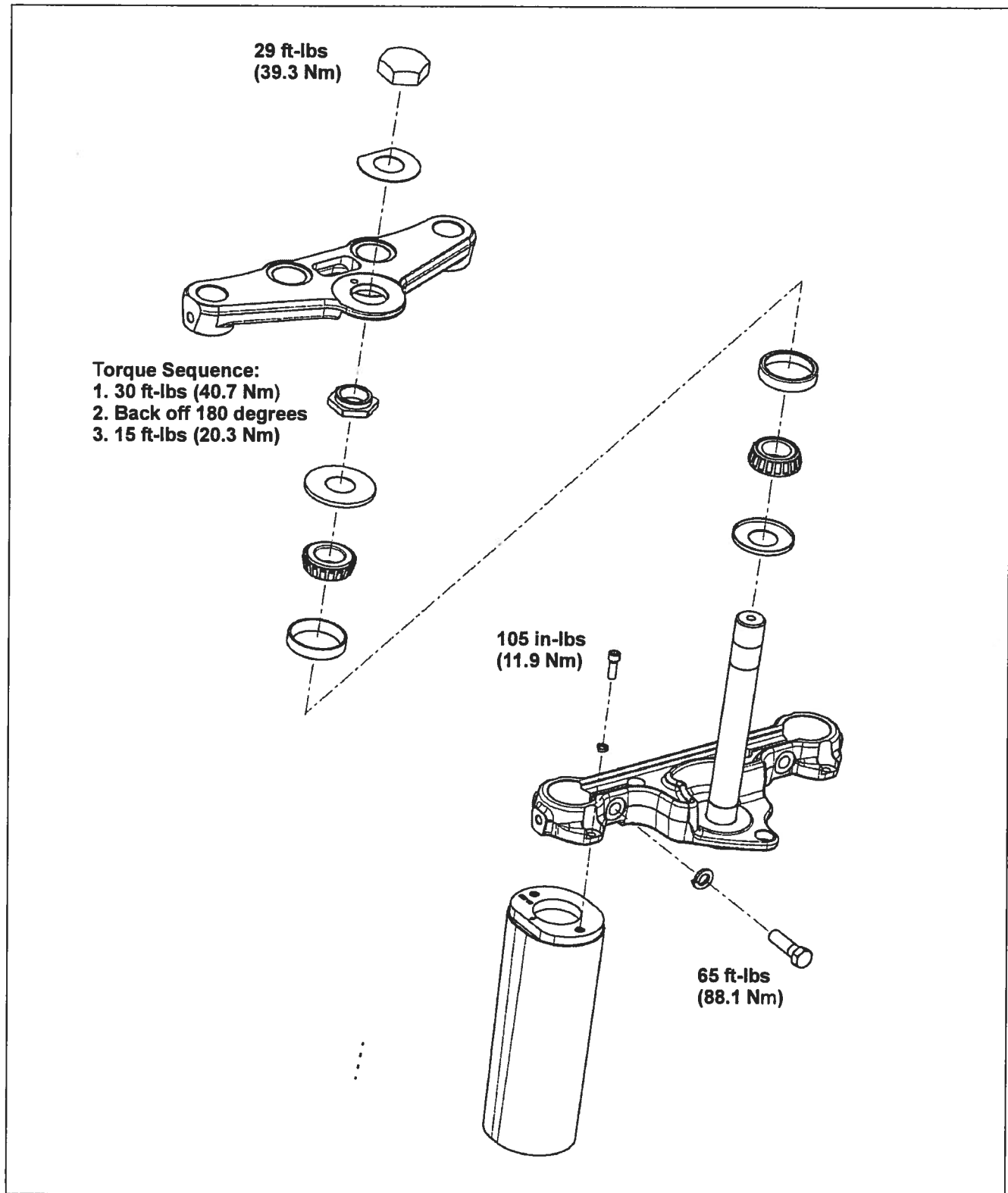
FRONT WHEEL / SUSPENSION

ASSEMBLY VIEWS & TORQUE VALUES

ASSEMBLY VIEW, FRONT FENDER

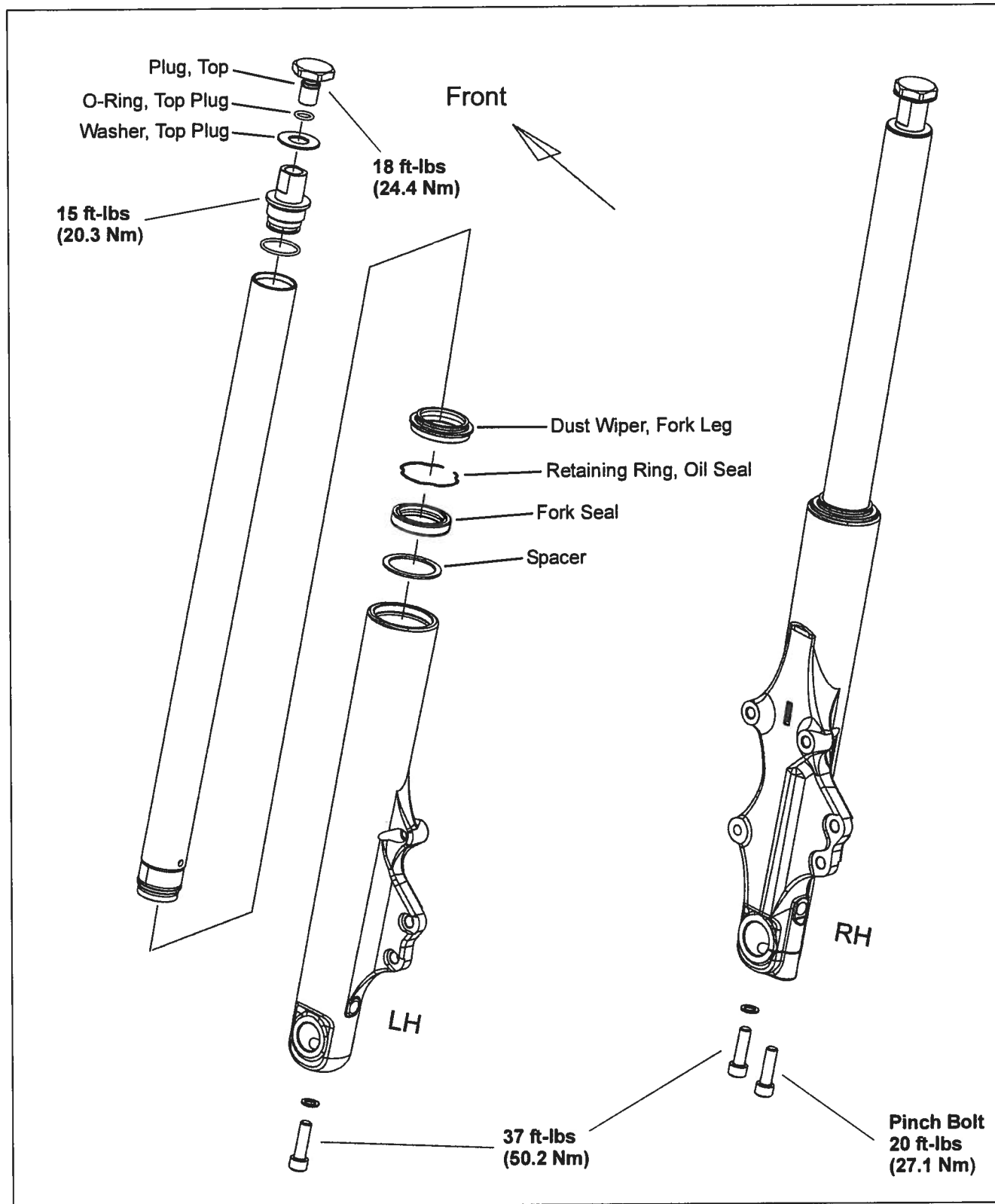


ASSEMBLY VIEW, TRIPLE CLAMP

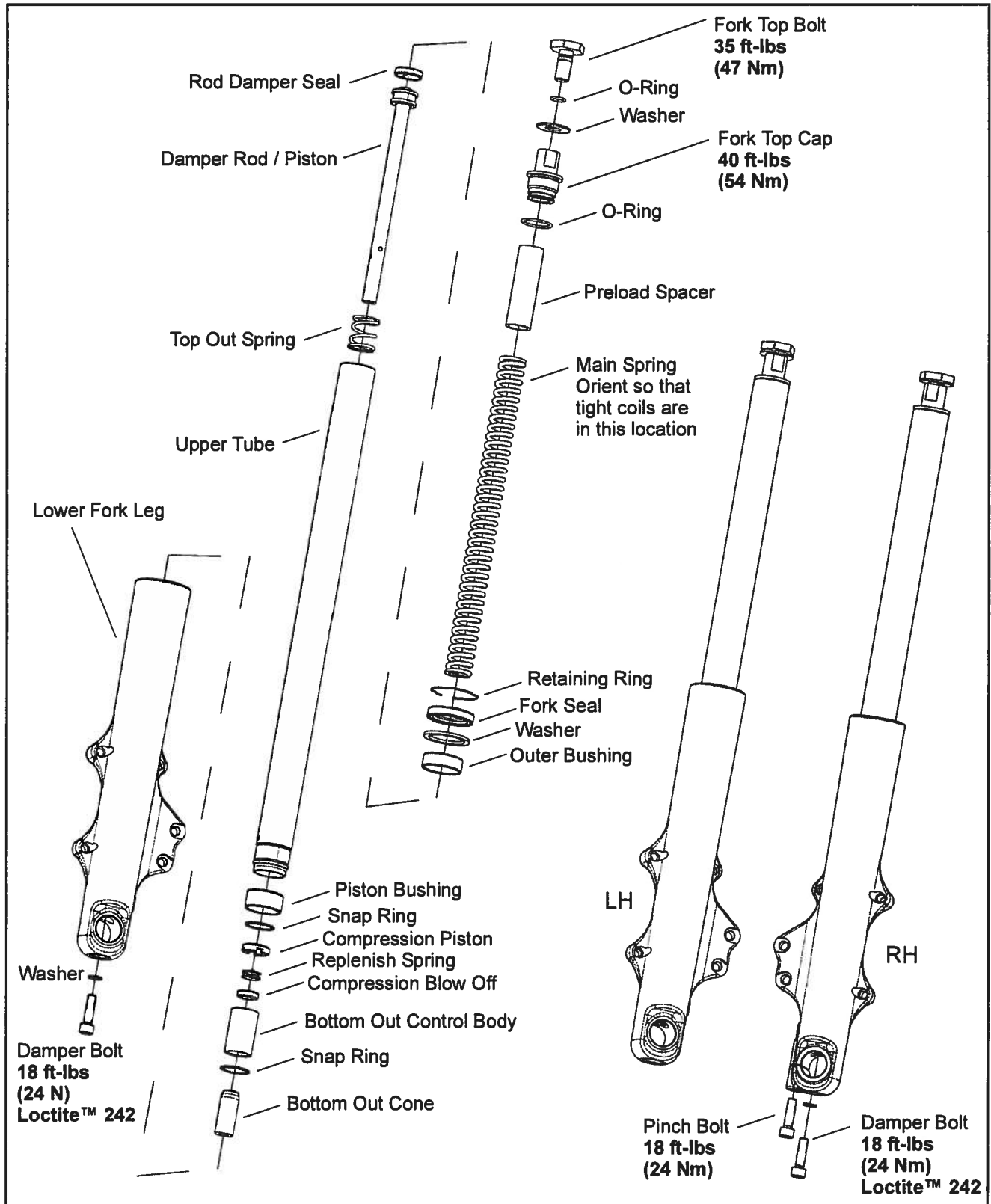


FRONT WHEEL / SUSPENSION

ASSEMBLY VIEW, FRONT FORK 2009-2011



ASSEMBLY VIEW, FRONT FORK 2012



12



FRONT WHEEL / SUSPENSION

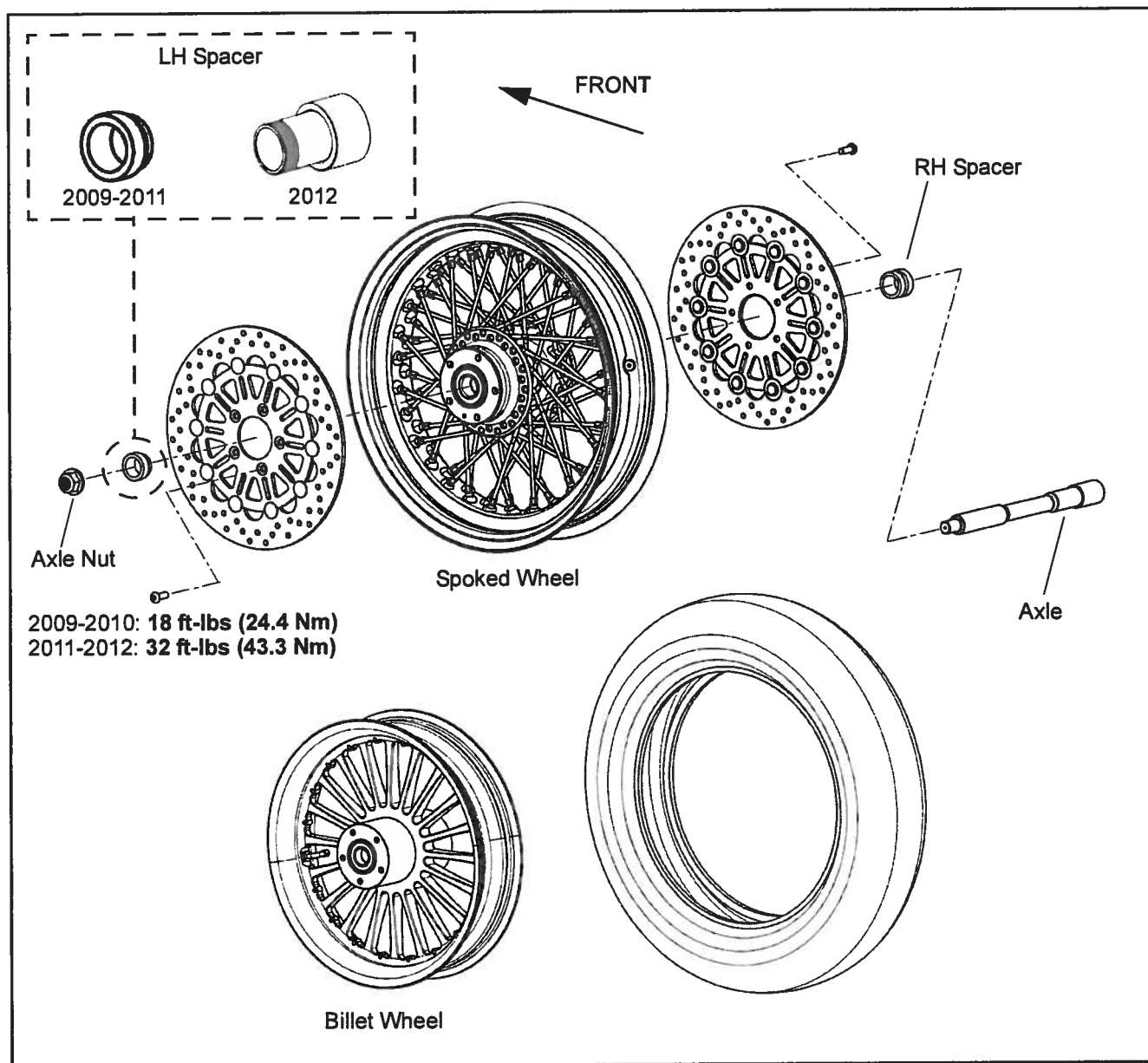
ASSEMBLY VIEW, FRONT WHEEL

Wheel / hub assemblies are non-serviceable. If damage occurs to individual wheel components, wheels must be replaced as a complete assembly.

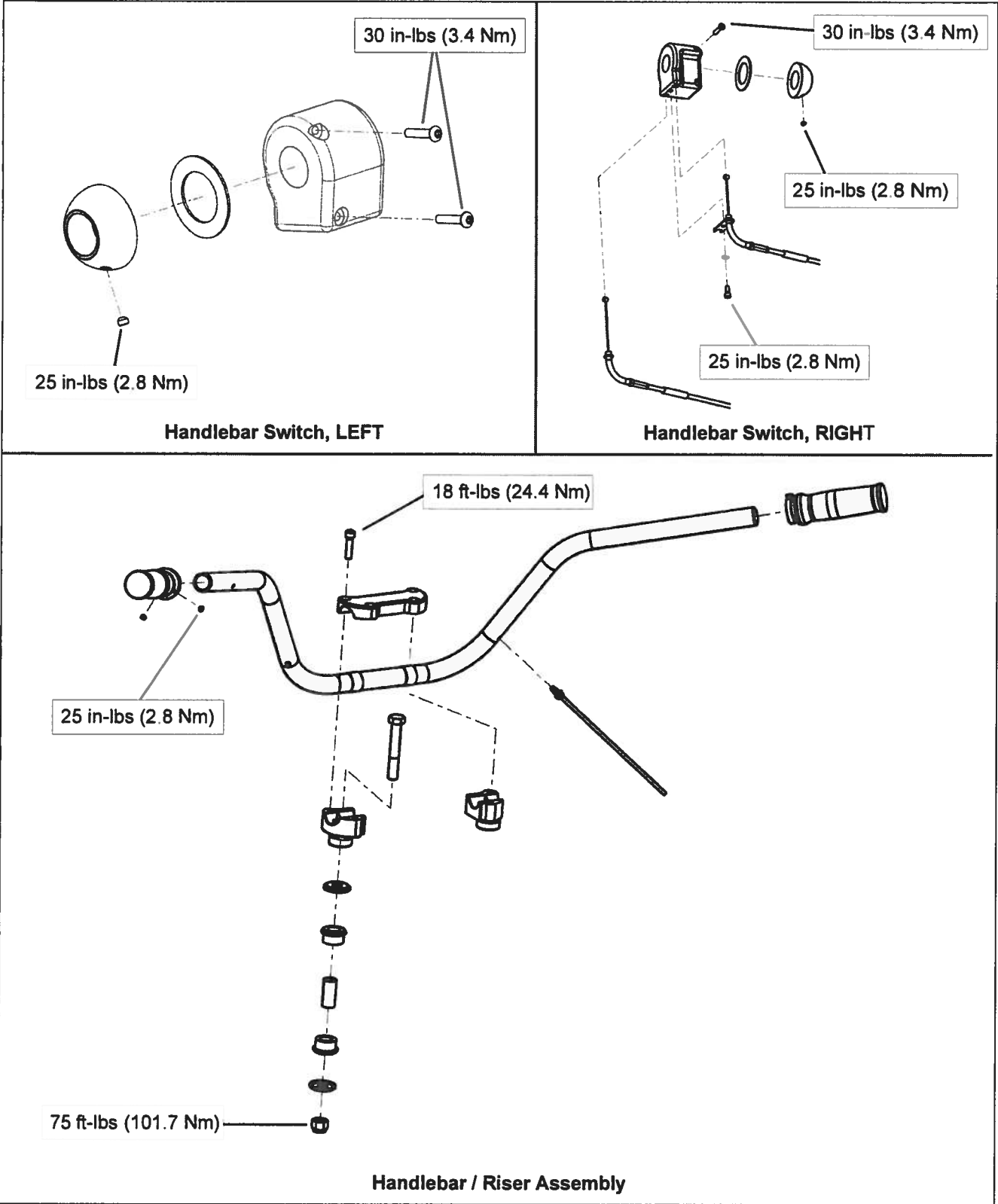
IMPORTANT: Two different left hand wheel spacers are used depending on model year. The first spacer fits model year 2009-2011 Indian Motorcycles while the second type fits model year 2012 Motorcycles.

WARNING

For 2012 models, the left hand spacer must be placed into the LEFT fork on the same side as the axle nut. If spacer is placed in RIGHT fork, pinch bolt will clamp spacer instead of axle shoulder and axle will be in a free-floating state. This can lead to reduced handling capabilities and a possible loss of control.



ASSEMBLY VIEW, HANDLEBAR



FRONT WHEEL / SUSPENSION

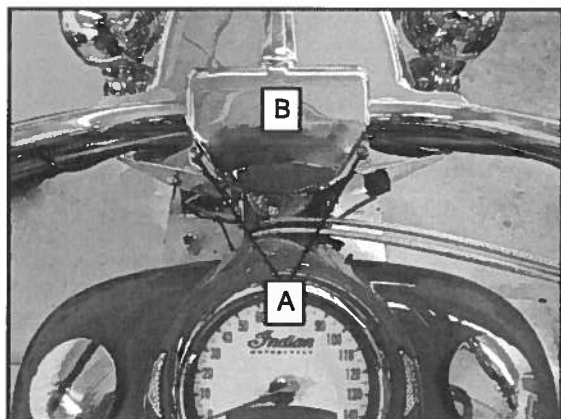
SERVICE PROCEDURES

CONTROL / SWITCH CUBE REMOVAL

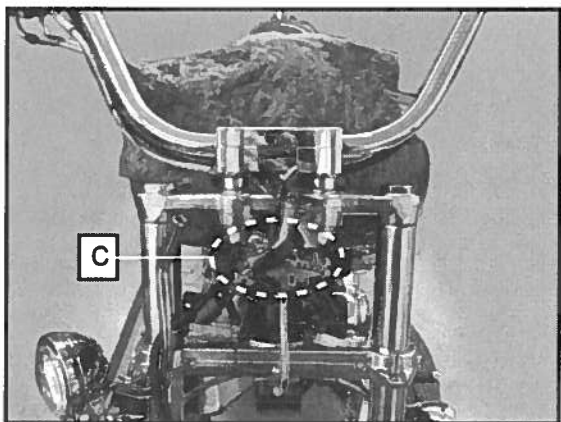
NOTE: Procedures for removing left and right hand switch / control assemblies are the same unless otherwise designated.

Left & Right Hand Control Removal

1. Secure motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Place a protective cover over the fuel tank to prevent damage to painted surfaces.
3. Remove screws (A) securing riser cover (B) and remove riser cover.



4. Remove headlight assembly from motorcycle (see Chapter 19).
5. Disconnect switch cube harness connectors (C) from main harness located behind headlight.



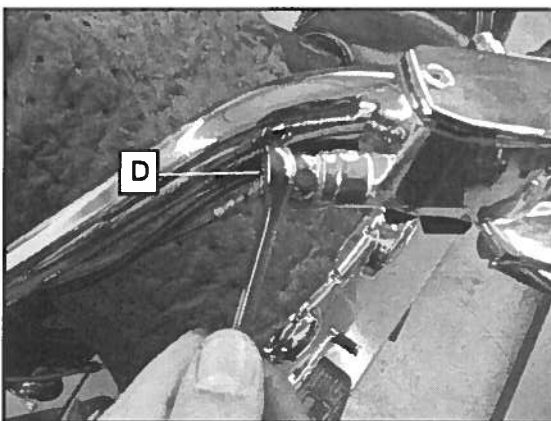
6. Route switch housing wire harness from under headlight housing and out from around handlebar riser assembly. **Note routing for installation.**
7. Remove barbed end zip ties securing switch housing harness to handlebar.
8. Remove clutch / brake master cylinder cover(s) (page 2.13) and extract fluid using a suitable suction device.

CAUTION

Replace master cylinder cover(s) immediately following fluid extraction to prevent contamination.

9. Remove banjo bolt (D) and sealing washers from clutch / brake master cylinder(s). Discard sealing washers.

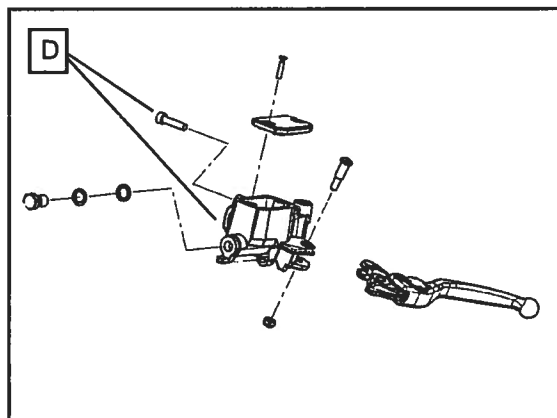
NOTE: Install rubber stopper in master cylinder outlet port(s) to prevent fluid leakage and contamination.



Left Hand Grip Removal:

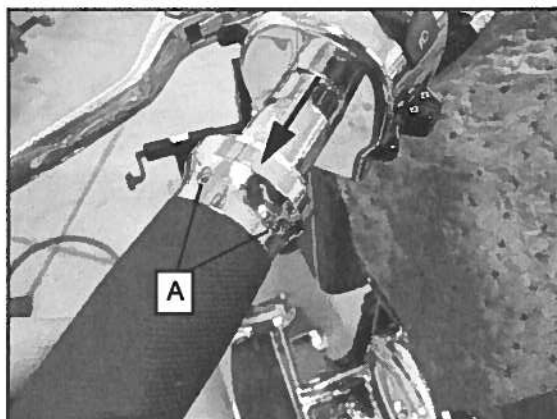
10. Disconnect clutch lever micro-switch connector from harness behind headlight. Cut cable ties securing micro-switch harness to handlebar.

11. Remove bolts (D) securing the clutch master cylinder to the handlebar and remove master cylinder.



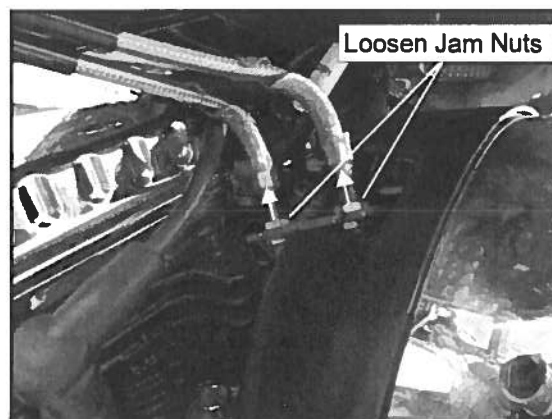
12. Remove screws securing the left hand switch assembly and remove switch.

13. Loosen the set screws (A) securing the left hand grip and slide grip off of handlebar.

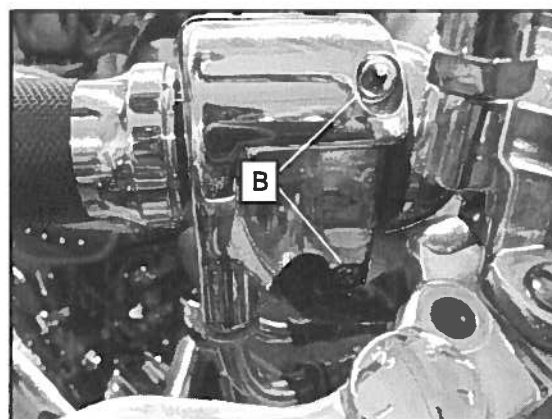


Right Hand (throttle) Grip Removal:

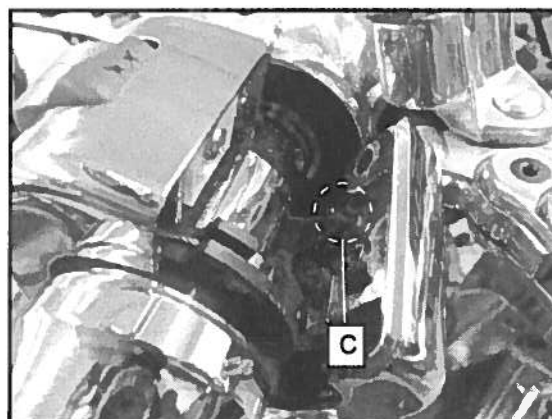
14. Slacken throttle cables at the throttle body by loosening the upper jam nuts and turning them all the way in to the cable housing.



15. Remove screws (B) from switch cube and split switch cube housing.

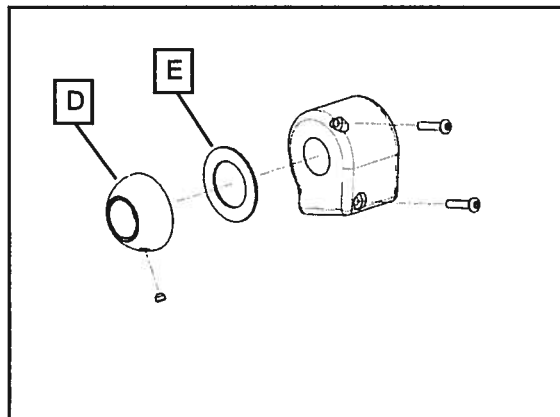


16. Spread switch cube apart far enough to release the dowel pin (C) and slide throttle grip assembly off of handlebar.



FRONT WHEEL / SUSPENSION

17. Remove hand control spacer (D) and hand control spacer gaskets (E) from handlebar.

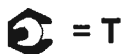


CONTROL / SWITCH CUBE INSTALLATION

1. Install hand control spacer gasket(s) and hand control spacer(s) onto handlebar.

Left Hand Grip Installation

- Slide hand grip into position and torque set screws to specification.
- Position left hand switch cube, install screws and tighten to specification.
- Position the hand control spacer gasket and spacer against the switch cube and tighten set screw to specification.
- Install clutch master cylinder, rotate reservoir so it is perpendicular to the ground. Torque bolts to specification.
- Install clutch line to master cylinder using banjo bolt and new sealing washers. Torque to specification.
- Fill master cylinder reservoir with DOT 4 fluid and bleed clutch hydraulic system (see page 2.13).



Hand Grip Set Screws: **25 in-lbs (2.8 Nm)**
Switch Cube Screws: **30 in-lbs (3.4 Nm)**
Clutch Master Cylinder Bolts: **105 in-lbs (11.9 Nm)**
Clutch Master Banjo Bolt: **15 ft-lbs (20.3 Nm)**
Hand Control Spacer: **25 in-lbs (2.8 Nm)**

Right Hand (throttle) Grip Installation

- Install throttle grip and switch cube assembly onto handlebar.
- With throttle grip positioned inside switch housing, install screws. **DO NOT TIGHTEN.**
- Position switch cube / control assembly so that the dowel pin fits inside of the hole drilled in the handlebar. Tighten to screws to specification.
- Position the hand control spacer gasket and spacer against the switch cube and tighten set screw to specification.
- Position master cylinder assembly and clamp onto handlebars and install fasteners. Do not tighten.
- Rotate master cylinder assembly and switch housing together to desired location. Master cylinder reservoir should be perpendicular to ground. Torque bolts to specification.
- Install brake line to master cylinder using banjo bolt and new sealing washers. Torque to specification.
- Fill master cylinder reservoir with DOT 4 fluid and bleed brake hydraulic system (see Chapter 15).
- Set throttle cable freeplay (see page 2.11).
- Route left and right switch cube connectors between the handlebar risers, secure with cable ties and reconnect.
- Install headlamp assembly (see Chapter 19).
- Install riser cover and torque to specification.



Switch Cube Screws: **30 in-lbs (3.4 Nm)**
Brake Master Cylinder Bolts: **105 in-lbs (11.9 Nm)**
Brake Master Banjo Bolt: **15 ft-lbs (20.3 Nm)**
Hand Control Spacer: **25 in-lbs (2.8 Nm)**
Riser Cover: **85 in-lbs (9.6 Nm)**



HANDLEBAR REMOVAL

CAUTION

Many items will be hanging loose when removing the handlebars. Cover painted or chrome parts to prevent damage. Keep master cylinder reservoirs upright to prevent air from entering. Special care should be taken to protect cosmetic surfaces from loose parts during the removal process. Secure or support parts or set them aside as they are removed. Note wire harness and cable routing for assembly later. **DO NOT** bend or kink cables during the removal process.

NOTE: Refer to illustration on page 12.9 for torque values of fasteners.

1. Remove CONTROL / SWITCH CUBE assemblies as outlined in this chapter.
2. Hold the handlebar in place and remove riser cover, riser cap bolts and riser cap.
3. Remove handlebar from risers.

HANDLEBAR INSTALLATION

NOTE: Refer to illustration on page 12.9 for torque values of fasteners.

1. Position and center handlebar on risers.
2. While holding handlebar in position, place riser clamp over handlebars and align mounting holes in riser clamp with tapped holes in risers.
3. Install fasteners and evenly torque them to ensure gap between riser clamps and risers are consistent after torque.
4. Install left and right hand controls and switch cubes.
5. Check operation of throttle assembly.
6. Check operation of switches and controls.
7. Check operation of front brake.
8. Move handlebar from left stop to right stop. Ensure that there is adequate clearance between fuel tank and handlebar assembly.

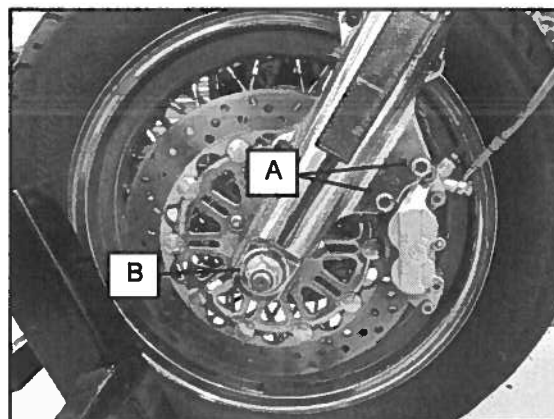
FRONT WHEEL REMOVAL

1. Place motorcycle on a suitable lift and secure so that the front wheel can be raised.

CAUTION

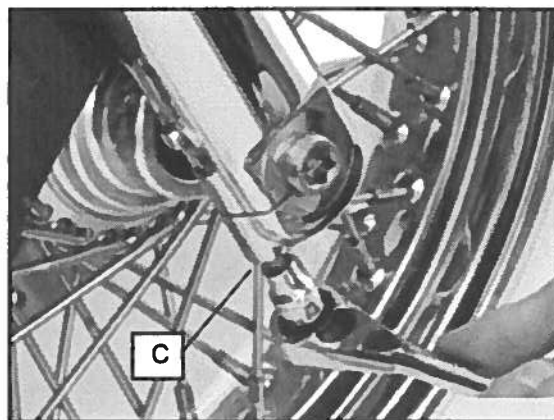
Take precautions so that the motorcycle is securely supported when the tire is off the ground.

2. If model is equipped with caliper covers, remove (see page 2.16).
3. Remove bolts securing front brake calipers (A) and move calipers out of the way so that brake lines aren't stressed.
4. Remove axle nut (B).



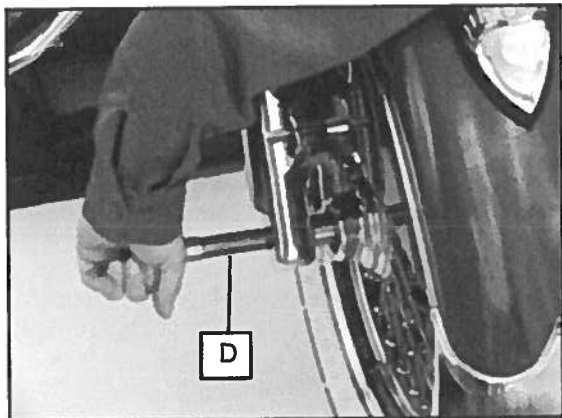
12

5. Loosen the axle pinch bolt (C) located on the bottom of the right fork slider.



FRONT WHEEL / SUSPENSION

6. Raise the front wheel using a suitable jack.
7. Remove the axle (D) and collect spacers noting which side they are removed from.



8. Raise front wheel to gain adequate clearance and remove front wheel.

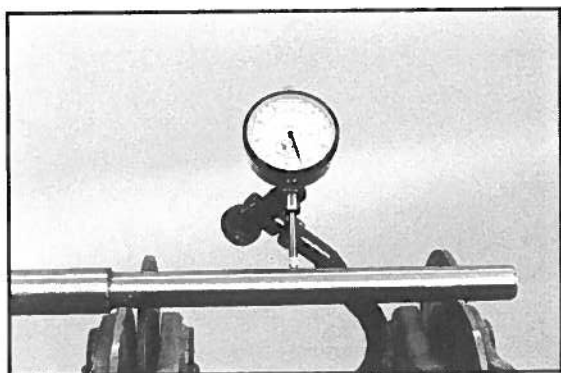
CAUTION

Do not twist the brake hose or brake line.
Do not allow caliper to hang from the brake hose.
Secure caliper in such a way to avoid hose damage.

NOTE: Do not operate the front brake lever with the caliper or wheel removed.

FRONT AXLE INSPECTION

1. Place axle in V-blocks and inspect runout. Compare to specifications on page 12.3.



2. Replace axle if it fails inspection. Do not attempt to straighten a bent axle.

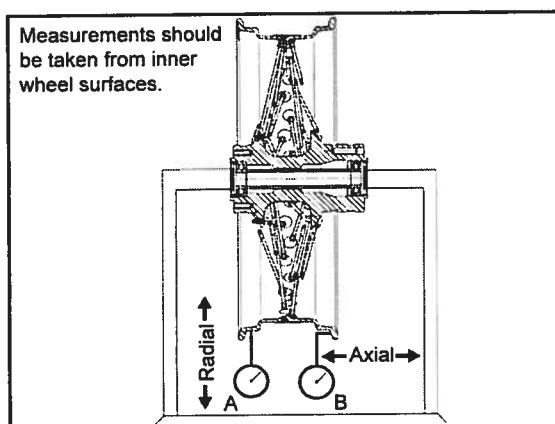
FRONT WHEEL INSPECTION

NOTE: Indian Motorcycle 60 spoke rims are tubeless and are designed to be maintenance free. Service procedures associated with wheel inspection should be performed by a qualified technician. Follow specifications below for cast or spoke wheels.

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 (page 12.3).
3. Position dial indicator to measure axial runout (side to side) (B) and compare to specifications (page 12.3).



4. Inspect wheel for loose spokes.
5. Visually inspect wheel for cracks.
6. Replace wheel if it fails visual or measured inspection. Do not attempt to tighten spokes or straighten wheel.

FRONT WHEEL BEARING INSPECTION

NOTE: Indian Motorcycle wheel bearings are sealed. They are not serviceable. Wheel bearings must be inspected while installed in wheel assembly. Once a bearing is removed from the wheel assembly it must be discarded.

1. Visually inspect bearing seals (A) on each side for wear or damage.
2. Check bearings by turning inner race (B) 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 inner race of bearings. Bearings should turn smoothly and quietly. Inner race should be firm with minimal side to side movement and no detectable up and down movement.
3. Discard bearings that fail inspection.

CAUTION

Do not reuse bearings after removing them from the wheel. Removal damages the bearings internally.

4. Inspect bearing fit in wheel hub. Outer race of bearing must fit tightly in bore. You should not be able to move it (or remove it) by hand. Replace wheel if outer race of a new bearing does not fit tightly in the bore.

BRAKE DISC REMOVAL

WARNING

Do not allow brake fluid or other lubricants to contact brake discs.

1. Remove front wheel as outlined in this chapter.
2. Remove bolts securing brake discs to hub and discard.
3. Remove brake discs.

BRAKE DISC INSTALLATION

1. Clean any remaining Loctite out of brake disc bolt holes.

2. Thoroughly clean the brake disc surface of any contaminants using a suitable solvent or brake cleaner.
3. Using new brake disc fasteners, install brake disc and loosely install bolts.
4. Torque brake disc bolts to specification in a cross pattern.



Front Brake Disc Screws:
2009-2010: 18 ft-lbs (24.4 Nm)
2011-2012: 32 ft-lbs (43.4 Nm)

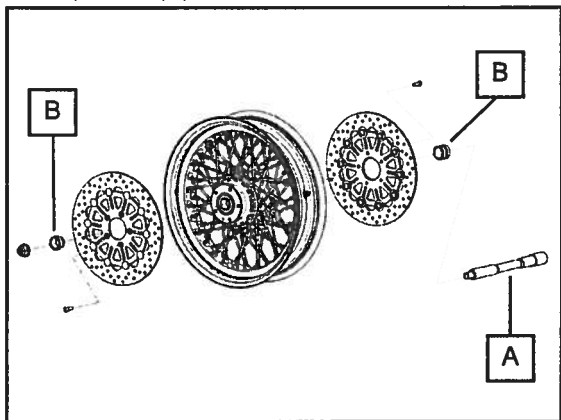
5. Install front wheel as outlined in this chapter.



FRONT WHEEL / SUSPENSION

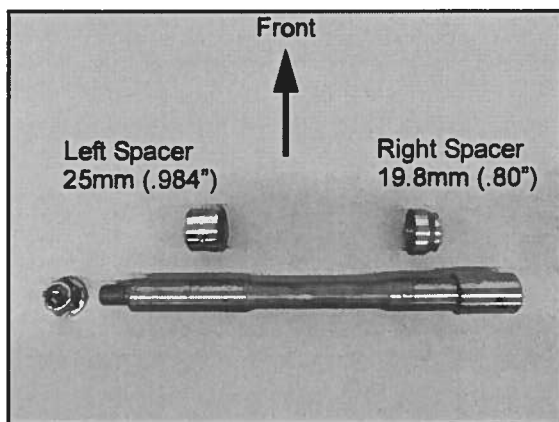
FRONT WHEEL INSTALLATION (2009-2011)

1. Clean all wheel components before installation.
2. Apply a light coat of anti-seize compound on axle (A) and spacers (B).



3. Note direction of tire rotation and position front wheel assembly into front fork.

IMPORTANT: Wheel spacers ARE NOT INTERCHANGABLE! Note measurement specifications before installation.



4. With wheel spacers held in position, install axle from right side through fork lowers, right hand wheel spacer, wheel hub, left hand wheel spacer and left fork lower.

NOTE: The left-hand spacer is wider than the right.

5. Install axle nut and torque to specification.
6. Torque axle pinch bolt to specification.



Axle Nut: **55 ft-lbs (74.6 Nm)**
Axle Pinch Bolt: **20 ft-lbs (27.1 Nm)**

7. Install front brake calipers as outlined in Chapter 15.
8. Install caliper covers, if equipped (see page 2.16).
9. Slowly pump front brake lever to regain pressure.
10. Apply and hold front brake. Pump forks to move suspension through full range of travel at least 4 times.

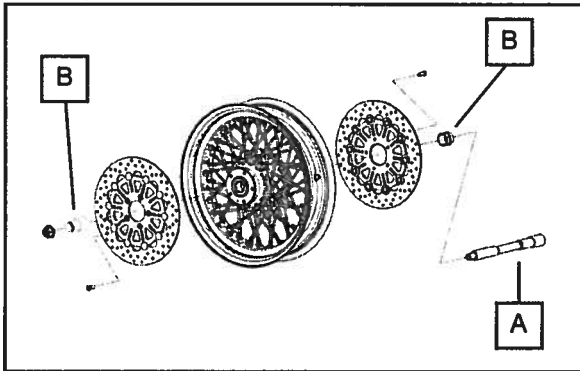
NOTE: Fork action should be smooth without binding. If problems are found, inspect for cause and correct as necessary.

11. Elevate front wheel and spin it to check for drag. Apply and release front brake. Wheel should spin freely and quietly without drag when brake lever is released.
12. Install the front fender (see page 3.10).
13. Lower front end of machine.
14. Inspect operation of front brake lever. Bleed front brake system if lever is not firm. (Refer to Chapter 15).

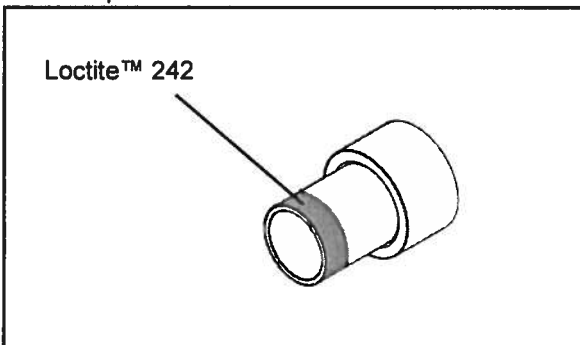


FRONT WHEEL INSTALLATION (2012)

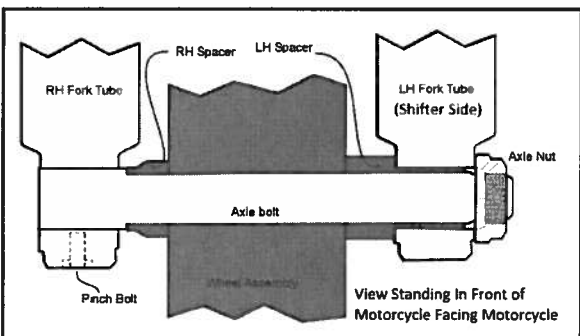
1. Clean all wheel components before installation.
2. Apply a light coat of anti-seize compound on axle (A) and spacers (B).



3. If left hand wheel spacer was removed, apply Loctite™ 242 to the first 1/2 inch of the sleeve and install spacer into LEFT fork.



IMPORTANT: Wheel spacers ARE NOT INTERCHANGABLE! Note assembly location before installation.



4. Note direction of tire rotation and position front wheel assembly into front fork.
5. With wheel spacers held in position, install axle from right side through fork lowers, right hand wheel spacer, wheel hub, left hand wheel spacer and left fork lower.

WARNING

For 2012 models, the left hand spacer must be placed into the LEFT fork on the same side as the axle nut. If spacer is placed in RIGHT fork, pinch bolt will clamp spacer instead of axle shoulder and axle will be in a free-floating state. This can lead to reduced handling capabilities and a possible loss of control.

6. Install axle nut and torque to specification.
7. Torque axle pinch bolt to specification.



Axle Nut: **55 ft-lbs (74.6 Nm)**
Axle Pinch Bolt: **18 ft-lbs (24.4 Nm)**

8. Install front brake calipers as outlined in Chapter 15.
9. Install caliper covers, if equipped (see page 2.16).
10. Slowly pump front brake lever to regain pressure.
11. Apply and hold front brake. Pump forks to move suspension through full range of travel at least 4 times.

NOTE: Fork action should be smooth without binding. If problems are found, inspect for cause and correct as necessary.

12

12. Elevate front wheel and spin it to check for drag. Apply and release front brake. Wheel should spin freely and quietly without drag when brake lever is released.
13. Install the front fender (see page 3.10).
14. Lower front end of machine.
15. Inspect operation of front brake lever. Bleed front brake system if lever is not firm. (Refer to Chapter 15).

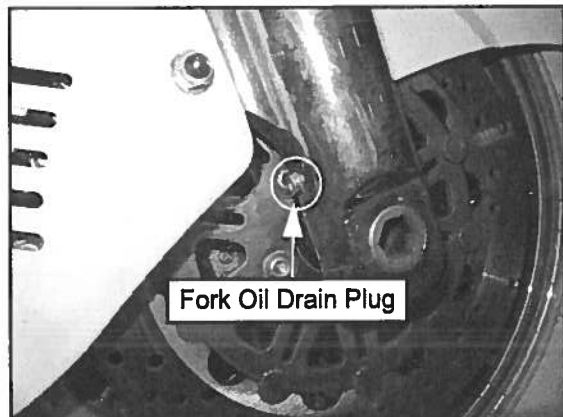


FRONT WHEEL / SUSPENSION

FORK OIL DRAINING & REPLACEMENT (2009-2011)

Fork Oil Draining

1. Secure motorcycle in an upright position with wheel clamped in a wheel vise.
2. Place a suitable drain pan beneath the right fork slider.
3. Remove drain plug and sealing washer as shown.



4. Compress front suspension several times to assist oil draining.
5. Once oil is completely drained, install drain plug with a new sealing washer. Torque to specification.

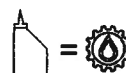
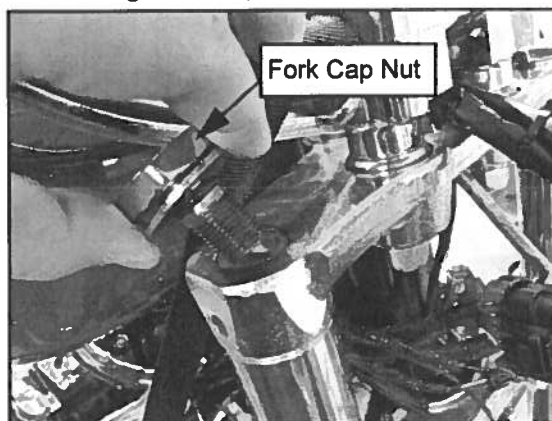


Fork Oil Drain Plug:
82 in-lbs (9.3 Nm)

6. Repeat steps 2-5 for left fork slider.

Fork Oil Replacement

7. Remove headlamp housing, turn signals and light bar, if equipped (see Chapter 19).
8. Remove right fork cap nut.



Fork Oil PN: N90700007
Fork Tube Capacity: 10.5 oz (310.5 cc)

9. Repeat steps 8-9 for left fork assembly.
10. Torque left and right fork cap nuts to specification.



Fork Cap Nuts:
18 ft-lbs (24.4 Nm)

11. Install headlamp housing, turn signals and light bar, if equipped (see Chapter 19).
12. Compress front suspension several times to purge air and check for smooth operation.

FORK OIL DRAINING & REPLACEMENT (2012)

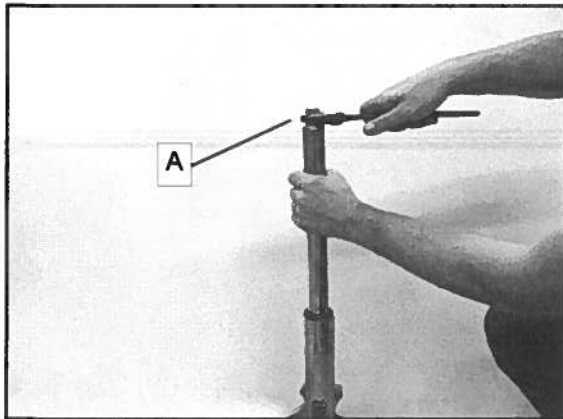
Fork Oil Draining

1. Remove right fork. See "Front Fork Removal."
2. Extend slider to ensure preload is relieved.

WARNING

If spring preload has not been completely relieved, fork cap may eject from the tube causing severe injury.

3. Using a suitable wrench, remove the fork tube cap (A).



4. Extract preload spacer and main spring from fork tube.
5. Turn fork tube upside down over a suitable drain pan and allow fork oil to drain. Slowly cycle fork tube up and down to ensure that all oil has been removed from cylinder.
6. Install main spring with tightly coiled end toward top of spring. Install preload spacer.
7. Install fork tube cap and torque to specification.



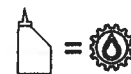
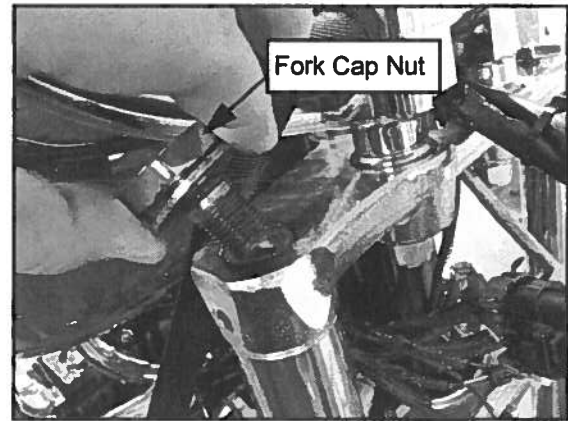
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Fork Tube Cap:
40 ft-lbs (54 Nm)

8. Repeat steps 1-7 for left fork slider.

Fork Oil Replacement

9. Complete steps 1-4 of the "Front Fork Tube Installation" section.
10. Add specified oil to fork tubes at fork cap nut.



Fork Oil PN: 2872184
Fork Tube Capacity: 11 oz (325 cc)

11. Complete remaining steps in "Front Fork Tube Installation" section.

FRONT WHEEL / SUSPENSION

FRONT FORK REMOVAL

1. Securely support front end of motorcycle so front wheel is off the ground.

CAUTION

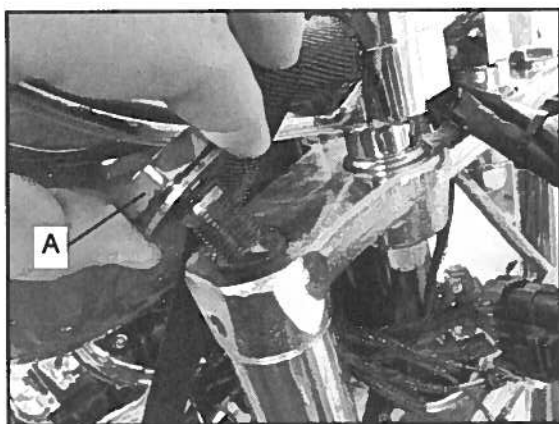
Take precautions so that the motorcycle is securely supported when the tire is off the ground.

2. Remove front fender (see page 12.4).
3. Remove front brake calipers as outlined in Chapter 15, and secure them out of the way.

CAUTION

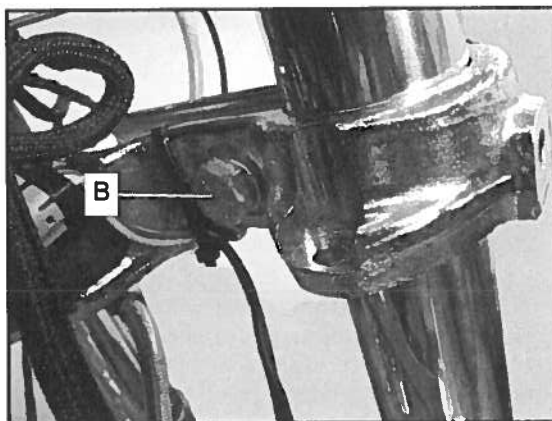
Do not twist the brake hose or brake line.
Do not allow caliper to hang from the brake hose.
Secure caliper in such a way to avoid hose damage.

4. Remove the front wheel.
5. Remove headlamp housing, turn signals and light bar, if equipped (see Chapter 19).
6. 2009-2011: If servicing fork components, drain fork oil as outlined in this chapter.
7. Remove right fork cap nut and washer (A).



8. Apply lubricant to fork upper leg between the upper and lower triple clamp

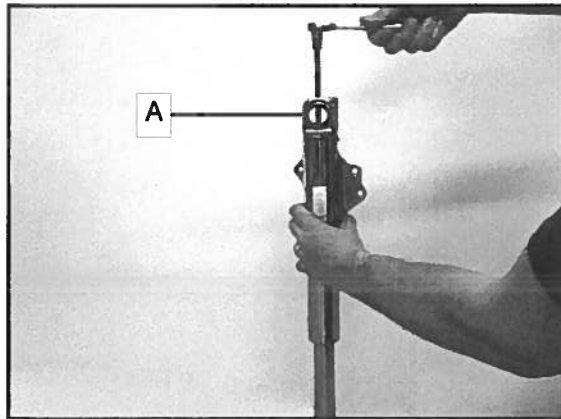
9. While holding the right fork assembly, loosen pinch bolt (B) on lower triple clamp.



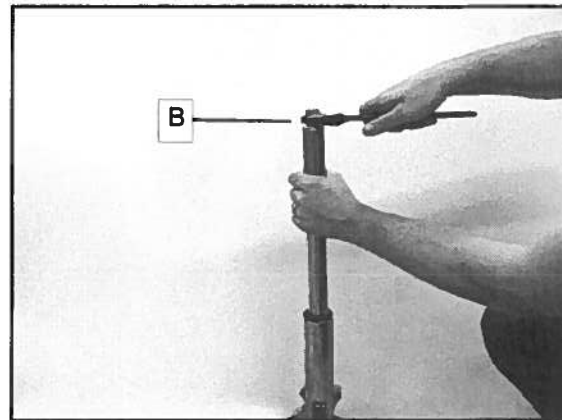
10. Remove right fork assembly. Slide downward through lower triple clamp and fork cover.
11. Repeat steps 7-10 to remove left fork assembly.

FRONT FORK DISASSEMBLY

1. 2009-2011: Drain fork oil from left and right fork legs (see page 12.18).
2. Remove fork legs from motorcycle (see page 12.20).
3. 2012: Drain fork oil from fork tubes by turning them upside down once removed.
4. Position fork leg upside down on a soft, non-scratching surface and remove the damper rod screw (A) and sealing washer.

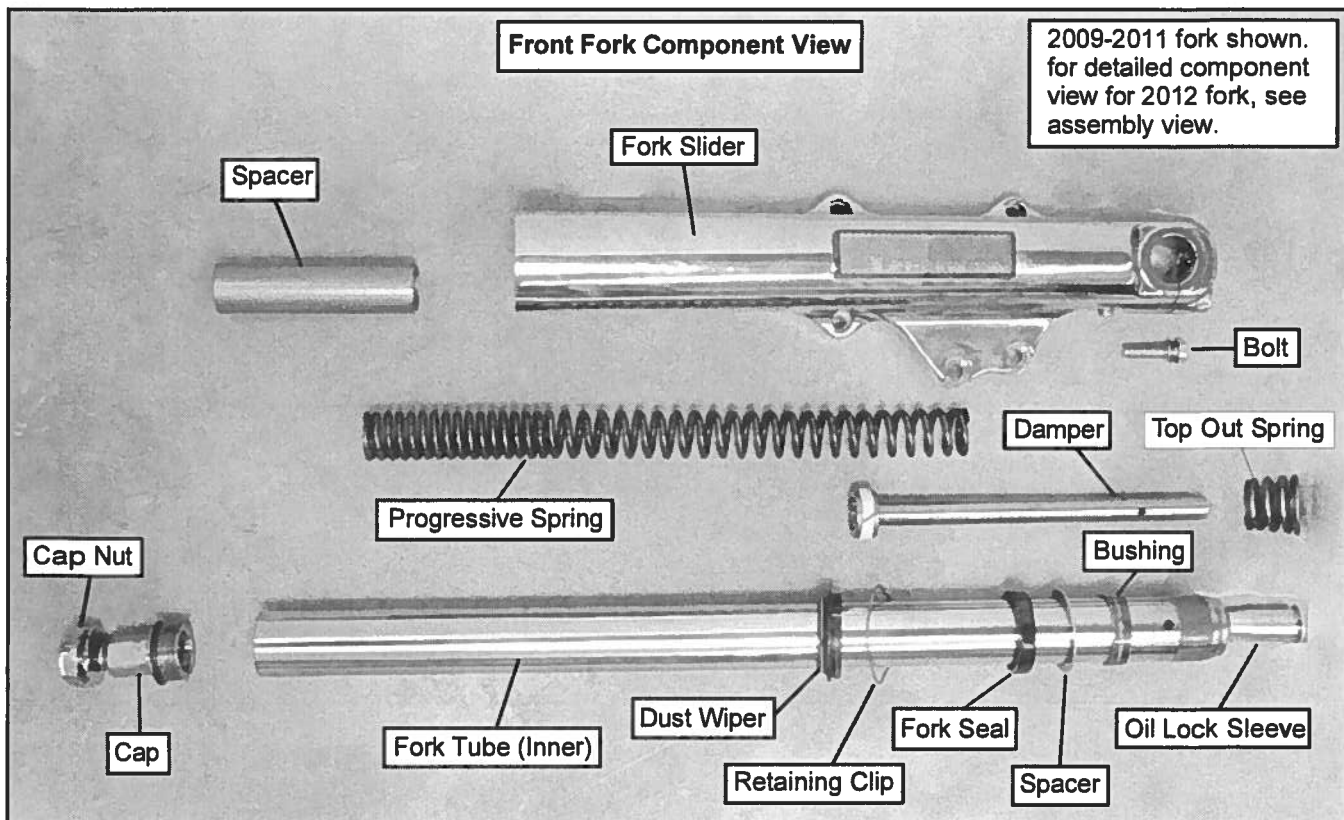


5. Turn fork assembly over and, using a suitable wrench, remove the fork tube cap (B).



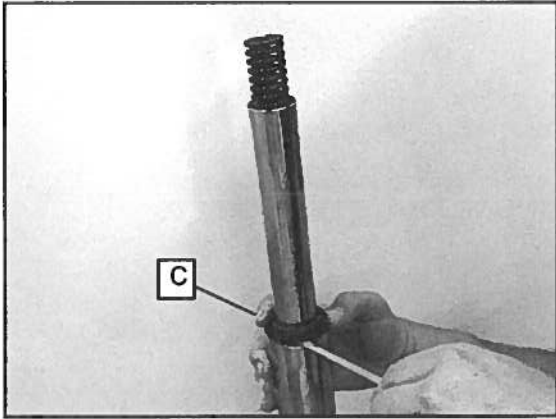
WARNING

Use caution when removing the fork tube cap as there may be a small amount of spring preload. Wear safety glasses.

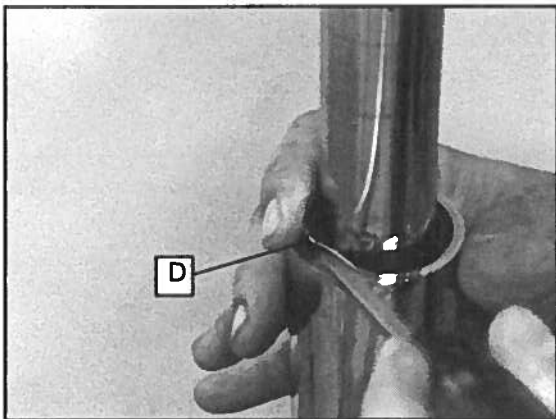


FRONT WHEEL / SUSPENSION

6. With the cap removed from the fork assembly, remove the upper spacer and spring from the fork tube.
7. Using a flat blade screw driver or similar tool, pry the dust wiper (C) out of the fork slider.



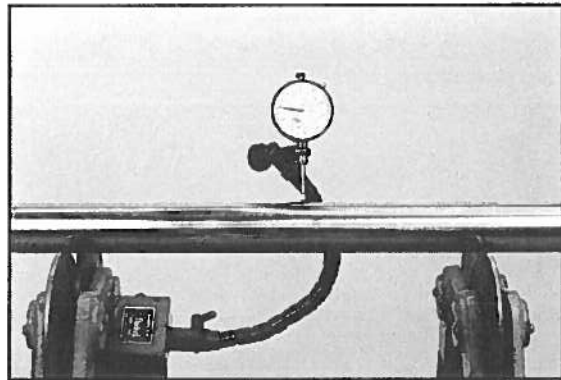
8. Using a flat blade screwdriver or similar tool, remove the fork seal retaining ring (D) from the fork slider.



9. Push fork tube and slider together until bottomed out. Pull apart quickly to produce a slide-hammer motion to separate fork tube and slider.
10. At this point the oil lock valve, slider bushings, damper and top out spring can be removed and inspected / replaced.
11. Repeat steps 1-9 for left fork leg disassembly.

FRONT FORK INSPECTION

1. Inspect inner fork tube for scoring, heavy scratches, dents due to rocks or other road debris, or excessive wear. Replace tube if scratched, pitted, or dented.
2. Place fork tube in V-blocks or fixture and measure runout. Replace tube if runout exceeds service limit.



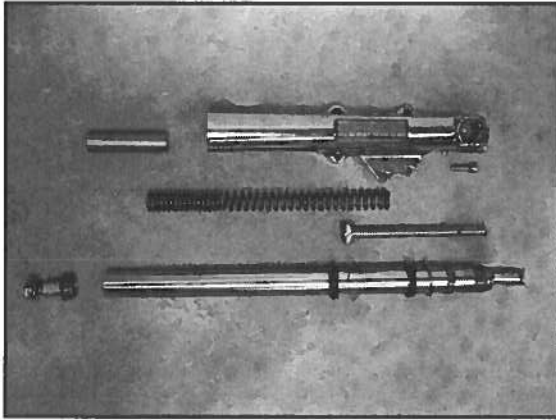
WARNING

Do not attempt to straighten bent fork tubes. Doing so will weaken the structural integrity of the forks and make the motorcycle unsafe to operate.

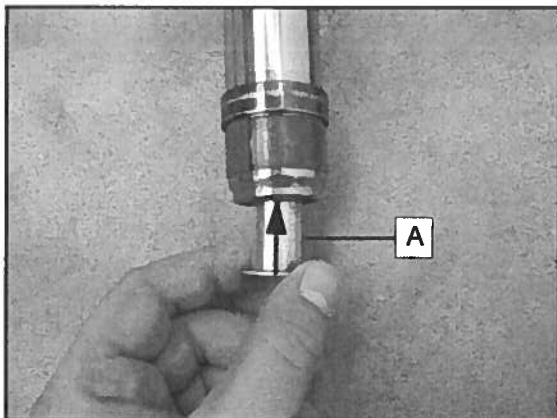
3. Inspect fork slider (outer tube) for dents, cracks, or other damage. If the fork will be reassembled with new upper and lower fork tube bushings, move inner tube through complete travel range. Check for resistance or binding. Replace slider if binding or resistance is evident, or if damaged.
4. Inspect damper assembly by moving damper rod through travel range. If binding is evident, replace the damper assembly.

FRONT FORK ASSEMBLY

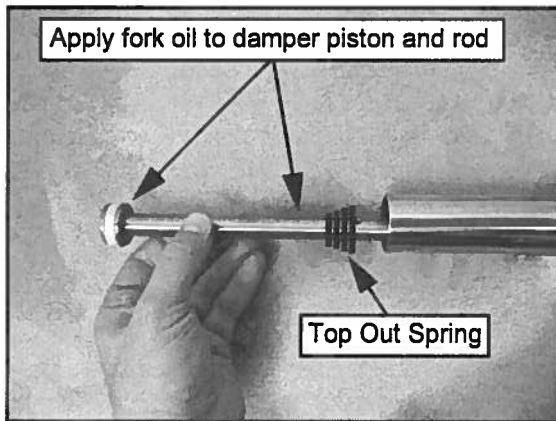
NOTE: Clean and inspect all parts prior to assembly.



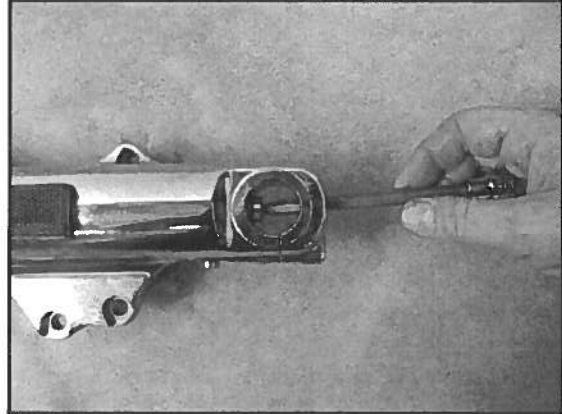
1. Install oil lock sleeve (A) into end of fork tube as shown.



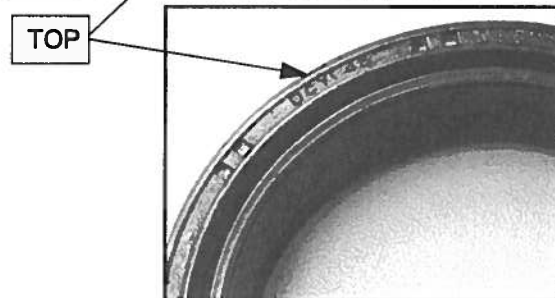
2. Apply a light film of fork oil to the damper piston and rod. Install the top out spring and damper assembly into inner fork tube.



3. Apply a light film of fork oil to outside diameter of fork tube bushings and fork tube. Slide fork tube completely into slider and bottom out against the oil lock sleeve.
4. With a new sealing washer in position, thread the damper bolt into damper rod until finger tight. **This bolt will not be fully tightened until STEP 16 in this procedure.**

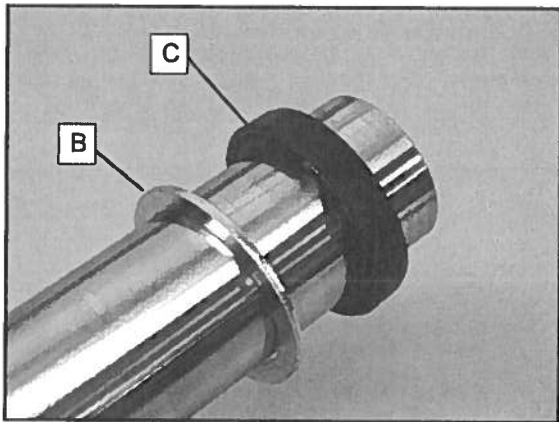


5. Apply a light film of oil to lips of seal. Install spacer, then oil seal with markings facing UP, (toward top of tube) onto fork tube.

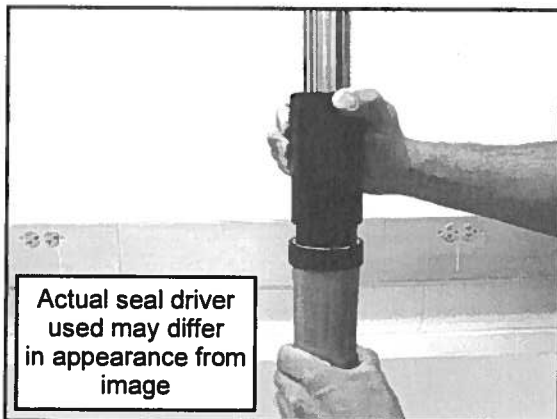


FRONT WHEEL / SUSPENSION

6. Slide the spacer (B) and new oil seal (C) down tube and into outer fork leg as shown.

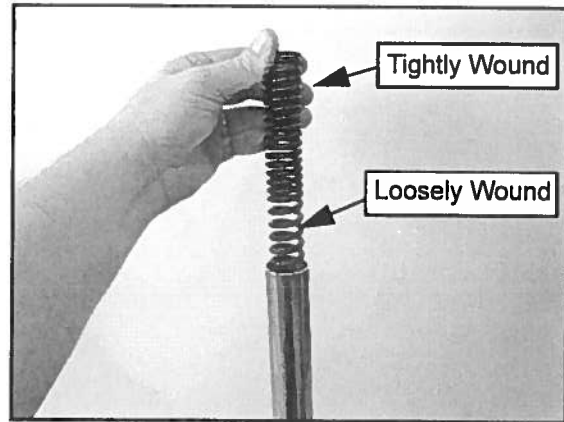


7. Using a suitable seal driver, install the oil seal until seated. Be sure top edge of seal is past (below) retaining ring groove.

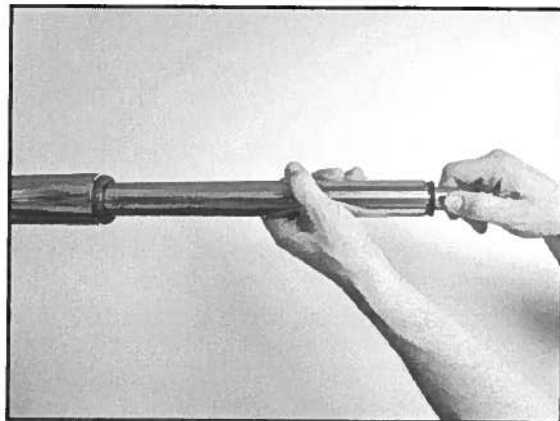


8. Install fork seal retaining clip and dust wiper.
9. Move fork tube back and forth through travel to verify smooth operation.
- IMPORTANT:** If any binding OR excessive play occur when moving through travel, do not proceed until corrective action has been taken.
10. Position the fork assembly right side up (tube facing up) on a soft, non-scratching surface.

11. Install the spring into the fork tube with tightly wound coils towards the top as shown.



12. Fully extend fork assembly and install upper spacer on top of spring in fork tube.
13. Apply a thin film of fork oil to the fork cap sealing O-ring.
14. Loosen the damper bolt until the upper spring spacer draws into fork tube and fork cap can be easily installed.
15. Thread the fork cap into the tube approximately 2-3 complete turns.



16. Tighten the damper rod bolt to specification.



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Damper Rod Bolt:
2009-2011: 37 ft-lbs (50.2 Nm)
2012: 18 ft-lbs (24 Nm)

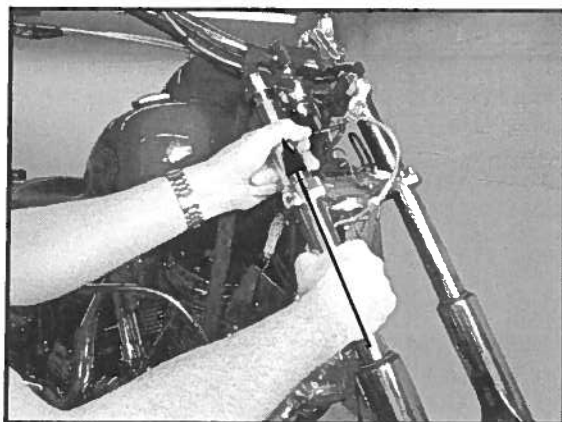
17. Tighten the fork cap to specification.

 = T
Fork Cap: 2009-2011: 15 ft-lbs (20.3 Nm) 2012: 40 ft-lbs (54 Nm)

FRONT FORK TUBE INSTALLATION

Also refer to illustration on page 12.5.

1. Clean the fork tubes and the clamping surfaces of the triple clamps to remove any oil or grease.
2. Install one fork tube assembly into lower triple clamp.
3. Continue to slide tube through lower triple clamp and into upper triple clamp. The fork tube cap should be completely seated against the upper triple clamp.



4. If fork has been drained of oil, refer to page 12.18 for oil filling procedure.
5. Install fork cap nut and washer. Torque to specification.

 = T
Fork Cap Bolt: 2009-2011: 18 ft-lbs (24.4 Nm) 2012: 35 ft-lbs (47 Nm)

6. Torque triple clamp pinch bolt to specification.

 = T
Triple Clamp Pinch Bolt: 65 ft-lbs (88.1 Nm)

7. Repeat steps 1 through 6 for the other fork tube.
8. Install front fender assembly (see page 3.10).
9. Install front wheel (page 12.16).
10. Install brake calipers and caliper covers as outlined in Chapter 15.
11. Install headlamp housing, turn signals and light bar, if equipped, as outlined in Chapter 19.
12. Lower front end of motorcycle to the ground and test front suspension / fork operation.

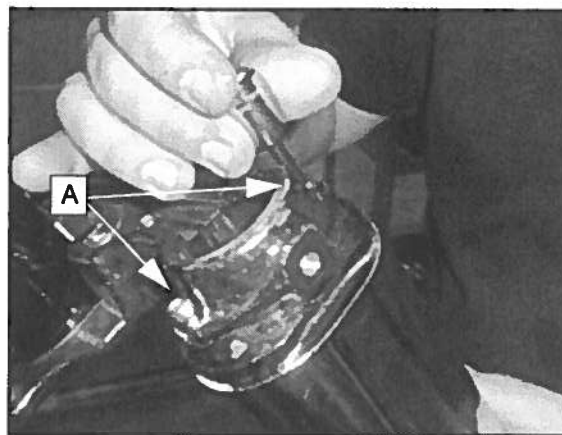
TRIPLE CLAMP REMOVAL

1. Elevate front of machine so that front wheel can be removed. Support machine securely in an upright position.

CAUTION

Take precautions so that the motorcycle is securely supported when the tire is off the ground.

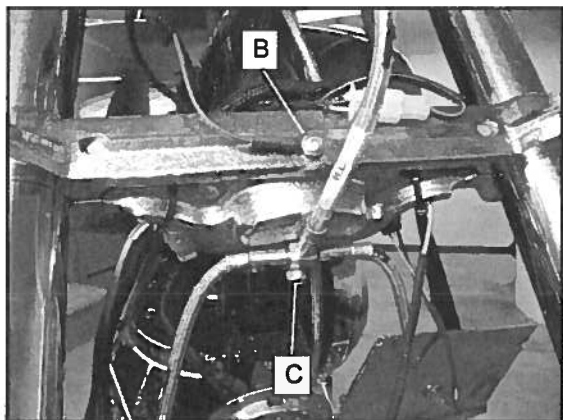
2. Remove front wheel (page 12.13).
3. Remove front fender (page 3.10).
4. Remove headlamp housing, turn signals and light bar, if equipped, as outlined in Chapter 19.
5. Remove fork tubes (page 12.20).
6. Remove fork tube covers by removing screws (A) and washers.



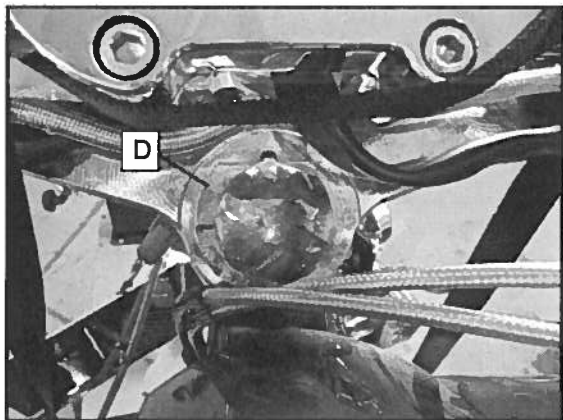
7. Remove handlebar (page 12.13)

FRONT WHEEL / SUSPENSION

8. Remove fasteners securing the grounding wire (B) and 3-way brake splitter (C) from the lower triple clamp.



9. Using a suitable tool, flatten the lock washer (D) securing the stem nut.



10. Remove the stem nut and locking washer. Discard the locking washer.

11. Remove the upper triple clamp.

NOTE: Support lower triple clamp while removing the adjusting nut.

12. Remove adjustment nut from steering stem.

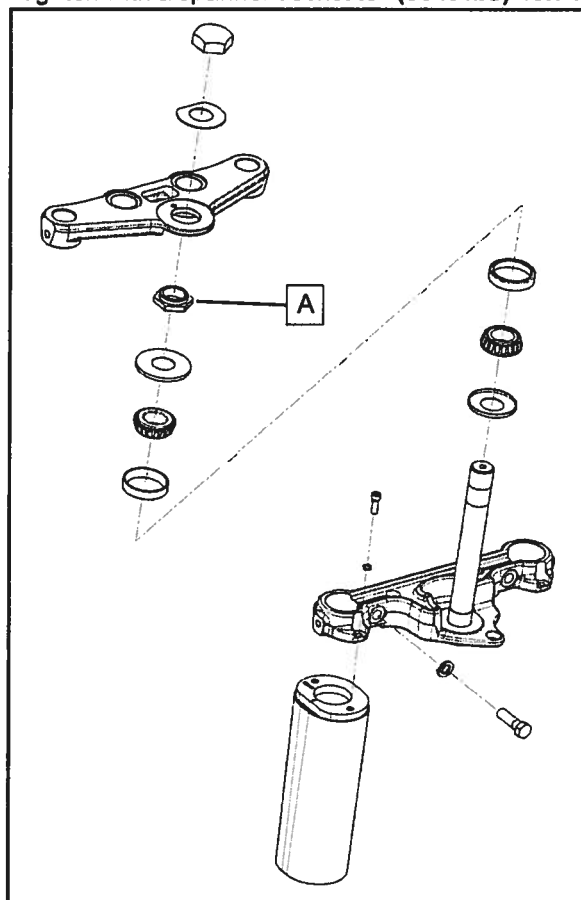
13. Remove lower triple clamp with steering stem and lower bearing.

14. Inspect bearings and bearing races for pitting, excessive wear or damage.

TRIPLE CLAMP INSTALLATION / STEERING HEAD BEARING ADJUSTMENT

Refer to page 12.5 for assembly view and torque specifications.

1. Clean and repack tapered bearings with All-Purpose grease.
2. If tapered bearing and dust shield were removed from steering stem, install the dust shield (flanged edge facing up) first and then tapered bearing (smaller diameter facing up) onto the stem.
3. Raise lower triple clamp into position through steering head.
4. Install upper tapered bearing over steering stem and into frame with smaller diameter facing downward.
5. Install dust shield with flanged edge facing downward.
6. Place bearing adjustment nut (A) on steering stem and tighten with a spanner socket to **(30 ft-lbs) 40.7 Nm**.



7. Check for smooth operation by turning lower triple clamp from lock to lock five times.
8. Complete steering head adjustment sequence below.

Steering Head Adjustment Sequence:

1. Tighten adjustment nut to 30 ft-lbs (40.7 Nm)
2. Move triple clamp back and forth 5 times.
3. Loosen adjustment nut 180 deg (1/2 turn).
4. Retorque adjustment nut to 15 ft-lbs (20.3 Nm)

9. Place upper triple clamp over steering stem on adjustment nut.
10. Position new locking washer on upper triple clamp with slight bend facing upward.
11. Thread stem nut onto steering stem. **Do not torque at this time.**

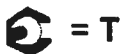
NOTE: Do not install or torque any fasteners in while performing step 12. Fork assembly is only to confirm and sustain alignment while tightening stem nut.

12. To align upper and lower triple clamps, position the right fork assembly into the upper and lower triple clamp.
13. While holding the fork assembly in position, torque stem nut to specification.



Stem Nut:
29 ft-lbs (39.3 Nm)

14. Remove fork legs from triple clamp.
15. Bend locking washer to flat of stem nut.
16. Install lower triple clamp ground wire and 3-way brake splitter. Torque to specification.
17. Install fork tube covers. Torque to specification.



Grounding Wire: 30 in-lbs (3.4 Nm)
3-Way Brake Splitter: 102 in-lbs (11.5 Nm)
Fork Tube Cover Screws: 105 in-lbs (11.9 Nm)

NOTE: CHECK STEERING BEARINGS at this time. Pull firmly on fork tubes with a front-to-rear motion. If movement (play) can be felt in steering bearings, disassemble and go back to Step 8. Tighten steering stem adjuster nut an additional 5 degrees, and reassemble following Steps 8-14. Repeat this procedure until no play can be felt.

18. Install fork legs (page 12.25).
19. Install handlebars (page 12.13).
20. Install front fender (page 3.10).
21. Install front wheel (page 12.16).
22. Install headlamp housing, turn signals and light bar, if equipped (see Chapter 19).
23. Verify all fasteners are installed and properly torqued.



FRONT WHEEL / SUSPENSION

TROUBLESHOOTING

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	REPAIR RECOMMENDED
Heavy Steering	Steering Stem Nut Over Tightened	Adjust
	Front Tire Damaged or Worn	Replace
	Low Tire Pressure	Inflate to specification
	Damaged / Worn Steering Stem Bearings or Races	Replace
	Bent Steering Stem	Replace
Pulls to One Side or Wanders	Damaged Steering Stem Bearings or Races	Replace
	Low Tire Pressure	Inflate to specification
	Steering Stem Nut Over Tightened or Under Tightened	Torque to specification
	Rear Wheel Not Aligned Correctly	Align
	Bent Front Axle	Replace
	Damaged or Excessively Worn Front Tire / Incorrect Tire	Replace
	Damaged / Worn Wheel Bearings	Replace
	Damaged / Worn Swing Arm Bearings	Replace
	Loose Swing Arm Pivot Nut	Torque to specification
	Bent Frame or Swingarm	Replace
Handlebars Oscillate (Wobble)	Incorrect Tire Pressure / Tire Type	Correct
	Tire Mounted Incorrectly	Check Mounting and Balance
	Damaged Tire / Worn Tire	Replace
	Loose Steering Stem Nut	Torque to specification
	Suspension Adjusted Incorrectly	Adjust Properly For Load
	Bent Front Axle	Replace
Front Wheel Oscillates (Wobbles)	Bent Front Rim	Replace
	Damaged Front Wheel Bearings	Replace
	Damaged or Incorrect Tire	Replace
	Loose Axle or Axle Pinch Bolts	Torque to specification
	Fork Tube Height Unequal (L&R)	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
Noise In Front Suspension	Worn Fork Bushings	Rebuild Forks
	Low Fork Oil	Determine Cause/Replace Fork Oil
	Loose Fasteners	Torque to specification
	Loose Steering Stem Bearings	Determine Cause/Correct
	Fender, Brake Lines, Brake Caliper	Determine Cause/Correct



FRONT WHEEL / SUSPENSION

TROUBLESHOOTING (cont.)

PROBLEM	POSSIBLE CAUSE	REPAIR RECOMMENDED
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
	Incorrect Fork Oil	Replace
	Fork Oil Level Too High	Set Correctly
	Plugged Oil Passages	Rebuild Front Forks
	Damaged Sliders or Fork Tubes	Replace
	Forks Binding, Incorrect Assembly Front Fender and/or Front Wheel	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



FRONT WHEEL / SUSPENSION

NOTES

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

CHAPTER 13

REAR WHEEL & SUSPENSION

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REAR WHEEL & SUSPENSION

GENERAL INFORMATION

WARNINGS AND PRECAUTIONS

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 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.

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.

CAUTION

Work performed to the rear end of the motorcycle usually 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. This reduces the possibility of personal injury or damage to the motorcycle.

- The rear shock absorber is a sealed unit and cannot be re-built.
- Refer to Chapter 2 for maintenance of rear wheel & suspension components, and suspension ride height adjustment.
- Refer to Chapter 15 for brake system service.
- Refer to Chapter 14 for tire removal, repair, & balancing.

SPECIAL TOOLS

SPECIAL TOOLS

See Chapter 1 for tool ordering information.

Platform Jack or Hoist	Commercially available
Bearing Driver	Commercially available



SPECIFICATIONS

SPECIFICATIONS - REAR WHEEL AND SUSPENSION

SPECIFICATIONS		
Item	Standard	Service Limit
Axle Runout	-	.20 mm (.008")
Rear Shock Absorber	Single, Coil Over Shock (Sealed unit not serviceable)	--
Rear Wheel Runout (Spoked & Billet Type)	Axial	.80 mm (.030 inch)
	Radial	.80 mm (.030 inch)
Rear Wheel Size / Type	3.5 x 16"	--
Rear Wheel Travel	2.87 in. (7.3 cm)	--
Shock Free Length (Eye to eye center)	266.8 mm (10.5 inch) +/- 2mm (.10 in)	--
Suspension Ride Height Measurement	(see REAR SUSPENSION ADJUSTMENT on page 2.29)	--
Swing Arm bearing O.D.	1.4375 inch	--
Swing Arm bearing I.D.	.75 inch	--
TORQUE SPECIFICATIONS (Also see Assembly Views page 13.4 and 13.5)		
Brake Disc Screws	30.0 Nm (22 lb-ft)	Install NEW screws if loosened or removed. New screws have special pre-applied locking agent.
Rear Axle Nut	55 ft-lbs (74.6 Nm)	--
Rear Axle Adjuster Nut	12 ft-lbs (16.3 Nm)	--
Sprocket Bolts	65 ft-lbs (88.1 Nm)	Torque in star pattern
Swing Arm Nut, Left Side	60 ft-lbs (81.3 Nm)	Apply Loctite 262 (Red)
Swing Arm Nut, Right Side	60 ft-lbs (81.3 Nm)	--
Shock Mount Bolt (Lower)	32 ft-lbs (43.4 Nm)	--
Shock Mount Bolt (Upper)	32 ft-lbs (43.4 Nm)	--

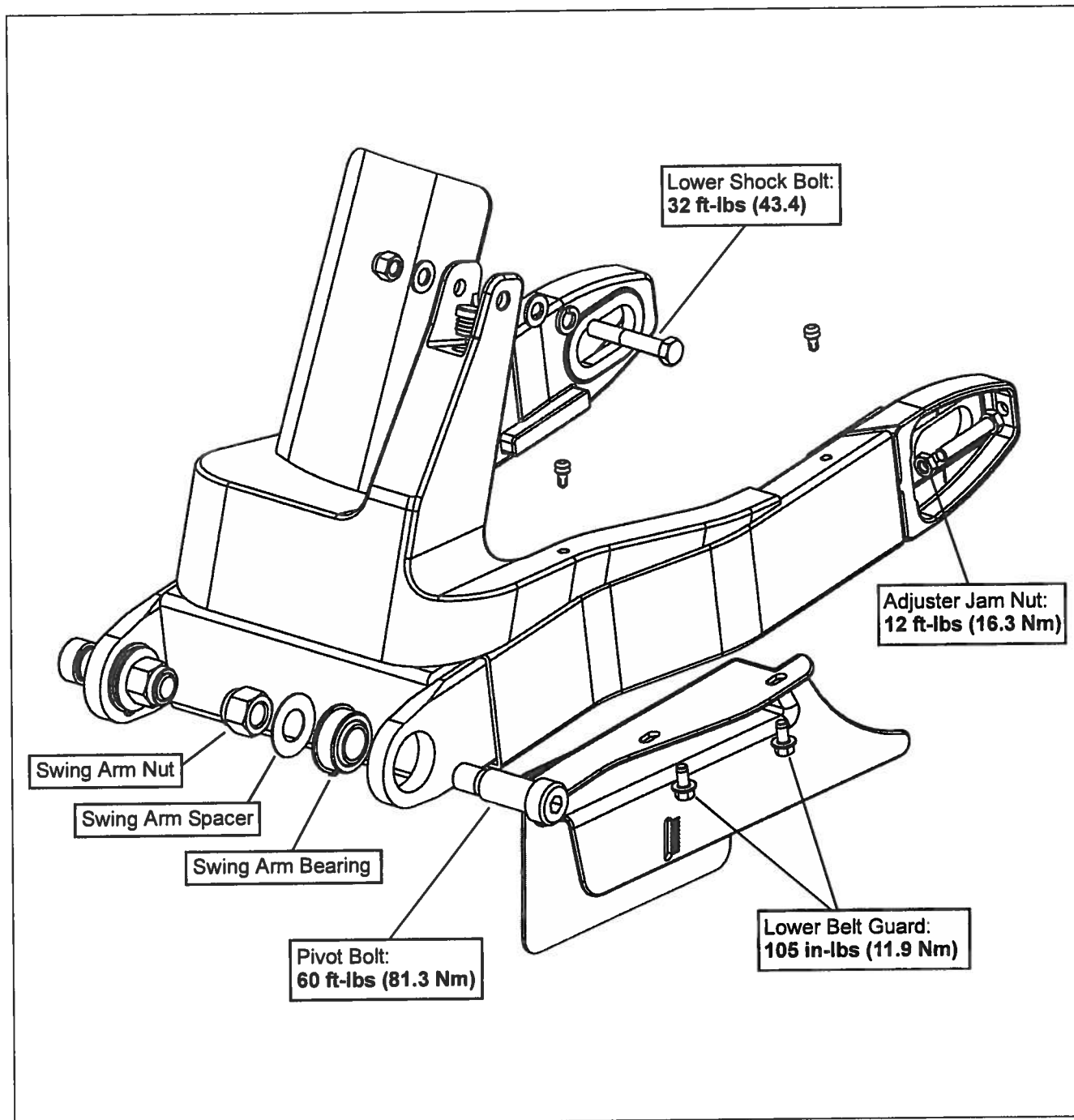


REAR WHEEL & SUSPENSION

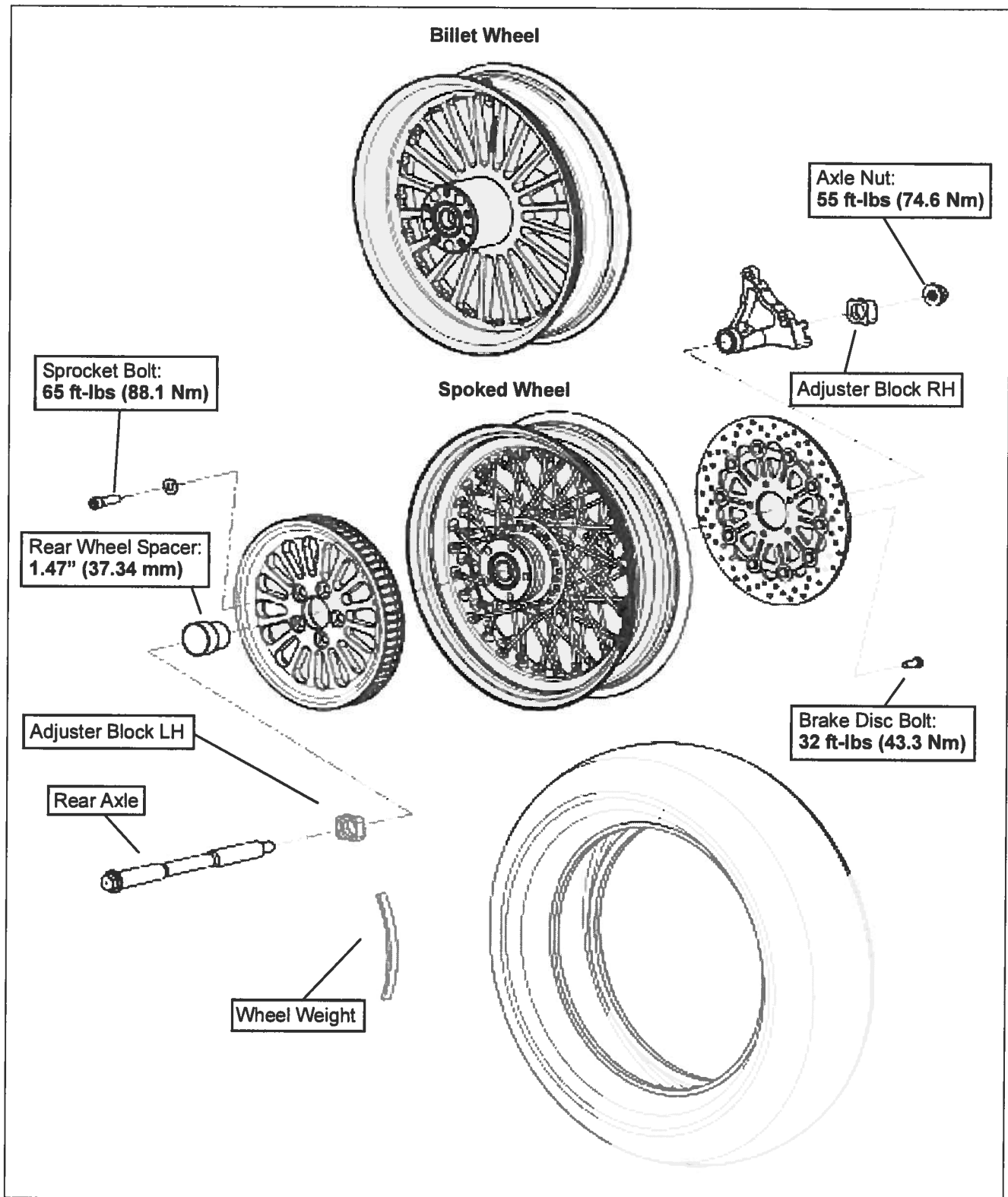
ASSEMBLY VIEWS & TORQUE

ASSEMBLY VIEW - SWING ARM & AXLE ADJUSTERS

Refer to the illustration below for fastener torque



ASSEMBLY VIEW - REAR WHEEL



REAR WHEEL & SUSPENSION

REAR WHEEL SERVICE

REAR WHEEL REMOVAL



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.

1. Secure the motorcycle in an upright position with the front wheel clamped in a wheel vise (A).
2. Place a platform jack (B) under the engine. Elevate the motorcycle enough to take the weight off the rear wheel, but still leave the wheel touching the platform.
3. Remove saddlebags, if equipped (page 3.12).
4. Remove muffler (page 3.9).
5. Remove the lower belt guard (page 13.4).
6. Remove the upper belt guard, if equipped.
7. Remove rear caliper from caliper hanger (see Chapter 15).

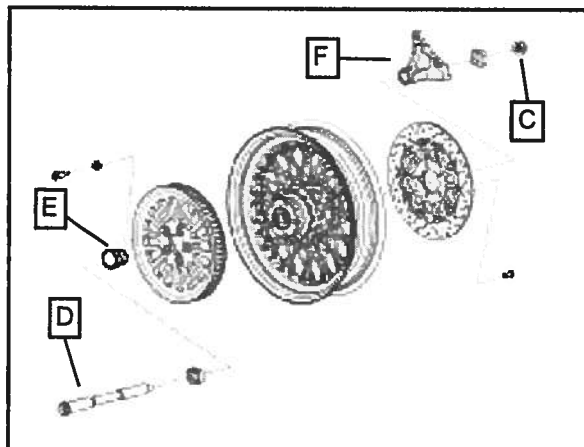
CAUTION

Do not allow rear brake caliper brake line to hang or twist. Brake line damage may result.

NOTE: Do not apply rear brake pedal once the brake caliper has been removed.

8. Remove axle nut (C).

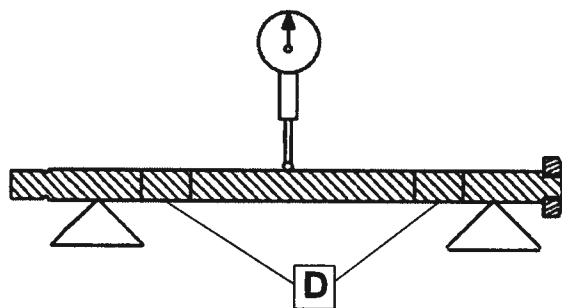
NOTE: 2009-2010 models will not have a washer beneath the axle nut.



9. Loosen the wheel adjuster jam nuts and turn adjuster bolts in to release tension from drive belt.
10. Remove rear axle (D) from swing arm and wheel assembly.
11. Remove rear wheel spacer (E) and caliper hanger (F).
12. Roll wheel assembly forward and remove the drive belt from the rear sprocket.
13. Using the platform jack, raise the rear of the motorcycle enough to gain enough clearance to remove the rear wheel.
14. Remove rear wheel.

REAR AXLE INSPECTION

1. Place rear axle in V-blocks and measure runout. Compare to service limit on page 13.3
2. Axle diameter should be measured on bearing surfaces at (D).



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. Refer to Chapter 14 for procedure. Compare measurements to service limits.
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 (Chapter 2). Do not remove bearings from wheel to inspect. Bearings cannot be reinstalled. 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. Outer race of bearing must fit tightly in bore.
3. Slide axle into wheel. 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.

BRAKE DISC REMOVAL

1. Remove rear wheel (page 13.6).
2. Position wheel with brake disc facing up. Support wheel so as not to damage the belt sprocket.
3. Remove and discard brake disc screws (A).
4. Remove brake disc from wheel.

BRAKE DISC INSTALLATION

1. Clean bolt hole threads with Loctite Primer N.
2. Clean mating surfaces of disc and hub.
3. Install brake disc on hub and align holes.

REAR WHEEL & SUSPENSION

4. Install new brake disc screws and torque to specification. Do not re-use brake disc screws.



Rear Brake Disc Screws:
32 ft-lbs (43.4 Nm)

5. Install rear wheel (page 13.8).

REAR SPROCKET REMOVAL

1. Remove rear wheel (page 13.6).
2. Remove the sprocket bolts.
3. Remove rear sprocket from wheel.

REAR SPROCKET INSTALLATION

1. Clean the bolt threads in hub to remove all grease or oil residue.
2. Clean mating surfaces of wheel and sprocket.
3. Tighten nuts in a star pattern to specified torque.
4. Install sprocket and new sprocket bolts.
5. Torque bolts in a star pattern to specified torque.



Rear Sprocket Screws:
65 ft-lbs (88.1 Nm)

6. Install rear wheel (page 13.8).

REAR WHEEL INSTALLATION

1. Position the rear wheel assembly under the rear fender and roll assembly forward to obtain drive belt installation position.
2. Install the drive belt onto the rear sprocket.
3. Position the rear caliper hanger between wheel assembly and swingarm on right-side.

NOTE: Rear Caliper Hanger and swingarm have mating bracket tab/slot inboard right swingarm.

4. Position wheel spacer between the wheel assembly and swingarm on the left side.
5. Apply a thin film of anti-seize to the axle surface.
6. Install axle from the left-side of the motorcycle through left axle block adjuster, wheel spacer, hub assembly, caliper hanger and right axle block adjuster.
7. Confirm that the caliper hanger is still engaged in slot on the right side of the swing arm.
8. Install washer and axle nut. Tighten axle nut until seated and back off one full turn.

NOTE: 2009-2010 models will not have a washer beneath the axle nut.

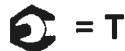
9. Adjust drive belt tension and wheel alignment (page 2.24).

10. Torque axle nut to specification.



Rear Axle Nut:
55 ft-lbs (74.6 Nm)

11. Install rear brake caliper as outlined in Chapter 15.
12. Install upper (if equipped) and lower drive belt guards and torque to specification.

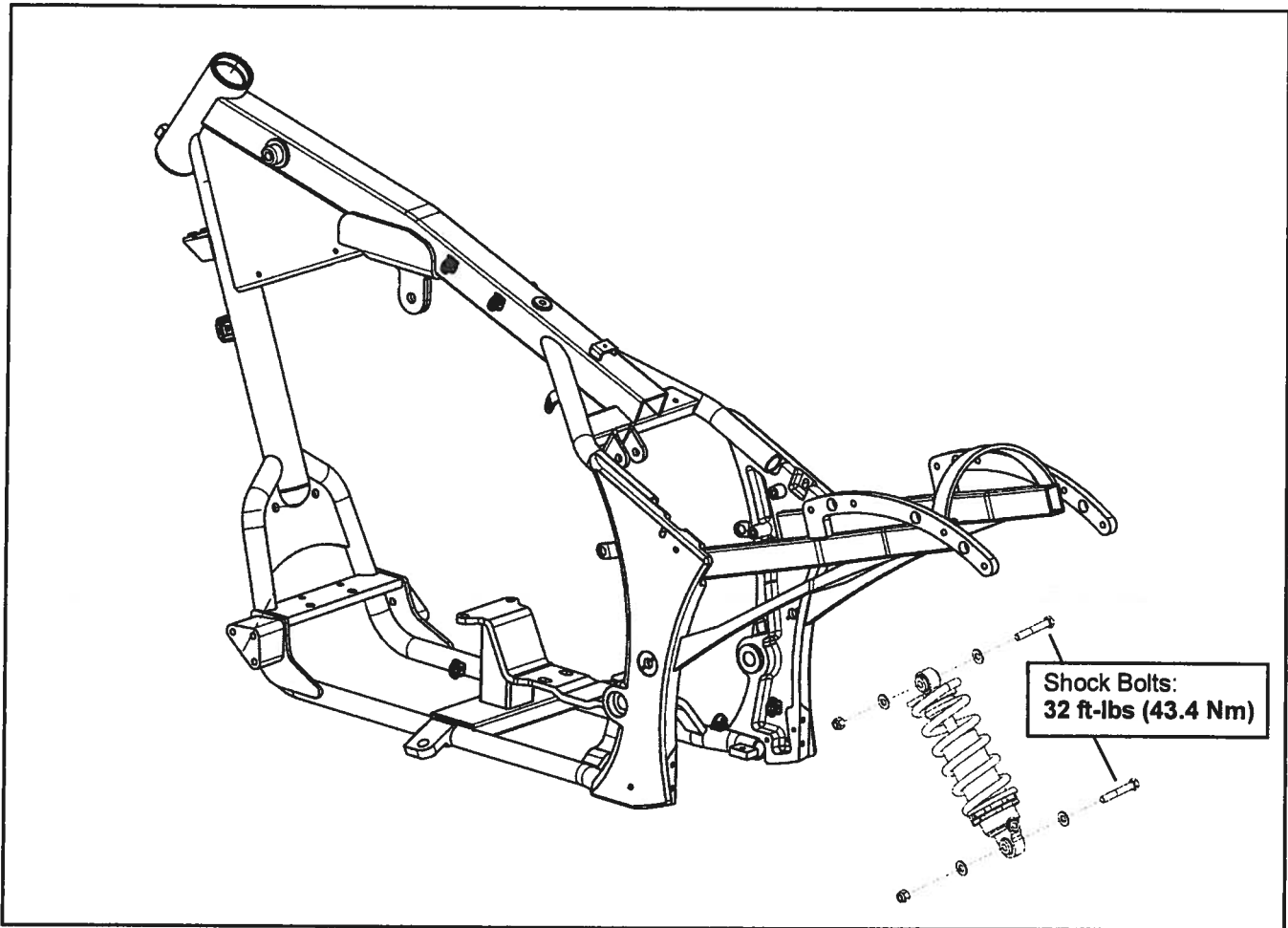


Upper and Lower Belt Guards:
105 in-lbs (11.9 Nm)

13. Install muffler (page 3.9).
14. Rotate rear wheel and check for smooth operation.



REAR SHOCK



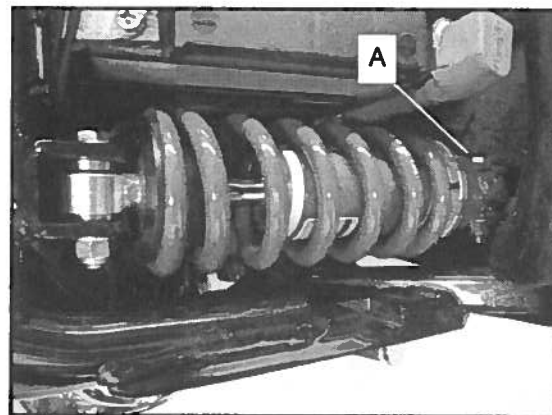
REAR SHOCK REMOVAL

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 suspension is extended. Severe personal injury or death can occur if the motorcycle tips or falls.

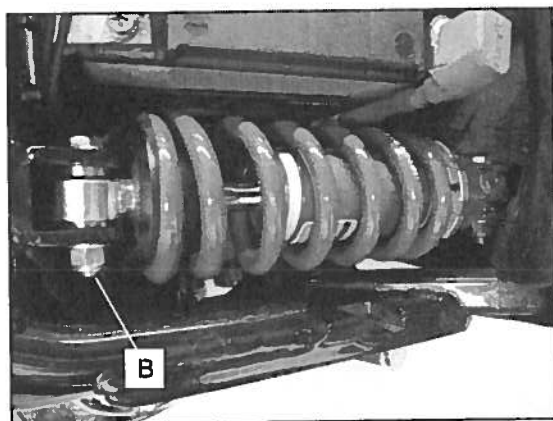
1. Secure motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove seat (page 3.7).
3. Remove battery (page 2.19).

4. Using a scissor jack, lift the rear of the motorcycle until the rear suspension is fully extended. The rear tire should remain in contact with the table.
5. Remove rear shock absorber hardware (A). Adjustment of scissor jack may be required until pressure is relieved from hardware.



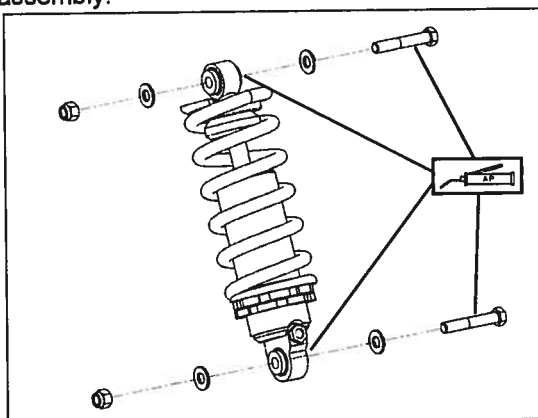
REAR WHEEL & SUSPENSION

6. Remove front shock absorber hardware (B) and remove shock absorber.

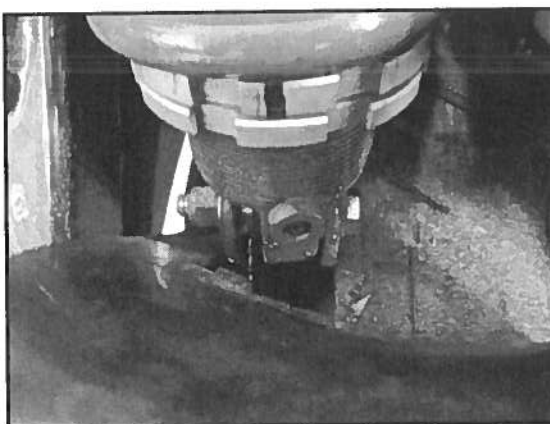


REAR SHOCK INSTALLATION

1. Apply All Purpose Grease to all pivot points before assembly.



2. Install top of shock absorber into the front frame mount with shock adjustment screw (near lower eyelet) facing up. Install hardware.



3. Install lower shock eyelet into swingarm shock mount, align holes, and install hardware.
4. Torque upper and lower shock mounting bolts to specification.



Shock Eyelet Fastener Torque:
32 ft-lbs (43.4 Nm)

REAR SHOCK INSPECTION

WARNING

The rear shock absorber is gas pressurized and is not rebuildable. **DO NOT** attempt to disassemble or service the shock.

1. Measure and record the spring installed height, so ride height adjustment (preload) can be returned to rider's preference.
2. Lubricate spring collars and loosen completely.
3. Remove and clean shock spring.
4. Inspect shock for signs of oil seepage around the shaft seal. If leakage is suspected replace the shock absorber assembly.
5. Inspect eyelets for cracks or damage. Replace shock if either eyelet is cracked.
6. Clean shock thoroughly.
7. Inspect for corrosion, pitting, or damage. Replace shock if any of the above is evident.
8. Depressurize the shock.
9. With shock upright, cycle through entire travel range. Shock should move smoothly with consistent damping through the entire travel range, and return to the fully extended position when released. Replace shock assembly if damping is inconsistent, oil leakage has occurred, or if the damper rod does not fully extend when released.
10. Inspect shock spring for cracks or coil distortion.

5. Lower scissor jack and actuate rear suspension, ensuring it has free range of motion and is functioning correctly.
6. Install battery (page 2.20).
7. Install seat (page 3.7).
8. Verify ride height is adjusted properly (page 2.29).

SWINGARM SERVICE

SWING ARM REMOVAL

WARNING

Swing arm removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear suspension is extended. Severe personal injury or death can occur if the motorcycle tips or falls.

1. Secure the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Position a scissor jack beneath the motorcycle and raise the rear of the motorcycle off of the lift table.



3. Remove the seat (page 3.7) and disconnect the battery (page 2.19).
4. Remove the side covers (page 3.3).
5. Remove the exhaust system (page 3.9).
6. Remove the lower belt guard as outlined in Chapter 11.
7. Remove the rear fender (page 3.11).
8. Remove the rear wheel (page 13.6).
9. Remove oil tank (page 4.5).
10. Remove cable tie securing rear brake line to lower right of swing arm.
11. Supporting the swing arm, remove the lower shock mounting bolt.
12. Remove the left and right swing arm bolts and carefully remove the swing arm assembly from the frame.

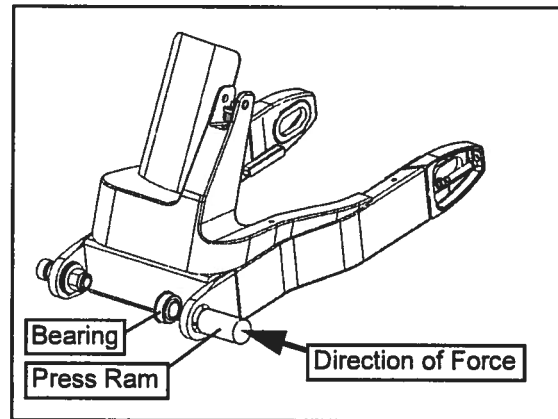
IMPORTANT: Note the location of any swing arm shims that are removed during disassembly.

SWING ARM BEARING REPLACEMENT

Removal

1. Remove swing arm assembly as outlined in this chapter.
2. Using a suitable press or bearing driver, remove left and right swing arm bearings from swing arm assembly.

NOTE: Drive bearings out by pressing towards the center of the swing arm assembly as shown below.



3. Remove bushing (D) from left side of swingarm.

Inspection

4. Inspect eyelets for cracks, corrosion, or damage. Replace bushing/bearing if any damage is present.

Installation

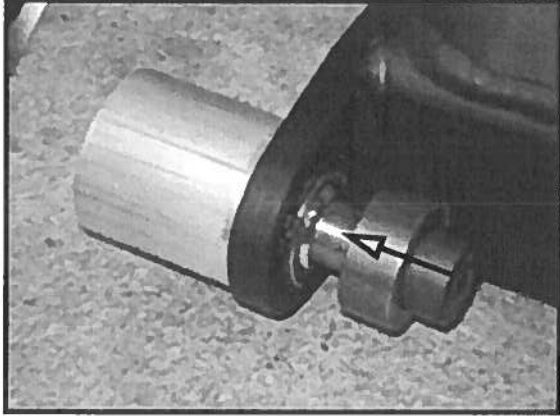
CAUTION

Do not reuse bearings that have been removed.

IMPORTANT: For standard fitment of bearings into the swing arm, coat the bearings with 20W50 oil. For fitment of bearings in oversized bores, apply green Loctite® to outside of bearing.

REAR WHEEL & SUSPENSION

- Using a suitable press or bearing driver, press the left and right bearings into the swing arm assembly starting from the inside. Once the retaining ring on the bearing bottoms out, the bearing is at the proper depth.

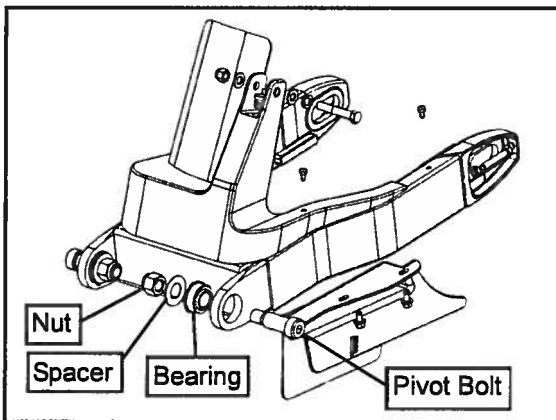


SWING ARM INSTALLATION

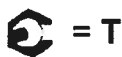
- Install the drive belt onto the drive sprocket.
- Position the left side of the swingarm through the drive belt and install swingarm into frame.

NOTE: If applicable, ensure shims that were removed with the swing arm assembly in Step 12 of SWING ARM REMOVAL are reinstalled in the same location.

- Place the swing arm into position and loosely install pivot bolts (A) as shown.



- Torque pivot bolts to specification.



Swing Arm Pivot Bolts:
60 ft-lbs (81.3 Nm)

- Grasp swing arm and verify that there is no lateral play, and that rotational (up and down) movement is smooth. If excessive play is found, utilize shims to correct.
- Install rear shock absorber (page 13.10).
- Install oil tank (page 4.5).
- Install rear wheel (page 13.8).
- Align rear wheel and set drive belt tension (page 2.24).
- Install rear fender (page 3.11).
- Install lower belt guard.
- Install exhaust system (page 3.9).
- Install side covers.
- Connect battery (page 2.20) and install seat (page 3.7).
- Test ride motorcycle to be sure rear suspension operates smoothly without binding or abnormal noises.



TROUBLESHOOTING

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	REPAIR RECOMMENDED
Rear Wheel Feels "Loose" or Wobbles	Low tire pressure	Inflate to specification
	Worn or damaged wheel bearings	Replace wheel bearings
	Worn or damaged swing arm bearings.	Replace bushings or bearings
	Damaged or incorrect rear tire	Replace rear tire
	Unbalanced rear wheel assembly	Balance tire/wheel
	Distorted (bent) rear wheel	Replace wheel
	Loose swing arm, axle or suspension fasteners.	Torque to specifications
Rear Suspension Too Hard	Bent / corroded shock damper rod	Replace shock
	Dry, seized, damaged, corroded suspension bearing(s)	Correct as necessary
	Incorrect preload adjustment	Adjust to rider & load
	Damaged, dry, or corroded shock bushings, bearings or pivot bolts.	Lubricate or Replace
	High tire pressure	Deflate to specification
	Drive belt adjustment too tight	Adjust drive belt tension
Rear Suspension Too Soft	Shock leaking oil	Replace shock / repair line leak
	Weak shock spring	Replace shock spring
	Incorrect preload adjustment	Adjust to rider & load
	Excessive load placed on motorcycle	Educate rider / operator
	Low tire pressure	Inflate to specification
Rear Suspension Noisy	Loose fasteners	Torque to specifications
	Worn wheel bearings	Replace
	Worn swing arm bearings and/or pivot bolts	Replace
	Damaged shock absorber	Replace as necessary
	Contact between moving and stationary parts	Check all swingarm, wheel, and brake system components for contact with frame, exhaust, body, etc. Check routing and the all fasteners are in place and tight
Rear Wheel Drag (Turns Hard)	Incorrect drive belt adjustment	Adjust drive belt tension
	Tire contact with object or chassis	Determine point of contact and correct
	Bent rear axle	Replace
	Damaged wheel bearings	Replace
	Brake problem	Refer to chapter 15



REAR WHEEL & SUSPENSION

NOTES

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal black lines across the entire width of the page, typical of standard notebook or legal stationery. The background is a solid off-white color. There are no margins, text, or other markings present.

CHAPTER 14

TIRES / WHEELS

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TIRES / WHEELS

GENERAL / SAFETY

WARNINGS / PRECAUTIONS

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 department 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 clearance between tire and various parts of the motorcycle.

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 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.

The use of tire valves and valve cores other than original equipment replacement Indian Motorcycle parts could cause tire deflation during driving. Always use genuine Indian Motorcycle parts or their equivalent. Be certain to install the valve stem caps securely. Do not allow the motorcycle to be ridden without properly installed valve stem caps.

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 / feathering.
- 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. Indian Motorcycle recommends the use of "head-type" plugs such as: Tech Tire Repair™ Uni-Seals. Complete Tech Tire Repair™ kits are commonly available at most automotive parts outlets.

WARNING

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.

WARNING

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

FRONT TIRE MINIMUM TREAD DEPTH	REAR TIRE MINIMUM TREAD DEPTH
1.6 mm (.063") (1/16 inch)	1.6 mm (.063") (1/16 inch)

TIRE DATA

TIRE SPECIFICATIONS

Tire Type, Pressure & Size Ratings 2009-2010

2009-2010	TIRE TYPE / SIZE	PSI - SINGLE RIDER	PSI @ GVWR
Front	Black - Michelin Commander 67H 130/90-16 White Wall - Metzler Marathon ME880 130/90-16	36 psi (all)	38 psi (all)
Rear	Black - Michelin Commander 71H 150/80-16 White Wall - Metzler Marathon ME880 150/80B-16	39 psi (all)	41 psi (all)

Tire Type, Pressure & Size Ratings 2011

2011	TIRE TYPE / SIZE	PSI - SINGLE RIDER	PSI @ GVWR
Front	Black - Michelin Commander II 73H 130/90B-16 White Wall - Metzler Marathon ME880 130/90-16	36 psi (all)	38 psi (all)
Rear	Black - Michelin Commander II 77H 150/80B-16 White Wall - Metzler Marathon ME880 150/80B-16	39 psi (all)	41 psi (all)

WHEEL DATA

WHEEL SPECIFICATIONS

Item		Standard	Service Limit
Front Wheel			
Front Wheel Size		3.50 x 16 Spoked or Billet	-
Front Wheel Runout (Spoked and Billet Type)	Axial	∠ .75 mm (.030 inch)	2.0 mm (.080")
	Radial	∠ .75 mm (.030 inch)	2.0 mm (.080")
Rear Wheel			
Rear Wheel Size		3.50 x 16 Spoked or Billet	-
Rear Wheel Runout (Spoked and Billet Type)	Axial	∠ .75 mm (.030 inch)	2.0 mm (.080")
	Radial	∠ .75 mm (.030 inch)	2.0 mm (.080")



TIRES / WHEELS

TIRE INSPECTION

TIRE WEAR PATTERNS & GENERAL CAUSES

WEAR PATTERNS AND GENERAL CAUSES	
SYMPTOM	CAUSE
Wear on Left Side	Riding on Crowned Roads
Edges Worn	Underinflation or Excessive Loads
Excess Wear in the Middle of Tire	Over-inflation or Tire Abuse
Cracks in Tread Grooves	Underinflation, 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 CHANGING

GENERAL

There are three generally acceptable methods to dismount and mount a tubeless motorcycle tire from its rim. For each of the three methods, there are countless variations.

The three general methods:

- Pneumatic or electrically operated tire machine
- Manually operated tire machine
- Manual manipulation of tire irons

The seal between the tire and rim is one of the most critical factors that contribute to the safe operation of the wheel/tire assembly. 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 disc, 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 method 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 the drop center of the wheel during mounting and dismounting of the tire.

The following method describes the procedure using manually manipulated tire irons. Other than the actual operation of various tools, the general concept is the same regardless of which method is used.

The following procedure shows the front tire being removed from its rim. Other than the possibility of interference of the sprocket, the procedure is the same for the rear tire.

NOTE: Rear sprocket bolts and brake rotor bolts have a pre-applied locking agent and bolts should either be replaced or a locking agent applied upon assembly. Refer to Chapter 11 for rear sprocket removal and installation. Refer to Chapter 13 for rear brake rotor removal and installation. Brake rotor bolts should not be re-used.

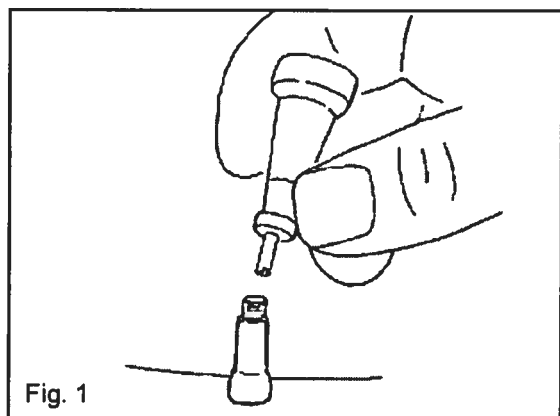


TIRES / WHEELS

TIRE REMOVAL

TIRE REMOVAL (TYPICAL)

1. Remove wheel / tire assembly from motorcycle (front refer to Chapter 12, rear refer to Chapter 13).

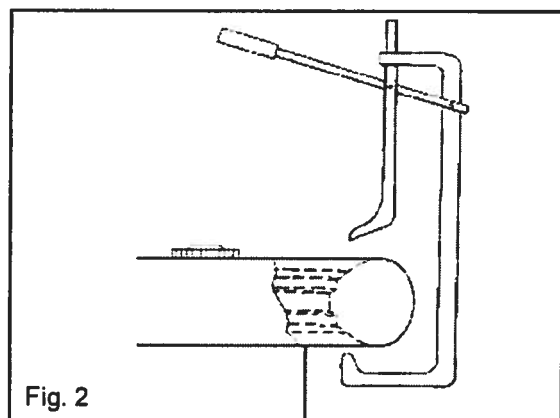


2. Remove valve core from valve stem and let all air escape. (Fig. 1)

CAUTION

If the tires have a directional arrow it must be observed and the tire installed correctly.

3. Mount the wheel assembly into a tire bead breaker and break the bead. (Fig. 2)

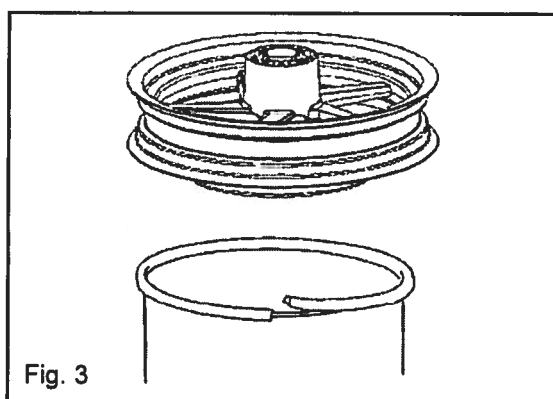


4. Flip the wheel assembly over and break the bead on the other side.

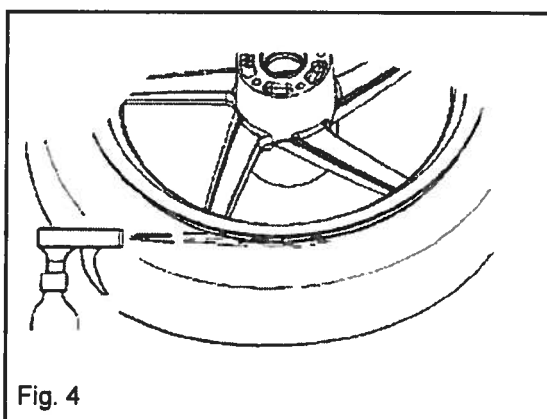
CAUTION

IMPORTANT: Take 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 disc and/or belt driven sprocket, remove the disc or sprocket as required.

NOTE: This procedure can be performed on an empty drum or similar fixture. The top lip of the drum should be covered with protective material or split hose to protect the rim. (Fig. 3)



5. Position wheel assembly so brake disc will not be damaged and rim will not be scratched.
6. Push tire down and lubricate tire bead with tire lubricant on both sides of tire. (Fig. 4)



7. Install rim protectors at 12:00 and 2:00 positions. (Fig. 5)

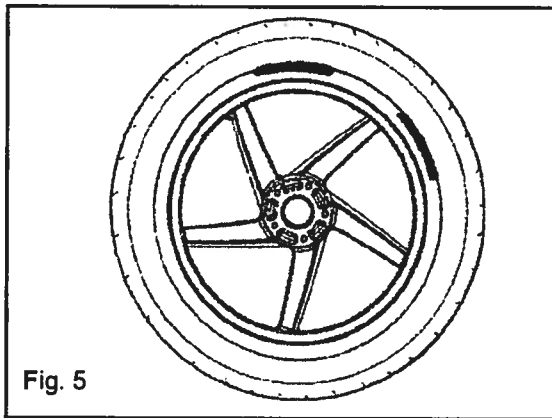


Fig. 5

8. Stand opposite of rim protectors. Use your knee to push tire bead down into the rim's drop center at location (Fig. 6, A) while pulling bottom bead up into drop center. Beads must be kept in drop center during following steps.
9. With both beads in the drop center, slide a tire iron between tire bead and 12 o'clock rim protector (Fig. 6, B), lift the bead up with the tire iron, and hold.

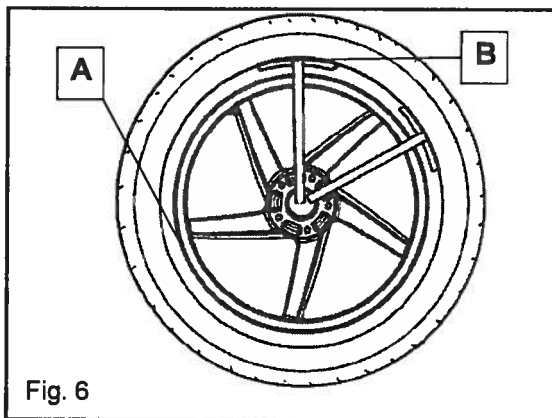


Fig. 6

10. Using another tire iron to lift the bead at the 2 o'clock position.
11. Remove the 2 o'clock tire iron and slide rim protector to the 4 o'clock position, and lever the bead up.

IMPORTANT: The top and bottom tire beads that are opposite the area being worked with the tire irons must continually be pushed into the drop center of the wheel, or bead removal will be difficult and tire could be damaged.

12. Continue going around the tire in small steps, until one side of the tire is off the rim.

13. Turn the tire and wheel assembly over on the drum, so the removed bead is on the bottom side.

TUBE TYPE TIRES:

Remove valve stem nut, push stem through rim.
Remove tube and inspect tube carefully for signs of abrasion or other damage.
Replace tube and rim band whenever a tire is removed.

14. Push the tire away from you so the remaining bead is in the drop center of the rim.
15. Lubricate the bead and start it over the rim with a tire iron.
16. In most cases the tire can be forced off of the rim by hand. Continue to work around the tire until the tire is completely dismounted.

WHEEL INSPECTION

VISUAL INSPECTION & RUNOUT

1. Refer to chapter 12 for complete front wheel inspection procedures.
2. Refer to chapter 13 for complete rear wheel inspection procedures.
3. Clean the rim of all rubber particles and corrosion.

WARNING

If any of the following problems are discovered, replace the wheel.

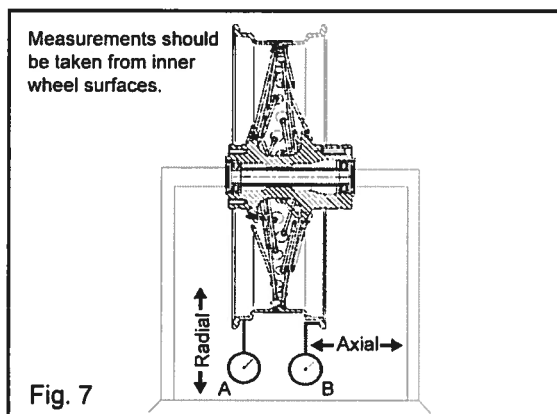
4. Inspect wheel for cracks and/or distortion.
5. Inspect bead seating area of scratches, gouges, distortion or any damage that could create a sealing problem.
6. Inspect wheel for axial runout, measured on the inner bead-sealing surface of wheel as shown in Fig. 7 (B).

14



TIRES / WHEELS

7. Measure wheel for radial runout Fig. 7 (A).



NOTE: Measure runout on the inside tire bead sealing surface of wheel. Be sure surface is clean before measuring

8. Compare measurements of axial and radial runout to specifications listed on page 14.3. Replace wheel if any measurement exceeds Service Limit. Cast or Billet wheels cannot be straightened.
9. 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 unmounted 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 the tire cools for at least three hours following initial operation.

VALVE STEM

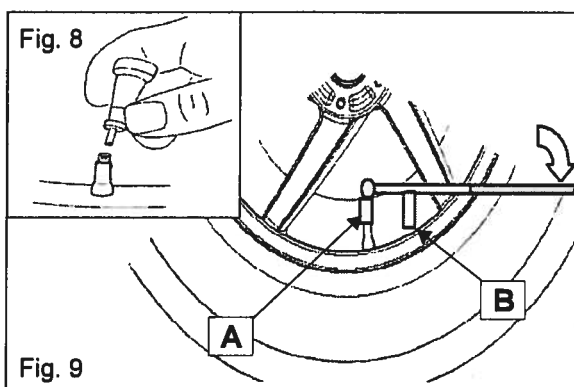
TIRE VALVE AND STEM INSPECTION

1. Remove and inspect valve core (Fig. 8). Replace if seal is worn, deformed or otherwise damaged. Inspect tire valve for cracks or visible damage and replace if necessary.

NOTE: Valve stem replacement is recommended when tire is being replaced.

VALVE STEM INSTALLATION - RUBBER

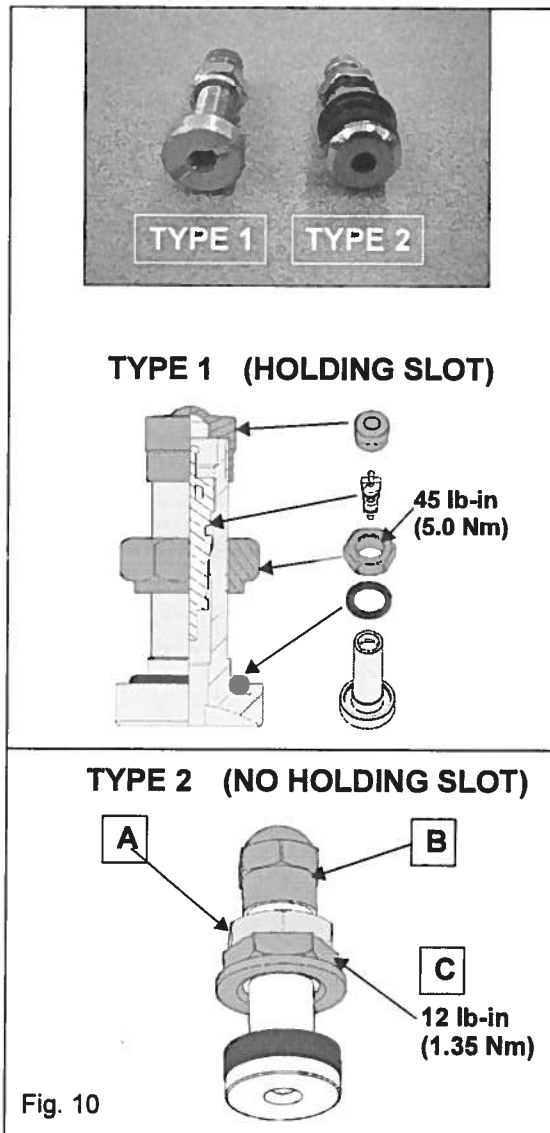
1. Remove tire from wheel and cut valve stem with a diagonal cutter to remove.
2. Clean tire valve hole and sealing area thoroughly.
3. Lubricate tire valve and hole with P-80 rubber lubricant or equivalent.
4. Place tire valve into hole and screw a tire valve installation tool (commercially available) onto valve.
5. Place a small wood block against the rim to improve leverage point and keep the pulling angle as straight as possible. (Fig. 9)
6. Pull the valve until fully seated and remove tool.



VALVE STEM INSTALLATION - METAL

1. Remove tire from wheel and remove old stem.
2. Clean gasket or O-ring seal surface of wheel.
3. Place tire valve (with seal washer or O-ring installed) through hole in rim and secure it hand tight with nut.
4. Refer to Fig. 10. On Type 2 valve stems (with no holding slot) tighten upper nut (A) to stem cap (B).
5. Hold nut (A) to prevent valve stem rotation, and torque lower stem nut (C) to 1.35 Nm (12 lb-in) using an open end torque wrench.

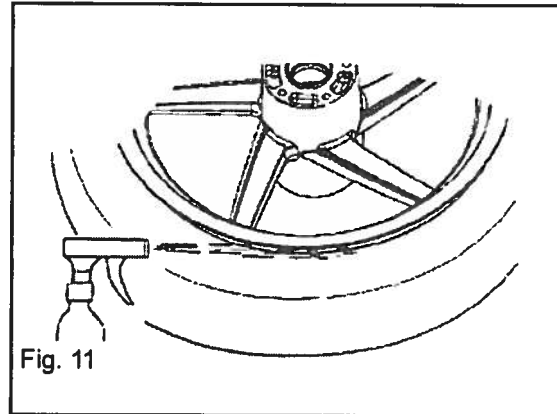
6. Release upper nut from cap and screw it down against stem nut.
7. Hold stem nut and tighten lock nut to 12 lb-in).



TIRE INSTALLATION

TIRE MOUNTING

1. Lubricate both tire beads with rubber lubricant. (Fig. 11).



! 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.

Balance Dots

Dunlop tires have a yellow dot on the sidewall which corresponds to the lightest part of the tire. This dot is meant to line-up with the tire valve which often is the heaviest part of the rim (although this is not always the case).

! WARNING

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

If tires have directional arrows, they must be observed and tires installed correctly. When tires are manufactured, tread rubber is laid down as a strip and its ends connect as overlapping joints. When the tire is mounted correctly the scrubbing forces of acceleration (rear) or braking (front) press the lap joints together rather than try to separate the joint.

TIRES / WHEELS

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.

Ensure that bead is correctly seated.

TUBE TYPE TIRES:

Install new rim band (rim flap) on rim with hole oriented over valve stem hole in rim.

1. Place tire on drum.



CAUTION

Support tire assembly in such a way that brake disc or belt drive sprocket will not be damaged.

2. Lubricate the bead.
3. Orient tire correctly as to the balance dot and directional arrow.
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.
5. Turn the tire / wheel over on the drum so the un-installed portion of tire is facing up.

NOTE: Confirm tire is positioned correctly by observing directional arrows. (Fig. 12)

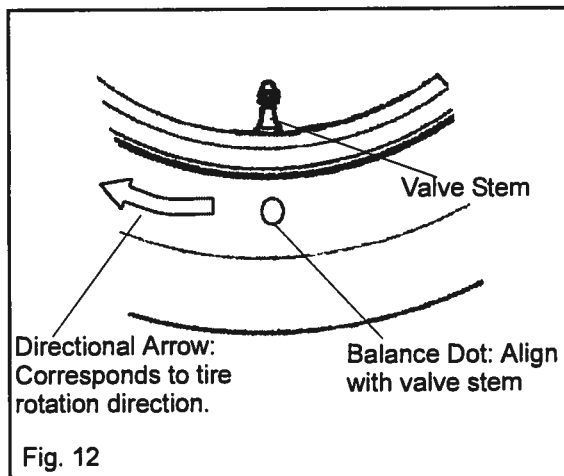


Fig. 12

6. For tube type tires, also observe the following:

TUBE TYPE TIRES:

Apply baby powder to new (deflated) tube and install by inserting valve stem through the rim band and rim.

Install and turn the valve stem lock nut a few threads, but do not tighten at this time.

Install the tube in the tire starting at the valve stem and working around until the entire tube is laying inside the tire in a natural position.

Arrange the tube, if necessary, to remove kinks or bends, making sure that the valve stem projects straight out and forms a 90 degree angle with the rim.

Tighten the lock nut by hand to hold the stem in position.



CAUTION

Make sure your tire irons are smooth and free of scratches or any sharp edges. Polish them if necessary. Do not slide the tire iron in any more than is necessary. When installing tube type tires, avoid lifting the tire iron past vertical to minimize the chance of pinching the tube.

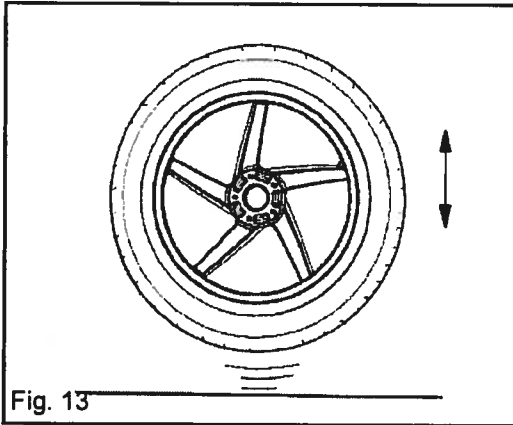
7. Lubricate the tire bead.
8. With your hands, push as much of the remaining tire bead as possible into the rim, pinching both upper and lower beads into the drop center.
9. When no more of tire can be installed by hand, press down on portion of tire in front of you with your knee to keep the top bead in the drop center.
10. Carefully slide a tire iron between the rim and tire at the other side of the un-installed portion of the tire.

NOTE: Be sure both beads are forced as far as possible into the drop center of the rim.

11. Lever the tire iron over and install that portion of tire. Continue to move tire iron in small increments until tire is completely installed.
12. Install valve core if it was removed.
13. Line up balance dot.
14. Confirm that the directional arrows are pointing in the correct direction.



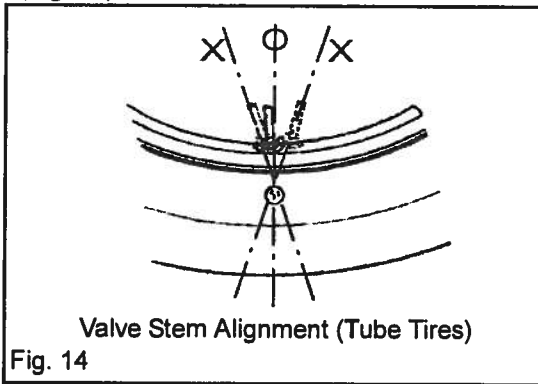
15. Bounce tire on the floor several times while rotating tire. This will expand tire bead outward slightly which will make tire inflation easier. (Fig. 13)



16. Inflate tire observing the precautions listed below and on page 14.10.

TIRE INFLATION & PRECAUTIONS

- Wear approved eye protection
- Lubricate the tire beads with a tire mounting lubricant before inflation.
- Before inflating a tube type tire, check to be sure valve stem is still straight. If not, rotate tire slightly on rim (in the direction the stem is pointing) to align (Fig. 14).



- 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.

1. 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.
2. If tire is not seated correctly, deflate and unseat the tire, relubricate the tire beads and repeat inflation procedure.
3. Install wheel assembly onto balance stand and spin. Observe the wheel assembly while it is spinning to make sure the tire is seated properly.
4. Adjust tire pressures to specifications.
5. Balance tire / wheel assembly. Refer to page 14.11.

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".

TIRES / WHEELS

TIRE BALANCING

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.

All Dunlop street tires should be installed with the yellow balance dot at the tire valve.

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 balance stand.

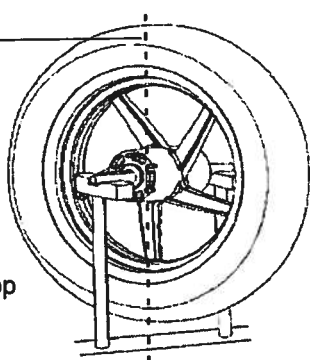
Typical Balance Stand (Commercially available)

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. (Fig. 15)

Mark lightest
part of tire



1. Spin tire.
2. Allow tire to stop on its own.
3. Mark lightest part of tire

Fig. 15

NOTE: If the bearings are totally free to rotate and the wheel does not stop in the same place each time, the wheel is in balance.

5. Place balance weights at the lightest portion of wheel in small increments. (Fig. 16)

Add small amounts
of weight to the
lightest part of the
rim.

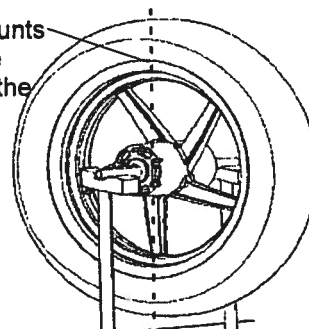


Fig. 16

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.
8. Install wheel / tire assembly tire on motorcycle.

Front wheel installation: Chapter 12

Rear wheel installation: Chapter 13

CAUTION

Do not add more than 85 grams (3.0 oz.) of weight to the rear wheel.

Do not add more than 85 grams (3.0 oz.) of weight to the front 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.

TROUBLESHOOTING

TROUBLESHOOTING

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 bearings.	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 bolts	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



TIRES / WHEELS

NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

CHAPTER 15

BRAKES

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BRAKES

BRAKE SYSTEM SAFETY

GENERAL

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 fluid should be completely replaced every 24 months or 12,500 miles.

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.

NOTICE: 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.



SPECIFICATIONS

GENERAL SPECIFICATIONS

BRAKE SYSTEM		
Item	Standard	Service Limit
Specified Brake Fluid	DOT 4	Replace every 24 months or 12,500 miles
Brake Disc Thickness, Front	5 mm	4.5 mm (.177") (Min)
Brake Disc Thickness, Rear	5 mm	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
Master Cylinder Pushrod Free Play (Rear)	1 - 2 mm (.040 - .080")	-
Brake Lever Freeplay (Front)	No Adjustment	-

TORQUE SPECIFICATIONS

BRAKE SYSTEM TORQUE SPECIFICATIONS

Refer to the exploded views in this chapter for components not listed here.

Description	Torque Nm	Torque ft-lbs (in-lbs)	NOTES
Bleed Screw, Caliper (Front and Rear Caliper)	3.6 Nm	(32 in-lbs)	
Footrest Support to Frame	5.7 Nm	(50 in-lbs)	
Front Brake Caliper to Fork Leg	54.2 Nm	40 ft-lbs	
Front Brake Caliper Body Screws	23 Nm	17 ft-lbs	
Front Brake Disc to Wheel Hub 2009-2010 / 2011	24.4 Nm / 43.3 Nm	18 ft-lbs / 32 ft-lbs	See Chapter 12
Front Brake Lever Pivot Screw	1.0 Nm	(9.0 in-lbs)	
Front Brake Lever Pivot Screw Nut	6.0 Nm	(52 in-lbs)	
Front Brake Line Banjo Bolt (All)	20.3 Nm	15 ft-lbs	
Front Brake Master Cylinder to Handlebar	11.9 Nm	(105 in-lbs)	
Front Brake Master Cylinder Reservoir Cover	1.1 Nm	(10 in-lbs)	
Rear Brake Disc to Wheel Hub	43.3 Nm	32 ft-lbs	See Chapter 13
Rear Brake Line Banjo Bolt (All)	20.3 Nm	15 ft-lbs	
Rear Brake Master Cylinder Mounting Screws	11.9 Nm	(105 in-lbs)	
Rear Brake Reservoir Mounting Screw	2.3 Nm	(20 in-lbs)	

SPECIAL TOOLS

BRAKE SERVICE SPECIAL TOOLS

Front Master Cylinder Snap Ring Pliers (commercially available)

Caliper Piston Pliers (commercially available)

Vacuum Brake Bleeder (commercially available)

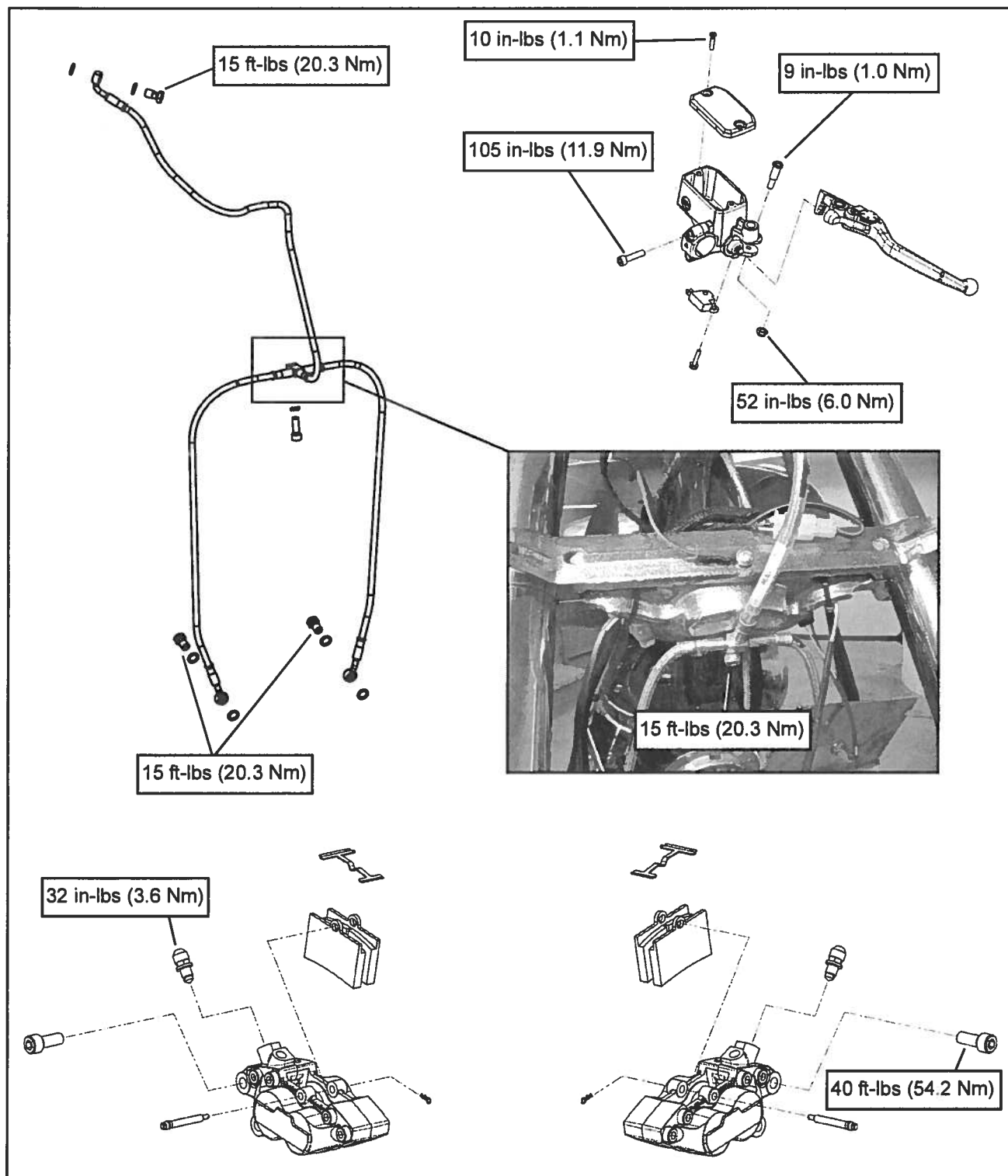
Pressure / Vacuum Pump (alternative to Vacuum Brake Bleeder above) PV-43545



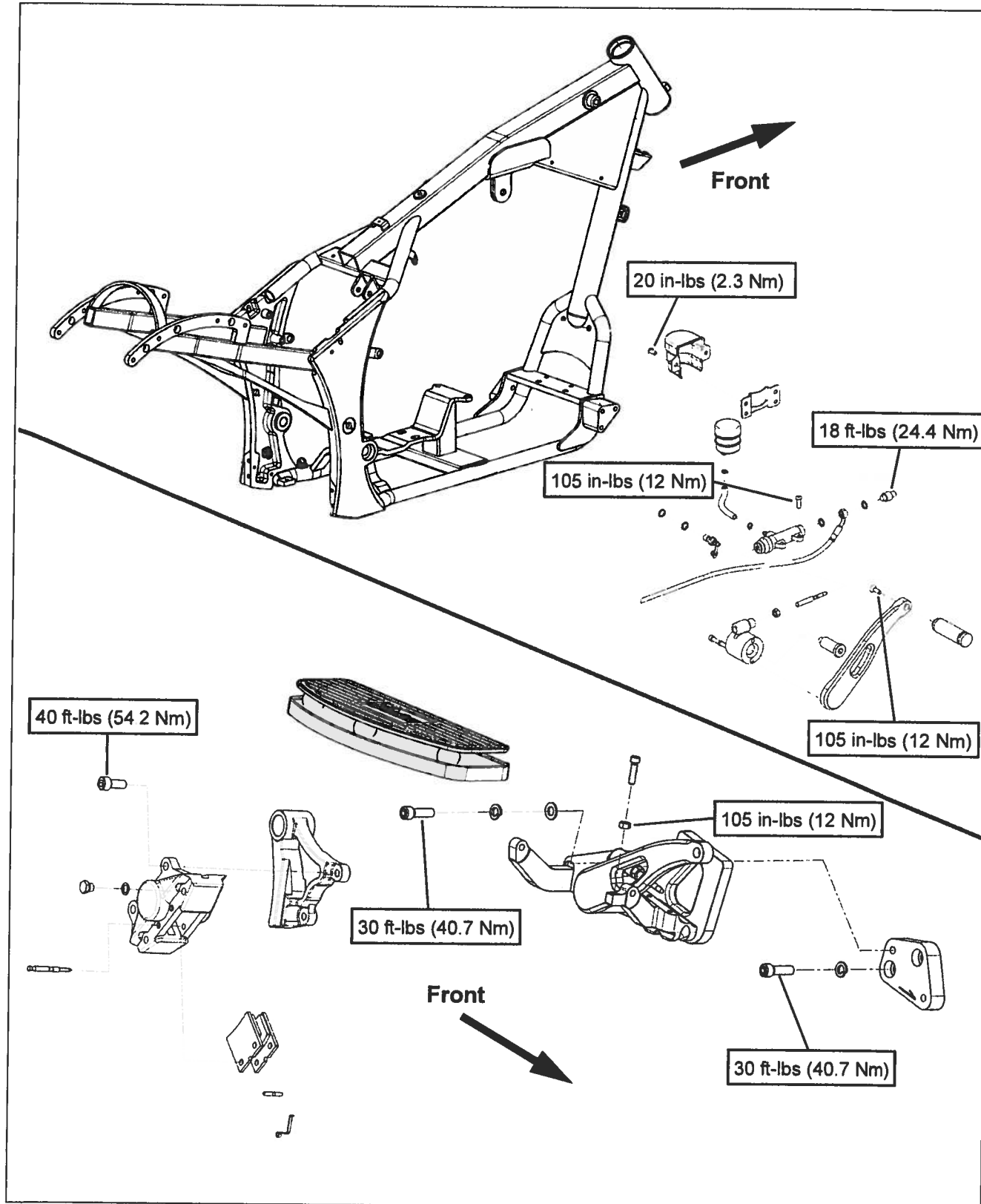
BRAKES

ASSEMBLY VIEWS & TORQUES

FRONT BRAKE



REAR BRAKE



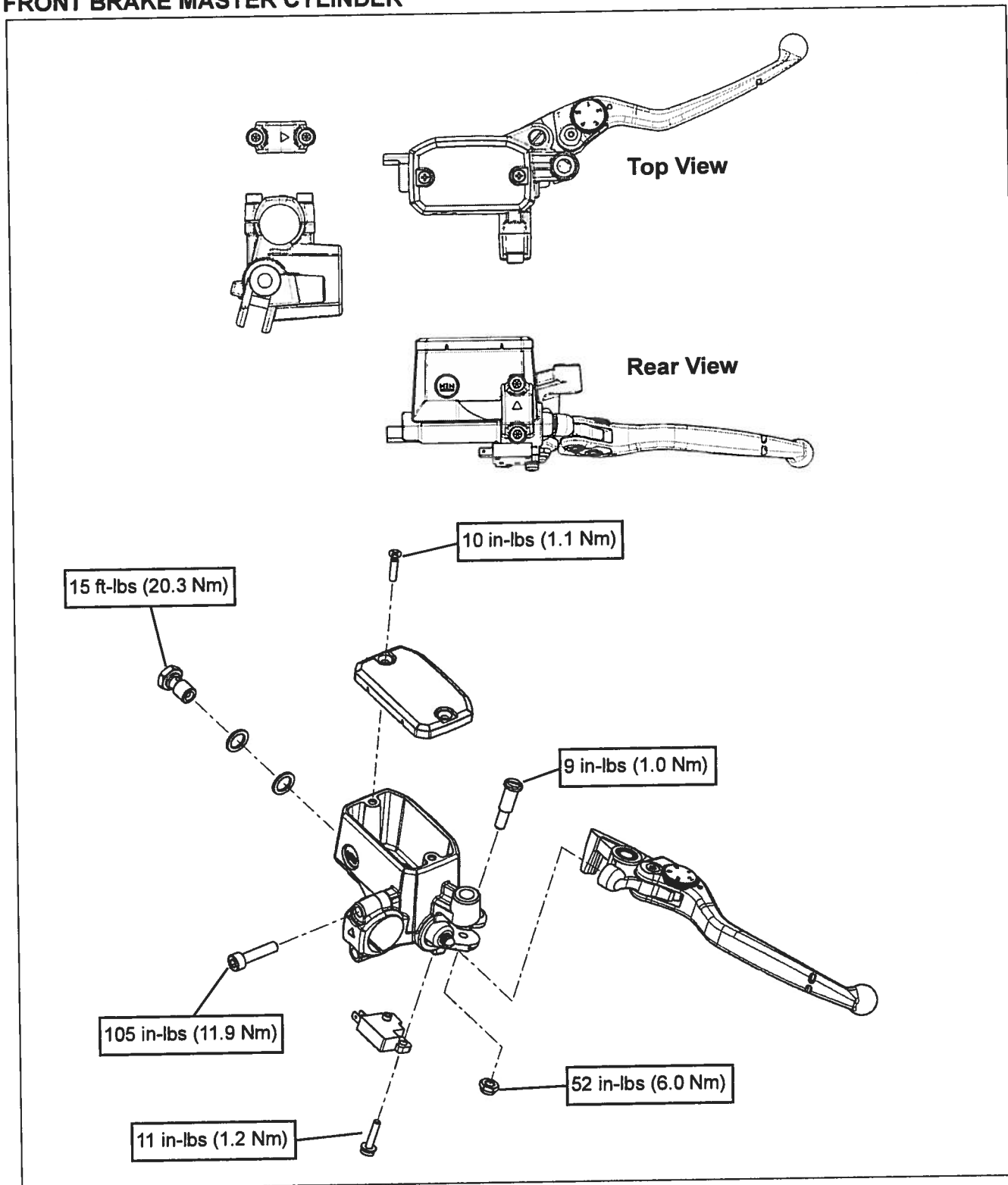
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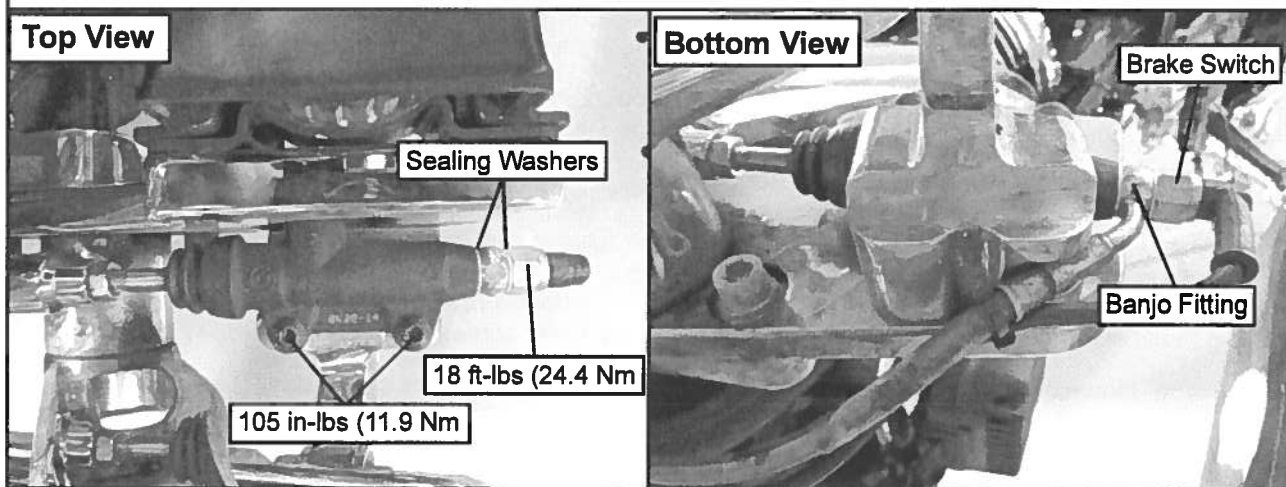
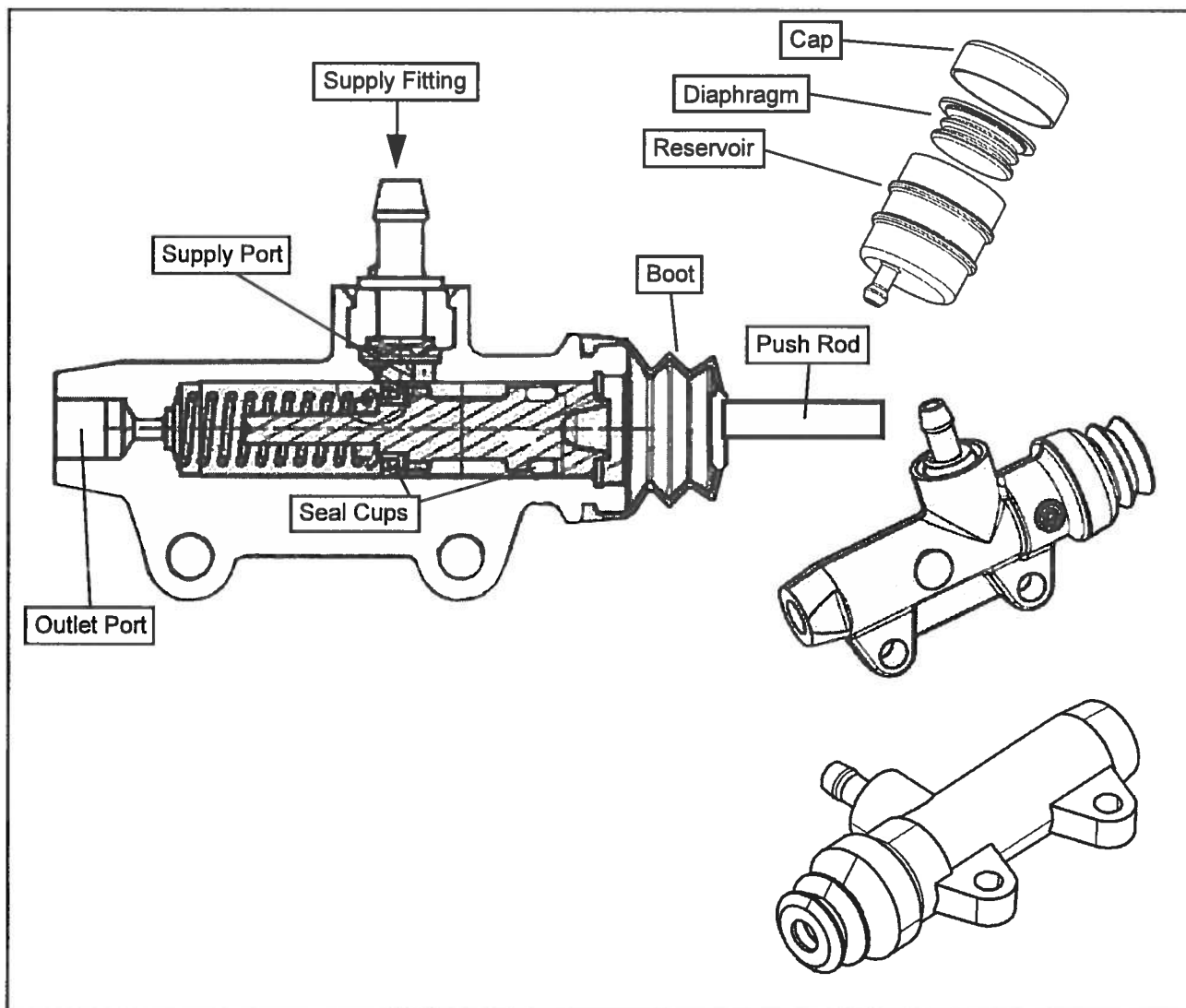
BRAKES

MASTER CYLINDERS

FRONT BRAKE MASTER CYLINDER



REAR BRAKE MASTER CYLINDER



BRAKES

BRAKE SYSTEM SERVICE

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 its 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).

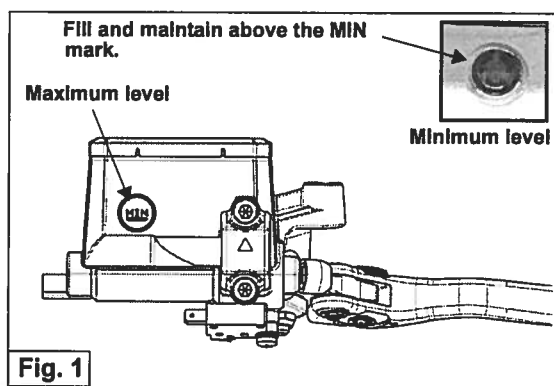


BRAKE BLEEDING / FLUID CHANGE

NOTE: Procedure is basically the same for both front and rear brakes.

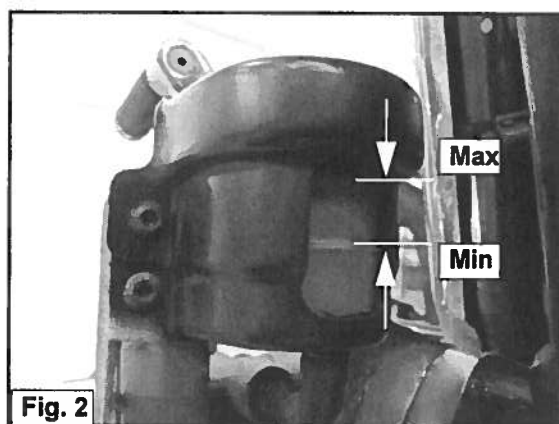
NOTE: Throughout the following procedure, monitor fluid level in master cylinder reservoir constantly. Do not allow fluid level to fall below minimum level. (Fig. 1 and 2)

1.



Use Only DOT 4 Brake Fluid (PN: 2872189)

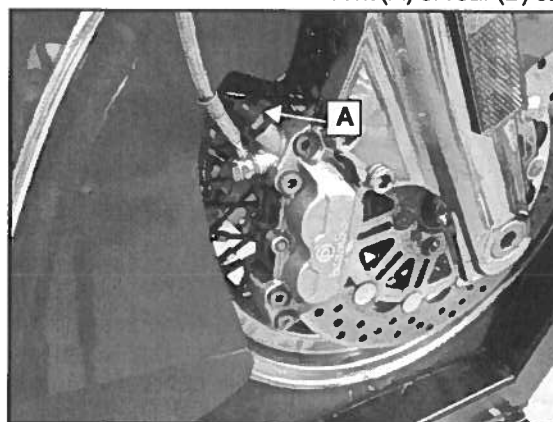
2. Between fills, set reservoir cover on reservoir to prevent entry of contaminants.



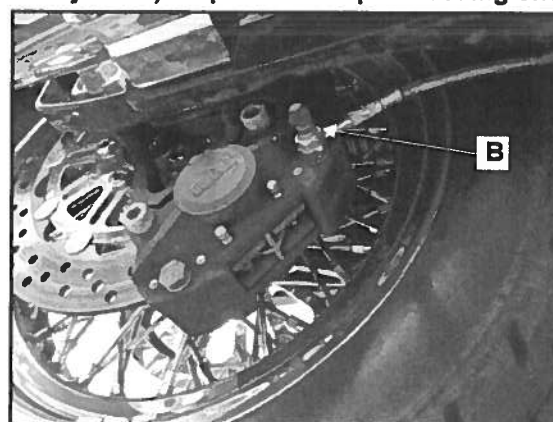
NOTE: If system is dry or very low on fluid due to parts replacement or disassembly, pump the lever or pedal *slowly* until air bubbles no longer rise through the fluid in the reservoir. For normal bleeding or system flush, continue with Step 3.

NOTE: Brake systems should be flushed every 2 years or more often if the fluid is discolored. To flush the system, follow the normal brake bleeding process, and continue bleeding and filling the reservoir until fluid moving through the bleeder hose is clear.

3. Remove rubber cap and install an 11mm box end wrench over the bleeder screw. Connect a tight-fitting clear hose to bleed screw of front (A) or rear (B) caliper.

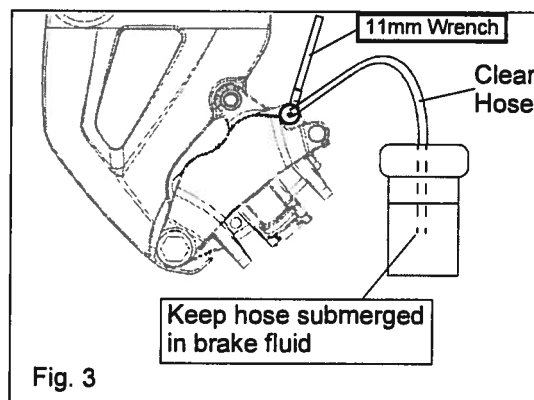


NOTE: When bleeding dual front disc brake systems, bleed left side lines / caliper first (farthest from master cylinder) then bleed right side (closest to master cylinder). Repeat left caliper bleeding once.



4. Place a small quantity of fresh brake fluid into a small, clear jar.

5. Place the other end of bleeder hose into the jar. (Fig. 3).



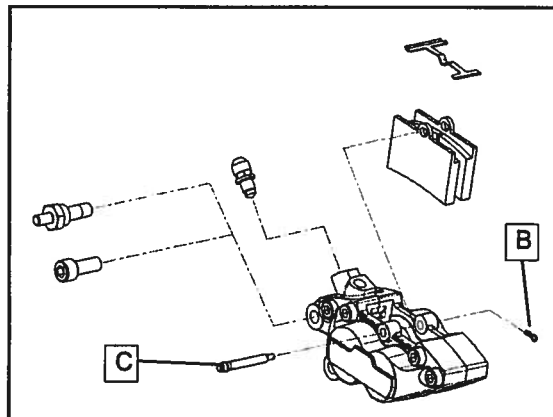
BRAKES

6. *Slowly* pump brake lever or pedal until pressure builds and then hold.
7. Quickly open and close the bleed screw while holding pressure on lever or pedal / lever.
8. Release lever or pedal pressure.
9. Check level of fluid in reservoir and add if necessary.
10. Repeat Steps 6, 7, 8, and 9 until lever or pedal is firm and no air can be seen moving through the clear hose.
11. For dual front disc brake models repeat process for the right caliper, then bleed left caliper again.
12. Torque bleed screw (s) to specification.
3. Remove clips (B) securing the brake pad retaining pins (C).

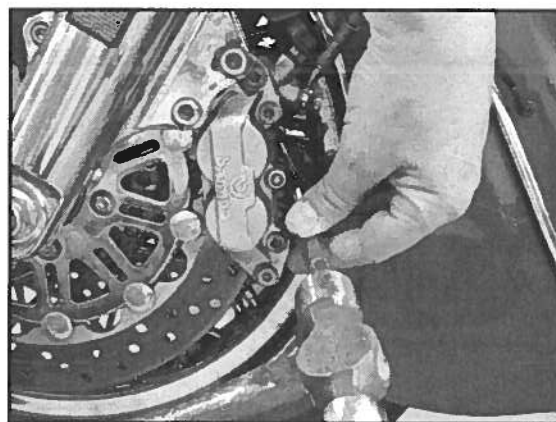


Bleed Screws:
32 in-lbs (3.6 Nm)

13. After completing the bleeding procedure, inspect brake fluid level (page 2.14). clean the reservoir cover, diaphragm, and reservoir sealing surface. If diaphragm is extended, return it to normal (flat) position. Install diaphragm and cover.
14. Inspect the feel when pressure is applied to the lever or pedal. The lever or pedal should feel firm, not spongy. If lever or pedal is not firm, repeat bleeding procedure and insect brake system. See Troubleshooting at the end of this chapter.



4. Using a long drift, access the inside tip of the brake pad retaining pin (through the spokes) from the opposite side of the motorcycle.

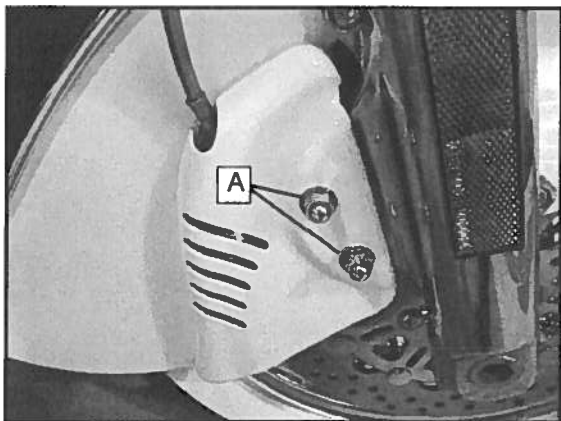


FRONT BRAKE PAD REPLACEMENT

NOTE: Caliper removal is not necessary for front brake pad service.

Removal

1. Secure motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. If equipped, remove acorn nuts (A) and caliper covers.

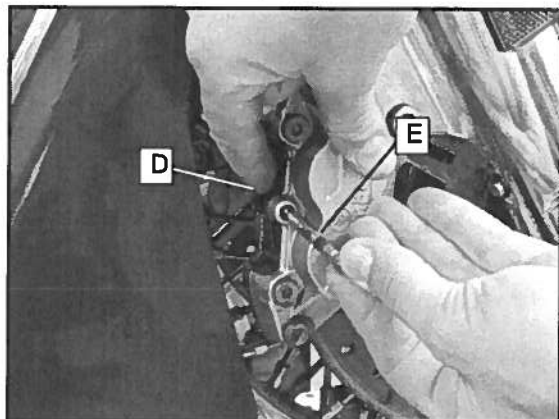


CAUTION

Use care not to contact any painted or finished surface with the drift or hammer while driving the retaining pin out of the caliper assembly.

5. Carefully drive the retaining pin approximately 1/2 way out of the caliper.

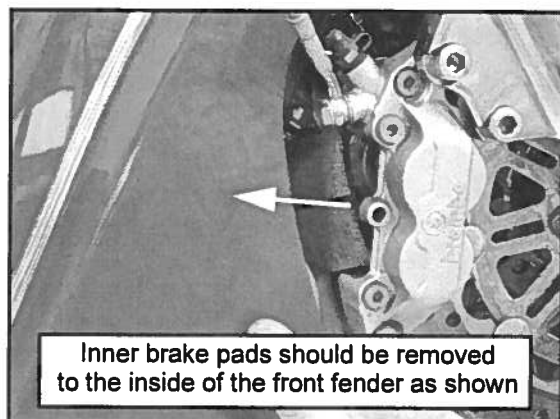
6. Hold the brake pad spring (D) in place and remove the retaining pin (E) from the caliper assembly.



7. Remove the pad spring; note direction of the spring for assembly.
8. 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 (as described in the **BRAKE BLEEDING** section of this chapter) and open the bleed screw while pushing the pads and pistons back.

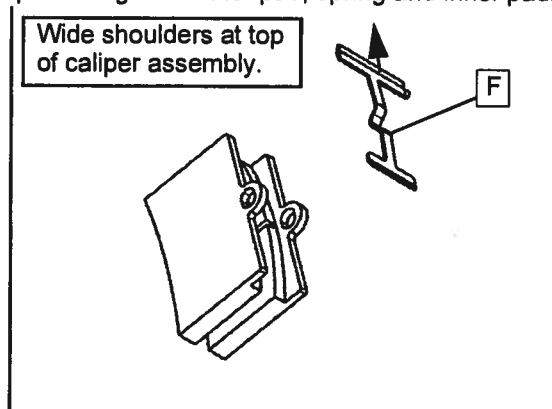
9. Remove brake pads from the caliper assembly.



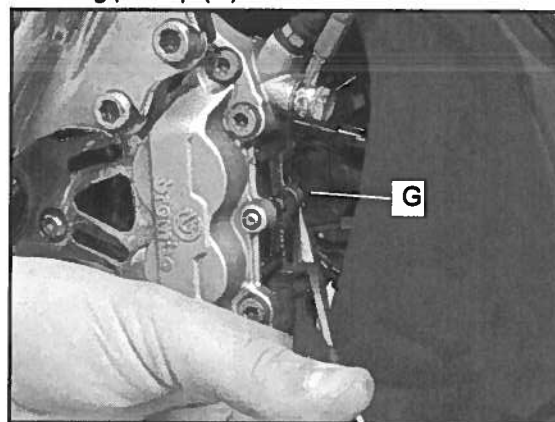
Installation

10. Inspect caliper piston seals for any sign of fluid leakage.
11. Wipe brake discs clean with a shop towel sprayed with brake cleaner.
12. Install new brake pads into caliper with friction material facing the brake disc surface.

13. Lay spring in place over pads (wide shoulders at the top of the caliper) and press on center (F) while sliding pin through the outer pad, spring and inner pad.



14. Drive the retaining pin into the caliper until fully seated.
15. Using needle nose pliers, install the brake pad retaining pin clip (G) as shown.



16. Repeat brake pad service procedure for other caliper.
17. If equipped, install caliper covers and torque to specification.
18. Inspect brake fluid in reservoir and set to proper level (page 15.9).
19. 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 (page 15.9) and inspect brake disc (see page 15.15).
20. Install reservoir cover. Torque screws to specification. Operate brake lever several times until lever is firm and pressure can be felt.



Front Master Cylinder Cover: 10 in-lbs (1.1 Nm)
Caliper Covers: 10 ft-lbs (13.6 Nm)



BRAKES

REAR BRAKE PAD REPLACEMENT 2009-2010

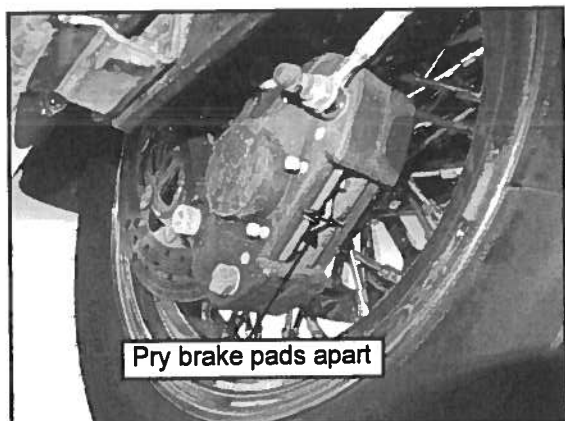
Always replace brake pads as a set. The rear pads can be changed with the caliper installed on the motorcycle.

Refer to page 2.16 for rear brake pad inspection.

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 (as described in Brake Bleeding on page 15.9) and open the bleed screw while pushing the pads and pistons back.

Removal

1. Using a suitable tool, pry the brake pads apart to retract the caliper pistons.



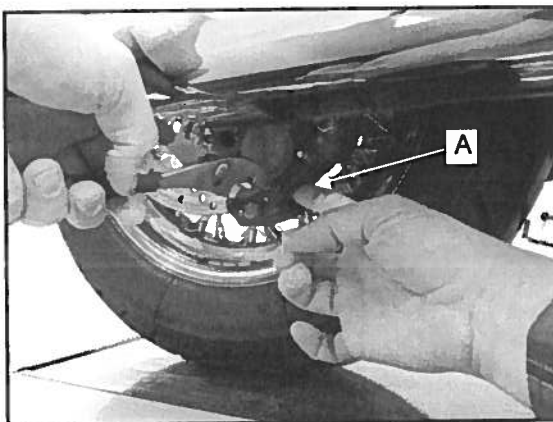
2. Working on the sprocket side of the motorcycle, access the inside tips of the brake pad retaining pins (through the spokes), and drive out using a long drift.



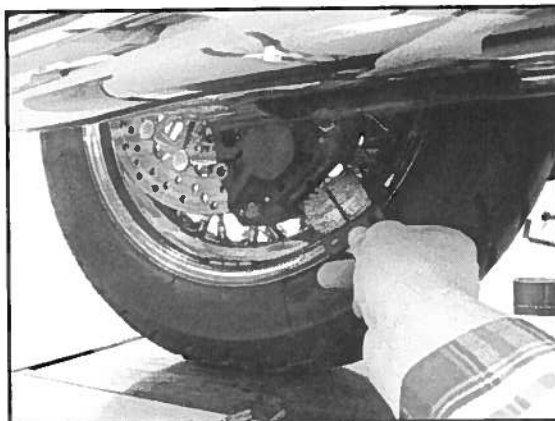
CAUTION

Use care not to contact any painted or finished surface with the drift or hammer while driving the retaining pins out of the caliper assembly.

3. Carefully drive the retaining pin approximately 1/2 way out of the caliper.
4. Working from the caliper side of the motorcycle, hold pad spring (A) in place and completely remove both retaining pins.

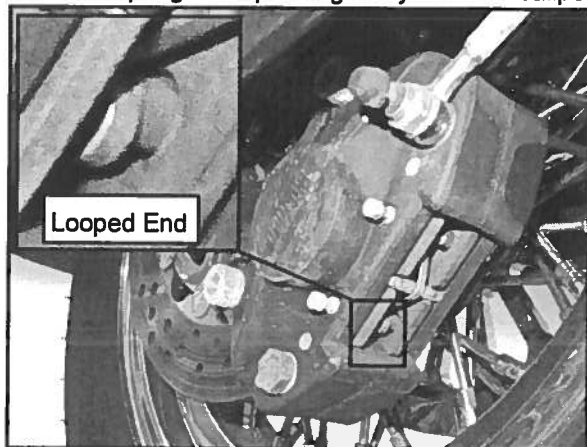


5. Collect brake pad retaining pins, pad spring and spring pin from the caliper assembly. Note the position of each component for assembly.
6. Slide brake pads out of the caliper assembly.



Installation

- Inspect caliper piston seals for any sign of fluid leakage.
- Wipe brake discs clean with a shop towel sprayed with brake cleaner.
- Install new brake pads into caliper with friction material facing the brake disc surface.
- Place the pad spring into the caliper assembly with the looped end of the spring toward the rear of the caliper and the spring bend pointing away from the caliper.



- Install the rear pad retainer pin.
- Place the spring pin into the cutouts on top of the brake pads.
- Rotate the pad spring into position over the spring pin and install the forward brake pad retaining pin.
- Using a suitable hammer, drive the brake pad retaining pins into the caliper assembly until fully seated.
- Inspect brake fluid in reservoir and set to proper level (page 15.9).
- Slowly pump pedal to set brake pads against disc. Pedal should be firm, not spongy. If pedal is spongy, inspect pad installation, bleed brake lines (page 15.9) and inspect brake disc (see page 15.15).
- Install reservoir cover. Operate brake pedal several times until pedal 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 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 2011-2012

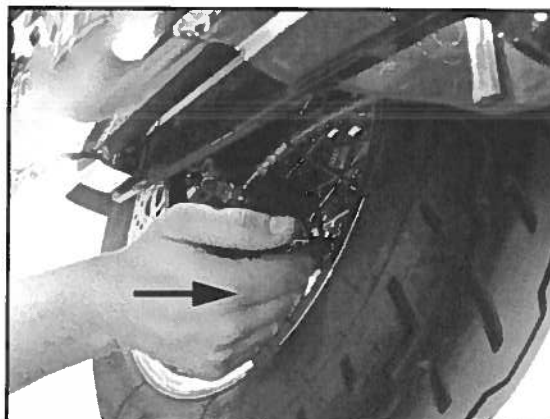
Always replace brake pads as a set.

Refer to page 2.16 for rear brake pad inspection.

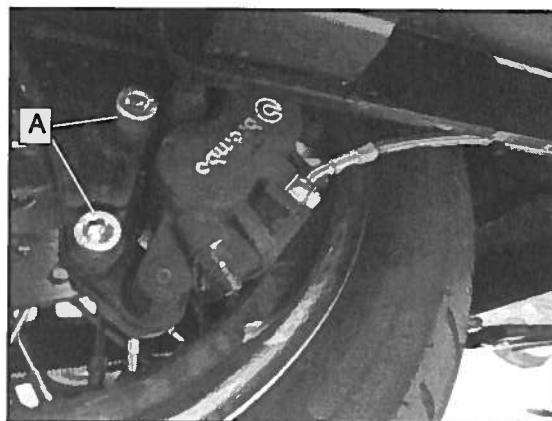
NOTE: Brake fluid will be forced back into the reservoir when pads are pushed back. Remove reservoir cover and monitor fluid level, or attach a hose to the brake bleeder screw (as described in Brake Bleeding on page 15.9) and open the bleed screw while pushing the pads and pistons back.

Removal

- Remove saddlebags, if equipped.
- Push caliper toward wheel to push pad and pistons back and provide clearance for new pad installation.



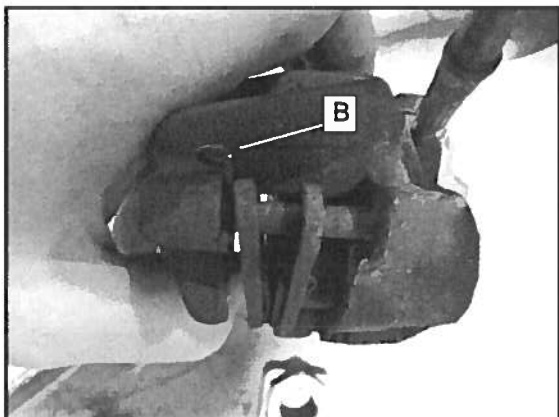
- Remove caliper mounting bolts (A).



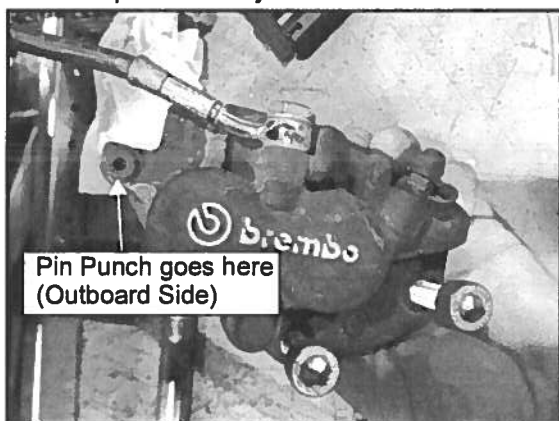
- Slide brake caliper assembly off of the brake disc.

BRAKES

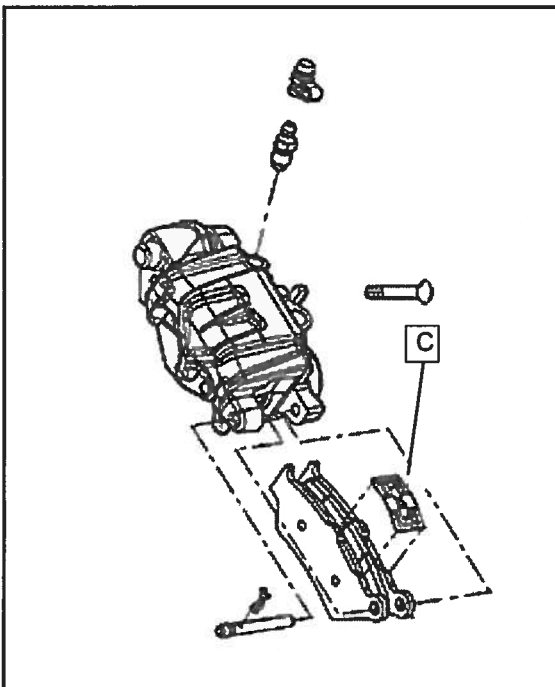
5. Remove the brake pad retaining pin clip (B).



6. Using a pin punch, drive the brake pad retaining pin out of the caliper assembly.

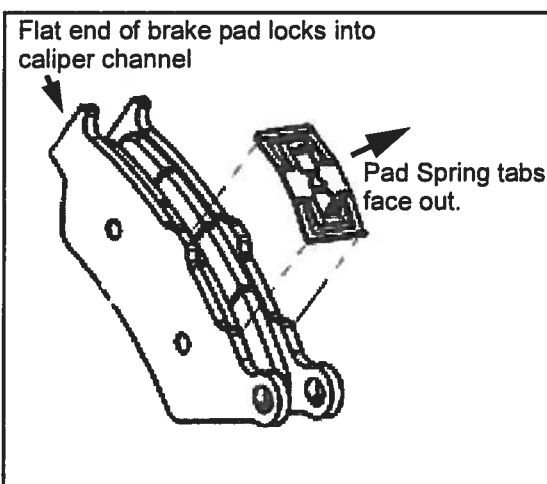


7. Remove the brake pads and pad spring (C), noting the position of the spring for assembly.



Installation

8. Inspect caliper piston seals for any sign of fluid leakage.
9. Wipe brake discs clean with a shop towel sprayed with brake cleaner.
10. Place the pad spring into position and install new brake pads as shown.



11. While holding the brake pads in position, install the brake pad retaining pin from the inboard side of the caliper until fully seated.
12. Install retaining pin clip.
13. Fit rear caliper assembly over brake disc and align mounting holes in brake bracket.
14. Install mounting bolts and torque to specification.



Rear Caliper Mounting Bolts:
40 ft-lbs (54.4 Nm)

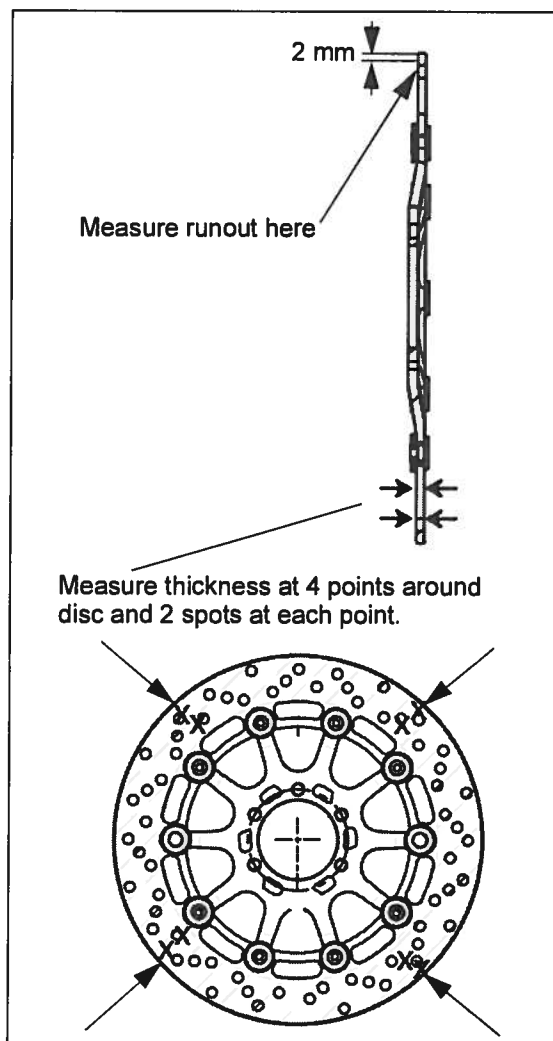
15. Inspect brake fluid in reservoir and set to proper level (page 15.9).
16. Slowly pump pedal to set brake pads against disc. Pedal should be firm, not spongy. If pedal is spongy, inspect pad installation, bleed brake lines (page 15.9) and inspect brake disc (see page 15.15).
17. Install reservoir cover. Operate brake pedal several times until pedal 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 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 (Front & Rear)

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 found on page 15.3.



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 and compare to specifications found on page 15.3. Runout should be measured 2-4mm in from outside edge of disc.
4. If runout is excessive, refer to Troubleshooting at the end of this Chapter. Replace brake disc if dial indicator reading displays excessive brake disc runout and other possible causes have been eliminated.
5. Refer to Chapter 12 for front brake disc removal and installation. Refer to Chapter 13 for rear brake disc removal & installation.

BRAKES

FRONT MASTER CYLINDER INSTALLATION

1. Refer to "CONTROL / SWITCH CUBE INSTALLATION" on page 12.12

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 disc(s) clean.
3. Separate brake pads and install caliper assembly over brake disc.
4. Install caliper mounting bolts and torque to specification.
5. Connect brake hose to caliper with banjo bolt and new sealing washers. Torque Banjo bolt to specification.



Front Caliper Mounting Bolts: 40 ft-lbs (54.2 Nm)
Front Caliper Banjo Bolt: 15 ft-lbs (20.3 Nm)

6. Fill and bleed the front brake hydraulic system (page 15.9).
7. If equipped, install caliper covers.

WARNING

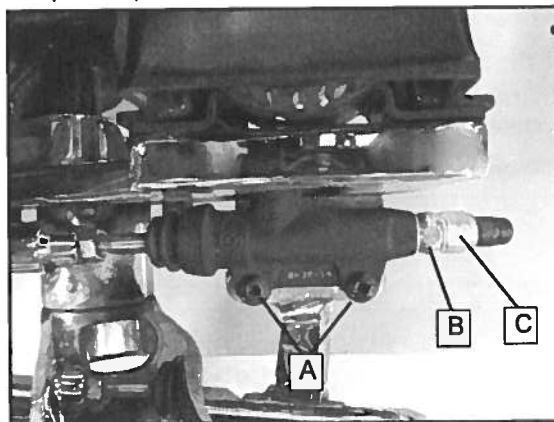
After pad installation or any brake system repair, safely elevate the wheel, apply and release the brake pedal or lever 2-3 times and release. Verify the wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect the vehicle to determine the cause and then repair as necessary.

REAR MASTER CYLINDER INSTALLATION

Also refer to the appropriate Assembly View at the beginning of this chapter.

1. Install master cylinder assembly onto right hand floorboard support.
2. Torque master cylinder fasteners (A) to specification.

3. Install banjo fitting (B) and brake light switch (C). Torque to specification.

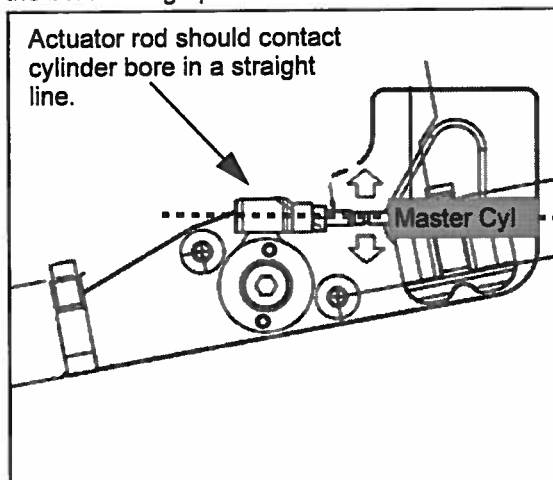


Master Cylinder Bolts: 105 in-lbs (11.9 Nm)
Brake Light Switch: 18 ft-lbs (24.4 Nm)

4. Bleed rear brakes (see page 15.9).
5. Confirm that the brake pedal assembly operates smoothly.

PUSH ROD ADJUSTMENT

1. Observe the brake actuator rod position relative to the master cylinder bore when activating the brake. The actuator rod should remain in line with the center of the bore during operation.



2. Loosen actuator rod jam nut.
3. Rotate the actuator rod in or out as needed until it forms a straight line with the master cylinder.



4. Hold the actuator rod in place and torque the jam nut to specification.

 = T
Actuator Rod Jam Nut: 195 in-lbs (22 Nm)

REAR CALIPER INSTALLATION

1. Install caliper and bracket. "REAR WHEEL INSTALLATION" on page 13.8
2. Install brake hose, and banjo bolt with new sealing washers.
3. Torque banjo bolt to specification.

 = T
Rear Caliper Banjo Bolt: 15 ft-lbs (20.3 Nm)

4. Fill and bleed the rear hydraulic brake system. Refer to page 15.8.

BRAKES

TROUBLESHOOTING

Problem	Symptom and/or Possible Cause	Possible Repair
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, See Chapter 12 & 13 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	Symptom and/or Possible Cause	Possible Repair
Brakes Drag Excessively or Self-Apply (Brakes Overheat)	Reservoir Over Filled	Adjust Level As Necessary
	Brake Pedal Or Lever Not Returning Completely To Rest Position	Inspect Linkage, Pivots and Mechanism For Cause Of Binding Or Restricted Movement;
	Inadequate Freeplay	Measure Pedal Clearance / Adjust
	Compensating Port Plugged	Repair or Replace Master Cylinder
	Internal Corrosion of Components (Master Cylinder / Caliper)	Replace Damaged Component
	Rear Caliper: Corrosion of Sliding Parts, Bent or Damaged Parts	Repair or Replace As Necessary
	Contaminated Brake Fluid	Flush System, Install Correct Fluid
	Caliper Pistons Sticking	Repair / Replace Caliper (Corrosion / Buildup of Residue In Caliper Piston Seal Grooves)
Brake Squeal/Squeak	Rider Error (Operator Riding Brakes)	Educate Operator
	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.	Apply non oil-based solvent (such as Brake Cleaner or isopropyl alcohol) to a clean shop towel and wipe dust / dirt from brake disc.
	Pad Not Secure in Caliper	Repair as Necessary Inspect Pad Installation
	Aftermarket (not genuine Indian Motorcycle) Parts	Install Genuine Indian Motorcycle Parts
	Worn or Damaged Wheel Bearing(s)	Replace
	Worn Pads / Disc	Replace



BRAKES

NOTES

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CHAPTER 16

BATTERY CHARGING SYSTEM

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BATTERY CHARGING SYSTEM

IMPORTANT INFORMATION

GENERAL

All electrical system and component service can be performed with the engine in the frame.

CAUTIONS TO OBSERVE DURING ELECTRICAL SYSTEM SERVICE:

CONNECTORS

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 SAFETY

IMPORTANT: 2009-2012 Indian motorcycles are equipped with sealed AGM (absorbed glass mat) batteries. Use only battery chargers suitable for use with AGM battery technology. Some automotive battery chargers will damage AGM-type batteries.

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.**

NOTICE

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.

NOTICE

Even with a good battery, battery voltage can recover after charging, but under excessive load the battery voltage will drop quickly. Often the charging system is suspect when it is not the cause of the problem. Always inspect for excessive loads or current draw with the key OFF. Items such as incorrect wattage bulbs or a sticking brake or trunk light switch can drain a battery even if the charging system is operating correctly.



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

CONNECTING AND DISCONNECTING THE BATTERY

Always disconnect the negative battery cable first when removing the battery.

Always connect the positive battery cable first when connecting the battery.

If corrosion is found on terminals, remove battery and clean terminals with a solution of baking soda and water. Finish the process by cleaning terminals (both battery and battery cables) with a wire brush.

Once connections are secured, apply a thin film of Nyogel™ grease to the terminals.

Verify the positive terminal has it's protective boot in place.

CAUTION

WIRE ROUTING

Make sure that all wires are routed correctly.

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 chapter 5 (Fuel Injection) and chapter 17 (Ignition System), very carefully when working on electronic components. Failure to follow instructions may cause irreparable damage to the part being inspected.

SPECIAL TOOLS

The following tools are available for purchase from our tool supplier, SPX:

- Digital Multi-meter: PV-43546
- Battery Load Tester: (Commercially Available)



BATTERY CHARGING SYSTEM

SPECIFICATIONS

GENERAL

Item	Specifications	
Electrical (General)	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 & ALTERNATOR

Item		Specifications
Alternator No Load AC Output (Minimum)		16.3-19.0 V AC @ Idle
Alternator No Load AC Output @ 2000 RPM (Minimum)		38.3 V AC @ 2000 RPM
Stator Coil Resistance (@ 21°C / 70°F) (stator Black wire to other Black wire)		Less than 1 ohm
Stator Coil Resistance To Ground (each stator Black wire to ground)		Infinite (no continuity)
Regulator/Rectifier Regulated Voltage		13.4-14.4 V DC
Alternator Output (Amps / Watts)		45 A 13VDC @ 3500 PRM
Battery (P/N: N60300002)	Type	DEKA: ETX18L (AGM)
	Voltage	12 Volts DC
	Nominal Capacity @ 10 Hr Rate	20 AH
	Recommended Battery Charging Current	See 'BATTERY CHARGING - NEW BATTERY" on page 16.5
	Cold Cranking Amp Rating	340

FASTENER TORQUE

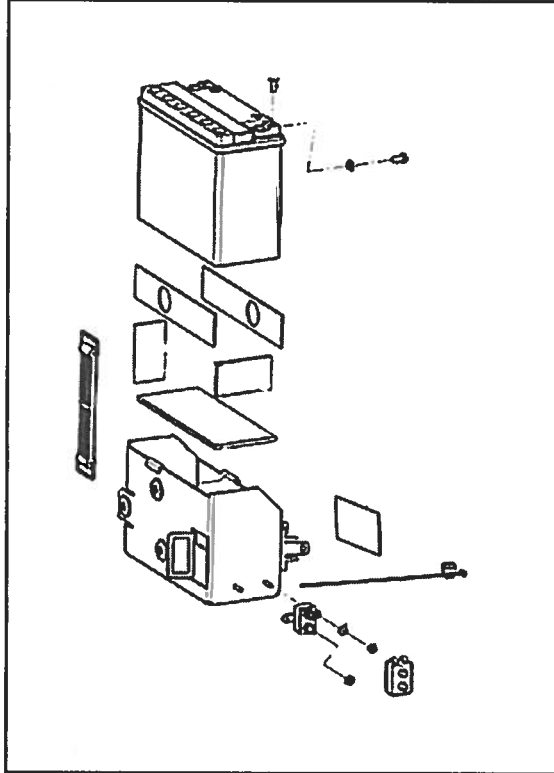
Charging System		
Description	Torque Nm	Torque lb-ft (in-lb)
Battery Box Screws	24.4 Nm	18 ft-lbs
Battery Terminal Screws	8.5 Nm	(75 in-lbs)
AUX Charging Plug Terminal	5.1 Nm	(45 in-lbs)
Circuit Breaker to Battery Box Screws	2.8 Nm	(25 in-lb)
Circuit Breaker Terminal Nuts	2.3 Nm	(20 in-lb)
Flywheel (Rotor) Bolt	203 Nm	150 lb-ft
Primary Cover Screws	12 Nm	(105 in-lbs)
Regulator/Rectifier to Bracket	10 Nm	(85 in-lb)
Regulator/Rectifier Bracket to Crankcase	12 Nm	(105 in-lbs)
Stator Mounting Screws	4.5 Nm	(40 in-lbs) Loctite™ 242



BATTERY

BATTERY REMOVAL

1. See page 2.19.



BATTERY CHARGING - NEW BATTERY

CAUTION

It is very important that a regulated voltage charger is used with AGM type batteries. Also, the charger must be temperature-compensated to prevent undercharging and overcharging due to changes in ambient temperature.

Constant current chargers should NEVER be used on AGM type batteries.

IMPORTANT: Always use a voltage-regulated, temperature-sensing battery charger. Set charger voltage to 14.4 - 14.6V at 68F° ambient. DO NOT exceed 14.6V for AGM type batteries.

1. Disconnect or remove battery from the motorcycle (page 2.19).
2. Place the battery on a voltage regulated charger to maintain proper charge voltage.
3. Review the table below to determine charge times relative to charger type.

Charge Rate for AGM-type Batteries

Part Number	STATE OF CHARGE		TYPICAL CHARGING TIMES (HOURS)			
	Voltage	% of Charge	5 Amp Charger	2 Amp Charger	1.5 Amp Charger	.75 Amp Charger
DEKA PN: ETX18L	12.7V	100%	Full	Full	Full	Full
	12.6V	75%	2.4	4.5	5.7	10.3
	12.3V	50%	3.8	8.0	10.3	19.7
	12.0V	25%	5.2	11.5	15.0	29.0
	11.8V	0%	6.6	15.0	19.7	38.3

BATTERY CHARGING SYSTEM

BATTERY CHARGING - GENERAL

CAUTION

Do not allow battery voltage to fall below 12.45V.

1. Check battery voltage through the instrument cluster (page 1.20)
2. Disconnect or remove battery from the motorcycle (page 2.19).
3. Place the battery on a voltage regulated charger.
4. Review the table on page 16.5 to determine charge times relative to charger type.
5. Once charge is complete, remove battery from charger and let it sit for 30 minutes or longer.
6. Measure battery voltage with a digital multimeter. If battery voltage is lower than 12.5 Vdc, battery must be recharged again in accordance with step 2 and 3 above.
7. 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.

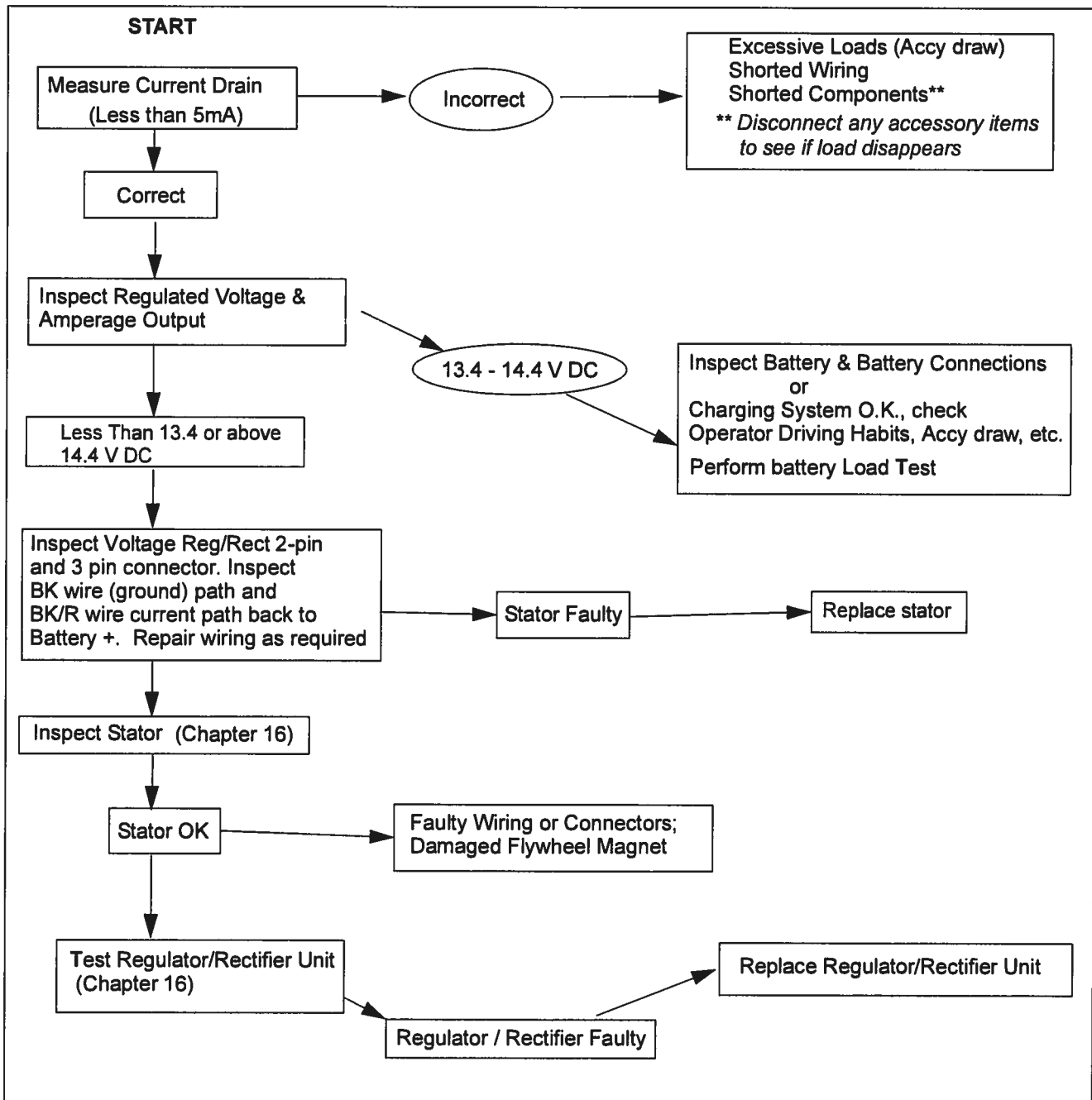
NOTE: When motorcycle is not used for one (1) week or more, remove battery and store it in a cool, dry area. Inspect voltage monthly and charge according to above instructions if necessary.



DIAGNOSTICS

TROUBLESHOOTING

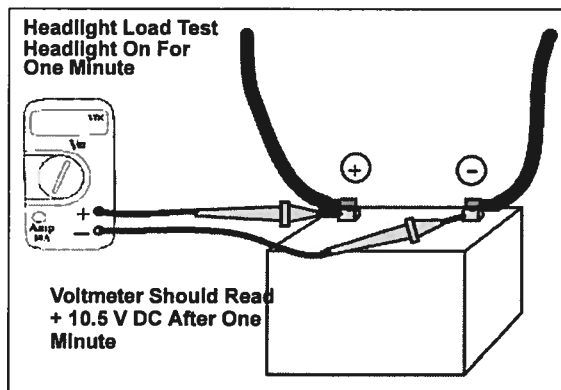
NOTICE: The battery must be fully charged and in good condition to obtain accurate readings. Battery charging current is automatically reduced by the regulator / rectifier if the regulator / rectifier unit reaches a critical temperature (overheated). The system should be cool when testing DC charging output or when testing the regulator / rectifier to ensure accurate readings. Refer to test procedure for individual charging system components for more information.



BATTERY CHARGING SYSTEM

BATTERY LOAD TEST

1. Perform a battery load test using a battery load tester. Follow the load tester manufacturer's instructions carefully.



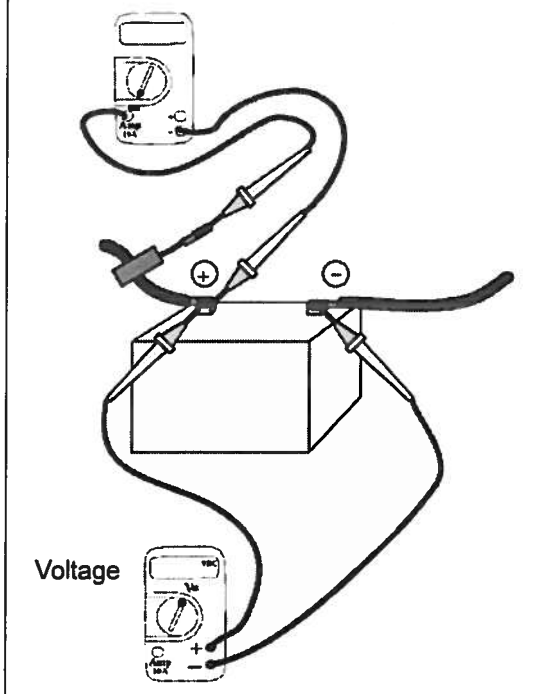
NOTE: Although not as conclusive, the following test can be used to direct troubleshooting efforts if a battery load tester is not available.

2. Charge battery as outlined in this section.
3. Install fully charged battery.
4. Connect a digital multimeter to battery and keep it connected for duration of test.
5. Turn ignition key on.
6. Switch head light to high beam position and leave it on for 1 minute (without the engine running).
7. At end of one minute, the digital multimeter should show a reading of above 12.0 V DC.
8. If battery voltage drops below 12.0 V DC, battery should be charged again and the test repeated.

REGULATED VOLTAGE / AMPERAGE OUTPUT INSPECTION

1. Remove negative battery leads and connect a 12V shunt as outlined in the instructions provided with shunt or use an inductive amperage clamp.

NOTICE: Current can easily exceed the measuring limits of your ammeter or its internal fuse. An inductive ammeter clamp or a suitable shunt must be used to avoid meter or fuse damage.



2. Set digital multimeter (DMM) to V DC scale.
3. Connect DMM red (+) lead to battery red (+) lead and DMM black (-) lead to battery black (-) lead.
4. Start engine and warm to operating temperature.
5. At idle, 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:
900-1000 RPM

6. Increase engine RPM to 2500. The ammeter should rise a slight amount, then stabilize. Volt meter should read above 14 V DC.

BATTERY CHARGING SYSTEM

7. 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 14.4 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 O.K. 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 14.6 V DC and may continue to rise. Go to stator & voltage regulator/rectifier inspection.

EXCESSIVE LOAD: Amperage 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).

8. Turn ignition key off.
9. Remove ammeter shunt or inductive clamp.
10. Re-connect negative battery cables to battery.
11. Install seat and right and left side covers.

STATOR NO-LOAD AC VOLTAGE OUTPUT INSPECTION

NOTE: DMM set to VAC (if meter has Vrms selection use Vrms). Engine cool - not to operating temperature. Regulator Rectifier disconnected (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

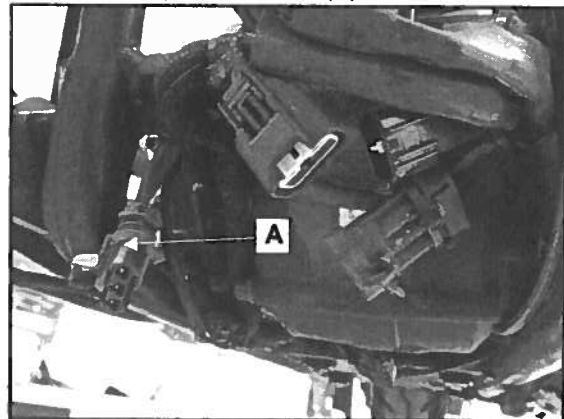
Never run an engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas that can cause loss of consciousness and may lead to death. If you must run the engine to do some repairs, do so in an open area or with an exhaust evacuation system operating.

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. Locate three wires coming from stator and follow the wires to the 3-pin connector.
2. Disconnect 3-pin connector (A).

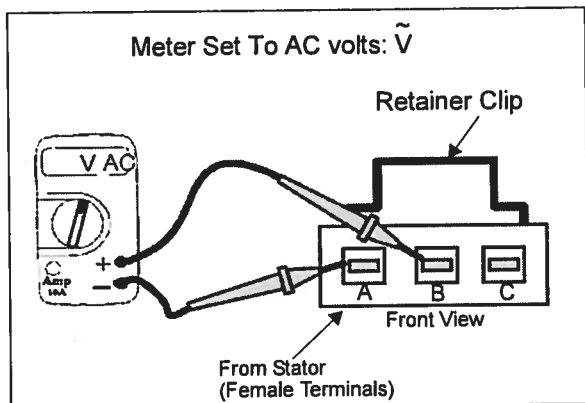


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BATTERY CHARGING SYSTEM

3. Set Digital Multimeter (DMM) to AC Volts scale.
4. Connect one lead of DMM to Pin A on wire connector that comes from stator.



5. Connect other lead to pin B.
6. Start engine and let it idle. Observe DMM reading.
7. The DMM should indicate a minimum reading of 16.3-19 V AC at idle.
8. If using a meter other than the Fluke 73, be sure your meter reads rms volts.
9. Repeat test for pins A & C.
10. Repeat test for pins B & C.

Specification:

No load AC Volts @ 900 RPM:

45A Alternator - Approx ~ 16.3-19 VAC @ 900 RPM

NOTE: The test results in steps 7, 8 and 9 can read more than specified VAC, but it is important that the reading for each pair of wires is approximately equal.

11. Increase RPM to 2000. Repeat Steps 4-10.

Specification:

No load AC Volts @ 2000 RPM:

45A Alternator - Approx ~ 38.3 VAC @ 2000 RPM

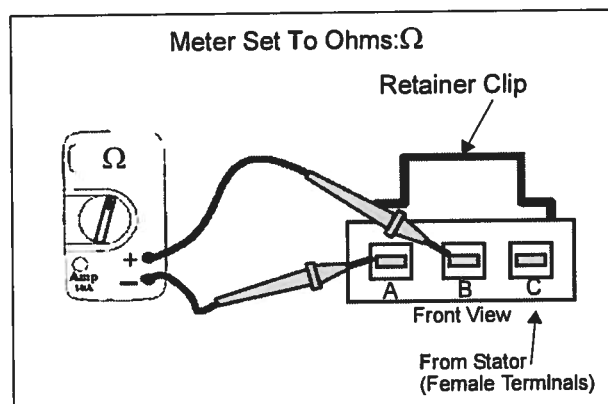
NOTE: The test results obtained in step 11 can read more than specified VAC, but it is important that they are all approximately equal.

STATOR RESISTANCE INSPECTION

NOTICE

Do not run the engine during this test.

NOTE: Meter set to measure resistance. Engine OFF and cool.



1. Disconnect the 3 pin connector from stator.
2. Set DMM to OHMs scale.

NOTE: Make sure DMM leads are plugged into correct jacks.

3. Connect one lead of DMM to any one of pins in multi-connector leading from stator.
4. Connect other lead of DMM to any one of the other two pins in the multi-connector and observe circuit resistance reading.

Specification:

Stator Resistance:

0.1-0.5 Ω (plus meter resistance, see below)

NOTICE

Do not touch meter leads or reading obtained will be inaccurate.

NOTE: 0.3 Ω to 0.5 Ω ohms may be less than the internal resistance of your meter leads or meter. Before measuring stator resistance, connect the meter leads together and read the display and record this measurement. Subtract this reading from stator resistance readings.



EXAMPLE: Connect meter leads together, meter reads 0.3 ohms. Measure stator resistance, meter reads .7 ohms. Subtract 0.3 ohms (meter/lead resistance) from .7 ohms.

True reading is:

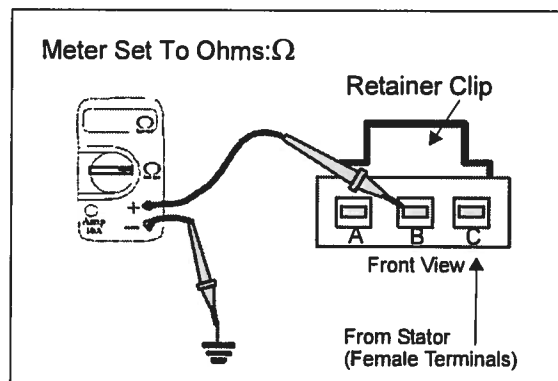
.7 ohms (observed reading when checking stator)
 $- 0.3$ ohms (meter/lead resistance)
 $= 0.4$ ohms (true stator winding resistance)

- Remove one of the DMM leads and connect it to the other pin in the multi-connector. The reading should be the same as the first test reading.
- Remove the lead that was connected to the same multi-connector pin for the first two tests and connect it to the other multi-connector pin. This reading should also be the same as the first two readings.

STATOR WINDINGS TO GROUND INSPECTION

NOTE: DMM set to resistance. Engine OFF and cooled. Disconnect the stator (3-pin connector).

- Connect one DMM lead to one of the multi-connector pins and place the other lead of the DMM in contact with a good engine ground, observe resistance to ground reading.

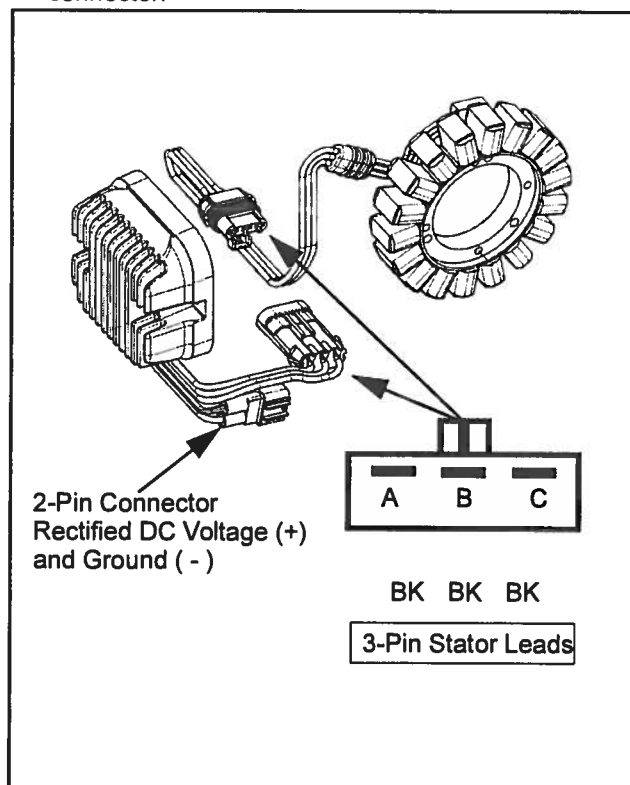


Specification: Stator Windings to Ground:
Open Circuit (OL)

- Repeat test for other two stator leads to ground.
- There should be no connection from stator windings to ground.

RECTIFIER / REGULATOR CONNECTOR INSPECTION

- Disconnect 3 pin stator connector and 2 pin rectifier connector.



- Inspect male and female pins in the 3-pin stator connector and the male and female pins of the 2-pin regulator / rectifier leads. Check for corrosion, loose pins, poor connections, or evidence of overheating or other damage.
- 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 as described in the following tests.

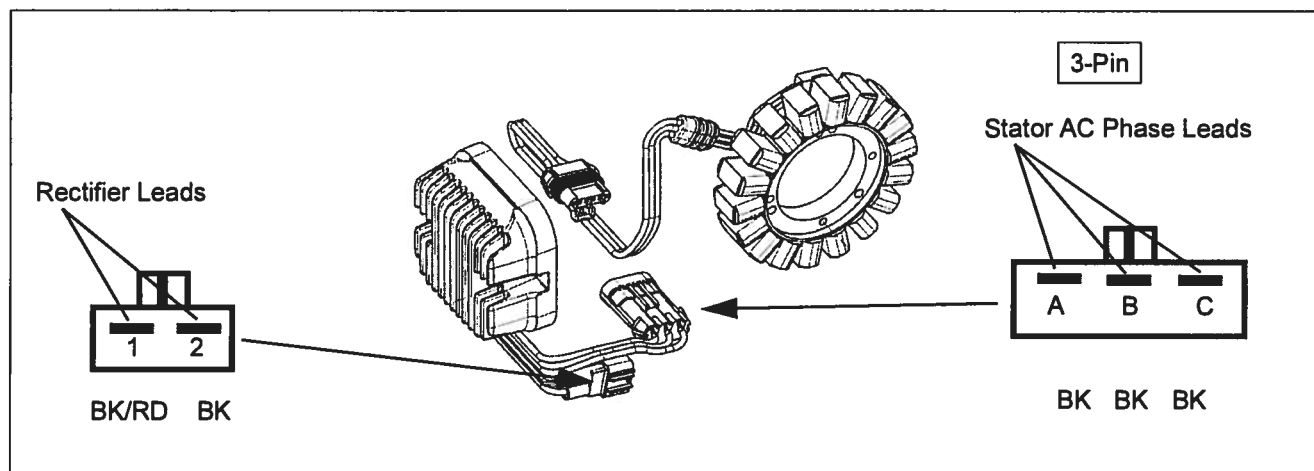
NOTE: Do not touch the meter leads when testing the regulator rectifier. Readings in the following chart are correct for a Fluke™ 73 multimeter. Use of other meters may affect test results.

BATTERY CHARGING SYSTEM

REGULATOR / RECTIFIER TEST

- Remove regulator / rectifier or completely disconnect all wires (3-Pin stator connector, ground (black) from engine case, and BK/R wire from circuit breaker (inside) terminal). Unit must be cool for accurate testing.

- Use **DIODE CHECK** function on the Fluke 73 DMM
- Perform all tests described in test table below. Test results describe a properly functioning part.

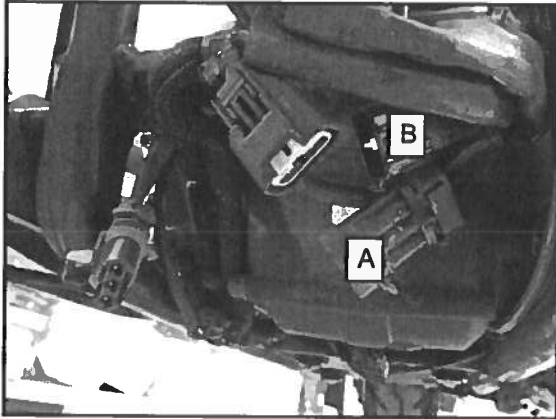


Regulator / Rectifier Test Table - Set DMM to *DIODE CHECK* Function

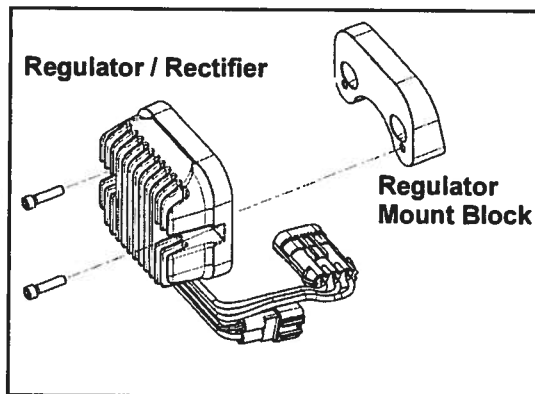
DMM RED LEAD	DMM BLACK LEAD	RESULT
AC Phase 1 (Pin A of 3-pin)	AC Phase 2 (Pin B of 3-pin)	Open Circuit
AC Phase 2 (Pin B of 3-pin)	AC Phase 3 (Pin C of 3-pin)	Open Circuit
AC Phase 1 (Pin A of 3-pin)	AC Phase 3 (Pin C of 3-pin)	Open Circuit
AC Phase 2 (Pin B of 3-pin)	AC Phase 1 (Pin A of 3-pin)	Open Circuit
AC Phase 3 (Pin C of 3-pin)	AC Phase 1 (Pin A of 3-pin)	Open Circuit
AC Phase 3 (Pin C of 3-pin)	AC Phase 2 (Pin B of 3-pin)	Open Circuit
Battery + Lead (Pin 1 of 2-pin)	Ground Lead (Pin 2 of 2-pin)	Open Circuit
Ground Lead (Pin 2 of 2-pin)	Battery + Lead (Pin 1 of 2-pin)	Open Circuit
Ground Lead (Pin 2 of 2-pin)	Case	Closed Circuit (continuity)
Ground Lead (Pin 2 of 2-pin)	Any Phase	Open Circuit
Any Phase	Ground Lead (Pin 2 of 2-pin)	Open Circuit
Battery + Lead (Pin 1 of 2-pin)	Any Phase	Open Circuit
AC Phase 1 (Pin A of 3-pin)	Battery + Lead (Pin 1 of 2-pin)	365mV to 515mV
AC Phase 2 (Pin B of 3-pin)	Battery + Lead (Pin 1 of 2-pin)	365mV to 515mV
AC Phase 3 (Pin C of 3-pin)	Battery + Lead (Pin 1 of 2-pin)	365mV to 515mV

REGULATOR / RECTIFIER REPLACEMENT

1. Disconnect the 3-pin stator connector (A) and the 2-pin regulator / rectifier connector (B).



2. Cut cable ties securing the regulator / rectifier harness to the chassis.
3. Remove the bolts securing the regulator / rectifier to the mounting block.



4. Remove the regulator / rectifier.
5. Reverse order of removal to install. Be sure mounting bracket is clean and all connections are clean and tight. Secure wires and connectors, and torque all screws to specification.



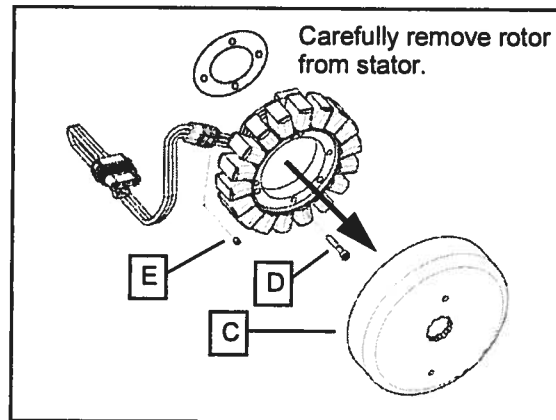
Mount Block to Chassis: 105 in-lbs (11.9 Nm)
Regulator to Mount Block: 85 in-lbs (9.6 Nm)

STATOR REMOVAL

CAUTION

The alternator rotor / flywheel assembly contains strong magnets. Use caution when removing the rotor assembly from the stator as serious pinch injury may occur.

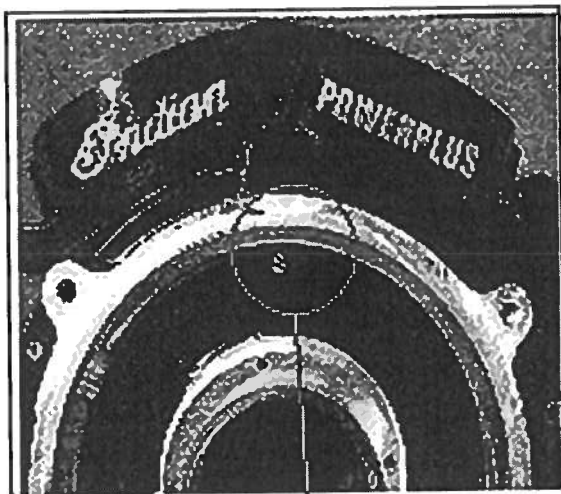
1. Remove seat (see Chapter 3).
2. Disconnect battery (see Chapter 2).
3. Remove side covers (see Chapter 3).
4. Remove left side foot control assembly (see page 3.6).
5. Remove primary cover (see page 9.8).
6. Remove primary drive assembly (see page 9.9).
7. Remove jackshaft assembly (see page 9.12).
8. Remove starter motor (see Chapter 18).
9. Remove inner primary (see page 9.13).
10. Remove alternator rotor / flywheel assembly (C).



11. Remove bolts (D) securing the stator assembly to the engine case and discard.
12. Cut the cable tie securing the stator and regulator wires to the bottom of the chassis.
13. Disconnect the stator AC phase lead from the regulator / rectifier assembly.
14. Remove set screw (E).
15. Disassemble AC phase lead electrical connect on stator.
16. Remove stator by feeding phase lead wires through engine case.

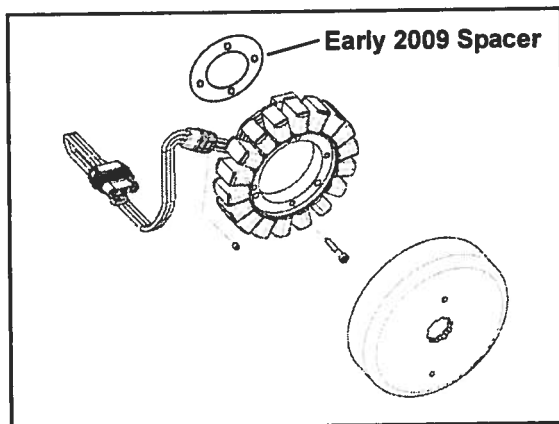
BATTERY CHARGING SYSTEM

IMPORTANT: Early build 2009 Indian motorcycles that have an "S" stamped on the engine case will utilize a spacer behind the stator assembly. (Figure 1)



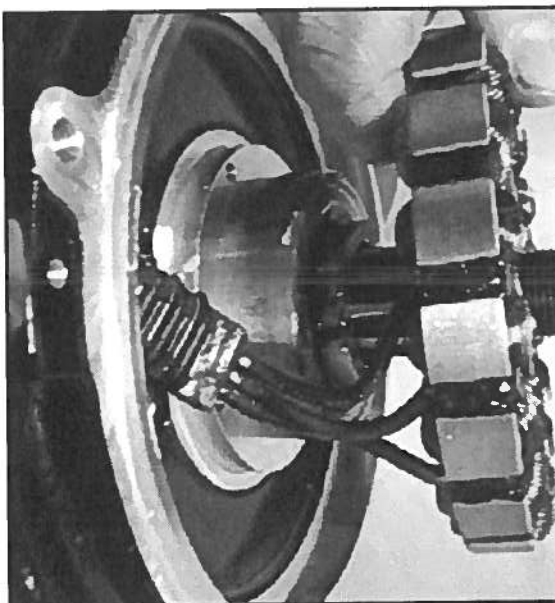
This spacer is only applicable on Model year 2009 with "S" stamped on case.

Stator spacer position shown below.



STATOR INSTALLATION

1. Clean surface area round main bearing / crankshaft on engine case.
2. Install stator spacer for early 2009 models with an "S" stamped on the engine case.
3. Position stator over crank shaft with wires facing inboard and direct wiring through crankcase passage. Note: Apply P-80 lubricant on stator wire grommet to assist with stator wire routing and positioning of grommet.



4. Carefully pull stator wire with grommet through engine passage until the first rib of grommet is visible through engine case passage.
5. Install new bolts securing stator to engine and torque to specification.



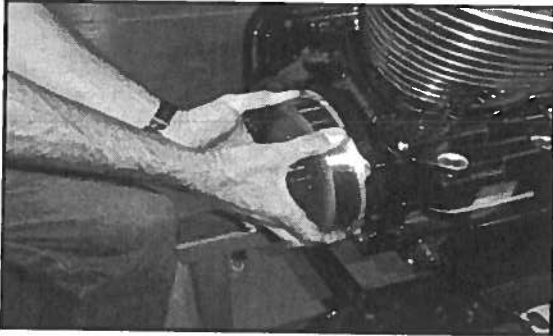
Stator Bolts: 40 in-lbs (4.5 Nm)

6. Install set screw above stator grommet achieving three visible threads below crankcase surface.
7. Assemble AC phase lead electrical connector on stator.

NOTE: AC phase leads are not designated to specific cavities within the connector housing.

BATTERY CHARGING SYSTEM

8. Connect stator AC phase lead between stator and regulator.
9. Secure voltage regulator wires under front engine frame mount with zip tie.
10. Align the splines from the crank shaft and the rotor. Slide the rotor onto the end of the crankshaft until fully seated.



11. Install inner primary (see Chapter 9).
12. Install starter motor (see Chapter 18).
13. Install jackshaft assembly (see Chapter 9).
14. Install primary drive and primary drive cover (see Chapter 9).
15. Install left side foot controls (see Chapter 3).
16. Install side covers (see Chapter 3).
17. Connect battery (see Chapter 2).
18. Install seat (Chapter 3).
19. Start engine and observe charge voltage at the instrument cluster.

Regulated Voltage = 13.4v - 14.4v

ROTOR / FLYWHEEL REMOVAL

Refer to Chapter 9.



BATTERY CHARGING SYSTEM

NOTES

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CHAPTER 17

IGNITION

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IGNITION

GENERAL INFORMATION

SAFETY INFORMATION

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

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 at the exhaust system (particularly the head pipes).

⚠ WARNING

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 switch is ON and current is present.

⚠ 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.

⚠ WARNING

Parts containing semi-conductors can be easily damaged if handled carelessly. Do not drop or subject the electronic components to shock loads.

⚠ WARNING

Using incorrect heat range spark plugs can damage the engine. Always follow the manufacturer's recommendations for spark plug heat range.

GENERAL CAUTIONS TO OBSERVE WHEN WORKING ON IGNITION SYSTEM

- 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 for spark to occur.



IGNITION SYSTEM COMPONENTS

Components associated with the engine management system are as follows:

- Engine Control Unit (ECU)
- Body Control Module (BCM)
- Crank Position Sensor (CPS)
- Ignition Coil
- Manifold Absolute Pressure sensor (MAP)
- Throttle Position Sensor (TPS)
- Idle Air Control Valve (IAC)
- Air Temp Sensor (IAT)
- Vehicle Speed Sensor (VSS)
- Oxygen Sensor (O2)
- Engine Temperature Sensor (ETS)

The ECU is located inside the side covers. It computes the ignition timing and fuel mapping based on sensor inputs (CPS, MAP, TPS, ATS and O2 sensors). The ECU is fully enclosed to protect all internal components and is non-repairable. In the event that the ECU itself fails, it must be replaced.

The BCM is located inside the left lower fairing next to the fuse block. The BCM is a module that acts like a circuit breaker on some occasions and a fuse on others. In the event that the BCM fails, it must be replaced.

The CPS is located at the left rear of the crankcase. The CPS produces a signal that is sent to the ECU.

The MAP sensor is located on the intake manifold. The MAP sensor monitors the intake manifold pressure and sends the signal to the ECU.

The TPS, MAP, ETS and ATS are sensors are input information to the ECU that aid in control of the fuel delivery and ignition curves.

The O2 sensor monitors the exhaust gas for oxygen content. The fuel/air mixture is adjusted accordingly to maintain an optimal air/fuel ratio.

The VSS is located at the rear engine side of the inner primary. The VSS information is used by the ECU to maintain idle speed control, gear information, and fuel delivery and ignition curves.

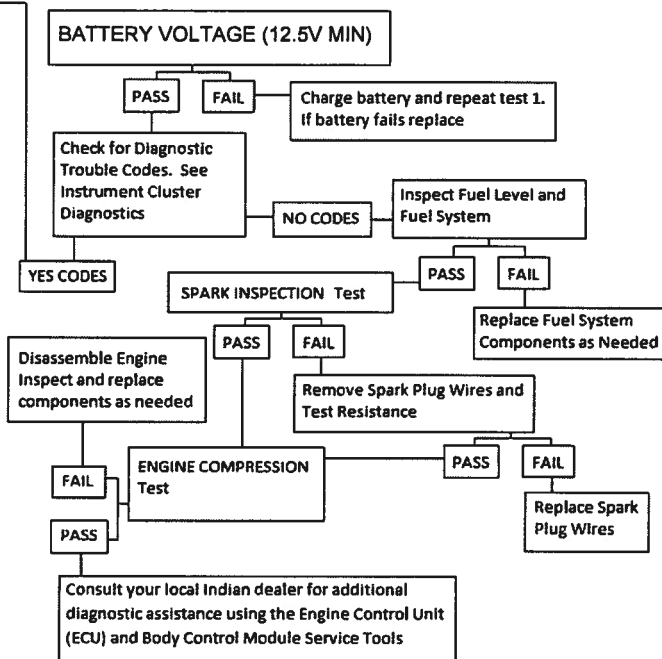


IGNITION

TROUBLESHOOTING

IGNITION SYSTEM TEST FLOWCHART

DTC	DESCRIPTION
P0130	Front O2 Sensor circuit (resistance for sensor not in range)
P0150	Rear O2 Sensor circuit (resistance for sensor not in range)
P0110	Intake Air temperature sensor circuit (resistance not in range)
P0560	Battery voltage out of range
P0601	Internal Engine control module memory checksum error
P0115	Engine Temperature (front cylinder) circuit (resistance not in range)
P0120	Throttle Position Sensor circuit "A"
P0351	Front Ignition coil circuit (ECU to Coil)
P0352	Rear Ignition coil circuit (ECU to Coil)
P0201	Injector 1 circuit (open), cylinder 1
P0202	Injector 2 circuit (open), cylinder 2
P0135	Front O2 sensor heater circuit (resistance not in range)
P0155	Rear O2 sensor heater circuit (resistance not in range)
P0105	Manifold Pressure (MAP sensor) circuit (resistance not in range)
P0604	Internal Control Module Random Access Memory (RAM) error
P0605	Internal Control Module Read Only Memory (ROM) error
P0335	Crankshaft Position sensor circuit (CPS)
P0505	Idle Air Control System (IAC)
P0606	ECM/PCM Processor
P0500	Vehicle Speed Sensor



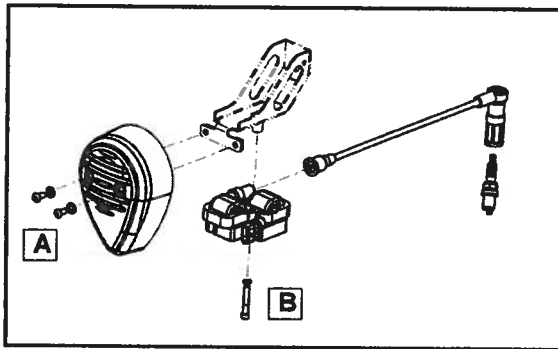
Codes P0601, P0604, P0605 and P0606 Require ECM Replacement



IGNITION COIL

IGNITION COIL REMOVAL

1. Remove the front and rear spark plug wires by pulling firmly on the boots at the spark plug. **DO NOT** pull on the wire or high tension leads may be damaged.
2. Remove coil cover by loosening the two fasteners (A) and disconnect ignition coil electrical connector.
3. Remove the two fasteners (B) retaining the coil and pull it back far enough to carefully remove the spark plug wires from the coil.



NOTE: Plug caps or coil ends are not removable. Wire must be replaced as an assembly.

4. Remove ignition coil from motorcycle.

IGNITION COIL INSTALLATION

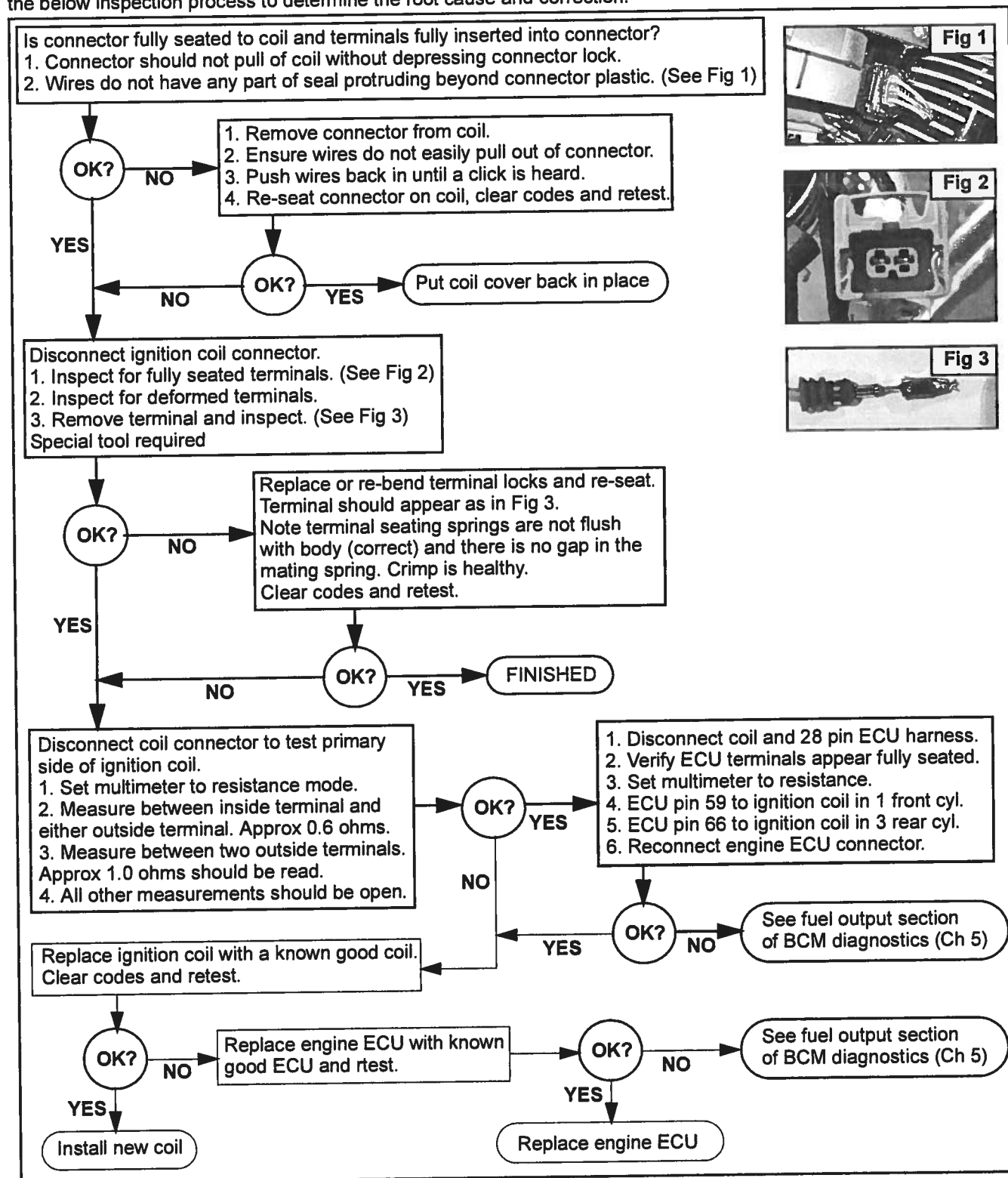
1. Installation procedure is the reverse of the removal procedure.
2. Apply light coating of dielectric grease to inside of spark plug boot of high tension leads and to ignition coil terminals.

NOTE: Ensure plug leads are routed to appropriate cylinder. Upper coil plug lead to front cylinder spark plug and lower coil plug lead to rear cylinder spark plug.

IGNITION

IGNITION COIL INSPECTION

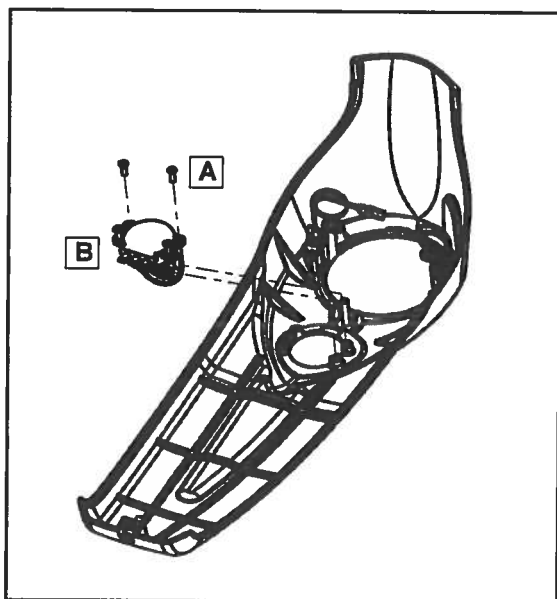
If it is suspected that there is an issue with the Ignition Coil or a code is displayed related to the Ignition Coil, complete the below inspection process to determine the root cause and correction.



IGNITION SWITCH

IGNITION SWITCH REMOVAL

1. Remove seat. See Chapter 3.
2. Disconnect battery.
3. Remove dash. See Chapter 3.
4. From underside of dash, remove four self-tapping screws (A). Remove ignition switch (B).



IGNITION SWITCH KEY COVER

NOTE: Key covers are not reusable. Cover must be replaced if removal is necessary.

- Position key into cover aligning head of key to pocket in cover. Position the second cover over the head of the key and align cover sides with head of key. Firmly press covers together using soft jaw pliers or similar on outer edges of key covers only. Verify key is tightly captured by key cover.

- See Chapter 1 for more information.

CAUTION

Key covers may become damaged if pressure is applied to center of cover. Apply pressure on outer edges only

IGNITION SWITCH INSTALLATION

1. Position the ignition switch into the dash, aligning the mounting holes in the switch with holes in dash.
2. Ensure the electrical tabs of the switch are toward the rear of the dash. Install self-tapping screws (Qty 4) and torque to specification.



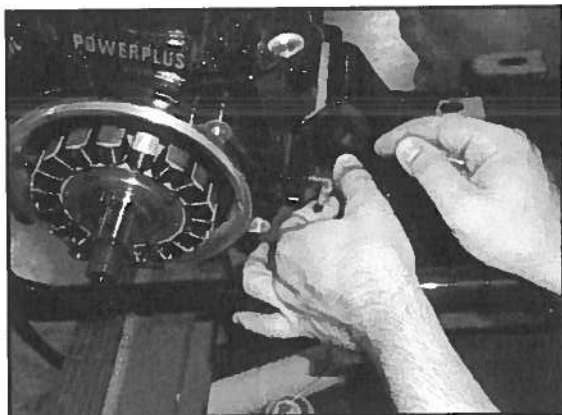
Ignition Switch Fasteners:
25 in-lbs (3 Nm)

IGNITION

CRANKSHAFT POSITION SENSOR

CPS REMOVAL

1. Remove seat. See Chapter 3.
2. Disconnect battery.
3. From underside of motorcycle, remove cable tie securing crank position sensor wiring and rear oxygen sensor wiring from frame center cross member.
4. Disconnect CPS sensor connector by lifting tab and pulling on electrical connector. DO NOT pull on connector wires.
5. Remove the fastener retaining CPS.
6. Remove CPS, taking care not to damage o-ring.



CPS INSTALLATION

1. Ensure CPS o-ring is free from damage. Apply P-80® to o-ring prior to installation.
2. Install CPS into left crankcase bore.
3. Install CPS fastener and torque to specification.



CPS Retaining Fastener:
105 in-lbs (12 Nm)

4. Connect CPS connector to harness.
5. Carefully bundle CPS and rear oxygen sensor wiring together and secure to frame center cross member with cable tie.

CAUTION

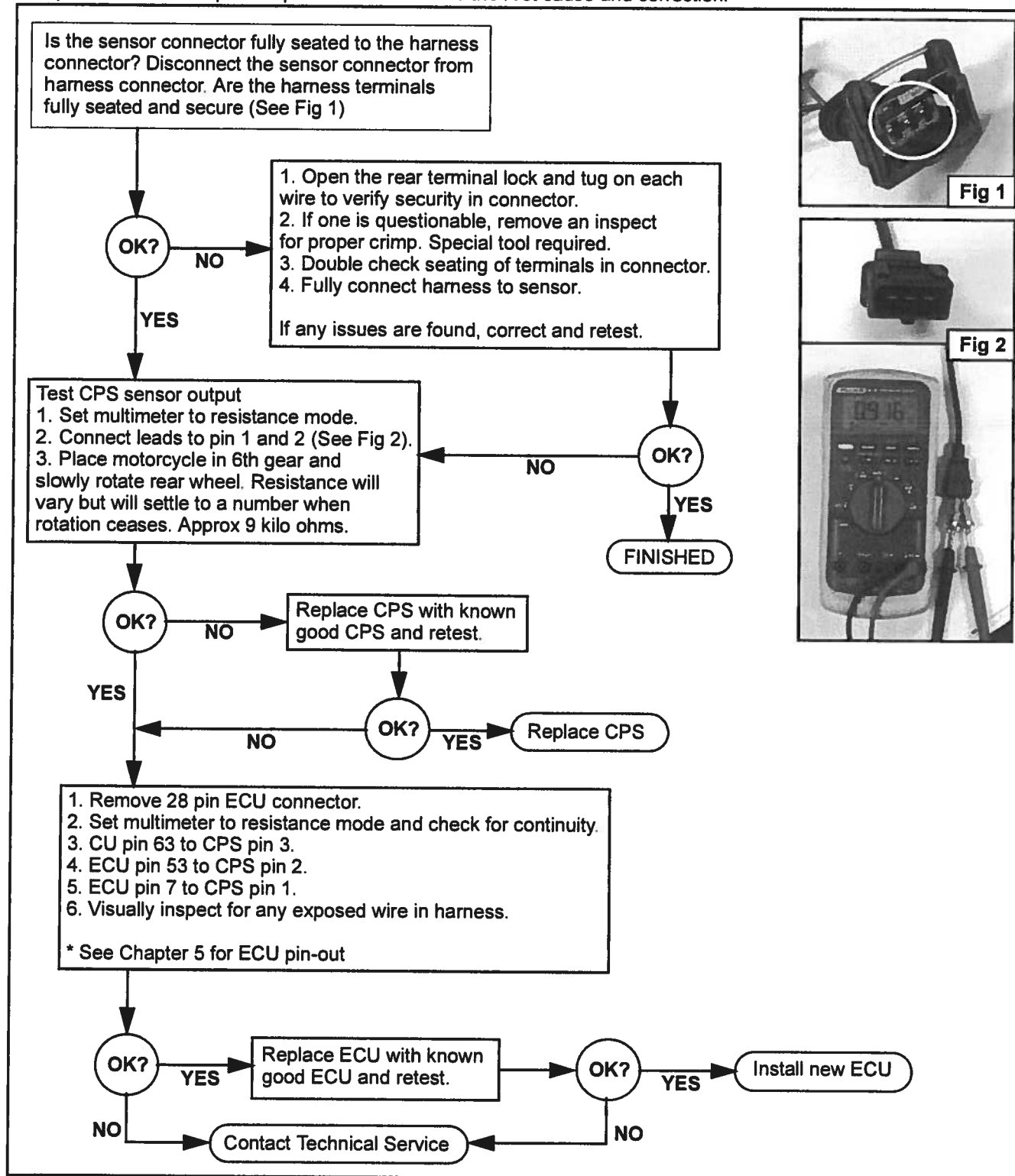
Ensure wiring is secured to the top of the frame center cross member so that it is protected.

6. Connect battery.
7. Install seat. See Chapter 3.



CPS INSPECTION

If it is suspected that there is an issue with the Crankshaft Position Sensor or a code is displayed related to the CPS, complete the below inspection process to determine the root cause and correction.



IGNITION

NOTES

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CHAPTER 18

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GENERAL

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 (on the backbone of the frame connecting directly to the battery) and battery cable connections.

SPECIFICATIONS

STARTER SPECIFICATIONS

ELECTRIC STARTER & STARTER CLUTCH		
Item	Standard	Service Limit
Battery Voltage (Open Circuit Voltage)	Above 12.5 Vdc	-
Commutator Resistance:		
Between Any Two Bars	Continuity (0 Ohms)	-
Any Commutator Bar to Armature Shaft	Infinity (OL on Fluke™ 73)	-
Battery Input Terminal Resistance to Insulated Brush	Continuity (0 Ohms)	-
Battery Cable Terminal Resistance to Motor Case	Infinity (OL on Fluke™ 73)	-
Voltage Drop Allowed: Each Connection - Pos Circuit	See test info. for range	-
Voltage Drop Allowed: Each Connection - Neg Circuit	See test info. for range	-
Total Voltage Drop Allowed - Pos Side Of Starter	See test info. for range	-
Total Voltage Drop Allowed - Neg Side Of Starter	See test info. for range	-

FASTENER TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS - STARTER SYSTEM		
Description	Torque Nm	Torque lb-ft (in-lb) & Notes
Electrical Terminal (+) to Starter Motor	11.9 Nm	(105 in-lbs)
Regulator / Rectifier Screws	10 Nm	(85 in-lbs)
Rotor Bolt (Flywheel)	203 Nm	150 ft-lbs
Starter Motor to Crankcase Bolts	24.4 Nm	18 ft-lbs
Double Stud Nut (Ground Ring Terminal)	24.4 Nm	18 ft-lbs



SPECIAL TOOLS**STARTER SYSTEM SPECIAL TOOLS**

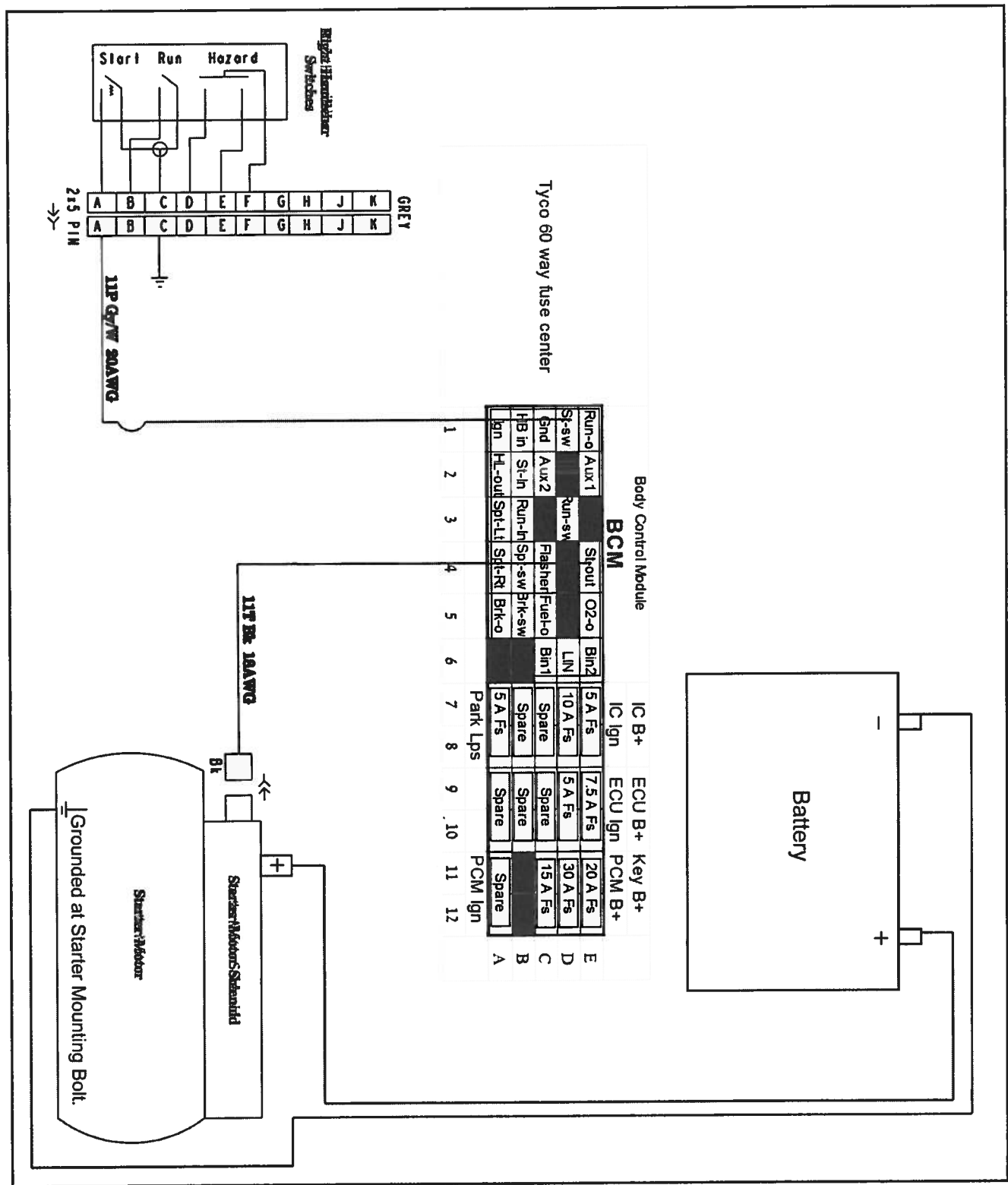
SPECIAL TOOL	PART NUMBER
Digital Multi-Meter	PV-43546
Optional Amp Meter Inductive Clamp	PV-39617
Connector Test Adapter Kit	PV-43526

DIAGNOSTICS**TROUBLESHOOTING FLOW CHART MENU**

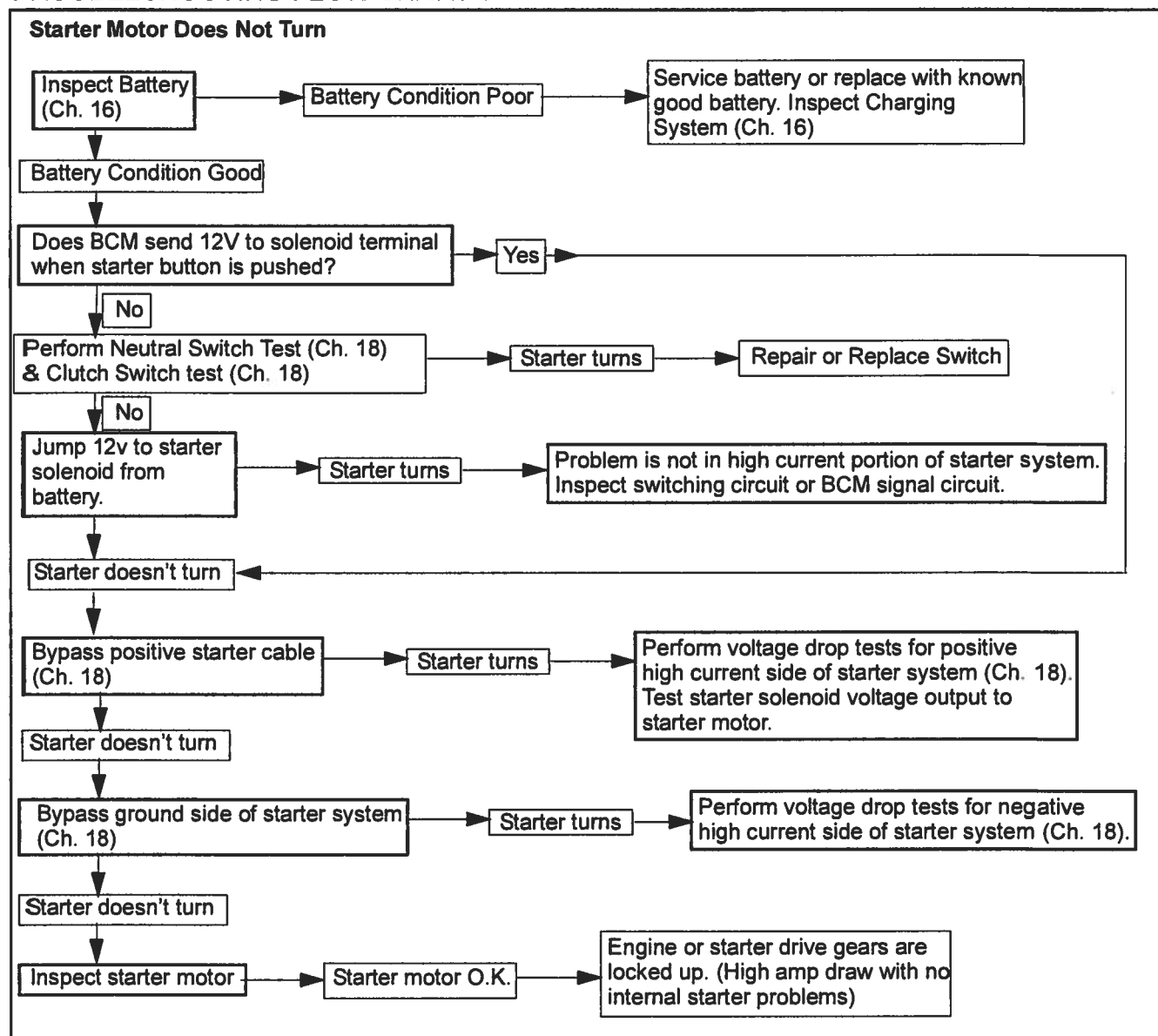
Symptom	Possible Cause	Refer To:
Starter motor does not turn with transmission in neutral. Turns with clutch pulled in.	Neutral switch or circuit malfunction	Test Neutral Switch (page 18.7)
Starter motor does not turn with transmission in gear and clutch lever pulled in. Turns with transmission in neutral.	Clutch switch or circuit malfunction.	Test Clutch Switch (page 18.8).
Starter motor will not turn	Low battery voltage. Starter button faulty. Poor cable connections. Main engine ground or starter ground loose.	See Troubleshooting Flow Chart 1 (page 18.5)
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 (page 18.6)
Starter motor turns, but engine does not turn.	Starter torque limit clutch slipping (Chapter 9).	See Troubleshooting Flow Chart 3 (page 18.6)
Starter motor turns engine at normal speed, but engine does not start.	Ignition Problem Engine Problem Fuel Delivery Problem	Chapter 17 Chapter 7-10 Chapter 5
Starter solenoid clicks but starter does not engage.	Faulty starter solenoid.	See Troubleshooting Flow Chart 1 (page 18.5)



STARTER CIRCUIT DIAGRAM



TROUBLESHOOTING FLOW CHART 1



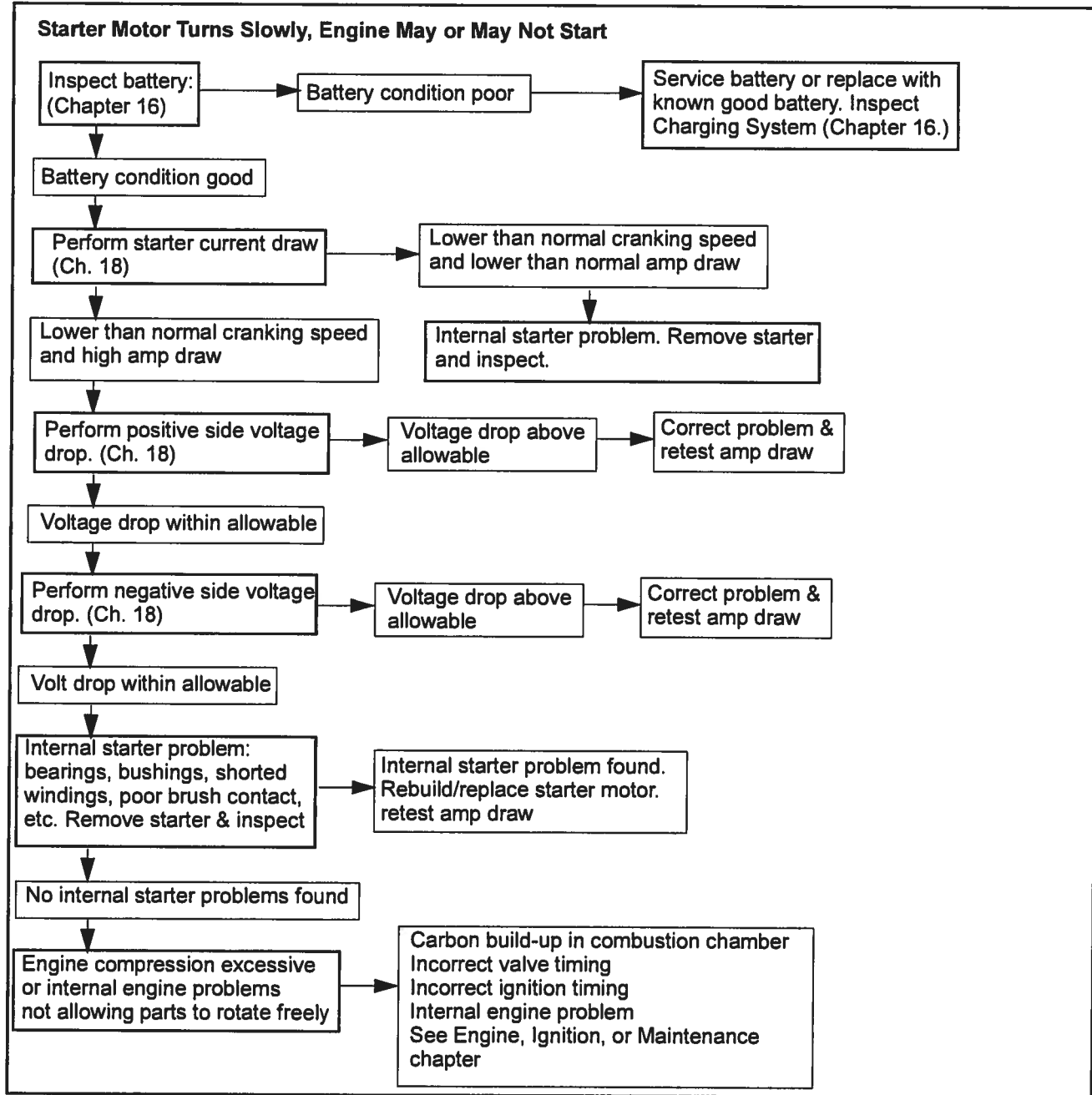
WARNING

Ensure that motorcycle is secure and transmission is in neutral for all tests.

CAUTION

Inspect fuses and make sure battery is fully charged before inspecting starter system.

TROUBLESHOOTING FLOW CHART 2



NOTE: Diagnostics require a Digital Multi Meter with a high current shunt or an inductive ammeter clamp.

TROUBLESHOOTING CHART 3

Symptom	Possible Cause	Possible Reason and/or Inspection Needed
Starter motor turns, but engine does not turn. The starter motor can be heard spinning.	Jackshaft malfunction.	Inspect jackshaft assembly.
	Starter torque limit clutch slipping.	Remove starter and inspect.
	Starter gears damage.	Replace starter.



BATTERY INSPECTION & CHARGING PROCEDURES

1. Refer to Chapter 16.

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 the battery completely (Chapter 16).
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. Turn ignition off. Measure battery voltage.
7. If battery voltage drops below 12.0 Vdc, re-charge and re-test battery or replace it.

CIRCUIT & SWITCH TESTING

NEUTRAL SWITCH BYPASS TEST

An obvious symptom of a faulty neutral switch / circuit is:

- Starter motor does not operate when transmission is in neutral,

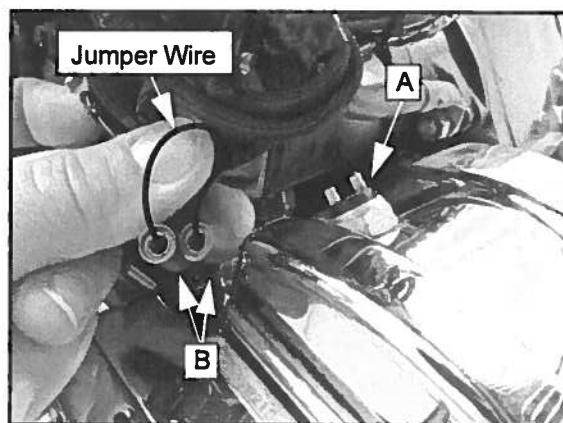
but...

- Starter will operate when clutch is pulled in.

1. Turn ignition switch on and place engine stop switch in the RUN position.
2. Shift transmission into Neutral.
3. Observe neutral indicator light.
4. If indicator is not working with transmission in neutral:

- Disconnect the wires from the neutral indicator switch (A).
- Connect a jumper wire across the two switch wires (B) and observe the neutral indicator light on the speedometer. The green 'N' should illuminate.

If the neutral indicator switch is at fault, the engine should now crank over.



5. If the neutral light comes on while jumper wire is in position, the neutral indicator switch is at fault. Continue to Step 6 to test the switch.

ELECTRIC STARTER

6. Set meter to measure resistance.
7. Place one meter lead on each of the neutral indicator switch terminals (C)
8. Compare reading to Table 1 below.
9. Replace neutral switch or repair wiring as necessary.
10. If neutral switch is working correctly and neutral indicator did not light with the connector terminals jumped, inspect neutral lamp circuit wiring and connectors for an open circuit.



If switch is faulty, refer to Gear Position Switch Removal / Installation (chapter 19).

TABLE 1 - TESTING NEUTRAL INDICATOR SWITCH

Gear Position	Meter Probe # 1	Meter Probe # 2	Ohmmeter Reading*
Neutral	Pin 1 or 2 of 2-pin connector	Pin 1 or 2 of 2-pin connector	$\leq .5 \Omega$
Any Gear - Other Than Neutral	Pin 1 or 2 of 2-pin connector	Pin 1 or 2 of 2-pin connector	OL

* Be sure to subtract meter probe resistance from resistance reading

CLUTCH SWITCH TEST

Symptom of a faulty clutch switch circuit:

- Starter motor will not operate with transmission in gear and clutch lever pulled in, but, starter **DOES operate** with transmission in neutral.

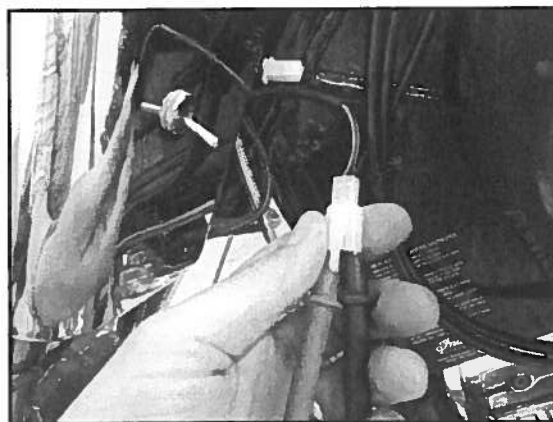
Use an ohmmeter to determine if continuity is present when the switch is closed (lever pulled in).

1. Transmission can be in neutral or in any gear.
2. Working from the left side of the motorcycle, locate the 2-pin clutch switch connector behind and headlight housing.

NOTE: It is not necessary to remove headlight housing to locate / disconnect the clutch switch connector.

3. Unplug the 2 pin connector.
4. Set meter to measure resistance (Ω).

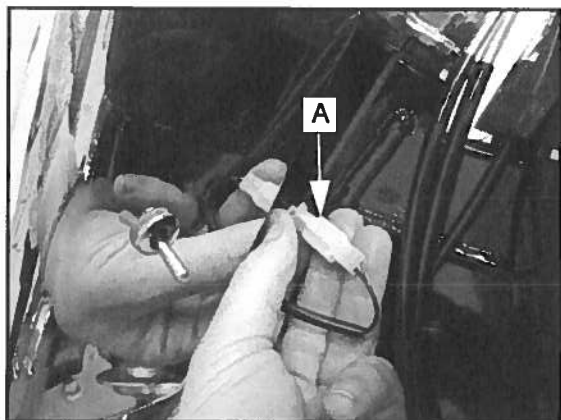
5. Connect the red and black meter leads across the male clutch switch terminals (blue and black wires).



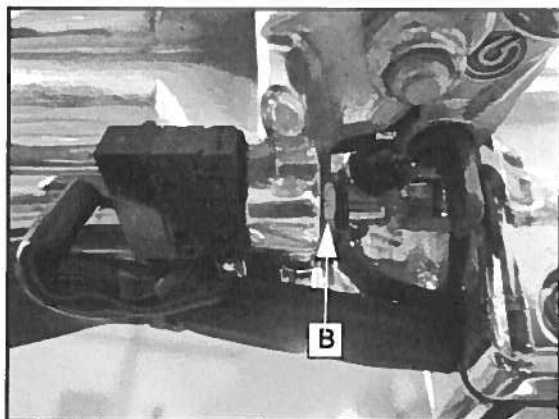
6. Operate clutch lever while observing meter display:
 - Pull clutch lever to the handlebar. Meter should display continuity or very low resistance (less than 1 ohm) when the clutch switch closes.
 - Release clutch lever, meter should display OL.
7. If the clutch switch does not test as described, inspect clutch switch, clutch switch wiring or mounting of switch to clutch lever for faults.

CLUTCH SWITCH REPLACEMENT

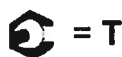
1. Disconnect clutch switch harness at connector (A).



2. Remove handlebar riser cover as outlined in Chapter 12.
3. Using an open ended wrench loosen the jam nut securing the clutch switch (B) to the left hand control assembly.



4. Clip cable ties securing clutch switch harness to handlebar and withdraw harness from headlamp housing.
5. Reverse procedure to install.
6. Torque handlebar riser cover and clutch switch jam nut to specification.



Handlebar Riser Cover: 85 in-lbs (9.6 Nm)
Clutch Switch Jam Nut: 10 in-lbs (1.1 Nm)

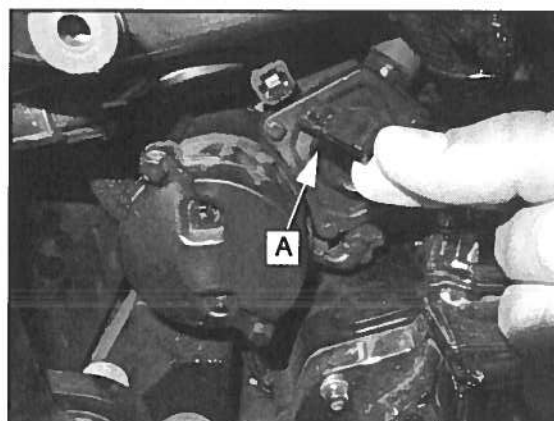
7. Replace cable ties removed in step 4.
8. Verify proper operation.

BCM (STARTER SIGNAL) BYPASS TEST

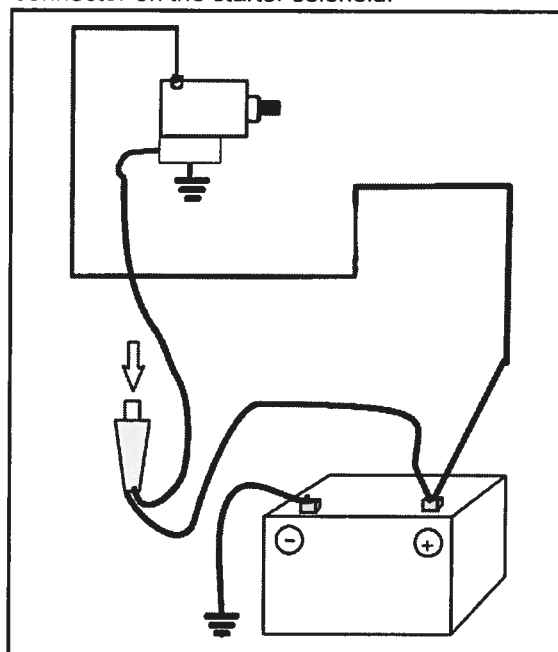
⚠ WARNING

Secure motorcycle and place transmission in neutral for the following test. Be sure the transmission is in neutral!

1. Place the transmission in neutral.
2. Remove the side covers (see Chapter 3) to access the starter solenoid signal wire (A) and disconnect.



3. Remove the seat (see Chapter 3) to access the battery terminals.
4. Connect one lead of a remote starter switch to the positive battery post and the other lead to the spade connector on the starter solenoid.



ELECTRIC STARTER

5. Depress button on remote starter switch.
6. If starter motor operates, and the entire starting system circuit has been carefully examined, the Clutch Switch Test and Neutral Switch Test have passed inspection, replace the Body Control Module (BCM).
7. If the starter motor does not operate, inspect cables and connections.

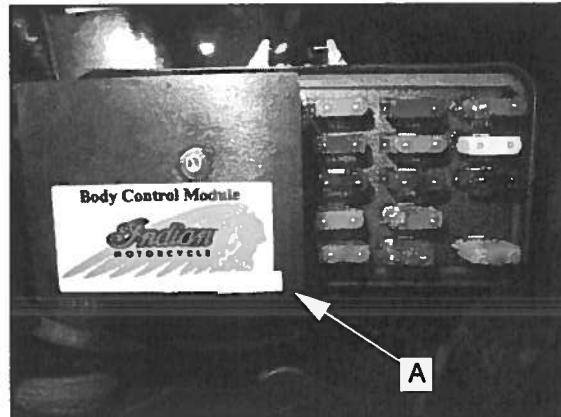
STARTER SWITCH / CIRCUIT TEST



CAUTION

The motorcycle ignition switch should remain in the OFF position while performing the following test.

1. Remove side covers (see Chapter 3).
2. Remove fuse box cover to access BCM.
3. Remove the BCM(A) from the fuse box.



4. Set the meter to measure resistance (Ohm's).
5. Connect the BLACK meter lead to a known good ground (the negative battery terminal is ideal).
6. Connect the RED meter lead to the ST-SW (start switch) terminal on the BCM side of the fuse box.



7. Without depressing the start switch, the DMM should read OL (no continuity).
8. When pressing the starter switch, the resistance reading should read between .4 - 1.0 Ohm.
9. If readings are different than described, inspect start switch and start switch circuit.



POSITIVE SIDE VOLTAGE DROP TEST

Symptoms: Starter motor does not turn or turns slowly when starter is operated normally (via start switch). Starter motor functions properly when solenoid is bypassed with a remote start switch.

CAUTION

The ignition system must be disabled when doing voltage drop tests, if engine starts it will be difficult to measure voltage drop. To disable ignition system quickly and safely, observe the following steps.

1. Remove spark plug caps.
2. Install test spark plugs or plugs with the gap CLOSED into plug caps.
3. Ground spark plug center electrode to engine.

NOTE: *The total voltage drop between the battery (+) and starter motor must not exceed 2.0 Vdc.

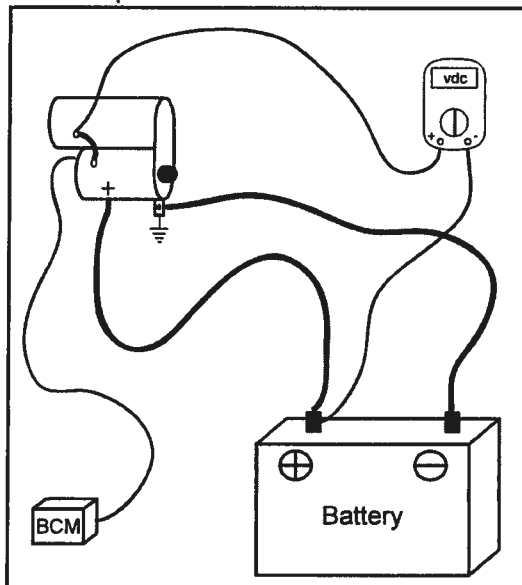
POSITIVE SIDE VOLTAGE DROP TESTS

Location	Allowable Voltage Drop
Battery (+) To Starter (+)	2.0 Vdc
Battery (+) to Battery Side of Solenoid	0.2 Vdc (200 mV)*
Across Solenoid	2.0 Vdc
Starter (+) to Starter Side of Solenoid	0.2 Vdc (200 mV)*

CAUTION

Only operate starter long enough to stabilize the reading on the DMM (less than 10 seconds). Let starter motor cool down between each voltage drop test to prevent damage to starter motor.

4. Place transmission in neutral.
5. Set DMM to DC Volts.
6. Place one lead of DMM to positive battery post.
7. Place the other lead of the DMM to the starter motor side of the positive brush connector as shown.



8. Turn ignition switch on, turn engine stop switch to run position. Pull in clutch lever.
9. Operate the starter normally (no jumper cables in place) and observe meter display.

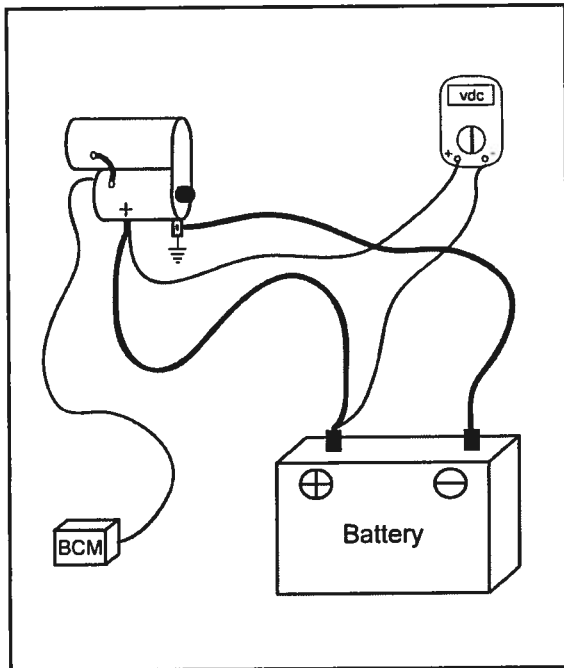
NOTE: Any voltage displayed while cranking the engine indicates voltage dropped across the circuit.

10. If DMM reads more than 2.0 Vdc when the starter motor is engaged, it indicates that there is excessive resistance in the starter's battery positive path or solenoid. Continue with the following tests to isolate each section of the positive path and observe the voltage drop with DMM leads placed as indicated.

(Cont.)

ELECTRIC STARTER

11. Place one lead of DMM to positive battery post. Ensure DMM is set to read DC Volts.

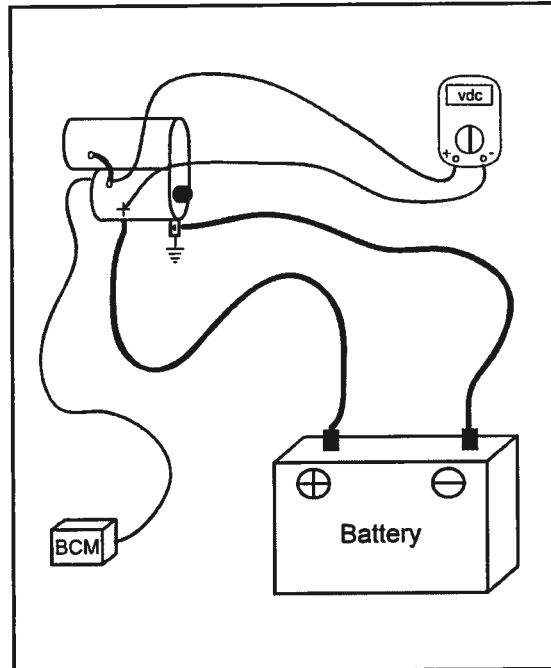


12. Place other lead of DMM to the solenoid B+ ring terminal coming from the battery.
13. Engage starter and observe meter display, it should read less than 0.2 Vdc (200 mV DC).
14. If voltage drop is observed, the cable, connection at the battery or connection at the solenoid is causing resistance and must be corrected.
15. Inspect cable ends for corrosion where cable is connected to terminal lugs.
16. Remove cable. Set the DMM to read Ohms.
17. Place DMM leads at both ends of the cable and measure the cable's resistance. The resistance should be 0 ohms. Replace cable if necessary.
18. Inspect battery post, battery cable lug and relay lug for corrosion or looseness.

NOTE: Corrosion has resistance that limits or stops the flow of current to the starter motor.

19. If corrosion is found, wash all connections with a solution of baking soda and water, wire brush all contact areas, apply a light film of dielectric grease to the hardware and tighten connections. Retest to verify problem has been corrected.

next...

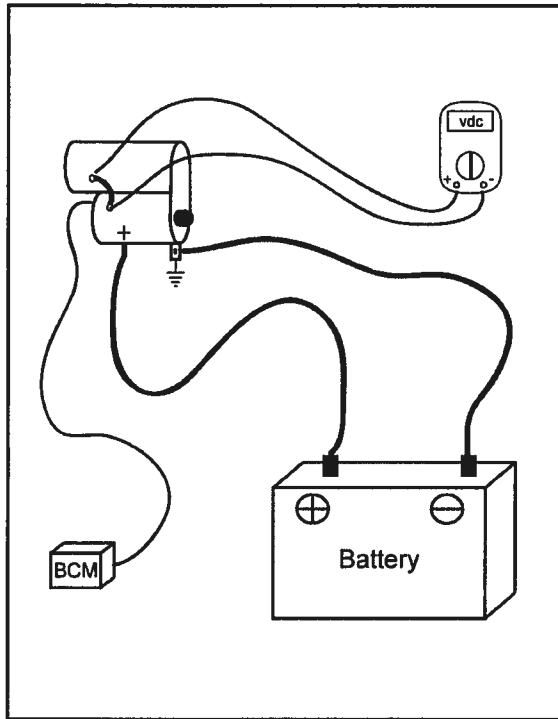


20. Place one lead of DMM to battery side of the solenoid. Reset DMM to read DC Volts if necessary.
21. Place other lead to starter motor side of solenoid.
22. Engage starter and observe meter display; it should read less than 2.0 Vdc.
23. If an unacceptable voltage drop is observed, inspect ring terminal at battery side and the positive brush connector joint on the starter side for corrosion and integrity. Retest voltage drop.
24. If voltage drop is still observed through the solenoid, replace the starter assembly.

(Cont.)



25. Place one lead of DMM to starter motor side of positive brush connector. Ensure DMM is set to read Volts DC.



26. Place other lead of DMM to the solenoid side of the positive brush connector.
27. Engage starter and observe meter display.
28. If voltage drop is observed, positive brush connector joint integrity or corrosion is causing resistance and must be corrected.
29. Inspect positive brush connector joints for corrosion.
30. Remove cable. Set DMM to read Ohms.
31. If corrosion is found, wash all connections with a solution of baking soda and water, wire brush all contact areas, apply a light film of dielectric grease to hardware and tighten connections. Retest to verify problem has been corrected.

ELECTRIC STARTER

NEGATIVE SIDE VOLTAGE DROP TEST

NEGATIVE SIDE VOLTAGE DROP TESTS	
Location	Allowable Voltage Drop
Battery (-) To Starter Body (-)	0.2 Volts DC (200 mV)

NOTE: *The total voltage drop between the items tested must not exceed 0.2 Volts DC (200 mV).

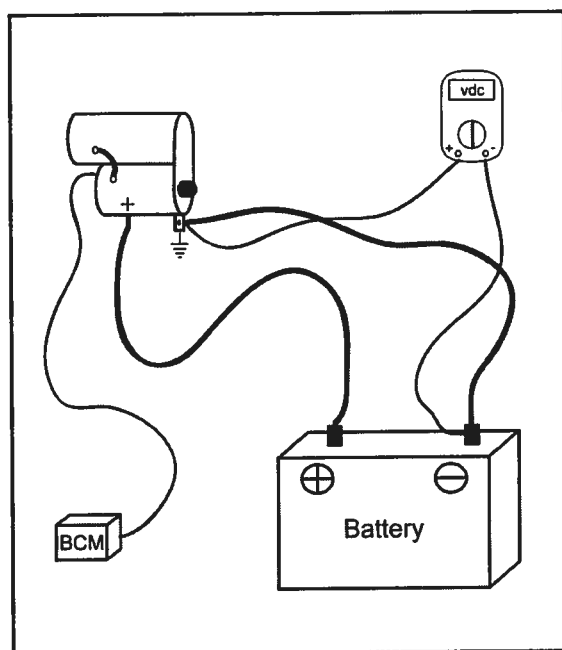
CAUTION

Only operate the starter long enough to stabilize the reading on the DMM (less than 10 seconds running time). Let starter motor cool down between each voltage drop tests to prevent damage to starter motor.

5. Turn ignition switch ON and engine stop switch to RUN position. Pull clutch lever in.
6. Operate starter normally (no jumper cables in place) and observe meter display.
7. If voltage drop is observed, the cable, connection at the battery, or the connection at the starter motor ground is causing resistance and must be corrected.

Disable the ignition system so engine will not start during this test.

- Remove spark plug caps.
 - Install test spark plugs or plugs with the gap closed into plug caps.
 - Ground center electrode of spark plugs to engine.
1. Place transmission in neutral.



2. Set DMM to DC Volts.
3. Place one lead of DMM to negative battery post.
4. Place other lead of DMM to the ring terminal ground on the forward starter motor mounting bolt.

STARTER MOTOR REMOVAL

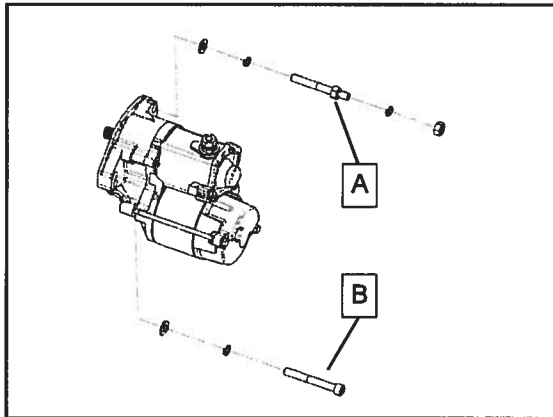
WARNING

Ensure that the ignition switch is turned off. Remove the negative cable at the battery before removing the starter motor.

1. Remove seat. (see Chapter 3)
2. Disconnect battery (see Chapter 2).
3. Remove primary cover (see Chapter 9).
4. Remove the starter jackshaft assembly (see Chapter 9).

NOTE: Jackshaft sleeve may stay on starter drive gear.

5. Remove positive cable from starter motor.
6. Unplug electrical connector to starter solenoid.
7. Remove ground cable from double stud (A) and remove double stud from starter mounting flange.
8. Remove rear starter mounting bolt (B) using care not to damage wire harness.



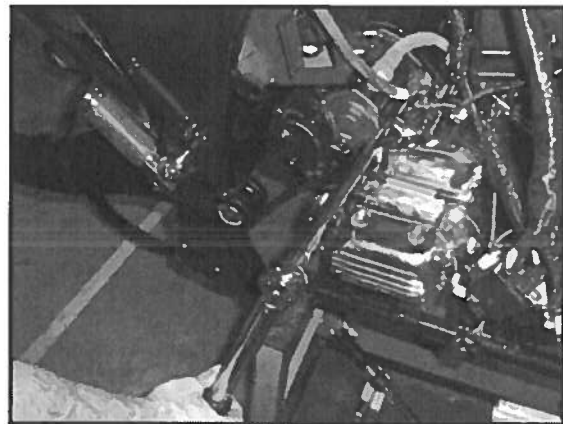
9. Remove starter assembly.

STARTER MOTOR INSTALLATION

WARNING

Make sure that the ignition switch is turned off and that the negative cable is disconnected from the battery before installing the starter.

1. Install jackshaft sleeve to starter.
2. Install starter by aligning it with the dowel pin in primary case.
3. Start double stud (A) and rear starter mounting bolt (B). Torque to specification.



4. Install ground cable to double stud (A) and torque nut to specification.
5. Install starter solenoid connector to starter.
6. Install positive cable to starter and torque to specification.



Starter Motor Mounting Bolts: **18 ft-lbs (24.4 Nm)**
Double Stud Nut: **18 ft-lbs (24.4 Nm)**
Positive Battery Cable Nut: **105 in-lbs (11.9 Nm)**

7. Install jackshaft assembly (see Chapter 9).
8. Install primary cover (see Chapter 9).
9. Connect battery (see Chapter 2).
10. Install seat (see Chapter 3).
11. Check starter motor for proper function.

ELECTRIC STARTER

NOTES

This image shows a full page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, typical of notebook paper. There are no margins, text, or other markings on the page.

CHAPTER 19

WIRING / LIGHTING SYSTEMS

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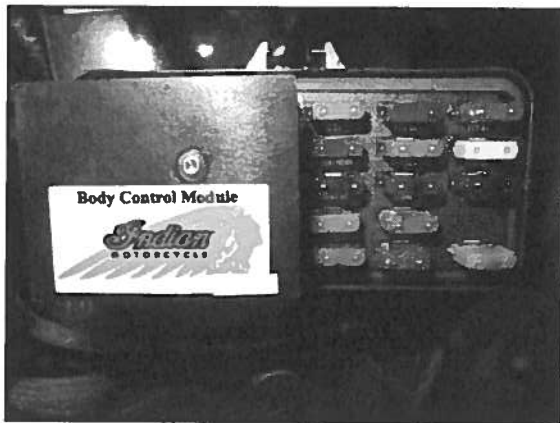
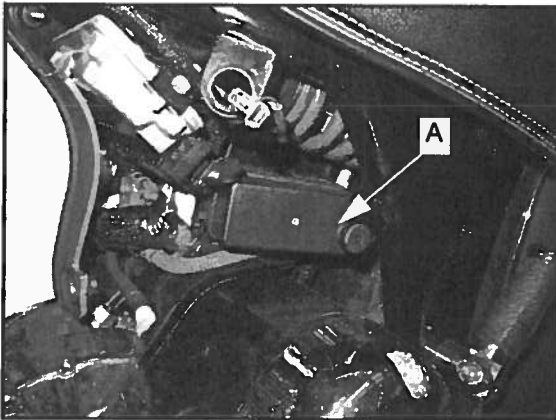


WIRING / LIGHTING SYSTEMS

FUSES

FUSE BOX LOCATION

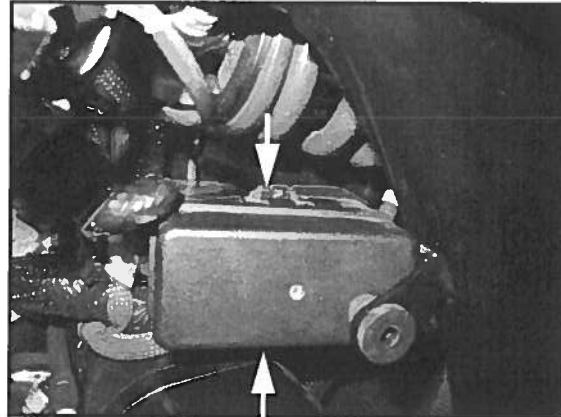
2009-2012 Indian motorcycles utilize a single fuse box (A) located beneath the left hand side cover. The fuse box houses all standard service fuses and the Body Control Module (BCM).



FUSE REPLACEMENT

To access BCM, fuses, and main circuit breaker:

1. Remove side covers (see Chapter 3).
2. Locate fuse box and remove cover by squeezing upper and lower clips together.



3. Fuse application information is printed on the fuse box beneath each fuse.

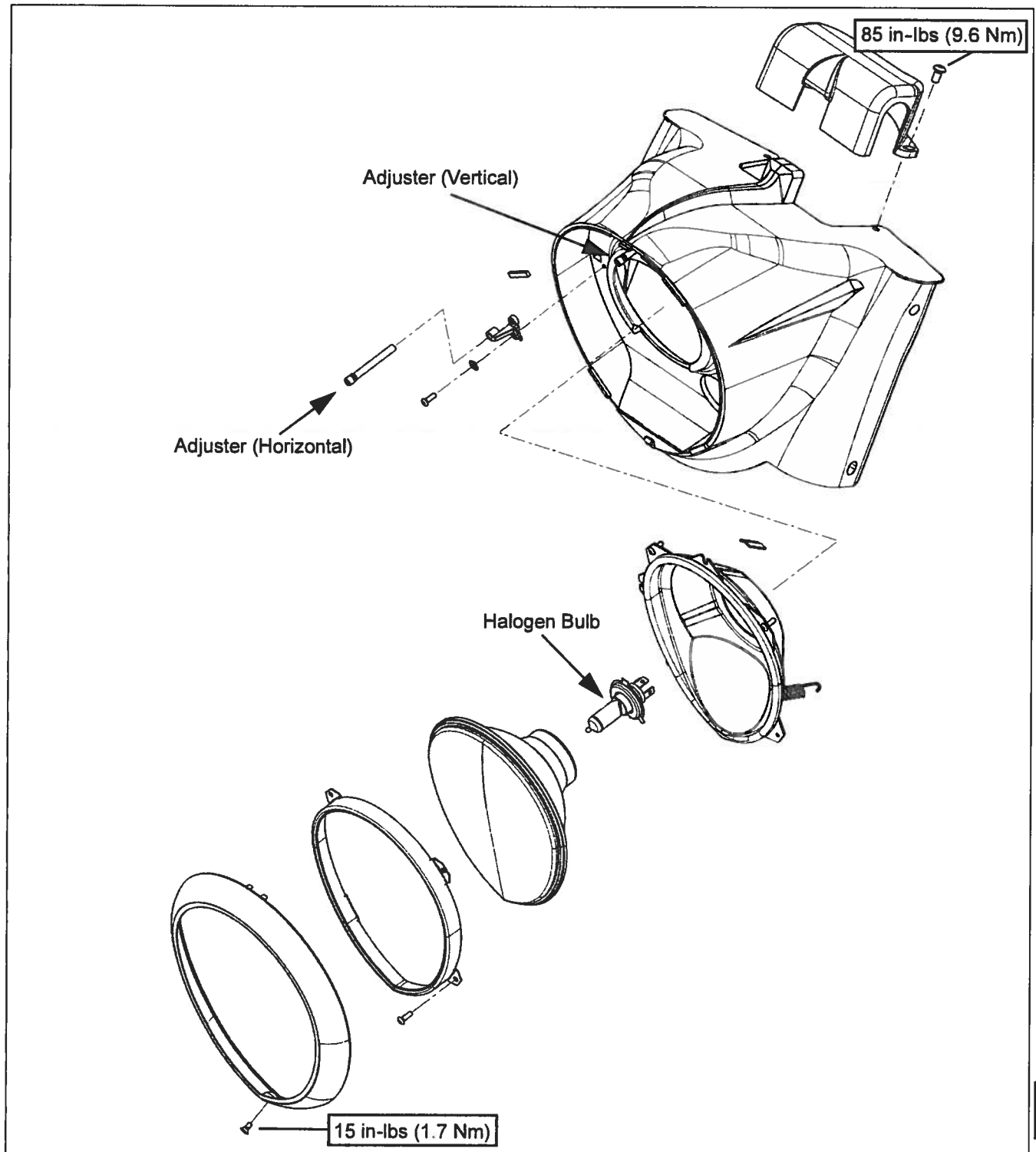
Fuse Application Chart

Body Control Module						IC B+	ECU B+	Key B+			
BCM						IC Ign	ECU Ign	BCM B+			
Run-o	Accy		St-out	Q2-o	Bn2	5 A Fs	7.5 A Fs	20 A Fs	E		
St-sw		Run-sw			LN	7.5 A Fs	5 A Fs	20 A Fs	D		
Gnd	Accy-F		N/A	Fuel-o	Bn1	10 A Fs	Spare	15 A Fs	C		
HB In	St-In	Run-In	Spl-sw	Brk-sw		5 A Fs	Spare		B		
Ign	HL-out	Spt-Lt	Spt-Rt	Brk-o		5 A Fs	Spare	15 A Fs	A		
						Fuse B+		BCM Ign			
						Fuse Ign					
						Park Lps		Aux Batt			
1	2	3	4	5	6	7	8	9	10	11	12



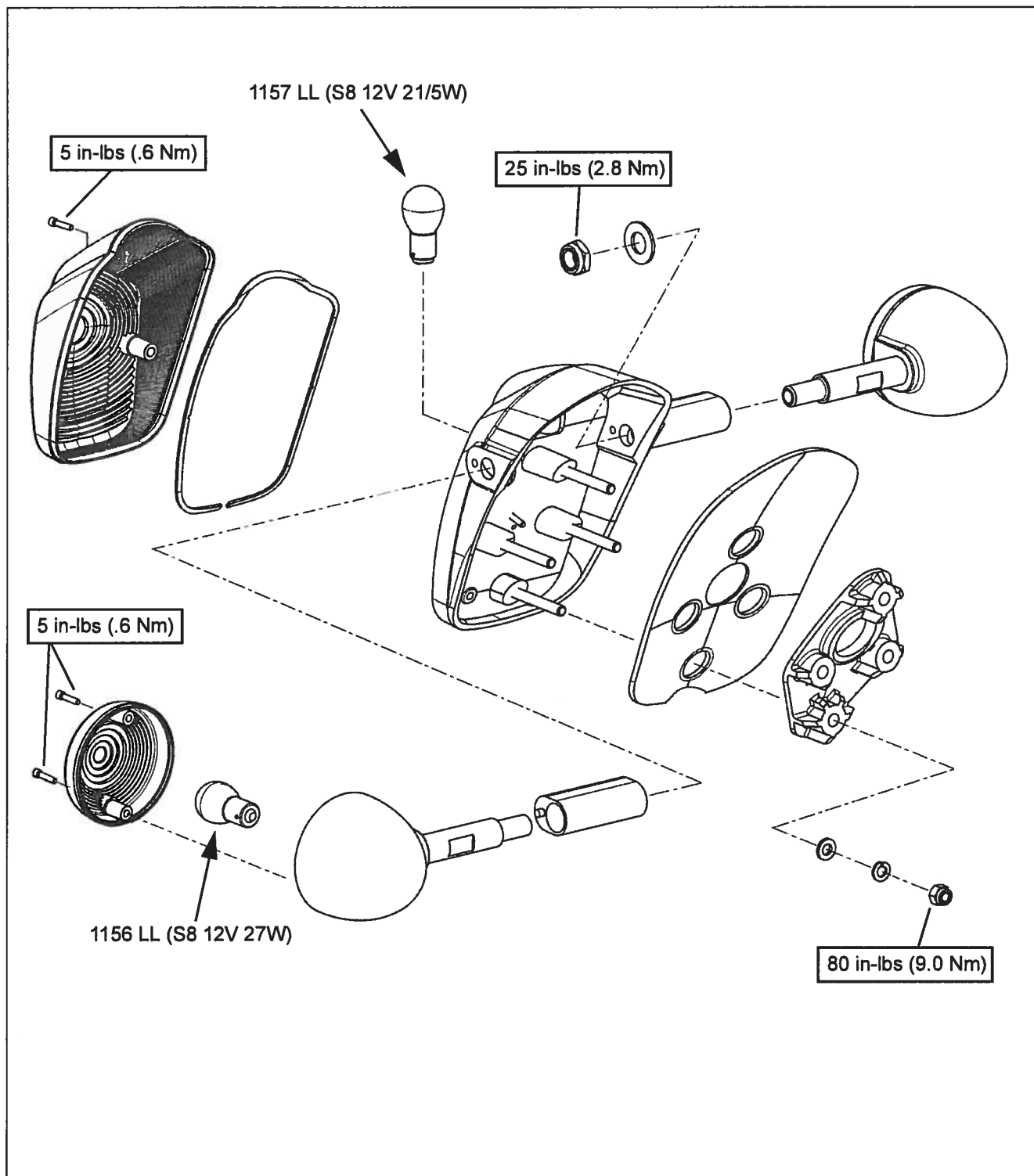
PRIMARY LIGHTING

ASSEMBLY VIEW - HEADLAMP

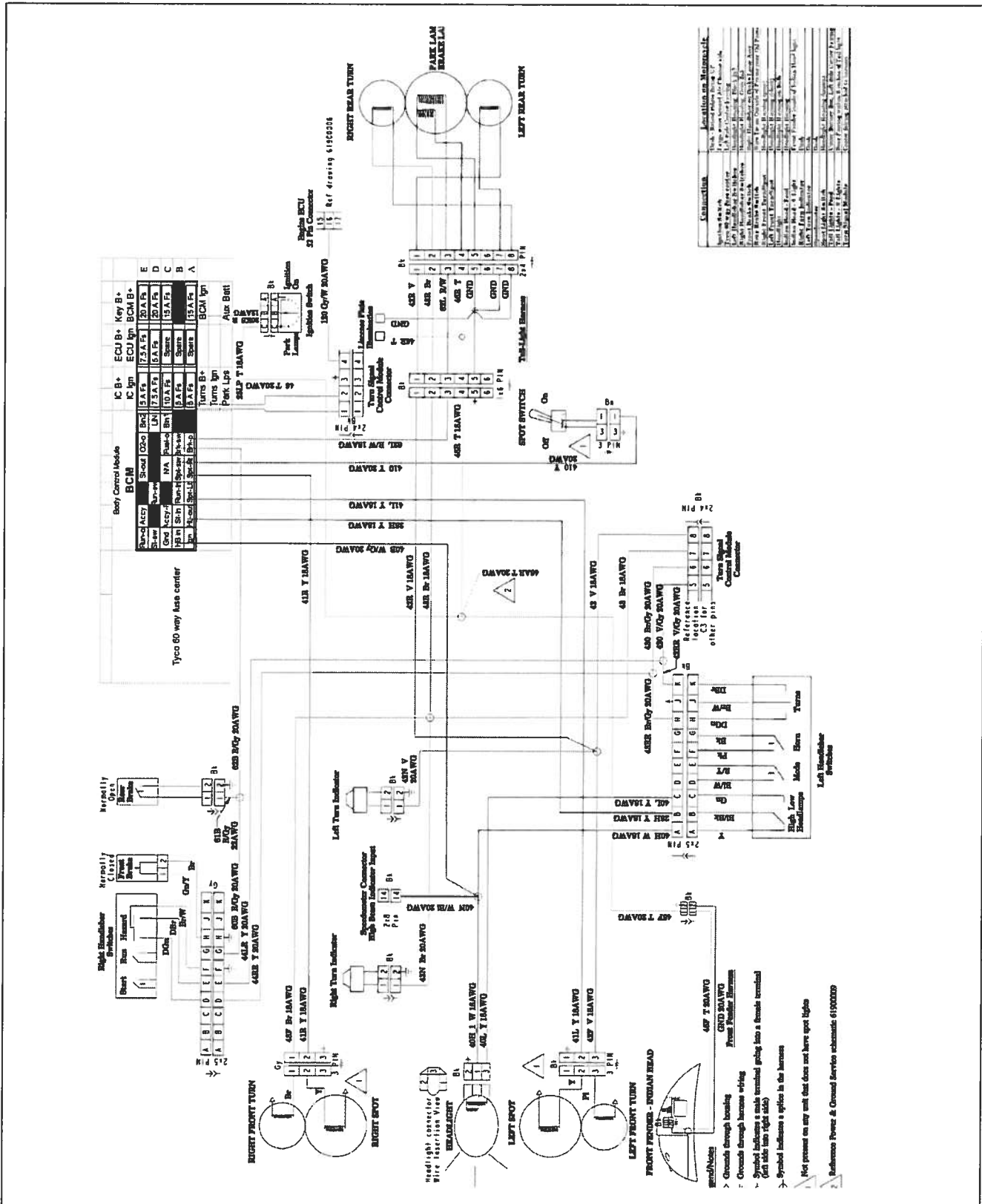


WIRING / LIGHTING SYSTEMS

ASSEMBLY VIEW - TAIL LAMP / TURN SIGNALS



LIGHTING - CIRCUIT DIAGRAM

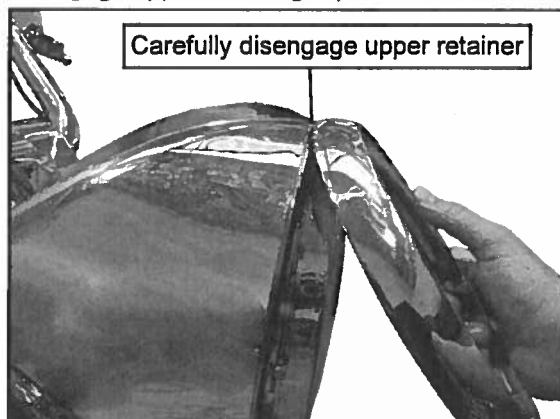


WIRING / LIGHTING SYSTEMS

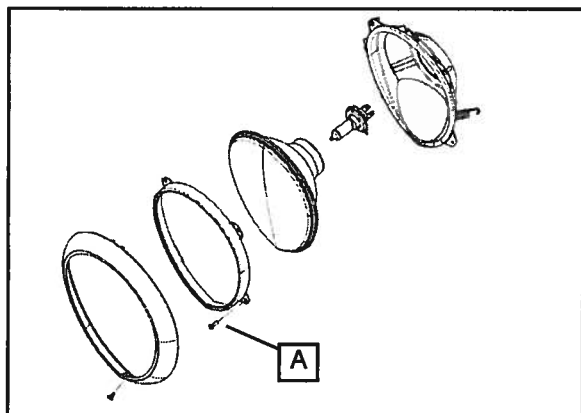
BULB REPLACEMENT

HEADLAMP BULB REPLACEMENT

1. Remove trim ring screw.
2. Rotate trim ring out from bottom slightly and carefully disengage upper retaining clip.



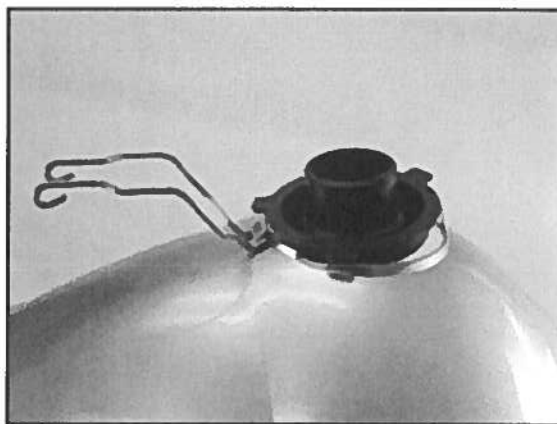
3. Remove screws (A) from the headlamp retaining ring.



4. Carefully withdraw headlamp assembly from housing.
5. Disconnect headlamp electrical connector from the headlamp bulb.



6. Remove the rubber boot covering the base of the bulb.
7. Unlock the headlamp bulb retaining clip.



8. Orientate headlamp bulb tabs into slots and lock bulb into position.

IMPORTANT: Use care not to touch the headlamp bulb glass during installation.

9. Connect headlamp electrical connector.
10. Position headlamp into housing and install retaining ring and retaining ring screws.
11. Set tabs of trim ring into the top of the headlamp housing and position trim ring. Verify that anti-rattle pads are exposed at the edges of the trim ring.
12. Install trim ring screw and torque to specification.

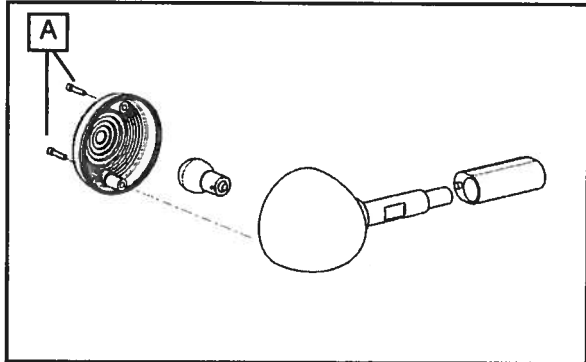


Trim Ring Screw:
15 in-lbs (1.7 Nm)

13. Check for proper headlamp operation.

TURN SIGNAL BULB REPLACEMENT

1. Remove screws (A) securing turn signal lens to housing.



2. Remove turn signal lens.
3. Remove bulb.
4. Apply dielectric grease to terminals of new bulb and install bulb.
5. Install turn signal lens and rubber seal onto housing.
6. Torque turn signal lens screws to specification.

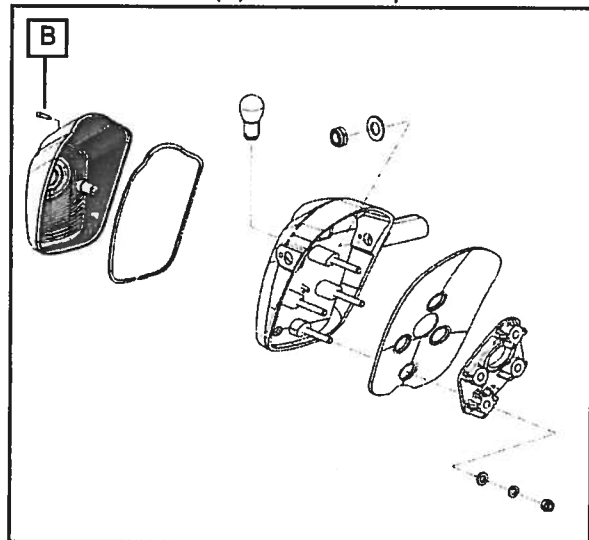


Turn Signal Lens Screws:
5 in-lbs (.6 Nm)

7. Check for proper turn signal operation.

TAIL LAMP / BRAKE LAMP REPLACEMENT

1. Remove screws (B) from tail lamp lens.



2. Remove tail lamp lens and gasket.
3. Remove tail lamp bulb.
4. Apply dielectric grease to bulb terminals and install bulb.
5. Install tail lamp gasket onto lens.
6. Install tail lamp lens and torque screws to specification.



Tail Lamp Lens Screws:
5 in-lbs (.6 Nm)

7. Check for proper tail / brake lamp operation.

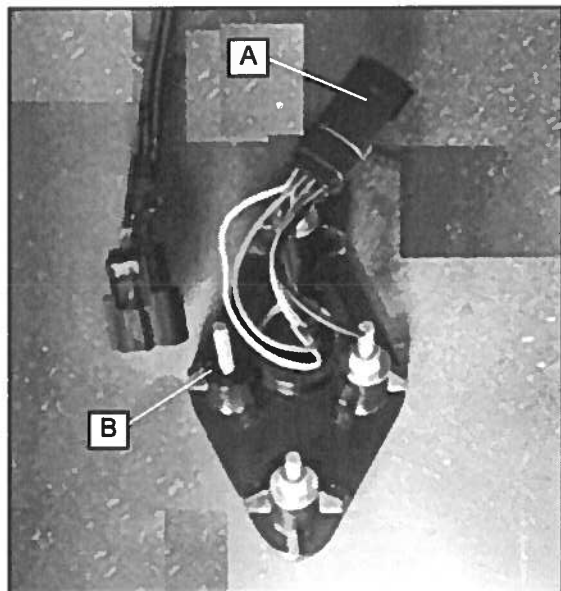
TAIL LAMP AND REAR TURN SIGNAL ASSEMBLY REMOVAL

NOTE: The tail lamp and turn signals can be removed as one complete assembly. A jumper harness connects the tail lamp and turn signal assembly to the main harness.

1. Secure motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. To gain additional access to the mounting fasteners of the tail lamp and rear turn signal assembly, position a scissor jack beneath the rear of the engine and raise the motorcycle until rear suspension is extended.

WIRING / LIGHTING SYSTEMS

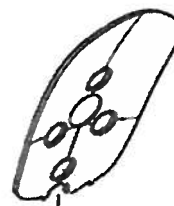
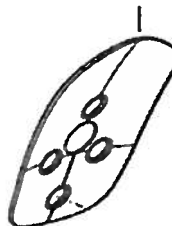
3. Disconnect the tail lamp and turn signal connector (A) from the rear jumper harness.



TAIL LAMP AND REAR TURN SIGNAL ASSEMBLY INSTALLATION

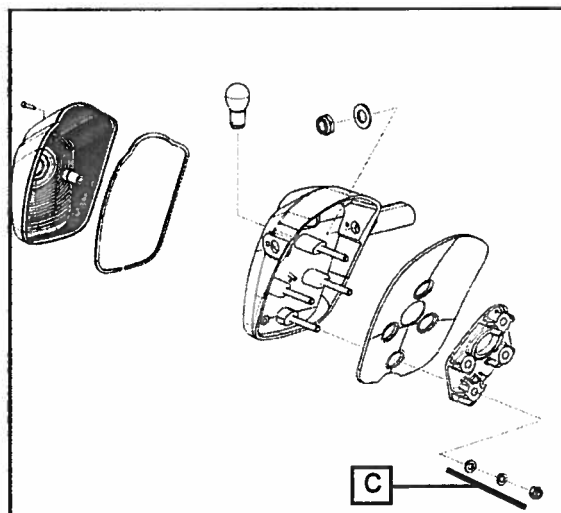
IMPORTANT: Tail Lamp gaskets were modified to include a drainage hole after Model Year 2009. Inspect gasket to confirm drainage cutout is in place. If gasket does not have the drainage hole modification, cut a hole as seen in illustration below.

2009 - No drainage cutout



2010-2012 Drainage Cutout Added

4. Remove hardware from left stud (B) securing the tail lamp bracket and tail lamp wiring. Note the orientation of hardware components (C) and stud mount wire harness retention zip tie.



1. Position tail lamp gasket onto tail lamp assembly.
2. Route wires through hole in fender with bushing on wires inserted into fender. Maintaining alignment of gasket to tail light housing, position assembly to outside of fender with mounting studs protruding into fender.
3. Install tail lamp bracket onto assembly mounting studs from inside of fender.
4. Install flat washer, stud mounting zip tie, flat washer, lock washer and nut onto left hand stud. Do not tighten.
5. On the three remaining mounting studs, install flat washer, lock washer and nut. Torque to specification.



Tail Lamp Mounting Nuts:
80 in-lbs (9.0 Nm)

5. Remove the remaining nuts and fasteners from bracket.
6. While supporting the tail lamp and rear turn signal assembly, remove the tail lamp bracket from the studs.
6. Connect tail lamp assembly to jumper harness.
7. Orientate the stud mount wire retention zip tie to 5 o'clock and torque nut to specification.

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