



THE NEW AMERICAN MOTORCYCLE™

2002–2004

VICTORY SERVICE MANUAL

P/N 9918960

| CLASSIC CRUISER
TOURING CRUISER |



THE NEW AMERICAN MOTORCYCLE™



2002 - 2004 SERVICE MANUAL

Part Number 9918960

Foreword

This manual is designed primarily for use by Victory 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 motorcycle 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.

This manual includes procedures for maintenance, component identification and repair, along with service specifications for Victory Classic Cruiser and Touring Cruiser motorcycles. Comments or suggestions about this manual may be directed to: Service Publications Dept. @ Polaris Sales Inc. 2100 Hwy 55 Medina, Minnesota 55340.

2002 - 2004 Victory Standard, Deluxe, Classic, and Touring Cruiser Service Manual PN9918960.

Refer to page 1.6 for Owner's Manual, Parts Book, and Microfiche part numbers.

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CHAPTER 1

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TRADEMARKS


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FLEXLOC, Registered Trademark of SPS Technologies
Loctite, Registered Trademark of the Loctite Corporation
STA-BIL, Registered Trademark of Gold Eagle
FOX, Registered Trademark of Fox Shocks
Nyogel, Trademark of Wm. F. Nye Co.
Fluke, Registered Trademark of John Fluke Mfg. Co.
Mity Vac, Registered Trademark of Neward Enterprises, Inc.
Torx, Registered Trademark of Textron

UNDERSTANDING SAFETY LABELS & INSTRUCTIONS

DANGER, WARNINGS, & CAUTION SYMBOLS


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

 **WARNING**
Indicates a potential hazard which could result in severe injury or death.










 **CAUTION**
Indicates a potential hazard which may result in minor personal injury or damage to the motorcycle.

CAUTION
Indicates a situation that can result in damage to the motorcycle.

NOTE:
The word "NOTE:" in this manual will alert you to key information or instructions.

 **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.

| | | |
|---|---|--|
| <p> WARNING The engine exhaust from this product contains chemicals known to cause cancer, birth defects or other reproductive harm.</p> | <p> WARNING Improper repairs or service can create unsafe conditions that may cause severe personal injury or death.</p> | <p> 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.</p> |
| <p> WARNING Never run the engine in an enclosed area without a properly functioning exhaust gas evacuation system connected to the product.</p> | <p> WARNING Modifications to this motorcycle not approved by Victory may cause loss of performance, excessive emissions, and make the machine unsafe for use.</p> | <p> WARNING Brake fluid is poisonous. KEEP OUT OF REACH OF CHILDREN.</p> |
| <p> WARNING Wear insulated protection for hands and arms or wait until hot components have cooled sufficiently before working on the product.</p> | <p> WARNING Brake fluid is poisonous. Do not ingest or allow brake fluid to contact eyes. Always wear eye protection when working with brake fluid.</p> | <p> WARNING Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing.</p> |

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

GENERAL

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. Photographs and illustrations have been included with text as an aid. Notes, Cautions and Warnings have also 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 Victory service parts.
- ⚠ Cleanliness of parts and tools as well as the work area is of primary importance. Dirt and foreign matter will act as an abrasive and 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, resulting in injury or death.
- ⚠ If a torquing sequence is indicated for nuts, bolts or screws of a certain component, start all fasteners in their holes 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.
- ⚠ If the condition of any gasket or o-ring is in question, replace it with a new one. 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.
- ⚠ Because removal damages seals, always replace with new seals during a repair.
- ⚠ Victory lubricants and greases have been specially formulated to provide maximum performance and protection when applied properly. In some applications, warranty coverage may be void if improper lubricants are used.
- ⚠ Parts requiring grease should be cleaned thoroughly and fresh grease applied before reassembly. Deteriorating grease loses lubricity and may contain abrasive foreign matter.

⚠ WARNING

Working with Batteries

- When removing or installing batteries, care should be taken to avoid the possibility of explosion resulting in serious burns. Remove battery from the motorcycle before charging. Keep battery away from the source of any combustion (sparks, fire, etc..) when charging.
- Always disconnect the negative (black) cable first and reconnect it last.
- Battery electrolyte contains sulfuric acid and is poisonous! Serious burns can result from contact with skin, eyes or clothing.
- **IN THE EVENT OF CONTACT WITH SULFURIC ACID:** **External** - Flush with water. **Internal** - Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call for medical attention immediately.
- **Eyes** - Flush with water for 15 minutes and call for medical attention immediately.

1.2

VICTORY TOUCH-UP AND REFINISHING PAINT

Service Paint products are available in three different sizes and applications. Some paint colors require up to 3 components to create a color. Prices subject to change without notice. Dealer is responsible for freight on paint and paint products.

.6 ounce bottle: (Order Multiple of 2) For brush touch-up of small nicks.

10 ounce aerosol can: (Order Multiple of 2)

Apply light even coats for best results. Recoat time is from 30-60 minutes or after 4 days of drying to prevent lifting.

Quarts: (Sold as each)

For repaint of properly prepared plastic components or metal substrates.

Paint is a high quality acrylic urethane manufactured by U.S. Paint.

Mix as indicated on back of paint can. Paint can be recoated after paint is tack free or has "flashed off".

Paint finish may be wet sanded and buffed after coating has cured.

Paint is available in a variety of sizes and styles for specific painting needs:

How to order:

Place your order via the dealer web site at : www.polarisdealers.com

Phone Customer Service: 1-800-330-9407

Fax your paint order to 1-866-245-7533 using the supplied paint order form.

Prices subject to change without notice.

Please have your dealer number, telephone number, and Polaris part # to give to the Customer Service Specialist, or include on the order form. Additional charges may apply for phoned in orders.

Note: There will be a 25% service fee charged for all returns. Polaris dealer will be responsible for return freight.

VICTORY DETAIL AND FINISH RESTORER KITS

A Detail Kit (polish, wax, and dressing) and a Restore Kit (Polish, Swirl, and Scuff remover) is available from the Victory parts department for painted surface protection and to remove minor surface imperfections.

Detail Kit: 2872195

Restore Kit: 2872192

GENERAL

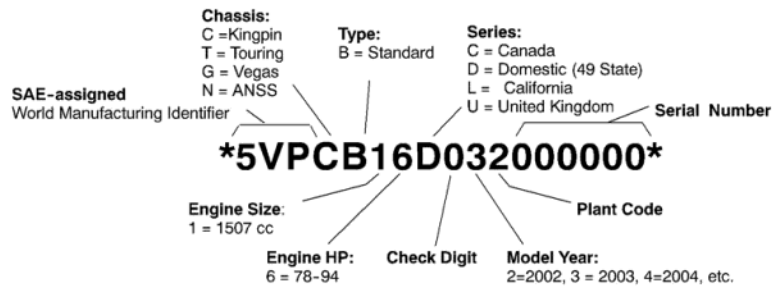
VICTORY PAINT COLORS BY MODEL

| <p>NOTE: The 8th Position in the model number is a letter that designates the country / region: C=Canada; D=49State; L=California; U=United Kingdom The last letter is the color designator. Refer to the chart below for model / color. Paint ordering information is available on the dealer web site.</p> | | | | | |
|--|------------|----------------------------|------------------------|---------|----------------------------|
| MODEL YEAR 2002 | | | | | |
| Model Number | Model | Description / Color | Model Number | Model | Description / Color |
| V02CB16CC,DC,LC,UC | Std. Crsr. | Cruiser Black | V02TB16CC, DC, LC, UC | TC | Cruiser Black |
| V02CB16CK,DK,LK,UK | Std. Crsr. | Solar Red / Stone White | V02TB16CO, DO, LO, UO | TC | Solar Red / Vogue Silver |
| V02CB16CL,DL,LL,UL | Std. Crsr. | Speed Yellow / Crs Black | V02TB16CP, DP, LP, UP | TC | Sonic Blue / Vogue Silver |
| V02CD16CC,DC,LC,UC | Dlx. Crsr. | Cruiser Black | V02TD16CC, DC, LC, UC | TC Dlx. | Cruiser Black |
| V02CD16CK,DK,LK,UK | Dlx. Crsr. | Solar Red / Stone White | V02TD16CO, DO, LO, UO | TC Dlx. | Solar Red / Vogue Silver |
| V02CD16CL,DL,LL,UL | Dlx. Crsr. | Speed Yellow / Crs Black | V02TD16CP, DP, LP, UP | TC Dlx. | Sonic Blue / Vogue Silver |
| V02CD16CM,DM,LM,UM | Dlx. Crsr. | Sonic Blue / Pearl White | V02TD16CQ, DQ, LQ, UQ | TC Dlx. | Cruiser Black/Vogue Silver |
| V02CD16CN,DN,LN,UN | Dlx. Crsr. | Cobalt Green / Pearl White | V02TD16CR, DR, LR, UR | TC Dlx. | Champagne / Pearl white |
| MODEL YEAR 2003 | | | | | |
| Model Number | Model | Description / Color | Model Number | Model | Description / Color |
| V03C116 / V03C216 | Classic | Feature / Option | V03T116 / V03T216 | TC | Feature / Option |
| V03CB16CA, DA, LA, UA | Classic | Cruiser Black | V03TB16CA, DA, LA, UA | TC | Cruiser Black |
| V03CB16CB, DB, LB, UB | Classic | Sonic Blue | V03TB16CB, DB, LB, UB | TC | Sonic Blue |
| V03CB16CC, DC, LC, UC | Classic | Solar Red | V03TB16CC, DC, LC, UC, | TC | Solar Red |
| V03CB16CD, DD, LD, UD | Classic | Flame Yellow | | | |
| MODEL YEAR 2004 | | | | | |
| Model Number | Model | Description / Color | Model Number | Model | Description / Color |
| V04T118 | Touring | Feature / Option | V04TB16CB, DB, LB | Touring | Sonic Blue |
| V04TB16CA, DA, LA | Touring | Cruiser Black | V04TB16CC, DC, LC | Touring | Solar Red |

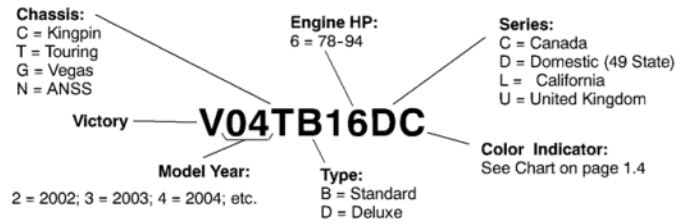
VICTORY PAINT CODES

| PAINT COLORS | PAINT CODE | PAINT COLORS | PAINT CODE |
|---|------------|-----------------|------------|
| Cruiser Black (PHAT) | P-266 | Pearl White | P-352 |
| Indy Red | P-293 | Cobalt Green | P-353 |
| Steel Grey | P-302 | Vogue Silver | P-354 |
| Speed Yellow | P-323 | Champagne | P-355 |
| Sparkle Grey (Fork Legs, Triple Clamp) | P-339 | | |
| Sonic Blue | P-341 | Flame Yellow | P-388 |
| Solar Red | P-342 | Retro Turquoise | P-389 |
| Stone White | P-351 | Daytona Orange | P-393 |
| Flame Tank (All Years) paint codes are made up of Indy Red, Stone White, Speed Yellow, and Daytona Orange | | | |

VEHICLE IDENTIFICATION NUMBER



MODEL NUMBER

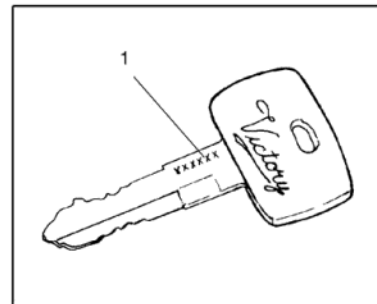


IGNITION KEY IDENTIFICATION NUMBERS

The key identification number (1) is stamped on the key tag. If the key and the identification number are lost or misplaced, the lock set (ignition switch, seat lock (where applicable), and steering lock) must be replaced.

Key blanks are available from service parts. Locksmiths familiar with the motorcycle industry will be able to cut a replacement key with the key I.D. number and a Victory key blank.

Should the keys and key identification number become lost, the ignition switch must be replaced.



VEHICLE IDENTIFICATION NUMBER (VIN)

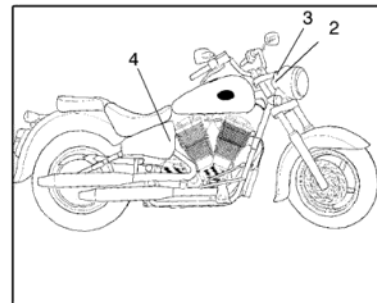
The vehicle identification number (2) is stamped on the front of the steering head.

MODEL IDENTIFICATION NUMBER

The model label (3) is located on the left side of the steering head.

ENGINE NUMBER DECAL

The engine label (4) is located on top of the crankcase behind the rear cylinder. This label identifies the engine model and serial number. The engine serial number is also stamped on the crankcase just to the right of the oil filter.



GENERAL

BREAK-IN PROCEDURES

There is never a more important period in the life of a new Victory motorcycle than the period between zero and 500 miles (805 km). A Victory motorcycle is manufactured using the best possible materials and manufacturing techniques, but the final machining process is the break-in. During break-in period, many parts in the engine wear and polish to correct operating clearances. During this time, the operator should:

- **Avoid prolonged full throttle operation.**
- **Avoid operation which might result in excessive heating of the engine.**

The general break-in guidelines are as follows:

| BREAK-IN GUIDELINES | | |
|-------------------------|--|---|
| Miles/km | Throttle Position | Notes |
| 0-90 miles | 0-1/3 | Avoid prolonged operation above 1/3 throttle. Stop engine and let it cool following every hour of operation. Vary speed of motorcycle. Do not operate machine at one set throttle position. |
| 90-300 miles | 0-1/2 | Avoid prolonged operation above 1/2 throttle. Stop engine and let it cool following every hour of operation. Vary speed of the motorcycle. Do not operate machine at one set throttle position. |
| 300-500 miles | 0-3/4 | Avoid cruising speeds above 3/4 throttle. |
| <u>500 miles</u> | <u>Replace the engine oil and engine oil filter.</u> Have Victory dealer perform 500 mile service on the machine. See chapter 2 for more information. | |
| 500 + | Avoid prolonged full-throttle operation. Vary the engine speed occasionally. Follow the pre-ride inspection outlined in the owner's manual. | |

PUBLICATION PART NUMBERS

The following chart lists the part numbers for Owner's Manuals, parts books, and parts microfiche.

| OTHER VICTORY PUBLICATIONS | | | |
|-----------------------------|--|------------|------------|
| Year / Model | Publication Part Numbers U.S. and (Canada) | | |
| | Owner's Manual | Parts Book | Microfiche |
| 2002 Standard Cruiser | 9917169 (Can 9917170) | 9917632 | 9917633 |
| 2002 Deluxe Cruiser | 9917169 (Can 9917170) | 9917630 | 9917631 |
| 2002 Touring Cruiser | 9917171 (Can 9917172) | 9917628 | 9917629 |
| 2002 Deluxe Touring Cruiser | 9917171 (Can 9917172) | 9917634 | 9917635 |
| 2003 Classic Cruiser | 9918229 (Can 9918230) | 9918364 | 9918365 |
| 2003 Touring Cruiser | 9918229 (Can 9918230) | 9918366 | 9918367 |
| 2004 Touring Cruiser | 9918946 (Can 9918947) | 9918952 | 9918953 |

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

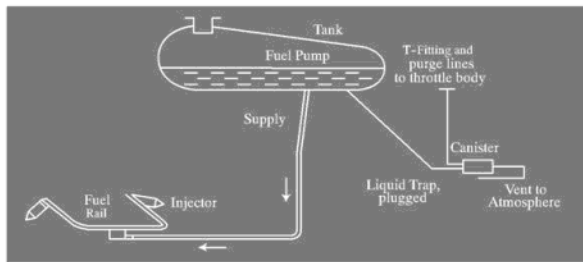
Victory Motorcycles utilizes an electronic engine management system which controls fuel delivery and ignition timing to control hydrocarbons and carbon monoxide. No adjustments should be made to the system. If components are replaced that affect idle speed follow the instructions in Chapter 5.

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 CONTROL (CA MODELS)

A vacuum hose connects the purge port manifold to the charcoal canister. Evaporated fuel vapor passes from the fuel tank, along the vent hose, and to the charcoal canister. Activated charcoal in the canister filters the regulated elements of the vapor for storage until the engine is started and the motorcycle is driven. The canister and liquid trap are cleaned as part of the engine's ordinary combustion cycle. Inspect the evaporative control system clamps, hoses, fittings, canister and other hardware for wear or damage during each maintenance period of the motorcycle. Refer to the owner's manual for emission system warnings and instructions.



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, or
2. The use of the motorcycle after such device or element of design has been removed or rendered inoperative.

Among those acts presumed to constitute tampering are the acts listed below:

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.

GENERAL

Multi-Function Display (MFD) Modes and Operation

The MFD lets the user toggle via the mode button to view the odometer, the trip odometer, the clock, the fuel gauge, the voltmeter, the instrument cluster light dimmer, the headlamp high beam indicator light dimmer, and the check engine indicator. The MFD operates only when the ignition switch is in the **On** position. To select the desired function, press the MFD **Mode** button (A). To adjust a particular function, press the MFD **Set** button (B).



Odometer

The odometer is the default mode of the MFD after starting the engine and displays the total miles traveled.

To toggle the odometer and trip odometer reading between miles / kilometers, and the fuel gauge reading between gallons / liters, the ignition switch must be in the **On** position with the MFD in odometer mode. Press and hold the MFD **Set** button for 3 seconds.

To change to the next MFD function, press the MFD **Mode** button.

Trip Odometer

“TRIP” appears as part of the display when in trip odometer mode. The trip odometer shows total miles traveled since the trip odometer was reset. You can use the trip odometer to calculate the miles per gallon and estimate the number of miles traveled on a tank of fuel.

To reset the trip odometer, the ignition switch must be in the **On** position with the MFD in trip odometer mode. Press and hold the MFD **Set** button for 3 seconds.

To change to the next MFD function, press the MFD **Mode** button.

Clock

A clock icon appears as part of the display when in clock mode. When the clock is operating normally, the colon between the hour and minutes flashes.

To set the clock, the ignition switch must be in the **On** position with the MFD in clock mode.

1. Press and hold the MFD **Set** button for 3 seconds when in clock mode. The hour digits should flash.
2. Press the MFD **Set** button to select the desired hour.
3. Press the MFD **Mode** button to accept the new hour setting. The ten-minute digit should flash.
4. Press the MFD **Set** button to select the desired ten-minute.
5. Press the MFD **Mode** button to accept the new ten-minute setting. The minute digit should flash.
6. Press the MFD **Set** button to select the desired minute.
7. Press the MFD **Mode** button to accept the new minute setting. The clock should return to normal operation, and the colon should flash.

To change to the next MFD function, press the MFD **Mode** button.

Notice The clock will not function if the battery voltage drops below 11.5 volts. The clock will reset to 12:00 if the battery is disconnected.

Multi-Function Display (MFD) Modes and Operation

Instrument Cluster Light Dimmer

“DIM” appears as part of the display when in instrument cluster light dimmer mode. To change the intensity of the instrument cluster light, press the MFD **Set** button to select from six (6) intensity levels. The engine does not need to be running to change the light intensity.

To change to the next MFD function, press the MFD **Mode** button.

Headlamp High Beam Indicator Light Dimmer

“HB” appears as part of the display when in headlamp high beam indicator light dimmer mode. To change the intensity of the headlamp high beam indicator light, press the MFD **Set** button to select from four (4) intensity levels. The engine does not need to be running to change the indicator intensity.

To change to the next MFD function, press the MFD **Mode** button.

Fuel Gauge

The fuel gauge shows the amount of fuel in the fuel tank. The fuel gauge range is from LOW (0.8 gallons/3.03 liters) to FULL (5 gallons/18.9 liters).

To change to the next MFD function, press the MFD **Mode** button.

Voltmeter

When the engine is not running, “BAT” and the battery voltage appear.

When the engine is running, “ALT” and the charging system voltage appear.

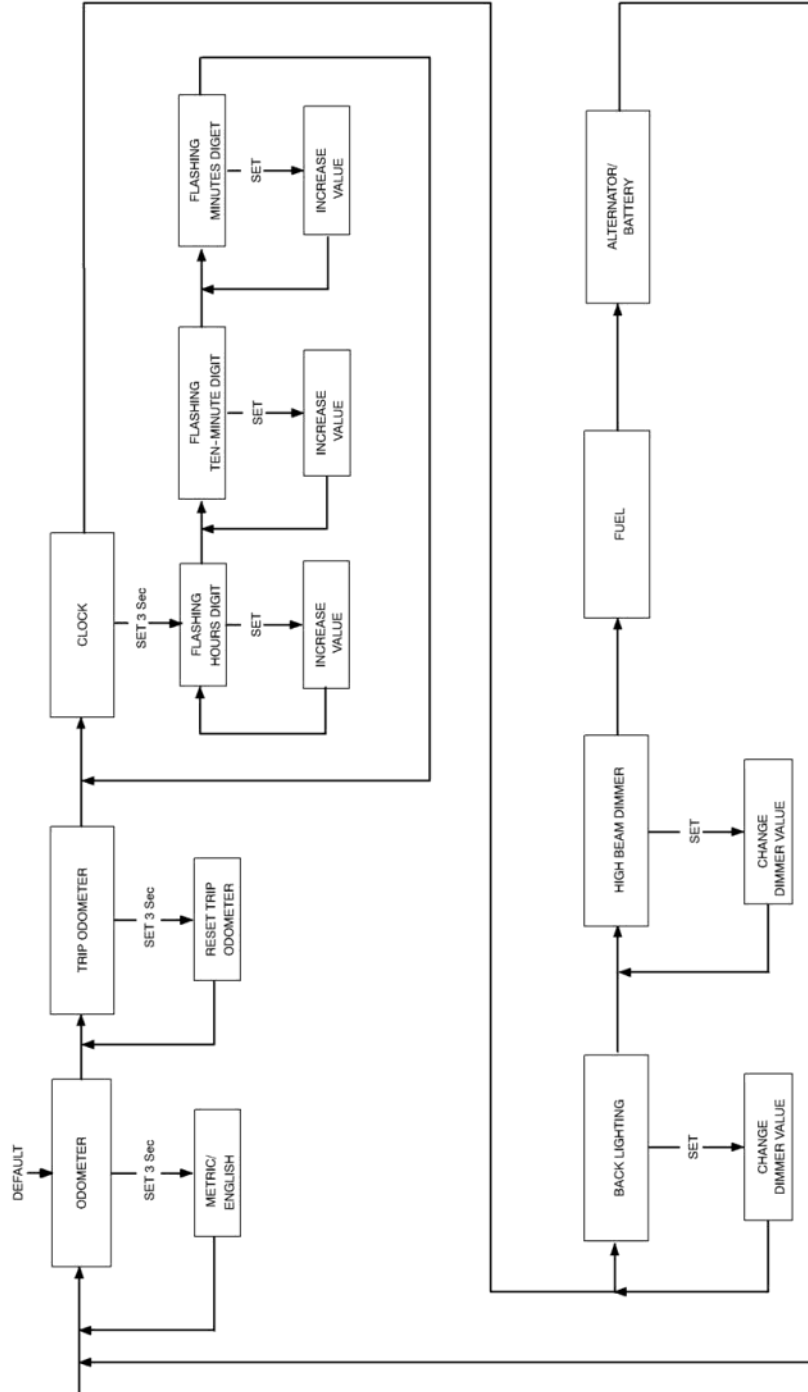
To return to the odometer function, press the MFD **Mode** button.

Check Engine Indicator

The check engine indicator will flash “CH ENG” any time the the ignition switch is in the **On** position and the Engine Control Module sensors report abnormal sensor or engine operation. The check engine indicator will continue to flash as long as the fault condition exists.

GENERAL

MFD FUNCTION FLOW CHART



1.10

SPECIAL TOOLS

| SPECIAL TOOLS - GENERAL & PRECISION MEASUREMENT | PART NUMBER |
|--|---|
| Bearing & Seal Driver Set | PV-43558 |
| Blind Bearing Remover Set | Commercially Available |
| Bore Gauge Set | PV-3017 |
| Decal, Service Bulletin Completion | 7170107 (Order from Victory Parts Dept.) |
| Dial Caliper (Metric, 0-150mm) | PV-26900-7 |
| Dial Caliper (Electronic, English / Metric Conversion) | PV-39776 |
| Dial Indicator (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 |
| Plastigauge® | Commercially Available |
| 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 in-lb) | PV-43543 |
| Torque Wrench (3/8" Drive lb-ft) | PV-43552; PV-43564 |

| SPECIAL TOOLS - TUNE UP & MAINTENANCE | PART NUMBER |
|--|--------------------|
| Belt Tension Gauge | PV-43532 |
| Cylinder Leakdown Tester | PV-35667-A |
| Compression Gauge Set | PV-33223 |
| Oil Pressure Gauge Set | PV-43531 |
| Oil Filter Wrench | PV-43527 |
| Wheel Alignment Tool | PV-43528 |

| SPECIAL TOOLS - ELECTRICAL | PART NUMBER |
|---|--------------------|
| Ammeter Inductive Clamp for Fluke 73 Multimeter | PV-39617 |
| Electrical Connector Test Adapter Kit | PV-43526 |
| Flywheel Puller | PV-43533 |
| Inductive Timing Light | PV-43537 |
| Multimeter, Fluke 73™ | PV-43546 |
| Speedometer Signal Tester | PV-43544 |
| Speedometer Signal Tester Adaptor (Use with PV-43544 on 2001+ models) | PV- |

GENERAL

SPECIAL TOOLS

| SPECIAL TOOLS - ENGINE / CLUTCH / TRANS | PART NUMBER |
|--|---|
| Clutch Hub Holding Tool | PV-43518 |
| Clutch Shaft Holder | PV-45028 |
| Crankcase Assembly Tool (Same as Mainshaft / Crankcase Installer) | PV-46299 |
| Crankshaft Bearing Protector | PV-43504 |
| Crankshaft Rotation Socket (2003-current) | PV-46988 |
| Crankcase Puller (Crankcase Separation) Used on 2001 and later; and on 1999-2000 if transmission kit has been installed) | PV-45029 |
| Crankcase Separating Bolts & Studs (1999-2000 only) | PV-43503 |
| Cylinder Bore Gauge | PV-3017 |
| Engine Hoist or Lift | Commercially Available |
| Engine Lock Tool | PV-43502-A |
| Engine Stand | Commercially Available |
| Flywheel Puller | PV-43533 |
| Mainshaft / Crankcase Installer (Crankcase Assembly) | PV-46299 |
| Moly Assembly Paste | PN 2871460 (Order from Victory Parts Dept.) |
| Mainshaft (Output Shaft) Seal Installation Tool | PV-43505 |
| Piston Ring Compressor (97mm +) | PV-43570 Pliers, PV-43570 Band (3 5/8" to 3 7/8") |
| Split Gear Line-Up Tool | Any 1/4" shaft: Example: 1/4" drill bit shank. |
| Valve Spring Compressor (Adapter) | PV-1253 or PV-4019, (PV-43513-A) |

| SPECIAL TOOLS STEERING / SUSPENSION | PART NUMBER |
|--|-------------|
| Blind Bearing Remover Set | PV-43551 |
| Damper Rod Holder | PV-43517 |
| Fork Seal Driver | PV-43516 |
| Fork Tube Removal / Installation Tool | PV-46196 |
| Steering Bearing; Wheel Bearing; Swing Arm Bushing Removal & Installation Set. | PV-43515 |
| Steering Stem Bearing Adjustment Socket | PV-43508 |
| Steering Stem Bearing Spanner Wrench | PV-43509 |
| Lower Steering Stem Bearing Removal Tool | PV-44683 |
| Shock Pre-Load Adjustment Wrench | PV-43507 |
| Shock Spring Compressor | PV-43571 |

1.12

| SPECIAL TOOLS STEERING / SUSPENSION (Cont.) | PART NUMBER |
|--|--------------------|
| Gas Shock Re-Charging Kit (Includes items below) | 2200421 |
| Kit Part Charging Needle | 7052069 |
| Kit Part Air Chuck | 7052068 |
| Kit Part Gas (Low) Pressure Hose | 2110003 |
| Kit Part Re-Charging Valve | 7051004 |
| Kit Part Female / Male Fitting | 7052066 |
| Kit Part Schrader Valve | 7051003 |
| Kit Part 1/8" 3-Way Tee | 7052067 |
| Kit Part 1/8" Male Fitting | 7052076 |
| Kit Part High Pressure Regulator | 2110005 |
| Shock Shaft Seal Protector (5/8") | 2201640 |
| Shock Rod Holding Tool (5/8") | 2872429 |
| Shock Body Holding Tool | 2871071 |

| SPECIAL TOOLS - WHEELS/TIRES | PART NUMBER |
|---|------------------------|
| Air Pressure Gauge | Commercially Available |
| 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 |
| Valve Core Remover | Commercially Available |
| Wheel Balancing/Truing Stand | PV-43556 |

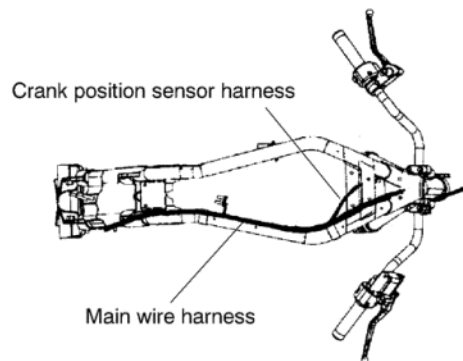
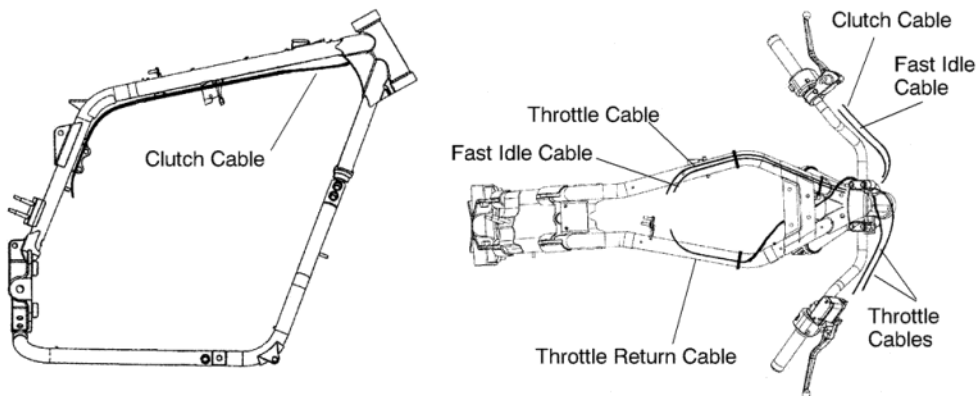
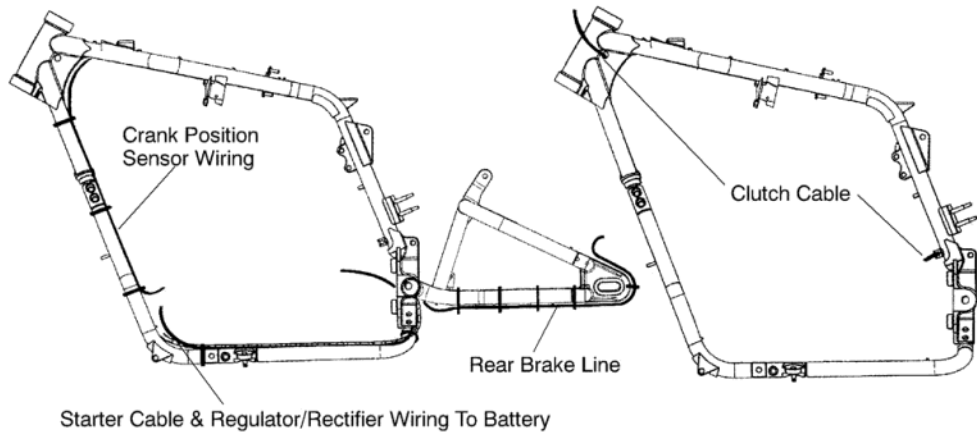
| TOOLS - FUEL SYSTEM / FUEL INJECTION | PART NUMBER |
|--|---|
| Victory / Polaris Diagnostic Tool Kit w/ Diagnostic Software | PV-46085 |
| PV-46085 Kit Contents (The items at right are included in main kit above and can be ordered separately) | Diagnostic Software Disk PV-46085-3 Interface Cable PV-46085-4 Instruction Manual PV-46085-5 |
| PV-45410 Kit Contents (The items at right are included in main kit above and can be ordered separately) | Tube PV-45410-1 O ₂ Sensor Cable PV-45410-2 Power Cable PV-45410-3 Instruction Sheet PV-45410-4 O ₂ Sensor PV-45410-5 |
| EGA Tool Kit With Lambda Sensor | PV-45410 |
| Fuel Pressure Gauge | PV-43506 |
| Laptop Computer (Refer to diagnostic software user manual for minimum specifications,) | Commercially Available |

* Order all tools from SPX Corporation at 1-800-328-6657 except where indicated as a Victory order number or as "Commercially Available". Refer to Victory Special Service Tool Catalog for ordering information.

GENERAL

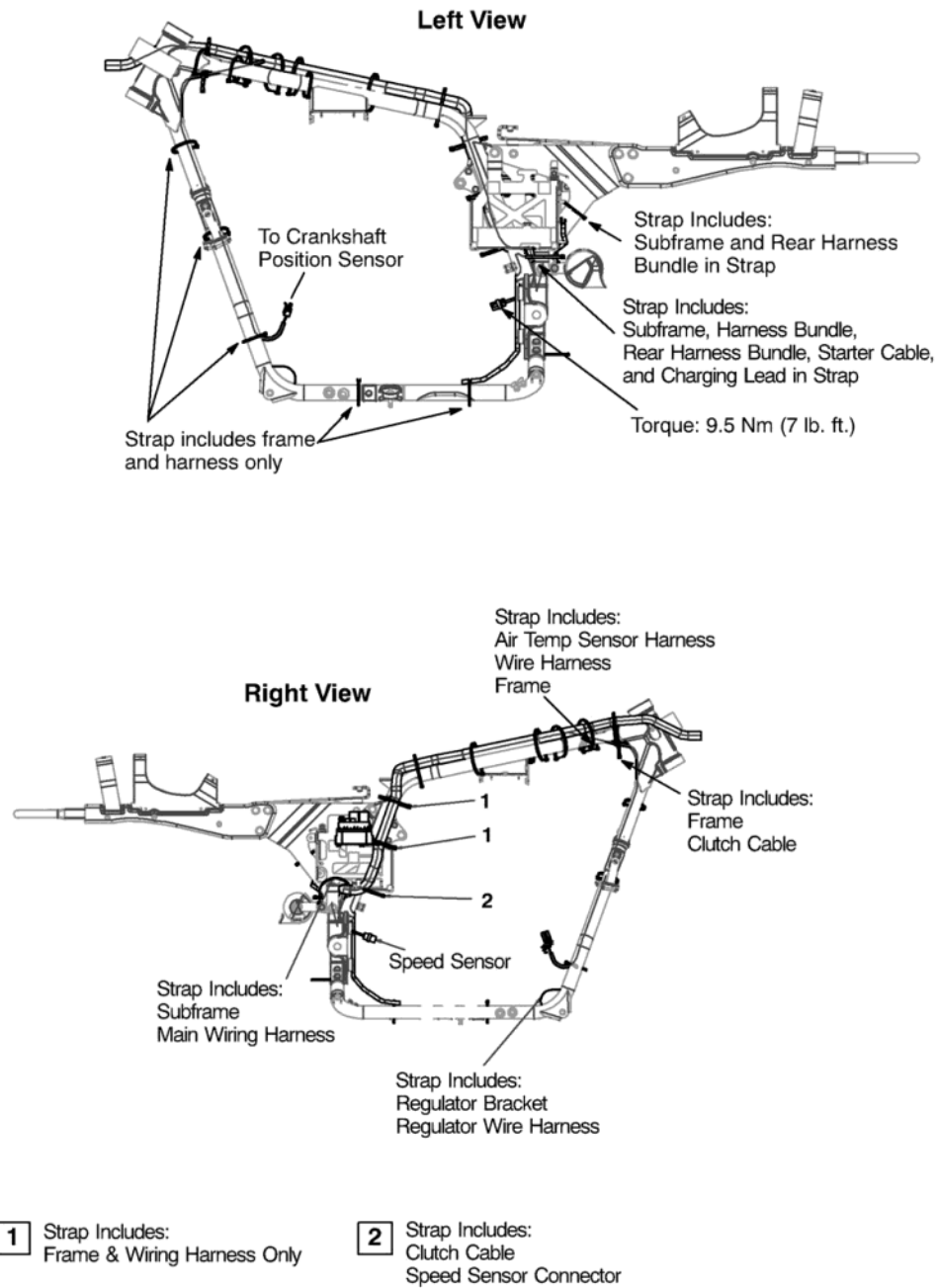
CABLE & HARNESS ROUTING

Refer to following pages for tie strap location



1.14

CABLE & HARNESS ROUTING



Torque Harness Guide Fasteners to 9.5 Nm (7 lb. ft.)

GENERAL

CABLE & HARNESS ROUTING

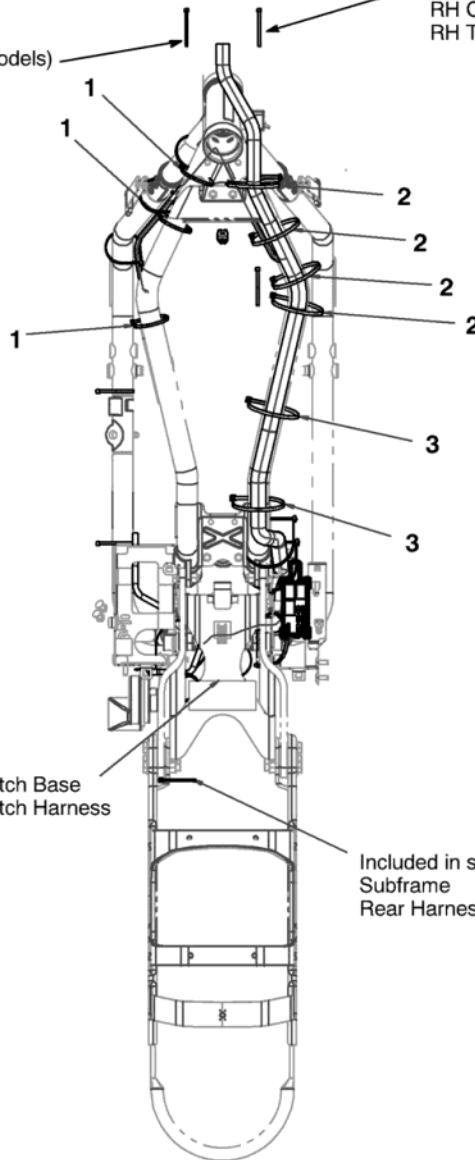
- 1 Tie Strap includes frame, harness, fast idle cable, and throttle "open" cable only
- 2 Tie Strap includes frame, harness, and throttle "close" cable only
- 3 Tie Strap includes frame & wire harness only

Included in strap:
Speedometer Bracket
LH Controls Harness
LH Turn Signal Harness
Driving Lights Harness (TC Models)

Included in strap:
Speedometer Bracket
RH Controls Harness
RH Turn Signal Harness

Included in strap:
Rear Brake Light Switch Base
Rear Brake Light Switch Harness

Included in strap:
Subframe
Rear Harness Connector



CHAPTER 2

MAINTENANCE

2

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MAINTENANCE

GENERAL SPECIFICATIONS - 2002

| C A P A C I T I E S - S P E C I F I C A T I O N S | | 2002 V92C | 2002 V92C Deluxe | 2002 V92TC | 2002 V92TC Deluxe |
|---|-----------------------|--------------------|--------------------|--------------------|--------------------|
| | Oil Capacity | 6 Qt (5.7 Ltr) | 6 Qt (5.7 Ltr) | 6 Qt (5.7 Ltr) | 6 Qt (5.7 Ltr) |
| | Fuel Capacity | 5 US Gal (19 Ltr) | 5 US Gal (19 Ltr) | 5 US Gal (19 Ltr) | 5 US Gal (19 Ltr) |
| | Wheelbase | 63.3 in (161 cm) | 63.3 in (161 cm) | 65.5 in (166 cm) | 65.5 in (166 cm) |
| | Seat Height | 29.5 in (75 cm) | 29.5 in (75 cm) | 28.3 in (72 cm) | 28.3 in (72 cm) |
| | Footrest Height | 10.6 in (26.9 cm) | 10.6 in (26.9 cm) | 10.6 in (26.9 cm) | 10.6 in (26.9 cm) |
| | Front Wheel Travel | 5.1 in (13 cm) | 5.1 in (13 cm) | 5.1 in (13 cm) | 5.1 in (13 cm) |
| | Rear Wheel Travel | 4 in (10 cm) | 4 in (10 cm) | 4 in (10 cm) | 4 in (10 cm) |
| | Rear Suspension Type | Single Shock | Single Shock | Single Shock | Single Shock |
| | Dry Weight | 634 lbs (287.6 kg) | 669 lbs (303.5 kg) | 720 lbs (326.6 kg) | 727 lbs (329.8 kg) |
| | Wet Weight | 675 lbs (306.2 kg) | 706 lbs (320.2 kg) | 759 lbs (344.3 kg) | 770 lbs (349.3 kg) |
| | Overall Length | 94 in (239 cm) | 94 in (239 cm) | 98 in (249 cm) | 98 in (249 cm) |
| | Overall Width | 29.5 in (75 cm) | 41 in (104 cm) | 42 in (107 cm) | 42 in (107 cm) |
| | Overall Height | 44.5 (113 cm) | 58.5 in (149 cm) | 60.8 (154 cm) | 60.8 (154 cm) |
| | Ground Clearance | 5.5 in (14 cm) | 5.5 in (14 cm) | 5 in (13 cm) | 5 in (13 cm) |
| | Passenger Capacity | 1 | 1 | 1 | 1 |
| | Maximum Load Capacity | 475 lbs (215 kg) | 447 (203 kg) | 451 (204.5 kg) | 440 (199.5 kg) |

| E N G I N E | | 2002 V92C | 2002 V92C Deluxe | 2002 V92TC | 2002 V92TC Deluxe |
|----------------------------|-------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| | Engine Model Number | MCVT1507D 2002 | MCVT1507D 2002 | MCVT1507D 2002 | MCVT1507D 2002 |
| | Engine Configuration | 50° V-Twin | 50° V-Twin | 50° V-Twin | 50° V-Twin |
| | Engine Displacement | 1507cc (92 cubic in) | 1507cc (92 cubic in) | 1507cc (92 cubic in) | 1507cc (92 cubic in) |
| | Engine Cooling System | Air/Oil Cooling | Air/Oil Cooling | Air/Oil Cooling | Air/Oil Cooling |
| | Compression Ratio | 9:2:1 | 9:2:1 | 9:2:1 | 9:2:1 |
| | Compression | 180 psi ± 20 1241 kPa ± 138 | 180 psi ± 20 1241 kPa ± 138 | 180 psi ± 20 1241 kPa ± 138 | 180 psi ± 20 1241 kPa ± 138 |
| | Valves Per Cylinder | 4 | 4 | 4 | 4 |
| | Bore x Stroke | 97 x 102 mm | 97 x 102 mm | 97 x 102 mm | 97 x 102 mm |
| | Starter | Direct Drive | Direct Drive | Direct Drive | Direct Drive |
| | Throttle Body Bore Size | Dual 44 mm | Dual 44 mm | Dual 44 mm | Dual 44 mm |
| | Exhaust System Type | Staggered Dual | Staggered Dual | Dual Crossover | Dual Crossover |
| | Lubrication System | Wet Sump | Wet Sump | Wet Sump | Wet Sump |
| | Engine RPM @ 60 mph | 2540 | 2540 | 2540 | 2540 |
| | Spark Plug | NGK CR7EB | NGK CR7EB | NGK CR7EB | NGK CR7EB |
| | Spark Plug Gap | .032 in (0.8 mm) | .032 in (0.8 mm) | .032 in (0.8 mm) | .032 in (0.8 mm) |

MAINTENANCE

GENERAL SPECIFICATIONS - 2002

| | | 2002 V92C | V92C Deluxe | 2002 V92TC | V92TC Deluxe |
|--|--|---|---|---|--|
| D R I V E S Y S | Transmission Type | Manual 5 Speed | Manual 5 Speed | Manual 5 Speed | Manual 5 Speed |
| | Clutch Type | Wet Multi-Disk Diaphragm Spring | Wet Multi-Disk Diaphragm Spring | Wet Multi-Disk Diaphragm Spring | Wet Multi-Disk Diaphragm Spring |
| | Primary Drive Reduction | Wet Multi-Gear | Wet Multi-Gear | Wet Multi-Gear | Wet Multi-Gear |
| | Primary Drive Gear Ratio | 1.5:1 | 1.5:1 | 1.5:1 | 1.5:1 |
| T I R E S | Front Wheel | Cast 5 spoke 16" x 3" | Laced 40 Spoke 16 x 3 in | Cast 5 spoke 16" x 3" | Laced 40 Spoke 16 x 3 in |
| | Rear Wheel | Cast 5 spoke 16" x 3" | Laced 40 Spoke 16 x 3.5 in | Cast 5 spoke 16" x 3" | Laced 40 Spoke 16 x 3.5 in |
| | Front Tire | Dunlop 491 Elite II MT90B16 71H | Dunlop 491 Elite II MT90 B16 71H (use w/ inner tube) | Dunlop 491 Elite II MT90B16 71H | Dunlop 491 Elite II MT90 B16 71H (use with inner tube) |
| | Rear Tire | Dunlop D417 160/80 B1675H | Dunlop D417 160/80 B16 75H (use with inner tube) | Dunlop D417 160/80 B1675H | Dunlop D417 160/80 B16 75H (use with inner tube) |
| | Minimum Tread Depth | .063 in. (1.6mm) | .063 in. (1.6mm) | .063 in. (1.6mm) | .063 in. (1.6mm) |
| S U S P | Front Type | Conventional Telescopic | Conventional Telescopic | Conventional Telescopic | Conventional Telescopic |
| | Front Travel (inches) | 5.1 in (13 cm) | 5.1 in (13 cm) | 5.1 in (13 cm) | 5.1 in (13 cm) |
| | Rear Type | Single-Shock | Single-Shock | Single-Shock | Single-Shock |
| | Rear Travel (inches) | 4 in (10 cm) | 4 in (10 cm) | 4 in (10 cm) | 4 in (10 cm) |
| B R A K E S | Brake Type | Disc/Disc | Disc/Disc | Disc/Disc | Disc/Disc |
| | Front Brake | Single 300 x 5 mm Disc with 4 Piston Fixed Caliper | Single 300 x 5 mm Disc with 4 Piston Fixed Caliper | Dual 300 x 5 mm Disc with 4 Piston Fixed Caliper | Dual 300 x 5 mm Disc with 4 Piston Fixed Caliper |
| | Rear Brake | Single 300 x 6 mm Disc with 2 Piston Floating Caliper | Single 300 x 6 mm Disc with 2 Piston Floating Caliper | Single 300 x 6 mm Disc with 2 Piston Floating Caliper | Single 300 x 6 mm Disc with 2 Piston Floating Caliper |
| L I G H T S | Headlight (Intl) | 5.5 amps ANSI HG024XV (H4) | 5.5 amps ANSI HG024XV (H4) | 5.5 amps ANSI HG024XV (H4) | 5.5 amps ANSI HG024XV (H4) |
| | Brake/Tail Light | 2.1/1.6 amps ANSI 198 | 2.1/1.6 amps ANSI 198 | 2.1/1.6 amps ANSI 198 | 2.1/1.6 amps ANSI 198 |
| | Turn Signal Light (Front) | 2.1 amps ANSI 198 | 2.1 amps ANSI 198 | 2.1 amps ANSI 198 | 2.1 amps ANSI 198 |
| | Turn Signal Light (Rear) | 1.6 amps ANSI 199 | 1.6 amps ANSI 199 | 1.6 amps ANSI 199 | 1.6 amps ANSI 199 |
| | Instrument Cluster Lights Backlight Dimming Feature | 1.3 amps | 1.3 amps | 1.3 amps | 1.3 amps |
| | UK Models Front Position Light | ANSI 193 | ANSI 193 | ANSI 193 | ANSI 193 |
| F U S E S | Horn/Brake/Headlamp | 20 amp fuse | 20 amp fuse | 20 amp fuse | 20 amp fuse |
| | Flashers | 15 amp fuse | 15 amp fuse | 15 amp fuse | 15 amp fuse |
| | PCM | 20 amp fuse | 20 amp fuse | 20 amp fuse | 20 amp fuse |
| | Fuel Pump | 10 amp fuse | 10 amp fuse | 10 amp fuse | 10 amp fuse |

2.2

MAINTENANCE

GENERAL SPECIFICATIONS 2003-2004

| CAPACITIES - S P E C I F I C A T I O N S | | Classic | Touring Cruiser |
|---|------------------------------------|---------------------------------------|---------------------------------------|
| | Oil Capacity | 6.5 Qt (6.15 Ltr) | 6.5 Qt (6.15 Ltr) |
| | Fuel Capacity | 5 US Gal (19 Ltr) | 5 US Gal (19 Ltr) |
| | Wheelbase | 63.3 in (161 cm) | 65.5 in (166 cm) |
| | Seat Height | 28.3 in (72 cm) | 28.3 in (72 cm) |
| | Footrest Height | 10.6 in (26.9 cm) | 10.6 in (26.9 cm) |
| | Front Wheel Travel | 5.1 in (13 cm) | 5.1 in (13 cm) |
| | Rear Wheel Travel | 4 in (10 cm) | 4 in (10 cm) |
| | Rear Suspension Type | Single Gas Shock; Pre-load Adjustable | Single Gas Shock; Pre-load Adjustable |
| | Dry Weight | 634 lbs (287.6 kg) | 720 lbs (326.6 kg) |
| | Wet Weight | 675 lbs (306.2 kg) | 759 lbs (344.3 kg) |
| | Overall Length | 94 in (239 cm) | 98 in (249 cm) |
| | Overall Width | 29.5 in (75 cm) | 42 in (107 cm) |
| | Overall Height | 44.5 (113 cm) | 60.8 (154 cm) |
| | Ground Clearance | 5.5 in (14 cm) | 5 in (13 cm) |
| | Passenger Capacity | 1 | 1 |
| | Maximum Load Capacity | 444 lbs (201 kg) | 441 (200 kg) |
| | Gross Vehicle Weight Rating (GVWR) | 1150 lbs. (522 kg) | 1210 lbs. (549 kg) |
| | Rake / Trail | 30.0 Degrees / 4.76 in. (121 mm) | 30.0 Degrees / 6.89 in. (175 mm) |
| ENGINE | | Classic | Touring Cruiser |
| | Engine Model Number | MCVT1507D 2003 | MCVT1507D 2003 |
| | Engine Configuration | 50° V-Twin | 50° V-Twin |
| | Engine Displacement | 1507cc (92 cubic in) | 1507cc (92 cubic in) |
| | Engine Cooling System | Air/Oil Cooling | Air/Oil Cooling |
| | Compression Ratio | 9:2:1 | 9:2:1 |
| | Compression | 180 psi ± 20 1241 kPa ± 138 | 180 psi ± 20 1241 kPa ± 138 |
| | Valves Per Cylinder | 4 | 4 |
| | Bore x Stroke | 97 x 102 mm | 97 x 102 mm |
| | Starter | Direct Drive | Direct Drive |
| | Throttle Body Bore Size | Dual 44 mm | Dual 44 mm |
| | Exhaust System Type | Staggered Dual | Dual Crossover |
| | Lubrication System | Wet Sump | Wet Sump |
| | Engine RPM @ 60 mph | 2540 | 2540 |
| | Spark Plug Type (Gap) | NGK CR7EB (.032 in. / 0.8 mm) | NGK CR7EB (.032 in. / 0.8 mm) |
| | Dry Weight | 244 lbs. (111 Kg) | 244 lbs. (111 Kg) |

2.3

MAINTENANCE

GENERAL SPECIFICATIONS 2003-2004

| D R I V E S Y S | | Classic | Touring Cruiser |
|--|--|---|---|
| | Transmission Type | Manual 5 Speed Constant Mesh | Manual 5 Speed Constant Mesh |
| | Clutch Type | Wet Multi-Disk Diaphragm Spring | Wet Multi-Disk Diaphragm Spring |
| | Primary Drive Reduction | Wet Multi-Gear | Wet Multi-Gear |
| T I R E S | Primary Drive Gear Ratio | 1.5:1 | 1.5:1 |
| | Front Wheel | Cast 5 spoke 16" x 3" | Cast 5 spoke 16" x 3" |
| | Rear Wheel | Cast 5 spoke 16" x 3" | Cast 5 spoke 16" x 3" |
| | Front Tire | Dunlop 491 Elite II MT90B16 71H White Wall: Dunlop CRUISEMAX 130/90-16 67H | Dunlop 491 Elite II MT90B16 71H White Wall: Dunlop CRUISEMAX 130/90-16 67H |
| S U S P | Rear Tire | Dunlop D417 160/80B16 75H White Wall: Dunlop CRUISEMAX 150/80B16 71H | Dunlop D417 160/80B16 75H White Wall: Dunlop CRUISEMAX 150/80B16 71H |
| | Minimum Tread Depth | .063 in. (1.6mm) | .063 in. (1.6mm) |
| | Front Type | Conventional Telescopic | Conventional Telescopic |
| | Front Travel (inches) | 5.1 in (13 cm) | 5.1 in (13 cm) |
| B R A K E S | Rear Type | Single-Shock w/Adjustable Preload | Single-Shock w/ Adjustable Preload |
| | Rear Travel (inches) | 4 in (10 cm) | 4 in (10 cm) |
| | Brake Type | Disc/Disc | Disc/Disc |
| | Front Brake | Single 300 x 5 mm Disc with 4 Piston Fixed Caliper | Dual 300 x 5 mm Discs with 4 Piston Fixed Caliper |
| L I G H T S | Rear Brake | Single 300 x 6 mm Disc with 2 Piston Floating Caliper | Single 300 x 6 mm Disc with 2 Piston Floating Caliper |
| | Headlight (Intl) | 5.5 amps ANSI HG024XV (H4) | 5.5 amps ANSI HG024XV (H4) |
| | Brake/Tail Light | 2.1/1.6 amps ANSI 198 | 2.1/1.6 amps ANSI 198 |
| | Turn Signal Light (Front) | 2.1 amps ANSI 198 | 2.1 amps ANSI 198 |
| F U S E S | Turn Signal Light (Rear) | 1.6 amps ANSI 199 | 1.6 amps ANSI 199 |
| | Instrument Cluster Lights Backlight Dimming Feature | 1.3 amps | 1.3 amps |
| | UK Models Front Position Light | ANSI 193 | ANSI 193 |
| | Horn/Brake/Headlamp | 20 amp fuse | 20 amp fuse |
| F U S E S | Flashers | 15 amp fuse | 15 amp fuse |
| | ECM | 20 amp fuse | 20 amp fuse |
| | Fuel Pump | 10 amp fuse | 10 amp fuse |

2.4

PERIODIC MAINTENANCE INTERVAL CHART

| Component (see operation codes below) | ODOMETER READING in MILES (KILOMETERS) | | | | | | | | | | | | | | | | | | | | | |
|--|--|---------------|--------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|
| | 500 (800) | 2,500 (4,000) | 5000 (8,000) | 7,500 (12,000) | 10,000 (16,000) | 12,500 (20,000) | 15,000 (24,000) | 17,500 (28,000) | 20,000 (32,000) | 22,500 (36,000) | 25,000 (40,000) | 27,500 (44,000) | 30,000 (48,000) | 32,500 (52,000) | 35,000 (56,000) | 37,500 (60,000) | 40,000 (64,000) | 42,500 (68,000) | 45,000 (72,000) | 47,500 (76,000) | 50,000 (80,000) | |
| Air Filter | I | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | |
| Auxiliary Lights | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Brake Fluid** | I | I | I | I | I | I | I | I | I | I | I | I | R | I | I | I | I | I | I | I | I | |
| Battery | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Brake Pads | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | |
| Clutch Lever | I | | I | | L | | I | | L | | I | | L | | I | | L | | I | | L | |
| Control Cables | I | | I | | L | | I | | L | | I | | L | | I | | L | | I | | L | |
| Crankcase Ventilation System | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Drive Belt | I | I | I | I | I | I | I | I | I | I | I | I | R | I | I | I | I | I | I | I | I | |
| Drive Sprocket and Sprocket Nut | | | | | | | I | | | | | | I | | | | | | I | | | |
| Engine Oil* | R | R | R | R | R | R | R | R | R | 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 | R | R | R | R | R | R | R | R | R | |
| Engine Compression | I | | | | I | | | | I | | | | I | | | | I | | | | I | |
| Evaporative Emission Control System (CA, Only) | 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 | I | I | I | I | I | I | I | I | I | |
| Fast Idle Lever | I | | I | | L | | I | | L | | I | | L | | I | | L | | I | | L | |
| Fasteners | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | |
| Front Fork Oil** | I | | I | | I | | R | | I | | I | | R | | I | | I | | R | | I | |
| Front Forks and Front Axle | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Front Brake Lever | I | | I | | L | | I | | L | | I | | L | | I | | L | | I | | L | |
| Fuel Filter | | | | | | | | | | | R | | | | | | | | | | R | |
| Fuel System | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | |
| Gear Shift Pedal | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Headlamp | I | | | | I | | | | I | | | | I | | | | I | | | | I | |
| Rear Brake Pedal | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Rear Shock Absorber (All except 2004 Touring Cruiser) | I | | I | | I | | R | | I | | I | | R | | I | | I | | R | | I | |
| Rear Shock Absorber* 2004 Touring Cruiser | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | R | |
| Rear Wheel Alignment | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Road Test | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | |
| Sidestand | I | | I | | L | | I | | L | | I | | L | | I | | L | | I | | L | |
| Spark Plugs | I | | I | | I | | I | | I | | I | | R | | I | | I | | I | | I | |
| Steering Bearings | I | I | I | I | I | I | L | I | I | I | I | I | L | I | I | I | I | I | L | I | I | |
| Swing Arm and Rear Axle | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Throttle | I | I | I | I | L | I | I | I | L | I | I | I | L | I | I | I | L | I | I | I | L | |
| Tires | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | |
| Wheel Spokes | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | |
| Operation Codes: I-Inspect (tighten, clean, adjust, correct or replace if necessary) R-Replace/Rebuild *Replace at specified interval or annually L-Lubricate with proper lubricant P-Perform **Replace at specified interval or every 2 years | | | | | | | | | | | | | | | | | | | | | | |

* Inspect sealed (non-rebuildable) shock on 2004 Touring Cruiser in accordance with chart. Replacement is recommended at 50,000 mile intervals (80,000 Kilometers).

MAINTENANCE

TUNE UP SPECIFICATIONS

| ITEM | SPECIFICATION |
|-------------------------------------|---|
| Lubrication Oil Pressure @ 3000 rpm | 552 kPa (80 psi) |
| Cooling Oil Pressure @ 3000 rpm | 414 kPa (60 psi) |
| Drive Belt Deflection | <u>All Except Touring Cruiser Models</u> 8 mm (.315") With 10-12 lb Load @ Center Span <u>Touring Cruiser Models</u> 9 mm (.354") With 10-12 lb Load @ Center Span |
| Throttle Grip Freeplay | 3-6mm (1/8-1/4") |
| Idle Speed | 950 RPM \pm 50 |
| Fast Idle Speed | 2000 RPM \pm 100 |
| Fast Idle Lever Freeplay | 3-6mm (1/8-1/4") |
| Clutch Lever Freeplay | .25-.75mm (.010-.030") |
| Spark Plug Type / Gap | <u>2002-2003</u> NGK CR7EB / .8mm (.032") <u>2004 Touring Cruiser</u> NGK CPR6EA-9 / .8mm (.032") |

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.

NOTE: After the engine is started, the oil indicator light should go off. If the indicator light flickers or remains on, immediately stop the engine and diagnose the problem before continuing.

| TIGHTENING TORQUE | |
|--|--|
| Drain Plug | <u>2002 (22x1.5)</u> - 38 Nm (28 ft. lbs.) |
| (Inspect / replace O-ring or sealing washer) | <u>2003-2004 (12x1.5)</u> - 27 Nm (20 ft. lbs.) |
| Oil Filter | 3/4 full turn after contacting the sealing surface |

| OIL TYPE / QUANTITY | |
|-----------------------|---|
| Oil Type | Victory Semi-Synthetic 20W40 Engine Oil |
| Oil and Filter Change | 6.15 liters (6.5 quarts) |

Use Victory 20W40 engine oil for all temperatures. If Victory oil is not available, use 20W40 SG or equivalent.

CAUTION

Do not put chemical additives in the oil. Victory motorcycle oil has been specially designed for this application. Additional additives are not necessary and have not been approved by Victory Engineering.

2.6

FASTENER TORQUE SPECIFICATIONS, TUNE-UP

| DESCRIPTION | TORQUE | | APPLY / NOTES |
|--|------------------------------|------------------|---------------|
| | N-m | Lb-ft (Lb-in) | |
| Air Box to Throttle Body | - | (85) | |
| Air Box Cover | - | (10) | |
| Air Filter Cover | - | (10) | |
| Axle Nut | 88 | 65 | |
| Axle Adjuster Jam Nut | 16 | 12 | |
| Brake Lever Pivot Nut (Front) | 7 | (60) | |
| Clutch Lever Pivot Nut | 5.5 | (48) | |
| Drive Sprocket Nut | 170 | 125 | |
| Drive Sprocket Nut Retainer Plate Screws | 10 | (85) | |
| Exhaust / Muffler | Refer to Chapter 3 | | |
| Fuel Tank Mounting Screws | 47 | 35 | |
| Oil Drain Plug | 2002 | 38 | 22x1.5mm |
| | 2003-2004 | 27 | 12x1.5mm |
| Oil Filter | 3/4 Turn Past Gasket Contact | | |
| Oil Pressure Sensor | - | (50) | Pipe Sealant |
| Oil Temperature Sensor | - | (50) | Pipe Sealant |
| Side Stand to Frame | 47 | 35 | |
| Spark Plug | 10 – 12 | 8 – 9 | |

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

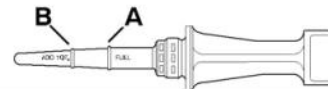
MAINTENANCE PRODUCTS

| | |
|--|---------|
| Victory All Purpose Grease: | 2872187 |
| Moly Assembly Paste: | 2871460 |
| Victory Semi-Synthetic 20W/40: | 2872176 |
| Oil Change Kit:: | 2873551 |
| Victory Cable Lubricant: | 2872863 |
| Carbon Clean Fuel Additive: | 2872190 |
| Victory DOT 4 Brake Fluid: | 2872189 |
| Nyogel™ Di-Electric Grease: | 2871329 |
| Victory Detail Kit: | 2872195 |
| Victory Restore Kit: | 2872192 |
| Loctite 262™ (50cc Tube) | 2871951 |
| Primer N™ (25g Aerosol) | 2870585 |
| Hand Grip Adhesive (Three Bond 1501) (10ml tube) | 2872575 |
| Victory Fork Oil | 2872184 |

MAINTENANCE

ENGINE OIL LEVEL INSPECTION

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.
5. **Screw the dipstick in until seated.**
6. Remove the dipstick and read the oil level. The oil level should be up to the full line (A) on the dipstick. If the oil level is low (B), add the recommended oil to raise the level to the full mark.



ENGINE OIL & FILTER CHANGE

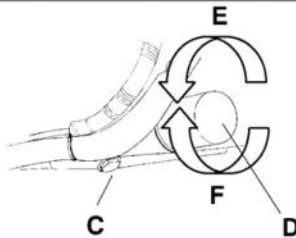
Oil Change Kit: P/N 2873551

Change engine oil and filter with the motorcycle on its side stand, engine warm.

WARNING

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

1. Remove the oil drain plug (C) (socket head allen screw) and drain the engine oil completely into a suitable container.
2. Discard drain plug sealing washer.
3. Remove oil filter (D) by turning counter clockwise (E). Be sure sealing ring is removed with filter.



Oil Filter Wrench: Strap Wrench

4. Allow oil to drain completely.
5. Install oil drain plug with new sealing washer. Lubricate with engine oil and install drain plug. Torque drain plug to specification.

TORQUE: Oil Drain Plug
2002 - 38 Nm (28 lb-ft)
2003-2004 - 27 Nm (20 lb-ft)

TORQUE: Oil Filter
3/4 turn after sealing ring contacts crankcase

6. Clean any residue or debris from the oil filter sealing area and threads. Apply oil to new oil filter sealing ring and threads. Install oil filter and tighten (F) 3/4 of a turn after sealing ring contacts crankcase.
7. Fill crankcase to capacity with the recommended oil and reinstall dipstick.
8. Start engine and run until operating temperature is reached. Stop engine and wait 3-5 minutes before checking oil level.

CABLE LUBRICATION

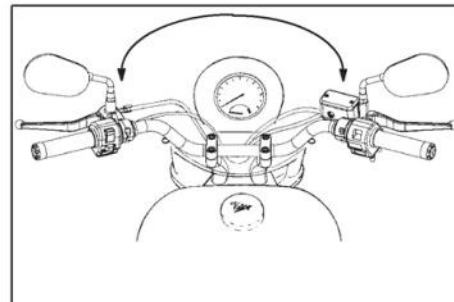
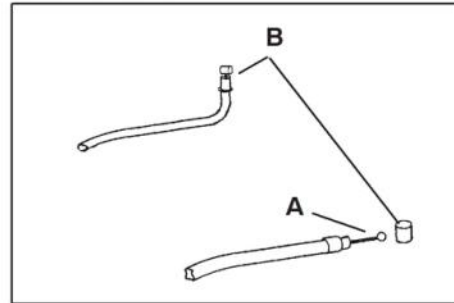
The cables used on the motorcycle require periodic lubrication for smooth operation and longevity.

Inspect cables for smooth movement and external damage. Inspect the exposed inner cable (A) for fraying, damage or rust. Replace any damaged cables.

Disconnect one end of the cable to be lubricated. Use Victory Cable Lubricant or a commercially available cable lubricant. The end of the cable (B) should also be lubricated at this time with Victory all purpose grease.

- Throttle cable.
- Clutch cable.
- Fast idle cable.
- Seat release cable.

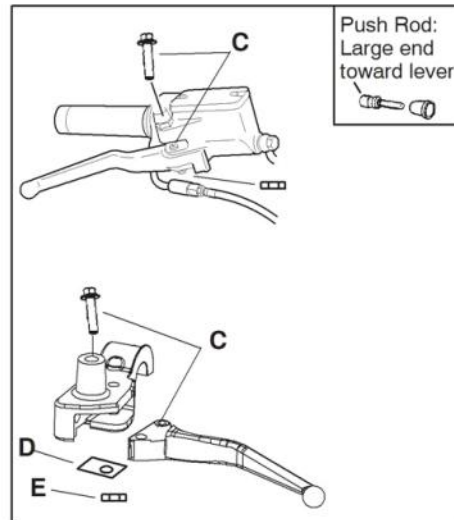
Victory All Purpose Grease: 2872187



CONTROL LEVER PIVOT LUBRICATION

Lubricate brake lever and clutch lever pivot points at intervals listed on periodic maintenance chart.

1. Remove right side mirror, brake lever pivot nut and pin.
2. Remove clutch and brake levers and clean old lubricant and dirt from pivot bolt, lever and housing.
3. Lubricate areas (C) with Victory All Purpose Grease on both clutch lever and brake lever.
4. If removed, install brake master cylinder push rod with large radius oriented toward lever, and small radius toward master cylinder.
5. Reinstall brake lever, lever pivot pin, and nut.
6. Torque lever pivot pin first, using a 4mm hex socket.
7. Hold the pivot pin stationary and torque nut using a 10mm socket to specification below.
8. Check front brake lever movement.
9. Front brake lever is self-adjusting. Refer to page 2.10 to inspect freeplay.
10. Install and adjust RH mirror.
11. Reinstall the clutch lever, lever pivot pin, and nut.
12. Torque clutch lever nut to specification above.
13. Adjust clutch lever freeplay as shown on page 2.13.



TORQUE:

Brake and Clutch Lever Pivot Pin and Nut:
5 ft-lbs (52 inch-pounds) (6 Nm)

MAINTENANCE

BRAKE PEDAL FREEPLAY INSPECTION & ADJUSTMENT

WARNING

Operating a motorcycle with inadequate or faulty brakes could cause an accident, resulting in serious injury or death.

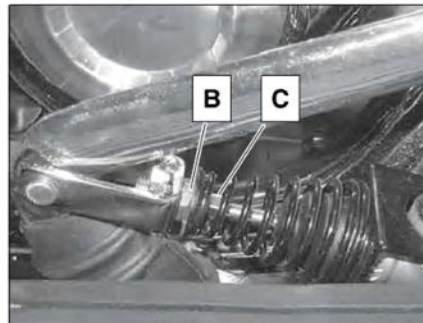
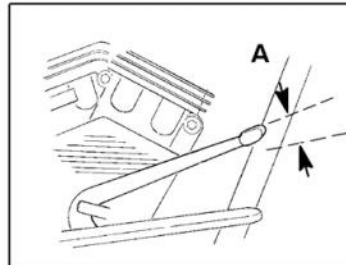
A soft or spongy feeling in the brake lever or pedal can indicate the presence of air in the brake system. This air must be removed by bleeding the brake system before the motorcycle is operated. Air in the system will cause greatly diminished braking capability and can result in loss of control of the motorcycle. Inspect and bleed the brake system if necessary.

1. Measure brake pedal freeplay (A).

Measurement (A) should be 5-8 mm (3/16-5/16 inch) when light downward pressure is applied to the pedal.

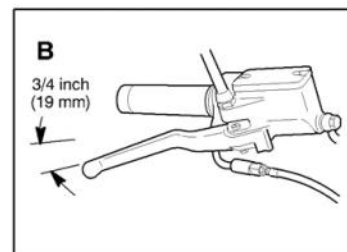
NOTE: No movement of the master cylinder piston should occur.

2. If the pedal freeplay is outside of specification, loosen the locking nut (B) and turn the adjustment rod (C) in or out as necessary to achieve the correct brake pedal freeplay.
3. Tighten the lock nut securely and verify that the rear wheel rotates freely without drag or binding through the full freeplay range.



FRONT BRAKE LEVER FREEPLAY INSPECTION

1. Measure brake lever freeplay (B).
2. Verify that the front wheel rotates freely without drag or binding through the full freeplay range.
3. The front brake lever freeplay is not adjustable. Refer to Chapter 15 and inspect the front brake system if lever freeplay is incorrect.



2.10

BRAKE FLUID LEVEL INSPECTION

WARNING

Low brake fluid levels may let air enter the brake system, possibly creating poor or non-existent braking. Before riding, check brake fluid level and add if necessary.

Observe the following precautions:

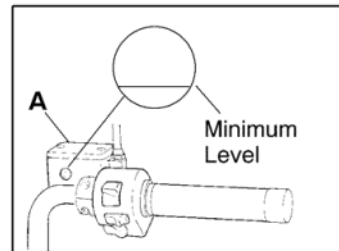
- When checking the level of the brake fluids, make sure the reservoir is level. It may be necessary to move the handlebars or stand the motorcycle upright.
- Use only DOT 4 brake fluid. Leakage or poor brake performance may result. Do not use brake fluid from a container that has been open for an extended period of time. Brake fluid can attract moisture when exposed to the atmosphere.
- Refill with the same type brake fluid. Mixing different types of fluids may result in detrimental chemical reactions and lead to loss of braking performance.
- Do not let water enter the master cylinder when refilling. Water significantly lowers the boiling point of the fluid and may result in poor braking.
- Brake fluid attacks many painted surfaces and plastic parts. Always clean up spilled fluid immediately with large quantities of water and mild detergent.
- A lowering of the brake fluid level is normal as the brake pads wear. If you notice a constant or sudden lowering of the brake fluid level, Refer to Chapter 15 for assistance in diagnosing the cause of the problem.

The front master cylinder reservoir (A) is located on the right handlebar.

The rear brake reservoir (B) is located behind the RH side cover.

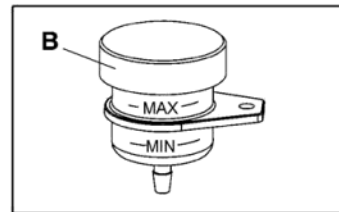
Front Brake Fluid

1. Straddle the motorcycle and bring it to a vertical position. Turn the handlebars until the reservoir (A) is horizontal.
2. View the front brake fluid level through the sight glass. The fluid should be clear and at a level in or above the sight glass. Add DOT 4 brake fluid if necessary.
3. Wipe the area around the reservoir cover with a clean cloth.
4. Wipe the brake fluid container with a clean cloth.
5. Remove the reservoir cover and gasket.
6. Carefully add enough brake fluid to bring the level above the sight glass.
7. Reinstall the reservoir gasket and cover and wipe the reservoir clean.



Rear Brake Fluid

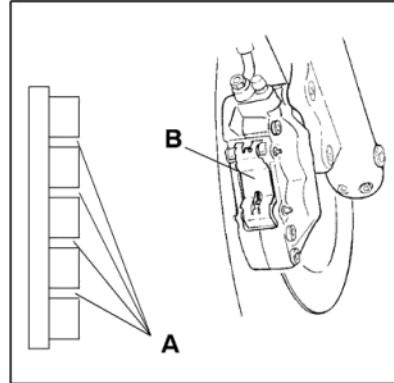
1. Straddle the motorcycle and bring it to a vertical position or until the reservoir (B) is horizontal.
2. View the fluid level through the side of the reservoir. The fluid should be clear and at a level between MIN and MAX. Add DOT 4 brake fluid if necessary.
3. Wipe the area around the reservoir cover with a clean cloth.
4. Wipe the brake fluid container with a clean cloth.
5. Remove the reservoir cover and gasket.
6. Carefully add enough brake fluid to bring the level between the marks.
7. Reinstall the reservoir gasket and cover and wipe the reservoir clean.



MAINTENANCE

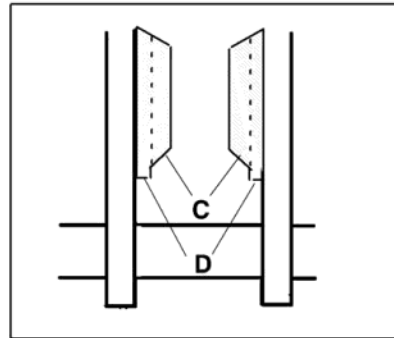
FRONT BRAKE PAD INSPECTION

Three wear indicator grooves (A) are provided on each front brake pad. These indicators allow for a visual indication of brake pad wear without disassembly of the caliper (B). Inspect the grooves. If they have almost disappeared, replace the brake pads. Refer to Chapter 15.



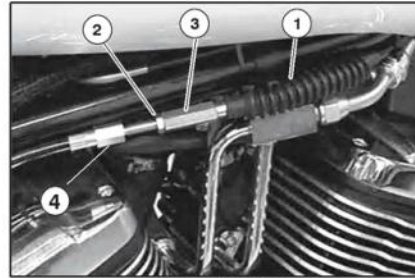
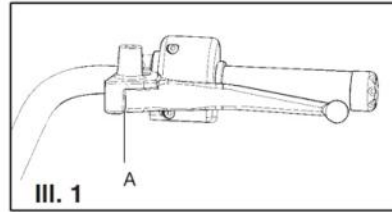
REAR BRAKE PAD INSPECTION

The rear brake pads do not have wear indicator grooves but rely on chamfers (C) for wear indication. When the pads are worn to the point that the chamfer no longer exists, on the end with the wear indicator (D), the brake pads must be replaced. Refer to Chapter 15.



CLUTCH LEVER FREEPLAY

1. Remove seat (operator's seat on Classic).
2. Remove front and rear fuel tank screws.
3. Raise the rear of the fuel tank high enough to expose the clutch cable. Support the rear of the fuel tank with a block of wood.
4. Slide the rubber cover (1) off cable adjuster, and loosen adjuster jam nut (2) while holding cable adjuster (3).
5. Hold cable (4) and turn the cable adjuster in or out until the clutch freeplay is .010-.030 inch (.25-.75 mm) measured at point "A" in Ill. 1.
6. Hold adjuster and tighten adjuster jam nut securely.
7. Reinstall rubber cover.
8. Reinstall and tighten front and rear fuel tank screws to specified torque listed on page 2.7.
9. Reinstall seat.



1. Clutch Cable Adjuster
2. Adjuster Jam Nut
3. Rubber Cover

If the operation of the clutch cable is not smooth, inspect and determine if any repair or lubrication is needed, or replace the cable.

NOTE: The starter interlock switch is dependent on the clutch lever freeplay being set correctly to ensure activation of the clutch safety switch. Refer to Chapter 18 for more information.

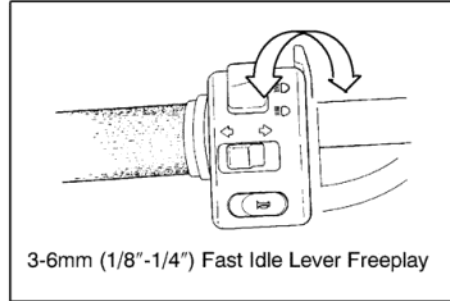
MAINTENANCE

FAST IDLE LEVER FREEPLAY INSPECTION AND ADJUSTMENT

1. Measure fast idle lever free-play.

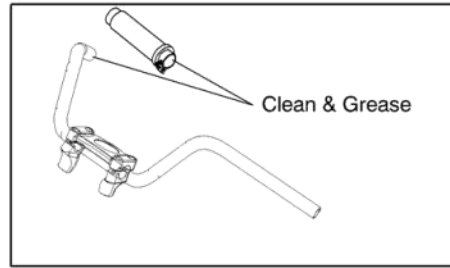
Specification: 3-6mm, 1/8-1/4in

2. If adjustment is necessary; remove seat (page 3.4) and fuel tank (page 5.8).
3. Loosen the fast idle cable adjuster jam nut.
4. Turn the cable adjuster in or out until the fast idle lever freeplay is 1/8-1/4 inch (3-6 mm).
5. Tighten the adjuster jam nut and reinstall the fuel tank and operator's seat.
6. Loosen fast idle cable locknut.
7. Move adjustment nut in or out as necessary to achieve specified fast idle lever free-play.
8. Tighten locknut.
9. Install fuel tank (page 5.17) and seat (page 3.4).



THROTTLE ASSEMBLY INSPECTION & LUBRICATION

1. Inspect throttle cables and throttle assembly for wear, kinks, or damage. Check that the throttle opens and closes automatically in all steering positions. If the throttle does not return properly, lubricate the cable and throttle grip housing.
2. To lubricate throttle cable, disconnect cable upper ends. Thoroughly lubricate cable with commercially available cable lubricant or light weight oil. Lubricate cable end pivot points with Victory all purpose grease.

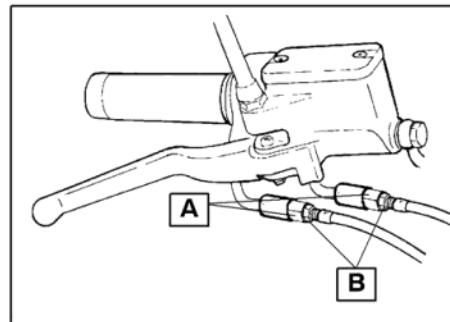


Victory All Purpose Grease: 2872187

3. With engine idling, turn handlebars all the way to the right and left. The engine idle speed should not change in any steering position. If engine idle speed changes, inspect throttle grip free play, cable connections, and routing. Refer to page 1.14 for cable routing illustration.
4. If throttle cable still does not return properly and throttle housing is undamaged; replace throttle cable(s).

THROTTLE FREE PLAY ADJUSTMENT

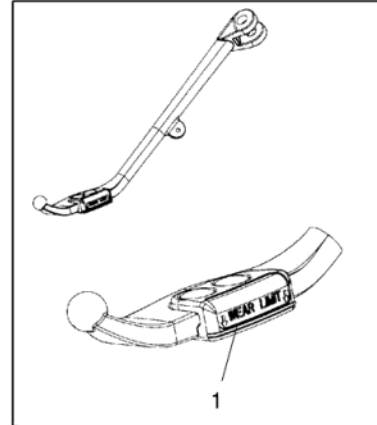
1. Measure throttle free play at throttle grip and compare to specification on page 2.6.
2. Adjustments to throttle free play are made at upper throttle cable adjusters.
3. Loosen lock nut (B) and rotate the adjuster (A) until correct free play is obtained.
4. Tighten lock nut(s) and reposition protective boot(s) when the job is completed.
5. Shift transmission into neutral.
6. Start engine and let it idle.
7. Move fast idle lever to the OFF position (low idle).
8. Turn handlebars all the way to the right and left. The engine idle speed should not change in any steering position. If engine idle speed changes, re-check throttle grip free play, inspect cables and replace if damaged, be sure cables are routed properly. Refer to page 1.14 for cable routing illustration.



MAINTENANCE

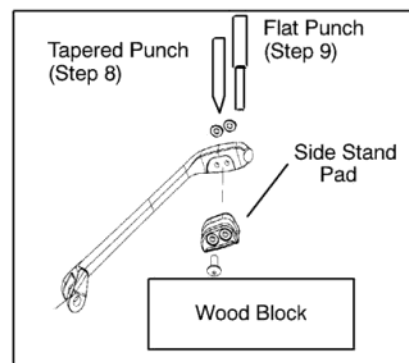
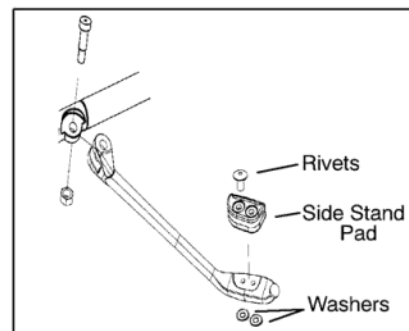
SIDESTAND PIVOT

1. Support the motorcycle in an upright position.
2. Inspect the sidestand spring for damage or loss of tension.
3. Inspect the sidestand for smooth movement. Lubricate if necessary as described below.
4. Inspect the sidestand pivot bolt nut for proper torque listed on page .
5. Make sure that the sidestand is not bent. If it is, it must be replaced. Do not attempt to straighten the sidestand.
6. Inspect the sidestand rubber pad for wear. Be sure the pad is secured properly in place. Replace the pad when it is worn beyond the wear mark (1).



SIDESTAND PIVOT LUBRICATION & SIDESTAND PAD REPLACEMENT

1. Safely support motorcycle with sidestand in the UP (retracted) position.
2. Remove sidestand nut.
3. Remove side stand bolt and remove stand from frame with spring.
4. Drill out rivets using a 1/4" drill bit.
5. Discard worn pad, rivets and washers.
6. Install new sidestand pad using new rivets and backing washers.
7. Use a wood block to prevent cosmetic damage to the rivet head when installing new rivets.
8. Use a tapered punch to expand hollow end of the rivet.
9. Use a flat punch to peen the end of each rivet, or clinch the rivet using a suitable arbor and a bench vise. The rivet must be recessed into rubber pad and should not contact road surface when bike is resting on side stand.
10. Clean and lubricate sidestand bolt with Victory All-Purpose grease.
11. Place stand with spring onto frame mount and align hole in stand with hole in frame rail and attach spring.
12. Install sidestand bolt and nut.
13. Torque nut to specification listed on page 2.7.



CAUTION

The sidestand pad is a safety component and must be installed properly.

2.16

AIR FILTER INSPECTION & REPLACEMENT

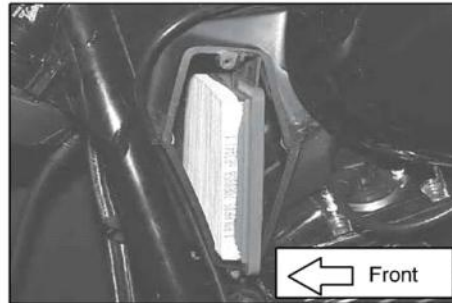
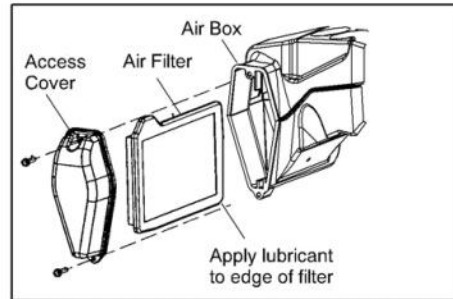
NOTE: If the motorcycle is operated in wet or dusty conditions, more frequent servicing is required.

NOTE: The air filter element cannot be cleaned. Replace the filter when necessary.

1. Remove air filter access cover. Inspect cover gasket for damage. Replace gasket if damaged or out of place.
2. Grasp the air filter frame and pull it out of air box housing.
3. Inspect filter element visually by holding it up to a strong light source. Replace filter if it shows dirt, water, oil or fuel contamination.
4. Reverse steps to install air filter. Apply lubricant to air filter element frame to ease installation. Arrows printed on the filter element point to the front of the vehicle.
5. Torque air filter cover fasteners to specification on page 2.7.

CAUTION

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

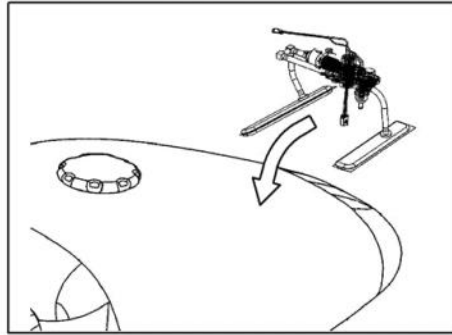


MAINTENANCE

FUEL PRE-FILTER INSPECTION

1. There are two pre-filters located inside the fuel tank on the fuel pump pickups. Scheduled maintenance is not required on these filters.

NOTE: If the fuel tank is extremely contaminated, refer to Fuel System Chapter 5 to remove, inspect, and clean the filters. The pre-filters can be cleaned and reused if not physically damaged. Restricted filters may cause a reduction in fuel pressure, resulting in poor engine performance or engine damage.

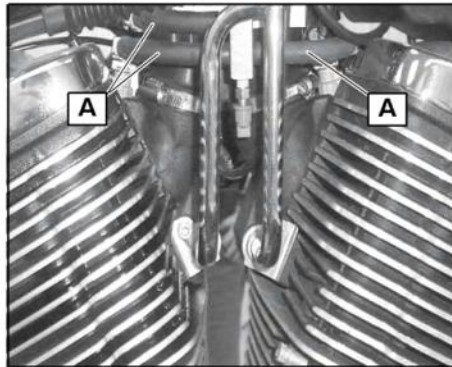


FUEL LINE INSPECTION

1. Remove seat.
2. Remove fuel tank (Refer to Chapter 5).
3. Inspect fuel lines (A) for deterioration, damage, leakage, or kinked areas.
4. Replace fuel line if necessary.

WARNING

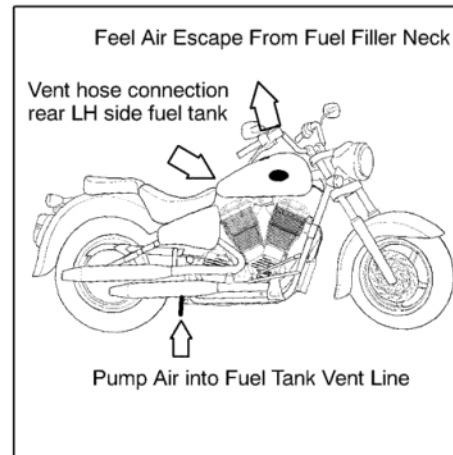
The fuel line exiting the fuel pump is subjected to high pressure. Replace with Original Equipment Manufacture (O.E.M.) parts to reduce the possibility of fuel line failure. Be sure the fuel line is routed properly, away from sharp or hot objects, or anything that may cause wear or damage. Refer to Chapter 5 and see Priming The Fuel System on page 5.18.



FUEL TANK VENT INSPECTION

1. Inspect fuel tank vent any time fuel tank has been removed and installed. There is a vent hose connector at rear left side of fuel tank. Be sure the hose is clear and not pinched or kinked, and that all connections are tight.
2. Remove fuel cap.
3. Pump low pressure air into vent hose as shown. If the vent is clear you will feel air escape from filler neck area.

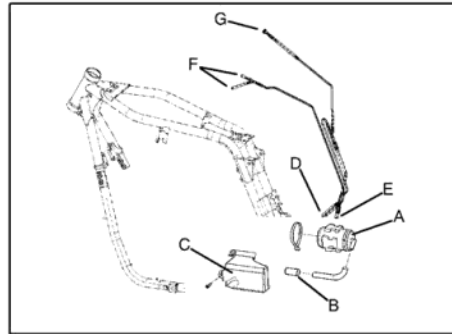
NOTE: CALIFORNIA MODELS: The fuel tank vent is routed to evaporative canister. Disconnect the vent line from canister to perform Step 3 above.



EVAPORATIVE EMISSION CONTROL SYSTEM

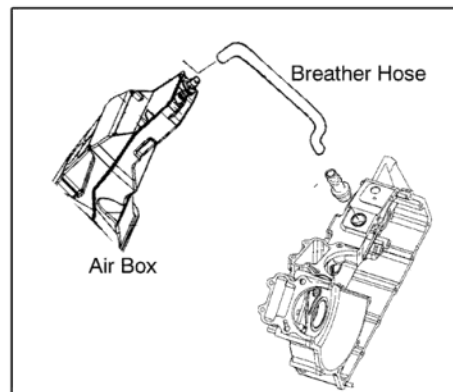
NOTE: CALIFORNIA MODELS: The fuel tank vent is routed to evaporative canister. The canister is located under the seat on Touring Cruiser models, and on the lower left rear corner of the engine on Standard Cruiser and Classic Cruiser models. Be sure all hoses are clear and not pinched or kinked, and that all connections are securely attached.

- A) Activated Charcoal Filter
- B) Vent Line Filter
- C) Tank
- D) Connect To PURGE Fitting
- E) Connect To TANK Fitting
- F) Connect To Orifice On Throttle Body
- G) Connect To Fuel Tank Vent



CRANKCASE VENTILATION (BREATHER) INSPECTION

1. Remove seat and fuel tank.
2. Inspect the condition of the rubber hose at the crankcase ventilation fitting on the engine.
3. Inspect the connection between the crankcase ventilation hose and the air box.
4. Inspect entire length of crankcase ventilation hose for leaks or damage.
5. Replace any parts that are damaged and/or correct the connections at either the air box housing or crankcase ventilation fitting.



MAINTENANCE

SPARK PLUG REMOVAL & INSPECTION

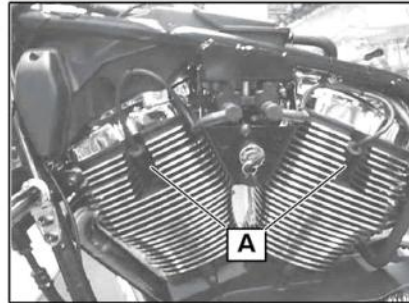
WARNING

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

1. With the engine at room temperature, remove seat.
2. Remove fuel tank (page 5.8).
3. Disconnect spark plug caps (A) and clean the area around spark plug base using compressed air.
4. Remove spark plugs.
5. Inspect spark plugs for:
 - Insulator for damage
 - Worn electrodes
 - Color of insulator

NOTE: The color of the insulator gives a general indications of engine operation. Additional troubleshooting is necessary to determine if a problem exists:

| | |
|----------------------------|----------------------|
| Light to dark brown | Good |
| Shades of white | Lean fuel mixture |
| Wet or black sooty deposit | Over-Rich mixture |
| | Oil control problems |



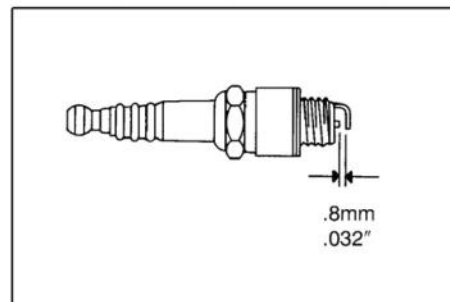
SPARK PLUG INSTALLATION

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

Specification: 2002-2003 NGK CR7EB
2004 NGK CPR6EA-9*
Gap: .8mm (.032in)

* CPR6EA-9 spark plugs are pre-gapped at .9mm (.040").
Re-gap plugs before installation.

2. Apply a small amount of anti-seize compound to spark plug threads. Be careful not to contaminate spark plug firing end.
3. Torque spark plugs to specification on page 2.7.



CAUTION

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

BATTERY

This motorcycle is equipped with a maintenance free battery and is located under the left frame cover. It is not necessary to check the electrolyte or add distilled water to the battery. If the battery discharges, refer to Chapter 16 for diagnostic procedures.

⚠ WARNING

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

External: Flush with water.

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

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

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

CAUTION

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

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

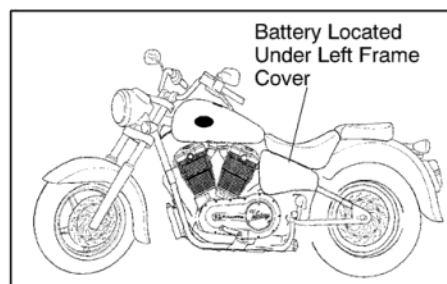
Take great care not to reverse the battery leads when installing the battery. Reverse power applied to the ECM will damage it instantly.

BATTERY CHARGING

Refer to page 16.7, Charging System and Battery.

BATTERY STORAGE

When the motorcycle is not used for periods of one month or longer, remove the battery and store it in a cool, dry area. The battery should be charged monthly using a 12 volt battery charger with a maximum charge rate of 1.8 amp-hr (trickle charger). The use of an automatic maintenance style battery charger is recommended for non-use periods.



⚠ WARNING

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

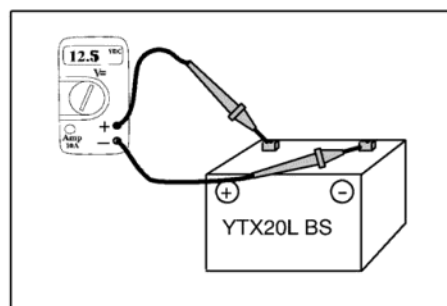
BATTERY INSPECTION

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

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

Specification: 12.5V DC minimum

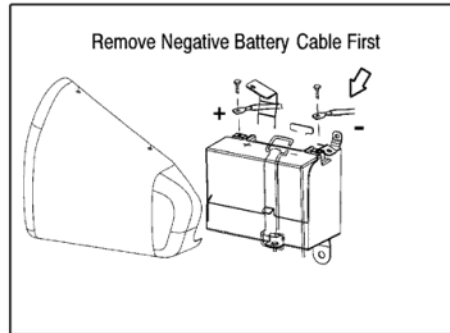
4. If the battery voltage is below 12.5 V DC, remove battery from motorcycle and charge (refer to page 16.7. Replace battery if it will not accept a charge.



MAINTENANCE

BATTERY REMOVAL

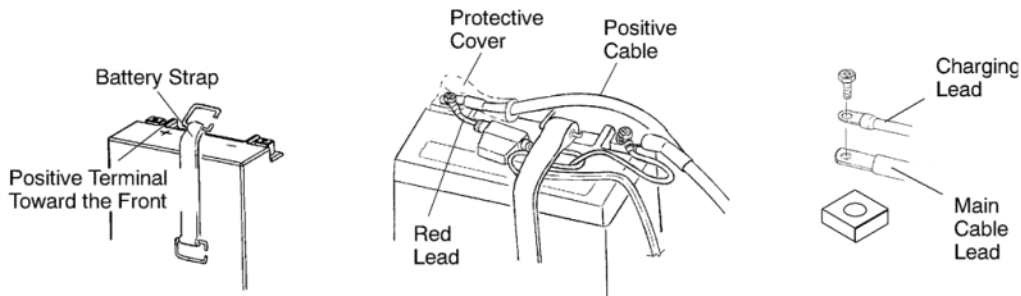
1. Remove seat. See page 3.4.
2. Remove left side frame cover.
3. Remove battery hold down strap.
4. Remove the negative battery terminal bolt and electrical leads.
5. Remove the positive battery terminal bolt and electrical leads.
6. Remove battery.



BATTERY INSTALLATION

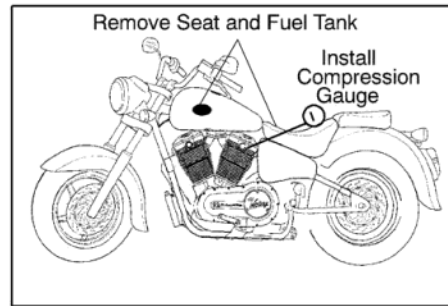
1. Remove Seat. See page 3.4.
2. Remove the left-hand side cover.
3. Carefully install the battery with the positive terminal toward the front of the vehicle.
4. Connect the positive (red) cable and charging lead ring terminal (with red marking) using the fasteners and washers provided. *See below.
5. Apply dielectric grease over the terminal area for corrosion protection.
6. Slide the red protective boot over the terminal.
7. Connect the ground (negative/black) cable and charging lead ring terminal (with no marking) using the fasteners and washers provided. *See below.
8. Apply dielectric grease over the terminal area for corrosion protection.
9. Install the battery strap.
10. The end of the charging lead should be located near the horn. Excess wire should be tucked underneath the battery strap.
11. Reassemble the side cover and then reinstall the seat.

*** The main battery cable should rest directly on the battery terminal with the charging lead ring terminal on top of the main cable. Torque to 40 in. lbs. (4.5 Nm).**



ENGINE COMPRESSION TEST

1. Warm engine to operating temperature.
2. Shift transmission into neutral and stop the engine.
3. Disconnect spark plug caps and remove spark plugs one at a time. Connect a spark plug to each cap and ground spark plugs to engine during the compression test.
4. Install the compression tester in one spark plug hole (leave the spark plug in the other cylinder).
5. Open the throttle completely and crank the engine until needle on the compression gauge stops rising.
6. Repeat the procedure for the other cylinder. Cylinder compression should be within 10% of each other.



Specification: STD: 180 psi \pm 20 psi (1241 \pm 138 kPa)
SERVICE LIMIT: Below 160 PSI

High engine compression may indicate:

- Carbon deposits on piston crown
- Carbon deposits on cylinder head
- Carbon deposits on valves
- Engine modification
- Addition of performance parts

Low engine compression may indicate:

- Slow starter motor cranking speed
- Worn piston and/or piston rings
- Piston ring stuck in the piston ring groove
- Leaking exhaust or intake valves
- Leaking head gasket
- Restricted exhaust system
- Valve timing incorrect
- Non-OEM camshafts

If cylinder compression is below specification, perform a cylinder leakage test to determine where the leak is occurring. Follow the instructions provided with the leakdown tester. Leakage should be below 10% .

Cylinder Leakdown Tester: PV-35667-A

ENGINE COMPRESSION TEST (WET)

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

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

MAINTENANCE

FUSE REPLACEMENT

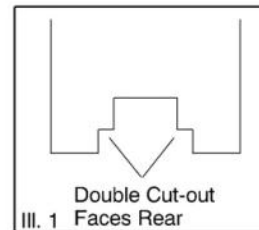
The fuses are located on the right side of the motorcycle under the right body side cover.

1. To access the fuses, remove seat and RH side cover.
2. Push back the tabs on each side of the fuse box cover (A) and lift cover off.



3. **NOTE:** The cover must be installed with the double cut-out facing rearward. (Ill. 1)

If any fuse is blown, turn off main switch to determine which fuse is blown. Install new fuse of the specified amperage. Turn on switches and see if system operates correctly. Repeat fuse failure usually indicates an electrical problem. Refer to the electrical section (beginning at Chapter 16.)



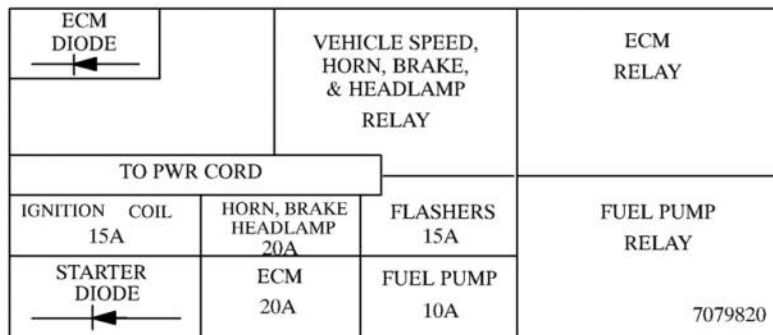
| Fuse Application | Fuse Size |
|---------------------------------|-----------|
| Ignition / Coil | 15 amp |
| Horn/Brake/Headlamp | 20 amp |
| Flashers | 15 amp |
| Electronic Control Module (ECM) | 20 amp |
| Fuel Pump | 10 amp |

CAUTION

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

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

FUSE BOX DIAGRAM

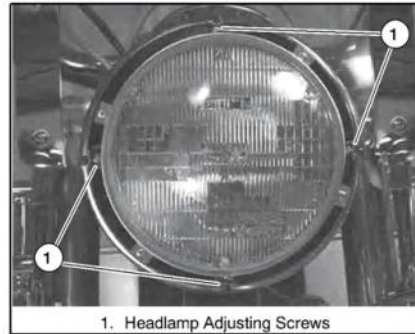
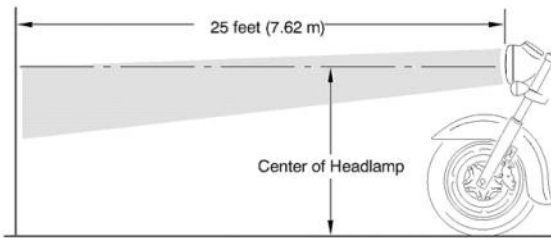


2.24

HEADLIGHT AIM ADJUSTMENT

The headlamp should shine straight ahead of the motorcycle. The top of the headlamp High beam should be just below the center of the lamp at a distance of 25 feet (7.62 m).

1. Check and adjust the tire pressure.
2. Verify suspension sag is 19-32mm before adjusting headlight.
3. Straddle the motorcycle in an upright position and sit in the operator's seat.
4. Set the ignition switch to the **On** position and set the headlamp to High beam. Check the headlamp for correct aim.
5. To adjust the headlamp, remove the headlamp bezel to expose the adjusting screws. Turn the desired adjusting screw clockwise one revolution, and turn the screw directly across the headlamp counterclockwise one revolution. Repeat if necessary, one revolution at a time.
6. Reinstall the headlamp bezel.

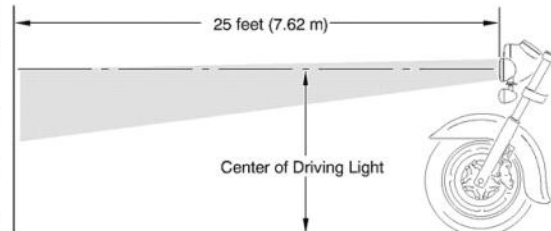


1. Headlamp Adjusting Screws

AUXILIARY LIGHT ADJUSTMENT (TC)

Each lamp should shine straight ahead or slightly to the right of the motorcycle. The top of each lamp beam should be just below the center of the lamp at a distance of 25 feet (7.62 m).

1. Check and adjust the tire pressure and rear shock absorber.
2. Straddle the motorcycle in an upright position and sit in the operator's seat.
3. Set the ignition switch to the **On** position and turn the auxiliary lights on. Check the auxiliary lights for correct aim.
4. To adjust the lights, remove the front running light/turn signal bracket to expose the auxiliary light nut. Loosen the nut and adjust the auxiliary light.
5. Tighten the auxiliary light nut and recheck the light for correct aim.
6. Reinstall the front running light/turn signal bracket.



1. Running Light/Turn Signal Bracket

MAINTENANCE

DRIVE BELT INSPECTION

NOTE: It is recommended that you inspect the drive belt annually, and replace at specified intervals regardless of belt condition.

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

DRIVE BELT TENSION INSPECTION

1. Secure the motorcycle in an upright position. Shift the transmission into NEUTRAL and be sure to ELEVATE the rear wheel off the ground when checking deflection or adjusting the belt. **This is extremely important for accuracy.**
 2. To find the tight spot in the belt, use the tire valve stem as a reference and perform the following steps:
 - Check and record belt deflection at 4 different points in the rear wheel rotation (90 degree intervals) rotating the rear wheel in a CLOCKWISE rotation as viewed from the belt side of the motorcycle.
 - Place a mark on the rear wheel at the tightest point (least deflection) to use as a reference.
 - Now rotate the wheel COUNTERCLOCKWISE, back to your reference mark (the tightest point).
 - Adjust belt deflection at this point, if required, to specification.
 3. Place a tape measure or ruler next to the drive belt as shown in figure 1 or use the graduations on the belt bracket for reference (1/2 way between sprocket centers on the lower belt span (Fig 2).
 4. Place the O-ring on the 10 lb. mark of the belt tension gauge (Fig 1).
 5. Determine the center of the belt and place the belt tension gauge squarely against the belt (figure 3).
- Belt tension gauge: PV-43532**
- Specification:**
- All Except Touring Cruiser 8 mm (0.31 in)**
- Touring Cruiser 9.0mm (0.354 inch)**
6. Push up on the belt tension tool until the O-ring just touches the tool body.
 7. If belt deflection is greater than the specified distance with 10 lbs. of force, the belt must be tightened. If the belt moved less than specified with 10 lbs. of force, the belt must be loosened.

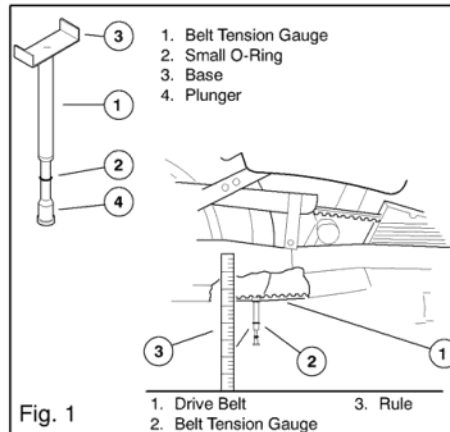
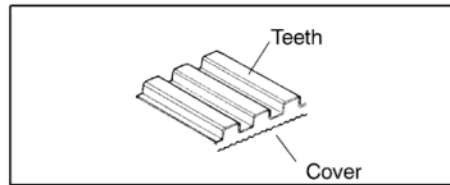


Fig. 1

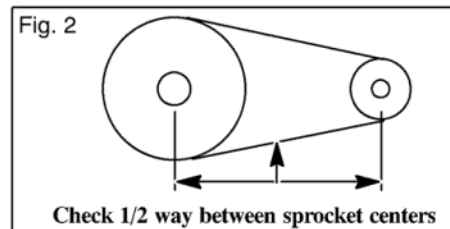


Fig. 2

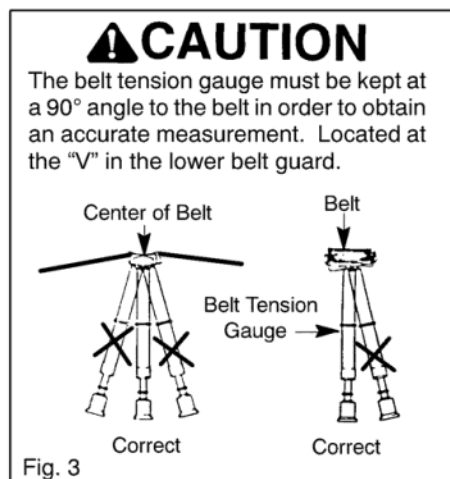


Fig. 3

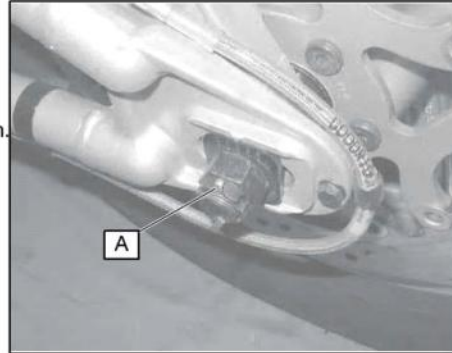
CAUTION

The belt tension gauge must be kept at a 90° angle to the belt in order to obtain an accurate measurement. Located at the "V" in the lower belt guard.

DRIVE BELT TENSION ADJUSTMENT

1. Remove rear axle cotter pin (A) and discard.
2. Loosen axle nut.

NOTE: Axle nut may be located on left side or right side depending on model. Refer to page 13.3 for more information.

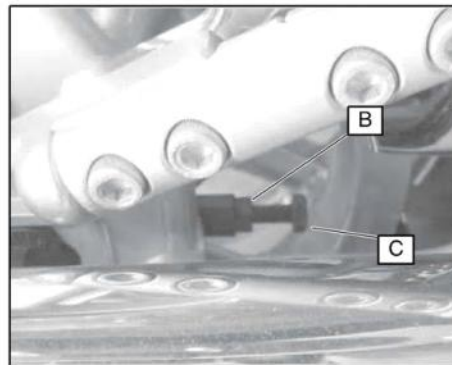


3. Loosen axle adjuster lock nuts (B) on each side.
4. Turn each adjuster bolt (C) 1/8-1/4 turn clockwise to reduce, counterclockwise to increase belt deflection.

NOTE: NOTE: Turn adjuster bolts equal amounts to maintain wheel alignment.

5. When belt deflection is correct, perform rear wheel alignment procedure (page 2.28) before tightening axle nut and adjuster lock nuts.

NOTE: Alignment and belt deflection adjustments impact each other. Work between adjustments until both wheel alignment and belt deflection are correct.

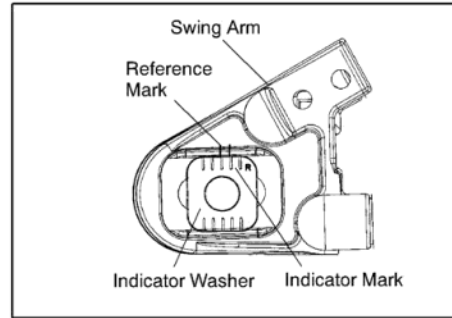


MAINTENANCE

REAR WHEEL ALIGNMENT INSPECTION

NOTE: Use the special tool PV-43528 to align the rear wheel. **Do not rely on the rear axle reference marks for wheel alignment.** Anytime work is performed on the rear wheel, drive belt, swingarm, or sprockets, inspect belt deflection and wheel alignment.

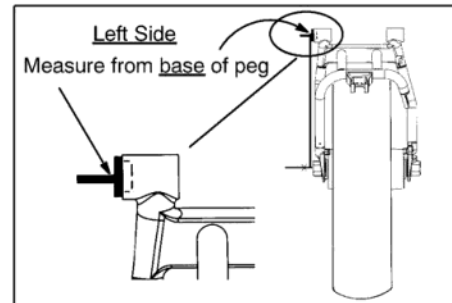
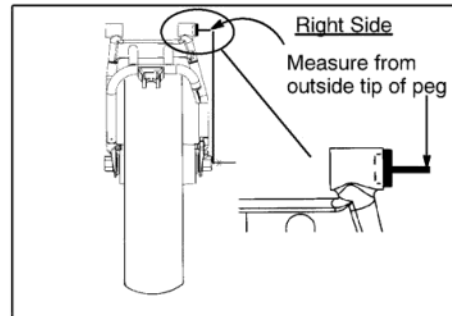
1. Secure machine in an upright position.
2. Remove swing arm pivot caps.
3. Install rear wheel alignment special tool in right side swing arm pivot.



Rear wheel alignment tool: PV-43528

NOTE: To ensure accuracy, be sure to measure from the proper point on the alignment tool (see illustration).

4. Measure from forward, **outside edge** of wheel alignment tool to center of rear axle, record your measurement.
5. Install rear wheel alignment special tool into left side swing arm pivot.
6. Measure from forward, **inner edge** of wheel alignment tool to center of rear axle.
7. The two measurements must be identical. If measurements are not identical, turn long side adjuster bolt counterclockwise 1/8 turn the short side adjuster bolt clockwise 1/8 turn.
8. Repeat steps 3 thru 7 until swing arm pivot to rear axle center to center measurement is the same on both sides of vehicle.
9. When wheel alignment is correct, inspect belt tension and adjust as necessary (see previous page).
10. Install swing arm pivot caps.
11. Tighten rear axle nut to specification.



TORQUE: Rear Axle Nut

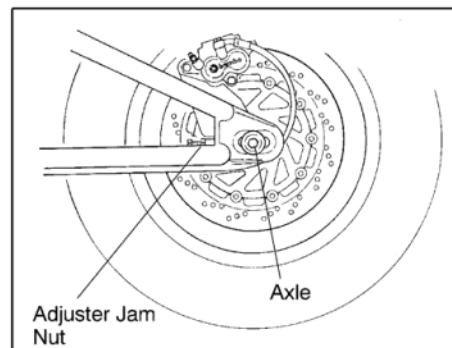
88 Nm (65 lb-ft)

12. Install new rear axle cotter pin. Bend cotter pin legs around axle in opposite directions.
13. Hold axle adjuster bolts in place with a wrench and tighten adjuster jam nuts.

TORQUE: Adjuster Jam Nut

16 Nm (12 lb-ft)

14. Pump rear brake pedal several times until pedal is firm.



2.28

DRIVE BELT SPROCKET INSPECTION

1. Inspect sprockets for wear or damage from foreign material or an accident. Check fastener(s) and tighten if necessary.

Inspect Drive Sprocket and Sprocket Nut

1. Remove the drive sprocket cover.

NOTE: On some models it may be necessary to remove portions of the exhaust system to access all of the drive sprocket cover screws (Refer to Chapter 11).

2. Inspect drive sprocket and sprocket nut for wear or damage. Make sure the sprocket nut is tight.
3. If the sprocket nut is loose, remove the sprocket nut retainer screws and the retainer.
4. Remove the sprocket nut. Replace with a new sprocket nut if necessary.
5. Inspect spacer. Machined surface should be flat and free from burrs or galling.
6. Clean the output shaft threads and the sprocket nut threads.
7. Apply a few drops of Loctite Thread Locker #262 or equivalent to the output shaft threads.
8. Apply the rear brake and tighten the drive sprocket nut.

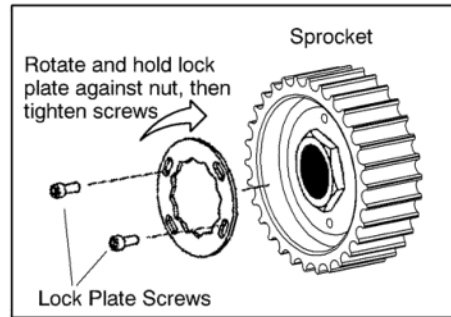
Torque: 125 ft-lbs (170 Nm)

9. Install the nut retainer and the retainer screws. Rotate the retainer plate clockwise to take up any lash between the plate and the nut. Hold in this position while tightening the retainer plate screws.

Torque: 85 in-lbs (10 Nm)

NOTE: The nut retainer can be installed in many positions and on either side. If you cannot align the mounting holes, tighten the sprocket nut slightly and install the nut retainer.

10. Check rear wheel alignment (see page 2.28) and drive belt tension (see page 2.26).



MAINTENANCE

FRONT FORK INSPECTION

CAUTION

Securely support the motorcycle so it does not fall.

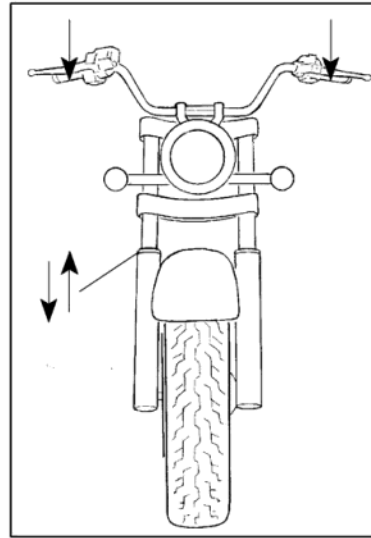
FORK OIL LEAK INSPECTION

Check for oil leakage. If any leakage is detected, take the machine to a Victory dealer for repairs.

NOTE: Fork tubes should be cleaned periodically with mild soap and water to remove bugs, dirt, or foreign material, which can cause oil leaks.

FORK OPERATION CHECK

Place the machine on a level place. Hold the machine in an upright position and apply the front brake. Push down hard on the handlebars several times to determine if the forks operate smoothly. Check for loose steering or abnormal noise. Check tightness of all fasteners.



CAUTION

Refer to the suspension section Chapter 12 for diagnostic procedures if unsmooth movement, damage, looseness or abnormal noises are detected in front fork.

⚠ WARNING

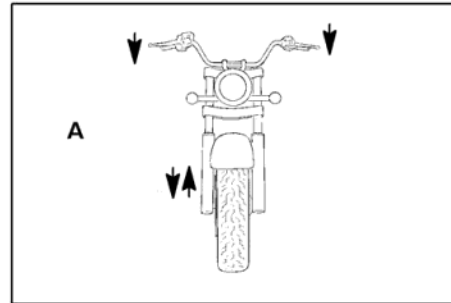
Do not operate a motorcycle with faulty suspension. Loose, damaged, worn or improperly adjusted suspension parts impair vehicle stability and control.

FRONT SUSPENSION INSPECTION

WARNING

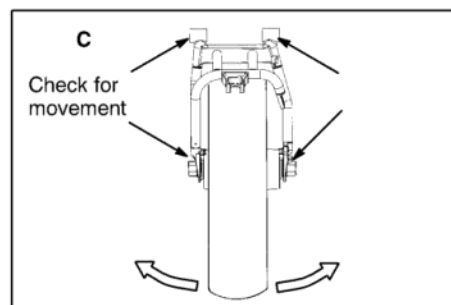
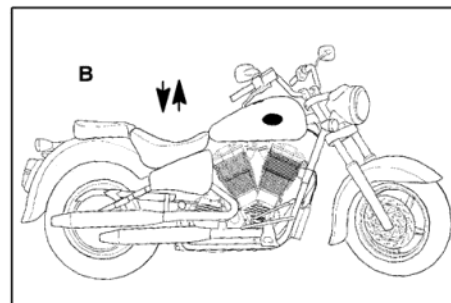
Damaged, worn, or loose suspension components may cause loss of control, increasing the chance of accidents or possible injury. Damaged, worn, or loose suspension components must be repaired before the motorcycle is operated.

1. Sit astride motorcycle and compress the front suspension several times while holding the front brake. (A)
2. Ensure that the action of the suspension is smooth and controlled.
3. Inspect all front suspension components for leaks, damage, or loose components.
4. Inspect outer surfaces of stanchion tubes for scoring, scratches, and foreign object damage or foreign material stuck to stanchion tubes.
5. Torque all fasteners to specification (Refer to Chapter 12).
6. Replace worn or damaged parts.



REAR SUSPENSION INSPECTION

1. Sit astride the motorcycle and compress the rear suspension several times. (B)
2. Ensure that the action of the rear suspension is smooth and controlled.
3. Secure motorcycle with rear wheel off the ground.
4. Inspect for worn swing arm bearings by grasping the rear wheel and attempting to move wheel side-to-side. (C)
5. If play is observed, inspect rear wheel bearings, swing arm pivot nut torque, rear axle torque and swing arm bushings.
6. Rotate rear wheel and inspect for smooth rotation of rear wheel bearings. If roughness or unusual sounds are detected inspect rear wheel and bearings (Refer to Chapter 13).
7. Inspect rear suspension components for leaks, damage, or loose fasteners.
8. Torque all fasteners to specification (Refer to chapters 12&13)
9. Replace any worn or damaged parts.



MAINTENANCE

SPRING PRE-LOAD INSPECTION

Rear Suspension

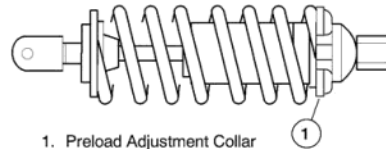
This procedure involves using the shock absorber preload wrench PV-43507, which is designed specifically for adjusting the shock absorber preload.

NOTE: The distance measured while the motorcycle is elevated will not change and is measured only once. After the measurement and the locations from where the measurement is taken are recorded (steps 1–4), you will only need to perform steps 5–8 to correctly adjust the rear shock absorber.

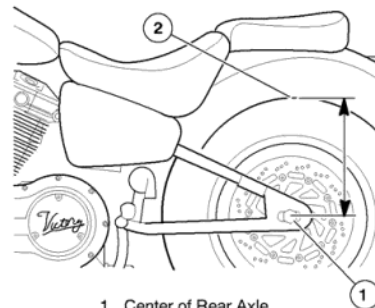
Have an assistant help you complete the following procedure:

1. Elevate the rear of the motorcycle until the rear wheel is about 1 inch (2.5 cm) off of the ground. Use an appropriate motorcycle lift placed securely under the frame.
2. Measure the distance from the center of the rear axle to the bottom of the rear fender directly above the axle.

On some models it may be easier to measure from the top of the drive belt guard to a convenient spot on the rear fender (along the pinstriping for example). Both locations must be directly above the rear axle.
3. Record the measurement and the locations from where the measurement is taken in the space provided.
4. Remove the motorcycle lift apparatus and return the motorcycle to the ground.
5. Load the motorcycle with all the things you intend to carry (cargo and accessories). With the motorcycle in an upright position, sit on the operator's seat with your riding gear on. If you plan on carrying a passenger, have them sit on the passenger seat with their riding gear on.
6. Have an assistant compress the rear suspension a few times by pushing down on the rear fender slowly and releasing. Make sure the suspension moves freely without binding.
7. Without moving the motorcycle, have an assistant measure the distance from the center of the rear axle to the bottom of the rear fender directly above the axle. This measurement must be taken from the same locations recorded in step 1.
8. Subtract the second measurement (step 7) from the first measurement (recorded in step 1). The difference is called "sag" and should be 3/4 to 1 1/4 inch (19 to 32 mm). Adjust the shock absorber preload and recheck the sag if necessary. Refer to Chapter 13 for adjustment procedure.



1. Preload Adjustment Collar
Suspension "sag" should be 3/4 to 1 1/4 inch (19 to 32 mm).



1. Center of Rear Axle
2. Bottom of Rear Fender

Measurement (step 1) _____

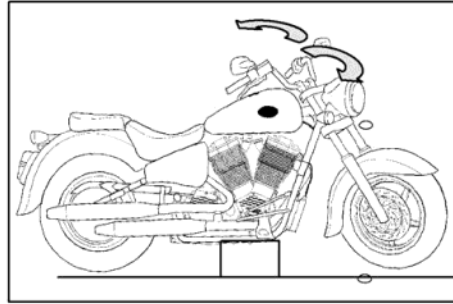
Upper Location (step 1) _____

Lower Location (step 1) _____

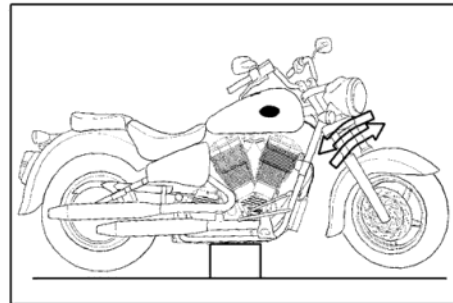
STEERING HEAD BEARING INSPECTION

NOTE: Ensure that the control cables, hoses and wiring are not interfering with handle bar rotation when the following procedures are performed.

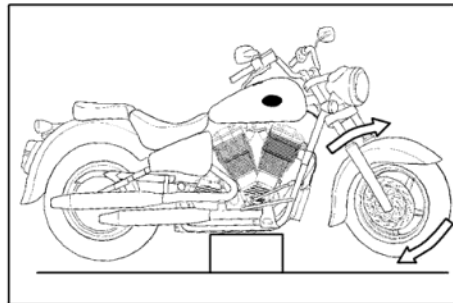
1. Secure motorcycle with front wheel raised off the ground.
2. Turn handlebars from lock to lock and inspect for smooth movement. III.1
3. If steering stem bearing feels rough or the handle bar binds, inspect, adjust and lubricate the steering head bearings (Refer to Chapter 12).
4. Point front wheel straight ahead, grasp fork tubes and pull/push the fork tubes back and forth. III. 2. If play is observed, adjust the steering head bearings (Refer to Chapter 12).
6. Lubricate steering head bearings at intervals noted on periodic maintenance chart. Refer to Chapter 12 for lubrication procedure.
7. Turn handle bars full right or left and hold that position. Attempt to move the front wheel side-to-side, III 3. If any play is observed, further inspection of front wheel bearings is required (Refer to Chapter 12).
8. Rotate front wheel and inspect for smooth rotation of front wheel bearings. If roughness or unusual sounds are present, further inspection of front wheel bearings is required (Refer to Chapter 12).



III.1



III.2



III.3

MAINTENANCE

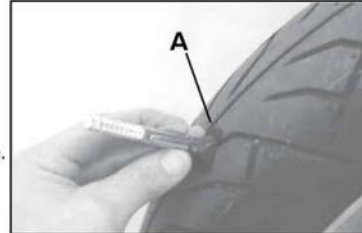
TIRE INSPECTION

⚠ WARNING

Victory motorcycles are produced using the designated tires listed below as original equipment. This includes field testing to ensure stability and superior handling. The use of tires other than original equipment may cause instability. A review of all tire related warnings can be found in chapter 14.

1. Inspect tires for weather checking, cuts, imbedded foreign objects, etc.
2. Inspect front and rear wheels for trueness. Refer to Chapters 12 and 13 for procedure.
3. Measure tread depth at center of tread. (A)

NOTE: Incorrect tire pressures will affect steering, handling and tire life.



⚠ 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 |
|--------------------------------|-------------------------------|
| 1.6mm (.063") | 1.6mm (.063") |

TIRE PRESSURE TABLES

*All Victory laced wheels require tubes

| 2002 V92C Standard Cruiser / 2003 Classic Cruiser | | |
|---|----------------------------|------------------------------|
| LOAD RATING | Up to 200 lbs (91 kg) load | 200-475 lbs (91-215 kg) load |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| 2002 V92C Deluxe Cruiser | | |
| LOAD RATING | Up to 200 lbs (91 kg) | 200-444 lbs (91-207 kg) |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| 2002 - 2004 Touring Cruiser | | |
| LOAD RATING | Up to 200 lbs (91 kg) load | 200-449 lbs (91-204 kg) load |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| 2002 V92TC Deluxe Touring Cruiser | | |
| LOAD RATING | Up to 200 lbs (91 kg) load | 200-441 lbs (91-200 kg) load |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| CRUISEMAX TIRES (U.S. and U.K. only) | | |
| LOAD RATING | Up to 200 lbs (91 kg) load | 200-475 lbs (91-215 kg) load |
| FRONT: Dunlop CRUISEMAX 130/90 16 67H | 34 psi (235 kpa) | 41 psi (280 kpa) |
| REAR: Dunlop CRUISEMAX 150/80 B16 71H | 36 psi (250 kpa) | 41 psi (280 kpa) |

WHEEL SPOKES

Inspect both wheels by grasping each spoke and try to move it side to side or up and down. All spokes should be equally tight and have the same amount of flex. Tighten loose spokes according to the procedures found in Chapter 12 of this service manual.

2.34

CLEANING

Before cleaning the motorcycle, do the following:

Be sure the exhaust has cooled completely. Block off the end of the exhaust pipes to prevent water from entering the exhaust system.

Make sure the spark plugs, oil dipstick and all filler caps are securely installed.

Avoid spraying the air box / air filter area.

Degreaser may be applied to excessively greasy areas. **NOTE:** When using degreaser, do not apply to any cosmetically painted or plated areas. Also, do not apply to any areas that depend upon grease for proper functioning such as brake and shifting pivot points. If degreaser is necessary in these areas, make sure to re-apply grease in the appropriate areas after your cleaning is finished.

Pre-soak, removing excess dirt and degreaser off with a low pressure garden hose.

CAUTION

High pressure washing may cause water seepage into bearings, pivoting or sliding areas. Electrical parts, electrical connectors, wheel bearings and seals can become damaged or contaminated with water if excessive pressure is used.

Once the bulk of the dirt has been rinsed off, wash all surfaces with warm water and a mild detergent.

Rinse the motorcycle off immediately with clean, low pressure water and dry the surfaces with a chamois cloth or clean soft absorbent cloth.

Do not use abrasive cleaners. Polishing and cleaning with them will accelerate the wear of your tank badge.

To clean the windshield, wash with a clean soft cloth, plenty of warm water, and if necessary, a non-abrasive soap such as dishwashing liquid. Flannel or a soft chamois cloth is recommended. Paint, glue residue, or grease removal: Moisten cotton with Naphtha or turpentine followed by a wash as stated above. Apply a high quality plastic cleaner such as McGuir's Mirror-Glaze MG-17, or Novus #2 plastic polish to the windshield. This will leave a protective coating on the windshield, making future cleanings easier.

CAUTION

Windshield material is polycarbonate plastic. Do not use cleaners or rain protective products meant for glass surfaces on the windshield. Refer to windshield care on page 2.36.

MAINTENANCE

WAXING, POLISHING, APPLYING PROTECTANTS

(Items Other Than Windshields)

After washing and drying the motorcycle, you can help extend the life and appearance of its components by waxing painted surfaces, polishing chrome surfaces, and applying a protectant to exposed rubber, vinyl, and plastic parts. Avoid cleaning-waxing compounds, as they may contain abrasives that may damage the finish of painted parts. For chrome surfaces, use either a window-cleaning solution or a polish specifically designed for chrome. Follow manufacturer's instructions for proper application and use of wax, polish, or protectants.

After washing and drying the motorcycle, to help extend the life and appearance of its components:

- Wax painted surfaces. Avoid cleaning-waxing compounds, as they may contain abrasives that may damage the finish of painted surfaces.
- Polish chrome surfaces. Use either a window-cleaning solution or a polish specifically designed for chrome.
- Apply a protectant to exposed rubber, vinyl, and plastic components.

WARNING

- **Do not use a protectant on the seats, footboard inserts, or handgrips that leaves a slippery coating after it dries. If these surfaces are slippery, you may have difficulty holding your position on the motorcycle while riding, which may cause you to lose control of the motorcycle.**
 - **Follow manufacturer's instructions and safety precautions on wax, polish, and protectant labels to prevent injury or damage.**
-

WINDSHIELD CARE

A windshield is included with some Victory models.

Wash the windshield using a soft cloth or sponge soaked in a solution of mild detergent and warm water, applying minimal pressure as you wash. Let the detergent do the cleaning, not the pressure you apply. Excessive washing pressure may cause dirt, sand, or other foreign materials on the windshield to scratch it. Soak the cloth or sponge in the detergent and water solution frequently to provide plenty of soapy water for washing, and keep the cloth or sponge clean by rinsing it frequently.

- Minor scratches may be removed with a quality plastic polishing compound. Follow the manufacturer's instructions when using plastic polishing compounds.
- Insects, oil, tar, and tree sap may also damage the motorcycle's finish. If normal washing does not remove these materials, you may need to use a special cleaner. Choose a cleaner designed for use on clear plastic and follow the manufacturer's instructions when using special cleaners.

Caution

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

REPAIRING PAINTED SURFACE DAMAGE

After cleaning the motorcycle, inspect it for damage to the painted surfaces. If you discover chips or scratches in the paint, apply genuine Victory touch-up paint as soon as possible to prevent corrosion. Refer to page 1.3 for paint information.

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.

Victory Fuel Stabilizer PN: 2870652

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.

Victory Detail Kit: 2872195

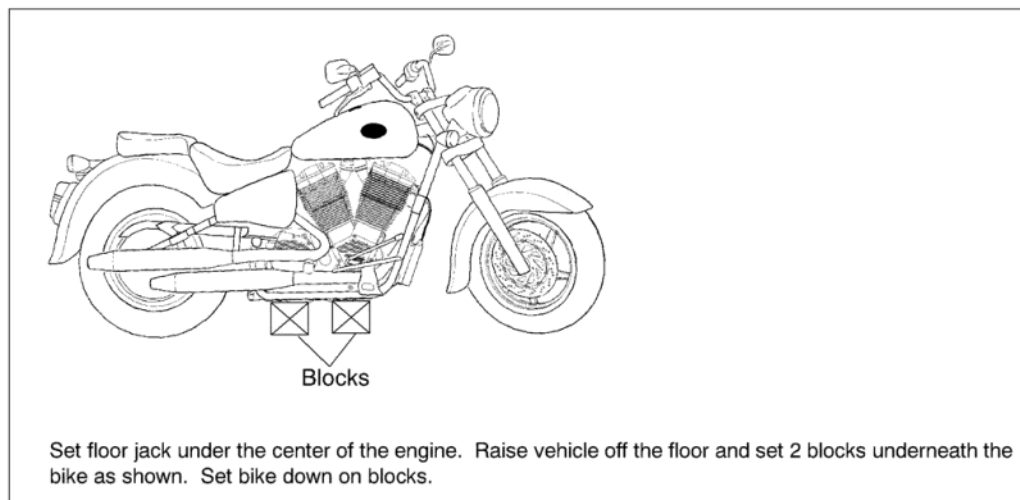
Victory Restore Kit: 2872192

5. Change engine oil as outlined on page 2.8.
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 according to instructions on page 16.7.
9. Store battery in a cool, dry area.
10. The battery should be charged monthly using a trickle charger.
11. Cover motorcycle with a covering containing fabric that allows for adequate ventilation. Do not use plastic or tarps, as corrosion may result.

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

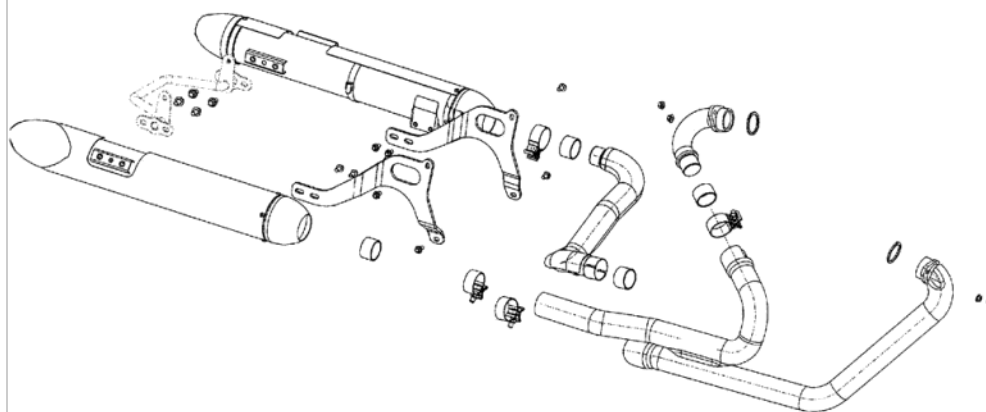


CHAPTER 3

FRAME, BODY, EXHAUST

| | |
|---|------|
| WARNINGS / TROUBLESHOOTING | 3.1 |
| EXHAUST EXPLODED VIEWS AND FASTENER TORQUE VALUES | 3.2 |
| WINDSHIELD AND DEFLECTOR EXPLODED VIEW | 3.3 |
| SEAT REMOVAL & INSTALLATION | 3.4 |
| SEAT BASE REMOVAL, PASSENGER, (STD, DLX, CLASSIC CRUISER) | 3.5 |
| SIDE COVER REMOVAL | 3.5 |
| MUFFLER REMOVAL & INSTALLATION (STD, DLX, CLASSIC CRUISER) | 3.6 |
| EXHAUST PIPE REMOVAL & INSTALLATION (STD, DLX, CLASSIC CRUISER) | 3.6 |
| MUFFLER REMOVAL & INSTALLATION (TOURING CRUISER) | 3.7 |
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| SADDLEBAG REMOVAL AND INSTALLATION | 3.8 |
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| WINDSHIELD (TOURING CRUISER) | 3.10 |
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| FENDER TIP INSTALLATION | 3.10 |

3



FRAME - BODY - EXHAUST SYSTEM

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. 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 Victory may cause loss of performance, excessive emissions, and make the machine unsafe for use.

WARNING

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

SPECIAL TOOLS

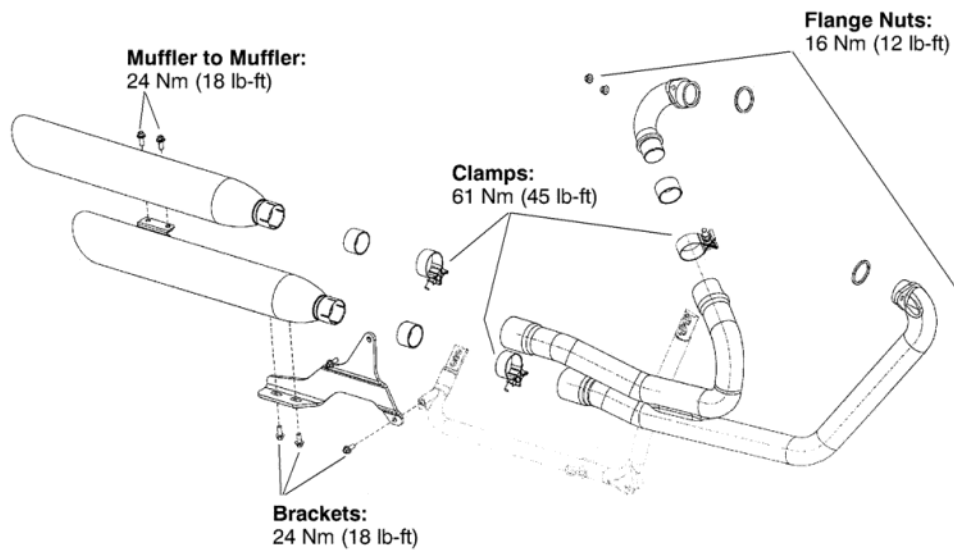
Refer to page 1.11 for special tool information.

TROUBLESHOOTING

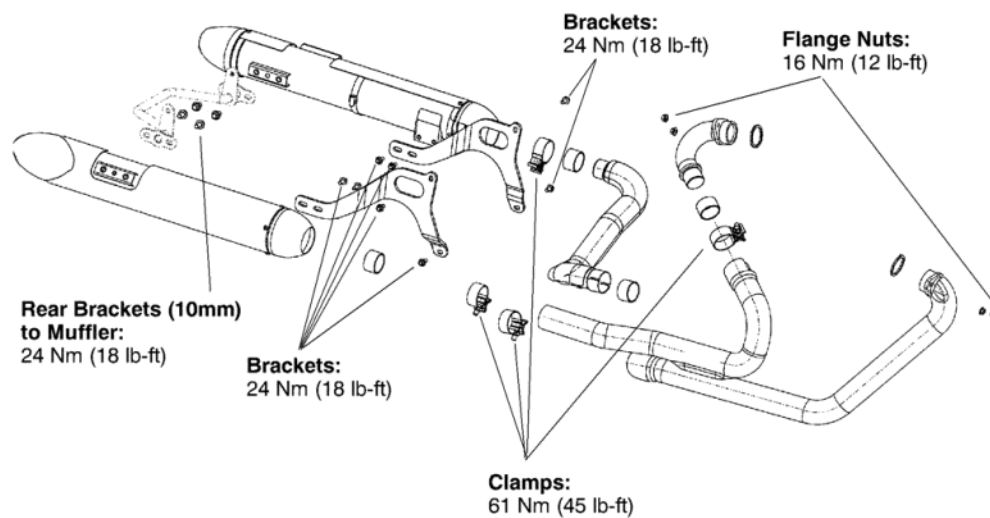
| EXHAUST SYSTEM TROUBLESHOOTING | |
|--------------------------------|---|
| SYMPTOM | POSSIBLE CAUSE |
| Excessive Exhaust Noise | Broken or Leaking Exhaust System |
| Vibration | Loose Exhaust Mounts Exhaust Contacting Frame |
| Poor Performance | Bent or Damaged Exhaust Components Deformed Exhaust Components Leaking Exhaust System Plugged or Restricted Exhaust System |

FRAME - BODY - EXHAUST SYSTEM

STANDARD, DELUXE, & CLASSIC CRUISER

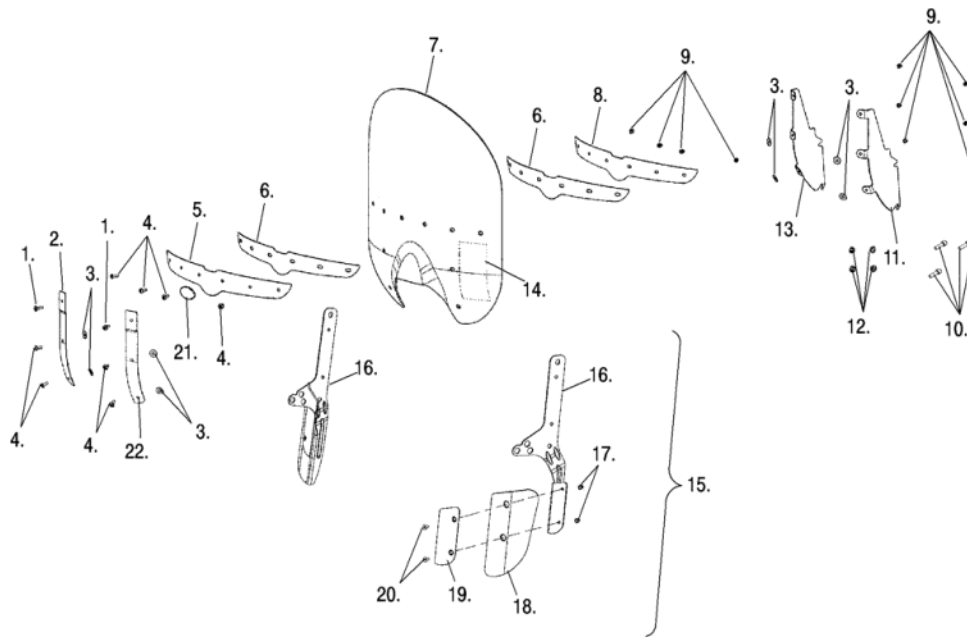


TOURING CRUISER & DELUXE TOURING CRUISER



FRAME - BODY - EXHAUST SYSTEM

WINDSHIELD ASSEMBLY VIEW - TOURING CRUISER



| | | |
|-----|----|-----------------------------------|
| 1. | 2 | Screw |
| 2. | 1 | Bracket, Front, Windshield, Right |
| 3. | 8 | Washer, Flat |
| 4. | 8 | Screw |
| 5. | 1 | Bracket, Front, Windshield, Top |
| 6. | 2 | Pad, Windshield, Top, Front/Rear |
| 7. | 1 | Windshield |
| 8. | 1 | Bracket, Rear, Windshield, Top |
| 9. | 10 | Nut, Acorn |
| 10. | 4 | Screw |
| 11. | 1 | Bracket, Windshield, LH |
| 12. | 4 | Nut |
| 13. | 1 | Bracket, Windshield, RH |
| 14. | 1 | Decal, Warn/Caut/Cln, Windshield |
| 15. | 1 | Asm., Deflector, Lower, LH |
| | 1 | Asm., Deflector, Lower, RH |
| 16. | 1 | Bracket, Lightbar Deflector, LH |
| | 1 | Bracket, Lightbar Deflector, RH |
| 17. | 4 | Nut, Acorn |
| 18. | 1 | Deflector, LH |
| | 1 | Deflector, RH |
| 19. | 1 | Plate, Deflector, Front, LH |
| | 1 | Plate, Deflector, Front, RH |
| 20. | 4 | Screw |
| 21. | 1 | Badge, Windshield, Stamp Silver |
| 22. | 1 | Bracket, Front, Windshield, Left |

9/02

3.3

FRAME - BODY - EXHAUST SYSTEM

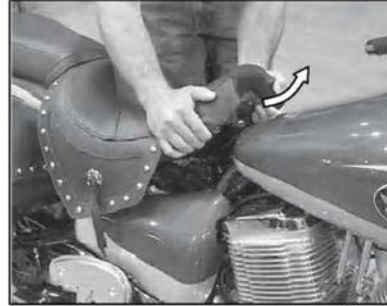
SEAT REMOVAL & INSTALLATION

WARNING

Always make sure the seats are securely locked before riding the motorcycle. An unlocked seat could cause a sudden shift in riding position, causing you to lose control of the motorcycle.

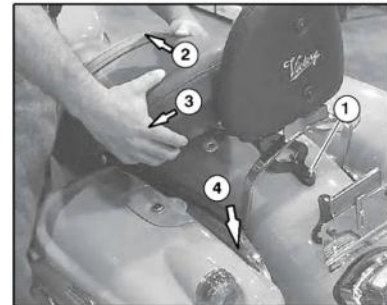
CLASSIC CRUISER

1. Insert the ignition key into the ignition switch/seat release and turn the key counterclockwise.
2. Lift the front of the seat and slide the seat forward and off of the motorcycle.
3. The passenger's seat mounting screws are located at the front of the seat. Removing the passenger seat is unnecessary for regular maintenance.
4. To reinstall the operator's seat, slide the tongue of the seat into the passenger's seat base. Push down on the front of the operator's seat until it locks.



TOURING CRUISER

1. Remove the acorn nut from behind the seat.
2. Lift rear of seat slightly to clear the rear mounting stud, then push rear of seat forward to clear backrest (where applicable).
3. Move rear of seat to left carefully until clear of backrest.
4. Pull seat rearward and to the left to disengage front tab and remove.
5. To reinstall the seat, slide it forward and into position on the motorcycle. Make sure the front seat mount is engaged. Lower the seat onto the rear mounting stud and reinstall the acorn nut.



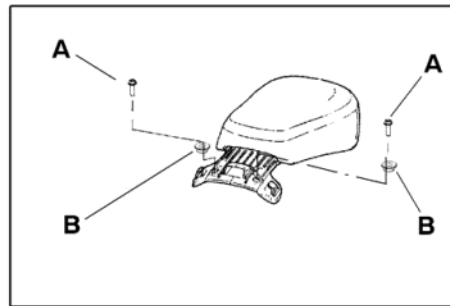
FRAME - BODY - EXHAUST SYSTEM

REAR SEAT BASE - CLASSIC CRUISER

WARNING

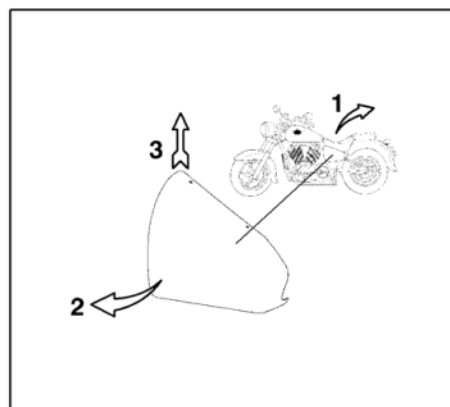
Never ride with a helmet in the helmet holder. The helmet may hit foreign objects, causing loss of control and possibly resulting in serious injury or death.

1. Remove operator's seat.
2. Remove two fasteners (A) and shoulder washers (B) and remove rear seat base.
3. To install, set seat base in place and install shoulder washers and fasteners. Torque to 11 Nm (8 lb-ft.)



SIDE COVER REMOVAL

1. Remove operator's seat.
2. Grasp the lower corners of the cover and pull the bottom out, away from the motorcycle.
3. Lift the cover up to disengage top pins.
4. Remove cover.
5. Reverse steps for installation.



FRAME - BODY - EXHAUST SYSTEM

MUFFLER REMOVAL / INSTALLATION

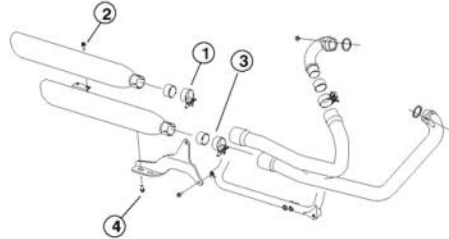
Classic Cruiser

1. Remove seat and frame side covers.
2. Loosen clamp for rear cylinder (top) muffler (1).
3. Remove muffler mount bolts (2).
4. Slide rear muffler back to remove muffler and gasket.
5. Loosen front muffler clamp (3).
6. Remove muffler mount bolts (4).
7. Slide front muffler back to remove muffler and gasket.
8. Discard used gaskets.
9. Install front (lower) muffler with new muffler gasket onto exhaust pipe.
10. Install rear (top) muffler with new muffler gasket onto exhaust pipe.
11. Install muffler-to-muffler bolts and torque to 24 Nm (18 lb-ft.)
12. Tighten muffler clamps to 61 Nm (45 lb-ft.)

NOTE: Clean any oil, grease or fingerprints from the exhaust system before starting the engine to reduce the chance of chrome discoloration.

REFER TO ILLUSTRATIONS
ON PAGE 3.2

NOTE: Clean any oil, grease or fingerprints from the exhaust system before starting the engine to reduce the chance of chrome discoloration.



EXHAUST PIPE REMOVAL

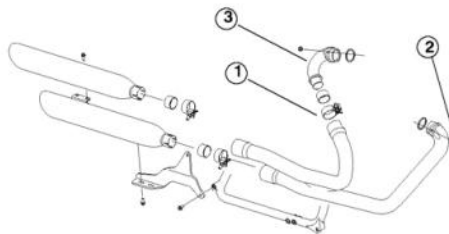
Classic Cruiser

1. Remove mufflers and gaskets.
2. Loosen rear manifold clamp (1)
3. Remove front exhaust pipe flange nuts (2)
4. Remove front and rear exhaust pipe assembly.
5. Remove rear manifold (3).
6. Remove exhaust sealing gaskets and discard. Do not reuse exhaust headpipe gaskets

EXHAUST PIPE INSTALLATION

Classic Cruiser

1. Clean all mating surfaces.
2. Install new exhaust sealing gaskets.
3. Install rear manifold (3) with flange nuts snug (tight enough to keep gasket in place).
4. Install exhaust header pipe assembly, aligning rear pipe to manifold and front pipe flange to studs.
5. Snug all fasteners.
6. Tighten flange nuts to 16 Nm (12 lb-ft.)
7. Torque manifold clamp to 61Nm (45 lb-ft.)
8. Install mufflers.



MUFFLER REMOVAL

Touring Cruiser

1. Remove saddlebags. See page 3.8.
2. Loosen clamps front muffler clamps.
3. Remove (4) 10mm rear muffler support bracket bolts.
4. Remove (4) 8mm front muffler support bracket bolts.
5. Pull each muffler rearward to remove.

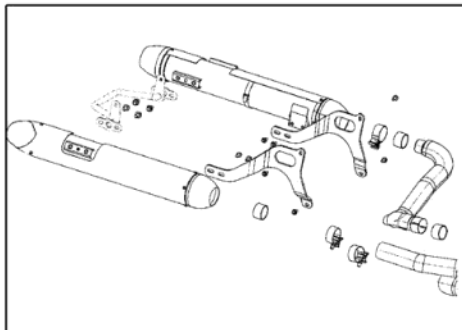
MUFFLER INSTALLATION

Touring Cruiser

1. Install new gaskets on exhaust pipes.
2. Install both mufflers with clamps. Leave clamps loose.
3. Install muffler to bracket bolts (4 front and 4 rear) and tighten by hand to align mufflers with brackets.
4. Tighten front muffler until snug but do not torque.
5. Tighten muffler-to-bracket bolts to 24 Nm (18 lb-ft)
6. Tighten muffler clamps to 61 Nm (45 lb-ft).

REFER TO ILLUSTRATIONS
ON PAGE 3.2

NOTE: Clean any oil, grease or fingerprints from the exhaust system before starting the engine to reduce the chance of chrome discoloration.



EXHAUST PIPE REMOVAL

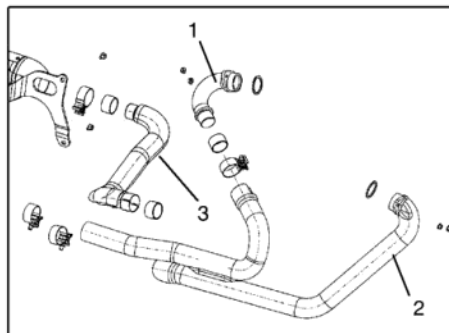
Touring Cruiser

1. Remove mufflers.
2. Loosen clamps on crossover pipe and rear cylinder exhaust manifold.
3. Remove flange nuts from front cylinder header pipe.
4. Remove exhaust header assembly.
5. Remove rear cylinder manifold flange nuts and manifold.
6. Remove all exhaust system gaskets and discard.

EXHAUST PIPE INSTALLATION

Touring Cruiser

1. Clean all mating surfaces and install new flange gaskets for header pipe (front cylinder) and manifold (rear cylinder).
2. Install rear manifold (1) with flange nuts snug (tight enough to keep gasket in place).
3. Install exhaust header pipe assembly (2) with rear manifold clamp, aligning rear pipe to manifold and front pipe flange to studs. Snug all fasteners.
4. Tighten flange nuts to 16 Nm (12 lb-ft.)
5. Torque manifold clamp to 61Nm (45 lb-ft.)
6. Install crossover pipe (3). Do not tighten clamps until mufflers are installed and alignment is established.
7. Install mufflers and tighten crossover clamps.



FRAME - BODY - EXHAUST SYSTEM

SADDLEBAG REMOVAL AND INSTALLATION - TOURING CRUISER

1. Remove the two (2) upper saddlebag mounting screws located inside the saddlebag.



1. Upper Mounting Bolts

2. Pull trim straight outward to expose wiring harness connector.



2. Remove Trim

3. Disconnect the wiring harness connector.



3. Disconnect Wire Harness

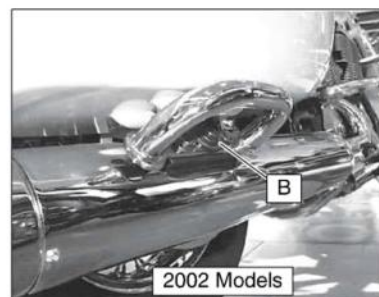
4. 2002 Models: Remove bolt from muffler bracket (photo).
2003-2004 Models: Disengage bracket on bottom of bag from muffler bracket and remove bag.

5. To reinstall the saddlebag, engage bottom of bag into bracket on muffler.

NOTE: Inspect plastic bushings in muffler bracket and replace if worn (2003-2004).

6. Reconnect the wire harness and trim, and install all spacers and fasteners in their original location.

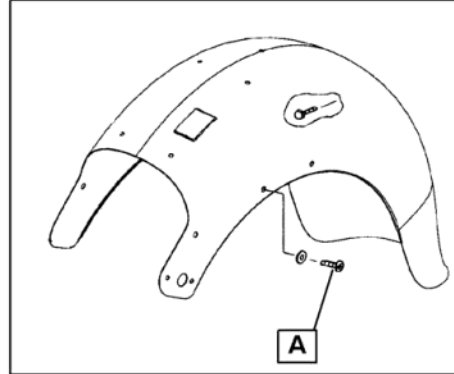
Saddlebag Fasteners:
Torque: 18 ft-lbs (25 Nm)



REAR FENDER REMOVAL & INSTALLATION

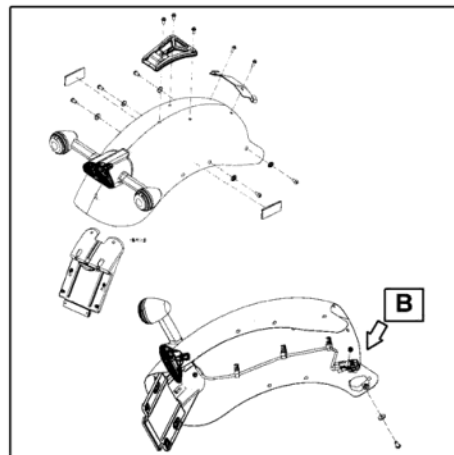
CLASSIC CRUISER

1. Remove seat. See page 3.4.
2. Remove frame side covers. See page 3.5.
3. Remove sissybar, saddlebags, and brackets (if applicable). See page 3.8.
4. Separate rear lights wiring harness connector.
5. Remove three screws (A) from each side of fender.
6. Remove fender.
7. Reverse steps for fender installation.
8. **Torque fender bolts and screws to 24 Nm (18 lb-ft).**



TOURING CRUISER

1. Remove seat. See page 3.4.
2. Remove frame side covers. See page 3.5.
3. Remove saddlebags. See page 3.8.
4. Separate rear lights wiring harness connector (B).
5. Remove (2) strut bracket screws from each side.
6. Remove one screw from each side of fender.
7. Remove fender.
8. Reverse steps for fender installation.
9. **Torque fender bolts and screws to: 24 Nm (18 lb-ft).**

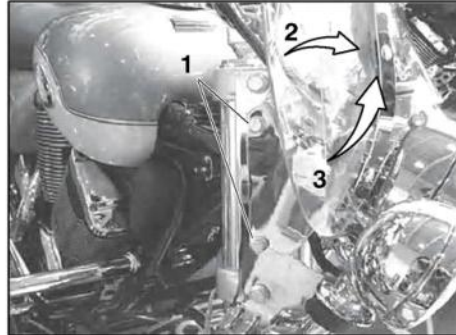


FRAME - BODY - EXHAUST SYSTEM

WINDSHIELD REMOVAL / INSTALLATION - TOURING CRUISER

Removal

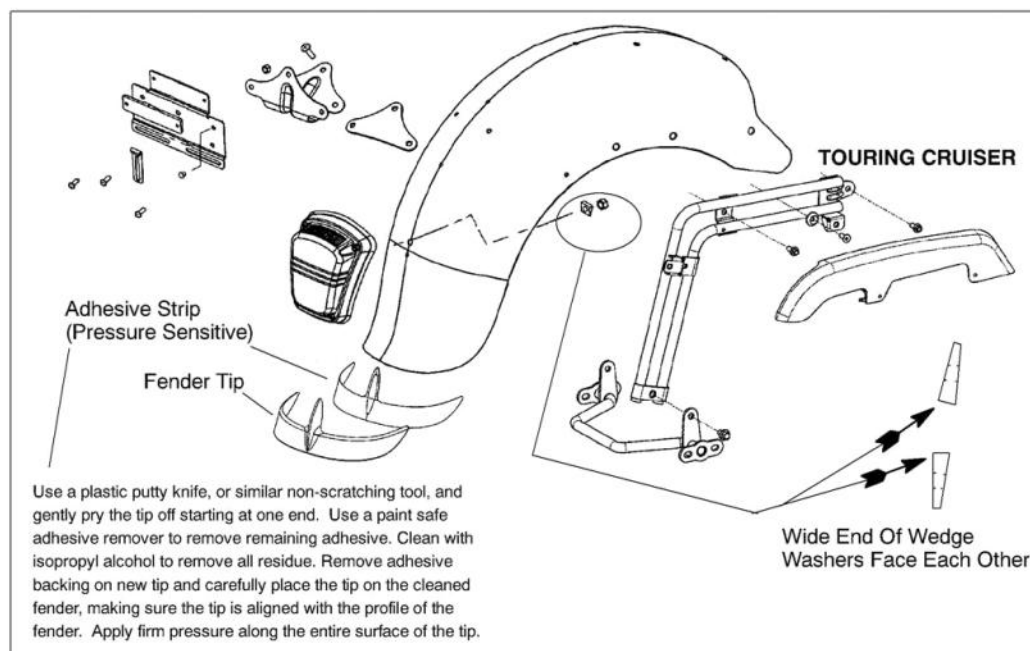
1. Loosen fasteners.
2. Move windshield forward.
3. Lift up to remove.



Installation

1. With fasteners loose, slide the bracket onto the lower bolts.
2. Tip windshield back until top fasteners are engaged in the slots.
3. Torque mounting bolts to 18-20 lb. ft. (25-28N-m)

TAIL LIGHT / REAR FENDER

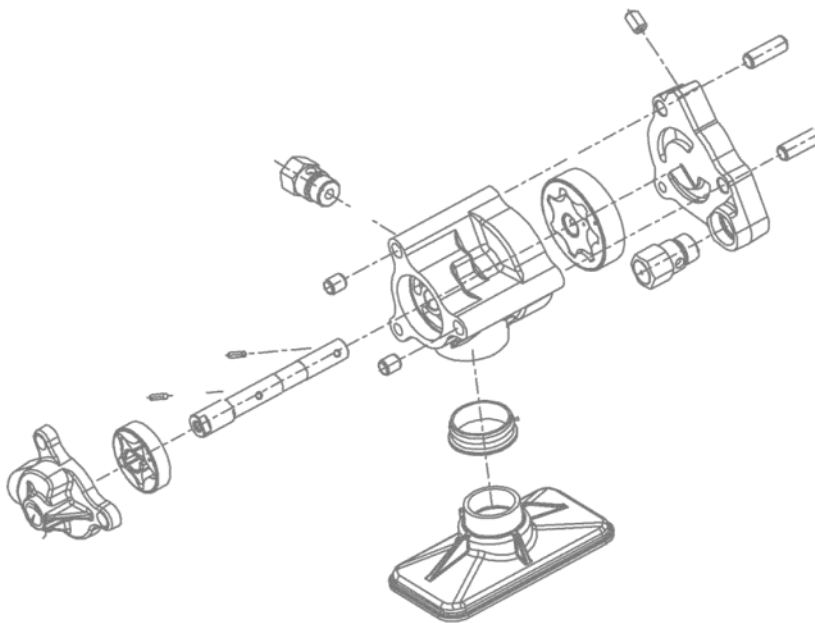


CHAPTER 4

LUBRICATION & COOLING

| | |
|----------------------------------|------|
| GENERAL | 4.1 |
| SPECIFICATIONS | 4.2 |
| SPECIAL TOOLS | 4.2 |
| TROUBLESHOOTING | 4.2 |
| OIL PRESSURE INSPECTION | 4.3 |
| OIL PUMP REMOVAL | 4.4 |
| OIL PRESSURE RELIEF VALVES | 4.5 |
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| OIL PUMP DISASSEMBLY | 4.8 |
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| OIL COOLER INSPECTION | 4.14 |
| OIL COOLER REMOVAL | 4.15 |
| OIL COOLER INSTALLATION | 4.15 |

4



GENERAL

The engine must be running in order to perform some of the procedures in this section. Read, understand and follow the warnings and cautions contained in this section.

 **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.

The engine must be removed from the frame and disassembled to access the oil pump. Use the troubleshooting charts contained in this chapter before removing and disassembling the engine.

Check oil pressure any time an engine is making objectionable noises that appear to be coming from rotating parts. Check oil pressure before the engine is disassembled for a visual inspection. Re-check oil pressure following the repair to verify the problem was corrected.

Unusual engine noises are typically associated with a lack of lubrication. Overheating may be caused by improper cooling (oil and/or air flow or oil cooler problem.) Technical troubleshooting skills will be needed to determine which system (or both) should be inspected. Record the oil pressure readings in the vehicle's service records for future reference.

LUBRICATION & COOLING

SPECIFICATIONS

| LUBRICATION & COOLING SYSTEM | | | |
|---|-------------------------|---|---|
| Item | | Standard | Service Limit |
| Engine Oil Capacity (After Disassembly) | | 6.1 Liters (6.5 U.S. qts) | Not Applicable |
| Engine Oil Capacity (At Change) Fill to full line with the engine at operating temperature. | | Approximately 5.2 Liters (5.5 U.S. qts) | Not Applicable |
| Recommended Engine Oil | | Victory 20W/40 for all operating temperatures. If Victory 20W/40 is not available, use a high quality 20W/40 motor oil rated SG or equivalent. DO NOT use oil additives of any kind. | Not Applicable |
| Oil Pressure @ 3000 rpm (Lubrication System) | | 552 kPa (80 psi) | Readings should be within 20% of the specifications. MINIMUM Pressure is 276 kPa (40 psi) |
| Oil Pressure @ 3000 rpm (Cooling System) | | 414 kPa (60 psi) | |
| ALL READINGS MUST BE TAKEN WITH ENGINE @ 82°C/180°F | | | |
| Oil Pump Clearances | Rotor Tip Clearance | .12mm (.005") | .20 mm (.008") |
| | Pump Body Clearance | .10 mm (.004") | .36 mm (.014") |
| | Pump End Clearance | .025 mm (.001") | .10 mm (.004") |
| | Cooling Rotor Width | 14.99 mm (.590") | 14.90 mm (.586") |
| | Lubrication Rotor Width | 9.99 mm (.393") | 9.90 mm (.389") |

| Fastener Torque Specifications - Lubrication & Cooling | | | |
|--|-----------|--|----------------------|
| Description | | Torque Nm | Torque lb-ft (in-lb) |
| Oil Pressure Sensor Loctite™ 565 or pipe sealant | | 6 | (50 in-lb) |
| Oil Temperature Sensor Loctite™ 565 or pipe sealant | | 13.5 | 10 lb-ft |
| Oil Filter - apply oil to filter o-ring | | 8Nm (72 in-lb) (Approximately 3/4 turn after sealing ring contacts case. | |
| Oil Drain Plug | 2002 | 38 Nm | 28 lb-ft |
| Replace drain plug washer or O-ring if damaged. | 2003-2004 | 27 Nm | 20 lb-ft |
| Oil Pump to Crankcase Bolts | | 10 | (85 in-lb) |
| Oil Pump Sprocket | | 10 | (85 in-lb) |
| Oil Manifold Screws to Cylinder Head | | 10 | (85 in-lb) |
| Oil Line to Cooler (for threaded line fitting) See page 4.14 | | 23 | 17 lb-ft |
| Oil Line Retaining Plate Screw to crankcase or cooler. See page 4.14 | | 10 | (85 in-lb) |
| Oil Line to Cylinder Head (retaining screw) | | 10 | (85 in-lb) |

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

TROUBLESHOOTING

| LOW OIL PRESSURE | HIGH OIL PRESSURE |
|---|---|
| Restricted oil filter, oil filter screen or passages Incorrect oil being used or low oil level Damaged o-rings or leaking piping or fittings Damaged or worn oil pump or oil pump drive Pressure relief valve stuck open Damaged engine bearings/excessive engine wear.4 | Incorrect oil being used Additives added to oil to increase viscosity Restricted oil passages Incorrect oil filter Pressure relief valve stuck closed |

4.2

LUBRICATION & COOLING

OIL PRESSURE INSPECTION

Oil pressure is inspected at one of two oil sensor locations shown. Check cooling oil pressure at the temperature sensor. Check lubricating oil pressure at the oil pressure sensor. Use caution when working around hot engine oil. See warnings at beginning of chapter.

1. Warm engine to operating temperature.
2. Stop the engine.
3. Remove oil pressure sensor (to check lubrication side) or temperature sensor (to check cooling side) and install oil pressure gauge.
4. Check engine oil using dipstick. Add recommended oil if necessary.
5. Start engine and check oil pressure at 3000 rpm.
6. If oil pressure is outside of specification, refer to the troubleshooting chart for possible causes.
7. Once testing is completed Apply thread sealant to the sensor and install.

Oil Pressure Sensor

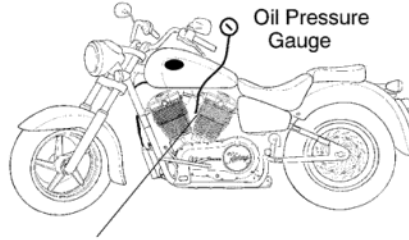
TORQUE: Pressure Sensor
6 Nm (50 in-lb)

Loctite™ 565 or pipe sealant

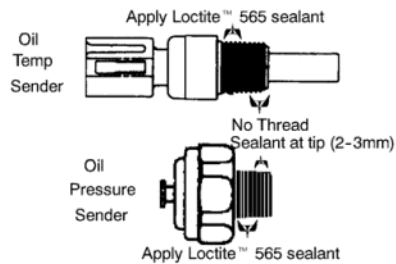
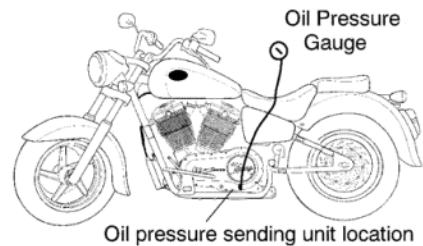
Oil Pressure Sensor

TORQUE: Temperature Sensor
13.5 Nm 10 lb-ft

Cooling System Oil Pressure Inspection



Lubrication System Oil Pressure Inspection

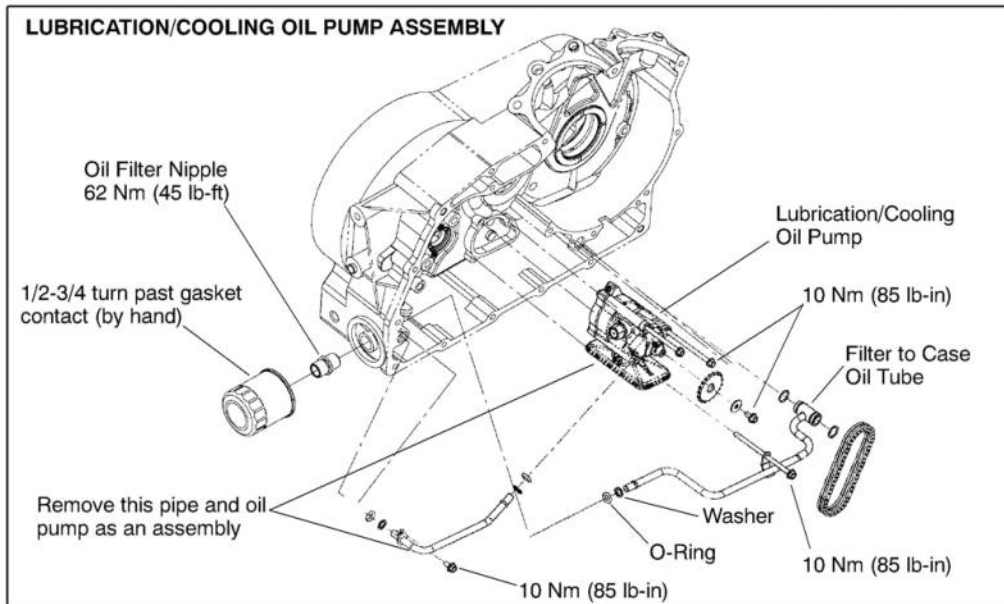


| Item | Standard | Service Limit |
|--|------------------|--------------------------------------|
| Oil Pressure @ 3000 rpm @ Pressure Sensor @ 82°C/180°F | 552 kPa (80 psi) | Standard ±20% |
| Oil Pressure @ 3000 rpm @ Temp. Sensor @ 82°C/180°F | 414 kPa (60 psi) | MINIMUM pressure is 276 kPa (40 PSI) |

NOTE: Extremely high oil pressure may indicate a system blockage. If oil pressure exceeds 100 PSI @ 82°C/180°F (Lubrication side or Cooling side) check the pressure relief valves on the oil pump.

LUBRICATION & COOLING

OIL PUMP REMOVAL



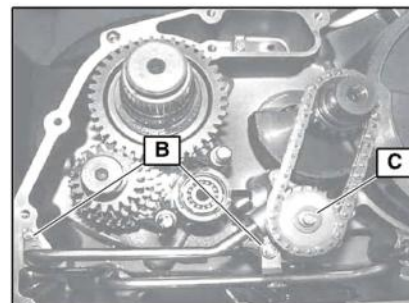
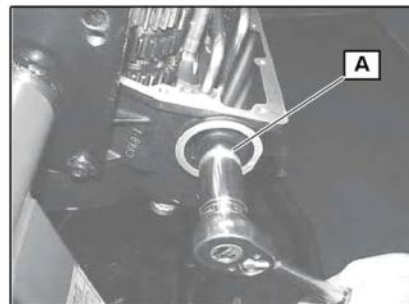
1. Remove engine from frame. (refer to ch 6)
2. Disassemble engine to access oil pump. (refer to ch 6-10)
3. Remove oil filter and nipple (fitting).
4. Remove retaining bolts for the oil tubes. There is a sealing washer and o-ring at each end of the oil tubes (B).
5. Remove oil pump drive sprocket bolt and sprocket (C).

NOTE:

The oil filter nipple **MUST** be removed to remove the long oil delivery tube. See photo at right.

The washers and/or o-rings for the oil piping may stay in the engine cases/oil pump body. Be sure to retrieve the used o-rings and washers and discard. Use new o-rings upon assembly.

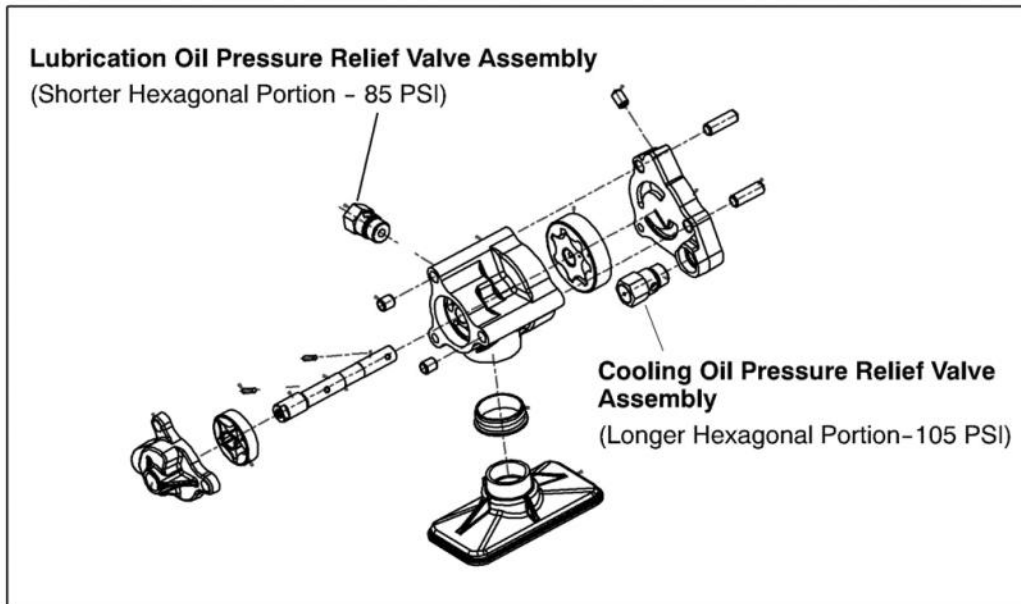
6. Remove oil pump mounting bolts. The oil pump mounting bolts also hold the oil pump body together.
7. Remove long oil tube.
8. Remove oil pump and oil tube together as a unit. Use caution not to drop any parts when removing oil pump from crankcase.



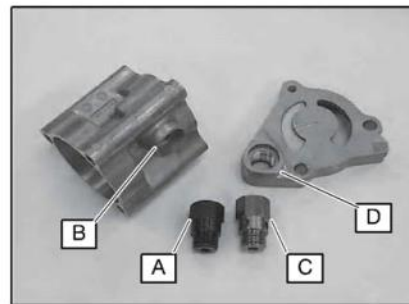
4.4

OIL PRESSURE RELIEF VALVES

The lubrication and cooling systems operate at different oil pressures, regulated by pressure relief valves. **The valves are not interchangeable.** Be sure to install each valve in the proper location on the oil pump. The lubrication pressure relief valve screws into the main oil pump body, and has a shorter hexagonal portion. The cooling pressure relief valve screws into the oil pump base, and has a longer hexagonal portion.



1. Remove the relief valves. The black lubrication relief valve (A) has a shorter hexagonal portion and screws into the pump BODY (B). The cooling pressure relief valve (C) has a longer hexagonal portion and screws into the pump BASE (D).
2. Visually inspect the relief valve for obstruction or unusual wear.
3. Follow assembly and torque procedure on following pages to reassemble.



LUBRICATION & COOLING

OIL PUMP INSPECTION

Inspect the oil pump when lubrication and/or cooling oil pressure is below specification. The oil pump assembly is actually two pumps in one. Follow the inspection directions below for the lubrication and cooling oil pumps. Measure pump clearances to determine if pump is worn beyond the service limit and must be replaced, or if low oil pressure is caused by excessive clearance(s) elsewhere in the pressure side of the system(s).

Some of the internal components of the oil pump look similar but are not identical. The parts are not interchangeable. Keep the pump components separate during disassembly and inspection to ensure parts are assembled correctly.

Replace any worn or damaged components. Measure clearances before assembling the engine.

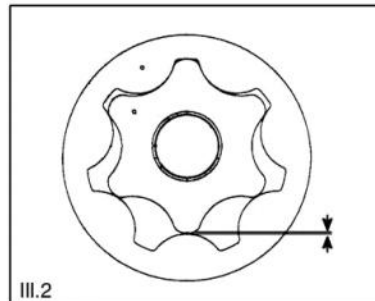
Before disassembling pump completely, follow these inspection steps.

1. Remove the lubrication side end cap.



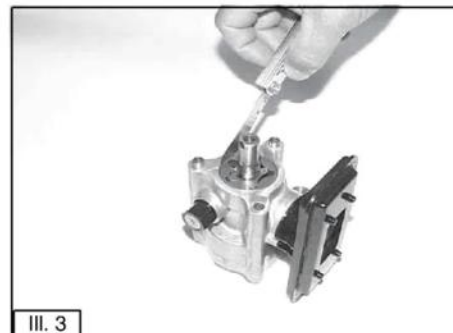
2. Measure the pump rotor tip clearance. (Ill. 2)

Specification: Service limit 0.20mm (.008in)



3. Measure the pump body clearance using a feeler gauge as shown. Lubrication side of pump is shown in Illustration 3.

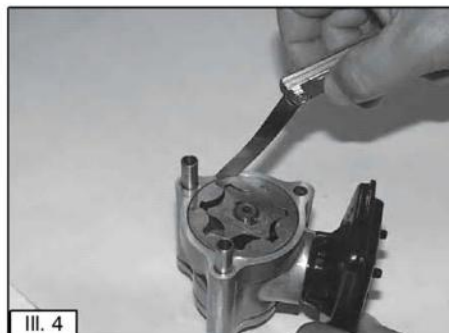
Specification: Service limit 0.36mm (.014in)



OIL PUMP INSPECTION (Cont.)

4. Remove the pump base and measure the pump body clearance on the cooling side of the pump using a feeler gauge as shown.

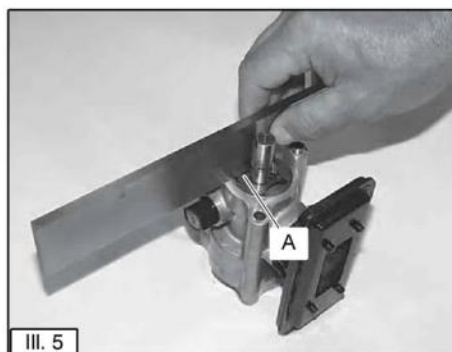
Specification: Service limit 0.36mm (.014in)



5. Measure the oil pump end clearance with a feeler gauge at point "A". Lubrication side of pump is shown in Illustration 5. Cooling side is measured in the same manner.

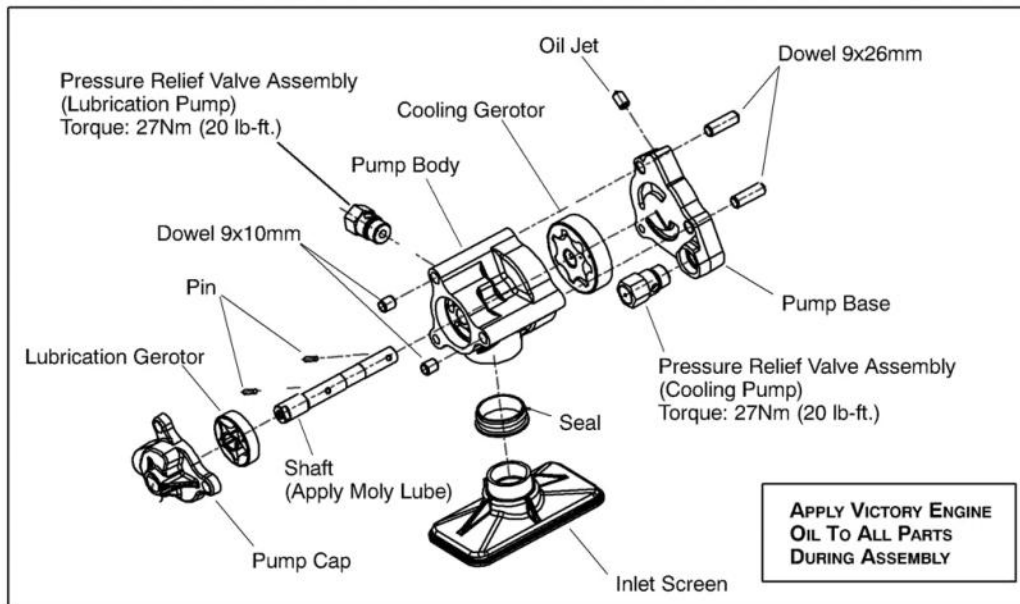
Specification: Service limit 0.10mm (.004in)

If the clearance is too tight, lightly sand the rotor using 600 grit sandpaper on a surface plate to remove any burrs. Thoroughly clean the rotor of metal shavings after sanding, reassemble, and inspect end clearance.



LUBRICATION & COOLING

OIL PUMP DISASSEMBLY



1. Remove cooling outer gerotor.



2. Push on cooling pump end of shaft to allow pin to be removed from lubrication rotor. Pull lubrication rotor back to expose pin and remove pin.
3. Push shaft back toward cooling end of pump and remove pin from cooling rotor.
4. Pull shaft with lubrication rotor from pump.
5. Clean all parts and inspect for wear.
6. Dry with compressed air.

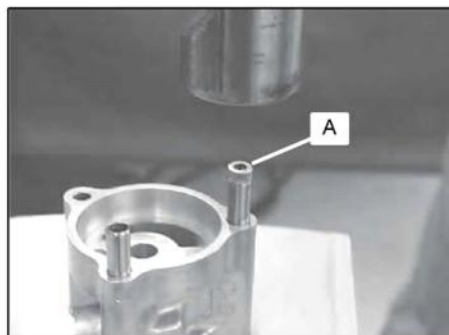


4.8

OIL PUMP ASSEMBLY



1. Press short dowel pins into lubrication side of pump body using an arbor press and a 6mm allen head screw (A) for an arbor.
2. Press long dowel pins into cooling side of pump body using same method as above.



3. Secure pump body in a soft jaw vise. Apply Victory engine oil to threads of lubrication pressure relief valve and install into pump body. The lubrication relief valve has a shorter hexagonal portion than the cooling relief valve.

Torque to 27 Nm (20 lb-ft.)



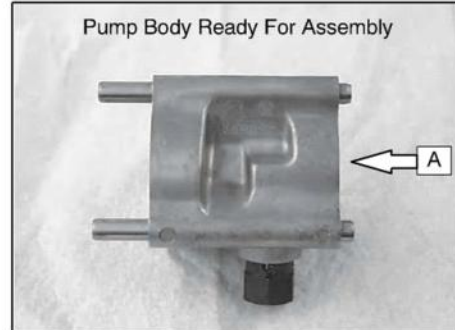
4. Assemble lubrication gerotor on pump shaft.
5. Lubricate shaft with Victory moly assembly grease (starter drive grease) PN 2871460.



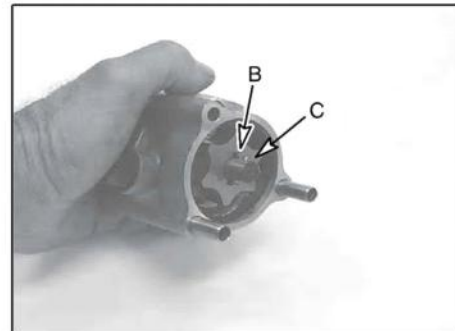
LUBRICATION & COOLING

OIL PUMP ASSEMBLY (cont.)

6. Insert pump shaft/rotor assembly into pump body in direction shown (A).



7. Lubricate and install the cooling gerotor with pin slot (B) facing OUT.
8. Insert pin (C) into shaft on cooling side.
9. Push shaft inward while rotating to align pin and slot.



10. Install outer gerotor.



11. Push shaft toward lubrication side and hold in place. Install pin for lubrication rotor. Lubricate both gerotors with oil.

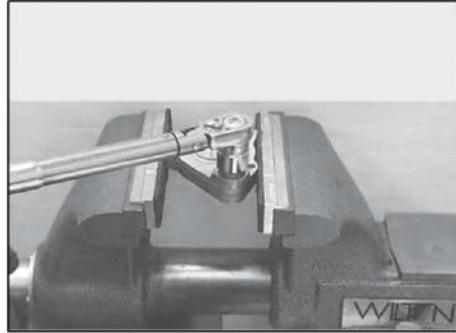


4.10

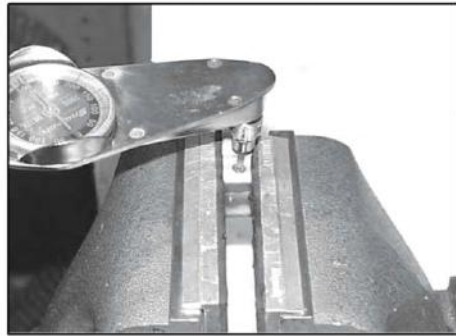
OIL PUMP ASSEMBLY (cont.)

12. Secure pump base in a soft jaw vise. Apply Victory engine oil to threads of cooling pressure relief valve and install into pump base. The cooling relief valve has a longer hexagonal portion than the lubrication relief valve.

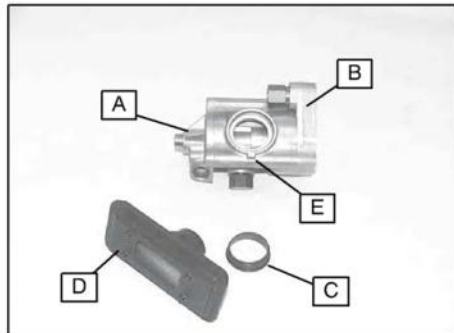
Torque to 27 Nm (20 lb-ft.)



13. Install oil jet to oil pump base.
Torque to 13 Nm (115 lb-in.)



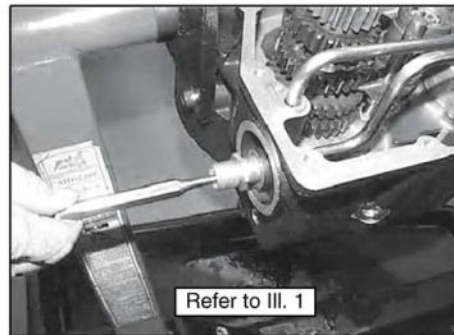
14. Lubricate pressure relief valve assemblies and both lubrication and cooling gerotors with engine oil.
15. Install body cap (A) and base (B) to pump.
16. Install oil inlet seal (C) to inlet screen (D).
17. Lubricate seal with oil and assemble to oil pump body, aligning groove in screen to tab on pump body.



LUBRICATION & COOLING

OIL PUMP INSTALLATION

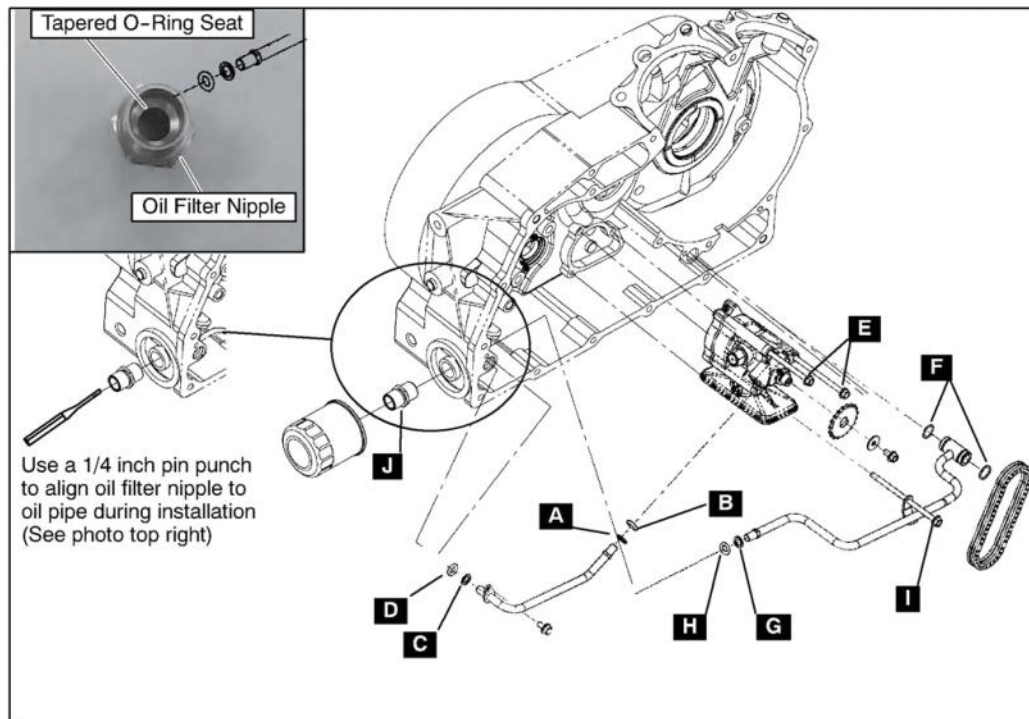
1. Clean oil pipes and dry with compressed air.
2. Install washer (A) and lightly greased O-ring (B) onto short oil pipe. Insert pipe into pump body with a twisting motion.
3. Place washer (C) onto oil pipe followed by a new lightly greased o-ring (D).
4. Install oil pump and short pipe into left crankcase. Start by inserting the oil pipe into case. Position the pump into the crankcase alignment holes.
5. Start the top two oil pump retaining bolts (E) (do not tighten at this time).
6. Install new lightly greased o-rings (F) onto the front of the long oil pipe. Install washer (G) on the end of the pipe and a new o-ring (H) (hold in place with a small amount of grease.)
7. Install the pipe with retaining bolt (I), fitting the front end of the pipe into position on the crankcase and the rear through the oil filter boss.
8. Install oil filter nipple. See note below.
9. Torque oil pump and oil pipe clamp retaining bolts to specification.



TORQUE: Oil Pump Bolts
Oil Tube Bolts
10 Nm (85 in-lb)

NOTE:IMPORTANT ASSEMBLY NOTE

The oil filter nipple **MUST** be removed to install the long oil pump delivery pipe. With pipe installed, use a pin punch or similar tool to align the oil filter nipple with the oil pipe. Install the nipple carefully, with tapered side of nipple toward the crankcase (oil pipe).



4.12

OIL PUMP INSTALLATION (cont.)

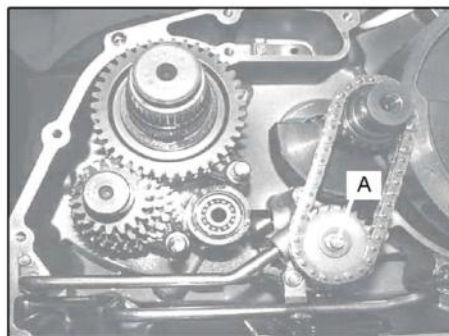
10. Temporarily install the pump sprocket and turn the oil pump over by hand.

NOTE: Turn pump shaft by hand to make sure it turns.

11. Remove the sprocket.
12. Install drive chain on sprocket and assemble. Torque the sprocket retaining bolt to specification.

TORQUE:

10 Nm (85 in-lb)

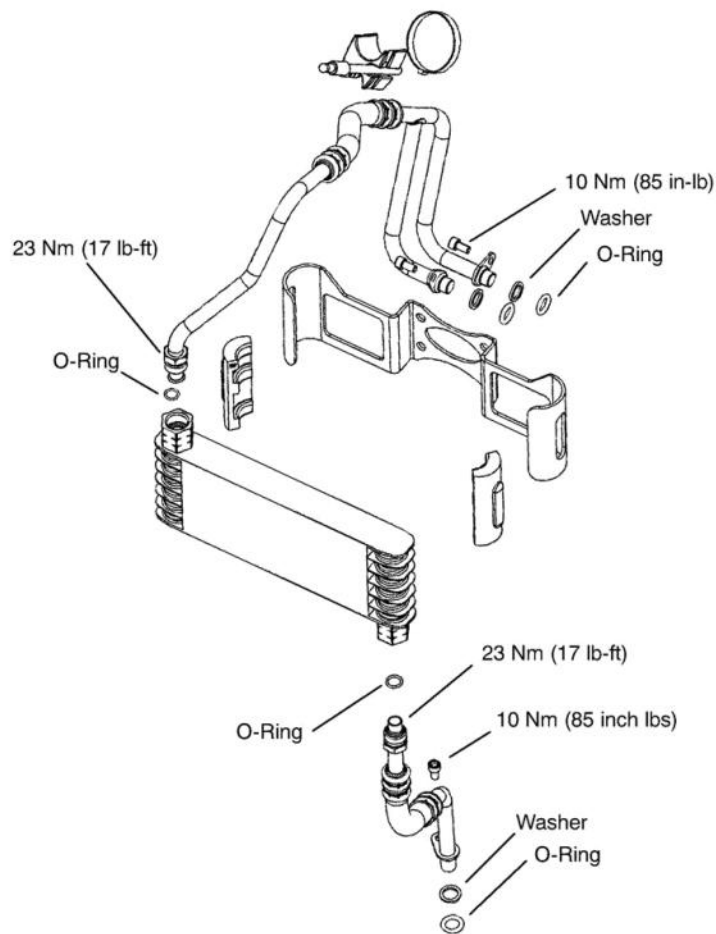


13. Refer to chapter 10 for crankcase assembly.
14. Inspect oil pressure following engine assembly and installation to ensure it is within specification. Refer to page 4.3.

LUBRICATION & COOLING

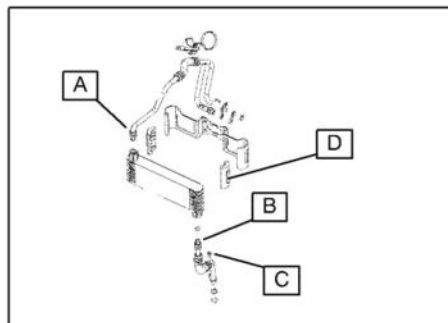
OIL COOLER INSPECTION

1. Inspect oil cooler, oil lines, and all connections for leaks.
2. Inspect oil lines for proper routing and replace if there is any sign of abrasion or damage.
3. Inspect oil cooler surface for obstructions, clean as necessary.
4. Inspect oil cooler fins for deformation. Fins can be straightened if not severely deformed and no oil leaks are present.
5. Inspect oil cooler mounting fasteners for proper torque and inspect mounting bracket and rubber grommets for cracks or damage.
6. Replace damaged components.



OIL COOLER REMOVAL

1. Place drain pan beneath oil cooler.
2. Remove top oil pipe from cooler (A).
3. Remove lower (left side) oil pipe from cooler (B) or remove it from crankcase by removing the retaining plate screw (C).



4. Lubricate rubber mounts (D) with silicone spray. Push downward on cooler and carefully remove from bracket.



OIL COOLER INSTALLATION

1. To install oil cooler, reverse removal procedure steps. Torque oil lines to specification (Refer to Page 4.14). Lubricate fitting threads with engine oil.

CHAPTER 5

FUEL SYSTEM / FUEL INJECTION

| | |
|--|------|
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| EVAPORATIVE EMISSIONS ROUTING, STD, DLX, CLASSIC | 5.4 |
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| FUEL PUMP REMOVAL | 5.10 |
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
5

GENERAL

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 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

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!

NOTE:

If the motorcycle will be stored for one month or longer, treat the fuel with fuel stabilizer according to the instructions listed on the product.

Victory Fuel Stabilizer: 2870652

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.

- For fuel tank removal and installation, refer to page 5.8.
- If a new fuel pump is installed or if tank is run completely dry, prime the fuel system. See page 5.18.
- Note the location of all o-rings and gaskets and sealing washers. Replace all o-rings and gaskets sealing washers encountered during fuel injection service.
- If the throttle body is removed, cover the inlet tracts with a clean shop towel to prevent foreign debris from entering the engine. Remove the shop towel before reinstalling the throttle bodies.
- Always verify proper routing of hoses and wiring. Hoses should be routed smoothly without kinks or sharp bends, and away from exhaust and other hot engine components. Be sure protective shields are in place and secured properly.
- Before removing a fuel injector, clean the area around the injector body with compressed air to reduce the chance of debris entering the engine.

FUEL SYSTEM / FUEL INJECTION

SPECIFICATIONS

| FUEL SYSTEM | |
|-----------------------------------|--|
| Item | Specifications |
| Fuel Pump Pressure | 3.37 BAR (338 kPa) (49 psi) |
| Fuel Pump Volume | 45 liters/hr 325 ml/30 seconds (11 oz./30 seconds) (0.165 gal/min.) |
| Idle Speed | 1000 rpm \pm 50 rpm |
| Throttle Grip Free-Play | 3-6 mm (1/8"-1/4") |
| Fast Idle Lever Free-Play | 3-6 mm (1/8"-1/4") |
| Fast Idle Speed | 2000 RPM |
| Fuel Pump Amp Draw | 5 amps maximum @ 13.8 VDC |
| Recommended Octane | 92 Octane Minimum |
| Recommended Fuel Storage Additive | Victory Fuel Stabilizer 2870652 |

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

TROUBLESHOOTING

IMPORTANT:

Although every effort is made to compile a comprehensive chart, no chart can take the place of a methodical diagnostic process. Fuel injection problems may include (but are not limited to) the items listed in the troubleshooting charts. Avoid the temptation to "just start replacing parts" and hope that the problem will be corrected.

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. Exhaust leaks can cause inaccurate Lambda readings
4. Engine mechanical condition (compression). Check and compare to specifications on page 2.23.
5. Corroded or disconnected wiring or poor ground connections - be sure they are clean and tight.
6. Exhaust system restriction or improper exhaust.
7. Contaminated or improper fuel.
8. Restricted fuel flow / filters (low fuel pressure).
9. Fuel tank vent line pinched or obstructed.
10. Faulty spark plug(s).
11. Incorrect TPS calibration.

NOTE: Exhaust evacuation systems (workshop ventilation hoses) that are connected directly to the exhaust muffler can affect Lambda readings. Be sure to review TPS Calibration procedure completely prior to performing the procedure.

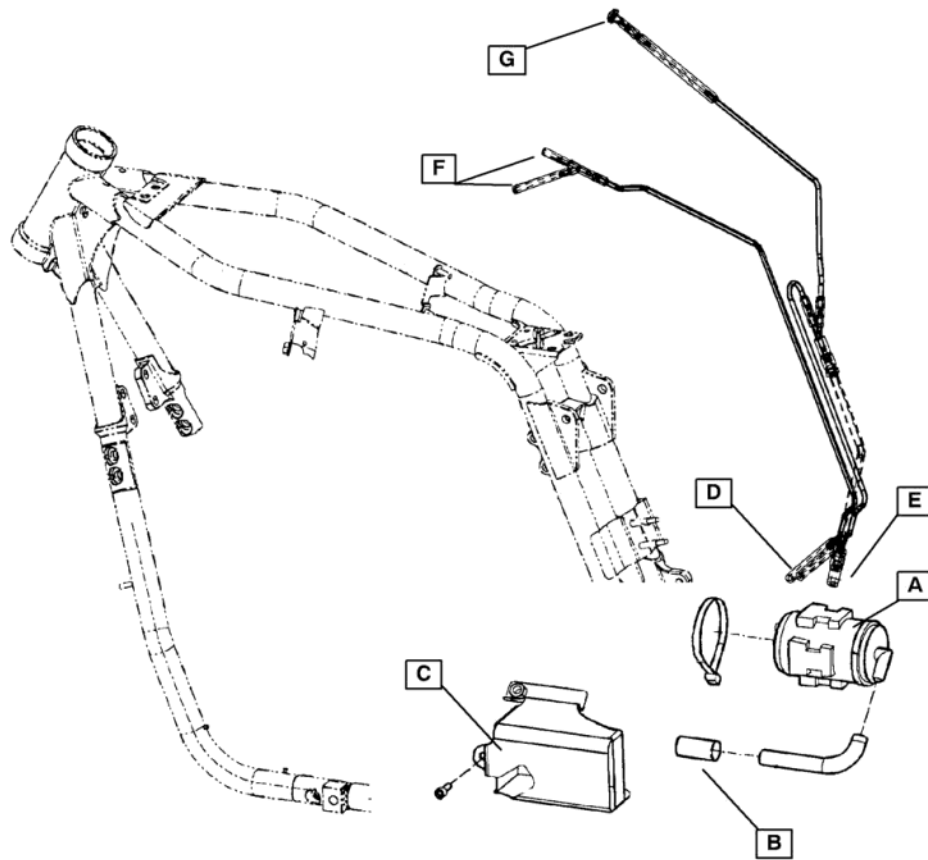
NOTE: Also refer to page 5.49 through page 5.52 for more troubleshooting information.

5.2



FUEL SYSTEM / FUEL INJECTION

EVAPORATIVE EMISSIONS ROUTING - CLASSIC CRUISER



Canister and tank located on frame
at left rear of engine

- A) Activated Charcoal Filter Canister
- B) Vent Line Filter
- C) Tank
- D) Connect To PURGE Fitting On Canister
- E) Connect To TANK Fitting On Canister
- F) Connect To Orifice On Throttle Body
- G) Connect To Fuel Tank Vent

5.4

FUEL INJECTION SERVICING PROCEDURES

CAUTION

While electronic fuel injection is very durable and reliable, the components can be easily damaged or problems can be introduced if the following precautions are not adhered to.

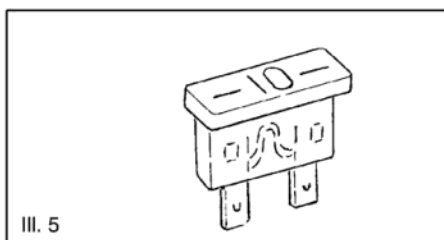
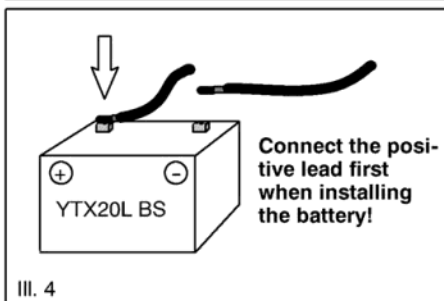
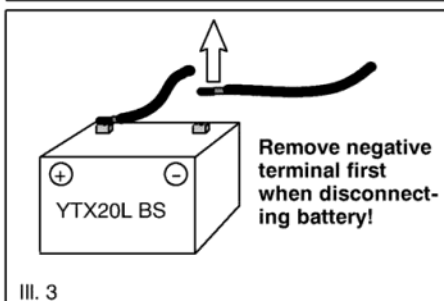
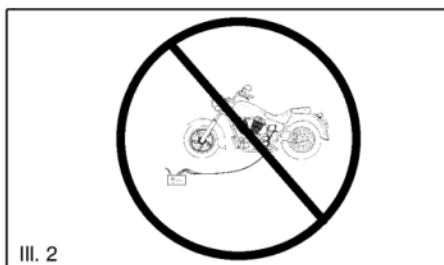
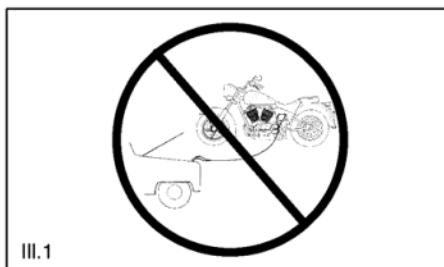
It is not advisable to "jump start" the machine with another battery. Although problems are unlikely to occur if everything is done carefully, the possibility of permanent damage to expensive electrical component exists. III. 1.

Never charge the battery while it is connected to the machine. III. 2. Never disconnect the battery while the engine is running.

Pay special attention when connecting the battery terminals. Inadvertently reversing the connections will permanently damage the ECM. Disconnect the negative battery lead first whenever removing the battery from the motorcycle. Connect the positive battery lead first when installing the battery.

Before disconnecting or connecting electrical connections, be sure the key switch is off. An even better practice is to disconnect the battery when disconnecting or connecting electrical connections.

Fuses protect critical electrical components and circuits. Investigate the cause, repair the problem, then replace the fuse. Never replace the fuse with a larger value fuse or "jumper" the fuse with wire, aluminum foil or any other means. III. 5.



FUEL SYSTEM / FUEL INJECTION

FUEL INJECTION SERVICING PROCEDURES

The ECM is a sensitive piece of electronic equipment. Dropping it or hitting it may cause irreparable damage. This is also true for the sensors used on the system. III. 1.

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. III. 2.

Anti-static wrist strap PV-43541

CAUTION

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

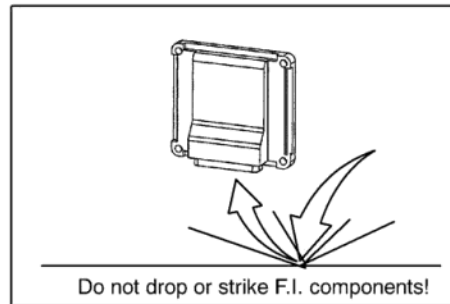
Always use the proper adapter from the Connector Test Adapter Kit when probing the terminals. Most of the connectors are sealed and cannot be back probed. Be extremely careful not damage the connectors by forcing meter probes into the connectors. III. 3.

Connector test adapter kit PV-43536

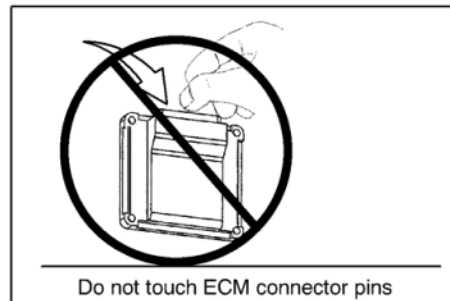
Poor connections are the most common cause of Electronic Fuel Injection malfunctions. Inspect connector and wiring connections carefully during troubleshooting.

Anti-static wrist strap PV-43541

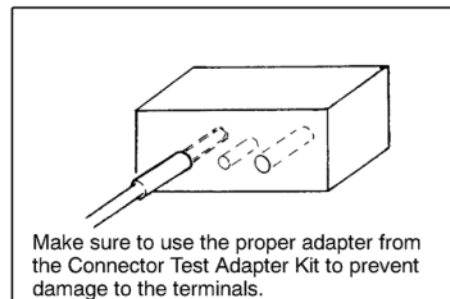
Carefully inspect the connections of the failed circuit before doing any other troubleshooting steps. Wire terminals should be corrosion free and fully seated into the connectors. Connector should snap together and lock. Replace connectors that do not snap and lock together. III. 4.



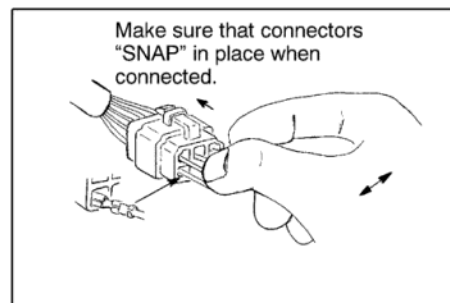
III. 1



III. 2



III. 3

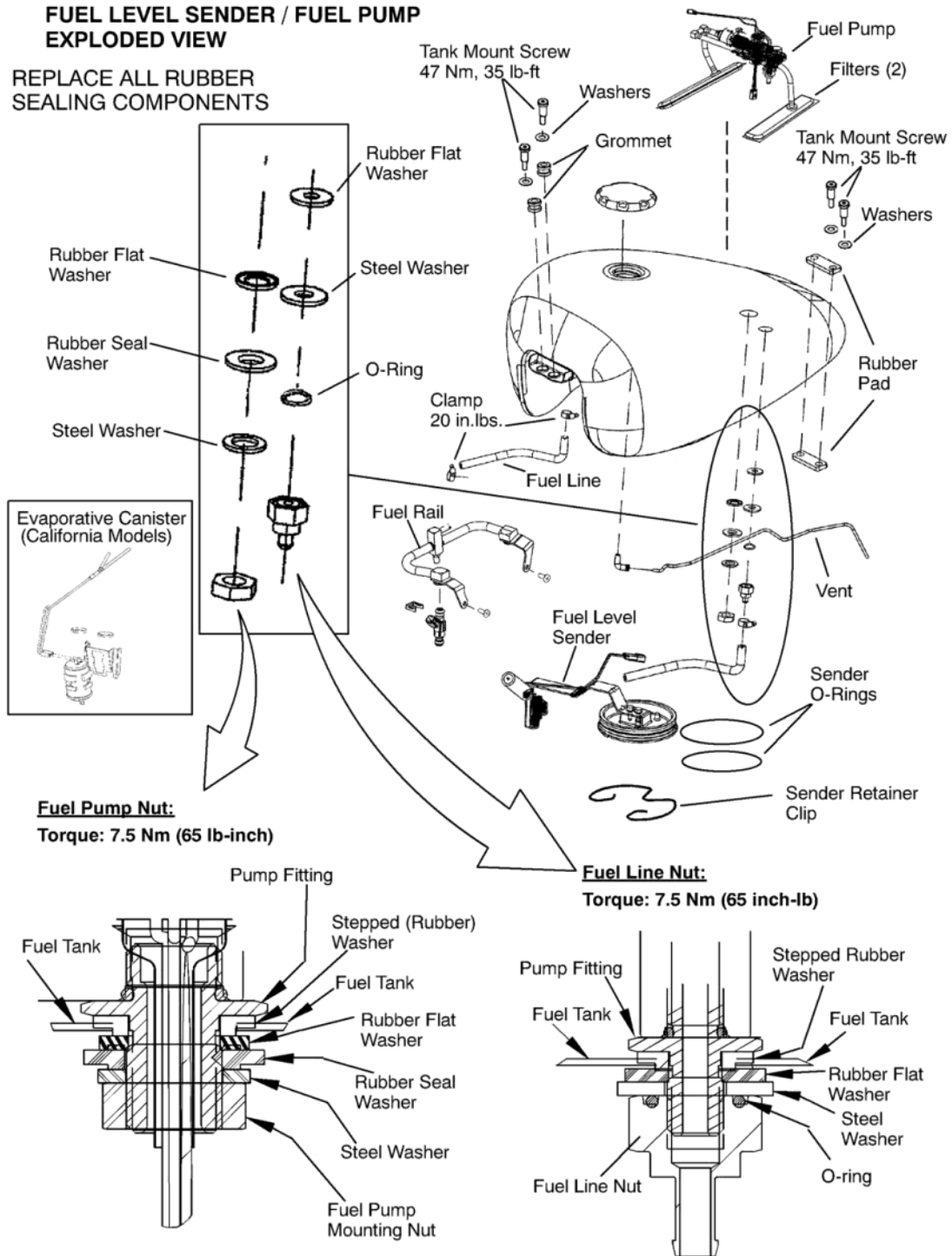


III. 4

FUEL SYSTEM / FUEL INJECTION

FUEL LEVEL SENDER / FUEL PUMP EXPLODED VIEW

REPLACE ALL RUBBER
SEALING COMPONENTS



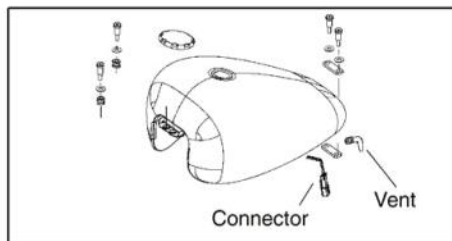
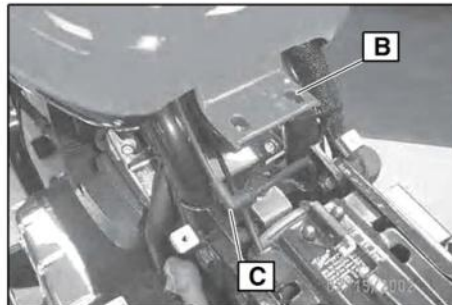
FUEL SYSTEM / FUEL INJECTION

FUEL TANK REMOVAL

CAUTION:

Review gasoline warnings on page 5.1. Fuel tank finish can be damaged if care is not taken when removing, storing, and installing fuel tank.

1. Remove seat and side covers (page 3.4).
2. Remove two (2) screws at front of fuel tank (A).
3. Remove two (2) screws from rear fuel tank (B).
4. Position front wheel straight ahead to gain adequate clearance between tank and triple clamps.
5. Lift rear of tank 2-3 inches above frame and support.
6. Disconnect vent line from coupler fitting (C) at rear of tank on the left side.
7. Disconnect fuel level sensor / fuel pump wiring harness, accessible under the rear right side of fuel tank. Use a small screwdriver to release the connector locking tab.



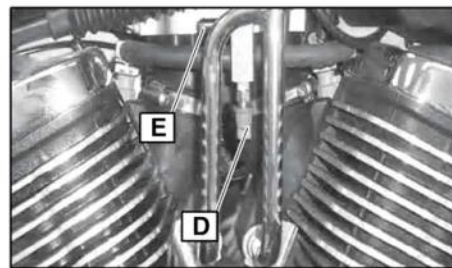
CAUTION:

Remove cap (D) from bleed valve on fuel rail. Wrap a clean rag around fitting and depress center of bleed valve to relieve pressure on fuel line.

CAUTION:

Protect fuel tank from damage with a soft cloth or pad when installing tank mounting bolts.

8. Loosen clamp and remove fuel line from fuel rail fitting (E). A small amount of fuel will drain from fuel line. Catch in an appropriate container or a shop towel.
9. Remove the fuel tank.
10. Place fuel tank in a safe area and cover with a soft, protective covering so the finish will not be damaged.



FUEL LEVEL SENDER REMOVAL

CAUTION:

Review gasoline warnings on page 5.1. Refer to fuel system detail view on page 5.7. Fuel tank finish can be damaged if care is not taken when removing, storing, and installing fuel tank.

1. Drain Fuel from tank.
2. Invert tank and place on a soft protective mat.
3. Remove vent line (A) and fuel line (B). Note position and orientation of fuel line to ensure proper assembly.
4. Remove fuel sender retaining ring (C).
5. Be sure the sender alignment tab (D) is positioned in the center of the notch in tank.

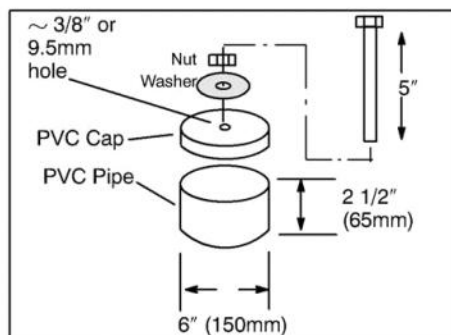
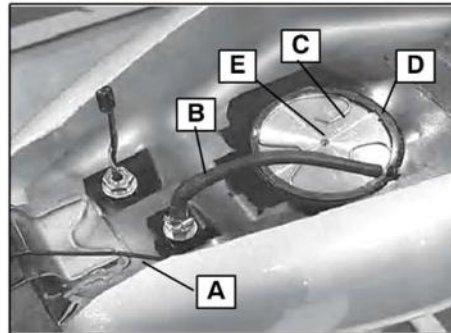
NOTE: There are many methods that can be used to remove the fuel sender. All methods involve the use of the 8x1.25mm hole (E) in the center of the sender.

Use Special tool 2872621. Adjust the legs to or...

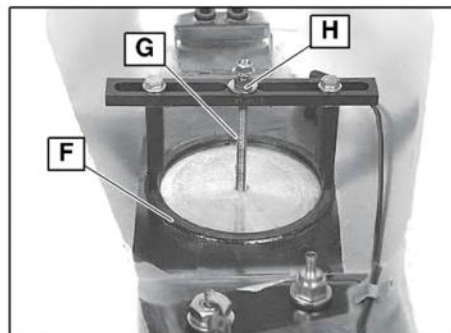
An extractor can be made using a 2 1/2 inch length of 6 inch diameter PVC pipe as shown at right.

or...

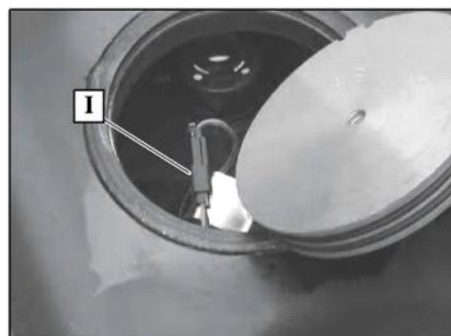
Use a slide hammer with an 8x1.25 bolt attached. Have an assistant hold the tank down to prevent damage.



6. Place the special tool (2872621) on the tank with legs adjusted to the diameter of sender flange (F). Install an 8mm bolt, nut, and washer through the center opening in tool as shown. Screw the bolt (G) into sender. Slowly turn nut (H) toward tool to draw sender out of tank. Be sure the tab at front of sender does not catch in the locating slot or on any part of the tool as you remove the sender. If you are using the PVC pipe, keep it centered on the fuel sender opening. Draw the sender out of the tank until O-rings on sender cap are clear of the tank.



7. Carefully move sender until wire connector (I) is exposed. Use care not to bend the float arm when removing the sender assembly.
8. Place a plastic tie strap around the pump side of wire harness connector to make installation easier.
9. Disconnect wire connector and carefully remove sender from tank. Be careful not to bend or damage float arm. Refer to sender testing on page 5.16.



FUEL SYSTEM / FUEL INJECTION

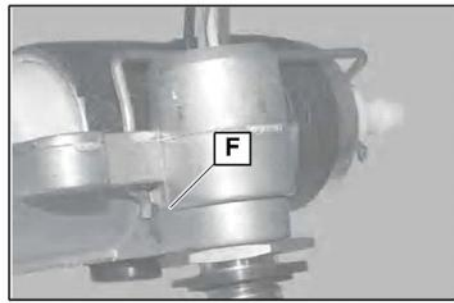
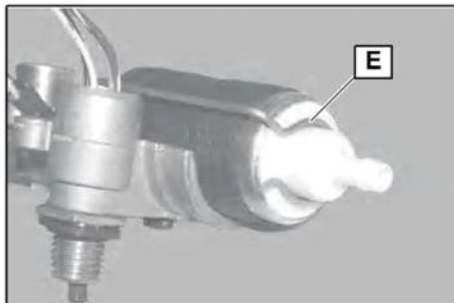
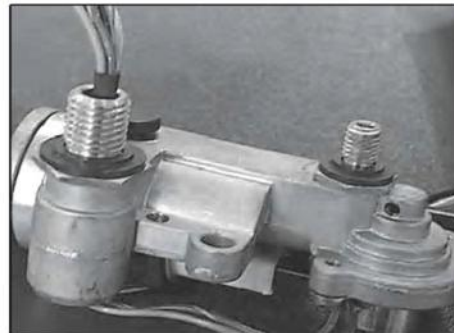
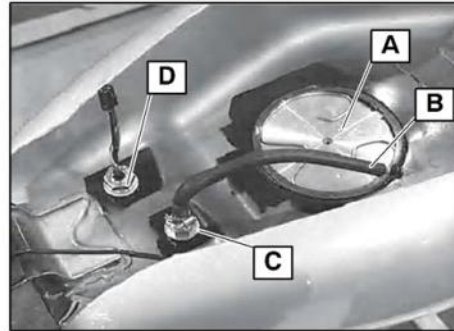
FUEL PUMP REMOVAL

CAUTION:

Replace all sealing washers and O-rings upon assembly!

Review gasoline warnings on page 5.1. Fuel tank finish can be damaged if care is not taken when removing, storing, and installing fuel tank.

1. Refer to detail views on page 5.7, and note position of washers, O-rings and hardware during disassembly.
2. Remove fuel level sender (A) (page 5.9)
3. Loosen fuel line clamp and remove line (B). Note orientation of line for assembly.
4. Remove fuel line fitting (C) and washers.
5. Remove pump mounting nut (D) and washers.
6. Carefully remove fuel pump through fuel sender opening.
7. Be sure retainer clip ring (E) is positioned properly on the pump outlet, and leg of retainer is engaged in hole on pump body (F).

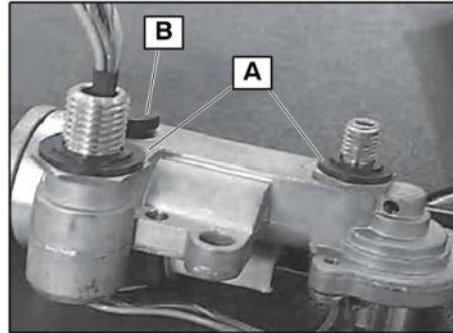


FUEL PUMP INSTALLATION

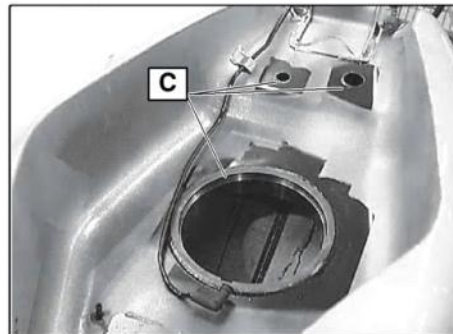
CAUTION:

Replace all rubber sealing parts upon assembly.

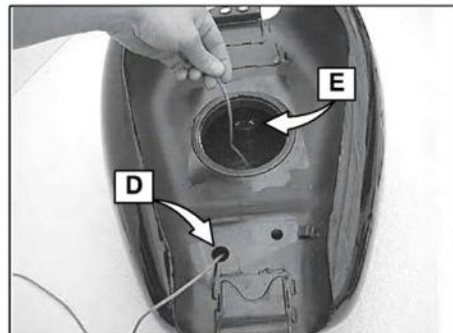
1. Be sure stepped rubber washers (A) are installed as shown at right with inner shoulder facing up, toward threads of pump mount and fuel supply nozzle.
2. Install support button on pump (B).



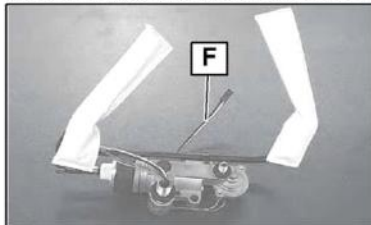
3. Prepare fuel tank for assembly by thoroughly cleaning all sealing surfaces (C).



4. Feed a coated wire into tank through the fuel pump wire hole (D) and out through the sender opening (E).
5. Attach the "E" end of the wire to the fuel pump wiring connector to ease routing of wires through tank.



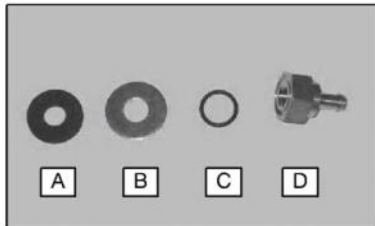
6. Before installing pump, be sure fuel sender wire harness (F, below) is pointing toward front of the tank and accessible after pump is installed. Install fuel pump through sender opening as shown.



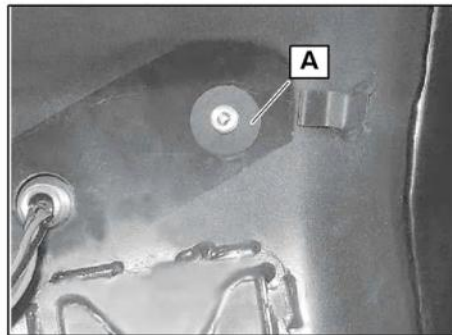
FUEL SYSTEM / FUEL INJECTION

FUEL PUMP INSTALLATION (cont.)

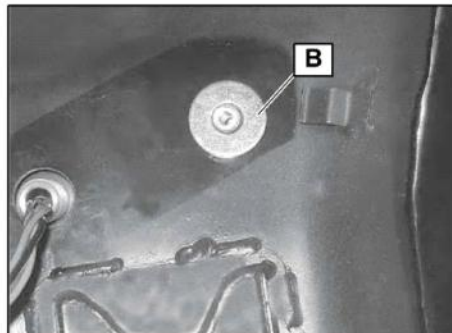
7. Refer to photo below and photos at right. Carefully pull wire harness through tank and position pump as shown with stepped grommets centered in holes and flush with the tank surface.



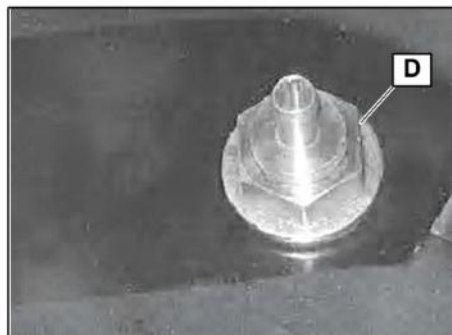
8. Hold pump in place with wires and install flat rubber washer (A) on fuel supply fitting...



9. the flat steel washer (B)...

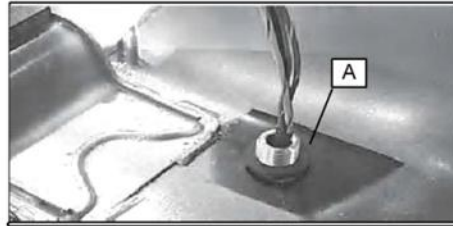


10. and the the fuel line fitting (D) with O-ring (C, top left photo) installed in groove on fitting. Tighten finger tight to hold in place.

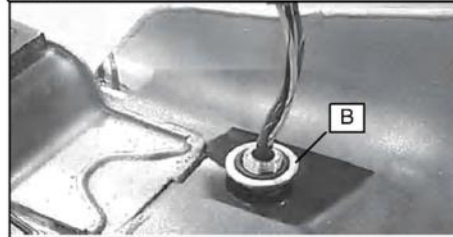


FUEL PUMP INSTALLATION (cont.)

11. Install the flat rubber washer (A) on fuel pump fitting.



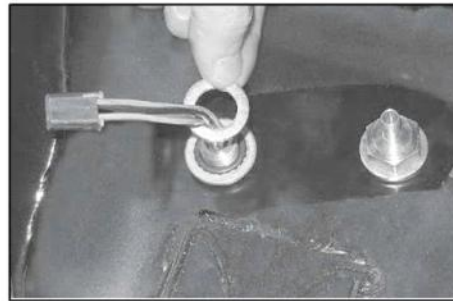
12. Screw the sealing washer (B) onto the fitting with a clockwise rotating motion until seated against rubber washer.



CAUTION:

Do not push the sealing washer into place on the fitting or the rubber sealing surface on washer may be damaged. Turn the washer in a clockwise direction onto fitting so seal portion follows threads of fitting.

13. Install the flat washer and nut. Tighten nut finger tight to hold in place.



14. After installing nut, fold wires as shown so fitting can be torqued with a standard deep well socket.



15. Torque fuel pump nut and fuel fitting to specification.

TORQUE: Fuel Pump Nut & Fuel Line Fitting

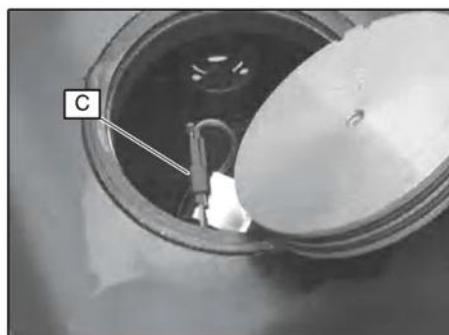
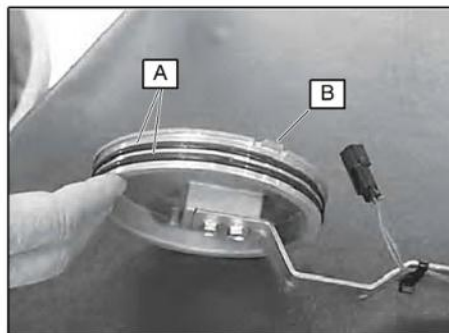
7.5 Nm (65 lb-inch)



FUEL SYSTEM / FUEL INJECTION

FUEL LEVEL SENDER INSTALLATION

1. Install new O-rings (A) and lubricate with a light film of Victory All Purpose Grease.
2. Install sender in tank.
3. Connect wire connector (C) to fuel pump harness.
4. Orient fuel sender so tab (B) aligns with notch in tank.
5. Press sender evenly into tank as far as possible by hand.
6. Tap fuel sender with a rubber mallet, keeping sender square with opening until fully seated.



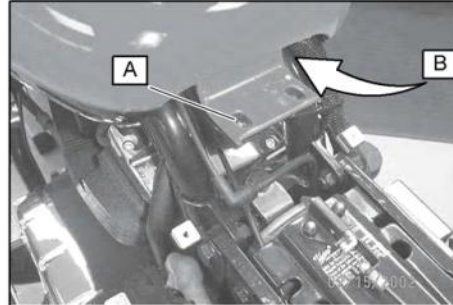
7. Install retaining ring (D). Be sure retaining ring is fully seated in the groove.
8. Verify fuel level sender float is free to move through operating range by performing fuel sender test on page 5.15.
9. Install the fuel tank. See page 5.17.
10. Prime the fuel system. See page 5.18.



FUEL SENDER RESISTANCE TEST (FUEL TANK INSTALLED)

The fuel level sender is located inside fuel tank. The sender can be tested using a digital multimeter with the fuel tank empty or full. Resistance readings obtained with the tank installed will be in proportion to the amount of fuel in the tank. The sender connector is located near the right rear side of the fuel tank.

1. Remove two (2) screws from rear fuel tank (A).
2. Loosen (2) mounting screws at front of tank.
3. Carefully raise and support rear of tank to access connector (B) Disconnect fuel pump / level sender connector.
4. Set multimeter to measure resistance.

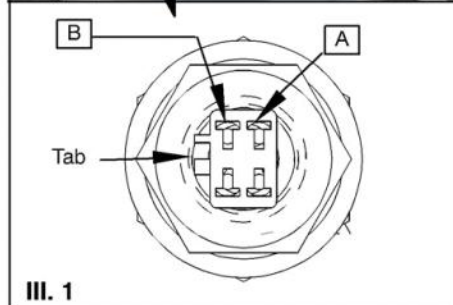


5. Refer to photo and III. 1 (below, right) to identify pins A (yellow/ red wire) and pin B (black wire) in reference to the lock tab.
6. Connect the meter leads to pin A and pin B of the 4 pin fuel sender connector and compare resistance reading to the table.
7. Fuel tank must be removed to test complete range of sender. A properly functioning sender will range from approximately 5 Ω (empty) to approximately 103 Ω (full) without interruption in the resistance reading as the sender float is raised.



NOTE: To check the range of resistance from empty to full, drain the fuel from the tank and remove the tank from the motorcycle (refer to page 5.8). Attach the meter leads to the connector pins (A and B) and compare to the chart. Invert the tank to test the FULL sender resistance.

| Measure Resistance at Fuel Sender Connector Pin A to B | Fuel Level | |
|---|--------------|--------------|
| | Full | Empty |
| Sender Resistance $\pm 20\%$ | 103 Ω | 5.5 Ω |

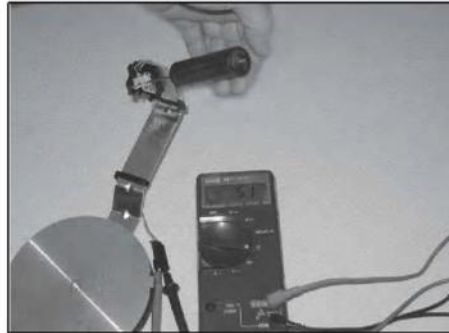


FUEL SYSTEM / FUEL INJECTION

FUEL SENDER RESISTANCE TEST (BENCH TEST, SENDER REMOVED)

NOTE: If the fuel level sender is installed in the fuel tank, refer to page 5.15 for test procedure.

1. Attach the meter leads to the connector pins (A and B) for the Yellow/Red and Black wire.
2. Measure resistance with the arm in the EMPTY position as shown.



3. Measure resistance with the arm in the FULL position as shown.
4. Compare resistance readings to the chart in the EMPTY and FULL in the chart.
5. Move the sender float slowly through entire range of operation. A properly functioning sender will range from approximately 5 Ω (empty) to approximately 103 Ω (full) without interruption in the resistance reading as the sender float is slowly raised and lowered.



| Measure Resistance at Fuel Sender Connector Pin A to B | Fuel Level | |
|--|--------------|--------------|
| | Full | Empty |
| Sender Resistance $\pm 20\%$ | 103 Ω | 5.5 Ω |
| Resistance reading should change slowly as arm is moved through range, without interruption. | | |

FUEL TANK INSTALLATION

1. With front wheel pointed straight ahead, install rubber pad onto frame to support fuel tank at rear. See illustration at right.
2. Install molded end of fuel line (A) on fuel line fitting with line facing forward, as shown. Install hose clamp and torque to specification.

TORQUE: Fuel Line Hose Clamps

2.5 Nm (20 lb-inch)

3. Place fuel tank on frame, **routing fuel line under breather hose** and over to right side of frame to fuel rail.
4. Connect fuel sender wiring harness connector. Press the connectors together until a "click" is heard or felt.
5. Install hose clamp on fuel line and connect fuel line to fuel rail (B). Torque clamp to 20 in. lb. (2.5 N-m).
6. Connect vent line (C) at rear of tank.
7. Lower rear of the fuel tank into position. Check the vent line for kinks or sharp bends that may restrict airflow.
8. Install front and rear fuel tank mounting hardware. Torque fasteners to specification.

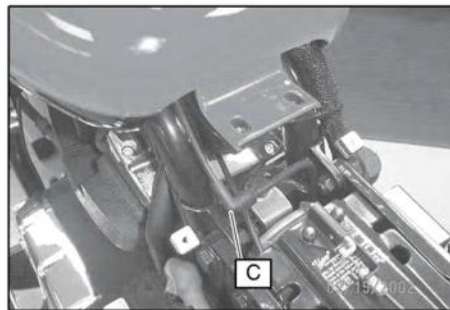
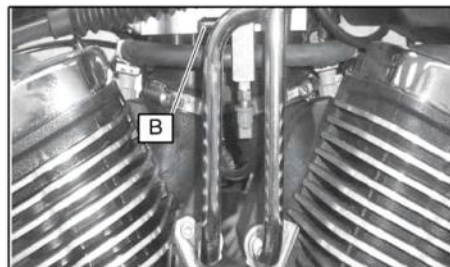
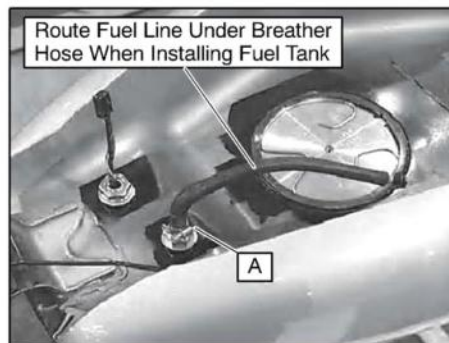
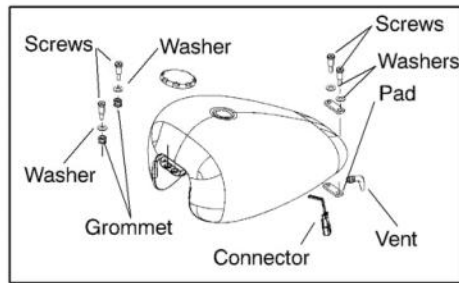
TORQUE: Fuel Tank Mounting Bolts

47 Nm, 35 lb-ft

9. Start motorcycle and inspect for fuel leaks.
10. Turn engine off and install seat.
11. Perform fuel tank vent inspection procedure as described on page 5.18. If air does not pass freely through fuel tank vent, inspect vent line for kinks and repair as necessary.

⚠ WARNING

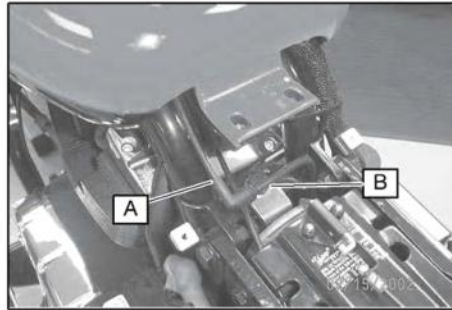
A kinked or obstructed vent line may damage fuel tank or cause engine runability issues. Be sure vent line is properly installed in routed in fuel tank guide clamps and routed smoothly through frame without kinks or obstructions.



FUEL SYSTEM / FUEL INJECTION

FUEL TANK VENT INSPECTION

1. Remove seat (see page 3.4.)
2. Remove fuel tank cap.
3. Disconnect vent line at rear left side of fuel tank (A).



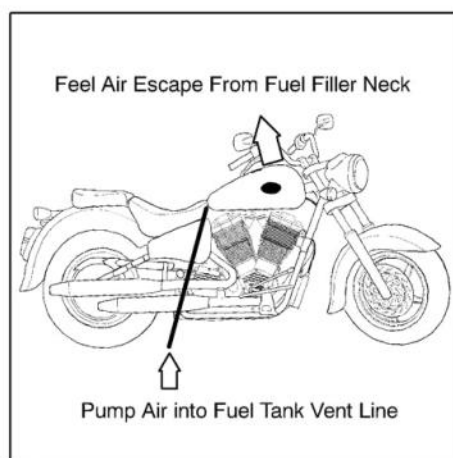
4. Connect a vacuum pump to the fuel tank vent line and pump air into vent line (toward tank).
5. You should be able to feel air escape from fuel filler neck as you pump air into the line toward tank.
6. Connect a vacuum pump to the chassis side of the vent line (B in photo above) and pump air into vent line (toward the frame.)

NOTE: CALIFORNIA MODELS: Disconnect vent line from evaporative emission canister. Refer to page 2.19 for system information and 5.24 for location.

7. If air does not pass freely through fuel tank vent lines, inspect vent line to determine the cause of the restriction and repair as necessary.

CAUTION:

Restricted vent lines may cause runability problems or tank damage. Perform fuel tank vent test above any time fuel tank or vent line has been disturbed.



PRIMING THE FUEL SYSTEM

1. Fill the fuel tank.
2. Turn the ignition key switch to the ON position.
3. Toggle the right-hand control run switch 2-3 times to prime the fuel system.
NOTE: Allow the switch to remain in the ON position for a minimum of ten seconds before toggling back to OFF.
4. Turn ignition key to the OFF position when priming is complete.

FUEL PUMP ELECTRICAL DIAGNOSTICS

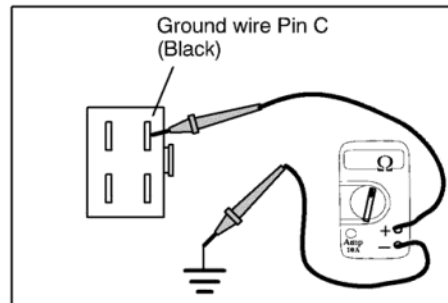
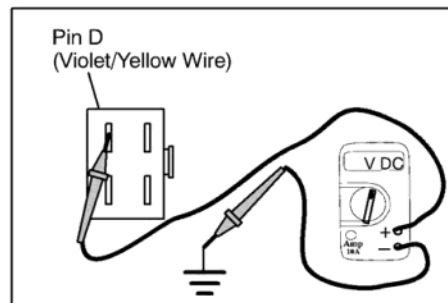
| FUEL SYSTEM | |
|-----------------------------------|--|
| Fuel Pump Pressure | 3.37 BAR (338 kPa) (49 psi) |
| Fuel Pump Volume | 45 liters/hr (325 ml/30 seconds) (11 oz./30 seconds) (0.165 gal/min) |
| Recommended Octane | 92 Octane Minimum |
| Recommended Fuel Storage Additive | Victory Fuel Stabilizer 2870652 |
| Fuel Pump Current Draw | 5 amps maximum @ 13.8 VDC |

If a fuel delivery problem is suspected, perform the tests outlined on the following pages.

NOTE: When the engine stop switch is in the run position and the ignition switch is turned ON, the fuel pump should run momentarily (a few seconds.)

FUEL PUMP SUPPLY VOLTAGE TEST

1. Secure handlebars in the straight forward position to avoid fuel tank damage.
2. Remove seat (see page 3.4.) and rear fuel tank bolts.
3. Loosen front tank bolts, and carefully lift rear of tank until fuel pump/fuel level sender 4 pin connector is accessible. Lift tab and separate connector.
4. Connect meter on the wiring harness side of pump connector as shown in the illustration at right.
5. Turn engine stop switch on.
6. Turn ignition key on and read DC voltage on meter when key is first turned on. Voltage reading should be equal to the battery voltage for 1-2 seconds after turning key ON.
7. If no or low voltage is delivered to the fuel pump, verify ground wire (Pin C, Black) has good continuity to ground battery (-) post. If ground is OK, check to be sure Gray wire from fuel pump relay is receiving a momentary ground from ECM pin 2 (for about 2 seconds). Trace the power and ground circuits to determine fault if battery voltage is not present at connector for 1-2 seconds.



VOLTAGE PATH FROM BATTERY TO PUMP

1. **Battery** to: Ignition fuse and ignition switch. Turn ignition switch on: Voltage goes to kill switch. With kill switch in on position: Voltage to ECM relay. ECM relay turns on voltage to fuel pump relay (provided ECM pin #2 is supplying the ground). Fuel pump relay turns on: Voltage from fuel pump fuse through fuel pump relay to the **Fuel Pump** on Violet/Yellow wire.

BATTERY VOLTAGE NOT REACHING FUEL PUMP

1. Voltage through fuel pump fuse? (10A) If fuse is open, perform fuel pump current draw test on page 5.20.
2. Voltage at ECM fuse?
3. Voltage out of fuel pump relay (Violet/Yellow)?
4. Voltage to the fuel pump relay (Violet)? Ground wire (Gray) must have continuity to ECM pin 2.
5. Voltage at ECM relay (Red/White)?
6. Voltage at kill switch (Red/White) in RUN position?
7. Voltage at ignition switch (Pink) with key ON?
8. If low voltage readings are obtained, perform voltage drop tests from battery to each component.

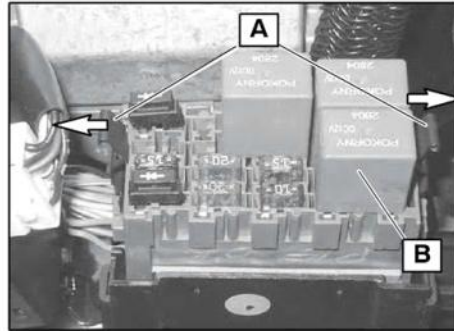
FUEL SYSTEM / FUEL INJECTION

FUEL PUMP ELECTRICAL DIAGNOSTICS (Cont.)

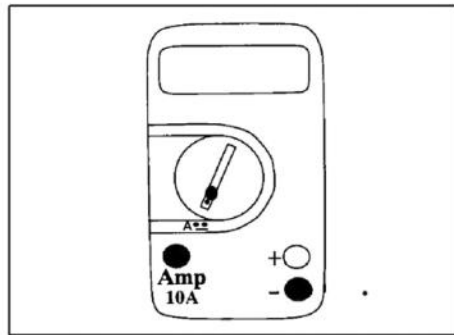
FUEL PUMP CURRENT DRAW TEST

Fuel pump current draw is a good indicator of fuel pump condition. Perform the following test if fuel pump operation is suspect, or if fuel pump fuse is found to be open (blown). NOTE: When meter leads are inserted the pump will run, and current draw will be displayed on the meter, even with key and kill switch off. Fuel tank must be completely installed and have enough fuel in it to cover the fuel pickup screens.

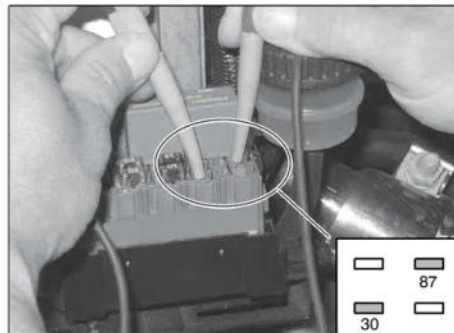
1. Remove the right side cover (page 3.5).
2. Remove the fuse box cover by opening clips (A) and lifting cover upward.
3. Remove the fuel pump relay (B) by pulling straight upward.
4. Attach the test lead adaptors from the Electrical Connector Test Lead Adaptor Kit (see page 1.11).



5. Set the meter set to DC Amps. Be sure red meter lead is inserted in the AMP 10A jack, black meter lead in the common (-) jack.



6. Insert one meter lead in the pin socket (# 30) and the other meter lead in the pin socket (# 87) of the relay block.
7. Read the fuel pump current draw on the meter and compare to specification.
8. Inspect fuel pump circuit wiring or replace the fuel pump if current draw exceeds specification.



SPEC: Fuel Pump Current Draw
Maximum: 5 DC Amps

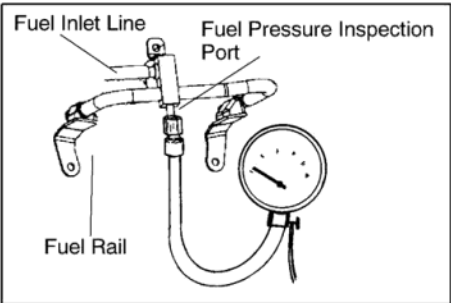
FUEL PUMP PRESSURE INSPECTION

⚠ 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 cap from the F.I. pressure inspection port.
2. Place a rag over the F.I. pressure inspection port. Carefully and slowly depress the Schrader valve with a small screwdriver to remove the pressure from the F.I. system.
3. Install the fuel pressure gauge securely.

Fuel pressure gauge: PV-43506

4. Start the motorcycle and record the fuel pressure.

Fuel pressure 3.37 BAR (338 kPa) (49 psi)

5. Turn ignition switch off, bleed gauge at T-valve and remove fuel pressure gauge fittings.
6. Reinstall protective cover on the F.I. pressure inspection port. Install fuel tank and seat.

| TROUBLESHOOTING | |
|---|---|
| FUEL PRESSURE TOO LOW: INSPECT | FUEL PRESSURE TOO HIGH: INSPECT |
| Fuel line kinked or restricted (from tank fitting to rail) | Plugged fuel return (in tank on pressure regulator) |
| Fuel hose leaking (leaking air in or fuel out) | |
| Plugged fuel filters (located in fuel tank) | Pressure regulator malfunction (located on pump 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 kill switch are turned ON. | |
| Fuel pump pressure relief valve malfunction | |
| Fuel flow to pump (See procedure and perform test) | |

FUEL SYSTEM / FUEL INJECTION

THROTTLE BODY REMOVAL & INSTALLATION

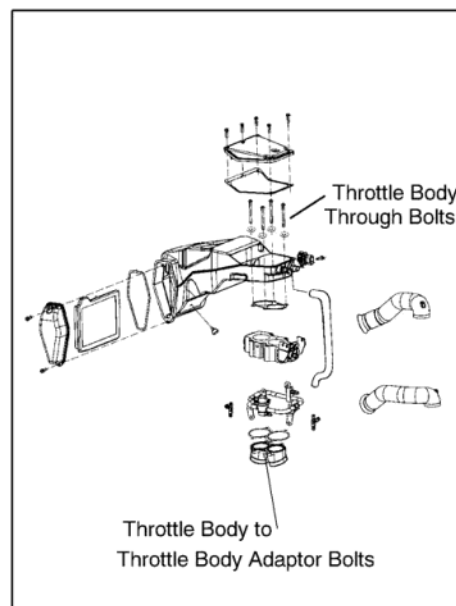
⚠ WARNING GASOLINE

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 seat. (see page 3.4.)
2. Remove fuel tank. (page 5.8)
3. Remove air box top cover.
4. Remove intake tubes from the air box.
5. Remove throttle body through-bolts.
6. Remove throttle body adaptor to throttle body bolts and fuel rail mounting bolts.
7. Remove fuel rail attachment bolts.
8. Remove throttle and throttle return cables.
9. Remove fast idle cable.
10. Disconnect TPS wiring connector.
11. Remove cooling oil delivery tubes. Do not reuse sealing washers or O-rings.
12. Remove throttle body assembly out right side.
13. Reverse steps for installation. Use new gaskets, sealing washers, and O-rings.



THROTTLE BODY ADAPTOR REMOVAL & INSTALLATION

1. Remove throttle body assembly, see above.
2. Loosen intake manifold hose clamps, remove throttle body adaptor.
3. Reverse steps for installation.

FUEL INJECTOR REMOVAL

1. Remove throttle body assembly (page 5.22).
2. Remove cap from the F.I. pressure inspection port.
3. Place a rag over the F.I. pressure inspection port. Carefully and slowly depress the Schrader valve with a small screwdriver to remove the pressure from the F.I. system.
4. Remove wiring harness connectors from injectors.

NOTE: Injector harness connectors are removed by lifting the tab and pressing the upper portion of the tab toward the wiring harness.

5. Remove fuel rail bolts.
6. Remove oil temperature sensor wires, route wires to allow for fuel rail removal.

CAUTION:

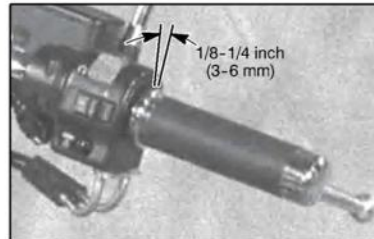
Clean the area around injectors to prevent foreign material from falling into the engine.

7. Remove fuel rail and injectors as an assembly.
8. The injectors are held in place on the fuel rail by the interference fit of the o-rings. The injectors can now be removed from the fuel rail.
9. Installation is the reverse of removal. Use new O-rings upon assembly.

THROTTLE CABLE ADJUSTMENT

Refer to page 2.15 for procedure.

Throttle cable freeplay 3-6 mm, 1/8"-1/4"

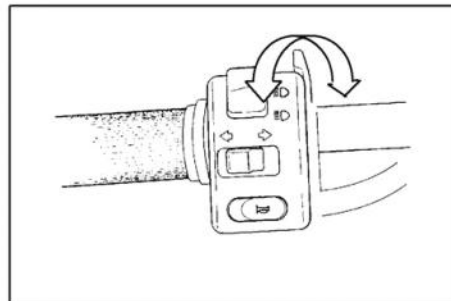


FAST IDLE CABLE ADJUSTMENT

Adjust the fast idle cable free play to specification. Refer to page 2.14 for procedure.

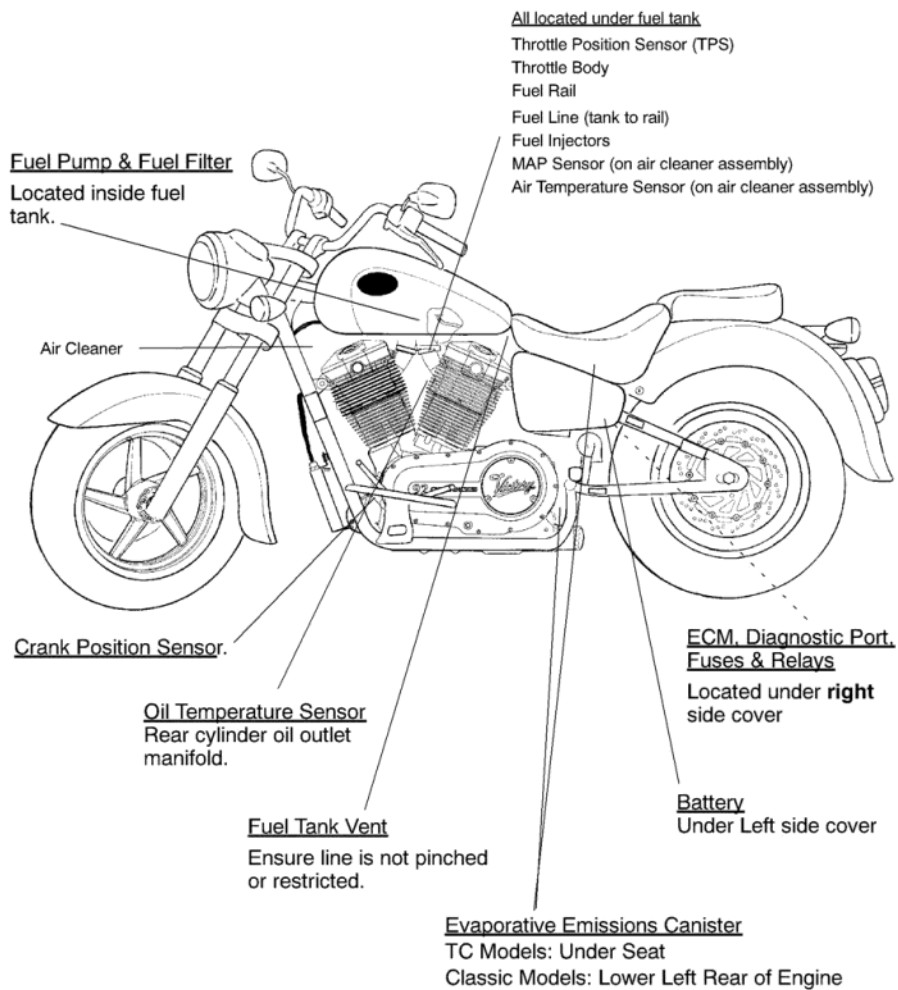
Fast idle cable freeplay 3-6 mm, 1/8"-1/4"

Fast idle speed 2000 rpm \pm 100

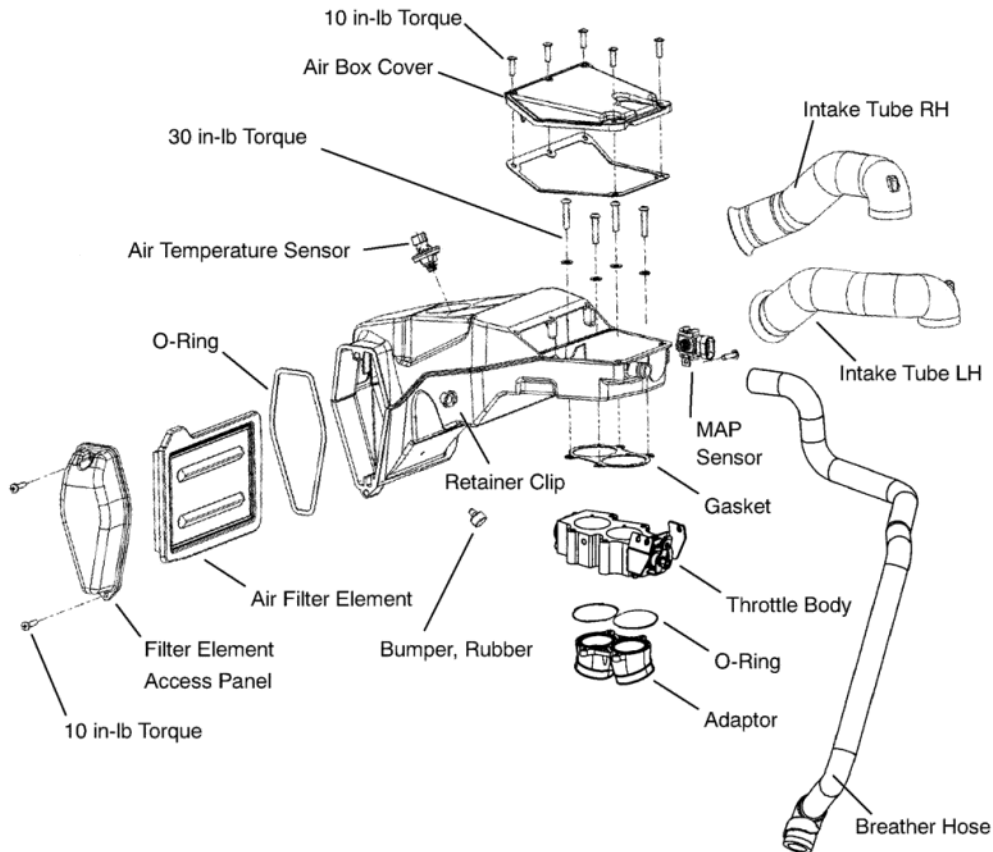


FUEL SYSTEM / FUEL INJECTION

FUEL INJECTION COMPONENT LOCATIONS



FUEL INJECTION EXPLODED VIEW



SELF-DIAGNOSIS FUNCTION

A self-diagnosis function is built into the ECM. There are two functions available: "User" & "Dealer".

The operator (user) is notified that a possible problem exists via the Chk Eng indication and a flashing light on the Multi-Function Display (MFD) on the speedometer face. The Chk Eng indication will remain on until the fault causing the code is corrected. If fault is intermittent, a fault code will be stored but the Chk Eng indication and light will turn off when the problem is not occurring.

FUEL INJECTION PROBLEM NOTIFICATION

| MFD DISPLAYS | POSSIBLE PROBLEMS |
|-------------------------|--|
| Check Engine (ChEng) | Sensors |
| | Injectors |
| | ECM |
| | Wiring Problem (Check Terminal Pins / Connections at ECM and Fuse Box, Etc.) |

FUEL SYSTEM / FUEL INJECTION

SENSOR DIAGNOSTICS

In the event of a sensor failure or sensor reading outside the normal range, a "pre-programmed" value is substituted until the sensor reading returns to the normal range. The check engine "ch eng" warning will appear on the MFD to alert the rider of a possible problem. Perform vehicle service inspection to determine the cause of the indicators soon as possible following a check engine light. The rider may not notice a change in vehicle performance.

| FAILED SENSOR | DEFAULT | POSSIBLE SYMPTOM |
|-------------------------------------|----------------------------|---|
| Crank Position | No Default | Engine will misfire or stop |
| Throttle Position | Full Throttle | Engine will misfire when not at full throttle |
| M.A.P. (Manifold Absolute Pressure) | Sea Level (1040mB) | No significant effect up to 2500 ft. |
| Oil Temperature | 90 Degrees Celsius (194 F) | No effect on warm engine |
| Air Temperature | 10 Degrees Celsius (50 F) | Slight effect on cold engine |

FUEL INJECTION DIAGNOSTICS

CAUTION

Read and understand the Fuel Handling Warnings on page 5.1, the Troubleshooting information on page 5.2 and 5.49 through 5.52, and the Fuel Injection Service Procedures on page 5.5 and 5.6 before working on the EFI system. Read each test and related information before performing the test.

NOTE: A laptop computer, and the Victory / Polaris Diagnostic Tool Kit w/ Diag Software (PV-46085) are necessary to access fault codes stored in the ECM. EGA Tool Kit with Lambda Sensor (PV-45410) is required to calibrate the Throttle Position Sensor (TPS).

Victory / Polaris Diagnostic Tool Kit w/ Diag Software (PV-46085)

EGA Tool Kit with Lambda Sensor (PV-45410)

Connector test lead adaptor kit (for testing resistance or voltage at various connectors: (PV-43526)

FAULT CODE OVERVIEW

The ECM used on the Victory motorcycle engines stores fault codes in memory to assist the technician during problem diagnosis. Fault Codes are stored by the ECM when a sensor reading is outside of the normal range. These codes are listed and described on page 5.27. The ECM is located under the right side cover.

When a fault occurs, the ECM records a code in the "Logged Faults" memory. If a fault is currently active, the code is also recorded in the ECM "Current Faults" memory, which is only active while the fault is present. If the problem is corrected, the "Current Fault" is erased, but the code remains in the "Logged Faults" memory until it is manually cancelled. This is true even if the power is removed from the ECM.

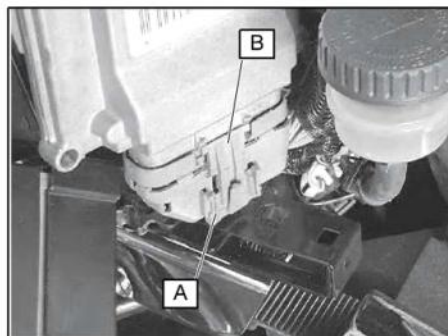
CAUTION:

Tests in this section may require measuring resistance and voltages at the ECM connector. Once ECM connector has been disconnected, do not touch pins on ECM. Static electricity from your body can easily damage ECM.

Do not attempt to perform tests on ECM. Tests are done on the wiring harness side of the ECM connector.

NOTE: A connector test adapter kit is necessary. Use of other means to probe female pins can easily damage the ECM connector and cause a poor connection.

1. Slide back red lock tab (A) and lift tab (B) to disconnect.



5.26

FUEL SYSTEM / FUEL INJECTION

FAULT CODES

| CODE NUMBER | DESCRIPTION | COMMENTS |
|-------------|--|--|
| P0107 | Barometric Pressure Sensor Circuit Low | Circuit voltage < 0.16 volts for 0.1 seconds |
| P0108 | Barometric Pressure Sensor Circuit High | Circuit voltage > 4.94 volts for 0.1 seconds |
| P0112 | Intake Air Temperature Sensor Low Input | Circuit voltage < 0.16 volts for 0.8 seconds |
| P0113 | Intake Air Temperature Sensor High Input | Circuit voltage > 4.94 volts for 0.8 seconds |
| P0122 | Throttle Position Circuit Low Input | Circuit voltage < 0.16 volts for 0.1 seconds |
| P0123 | Throttle Position Circuit High Input | Circuit voltage > 4.94 volts for 0.1 seconds |
| P0126 | Insufficient Oil Temperature for Stable Test Operation | Allow time for oil to reach 194°F minimum |
| P0197 | Engine Oil Temperature Sensor Low Input | Circuit voltage < 0.16 volts for 0.8 seconds |
| P0198 | Engine Oil Temperature Sensor High | Circuit voltage > 4.94 volts for 0.8 seconds |
| P0201 | Injector Circuit Malfunction - Cylinder #1 | Open load or short to Vbatt detected for 0.8 seconds. Test Injector & Related Wiring |
| P0202 | Injector Circuit Malfunction - Cylinder #2 | Open load or short to Vbatt detected for 0.8 seconds. Test Injector & Related Wiring |
| P0230 | Fuel Pump Primary Circuit Malfunction | Open load or short to Vbatt detected for 0.8 seconds |
| P0337 | Crankshaft Position Sensor Circuit Low | Test CPS & Related Wiring. Page 5.32 |
| P0338 | Crankshaft Position Sensor Circuit Low | Test CPS & Related Wiring. Page 5.32 |
| P0351 | Ignition Coil A Primary/Secondary Circuit Malfunction | Coil open load, short to ground or short to Vbatt detected for 6.4 seconds |
| P0352 | Ignition Coil B Primary/Secondary Circuit Malfunction | Coil open load, short to ground or short to Vbatt. detected for 6.4 seconds |
| P0500 | Vehicle Speed Sensor Malfunction; or, Neutral Light Switch Malfunction | Loss of VSS signal with engine running & vehicle in gear; Neutral Light Switch fault |
| P0502 | Vehicle Speed Sensor Low Input | Test VSS & Related Wiring. Page 19.3 |
| P0562 | System Voltage Low | Battery voltage < 11.0 V for 0.8 seconds |
| P0563 | System Voltage High | Battery voltage > 16.0 V for 0.8 seconds |
| P0601 | Internal Control Module Memory Check Sum Error | Code can usually be cleared. See page 5.34. |
| P0704 | Clutch Switch Input Circuit Malfunction | VSS input present, in gear state reported, calculated gear level is out of range (includes Neutral Switch failure) |
| P1101 | WOT Not Learned | Refer to page 5.34 for procedure |

FUEL SYSTEM / FUEL INJECTION

BAROMETRIC PRESSURE (MAP) SENSOR DIAGNOSTICS

FAIL CODE: P0107 / P0108

COMPONENT AFFECTED: Barometric Pressure Sensor (MAP sensor)

| INDICATES | INSPECT |
|---|--|
| Voltage received at ECM from MAP sensor is outside of parameters. | Resistance readings at ECM connector. This test will inspect the wiring, connectors and MAP sensor resistance. |

MAP SENSOR TESTING

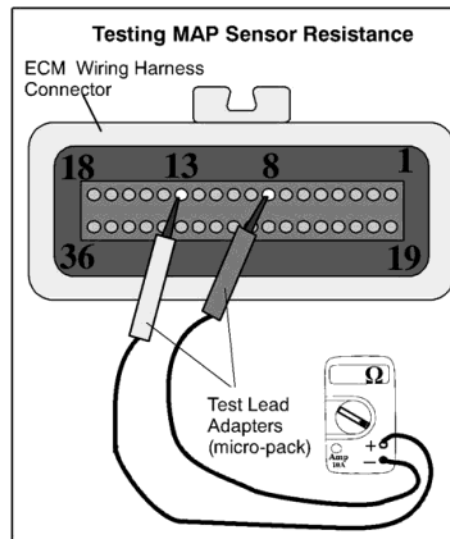
1. Perform step 1 (below) to inspect integrity of wiring, connectors & MAP sensor.
2. If step 1 (below) results are outside of specifications, disconnect wiring at MAP sensor and inspect wiring for continuity.
3. If wiring is correct, replace MAP sensor.
4. Clear the fail codes with the diagnostic system (refer to page 5.37.)
5. Go through procedure to access fail codes again.
6. If P0107 or P0108 fail code is still present, replace ECM.

MAP SENSOR RESISTANCE TEST

Connector test lead adaptor kit: PV-43526

1. Place the DMM leads in the pins of the connector indicated in the illustration at right (**not the ECM**).
2. Verify that readings obtained are within specifications.

Specification: $5.4\text{ K}\Omega \pm 10\%$



| TEST # | COMPONENT | METER SETTING | TEST CONNECTIONS | SPECIFICATIONS ($\pm 10\%$) |
|--------|------------|---------------|------------------|-------------------------------|
| | MAP SENSOR | OHMS | Pin # 8 to #13 | 5.4K ohms |

AIR TEMPERATURE SENSOR (ATS) DIAGNOSTICS

| | |
|---|--|
| FAIL CODE: P0112 / P0113 | |
| COMPONENT AFFECTED: Air Temperature Sensor | |
| INDICATES | INSPECT |
| Voltage received at ECM from Air Temperature sensor is outside of parameters. | Resistance readings at ECM connector. This will test wiring, connectors and Air Temperature sensor resistance. |

ATS TESTING

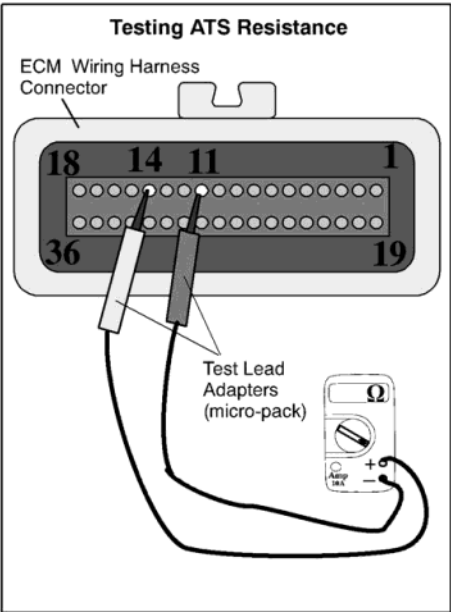
1. Perform step 1 (below) to inspect integrity of wiring, connectors & air temperature sensor.
2. If step 1 (below) results are outside of specifications, disconnect wiring at air temperature sensor and inspect wiring for continuity.
3. If wiring is correct, replace air temperature sensor.
4. Clear the fail codes with the diagnostic system (refer to page 5.37.)
5. Start engine.
6. Go through procedure to access fail codes again.
7. If P0112 or P0113 fail code is still present, replace ECM.

ATS RESISTANCE TEST

Connector test lead adaptor kit: PV-43526

1. Place the DMM leads in the pins of the connector indicated in the illustration at right (**not the ECM**).
2. Verify that readings obtained are within specifications.

Specification: 3.15 K Ω @ 21°C \pm 10%



| TEST # | COMPONENT | METER SETTING | TEST CONNECTIONS | SPECIFICATIONS (\pm 10%) |
|--------|------------------------|---------------|------------------|-----------------------------|
| | AIR TEMPERATURE SENSOR | OHMS | Pin # 11 to #14 | 3.15 K ohms at 21° C |

FUEL SYSTEM / FUEL INJECTION

THROTTLE POSITION SENSOR (TPS) DIAGNOSTICS

FAIL CODE: P0122 / P0123

COMPONENT AFFECTED: Throttle Position Sensor

| INDICATES | INSPECT |
|--|---|
| Voltage received at ECM from TPS is outside of parameters. | Resistance readings at ECM connector. This will test will inspect the TPS and the wiring. |

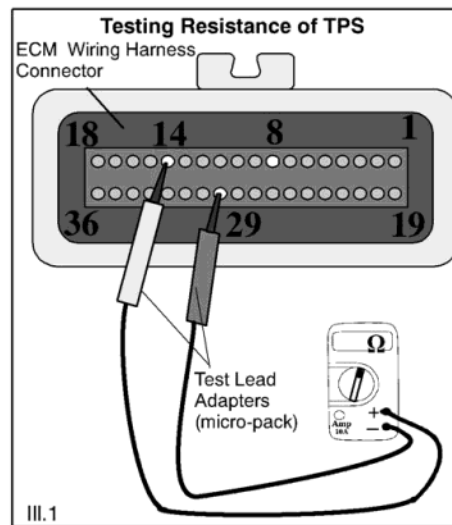
TPS TESTING

1. Perform step 1 (below) to inspect integrity of wiring, connectors & TPS sensor.
2. If step 1 (below) results are outside of specifications, disconnect wiring at TPS and inspect wiring for continuity.
3. If wiring is correct, replace TPS.
4. Clear the fail codes using the diagnostic system (refer to page 5.37.)
5. Go through procedure to access fail codes again to see if fail code returns.

TPS RESISTANCE TESTS

Connector test lead adaptor kit: PV-43526

1. Place the DMM leads in the ECM harness connector pins **(not the ECM)** as indicated in the chart below. Example of one test shown at right.
2. Verify that readings obtained are within specifications.



| TEST # | COMPONENT | METER SETTING | TEST CONNECTIONS | SPECIFICATIONS ($\pm 10\%$) |
|--------------------------|-----------|---------------|------------------|---|
| THROTTLE POSITION SENSOR | | OHMS | Pin #29 to #8 | 3.7 - 5K ohms throttle closed 1130 ohms throttle open |
| TPS | | OHMS | Pin #29 to #14 | 1130 ohms throttle closed 3.7 to 5K ohms throttle open |
| TPS | | OHMS | Pin #8 to #14 | 3.7 - 5K ohms NOTE: Reading will not change with throttle position |

5.30

OIL TEMPERATURE SENSOR (OTS) DIAGNOSTICS

| | |
|---|---|
| FAIL CODE: P0197 / P0198 | |
| COMPONENT AFFECTED: Oil Temperature Sensor (Engine Temperature) | |
| INDICATES | INSPECT |
| Voltage received at ECM from Oil Temperature sensor is outside of parameters. | Resistance readings at ECM connector. This will test will inspect the wiring, connectors and Oil Temperature sensor resistance. |

OTS TESTING

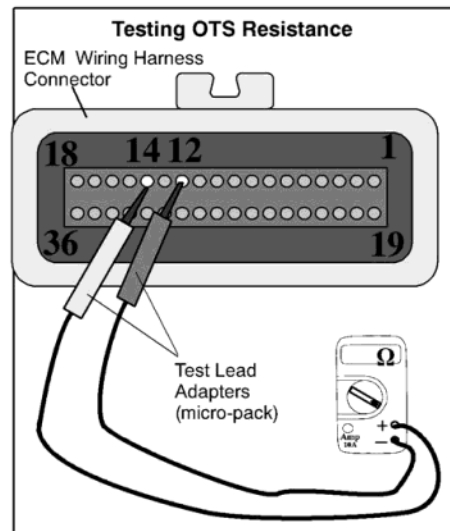
1. Perform step 1 (below) to inspect integrity of wiring, connectors & oil temperature sensor.
2. If step 1 (below) results are outside of specifications, disconnect wiring at oil temperature sensor and inspect wiring for continuity.
3. If wiring is correct, replace oil temperature sensor.
4. Clear the fail codes with the diagnostic system (refer to page 5.37.)
5. Start engine.
6. Go through procedure to access fail codes again.
7. If P0197 or P0198 fail code is still present, replace ECM.

OTS RESISTANCE TEST

Connector test lead adaptor kit: PV-43526

1. Place the DMM leads in the pins of the connector indicated in the illustration at right (**not the ECM**).
2. Verify that readings obtained are within specifications.

Specification: 11.15 K Ω @ 25°C \pm 10%



| TEST # | COMPONENT | METER SETTING | TEST CONNECTIONS | SPECIFICATIONS ($\pm 10\%$) |
|--------|------------------------|---------------|------------------|-------------------------------|
| | OIL TEMPERATURE SENSOR | OHMS | Pin # 12 to #14 | 12.3 K ohms @ 21° C |

FUEL SYSTEM / FUEL INJECTION

CRANKSHAFT POSITION SENSOR DIAGNOSTICS

FAIL CODE: P0337 / P0338

COMPONENT AFFECTED: Crankshaft position sensor

INSPECT

Sensor resistance / AC Output

Wiring and connectors

CRANK POSITION SENSOR (CPS) TESTING

CAUTION

Make sure AC voltage is correct before replacing ECM. If AC voltage signal is not present with new sensor, remove the primary cover and inspect the flywheel exciter ring (flywheel adaptor).

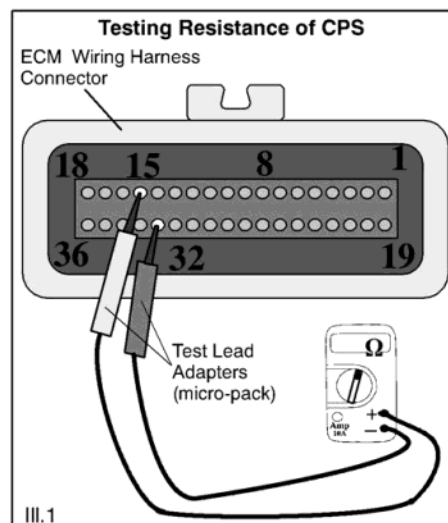
RESISTANCE AND AC VOLTAGE OUTPUT TESTS

Connector test lead adaptor kit: PV-43526

CPS RESISTANCE TEST

1. Remove right side frame cover.
2. Make sure ignition switch is in the off position.
3. Disconnect ECM connector.
4. Set Digital Multimeter (DMM) to the ohms scale.
5. Place one lead of the DMM in female pin # 15 & the other DMM lead in female pin #32 of the connector **(not the ECM)**.
6. Observe the meter reading and compare to specifications.

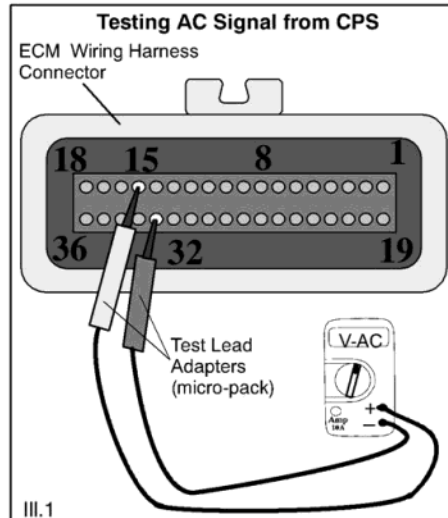
Crank position sensor resistance 1450Ω-1800Ω



CRANKSHAFT POSITION SENSOR AC VOLTAGE TEST

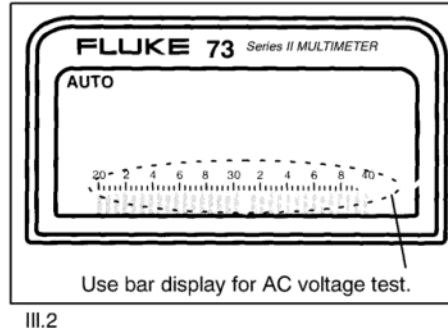
1. Set DMM to AC volts scale.
2. Turn ignition switch on. Turn engine over with electric starter and observe DMM display. III. 2.
3. With the spark plugs in the engine the voltage reading will be erratic due to the low rpm and pulsing nature of the signal. The meter display will be erroneous. Watch the bar at the bottom of display to determine if a signal exists. Any fluctuating AC signal is correct for this test. III.1.

NOTE: The bar display at the bottom of the display window on a Fluke™ 73 DMM updates 10 times faster than the numeric display. III. 2.



NOTE: If a signal is not evident in steps 1-3 above, proceed with step 4 to test CPS AC output with spark plugs removed.

4. Remove the spark plugs. Install spark plugs into spark plug caps and ground the center electrode.
5. When engine is turned over with electric starter (and spark plugs out), the reading on the meter should be 3V AC \pm 10%.
6. Remove crank position sensor from crankcase.
7. Visually inspect the working end of the crank position sensor for damage or metal particles clinging to the magnet.
8. If the crank position sensor shows physical damage to the working end, remove the primary cover and inspect the flywheel exciter ring (flywheel adaptor). Refer to page 9.7 for primary cover removal. Refer page 16.15 for flywheel removal. Refer to page 17.11 for flywheel adapter removal.
9. Visually inspect wiring exiting engine speed sensor for loose or broken wires.
10. Replace crank position sensor if necessary.



FUEL SYSTEM / FUEL INJECTION

VEHICLE SPEED SENSOR DIAGNOSTICS

| FAIL CODE: P0500 | |
|---|---|
| COMPONENT AFFECTED: VEHICLE SPEED SENSOR or NEUTRAL LIGHT SWITCH | |
| INDICATES | INSPECT / ACTION |
| Vehicle Speed Sensor or sensor wiring malfunction; Neutral light switch or switch wiring malfunction | Test Vehicle Speed Sensor Test or Replace Neutral Light Switch |

VEHICLE SPEED SENSOR TESTING

1. Refer to page 19.3 to test the speed sensor.

NOTE: If speedometer needle indication is normal, the speed sensor has no current fault.

NEUTRAL LIGHT SWITCH TESTING

1. Refer to page 18.7 to test the neutral light switch and circuit.

MEMORY CHECK SUM ERROR

| FAIL CODE: P0601 | |
|---|--|
| COMPONENT AFFECTED: ECM | |
| INDICATES | INSPECT / ACTION |
| Module Memory Check Sum Error - Usually due to code not clearing successfully at TPS initial setup when installing new ECM. | Clear the code and check to see if code re-appears |

NOTE: All new ECMs have the "Memory Check Sum Error" at first power-up after the memory is loaded into the ECM. This code must be cleared at the time the ECM is initialized. If this code appears when using the diagnostic software, it is possible that a new ECM was not cleared successfully. If this is the case, the code may be present without an actual fault.

1. If Fault Code message P0601 (Internal Control Module Memory Check Sum Error) is present when using the diagnostic software, first try clearing the fault code.
2. Record any other fault codes present before clearing. If the code reappears, further inspection is required; however, it is more likely the code was not cleared from memory during initialization, and will not be present after it is cleared.

WOT (WIDE OPEN THROTTLE) NOT LEARNED

| FAIL CODE: P1101 | |
|---|--|
| COMPONENT AFFECTED: Throttle Position Sensor and ECM | |
| INDICATES | INSPECT / ACTION |
| A new ECM has not "learned" where the full throttle position is located | Turn ignition switch and kill switch to ON position. <u>Do not start engine.</u> Turn throttle to wide open position and hold for 5 seconds. Release throttle and return it to idle. Turn ignition switch to OFF. |

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BATTERY VOLTAGE AT ECM DIAGNOSTICS

| | |
|---|-------------------------|
| FAIL CODE: P0562 / P0563 | |
| COMPONENT AFFECTED: Battery Voltage to ECM | |
| INDICATES | INSPECT |
| Voltage received at ECM is outside of parameters. | Vehicle Battery Voltage |

BATTERY VOLTAGE TESTING

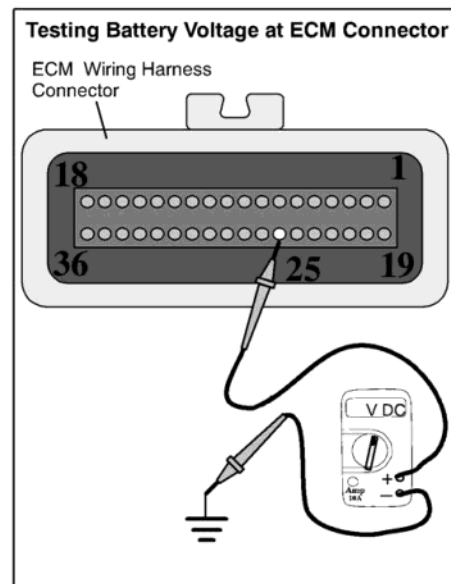
1. Measure voltage at battery. Refer to page 16.7 for battery charging information.
2. Battery voltage must be 12.5V DC or above. If it is not, correct battery problem before proceeding.
3. Perform Step 1 below to measure battery voltage at ECM.
4. If step 1 (below) results are outside of specifications, trace the system from the connector to the battery to find the cause of the problem.
5. Start motorcycle and clear fail codes.
6. Go through procedure to access fail codes again.
7. If P0562 or P0563 fail code is still present, repeat test.

BATTERY VOLTAGE AT ECM CONNECTOR**Connector test lead adaptor kit: PV-43526**

1. Place the DMM leads in the pins of the connector indicated in the illustration at right (**not the ECM**).
2. Verify that readings obtained are within specifications.

Specification: 12.5V DC or greater

3. If the voltage at the ECM connector is not the same as battery voltage, trace the system from the connector to the battery.



FUEL SYSTEM / FUEL INJECTION

ECM CONNECTOR

| ECM CONNECTOR MAP | | | | | | | | | | | | | | | | | |
|--|------|---------------------|-----------------------------------|--------------------------------------|------------------------|--------------------------------|--------------------------------|---|-------------------------|---------------------------|-----------------------------|-----------------------------|----------------------------|----------------------------|---------------------------|-----------------------------|-----------------------------------|
| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| W/GN #2 CYL (REAR) PRIMARY COIL WIRE | OPEN | OPEN | BK CRANK POSITION SENSOR | BN/GN SENSOR VOLTAGE | OR/BN MAP SENSOR | OR/BU OIL TEMP SENDER | OR/GN AIR TEMP SENDER | GN/BN SPEED SENSOR & MFD Pin #8 | GY/BK DIAG PIN #7 | BN/R SYSTEM VOLTAGE | VIO/PK Sensor Voltage | VIO/PK SYSTEM VOLTAGE | BK/VIO SYSTEM GROUND | BK/VIO SYSTEM GROUND | OPEN | GY FUEL PUMP RELAY | W/GY INJECTOR #2 (REAR) |
| BN = Brown BU = Blue GN = Green BK = Black GY = Grey OR = Orange PK = Pink R = Red TRANS = Transparent VIO = Violet W = White Y = Yellow | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |
| W/BK #1 CYL (FRONT) PRIMARY COIL WIRE | OPEN | GN ECM GROUND | OPEN | TRANS CRANK POSITION SENSOR | OPEN | BU/Y | OR/Y TPS | OPEN | OPEN | OPEN | R 12VDC POWER | GY/R DIAG PIN #13 | OPEN | OPEN | BK/OR TO MFD PIN#16 | GN/W TO MFD PIN#15 | W/BU INJECTOR #1 (FRONT) |
| VERIFY TERMINAL PINS ARE NOT LOOSE IN CONNECTOR AND WIRE CONNECTION TO TERMINAL IS PIN IS SECURE. BACK OF CONNECTOR IS NUMBERED AT THE PIN SLOT AS SHOWN ABOVE. | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

ECM HARNESS / CONNECTOR TESTING

| COMPONENT | METER SETTING | TEST CONNECTIONS | SPECIFICATIONS ±10% @ Room Temp. 70° F/ 21° C |
|----------------------------------|------------------|--|---|
| #1 FUEL INJECTOR | OHMS | Pin #19 to Pin #7 | 15 ohms / No cont. to ground |
| #2 FUEL INJECTOR | OHMS | Pin #1 to Pin #7 | 15 ohms / No cont. to ground |
| #1 IGNITION COIL (FRONT CYL.) | OHMS | Pin #36 to plug cap of front ignition coil. | 11K ohms |
| #2 IGNITION COIL (REAR CYL.) | OHMS | Pin #18 to plug cap of rear ignition coil. | 11K ohms |
| CRANK POSITION SENSOR | OHMS | Pin #15 to #32 | 1500 ohms ± 100 ohms |
| CRANK POSITION SENSOR | AC VOLTAGE | Pin #15 to #32 | Spark plugs out: 3V AC Spark plugs in: Any fluctuating AC signal. |
| AIR TEMP. SENSOR | OHMS | Pin #11 to #14 | 3.15K ohms |
| OIL TEMP. SENSOR | OHMS | Pin #12 to #14 | 12.3K ohms |
| THROTTLE POSITION SENSOR | OHMS | Pin #29 to #8 | 3.7 - 5K ohms throttle closed 1130 ohms throttle open |
| TPS | OHMS | Pin #29 to #14 | 1130 ohms throttle closed 3.7 to 5K ohms throttle open |
| TPS | OHMS | Pin #8 to #14 | 3.7 - 5K ohms NOTE: Reading will not change with throttle position |
| MAP SENSOR | OHMS | Pin # 8 to #13 | 5.4K ohms |

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OVERVIEW OF OPERATION - FUEL INJECTION SYSTEM

The electronic control module, or ECM, is programmed to provide the proper fuel and ignition timing based on the engine's RPM and throttle position. A throttle position sensor, which is mounted at one end of the throttle plate shaft, monitors throttle position. This sensor changes its voltage output based on its position. The TPS output voltage is monitored by the ECM to determine the amount of air the engine is receiving.

The fuel pump supplies approximately 49 PSI fuel pressure to the injectors.

Injectors are grounded by the ECM for a period of time based on sensor inputs and relative position on fuel map. The amount of time the injectors are grounded determines amount of fuel delivered.

USING VICTORY DIAGNOSTIC SOFTWARE

Refer to Section 2, 3, and 4 in the Instruction Manual provided with Victory / Polaris Diagnostic Tool Kit PV-46085 to install the Polaris / Victory Diagnostic System software on a laptop computer.

PERIODIC TPS CALIBRATION IS NOT REQUIRED

The TPS does not require periodic calibration. TPS calibration should be performed only if related parts are replaced (throttle body, TPS, ECM, or a faulty sensor, etc.) or if other causes of a running condition have been inspected (spark plugs, air filter, air leaks, fuel quality, engine mechanical condition, etc.) Two characteristics are most likely to occur if the TPS is set incorrectly.

1. Mixture Is Too Rich

- Fouls spark plug(s)
- Black, sooty exhaust gasses
- Doesn't run well
- Fuel mileage complaints
- Muffler discoloration

2. Mixture Is Too Lean

- Backfires excessively
- Hard starting
- Runs rough
- ECM is mistakenly replaced due to incorrect TPS adjustment
- Transmission sounds are greatly magnified
- Misses
- If extremely lean: while attempting to set the TPS, engine rpm drops until the engine dies.
- Muffler discoloration.

Follow the instructions and perform all of the steps carefully as they are described.

FUEL SYSTEM / FUEL INJECTION

TPS CALIBRATION NOTES

When performing the TPS calibration, airflow is calibrated to match the fuel and ignition timing instructions from the ECM under controlled conditions. If this calibration is correct at idle, it will be correct throughout the operating range of the engine. If the calibration is incorrect, the ECM will receive incorrect information on the requirements of the engine and create a lean or rich condition.

Establishing the correct calibration of the TPS to the throttle plates is accomplished with the TPS Calibration Procedure. During the TPS adjustment procedure we "lock" the ECM at a specific position to give the engine the proper amount of fuel at a specified operating condition near the idle point. This establishes the fuel calibration at the proper air/fuel ratio.

There are several items to be aware of to ensure accurate TPS calibration:

ENVIRONMENTAL CONDITIONS

Be aware that environmental conditions such as temperature, humidity, and altitude will affect final calibration.

Minor adjustments will be made later in the procedure to compensate for these conditions if necessary.

MECHANICAL CONDITION OF ENGINE

Be sure the engine is in good mechanical condition. Perform a cranking compression or cylinder leakage test if you have any doubt as to the mechanical condition of the engine.

AIR LEAKS IN INTAKE TRACT

Check for air leaks in the intake tract or exhaust system and repair if necessary. Air leaks will prevent accurate Lambda readings, which are critical for proper TPC calibration.

EXHAUST EXTRACTION EQUIPMENT

Work shop exhaust extraction systems can cause TPS calibration errors. Be sure to check the affect of the extraction system on Lambda sensor voltage readings before setting final TPS calibration. A special precaution is required on Touring Cruiser models. See **NOTE:** on page 5.41.

SPARK PLUG / AIR FILTER CONDITION

The spark plugs should be in good condition or replace them if there is any sign of carbon fouling. The air filter should be inspected, and the engine should have no modifications other than Victory accessory items such as slip on mufflers or a high flow air filter, with the appropriate re-flash installed.

TOOLS To perform this procedure you will need the following tools:

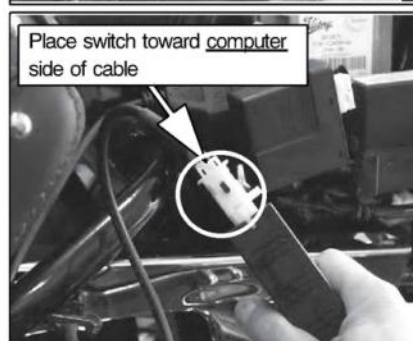
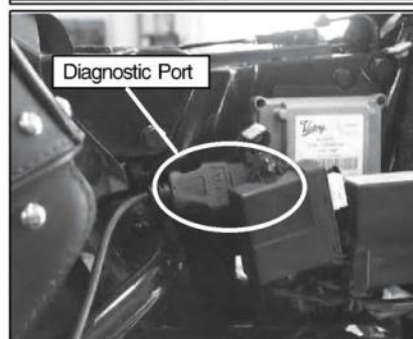
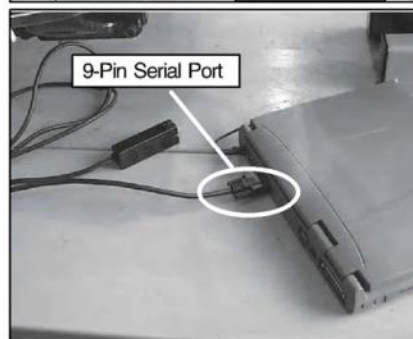
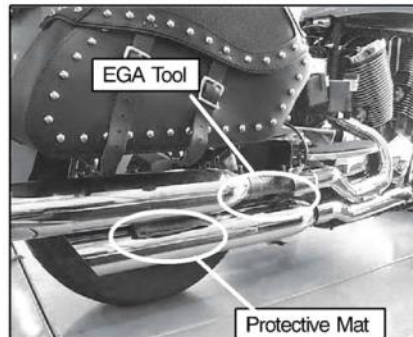
- 13mm and 15 mm socket
- 13 mm and 15 mm open end wrenches
- 22 mm open end wrench
- Exhaust pipe service tool
- Anti-seize compound
- Long #2 phillips screwdriver
- Volt meter (Fluke 73 or higher recommended)
- Diagnostic software and laptop computer (Refer to page 1.13)
- Communication cable (Refer to page 1.13)
- Lambda sensor with power adapter harness (Refer to page 1.13)
- Cooling fan
- Exhaust fan and hose

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TPS CALIBRATION PROCEDURE

1. Remove the upper exhaust muffler on Standard and Deluxe Cruiser (C&DC), remove the *right* muffler on Touring Cruiser (TC and TCD) models.
2. Insert the EGA tool EGA tool (PV-45410) between the header pipe and the muffler.
3. Re-install muffler and place a protective mat between the upper and lower pipe on C and DC models to ensure the pipes do not rub against each other. The service pipe and exhaust pipe connections must be tight. If gaskets were damaged upon removal, replace the gaskets.
4. Apply anti-seize compound to the threads of the lambda sensor and install into service pipe.
5. Torque the sensor to 37-44 foot pounds, or 50-60 newton meters.
6. Connect the computer diagnostic cable to the 9-pin serial port on the back of your laptop computer.
7. Locate the ECM diagnostic port, which is under the right hand cover near the ECM. Remove the diagnostic port cover *carefully* and connect the cable to the port.
8. Connect the two cables together.
9. Move the two-position switch on the white connector toward the computer cable side of the switch (AWAY from the motorcycle). The switch position that is toward the diagnostic port (toward the motorcycle) is for flash programming and is not to be used for this procedure.

NOTE: If the switch is in re-flash position, the engine will not start.



FUEL SYSTEM / FUEL INJECTION

TPS CALIBRATION PROCEDURE (cont.)

10. If software has not been installed on your laptop computer, install it now following instructions in the diagnostic software instruction manual included with the Diagnostic Tool Kit (PV-46085).
11. Start the Victory diagnostic software program (click on the icon) and then click on the *Special Operations* button.
12. Turn the ignition switch and kill switch to the ON (run) position.

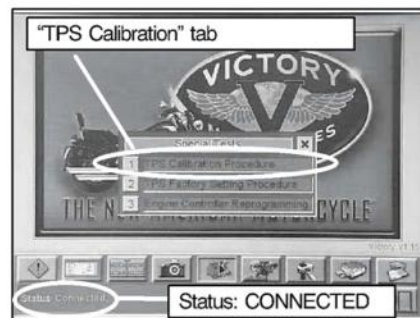


13. Click the *TPS Calibration* tab to begin the procedure.

NOTE: The *Status* shown in lower left hand corner of screen should read "Connected", and there should be 3 menu items displayed in the Special Tasks window:

- 1 TPS Calibration Procedure
- 2 TPS Factory Setting Procedure
- 3 Engine Controller Reprogramming (Re-Flash)

If the status displayed is "Not Connected" OR if there are less than 3 menu items displayed in the Special Tasks window, leave the key and kill switch ON and re-start the diagnostic program. Status must say "Connected".

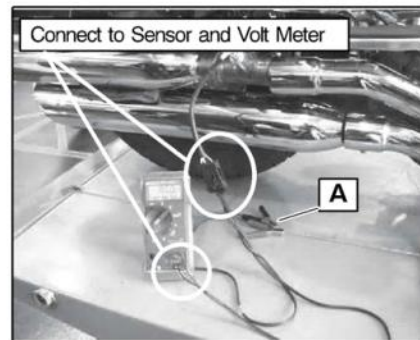


14. Next, connect the lambda sensor cable to the lambda sensor and to the voltmeter. Secure the lambda harness away from the exhaust.

15. Turn on the voltmeter and switch to **DC voltage**.

NOTE: IMPORTANT! Do not connect the lambda sensor power leads (A) to the battery at this time.

The power leads should not be connected unless the engine is running, or sensor failure may result.



TPS CALIBRATION PROCEDURE (cont.)

16. Secure the exhaust vent system on the exhaust pipes.

⚠ WARNING Exhaust Gases Are Poisonous

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

⚠ WARNING Hot Exhaust Components!

The engine and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wear insulated protective clothing.

17. Start the engine and let it run at high idle for 30 seconds.
18. After 30 seconds, return the fast idle lever to the off position.

NOTE: Touring Cruiser Models

In order to ensure accurate readings from the Lambda sensor on Touring Cruiser models, the left muffler must be plugged during TPS calibration. This is especially critical when a TC is equipped with accessory exhaust. Use a rubber stop or similar non-flammable instrument of correct size and shape to block off the left exhaust pipe outlet before proceeding.

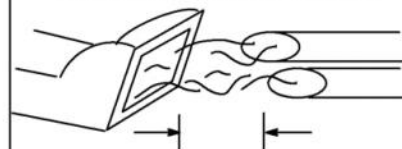
19. During this time frame watch the speedometer for 10 or more seconds to see if any check codes develop. If you do receive a flashing code, stop the engine and refer to the software manual in kit PN PV-46085 for diagnostic procedures.
20. With the engine running, toggle the LCD screen on the speedometer to "ALT" to verify that battery voltage is between 13 and 14.5 volts. If it is below 13 volts, shut the engine off and charge the battery before continuing.

21. After the motorcycle has run for 30 seconds, no codes are present, and battery voltage is above 13 volts, connect the lambda sensor red lead to battery positive and black lead to battery negative.

NOTE: The voltmeter should display a POSITIVE DC voltage reading. If the reading is negative, reverse the leads at the voltmeter to display a positive voltage to avoid confusion. (Place the red meter lead in the "common" (-) jack and the black meter lead in the red (+) jack on the meter.)



Typical Exhaust Extraction System



Leave space when performing final TPS calibration **ONLY!** Be sure exhaust fumes are drawn away by the evacuation system and do not enter the work shop area.

Check Speedometer for Flashing Codes



FUEL SYSTEM / FUEL INJECTION

TPS CALIBRATION PROCEDURE (cont.)

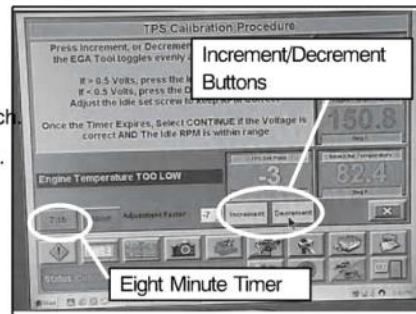
NOTE: The engine oil temperature is critical to ensure accurate TPS calibration. Be sure to allow sufficient warm up time and monitor engine temperature throughout the entire procedure.

22. Allow engine to run for the 8 minute warm-up period indicated by the timer on the TPS calibration screen before proceeding to the next screen.
23. **A minimum of eight minutes run time is required prior to performing the TPS procedure.** After the timer has run out, click the continue button to move to the next screen.

NOTE: If you are having difficulties keeping the engine running during this 8 minute time frame:

- a) Click continue to move to the next screen.
- b) Click on "increment" if you suspect the engine is running too rich.
- c) Click "decrement" if you suspect the engine is running too lean.

DO NOT attempt to fine-tune the running quality of the engine at this point! At this step it is important to get the engine to operating temperature.



24. Check the voltage displayed on the DC volt meter. The voltage should read between **0.01 and 1.2 volts**.



25. Place the cooling fan at a 45 degree angle on the front of the engine and turn it on. Make sure that the air box, engine, header pipes, and oil cooler is in the airflow of the fan.

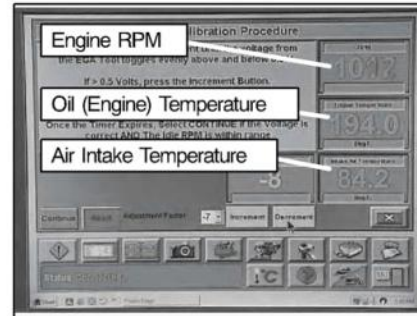


TPS CALIBRATION PROCEDURE (cont.)

26. To adjust the TPS make sure the following conditions are met:

- The intake air temperature should stay between 65 and 90° F (18-32° C)
- The oil (engine) temperature must be maintained between 194 and 212° F (90-100° C) as displayed on the diagnostic screen.
- Adjust the idle screw as necessary to maintain engine RPM between 950 and 1050.

NOTE: Ensure the fast idle lever is in the fully closed position.

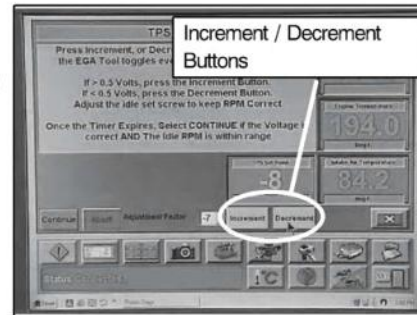


27. When all operational conditions are met:

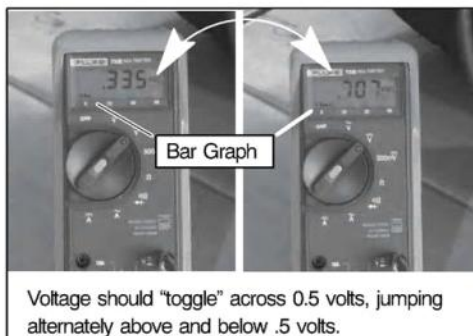
- Click "increment" (if the volt meter reads above 0.5 volts)
- Click "decrement" (if below 0.5 volts)...

until the sensor voltage jumps back and forth evenly across 0.5 volts.

NOTE: Decrement has a "richening" effect
Increment has a "leaning" effect



Watch the bar graph on the bottom of the meter display for accurate readings.



Check to see if reading is affected by your shop exhaust extraction system:

The use of an exhaust extraction system can cause false lambda sensor value readings. To see if you are obtaining false readings, perform the following:

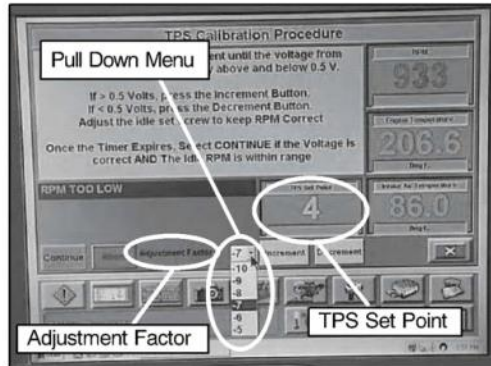
- Pull the exhaust extraction hose from each muffler and hold it about 2 inches behind the end of the muffler. Be sure to remove hose from both mufflers (where applicable).
- If the volt meter changes significantly the lambda reading is being affected by the vacuum created on the exhaust system with the extraction hose attached.
- *If your reading is affected by the exhaust extraction system, secure the hoses just behind the end of the muffler to evacuate exhaust fumes without affecting the Lambda reading, then repeat Step 27. If the reading was not affected proceed to Step 28.*

FUEL SYSTEM / FUEL INJECTION

TPS CALIBRATION PROCEDURE (cont.)

28. When the sensor voltage evenly jumps back and forth evenly across 0.5 volts, locate the "adjustment factor" number on the computer screen. You will need to choose an adjustment factor from the pull down menu.

- Choose "-7 adjustment factor" for most geographic areas.
- If your geographic area is very dry (humidity below 25%): select "-5 adjustment factor".
- If your geographic area is very humid (above 75%) select "-10 adjustment factor".



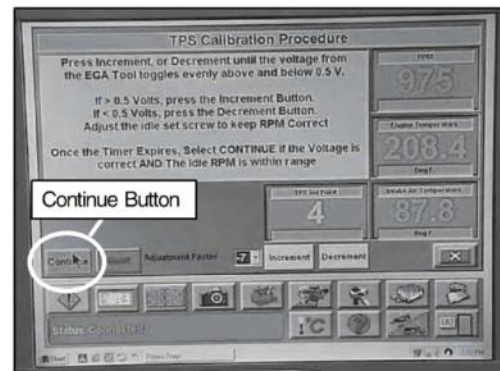
29. It is advisable to record the TPS Set Point and the Adjustment Factor for each motorcycle that you perform this procedure on for future reference.

30. When you have the **TPS Set Point** fixed and recorded, and you have selected your **Adjustment Factor** and recorded it, press the "continue" button.

Pressing the continue button will cause the final TPS setting to occur.

The sensor voltage will change and stabilize between 0.5 and 1.0 volts.

At 1000 RPM, voltmeter typically reads between .81 and .85 DCV.



NOTE: If the voltage continues to flash under 0.5 volts, the TPS adjustment was not performed properly. Make sure that there are no exhaust leaks, and that you selected the proper adjustment factor.

Do not stop the engine if the following conditions are met:

- Intake air temperature is between 65 and 90 degrees F. and the oil (engine) temperature is maintained between 194 and 212 degrees F. as displayed on the diagnostic screen.
- Adjust the idle screw to maintain engine RPM between 950 and 1050.
- Ensure the fast idle lever is in the fully closed position.

If all of these conditions are met, step through the TPS adjustment procedure again without waiting eight minutes (*only if the engine was not stopped*!).

If the engine was stopped you must re-start the eight minute timer. The voltage should change and stabilize between 0.5 and 1.0 volts.

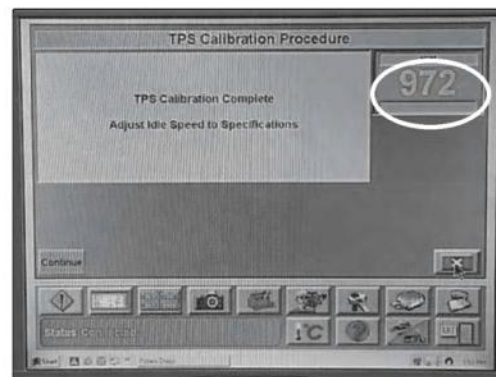
5.44

TPS CALIBRATION PROCEDURE (cont.)

31. Click the "continue" button. The diagnostic screen will tell you when the TPS calibration is complete.



32. Adjust the idle speed to factory specifications which is 950 +/- 50 RPM for model year 2002 motorcycles.
33. Exit the diagnostic software, and turn off the engine.
34. Let the engine and exhaust cool down.
35. Remove all test equipment and re-install muffler. Use care when working with the exhaust pipe prevent gasket damage. Replace any damaged gaskets.
36. Remove the plug from left muffler on TC models equipped with accessory exhaust.
37. Test ride the motorcycle to ensure proper running quality.



FUEL SYSTEM / FUEL INJECTION

RE-FLASH SOFTWARE

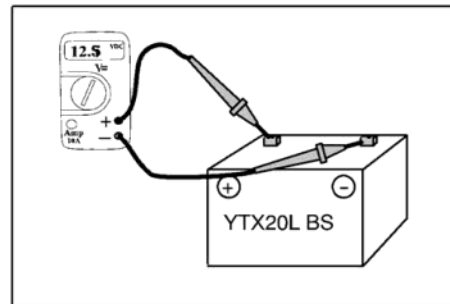
NOTE: Failure to follow all instructions completely and correctly can result in an engine that does not run!

RE-FLASH is a unique feature found on the Victory diagnostic software (2002 to subsequent) which allows re-programming of the ECM fuel and ignition map via a download from the dealer Extranet. This feature is used when installing Victory accessory exhaust, Stage kits, etc.

The Re-Flash feature is on the main menu of the Victory Diagnostics screen. The procedure is not difficult, but the technician should be familiar with the process and with computer operation in general.

Before installing software, read the *Install* Instructions completely in the "Getting Started" section of the MSE Diagnostic System Installation Guide and User Manual. Laptops that fit the *System Requirements* guidelines listed in the User Manual can be used to perform the Re-Flash procedure. Pay close attention to the required memory listed for the version of Windows on your laptop. *Resource: Page 3 of the User Manual*

1. **BATTERY VOLTAGE:** Be sure the battery is fully charged before you begin. The majority of problems with re-flash can be attributed to a low battery. Be sure the open circuit voltage (no load) is at least **13 volts and at least 12.5 volts with the key ON**. Connect a battery charger if necessary to bring voltage level above minimum. Fully charge the battery before you attempt to re-flash, or leave charger connected during re-flash. If "Key ON" voltage is marginal, it may help to remove the headlamp relay. Refer to page 2.24.
2. If the battery voltage is below that specified below, remove battery from motorcycle and charge (refer to page 16.7. Replace battery if it will not accept a charge.



Measure battery voltage.

Specification (Minimum):

13.0 DCV Key Off

12.5V DCV Key On

3. **DEDICATED LAPTOP:** Best results are obtained using a laptop computer that is "dedicated to Polaris/Victory service". A laptop that is used by a variety of people and in several applications around the dealership is more likely to cause a re-flash problem than one dedicated to Polaris/Victory diagnostics only.

RE-FLASH SOFTWARE (Cont.)

4. **CLOSE NON-ESSENTIAL PROGRAMS:** The programs necessary to run a computer vary depending on what operating system you are using (95,98,NT,ME,XP.....). It is recommended that you **DO NOT** install non-essential programs on the service department laptop. Things such as Digital Camera detection software, Virus Scanners, Tool Bars, etc. may clog up memory if running in the background and make it harder for the diagnostic software to operate. A good "quick check" is the number of little icons in the system tray, (icons in the task bar next to the clock). More than 4, or 5 items indicates the potential for a problem. Things to watch out for include but are not limited to:

- Video playing software
- Automatic programs started by your Internet Service Provider
- Financial software (checking account, business operations and accounting, tax reporting software etc.)
- All "shareware" & "freeware" downloaded from the internet
- Personal hand-held PC links (can prevent the diagnostic software and Re-Flash from working)
- Internet firewalls set to "high security mode" or virus scanning software running in the system tray.

A good rule to follow is that if a particular piece of software wasn't installed when Windows was installed, it has the potential to create problems if it's running at the same time as the diagnostic software. If you're having problems, click on the icons of *non-essential* programs and close, quit, or exit them before starting the reprogramming (re-flash) procedure.

5. **KNOW THE PROCESS:** If you are not familiar with the entire re-flash process, review the **HELP** section of the diagnostic software before trying a re-flash. Click on the ? on the toolbar or press F11. There is considerably more about re-flash in the on-line help than there is in the user manual. This should be your first step until you are familiar with the process.

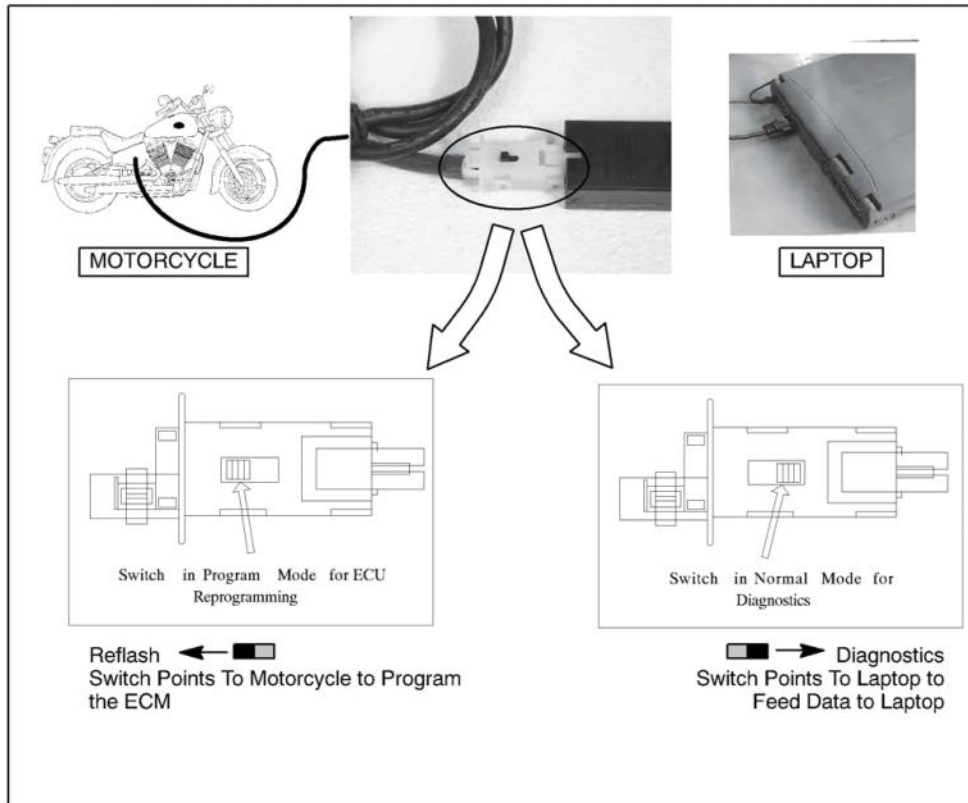


6. **COMMUNICATION PROBLEMS:** If you have had problems communicating with a vehicle while performing diagnostic functions, do not attempt a re-flash until the cause has been identified and fixed. Check all connections, and be sure battery voltage is **13 volts (key off) and at least 12.5 volts with the key ON as specified in step 2**. Be sure to follow the diagnostic power-up procedure precisely and be familiar with the re-flash process before you begin.
7. **DON'T DISTURB THE PC** when a re-flash is in progress. Don't move the mouse, and don't touch the keyboard. The process only takes a few seconds, and is best left alone until complete.
8. **REVIEW:** Read and understand the re-flash process before you begin, using the on-line help in the diagnostic software.

FUEL SYSTEM / FUEL INJECTION

RE-FLASH SOFTWARE (Cont.)

9. **RE-FLASH/DIAGNOSTIC SWITCH SETTING:** (See below). There is a two-position switch on the diagnostic communication cable. One position is for diagnostics and the other is for re-flash. Be aware that in order to re-flash the ECM, the communication cable switch must be moved toward the motorcycle (toward the ECM). Data will be going *into* the ECM, so the switch must be positioned accordingly.



10. Another way to tell if the switch is set to Diagnostic mode or Re-flash mode is the behavior of the fuel pump when the ignition is turned on. When the switch is set for normal operation (Diagnostics), the fuel pump will run IMMEDIATELY for approximately 2 seconds the instant that both the ignition key and kill switch are turned ON. When the switch is set to Re-Flash mode, there will be a 4 second delay from the instant the ignition key/kill switch is turned ON.

FUEL SYSTEM / FUEL INJECTION

FUEL SYSTEM TROUBLESHOOTING

Loose terminal pins , poor connections at terminals or connectors are the most common cause of Fuel Injection system problems. Always verify terminal pins are not loose in the connector and that wires are securely connected to the terminal pins before replacing fuel injection components. Important areas to check are the back of the fuse box and the ECM connector.

| 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 | Blown Fuse | Replace |
| | | Plugged fuel filters fuel hose | Clean/Replace |
| | | Fuel pump not working | Test / Replace |
| | | Fuel pressure regulator not working correctly | Test / Replace |
| | | Fuel injector not working | Test / Replace |
| | | Faulty fuel pump relay | Test / Replace |
| | Excessively rich or lean fuel mixture | Open in wiring or connector | Inspect/Repair |
| | | Faulty ECM | Replace |
| | | Throttle Position Sensor (TPS) out of adjustment | Adjust / Reset w/ECM |
| | | Fuel pump | Test / Replace |
| | | Fuel pressure regulator | Test / Replace |
| | | Faulty TPS | Test / Replace |
| | | Crank Position Sensor | Test / Replace |
| | | Barometric pressure sensor | Test / Replace |
| | | Coolant temperature sensor | Test / Replace |
| | | ECM | Reset w/ TPS or Replace |
| | | Air temperature sensor | Test / Replace |
| | | Fuel Injector | Test / Replace |
| | Spark at wrong time or no spark. Fuel delivery timing incorrect. | Low battery voltage | Charging system |
| | | Flywheel installed incorrectly | Install Correctly |
| Poor idle | Excessively rich or lean fuel mixture | Vacuum Leaks | Repair/Replace gaskets and/or connections |
| | | Exhaust Leaks | Seal exhaust and re-calibrate TPS |
| | | Crank Position Sensor | Test / Replace |
| | | TPS | Calibrate / Adjust |
| | | Fuel Pump | Test fuel pressure |
| | | Fuel injector or fuel rail obstructed or leaking | Clean/Repair/Replace |
| | | Fuel Pressure Regulator | Test / Replace |
| | | Air Filter | Replace |
| | | ECM | Replace |

5.49

FUEL SYSTEM / FUEL INJECTION

FUEL SYSTEM TROUBLESHOOTING (cont.)

| PROBLEM | POSSIBLE CAUSE | AFFECTED PART(s) | REPAIR RECOMMENDED |
|----------------------------------|--|--|---|
| Engine Stalls | Fuel Pump Power Interruption | ECM Protection Diode | Check diode, connections, in fuse box and power / ground path for fuel pump circuit |
| | Fuel Injector Problem | Faulty fuel injector No signal from ECM Wiring problem Low battery voltage Improper TPS Adjustment | Test / Replace Repair/Replace Repair/Replace Charging system Adjust TPS |
| | Excessive rich or lean fuel/air mixture | Manifold Absolute Pressure (MAP) Sensor Plugged fuel filter Fuel pump Fuel pressure regulator Vacuum or Exhaust Leak Wiring problem Air Filter TPS Low battery voltage | Repair/Replace Replace Test fuel pressure Test fuel pressure Repair/Replace hoses Repair/Replace Missing-Replace Adjust / Replace Charging system |
| | Control Circuit/Sensors not functioning correctly | Fuel pressure regulator TPS Engine speed sensor Fuel pump relay Flywheel Fuse ECM Relay Low battery voltage ECM | Test Pressure / Replace Test / Replace Test / Replace Test / Replace Inspect / Install correctly Replace Replace Inspect Charging system Replace |
| | Valve train problems or Compression low | Refer to chapter 7 | |
| Poor Running in upper rpm ranges | Valve train problems Ignition problems Overfilled with oil Low Battery Voltage Moisture in multi-pin connector | Battery ECM and wiring harness | Refer to cyl. head & valves Refer to ignition section. Refer to maintenance Refer to battery section Unplug and dry connections |

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 | | |
| | | Barometric pressure sensor | Test / Replace | | |
| | | Intermittent wiring /connector problem | Repair/Replace | | |
| | | ECM | Test / Replace | | |
| | Fuel delivery incorrect | Plugged or kinked fuel and/or vent hoses | Repair/Replace | | |
| | | Fuel pump | Test / Replace | | |
| | | Fuel pressure regulator | Test Pressure / Replace | | |
| | | Fuel filters restricted | Clean or replace | | |
| | | Battery/Charging System | Charge/Replace | | |
| | | Fuel Injector plugged | Clean/Replace | | |
| Contaminated fuel (water, additives, etc.) | | Clean/Replace | | | |
| Inadequate octane | | Use correct fuel | | | |
| Air intake restriction | Defective throttle valve | Replace throttle body | | | |
| | Low battery voltage | Charging system | | | |
| Air Leak | Dirty Air Cleaner | Clean | | | |
| | Intake restriction | Repair | | | |
| | Throttle body gasket surfaces | Repair/Replace | | | |
| Engine lacks power | Engine component problems Ignition problems Overfilled with oil | Throttle body | Repair/Replace | | |
| | | Intake manifold | Repair/Replace | | |
| | | Throttle body | Repair/Replace | | |
| | Improper fuel delivery | See chapter 7, 8 See chapter 17 See chapter 2 | See chapter 7, 8 | | |
| | | | See chapter 17 | | |
| | | | See chapter 2 | | |
| | | | Plugged fuel injector | Clean/Replace | |
| | | | | TPS | Adjust or 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 line | | | | Charge Battery / Replace | |
| Low battery voltage | | | | Test batt./Charging system | |
| ECM | | | | Test / Replace | |

FUEL SYSTEM / FUEL INJECTION

FUEL SYSTEM TROUBLESHOOTING (cont.)

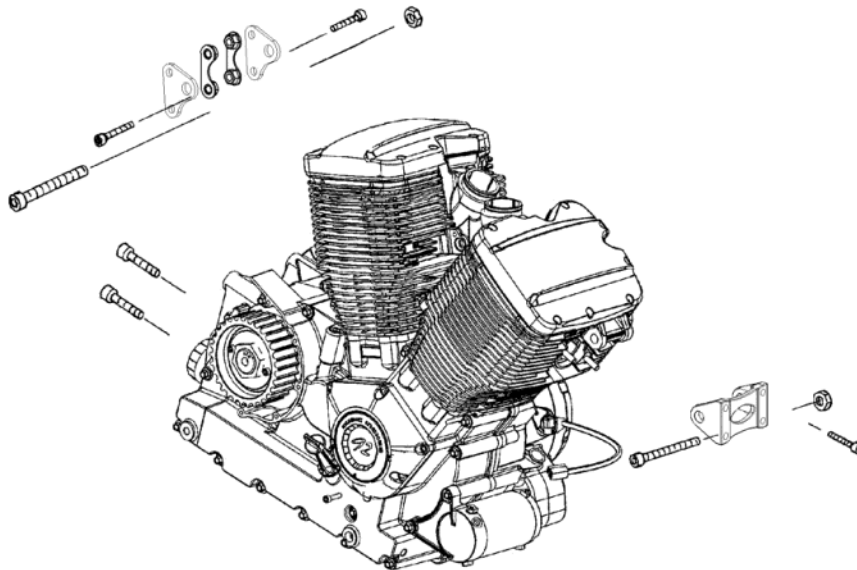
| PROBLEM | POSSIBLE CAUSE | AFFECTED PART(s) | REPAIR RECOMMENDED |
|------------------|--|---|---|
| Engine overheats | Internal Engine Parts Lubrication & Cooling system Low or incorrect oil Drive belt too tight Ignition timing incorrect | Cooling System Cooling System Engine Oil Drive Belt Ignition Coils Faulty coolant temperature sensor Faulty engine speed sensor Faulty ECM Heat range incorrect | Refer to chapter 4 Refer to chapter 4 Refer to chapter 3 Refer to chapter 3 Refer to chapter 17 Replace Replace Replace Replace |
| | Spark plug(s) Low battery voltage | Charging System Faulty Battery Faulty Wiring | 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 line plugged/kinked TPS Air leak at throttle body to manifold seal | Repair/Replace Repair Clean/Replace Replace Repair Refer to fuel injection Repair |

CHAPTER 6

ENGINE REMOVAL & INSTALLATION

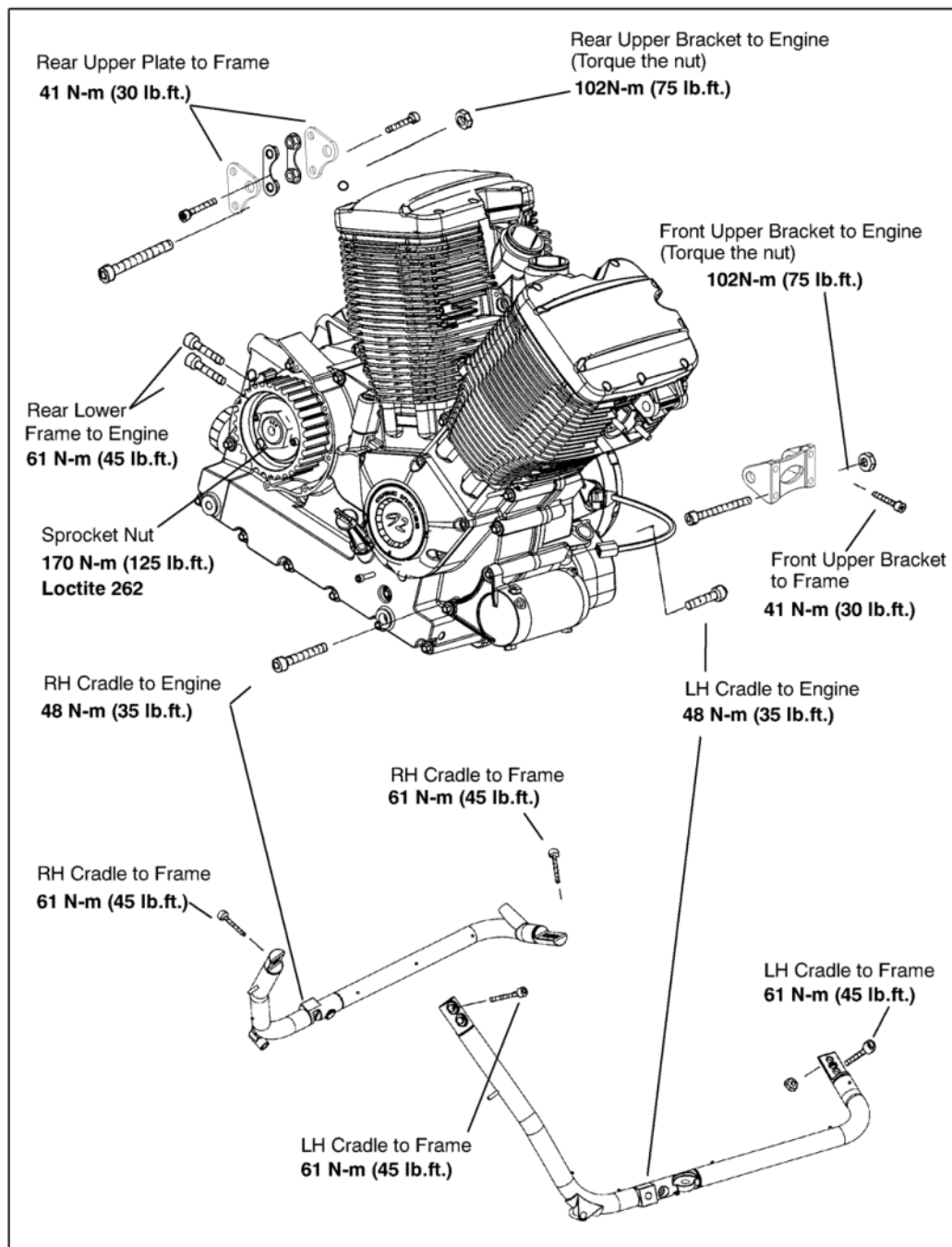
| | |
|---|------|
| ENGINE MOUNTING EXPLODED VIEW / FASTENER TORQUE | 6.1 |
| SPECIFICATIONS | 6.1 |
| FASTENER SIZE and TORQUE CHARTS | 6.1 |
| ENGINE REMOVAL | 6.4 |
| ENGINE INSTALLATION | 6.10 |

6



ENGINE REMOVAL & INSTALLATION

ENGINE MOUNTING - TORQUE VALUES



6.1

ENGINE REMOVAL & INSTALLATION

GENERAL

A floor jack or commercially available motorcycle engine jack is required for engine removal. Arrange for assistance when removing and installing the engine into frame to avoid damage and personal injury.

Once the engine is removed from the frame, an engine stand greatly facilitates engine disassembly and assembly.

| REQUIRES ENGINE REMOVAL FOR SERVICE | CAN BE SERVICED WITH ENGINE IN FRAME |
|--|---|
| Oil Pump | Clutch / Primary Drive |
| Camshaft | Fuel Injection |
| Cylinder Heads | External Gearshift Linkage |
| Crankcase Breather Reed Valve | Alternator |
| Crankshaft & Crankshaft Component Service | Starter, Starter Clutch, Flywheel, Anti-Kickback Clutch |
| Piston/Cylinder | Ignition System |
| Transmission/All Internal Transmission Parts | Output Shaft Seal |
| Oil Pump Drive/ Balance Shaft | Torque Compensator |
| Airbox Replacement | Cam Chain Tensioner Mechanism |
| | Valve Cover/Valve Cover Gasket |
| | Torque Head Bolts |

SPECIFICATIONS

| ENGINE WEIGHT and OIL CAPACITY | |
|--------------------------------|--|
| Item | Specifications |
| Engine Dry Weight | Approximately 111 Kilograms (244 lbs) |
| Oil Capacity | Approximately 6.15 Liters (6.5 Quarts) |

SPECIAL TOOLS

Refer to page 1.11 for Special Tool information.

FASTENER TORQUE SPECIFICATIONS

| Description | Torque Value | | Apply/Notes: | |
|-------------------------------|----------------|----------------|--------------|--|
| | N-m | lb-ft. (lb-in) | | |
| Frame Cradles | | | | |
| Cradles to Main Frame | (M10x1.5x25) | 61 | 45 | |
| Cradles to Engine | (M10x1.5x70) | 48 | 35 | |
| Engine Mounting | | | | |
| Front Upper Bracket to Engine | (M12x1.75x25) | 102 | 75 | Torque the nut |
| Rear Upper Brackets to Frame | (M8x1.25x25) | 41 | 30 | |
| Rear Upper Brackets to Engine | (M12x1.75x100) | 102 | 75 | Torque the nut |
| Rear Lower Frame to Engine | (M10x1.5x45) | 61 | 45 | Install ground cables on upper left bolt |

6.2

ENGINE REMOVAL & INSTALLATION

FASTENER TORQUE SPECIFICATIONS

| Description | Torque Value | | Apply/Notes: |
|--|--------------|---------------|------------------|
| | N-m | lb-ft (lb-in) | |
| LH Floorboard | | | |
| Floorboard Support To Cradle (M10x1.5x25) | 48 | 35 | |
| Rear Linkage Clevis To Splined Shaft (M6x1.0x20) | 12 | 9 | |
| Rod End To Shift Linkage Clevis (M6x1.0x20) | 11 | 8 | Torque the nut |
| Shift Linkage Rod End To Shift Linkage Clevis (M6x1.0x20) | 14 | 10 | |
| RH Floorboard | | | |
| Brake Pedal Support To Floorboard Support (M8x1.25x20) | 24 | 18 | |
| Brake Rod Jam Nut (M8x1.25) | 11 | 8 | (TC Models) |
| Floorboard Support To Cradle (M10x1.5x25) | 48 | 35 | |
| Side Stand | | | |
| Side Stand To Cradle (M10x1.5x25) | 48 | 35 | Torque the nut |
| Exhaust | | | |
| Crossover Pipe Clamp (M10x1.5) | 59 | 44 | (TC Models) |
| Exhaust Pipe to Cylinder Head (M8x1.25) | 16 | 12 | |
| Exhaust Pipe Clamp to Muffler (M10x1.5) | 59 | 44 | |
| Manifold To Exhaust Pipes (Rear) (M10x1.5) | 59 | 44 | |
| Muffler Support Bracket To RH Cradle (M8x1.25x16) | 24 | 18 | |
| Muffler Support Bracket To RH Passenger Peg Support (M8x1.25x16) | 24 | 18 | |
| Muffler To Muffler Support Bracket (M8x1.25x16) | 24 | 18 | (Classic Models) |
| Muffler To Muffler (M8x1.25x16) | 24 | 18 | (Classic Models) |
| Muffler To Front Support Bracket (M8x1.25x16) | 24 | 18 | (TC Models) |
| Muffler To Rear Support Bracket (M10x1.5x16) | 48 | 35 | (TC Models) |
| Muffler Support Bracket to LH Cradle (M8x1.25x16) | 24 | 18 | (TC Models) |
| Muffler Support Bracket to LH Passenger Peg Support (M8x1.25x16) | 24 | 18 | (TC Models) |

ENGINE REMOVAL & INSTALLATION

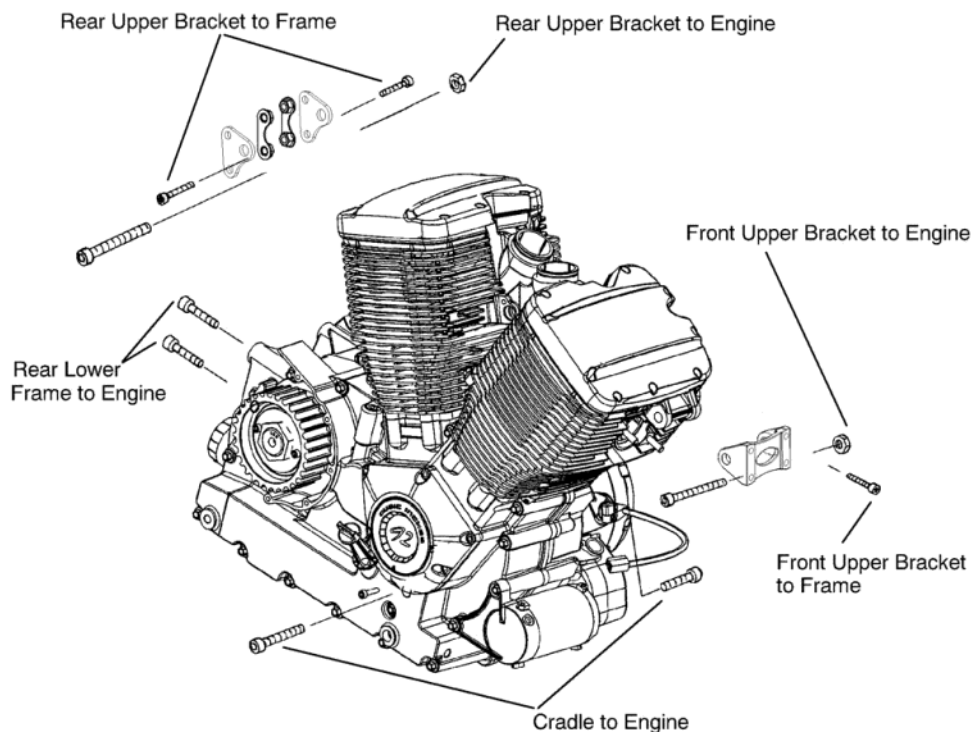
FASTENER TORQUE SPECIFICATIONS

| Description | Torque Value | | Apply/Notes: |
|--|---|---------------|----------------------------------|
| | N-m | lb-ft (lb-in) | |
| Air Box | | | |
| Air Filter Cover Bolts (M6x1.0x12) | 10 | 8 | |
| Air Box Cover | 1 | (10) | |
| Air Box To Throttle Body Adapter | 3.7 | (30) | |
| Throttle Body Adaptor To Throttle Body | 10 6 | (85) (50) | 6mm Screws (4) 5mm Screws (2) |
| Intake Manifold Clamps | 2.5 | (20) | |
| Electrical | | | |
| Battery Cable To Starter Motor (1/4-20) | 11 | 8 | |
| Battery Cables to Starter Solenoid (M6x1) | 3 | (25) | |
| Flasher Module to ECM Mount (M6x1) | 5 | (40) | |
| Horn to Horn Bracket (M8x1.25) | 13 | 10 | |
| Ignition Switch Bracket To Frame Bracket (M6x1x12) | 10 | 8 | |
| Ignition Key Switch To Ignition Bracket (M6x1x12) | 10 | 8 | |
| Starter Solenoid To Battery Box (M6x1) | 5 | (40) | |
| Oil Cooler | | | |
| Front Upper Oil Cooler Bracket to Frame | 41 | 30 | |
| Oil Line Retaining Bracket (To Crankcase) | 10 | (87) | |
| Oil Lines to Cooler (Top and Bottom) | 23 | 17 | |
| Engine Oil | | | |
| Oil Drain Plug (M12x1.5) | 27 | 20 | |
| Oil Filter | 3/4 turn after o-ring touches crankcase | | |
| Fuel Tank | | | |
| Fuel Tank Mount to Frame (M10x16) | 48 | 35 | |
| Hose Clamp | 8 | (69) | |
| Belt Guards | | | |
| Belt Guard to Swing Arm (Lower) (M6x1.0x16) | 11 | 8 | |
| Belt Guard to Swing Arm (Upper) (M8x1.25x20) | 24 | 18 | |
| Drive Sprocket (Belt) Cover (M6x1.0x16) | 16 | 12 | |
| Drive Sprocket Nut (M36x1.5) | 170 | 125 | Loctite 262 |

6.4

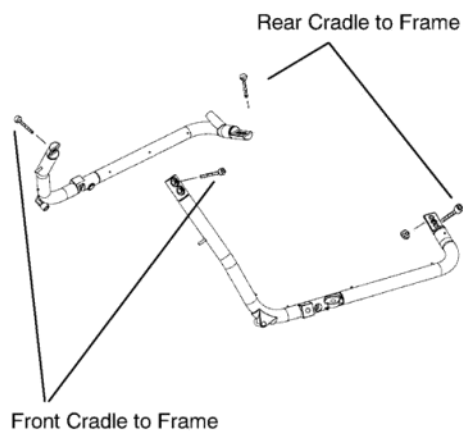
ENGINE REMOVAL & INSTALLATION

ENGINE MOUNTING EXPLODED VIEW



ENGINE REMOVAL

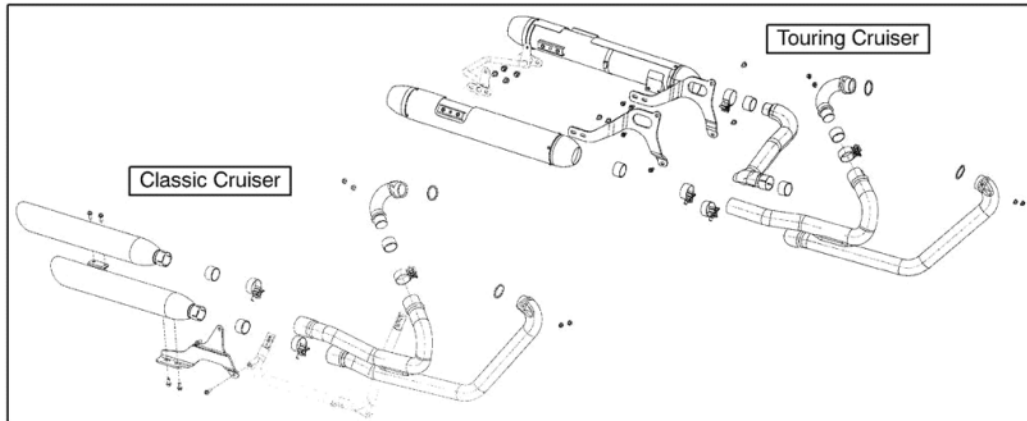
1. Support motorcycle securely in an upright position. Strapping the unit down to a lift table works well.
2. Disconnect the negative cable from battery.
3. Disconnect the positive cable from battery.
4. Remove battery from vehicle.
5. Drain engine oil.
6. Remove seat, frame side covers, and fuel tank (Refer to Ch.3)
7. Disconnect spark plug wires from spark plugs.



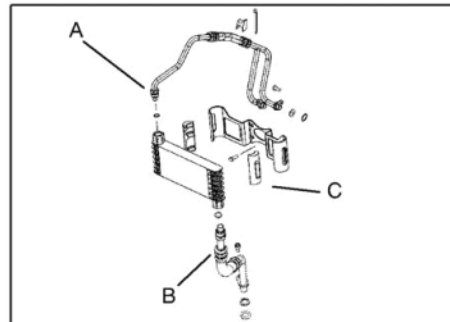
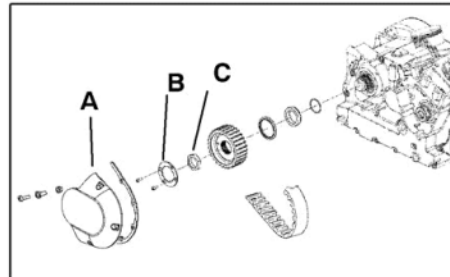
ENGINE REMOVAL & INSTALLATION

ENGINE REMOVAL (Cont.)

8. Remove exhaust system (Refer to Chapter 3)



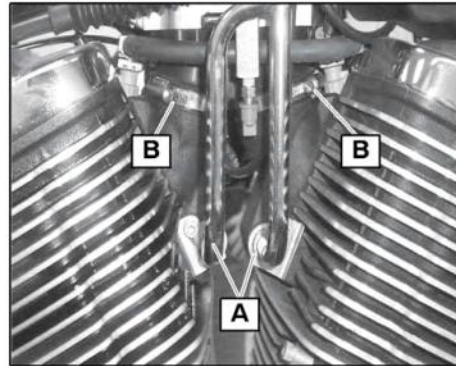
9. Remove drive belt cover (A) and gasket. If you plan to disassemble the engine crankcase, remove engine sprocket lock plate (B) and apply rear brake to hold sprocket while removing nut (C).
10. Loosen rear axle and belt adjustment lock nuts (Refer to Chapter 11), loosen adjuster bolts equally and push wheel forward to relieve belt tension.
11. Slip belt off drive sprocket and remove drive sprocket.
12. Disconnect speed sensor at connector.
13. Remove guide clips for wiring and hoses on RH frame rail.
14. Remove top oil pipe from cooler (A).
15. Remove lower oil pipe at the cooler fitting (B) or at the engine by removing retainer plate.
16. Lubricate rubber mounts (C) with silicone spray. Push downward on cooler and carefully remove from bracket. Leave cooler bracket on at this time.



ENGINE REMOVAL & INSTALLATION

ENGINE REMOVAL (Cont.)

17. Place a drain pan beneath lift to catch any oil that may drain from passages. Remove oil pipes (A) with oil hose.
18. Loosen inlet manifold clamps (B).

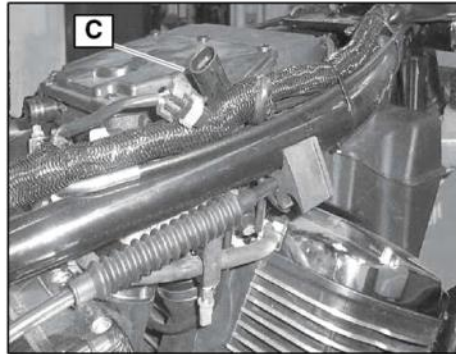


19. FRONT INJECTOR: Disconnect front injector at connector (C) located on RH side of air box.

20. REAR INJECTOR: Disconnect rear injector at the injector.

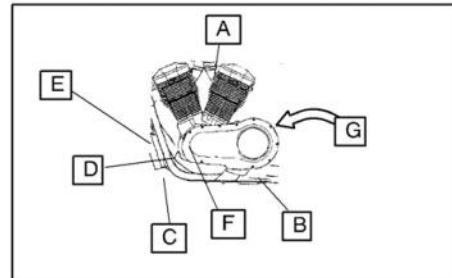
NOTE: This is a double-lock connector. Slide back the red lock tab and then depress the secondary locking tab. Slide harness from injector.

21. Disconnect clutch cable from lifter arm on primary cover.

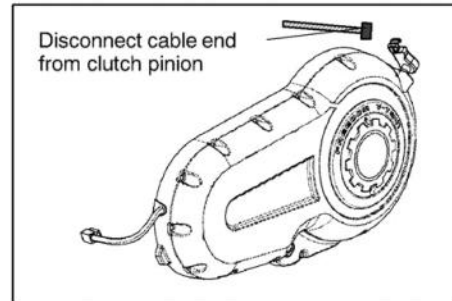


22. Disconnect the following wiring harness connectors or remove the component as indicated:

- Oil temperature switch (A) Release tab on flat side of connector to remove harness.
- Oil Pressure Switch (B)
- Regulator/Rectifier (C) (2 screws)
- Alternator wire connector (D)
- Starter motor cable (E)
- Crankshaft position (trigger) sensor (F)
- Neutral Switch (in front of drive sprocket) (G)



23. Disconnect clutch cable from clutch lifter arm. Protect the arm with a cloth or use a soft jaw pliers to prevent damage to lifter arm finish.



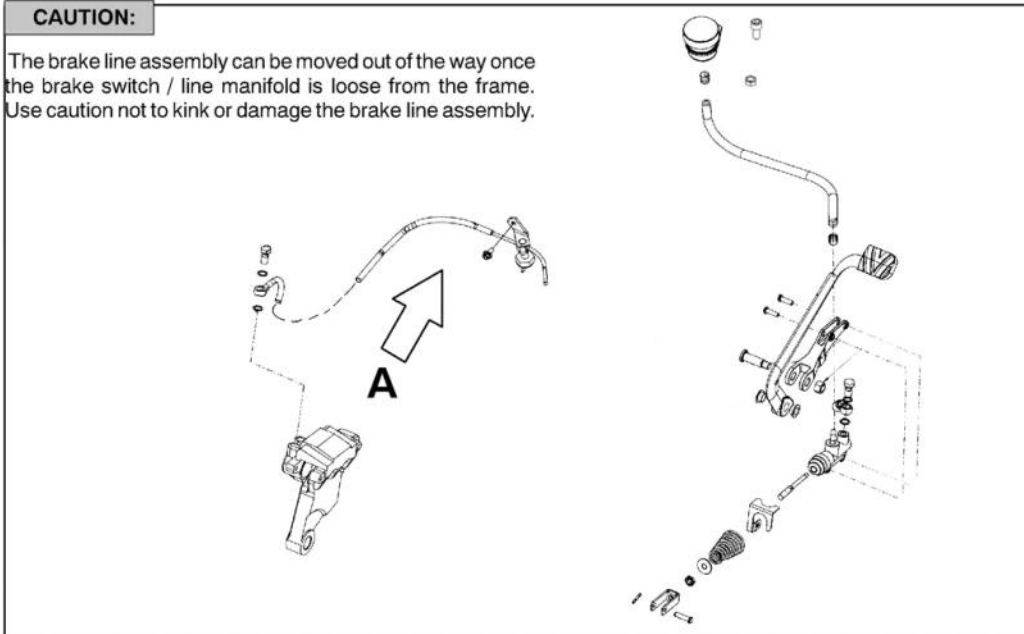
ENGINE REMOVAL & INSTALLATION

ENGINE REMOVAL (Cont.)

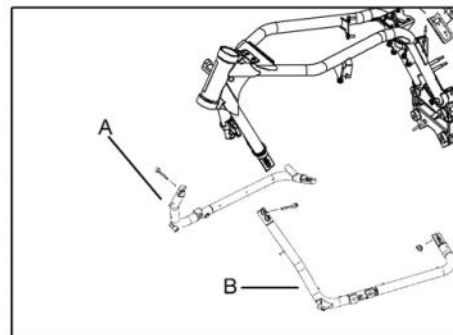
24. Remove brake switch mounting bolt (A). Remove the brake line retainers from RH frame cradle and frame.

CAUTION:

The brake line assembly can be moved out of the way once the brake switch / line manifold is loose from the frame. Use caution not to kink or damage the brake line assembly.



25. Remove the right side frame cradle as an assembly as shown (A). Secure assembly to the rear of vehicle so brake fluid reservoir remains upright and brake lines and wiring are not damaged.
26. Remove cable ties as needed. Secure wiring so that it does not interfere with engine removal. Study and make notes on cable tie locations and harness routing for assembly.
27. Remove shifter arm pinch bolt. Note position of dot aligned with slot for assembly, or mark shaft and lever arm for alignment upon reassembly.
28. Remove right side lower frame tube assembly
29. Remove shift shaft pinch bolt and shift linkage from left side.
30. Remove left side lower frame tube assembly (B). Floorboard or footpeg does not have to be removed from frame tube.
31. Disconnect or remove crankcase breather hose.



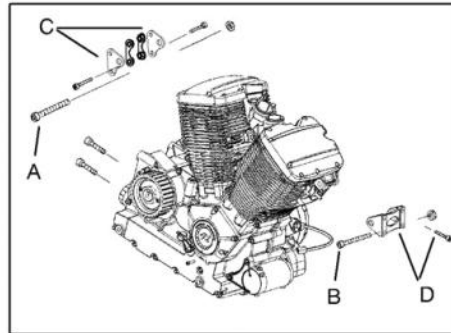
ENGINE REMOVAL & INSTALLATION

ENGINE REMOVAL (Cont.)

32. Remove upper rear engine mount bolt (A).

NOTE: A 4 inch long or longer 8mm ball driver socket works well to remove some engine mount fasteners.

33. Remove front upper engine mount bolt (B).



34. Place a lift hoist in a position that will center the load and not damage components. Apply slight upward pressure to support engine.

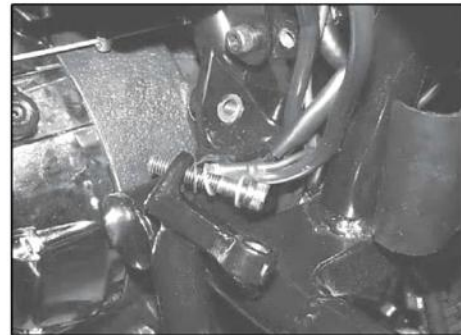
35. Remove rear upper engine mounting plates (C) from frame along with nut plates.

36. Remove oil cooler bracket and front mount (D).

37. Remove mounting bolts from electrical panel on right side and pivot out of the way to gain access to rear engine mounting plate bolts.

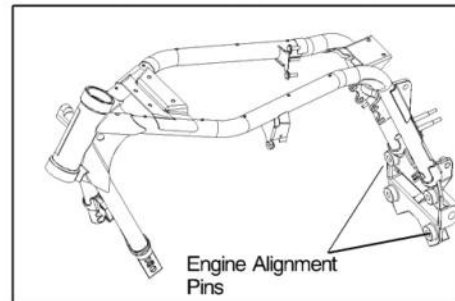
38. Remove lower rear frame-to-engine mounting bolts.

39. Remove upper left bolt which also attaches battery ground cable mount and passenger peg bracket.



NOTE: Move engine back and forth slightly to release engine from alignment pins at the rear of crankcase.

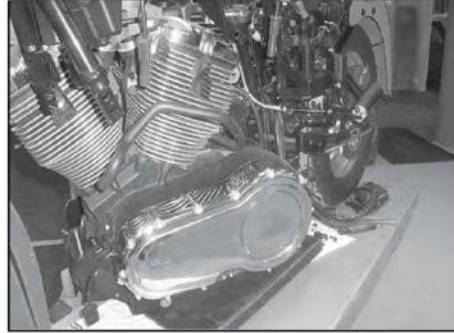
CAUTION: Arrange to have assistance when engine is ready to be removed from frame. The engine must be held securely to prevent damage to engine, front fender or frame. The engine is very heavy and could cause personal injury if not handled properly.



ENGINE REMOVAL & INSTALLATION

ENGINE REMOVAL (Cont.)

40. Lower engine slowly while observing throttle body and all other areas to avoid damage. Turn front of engine carefully to the right until clear of frame. Remove engine from frame.



NOTE: Attach engine securely to an engine stand to prevent damage and for ease of disassembly. Use spacers as needed.



INJECTOR REMOVAL

NOTE: IMPORTANT! Debris may collect in and around the injector cavity during operation. Clean injector cavity and surrounding area with compressed air before removing injectors from cylinder heads to prevent debris from falling into engine.



NOTE: Engine removal is not required to service the injectors.

ENGINE REMOVAL & INSTALLATION

ENGINE INSTALLATION

REFER TO PAGE 6.1 FOR TORQUE VALUES.

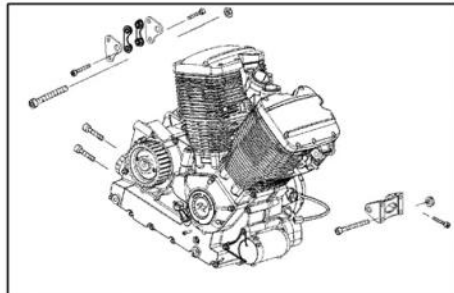
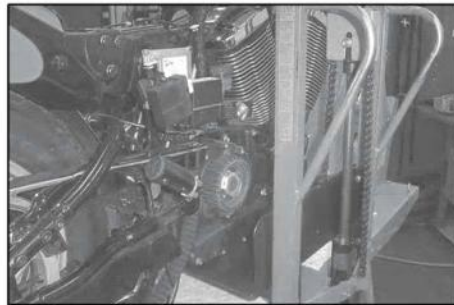
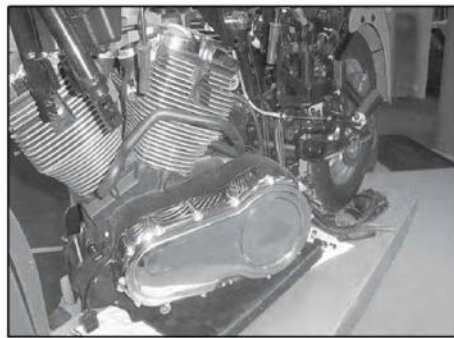
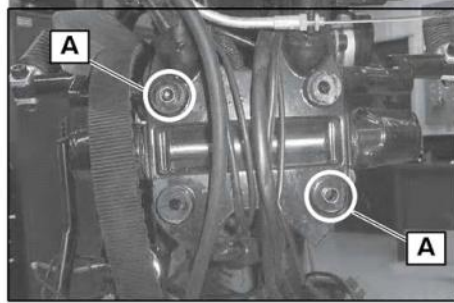
Ensure that the hoses, brake lines, and wiring are routed between the rear mounts so that engine can be installed into frame without pinching or pulling wires or hoses.

NOTE: IMPORTANT! Be sure alignment dowel pins (A) are in place before installing engine.

Arrange for assistance when installing the engine into the frame. The engine must be held securely to prevent damage to the engine, front fender, frame tubes, wiring and hoses or personal injury.

NOTE: Install all engine and frame cradle mounting fasteners hand tight at first, then tighten to specified torque value in the order shown on page 6.10.

1. Place engine on suitable lift. Move engine toward frame at an angle.
2. Inspect the alignment of throttle body adaptor to the cylinder intake manifolds. Place the adaptor clamps onto the intake manifolds before raising the engine into mounting position. Lightly grease the throttle body to ease installation.
3. Re-position engine to center of frame and raise until aligned with rear mounts.
4. The rear brake line passes between the rear engine mounts and the frame. Check to make sure the brake line is properly routed before installing rear mounting bolts.
5. Carefully raise the engine with the lift and fit the rear of crankcase onto mount alignment pins, and throttle body is seated in the manifolds.
6. Install bottom two rear engine mounting bolts through the frame and hand tighten to hold engine in position.

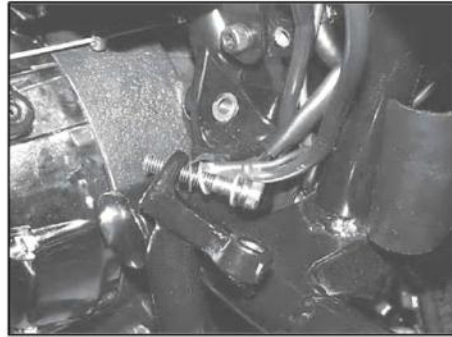


6.11

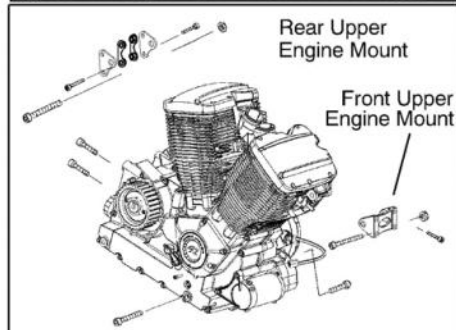
ENGINE REMOVAL & INSTALLATION

ENGINE INSTALLATION (Cont.)

7. Install top two rear engine mounting bolts with passenger peg brackets. Be sure the ground cable is installed on bolt for upper left peg mount.



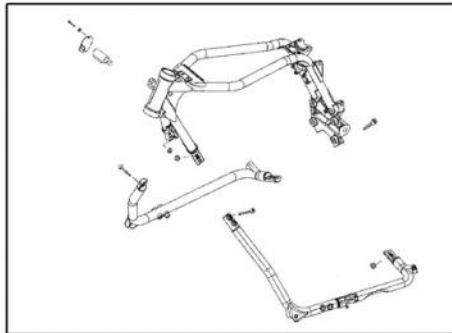
8. Loosely install engine front upper bracket to frame.
9. Install engine front upper bracket through bolt.
10. Install rear upper engine mounting plate to frame.
11. Install engine to rear upper bracket through-bolt.



12. Install lower frame cradles and hand tighten the bolts. It may be necessary to use an alignment tool to align the holes in order install lower frame tube bolts. Install the rear first, then the front bolts.
13. Install lower cradle-to-engine bolts and hand tighten.

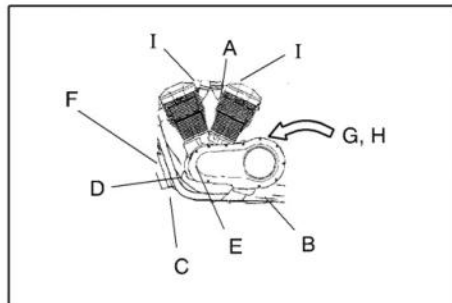
REFER TO PAGE 6.1 FOR TORQUE VALUES.

14. Install crankcase breather manifold hose.
15. Fully seat throttle body adaptors and tighten clamps to 20 inch-lbs.



16. Connect the following wiring harness connectors:

- Oil Temperature (A)
- Oil Pressure (B)
- Rectifier/Regulator Connectors (C)
- Alternator Connector (D)
- Crankshaft Position Sensor (E)
- Starter Motor Cable (F)
- Neutral Switch (below engine sprocket) (G)
- Vehicle Speed Sensor (H)
- Front and Rear Injector (I)

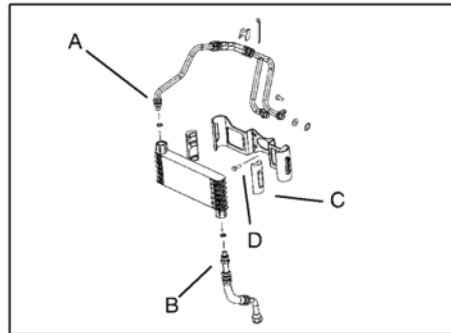


ENGINE REMOVAL & INSTALLATION

ENGINE INSTALLATION (Cont.)

17. Connect starter motor cable and cover connection with weather boot.
18. Connect high tension leads to spark plugs.
19. Install oil cooler bracket (D), and cooler.
20. Place mounting grommets (C) on sides of cooler. Lubricate with silicone spray and install cooler in bracket. Be sure the projections on side of grommets engages slot in cooler bracket securely.
21. Apply lubricating oil to oil pipe fitting sleeve(s), threads remain dry.
22. Torque oil pipe fittings (A, B).

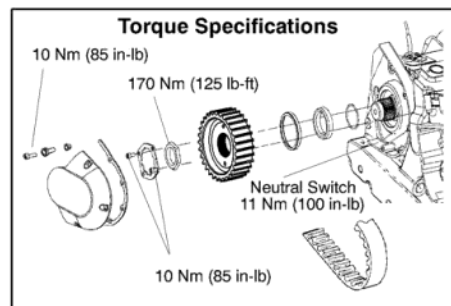
TORQUE: Oil Pipe Fittings
17 lb-ft, 23 Nm



23. Install drive belt and align rear tire. Refer to Chapter 11 for drive belt installation.
24. Clean threads of output shaft with a wire brush or pick to remove old thread locking agent. Spray the threads with Loctite Primer N and allow it to dry completely. If a new nut is installed, there is a pre-applied locking agent already applied. If installing the original nut, apply Loctite 262 to threads of nut and shaft.
25. Install engine sprocket and nut. Apply the rear brake to hold output shaft stationary when applying final torque to the sprocket nut.

26. Torque sprocket nut to specification.

TORQUE: Drive Sprocket Nut
170 Nm, 125 lb-ft
Loctite 262



27. Install sprocket nut retainer plate and plate screws. Rotate plate clockwise and hold it against the nut when tightening retainer plate screws. Torque screws to 10 Nm (85 inch lbs.)
28. Install sprocket cover and gasket.
29. Install exhaust system using new gaskets. Refer to Chapter 3 for exhaust assembly and torques.
30. Torque exhaust system clamps and mounting bolts to specification.

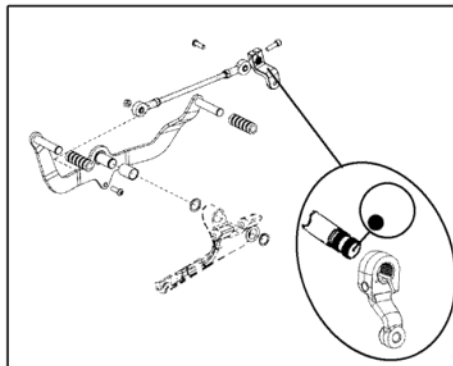
ENGINE REMOVAL & INSTALLATION

ENGINE INSTALLATION (Cont.)

31. Install shifter linkage clevis with slot in clevis aligned with dot on splined shaft; or, align marks you made upon disassembly. Linkage rods and clevis arms should form (approximate) 90° angles.

32. Torque shift lever pinch bolt to specification

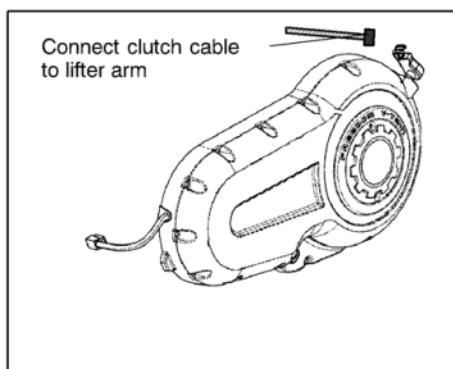
TORQUE: Shift Linkage Pinch Bolt
12 Nm (108 inch) lbs.



33. Connect clutch cable into clutch pinion. Use a soft jaw pliers to prevent damage to pinion arm finish.

CAUTION:

Fuel tank vent line restriction may cause fuel tank damage and engine running problems. Inspect fuel tank vent line for proper routing. Be sure the line is not kinked or pinched.



34. Install the fuel tank. Refer to Chapter 5 for Fuel Tank installation procedure.

35. Connect the positive battery cable.

36. Connect the negative battery cable.

37. Install seat, frame side covers (Refer to Chapter 3).

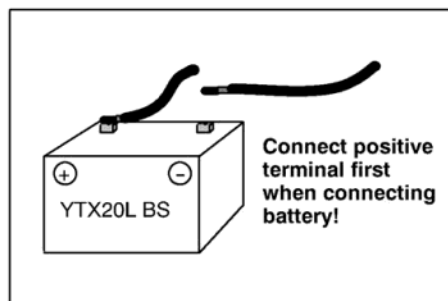
38. Install new oil filter and fill crankcase to specification with Victory engine oil (Refer to Chapter 2).

39. Inspect operation of all controls. Adjust to specification (Refer to Chapter 2).

40. Start engine, inspect for oil leaks.

41. Ensure that the engine RPM does not increase when the handlebars are turned lock-to-lock, correct if necessary (Refer to Chapter 2).

42. Test ride machine, inspect for proper operation, fluid leaks, and top off oil level if necessary.



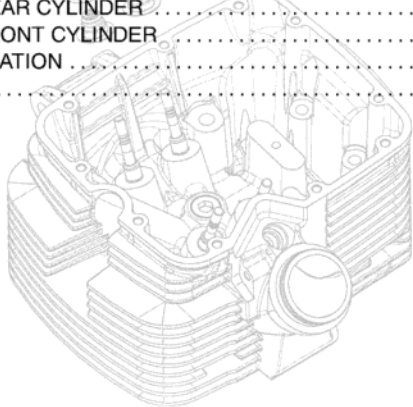
6.14

CHAPTER 7

CYLINDER HEAD & VALVE TRAIN

| | |
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7



CYLINDER HEAD & VALVE TRAIN

GENERAL

- This section covers service of the cylinder heads, camshafts, cam chains and tensioners, cam chain guides and rocker arms. Cam chain tensioners can be service with the engine in the frame. The other components require engine removal. Refer to Chapter 6 for engine removal and installation.
- Mark and store all mating parts for correct engine assembly.
- Use moly assembly paste to lubricate the cam shafts and rocker arms during start up and engine break-in.

Moly assembly paste PN: 2871460

Victory Semi-Synthetic 20W/40 PN: 2872176

- Handle and store all parts in such a way that they will not be damaged.
- If engine damage has occurred due to lack of lubrication or debris has circulated within the engine, all oil passages must be inspected before engine assembly is completed.
- Pay attention to the notes concerning assembly lubrication. Many parts require pre-lube and various parts require different types of pre-lube.
- There are many precision measuring steps and some precision machining steps to be performed in this section. If you are not sure of your capabilities in these areas, have a competent machinist perform these operations. Valve seat reconditioning should be performed by a technician proficient in cylinder head reconditioning techniques using grinding stones. The use of carbide cutters is not recommended.
- Cleanliness of parts is critical to engine life and accurate parts inspection. Use clean solvent to clean all disassembled parts. Dry parts with compressed air before engine inspection and engine assembly.

SPECIAL TOOLS

Refer to page 1.11 for Special Tool information.

CYLINDER HEAD & VALVE TRAIN

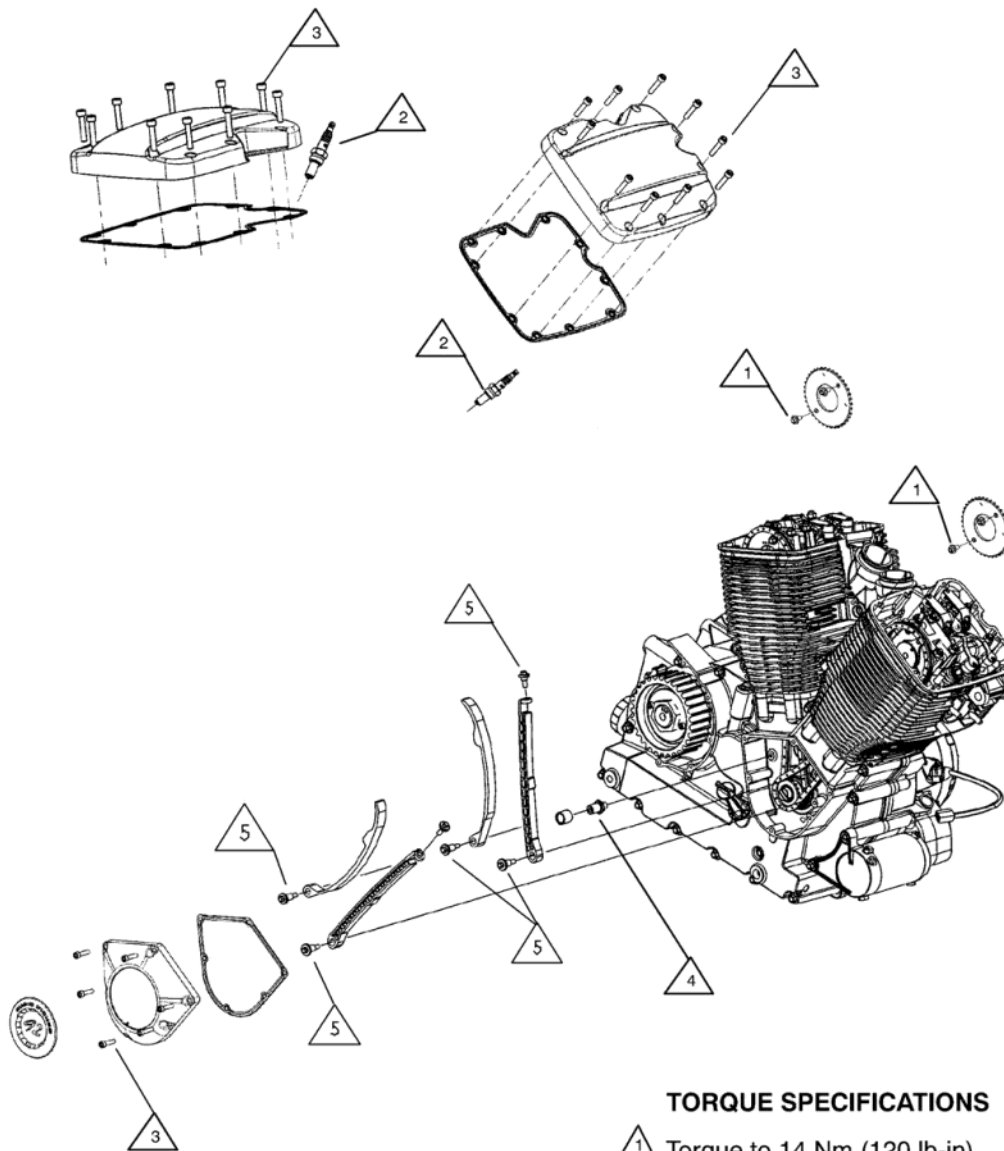
SPECIFICATIONS

| CYLINDER HEAD | | |
|---------------|-----------------------------------|--|
| | Valve Train | Single Overhead Cam / 4 valves per cyl 2 Intake valves / 2 Exhaust valves |
| | Intake Valve Opens At 1 mm Lift | 10° BTDC |
| | Intake Valve Closes At 1 mm Lift | 45° ABDC |
| | Exhaust Valve Opens At 1 mm Lift | 40° BBDC |
| | Exhaust Valve Closes At 1 mm Lift | 10° ATDC |

| CYLINDER HEAD & VALVE TRAIN | | | |
|--------------------------------|---|----------|---|
| Item | | Standard | Service Limit |
| Cam Chain Tensioner | Spring Length | - | 58.8mm (2.31in) |
| Cam Shaft | Lobe Height | IN EX | 40.27 mm (1.585") 40.09 mm (1.578") |
| | Oil Clearance | | .036 mm to .086 mm (.0014" to .0034") |
| | Journal O.D. | | 23.96 - 23.98 mm (.943 - .944") 23.93 mm (.942") |
| | Warpage (Distortion) | - | .10 mm max. (.004") |
| Rocker Arm, Shaft, & Lifter | Rocker Arm Bore I.D. | In/Ex | 12.01 - 12.03 mm (.473 - .474") 12.065 mm (.475") |
| | Rocker Arm Shaft O.D. | In/Ex | 11.974 - 11.986 mm (.471-.472") 11.944 mm (.470") |
| | Rocker Arm to Rocker Arm Shaft Clearance | In/Ex | .024 - .056 mm (.001 - .0022") .156 mm (.006") |
| Valve, Valve Guide, Valve Seat | Valve Clearance | | Hydraulic/Self Adjusting -- |
| | Valve Stem O.D. | In Ex | 6.953 - 6.973 mm (.2737 - .2745") 6.928 mm (.2727") |
| | Valve Stem Deflection | | - .13 mm max. (.005") |
| | Valve Seat Width | Intake | 1.2 mm (.047") - |
| | Valve Seat Width | Exhaust | 1.75 mm (.068") - |
| Valves | Valve Stem Runout | | - .13 mm max. (.005") |
| | Valve Head Radial Runout | | - .05 mm max. (.002") |
| | Installed Height (Without Valve Seal Installed) | | INTAKE: 49.31 - 50.31 mm (1.941 - 1.981") EXHAUST: 48.78 - 49.78 mm (1.920 - 1.960") -- |
| Valve Spring | Free Length | In/Ex | 43.36 mm (1.708") 41.40 mm (1.630") |
| | Intake Valve Maximum Lift | | 10.0 mm (.393") -- |
| | Exhaust Valve Maximum Lift | | 10.0 mm (.393") -- |
| | Installed Height (With Valve Seal Installed) | | 34.20 - 36.20 mm (1.346 - 1.425") -- |

CYLINDER HEAD & VALVE TRAIN

CAM DRIVE & VALVE COVER EXPLODED VIEW

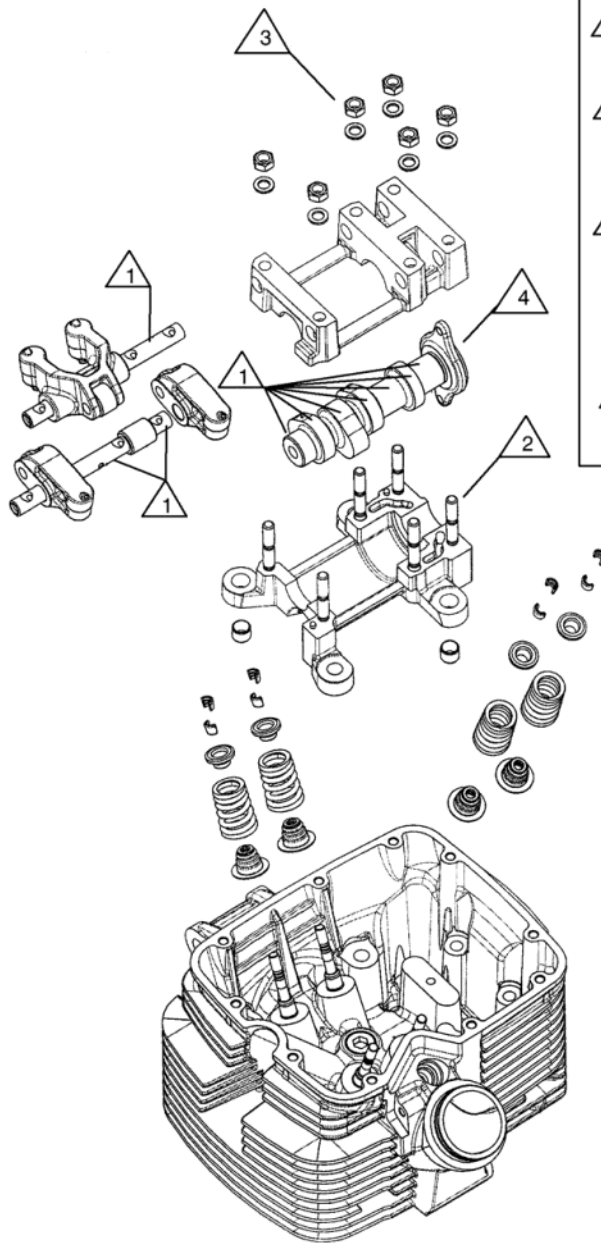


TORQUE SPECIFICATIONS

- △1 Torque to 14 Nm (120 lb-in)
- △2 Torque to 11 Nm (96 lb-in)
- △3 Torque to 10 Nm (85 lb-in)
- △4 Torque to 24.5 Nm (18 lb-ft)
- △5 Torque to 12 Nm (100 lb-in)

CYLINDER HEAD & VALVE TRAIN

CAMSHAFT CARRIER / ROCKER ARM

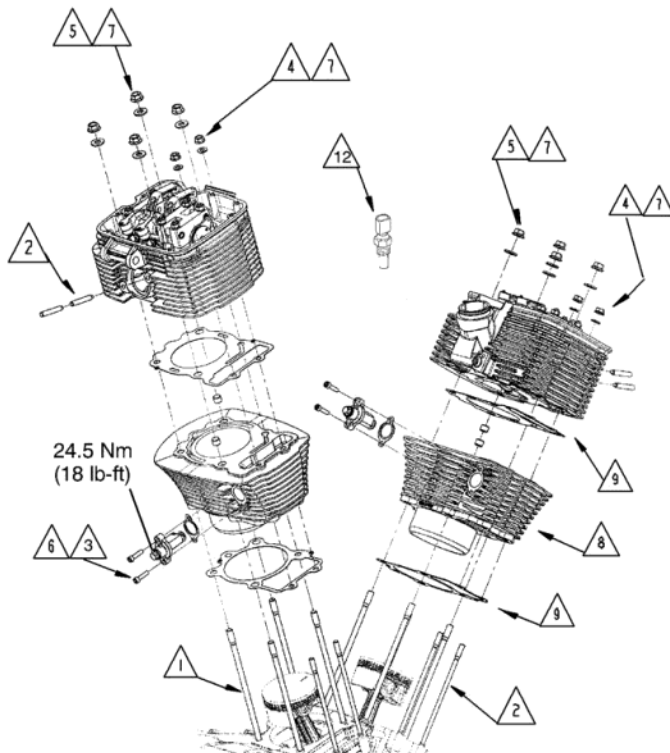


KEY

- 1 Apply Molybdenum Disulfide Grease
- 2 Torque carrier studs to 15 lb-ft before installing upper cam carrier, washers, and nuts.
- 3 Cam Carrier - Refer to page 7.5 for installation notes. Lubricate threads with oil before assembly. Tighten *slowly* and evenly or cam holder assembly may crack.
- 4 Camshaft - Install with lobes down. Refer to page 7.27 for camshaft installation.

CYLINDER HEAD & VALVE TRAIN

CYLINDER HEAD AND CAMSHAFT CARRIER

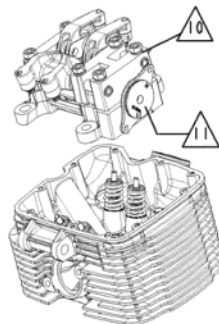
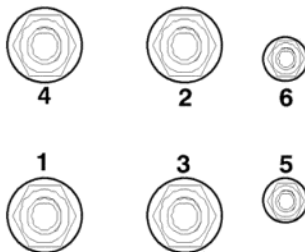


IMPORTANT: Be sure gaskets and gasket sealing surfaces are clean and oil free. Apply a small amount of Loctite 598 to crankcase parting line below base gasket.

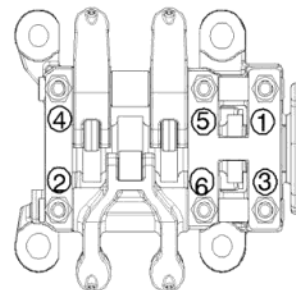
TORQUE SPECIFICATIONS

- ① Torque to 25 lb-ft
- ② Torque to 15 lb-ft
- ③ Torque to 115 lb-in
- ④ Torque 8mm nuts to 18 lb-ft
- ⑤ Refer to cylinder head torque procedure on page 7.26.
- ⑥ Apply (Blue) Loctite 242 to threads
- ⑦ Apply Victory engine oil to nut threads and nut bases
- ⑧ Apply thin film of Victory engine oil to entire length of cylinder bores
- ⑨ Gasket and gasket sealing surfaces must be free of oil and grease. Apply a small amount of Loctite 598 to crankcase parting seam (below base gasket) before installing base gasket.
- ⑩ Front and rear cam carrier assemblies are to be installed with the upper halves loose. Upper cam carrier half must be allowed to move upward when cylinder head nuts are torqued. After cylinder head nuts have been torqued, torque upper cam carrier as follows:
Torque cam carrier in sequence shown below, first to 12 lb-ft to seat upper carrier, then to 20 lb-ft final torque.
- ⑪ Rotate cams back and forth slightly to verify free rotation. Allow time for lifters to bleed down before performing this inspection
- ⑫ Apply Loctite™ 565 or Pipe Sealant. Torque to 14 Nm (10 lb-ft)

CYLINDER HEAD TORQUE SEQUENCE (Refer to Notes 4, 5, and 7)

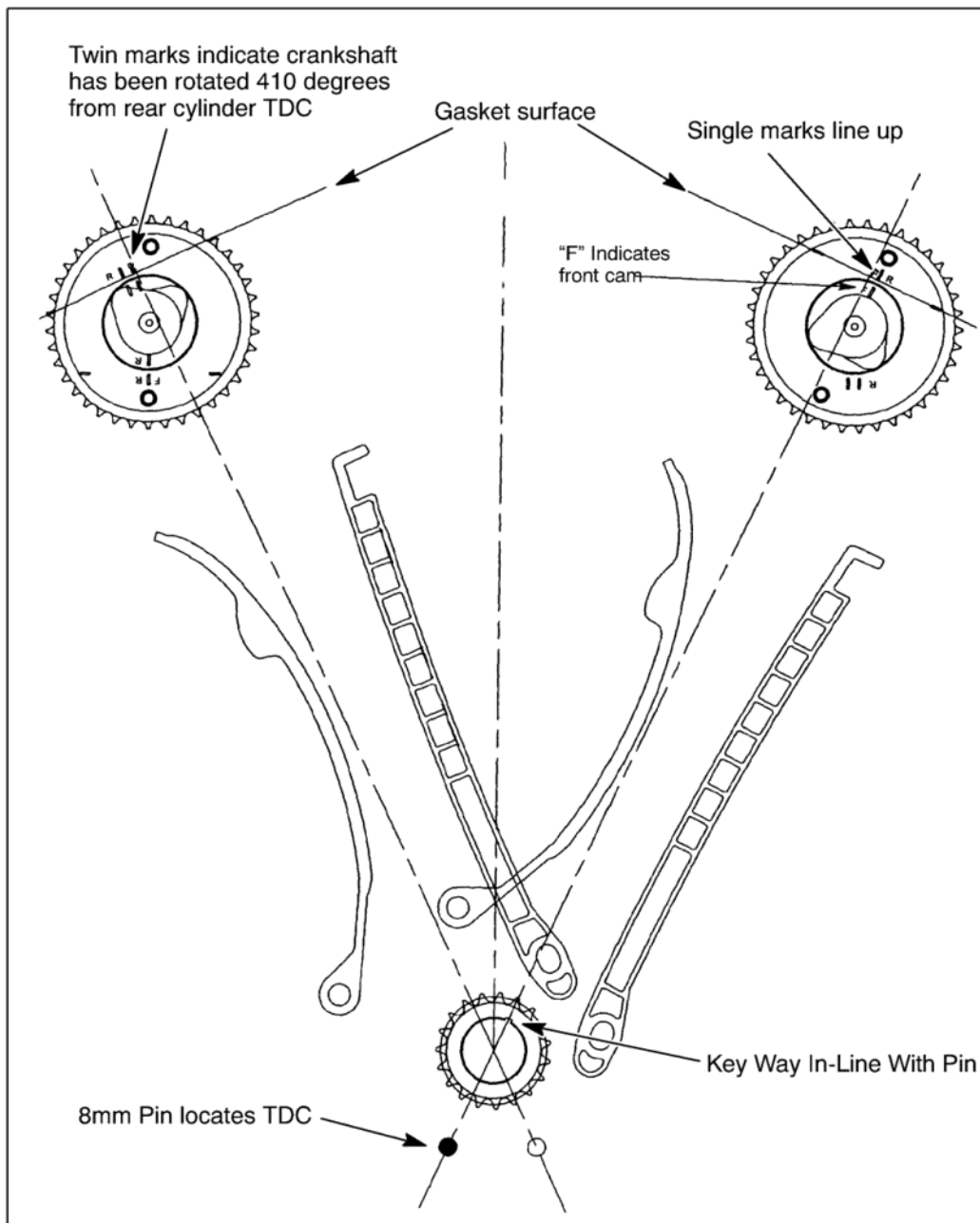


CAM CARRIER TORQUE SEQUENCE (Refer to Note 10 and 11 above)



CYLINDER HEAD & VALVE TRAIN

CAMSHAFT TIMING QUICK REFERENCE



EXTERNAL INSPECTION

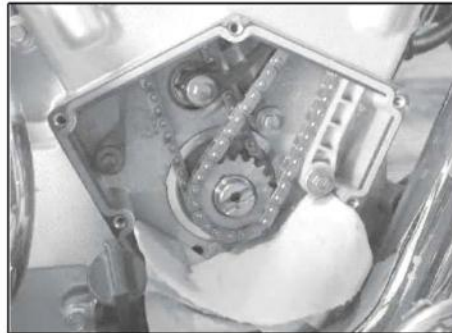
1. Perform a cranking compression test (refer to Chapter 2).

CAMSHAFT DRIVE COVER REMOVAL

1. Remove engine from frame (refer to ch 6).
2. Attach engine to an engine stand.
3. Remove spark plugs.
4. Remove oil dipstick.
5. Remove lower cam drive cover and discard used gasket.
6. Place a clean shop towel in the cavity below the cam drive sprocket to prevent objects from falling into crankcase.

CAUTION

Cover cavity below cam drive sprocket with a clean shop towel. Any debris or engine parts dropped into the lower crankcase will require complete engine disassembly to retrieve.

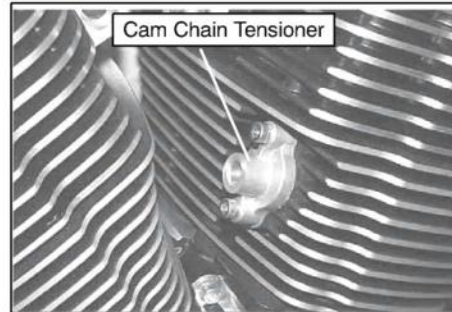
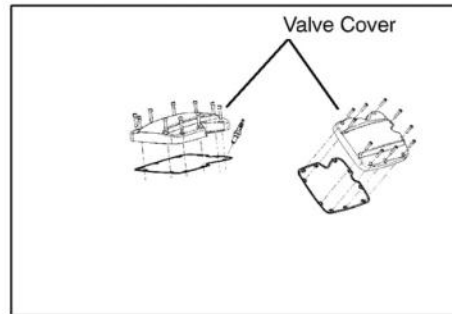


NOTE: It is possible to replace valve cover gaskets and/or torque cylinder heads to specification with the engine in the frame. Do not remove engine from frame to replace valve cover gaskets or to re-torque cylinder heads. Follow fuel injector removal procedure in Chapter 5.

CYLINDER HEAD & VALVE TRAIN

VALVE COVER REMOVAL

1. Remove valve cover screws.
2. Tap lightly on cover with a soft faced hammer to loosen cover if necessary.
3. Remove cover and gasket.

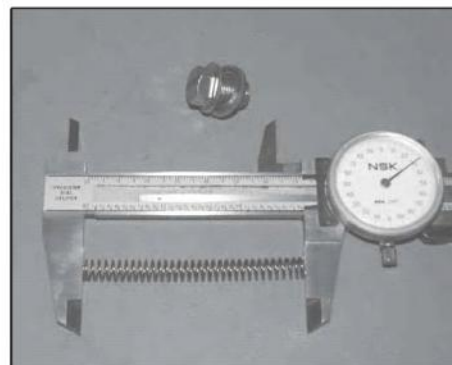
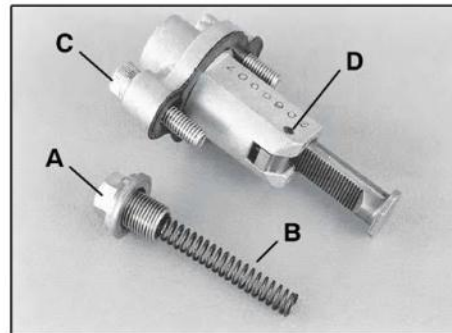


CAM CHAIN TENSIONER REMOVAL

1. Remove cam chain tensioner spring cap (A) and spring (B).
2. Remove cam chain tensioner body mounting bolts (C) and remove tensioner from cylinder.
3. Remove cam chain tensioner body with plunger.

CAM CHAIN TENSIONER INSPECTION

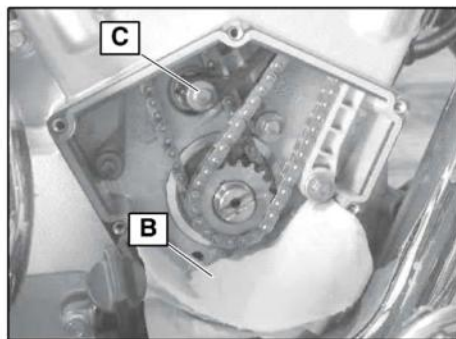
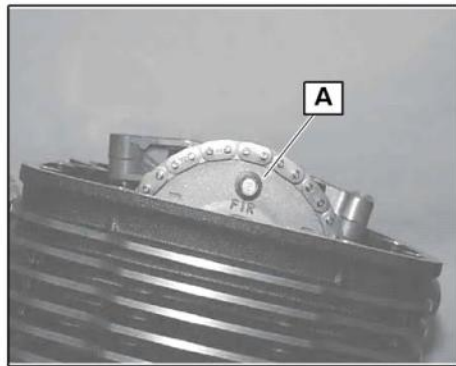
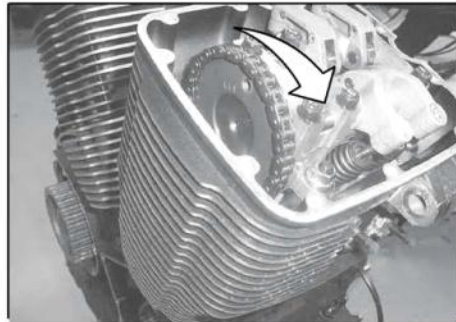
1. Remove cam chain tensioner.
2. Visually inspect spring. Coils should be evenly spaced.
3. Inspect ratchet pawl pin (D). If pin is loose, replace tensioner assembly.
4. Measure free length and compare to specification at the front of this chapter.
5. Inspect small spring for ratchet pawl. If spring is broken or missing, replace tensioner assembly.
6. Inspect rack for unusual wear, replace if necessary.
7. Replace tensioner assembly if worn or damaged.
8. Use new gasket on tensioner body and a new sealing washer on spring cap.



7.8

CAMSHAFT CHAIN & SPROCKET REMOVAL

1. If cam chain tensioners were not previously removed, remove them following procedure on page 7.8.
2. Rotate crankshaft clockwise past TDC on the compression stroke for front cylinder, indicated by the camshaft sprocket timing marks. Continue rotating crankshaft clockwise until bottom sprocket bolt can be removed. Remove bottom bolt.
3. Rotate crankshaft counterclockwise back to TDC on compression (camshaft marks aligned with cylinder head surface) and remove top sprocket bolt (A).
4. Place a shop towel in the open area (B) below cam chain drive sprocket to prevent anything from falling into crankcase.
5. Remove front cylinder tensioner blade lower bolt (C).
6. Remove cam chain and sprocket from camshaft.
7. Remove chain from drive sprocket (lower).
8. Lift chain, sprocket, and tensioner blade out of engine. Repeat steps for the rear cylinder if necessary.



CYLINDER HEAD & VALVE TRAIN

ROCKER ARM REMOVAL

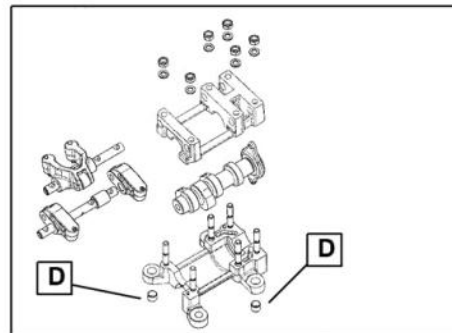
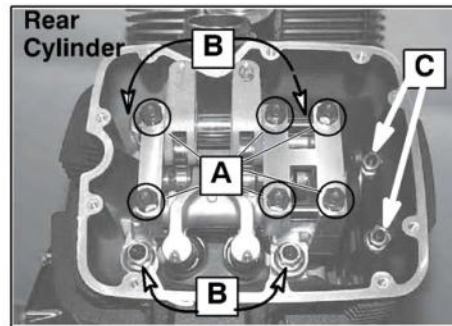
CAUTION

Keep mated rocker arm shafts and rocker arms together. Do not interchange mated parts. Rocker arm carrier is marked "F" for front cylinder. If mark is not visible, use a permanent marker to identify the part for assembly.

1. Remove or loosen rocker arm carrier nuts (A) 1/2 turn at a time using a cross pattern until loose.

NOTE: The camshaft upper and lower carrier can be removed as an assembly together with camshaft. To do this, loosen nuts (A) evenly in a cross pattern about 3 full turns, then go to Step 4. Do not loosen cylinder head nuts (B, C) if only the upper carrier / rocker assembly or camshaft is being serviced.

2. Remove rocker arm carrier nuts & washers.
3. Remove upper cam carrier and camshaft.
4. Loosen cylinder head 10mm (B) and 8mm nuts (C) 1/4 turn at a time until loose. Remove 10mm nuts and washers and lift upper and lower rocker arm carrier from cylinder head along with camshaft and rocker arms.
5. Remove alignment dowels (D) from cylinder head only if necessary.



CAUTION

Front and rear cylinder heads use different camshafts. Camshafts are marked at drive end.

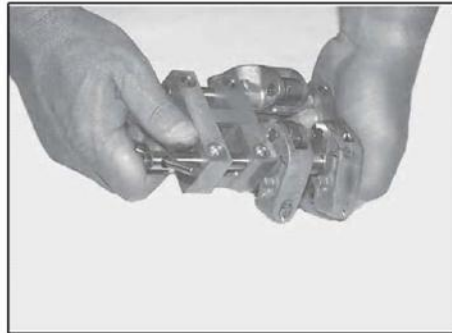


ROCKER ARM & SHAFT INSPECTION

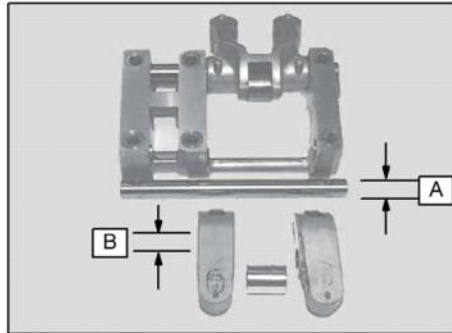
1. Separate top and bottom half of rocker carrier. Tap shaft out of top carrier until hole in shaft is exposed on the other end.



2. Remove the shafts with a twisting motion.



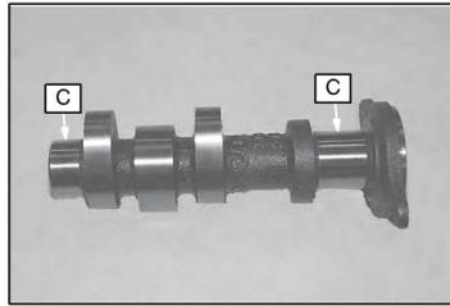
3. Visually inspect rocker arms and rocker arm shafts for excessive wear, scoring or damage. Replace as necessary.
4. Inspect all oil passages and clean thoroughly. Use only clean solvent. Do not allow dirt to contaminate the hydraulic adjuster on rocker arm.
5. Rotate rocker arm on shaft. The rocker arm should fit the shaft tightly without excessive play, and rotate smoothly on the shaft without binding.
6. Measure O.D. of each rocker arm shaft(A) and compare to specification.
7. Measure I.D. of each rocker arm (B).
8. Subtract rocker arm shaft O.D. from its matching rocker arm I.D. to determine rocker arm shaft-to-rocker arm clearance. Compare to specification.
9. Replace parts worn beyond service limits.



CYLINDER HEAD & VALVE TRAIN

CAMSHAFT INSPECTION

1. Visually inspect camshaft journal surfaces (C) for scoring or signs of insufficient lubrication. Replace camshaft if heavy scoring or damage is noted.



2. Measure O.D. of each camshaft journal.



3. Use micrometer to inspect height of each cam lobe.

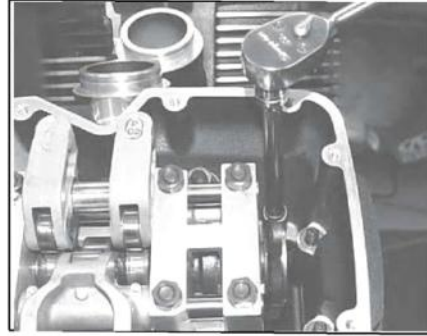
Replace camshaft, camshaft carrier, and rocker arms as a set if either camshaft or rockers fail inspection.



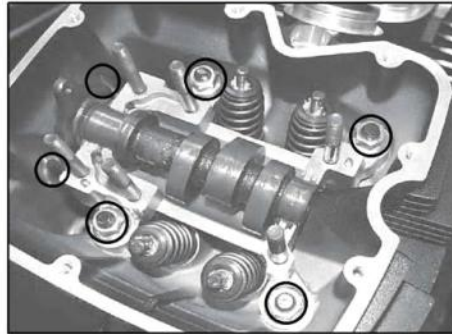
CYLINDER HEAD & VALVE TRAIN

CYLINDER HEAD REMOVAL

1. Remove upper retaining bolt for cam chain guide.
2. Remove lower cam chain guide bolt.
3. Remove cam chain guide.
4. Place an oil catch pan under the engine.



5. Loosen cylinder head nuts 1/4 turn at a time using a cross pattern until loose.
6. Remove cylinder head nuts and washers, along with lower camshaft carrier.



7. Remove cylinder head.

CAUTION

Use care not to damage gasket sealing surfaces.

8. Remove and discard the cylinder head gasket. Do not reuse gaskets.



CYLINDER HEAD & VALVE TRAIN

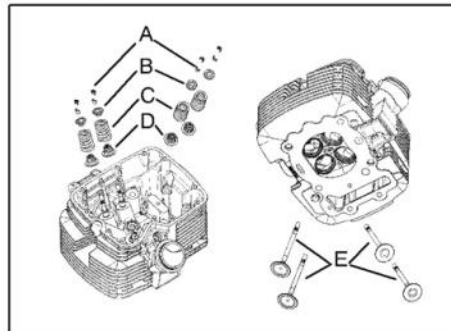
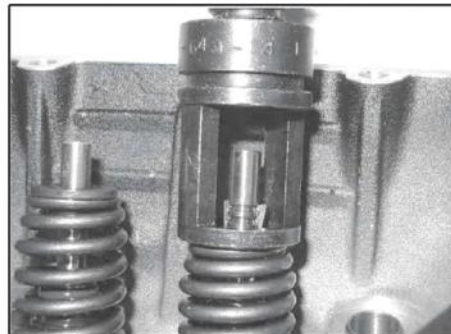
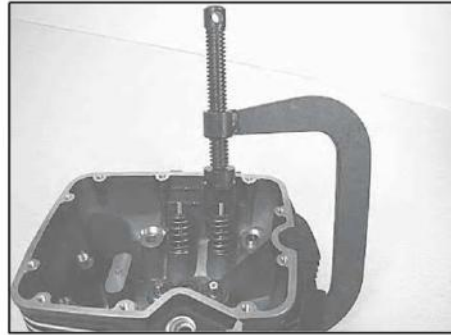
CYLINDER HEAD DISASSEMBLY

CAUTION

Wear eye protection while removing valve springs.

NOTE: Keep mated parts together for assembly. It is important to put cylinder head parts back in the same location.

1. Remove the valve keepers (A) using a valve spring compressor tool. Use a pencil magnet to remove valve keepers.
2. Remove upper valve spring retainers (B), springs (C), and valves (E).
3. Remove and discard valve guide seals (D). Do not reuse valve guide seals.
4. Wipe carbon deposits from the combustion chamber using a rag and Carbon Clean fuel system additive. Hardened deposits can be removed with a rounded edge scraper.
5. Remove head gasket material from both cylinder and cylinder head.

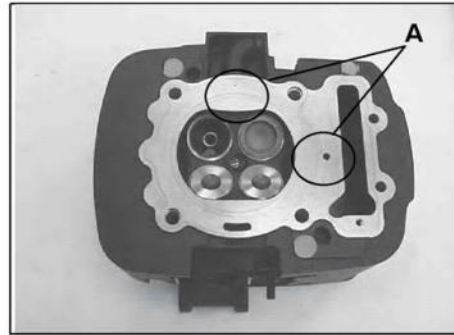


7.14

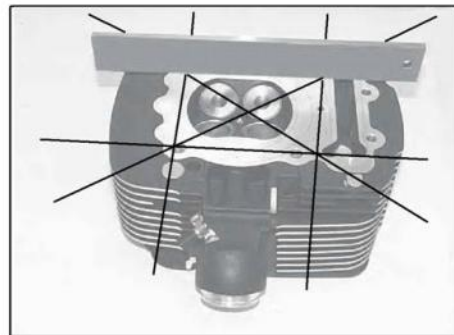
CYLINDER HEAD & VALVE TRAIN

CYLINDER HEAD INSPECTION

1. Visually inspect the cylinder head for cracks or damage. Pay close attention to the areas around spark plug and valve seats.
2. Be sure oil passage and bleed hole (A) in cylinder head is unobstructed.



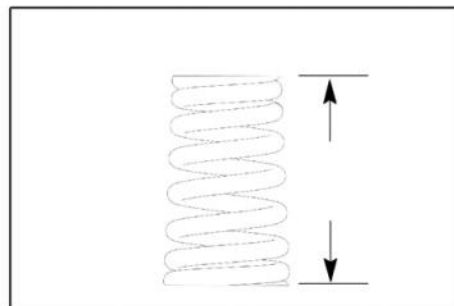
3. Inspect cylinder head for distortion with a straight edge and feeler gauge. Check in different directions and locations on the cylinder head as shown.



VALVE SPRING FREE LENGTH INSPECTION

1. Measure free length of valve springs. Replace springs that do not meet specification on page 7.2.

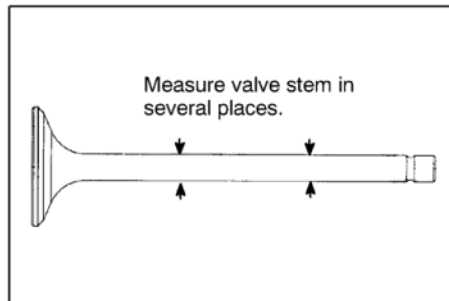
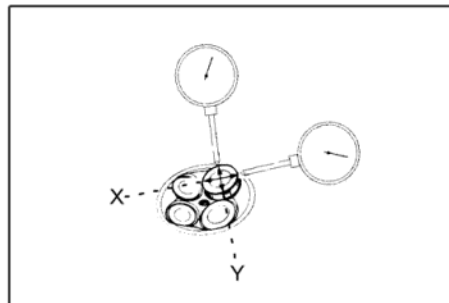
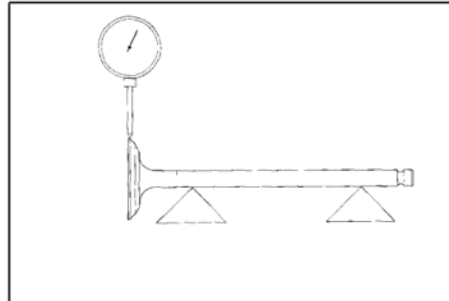
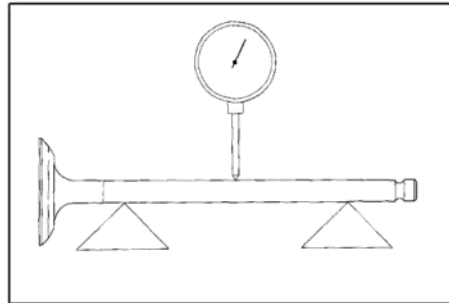
NOTE: Intake and exhaust springs are identical.



CYLINDER HEAD & VALVE TRAIN








VALVE INSPECTION

1. Place valves on V-blocks as shown and measure valve stem runout. Replace valve if runout exceeds service limit.
2. Inspect the valve face for damage from burning, pitting or uneven contact. Replace valve if damaged.
3. Place valves in V-block as shown in and inspect valve head radial runout. Replace valve if run-out exceeds service limit.
4. Insert the valves into their original locations in the cylinder head.
5. Inspect that each valve moves up and down smoothly without binding.
6. Measure valve stem deflection for each valve to determine if the valve or valve guide requires replacement.
 - A. Raise valve 10mm (0.400") off of seat.
 - B. Position dial indicator as shown. Measure deflection in two directions perpendicular to each other (X & Y axis).
7. If the valve deflection exceeds the service limit measure the valve stem.
8. Replace the valve and repeat step 6 if the valve stem O.D. measures outside the standard range. If valve stem deflection exceeds service limits with a new valve installed, the valve guide must be replaced.
9. If the valve stem measures correctly and the deflection is incorrect, the valve guide must be replaced. Installation of new valve guides and/or new valves requires valve seat reconditioning.



CYLINDER HEAD & VALVE TRAIN

VALVE INSPECTION

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

CYLINDER HEAD & VALVE TRAIN

VALVE GUIDE REMOVAL / INSTALLATION

CAUTION

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

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

CAUTION

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

3. Apply 90 weight oil to the outside of the new valve guides.
4. Drive in new valve guides from the camshaft side of the head. Drive the valve guides in until the circlip (B) seats against the head (C).
5. Measure valve guide height from spring seat:

GUIDE INSTALLED HEIGHT: 12.20-12.80mm

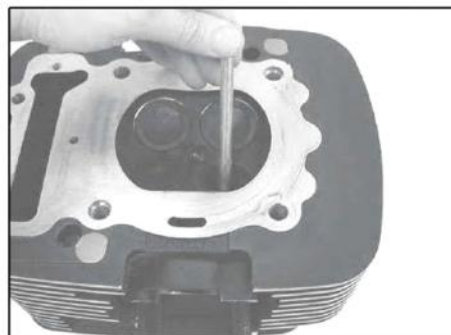
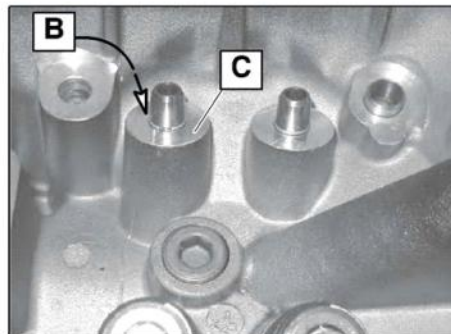
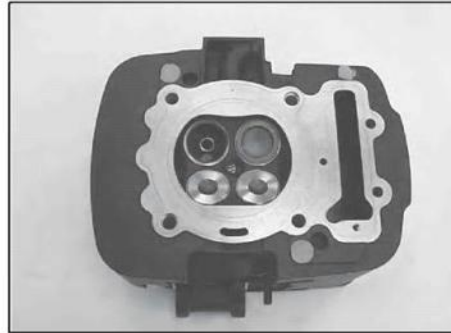
6. Ream new valve guides with a 7mm reamer. Insert the reamer from the combustion chamber side of the head.

CAUTION

Do not tilt the reamer while reaming the guide. This will cause the valve to be positioned at an angle to the valve seat which will require the removal of more valve seat material when seat is reconditioned.

Always rotate the reamer in a clockwise direction.

7. Clean cylinder head thoroughly with clean solvent.
8. Inspect and recondition the valve seat, refer to the next section.



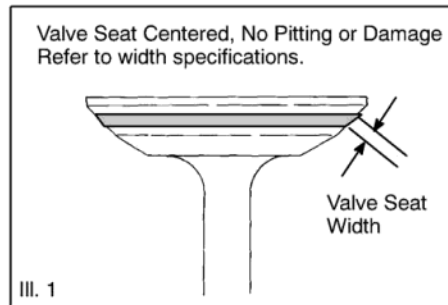
CYLINDER HEAD & VALVE TRAIN

VALVE SEAT INSPECTION

1. Clean all carbon deposits off valves and valve seats.
2. Inspect valve face for burning, pitting or uneven contact. (III. 1)

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

3. Apply a light coating of Prussian Blue to valve face.
4. Install valve into valve guide.
5. Tap valve several times to make a clear impression on the valve face. Do not rotate valve!
6. Remove valve and measure contact area (valve seat width).
7. If valve seat is incorrect, recondition as needed.



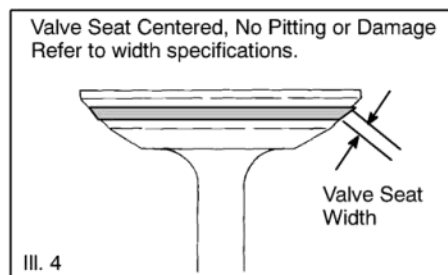
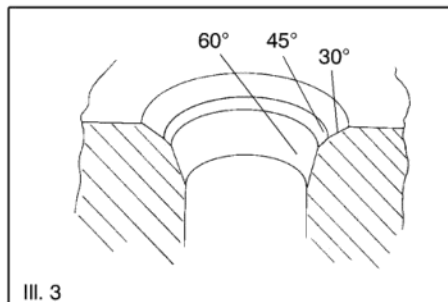
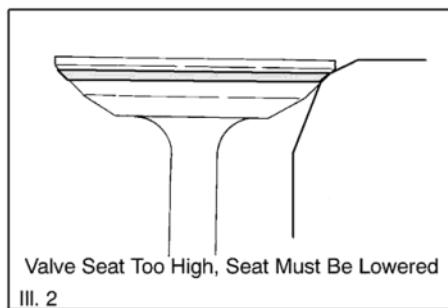
VALVE SEAT RECONDITIONING

NOTE: Valve seat reconditioning should be performed by a technician proficient in cylinder head reconditioning techniques using grinding stones. The use of carbide cutters is not recommended. Follow recommendations of the manufacturer of the valve seat reconditioning equipment being used. Ensure that seats are not ground more than absolutely necessary.

Valve Seat Too High, Seat Must Be Lowered (III. 2)

NOTE: The valve seat contact area must be inspected after each cut. Use Prussian Blue to determine seat contact area.

1. Using a 45° stone, dress seat slightly. (III. 3)
2. Using a 30° (intake) stone, lower seat slightly and inspect seat contact area. (III. 3)
3. Continue using a 30° stone until contact area is in middle of valve face. (III. 3)
4. Use a 45° stone to bring valve seat to specified width. (III. 3)
5. Inspect width of valve seat. The valve seat must be uniform in width all the way around with no pitting or irregularities on the seat. (III. 4)



CYLINDER HEAD & VALVE TRAIN

Valve Seat Too Low, Seat Must Be Raised

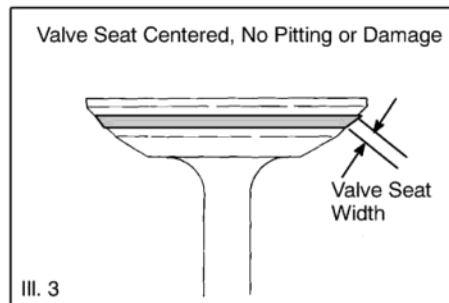
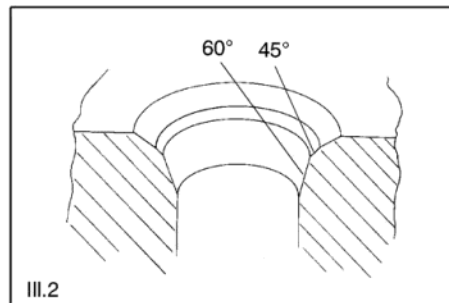
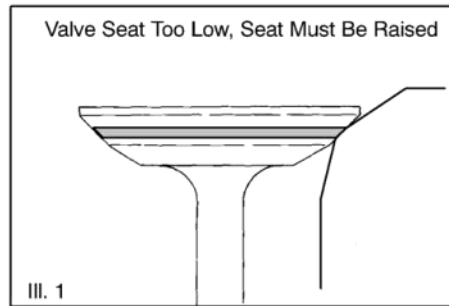
(III. 1)

NOTE: The valve seat contact area must be inspected after each cut. Use Prussian Blue to determine seat contact area, or mark the valve face with a black felt-tip marker.

1. Using a 45° stone, dress seat lightly. (III. 2)
2. Using a 60° (exhaust) stone, dress seat lightly and inspect the seat contact area. (III. 2)
3. Continue using a 60° stone until contact area is in middle of valve face. (III. 2)

4. Use a 45° stone to bring valve seat to specified width. (III. 2)

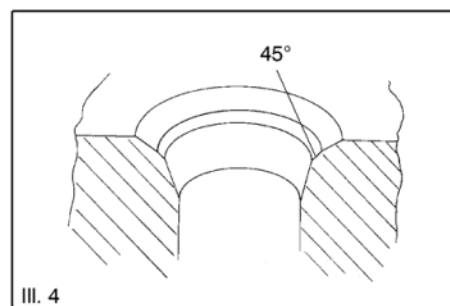
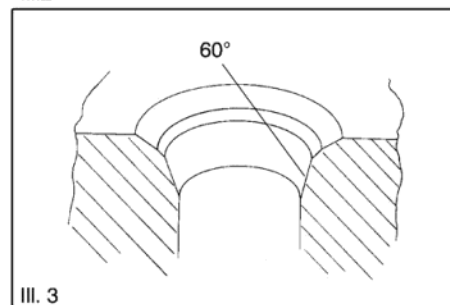
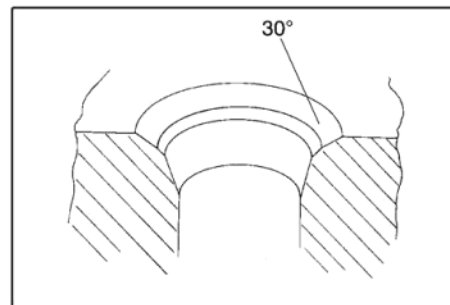
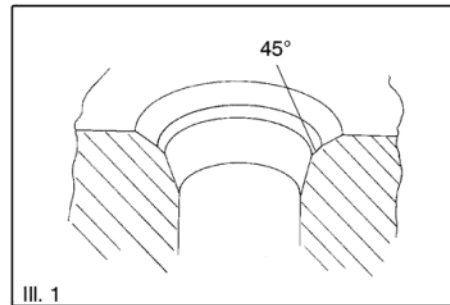
5. Inspect width of valve seat. The valve seat must be uniform in width all the way around with no pitting or irregularities on seat. III. 3.



New Valve Guide Installed Requires Complete Reconditioning

NOTE: The valve seat contact area must be inspected after each cut. Use Prussian Blue to determine contact area.

1. Using a 45° stone, remove any roughness or irregularities from seat. (III. 1)
2. Inspect seat often and continue to grind seat until completely uniform. (III. 2)
3. Using a 30° stone, remove 1/4 of the existing valve seat material. (III. 2)
4. Using a 60° (exhaust) stone, remove bottom 1/4 of old seat. (III. 3)
5. Use the 45° stone to bring the valve seat to specified width. (III. 4)



CYLINDER HEAD & VALVE TRAIN

New Valve Guide Installed Requires Complete Reconditioning

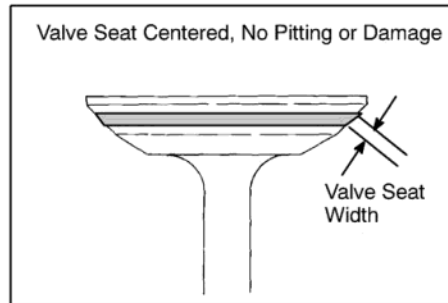
6. Inspect width of valve seat. The valve seat contact area must be uniform in width all the way around with no pitting or irregularities on seat. (Ill. 1)

NOTE: Ensure seats are not ground more than absolutely necessary.

CAUTION

Do not use lapping compound after valve seat(s) are ground. The interference angle and finish left by valve seat reconditioning kit leaves a surface that provides for almost instantaneous seating when the engine first starts.

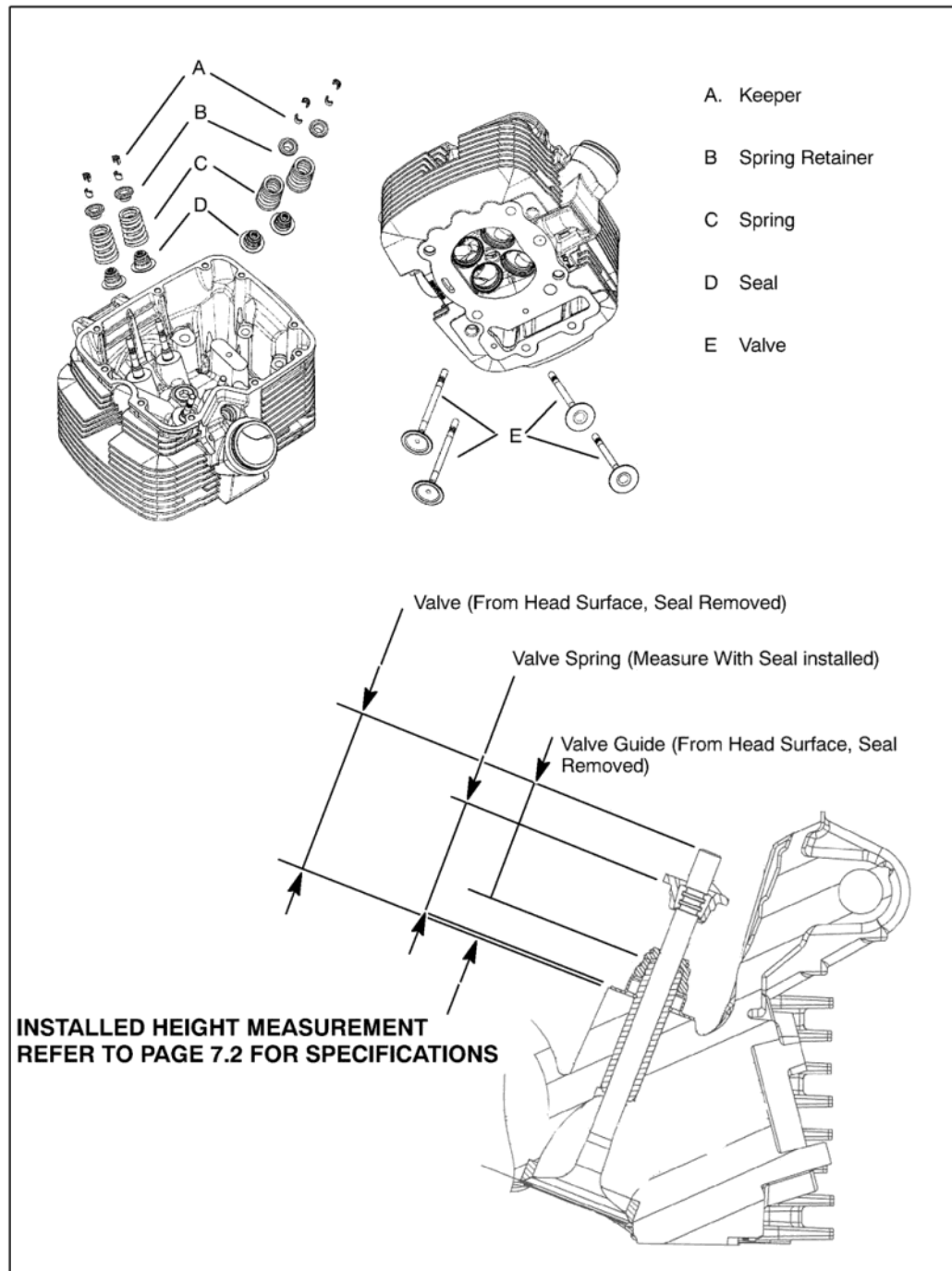
7. Wash cylinder head of all abrasive material in clean solvent.
8. Dry components thoroughly with compressed air.
9. Assemble cylinder head.
10. Fill the intake and exhaust ports with clean solvent and inspect for leaks around valve seating area.
11. After 15-30 seconds some leakage is normal. If leaks are evident immediately after filling with solvent, disassemble head and rework the defect.



Ill. 1

CYLINDER HEAD & VALVE TRAIN

CYLINDER HEAD ASSEMBLY



7.23

CYLINDER HEAD & VALVE TRAIN

CYLINDER HEAD ASSEMBLY (cont.)

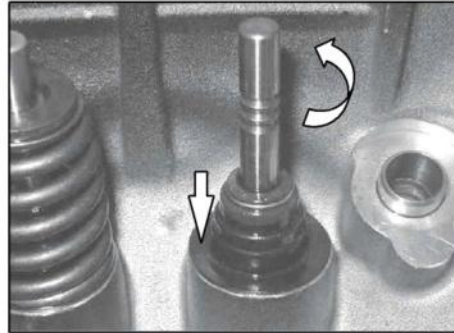
CAUTION

Wear eye protection during assembly.

1. Lubricate valve stems with assembly lube.

Moly assembly paste PN: 2871460

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



CAUTION

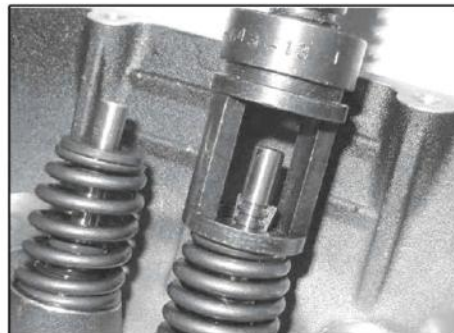
Support cylinder head so valves will not be damaged.

Do not compress valve springs more than necessary to install keepers.

6. Compress the valve springs using a valve spring compressor and adapter.



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



7.24

CYLINDER HEAD INSTALLATION

NOTE: Base gasket seal is broken upon cylinder head removal. The base gasket should also be replaced at this time. Refer to Chapter 8 for cylinder base gasket replacement procedure.

1. Thoroughly clean cylinder and cylinder head gasket surfaces. Both surfaces and gasket must be free of oil or grease.

IMPORTANT! Gaskets and gasket sealing surfaces must be free from oil and grease during assembly.

2. Install dowel pins (A).
3. Install a new head gasket. Do not reuse gaskets.

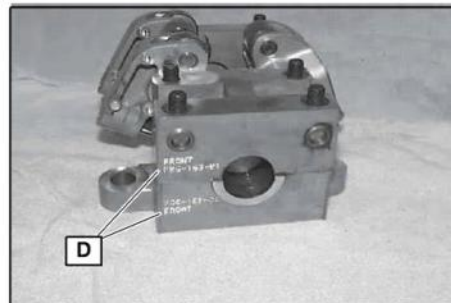
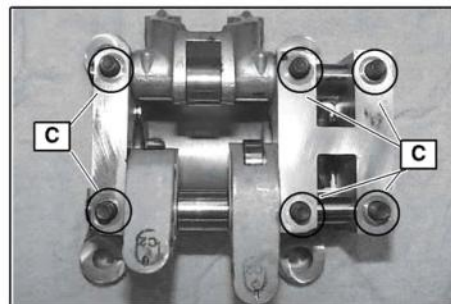
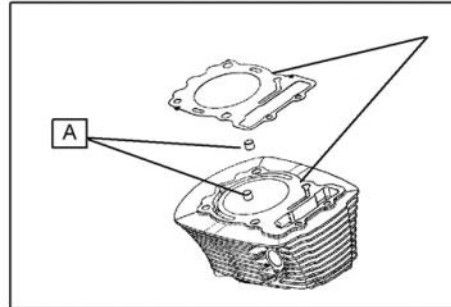
NOTE: Front and rear cylinder head gaskets are identical.

4. Install cylinder head onto cylinder. If guide (B) is installed, be sure to move it out of the way before installing the cylinder head.
5. Apply a light film of Victory Engine Oil to the cylinder threads of all studs (B).

CAUTION

The camshaft carrier can be installed as an assembly, with camshaft. However, all of the nuts (C) on the upper half of carrier must be removed or loosened to allow the upper half to move upward when cylinder head / lower carrier nuts are tightened. Severe damage may occur to the lower holder if assembly is installed with upper carrier nuts tight. Installation procedure below describes individual assembly of components.

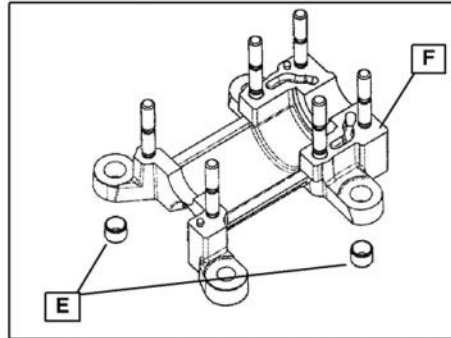
6. Camshaft carriers are matched. Carriers are marked FRONT or REAR for installation in their respective cylinders (D).



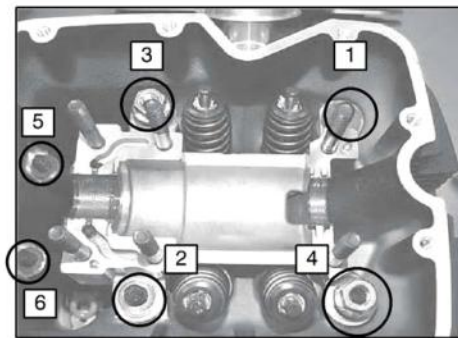
CYLINDER HEAD & VALVE TRAIN

CYLINDER HEAD INSTALLATION (cont.)

7. Be sure dowel pins (E) are in place on cylinder head.
8. Install lower cam carrier (F) over dowel pins and tap lightly to seat in place on cylinder head.



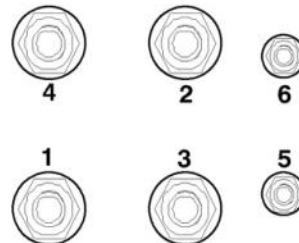
9. Apply Victory engine oil to nut threads and nut bases.
10. Install washers and nuts on cylinder studs. Tighten finger tight.
11. Follow the torque procedure to ensure accurate final torque:



CYLINDER HEAD TORQUE PROCEDURE

- Step 1 Tighten all nuts to 14 Nm (10 lb-ft) following the pattern below.
- Step 2 Tighten the 10mm nuts (1 through 4) to 27 Nm (20 lb. ft.)
- Step 3 Tighten the 10mm nuts (1 through 4) to 41 Nm (30 lb. ft.)
- Step 4 Tighten the 10mm nuts (1 through 4) to 54 Nm (40 lb. ft.)
- Step 5 Repeat the 54 Nm (40 lb-ft) torque on 1-4.
- Step 6 Torque the 8mm nuts (5&6) to 24.5 Nm (18 lb-ft).

CYLINDER HEAD TORQUE SEQUENCE



CAMSHAFT & ROCKER ARM INSTALLATION

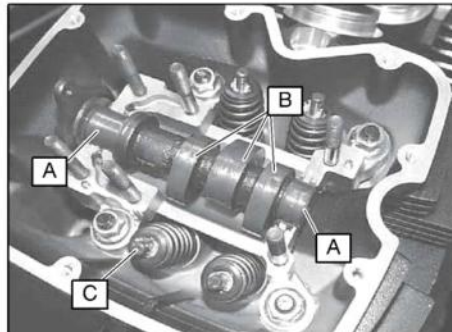
1. Camshafts are marked F (front) or R (rear) on drive end for installation in their respective cylinders. Align mark on cam and sprocket to ensure proper orientation. Mount cam chain sprocket onto camshaft temporarily with one bolt finger tight. Front cylinder camshaft is marked with an "F" on drive end. Ensure the front camshaft is installed into the front cylinder head.



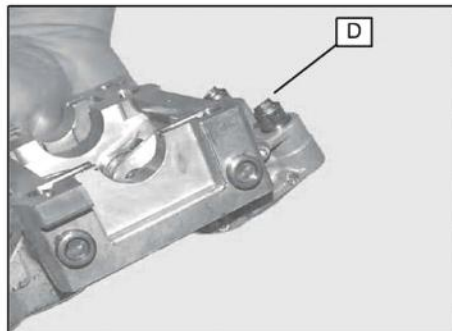
2. Apply moly paste to camshaft journals (A) cam lobes (B) and ends of all valve stems (C). Install camshaft into lower carrier.

Moly assembly paste PN: 2871460

3. Be sure mating surfaces of upper and lower carrier are clean.
4. Verify the camshaft lobes are pointing down as shown.



5. Inspect each rocker arm and position the flat side of hydraulic adjuster down as shown at right (D).
6. Apply engine oil to rocker arms.



7. Install rocker arm assembly over lower carrier studs.
8. Install washers and nuts.
9. Tighten the nuts in a cross pattern 1/2 turn at a time until rocker assembly is seated.

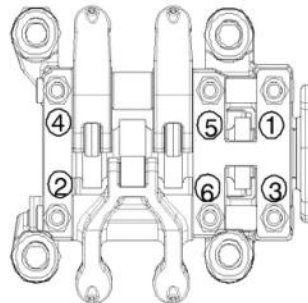


CYLINDER HEAD & VALVE TRAIN

CAMSHAFT & ROCKER ARM INSTALLATION (cont.)

10. Torque rocker arm carrier to specification in 3 steps following the torque pattern shown at right.
11. Rotate cams back and forth slightly to verify free rotation. Allow sufficient time (up to 3-4 minutes) for lifters to bleed down before performing this inspection.

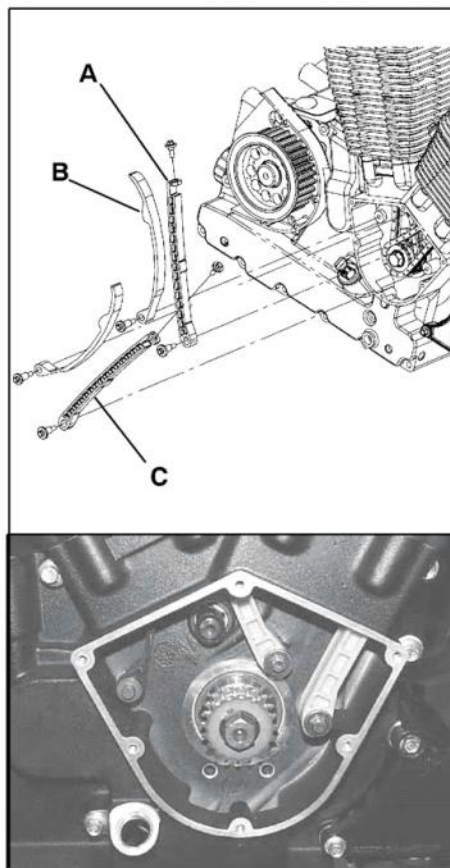
CAM CARRIER TORQUE SEQUENCE 27 NM (20 LB-FT.)



CAMSHAFT CHAIN GUIDE INSTALLATION

NOTE: Rear cylinder cam chain, chain guide, and tensioner blade must be installed before front cylinder components. The rear cylinder cam chain runs on the inner most sprocket. The front guide can also be installed at this time.

1. Install rear cylinder cam chain guide (A), and cam chain tensioner blade (B).
2. Torque cam chain guide and tensioner blade bolts to specification.
3. Install front guide (C) and torque bolts to specification.

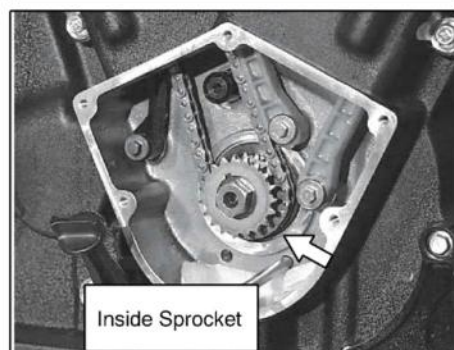
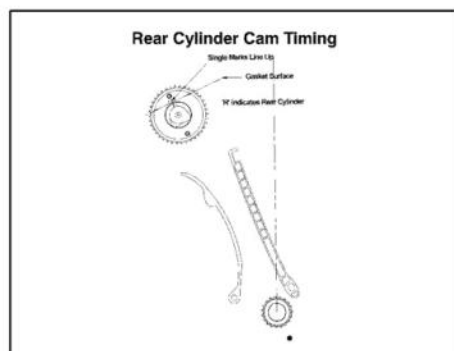
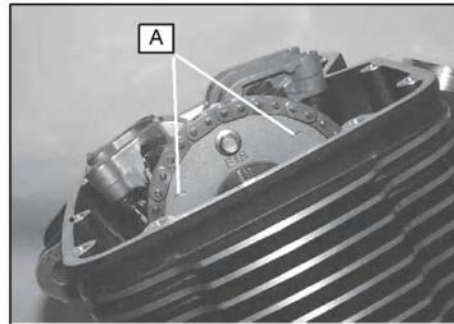
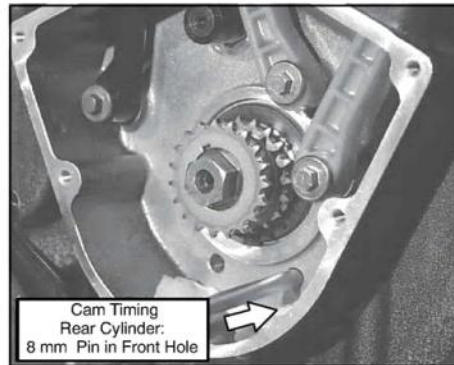


CYLINDER HEAD & VALVE TRAIN

CAMSHAFT TIMING - REAR CYLINDER

NOTE: Rear cam chain must be installed first.

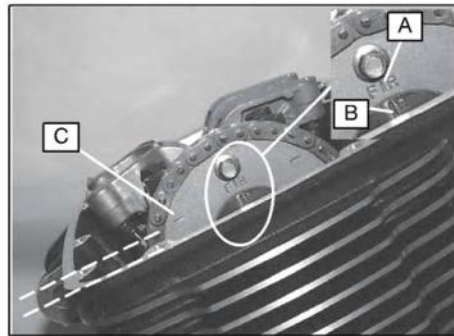
1. Rotate crankshaft clockwise to TDC (rear cylinder). Locate TDC by slowly and carefully inserting an 8 mm locating pin through crankcase hole into crankshaft.
2. Position camshaft to TDC compression stroke. The two timing marks (A) on cam chain sprocket should be parallel to the valve cover gasket surface.
3. Remove cam sprocket temporarily (be careful not to move camshaft).
4. Place cam chain around top sprocket and lower it down the cam chain cavity between the cam chain guides.
5. Place cam chain around **inside** drive sprocket. The rear cylinder cam chain runs on the inside lower sprocket.



CYLINDER HEAD & VALVE TRAIN

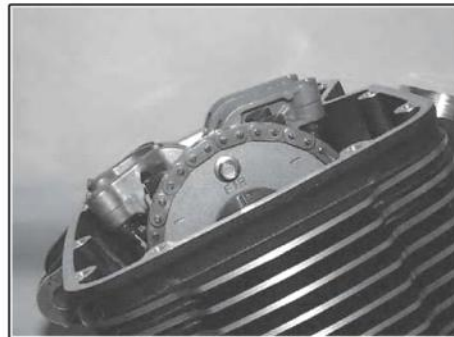
CAMSHAFT TIMING - REAR CYLINDER (cont.)

6. Inspect timing marks before installing sprocket on camshaft. The mark on the sprocket (A) should line up with the line on the camshaft (B). The outer marks on the sprocket (C) should be parallel with the valve cover gasket surface.

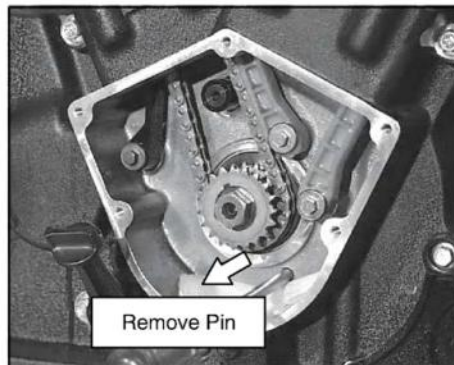


7. Install cam chain and sprocket onto camshaft. Line up camshaft sprocket holes as you install sprocket.
8. Install top camshaft sprocket bolt and torque to specification.

NOTE: Remember to put in the second camshaft sprocket bolt when timing the front cylinder cam.



9. **Remove TDC locating pin** from crankcase once you are certain camshaft is properly positioned.

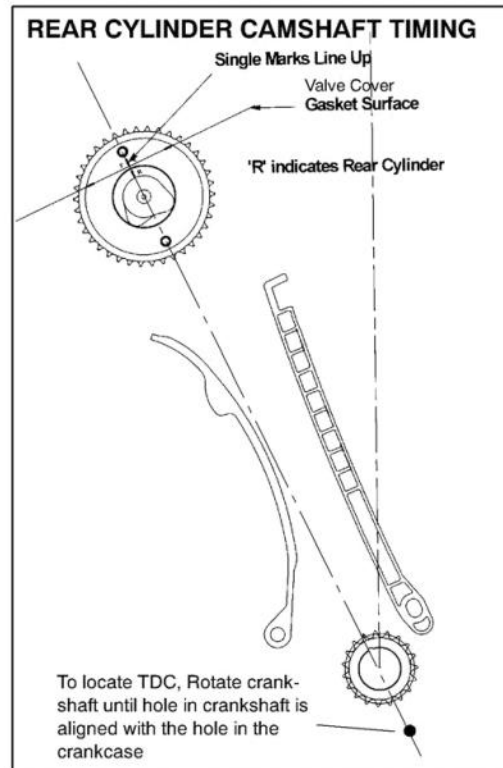


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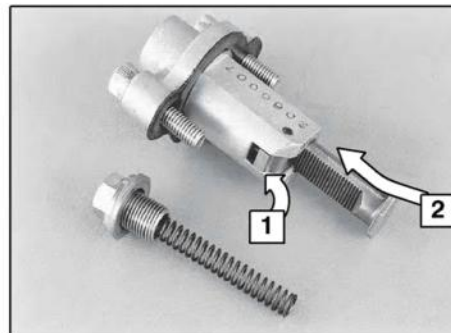
CYLINDER HEAD & VALVE TRAIN

CAMSHAFT TIMING - REAR CYLINDER (cont.)

10. Take the time to check the timing carefully before proceeding.



11. Push and hold ratchet pawl (1) down. Push tensioner plunger (2) into tensioner body until it stops.
12. Apply Loctite 242 (blue) to the cam chain tensioner screws.
13. Place a new gasket on tensioner body and install (with plunger fully retracted). Torque to specification.
14. Install tensioner spring and cap bolt with new sealing washer. Torque to specification.



CYLINDER HEAD & VALVE TRAIN

CAMSHAFT TIMING - FRONT CYLINDER

1. Starting from TDC on the **rear** cylinder compression stroke. Insert locating pin to **verify REAR TDC** position, then remove the pin.
2. Remove TDC locating pin (8mm).
3. Rotate crankshaft clockwise 410° to TDC on the front cylinder (**one full turn plus an additional 50°**).

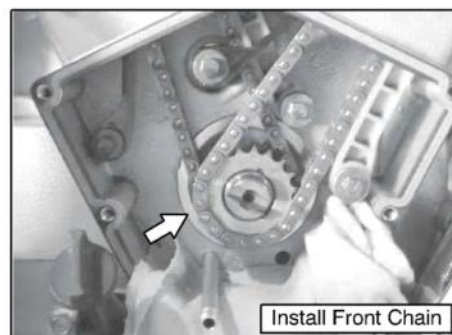
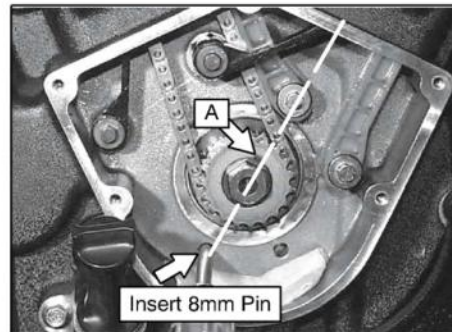
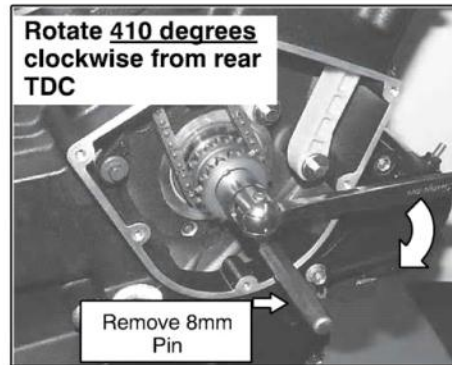
NOTE: Install and tighten the **rear cam chain sprocket bolt** at this time. The bolt hole should be accessible now that crank has been rotated.

4. Insert a locating pin (8 mm) into crankshaft to locate and maintain front piston TDC (sprocket key will be aligned with pin and cylinder centerline A).
5. Install front cylinder cam chain tensioner blade.

6. Position front camshaft to TDC compression stroke (lobes down).
7. Install chain on front sprocket and drop chain into front cylinder chain tower with front tensioner blade.

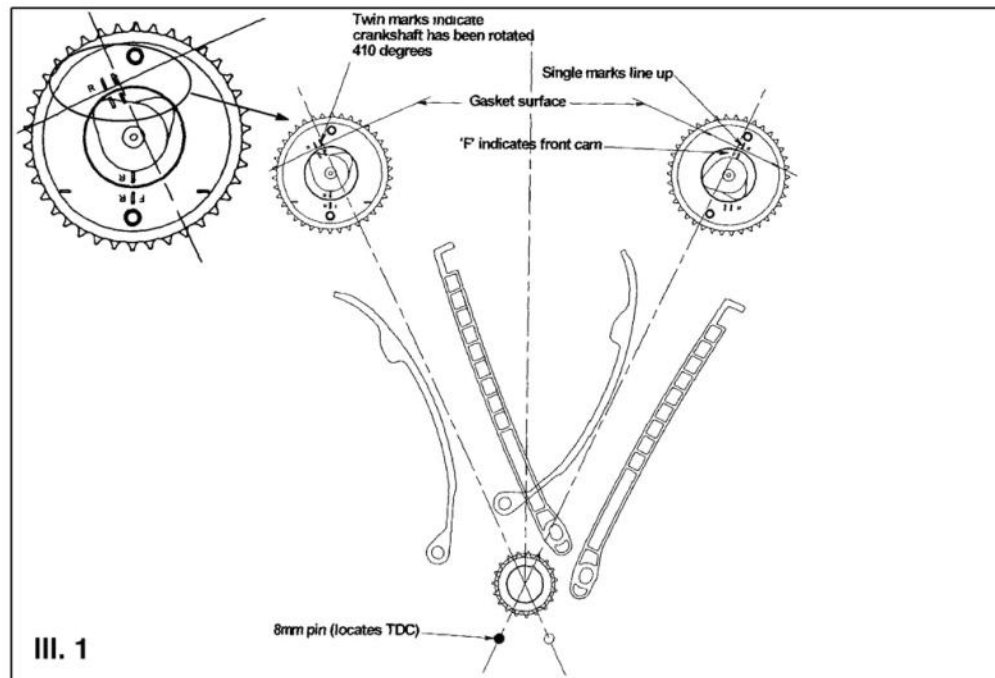
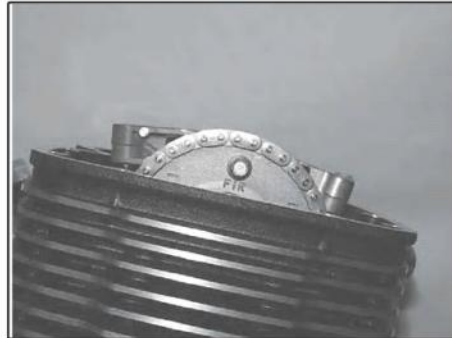
8. Place chain over bottom (outer) drive sprocket.
9. Install tensioner blade screw and torque to specification.

10. Install sprocket on cam with two lines on sprocket parallel to valve cover gasket surface.

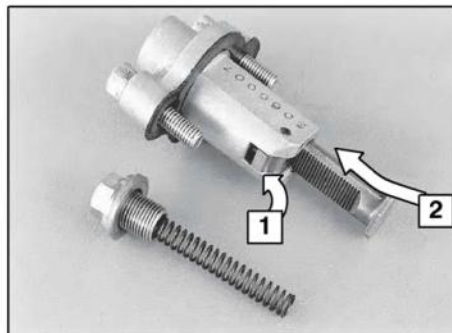


CAMSHAFT TIMING - FRONT CYLINDER (cont.)

11. Verify position of front cylinder by looking for the two marks on rear cylinder cam (See III. 1) below. The two marks on rear cylinder camshaft should be facing up if the front cylinder is in the correct position (410 degrees clockwise rotation from rear TDC.)
12. Install top camshaft sprocket bolt and torque to specification.



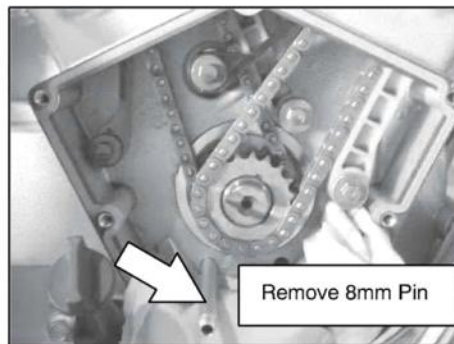
13. Push and hold ratchet pawl (1) down. Push tensioner plunger (2) into tensioner body until it stops.
14. Apply Loctite 242 (blue) to the cam chain tensioner screws.



CYLINDER HEAD & VALVE TRAIN

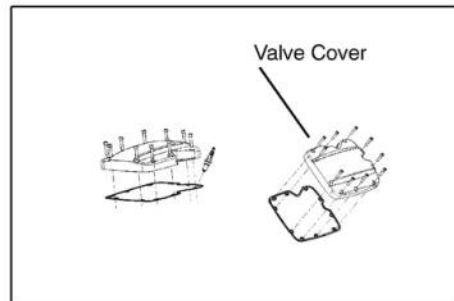
CAMSHAFT TIMING - FRONT CYLINDER (cont.)

15. Place a new gasket on tensioner body and install (with plunger fully retracted). Torque to specification. Be sure gasket and gasket sealing surfaces are clean and dry.
16. Install tensioner spring and cap bolt with new sealing washer. Torque to specification.
17. **Remove TDC locating pin(8mm).**
18. Torque the camshaft sprocket bolts to specification. TIP: Put in the top bolt, tighten it to specification, then wait to install the bottom bolt until you remove the pin and rotate the crank by hand until the second bolt hole is accessible.
19. Fill cam carrier area with Victory engine oil.
20. Rotate crankshaft three complete revolutions to TDC, front cylinder compression stroke.
21. Using illustration on page 7.6, verify the camshaft timing is correct.



VALVE COVER INSTALLATION

1. Install new valve cover gaskets.
2. Install valve covers and all screws (hand tight).
3. Tighten valve cover bolts in a two step cross pattern.



CYLINDER HEAD & VALVE TRAIN

TROUBLESHOOTING, CYLINDER HEAD AND VALVE TRAIN

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

- Leak down or compression gauge
- Visual inspection for the source and cause of a fluid leak
- Listening to the engine with a stethoscope to determine source of abnormal noise

The troubleshooting table below lists problems and possible causes, parts affected, and repair suggestions. Thoroughly investigate the problem and possible solution before disassembling the engine to replace suspect parts.

| 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. |
| | Excessive Starter Load | Internal Engine / Drive Components Seized or Binding | Determine Cause of Seizure or Binding |
| Abnormal Pre-ignition | | | |
| 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 |

CYLINDER HEAD & VALVE TRAIN

| PROBLEM | POSSIBLE CAUSE | PART(s) AFFECTED | REPAIR RECOMMENDED |
|--------------------------|-------------------------------------|---|--|
| Poor Engine Idle Quality | Air leak | Mounting Surfaces, Hoses | Repair Air Leak |
| | Fuel Mixture Rich | F.I. System | Refer to Chapter 5 |
| | Fuel Mixture Lean | F.I. System / Inlet Tract | Refer to Chapter 5 |
| | TPS Adjusted Incorrectly | Adjust TPS | Refer to Chapter 5 |
| | Ignition Misfire | Ignition System | Refer to Chapter 17 |
| | Excessive Oil in Combustion Chamber | Valve guides | Replace |
| | Excessive Oil in Combustion Chamber | Worn Rings, Cylinder, or Piston | Refer to Chapter 8 |
| Engine Noise | Valve Train Area | Engine Oil Overfilled | Correct |
| | | Valves Not Opening Fully | Worn Cam Shaft or Rocker Arms |
| | | 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. |
| | | Lifter(s) Locked | Replace Lifter(s) |
| | | Broken or Weak Valve Springs | Replace |
| | | Worn Camshaft or Rocker Arm | Replace |
| | Piston/Cylinder Area | Rocker Arm Roller Bearing Damage | Replace |
| | | Cam Journal Worn or Damaged | Replace |
| | | Worn Pistons and/or Cylinders | Replace |
| | | Excessive Carbon Build-up in Combustion Chamber | Clean |
| | Timing Chain Area | Worn Piston Pin, Piston Pin Bore and/or Small End of Connecting Rod | Replace |
| | | Worn Piston Rings or Piston Ring Lands. | Replace |
| | | Stretched Chain | Replace |
| Engine Noise | Primary Cover Area | Worn Sprockets | Replace |
| | | Tensioner Not Working | Replace |
| | | Clutch | Refer to Chapter 9 |
| | Bottom End Area | Flywheel | Refer to Chapter 9 |
| | | Starter System | Refer to Chapter 18 |
| | | Torque Compensator | Refer to Chapter 9 |
| | | Main Bearings | Refer to Chapter 10 |
| | Transmission Area | Rod Bearings | Refer to Chapter 10 |
| | | Loose Side Clearance | Refer to Chapter 10 |
| | | Bearings | Refer to Chapter 10 |
| | | Misplaced Circlips | Refer to Chapter 10 |
| | | Incorrect Side Clearance | Refer to Chapter 10 |

7.36

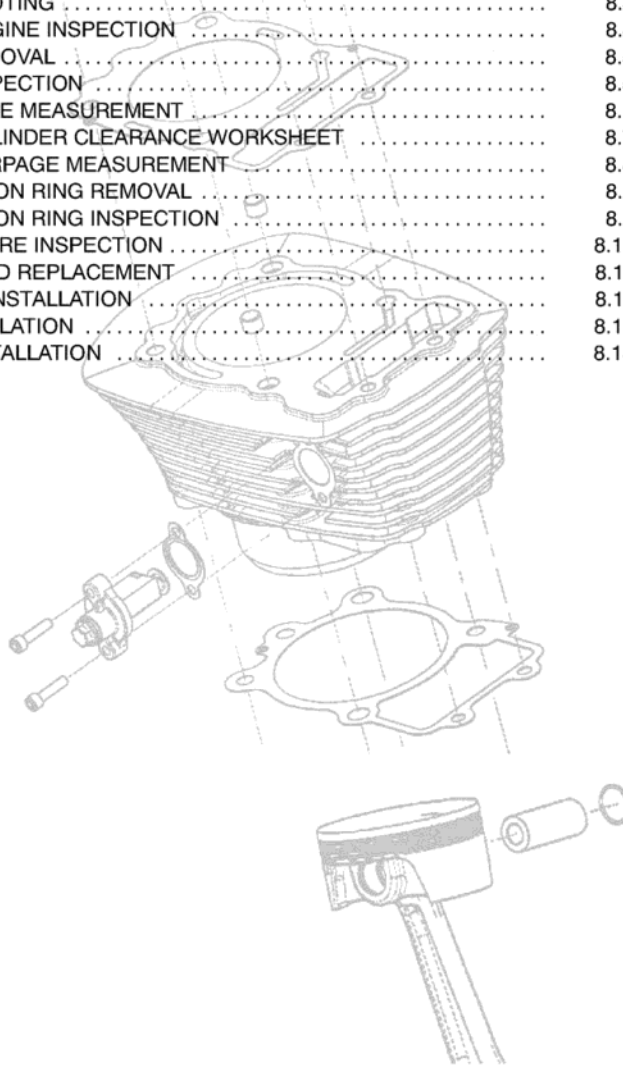
CYLINDER HEAD & VALVE TRAIN

| 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 |
| Using/Burning Oil | Oil in Combustion Chamber | Oil Overfilled | Correct |
| | Oil Past Rings | Worn or Damaged Piston, Rings, Cylinder | Replace |
| | Oil Past Valve Guides | Worn Valve Guides | Replace |
| | | Worn Valve Guide Seals | Replace |

CHAPTER 8

CYLINDER & PISTON

| | |
|--|------|
| GENERAL | 8.1 |
| TORQUE VALUES | 8.1 |
| PISTON RING PROFILE AND ORIENTATION | 8.1 |
| SPECIFICATIONS | 8.2 |
| TROUBLESHOOTING | 8.3 |
| EXTERNAL ENGINE INSPECTION | 8.4 |
| CYLINDER REMOVAL | 8.5 |
| CYLINDER INSPECTION | 8.5 |
| CYLINDER BORE MEASUREMENT | 8.6 |
| PISTON TO CYLINDER CLEARANCE WORKSHEET | 8.7 |
| CYLINDER WARPAGE MEASUREMENT | 8.8 |
| PISTON & PISTON RING REMOVAL | 8.8 |
| PISTON & PISTON RING INSPECTION | 8.9 |
| PISTON PIN BORE INSPECTION | 8.10 |
| CYLINDER STUD REPLACEMENT | 8.11 |
| PISTON RING INSTALLATION | 8.11 |
| PISTON INSTALLATION | 8.12 |
| CYLINDER INSTALLATION | 8.13 |



8

GENERAL

NOTE: Clean the machine thoroughly before removing engine from frame.

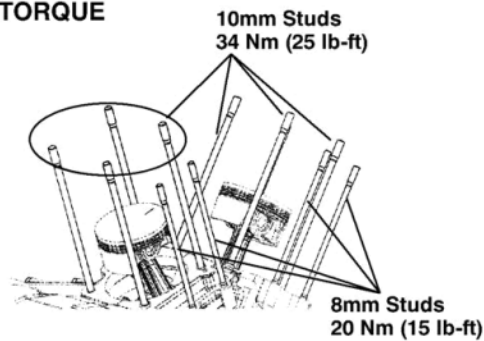
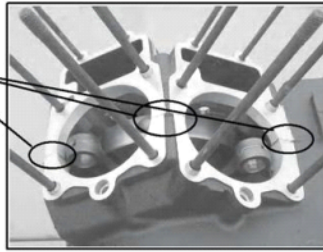
- This section covers service of the cylinder, piston and rings. The engine must be removed from the frame to perform the procedures in this section. Refer to chapter 6 for engine removal and installation.
- Mark and store all mated parts for assembly. Assemble the engine by putting the used parts that 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

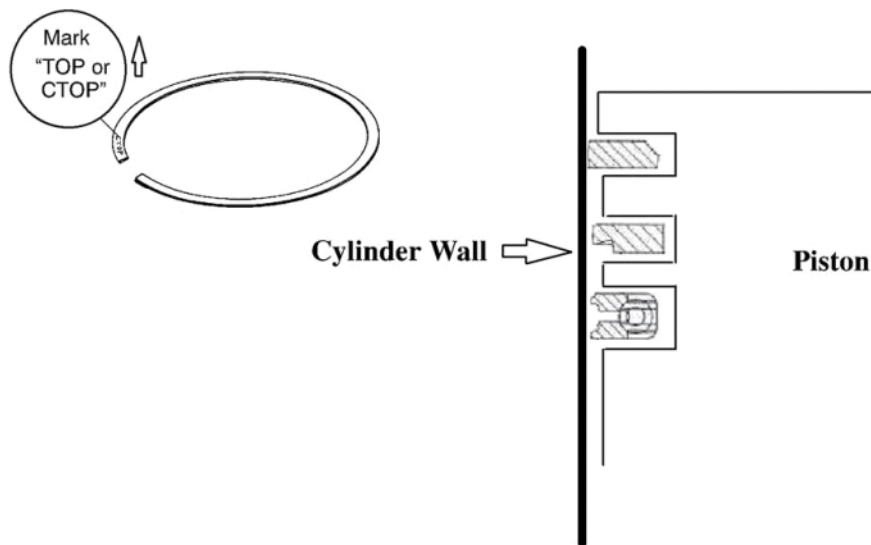
- There are many precision measuring steps in this section. If you are not sure of your capabilities in these areas, have a competent machinist perform the precision part inspection operations.
- Cleanliness of parts is critical to engine life and proper parts inspection. Use clean solvent and hot, soapy water to clean parts. Dry with compressed air before inspection and engine assembly. Coat parts with fresh lubricant to reduce oxidation after cleaning.

BASE GASKET SEALING & CYLINDER STUD TORQUE

Apply sealant to case parting line before installing base gasket



PISTON RING PROFILE & ORIENTATION



CYLINDER & PISTON

SPECIFICATIONS

| CYLINDER & PISTON | | | |
|-------------------|--|---|---|
| Item | | Standard | Service Limit |
| Cylinder | I.D. | 96.945 mm ± .013 (3.8167" ± .0005") | 97.008 mm (3.8192") |
| | Out of Round | -- | 0.05 mm (.002") |
| | Taper | -- | 0.05 mm (.002") |
| | Gasket Surface Warpage | .1mm max. (.0039") | ← |
| Piston | Piston Mark Direction | Piston orientation is determined by the arrow on the piston crown (top). Position BOTH pistons so the arrows point to the front of the engine. | |
| | Piston O.D. (Measured 8mm up from bottom of skirt, 90 degrees to pin) | 96.9 mm ± .009 (3.8149 ± .0003") | 96.816 mm (3.8116") |
| | Piston Pin Hole I.D. | 22.006 - 22.012 mm (.8664 - .8666") | 22.047 mm (.8680") |
| | Piston Pin O.D. | 21.995 - 22.000 mm (.8659 - .8661") | 21.96 mm (.864") |
| Piston Clearances | Piston to Cylinder | .023 - .067 mm (.0009 - .0026") | .15 mm (.006") |
| | Piston to Piston Pin | .006 - .017 mm (.0002 - .0007") | .07 mm (.0027") |
| | Ring End Gap - Top (Installed) | .15 - .35 mm (.006 - .014") | .80 mm (.030") |
| | Ring End Gap - 2nd (Installed) | .33 - .53 mm (.013 - .021") | 1.11 mm (.040") |
| | Ring End Gap - 3rd (Installed) | .15 - .35 mm (.006 - .014") | .80 mm (.030") |
| | Piston Ring Marks | -- | "CTOP" mark must face UP on all rings. See page 8.1 and page 8.9. |
| | Piston Ring to Ring Land | | |
| | Top Ring | .02 - .055 mm (.0008 - .002") | .11 mm (.010") |
| | 2nd Ring | .02 - .055 mm (.0008 - .002") | .11 mm (.010") |

SPECIAL TOOLS

Refer to page 1.11 for Special Tool information.

8.2

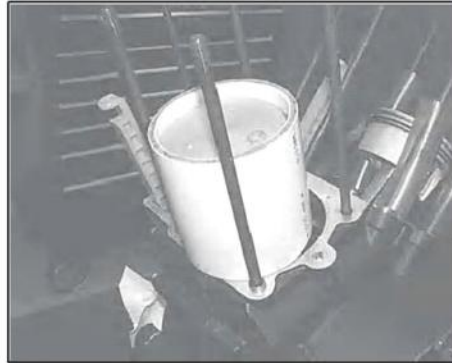
EXTERNAL ENGINE INSPECTION

Perform a compression test or cylinder leakage test (refer to ch 3) before removing engine from frame.

CYLINDER REMOVAL

1. Remove engine from frame (refer to ch 6).
2. Remove cylinder head(s) (refer to ch 7).
3. Remove cylinder(s). Support the pistons while removing cylinders so they do not fall into the cylinder studs.

Slide large diameter section of PVC pipe or an 8 inch length of fuel line or hose over cylinder studs to protect pistons and rings from damaged by contact with cylinder studs.



4. Clean gasket surfaces of cylinders thoroughly.

CAUTION

Careless handling of cylinder, pistons or rings may cause irreparable damage. Handle these parts with care. Do not damage gasket surfaces during cleaning.



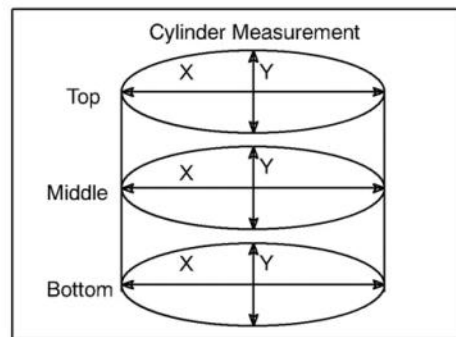
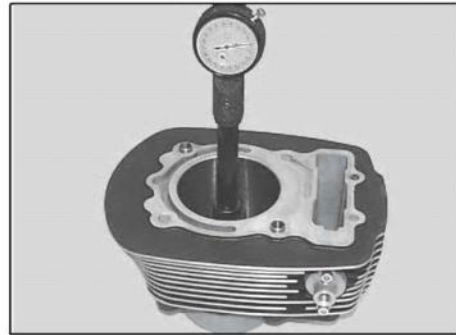
CYLINDER INSPECTION

1. Visually inspect cylinder bores for scratches and wear.
2. Inspect cam chain tensioner gasket surface for scratches or cracks that may cause an oil leak.

CYLINDER & PISTON

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 on page 8.5 to record measurements and calculate the clearance.



CYLINDER & PISTON

PISTON TO CYLINDER CLEARANCE WORKSHEET

| Front Cylinder | Recorded Measurement | Specification |
|--|-------------------------------|--|
| Top "X" | | |
| Middle "X" | | |
| Bottom "X" | | |
| Top "Y" | | |
| Middle "Y" | | |
| Bottom "Y" | | |
| Difference between largest "Y" measurement and smallest "Y" measurement | Taper for "Y" axis: | Taper Service Limit: 0.05mm (0.002") |
| Difference between largest "X" measurement and smallest "X" measurement | Taper for "X" axis: | |
| Largest difference between any "X" axis measurement and "Y" axis measurement | Cylinder Out-of-Round: | Out-of-Round Service Limit: 0.05mm (0.002") |
| Piston Skirt Measurement (page 8.7) | | |
| Difference between largest "X" axis measurement and piston measurement | Piston-to-Cylinder Clearance* | Piston-to-Cylinder Clearance Service Limit: 0.15 mm (0.006") |

| Rear Cylinder | Recorded Measurement | Specification |
|--|-------------------------------|--|
| Top "X" | | |
| Middle "X" | | |
| Bottom "X" | | |
| Top "Y" | | |
| Middle "Y" | | |
| Bottom "Y" | | |
| Difference between largest "Y" measurement and smallest "Y" measurement | Taper for "Y" axis: | Taper Service Limit: 0.05mm (0.002") |
| Difference between largest "X" measurement and smallest "X" measurement | Taper for "X" axis: | |
| Largest difference between any "X" axis measurement and "Y" axis measurement | Cylinder Out-of-Round: | Out-of-Round Service Limit: 0.05mm (0.002") |
| Piston Skirt Measurement (page 8.10) | | |
| Difference between largest "X" axis measurement and piston measurement | Piston-to-Cylinder Clearance* | Piston-to-Cylinder Clearance Service Limit: 0.15 mm (0.006") |

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

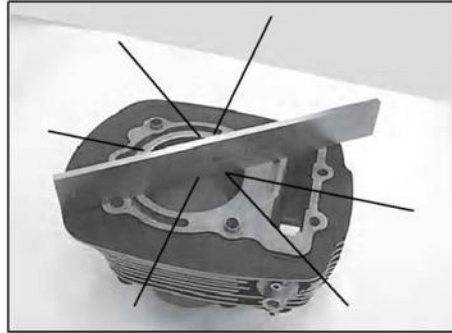
NOTE: The cylinders are NiCaSil plated and cannot be reconditioned by boring or honing. If excessive surface damage, taper or out-of-round exists, the cylinder must be replaced.

- 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 & PISTON

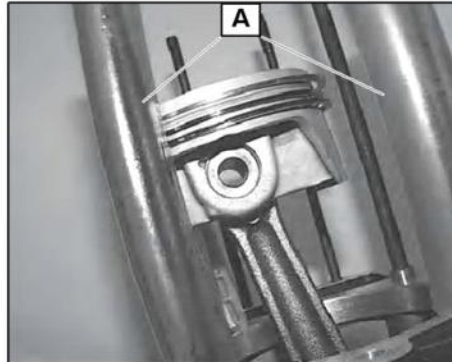
CYLINDER WARPAGE MEASUREMENT

1. Inspect cylinder for warpage at cylinder head surface and base gasket surface.
2. Place a straight edge diagonally across cylinder mating surfaces in several positions. Attempt to slide a 0.002" feeler gauge under straight edge in each position.
3. Replace cylinder if a feeler gauge larger than 0.002" will slide under straight edge.



PISTON & PISTON RING REMOVAL

1. Cover crankcase with a clean shop towel to prevent piston clip from falling into the crankcase.
2. Slide large diameter fuel line or hose (A) over cylinder studs to protect pistons from damage.
3. Remove left side piston pin circlip.



4. Push piston pin out to left side of engine and remove the piston. No puller is required.
5. Rotate rings in piston grooves. Rings should be able to rotate in grooves without catching.
6. Clean carbon deposits from piston.
7. Spread rings only wide enough to remove them from piston. Spreading rings too wide will damage them.
8. Clean piston ring grooves. Break or cut a piston ring in half. File or grind one edge square and remove all burrs. Use this piston ring to carefully clean piston ring grooves.



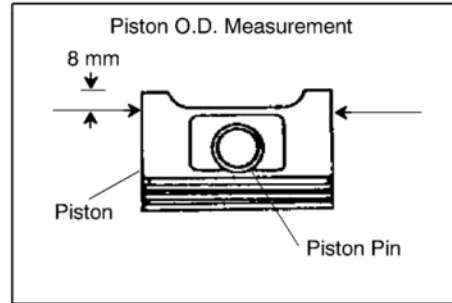
NOTE: A soft wire brush is permissible to clean top of piston. Do not use a wire brush to clean sides of piston or the piston ring grooves, as this can damage the piston ring grooves.

8.6

CYLINDER & PISTON

PISTON & PISTON RING INSPECTION

1. Visually inspect piston for cracks, excessive wear, scoring, etc.
2. Measure piston skirt O.D. (90° to pin and 8 mm from bottom of piston skirt and compare to specifications listed on page 8.2. Replace piston if worn beyond the service limit.



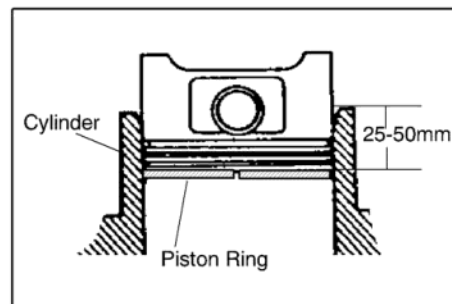
3. Calculate Piston to Cylinder Clearance. Subtract piston O.D. from cylinder bore I.D. and compare to specification listed on page 8.2.
4. Replace parts that do not meet specification.

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.

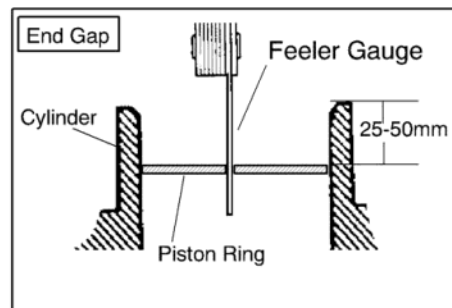
Piston to Cylinder Clearance Calculation

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

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



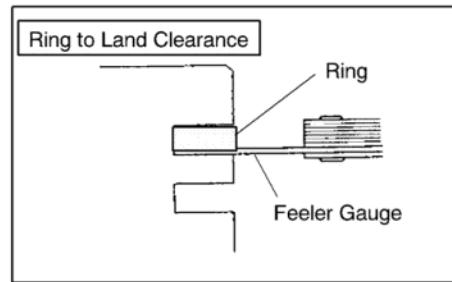
6. Measure installed ring end gap with a feeler gauge and compare to specification listed on page 8.2. If either ring exceeds the service limit, replace ring set for that cylinder.



CYLINDER & PISTON

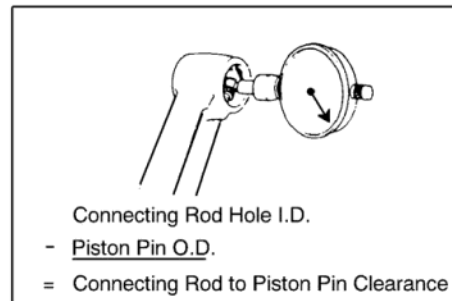
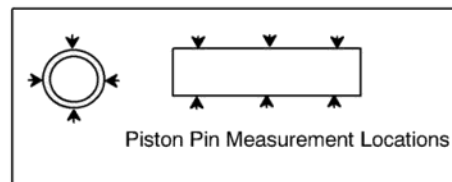
PISTON AND PISTON RING INSPECTION (cont.)

7. Install rings onto a cleaned piston. Push rings in until they are flush with piston. Using a feeler gauge, measure side clearances for the 1st & 2nd rings. If any of clearances exceed limit, replace piston and piston rings.



PISTON PIN / PIN BORE INSPECTION

1. Measure piston pin hole I.D. in four locations with a telescoping gauge. Record the smallest.
2. Measure piston pin O.D. at six locations. Record largest measurement.
3. Calculate piston pin-to-piston clearance. Subtract pin O.D. from pin hole I.D..
4. Measure connecting rod small end I.D. at two locations.
5. Calculate connecting rod-to-piston pin clearance by subtracting pin O.D from rod hole I.D..
6. Compare measurements to specifications listed on page 8.2 and replace any worn parts.

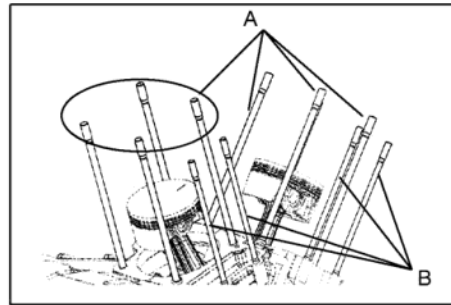


CYLINDER STUD REPLACEMENT

NOTE: Only remove cylinder studs if broken or when replacing crank cases. Cylinder studs do not need to be removed for normal engine disassembly and assembly.

1. Use a stud remover to remove 10mm studs (A) and 8mm studs (B).
2. Clean threads in cases thoroughly.
3. Install studs and torque them to specification shown on page 8.1.

NOTE: Apply engine oil to stud threads.



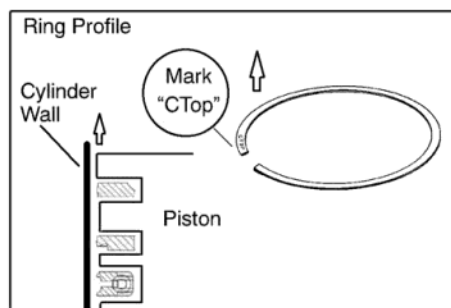
PISTON RING INSTALLATION

CAUTION

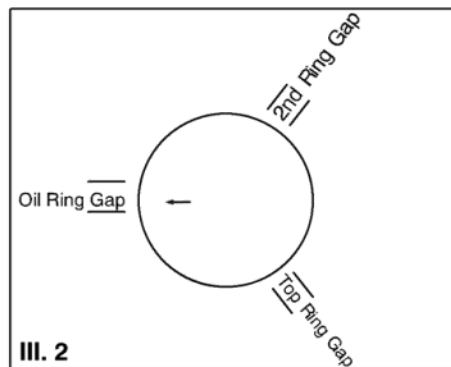
Rings may be damaged if expanded any more than necessary when installing. Refer illustration on page 8.1.

1. Carefully install oil control ring assembly (bottom ring) with "CTOP" mark facing up. The oil control ring consists of a backing spring and one rail component.
2. Install first and second rings with "CTOP" mark facing up.
3. Make sure that rings rotate freely in piston grooves without catching.
4. Stagger ring end gaps at 120° intervals in relation to arrow on piston crown as shown in III. 2.

NOTE: Arrow on piston faces FRONT of engine for both front and rear cylinders.



III. 1



III. 2

CYLINDER & PISTON

PISTON INSTALLATION

The pistons are marked with an arrow on the crown. Install pistons on the connecting rod with arrow (A) facing the FRONT of the engine.

1. Place a clean shop towel over crankcase to prevent foreign material from entering crankcase. Careful not to drop the piston clip into the crankcase.
2. Ensure that crankcase gasket surfaces are thoroughly clean and in good condition.
3. Install a new circlip on one side of the piston with end gap facing UP (12:00 position.) (III. 2)

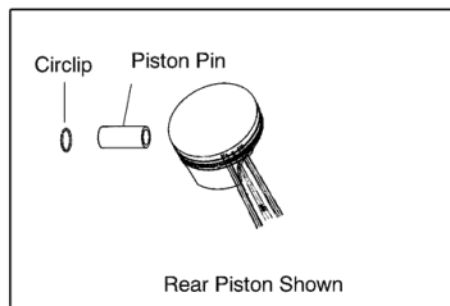
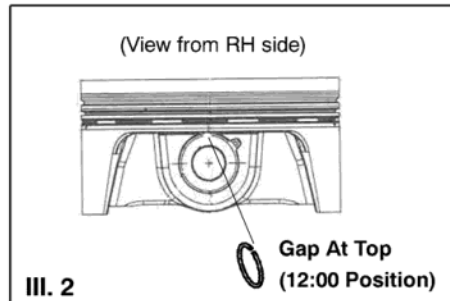
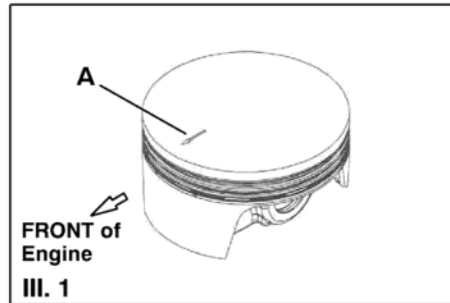
CAUTION

Never reuse piston pin circlips.

4. Apply assembly lube to the piston pin outer surface and the I.D. of connecting rod small end.

Moly assembly paste PN: 2871460

5. Install piston over connecting rod with arrow on piston crown facing FRONT of engine.
6. Push piston pin through rod and piston pin hole until it is stopped by circlip.
7. Install remaining circlip with end gap facing up (12:00 position.)
8. Make sure both piston circlips are seated properly in the groove.



CYLINDER INSTALLATION

1. Wash cylinders with clean solvent first, then with hot soapy water.
2. Rinse cylinders with hot water.
3. Dry cylinders immediately with compressed air.
4. Wipe cylinder bore with a clean white shop towel until clean. Apply a light coat of engine oil to cylinder bore to prevent rust and ease assembly.
5. Apply a light coat of engine oil to piston and rings.
6. Ensure cylinder alignment dowel pins are in place and gasket surfaces are clean.
7. Apply a small amount of crankcase sealant to the case parting lines on the base gasket surface (A).
8. Install new cylinder base gaskets onto crankcase.

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

9. Place a small amount of engine oil to the inside surfaces of a piston ring compressor.

Piston ring compressor PV-43570-2 band

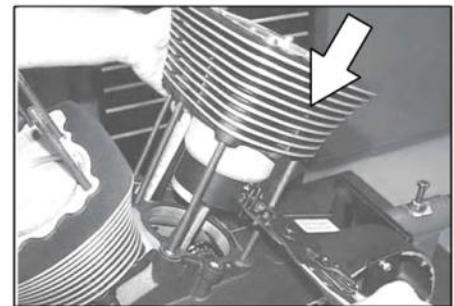
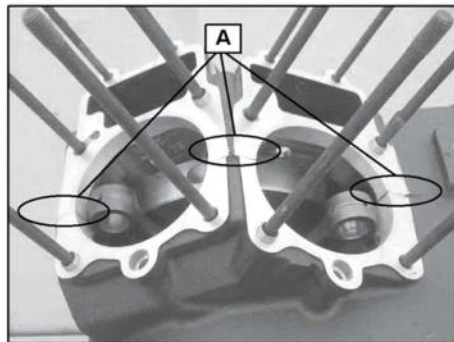
Piston ring compressor pliers PV-43570-1

10. Install piston ring compressor over rings and compress rings forcing them into the ring grooves.

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

NOTE: Install cylinders in their original locations.

11. Remove protective covering from crankcase.
12. Carefully install cylinder(s) onto the piston/ring assembly. Do not force cylinder over piston. Monitor rings carefully. Remember to remove shop towel from crankcase before seating cylinder to crankcase. If a piston ring becomes dislodged from the ring compressor; remove cylinder, reinstall the ring compressor and begin again.
13. Remove piston ring compressor once rings are fully inserted into cylinder.
14. Slide the cylinder down over the piston until seated to the base gasket and crankcase surface.
15. Repeat for other cylinder if necessary.
16. Install cylinder head(s). (Refer to Chapter 7).
17. Install engine into frame. (Refer to Chapter 6).



CYLINDER & PISTON

TROUBLESHOOTING, CYLINDER & PISTON

Piston and or cylinder problems are usually related to engine compression, external fluid leaks, excessive use of engine oil or abnormal noises from above the base gasket. Troubleshooting piston and/or cylinder problems involves using a cylinder leak-down tester or compression gauge, searching for the source of a fluid leak, or listening to the engine with a listening device to pinpoint the source of an abnormal engine noise.

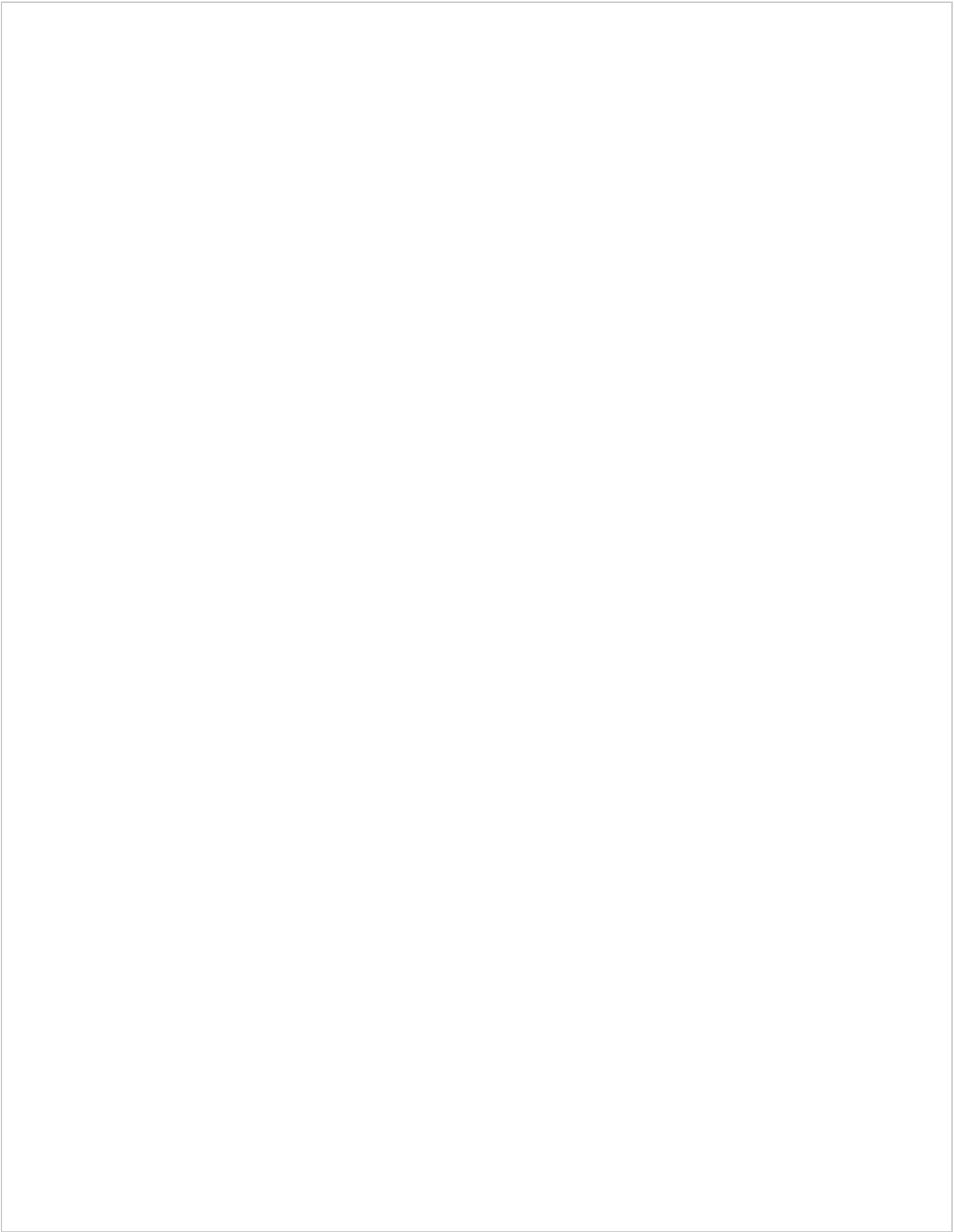
| PROBLEM | POSSIBLE CAUSE | AFFECTED PART(s) | REPAIR RECOMMENDED |
|---|--|---|--|
| Engine Hard Starting (or) Engine Will Not Start | Low Compression | Lifter(s) Locked | Refer to chapter 7 |
| | | Collapsed Hydraulic Lifter(s). Lifter Extremely Noisy. | Refer to chapter 7 |
| | | Worn Valve Guide(s) | 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 (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 |
| Electric Starter Straining to Turn Engine Over Abnormal Pre-ignition | High Compression | Excessive Carbon Build-up In Combustion Chamber. | Use Carbon Clean fuel system additive or disassemble engine to remove carbon from combustion chamber |

8.12

CYLINDER & PISTON

TROUBLESHOOTING (Cont.)

| PROBLEM | POSSIBLE CAUSE | AFFECTED PART(s) | REPAIR RECOMMENDED |
|------------------------------------|--------------------------------------|---|---|
| Engine Idles Poorly | 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 |
| | | Worn Cylinder, Pistons and/or Rings | Replace parts that do not meet specification |
| 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 do not meet specification |
| Leaks | Improper Assembly | Cylinder, Gaskets, Gasket Surfaces Incorrect Fastener Torque | Perform white powder test to determine leak path. 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 |

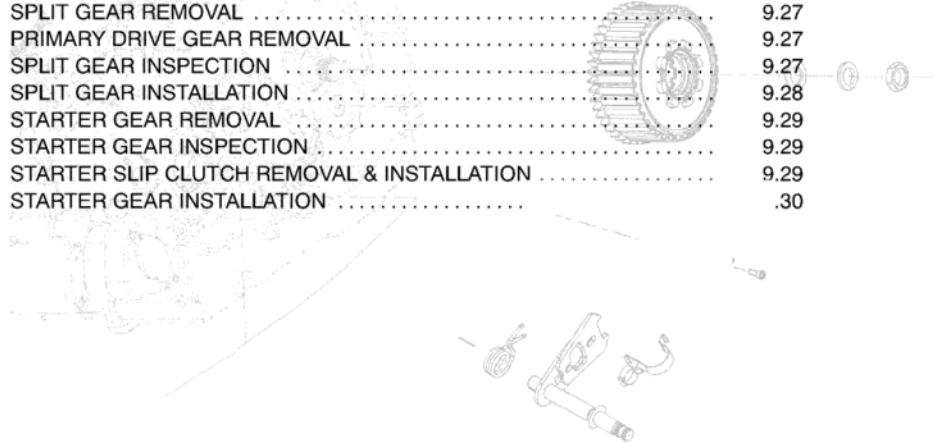


CHAPTER 9

CLUTCH, PRIMARY DRIVE, & SHIFT LINKAGE

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9



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

GENERAL

- Clutch and external transmission shift linkage repair can be accomplished with the engine in the frame.
- Internal transmission or shifting mechanism service requires engine removal and crankcase separation.
- Oil additives of any kind are not recommended by Victory. Using oil additives can have a detrimental affect on clutch performance and operation.
- Engine oil type and viscosity can affect clutch operation. Always determine what type of oil is being used, if oil is contaminated or low, or if oil additives are present before servicing the clutch system. If any of these items are present, change the oil before performing clutch service.
- Burnt clutch plates are not an indication of defective clutch plates. Burnt clutch plates indicate that a problem exists within the clutch system or the the clutch has been used improperly.
- Victory 20W/40 motorcycle oil is recommended for all operating temperatures. If Victory 20W/40 oil is not available, any 20W/40 oil SG rated oil can be substituted. Do not use oils rated higher than SG.
- Lubricate parts during assembly as described in the procedures.

CAUTION: Corroded or sticking shift linkage pivot points can cause abnormal shifting. Replace any linkage components that are damaged or do not move freely.

SPECIFICATIONS, GENERAL

| Item | | Specifications |
|--------------------------------------|--------------------------------|---|
| Clutch Gear Shift and Linkage | Clutch Type | Wet, Multi-Disk |
| | Clutch Operating Mechanism | Manually Operated Cable |
| | Torque Compensator | Belleville Spring Loaded Cam Assembly |
| | Primary Reduction Ratio | 1.50 : 1 |
| | Transmission Shift Mechanism | Manually Operated, Spring Centered |
| | Gearshift Pattern | 1-N-2-3-4-5 |
| | Clutch Spring (Diaphragm Type) | Yellow Paint Mark 125 lb. (Standard) Green Paint Mark 145 lb. (For Stage Kits) |

SPECIFICATIONS, SERVICE

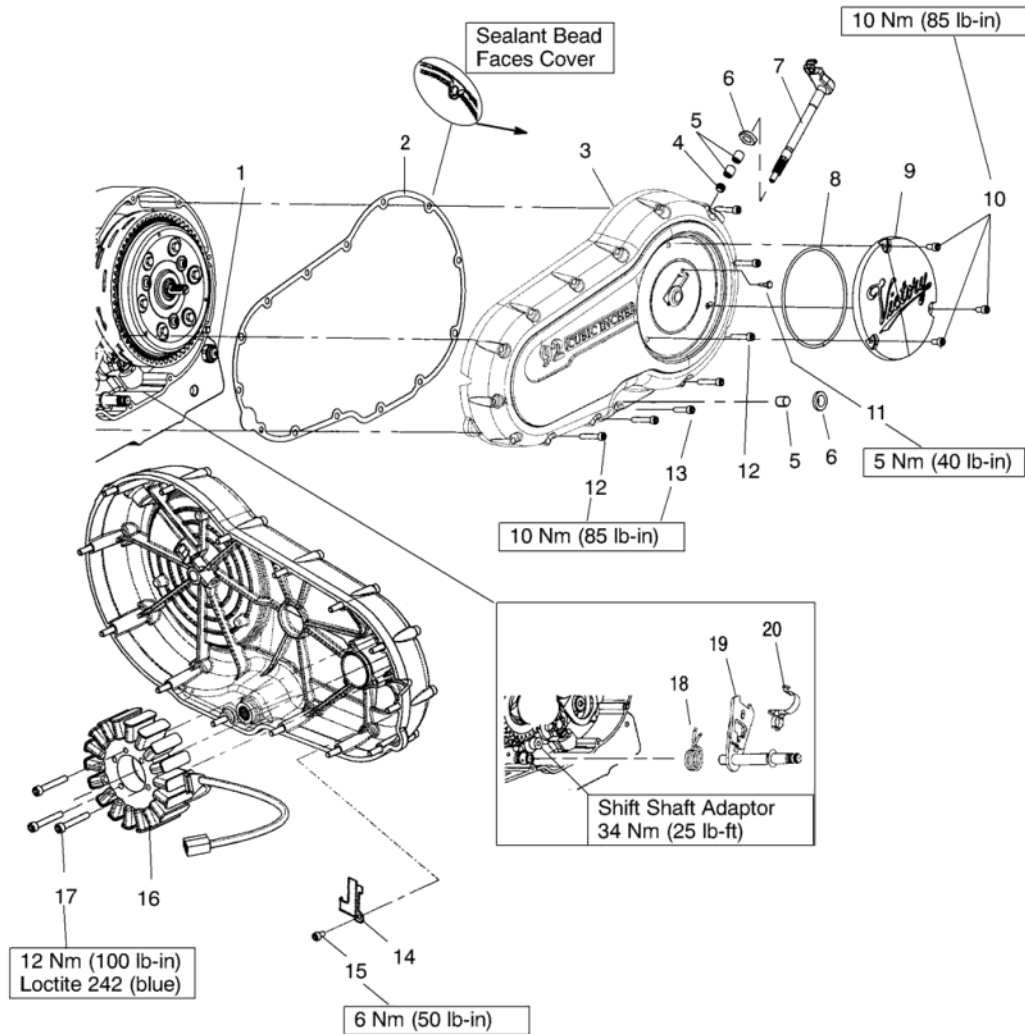
| CLUTCH/GEARSHIFT/LINKAGE | | |
|--------------------------|--------------------------|---------------|
| Item | Standard | Service Limit |
| Clutch Lever Free Play | .25-.75 mm (0.010-.030") | ← |
| Clutch Lever Free Play | .25-.75 mm (0.010-.030") | ← |

SPECIAL TOOLS

Refer to page 1.11 for Special Tool information.

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

PRIMARY COVER, 2002

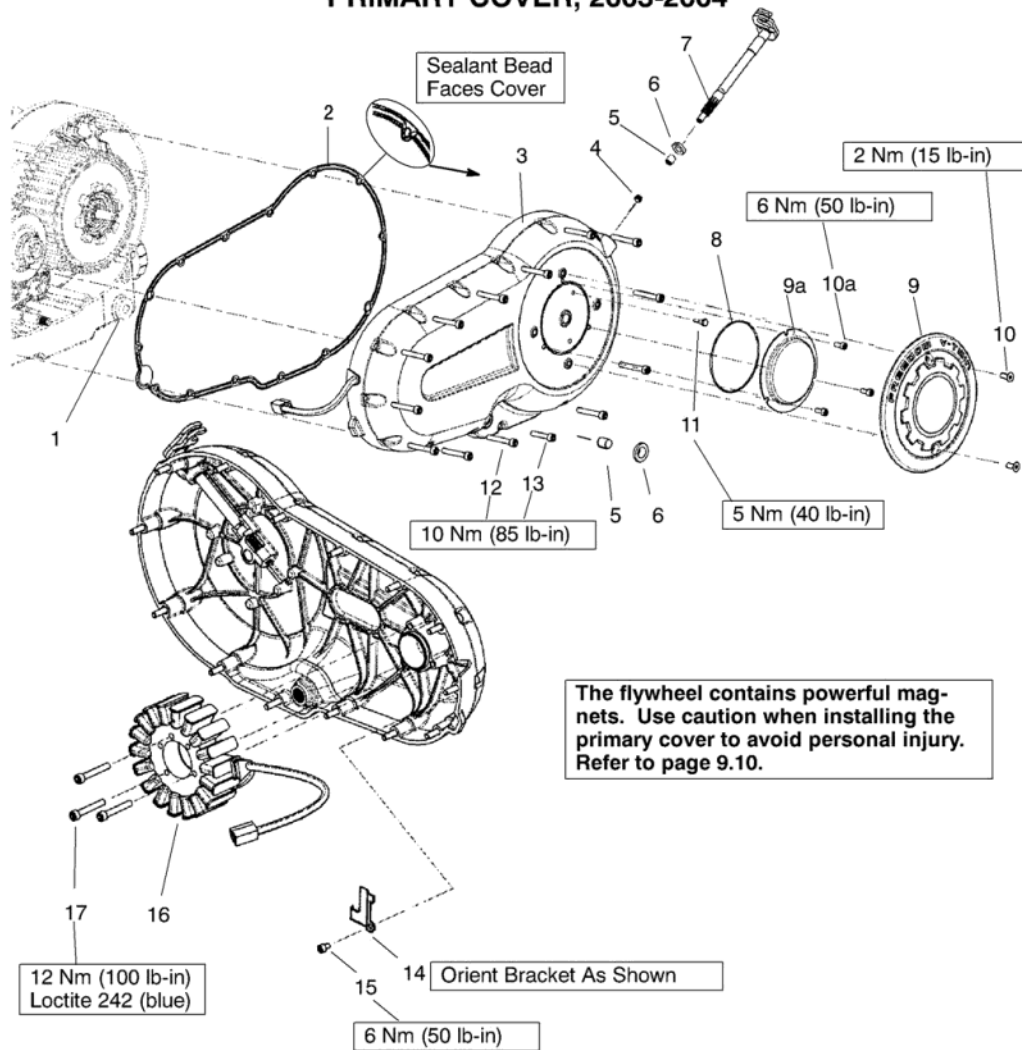


- | | |
|--|--|
| 1. Sensor, Oil Pressure | 11. Screw (1) |
| 2. Gasket, Primary Drive | 12. Screw (13) 6x65 |
| 3. Asm, Primary Cover (Includes items 4, 5, 6) | 13. Screw (1) 6x30 |
| 4. Bearing, Needle (1) | 14. Bracket, Stator Wire |
| 5. Bearing, Needle (3) | 15. Screw |
| 6. Seal (2) | 16. Stator |
| 7. Pinion, Clutch | 17. Screw (3) |
| 8. O-Ring | 18. Spring |
| 9. Plate, Emblem | 19. Asm, Shifter Ratchet (Incl. items 18 & 20) |
| 10. Screw (3) | 20. Spring |

9.2

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

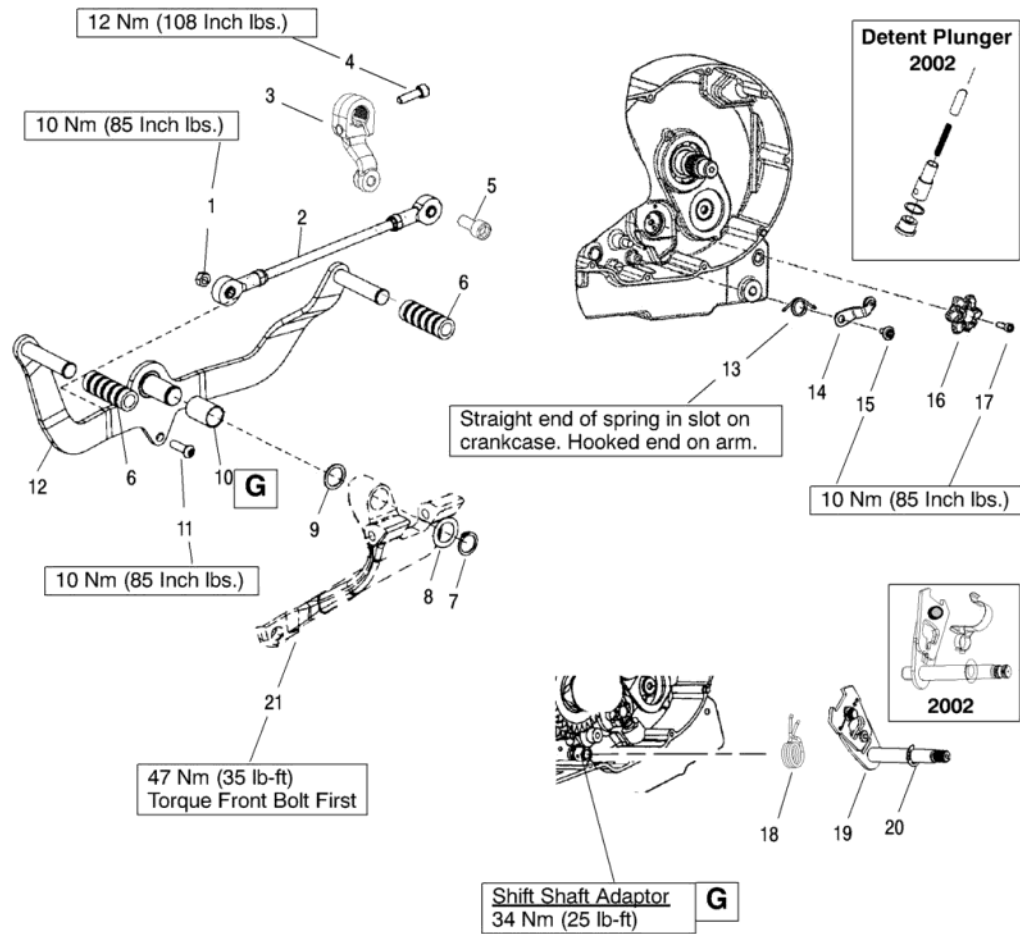
PRIMARY COVER, 2003-2004



- | | |
|--|------------------------------|
| 1. Sensor, Oil Pressure | 10. Screw (3) 6x14 |
| 2. Gasket, Primary Cover | 10a. Screw (3) 5x12 |
| 3. Asm, Primary Cover (Includes items 4, 5, 6) | 11. Screw (1) 8x16 Dog point |
| 4. Bearing, Needle (1) | 12. Screw (16) 6x40 |
| 5. Bearing, Needle (2) | 13. Screw (1) 6x30 |
| 6. Seal (2) | 14. Bracket, Stator Wire |
| 7. Pinion, Clutch | 15. Screw 5x8 |
| 8. O-Ring | 16. Stator |
| 9. Plate, Cap | 17. Screw (3) 6x40 |
| 9a. Plate, Cap Seal | |

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

SHIFT MECHANISM



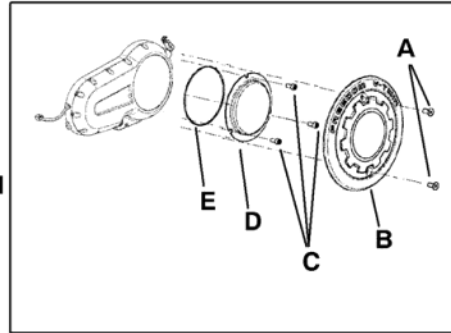
G = Apply Grease

- | | |
|-------------------------|----------------------------|
| 1. Nut | 12. Shift Pedal |
| 2. Shift Rod | 13. Spring |
| 3. Shift Lever (Arm) | 14. Roller Arm Assembly |
| 4. Screw, 6x20 | 15. Flanged Screw |
| 5. Screw, 6x20 | 16. Shift Star |
| 6. Shift Pedal Pad | 17. Screw 6x20 |
| 7. Retaining Ring | 18. Spring |
| 8. Flat Washer | 19. Shift Ratchet Assembly |
| 9. Wave Washer | 20. Retaining Ring |
| 10. Shift Pedal Bearing | 21. Footrest Support |
| 11. Screw | |

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

CAP PLATE & CAP PLATE SEAL REMOVAL

1. Remove the two screws (A) and remove cap plate (B).
2. Remove cap plate.
3. Remove (3) screws (C).
4. Remove cap plate seal (D) and O-ring (E).

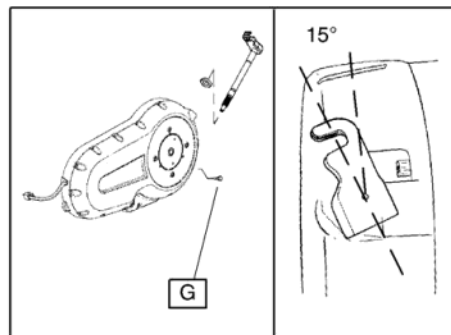
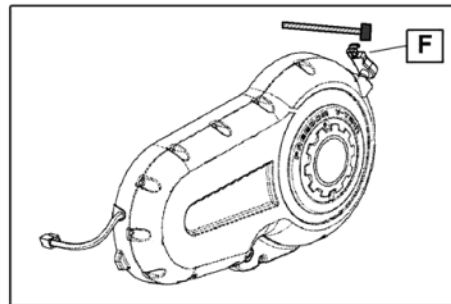


CAP PLATE & CAP PLATE SEAL INSTALLATION

1. Install new o-ring.
2. Re-install covers. Torque screws to specification on page 9.3.

CLUTCH PINION SHAFT REMOVAL

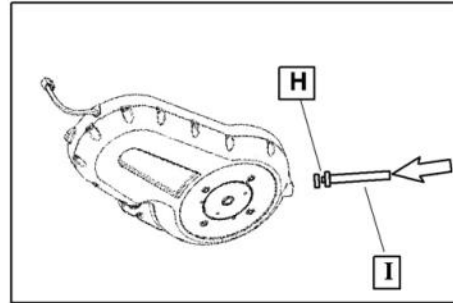
1. Using a pair of soft jaw pliers to avoid damage to the pinion arm finish, rotate arm toward clutch cable until cable is slack. Remove clutch cable from the clutch pinion shaft (F).
2. Remove the primary cover cap plate, cap plate seal, and O-ring.
3. Remove the clutch pinion shaft retaining bolt (G).
4. Pull the clutch pinion shaft out of the primary cover.
5. Inspect the pinion gear teeth for cracks, broken teeth, or wear.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

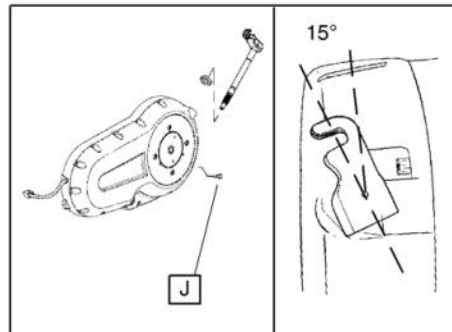
CLUTCH PINION SHAFT SEAL REMOVAL & INSTALLATION

6. Use a suitable seal remover and carefully pry the seal (H) out of the primary cover.
7. Clean all parts thoroughly.
8. Apply engine oil to bearings and contact surfaces of clutch release pinion shaft.
9. Lubricate the O.D. of seal with a thin film of engine oil.
10. Lubricate sealing lip of the seal with grease.
11. Drive the pinion shaft seal into place with a suitable driver (I).



CLUTCH PINION SHAFT INSTALLATION

1. Reverse steps 1-4 of removal procedure to install clutch pinion shaft.
2. Torque pinion shaft dog-point screw (J) to specification found on page 9.3.
3. Pinion arm must be positioned at a $15^{\circ} \pm 5^{\circ}$ angle to primary cover parting line.

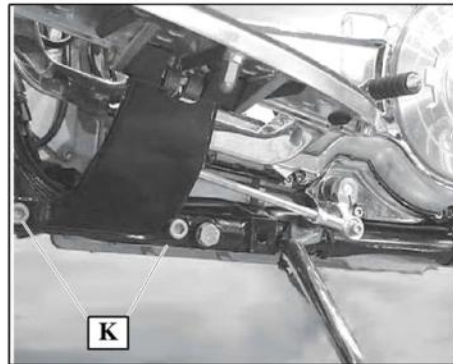


SHIFT LEVER ARM REMOVAL

1. Securely support motorcycle in an upright position.
2. Drain engine oil into suitable container.

NOTE: Primary cover can be removed without draining the engine oil. Use a suitable oil drain pan to catch the small amount oil present under the primary cover if preferred.

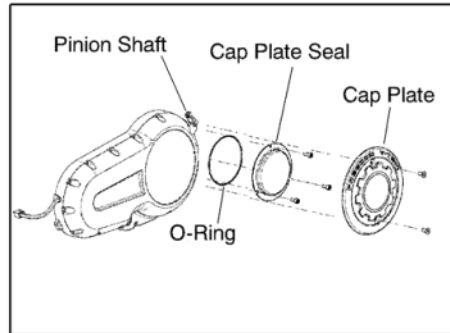
3. Remove shift lever arm pinch bolt.
4. Place a mark on the shift shaft in line with the opening on shift lever arm to ease assembly.
5. Remove two footrest mount retaining bolts. Remove shift pedal, lever arm, and footpeg as an assembly.
6. To install, reverse the steps above. Align the opening in shift lever arm with mark made before disassembly. Tighten front footrest bolt first, then rear. Torque footrest bolts and shift lever arm pinch bolt to specifications found on page 9.4.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

PRIMARY COVER REMOVAL

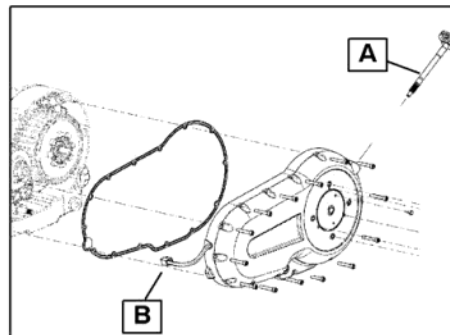
1. Refer to exploded view on page 9.3 and procedure on page 9.6 to remove shift pedal and footrest as an assembly. Refer to page 9.5 to remove the clutch cable from the pinion shaft, and to remove cap plate and cap plate seal.



2. Remove clutch pinion shaft (A). Refer to page 9.5.
3. Disconnect stator wire connector (B).
4. Remove primary cover screws.

NOTE: The short screw (6x30) is installed next to the shift shaft.

5. Remove primary cover. Discard used primary cover gasket.



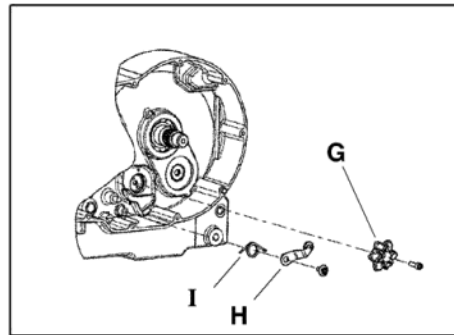
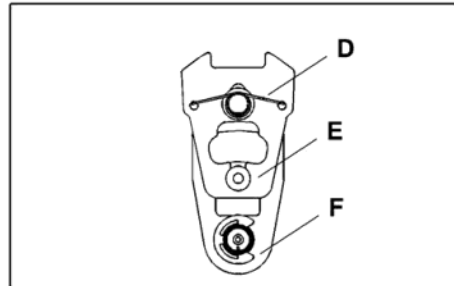
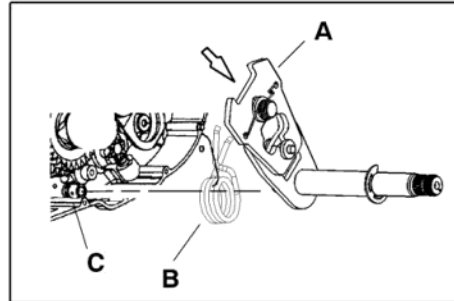
CLUTCH PINION SHAFT BEARING INSPECTION

1. Clean the clutch pinion bearings and dry with compressed air.
2. Apply engine oil to the bearings.
3. Temporarily install the clutch pinion shaft into the primary cover.
4. Turn the clutch pinion shaft by hand. Observe the feel of the bearings. Replace the bearings if rough or notched action is noticed.

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

SHIFT RATCHET REMOVAL & INSPECTION

1. Shift transmission into neutral.
2. Remove primary cover. Refer to page 9.7.
3. Remove clutch. Refer to page 9.13.
4. Push shift ratchet (A) toward shaft to release ratchet from shift star.
5. Remove shift ratchet from crankcase with centering spring (B) attached by pulling straight outward.
6. Inspect shift shaft centering spring. The spring should have enough tension to keep shift shaft centered.
7. Inspect shift shaft for excessive wear or damage.
8. Inspect shift shaft adapter (C) on crankcase for wear and verify it is tight.
9. Inspect compression spring for cracks. The spring should apply enough tension on the shift ratchet mechanism to keep it extended.
10. Inspect fit of the rivet (E) on shift ratchet assembly. The fit should allow for free movement, but not be excessively loose.
11. Inspect fit of the locating C-clip (F).
12. Inspect cases around shift shaft adapter for cracks.
13. Inspect shift star (G) on shift drum and shift ratchet mechanism for cracks or excessive wear. Check the shift star retaining bolt to be sure it is tight.
14. Inspect detent roller arm (H) for wear or damage; spring (I) for proper tension, and retaining bolt to be sure it is not loose.



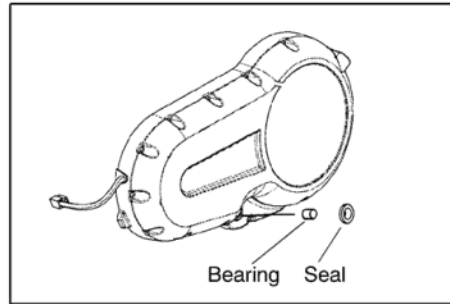
CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

SHIFT RATCHET INSTALLATION

1. Apply a small amount of lithium grease to ratchet shaft and shift shaft adaptor.
2. Install shift ratchet into shift shaft adaptor with centering spring attached by pushing ratchet to the retracted position.
3. Engage ratchet with shift star.
4. Install clutch. Refer to page 9.20.

SHIFT SHAFT BEARING & SEAL REPLACEMENT (Primary Cover Removed)

5. Using a small seal remover, remove the shift shaft seal.
6. Using a suitable arbor and arbor press, press the bearing out towards the outside of the cover.
7. Clean all parts thoroughly
8. Apply assembly lube to inner & outer surfaces of new bearing.

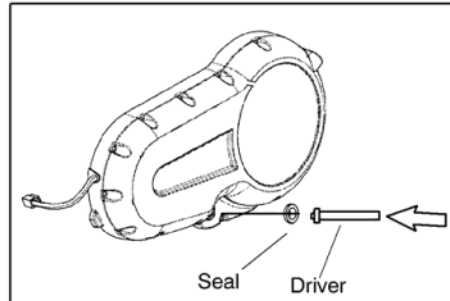


Moly assembly paste PN: 2871460

9. Press the bearing into place until it fully seats.

NOTE: Press all needle bearings from the numbered side.

10. Apply a small amount of grease to the sealing lip of the seal and apply engine oil to the O.D. of the seal.
11. Using a suitable driver, drive the seal into place.
12. Install primary cover. Refer to page 9.10.
13. After installing primary cover, verify proper shift ratchet (shaft) end play (.005-.015 in.) so that shaft does not bind.
14. Install clutch pinion shaft. (Refer to page 9.5)
15. Install the primary cover. (Refer to page 9.10)
16. Install footrest and shift pedal.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

PRIMARY COVER INSTALLATION

1. Clean gasket surfaces of crankcases and primary cover.

CAUTION

Use care when removing old gaskets. Careless removal practices can damage the gasket surfaces.

2. Verify that the alignment dowels are in position and clutch pinion shaft is removed.
3. Place a new primary cover gasket on the crankcase with sealant bead out (toward cover).
4. Place primary cover onto crankcases. Hold alternator side (front) of the primary cover to keep from sticking on shift shaft and flywheel.

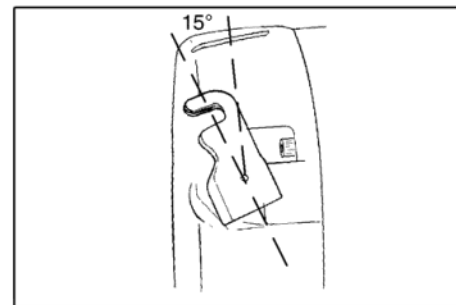
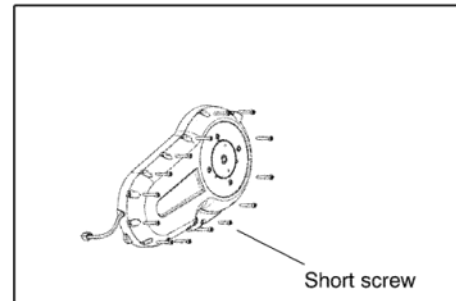
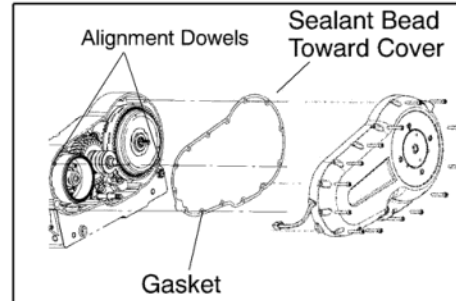
CAUTION

The flywheel magnets have considerable energy. Make sure that fingers are not trapped between the primary cover and the center cases or they may be pinched.

5. Install the primary cover screws and torque them in two steps to specification. Repeat torque on all screws to ensure all are tight. Refer to torque specifications on page 9.3.

NOTE: The short screw goes in the hole just behind the shift shaft.

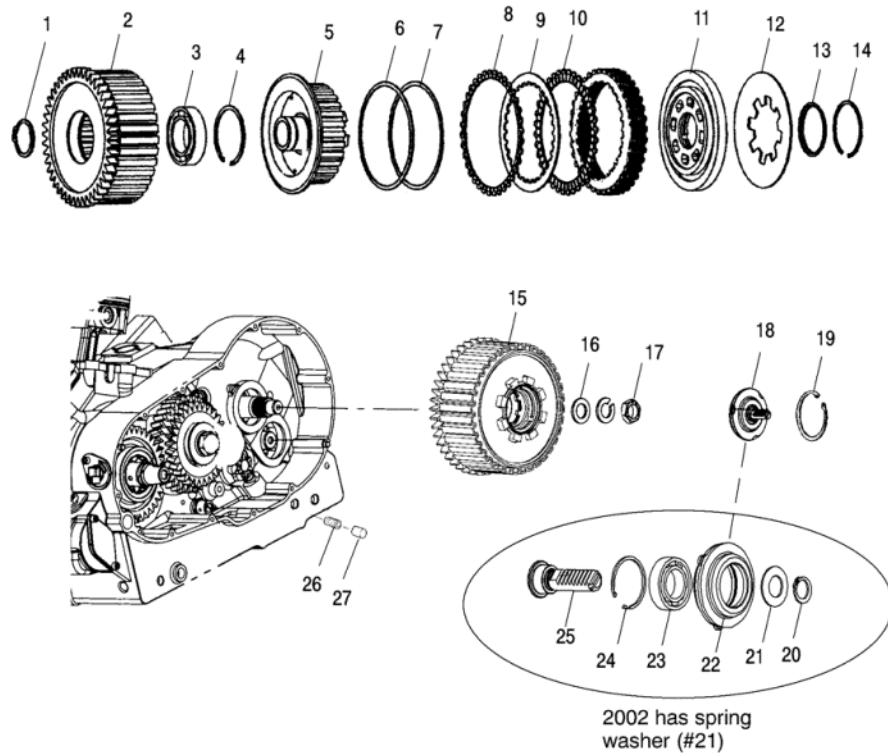
6. Observe the alignment of the pinion shaft (arm) cable retainer. If necessary, pull back on the primary cover slightly and turn the clutch release pinion shaft until proper alignment is obtained. Adjust clutch rack insert using a flat blade screwdriver as needed to get the $15^{\circ} \pm 5^{\circ}$ off centerline orientation.
7. Install the cap plate and cap plate seal. Refer to procedure on page 9.5.
8. Install clutch cable into pinion arm. Adjust clutch lever for proper freeplay (refer to page 2.13).
9. Install shift linkage and adjust if necessary.
10. Fill engine to with oil (refer to page 2.8.) Run the engine until it reaches operating temperature and fill oil to the full line.



9.10

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

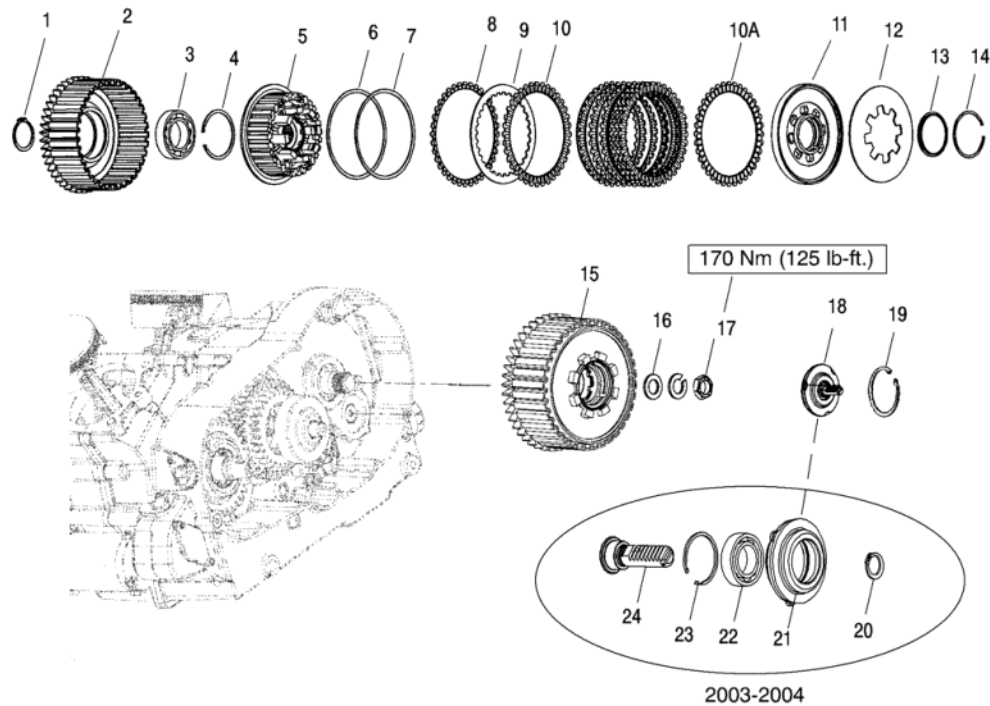
CLUTCH, 2002



1. Clip, External
2. Asm., Gear/Basket
3. Bearing, Ball
4. Circlip, Internal
5. Hub, Clutch
6. Seat, Judder Spring
7. Spring, Diaphragm, Judder
8. Plate, Friction, Judder (1)
9. Plate, Separator (9)
10. Plate, Friction (9)
11. Plate, Pressure
12. Spring, Clutch, Diaphragm
13. Seat, Snap Ring
14. Circlip, Internal

15. Asm., Clutch (Asm., Clutch Pack incl 9&10)
16. Washer
17. Nut
18. Asm, Rack Insert (Incl 22,23,24)
19. Circlip
20. Ring, Retaining
21. Washer, Spring
22. Insert, Pressure Plate
23. Bearing, Ball
24. Circlip, Internal
25. Rack, Clutch
26. Plug
27. Screw, set

CLUTCH, 2003-2004

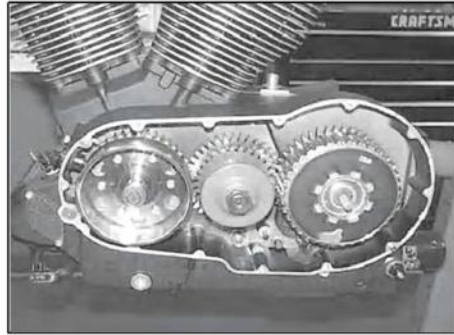


- | | |
|--|--|
| 1. Clip, External | 13. Seat, Snap Ring |
| 2. Asm., Gear/Basket | 14. Circlip, Internal |
| 3. Bearing, Ball | 15. Asm., Clutch (Asm., Clutch Pack Incl 9&10) |
| 4. Circlip, Internal | 16. Washer |
| 5. Hub, Clutch | 17. Nut, 20x1.5 |
| 6. Seat, Judder Spring | 18. Asm, Rack Insert (Incl 22,23,24) |
| 7. Spring, Diaphragm, Judder | 19. Circlip, Internal |
| 8. Plate, Friction, Judder (1) | 20. Ring, Retaining |
| 9. Plate, Separator (9) | 21. Insert, Pressure Plate |
| 10. Plate, Friction (8) | 22. Bearing, Ball |
| 10A Plate, Friction, Special Outer (1) | 23. Circlip, Internal |
| 11. Plate, Pressure | 24. Rack, Clutch |
| 12. Spring, Clutch, Diaphragm | |

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

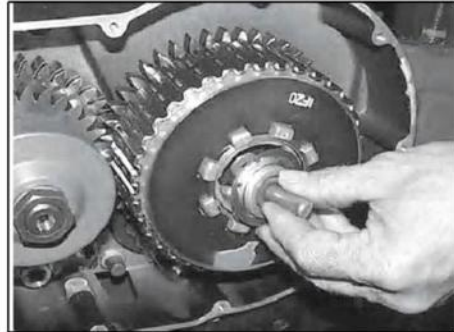
CLUTCH REMOVAL

1. Remove primary cover.



2. Using a snap ring pliers, remove clutch rack insert.

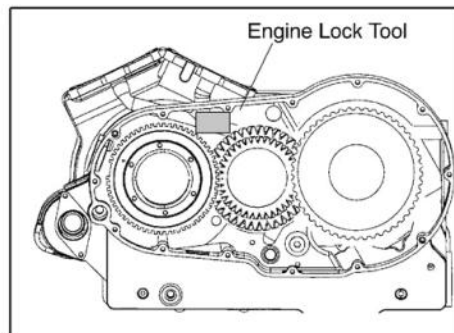
NOTE: There is no need to remove the clutch basket and hub assembly from the shaft if you are only going to service the clutch packing. The clutch plates and spring can be serviced with the clutch on the input shaft.



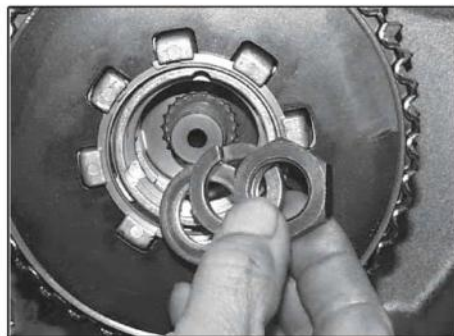
3. Install engine lock tool PV-43502-A as shown between crankshaft gear and split gear so the clutch nut can be loosened.

CAUTION: DO NOT LOCK ENGINE USING SQUARE TIMING GEAR TEETH. Lodge the lock tool between crankshaft gear and split gear to lock engine. Use caution when removing nut and keep hands and body clear of engine lock tool in case it slips off the gears.

Special tool: Engine lock tool PV-43502-A



4. Remove clutch nut, lock washer, and flat washer.
5. Remove clutch assembly from clutch shaft.

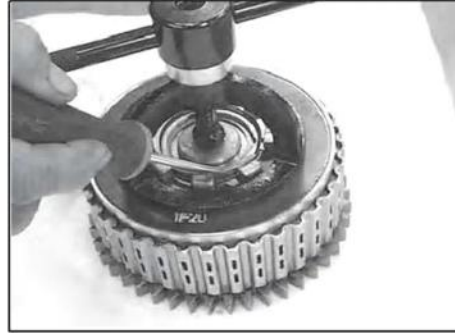


CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

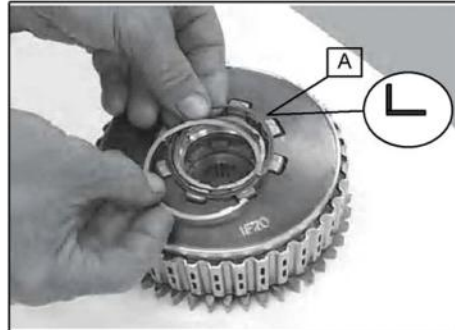
CLUTCH DISASSEMBLY

1. Set clutch on a clean shop towel or work surface. Install clutch spring compressor tool.
2. Compress the clutch spring.
3. Remove the retaining ring...

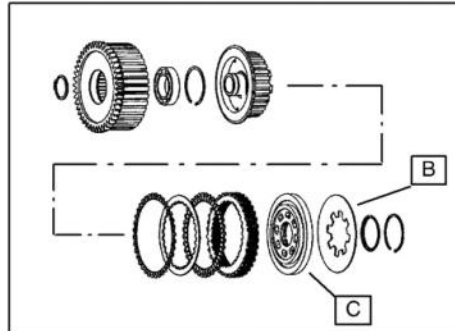
Special tool: Clutch spring compressor PV-45032



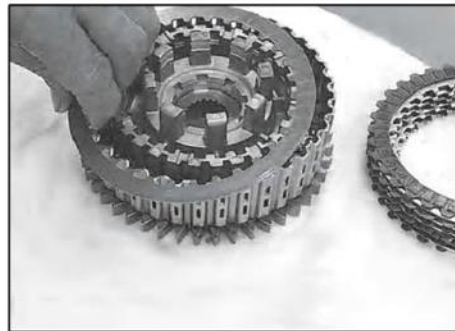
4. ...and retaining ring seat (A) (stepped washer).
5. Remove the clutch spring compressor tool from clutch.



6. Keep parts in order during disassembly. Refer to exploded views on page 9.11 (2002) and 9.12 (2003-2004).
7. Disassemble the clutch and lay the parts out for inspection.
8. Remove clutch spring (B) and pressure plate (C).



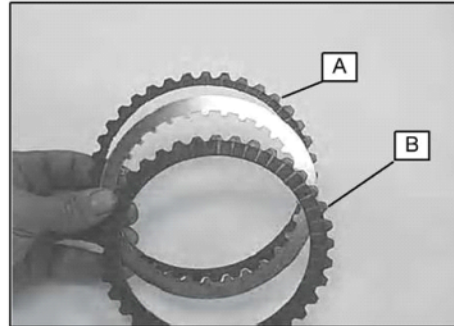
9. Remove clutch plates and set on bench in order of removal. On 2003-2004 models, there are 8 friction plates that are identical and 1 special friction plate that is placed outermost against the pressure plate. There are 9 steel plates that are identical. The innermost friction plate is the judder plate. The last parts to remove are the judder spring, and then the judder spring seat. Refer to exploded view on page 9.12.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

CLUTCH DISASSEMBLY (cont.)

10. Note the difference between judder plate (A) and the next friction plate (B). The judder plate is located innermost on clutch hub.

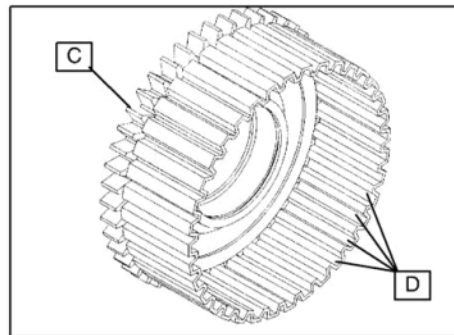


CLUTCH INSPECTION

1. Clean the clutch plates, inner hub, and outer basket thoroughly and dry using shop air.

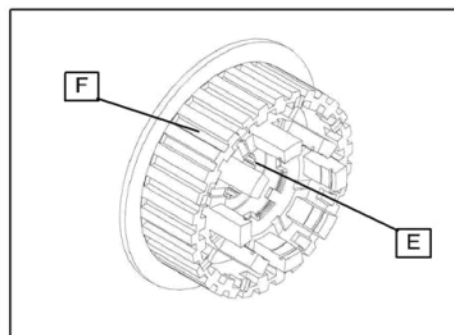
Clutch Basket

2. Inspect clutch gear teeth (C) for unusual wear, cracks or damage.
3. Inspect the inside surfaces (D) of the basket for cracks or heavy wear (grooves) from clutch plates.
4. Clean the basket & hub assembly thoroughly making sure the lubrication holes are clean.
5. Replace parts that fail inspection
6. Rotate the hub inspecting for smooth bearing feel without any play.
7. Lubricate the bearing with engine oil to protect it from rust or corrosion.



Clutch Hub

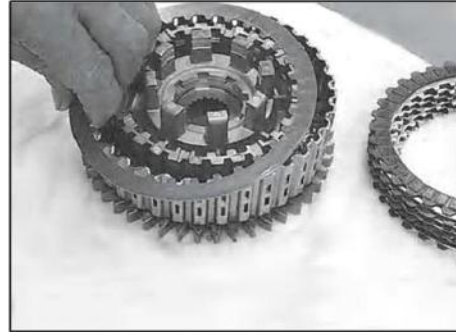
8. Inspect clutch spline teeth (E) for unusual wear, cracks or damage.
9. Inspect surface of separator plate guides (F) on outer edge of hub for wear, grooves, or damage.



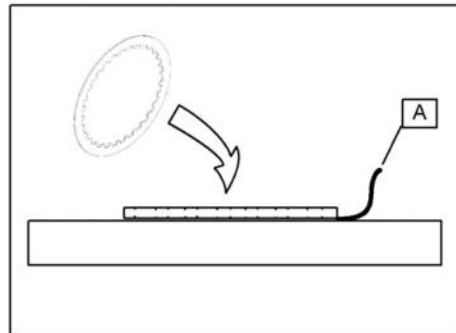
CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

CLUTCH INSPECTION (cont.)

10. Visually inspect the friction plates and separator (steel) plates for wear or damage on both surfaces. Replace plates as a set if any plate is worn or damaged.



11. Replace any separator (steel) plates that are grooved, distorted or bluish in color. Inspect plates for distortion by placing each plate on a precision flat surface. Insert a feeler gauge (A) between the plate and the flat surface in several places. Replace any plate that is warped more than 0.008in.



Clutch separator plate warp limit: .20mm (.008in)

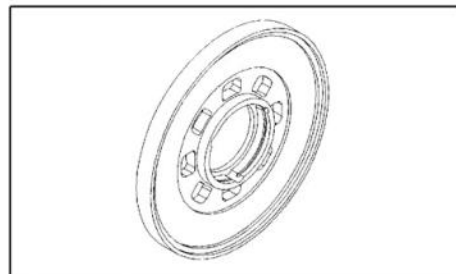
12. Measure the thickness of the friction plates in several places. The thickness of the plate should be the same at each place. Replace the entire clutch plate set if any plate fails inspection.

**Friction plate thickness service limit:
2.00mm (.078in)**



CLUTCH PRESSURE PLATE INSPECTION

13. Inspect the clutch pressure plate for cracks, deep scoring, or steps on the friction surface.
14. Inspect the rack insert retaining ring groove for cracks or chips. Replace the pressure plate if it fails inspection.

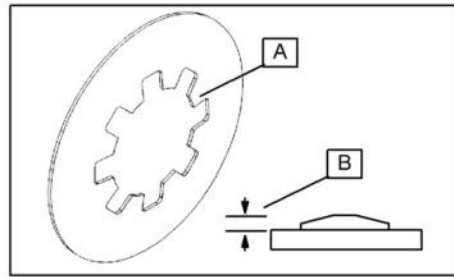


CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

CLUTCH INSPECTION (cont.)

Clutch Hub

15. Inspect the clutch pressure plate for cracks, deep scoring, or steps on the friction surface.
16. Inspect clutch diaphragm spring for cracks or distortion.
17. Inspect the inner and outer edges of the spring carefully for unusual wear or damage. The outer edge should lay flat against a surface plate and the inner tabs (A) should be even in height (B).

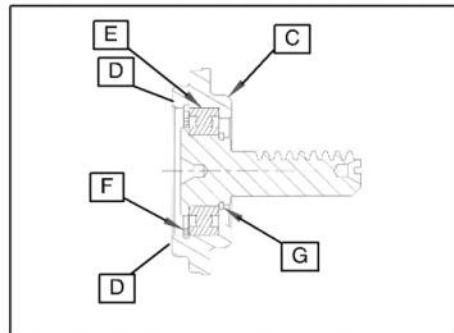


Rack Insert Disassembly & Inspection

18. Inspect the clutch rack for broken or damaged teeth.
19. Remove the retaining ring and disassemble the lifter assembly as shown.
20. Inspect lifter bearing visually for any signs of wear or discoloration. Rotate the bearing inner race with your finger and check for smooth movement and no play.



21. If the bearing fails inspection, remove it from the pressure plate insert (C) using an arbor press. Support the the pressure plate insert in area (D) during bearing removal to prevent damage to bearing and insert.
22. Press new bearing (E) on the outer race only until seated and past snap ring groove (F).
23. Install rack into bearing as shown.
24. Install the retaining ring (G) with the sharp edge away from the bearing. Fully seat the retaining ring in the groove.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

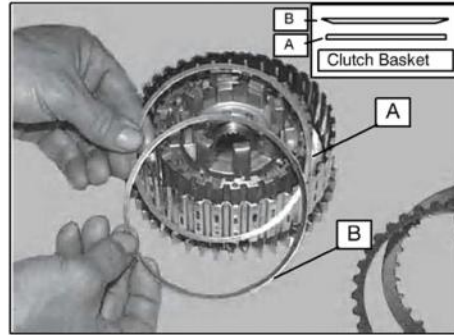
CLUTCH ASSEMBLY

1. Refer to exploded views on page 9.11 (2002) and 9.12 (2003-2004). Apply Victory Engine Oil to the judder spring seat (A) and judder spring (B).

2. Install judder spring seat.

3. Install judder spring.

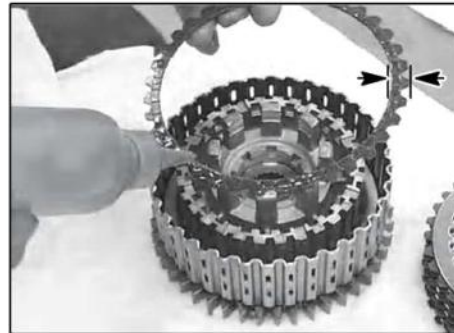
NOTE: Judder spring must be installed with the concave side facing **UP** (toward *outside* of basket).



4. Apply Victory Engine oil to the judder friction plate and install.

NOTE: This plate has a thinner profile than the rest of the friction plates.

NOTE: Feel the edge of the separator plates and friction plates with your finger. One side of the plate is machined (sharp) at the edges and the other side is a rolled edge (rounded). Separator plates (steel) must be installed with the **machined (sharp) edge facing UP**. Friction plates must be installed with the **rolled edge facing up**.



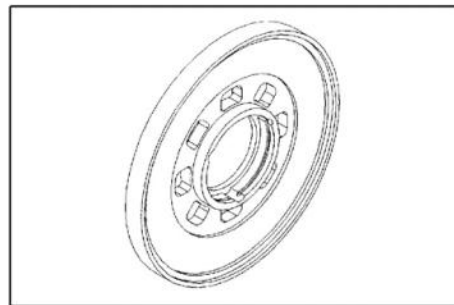
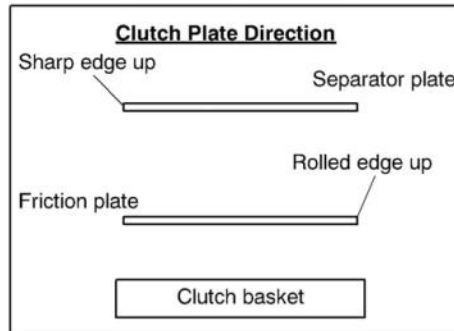
5. Place an oiled separator plate into the clutch basket with the machined edge UP.

NOTE: If the friction plates are new, soak them in clean engine oil for a few minutes before installing into the clutch basket.

6. Continue stacking oiled clutch plates into the clutch basket alternating friction and separator plates until all are installed, ending with the special friction plate.

NOTE: 2003-2004 Models: Be sure to install the special friction plate last (against the pressure plate). This plate has a different material than the other (8) main friction plates. Refer to illustrations on page 9.11 and page 9.12.

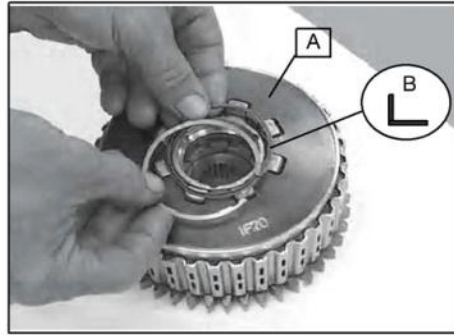
7. Install the clutch pressure plate on top of the clutch packing.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

CLUTCH ASSEMBLY (cont.)

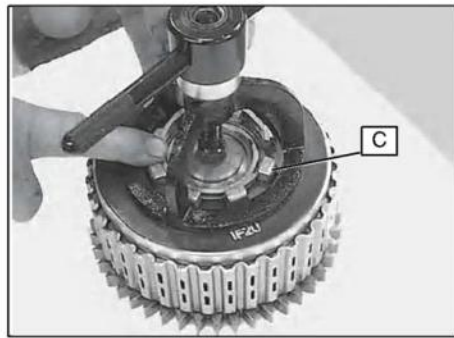
8. Install clutch diaphragm spring (A) with concave side down on top of the pressure plate.
9. Place the snap ring seat (B) over the clutch assembly before installing the clutch spring compressor tool. Make sure the flange is facing UP as shown.



10. Install the clutch compressor tool and compress the spring so that the snap ring seat can be positioned and the retaining ring installed.

Special tool: Clutch spring compressor PV-45032

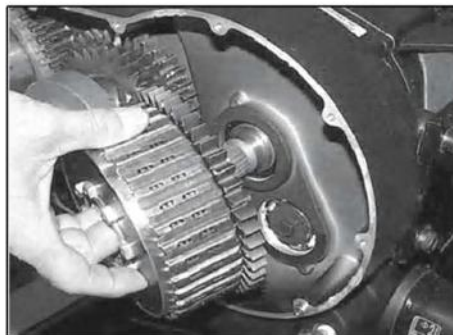
11. Install the retaining ring with the machined (sharp) edge up. Position the retaining ring so one end of the retainer is located on one of the posts (C).
12. Once the retaining ring is installed, release the pressure from the tool and guide the flange into position under the retaining ring.
13. Remove the spring compressor tool and inspect the retaining ring to be sure it is fully expanded.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

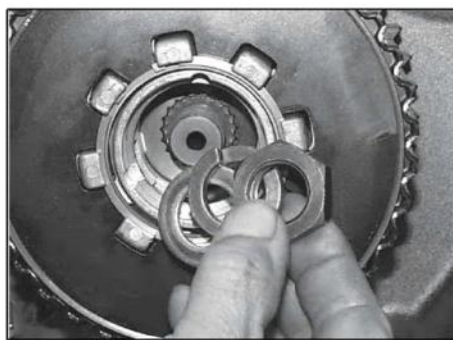
CLUTCH INSTALLATION

1. Install the clutch assembly onto the clutch shaft.

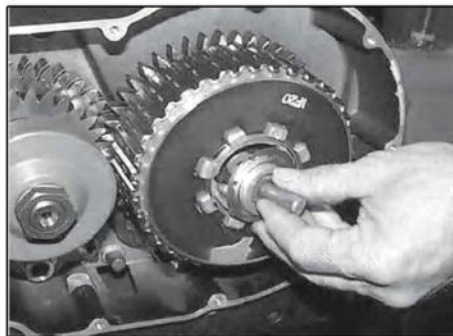


2. Clean shaft and nut threads with Loctite™ Primer N, and apply Loctite 262 (red).
3. Install washer, a new lock washer, and a new nut. Torque nut to 170 Nm (125 lb-ft). Allow 12 hours cure time before operating engine.

| | |
|---------------------------|-------------------|
| TORQUE: | Clutch Nut |
| 170 Nm (125 lb-ft) | |
| Loctite™ 262 (Red) | |

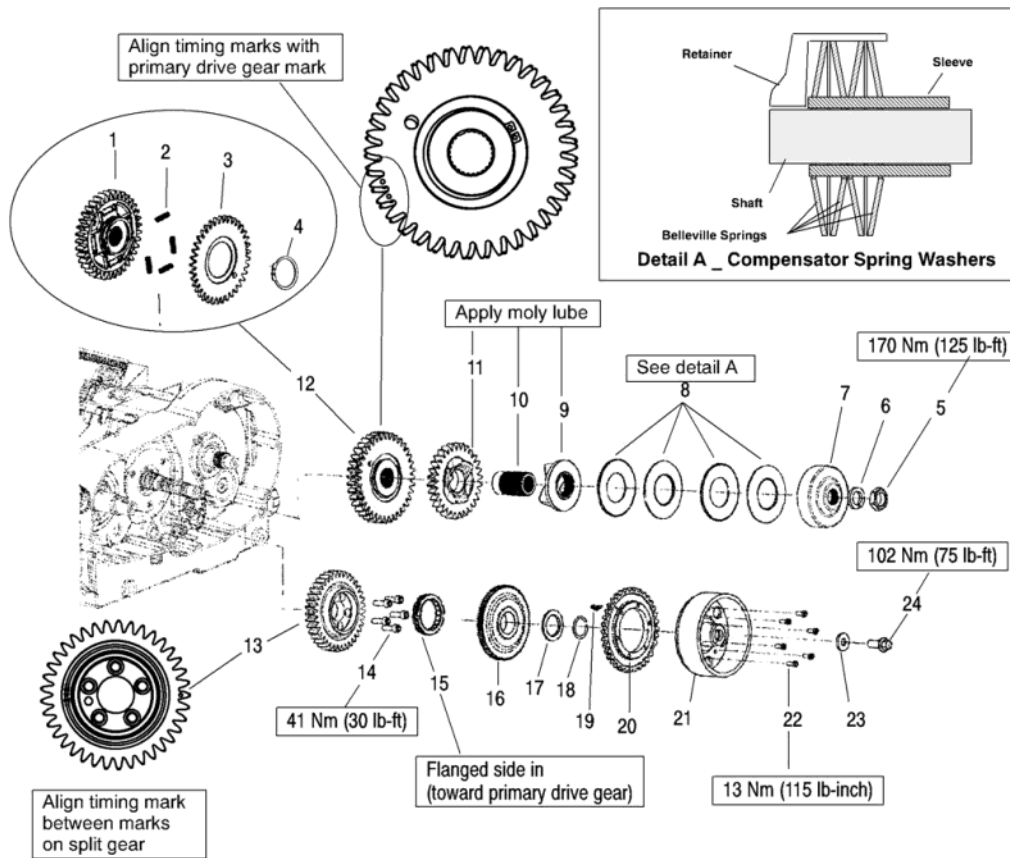


4. Install clutch lifter assembly. Be sure snap ring is seated in groove.
5. Install primary cover. Refer to page 9.10.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

PRIMARY DRIVE / TORQUE COMPENSATOR / SPLIT GEAR / FLYWHEEL



- | | |
|---|--|
| 1. Gear, Split, Drive, 37T | 13. Gear, Crankshaft |
| 2. Spring, Split Gear (4) | 14. Screw (5) 8x25 |
| 3. Gear, Split, Backlash | 15. Clutch, Starter Drive |
| 4. Ring, Retaining | 16. Asm, Crankshaft Gear Starter Drive |
| 5. Nut | 17. Washer, Flat |
| 6. Washer, Split Lock | 18. Ring, Retaining |
| 7. Retainer, Compensator | 19. Key, Woodruff |
| 8. Spring, Belleville Compensator (4) | 20. Adaptor, Flywheel |
| 9. Slider, Compensator | 21. Flywheel |
| 10. Sleeve, Compensator | 22. Screw (6) |
| 11. Gear, Compensator | 23. Washer, Flat |
| 12. Asm, Split Gear, 37T (Incl items 1-4) | 24. Bolt, Oil Jet |

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

TORQUE COMPENSATOR REMOVAL

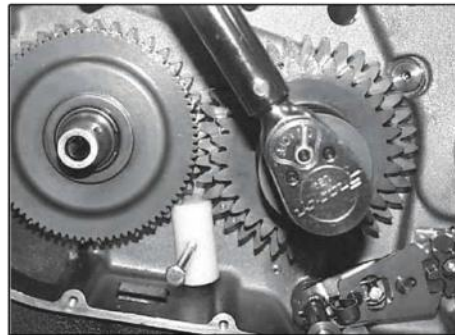
1. Remove primary cover. Refer to page 9.7.
2. Install engine lock tool as shown.

Engine lock tool PV-43502-A

3. Remove the torque compensator nut.

NOTE: NOTE: It is not necessary to remove the flywheel to service the torque compensator nut, retainer plate, Belleville springs, slider, sleeve and compensator gear.

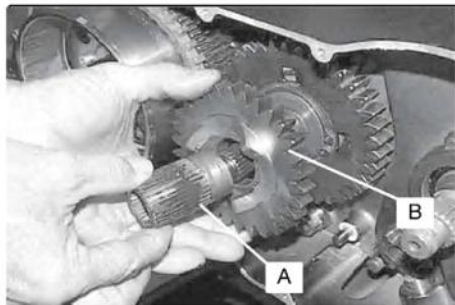
4. Remove retainer plate and Belleville springs.
Note position of spring washers for installation.



5. Remove compensator slider.



6. Remove compensator sleeve (A) and gear (B).

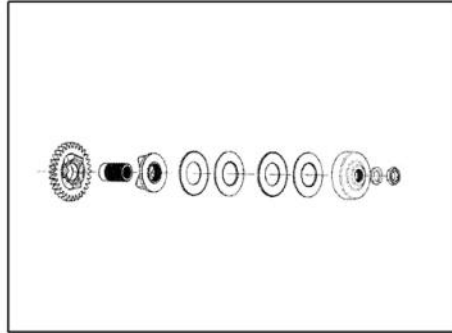


CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

TORQUE COMPENSATOR INSPECTION

1. Inspect all parts for excessive galling or damage.

NOTE: Some polishing will be evident between the compensator gear and the compensator slider and is a normal condition. Replace assembly if ramps are worn.

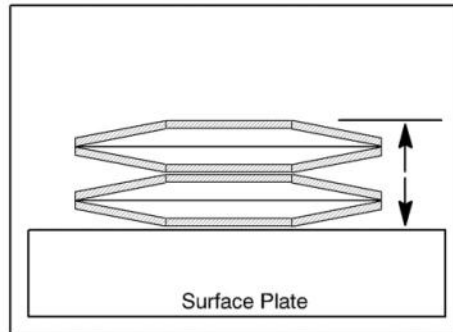


2. Measure free length of torque compensator spring stack.

Specification: Compensator Spring Stack Height

Standard: 17.68-18.08mm
(.696 - .712 inch)

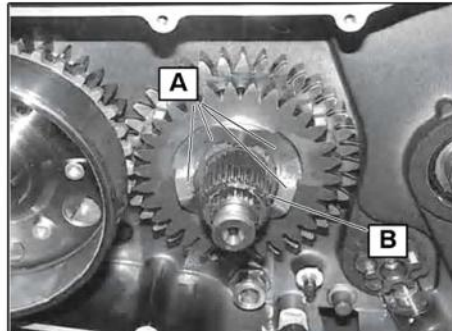
Service Limit: 16mm
.630 inch



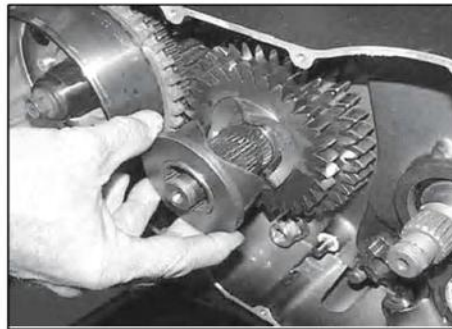
TORQUE COMPENSATOR INSTALLATION

1. Apply moly paste to the back side of compensator drive gear and install along with compensator sleeve onto balancer shaft.
2. Apply a thin film of Moly Assembly Paste to the ramp surfaces (A) and sleeve (B).

Moly Assembly Paste: 2871460



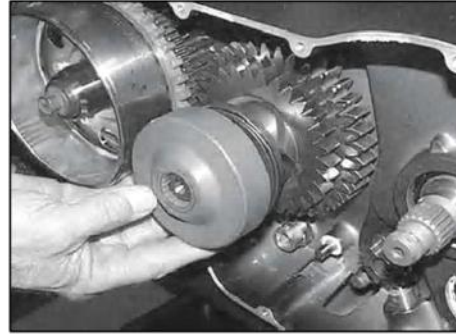
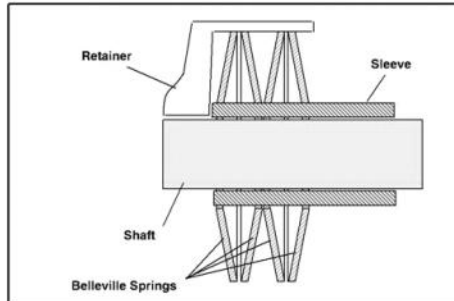
3. Apply a thin film of Moly Assembly Paste to the ramp surfaces of the compensator slider, and install on sleeve.



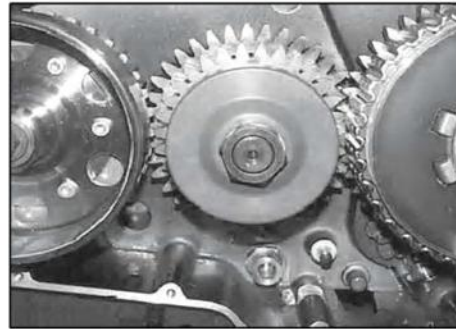
CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

TORQUE COMPENSATOR INSTALLATION (cont.)

4. Refer to exploded view on page 9.21. Apply a thin film of Moly Assembly Paste to the Belleville springs and retainer plate. Be sure spring washers are correctly assembled, with concave edge facing each other. The assembled sets of two springs are stacked back to back as shown below. Be sure splines in retainer plate engage splines of shaft.



5. Clean balance shaft threads and threads of compensator retaining nut thoroughly with Loctite™ Primer N. Place two drops of Loctite™ 262 onto balance shaft threads.
6. Install a new lock washer, and nut.
7. Hold shaft with engine lock tool and torque nut to 170 Nm (125 lb-ft.). Allow 12 hours cure time before operating engine.



Engine lock tool PV-43502-A

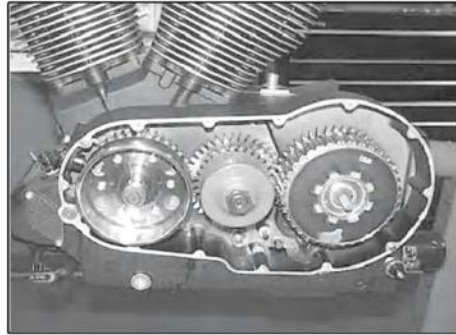
| | |
|---------------------------|------------------------|
| TORQUE: | Compensator Nut |
| 170 Nm (125 lb-ft) | |
| Loctite™ 262 (Red) | |

8. Install primary cover (refer to page 9.10).
9. Fill engine oil to specification (refer to chapter 2).

Victory semi-synthetic 20W/40 PN: 2872176

FLYWHEEL REMOVAL

1. Remove primary cover. Refer to page 9.7.

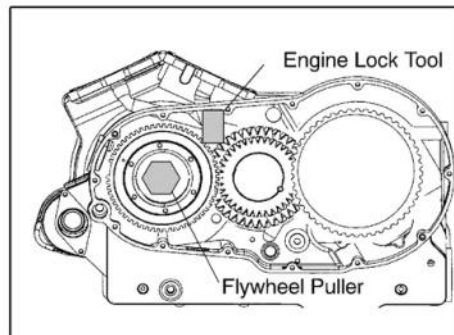


2. Remove flywheel bolt and install puller tool PV-43533. Use engine lock tool PV-43502-A to hold flywheel stationary while removing bolt.

CAUTION: Lodge the engine lock tool between the crankshaft gear and the split gear NOT the square timing gear teeth and split gear.

Engine lock tool PV-43502-A

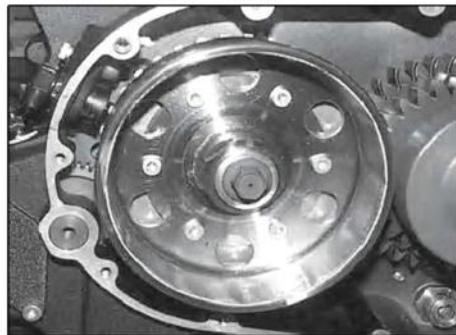
Flywheel puller PV-43533



3. Cover the crankcase cavity under the flywheel with a clean shop towel to prevent parts from falling into the crankcase. The flywheel key can easily fall into the crankcase when the flywheel is removed.
4. Remove flywheel and key. Store the flywheel key on the flywheel magnet.

FLYWHEEL INSTALLATION

1. Clean taper of flywheel and crankshaft thoroughly.
2. Inspect condition and installation of woodruff key, replace if necessary.
3. Install flywheel on crankshaft while aligning woodruff key with key-way. Use caution not to drop the woodruff key into crankcase.
4. Install washer & nut. Torque to specification listed on page 9.21.



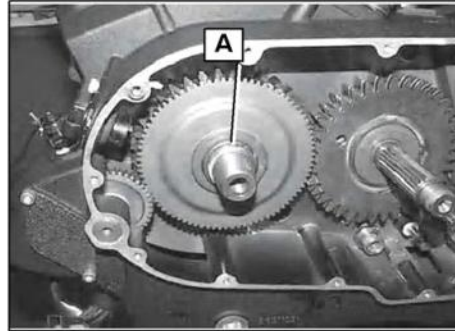
CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

SPLIT GEAR REMOVAL

1. Rotate engine until timing marks on split gear are aligned with mark on crankshaft gear. Remove torque compensator assembly (see page 9.22) and flywheel (see page 9.25).

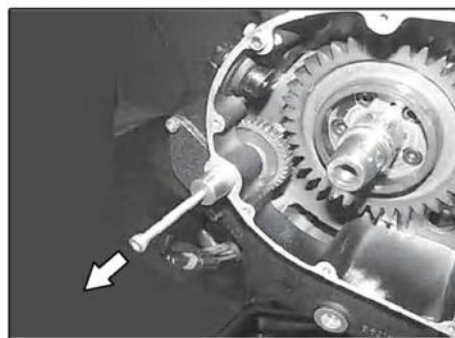


2. Remove starter gear retaining ring (A) using a pair of external ring pliers. Remove any burr from crankshaft using emery cloth so that starter gear can be removed without damage to the bushing.



Flywheel Puller PV-43534

3. Remove starter gear.
4. Remove sprag clutch. Note direction of sprag clutch with flanged side inward (toward engine) for reassembly.
5. Be sure marks on split gear are aligned with mark on primary drive gear.
6. Remove starter idler gear shaft using a primary cover screw as a removal tool. The end of the shaft is threaded.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

SPLIT GEAR REMOVAL (cont.)

7. Insert a 1/4" rod into split gear alignment hole to relieve spring pressure on gear teeth.



8. Remove primary gear from crankshaft.
9. Remove split gear from balancer shaft.



SPLIT GEAR INSPECTION

1. Visually inspect contact surfaces of gears, springs, spring channels, and gear teeth.
2. Make sure the lubrication holes are free of debris. Clean if necessary.

NOTE: Some wear polishing may be evident in the spring channels of the gears. This is normal. Replace the gear assembly if wear is evident.

3. Replace worn or damaged parts as necessary.
4. After re-assembly, the split gear must rotate and return freely without binding on the drive gear.

CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

SPLIT GEAR INSTALLATION

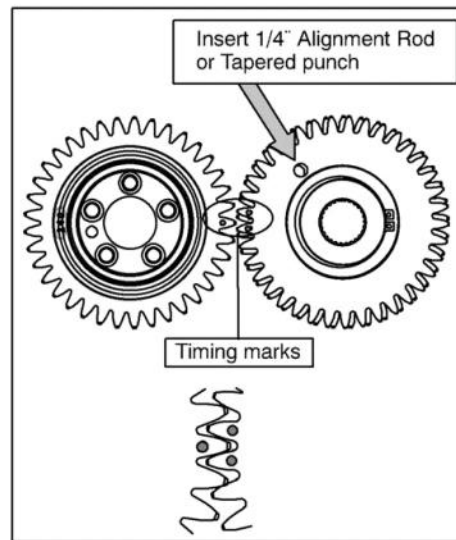
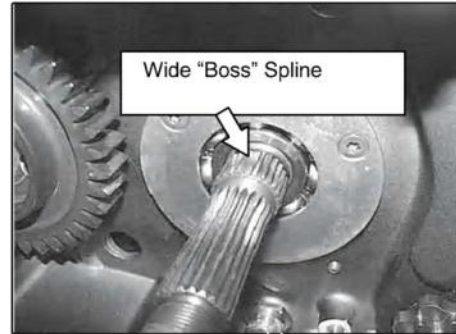
1. Refer to exploded view on page 9.21. Rotate the balancer shaft until the "boss" spline (double wide spline) is at the 12:00 o'clock position.
2. Apply grease to the balance shaft and mating surface of the crankcase and back of split gear assembly.
3. Line up teeth of split gear assembly with 1/4" straight alignment bar (shank of 1/4" drill bit works well). Leave the alignment bar in place.

NOTE: Do not allow the alignment bar to protrude out the back of the split gear assembly or installation will be difficult.

4. Place the alignment dots on the split gear at the 9:00 o'clock position and place the split gear onto the balancer shaft.
5. Align the "boss" splines of the balancer shaft and split gear while simultaneously aligning the alignment dots of the split gear and primary drive gear. Failure to do so will result in excessive vibration and/or engine failure.

NOTE: The two alignment dots on the split gear must straddle the one alignment dot on the primary drive gear.

6. Fully seat the split gear until it is flush with the primary drive gear. The alignment pin will have to be moved to fully align and seat the split gear.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

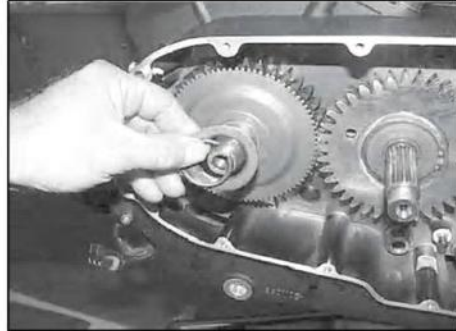
STARTER GEAR REMOVAL

1. Remove primary cover (page 9.7) and flywheel (page 9.25). Use flywheel puller tool PV-43533 to remove flywheel.
2. Remove starter gear retaining ring using external ring pliers PV-43534.

Flywheel Puller PV-43534

3. Remove any burrs from the crankshaft ring groove.

Burrs on the crankshaft end will damage the starter gear when it is removed from the crankshaft.

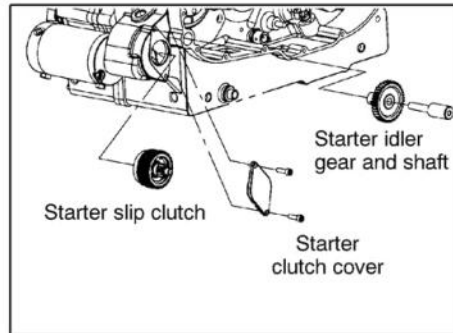


STARTER GEAR INSPECTION

1. Inspect gear teeth for chips, cracks or excessive wear.
2. Inspect bushing for excessive wear and scoring.
3. Replace gear as necessary.

STARTER SLIP CLUTCH REMOVAL / INSTALLATION

1. Remove starter clutch cover.



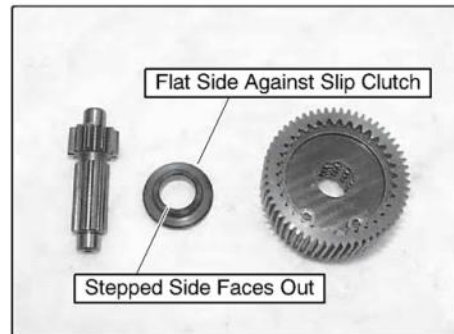
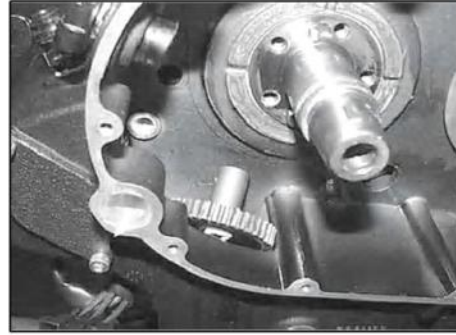
2. Remove the starter idler gear shaft using a primary cover screw. Let the idler gear fall down into the housing so the slip clutch can be removed.



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

STARTER GEAR REMOVAL (cont.)

3. If idler gear must be removed from the engine, remove the crankshaft gear.
4. Remove starter clutch and shaft.
5. Installation is the reverse of removal. Apply lithium grease to shafts upon assembly.

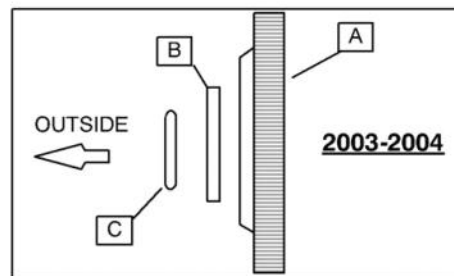
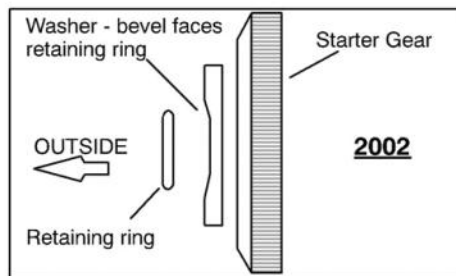
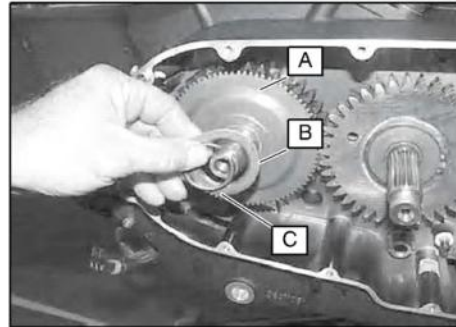


STARTER GEAR INSTALLATION

1. Install starter gear (A), starter gear washer (B), and starter gear retaining ring (C).

NOTE: On 2002 models, Bevel on inner edge of retaining ring washer (B) faces out (toward retaining ring).

2. Install compensator assembly (refer to page 9.23).
3. Install flywheel (refer to page 9.25).
4. Install clutch (refer to page 9.20).
5. Install primary cover (refer to page 9.10).
6. Fill engine oil to specification (refer to Chapter 2).



CLUTCH, PRIMARY DRIVE & SHIFT LINKAGE

TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | PART(s) AFFECTED | REPAIR RECOMMENDED |
|--|---|--|--|
| Clutch Lever Pulls Excessively Hard | Outer clutch cable housing damaged | Clutch Cable | Replace |
| | Clutch cable is dry, corroded, contaminated, worn, etc. | Clutch Cable | Lubricate or replace |
| | Clutch lever pivot needs lubrication | Clutch Lever Pivot Point | Lubricate |
| | Drive plates catching on primary driven gear basket | Clutch Primary Driven Gear/Clutch Plates | Replace Necessary Parts |
| | Clutch cable routed incorrectly | Clutch Cable | Inspect for wear, replace if necessary, and / or re-route |
| | Clutch lifter plate bearing damage | Clutch Plate Bearing Lifter | Replace |
| | Damaged clutch lifter mechanism | Clutch Release Mechanism | Repair as Necessary |
| Clutch Slips | Clutch Cable Out of Adjustment (no lever free play) | Clutch Cable Adjustment | Adjust (refer to ch 2) |
| | 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 or Warped/Distorted | Pressure Plate | Replace |
| | Clutch Plate(s) Worn or Warped/Distorted | Driven Plates (possibly 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 (clutch doesn't disengage completely, motorcycle may creep with clutch disengaged) | Too Much Clutch Lever Free Play | Clutch Cable Adjustment | Adjust (refer to ch 2) |
| | Weak Clutch Spring(s) | Clutch Springs | Replace All |
| | Pressure Plate Worn or Warped/Distorted | Pressure Plate | Replace |
| | Clutch Plate(s) Warped/Distorted | Driven Plates (possibly drive plates) | Replace |
| | 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 |

CLUTCH, PRIMARY DRIVE & 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 Seized | 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 as |
| | Bent or Distorted Shift Forks | Shift Forks | Replace |
| | Bent or Distorted Shift Fork Rails | Shift Fork Rails | 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 Adjustment | Clutch Adjustment | Adjust |
| | Bent, Rubbing, Sticky, Broken Shift Shaft (internal) | 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 Shift Stop Pin | Shift Stop Pin | Replace |
| | Worn Shift Drum Pawls or Shift Drum Pawl Ratchet | Shift Drum or Shift Linkage | Replace as Necessary |
| | Broken Shift Return Spring | Shift Return Spring | Replace |
| | Damaged Shift Drum Grooves | Shift Drum | Repair or Replace |
| | Bent or Worn Shift Forks | Shift Forks | Repair or Replace |
| | Bent/Binding Shift Fork Rails | Shift Fork Rails | Repair or Replace |
| | Worn Engagement Dogs on Transmission Gears | Transmission Gears | Repair or Replace |
| Transmission Noise | Drive Belt Tension Incorrect | Drive Belt | Adjust or Replace |
| | Clutch Plates Bind or Drag (When Clutch is Disengaged) | Clutch Plates | Adjust / Repair / Replace |
| | Gear/Bearing Wear/Damage | Transmission Components | Inspect / Repair / Replace |

9.32

CHAPTER 10

TRANSMISSION & CRANKSHAFT

| | |
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10

TRANSMISSION & CRANKSHAFT

GENERAL

- Remove engine from frame to service internal transmission and/or crankshaft components.
- The crankcase must be separated to access the internal transmission components and crankshaft.
Remove:
 - Cylinder heads
 - Cylinders & pistons
 - Primary cover
 - Clutch
 - Torque compensator
 - Gear shift linkage
 - Starter motor
 - Starter motor drive assembly
 - Flywheel
 - Starter clutch
- Label and store parts neatly to speed the assembly process.
- Crankshaft main bearing replacement requires line boring. This procedure requires full machine shop capabilities and specialized knowledge. It is recommended that a qualified machine shop perform this procedure if it becomes necessary.
- Crankshafts and connecting rods are color coded for manufacturing tolerances with a white or red paint mark. White connecting rods must be used with white crankshafts and red connecting rods must be used with red crankshafts.
- Label and store connecting rods, crankshaft and bearings so parts can be installed in original location.
- All torque specifications are "dry" unless specified for oil or locking agent. Refer to exploded views.
- When locking agents are required, use Loctite Primer N™ to clean fastener before applying locking agent. Primer N™ reduces cure time of thread locking agent in addition to cleaning the surfaces.

SPECIAL TOOLS

Refer to page 1.11 for Special Tool information.

SPECIFICATIONS

| Item | | Specifications | |
|------------------------------|-------------------------|------------------------------|-----------|
| Drive Train (General) | | 2002 | 2003-2004 |
| | Transmission | Direct Drive, 5 Speed Manual | |
| | Primary Reduction Ratio | 1.50 : 1 | 1.50 : 1 |
| | Final Reduction Ratio | 2.13 : 1 | 2.13 : 1 |
| Drive Train (Gear Ratios) | Gear Ratio: 1st Gear | 3.20 : 1 | 2.96 : 1 |
| | Gear Ratio: 2nd Gear | 2.19 : 1 | 2.03 : 1 |
| | Gear Ratio: 3rd Gear | 1.53 : 1 | 1.53 : 1 |
| | Gear Ratio: 4th Gear | 1.24 : 1 | 1.24 : 1 |
| | Gear Ratio: 5th Gear | 1 : 1 | 1 : 1 |

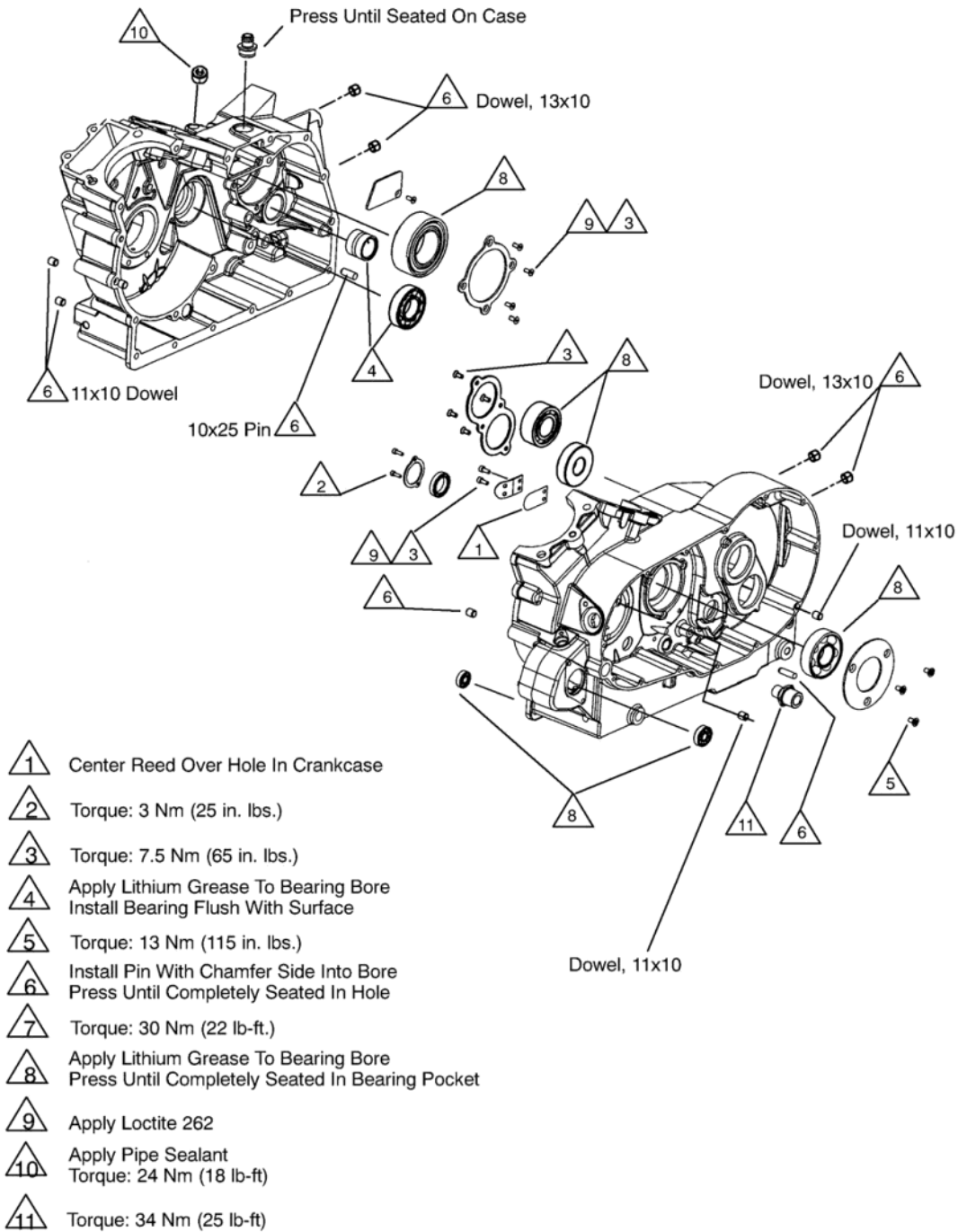
TRANSMISSION & CRANKSHAFT

CONNECTING ROD AND CRANKSHAFT SPECIFICATIONS

| CRANKSHAFT and COMPONENTS | | | |
|---|--|--|--|
| Part | Part Specific | Standard | Service Limit |
| Connecting Rod | Connecting Rod to Crankshaft Side Clearance | .22 - .42 mm (.0087 - .0165") | .65 mm (.025") |
| | Connecting Rod Bearing to Crankshaft Oil Clearance | .0254 - .0635 mm (.001 - .0025") | .11 mm (.0043") |
| | Connecting Rod Small End I.D. | 22.01 - 22.02 mm (.8665 - .8670") | 22.09 mm (.8694") |
| | Connecting Rod Width | 20.28 - 20.34 mm (.798 - .801") | 20.03 mm (.788") |
| | Connecting Rod Big End I.D. (White) | 50.84 - 50.85 mm (2.0016 - 2.0020") | 50.89 mm (2.0031") |
| | Connecting Rod Big End I.D. (Red) | 50.85 - 50.86 mm (2.0019 - 2.0024") | 50.89 mm (2.0034") |
| Crankshaft Main Bearing / Rod Journals | Connecting Rod Journal Width | 40.00 - 40.58 mm (1.5748 - 1.5976") | 41.35 mm (1.627") |
| | Crankshaft Rod Journal O.D. (White) | 47.970 - 47.978 mm (1.888 - 1.889") | 47.94 mm (1.8871") |
| | Crankshaft Rod Journal O.D. (Red) | 47.978 - 47.986 mm (1.8888 - 1.8891") | 47.95 mm (1.8875") |
| | Main Bearing Oil Clearance | Left .013 - .060 mm (.0005-.0023") Right .014 - .061mm (.0005 - .0024") | .10 mm (.004") .10 mm (.004") |
| | Left Main Bearing Journal O.D. | 64.952 - 64.973 mm (2.5571 - 2.5579") | 64.93 mm (2.556") |
| | Right Main Bearing Journal O.D. | 59.952 - 59.973 mm (2.3603 - 2.3611") | 59.93 mm (2.359") |
| Balance Shaft | Journal O.D., Left (Primary Side) | 29.980 - 29.992 mm | - |
| | Journal O.D., Right (Oil Pump Drive Side) | 29.969 - 29.979 mm | - |
| Transmission | | | |
| Shift Fork | Shift Fork I.D. (Dimension A, Page 10.12) | 12.00-12.026 mm (.4725-.4732") | 12.05 mm (.4744") |
| | Shift Fork Pin O.D. (Dimension B, Page 10.12) | 6.04-6.14 mm (.2378-.2417") | 6.02 mm (.2370") |
| | Shift Fork Width (Dimension D, Page 10.12) | 5.10-5.30 mm (.2008-.2086") | 5.05 mm (.1988") |
| Shift Fork Rail | Shift Fork Rail O.D. (Dimension C, Page 10.12) | 11.96 mm (.470") | 11.80 mm (.4645") |
| | Shift Fork Rail Runout | - | .025 mm (.001") |
| Shift Drum | Shift Drum Groove | - | Replace drum if any wear is evident |

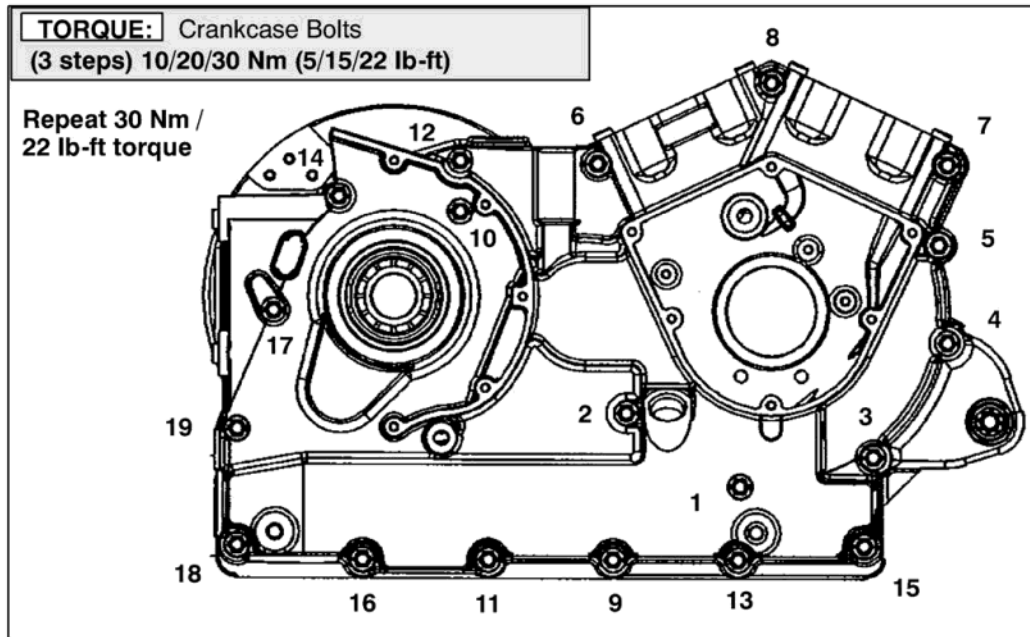
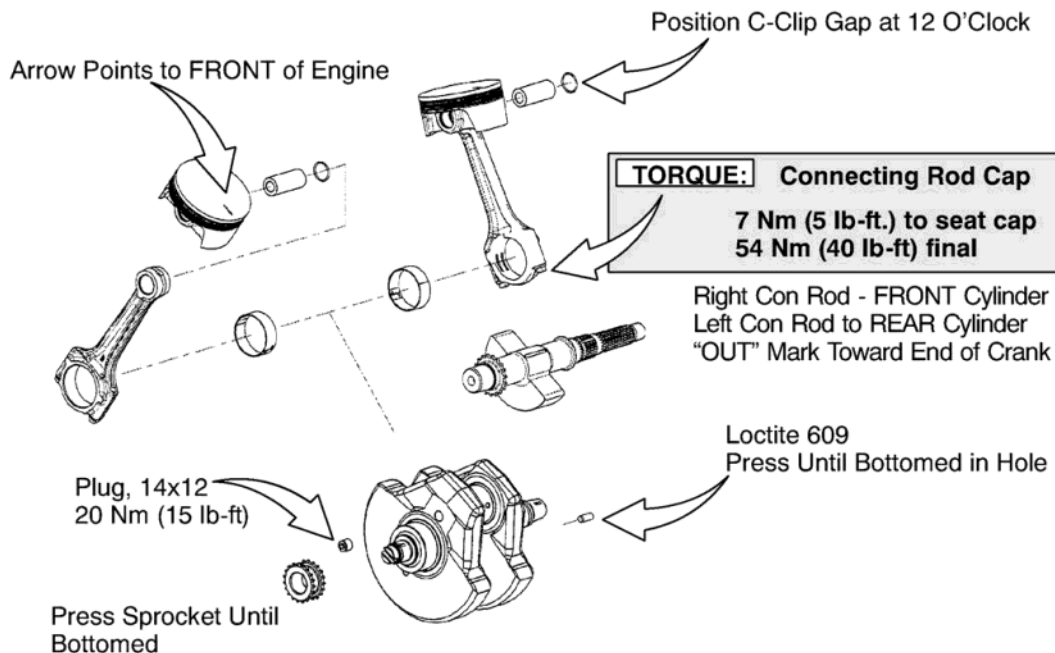
10.2

CRANKCASE COMPONENT and FASTENER TORQUES



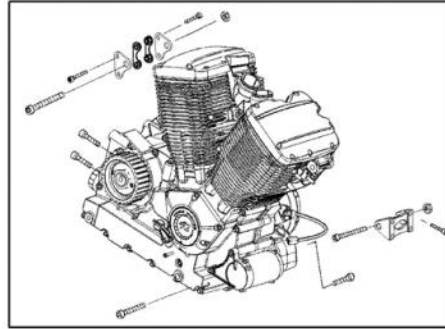
TRANSMISSION & CRANKSHAFT

CRANKSHAFT / CONNECTING ROD / CRANKCASE TORQUE

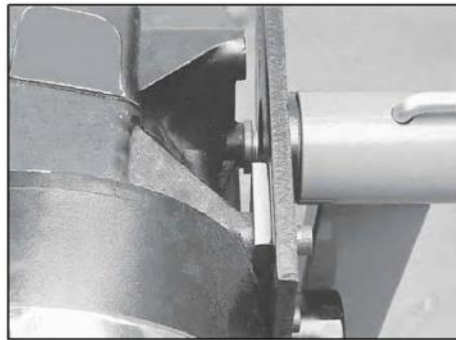


CRANKCASE SEPARATION

1. Drain engine oil and loosen drive sprocket nut. Remove engine from frame. Refer to Chapter 6 for complete engine removal procedures.



2. Secure engine to engine stand using the two mounts on the primary side crankcase half. Depending on the engine stand mounting bracket, spacers may be needed to attach engine to stand bracket. Place a large oil pan beneath engine to catch residual oil.
3. Remove primary cover (refer to Chapter 9.)
4. Remove cylinder heads (Chapter 7), cylinders, and pistons (Chapter 8).



5. Protect pistons and rings during engine disassembly by slipping a length of 4" diameter PVC pipe over them or slip large diameter fuel line over cylinder studs.



TRANSMISSION & CRANKSHAFT

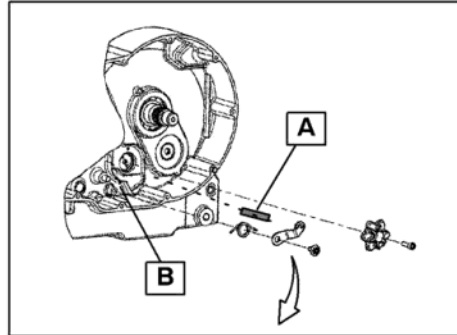
CRANKCASE SEPARATION (Cont.)

6. Remove shift ratchet and clutch nut. Refer to Chapter 9.

NOTE: For transmission service only, remove:

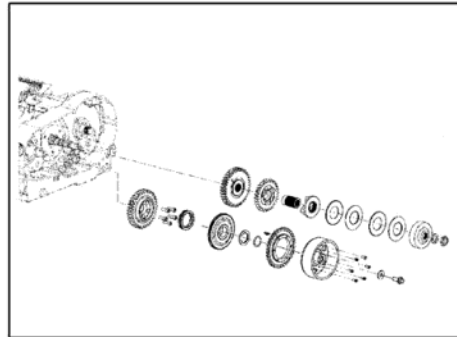
- Clutch
- Shift star Remove detent plunger on 2002 models, or rotate roller detent arm down and temporarily place a 5mm pin (A) into assembly hole in crankcase (B) to hold roller away from shift star until shift drum is removed.
- Countershaft retaining bolt.

This will allow transmission removal once the cases are split.



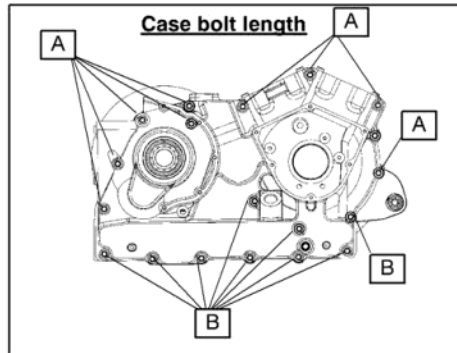
NOTE: For complete engine disassembly, refer to Chapter 9 to remove:

- Clutch and primary drive
- Flywheel
- Torque compensator
- Starter gear & one way clutch
- Primary drive gear
- Starter idler gear and shaft



7. Loosen the (19) crankcase bolts and remove from case.

8. There are two different length bolts used on the crankcase. (A) (8x110mm) and the longer bolts (B) are used in the lower portion of the case.

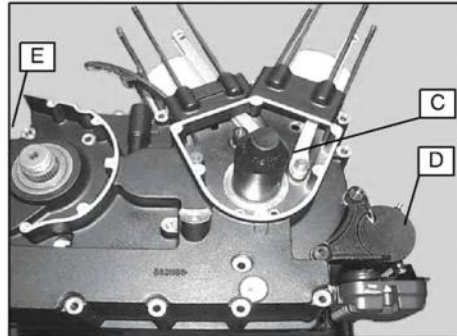


CRANKCASE SEPARATION (cont.)

9. Install the crankshaft bearing protector tool (C).

Special tool: PV-43504

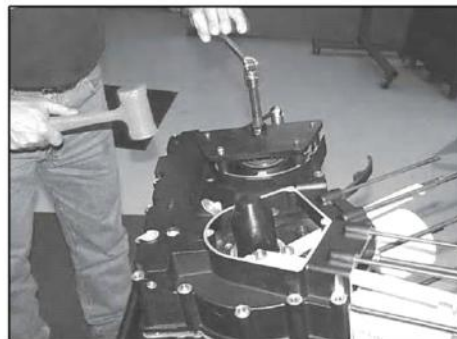
10. Remove starter motor (D) and speed sensor bracket (E).



11. Install the crankcase separator tool on to the main shaft.

Special tool: PV-46299

12. Separate the cases by tightening the press bolt while tapping on the cases with a soft mallet. The tool will press the main shaft out of the case bearing inner race.



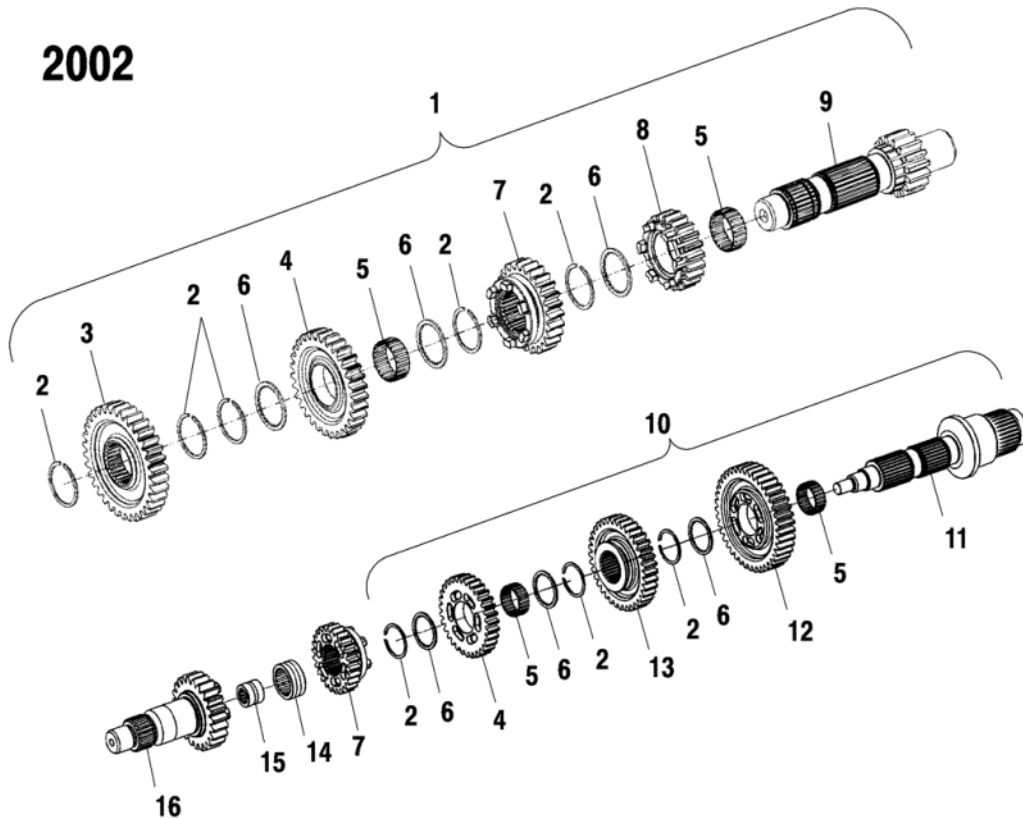
13. Lift the crankcase half off the crankshaft.



TRANSMISSION & CRANKSHAFT

TRANSMISSION ASSEMBLY, 2002 MODELS

2002



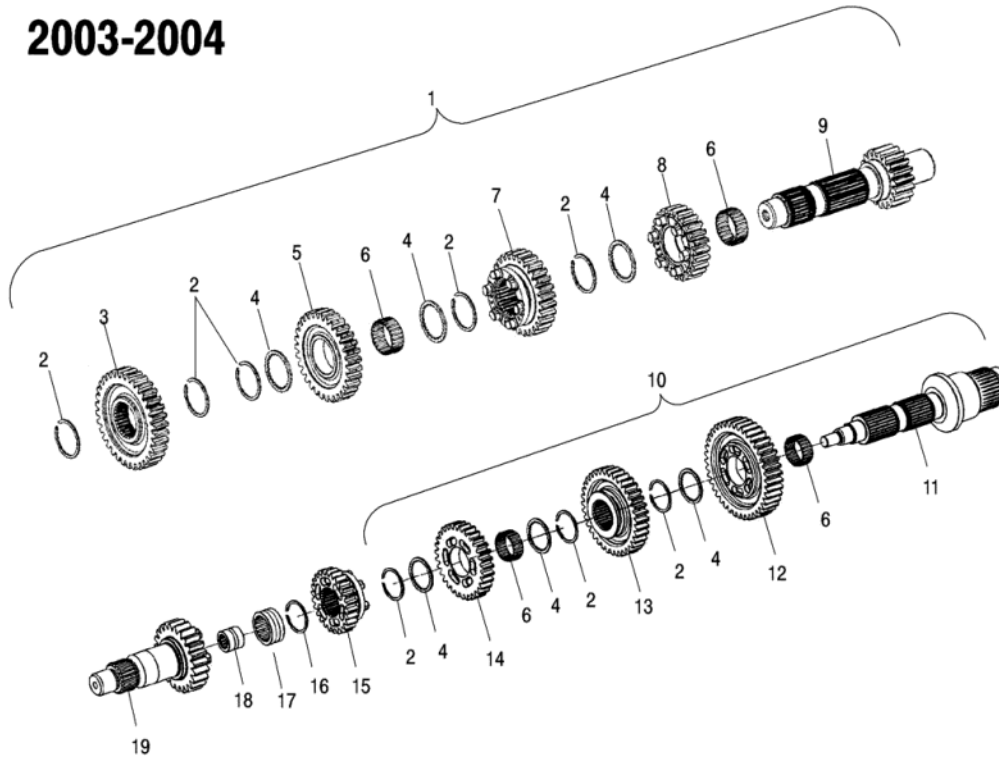
- 1. Assembly, Countershaft. Incl. 2-9
- 2. Ring, Retaining (Qty 8)
- 3. Gear, Countershaft 34 Teeth
- 4. Gear, 3rd Main, 4th C.S., 29Teeth (Qty 2)
- 5. Bearing, Roller (Qty 4)
- 6. Washer, Thrust, (Qty. 6)
- 7. Gear, Countershaft 3rd, 26 Teeth (Qty 2)
- 8. Gear, Countershaft 2nd, 23 Teeth

- 9. Countershaft, 18 Teeth
- 10. Assembly, Mainshaft (Incl. 2, 4-6, 11-13)
- 11. Mainshaft
- 12. Gear. 1st Mainshaft, 39 Teeth
- 13. Gear. 2nd Mainshaft, 34 Teeth
- 14. Bearing, Roller
- 15. Bearing, Needle
- 16. Assembly, Clutchshaft, 5th (Incl. 14,15)

10.8

TRANSMISSION ASSEMBLY EXPLODED VIEW, 2003-2004 MODELS

2003-2004

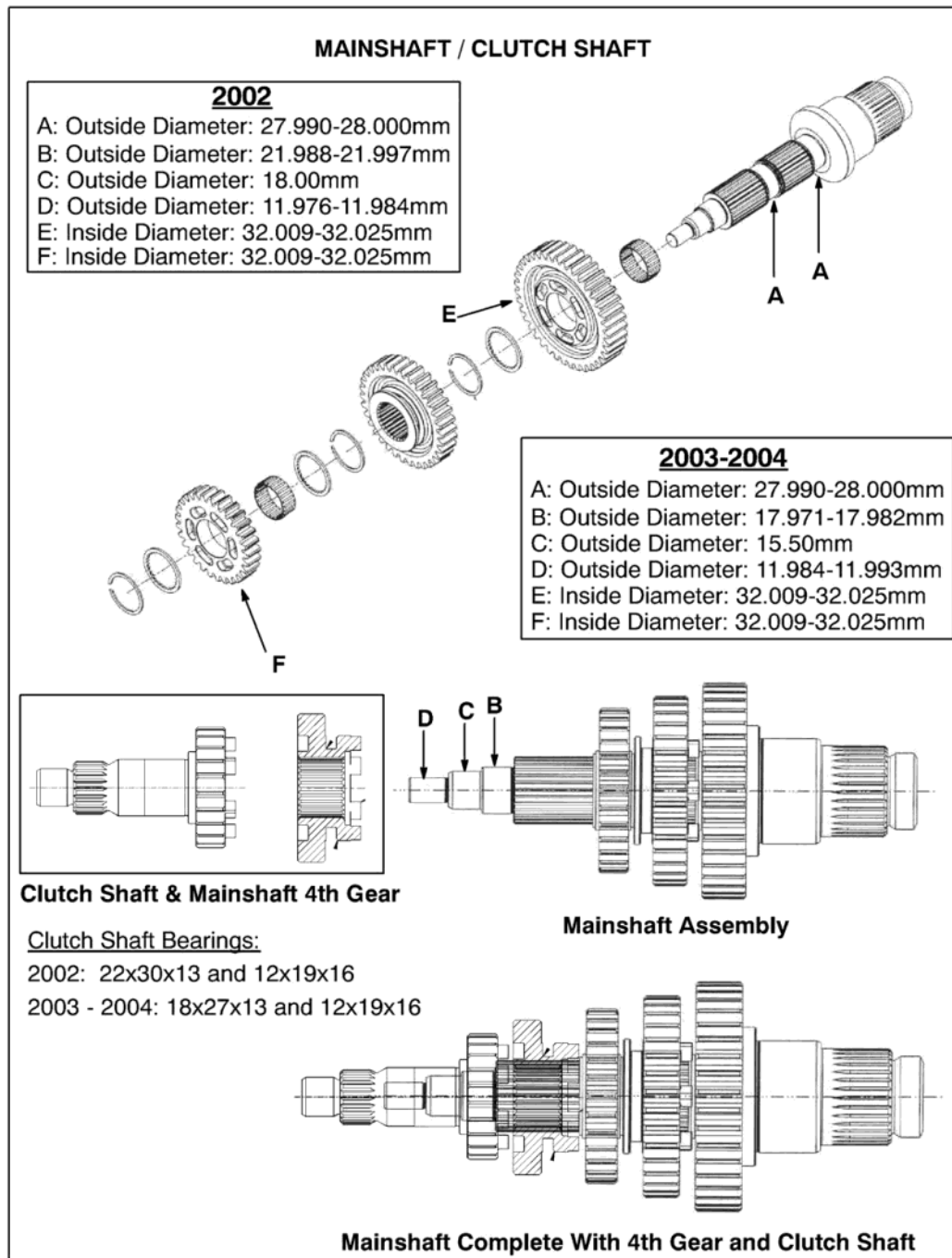


1. Assembly, Countershaft. Incl. 2-9
2. Ring, Retaining (Qty 8)
3. Gear, Countershaft 34 Teeth
4. Washer, Thrust, (Qty. 6)
5. Gear, Countershaft 4th, 31 Teeth
6. Bearing, Roller (Qty 4)
7. Gear, Countershaft 3rd, 28 Teeth
8. Gear, Countershaft 2nd, 24 Teeth
9. Countershaft, 19 Teeth
10. Assembly, Mainshaft (Incl. 2, 4-14, 11-13)

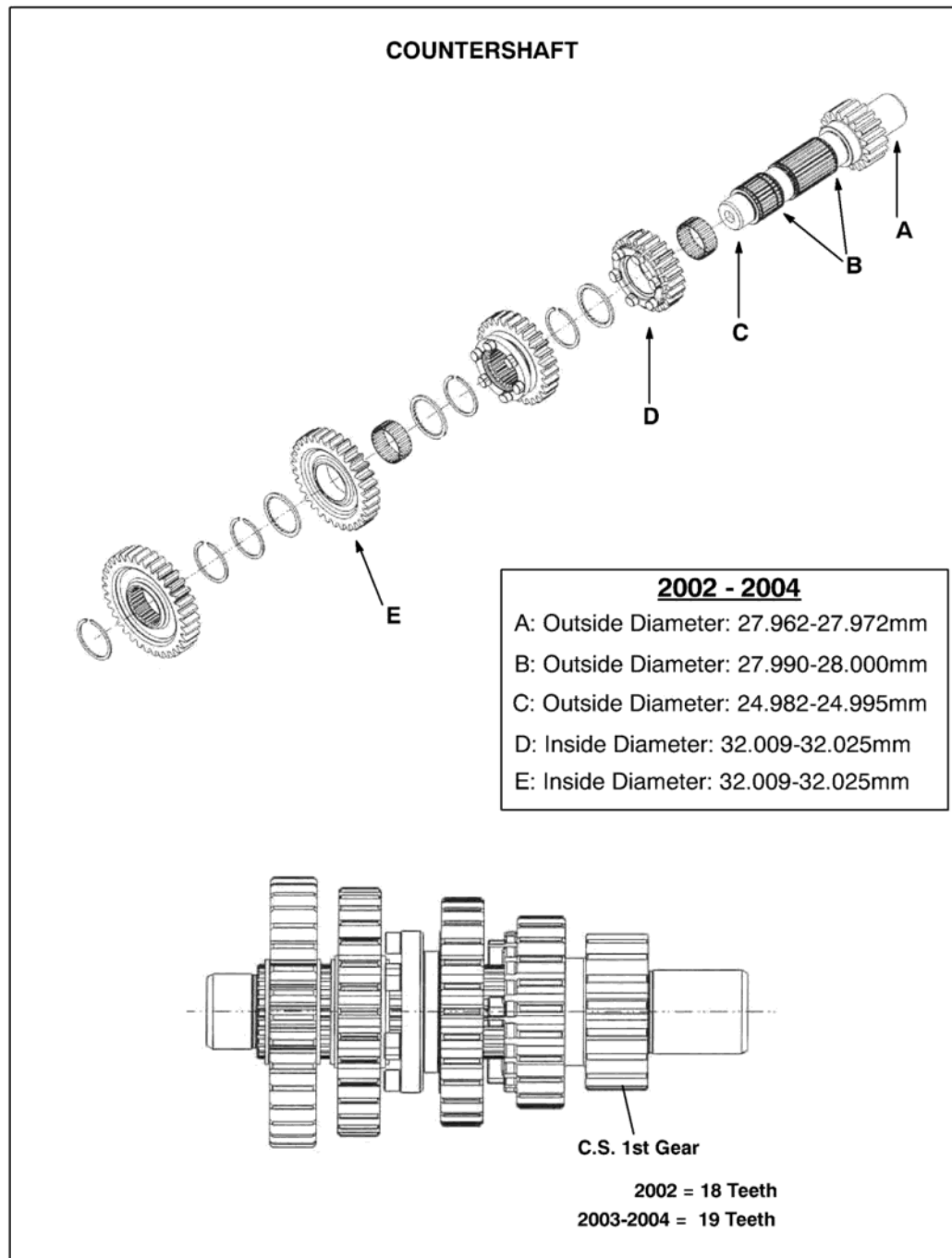
11. Mainshaft
12. Gear, 1st Mainshaft, 38 Teeth
13. Gear, 2nd Mainshaft, 33 Teeth
14. Gear, 3rd Mainshaft, 29 Teeth
15. Gear, 4th Mainshaft, 26 Teeth
16. Ring, Retaining
17. Bearing, Roller
18. Bearing, Needle
19. Assembly, Clutch Shaft, 5th (Incl. 17,18)

TRANSMISSION & CRANKSHAFT

MAINSHAFT EXPLODED VIEW

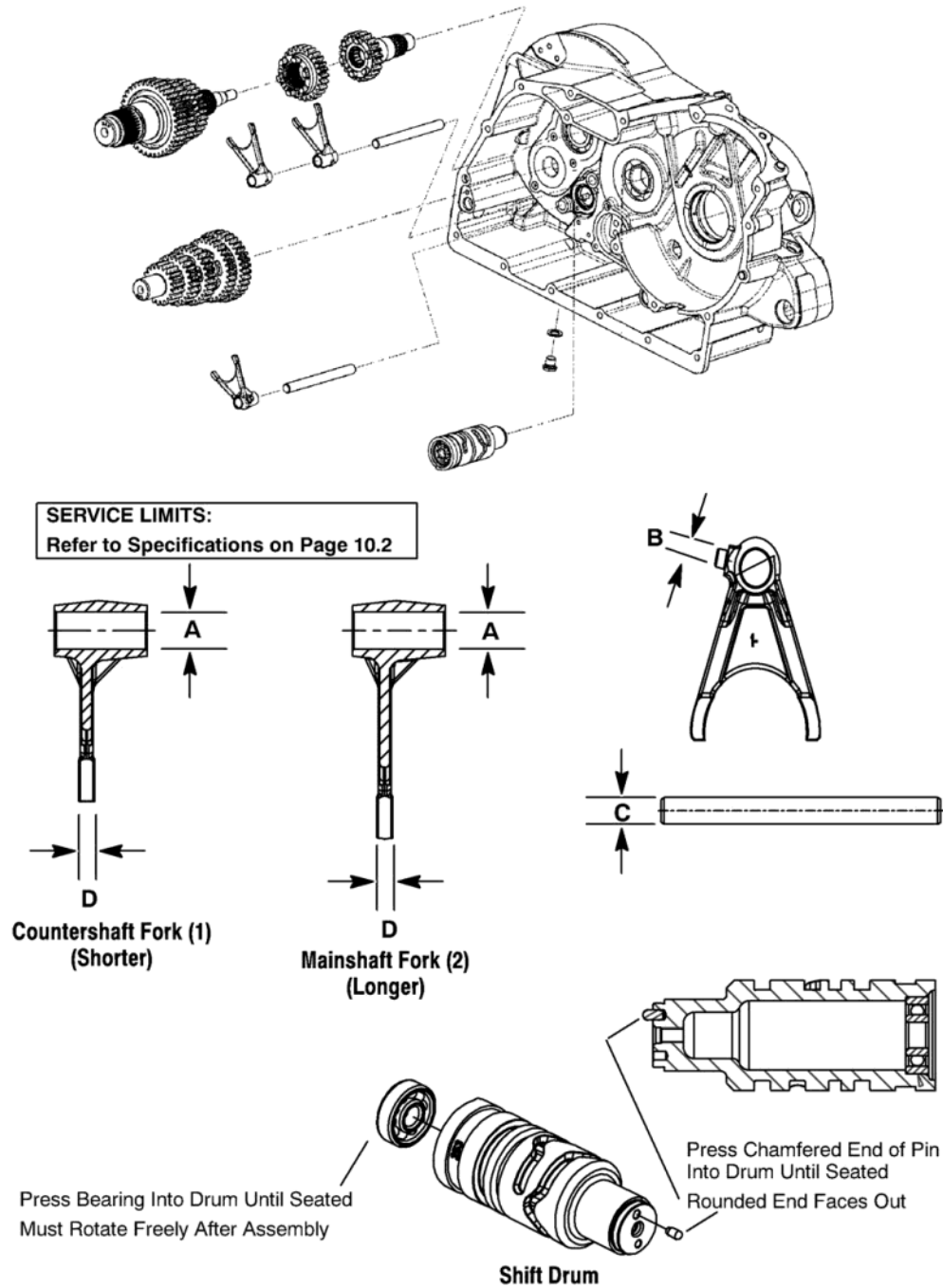


COUNTERSHAFT EXPLODED VIEW



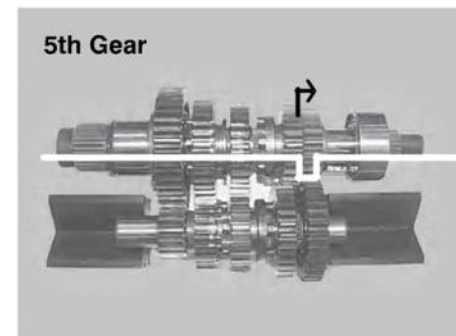
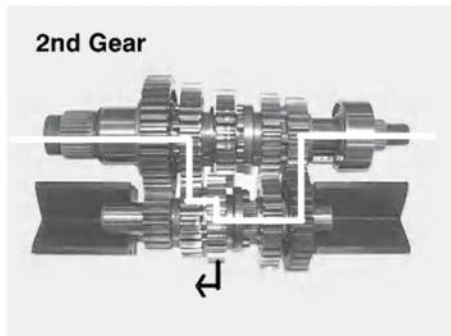
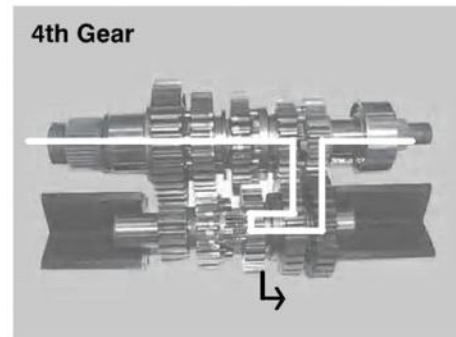
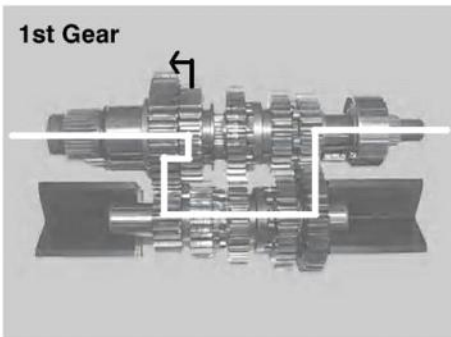
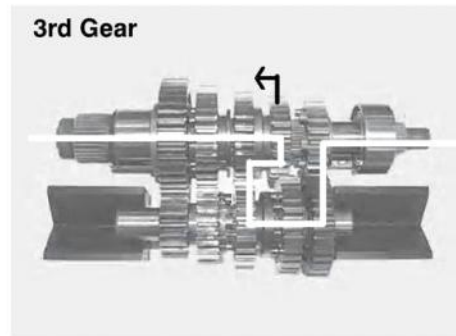
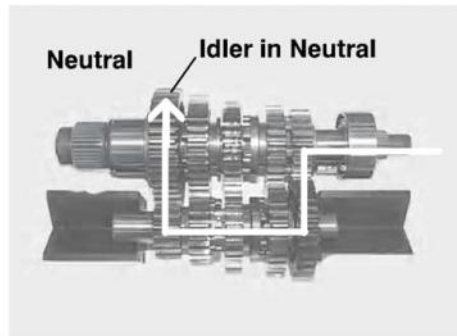
TRANSMISSION & CRANKSHAFT

SHIFT DRUM AND SHIFT FORK EXPLODED VIEW



10.12

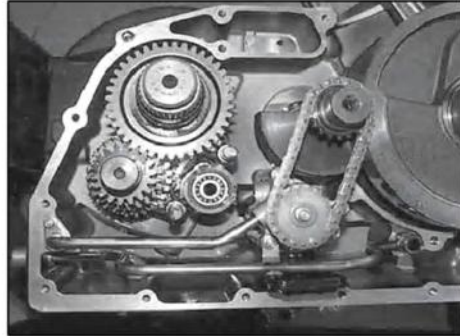
POWER DELIVERY



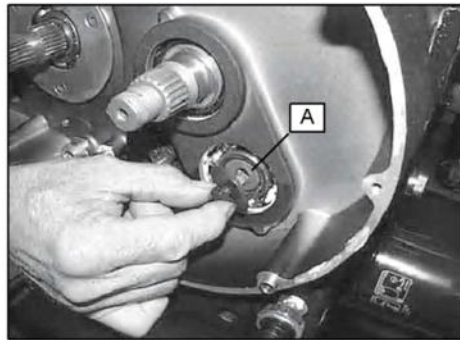
TRANSMISSION & CRANKSHAFT

TRANSMISSION REMOVAL

1. The transmission, oil pump, or crankshaft can be removed individually for service. Refer to page 4.4 for oil pump removal procedure.

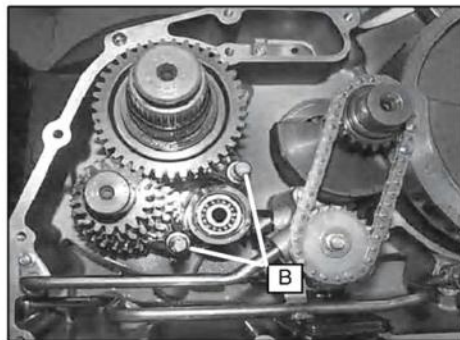


2. Remove the countershaft locating bolt and washer (A).



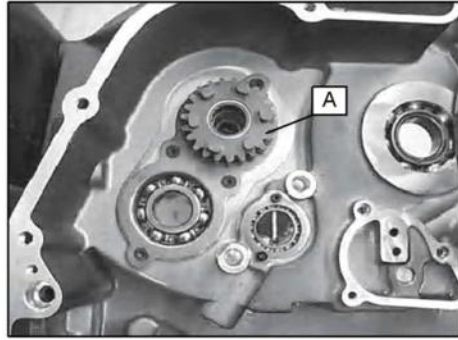
3. Remove shift fork shafts (B).
4. Dislodge shift forks from the grooves in the shift drum
5. Remove shift drum and forks one piece at a time.
6. Remove main shaft and counter shaft from the crankcase.

The mainshaft 4th gear may slide off and lay on the clutch shaft when the mainshaft is removed. Lift the gear out of the case and put it with the main shaft in order to keep all parts together for assembly.



TRANSMISSION & CRANKSHAFT

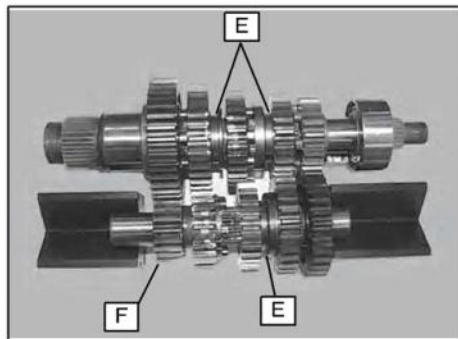
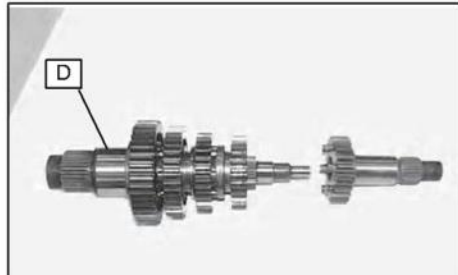
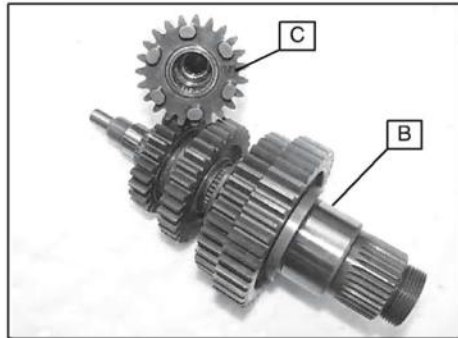
7. The clutch shaft (A) (Mainshaft 5th) is press-fit into the bearing inner race. Inspect the clutch shaft while it is in the case. Rotate the gear and check for smooth movement and no play. Remove the clutch shaft only if bearing or gear service is required. Inspect the gear, bearings, and shaft splines for unusual wear or damage.
8. If the clutch shaft or bearing fails inspection, it must be removed and replaced. Use an arbor press to push the shaft out of the bearing from the clutch side. Support crankcase and protect case mating surface during the press operation.
DO NOT APPLY A FLAME TO BEARING



TRANSMISSION INSPECTION

Refer to exploded views on page 10.9. Shaft and Gear specifications are on page 10.10 (Mainshaft and Clutch shaft) and page 10.11 (Countershaft).

1. Visually inspect all gear splines, teeth, dogs, dog slots, and bearing surfaces on the mainshaft (B) for damage or excessive wear. The clutch shaft (C) has two needle bearings down in the bore that support the mainshaft. They must be smooth and spin freely.
2. Inspect the spline grooves and sliding surfaces of main shaft (D) for scoring, abnormal wear, or damage.
3. Inspect sliding gears for blueing or wear in the shift fork grooves (E).
4. Repeat inspections above for countershaft (F) and all countershaft gears and bearings.



10.15

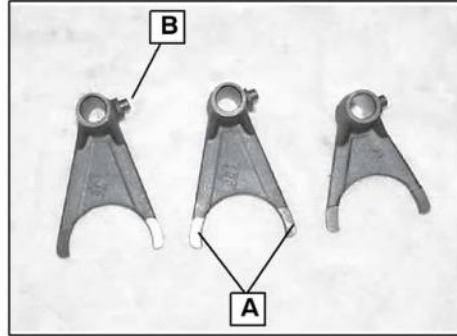
TRANSMISSION & CRANKSHAFT

TRANSMISSION INSPECTION (cont.)

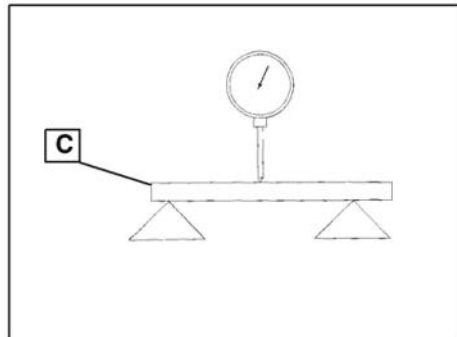
Shift Forks, Shift Fork Rails

Refer to specifications listed on page 10.2.

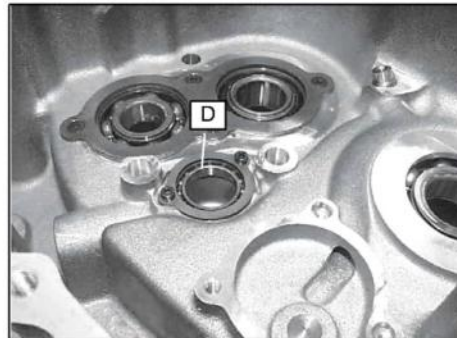
5. Inspect the contact surface (A) of each shift fork. Replace a shift fork if any part is blued (overheated), unusually scored, warped, or worn beyond service limit.
6. Inspect each shift fork pin (B) for wear or damage and compare to specifications.



7. Inspect the shift fork rails (C) for wear, scoring, or runout. Measure runout using a dial indicator and V-blocks.
8. Measure the shift fork rail O.D. for wear in 3 or 4 places along the length. The rail O.D. should be consistent throughout the entire length.
9. Slide the rails into the crankcase holes and check for a good snug fit.



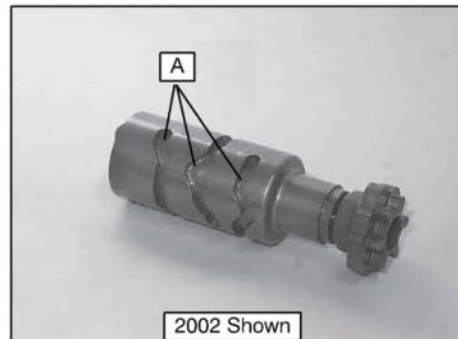
10. Visually inspect the shift drum bearing (D) in the left crankcase for wear or damage. The bearing must be fully seated in the case and held in position by the retaining plate. Replace the bearing if it is loose in the bore, or if any side play is detected.
11. Temporarily install the shift drum into the bearing and rotate, checking for smooth bearing movement. Also, inspect the shift drum bearing pin in the right crankcase to ensure it is not loose or worn.



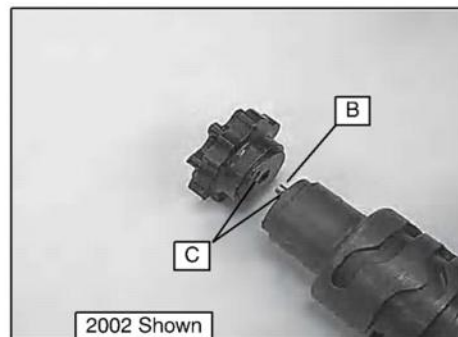
TRANSMISSION INSPECTION (cont.)

SHIFT DRUM INSPECTION

12. Inspect the shift drum grooves (A) for excessive wear.

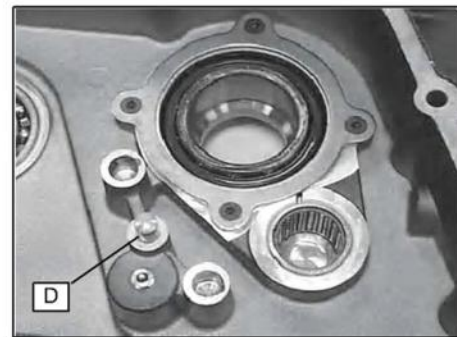


13. Inspect the shift star alignment pin (B) to ensure it is in good condition and fits tightly in holes (C) in drum and star. The rounded end of pin faces out (toward shift star) and the chamfered end is pressed into drum.



14. Inspect the shift star surfaces for excessive wear or damage.

15. Inspect right side shift drum pin (D) for looseness or wear. Pin is pressed into right crankcase and must be tight.



16. Temporarily install shift drum on pin and test for play. Spin drum to check for smooth bearing operation.

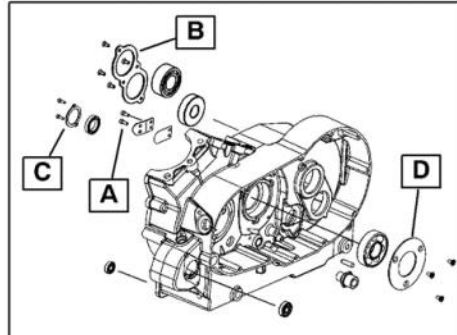
17. Inspect right side shift drum bearing for damage.

TRANSMISSION & CRANKSHAFT

CRANKCASE ASSEMBLY

Refer to exploded view on page 10.3 for torque values and locking agent. Prepare **LEFT** crankcase for assembly:

1. Install new bearings as required. Apply a film of lithium grease to outer race of bearings to prevent galling upon installation.
2. Press on the outer race of bearings using an arbor press and a suitable arbor that is slightly smaller than bearing O.D. DO NOT press on inner race of ball bearings.
3. Install breather reed valve assembly (A).
4. Install screws for the clutch shaft bearing and countershaft bearing retainer plate (B), shift drum retainer plate (C), and balance shaft retainer plate (D). Apply locking agent and torque as specified on page 10.3.



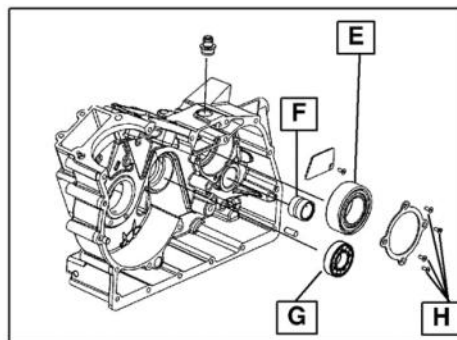
CLUTCH SHAFT INSTALLATION

5. Install the clutch shaft using an arbor press and clutch shaft installation tool. Support bearing inner race on clutch side of crankcase with tool, and press clutch shaft into the bearing until fully seated.



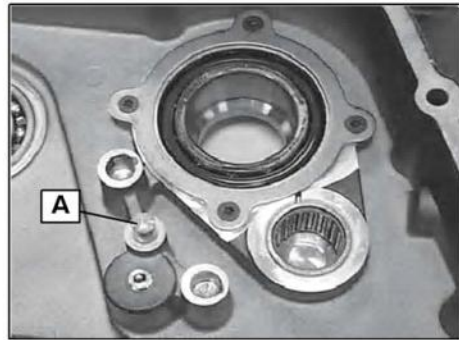
Refer to exploded view on page 10.3 for torque values and locking agent. Prepare **RIGHT** crankcase for assembly:

6. Install new mainshaft bearing (E) countershaft bearing (F) and balance shaft bearing (G) as required. Apply a film of lithium grease to outer race of bearings to prevent galling upon installation.
7. Press on the outer race of bearings using an arbor press and a suitable arbor that is slightly smaller than bearing O.D. DO NOT press on inner race of ball bearings.
8. Install screws (H) for the mainshaft (output) bearing retainer plate. Apply locking agent and torque as specified on page 10.3.

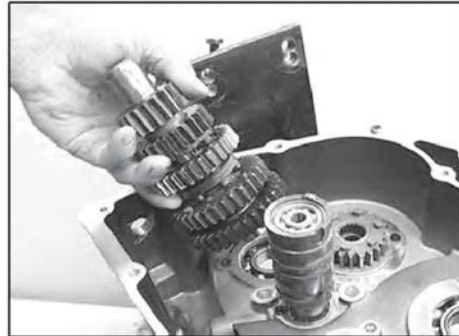


TRANSMISSION INSTALLATION

9. Press a new the shift drum center pin (A) (if removed) into case.



10. Install the shift drum and counter shaft into the left crankcase.



11. Install the mainshaft assembly. It will be necessary to hold fourth gear on the main shaft during installation. Make certain both shafts are fully seated, lightly lubricated with Victory engine oil, and rotate freely.



12. Install shift forks into the appropriate transmission shaft gears. The longer forks move gears on the main shaft. Refer to page 10.12.



TRANSMISSION & CRANKSHAFT

TRANSMISSION INSTALLATION (Cont.)

13. Insert the shift rails through the shift forks to hold them in position, but don't seat rails into the crankcase.

The photo shows the shift forks and rails partially installed to allow the shift drum to be rotated.

NOTE: Oil pump and balance shaft removal is not required.

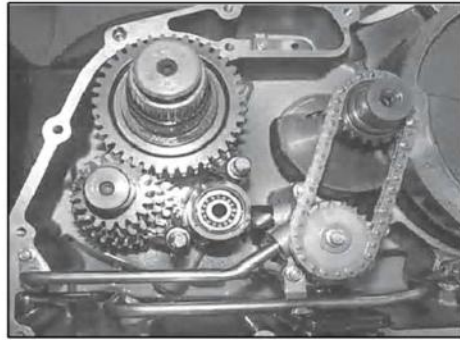


14. Move the shift fork pins into the drum grooves and seat the rails.

15. Photo shows the transmission installed and the shift forks engaged, shift rails seated.

At this point, test the transmission by shifting through the gears while moving the shafts. Test the operation in each gear to ensure the transmission works properly before proceeding.

16. Shift the transmission into 5Th gear for crankcase assembly.



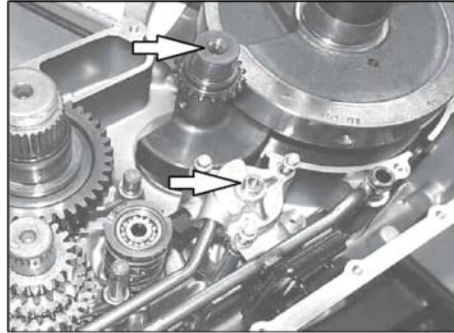
17. Install and fully seat o-ring onto output shaft. The o-ring can also be installed after crankcase assembly.

18. Refer to Crankcase Assembly on page 10.31.



CRANKSHAFT REMOVAL

1. Separate RH crankcase from LH case (page 10.5).
2. Remove oil pump sprocket and chain (page 4.4).
3. Rotate balance shaft until counter weights are clear of crankshaft. Tap lightly with a soft-faced mallet to remove.



4. Grasp the crankshaft, pull crankshaft straight out of the left crankcase half.

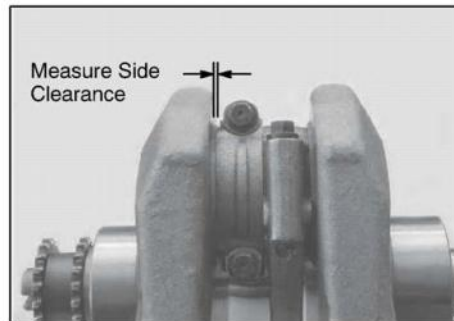
CAUTION:

Connecting rod bearings and main bearings are easily damaged. Be careful not to cause damage to these parts when servicing items within the crankcase.



CONNECTING ROD SIDE CLEARANCE INSPECTION

1. Move the rods to one side of crankshaft. Insert a feeler gauge between one connecting rod and the crankshaft. Compare measurement to specification on page 10.2.
2. If clearance recorded exceeds service limit, the crankshaft, connecting rod or both must be inspected and worn parts replaced. Refer to crankshaft inspection on page 10.23 and specifications on page 10.2 to determine which part(s) are outside of specifications.



TRANSMISSION & CRANKSHAFT

CONNECTING ROD REMOVAL / IDENTIFICATION

NOTE: The connecting rod caps are marked from the factory, however it is recommended that an additional reference mark be added for clarity. Caps are matched to rods and must be installed with the proper orientation. DO NOT strike or stamp the connecting rod.

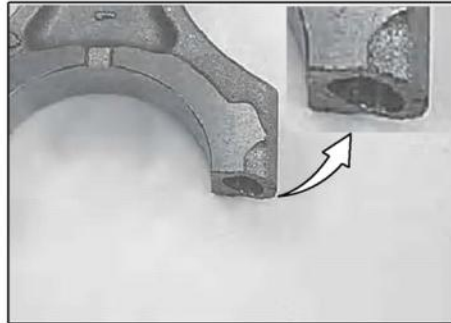
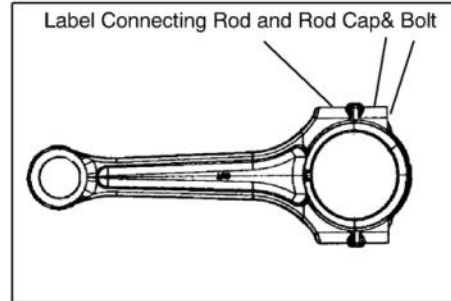
1. Use a permanent marker to mark the orientation of the connecting rods and the rod bearing caps. These parts must be installed in their original locations.

EXAMPLE: Right connecting rod must be assembled to the right with the bearing cap that was removed from it. The bearing cap and connecting rod must be assembled in the same direction as it was removed using the **same bolt**.

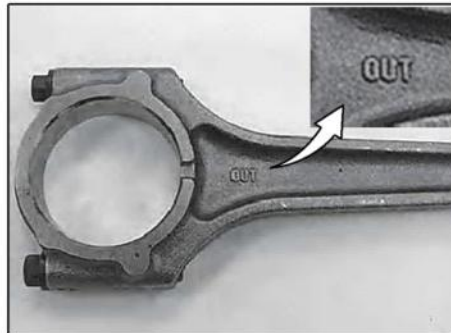
2. Remove connecting rod bolts and connecting rod bearing caps.

NOTE: It may be necessary to lightly tap on the side of the caps with a plastic mallet to loosen them.

CAUTION: The mating surface of the connecting rod and cap is rough in appearance, which is a normal condition due to the manufacturing process. If the rod caps are installed *incorrectly* and tightened, the precision mating surfaces will be damaged. Replace the connecting rod assembly if mating surfaces are damaged.

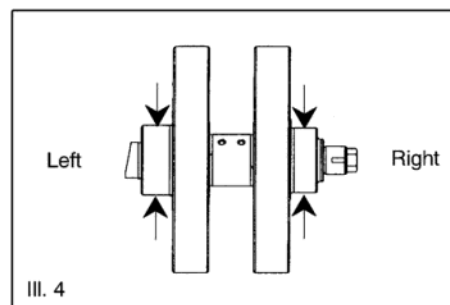
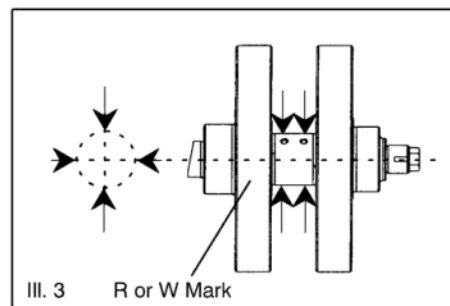
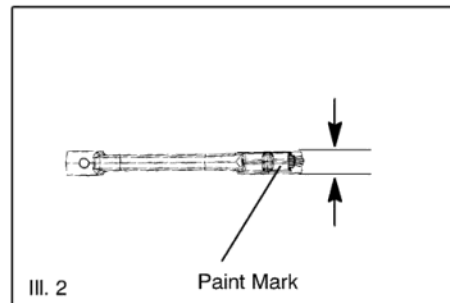
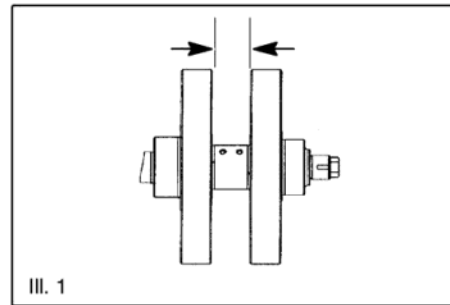


NOTE: Rods are marked OUT as shown in photo. Observe "OUT" on the connecting rods. "OUT" must face toward the **left** for the **left** connecting rod and must face toward the **right** for the **right** connecting rod (outside of the engine).



CRANKSHAFT INSPECTION

1. Measure the width of the crankshaft rod bearing journal and compare measurement to specification on page 10.2. (Ill. 1)
2. Measure the width of the connecting rods at big end and compare measurement to specification on page 10.2. (Ill. 2)
3. Visually inspect all bearing journals for scoring, damage or excessive wear. Replace crankshaft if it fails visual inspection.
4. Crankshaft and connecting rods are marked either red or white, and matched by color (Ill. 2 and 3). Measure O.D. of the crankshaft rod journal in four places and compare measurement to specification on page 10.2. for the matching color code. Replace the crankshaft if worn beyond service limit.
5. Measure O.D. of main bearing journals. Record measurements and compare to specification on page 10.2. (Ill. 4) Replace crankshaft if worn beyond Service Limit.



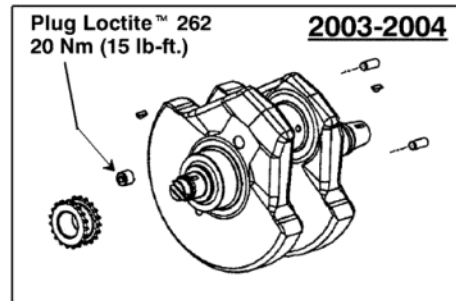
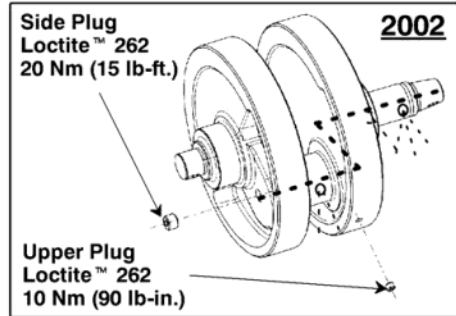
TRANSMISSION & CRANKSHAFT

CRANKSHAFT CLEANING

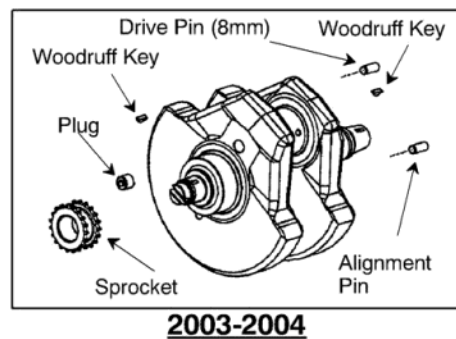
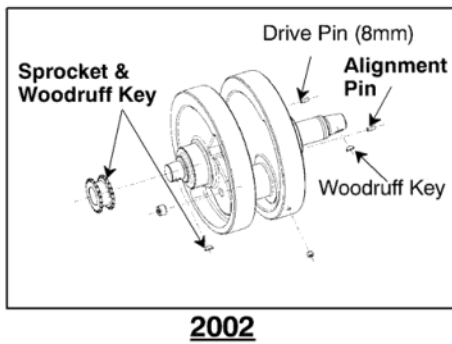
1. Remove blind plugs from crankshaft to ensure that all passages are clear.

CAUTION:

Blind plugs are installed with Loctite™ 262. Use localized heat (such as a soldering gun) when removing blind plugs.



2. After cleaning passages, apply Loctite™ 262 to blind plug threads and install plugs into crankshaft to specified torque. Plug should be flush with surface of crankshaft.
3. Install woodruff key(s). Install drive and alignment pins.

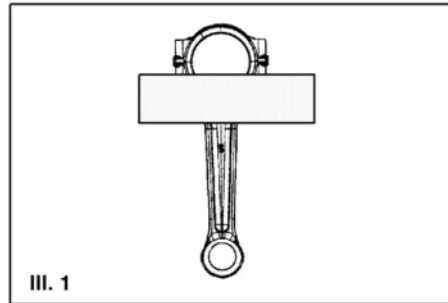


CONNECTING ROD INSPECTION (Big end)

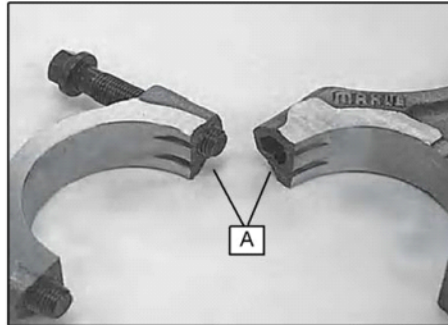
1. Refer to page 8.8 for connecting rod small end inspection.

CAUTION:

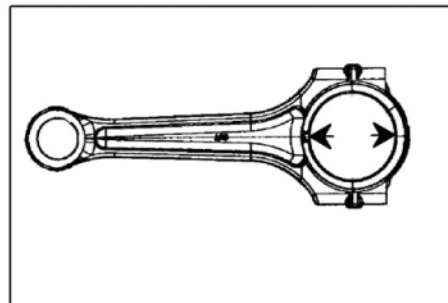
Be sure to match connecting rod caps with their respective rod and orient the cap properly before installing the cap. Secure the big end of rods in a vise equipped with soft, protective jaws before torquing rod bolts. (Ill. 1)



2. Install caps on connecting rods. Be sure mating surfaces (A) of rod and cap are clean.
3. Apply Victory Engine Oil to threads of rod bolts and nuts. Torque evenly in 2 steps to specification listed on page 10.4.



4. Measure the I.D. of connecting rod big end. Replace the connecting rod(s) if worn beyond the service limit or out-of-round as listed on page 10.2.
5. Visually inspect connecting rod upper and lower ends for scoring, damage, or excessive wear. Replace connecting rod(s) if they fail visual inspection.



CONNECTING ROD BEARING INSPECTION

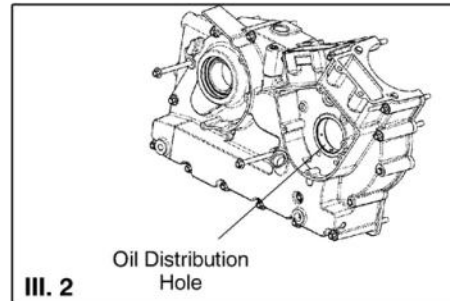
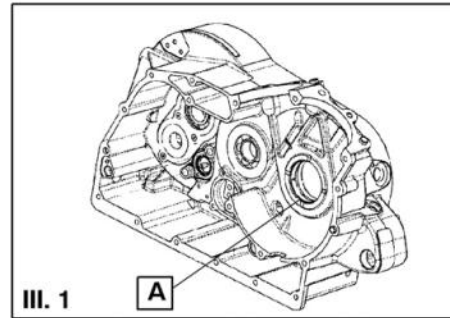
1. Inspect bearing inserts for unusual wear, peeling, scoring, damage etc. Replace as a set if damage is noted.

NOTE: If one insert requires replacement, replace both connecting rod bearing inserts as a set.

TRANSMISSION & CRANKSHAFT

MAIN BEARING INSPECTION

1. Inspect crankcase main bearing surfaces for unusual wear, peeling, scoring, damage etc. Replace cases if the main bearing is not useable.
2. Inspect location of lubrication hole in left crankcase. It should be located at the bottom (III. 1)
3. Inspect lubrication hole (B, below) in right crankcase. It should be positioned to front of engine as shown. (III. 2)



CONNECTING ROD BEARING CLEARANCE INSPECTION

1. Clean all oil from bearing inserts and crank pins.
2. Place a strip of Plastigauge® across the complete width of the crank pin.
 - Do not place Plastigauge across oil holes
 - Do not allow connecting rods to move during this procedure
3. Install connecting rods and bearing caps in the correct orientation (put them on the same way they were taken off using the same bolts).
4. Torque rod cap bolts to specification on page 10.4.
5. Remove bearing caps being careful not to disturb the Plastigauge®.
6. Use measuring scale on the Plastigauge® wrapper to measure thickness of Plastigauge® for each connecting rod and compare measurement to specification on page 10.2.

NOTE: Use widest part of the Plastigauge® to determine the rod to crankshaft oil clearance.

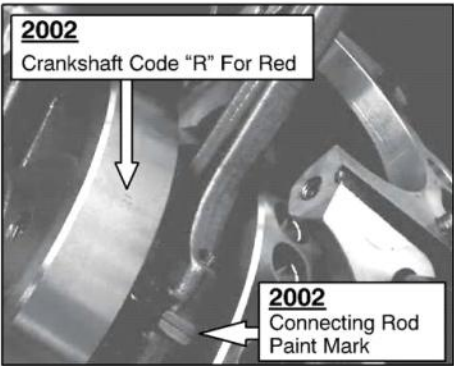
7. If service limits are exceeded, install new rod bearings and recheck the oil clearance.
8. If service limits are still exceeded, determine if crankshaft or connecting rods need to be replaced.
9. At completion of measurement procedure; remove all traces of Plastigauge® from bearing and crankshaft.



TRANSMISSION & CRANKSHAFT

CONNECTING ROD BEARING SELECTION

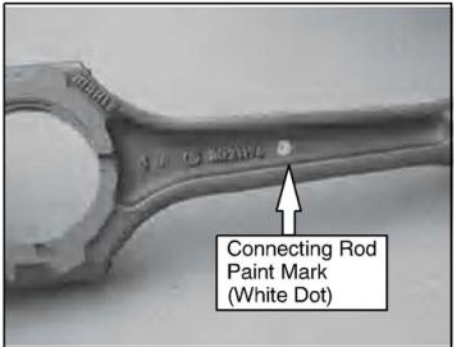
1. There are 3 sizes of connecting rod bearings available: Black, Orange and Blue.



2. To determine which bearing to use, look at the color code on the crankshaft...



3. ...and the color code on the connecting rod.



4. Refer to the chart below to select the proper bearing insert.

FOR EXAMPLE: If the CONNECTING ROD paint mark is RED and the CRANKSHAFT stamp is W (white) (or not stamped), use BLUE bearing inserts.

| Connecting Rod Bearing Selection Chart | | |
|--|---------------|-------------------|
| CON ROD COLOR / CRANKSHAFT | BEARING COLOR | BEARING THICKNESS |
| WHITE Connecting Rod with RED Crankshaft | Black | 1.409 - 1.415 mm |
| WHITE Connecting Rod with WHITE Crankshaft | Orange | 1.413 - 1.419 mm |
| RED Connecting Rod with RED Crankshaft | Orange | |
| RED Connecting Rod with WHITE Crankshaft | Blue | 1.417 - 1.423 mm |

TRANSMISSION & CRANKSHAFT

CONNECTING ROD INSTALLATION

1. Make sure proper bearing clearance is achieved by using the correct colored bearing insert for a given color combination of connecting rod and crankshaft.
2. Clean all oil off connecting rod, connecting rod cap and bearing inserts.
3. Install bearing inserts into connecting rods and caps. First, install bearing tab into groove, then press the rest of the bearing into place.

NOTE: Procedure during disassembly called for marking of connecting rods and caps. Ensure that each part is installed in original location including rod cap bolts.

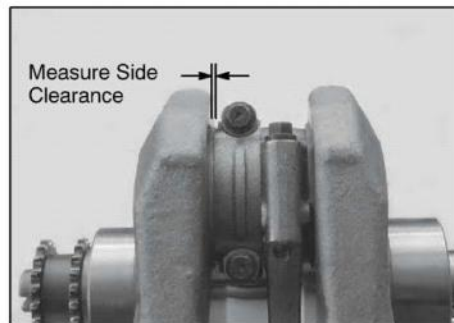
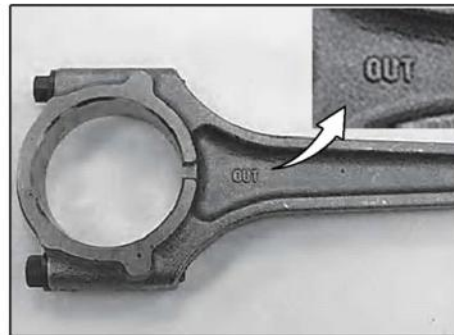
4. Apply assembly lube to connecting rod bearings and crank pin.

Moly assembly paste PN: 2871460

5. Install rods and caps onto the crankshaft, observing the "OUT" mark on the connecting rods. "OUT" must face toward the **left** for the **left** connecting rod and must face toward the **right** for the **right** connecting rod (outside end of crankshaft). Be sure the I.D. marks made previously are aligned.
6. Tighten rod cap bolts:
 - To 7 Nm (5 lb-ft) to seat caps and bearings.
 - Tighten to specification in two steps.

| | |
|----------------|---|
| TORQUE: | Connecting Rod Cap |
| | 7 Nm (5 lb-ft) (To Seat Bearing) |
| | 55 Nm (40 lb-ft) (Final Torque) |

7. Inspect that the connecting rods are free to rotate on crankshaft journal.
8. Measure the rod side clearance to be sure it is within specification listed on page 10.2 before assembling engine.



MAIN BEARING OIL CLEARANCE INSPECTION

1. Record crankshaft main bearing journal O.D. for both right and left side. Refer to crankshaft inspection procedure.
2. Measure and record installed main bearing I.D.
3. Determine the clearance between crankshaft main bearing journals and main bearings.

$$\begin{aligned} & \text{Main Bearing I.D.} \\ & - \text{Crankshaft Main Bearing Journal O.D.} \\ & = \text{Main Bearing Oil Clearance} \end{aligned}$$

4. Compare measurement to specification on page 10.2.
5. If crankshaft dimensions are within tolerances per Crankshaft Inspection and oil clearances are incorrect, the crankcase must be replaced.

NOTE: Main crankshaft bearings are not serviceable. Crankcases must be replaced if crankshaft main bearings are damaged or out of specification.

NOTE: Replace crankcase halves as a set.

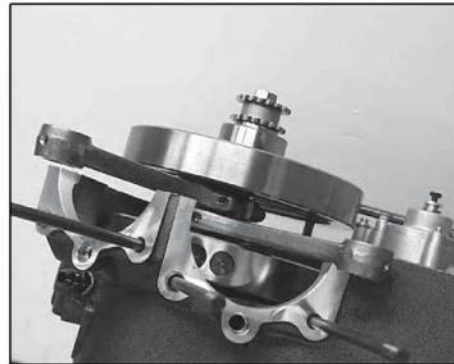
CRANKSHAFT INSTALLATION

NOTE: Install the left engine case onto an engine stand.

1. Apply assembly lube to the main bearing inserts.

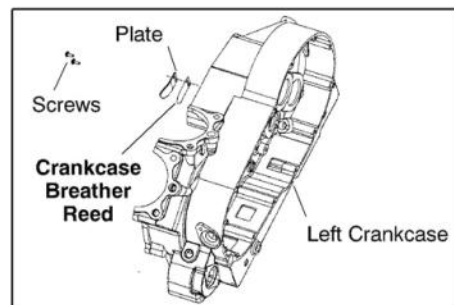
Moly assembly paste PN: 2871460

2. Hold the crankshaft over the left crankcase and position rods so that left side rod is in the cutout for rear cylinder and right side rod is in cutout for the front cylinder.
3. Place crankshaft into left crankcase half.



CRANKCASE REED VALVE ASSEMBLY REMOVAL & INSPECTION

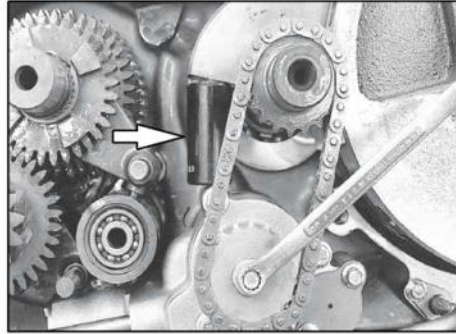
1. Separate engine cases (page 10.5).
2. Remove the retaining screws for the reed valve assembly. Remove breather valve assembly.
3. Inspect the reed valve for bending, pitting, or other damage at the sealing surface that would prevent a good seal.
4. Replace the reed valve as necessary. Refer to page 10.3.



TRANSMISSION & CRANKSHAFT

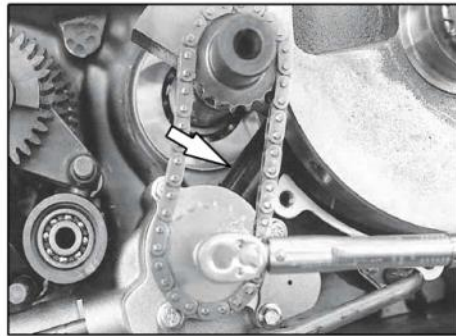
BALANCE SHAFT REMOVAL & INSPECTION

1. Separate engine cases (Refer to page 10.5)
2. Remove bolt from oil pump drive sprocket.
3. Remove sprocket & chain from oil pump.
4. Remove chain from balance shaft sprocket.
5. Grasp balance shaft and remove it from the case. It may be necessary to tap the balance shaft lightly with a soft faced mallet to remove.
6. Inspect balance shaft gear and sprocket teeth for cracks, broken teeth, runout, or twisting.
7. Rotate right and left balance shaft bearings by hand while observing bearing freedom of rotation. Bearings should run smooth and quiet.
8. Visually inspect bearings for damage.
9. Replace bearings that fail inspection.



BALANCE SHAFT INSTALLATION

1. Lubricate balance shaft bearings and bearing contact surfaces of balance shaft with Victory engine oil.
2. Insert threaded end of balance shaft into left side bearing.
3. Install oil pump drive chain onto balance shaft.
4. Install chain and sprocket onto oil pump driven shaft.
5. Install engine lock tool to lock balance shaft.
6. Install oil pump sprocket bolt and torque to specification.



TORQUE:

10 Nm (85 in-lb)

CRANKCASE ASSEMBLY & SEALING

1. Lubricate balance shaft bearings and bearing contact surfaces of balance shaft with engine oil.
2. Thoroughly clean the crankcase sealing surfaces and apply an even bead of Loctite™ Ultra Black 598. Apply the sealer sparingly yet cover the case mating surfaces completely.
3. Spread out the crankcase sealer into a thin even layer on the case mating surfaces. Be sure all areas are covered.

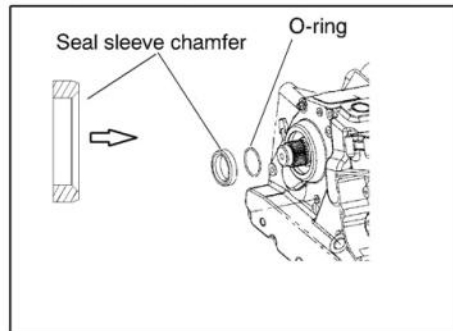


4. Install the clutch shaft holding tool.

NOTE: Be sure transmission is in 5th gear prior to crankcase assembly.

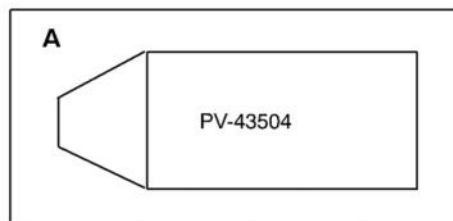


5. Lubricate and install a new O-ring on output shaft (if not previously installed.)
6. Inspect the output shaft seal sleeve for burrs, nicks, or surface wear. The end surfaces that contact the bearing race and drive sprocket must be smooth and flat to prevent loosening of the drive sprocket.
7. Install the sleeve with chamfer facing in (toward O-ring.)
8. Install new O-rings on oil feed pipe. (Refer to Chapter 4.)



9. Install the crankshaft bearing protector tool onto the cam drive sprocket end of the crankshaft.

Special tool:
Crankshaft bearing protector PV-43504



TRANSMISSION & CRANKSHAFT

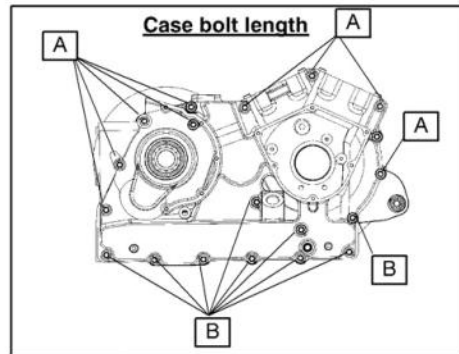
CRANKCASE ASSEMBLY & SEALING (cont.)

10. Install the output shaft / crankcase installation tool onto the output shaft.

Special tool:

Mainshaft / Crankcase Installer PV-46299

11. Pull the crankcase together by tightening the tool nut and tapping on the crankcase with a soft mallet.
12. The cases will mate before the mainshaft fully seats. Continue to turn the nut and tap the case until the shaft is fully seated (approximately 102-136 Nm (75-100 lb-ft.) Remove the tool.
13. Install crankcase bolts with speed sensor bracket and starter motor bracket. Install the long crankcase bolts (B) in the lower and the short bolts (A) in the upper half of the case.



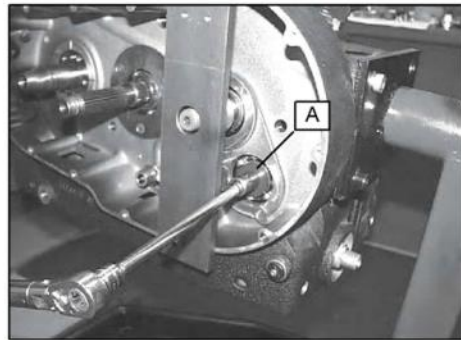
14. Torque to the specification in three steps using the torque sequence shown on page 10.4.
15. Apply 2 drops of Loctite 262 to threads of countershaft bolt. Install the bolt with washer (A) and tighten to specified torque.

TORQUE: Countershaft Bolt
24 Nm (18 lb-ft.)
Loctite 262

16. Install a new mainshaft (output) seal in RH crankcase using seal installer.

Special tool:

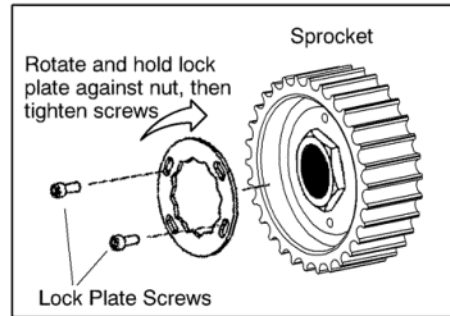
Final Drive Seal Installer PV-43505



CRANKCASE ASSEMBLY & SEALING (cont.)

17. Install the engine sprocket. Clean the shaft threads and nut of old thread locking agent. Apply primer N and then Loctite™ 262 (red) to the mainshaft threads. Torque drive sprocket nut to specification.

TORQUE: Drive Sprocket Nut
170 Nm (125 lb-ft.)
Loctite 262



18. Install lock plate screws.

NOTE: The lock plate can be installed in many positions and either side of the plate can be used. If you cannot find a position that will work, flip the plate over and again try to install it. If the plate still does not align, tighten the sprocket nut slightly and try to fit the lock plate again.

19. Rotate the plate **CLOCKWISE** until it stops and hold it firmly against the nut.

20. Tighten the lock plate screws to specified torque.

TORQUE: Lock Plate
10 Nm (85 in-lb)

21. Assemble shift mechanism, primary drive, and primary cover. Refer to Chapter 9.

22. Install engine. Refer to Chapter 6.

TRANSMISSION & CRANKSHAFT

MAINSHAFT SEAL INSTALLATION (Engine In Frame)

1. Remove drive belt and drive sprocket. Refer to page 11.4.
2. Clean area around seal thoroughly.
3. Remove seal sleeve.
4. Remove o-ring.
5. Using suitable seal remover, work around inner portion of seal until seal is free of engine case.

CAUTION:

Choose a seal remover with a rounded, polished working end. Take care not to gouge the seal bore of the engine cases. Scratching or damaging the cases can result in an oil leak.

6. Inspect the output shaft seal sleeve for burrs, nicks, or surface wear. The end surfaces that contact the bearing race and drive sprocket must be smooth and flat to prevent loosening of the drive sprocket.
7. Lightly grease sealing lip of seal and surface of seal installation tool.

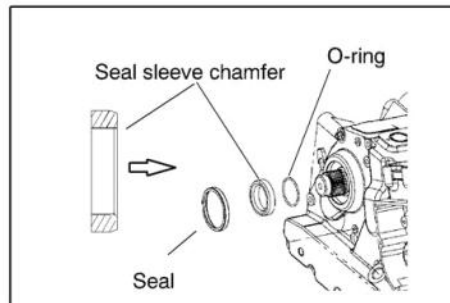
Victory All Purpose Grease: 2872187

8. Place thin film of engine oil to O.D. of new seal and "Load" seal onto seal driver.

Special tool:

Final Drive Seal Installer PV-43505

9. Use seal driver to drive seal into place. Seal driver will stop at correct seal depth.
10. Lightly grease seal sleeve. Install seal sleeve with slight chamfer on inside diameter of sleeve facing IN (toward engine).
11. Install drive sprocket and drive belt (refer to page 11.5).



TRANSMISSION & CRANKSHAFT

TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | PART(s) AFFECTED | REPAIR RECOMMENDED |
|---|---|---|-----------------------------------|
| Transmission Will Not Shift | Broken Shift Cam | Shift Cam | Replace shift cam |
| | Bent Shift Forks | Shift Fork | Replace shift fork(s) |
| | Worn Gearshift Pawl | Shift Cam | Replace shift cam |
| | Broken Gears | Transmission Gears | Replace necessary parts |
| | Damaged/Broken Bearings | Transmission, Shift Cam Bearings | Replace necessary parts |
| | Worn Gear Shift Ratchet Mechanism | Shifter Ratchet | Refer to chapter 9 |
| | Broken or out-of-place spring on shift ratchet | Shift Ratchet Spring | Refer to chapter 9 |
| | Shift Detent Plunger Stuck | Shift Detent Plunger | Repair as necessary |
| | Frozen Pivot Point, Bent External Shift Linkage | External Shift Linkage | Repair as necessary |
| | Bent or Distorted Shift Fork Rails | Shift Fork Rails | Replace Shift Fork Rails |
| | Debris From Broken Parts Locking Transmission | Transmission Components | Repair as necessary |
| Excessive Noise Related to Bottom End of Engine | Worn Main Bearings | Crankshaft and/or Crankshaft Bearings | Repair as necessary |
| | Worn Connecting Rod Bearings | Connecting Rod Bearings and/or Connecting Rod and/or Rod Bearings | Repair as necessary |
| | Worn Connecting Rod Small End Bushing | Connecting Rod, Connecting Rod Bushing, Piston Pin, Piston | Repair as necessary |
| | Worn, seized, chipped or broken gear teeth | Transmission Gears | Repair as necessary |
| | Worn, seized, chipped or broken Transmission Bearings | Transmission Bearings | Repair as necessary |
| | Originates from Primary Cover | Clutch, Torque Compensator, Flywheel, Starter Drive Assembly, Starter Clutch, Starter Motor | Refer to chapter(s) 9, 16, 17, 18 |
| | Oil Pump | Oil Pump, Oil Pump Drive | Refer to chapter 4 |
| | Cam Drive | Cam Chain, Cam Sprocket | Refer to chapter 7 |

TRANSMISSION & CRANKSHAFT

| PROBLEM | POSSIBLE CAUSE | PART(s) AFFECTED | REPAIR RECOMMENDED |
|--------------------------------|---|-----------------------------|---|
| Transmission Hard to Shift | Improper Clutch Operation | Clutch | Refer to chapter 9 |
| | Incorrect Oil Viscosity | Engine oil and filter | Refer to chapter 3 |
| | Incorrect Clutch Adjustment | Clutch Adjustment | Refer to chapter 3 |
| | Bent, Rubbing, Sticky, Broken Shift Shaft | Shifter Ratchet Assembly | Refer to chapter 9 |
| | Sticking Pivot Point, Bent External Shift Linkage | External Shift Linkage | Repair or replace components as necessary |
| | Bent or Distorted Shift Forks | Shift Forks | Replace bent shift fork |
| | Damaged Shift Drum Grooves | Shift Drum | Replace damaged shift drum |
| | Shift Detent Plunger Stuck | Shift Detent Plunger | Repair as necessary |
| | Bent or Distorted Shift Fork Rails | Shift Fork Rails | Replace Shift Fork Rails |
| Transmission Jumps Out of Gear | Broken Shift Stop Pin | Shift Stop Pin | Replace stop pin |
| | Worn Shift Drum Pawls or Shifter Ratchet | Shift Drum or Shift Linkage | Replace damaged shift drum or shifter ratchet |
| | Broken Shift Ratchet Spring | Shift Ratchet Spring | Replace spring |
| | Damaged Shift Drum Grooves | Shift Drum | Replace shift drum |
| | Bent, Worn, Distorted Shift Forks | Shift Forks | Replace shift forks |
| | Bent or Distorted Shift Fork Rails | Shift Fork Rails | Replace shift fork rails |
| | Worn Engagement Dogs on Transmission Gears | Transmission Gears | Replace necessary parts |

CHAPTER 11

DRIVE LINE

| | |
|---|------|
| GENERAL | 11.1 |
| SPECIAL TOOLS | 11.1 |
| SPECIFICATIONS | 11.1 |
| DRIVE LINE FASTENER TORQUE SPECIFICATIONS | 11.1 |
| DRIVE LINE FASTENER TORQUE SPECIFICATIONS | 11.2 |
| BELT INSPECTION | 11.2 |
| BELT REMOVAL | 11.3 |
| BELT INSTALLATION | 11.4 |
| DRIVE SPROCKET REMOVAL | 11.4 |
| DRIVE SPROCKET INSPECTION | 11.5 |
| DRIVE SPROCKET INSTALLATION | 11.5 |
| REAR SPROCKET REMOVAL | 11.7 |
| REAR SPROCKET INSPECTION | 11.7 |
| REAR SPROCKET INSTALLATION | 11.8 |
| TROUBLESHOOTING | 11.9 |

11



GENERAL

MAINTENANCE PRODUCTS

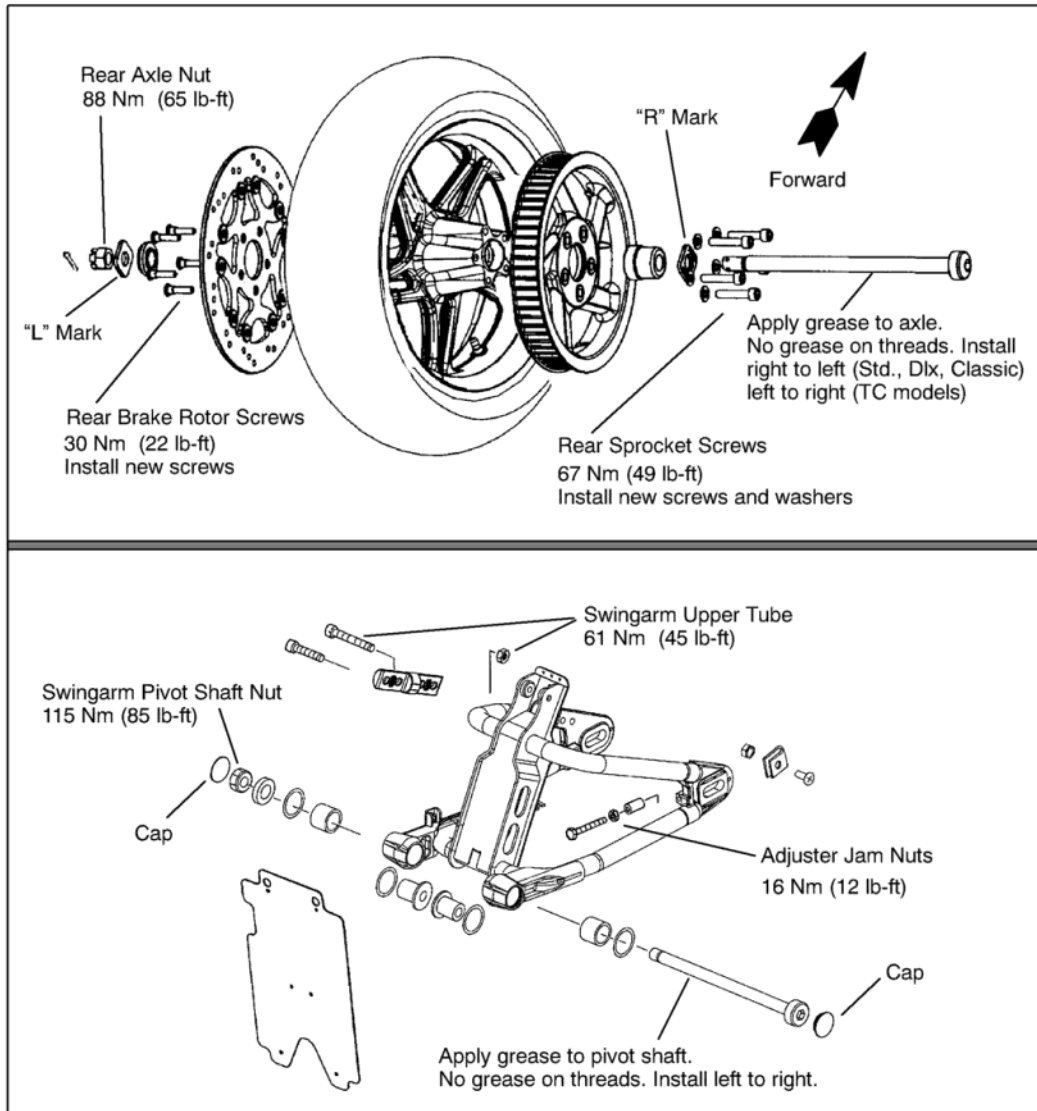
Refer to page 2.7 for a list of maintenance products and part numbers..

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

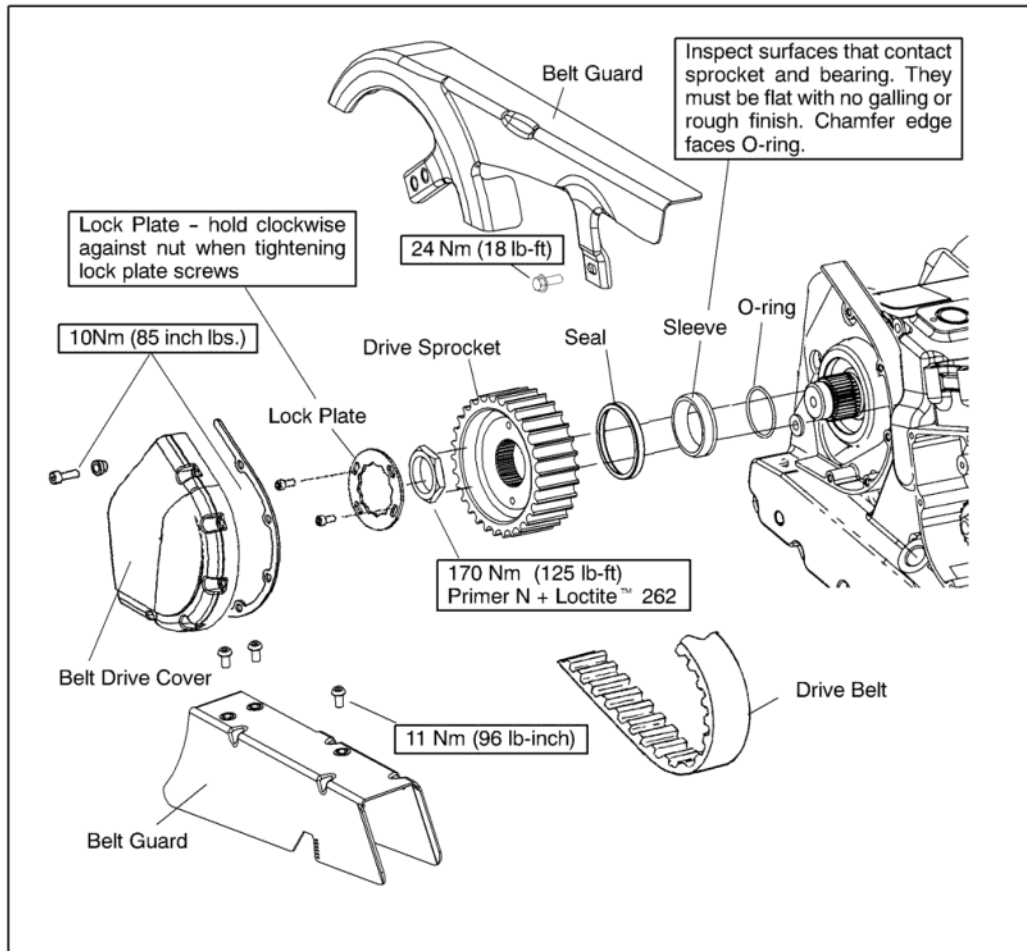
DRIVE LINE FASTENER TORQUES

Refer to the illustrations below for fastener torque and locking agent.



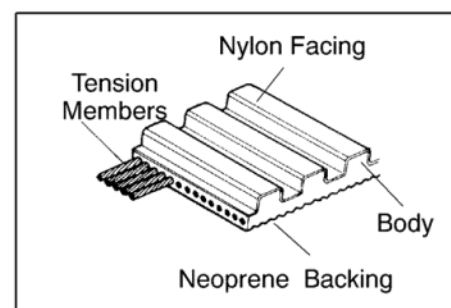
DRIVE LINE

DRIVE LINE FASTENER TORQUES



BELT INSPECTION

1. Inspect belt backing for delaminating.
2. Inspect belt teeth for foreign material damage.
3. Inspect belt tension, adjust if necessary.
4. Inspect all belt surfaces for excessive wear or foreign material damage.



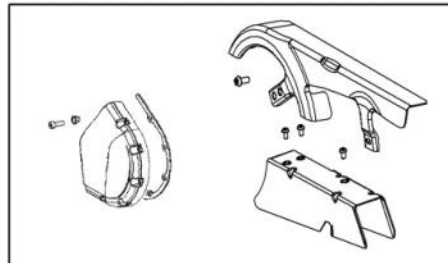
11.2

BELT REMOVAL

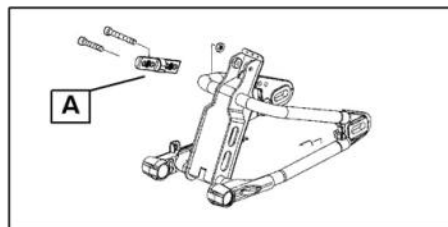
NOTE: If you plan to remove the front sprocket, refer to page 11.4.

NOTE: If belt is to be reinstalled, mark direction of rotation on the outer surface of belt. Reinstall belt in same direction as it was removed.

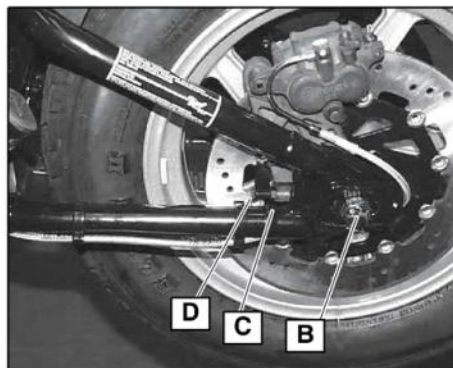
1. Remove muffler(s) and discard gasket(s). Refer to pages 3.6 through 3.2.
2. Remove drive sprocket cover and belt guard.



3. Remove upper swing arm tube (A). Removing the tube allows belt to be removed without removing the rear wheel.



4. Remove cotter pin and loosen rear axle nut (B).
5. Loosen belt adjuster jam nut (C) on each side.
6. Loosen the belt adjustment bolt (D) on each side of wheel so the axle is free to move forward.
7. Slide rear wheel forward as far as it will go.
8. Slide belt off rear sprocket to the inside, then remove belt off front sprocket.
9. Remove drive belt from motorcycle passing it through the swing arm upper tube.



DRIVE LINE

BELT INSTALLATION

1. Inspect sprockets and verify sprocket fasteners are tightened to specification shown on pages 11.1 and 11.2.
2. Place belt to the inside of the rear sprocket.
3. Place belt onto drive sprocket and work belt onto rear sprocket.
4. Install upper swing arm tube, drive sprocket cover, and belt guards and torque fasteners to specification.
5. Adjust belt tension (refer to page 2.26).

CAUTION:

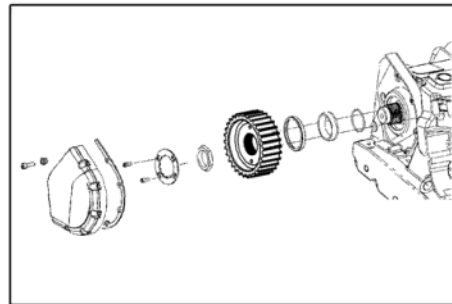
Improper alignment of rear wheel will cause steering instability and premature belt wear. Take precautions to do this procedure correctly any time belt is removed or during maintenance services.

6. Inspect wheel alignment (refer to page 2.28).
7. Install muffler(s) using new gasket. Refer to pages 3.6 through 3.2.

DRIVE SPROCKET REMOVAL

NOTE: Belt does not have to be removed in order to remove drive sprocket.

1. Remove drive sprocket cover and gasket.
2. Remove sprocket lock plate screws and lock plate.
3. Apply rear brake to hold sprocket, remove sprocket nut.
4. Remove cotter pin and loosen rear axle nut.
5. Loosen rear wheel alignment bolt lock nuts.
6. Loosen rear wheel alignment bolts evenly and push wheel forward until belt is loose.
7. Move belt & front sprocket to the right of the machine and remove the front sprocket.

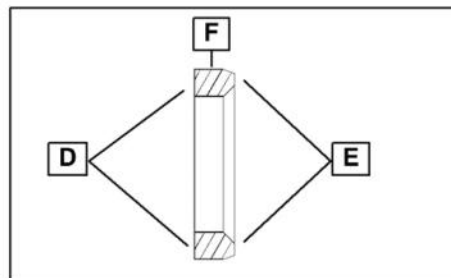
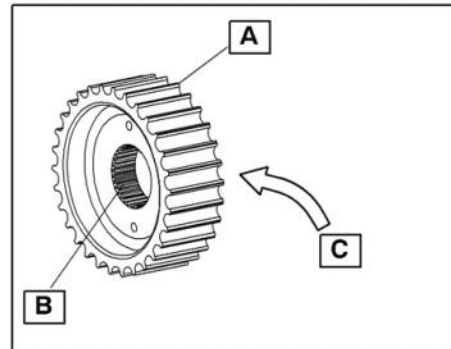


DRIVE SPROCKET INSPECTION

1. Visually inspect sprocket teeth (A) for excessive wear, foreign material damage due to road debris between sprocket and belt. Check for bent, cracked, or broken teeth.
2. Inspect splines (B) for a tight fit on shaft splines.
3. Inspect surface of sprocket hub (C) where it contacts the seal sleeve. Replace if worn or if surface is rough.

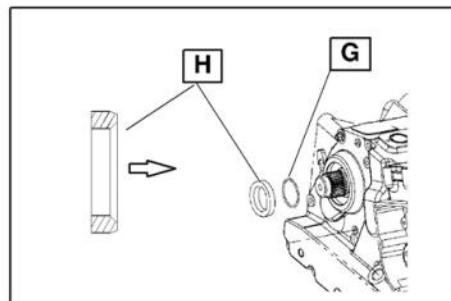
NOTE: Sprockets and belt normally exhibit a polished appearance after operation. Do not needlessly replace belt or sprockets unless damage is noted. Most damage due to foreign material getting between drive belt and sprocket or from running the belt too loose.

4. Inspect outer surface (D), inner surface (E), and sealing surface (F) of seal sleeve. Surfaces must be flat without wear or galling. Replace the sleeve if worn, or if the surface appears rough or chafed. The O-ring sealing surface of chamfered edge must be smooth to seal the shaft.



DRIVE SPROCKET INSTALLATION

1. Apply grease to a new O-ring (G) and install on output shaft.
2. Install seal sleeve (H) with chamfer facing in, toward O-ring.
3. Clean the shaft threads and sprocket nut of old thread locking agent and apply Loctite Primer N™. Allow 5 minutes drying time for the Primer N.
4. Place belt onto front sprocket, place sprocket over splines of output shaft.
5. Tighten rear axle then back it off 1 turn.
6. Adjust belt tension visually to provide enough tension to keep belt from jumping the teeth of sprocket while torquing sprocket nut.
7. Apply Loctite 262 to threads of output shaft and nut.
8. Install drive sprocket nut.
9. Apply rear brake and torque drive sprocket nut to specification found on page 11.2.



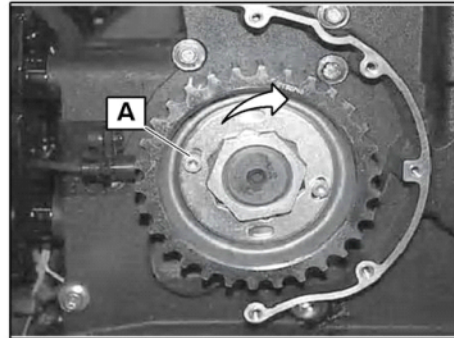
DRIVE LINE

DRIVE SPROCKET INSTALLATION (cont.)

10. Install lock plate.

NOTE: The lock plate can be installed in many positions and either side of the plate can be used. If you cannot find a position that will work, flip the plate over and again try to install it. If the plate still does not align, tighten the sprocket nut slightly and try to fit the lock plate again.

11. Install lock plate screws (A).
12. Rotate the plate **CLOCKWISE** until it stops and hold it firmly against the nut.
13. Tighten the lock plate screws to specified torque found on page 11.2.
14. Adjust belt tension (page 2.26) and wheel alignment (page 2.28).
15. Install drive sprocket cover and a new gasket. Torque fasteners to specification found on page 11.2.

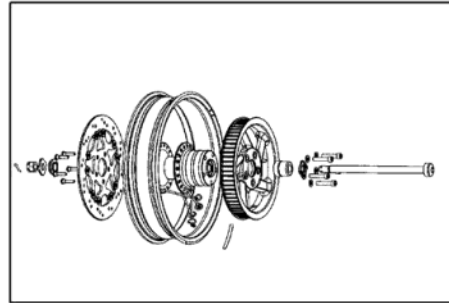


REAR SPROCKET REMOVAL

1. Remove rear wheel (refer to page 13.4).
2. Remove and discard sprocket bolts and washers.
Do not reuse sprocket bolts and washers.

CAUTION:

While working on the rear sprocket (or any rear wheel repair procedures) take necessary steps to protect the brake disc surface.



REAR SPROCKET INSPECTION

1. Visually inspect the sprocket teeth (A) for excessive wear, foreign material damage due to road debris between sprocket and belt, bent or cracked flanges, and cracks of any kind.
2. Visually inspect the sprocket bolt holes (B) for excessive wear, out-of-round, and cracks of any kind.

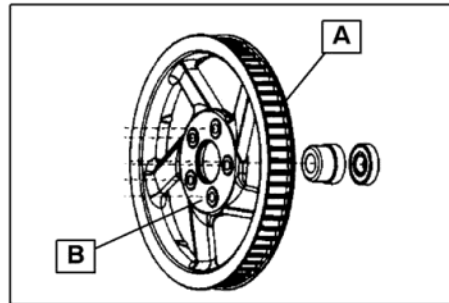
NOTE: Both front and rear sprockets (and to some extent, the belt) will exhibit a polished and worn appearance due to normal operation. Do not needlessly replace belt and/or sprockets unless uncharacteristic damage is noted. Most damage is from foreign debris getting between belt and sprocket or from running the belt too loose.

3. Check the torque on sprocket retaining bolts. If the bolts are loose, remove them and inspect the hub and sprocket mating surfaces as in step 3. Clean the threads of hub.

CAUTION

Replace all sprocket bolts and washers if sprocket bolts were loose or if bolts are removed.

4. Inspect hub mating surface on sprocket for wear or damage. The surface must be flat, with no burrs, nicks, or galling. Inspect the wheel hub surface also.



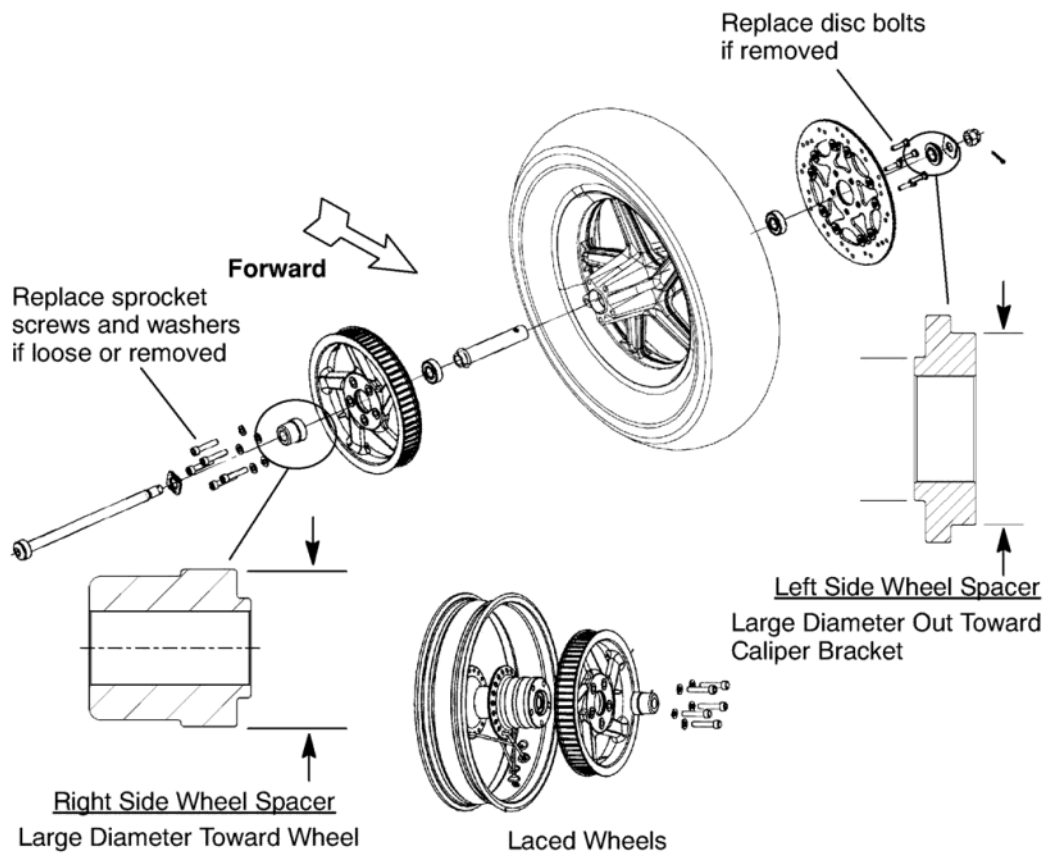
DRIVE LINE

REAR SPROCKET INSTALLATION

1. Clean all mounting surfaces of the rear wheel and rear sprocket. Make sure that all mating surfaces are flat and free from burrs or galling.
2. Clean sprocket screw threads in wheel with contact cleaner or Loctite Primer N, and dry with clean compressed air. Make sure all traces of old thread locking agent are removed.
3. Install new washers onto new screws.

NOTE: Do not re-use the sprocket screws or washers.

4. Install sprocket and sprocket screws. Torque bolts using a cross pattern in 2-3 steps to specification found on page 11.1.
5. Refer to page 13.9 for rear wheel installation procedure.



TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | POSSIBLE REPAIR NEEDED |
|---------------------------------------|--|--------------------------------------|
| Belt Shows Excessive Wear On One Side | Out-of-Alignment | Align rear wheel |
| Belt Squeal | Out-of-Alignment | Align rear wheel |
| 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 for long period of time. | Replace Belt, Inspect Sprockets |
| Belt Delaminating | Foreign material damage weakened belt. Chemical Contamination | Replace Belt |

CHAPTER 12

FRONT WHEEL & SUSPENSION

| | |
|---|-------|
| GENERAL | 12.1 |
| SPECIFICATIONS, FRONT WHEEL AND SUSPENSION | 12.2 |
| SPECIAL TOOLS | 12.1 |
| FASTENER TORQUE SPECIFICATIONS TABLE | 12.2 |
| EXPLODED VIEW & TORQUE - HANDLEBAR & FORK (2003 CLASSIC) | 12.3 |
| EXPLODED VIEW / TORQUE - HANDLEBAR & FORK (TOURING CRUISER) | 12.4 |
| EXPLODED VIEW / TORQUE - FRONT WHEEL & BRAKE) | 12.5 |
| HANDLEBAR REMOVAL | 12.6 |
| HANDLEBAR INSTALLATION | 12.6 |
| LOWER HANDLEBAR CLAMP (RISER) REMOVAL | 12.9 |
| LOWER HANDLEBAR CLAMP (RISER) INSTALLATION | 12.9 |
| FRONT WHEEL REMOVAL | 12.10 |
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| FRONT BRAKE DISC REMOVAL / INSTALLATION | 12.11 |
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| STEERING HEAD BEARING INSTALLATION | 12.26 |
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| STEERING BEARING PRELOAD MEASUREMENT | 12.30 |
| TROUBLESHOOTING | 12.31 |

12

FRONT WHEEL & SUSPENSION

GENERAL

WARNING

Victory 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.

Tubeless tires are used on certain Victory 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 after the 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 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.

- Refer to Chapter 2 for **MAINTENANCE** of front end components.
- Refer to Chapter 14 for **TIRE REMOVAL, REPAIR, BALANCING, and SPOKE WHEEL TRUING**.
- Refer to Chapter 15 for **BRAKE SYSTEM** service and repairs.

SPECIFICATIONS

| FRONT WHEEL, SUSPENSION & STEERING | | | |
|--|---------------------------------------|---|----------------|
| Item | | Standard | Service Limit |
| Axle Runout | | - | .20 mm (.008") |
| Front Wheel Rim Runout (Cast Type) | Axial | .25mm (.010 inch) | 2.0 mm (.080") |
| | Radial | .25mm (.010 inch) | 2.0 mm (.080") |
| Front Wheel Rim Runout (Spoke Type) | Axial | 1.0mm (.040 inch) | 2.0 mm (.080") |
| | Radial | .8mm (.032 inch) | 2.0 mm (.080") |
| Fork Spring Free Length | | 330 mm \pm 3 mm (13.0" \pm .118") | 320 mm (12.6") |
| Fork Top-Out Spring Free Length | | 32 mm \pm 1.5 mm (1.26" \pm .059") | 28 mm (1.10") |
| Fork Tube Runout | | Not Applicable | .20 mm (.008") |
| Fork Oil Type/Weight | Victory 7.5W/10 Fork Oil | | |
| Fork Oil Level | | 230 mm (9.055") | Not Applicable |
| Fork Oil Capacity (per leg) | | 435 cc (14.7 fl. oz.) | Not Applicable |
| Steering Bearing Preload | 20 Nm (15 lb.-ft.) Refer to procedure | | |
| Tires | Refer to page 2.4 | | |

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

MAINTENANCE PRODUCTS

Hand Grip Adhesive - 2872575 Three Bond 1501 (10ml tube). Refer to page 2.7 for a list of maintenance products and part numbers.

FRONT WHEEL & SUSPENSION

TORQUE SPECIFICATIONS

Also refer to exploded views on following pages.

| Fastener Torque Specifications - Suspension, Steering & Front Wheel | | |
|---|---|-------------|
| Axle Bolt, Front | 48 Nm | 35 lb-ft |
| Axle Pinch Bolt, Front | 25 Nm | 18 lb-ft |
| Brake Master Cylinder to Handlebar | 9 Nm | (80 in-lbs) |
| Brake Master Cylinder Cover, Front | 1 Nm | (9 in-lbs) |
| Brake Caliper to Fork, Front | 47 Nm | 35 lb-ft |
| Brake Disc (Rotor) to Wheel*, Front | 30 Nm | 22 lb-ft |
| Brake Line Clamp to Front Fork | 11 Nm | (96 in-lbs) |
| Clutch Lever Bracket to Handlebar | 11 Nm | 8 lb-ft |
| Fender, Front to Fork Leg | 10 Nm | 7 lb-ft |
| Fork Spring Cap | 25 Nm | 18 lb-ft |
| Fork Damper Rod Bolt | 50 Nm | 37 lb-ft |
| Handlebar Riser To Upper Triple Clamp | 48 Nm | 35 lb-ft |
| Handlebar Clamp To Riser | 24 Nm | 18 lb-ft |
| Handlebar Controls to Handlebar | 3 Nm | (25 in-lbs) |
| Headlight Assembly to Forks | 27 Nm | 20 lb-ft |
| Headlight Stiffener Bracket | 9.5 Nm | (85 in-lbs) |
| Hub Cap (Front Wheel) | 5.5 Nm | (48 in-lbs) |
| Triple Clamp Pinch Bolt (Lower) | Refer to Exploded Views Page 12.3 and 12.4 | |
| Triple Clamp Pinch Bolt (Upper) | | |
| Steering Stem Bearing Adjustment Nut | Refer to procedure this Chapter, page 12.31 | |
| Steering Stem Bearing Jam Nut | Refer to procedure this Chapter, page 12.31 | |
| Steering Stem Cap Nut (Upper Triple Clamp Center) | 68 Nm | 50 lb-ft |
| Valve Stem Nut (Tube type tires) | 3 Nm | (24 in-lbs) |
| Wheel Hub Cap to Wheel | 6 Nm | 4 lb-ft |

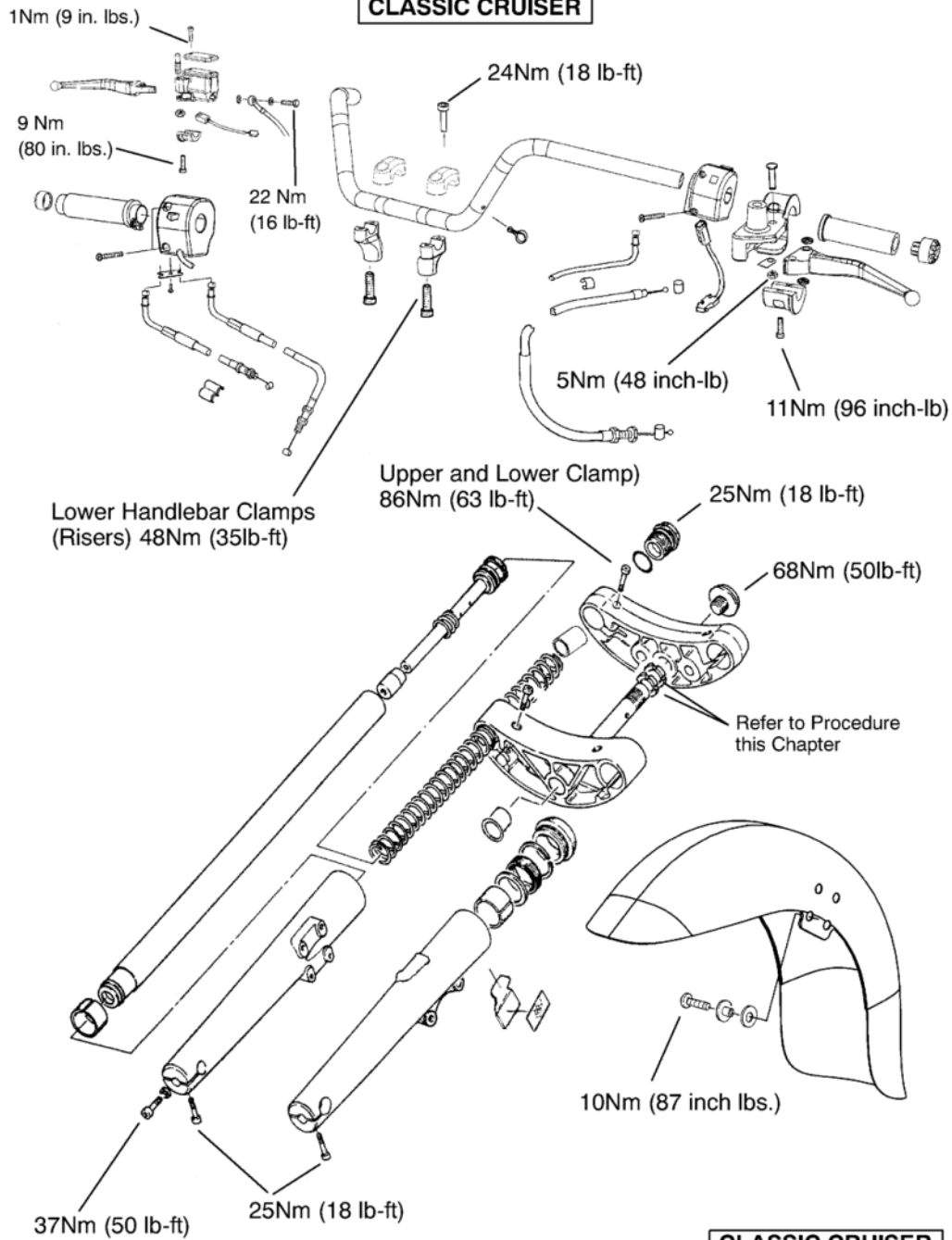
* Use new rotor bolts that have a pre-applied locking agent.

12.2

FRONT WHEEL & SUSPENSION

HANDLEBAR / FRONT FORKS, 2002-2003 STD, DLX, & CLASSIC

CLASSIC CRUISER

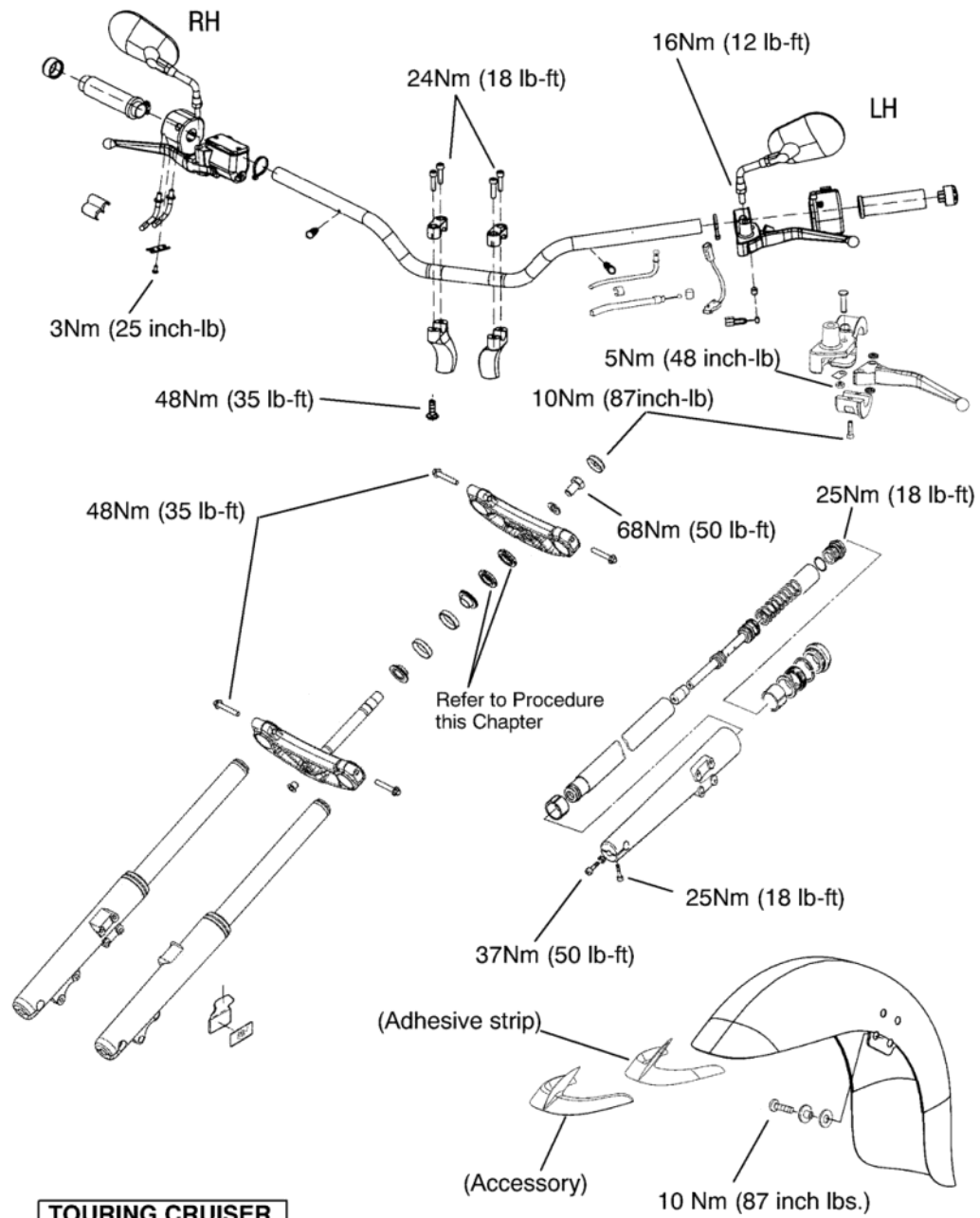


CLASSIC CRUISER

FRONT WHEEL & SUSPENSION

HANDLEBAR / FRONT FORKS, 2002-2003 TOURING CRUISER

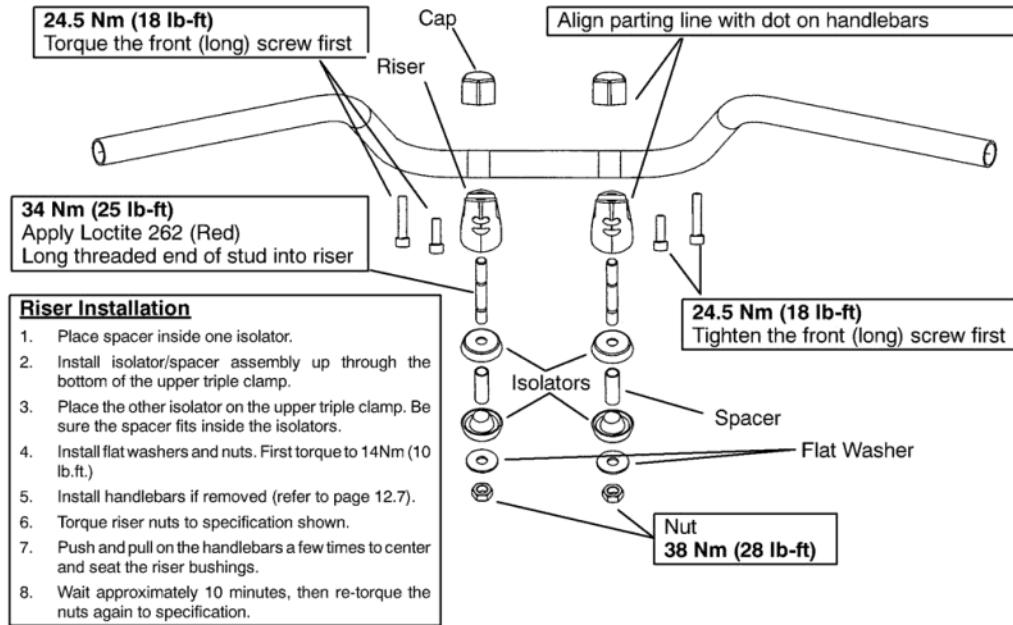
TOURING CRUISER



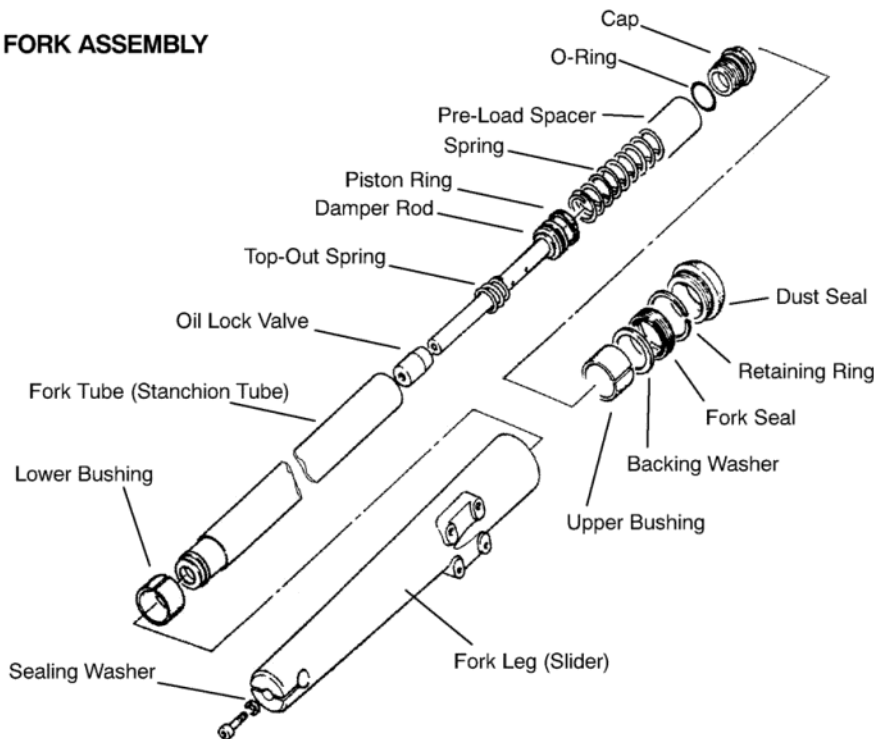
TOURING CRUISER

12.4

HANDLEBAR MOUNTING, 2004 TOURING CRUISER



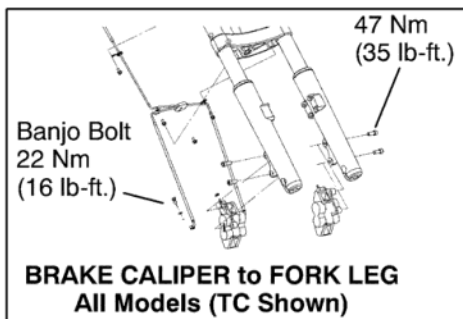
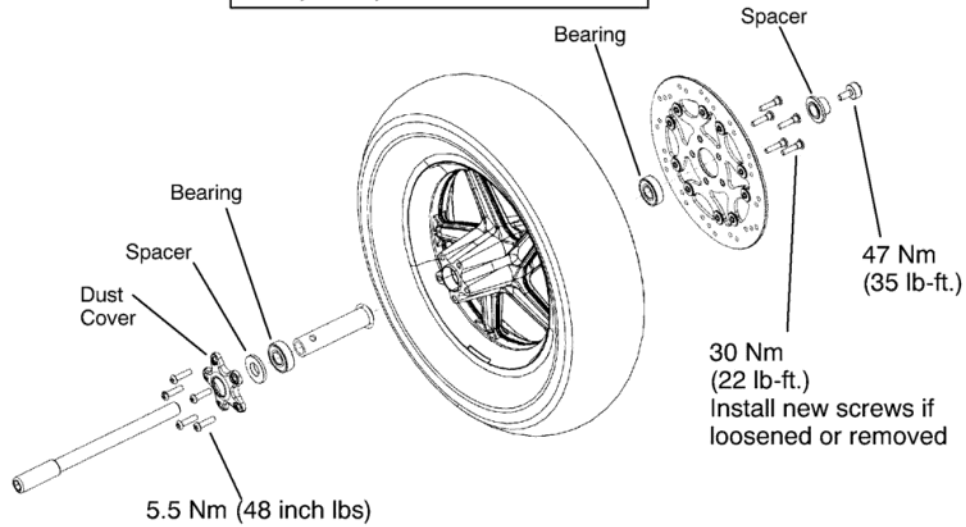
FORK ASSEMBLY



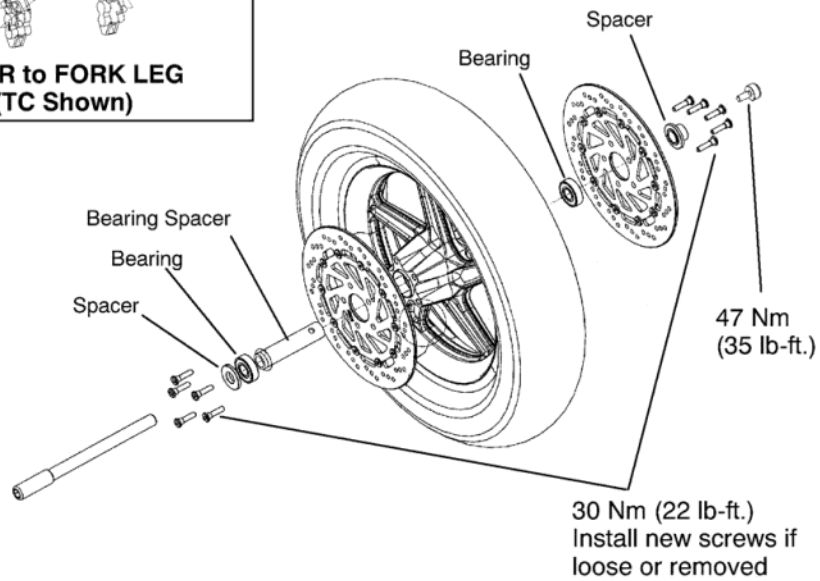
FRONT WHEEL & SUSPENSION

FRONT WHEEL / BRAKE

STD, DLX, & Classic Cruiser



Touring Cruiser



HANDLEBAR REMOVAL

CAUTION: Left handlebar grip and grip end may be damaged during the removal process. Plan on replacing the left grip and grip end if it must be removed. Many items will be hanging loose when removing the handlebars. Cover painted or chrome parts to prevent damage from dangling parts. Special care should be taken to protect the fuel tank and front fender finish. Remove the fuel tank and put it in a safe spot until work on the handlebars is complete.

NOTE: Refer to illustrations on page 12.3 (Classic Cruiser) or 12.4 (Touring Cruiser).

1. Remove and discard wiring harness retainers.
2. Disconnect clutch switch connector.
3. Remove 2 screws for clutch lever bracket clamp, remove clutch lever bracket from handlebar.
4. Remove screws for left handlebar switch assembly. Disconnect fast idle cable from lever. Remove switch assembly and tie it out of the way so it does not damage the fuel tank or fender.
5. Grasp left grip end firmly. While twisting grip end back & forth, pull grip end off. Replace grip end upon assembly.
6. Remove left grip by inserting a thin screwdriver between grip and handlebar end. Spray a small amount of water/soap solution into area between grip and handlebar end. Aggressively twist the grip back-and-forth while simultaneously pulling grip off.
7. Disconnect front brake light switch wires.
8. Remove brake master cylinder clamp screws. Remove master cylinder clamp and master cylinder and secure in an upright position.
9. Remove right handlebar switch housing screws, separate and remove handlebar switch.
10. Remove bolts from upper handlebar clamp, remove clamp.
11. Move handlebars to left, slide throttle grip assembly off handlebar, leaving throttle cables attached. If right grip will be replaced, loosen throttle cable adjusters and detach cables.

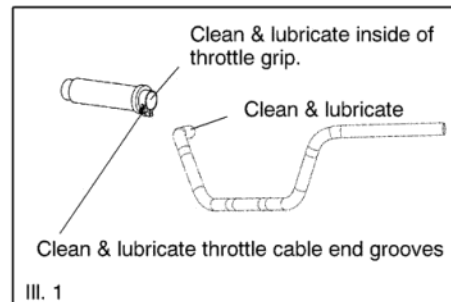
HANDLEBAR INSTALLATION

Refer to illustrations on page 12.3 and 12.4 for torque specifications.

1. Clean inside of throttle grip assembly and grooves for throttle cable ends. (Ill.1)
2. Clean throttle grip area. (Ill.1)
3. Apply a thin film of grease on the contact area of handlebar between throttle grip and handlebar. (Ill.1)

Victory All Purpose Grease: 2872187

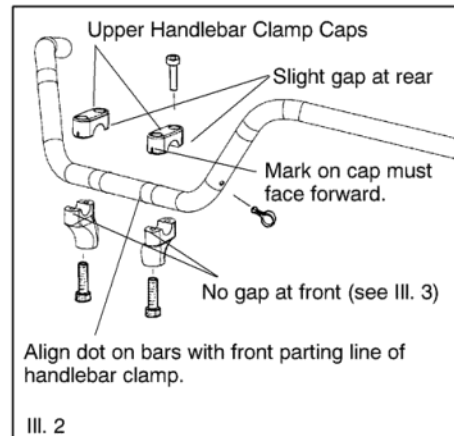
4. Apply a thin film of grease to grooves for throttle cable ends. (Ill.1) Attach cables if they were removed from grip.
5. Slide throttle assembly onto right handlebar end (cables have not been removed and should still be attached to throttle tube).



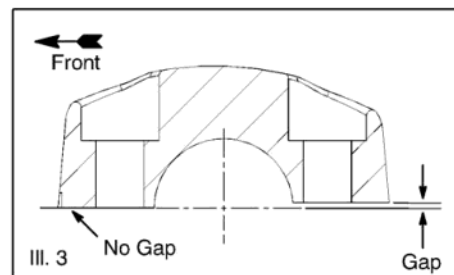
FRONT WHEEL & SUSPENSION

HANDLEBAR INSTALLATION (cont.)

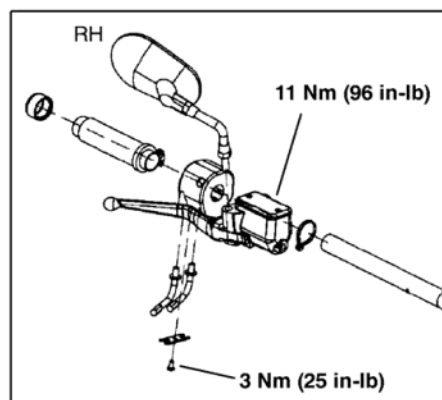
6. Position handlebar onto lower handlebar clamps, install upper handlebar clamp.
7. Position alignment dot (on front left of handlebar) with inside edge of handlebar clamp parting line. (III. 2)
8. Start all handlebar clamp cap bolts. Witness mark on caps must face forward. Tighten front handlebar clamp to riser bolts to specification listed on page 12.3 or 12.4.
9. Torque rear handlebar clamp to riser bolts to specification listed on page 12.3 or 12.4.



NOTE: When final tightening is completed, handlebar clamp will be flush at the front and a gap will exist at rear. (III. 3)



10. Install right handlebar switch housing onto handlebar. Make sure locating pin of switch assembly aligns with hole in handlebars.
11. Install right handlebar switch housing screws, make sure locating pin properly aligns with hole in handlebar. Torque screws to specifications on page 12.3 or 12.4.
12. Connect brake switch harness to housing.
13. Install master cylinder and clamp. Install screws and torque to specification.

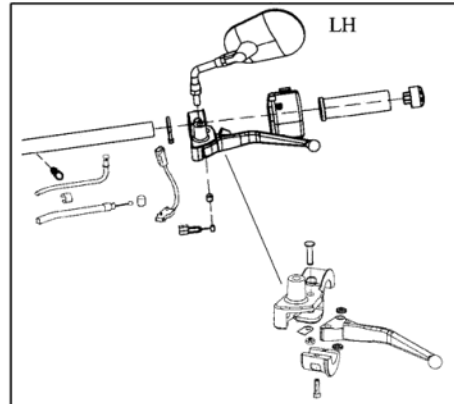


HANDLEBAR INSTALLATION (cont.)

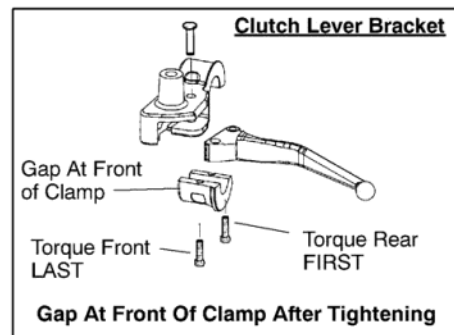
14. Install fast idle cable into fast idle lever.
15. Clean surfaces of **new** left grip and cap and apply grip cement to inside of grip and outside of grip cap. Follow directions supplied with grip cement for proper application.

Grip Cement: 2872575 (Three Bond 1501)

16. Install left handlebar grip cap.



17. Install left handlebar switch housing onto handlebar. Make sure dot on handlebar aligns with parting line of switch housing.
18. Install clutch lever bracket, clamp and screws.
19. Torque the rear screw first and then the front (gap will exist at front of the clutch lever clamp).
20. Connect clutch interlock switch terminals.
21. Inspect operation of throttle assembly and fast idle lever. Adjust throttle freeplay (page 2.15) and fast idle control freeplay (page 2.14) to specification.
22. Inspect clutch interlock switch operation and clutch lever free play (refer to page 2.13).
23. Inspect operation of front brake. Bleed brakes if lever is not firm. (refer to Chapter 15)



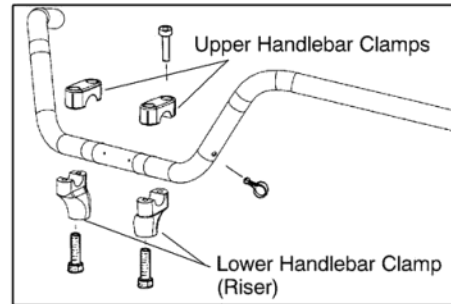
FRONT WHEEL & SUSPENSION

LOWER HANDLEBAR CLAMP (RISER) REMOVAL

CAUTION: The lower handlebar clamps (risers) can be removed without complete handlebar removal. However, extreme caution must be taken not to damage the fuel tank.

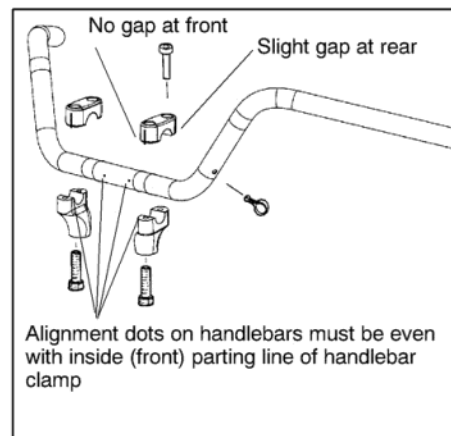
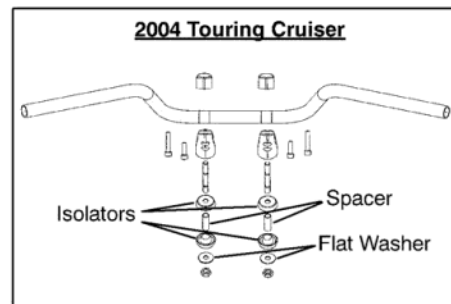
CAUTION: Secure handlebar assembly in such a way that other components cannot be damaged and the brake master cylinder is held upright and level to prevent air from entering the hydraulic brake system.

1. Before removing handlebars, loosen lower handlebar clamp (riser) retaining bolts on underside of upper triple clamp.
2. Remove upper handlebar clamp bolts and upper handlebar clamps.
3. Secure handlebars out of the way.
4. Remove lower clamp retaining bolts
5. Remove lower handlebar clamp(s).



LOWER HANDLEBAR CLAMP INSTALLATION

1. Clean lower handlebar clamp mounting surfaces of triple clamp.
2. Install lower handlebar clamp(s) (riser).
3. Install bolts, tighten finger tight.
4. Install handlebars, upper handlebar clamp and handlebar clamp bolts.
5. Tighten upper handlebar bolts snugly, do not torque to final specification at this time.
6. Tighten lower handlebar clamp bolts to final torque specification listed on page 12.3 or 12.4.
7. Loosen upper handlebar clamp bolts.
8. Position alignment dots with inside edges of handlebar clamp caps parting lines.
9. Start all handlebar clamp cap bolts. Tighten front handlebar clamp cap bolts to specified torque listed on page 12.3 or 12.4.
10. Torque rear handlebar clamp cap bolts to specification listed on page 12.3 or 12.4. There will be a slight gap at the rear.



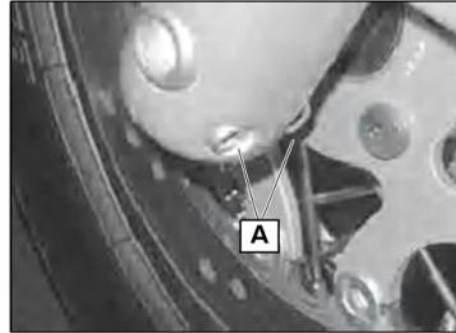
12.10

FRONT WHEEL REMOVAL

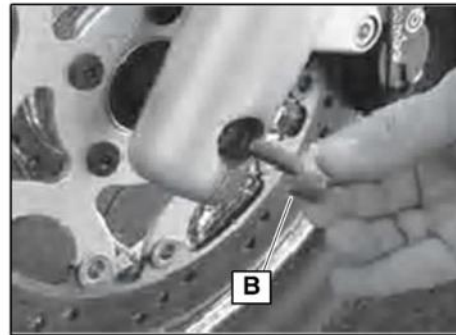
1. Securely support front end of motorcycle so front wheel is off the ground.

NOTE: It is only necessary to raise the front wheel 1 1/2-2in off the floor to gain clearance for wheel removal.

2. Loosen axle pinch bolts (A) on lower left fork leg.



3. Loosen and remove axle bolt (B) from left side of axle.
4. Loosen axle pinch bolts on lower right fork leg.



5. Remove front brake caliper(s)(C) as needed to gain clearance to remove wheel.

CAUTION: Do not allow caliper to hang from the brake hose. Secure brake caliper in such a way to keep stress off of brake hose.

6. Support wheel and remove axle from right side of motorcycle.
7. Lower wheel, tilt the wheel slightly and remove it.
8. Remove axle spacer from right side.

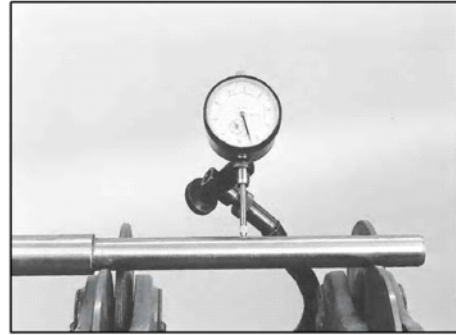


NOTE: Do not operate the front brake lever with the wheel removed. Doing so will make it difficult to get the disc back between brake pads.

FRONT WHEEL & SUSPENSION

FRONT AXLE INSPECTION

1. Place axle in V-blocks and inspect runout. Compare to specifications on page 12.1.
2. Replace axle if it fails inspection. Do not attempt to straighten a bent axle.

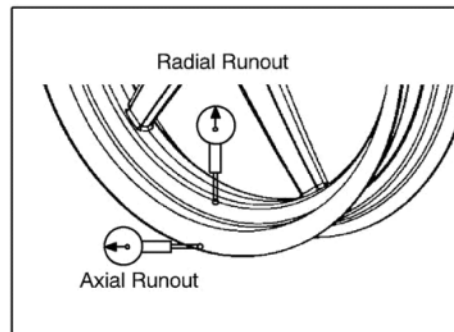


FRONT WHEEL INSPECTION

1. Install front wheel in truing stand.

NOTE: Bearings must be in good condition to accurately measure runout.

2. Set up a dial indicator to measure radial runout (up and down) and compare to specifications on page 12.1.
3. Position dial indicator to measure axial runout (left to right) and compare to specifications on page 12.1.
4. Visually inspect wheel for cracks.
5. Replace wheel if it fails visual or measured inspection. Do not attempt to straighten cast aluminum wheels. Spoked wheels can be trued to a certain degree by tightening spokes as required.



BRAKE DISC REMOVAL

1. Remove front wheel refer to page 12.11.
2. Position wheel with brake disc facing up.
3. Remove and discard brake disc bolts. Do not reuse brake disc bolts
4. Remove brake disc from wheel.

BRAKE DISC INSTALLATION

1. Clean bolt hole threads with Loctite Primer N.
2. Replace bolts with new bolts that have pre-applied locking agent.
3. Install brake disc with part number to outside. Install new brake disc bolts and torque to specification listed on page . Do not re-use brake disc bolts.

FRONT WHEEL BEARING INSPECTION

NOTE: Inspect bearings installed in the wheel. Do not remove to inspect. Bearings cannot be repacked. Replace both wheel bearings if one or both fail inspection.

1. Visually inspect integral bearing seal for damage.
2. Check bearings by turning inner race by hand.

NOTE: Look for signs of discoloration, scoring, galling, or contamination from moisture or dirt. Replace bearings if any of the above are present. Turn the inner race of the bearings. The bearings should turn smoothly and quietly. The inner race should be firm with minimal side to side movement and no detectable up and down movement.

3. Inspect bearing fit into wheel hub. The outer race of the bearing must fit tightly into the bore. You should not be able to move it by hand.
4. Replace bearings that fail any of the above inspections.

CAUTION: Do not reuse bearings after removing them from the wheel. Removal damages the bearings internally.

12.12

FRONT WHEEL BEARING REMOVAL

NOTE: Classic Cruiser models have a bearing cover on one side that must be removed.

1. Install bearing remover element into one bearing.

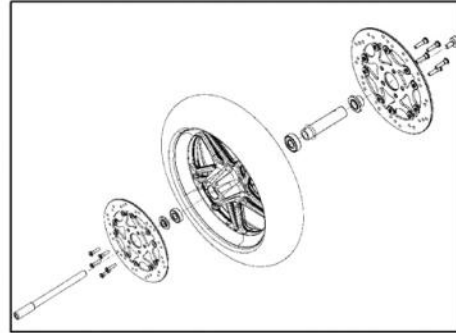
Blind bearing remover PV-43551

2. Remove bearing.
3. Remove bearing spacer from wheel hub.

NOTE: The o-ring on the bearing spacer is used to align spacer with bearings to ease axle installation. It may be helpful to position the o-ring in the middle of the spacer to ease axle installation.

4. Use an appropriate drift punch and drive out remaining bearing.

NOTE: Replace both wheel bearings as a set. Do not replace only one wheel bearing.



FRONT WHEEL BEARING INSTALLATION

1. Clean inside of wheel hub and bearing spacer.
2. Place new bearing into right hand side of wheel with markings facing up.
3. Install wheel bearing installation tool. Pull the wheel bearing into the hub until fully seated.

NOTE: The (right) wheel bearing must be seated firmly in the hub.

Bearing installation set PV-43515

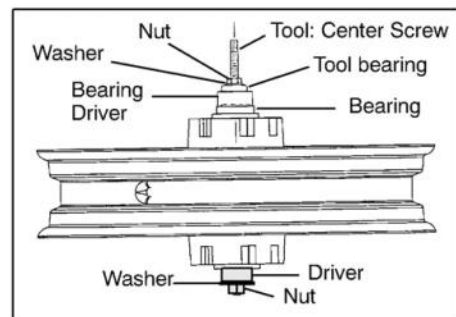
4. Turn wheel over, install bearing spacer. The spacer o-ring keeps spacer aligned with bearings to ease axle installation. The spacer can be installed in either direction.
5. Place new left wheel bearing onto wheel with markings facing up.
6. Install wheel bearing using the installation tool until fully seated against the spacer.
7. Clean brake disc with Victory Disc Brake Cleaner or an equivalent disc brake cleaner.

WARNING: Grease or oil on the brake disc will increase stopping distance and may result in loss of vehicle control.

NOTE: Install bearing cover if removed.

Front Wheel Bearing Installation Note:

Install right hand side bearing first - must be fully seated in hub.
Install left side bearing last, must be fully seated against spacer.



FRONT WHEEL & SUSPENSION

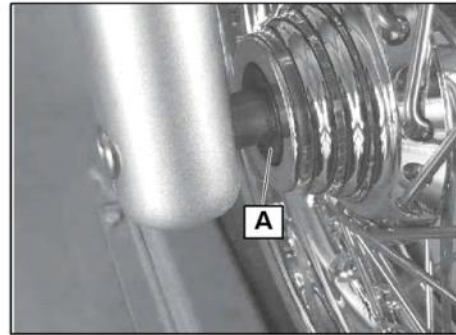
FRONT WHEEL INSTALLATION

1. Position wheel between fork legs.
2. Apply a thin film of grease onto the surface of the front axle.

Victory All Purpose Grease: 2872187

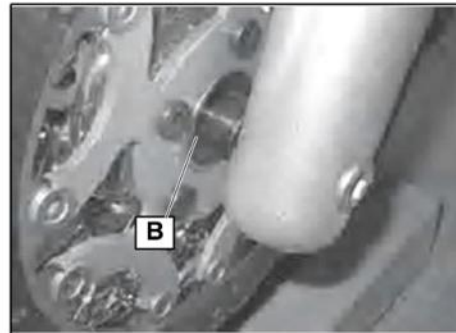
3. Align and place axle shaft from right side through fork tube and partially into right side axle spacer.

NOTE: The side of spacer (A) with the large diameter must face the wheel hub.



4. Slide axle shaft through wheel and insert left side spacer (B) with large diameter side facing wheel hub.

NOTE: If axle will not slide through the wheel hub, check bearing spacer alignment in hub and re-align if necessary, then insert axle.



5. Slide shaft completely through wheel, left side spacer, and into left fork leg.

6. Fully seat axle into fork.

7. Install axle bolt (C) into left end of axle. Hold right side of axle and torque axle bolt to specification found on page 12.6.



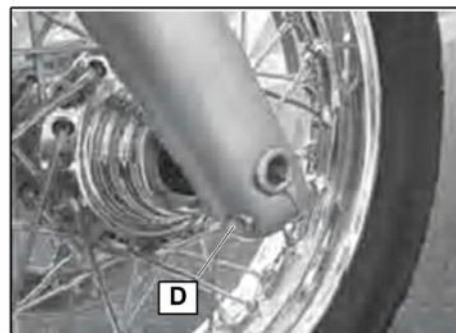
8. Install brake caliper(s) on fork leg(s) and torque to specification found on page 12.6.

9. Spin front wheel by hand and inspect for proper assembly.

10. Lower front of machine.

11. Apply front brake and push front end up and down several times. Fork action should be smooth without binding or excessive "stiction". If problems are found, inspect for cause and correct as necessary.

12. Torque axle pinch bolts (D) on bottom of each fork leg to specification found on page 12.3 or 12.4.



13. Operate front brake lever slowly until lever resistance is felt.

14. Inspect operation of front brake lever. Bleed front brake system if lever is not firm. (refer to ch 15)

12.14

FRONT FORK REMOVAL

1. Remove front wheel (refer to page 12.11).
2. Remove front fender. (III.1)

CAUTION: Carefully remove front fender taking care not to scratch it. Place fender in protected area until it is needed for assembly.

3. Remove front brake calipers and secure them to the motorcycle so they do not hang from the brake line or scratch the bike.

CAUTION: Do not allow caliper to hang from the brake hose. Secure brake caliper in such a way to keep stress off of brake hose.

4. Loosen upper triple clamp bolts on both forks. (Photo 1)
5. Loosen fork caps until o-ring is fully exposed, do not fully remove fork cap. (Photo 2)

WARNING

Failure to loosen upper triple clamp bolts before loosening fork caps will do irreparable damage to the fork caps.

6. If forks are to be disassembled, loosen damper rod bolts slightly at this time.

CAUTION: Do not remove fork damper rod bolts completely at this time. Only loosen them 1/2 to 1 turn.

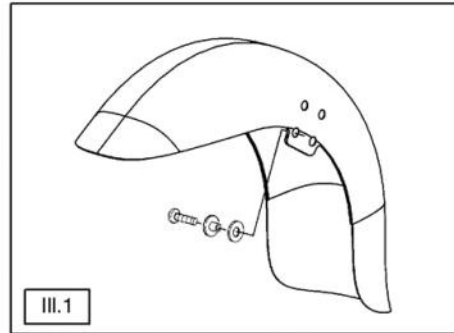
NOTE: Damper rod may spin and the bolt will not loosen. If the damper rod spins, do not continue to attempt to loosen the bolt. Proceed to Step 7.

7. Loosen lower triple clamp bolts. (Photo 3)

NOTE:

On Touring Cruiser Models, use service tool PV-46196 to spread pinch area of triple clamps enough to allow removal of fork tube. Follow instructions provided with the tool.

8. Remove forks from triple clamps.



Classic Cruiser Shown



Classic Cruiser Shown



Classic Cruiser Shown



FRONT WHEEL & SUSPENSION

FRONT FORK DISASSEMBLY

NOTE: Refer to Front Fork Exploded View on page 12.5.

1. Remove fork cap.

⚠ WARNING

The fork cap is under spring pressure. Apply firm downward pressure on fork cap and use extreme caution when removing the fork cap(s). Take care not to damage o-ring. Wear safety glasses and a face shield.

2. Remove spacer and fork spring.



3. Invert the fork over a drain pan. Pour out fork fluid by moving the fork through entire stroke several times.



4. Carefully pry up dust seal cap and remove.

5. Remove damper rod bolt and sealing washer.

NOTE: If the damper rod spins while attempting to remove the damper rod bolt, it will be necessary to install the damper rod holding tool into the top of the damper rod.

Damper rod holder PV-43517

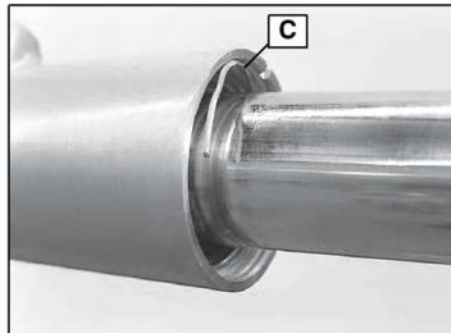
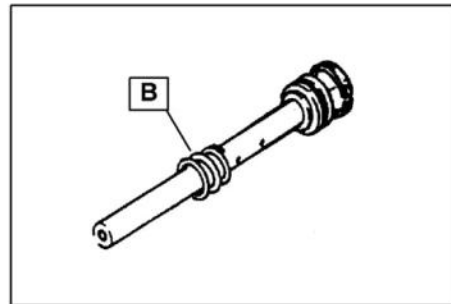
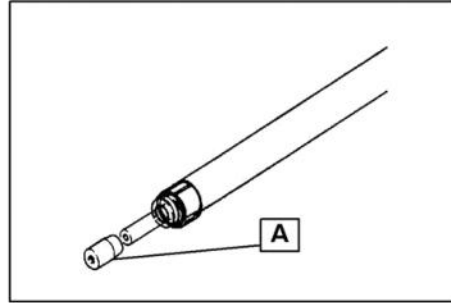
6. Pull the stanchion tube out of the slider.

NOTE: Resistance may be encountered because of the bushings; this is normal. Once forks are disassembled, fork seals will be damaged and must be replaced with new ones. It is also possible the disassembly process will damage the upper slider bushing and/or lower stanchion tube bushing. Inspect them carefully upon assembly and replace bushings if they fail inspection.



FRONT FORK DISASSEMBLY (cont.)

7. Remove foot valve (A) from bottom of damper rod.
8. Remove damper rod from stanchion tube along with top-out spring (B).
9. Remove wire seal retaining ring (C).
10. Protect the edge of the slider with a shop towel. Use a large, flat pry-bar to pry the fork seal out of the slider.
- CAUTION:** Work carefully around circumference of slider and pry seal out in small steps. Do not contact seal bore with tip of the pry bar or slider will be permanently damaged.
11. Remove seal cap (large flat washer under seal).

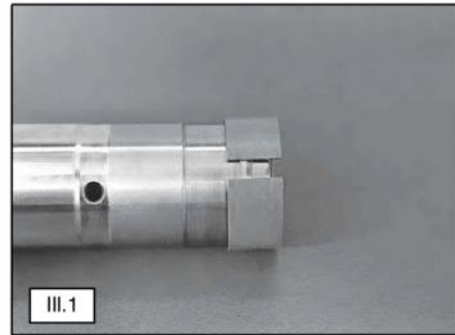


FRONT WHEEL & SUSPENSION

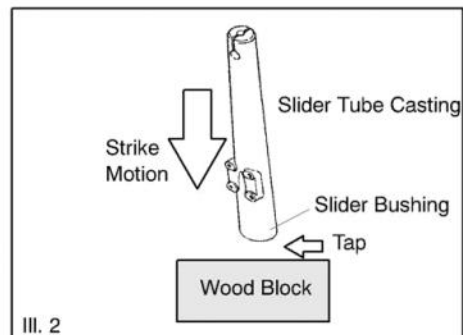
FRONT FORK DISASSEMBLY (cont.)

12. Spread stanchion tube bushing and remove it from stanchion tube. (III. 1)

NOTE: Do not remove the upper & lower bushings and the damper rod piston ring unless they are going to be replaced with new parts.



13. Remove slider bushing from lower casting by inverting slider and striking it squarely on a wood block as shown in III. 2. The impact will cause the bushing to come loose from the slider.



FRONT FORK INSPECTION

1. Measure fork spring free length and compare to specifications on page 12.1.
2. Inspect stanchion tube for scoring, indentations due to rocks or other road debris, excessive or abnormal wear. Very light scratches may be polished out, deeper scratches will damage the seal and upper bushing and may cause oil to leak past seals. Replace stanchion tube(s) if deep scratches or indentations are found.
3. Inspect slider for dents or other indentations due to rocks or other road debris. If damage is found on exterior of slider, insert stanchion tube into slider and move the stanchion tube throughout its complete stroke observing for binding at the indentation discovered. If binding is found, slider must be replaced.
4. Inspect foot valve for scoring, excessive or abnormal wear.
5. Inspect damper rod for scoring, excessive or abnormal wear.
6. Place stanchion tube in V-blocks and measure runout. Replace the stanchion tube if runout exceeds service limit listed on page 12.1.

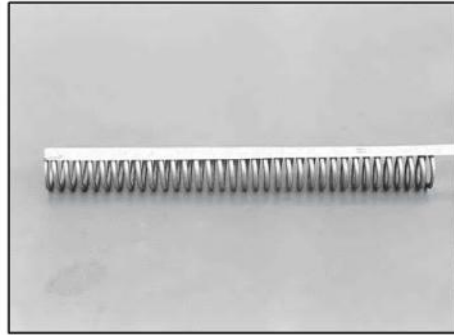
WARNING

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.

7. Visually inspect the slider bushing. Replace bushing if bronze material appears on more than 1/2 (50%) of the entire surface.
8. Visually inspect the lower stanchion bushing. Replace bushing if bronze material appears on more than 1/2 of the entire surface.
9. Inspect the seal cap (large washer under seal) for flatness. Replace the seal cup if it is warped or damaged.
10. Visually inspect the damper rod piston ring. Replace ring if scoring, deep scratches and/or abnormal or excessive wear is noted.

NOTE: Forks are usually disassembled to replace leaking fork seals. Carefully inspect the sealing surface of the seal you are replacing. Often times the surface of the seal will help determine the cause of the leak.

NOTE: .



FRONT WHEEL & SUSPENSION

FRONT FORK ASSEMBLY

1. Clean all parts thoroughly with clean solvent.
2. If upper and/or lower bushings were removed, carefully install new bushings.
3. Lubricate the outside of the upper bushing with a thin film of grease. Lightly squeeze the ends of bushing together and install into slider until fully seated.

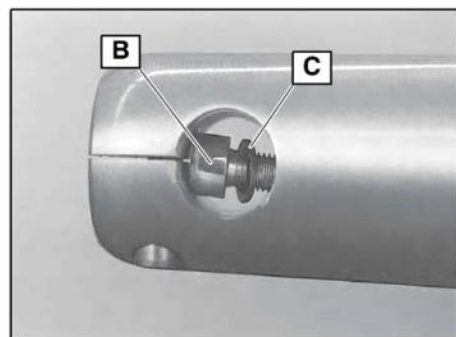
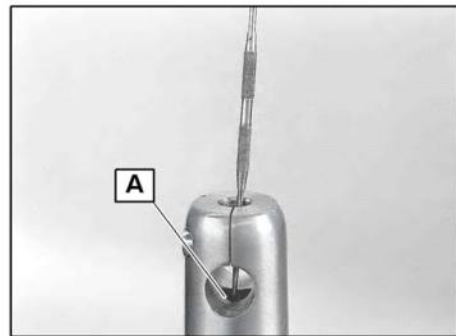
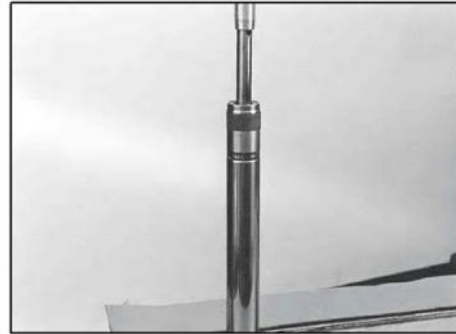
Victory All Purpose Grease: 2872187

4. Place a thin film of grease on the surface of damper rod piston ring.
5. Install damper rod assembly into stanchion tube.
6. Insert spring, preload spacer, and fork cap. Screw cap in until the o-ring just contacts stanchion tube. Spring, preload spacer, and fork cap will be removed and replaced later in this procedure.
7. Place stanchion tube upside down in a soft jaw vise. Do not apply excessive pressure to the tube with the vise or the tube will be damaged.
8. Place foot valve on damper rod.
9. Apply a thin film of grease to the upper and lower bushings.
10. Lower fork tube over stanchion tube.

NOTE: Resistance will be encountered due to the bushings. Twist the fork tube back and forth during the installation process.

11. Using a machinist's scribe or a similar tool, center the foot valve with the fork slider tube. When properly aligned, the damper rod threads will be aligned with the bolt hole in the slider.

12. Install damper rod bolt (B) and a new sealing washer(C). Torque damper rod bolt to specification on page 12.3 or 12.4 using damper rod holder (refer to page 1.12).



FRONT FORK ASSEMBLY (cont.)

13. Secure fork in upright position. Remove fork cap, spring spacer, and fork spring.
14. Gently lower stanchion tube until it bottoms in slider. The tube should slide freely in and out of the slider. If it binds, loosen damper rod screw about 2 turns, rotate tube and slider, and re-tighten. If tube still binds, inspect parts again as described in INSPECTION.
15. Lightly grease I.D. of new fork seal with light weight grease.
16. Install seal cap (large washer under seal).
17. Lightly oil O.D. of new fork seal with fork oil.
18. Place plastic wrap over stanchion tube and place seal over fork tube. This will prevent damage to the lip of the fork seal caused sliding it over the machined end of fork tube.
19. Lower seal until it is fully installed on tube.



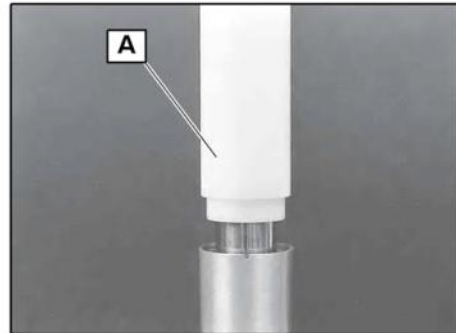
FRONT WHEEL & SUSPENSION

FRONT FORK ASSEMBLY (cont.)

20. Drive seal into the fork slider with fork seal driver (A) until fully seated (below stop ring groove).

Fork seal driver PV-43516

21. Install stop ring (B) into groove of fork tube. Make sure stop ring is properly seated into groove.
22. Pour specified fork oil amount into fork. Refer to page 12.1.
23. Move stanchion tube up and down several times to disperse oil and purge air.
24. Stand the fork tube upright for several minutes before continuing to purge air bubbles.
25. Slowly push the stanchion tube into the slider until completely down (at bottom of travel).
26. Insert fork oil level tool (C) into fork. Be sure fork leg is standing upright.
27. Remove or add oil until fork oil level meets specification listed on page 12.1. Keep tube upright.
28. Lightly grease the o-ring and seal lip inside the dust cap (D). Place assembly over stanchion tube and drive into place with seal driver.

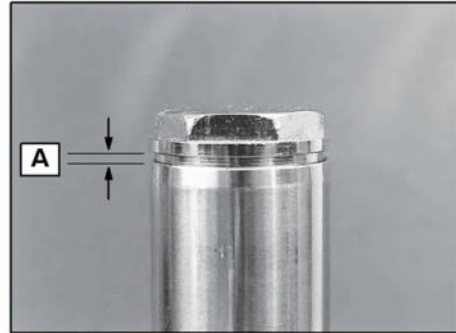


FRONT FORK ASSEMBLY (cont.)

29. Fully extend fork stanchion tube in slider.
30. Install fork spring and fork spring preload spacer.
31. Lightly oil the fork cap o-ring.
32. Install cap until o-ring just touches the stanchion tube as shown. This will leave a gap at (A).

CAUTION:

Do not tighten fork cap at this time. Make sure a 1mm gap exists between the fork cap and stanchion tube. Failure to do so can cause damage to the fork assembly and difficulty during installation.

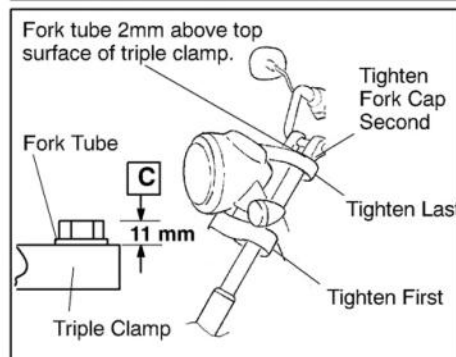
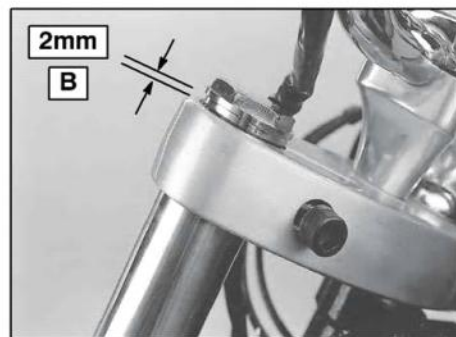


FRONT FORK INSTALLATION

NOTE: On TC Models, use service tool PV-46196 to spread pinch area of triple clamps to allow installation of fork tube. Follow instructions provided with tool.

NOTE: Torque fasteners and components to specification found on page 12.3 (STD., DLX, & Classic Cruiser, or page 12.4 (Touring Cruiser).

1. Install fork tube assembly into triple clamp.
2. Align top edge of *stanchion tube* with top surface of upper triple clamp, then raise the tube 2mm (B).
3. Torque lower triple clamp pinch bolts to specification.
4. Torque fork tube cap to specification. After tightening cap the top of the nut should be 11mm above the top surface of the upper triple clamp shown at (C) in Ill. 1.
5. Torque upper triple clamp pinch bolts to specification.
6. Install front fender. Torque bolts to specification.
7. Install front wheel (refer to page 12.14).
8. Install front brake calipers. (refer to Chapter 15)
9. Inspect all bolts for proper torque. Inspect hoses and wiring for proper routing.



FRONT WHEEL & SUSPENSION

TRIPLE CLAMP REMOVAL

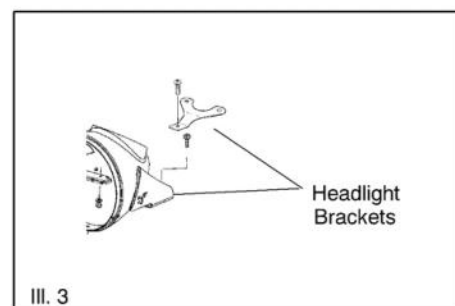
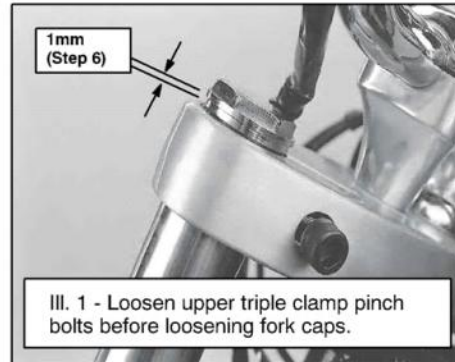
NOTE: Classic shown. Remove windshield and mounting hardware on Touring or if equipped with accessory.

1. Elevate front of machine so that front wheel can be removed. Support machine securely in an upright position.
2. Remove fuel tank (see page 5.8) and front wheel (page 12.11).
3. Remove front fender from motorcycle carefully to avoid damage to fender finish.
4. Remove brake calipers from forks. Remove brake line manifold from triple clamp. Secure calipers and manifold out of the way so that fork tubes can be removed.

CAUTION:

Do not hang calipers by brake lines.

5. Loosen right and left side upper triple clamp fork pinch bolts. (III.1)
6. Loosen fork caps until a 1mm gap exists between fork cap and stanchion tube. (III.1)
7. Remove lower handlebar clamp (riser) to triple clamp bolts. The riser bolts also hold the headlight stiffener bracket to the triple clamp. The controls can stay mounted to the handlebars. Secure the handlebars so the fuel tank or other parts of the bike are not damaged.
8. Loosen upper triple clamp center bolt. (III. 2)
9. Loosen lower fork pinch bolts.
10. Remove forks tube assemblies from triple clamps.
11. Remove bolts securing headlight assembly brackets to the triple clamps. Detach headlight assembly from clamps. Complete removal of headlight is not necessary. (III. 3)
12. Remove upper triple clamp center bolt. Remove upper triple clamp. (III. 2)



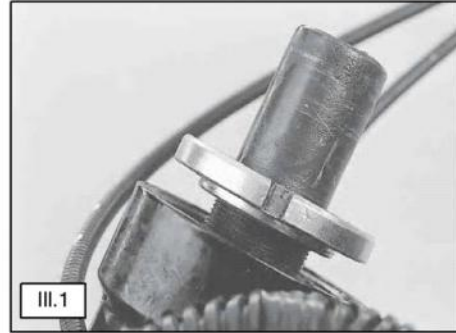
TRIPLE CLAMP REMOVAL (cont.)

13. Remove steering bearing lock nut and adjustment nut.
(III. 1)

Steering stem bearing adjustment socket PV-43508

14. Push lower triple clamp and stem down and out of steering neck of frame.
15. Remove upper bearing element.
16. Inspect outer bearing races for indentations, corrosion, cracks or abnormal wear.
17. Inspect bearing elements for corrosion, broken or cracked cages, deformed roller elements or any abnormal wear.

NOTE: Replace bearing and race as set as needed.



OUTER RACE REMOVAL

1. Insert long drift punch through top of steering neck. Place drift punch into recess of steering neck and drive out lower bearing race.

NOTE: Working end of drift punch must be dressed so the edges are square. The diameter of the working end of the punch must also be of the correct size so that it will fit into the recess provided.

2. Insert punch from bottom of steering neck and repeat above procedure to remove upper race.



LOWER STEERING STEM BEARING REMOVAL

Lower Steering Stem Bearing Removal Tool PV-44683

1. Remove triple clamp from frame. Mask the top cosmetic surface of the triple clamp to protect it from possible damage.



FRONT WHEEL & SUSPENSION

LOWER STEERING STEM BEARING REMOVAL (cont.)

2. Remove lower bearing cage and rollers. Use a cold chisel to cut through the cage. Then use a pliers to remove the cage.

CAUTION:

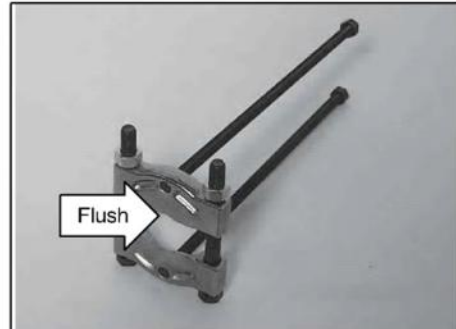
Use care not to damage steering stem bearing surface during bearing removal process. Mask the triple clamp top cosmetic surface to protect it from possible damage.



3. Install the two long bolts into the bearing collar. The two long bolts should be threaded into the bearing collar approximately 8 turns each or until flush with the bottom of the tapped hole.

CAUTION:

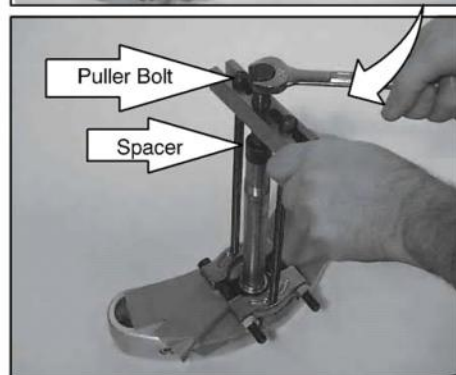
Do not turn the long bolts in too far or the lower triple clamp finish may be damaged.



4. Install bearing collar onto the lower bearing inner race. The knife edge of the bearing collar must catch under the inner race top lip. Torque the bearing collar nuts to 10 lb-ft.



5. Place the spacer and puller bracket on top of the steering stem.
6. Install puller bolt and turn clockwise to remove bearing race from steering stem. Hold the puller bracket to prevent it from turning and bending the long bolts.



12.26

STEERING STEM BEARING INSTALLATION

1. Thoroughly grease new bearing (grease both upper and lower bearings at this time), ensure that a thin film of grease completely covers all bearing elements.

Victory All Purpose Grease: 2872187

2. Install lower bearing over steering stem (tapered end up).
3. Place bearing driver over stem. Place lower triple clamp, with bearing driver, into hydraulic press. Press lower bearing down until it seats (A).

CAUTION:

Make sure that the bearing driver used only contacts the inner race of the bearing.

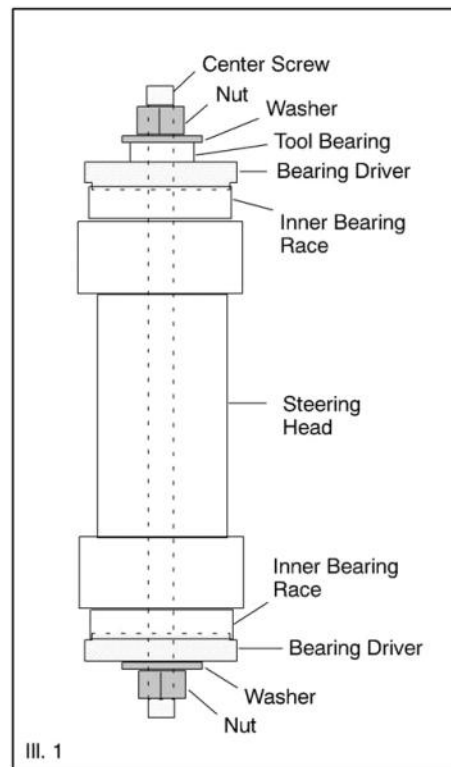
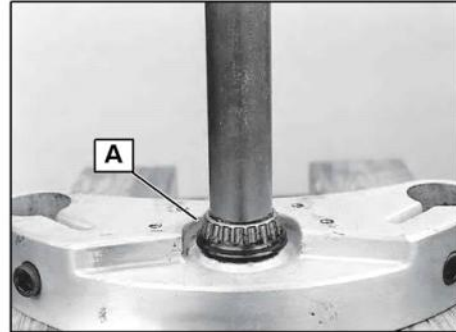
4. Grease inner and outer surfaces of outer bearing races.
5. Load lower bearing race onto special tool. (Ill. 1)
6. Insert tool from bottom of steering neck. (Ill. 1)
7. Place upper bearing race onto steering neck. (Ill. 1)
8. Assemble tool. Make sure that threads, washer, and bearing of tool are greased with the grease supplied with the tool. (Ill. 1)

Steering head bearing installation tool PV-43515

CAUTION:

Make sure that the bearings are started straight into the steering neck.

9. Tighten tool to draw bearing races into steering neck.



FRONT WHEEL & SUSPENSION

STEERING HEAD BEARING ADJUSTMENT

1. Make sure that both upper and lower bearing races are thoroughly greased.
2. Insert lower triple clamp from bottom of steering neck.
3. Install upper bearing while holding the lower triple clamp assembly.

NOTE: Upper bearing is not a press fit on steering stem, but may be a tight fit. If necessary, tap lightly on inner race to seat the bearing.

4. Install bearing preload adjustment nut (A) on to steering stem.

NOTE: Stepped side of nut faces bearing.

5. Torque nut initially to 39 Nm (29 lb-ft) (B).

Steering stem bearing adjustment socket PV-43508

6. Turn triple clamp assembly lock-to-lock 5 times.
7. Loosen bearing preload adjustment nut 1/2 to 1 turn. Torque nut to specification listed below.

TORQUE: Steering Stem Adjustment Nut
(Refer to Procedure Above)

Final Torque: 20 Nm (15 lb-ft)

8. Turn triple clamp assembly lock-to-lock several times.
9. Repeat steps 5, 6, 7, and 8 until triple clamp assembly turns with equal resistance in all positions.

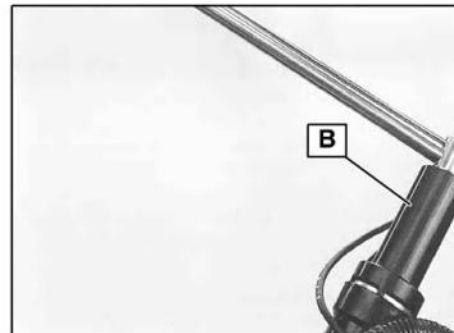
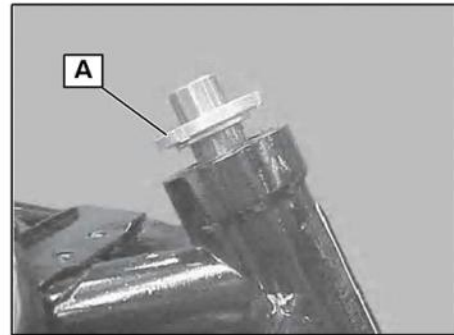
10. Install steering stem jam nut with inner groove on jam nut facing down (Classic) or stepped side facing down (Touring Cruiser).

11. Hold pre-load nut (C) with spanner wrench and torque lock nut to specification.

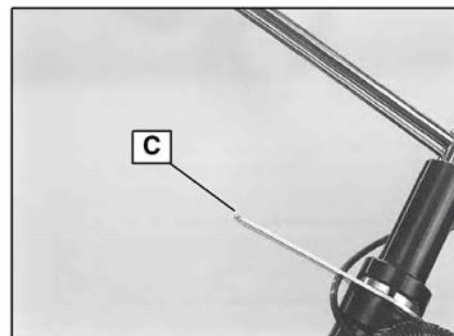
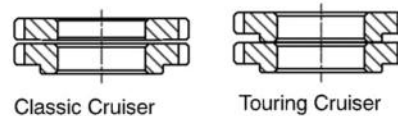
TORQUE: Steering stem jam nut

39 Nm (29 lb-ft)

Steering stem bearing spanner wrench PV-43509



Steering Stem Jam Nut

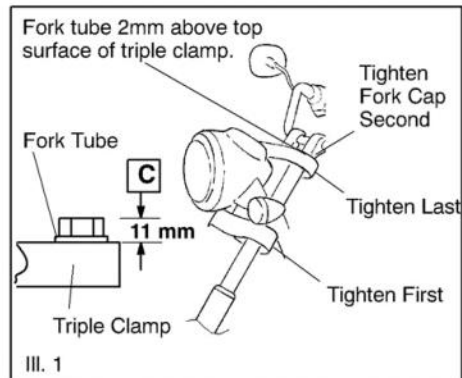
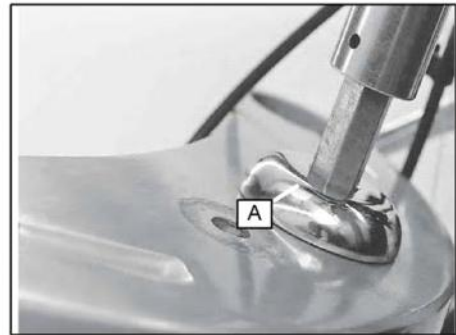
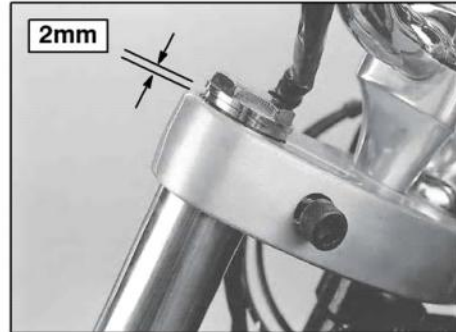


TRIPLE CLAMP ASSEMBLY

12. Place upper triple clamp over steering stem and loosely install steering stem bolt.
13. Clean fork tubes and inside of fork tube holes in triple clamp to prevent scratches and ensure proper clamping force.

NOTE: On Touring Cruiser Models, use service tool PV-46196 to spread pinch area of triple clamps enough to allow installation of fork tube. Follow instructions provided with the tool.

14. Install fork tube assembly through lower triple clamp and then into the upper triple clamp. Be sure cables and wiring are routed properly.
15. Align top edge of stanchion tube with top surface of upper triple clamp, then raise the tube 2mm.
16. Torque lower triple clamp pinch bolts to specification found on page 12.3 (Classic Cruiser) or page 12.4 (Touring Cruiser)..
17. Torque steering stem center bolt to specification on page 12.3 (Classic Cruiser) or page 12.4 (Touring Cruiser).
18. Torque fork cap to specification found on page 12.3 (Classic Cruiser) or page 12.4 (Touring Cruiser). After tightening cap the top of the nut should be 11mm above the top surface of the upper triple clamp as shown at (C) in Ill. 1 below right.
19. Torque upper triple clamp pinch bolts to specification found on page 12.3 (Classic Cruiser) or page 12.4 (Touring Cruiser).



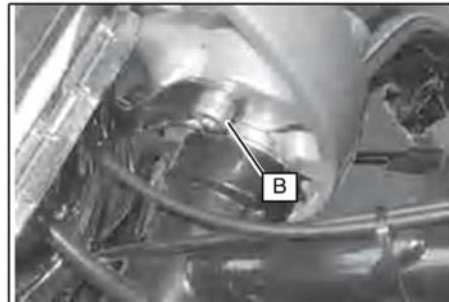
FRONT WHEEL & SUSPENSION

TRIPLE CLAMP ASSEMBLY (cont.)

20. Install lower headlight bracket attachment bolts (A and upper bracket bolts (B). Torque to 27 Nm (20 lb-ft)



21. Install handlebars, refer to page 12.7
22. Install front fender. Torque bolts to specification listed on page 12.3 or 12.4.



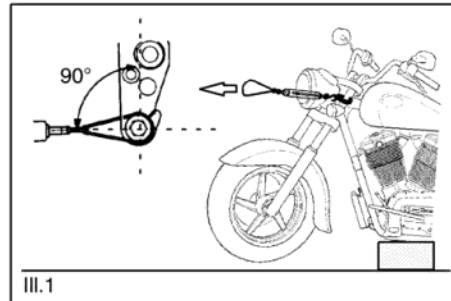
23. Install front wheel (Refer to page 12.14).
24. Install front brake calipers. (Refer to Chapter 15)
25. Pump brake lever several times to make sure brakes function correctly. Bleed brakes if necessary. (refer to ch 15)
26. Inspect all bolts for proper torque. Inspect hoses and wiring for proper routing.
27. Install windshield hardware and windshield (where applicable (refer to Chapter 3.)
28. Lower front of machine.



12.30

STEERING BEARING INSPECTION

1. Raise the front end of the machine until the tire is 1 inch off the floor or machine lift.
2. Ensure that cables and wire harness are properly routed and cannot bind the action of the handlebars when they are turned.
3. Position the front wheel straight ahead and attach a spring scale to the left fork tube cap as shown in III. 1.
4. Read the spring scale when the handlebar just begins to move. Repeat the procedure for the left side of the handlebar.



Specification: Initial force 11-18 oz

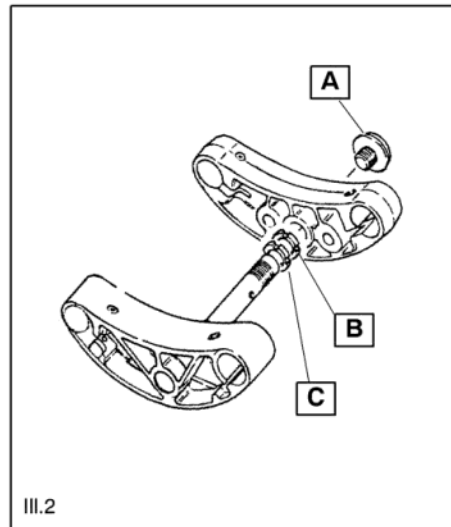
5. If the initial force required to start handlebar movement is too loose or too tight, further adjustment is necessary.

STEERING BEARING PRELOAD MEASUREMENT

1. Remove handlebars from triple clamp. The controls can remain mounted to handlebars. Secure bars so fuel tank or other parts of the bike are not damaged.
2. Loosen upper triple clamp fork pinch bolts.
3. Loosen fork caps until a gap of 1mm exists.
4. Remove upper triple clamp retaining bolt (A), and remove upper triple clamp.
5. Loosen steering bearing locknut (B).
6. Make adjustments in small increments when loosening or tightening the adjustment nut (C).

NOTE: Follow seating procedure outlined on page 12.28 if new bearings were installed.

7. Torque steering bearing locknut, triple clamp retaining bolt, fork caps and upper triple clamp fork pinch bolts to specifications. Refer to page 12.3 (Classic) or page 12.4 (Touring).
8. Replace handlebars. Refer to page 12.3 (Classic) or page 12.4 (Touring).
9. Recheck the initial force to initiate front fork movement. If the force is found within the specified range, adjustment is complete.
10. Lower machine, check operation of front brakes. If brake bleeding is necessary, refer to chapter 15.



FRONT WHEEL & SUSPENSION

TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | REPAIR RECOMMENDED |
|------------------------------------|---|----------------------------------|
| Heavy Steering | Steering Stem Nut Over Tightened | Torque to specification |
| | Damaged Steering Stem Bearings or Races | Replace |
| | Bent Steering Stem | Replace |
| | Front Tire Damaged or Worn Excessively | Replace |
| | Low Tire Pressure | Inflate to specification |
| Pulls to One Side or Wanders | Rear Wheel Not Aligned Correctly | Align |
| | Low Tire Pressure | Inflate to specification |
| | Damaged or Excessively Worn Front Tire / Incorrect Tire | Replace |
| | Damaged Wheel Bearings | Replace |
| | Damaged Swing Arm Bearings | Replace |
| | Loose Swing Arm Pivot Nut | Torque to specification |
| | Steering Stem Nut Over Tightened or Under Tightened | Torque to specification |
| | Damaged Steering Stem Bearings or Races | Replace |
| | Bent Front Axle | Replace |
| | Bent Frame | Replace |
| Handlebars Oscillate (Wobble) | Rear Wheel Not Aligned Correctly | Align |
| | Incorrect Tire Pressure | Correct |
| | Tire Mounted Incorrectly | Check Mounting and Balance |
| | Damaged Tire / Worn Tire | Replace |
| | Loose Steering Stem Nut | Torque to specification |
| | Incorrect Tire | Replace |
| | Bent Front Axle | Replace |
| Noise Coming From Front Suspension | Worn Fork Bushings | Rebuild Forks |
| | Low Fork Fluid | Determine Cause/Replace Fork Oil |
| | Loose Fasteners | Torque to specification |
| | Loose/tight Steering Stem Bearings | Determine Cause/Correct |

FRONT WHEEL & SUSPENSION

| | | |
|----------------------------------|--|--------------------------|
| 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 |
| | Right and Left Fork Not Installed at Same Height | Set Correctly |
| | Right and Left Fork Have Different Fork Oil Levels | Set Correctly |
| | Fork Spring Free Length Different Between Right & Left | Replace |
| | Wheel Assembly Out-of-Balance | Balance |
| | Low Tire Pressure | Inflate to specification |

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 |
| | Wrong Weight Fork Oil | Replace |
| | Too Much Fork Oil | Set Correctly |
| | Plugged Oil Passages | Rebuild Front Forks |
| | Damaged Sliders | 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 |

CHAPTER 13

REAR WHEEL & SUSPENSION

| | |
|--|-------|
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13

REAR WHEEL & SUSPENSION

GENERAL

WARNING

This motorcycle was produced with the designated tires as original equipment. The testing to ensure stability and superior handling was done using the OEM tires. Using non-OEM tires could result in poor motorcycle stability and handling, which can lead to a crash resulting in serious injury or death. Use only the recommended tires inflated to the recommended tire pressures.

Tubeless tires are used on certain Victory 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 Victory parts or equivalent so that quality is not compromised. The use of tire valves and valve cores other than original equipment replacement Victory 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.

- Refer to Chapter 3 for removal of seat, side cover, fender, and exhaust.
- Refer to Chapter 2 for maintenance of rear wheel & rear suspension components.
- Refer to Chapter 15 for brake system service and repairs.
- Refer to Chapter 14 for tire removal, repair, balancing, and spoke wheel truing.

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

SPECIFICATIONS - REAR WHEEL AND SUSPENSION

| REAR WHEEL & SUSPENSION | | | |
|---|--------|----------------------------------|-----------------------|
| Item | | Standard | Service Limit |
| Axle Runout | | - | .20 mm (.008") |
| Rear Wheel Runout (Cast Wheels) | Axial | .25mm (.010 inch) | 2.0 mm (.080") |
| | Radial | .25mm (.010 inch) | 2.0 mm (.080") |
| Rear Wheel (Rim) Runout (Laced Wheels) | Axial | 1.0mm (.040 inch) | 2.0 mm (.080") |
| | Radial | .8mm (.032 inch) | 2.0 mm (.080") |
| Shock Spring Free Length - All Models | | 203 mm (7.99") | 193 mm (7.60") |
| Shock Spring Installed Length - Classic Cruiser | | 194 mm (7.64") | -- |
| Shock Spring Installed Length - Touring Cruiser | | 192 mm (7.56") | -- |
| Swing Arm Pivot Shaft Runout | | Not Applicable | .20 mm (.008") |
| Swing Arm Pivot Shaft O.D. | | 16.20 -16.25 mm (.638 - .640") | 16.08 mm (.633") |
| Swing Arm Bushing Sleeve O.D. | | 29.95 mm - 30.00 mm | 29.83 mm (1.1744") |
| Swing Arm Bushing Sleeve I.D. | | 16.25 mm - 16.50 mm | 16.62 mm (0.6543") |
| Swing Arm Bushing I.D. | | 30.035 mm - 30.099 mm | 30.22 mm (1.1897") |
| Swing Arm Bushing O.D. | | 38.035 mm - 38.060 mm | 37.195 mm (1.4927") |

REAR WHEEL & SUSPENSION

SPECIFICATIONS - TIRES, WHEELS, AND SUSPENSION

| 2002 | | | | | |
|-----------------------|----------------------|------------------------------|--|------------------------------|--|
| T I R E S | | V92C | V92C Deluxe | V92TC | V92TC Deluxe |
| | Rear Wheel | Cast 5 spoke 16" x 3" | Laced 40 Spoke 16 x 3.5 in | Cast 5 spoke 16" x 3" | Laced 40 Spoke 16 x 3.5 in |
| | Rear Tire | Dunlop D417 160/80 B1675H | Dunlop D417 160/80 B16 75H (use with inner tube) | Dunlop D417 160/80 B1675H | Dunlop D417 160/80 B16 75H (use with inner tube) |
| | Minimum Tread Depth | .063 in. (1.6mm) | .063 in. (1.6mm) | .063 in. (1.6mm) | .063 in. (1.6mm) |
| S U S P | Rear Type | Single-Shock | Single-Shock | Single-Shock | Single-Shock |
| | Rear Travel (inches) | 4 in (10 cm) | 4 in (10 cm) | 4 in (10 cm) | 4 in (10 cm) |

| 2003 | | | |
|-----------------------|----------------------|------------------------------------|------------------------------------|
| T I R E S | | Classic Cruiser | Touring Cruiser |
| | Front Wheel | Cast 5 Spoke or Laced 16" x 3" | Cast 5 Spoke or Laced 16" x 3" |
| | Rear Wheel | Cast 5 Spoke or Laced 16" x 3" | Cast 5 Spoke or Laced 16" x 3" |
| | Front Tire | Dunlop 491 Elite II MT90B16 71H | Dunlop 491 Elite II MT90B16 71H |
| | Rear Tire | Dunlop D417 160/80B16 75H | Dunlop D417 160/80B16 75H |
| | Minimum Tread Depth | .063 in. (1.6mm) | .063 in. (1.6mm) |
| S U S P | Rear Type | Single-Shock FOX Gas | Single-Shock FOX Gas |
| | Rear Travel (inches) | 4 in (10 cm) | 4 in (10 cm) |
| | Shock Absorber Data | Refer to page 13.16. | Refer to page 13.17. |

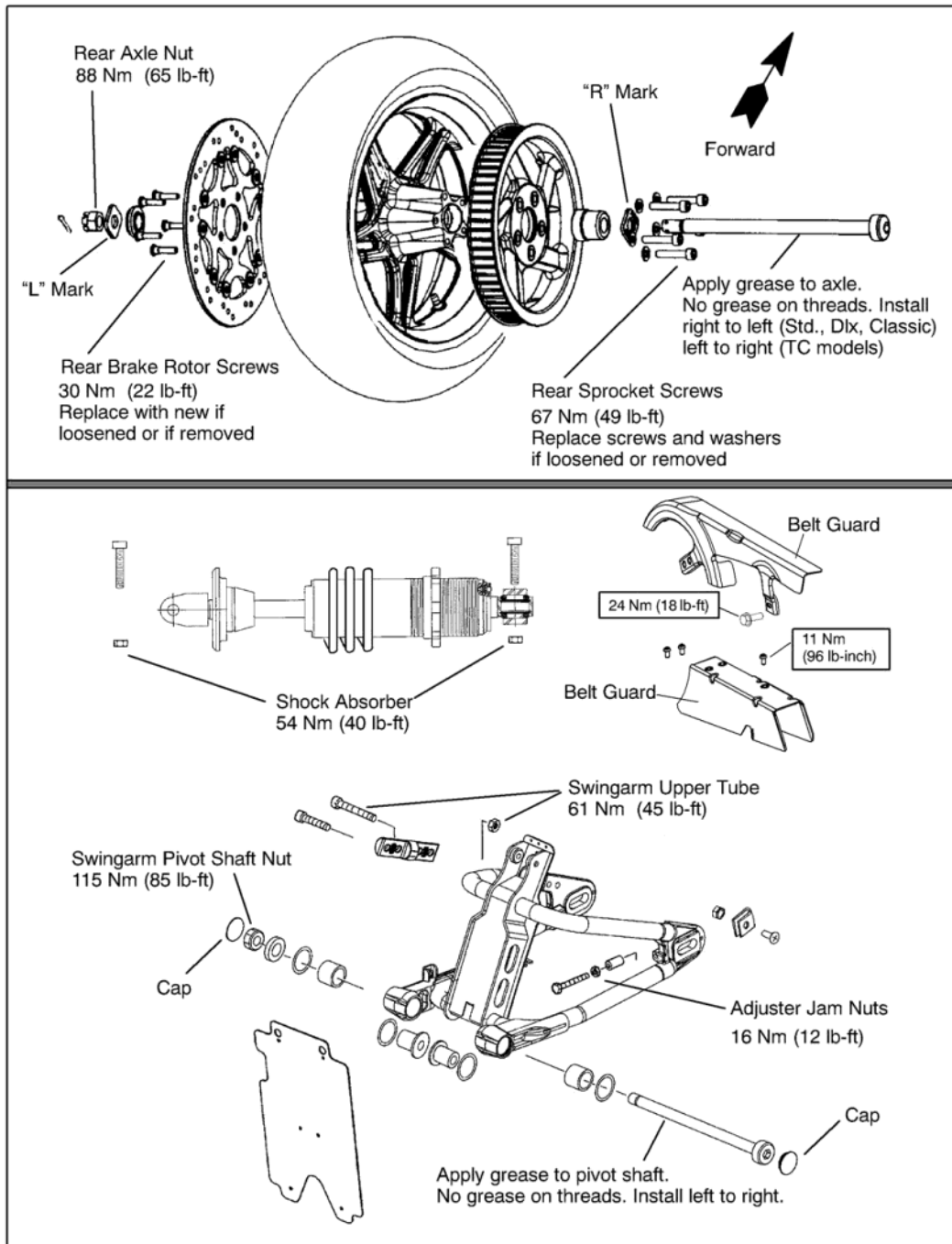
| 2004 | | | |
|-----------------------|----------------------|------------------------------------|--|
| T I R E S | | Touring Cruiser | |
| | Front Wheel | Cast 5 Spoke or Laced 16" x 3" | |
| | Rear Wheel | Cast 5 Spoke or Laced 16" x 3" | |
| | Front Tire | Dunlop 491 Elite II MT90B16 71H | CRUISEMAX Whitewall (U.S / U.K. Only) 130/90 16 67H |
| | Rear Tire | Dunlop D417 160/80B16 75H | CRUISEMAX Whitewall (U.S / U.K. Only) 150/80 B16 71H |
| | Minimum Tread Depth | .063 in. (1.6mm) | |
| S U S P | Rear Type | Single Gas Shock | |
| | Rear Travel (inches) | 4 in (10 cm) | |
| | Shock Absorber Data | Sealed Unit - Not Re-buildable | |

13.2

REAR WHEEL & SUSPENSION

REAR WHEEL / SUSPENSION FASTENER TORQUES

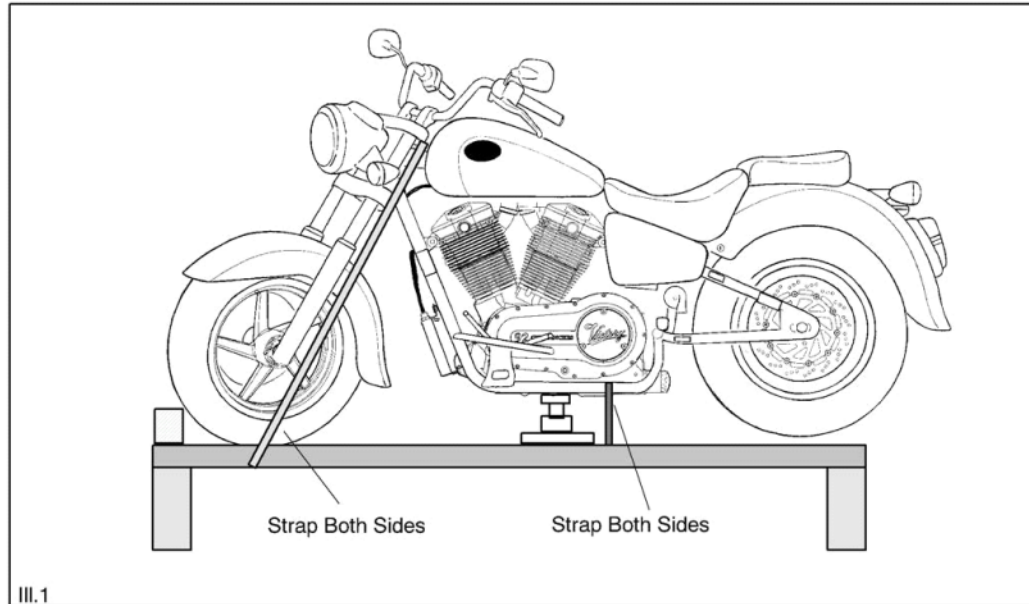
Refer to the illustrations below for fastener torque and locking agent.



13.3

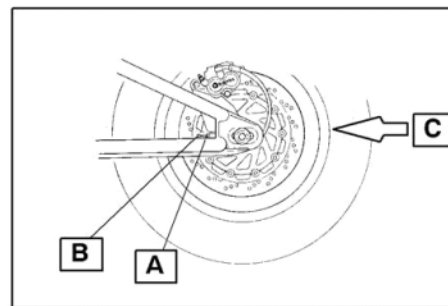
REAR WHEEL & SUSPENSION

REAR WHEEL REMOVAL



CAUTION: 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. This reduces the possibility of personal injury or damage to the motorcycle.

1. Elevate rear tire approximately 6". Make sure motorcycle is safely secured. (III. 1)
2. Remove RH muffler (refer to page 3.6 (Classic) or page 3.7 (Touring Cruiser).
3. Remove rear axle cotter pin and loosen rear axle nut. Do not reuse cotter pins.
4. Loosen belt adjuster bolt jam nuts (A) on each side of the motorcycle.
5. Completely loosen rear wheel adjustment bolts (B) on each side and slide rear wheel all the way forward (C). Move the drive belt out of the way so the wheel can be removed.



REAR WHEEL REMOVAL (cont.)

6. Lift up slightly on rear wheel and remove rear axle.

NOTE: Observe location and orientation of wheel spacers so they can be put back in the same location. The brake caliper will come loose from the mount when the axle is removed.

7. Lower rear wheel and remove from swing arm.
8. Secure brake caliper to swing arm with tie strap.

CAUTION:

Do not hang rear brake caliper brake line or twist the brake line or damage may result.

9. Remove rear wheel assembly from motorcycle.

NOTE: Do not apply rear brake pedal once the brake caliper has been removed.

REAR AXLE INSPECTION

1. Install rear axle in V-blocks and measure runout. Compare to service limit on page 13.1.



REAR WHEEL INSPECTION

NOTE: Wheel bearings must be in good condition for this inspection to be valid.

1. Set up a dial indicator to measure axial and radial runout of the wheel. Refer to page 14.7 for procedure. Compare measurements to service limit listed on page 13.1.
2. Visually inspect wheel for cracks or other damage.
3. Replace wheel if it fails visual or measured inspection.

NOTE: REFER TO PAGE 14.15 FOR SPOKE WHEEL LACING INFORMATION

REAR WHEEL & SUSPENSION

REAR WHEEL BEARING INSPECTION

NOTE: Bearings are not serviceable. Replace wheel bearings as a set if any one fails inspection.

1. Visually inspect integral bearing seal for damage.
2. Inspect bearing fit in wheel hub. The outer race of the bearing must fit tightly into the bore. You should not be able to move outer race by hand.

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.

3. Replace wheel bearings as a set if any one fails inspection.

WHEEL BEARING REMOVAL

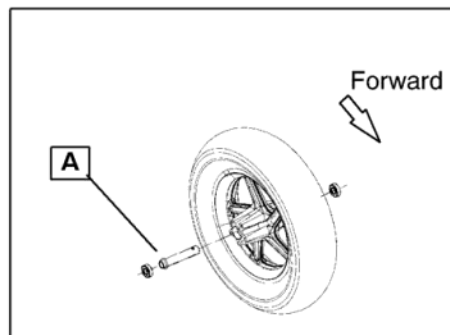
CAUTION

Do not reuse bearings that have been removed.

1. Take precautions to prevent damage to brake disc.
2. Install bearing remover element into bearing.

Blind bearing remover PV-43523

3. Remove bearing.
4. Remove bearing spacer with o-ring from wheel hub. Note o-ring (A) position on spacer.
5. Use an appropriate drift and drive out remaining bearing.



WHEEL BEARING INSTALLATION

CAUTION

Use appropriate wooden blocking to prevent damage to brake disc and/or driven sprocket when installing wheel bearings.

1. Clean inside of wheel hub and bearing spacer.
2. Place new bearing onto disc side of wheel with markings facing up.
3. Install wheel bearing installation tool. Install wheel bearing until fully seated in the hub.

Rear Wheel Bearing Installation Note:

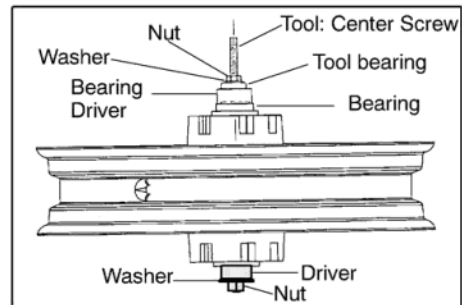
Install disc side bearing first - must be fully seated in hub.
Then install right side bearing; must be fully seated against spacer.

Wheel Bearing Installation Set PV-43515

4. Turn wheel over, install bearing spacer.

NOTE: The o-ring on the spacer is used to hold the spacer in line with the bearings to allow axle installation. It may be helpful to position the o-ring near the center of the spacer.

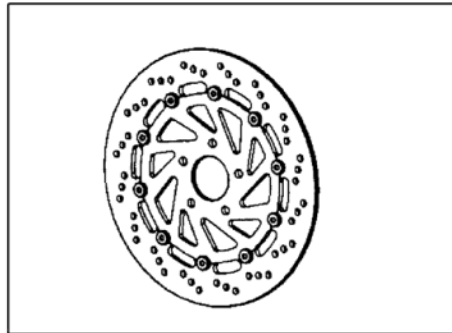
5. Place new bearing on sprocket side of wheel with markings facing up.
6. Install wheel bearing installation tool. Install bearing until seated against spacer.



7. Clean brake disk with commercially available Disk Brake Cleaner.

⚠ WARNING

Grease or oil on the brake disc will increase stopping distance which may lead to loss of vehicle control or an accident. Clean brake disc with brake cleaner and replace pads if oil is present.



REAR WHEEL & SUSPENSION

BRAKE DISC REMOVAL

1. Remove rear wheel.
2. Position wheel with brake disc facing up. Support wheel so as not to damage belt sprocket.
3. Remove and discard brake disc bolts. Do not reuse brake disc bolts.
4. Remove brake disc from wheel.

REFER TO ILLUSTRATION ON PAGE
FOR TORQUE SPECIFICATIONS.
REPLACE ALL BRAKE DISC AND
SPROCKET FASTENERS IF LOOS-
ENED OR REMOVED

BRAKE DISC INSTALLATION

1. Clean bolt hole threads with Loctite Primer N.
2. Clean mating surfaces of disc and hub.
3. Replace bolts with new bolts that have pre-applied locking agent.
4. Install brake disc with part number to outside. Install new brake disc bolts and torque to specification listed on page 13.3. Do not re-use brake disc bolts.
5. Install rear wheel.

REAR SPROCKET REMOVAL

1. Securely support rear of motorcycle off floor.
2. Remove rear wheel (page 13.4)
3. Remove sprocket screws and washers and discard. Do not reuse sprocket bolts or washers.
4. Remove rear sprocket from wheel.

CAUTION:

While working on the rear sprocket or wheel repair, take necessary steps to protect brake disc surface. Replace brake disc if damaged.

REAR SPROCKET INSTALLATION

1. Install rear sprocket onto wheel. Refer to page 11.8 for procedure.

REAR WHEEL INSTALLATION

1. Apply a thin film of grease to axle surface.
2. Insert wheel assembly from left side of motorcycle.
3. Install belt around rear sprocket.
4. Center wheel in swing arm and place belt over tab of belt guard.

Victory All Purpose Grease: 2872187

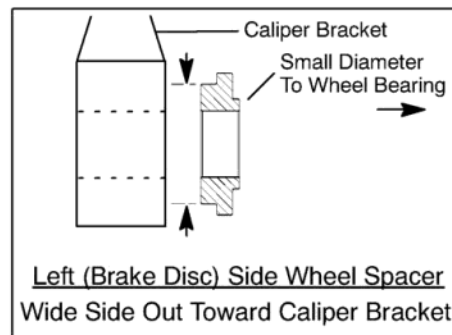
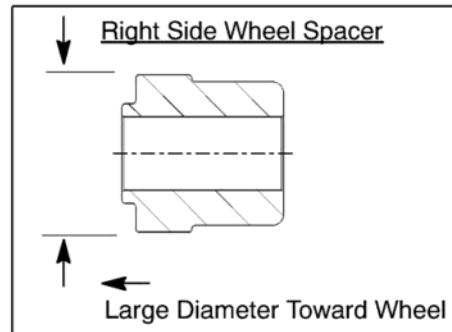
5. Apply grease to rear axle and inner portion of right side wheel spacer to hold it in place on the wheel bearing.

NOTE: Large diameter of spacer faces wheel bearing.

6. Install right side indicator washer on axle.

NOTE: An "R" is stamped on outside surface.

7. Start axle through right hand side of swing arm, through RH spacer and into wheel. Push axle in until 1/2" of axle is exposed on left side of wheel assembly. If the bearing spacer has shifted position inside the hub, it may be difficult to insert axle. Align spacer with bearings to allow axle to slide through wheel.
8. Install left side axle spacers with small diameter of shouldered inner spacer against wheel bearing (large surface toward brake caliper bracket).
9. Engage slot of rear brake caliper bracket with lug on swingarm.
10. Lift wheel and guide brake disc between brake pads and push axle through until seated.
11. Install left side indicator washer on axle.
12. Install axle nut. Tighten nut until it seats and back off 1/2 turn.
13. Adjust belt tension (refer to page 2.26).
14. Inspect wheel alignment (refer to page 2.28).
15. Torque rear axle nut to specification listed on page 13.3.
16. Install new rear axle nut cotter key.
17. Apply rear brake pedal 2-3 times to position brake pads. If brake bleeding is necessary, refer to Ch 15.
18. Turn rear wheel by hand and inspect for proper rotation without binding.
19. Install muffler. Refer to page NO TAG for Classic and page 3.7 for Touring Cruiser.



REAR WHEEL & SUSPENSION

SHOCK ABSORBER REMOVAL

CAUTION: Shock absorber removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear tire is off the ground. This reduces the possibility of personal injury or damage to the motorcycle.

NOTE: Note positioning of O-rings and spacers on shock mounting eyes.

1. Remove seat, and right and left frame side covers. (refer to chap. 3).
2. Elevate rear of machine slightly (1/2"-1"). Ensure motorcycle is secured in a safe manner.
3. Remove nuts from front and rear shock mount bolts.

NOTE: FRONT SHOCK MOUNT:

Note position of the spacers/reducers used in the front mount, along with an o-ring on the top reducer. Be sure to replace them in the same location during assembly.

NOTE: REAR SHOCK MOUNT:

Note position of the spacers/reducers used in the rear mount. The rear mount has an O-ring positioned on each one. Be sure to replace them in the same location during assembly.

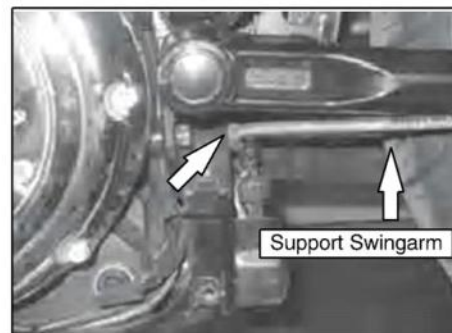
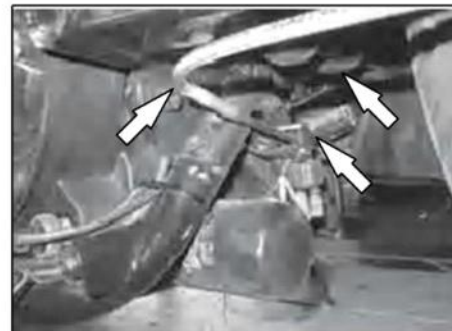
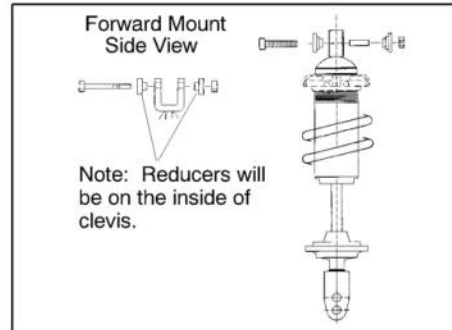
4. Lift rear wheel slightly to remove tension from shock mounting bolts. Remove mounting bolts.

CAUTION:

Do not drop the swing arm or lower it too far when shock is disconnected or brake line damage may occur. See photo at right. Support the swingarm as required to prevent contact with brake line or switch block.

5. Lift rear of shock out of mounting eye.
6. Lower wheel, pull shock back to disengage front mounting eye. Lower spacer may come loose when removing shock from forward mount.
7. Lift front of shock and remove shock.

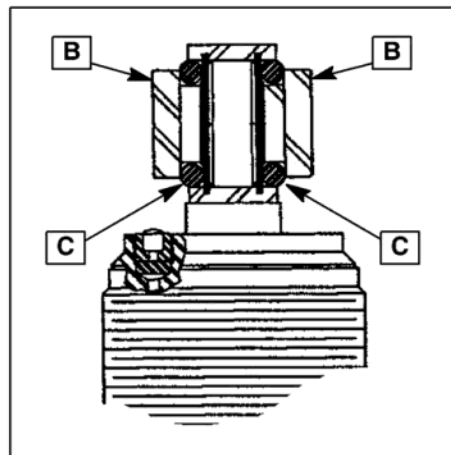
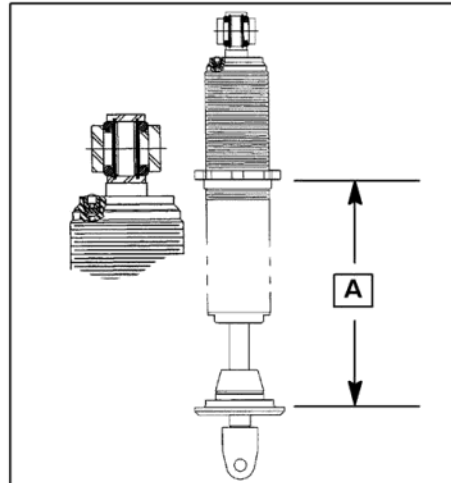
NOTE: Forward shock mount bushings may come loose during shock removal.



SHOCK ABSORBER INSPECTION

The gas volume for the rear shock is extremely small. Do not attempt to check the gas pressure. The amount of gas lost when the gauge is filled will lower the gas pressure significantly.

1. Measure spring preload distance (A) and record so preload adjustment can be returned to rider's preference if it is within specifications. Specifications are listed on page 13.16 (for Classic Cruiser) and page 13.17 (for Touring Cruiser).
2. Turn preload adjuster with tool from the motorcycle tool kit so all preload is removed from spring.
3. Clean shock thoroughly. Rinse shock and dry with compressed air.
4. Inspect for leaks. Submerge the shock in water and look for bubbles or oil seepage around the bearing and body caps. If leakage is suspected refer to shock rebuilding on page 13.18 or replace the shock.
5. Compress the shock by hand as far as possible. The damper rod should return slowly and smoothly to the fully extended position without assistance. If the damper rod does not return fully or if damping is inconsistent, rebuild or replace the shock. Refer to page 13.18 for rebuild procedure.
6. Inspect shock spring for cracks or distortion and proper free length. Specifications are listed on page 13.1.
7. Install spring, adjuster nut, and adjuster jam nut.
8. Adjust spring pre-load as required. Refer to page 2.32 for procedure.
9. Inspect shock eye bushings (B) and O-rings (C) for abnormal wear, replace if necessary.
10. Apply a thin film of grease to the inner and outer surfaces of the bushings. Install bushings into shock eyes.



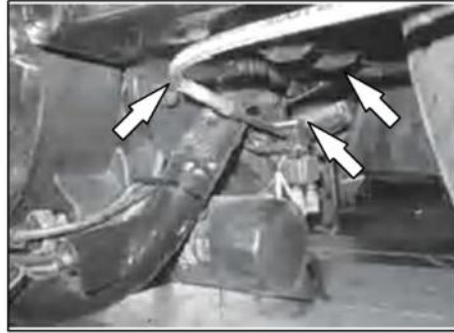
REAR WHEEL & SUSPENSION

FORWARD SHOCK MOUNT REMOVAL

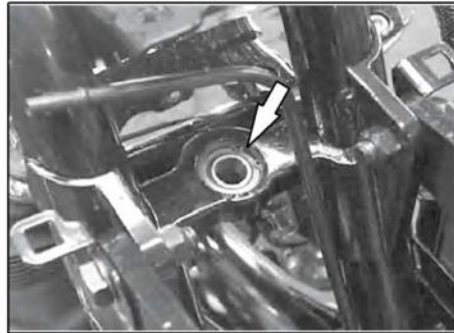
1. Remove right and left frame side covers. (refer to page 3.5)
2. Remove fuel tank (refer to page 5.8).
3. Remove shock (refer to page 13.10)

CAUTION:

Do not drop the swing arm or lower it too far when shock is disconnected or brake line damage may occur. See photo at right. Support the swingarm as required to prevent contact with brake line or switch block.



4. Remove shock mount bearing retaining ring using a snap ring pliers.
5. Lift the spherical shock mount out of frame or tap from the other side to remove.



FORWARD SHOCK MOUNT INSTALLATION

1. Remove dirt and foreign material from spherical bearing bore and retaining ring groove.
2. Apply a thin coat of grease to the outer and inner surfaces of the new shock mount.
3. Install the new spherical bearing. It may be necessary to tap the bearing into place carefully until seated.

NOTE: Bearing can be installed in either direction.

4. Install new snap ring with machined surface upward.

CAUTION:

Always use a new bearing retaining ring.

13.12

REAR WHEEL & SUSPENSION

SHOCK ABSORBER INSTALLATION

1. Install O-ring on top of spherical bearing and then install top mount spacer.
2. Install the lower reducer to bottom of spherical bearing and hold in place.

NOTE: Vent line should be on right side of shock.

3. Place front shock eye over front shock mount spacers (Fox decal faces up).
4. Install bolt for front shock mount from the top side.
5. Loosely install nut on front mount bolt.
6. Assemble an O-ring to each lower (rear mount) reducer.
7. Press reducer/O-ring assembly into each side of the shock mount on swingarm.
8. Lift rear tire, position rear of shock into swing arm mount, and install rear shock bolt from right side to left.

CAUTION:

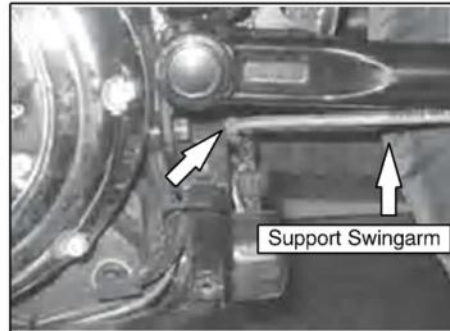
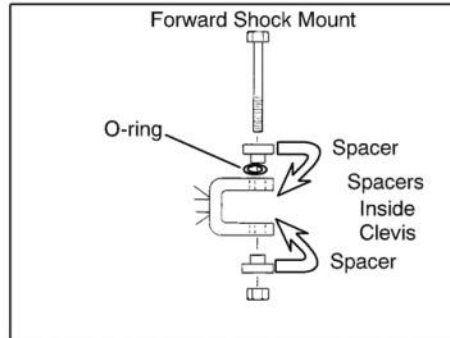
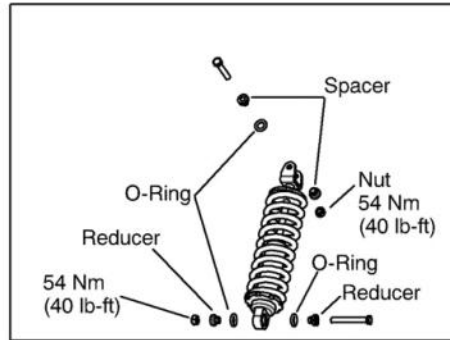
Do not drop the swing arm or lower it too far when shock is disconnected or brake line damage may occur. See photo at right. Support the swingarm as required to prevent contact with brake line or switch block.

9. Install nut for rear shock retaining bolt. Torque both shock mount bolts to specification listed on page 13.3.

NOTE: Be sure the O-rings are in place and not dislodged or squeezed out of place.

10. Check routing of all wiring and hoses in the area to be sure there is clearance for swingarm movement. Inspect rear brake operation (refer to chapter 15).

11. Install right and left frame side covers and seat.

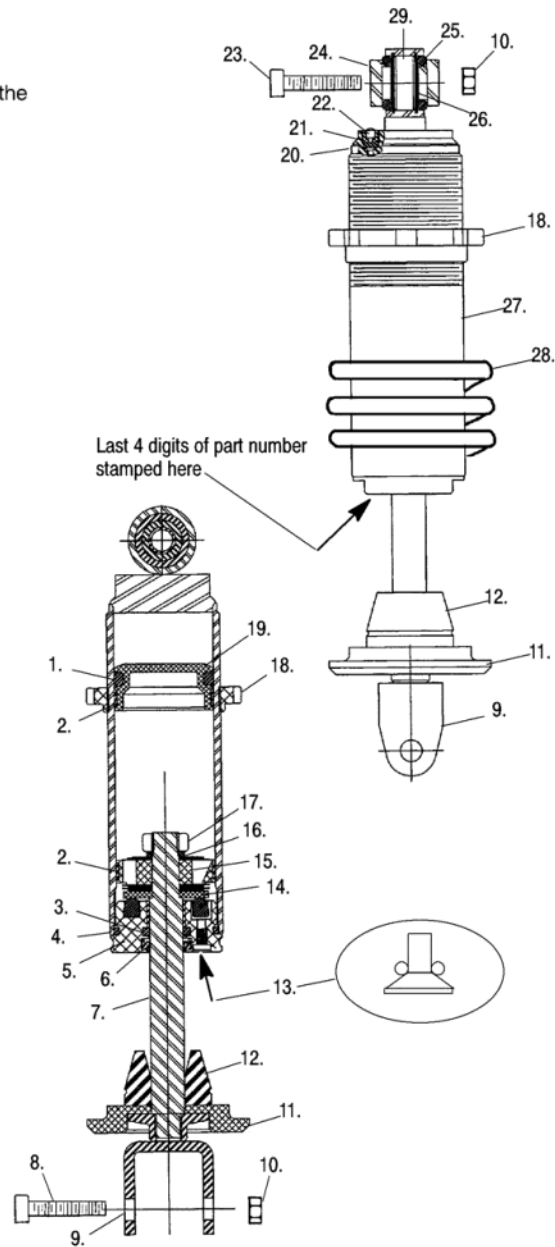


REAR WHEEL & SUSPENSION

REAR SHOCK EXPLODED VIEW (STANDARD, DELUXE, & CLASSIC CRUISER)

Refer to page 13.16 for valving detail. Refer to the appropriate parts manual for part numbers.

| | | |
|-----|---|---------------------------|
| 1. | 1 | O-Ring |
| 2. | 2 | Bearing, Step Cut |
| 3. | 1 | Pressure Seal |
| 4. | 1 | O-Ring |
| 5. | 1 | Bearing |
| 6. | 1 | U-Cup |
| 7. | 1 | Shaft |
| 8. | 1 | Screw |
| 9. | 1 | Eyelet, Clevis |
| 10. | 2 | Nut |
| 11. | 1 | Retainer, Spring |
| 12. | 1 | Bumper |
| 13. | 1 | Screw |
| 14. | 1 | O-Ring |
| 15. | 1 | Plate |
| 16. | 1 | Piston |
| 17. | 1 | Washer |
| 18. | 1 | Nut, Lock |
| 19. | 1 | Ring, Spring Preload |
| 20. | 1 | Piston, Internal Floating |
| 21. | 1 | Pellet |
| 22. | 1 | Retainer, Pellet |
| 23. | 1 | Ball, Nylon |
| 24. | 1 | Screw |
| 25. | 2 | Reducer |
| 26. | 2 | O-Ring |
| 27. | 2 | Ring, Snap |
| 28. | 1 | Body |
| 29. | 1 | Spring, Rear |



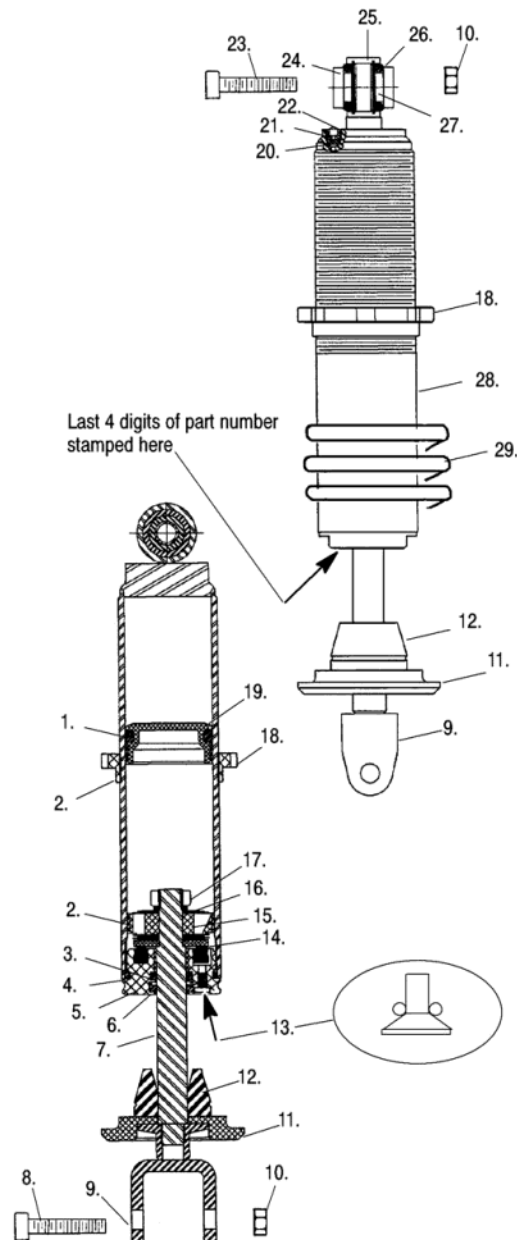
13.14

REAR WHEEL & SUSPENSION

REAR SHOCK EXPLODED VIEW (2003 TOURING CRUISER)

Refer to page 13.17 for valving detail. Refer to the appropriate parts manual for part numbers.

| | | |
|-----|---|---------------------------|
| 1. | 1 | O-Ring |
| 2. | 2 | Bearing, Step Cut |
| 3. | 1 | Pressure Seal |
| 4. | 1 | O-Ring |
| 5. | 1 | Bearing |
| 6. | 1 | U-Cup |
| 7. | 1 | Shaft |
| 8. | 1 | Screw |
| 9. | 1 | Eyelet, Clevis |
| 10. | 2 | Nut |
| 11. | 1 | Retainer, Spring |
| 12. | 1 | Bumper |
| 13. | 1 | Screw |
| | 1 | O-Ring |
| 14. | 1 | Plate |
| 15. | 1 | Piston |
| 16. | 1 | Washer |
| 17. | 1 | Nut, Lock |
| 18. | 1 | Ring, Spring Preload |
| 19. | 1 | Piston, Internal Floating |
| 20. | 1 | Pellet |
| 21. | 1 | Retainer, Pellet |
| 22. | 1 | Ball, Nylon |
| 23. | 1 | Screw |
| 24. | 2 | Reducer |
| 25. | 1 | Bearing, Spherical |
| 26. | 2 | O-Ring |
| 27. | 2 | Ring, Snap |
| 28. | 1 | Body |
| 29. | 1 | Spring, Rear |



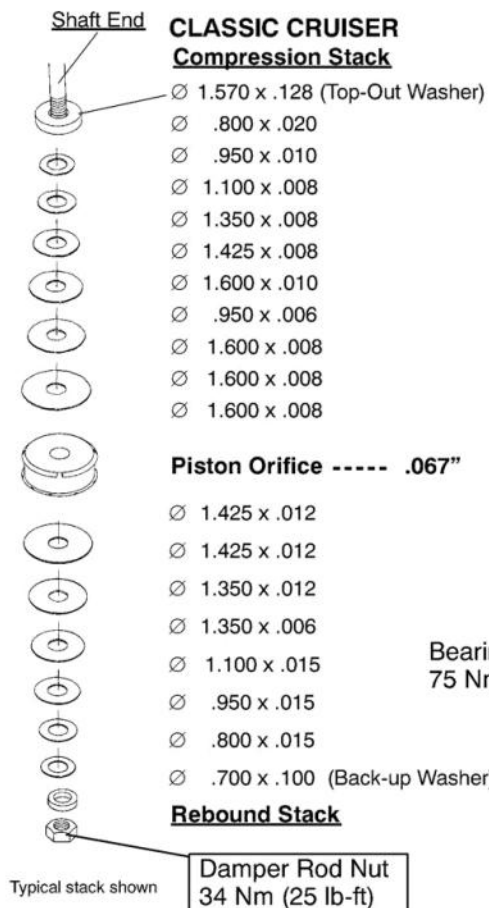
Change shock oil in accordance with the Periodic Maintenance Interval chart on page 2.5.

REAR WHEEL & SUSPENSION

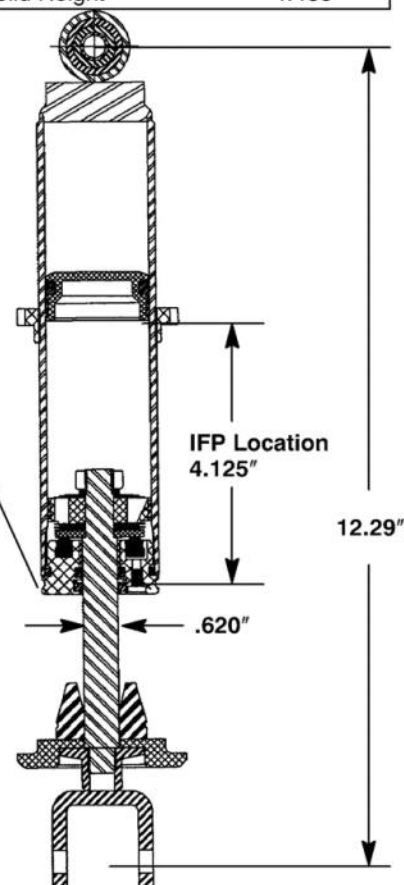
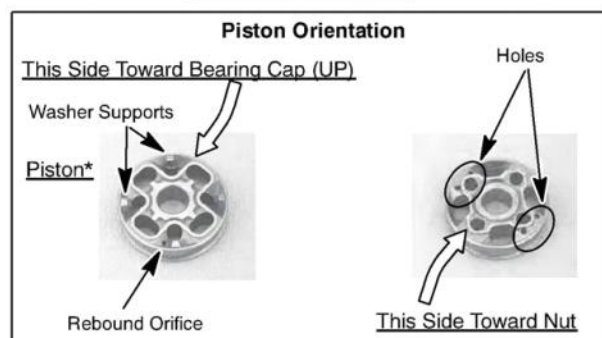
SHOCK ABSORBER TECHNICAL DATA (STANDARD, DELUXE, & CLASSIC CRUISER) SHOCK PART NUMBER 1541735

NOTE: All washer sizing and dimensions listed in INCHES

NOTE: Illustration is a general representation & may not accurately depict number and size of valving washers.



| Shock Specifications | |
|----------------------------|------------|
| Nitrogen Pressure ----- | 200psi |
| IFP Location ----- | 4.125" |
| Extended Length ----- | 12.29" |
| Compressed Length ----- | 9.47" |
| Travel ----- | 2.82" |
| Spring Specifications | |
| Color ----- | Black |
| Wire Diameter ----- | .500" |
| Spring Rate ----- | 600 lb/in. |
| Spring Free Length ----- | Std: 8.0" |
| Service Limit: | |
| Installed Length (Minimum) | 7.21" |
| Installed Length (Maximum) | 7.64" |
| Solid Height ----- | 4.485" |



13.16

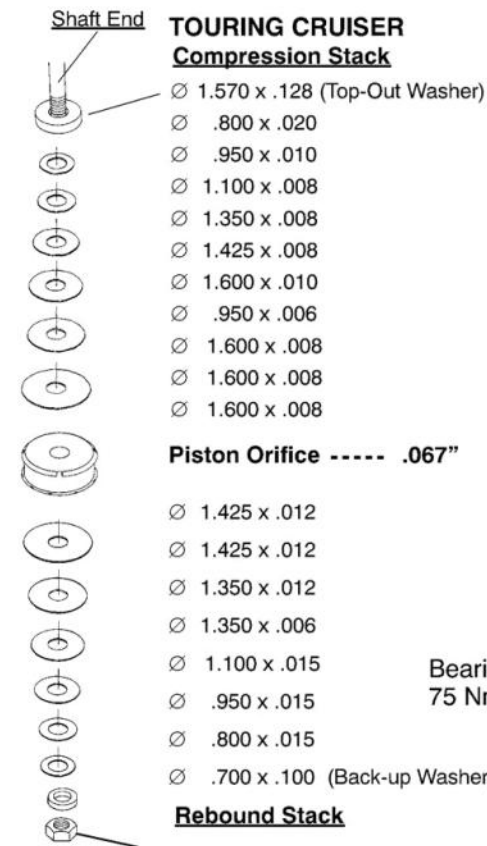
REAR WHEEL & SUSPENSION

SHOCK ABSORBER TECHNICAL DATA (2003 TOURING CRUISER)

SHOCK PART NUMBER 1541404

NOTE: All washer sizing and dimensions listed in INCHES

NOTE: Illustration is a general representation & may not accurately depict number and size of valving washers.

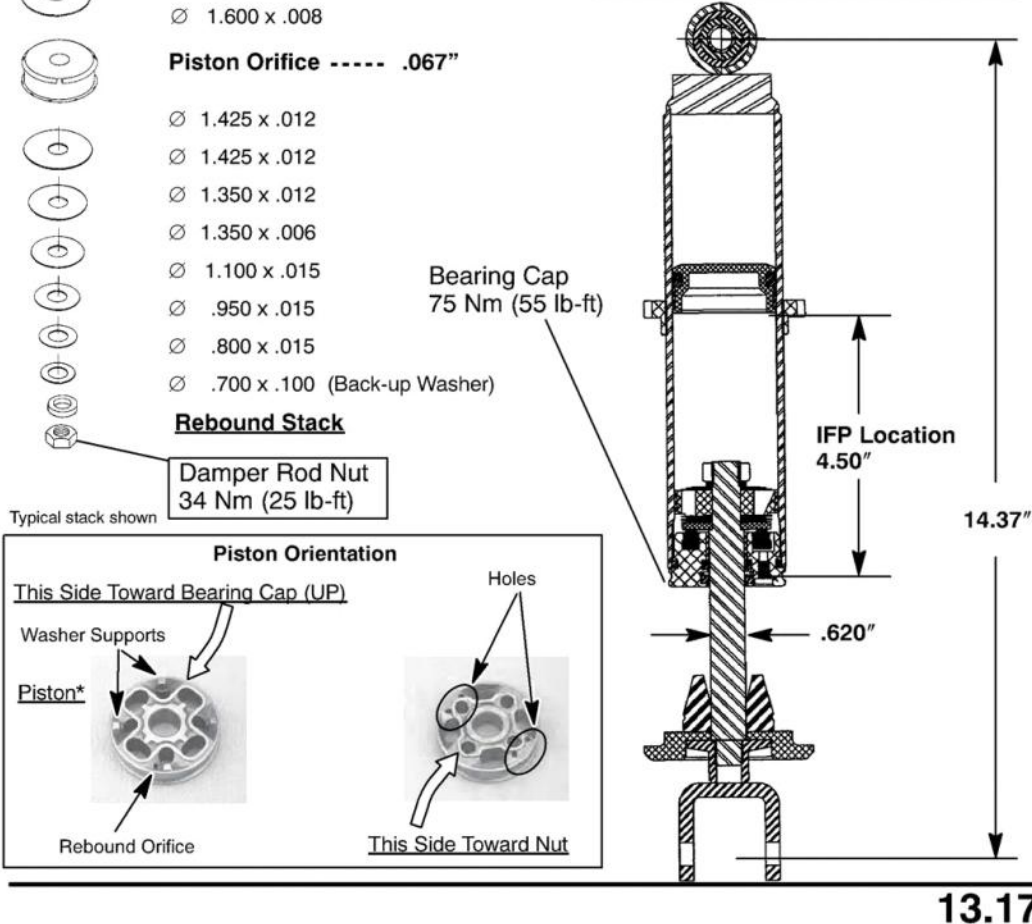


Shock Specifications

Nitrogen Pressure ----- 200psi
IFP Location ----- 4.50"
Extended Length ----- 14.37"
Compressed Length ----- 11.80"
Travel ----- 2.57"

Spring Specifications

Color ----- Black
Wire Diameter ----- .515"
Spring Rate ----- 750 lb/in.
Spring Free Length ----- Std: 8.0"
Service Limit:
Installed Length (Minimum) 7.21"
Installed Length (Maximum) 7.56"
Solid Height ----- 4.315"



REAR WHEEL & SUSPENSION

SHOCK REBUILDING

The rear shock should be disassembled, inspected and serviced in accordance with Periodic Maintenance Interval Chart on page 2.5.

When performing maintenance on Fox™ Shocks, use Gas Shock Recharging Kit PN 2200421 (Refer to page 1.13). It consists of the necessary valves, pressure gauge, and fittings to de-pressurize and pressurize the shocks. The Body Holder Tool (P/N 2871071), Shock Rod Holding Tool (P/N 2872429), and 5/8" Shaft Seal Protector (SPX P/N PS-45678) are not included in the Recharging Kit and must be ordered separately.

WARNING

Read the entire shock rebuilding procedure and become familiar with the process before you begin.

Extreme caution should be observed while handling and working with high pressure service equipment. Wear a face shield, safety glasses, and ear protection during service of these shocks.

Care should be observed while handling the inflater needle and pressure gauges. Maintain your equipment and keep it in good condition. If injury should occur, consult a physician immediately.

De-pressurizing and pressurizing the shock must be performed carefully to avoid personal injury or damage to the safety needle. It is recommended that an assistant be available to pressurize the shock while you support the safety needle and gauge assembly.

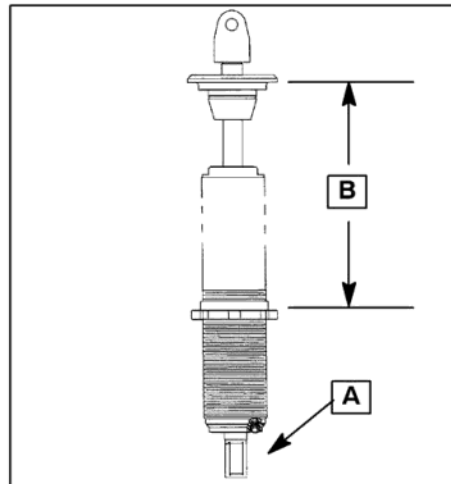
Extreme cleanliness is of utmost importance during all disassembly and reassembly operations to prevent any dirt or foreign particles from getting into the shock.

Keep the parts in order as they are disassembled. Note the direction and position of all internal parts for reassembly.

Refer to Exploded Views on page 13.14 (Classic Cruiser) or page 13.15 (Touring Cruiser).

NOTE: Refer to page 1.12 for special tool information. Technical data is listed on page 13.16 (for Classic Cruiser) and page 13.17 (for Touring Cruiser).

1. Remove shock from motorcycle. Refer to page 13.10.
2. Remove upper and lower eye bushings and O-rings.
3. Secure shock in a soft-jawed vise by the lower mounting eye (A).
4. Measure spring preload distance (B) and record so preload adjustment can be returned to rider's preference if it is within specifications.
5. Turn preload adjuster until all preload is removed from spring.
6. Remove spring, lock nut and adjuster nut.



13.18

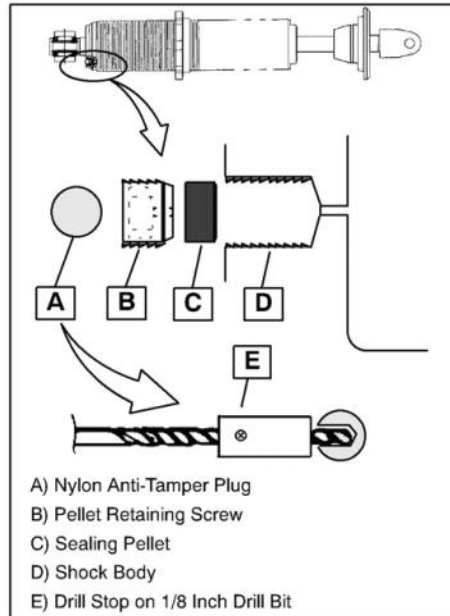
SHOCK DE-PRESSURIZATION

7. Clean shock thoroughly. Rinse shock and dry with compressed air.

⚠ WARNING

Nitrogen gas is under extreme pressure. Use caution when drilling the nylon anti-tamper ball (A) to avoid drilling into the pellet retaining screw (B) or sealing pellet (C). Drilling carelessly or drilling too deep can cause rapid de-pressurization of the shock and possibly severe personal injury. A new plug must be installed upon completion of the rebuild / charging procedure to prevent tampering with pellet retaining screw.

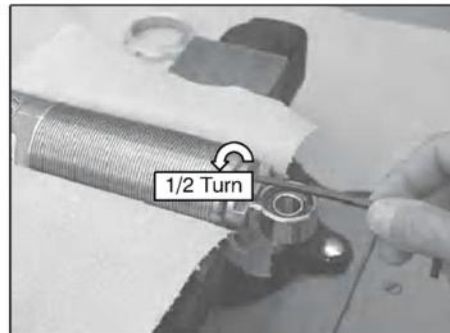
8. *Lightly* secure shock body horizontally in vise with anti-tamper ball facing up and accessible. **DO NOT** tighten vise any more than required to hold the shock securely or permanent shock damage may result.
9. Using a sharp center punch, mark the center of the nylon ball.
10. Using a 1/8 inch diameter drill bit and a slow drilling RPM, carefully drill the center of the plug until it can be removed. A depth stop (E) set to 1/8-3/16" depth is recommended to prevent drilling too deep.



11. When the plug has been removed, loosen the pellet retaining screw **about 1/2 turn**.

⚠ WARNING

DO NOT remove the screw or rapid de-pressurization may occur.

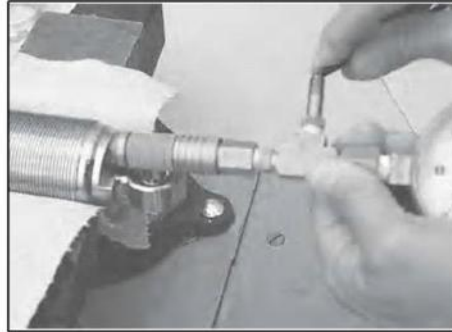


REAR WHEEL & SUSPENSION

SHOCK DE-PRESSURIZATION (Cont.)

12. Carefully insert the tip of the safety needle into the center of the retaining screw. Be sure the schrader valve is pointed in a safe direction, and that the valve is accessible as shown at right.
13. Depress the button on the safety needle and push needle and gauge assembly slowly toward the shock, inserting needle through the retaining screw and through the sealing pellet. Be sure to push needle completely into shock.

NOTE: The needle must be inserted in the center of the retaining nut and sealing pellet. If abnormal resistance is felt while trying to insert the needle, STOP. Try inserting the needle again at a slightly different angle. Forcing the needle in may damage the safety needle.



14. With needle inserted and the schrader valve pointed in a safe direction away from everyone, hold the safety needle securely and have an assistant depress the center of the schrader valve or turn the T-handle clockwise (if equipped) to release the nitrogen. Remove needle when de-pressurization is complete.

SHOCK DISASSEMBLY

15. Stand the shock upright and secure in a soft jawed vise by the lower mounting eye.
16. Push the damper rod down. It should stay down if shock is de-pressurized.
17. If the rod stays down, slowly loosen the bleed screw on the bearing cap (#13 on page 13.14 or 13.15).

CAUTION:

NOTE: If IFP O-ring is worn or damaged, some pressure may have leaked past the O-ring and into the main shock body. Push shock damper rod down. If damper rod rises, some pressure is still present in the shock. Repeat the de-pressurization process, then *slowly* loosen the bleed screw. Always treat a shock absorber as if it is pressurized until bleed screw is removed.

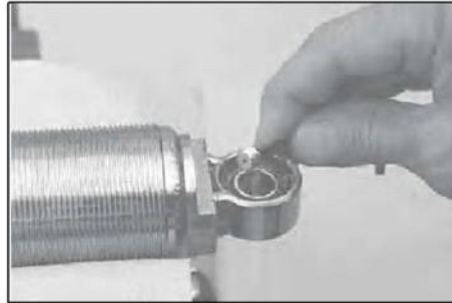
18. Using an open end wrench, slowly loosen the bearing cap and remove damper rod/cap assembly. Be prepared to catch the piston ring as you remove the valve piston.
19. Place damper rod assembly on a clean shop towel.
20. Remove shock from vise and pour out the oil into an approved storage container and dispose of properly.



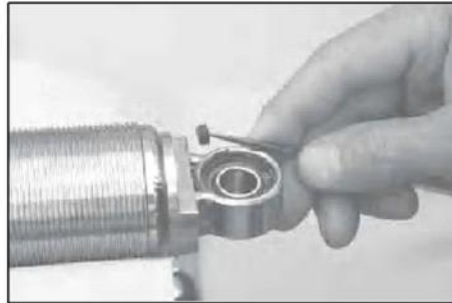
13.20

SHOCK DISASSEMBLY (Cont.)

21. Remove the pellet retaining screw.



22. Remove the pellet carefully with a machinist's scribe or similar tool. DO NOT scratch the pellet bore or damage the threads for the pellet retaining screw. Discard the pellet; it must be replaced upon assembly.



23. Remove the internal floating piston (IFP) with a caliper piston pliers (internal) or turn the shock upside down and place it on a padded surface such as a folded shop towel.

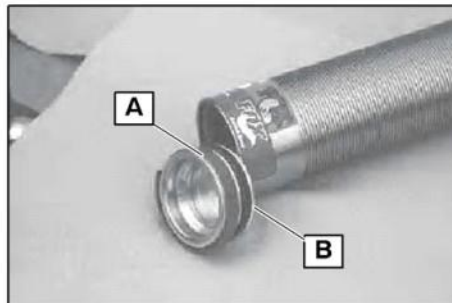


24. Apply low pressure air to the charging orifice in the bottom of the shock (where pellet was removed). This will force the IFP to the top of the shock body where it can be removed.

CAUTION: Use slight air pressure. If high air pressure is applied you may damage the IFP.

25. Place IFP on a clean shop towel.

26. Remove piston ring (A) and O-ring (B). Be careful not to scratch O-ring groove.



REAR WHEEL & SUSPENSION

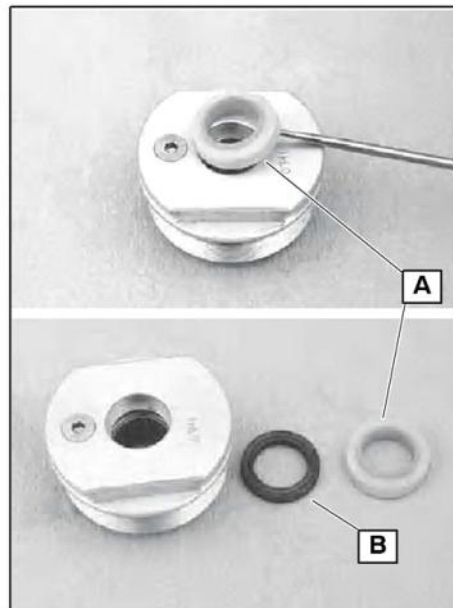
SHOCK DISASSEMBLY (Cont.)

27. Secure the damper rod assembly in the vise by the top shock eye and remove the damper rod nut and piston, with valve washers.
28. Remove parts carefully, keeping them in order. Lay out the parts on a clean shop cloth in sequence of disassembly.



SHOCK PARTS INSPECTION

29. Items to inspect or replace:
 - Shaft for straightness, nicks, burrs or corrosion.
 - Inside of shock body for scratches, burrs or excessive wear.
 - Replace piston wear bands and all O-rings. Inspect IFP and valve piston for chipped or nicked edges, or excessive wear.
 - Valve washers for kinks or waves. Replace if not perfectly flat, or if they are scratched or corroded.
 - Replace valve piston retaining nut upon assembly to ensure adequate locking properties.
 - Bearing cap assembly: Remove dust seal (A) from top of bearing cap first, and then remove pressure seal (B). Be careful not to scratch the seal bores or bushing.
 - Inspect bearing cap bushing. Replace bearing cap assembly if bushing is worn.
 - Replace pressure seal first (it can be installed either way) followed by dust seal, with large seal facing UP.
 - Replace bearing cap O-ring (C).



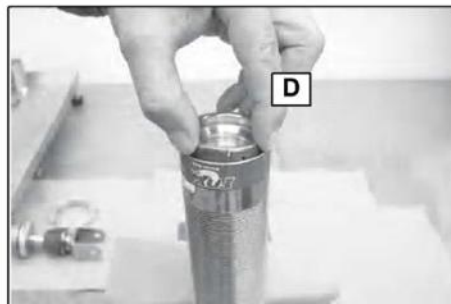
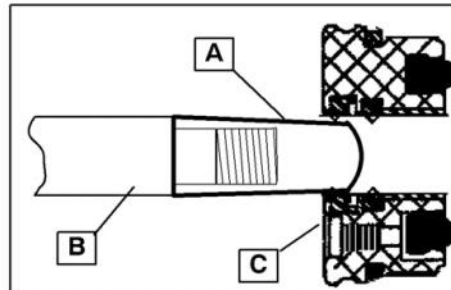
SHOCK ASSEMBLY

1. Place damper rod in the vise.
 2. Thread the bullet tool (A) on shock shaft (B) until seated against step in shaft. This tool prevents seal damage upon installation of bearing cap assembly (C).
 - PS-45678 TOOL, BULLET .620 Shaft / .510 Stem
 3. Slide the assembled bearing cap onto the piston rod and remove installation tool.
 4. Reassemble valve piston assembly in reverse order of disassembly. Special attention should be paid to the orientation of the valve piston and to the order of the rebound and compression washer stack. Be sure they are in the correct order. Refer to valve stack order and piston orientation on page 13.16 (Classic Cruiser) or page 13.17 (Touring Cruiser).
- NOTE:** The shock will not work properly if valve piston is installed upside down.
5. Install a NEW locknut on rod. Before you torque the lock nut, use compressed air to clean any debris that may be on the stack.
 6. Torque to specification found on page 13.16 (Classic Cruiser) or page 13.17 (Touring Cruiser).

CAUTION:

CAUTION: Do not over tighten the lock nut. If excessive torque is applied, damage to the piston valves will occur.

7. Secure the shock body in the vise by the lower mounting eye.
8. Lubricate and install the new IFP O-ring and piston ring on the IFP.
9. Hold the piston ring with end gap (D) closed and insert IFP into shock body, hollow side up (toward threaded end of shock body) with a slight rocking motion.

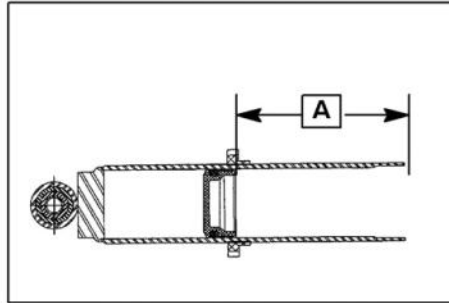


REAR WHEEL & SUSPENSION

SHOCK ASSEMBLY (Cont.)

10. Set the IFP to depth (A) specified on page 13.16 (Classic Cruiser) or page 13.17 (Touring Cruiser) using the IFP depth tool or a dial caliper. Measurement must be made from top edge of shock body to top outer edge of IFP as shown.

NOTE: Charging pellet must not be installed before IFP is set to depth.



11. Fill the shock with Victory shock oil to within 1/2 inch of the top of the shock body (about midway up threads).
12. Wrap a shop towel around shock body to catch overflowing oil.
13. Secure the shock body at a slight angle as shown to simplify bleeding process.
14. Be sure the damper rod is fully extended (bearing cap pushed down against the piston).
15. Dip the piston assembly in shock oil.
16. Locate the bleeder hole in the cap at the high side of the shock (B) for initial bleeding.
17. Carefully insert the shock rod into the shock body, slightly oscillating the rod to allow air to escape through bleeder hole, and piston assembly to enter the shock body. Do not move piston too quickly or IFP depth may change.
18. Slowly screw the bearing cap into the shock body. Oil will spill over the sides until the O-ring makes contact with the body. Air and some oil will continue to come out of the bleed screw orifice as you tighten the bearing cap. Tighten until O-ring is seated in body.



NOTE: Pull up slightly on the damper rod as you tighten the bearing cap. Do not compress the shock rod or air will enter the shock.

19. When bearing cap is seated, rotate shock rod slowly 2-3 times to allow any residual air to escape through the bleed orifice.
20. Wipe bubbles or add a small amount of oil to fill bleed hole.
21. Install a new O-ring on bleed screw and install. Tighten securely.
22. Torque bearing cap to specification listed on page 13.16 (Classic Cruiser) or page 13.17 (Touring Cruiser).



13.24

SHOCK PRESSURIZATION

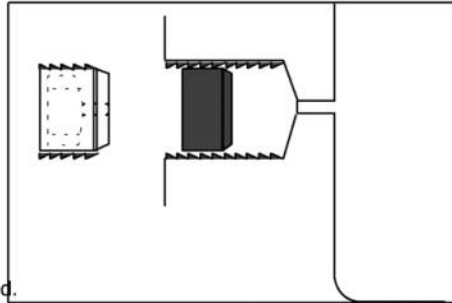
23. Wipe shock clean remove from vise. Lay the shock horizontally in a shop towel and *lightly* clamp it in the vise.

CAUTION:

DO NOT over-tighten the vise the shock body will be permanently damaged.

24. Push a new pellet squarely into the shock body, with chamfered side in (flat side of pellet toward retainer screw). Push the pellet in until 1 or 2 threads are showing in the bore as shown at right.

NOTE: Use the retaining screw to install the pellet until seated.



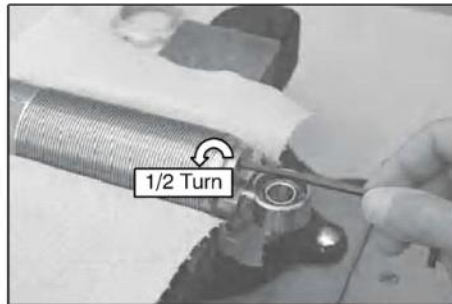
25. Tighten the retaining screw until snug, and pellet is firmly seated in cavity.

26. Back off screw 1/2 turn.

27. Set nitrogen regulator to 200 psi.

NOTE: Nitrogen pressure not to exceed 250 PSI to ensure 200 PSI charge.

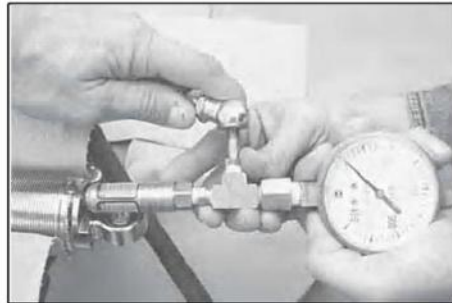
28. Insert safety needle carefully and hold securely as outlined in de-pressurization on page 13.19.



29. Have an assistant charge the shock to 200 psi. Keep the filler chuck on the safety needle schrader valve until needle is retracted from charging pellet.

NOTE: DO NOT insert the needle again to check pressure. The volume inside the gauge will reduce the pressure in the shock.

30. After successfully refilling nitrogen and removing the needle it is important to listen for nitrogen leakage in the time interval between removing the needle and tightening of the set screw. If any leakage can be heard, the set screw needs to be tightened slightly and the charging process repeated until no leakage occurs.



31. Immediately tighten the retaining screw firmly to seal the pellet. DO NOT OVER-TIGHTEN THE SCREW.

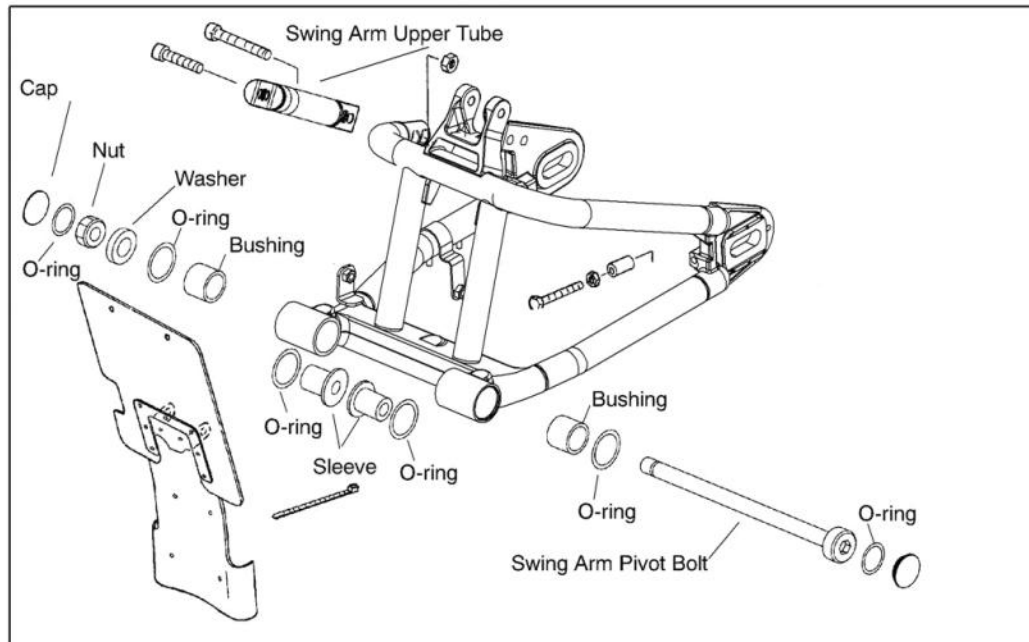
32. Install a new anti-tamper ball in set screw using a 1/4 inch flat punch.

33. Reinstall spring retainer, spring preload nut, bushings and O-rings and install shock on vehicle. Refer to page 13.13.



REAR WHEEL & SUSPENSION

SWING ARM ASSEMBLY EXPLODED VIEW



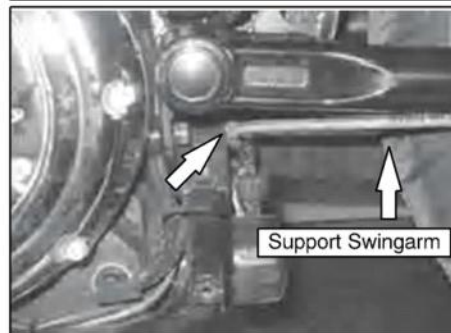
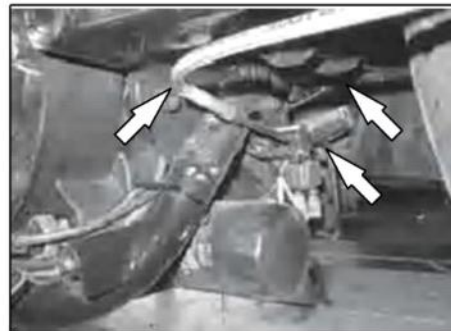
SWING ARM REMOVAL

1. Remove rear wheel assembly (see page 13.4).
2. Remove rear shock (see page 13.10).

CAUTION:

Do not drop the swing arm or lower it too far when shock is disconnected or brake line damage may occur. See photo at right. Support the swingarm as required to prevent contact with brake line or switch block.

3. Remove belt guard.
4. Remove swing arm upper tube. Place belt outside of swing arm.
5. Remove exhaust system.
6. Remove guide clips from rear caliper brake line. Set caliper aside being careful not to damage brake line.
7. Remove right & left end caps from swing arm pivot.
8. Remove swing arm pivot nut and bolt.
9. Remove swing arm.
10. Grasp bushing sleeves and attempt to move them up and down. If excessive play is noted, replace bushings and/or other swing arm pivot parts. Continue with inspection process.



13.26

REAR WHEEL & SUSPENSION

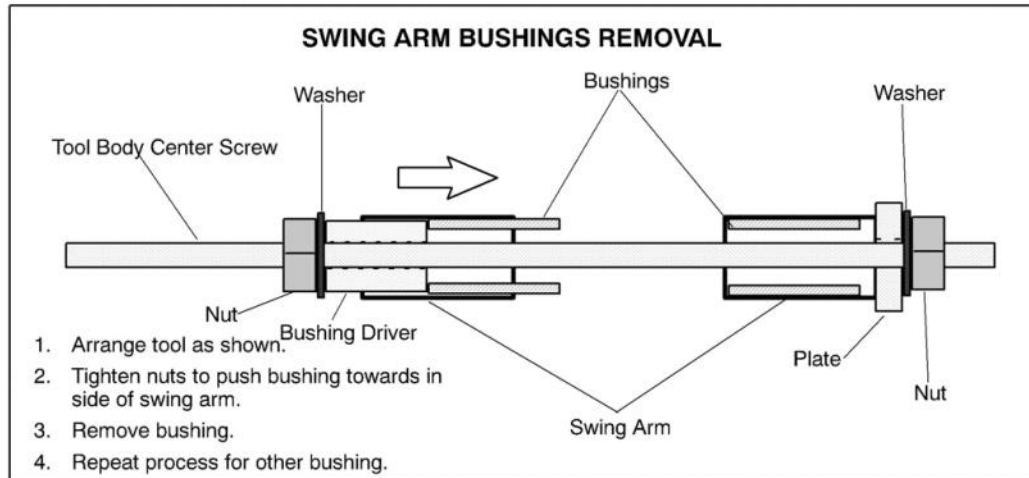
SWINGARM BUSHING REMOVAL

1. Remove O-rings and bushing sleeves.
2. Use bearing installation tool to remove swing arm bushing from one side of swing arm.
3. Once one bushing is removed, set up tool to remove other swing arm bushing in same manner.

Swing arm bushing driver PV-43515

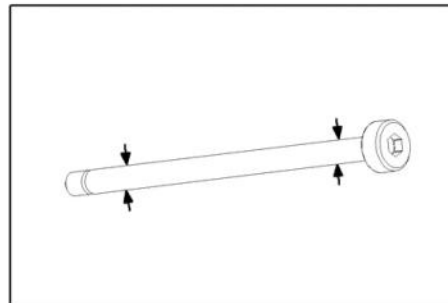
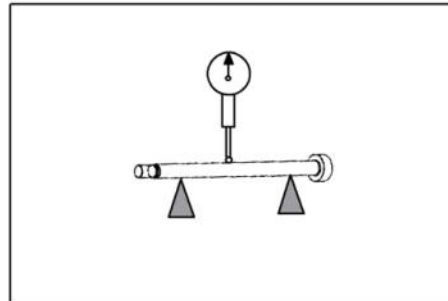
NOTE: Once bushings are removed they must be replaced.

4. Clean all parts thoroughly in solvent.



SWINGARM PIVOT PARTS INSPECTION

1. Visually inspect swing arm pivot shaft for excessive wear or corrosion damage, replace if it fails visual inspection.
2. Place swing arm pivot shaft on V-blocks and measure runout, replace shaft if runout exceeds service limit listed on page 13.1.
3. Measure swing arm pivot shaft O.D. in several places at bushing sleeve contact areas. Replace swing arm pivot shaft if worn beyond service limit listed on page 13.1.



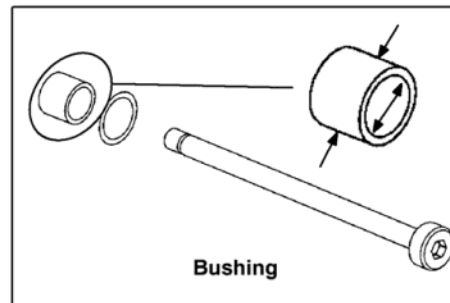
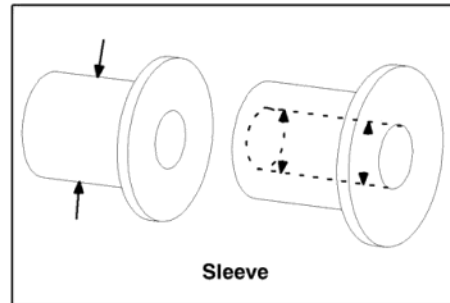
13.27

REAR WHEEL & SUSPENSION

SWINGARM PIVOT PARTS INSPECTION (Cont.)

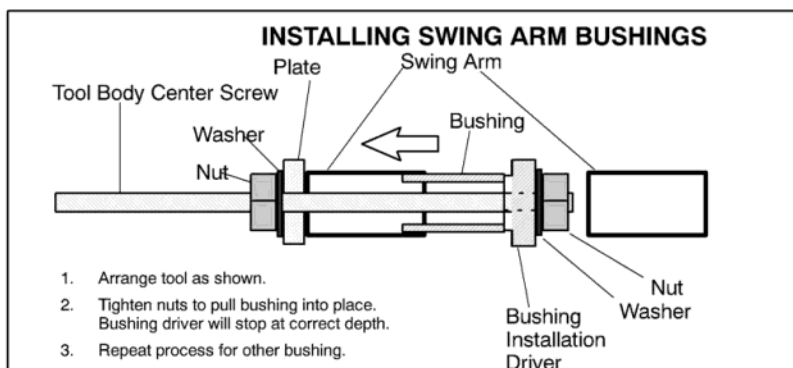
4. Visually inspect bushing sleeves for excessive wear, distortion or corrosion damage. Replace sleeves if they fail visual inspection.
5. Measure O.D. of bushing sleeves in several places, replace sleeve(s) if worn beyond service limit listed on page 13.1.
6. Measure I.D. of bushing sleeves in several places, replace sleeve(s) if worn beyond service limit listed on page 13.1.
7. O-rings should be replaced with new during assembly.
8. Measure O.D. and I.D. of swing arm bushings.

NOTE: Dimensions are provided for reference only. Once bushings are removed, they should be replaced.



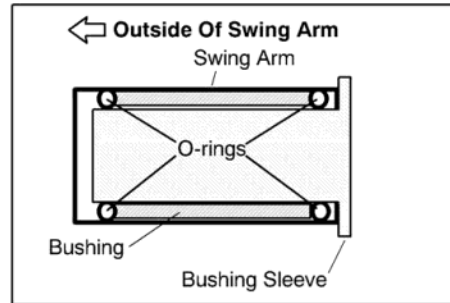
SWINGARM BUSHING INSTALLATION

1. Clean all parts thoroughly.
2. Lightly grease O.D. & I.D. of new swing arm bushings.
3. Insert new bushing from inner side of swing arm by hand. Push bushing in as far as it will go.
4. Arrange swing arm bushing installation tool as shown in below diagram.
5. Tighten nuts to pull bushing into place. Bushing driver will stop bushing at correct depth.
6. Repeat process for other side.



SWINGARM BUSHING INSTALLATION (cont.)

7. Lightly grease two o-rings and place one o-ring next to each bushing on the inner side of the bushings.
8. Lightly grease swing arm bushing sleeves and install into swing arm from inside of swing arm.
9. Lightly grease two remaining o-rings and place next to bushings on outside.-



SWINGARM INSTALLATION

NOTE: Refer to Swing Arm Assembly Exploded View on page 13.26 for orientation of components.

1. Lightly grease swing arm pivot shaft.
2. Install swing arm into place.
3. Install swing arm pivot shaft from left side of motorcycle.
4. Install washer and nut on to swing arm pivot. Torque nut to specification listed on page 13.3.
5. Install caps onto ends of swing arm pivot.
6. Install shock absorber (see page 13.13).
7. Install rear wheel (see page 13.9).
8. Secure brake caliper hose to swing arm with guide clips.
9. Install swing arm belt access member (upper swing arm tube) and torque to specification on page 13.3.
10. Install belt guard and torque fasteners to specification on page 13.3.
11. Install exhaust system. Refer to page 3.6 (Classic Cruiser) or page 3.7 (Touring Cruiser).
12. Install side covers and seat. (Page 3.4)

REAR WHEEL & SUSPENSION

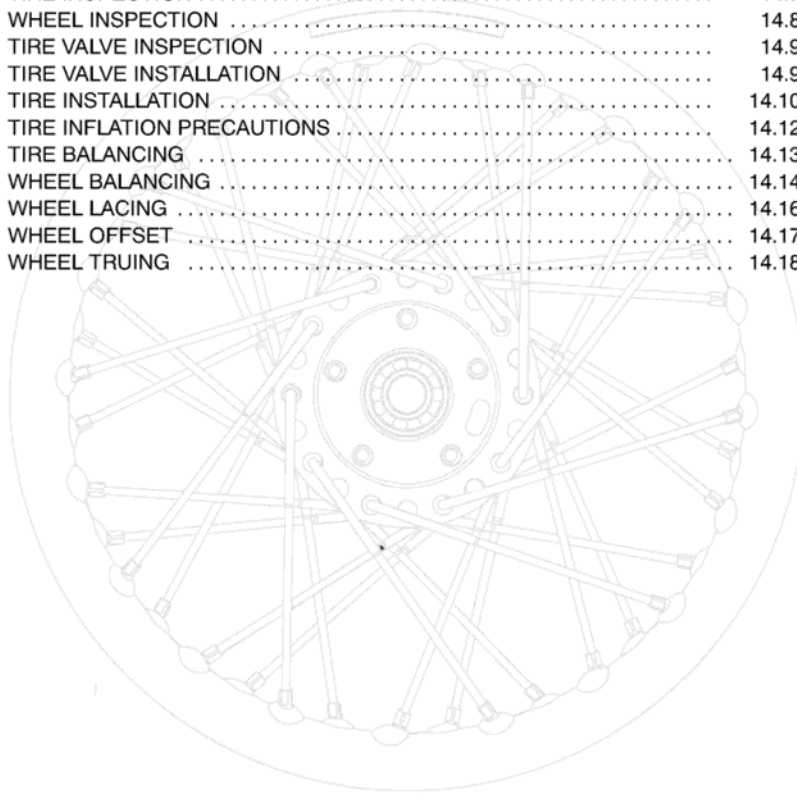
TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | REPAIR RECOMMENDED |
|-------------------------------------|--|--|
| Rear Wheel Feels "Loose" or Wobbles | Distorted (bent) rear wheel | Replace wheel |
| | Worn or damaged wheel bearings | Replace wheel bearings |
| | Worn or damaged swing arm bushings. | Replace swing arm bushings |
| | Damaged or incorrect rear tire | Replace rear tire |
| | Unbalanced rear wheel assembly | Balance tire/wheel |
| | Low tire pressure | Inflate to specification |
| | Loose swing arm, axle or suspension fasteners. | Torque to specifications |
| PROBLEM | POSSIBLE CAUSE | REPAIR RECOMMENDED |
| Rear Suspension Too Hard | Bent shock damper rod | Replace shock |
| | Damaged or corroded suspension mount bushing | Correct as necessary |
| | Incorrect preload adjustment | Adjust to rider & load |
| | Damaged or corroded swingarm bushings | Replace |
| | High tire pressure | Deflate to specification |
| | Drive belt adjustment too tight | Adjust drive belt tension |
| Rear Suspension Too Soft | Leaking | Rebuild or replace shock |
| | Weak shock spring | Replace shock spring |
| | Incorrect preload adjustment | Adjust to rider & load |
| | Excessive load placed on motorcycle | Educate consumer |
| | Low tire pressure | Inflate to specification |
| Rear Suspension Noisy | Loose fasteners | Torque to specifications |
| | Worn wheel bearings | Replace |
| | Worn swing arm bushings | Replace |
| | Damaged shock absorber | Replace as necessary |
| Wheel Drags (Turns Hard) | Bent rear axle | Replace |
| | Damaged wheel bearings | Replace |
| | Brake problem | Refer to chapter 15 |
| | Incorrect drive belt adjustment | Adjust drive belt tension |
| | Tire contact with object or chassis | Determine point of contact and correct |

CHAPTER 14

TIRES / WHEELS

| | |
|---|-------|
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| SPECIFICATIONS | 14.2 |
| SPECIAL TOOLS | 14.3 |
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| TIRE WEAR PATTERNS & GENERAL CAUSES | 14.4 |
| OZONE CRACKING | 14.4 |
| FRONT TIRE CUPPING | 14.4 |
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| TIRE BALANCING | 14.13 |
| WHEEL BALANCING | 14.14 |
| WHEEL LACING | 14.16 |
| WHEEL OFFSET | 14.17 |
| WHEEL TRUING | 14.18 |



14

GENERAL

WARNING

If a consumer wishes to replace the Original Equipment Manufacturer (OEM) tires with another brand of tire, Victory recommends contacting the tech-line department of the tire manufacturer being considered to ensure compatibility. Victory 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

Victory 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 Victory parts could cause tire deflation during driving. Always use genuine Victory 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.

CAUTION:

Two of the biggest factors contributing to premature tire wear are overloading and under-inflation. Do not deviate from the specifications for loading or inflation.

WARNING

Do not attempt to repair tires that have:

- Punctures with a diameter of greater than 6mm (0.240").
- Cuts with a length of greater than 6mm (0.240").
- Any punctures or cuts on the sidewall of the tire.
- Tread depth of less than 1.6mm (.063") for the front tire.
- Tread depth of less than 1.6mm (.063") for the rear tire.
- Ply separation
- Tread separation
- Severe tread cupping.
- Cuts, gouges or scratches on the sealing surface of the bead.
- Flat spots on the tread.
- Bubbles, separation or any unusual damage to the inner liner of the tire.
- Chemical sealants or balance additives added to tire.

WARNING

All repairs must be made from inside the tire. Victory 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.

TIRES / WHEELS

SPECIFICATIONS

Refer to page 12.1 for Front Wheel and Tire Specifications

Refer to page 13.2 for Rear Wheel and Tire Specifications

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

TIRE PRESSURE TABLE

*All Victory laced wheels require tubes

| 2002 V92C Standard Cruiser / 2003 Classic Cruiser | | |
|--|----------------------------|------------------------------|
| | Up to 200 lbs (91 kg) load | 200-475 lbs (91-215 kg) load |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| 2002 V92C Deluxe Cruiser | | |
| LOAD RATING | Up to 200 lbs (91 kg) | 200-444 lbs (91-207 kg) |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| 2002 - 2004 Touring Cruiser | | |
| | Up to 200 lbs (91 kg) load | 200-449 lbs (91-204 kg) load |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| 2002 V92TC Deluxe Touring Cruiser | | |
| LOAD RATING - Inner tubes required | Up to 200 lbs (91 kg) load | 200-441 lbs (91-200 kg) load |
| FRONT: Dunlop 491 Elite II - MT90 B16 71H | 34 psi (235 kpa) | 40 psi (275 kpa) |
| REAR: Dunlop D417 - 160/80 B16 75H | 36 psi (250 kpa) | 41 psi (280 kpa) |
| CRUISEMAX WHITEWALL TIRES (U.S. and U.K. only) | | |
| | Up to 200 lbs (91 kg) load | 200-475 lbs (91-215 kg) load |
| FRONT: Dunlop CRUISEMAX 130/90 16 67H | 34 psi (235 kpa) | 41 psi (280 kpa) |
| REAR: Dunlop CRUISEMAX 150/80 B16 71H | 36 psi (250 kpa) | 41 psi (280 kpa) |

WHEEL RUNOUT TABLE

| FRONT WHEEL | | | |
|---|--------|-------------------|----------------|
| Item | | Standard | Service Limit |
| Axle Runout | | - | .20 mm (.008") |
| Front Wheel Rim Runout (Cast Type) | Axial | .25mm (.010 inch) | 2.0 mm (.080") |
| | Radial | .25mm (.010 inch) | 2.0 mm (.080") |
| Front Wheel Rim Runout (Spoke Type) | Axial | 1.0mm (.040 inch) | 2.0 mm (.080") |
| | Radial | .8mm (.032 inch) | 2.0 mm (.080") |
| REAR WHEEL | | | |
| Rear Wheel Runout (Cast Type) | Axial | .25mm (.010 inch) | 2.0 mm (.080") |
| | Radial | .25mm (.010 inch) | 2.0 mm (.080") |
| Rear Wheel (Rim) Runout (Spoke Type) | Axial | 1.0mm (.040 inch) | 2.0 mm (.080") |
| | Radial | .8mm (.032 inch) | 2.0 mm (.080") |

14.2

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 REMOVAL-GENERAL

There are three generally acceptable methods to dismount and mount a tubeless motorcycle tire from its rim. Furthermore, there are countless variations for each of the three methods.

The three general methods are:

- Pneumatic or electrically operated tire machine.
- Manually operated tire machine.
- Manual manipulation of tire irons.

The seal between the tire and its rim is one of the most critical factors contributing to the safe operation of the wheel/tire assembly. Each of the three generally acceptable methods to dismount and mount tires is permissible and recommended by Victory. However, careless or improper work habits can damage both the tire and rim regardless of which method is used.

The pneumatic or electrically operated tire machine is preferred as it is the most efficient method to dismount and mount tires. It is also the most expensive way to change tires.

The manually operated tire machine is the next preferred method to dismount and mount tires. It can be just as efficient as a power assisted tire machine. With some types of manually operated tire machines, it will be necessary to remove the belt driven sprocket to gain sufficient clearance for tire removal.

Manual manipulation of tire irons is the least preferred method of tire dismounting and mounting. It will not generally deliver the same efficiency as the other two methods and greater care needs to be taken when performing the operation.

TIRES / WHEELS

TIRE REMOVAL-GENERAL (cont.)

Be very careful not to damage the rim, tire, inner tube, brake disk or sprocket regardless of which method is used.

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 page 11.7 for sprocket removal and page 11.8 for installation. Refer to page 13.8 for rear brake rotor removal and installation. Brake rotor bolts should not be re-used.

TIRE REMOVAL

1. Remove wheel / tire assembly from motorcycle (front refer to page 12.11, rear refer to page 13.4)
2. Remove valve core from valve stem and let all air escape. (III. 1)

IMPORTANT: 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 is often the heaviest part of the rim (although not always the case).

CAUTION:

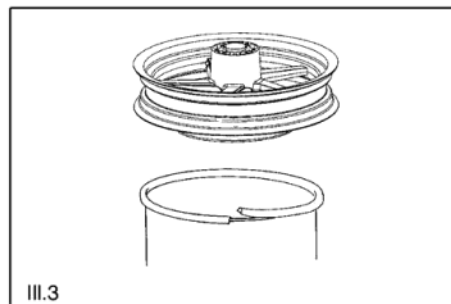
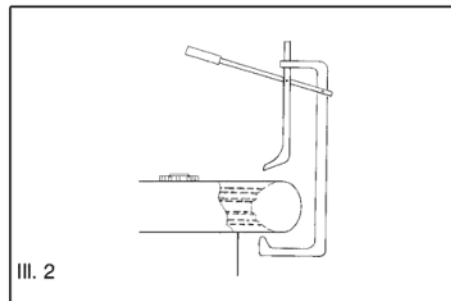
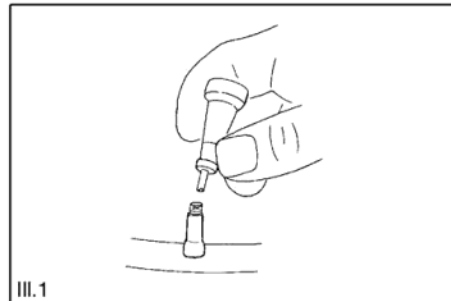
If the tires have a directional arrow they must be observed and the tires installed correctly.

3. Mount the wheel assembly into a tire bead breaker and break the bead. (III. 2)
4. Flip the wheel assembly over and break the bead on the other side.

CAUTION:

IMPORTANT: Take great care not to bend or otherwise damage the brake disc and/or belt driven sprocket. If the bead breaker being used interferes with either the brake disc and/or belt driven sprocket, remove the disc or sprocket as required.

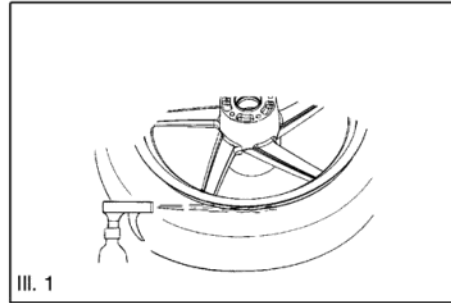
NOTE: This procedure can be performed on an empty 30 gallon drum with the top cut out. The top lip of the drum should be covered with a split rubber hose to protect the rim. (III.3)



14.4

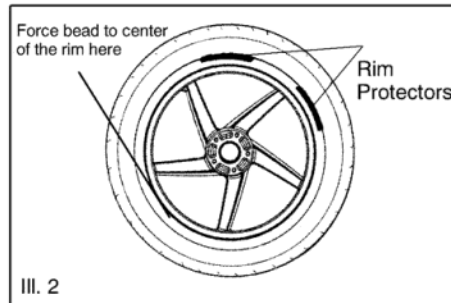
TIRE REMOVAL-GENERAL (cont.)

5. Position the wheel assembly so that the brake disc (s) cannot be damaged and the rim cannot be scratched.
6. Push tire down and lubricate tire sealing edge (bead) with tire lubricant on both sides of tire. (Ill. 1)
7. Install rim protectors. (Ill. 2)



Rim protectors PV-43536

8. Stand opposite of the rim protectors and use your knee to push a portion of the tire down into the rim's drop center while pulling the bottom bead up into the rim's drop center. For purposes of this procedure, the rim protector directly opposite you is now labeled the "12 o'clock" rim protector. (Ill. 3)
9. While keeping the tire in the rim's drop center, slide a tire iron between the tire bead and the 12 o'clock rim protector.
10. Using your other hand, slide a tire iron between the tire bead and the 2 o'clock rim protector.
11. Lever the 12 o'clock tire iron up and over (about 160°) and keep it positioned there.
12. Lever the 2 o'clock tire iron up and over.
13. Remove the 2 o'clock tire iron (leave the 12 o'clock tire iron in place and levered over) and slide it between the tire and rim protector at the 4 o'clock position.



IMPORTANT: The top and bottom tire beads must continually be pushed into the drop center of the wheel during the entire removal process.

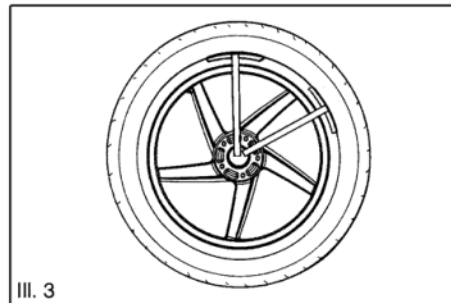
14. Continue going around the tire until one side of the tire is off the rim.

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.



TIRES / WHEELS

TIRE REMOVAL-GENERAL (cont.)

15. Lift the tire up and push it away from you so the bottom bead is in the drop center of the rim.
16. Place a tire iron at the 12 o'clock position and at the 2 o'clock position.
17. Lever the 12 o'clock tire iron up and over the rim and then the 2 o'clock iron.
18. Continue to work around the tire until the tire is off the rim.

TIRE INSPECTION

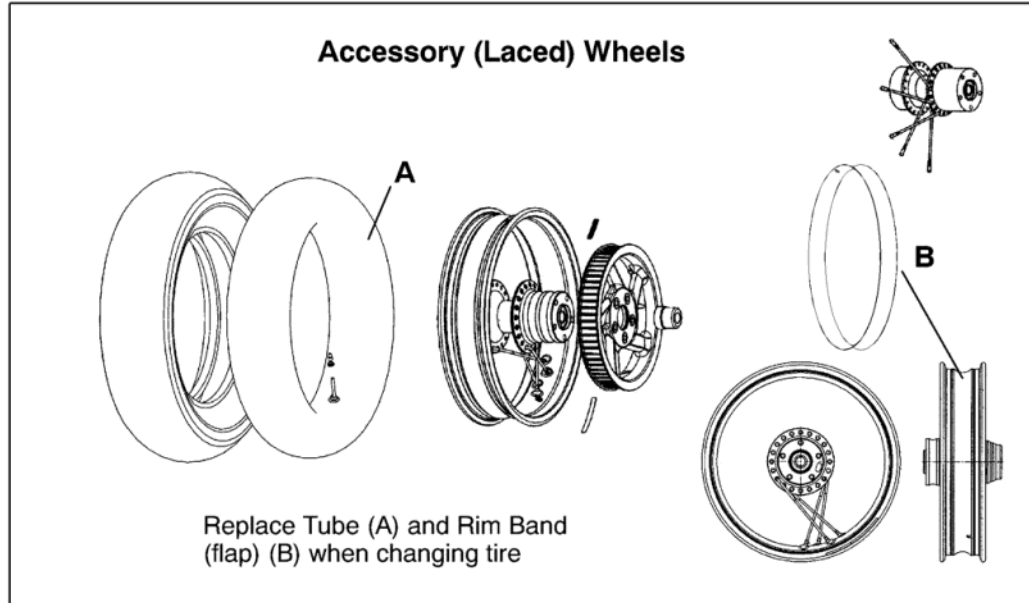
⚠ WARNING

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

Do not attempt to repair tires that have:

- Punctures with a diameter of greater than 6mm (0.080").
- Cuts with a length of greater than 6mm (0.080").
- Any punctures or cuts on the sidewall of the tire.
- Tread depth of less than 1.6mm (.063") for the front tire.
- Tread depth of less than 1.6mm (.063") for the rear tire.
- Ply separation
- Tread separation
- Severe tread cupping.
- Cuts, gouges or scratches on the sealing surface of the bead.
- Flat spots on the tread.
- Bubbles, separation or any unusual damage to the inner liner of the tire.
- Chemical sealants or balance additives added to tire.



WHEEL INSPECTION

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.

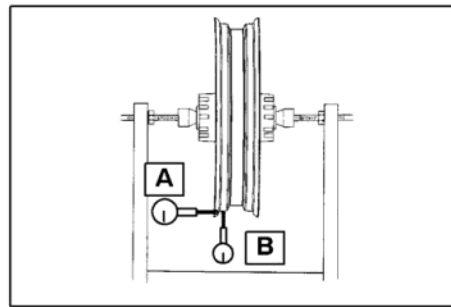
4. Inspect the wheel for cracks and/or distortion.
5. Inspect the bead seating area of scratches, gouges, distortion or any damage that could create a sealing problem.
6. Inspect the wheel for axial runout, measured on a smooth surface on the outer edge of wheel as shown at right (A).
7. Measure wheel for radial runout (B).

NOTE: Measure radial runout on the tire bead seating surface of wheel as shown. Be sure surface is clean before measuring.

8. Compare measurements of axial and radial runout to specifications listed on page 14.2. Replace wheel if any measurement exceeds Service Limit. Cast wheels cannot be straightened. Refer to page 14.18 for spoke wheel truing information.
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 the sealing surfaces of the rim. The tire could fail to seal properly and an air leak would be the result. Loss of air pressure can cause a loss of control and an accident, resulting in serious injury or death.



TIRES / WHEELS

TIRE INSPECTION

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.

TIRE VALVE INSPECTION

1. Inspect valve core. Replace if seal is worn, deformed or otherwise damaged. (III. 1 & 2)
2. Inspect tire valve for visible damage, replace if necessary. (III. 1 & 2)

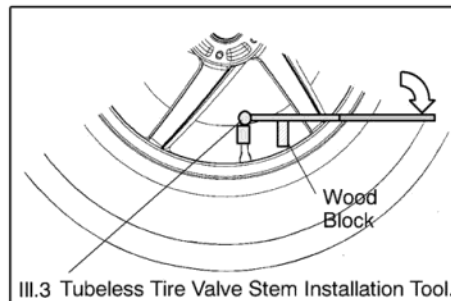
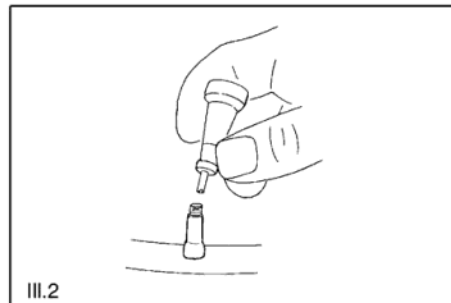
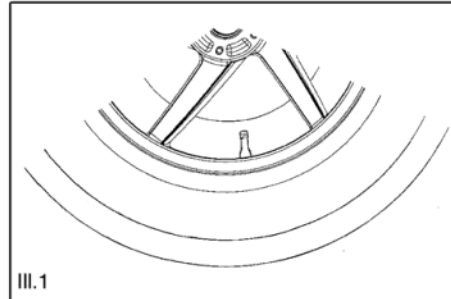
NOTE: If tire is being replaced due to normal wear, replace valve stem also.

TIRE VALVE INSTALLATION

1. Remove tire from wheel.
2. Clean tire valve hole and area around the valve hole thoroughly.
3. Lubricate tire valve and tire valve hole with rubber lubricant.
4. Place tire valve into hole from tire side of the rim with valve core facing the wheel hub.
5. Screw a tire valve installation tool onto tire valve. (III. 3)

Tire valve installation tool

6. Place a small piece of wood against the rim so leverage point for the tire valve tool will be advantageous when levering tire valve in. (III. 3)
7. Lever tire valve into place. Be sure it is fully seated. III. 3.
8. Remove tire valve tool.



TIRE INSTALLATION

1. Lubricate both tire beads with rubber lubricant.

⚠ WARNING

Never apply grease, oil, gasoline, spray type lubricants or anything other than rubber lubricant or a neutral soap and water solution to the tire bead. Doing so can damage the tire.

Important Point:

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

Victory 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.

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.

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.

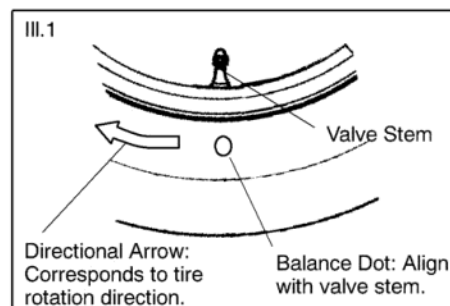
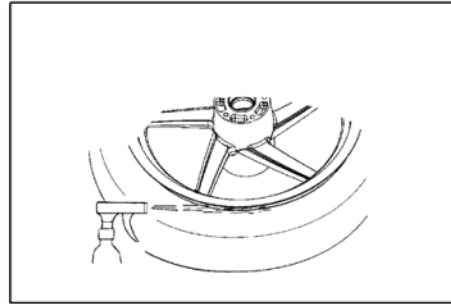
Ensure that bead is correctly seated.

TUBE TYPE TIRES:

Install new rim band (rim flap) on rim with hole oriented over valve stem hole in rim.

1. Hold tire vertically on floor.
2. Orient tire correctly as to the balance dot and directional arrow.
3. Place rim into the tire and push it down.
4. Pull/push tire on to rim until one sealing lip is on rim. It shouldn't be necessary to use tire irons to put one side of the tire onto the rim.
5. Place tire in a horizontal position with un-installed portion of tire facing up.

NOTE: Confirm tire is positioned correctly by observing directional arrows. (III. 1)



TIRES / WHEELS

TIRE INSTALLATION (cont.)

CAUTION:

Support tire assembly in such a way that brake disk or belt drive sprocket cannot be damaged.

NOTE: This procedure can be performed on an empty 30 gallon drum with the top cut out. The top lip of the drum should be covered with a split rubber hose to protect rim.

TUBE TYPE TIRES:

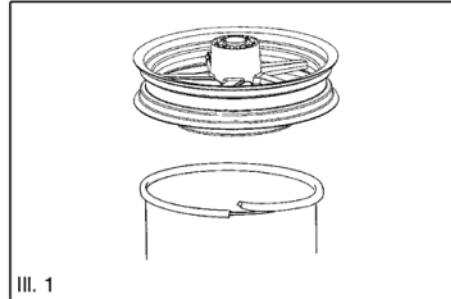
Apply baby powder to new tube and install by inserting valve stem through rim band and rim. Tube must be completely deflated at this time.

Install the valve stem lock nut a few threads. Do not tighten the lock nut at this time.

Install tube in tire starting at valve stem and working your way around until entire tube is laying inside the tire in a natural position.

Arrange the tube if necessary to eliminate kinks or bends, and be sure the valve stem projects straight out. The stem should form a 90 degree angle with the rim.

Finger tighten lock nut to hold stem in position.



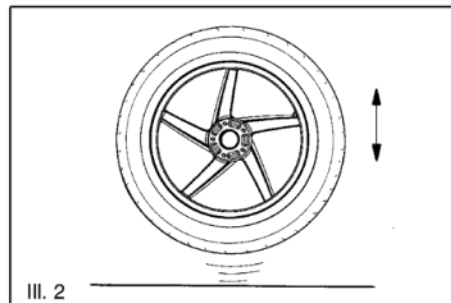
6. With your hands, push as much of the remaining tire bead as possible into the rim.
7. When no more of tire can be installed by hand, press down on portion of tire in front of you with your knee to push tire into rim's drop center.
8. Place one hand at the point where tire is above the rim to keep it in this position.
9. Carefully slide a tire iron between the rim and tire at the other side of the un-installed portion of the tire.

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.

NOTE: Be sure both beads are forced as far as possible into the drop center of the rim.

10. Lever the tire iron over and install that portion of tire. Continue to move tire iron in small increments and repeat procedure until tire is installed.
11. Install valve core if removed.
12. Line up balance dot.
13. Confirm that the directional arrows are pointing correct direction.
14. Bounce tire on the floor several times while rotating tire. This will expand tire bead outward slightly which will make tire inflation easier. (III. 2)
15. Inflate tire observing following precautions on page 14.11.



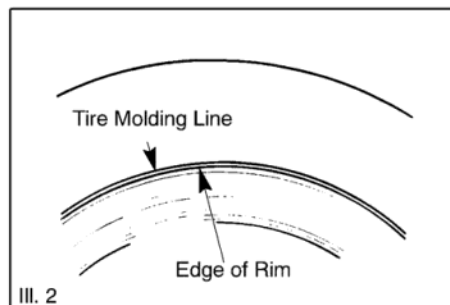
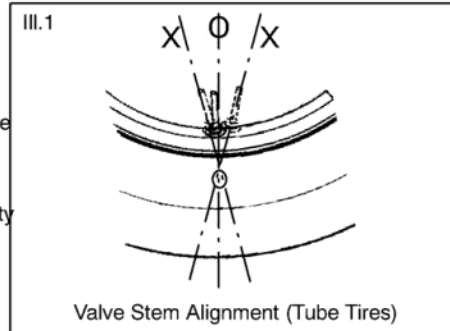
14.10

TIRE INFLATION

⚠ DANGER

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 (III.1).
 - 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.
16. Inspect the line molded onto the tire side walls. It must be same distance from rim all the way around tire. If the distance varies it indicates that tire is not seated properly. (III. 2)
 17. If tire is not seated correctly, deflate and unseat the tire, relubricate the tire beads and repeat inflation procedure.
 18. Install wheel assembly onto balance stand and spin. Observe the wheel assembly while it is spinning to make sure the tire is seated properly.
 19. Adjust tire pressures to specifications.
 20. Balance tire / wheel assembly. Refer to page 14.12.

**⚠ 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

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.

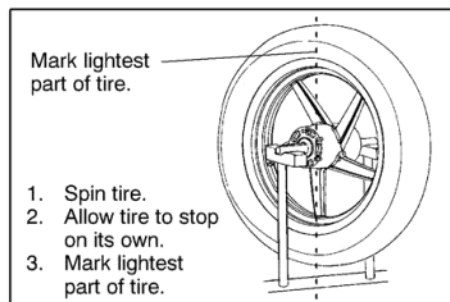
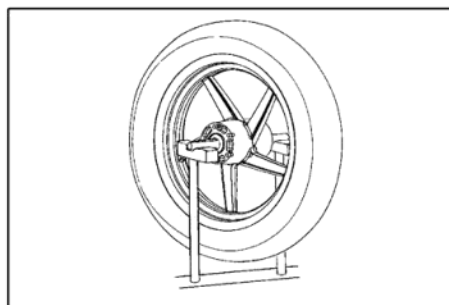
Balance Stand PV-43556

2. Remove all balance weights. Clean tire and rim thoroughly.

NOTE: While it is possible to balance a wheel assembly with axle and 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.

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.



TIRE BALANCING

5. Place balance weights at the lightest portion of wheel in small increments.
6. After each addition of weight, spin the wheel assembly and allow it to stop by itself.
7. When correct amount of weight has been added to wheel, it will no longer stop in the same location and the wheel assembly is balanced.
8. Install wheel / tire assembly tire on motorcycle (front refer to page 12.14, rear refer to page 13.9).

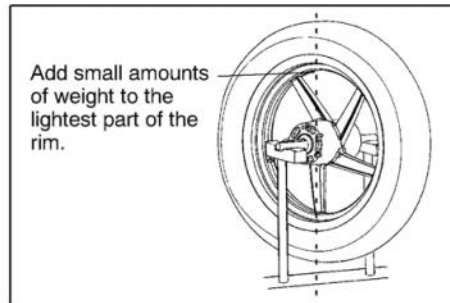
CAUTION:

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.

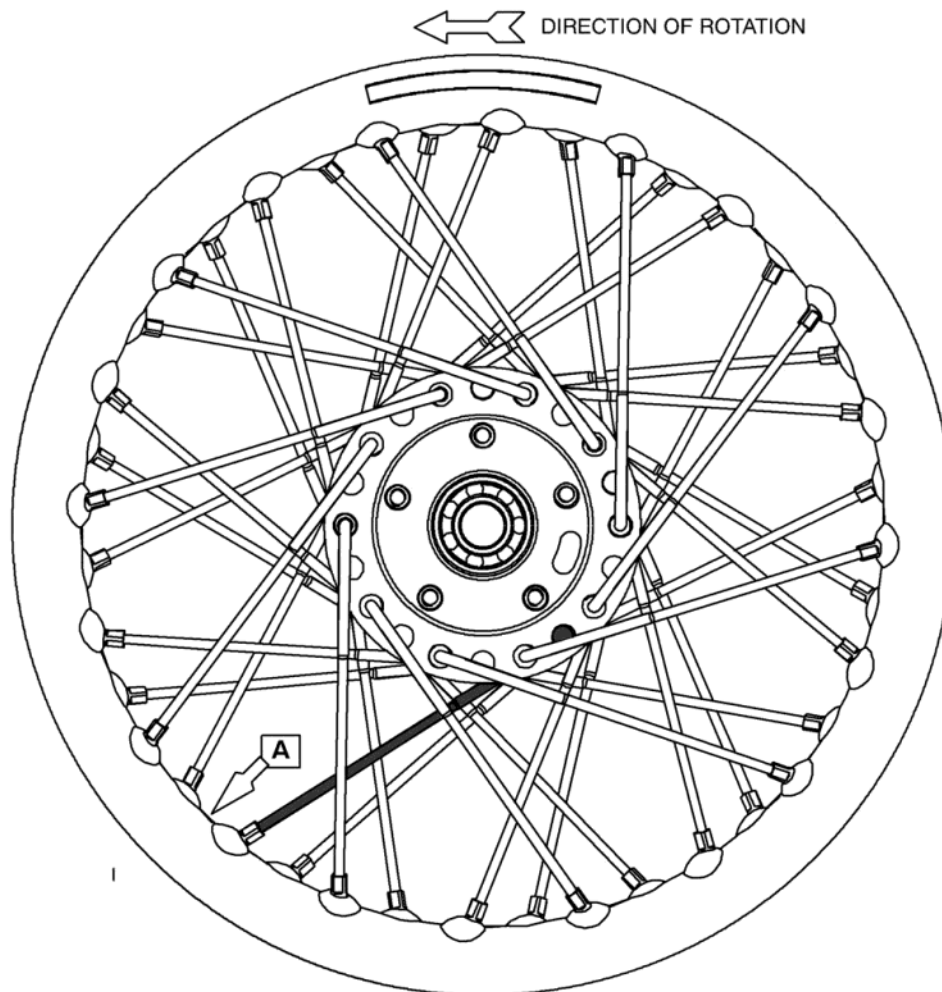
Part # 1520507 .25 oz Adhesive Weight



TIRES / WHEELS

WHEEL LACING

**FRONT WHEEL
VIEW FROM LEFT SIDE**



A VALVE STEM LOCATION (ON RIGHT SIDE OF WHEEL)

14.14

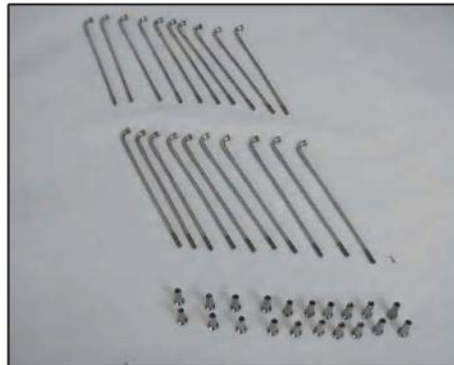
WHEEL LACING

1. Select matching components and organize your spokes carefully.

Use a properly laced wheel as an example of the spoke pattern.

Layout 20 inside spokes and nipples in an organized fashion.

Lubricate spoke nipples with 10W fork oil or similar lubricant.



2. Insert all inside spokes in the hub.

Install the remaining inner spokes on both hub flanges skipping every other hub flange hole.

Opposite flange inside spokes begin in the hole just to the right.



3. Lay rim in position with valve stem hole oriented to the right side as wheel is installed on bike (right from the rider's perspective) and start nipples a few threads.

Place a spoke into the first rim hole closest to the valve stem hole

Screw nipples onto spokes and tighten nipples equally.



TIRES / WHEELS

WHEEL LACING (CONT.)

4. Install outside spokes and screw on nipples. Work your way around the wheel, installing spokes on alternate sides of wheel.

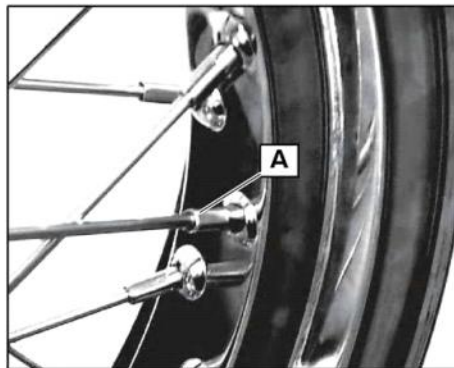
The outside spokes should cross over the inside spokes.

Continue until all spokes and nipples are installed. Tighten nipples equally by hand.



5. With all nipples installed, evenly snug all nipples using a hexdriver. Tighten until one thread shows above each nipple (A).

Work your way around the wheel tightening spokes equally.



6. Install wheel assembly into a truing stand for rim offset adjustment, final spoke tightening and truing of wheel.

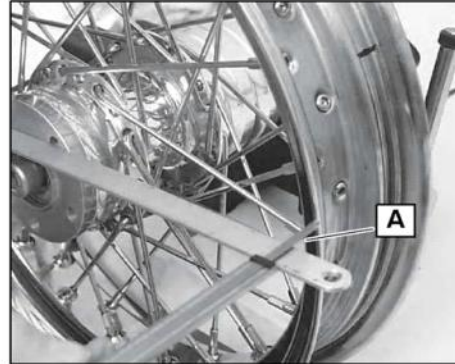
WHEEL OFFSET ADJUSTMENT

1. Lay a straight edge on the brake disc mounting surface and measure the offset distance (A).

If the measurement is not correct, loosen spokes in one side of rim and tighten spokes on the other side equal amounts.

SPEC: Front / Rear Wheel

$26.5 \pm 0.3\text{mm}$, $1.043 \pm .012\text{ in}$

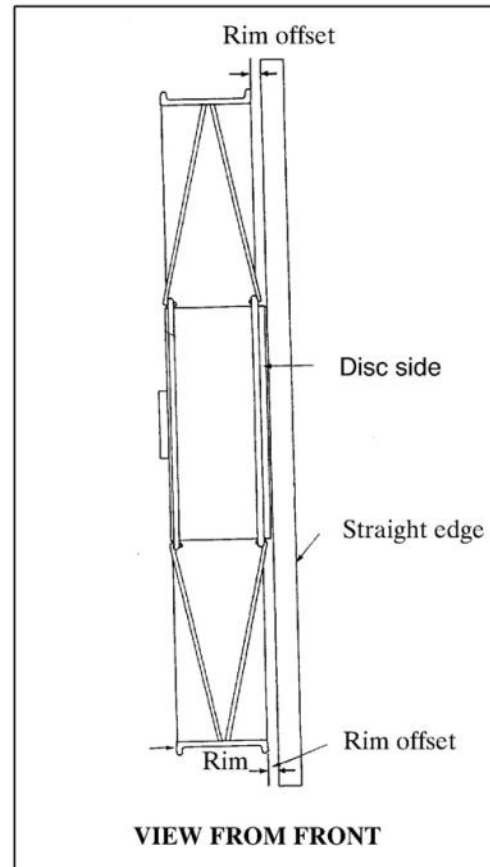


2. Initially tighten spokes in 3 steps to the specified torque while maintaining distance A. This is a starting torque only. Final torque is listed on page 14.19.

TORQUE: Initial Spoke Torque

4-5 Nm, 35-42 in-lb

3. Place straightedge on disc mounting surface and measure to rim.
4. Rim offset is adjusted by loosening all the spokes on one side of the wheel and tightening the spokes on the other side of the wheel.
5. All spokes must be loosened or tightened the same amount to maintain minimum axial and radial runout.



TIRES / WHEELS

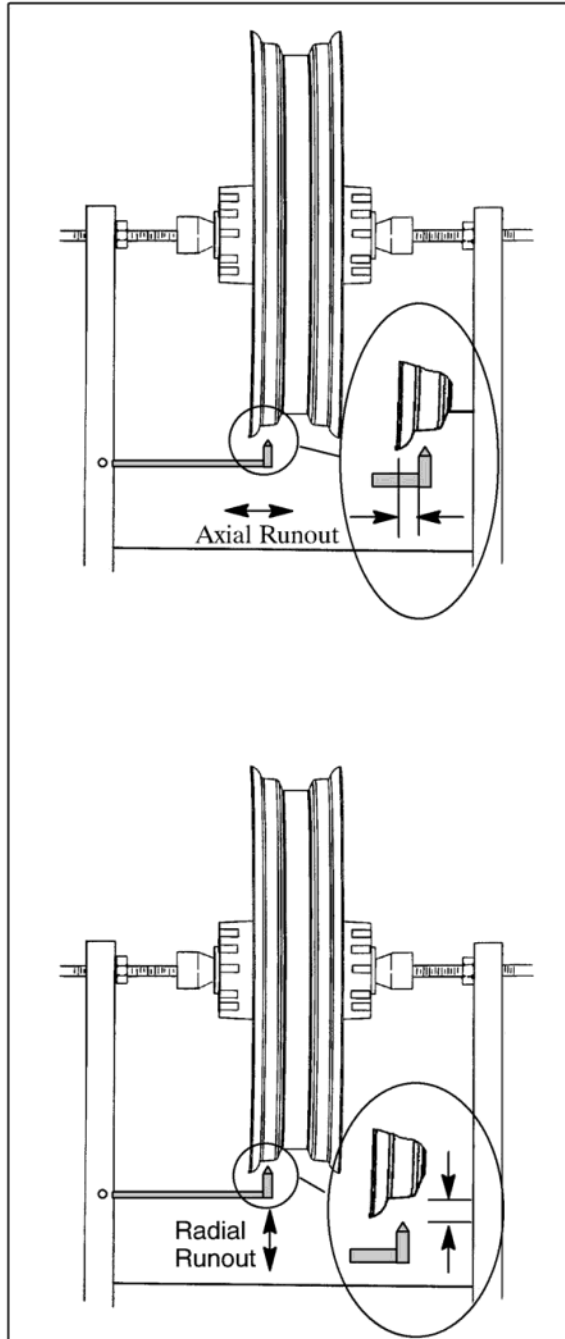
WHEEL TRUING

1. Inspect wheel offset as outlined on page 14.17 if it was not checked prior to beginning this truing process.

2. Measure axial and radial runout.

Axial runout is side to side movement or "wobble" of rim. It is measured on the inside wall of the rim just outside the horizontal bead sealing surface.

It is best to make an initial adjustment of axial runout first. This allows you to see how much radial runout is present.



Radial runout is up and down movement of rim ("hop"). It is measured on the bead sealing surface.

Monitor offset adjustment during the truing procedure to be sure the offset is correct.

WHEEL TRUING (CONT.)

3. Adjust radial runout.

Radial runout is how concentric (round) the rim is with the hub. Radial runout causes up and down movement.

At this point all spokes should be snug. It may be necessary to alternately adjust axial and radial runout.

Alternate between axial and radial adjustments until as close to zero runout is achieved. Acceptable runout specifications are found on page 14.2.

To move rim down: loosen spokes at bottom and tighten spokes at top



To move rim up: loosen spokes at top and tighten spokes at bottom

FINAL TIGHTENING

1. Perform final tightening of spokes.

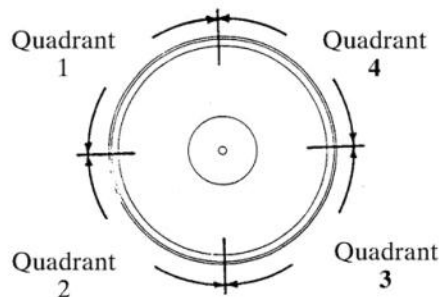
Using tape or crayon, divide wheel into four sections or *quadrants* to final tighten spokes.

Tighten each spoke equally.

Tightening sequence is 1,3,2,4.

TORQUE: FINAL Spoke Torque
8 Nm, 69 in-lb

Spoke final tightening sequence 1,3,2,4



2. Maintain proper runout adjustment during final tightening of spokes.

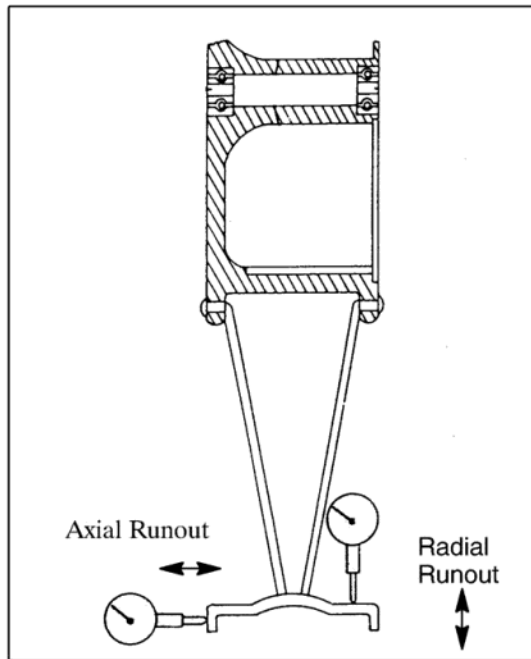
Proper tightening of spokes should have minimal effect on runout.

TIRES / WHEELS

WHEEL TRUING (CONT.)

3. Make a final check of runout and offset.
4. Check spokes for the correct tightness. Use a spoke wrench or check them by tone.

It is best to get as close as possible to zero runout.



IMPORTANT PRACTICES THAT MAKE WHEEL TRUING EASIER ARE:

- Progressively tighten and loosen spoke nipples.
- Keep all spokes at approximately the same tension (snug).
- Lubricate spoke nipples and threads.
- Do not try to change runout with only a few spokes.
- Alternately check axial and radial runout throughout the truing process.
- Properly final tighten all spokes.

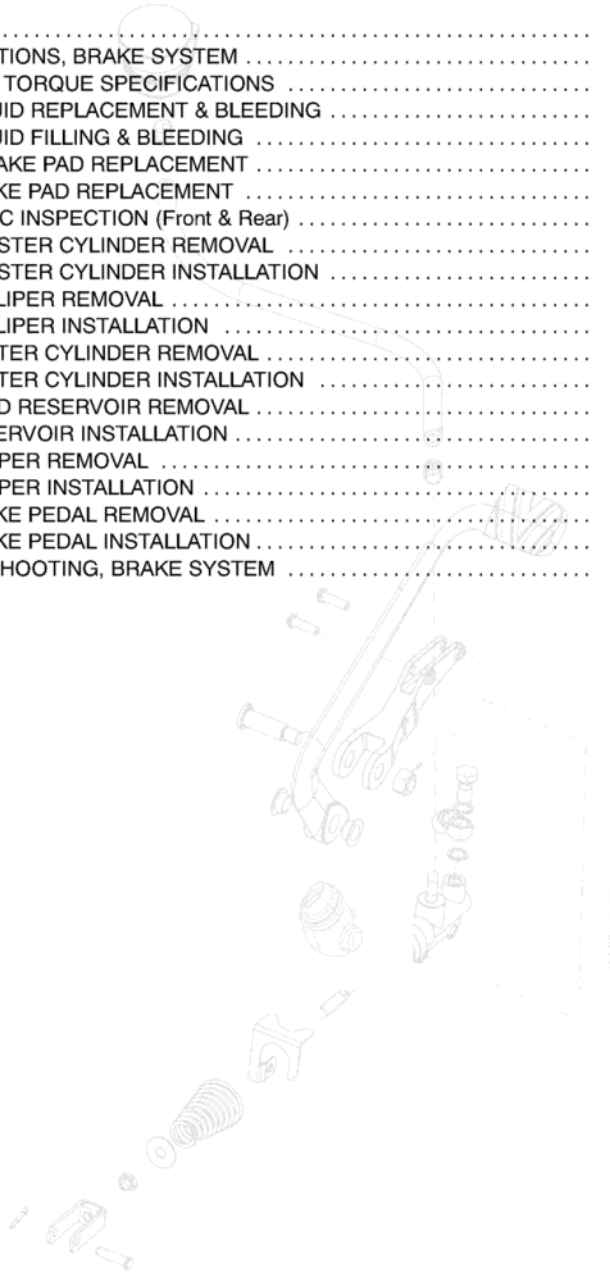
TROUBLESHOOTING

| 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 bushings. | Replace as a set |
| | Damaged or incorrect tire | Replace rear tire |
| | Wheel assembly out-of-balance | Balance wheel |
| | Low tire pressure | Inflate to specification |
| | Loose swing arm, axle or suspension fasteners. | Torque to specification |
| Handlebars Oscillate (Wobble) | Bent front axle | Replace |
| | Worn or damaged wheel bearings | Replace as a set |
| | Tire mounted incorrectly | Mount tire according to specifications |
| | 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 |

CHAPTER 15

BRAKES

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| FASTENER TORQUE SPECIFICATIONS | 15.2 |
| BRAKE FLUID REPLACEMENT & BLEEDING | 15.2 |
| BRAKE FLUID FILLING & BLEEDING | 15.3 |
| FRONT BRAKE PAD REPLACEMENT | 15.4 |
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| REAR BRAKE PEDAL INSTALLATION | 15.12 |
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15

GENERAL

Brakes play a critical role in vehicle safety. For this reason, Victory does not recommend rebuilding internal components of the brake master cylinder or brake wheel calipers. Replacement internal components of the master cylinder or wheel calipers are not available as service parts.

No procedures for rebuilding brake master cylinders or brake wheel calipers are presented in this manual or any other Victory publication. If it is determined that a problem exists within the internal workings of the brake master cylinders or brake wheel calipers, replace the faulty component as an assembly.

External parts such as, brake pedal, brake lever, brake hoses, external sealing washers, master cylinder diaphragm, master cylinder covers or caps and fasteners are available as replacement parts.

⚠ 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.

CAUTION:

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.

CAUTION:

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 petroleum-based fluids.

Do not use brake fluid taken from old, used or unsealed containers. Never reuse brake fluid.

Keep the container completely sealed and out of reach of children.

Make sure the master cylinder being worked on is level before removing the cap.

Do not leave the brake bleeder screw or banjo bolts loose for long periods of time with the reservoir cap removed. Doing so may allow brake fluid to overflow and damage painted, plastic or rubber parts.

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 anytime it is disassembled or when the brake action is spongy.

Always inspect the operation of the brakes before riding the motorcycle.

DO NOT re-use brake disc mounting screws. Install NEW screws if brake disc (front or rear) is removed.

SPECIFICATIONS

| BRAKE SYSTEM | | |
|-----------------------------------|-----------------------|--|
| Item | Standard | Service Limit |
| Specified Brake Fluid | DOT 4 | Replace every 24 months or 12,500 miles |
| Brake Disc Thickness, Front | 5.0 mm \pm .25mm | 4.5 mm (.177") |
| Brake Disc Thickness, Rear | 5.8 mm \pm .25mm | 5.2 mm (.205") |
| Brake Disc Runout - Axial | - | .30 mm (.012") |
| Front Brake Pads Wear Limit | - | When groove is no longer visible |
| Rear Brake Pads Wear Limit | - | When chamfer is no longer visible (1.8 mm friction material thickness) |
| Brake Pedal Freeplay - All Models | 5-8 mm (3/16-5/16") | - |

BRAKES

TORQUE SPECIFICATIONS TABLE

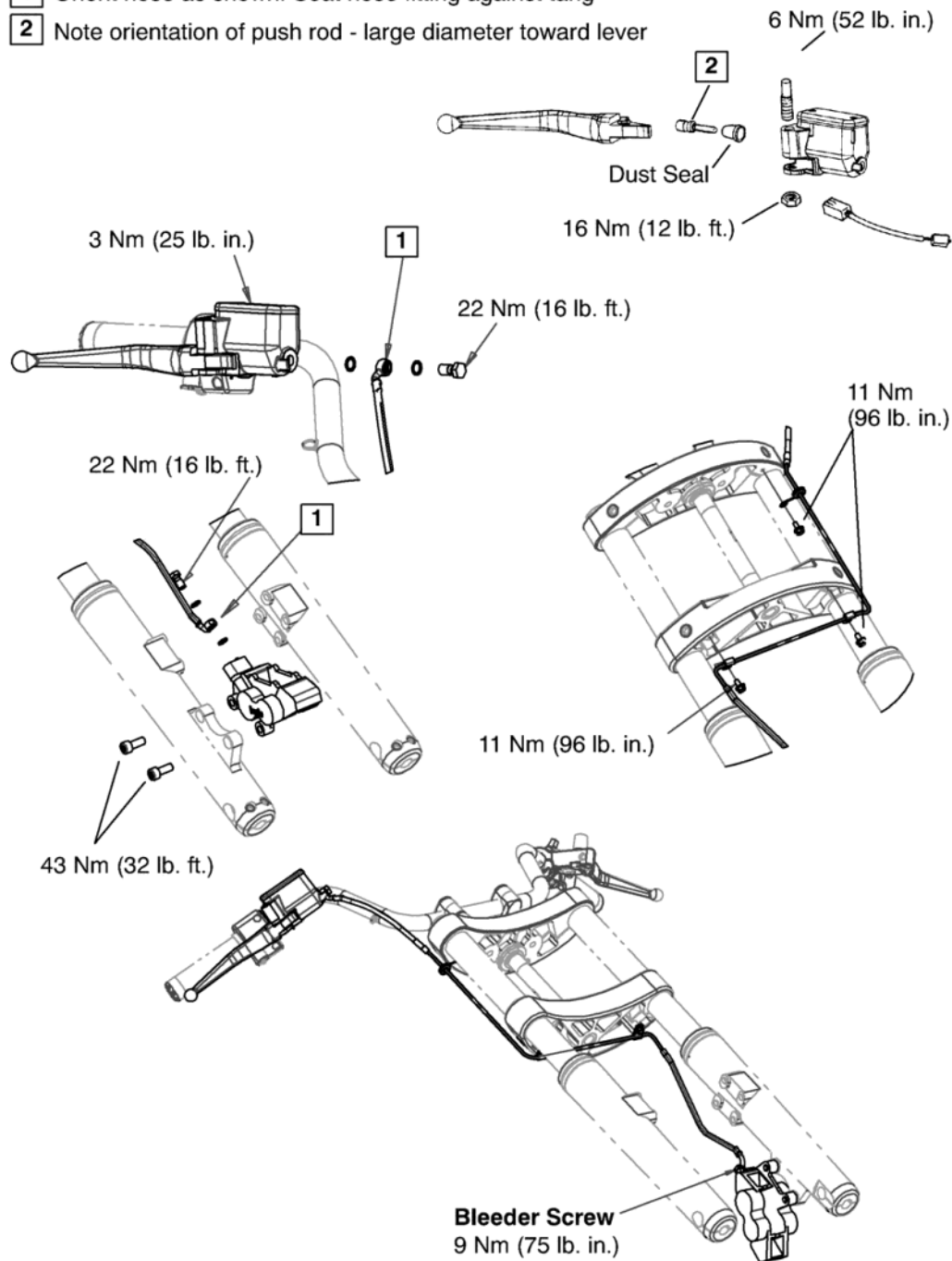
| Description | Torque Nm | Torque lb-ft (in-lb) |
|--|-----------|----------------------|
| Caliper Bleeder Screw | 5.5 Nm | (48 in-lb) |
| Brake Line Banjo Bolts (All) | 22 Nm | 16 lb-ft |
| Front Brake Lever Pivot Screw (Under Mirror) | 16 Nm | 12 lb-ft |
| Front Brake Master Cylinder to Handlebar | 9 Nm | (78 in-lbs) |
| Front Brake Master Cylinder Reservoir Cover | 3 Nm | (25 in-lbs) |
| Front Brake Caliper to Fork Leg | 43 Nm | 32 lb-ft |
| Rear Brake Light Switch Manifold to Frame | 11 Nm | (96 in-lbs) |
| Rear Brake Light Switch to Manifold | 13.5 Nm | 10 lb-ft |
| Rear Brake Master Cylinder Mounting Screws | 7 Nm | 5 lb-ft |
| Rear Brake Pedal Pivot Bolt | 16 Nm | 12 lb-ft |
| Rear Brake Reservoir Mounting Screw | 9.5 Nm | (84 in-lbs) |

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

FRONT BRAKE LINE ROUTING - STANDARD, DELUXE, CLASSIC CRUISER

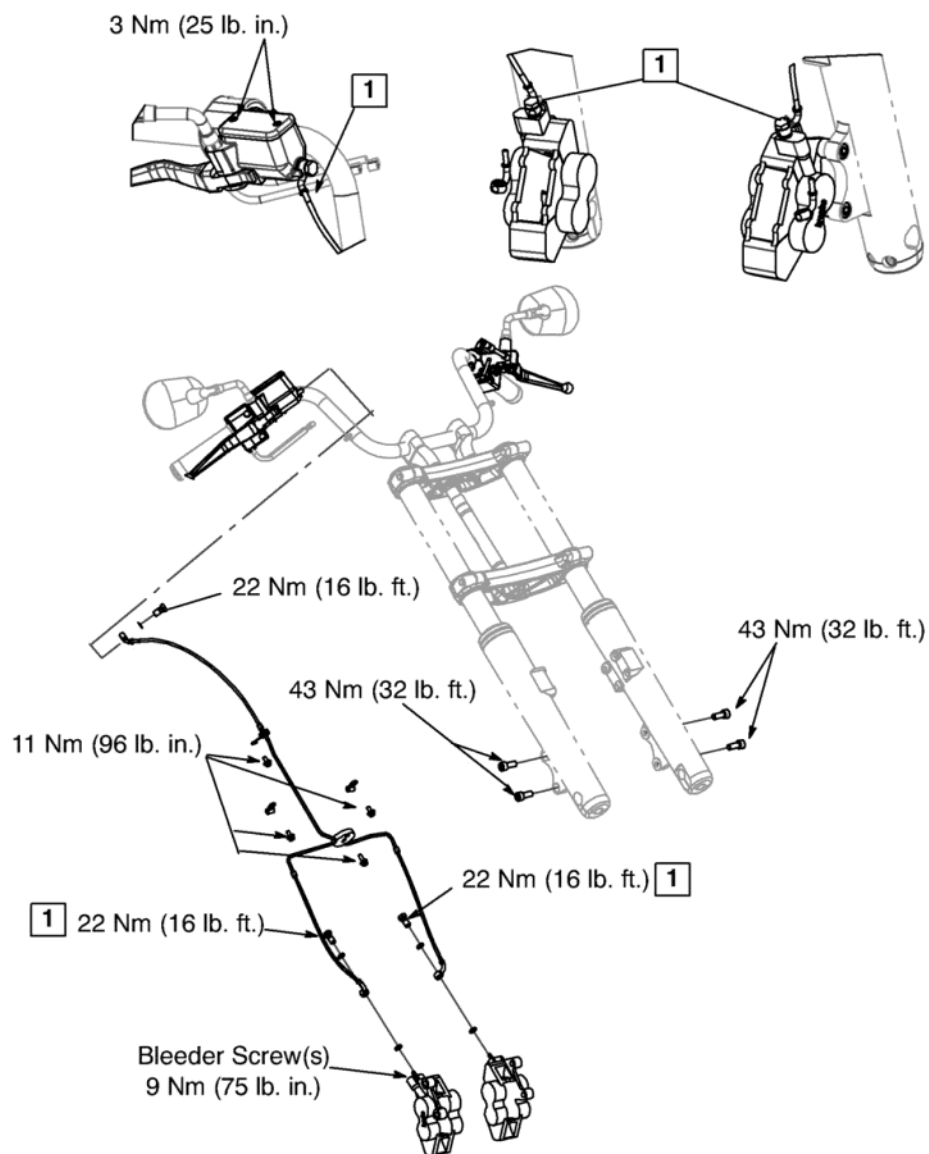
- 1 Orient hose as shown. Seat hose fitting against tang
- 2 Note orientation of push rod - large diameter toward lever



BRAKES

FRONT BRAKE LINE ROUTING - TOURING CRUISER

- 1** Orient hose as shown. Seat hose fitting against tang



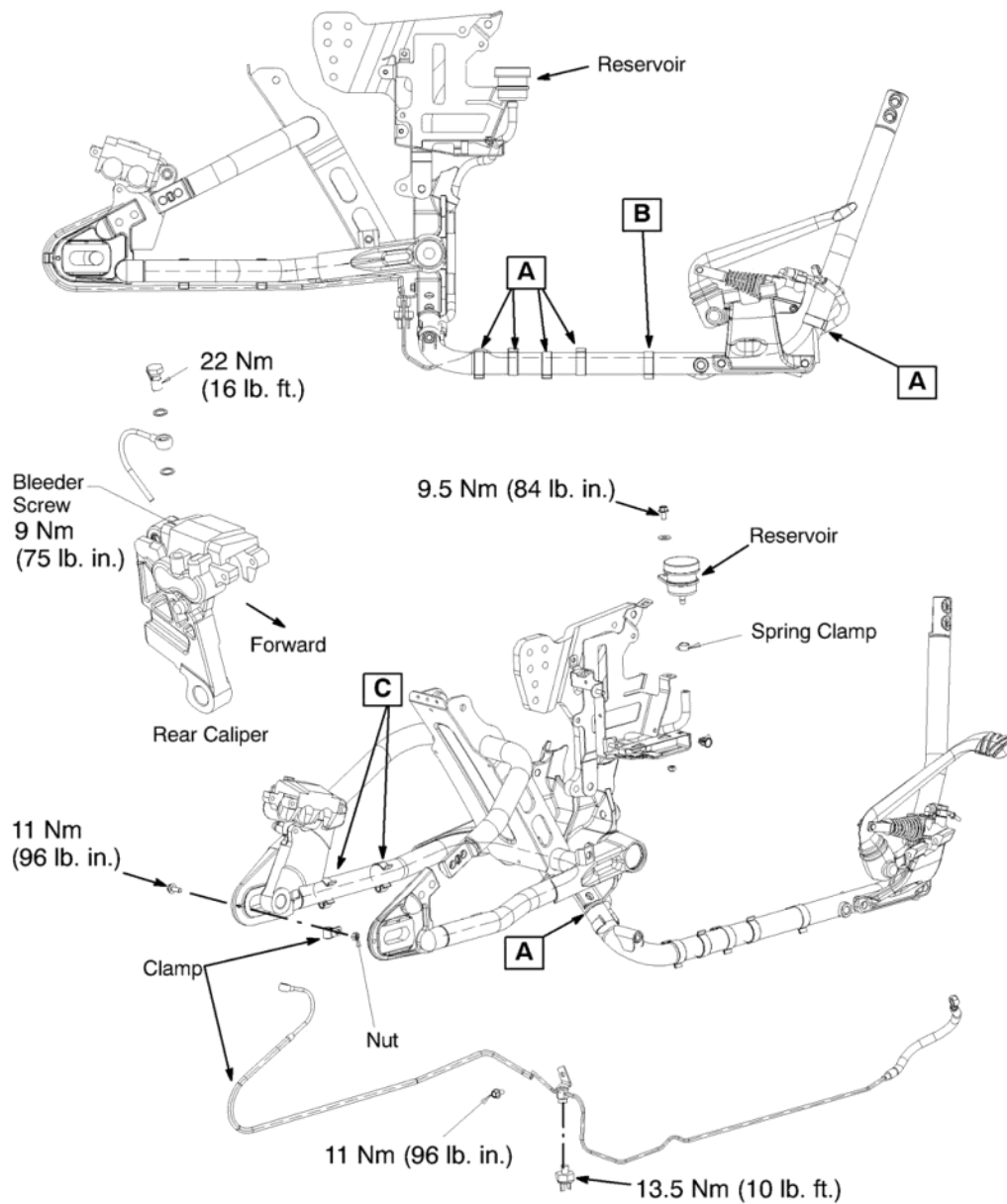
REAR BRAKE LINE ROUTING - STD, DLX, CLASSIC, TOURING CRUISER

A Line clip style A *

B Line clip style B *

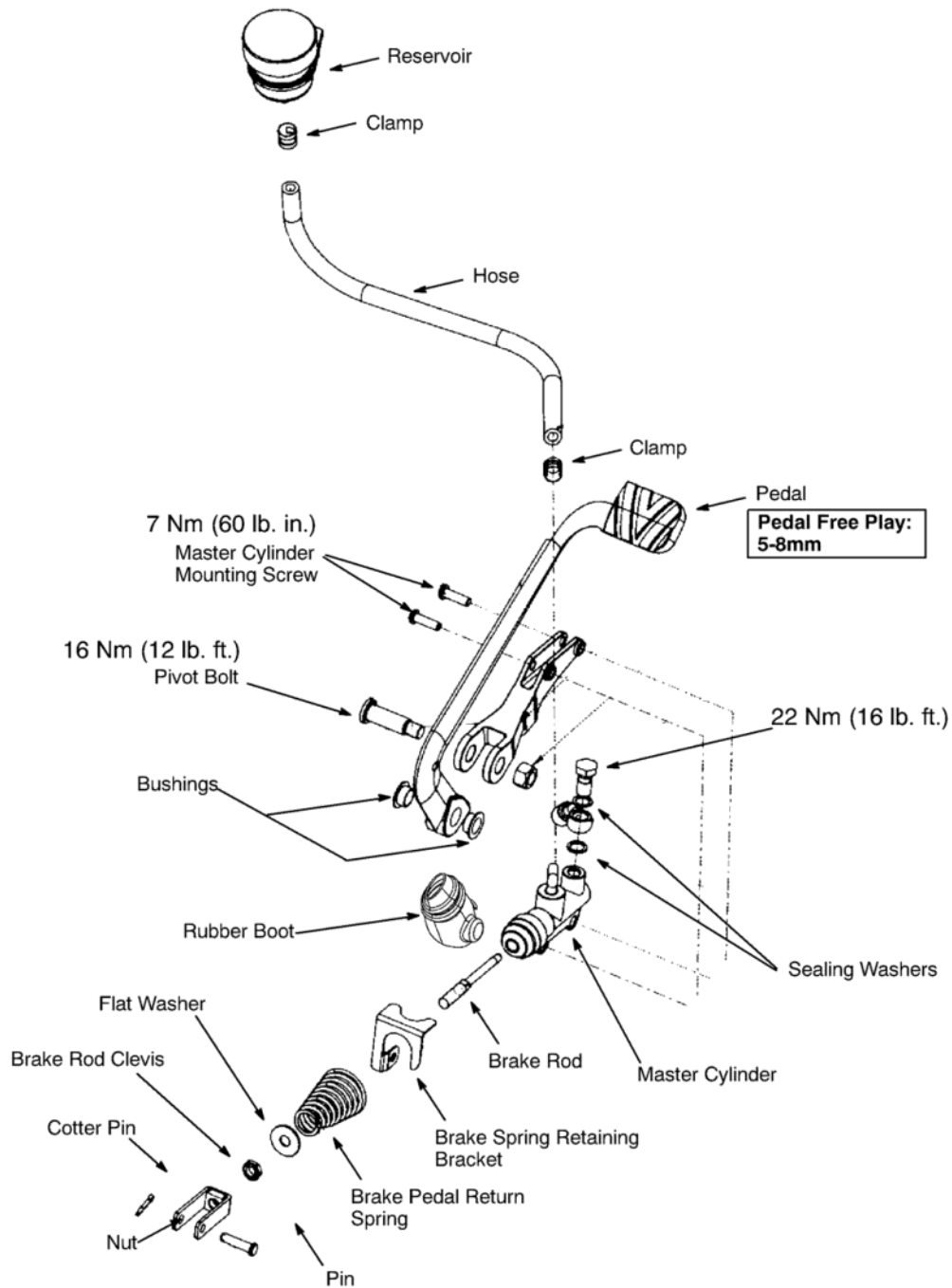
* Refer to appropriate parts book for part numbers

C Line clip style C *



BRAKES

REAR BRAKE ASSY - STD, DLX, CLASSIC, TOURING CRUISER



15.6

BRAKE FLUID REPLACEMENT & BLEEDING - WARNINGS & GUIDELINES

 **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.

 **WARNING**

Keep brake fluid tightly sealed and out of reach of children. Brake fluid can accumulate moisture, reducing its effectiveness.

 **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.

Pressure Bleeding Not Recommended

CAUTION

Pressure bleeding is not recommended by Victory. When fluid surges through the fittings, it is possible to cavitate the fluid and create air in the system. In addition, the fluid stored in a pressure bleeder may be contaminated. Always use fresh DOT 4 brake fluid from a sealed container.

Brake Bleeding Tips

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 prevent air from entering the system.
- Apply only light to moderate pressure to the lever or pedal when bleeding the brake system. Extreme pressure will cause a surge of fluid through the small orifices of the brake system when the bleeder screw is opened and introduce air into the system by means of cavitation.

BRAKES

BRAKE FLUID FILLING & BLEEDING

1. Fill reservoir until observation window is covered with DOT 4 brake fluid from a sealed container.

Victory DOT 4 Brake Fluid 2872189

2. Place reservoir cap on master cylinder to prevent entry of contaminants.

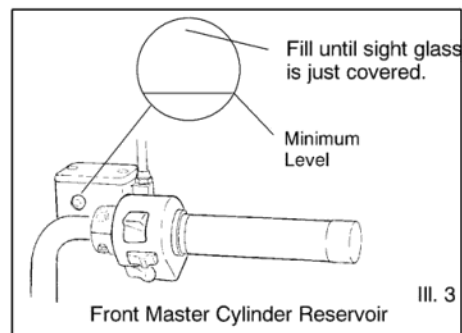
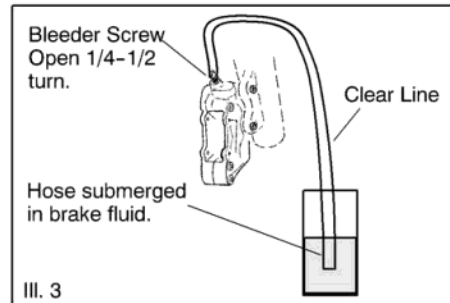
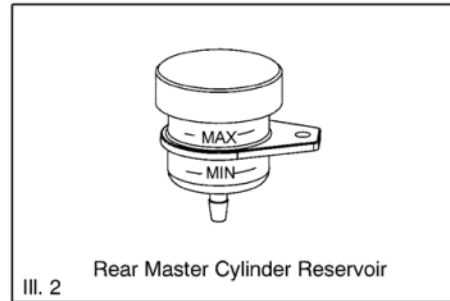
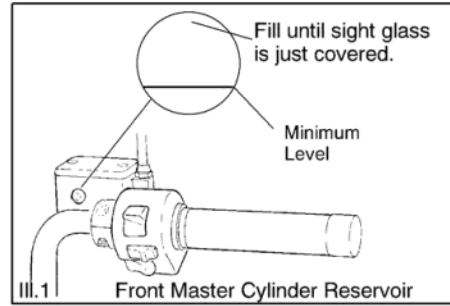
NOTE: Throughout the following procedure, monitor fluid level in master cylinder constantly. Do not allow fluid level to fall below minimum level. (III. 1 and III. 2)

3. Connect one end of a small hose to the bleed screw on the wheel caliper. This hose should be clear so air bubbles and fluid can be monitored.
4. Place a small quantity of fresh brake fluid into a small, clear jar.

5. Place the other end of bleeder hose into jar, making sure the end of hose is always submerged in brake fluid (III. 3).

NOTE: Keep the hose constantly submerged in brake fluid to prevent the system from drawing air on the return stroke of master cylinder.

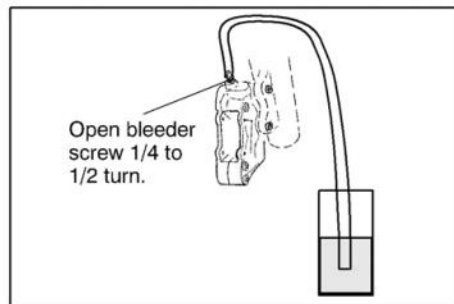
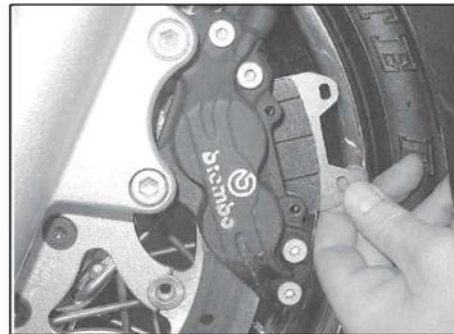
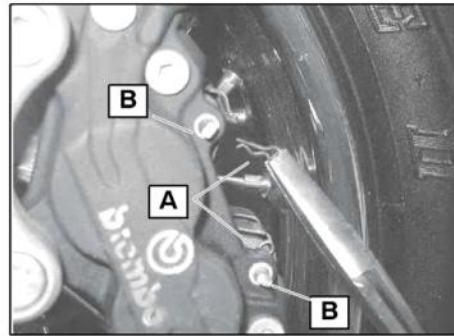
6. Open bleeder screw 1/4 to 1/2 of a turn.
7. *Slowly* pump brake lever while observing fluid level in the master cylinder. Add brake fluid as required during the bleeding procedure to keep fluid above the minimum level.
8. Continue to pump brake lever with bleeder screw open until a steady stream of air-free fluid is observed.
9. When no more air is observed, close bleeder screw when pulling brake lever toward handlebar. Torque screw to specification listed on page 15.2.
10. Release brake lever and inspect feel of brake lever. If it is spongy, repeat procedure.
11. After completing brake bleeding procedure, ensure fluid level is covering the sight glass. Install master cylinder diaphragm and reservoir cover. Torque screws to specification listed on page 15.2.
12. Rear brake bleeding is the same with the exception of the reservoir cap, location of bleeder screw and brake actuation by the foot pedal.



FRONT BRAKE PAD REPLACEMENT

NOTE: Always replace brake pads as a set. When brake pads wear, the pistons extend farther out of caliper bores and fluid level in the reservoir goes down. During normal maintenance procedures, fluid is added to reservoir. If the brake pads are being replaced because of wear, the pistons must be pushed back into their bores and brake fluid must be removed.

1. Remove retaining clips (A) from brake pins.
2. Remove brake pad pins (B).
3. Remove spring plate.
4. Slide brake pads out rear of caliper.
5. Place a bleeder hose on to the caliper bleed screw. Place the other end of the hose into a container.
6. Open the bleed screw and push the pistons into their bores. Close the bleed screw when the pistons are fully retracted.
7. Clean brake disc and brake caliper with brake cleaner.
8. Install new brake pads with friction material against disc.



BRAKES

FRONT BRAKE PAD REPLACEMENT (cont.)

9. Position the spring plate onto caliper.

NOTE: The arrow (A) on spring plate points in brake disc direction of rotation.

10. Install brake pad pins (B).
11. Install brake pad pin clips. Rotate the front pin so that clip is trapped under caliper spring plate.
12. Add fluid to brake fluid reservoir as necessary.

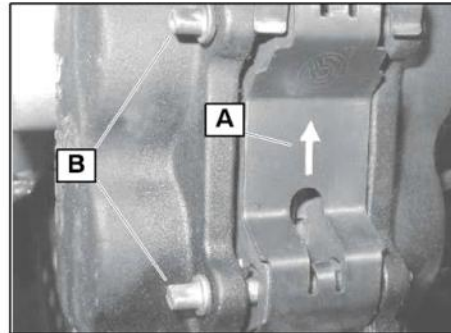
CAUTION

Do not overfill front or rear brake reservoirs. Too much fluid will not allow for thermal expansion during operation. Brake drag may result.

13. Operate brake lever several times until lever is firm and pressure can be felt. Bleed brakes if necessary.

CAUTION

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 BRAKE PAD REPLACEMENT

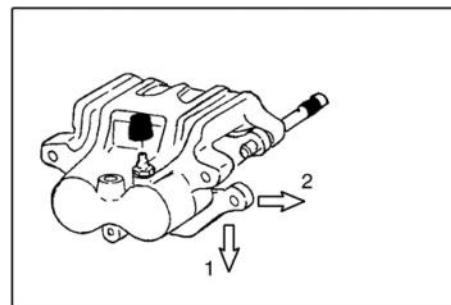
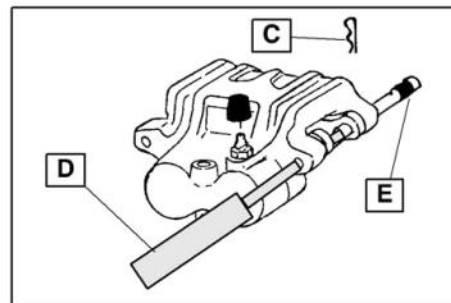
NOTE: Always replace brake pads as a set. When brake pads wear, the pistons extend farther out of their bores and the fluid level in the reservoir goes down. During normal maintenance procedures, fluid is added to the reservoir. If the brake pads are being replaced because of wear, the pistons must be pushed back into their bores and brake fluid level in the reservoir must be monitored. It may be necessary to remove some fluid from the reservoir as pads / caliper pistons are pushed back.

1. Remove retaining clip (C) from brake pin.
2. Use a 5/32" pin punch (D), drive the brake pad pin (E) past the outermost brake pad. Do not push the pin out of the innermost pad at this time. Remove pin punch.

CAUTION

Replace one pad at a time to prevent the spring plate at the top of the pads from becoming dislodged.

3. Push outer brake pad down and pull it toward the rear of the machine to remove it.



REAR BRAKE PAD REPLACEMENT (cont.)

4. Place a hose on the caliper bleed screw. Place the other end of the hose into a container.
5. Open the bleed screw 1/4–1/2 turn and push the caliper toward the wheel. Close the bleed screw when piston is fully retracted.
6. Clean the brake disc and brake caliper with brake cleaner.
7. Install new outer brake pad with friction material toward brake disc.
8. Install pin punch and drive brake pin (A) past inner brake pad.
9. Pull pin punch back just enough to remove inner brake pad and leave pin punch installed in outer brake pad. Remove inner brake pad.
10. Clean the brake disc and brake caliper with brake cleaner.
11. Pull caliper towards left side of machine to force the piston into caliper.
12. Install new, inner brake pad.

NOTE: Spring clip can be dislodged when removing pads. Be sure to replace spring clip in proper position (arrow on spring clip indicates brake disc rotation).

CAUTION

Make sure that the ends of the brake pads are correctly installed into the caliper.

13. Install brake pad pin. Use long drift punch to lightly drive the brake pad pin into place from the drive sprocket side of the motorcycle.

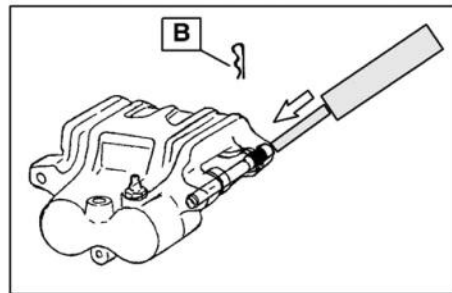
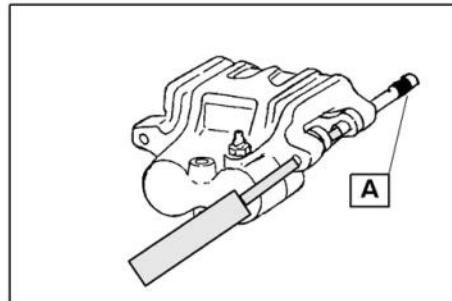
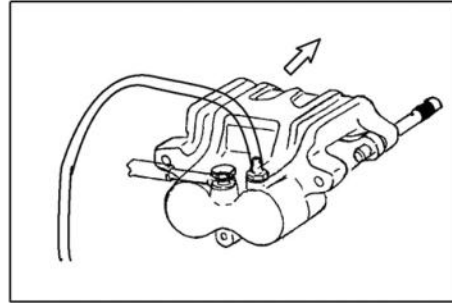
NOTE: Lift up on the brake pads while installing the brake pad pin.

14. Install brake pad pin clip (B).
15. Add fluid to brake fluid reservoir as necessary.

CAUTION

Do not overfill front or rear brake reservoirs. Too much fluid will not allow for thermal expansion during operation. Self-application of the brakes may result.

16. Operate brake pedal several times to insure that the brakes are operating correctly.
17. Bleed brakes if necessary.

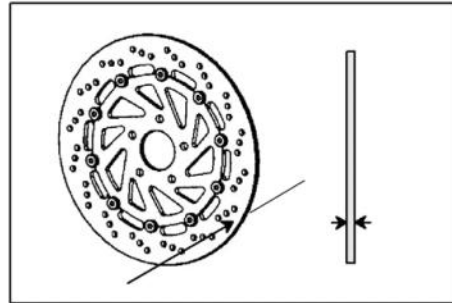


BRAKES

BRAKE DISC INSPECTION (Front & Rear)

1. Visually inspect the disc for cracks or damage.
2. Measure the brake disc thickness in several locations along the inner and outer wear surface and compare to specifications found on page 15.1.

NOTE: Replace the brake disc if any measurement is less than the service limit.



3. Inspect for brake disc warpage and compare to specifications found on page 15.1.

Excessive brake disc runout can be caused by several factors:

- Worn or damaged wheel bearings
 - Loose axle nut or axle pinch bolts
 - Foreign material between the disc and wheel hub
 - Damaged wheel hub or brake disc
4. Replace the brake disc if the dial indicator reading displays excessive brake disc runout and other possible causes have been eliminated.
 5. Refer to page 12.12 for front brake disc removal and installation. Refer to page 13.8 for rear brake disc removal & installation.

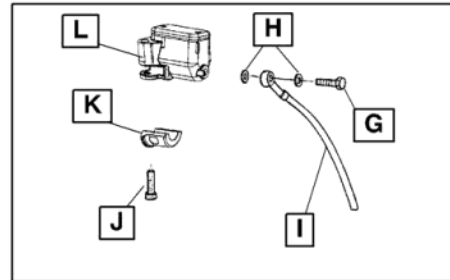
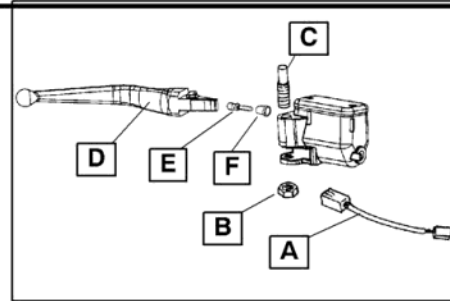


FRONT MASTER CYLINDER REMOVAL

CAUTION

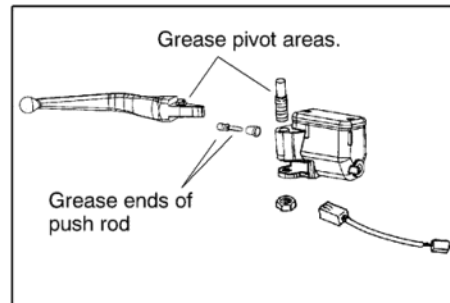
Brake fluid and some types of brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed.

1. Remove the right rear view mirror.
2. Attach a drain hose to the caliper bleed screw and place the end in a suitable container. Drain the brake fluid from the front brake system.
3. Disconnect the brake light switch harness (A) from the master cylinder.
4. Remove the pivot screw lock nut (B), pivot screw (C), brake lever (D), push rod (E), and dust seal (F). NOTE THE DIRECTION of the push rod, with large diameter facing out (toward lever).
5. Remove the banjo bolt (G), sealing washers (H) and brake hose (I) from the master cylinder.
6. Remove master cylinder clamp screws (J), clamp (K) and master cylinder (L).



FRONT MASTER CYLINDER INSTALLATION

1. Clean the mounting surface on the handlebar.
2. Install the master cylinder and its clamp. Align split between master cylinder and clamp to dot on handlebar.
3. Torque rear bolt first to close gap between master cylinder and clamp, then torque front bolt. Torque specifications are listed on page 15.2. (Gap at front).
4. Apply a light coating of grease to both ends of the master cylinder piston push rod and to the lever pivot bolt.
5. Install the brake lever and pivot bolt, torquing the pivot bolt first and then the nut to specification listed on page 15.2.
6. Connect the brake hose to the master cylinder with the banjo bolt and new sealing washers. Torque the banjo bolt to specification listed on page 15.2.
7. Connect front brake light switch wire connectors.
8. Fill and bleed the front hydraulic brake system. Refer to page 15.8.



III.1

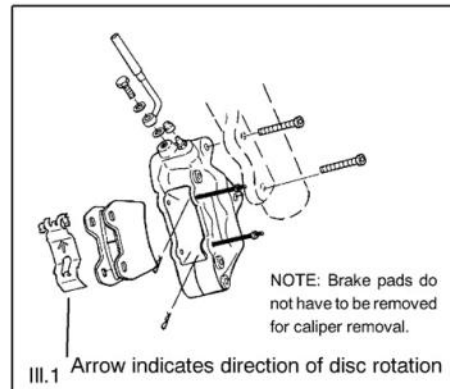
BRAKES

FRONT CALIPER REMOVAL

CAUTION:

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.

1. Drain the brake fluid from the front brake system.
2. Remove the brake pads.
3. Remove banjo bolt and sealing washers, remove brake hose from caliper assembly.
4. Remove front caliper mounting bolts, remove the caliper.



FRONT CALIPER INSTALLATION

1. Clean mounting surfaces thoroughly.
2. Clean brake disc and caliper with Victory brake cleaner.

Victory brake cleaner PN 2872191

3. Push brake pads apart and install caliper assembly over brake disc and onto the fork leg.
4. Install caliper mounting bolts. Torque to specification listed on page 15.2.
5. Connect brake hose to caliper with new sealing washers and banjo bolt. Torque to specification listed on page 15.2.
6. Install brake pads.
7. Fill and bleed the front brake hydraulic system. refer to page 15.8.

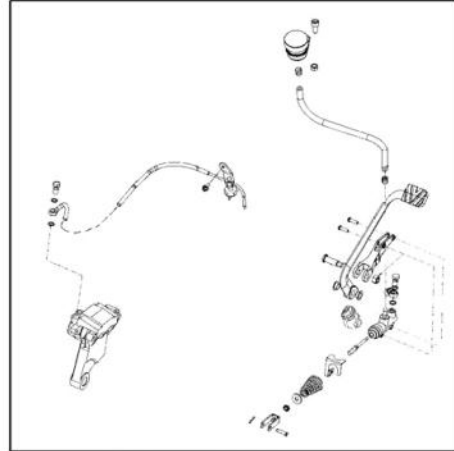


REAR MASTER CYLINDER REMOVAL

CAUTION:

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.

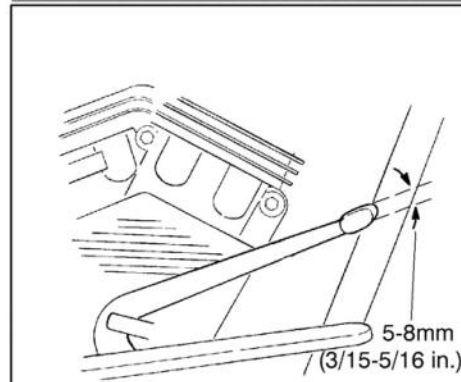
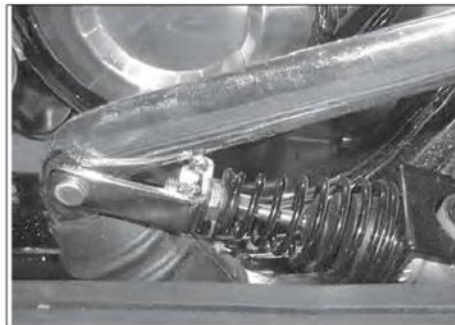
1. Drain brake fluid from rear brake system using the caliper bleed fitting.
2. Remove clamp for reservoir hose at master cylinder, remove hose. Catch the brake fluid in a suitable container and dispose of properly.
3. Remove brake line banjo bolt, sealing washers and brake line.
4. Remove two screws attaching the guard and master cylinder to brake pedal support. Remove master cylinder from footpeg support.



REAR MASTER CYLINDER INSTALLATION

1. Install master cylinder on brake pedal support. Feed the brake lever push rod into the master cylinder as you install the master cylinder.
2. Torque the master cylinder mounting bolts to specification listed on page 15.2.
3. Install clevis pin, washer, and cotter key.
4. Install reservoir hose to master cylinder, secure clamp.
5. Connect brake hose to master cylinder with banjo bolt and new sealing washers. Torque to specification listed on page 15.2.
6. Fill and bleed the rear hydraulic system. Refer to page 15.8.
7. Inspect and adjust brake pedal freeplay. Refer to page 2.10.

Specification: All Models-Brake Pedal Freeplay
5-8 mm (3/16-5/16 in) (.188 - .313 in)



BRAKES

REAR BRAKE FLUID RESERVOIR REMOVAL

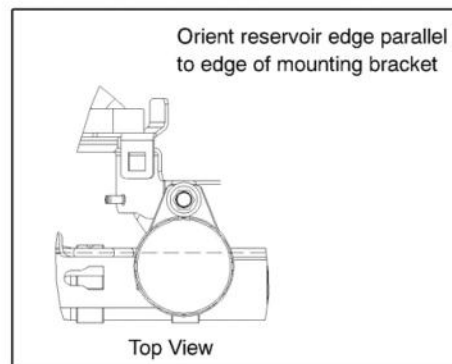
CAUTION:

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.

1. Drain brake fluid from rear brake system using the caliper bleed fitting.
2. Disconnect reservoir hose from reservoir, being careful to catch the fluid in a suitable container.
3. Remove mounting bolt and reservoir.

REAR RESERVOIR INSTALLATION

1. Connect reservoir hose to reservoir.
2. Install reservoir onto mounting bracket with edge parallel to edge of bracket. Tighten mounting bolt to specification on page 15.2.
3. Fill and bleed the rear hydraulic brake system. Refer to page 15.8.

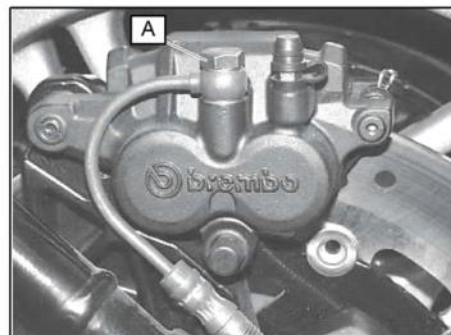


REAR CALIPER REMOVAL

CAUTION:

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.

1. Drain the brake fluid from the rear brake system.
2. Remove banjo bolt (A) and sealing washers from rear brake hose and remove hose from wheel caliper.
3. Remove rear wheel, refer to page 13.4.
4. Remove caliper assembly.
5. Remove brake pads and spring plate from caliper.

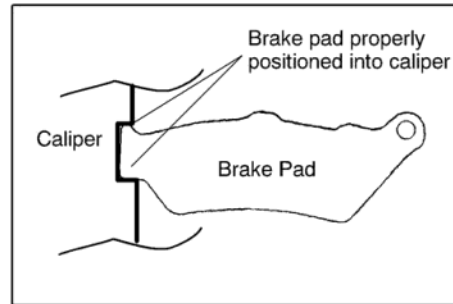


REAR CALIPER INSTALLATION

1. Install spring plate into caliper. Arrow on spring plate indicates direction of brake disc rotation.
2. Install brake pads.

NOTE: Brake pad installation is slightly different when caliper is removed. Unlike previous instructions, both pads will be removed and installed at the same time. Be extremely careful that the spring plate is properly installed and that the brake pads are properly retained in the caliper.

3. Position caliper and mount bracket onto swing arm
4. Install rear wheel (refer to page 13.9).
5. Install brake hose, banjo bolt and new sealing washers, torque banjo bolt to specification listed on page 15.2.
6. Fill and bleed the rear hydraulic brake system. Refer to page 15.8.



REAR BRAKE PEDAL REMOVAL

1. Remove cotter pin (A), and clevis pin (B).
2. Remove brake lever pivot bolt (C).
3. Remove brake pedal and bushings (D).

REAR BRAKE PEDAL INSTALLATION

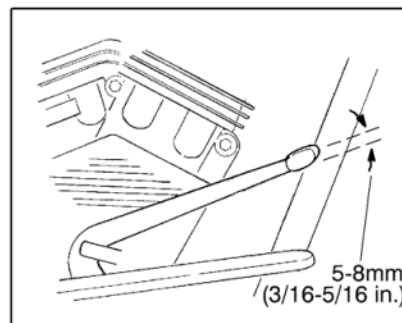
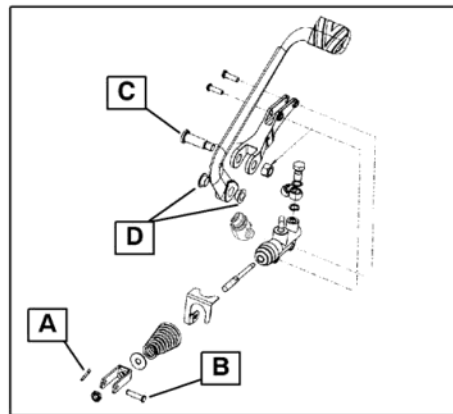
1. Inspect bushings, clevis pin, pivot bolt, and cotter pin. Replace worn or damaged parts.
2. Install brake pedal boot onto brake pedal. Install bushings on either side of brake pedal. Apply Victory All Purpose Grease to pedal, clevis pin, and bushings.
3. Insert brake pedal and bushings between the support and install bolt. Torque brake lever pivot bolt to specification listed on page 15.2.
4. Install clevis pin and cotter pin. Pull boot into place on pedal.
5. Operate brake pedal to ensure proper function.

CAUTION:

Make sure that brake rod is properly positioned into master cylinder.

6. Inspect and adjust brake pedal freeplay if necessary (refer to page 2.10).

Specification: All Models - Brake Pedal Freeplay
5-8 mm (3/16-5/16 in) (.188 - .313 in)



BRAKES

| 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 Clogged or Restricted Hydraulic Line Caliper Mount Bent or Distorted Fork Oil Level Incorrect Loose Brake Disc Loose or Damaged Steering Bearings 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 Replace Line(s) Replace Mount Set Level Correctly, See Chapter 12 Torque to Specification Adjust or Replace, See Chapter 12 Avoid Needless Heavy Braking For Initial 100 to 200 miles. |
| Poor Brakes or No Brakes When First Applied Brake Lever Pressure Present If Lever Is "Pumped" | Brake Disc is Bent or Warped Caliper Misalignment External Leak Internal Leak (master cylinder) Air In System Low Brake Fluid Level In Reservoir | Replace Brake Disc Determine Cause and Correct Repair or Replace Damaged Component Replace Master Cylinder Bleed Air From System Fill Reservoir, Bleed Brakes, Top Off Fluid Level. |
| Brake Pedal or Brake Lever Pulsates | Brake Disc is Bent or Warped Mounting Surface of Brake Disc Uneven or Disc Is 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. | Air in System Loose Mounting Hardware Low Brake Fluid Level In Reservoir Incorrect Brake Fluid Used | 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 Hose Worn Piston, Caliper or Seals Diaphragm leaking Fluid level too high (new brake pads installed without removing added fluid) | Tighten to Specified Torque Replace Replace Replace Master Cylinder or Wheel Caliper Replace diaphragm Correct fluid level |
| Brakes Drag Excessively or Self-Appl (Brakes Over Heat) | Reservoir Over Filled Brake Pedal Not Returning Completely To Rest Position Compensating Port Plugged Internal Corrosion of Components Rear Caliper: Corrosion of Sliding Parts, Bent or Damaged Parts Contaminated Brake Fluid Rider Error (riding brakes) | Adjust Level As Necessary Inspect Linkage, Pivots and Mechanism For Cause Of Binding Or Restricted Movement Replace master cylinder Replace Damaged Component Repair or Replace As Necessary Flush System, Install Correct Fluid Educate Operator |
| Brake Squeal/Squeak | If noise is minor and inconsistent, some Brake Squeak/Squeal is a characteristic of Disc Brakes. Contaminated Brake Pad or Disc (not oil or grease) Pad Not Secure in Caliper Damaged Wheel Bearing(s) Worn Pads | Clean Dirt & Dust From Disc Surface and Pad Surface Periodically. Repair Disc Surface With Emery Cloth; Replace Pads Repair as Necessary Replace Replace |

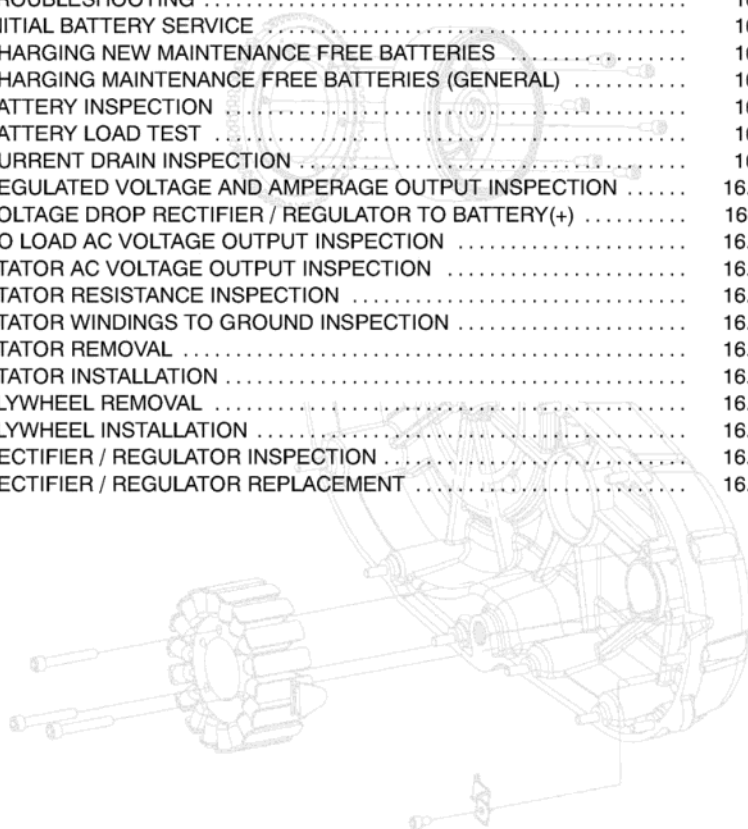
NOTE: If it is determined that a problem exists within the internal workings of the brake master cylinder(s) or wheel caliper(s), replace the master cylinder(s) or wheel caliper(s) as an assembly.

15.18

CHAPTER 16

CHARGING SYSTEM & BATTERY

| | |
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| CHARGING SYSTEM AND BATTERY PRECAUTIONS | 16.2 |
| SPECIFICATIONS | 16.3 |
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16

CHARGING SYSTEM & BATTERY

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 WARNING

⚠ 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.

CAUTION:

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.

CAUTION:

Even with a good battery, battery voltage can recover after charging, but under excessive loads the battery voltage will drop quickly and eventually become critically low. Often the charging system is suspect when it is not the cause of the problem. Always inspect for excessive loads if the battery continues to lose its charge. Items such as incorrect wattage bulbs, sticking brake light switch(s), continuous low rpm operation or leaving the lights on without the engine running for long periods of time can drain a battery even if the charging system is operating correctly.

CHARGING SYSTEM & BATTERY

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 the instructions outlined later in this section.

Overcharging is often caused by the battery itself which may appear to be a charging system problem. If one or more of the battery cells is shorted, the battery voltage may not increase. The regulator/rectifier unit monitors battery voltage to determine the amount of voltage sent to the battery. If the battery constantly "tells" the regulator/rectifier assembly that it needs more voltage, the cells that are not shorted will receive too much voltage and cause an overcharging problem to appear.

New batteries must be properly maintained as outlined in this section to ensure proper service life.

CAUTION: CONNECTING AND DISCONNECTING THE BATTERY

Be sure to disconnect the **negative** battery cable **first** when **removing** the battery.

Be sure to connect the **positive** battery cable **first** when **connecting** the battery.

If corrosion is found on the terminals, remove the battery and clean the terminals with a solution of baking soda and water. Finish the process by cleaning the terminals (both battery and battery cables) with a wire brush.

Once the connections are secured, apply a thin film of nyogel™ grease to the terminals.

Make sure that the positive terminal has its 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 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, rectifier/regulator, turn signal auto-cancel unit). Dropping electronic components can cause damage to the component.

Follow the 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 the instructions may cause irreparable damage to the part being inspected.

CHARGING SYSTEM & BATTERY

SPECIFICATIONS

| Item | Specifications | |
|---------------------------------|---------------------|--|
| Electrical (General) | Ignition System | Distributor-less Transistorized Dual Coil Type Ignition |
| | Starting System | Electric |
| | Charging System | Permanent Magnet/3 Phase/Full Rectification |
| | Regulator/Rectifier | Solid State Three Phase Voltage Regulator/Rectifier |
| | Lighting System | 12 V DC |

CHARGING SYSTEM & ALTERNATOR

| Item | Specifications | |
|--|--------------------------------------|-----------------------------|
| Alternator Charging Coil Resistance (@ 21°C / 70°F) (Black to Black) | 0.3 to 0.5 ohms | |
| Alternator No Load AC Output (Minimum) | 20 V AC @ Idle | |
| Alternator No Load AC Output @ 3000 - 4000 RPM (Minimum) | 65 V AC @ 3000 - 4000 RPM | |
| Alternator Charging Coil Output Wires To Ground | Infinity (no continuity) | |
| Regulator/Rectifier Regulated Voltage | 14-14.8 V DC | |
| Alternator Output (Amps / Watts) | 38 A / 525 Watts | |
| Battery | Type | Yuasa: YTX20L-BS |
| | Voltage | 12 Volts DC |
| | Nominal Capacity @ 10 Hr Rate | 18 AH |
| | Recommended Battery Charging Current | STD: 1.85 A for 5 to 10 hrs |

Fastener Torque Specifications - Charging System

| Description | Torque Nm | Torque lb-ft (in-lb) |
|---|-----------|--------------------------|
| Flywheel Bolt | 102 Nm | 75 lb-ft |
| Regulator/Rectifier to Bracket | 10 Nm | (85 in-lb) |
| Stator Mounting Screws to Primary Cover | 11 Nm | (100 in-lbs) Loctite 242 |
| Primary Cover Screws | 10 Nm | (85 in-lbs) |

SPECIAL TOOLS

Refer to page 1.11 for special tool information.

CHARGING SYSTEM & BATTERY

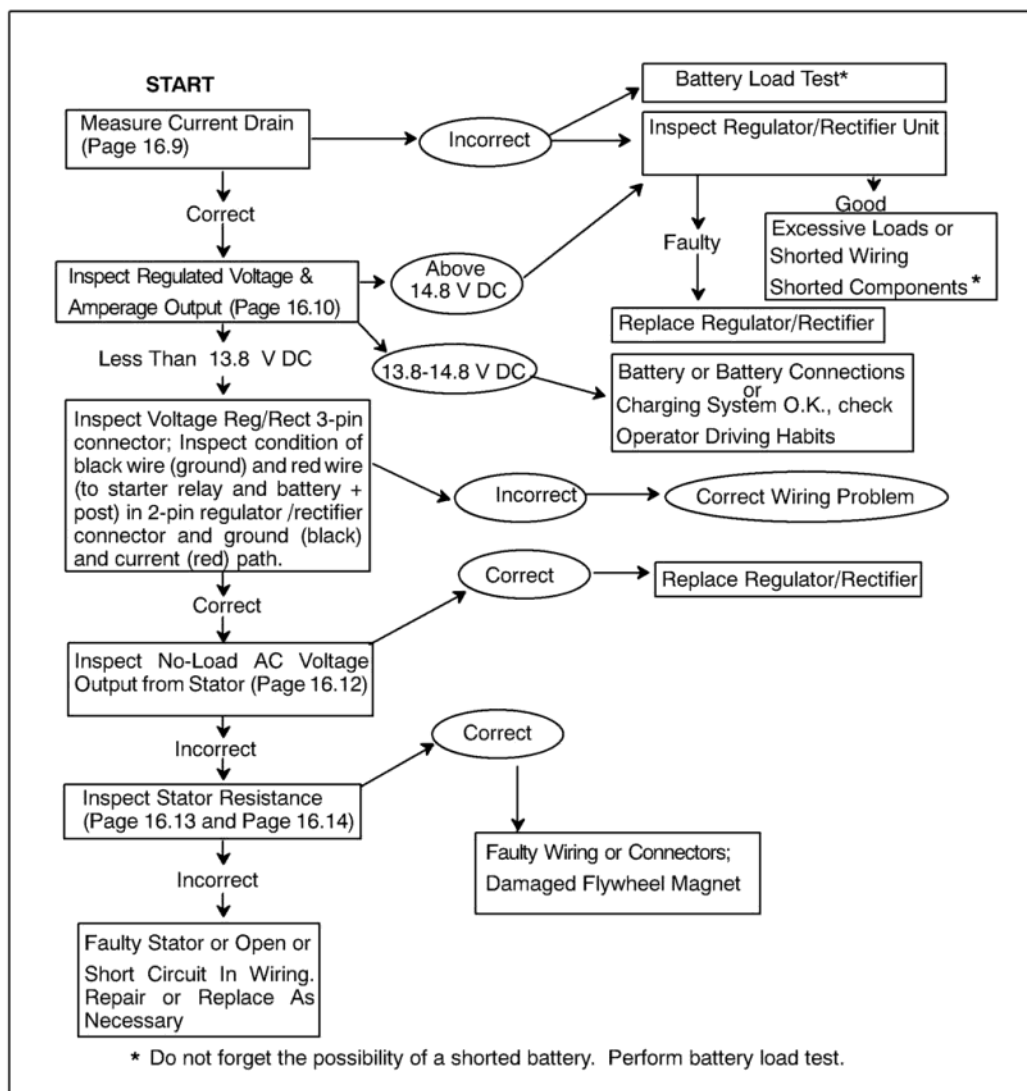
TROUBLESHOOTING

CAUTION:

The battery must be fully charged and in good condition to obtain accurate test readings.

After discovering the cause of the problem and correcting it, always recheck the charging system output to verify the repair.

For battery removal & installation, refer to Chapter 2.



INITIAL BATTERY SERVICE

⚠ WARNING

Read, understand and heed the warnings at the beginning of this section as related to battery electrolyte.

⚠ WARNING

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

External: Flush with water.

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

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

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

KEEP BATTERIES AND BATTERY ACID OUT OF REACH OF CHILDREN.

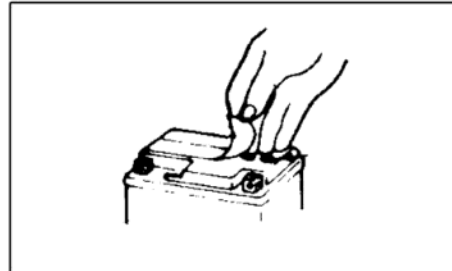
CAUTION:

The battery electrolyte used for the maintenance free battery on the motorcycle comes with the battery. Do not use common battery electrolyte. Failure to use the electrolyte that comes with the battery will result in reduced battery service life.

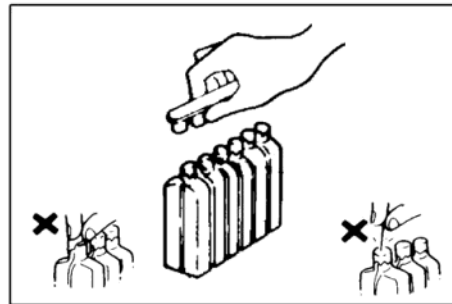
1. Place the battery in an acid proof catch pan or receptacle. Work in a well ventilated area.
2. Remove aluminum sealing tape from top of battery. III.1.
3. Remove cap assembly from battery acid pack. III.2.

CAUTION:

Do not attempt to remove or pierce the seal on acid pack. The seal will be pierced by battery when the acid pack is placed on battery. III. 2.



III.1



III.2

CHARGING SYSTEM & BATTERY

INITIAL BATTERY SERVICE (cont.)

4. Insert the nozzles of electrolyte container into battery filler holes. III. 3.
5. Press down firmly on acid pack so seal for acid pack is completely penetrated. Take precautions not to let any of the fluid spill.

NOTE: The acid pack will be secured in battery and be able to stand by itself if it is inserted correctly.

CAUTION:

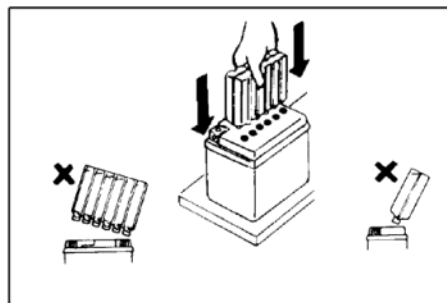
The filler pack is designed to slowly drain electrolyte into battery cells. Do not attempt to force electrolyte into battery cells.

6. Ensure seal on acid pack is completely penetrated by visually inspecting for air bubbles rising in each cell of acid pack. If air is not bubbling up in one of the cells, fully seat acid pack into battery again. Tap bottom of acid pack a couple of times and observe for bubbles again. Under no circumstances should the acid pack removed from the battery until all acid is drained from it. III. 4.
7. **Leave acid pack installed in battery for at least 20 minutes. Do not force the electrolyte into battery. Time is needed for the plates to absorb the electrolyte.**
8. After the 20 minute period has elapsed, verify that all acid has drained from acid pack. If it has not, allow time as required until all fluid has drained from acid pack.
9. Remove empty acid pack and place previously removed cap assembly onto acid pack. Dispose of acid pack properly.
10. Let battery sit with battery cap strip off for at least 20 minutes.
11. Insert battery cap strip into battery filler holes. Press firmly on cap strip and ensure that none of the strip is above the upper surface of battery top and that it is fully seated. (III. 5)

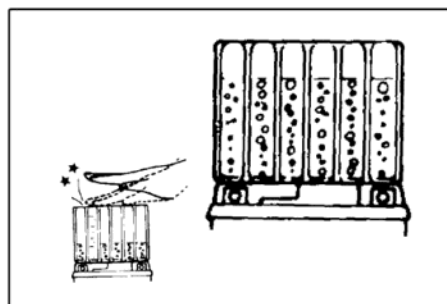
CAUTION:

Do not remove battery cap strip once it has been installed.

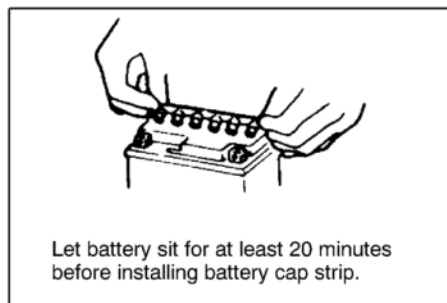
Specification: 12.5 V DC (III. 6)



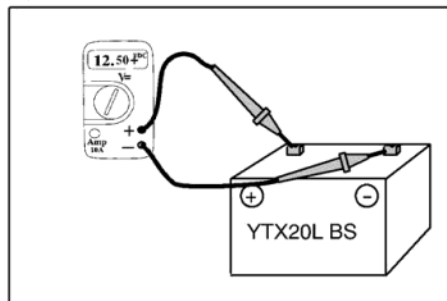
III.3



III.4



III.5



III.6

CHARGING SYSTEM & BATTERY

CHARGING NEW MAINTENANCE FREE BATTERIES

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

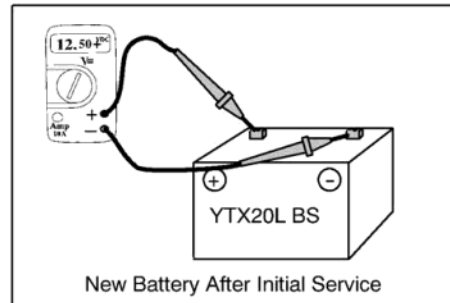
CAUTION:

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

2. Remove battery from charger and let it sit for 30 minutes or longer.
3. Measure battery voltage with a digital multimeter. If battery voltage is lower than 12.5 V DC battery must be recharged again in accordance with step 1 and 2 above.

Specification: 12.5 V DC

4. After charging battery and letting it sit for 30 minutes or more, check battery voltage again. If battery voltage is still below 12.5 V DC, replace the battery.



III.1

CHARGING MAINTENANCE FREE BATTERIES THAT HAVE BEEN IN SERVICE

1. Measure battery voltage with a digital multimeter. The reading should be above 12.50 V DC. If battery voltage is lower than 12.50 V DC battery must be charged according to the instructions given below.
III. 2.

CAUTION:

Remove battery from motorcycle before charging battery.

CAUTION:

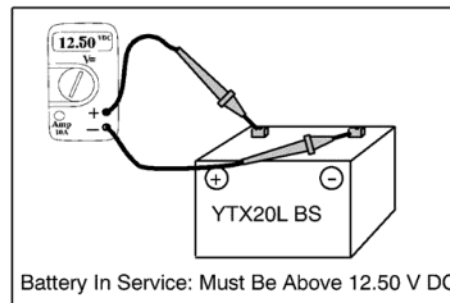
Do not remove caps on battery while recharging. Do not attempt to inspect or add fluid to a maintenance free battery.

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

Specification: 1.8 A for 5-10 hours

3. Remove battery from charger and let it sit for 30 minutes or longer.
4. Measure battery voltage with a digital multimeter. If battery voltage is lower than 12.50 V DC battery must be recharged again in accordance with step 1 and 2 above.
5. After charging battery and letting it sit for 30 minutes or more, check the battery voltage again. If battery voltage is still below 12.50 V DC, replace battery.

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



III.2

CHARGING SYSTEM & BATTERY

BATTERY INSPECTION

1. Remove the left side frame cover.
2. Inspect battery tray and hold-down cover for damage and tight fasteners.
3. Inspect for cracked or broken exterior case.
4. The motorcycle uses a maintenance free battery, it does not require inspection of specific gravity or fluid level.

CAUTION:

Do not remove the battery cap assembly in an attempt to inspect fluid level, specific gravity or attempt to add fluid to battery. After initial servicing, battery should remain sealed.

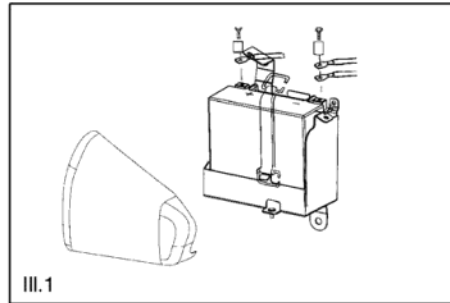
5. Inspect the terminals for corrosion. If corrosion is found, remove battery and clean terminals with a solution of baking soda and water. Finish process by cleaning terminals (both battery and battery cables) with a wire brush.

CAUTION:

Remove the negative terminal first when removing the battery.

Install the positive terminal first when installing the battery.

6. Install battery (refer to page 2.22)
7. Once connections are secured, apply a thin film of grease to terminals.
8. Install left side frame cover and seat.

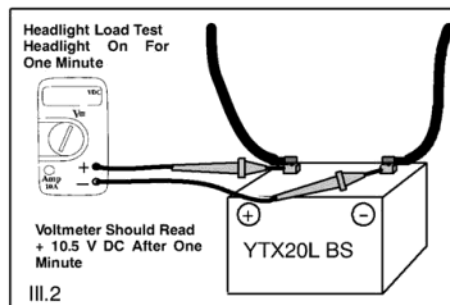


BATTERY LOAD TEST

1. Perform a battery load test using a battery load tester. Follow the load tester manufacturer 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 battery (refer to page 2.22).
4. Connect a digital multimeter to battery and keep it connected for duration of test. (III.2)
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 10.5 V DC.
8. If battery voltage drops below 10.5 V DC, battery should be charged again and the test repeated.



CHARGING SYSTEM & BATTERY

CURRENT DRAIN INSPECTION

1. Remove seat and left side cover.
2. Disconnect ground cable (-) from battery.
3. Connect digital multi-meter red (+) probe to ground cable and connect black DMM (-) probe to battery negative (-) terminal.

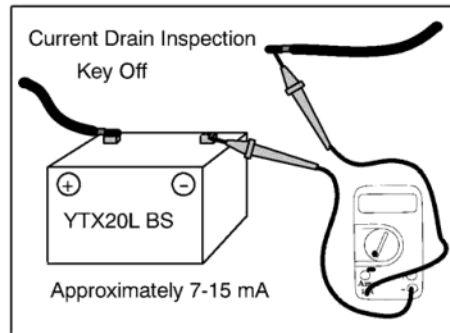
Fluke™ 73 Multimeter PV-43546

4. With ignition switch off, read current drain.
5. If current drain exceeds specifications, inspect wiring and components for short to ground.

NOTE: The speedometer assembly will initially draw about 70 milliamps as the meter leads are connected and then drop back to about 7 milliamps within a few seconds. This is a normal condition.

Specification: Less than 15 mA

6. Locate the faulty component or wiring by disconnecting wiring connections one-at-a-time while observing current drain. Use the wiring diagram to locate possible current drains from battery. When current drain falls within specifications, the last connection disconnected shows which circuit or component is affected.



CHARGING SYSTEM & BATTERY

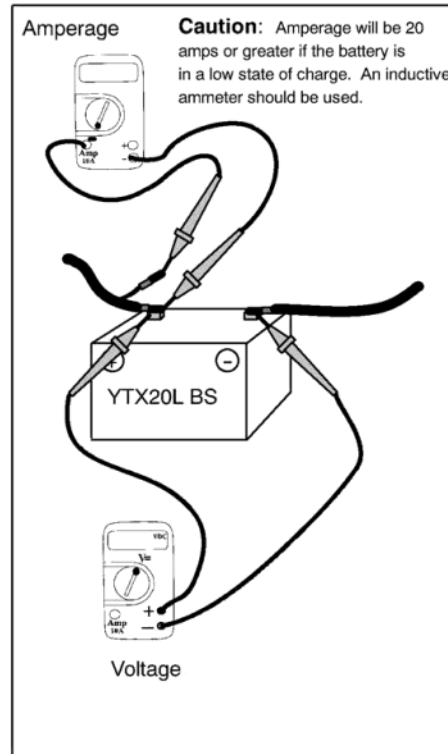
REGULATED VOLTAGE / AMPERAGE OUTPUT INSPECTION

1. Remove seat and left side cover.
2. Remove negative battery leads and connect a 12V shunt as outlined in the instructions provide with shunt or use an inductive amperage clamp.
3. Set digital multimeter (DMM) to V DC scale.
4. Connect DMM red (+) lead to battery red (+) lead and DMM black (-) lead to battery black (-) lead.
5. Start engine and warm to operating temperature.

⚠ 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.

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. Run in an open area or with an exhaust evacuation system operating.



6. At 1000 RPM or slightly above; the ammeter should reach the "break-even" point (no amperage leaving the battery) and the volt meter should read above 14 V DC.

Specification: "Break-even" point for charging Approx. 14 V DC @ 1000 rpm

7. Increase engine RPM to 2500. The ammeter should rise a slight amount, then stabilize. Volt meter should read above 14 V DC.
8. Use results obtained from preceding tests and the following descriptions to determine if charging system is functioning correctly. (continued on following page)

CHARGING SYSTEM & BATTERY

REGULATED VOLTAGE & AMPERAGE OUTPUT INSPECTION (cont.)

CHARGING SYSTEM OPERATING CORRECTLY: Ammeter goes up a small amount, then stabilizes slightly above +0 amps. Volt meter goes to $14.8 \pm$ V DC, drops off a little and starts to stabilize.

CHARGING SYSTEM UNDERCHARGING: Ammeter drops to 0 or remains below 0 at all rpm, volt meter remains the same or goes down. Go to voltage drop inspection.

CHARGING SYSTEM OVERCHARGING: Ammeter rises well above 0 and remains there or continues to rise. Volt meter goes well above 14.8 V DC and may continue to rise. Go to voltage regulator/rectifier inspection.

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.

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.

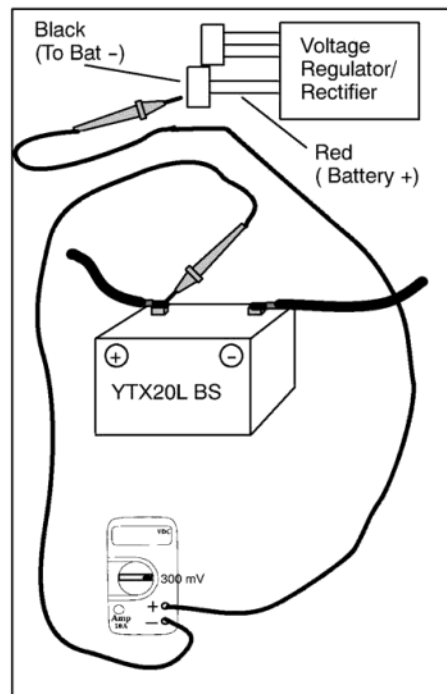
9. Turn ignition key off.
10. Remove ammeter shunt or inductive clamp.
11. Re-connect negative battery cables to battery.
12. Install right and left side covers and seat.

VOLTAGE DROP: RECTIFIER / REGULATOR TO BATTERY(+)

1. Set Digital Multi-Meter (DMM) to DC Volts scale.
2. Connect red lead (+) of DMM to red wire coming out of rectifier/regulator assembly.
3. Connect black lead (-) of DMM to positive (+) lead of battery.
4. DMM must read below 0.1 volts DC (100 mV). If it does read 0.1 V DC or less the circuit is O.K.

Specification: 0.1 V DC

5. If DMM reads above 0.1 volts DC there is excessive resistance in the circuit that must be corrected.
6. Likely problem areas will be the battery terminal connection and/or regulator/rectifier connector although the problem can be located at any point within the circuit. Visual inspections or continued voltage drop inspections are necessary to determine the cause.



CHARGING SYSTEM & BATTERY

STATOR AC VOLTAGE OUTPUT INSPECTION

NOTE: The following tests require engine to be operating. 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.

1. Locate three wires coming from stator follow the wires to the 3-pin connector.
2. Disconnect connector.
3. Set Digital Multimeter (DMM) to AC Volts scale.
4. Connect one lead of DMM to pin labeled "1" in III. 1 on the wire connector that comes FROM the stator.
5. Connect other lead of DMM to pin labeled "2" in III. 1.
6. Start the engine and let it run at idle. Observe the DMM reading.
7. The DMM should indicate a minimum reading of 20 V AC.
8. Repeat test for pins 1 & 3.
9. Repeat test for pins 2 & 3.

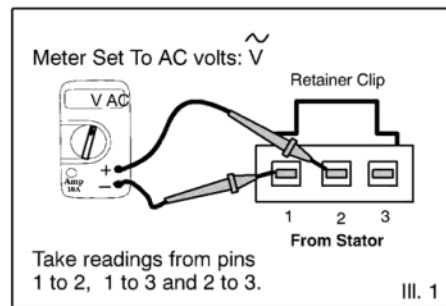
**Specification: No load AC Volts (Minimum)
20 V AC @ idle**

NOTE: The test results in steps 7, 8 and 9 can read more than 20 V AC, but it is important that the reading for each pair of wires is approximately equal.

10. Increase engine RPM to 3000-4000 RPM and repeat steps 4, 5, 8, and 9.
11. At 3000-4000 RPM the DMM should read 65 V AC.

NOTE: The test results obtained in step 10 can read more than 65 V AC, but it is important that they are all at least 65 V AC and approximately equal.

**Specification: No load AC Volts:
65 V AC @ 3500 rpm**



STATOR RESISTANCE INSPECTION

CAUTION:

The **engine must not be running** while performing the following inspections.

1. Locate three wires coming from stator contained within the multi-connector.
2. Disconnect connector.
3. Set Digital Multi-Meter to ohms scale.

NOTE: Make sure DMM leads are plugged into correct jacks.

4. Connect one lead of DMM to any one of pins in multi-connector leading from stator. (Ill. 1)
5. 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)**

CAUTION:

Do not allow your hands or fingers to touch meter leads or one meter lead and any grounded portion of the motorcycle or reading obtained will be inaccurate.

CAUTION:

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.

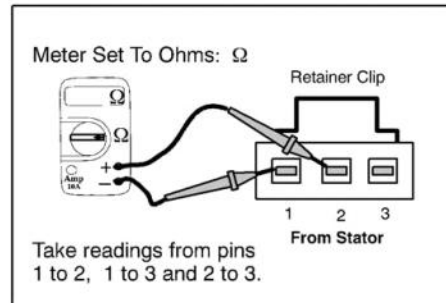
EXAMPLE: Connect meter leads together, meter reads 0.7 ohms. Measure stator resistance, meter reads 1.10 ohms. Subtract 0.7 ohms (meter/lead resistance) from 1.10 ohms.

True reading is:

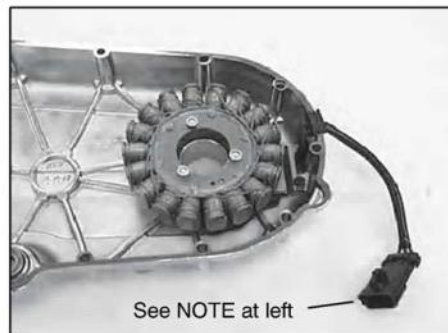
$$\begin{array}{r} 1.10 \text{ ohms (observed reading when checking stator)} \\ - 0.7 \text{ ohms (meter/lead resistance)} \\ \hline = 0.4 \text{ ohms (true stator resistance)} \end{array}$$

6. 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.
7. 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.

NOTE: If engine oil is found in the stator connector, drain oil from connector and re-connect. Oil in the connector does not indicate a faulty stator and does not affect charging system function.



Ill. 1



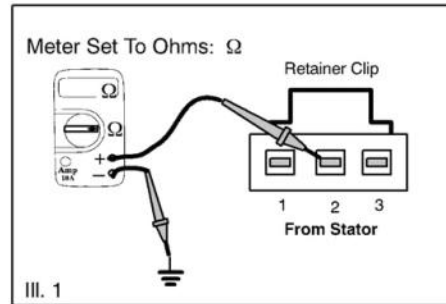
CHARGING SYSTEM & BATTERY

STATOR WINDINGS TO GROUND INSPECTION

1. 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. (Ill. 1)

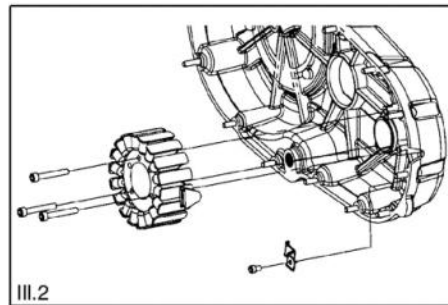
Specification: Open Circuit

2. Repeat test for other two stator leads to ground.
3. There should be no connection from stator windings to ground. Replace stator if electrical connection to ground is found.



STATOR REMOVAL

1. Remove primary cover. (refer to page 9.7).
2. Place primary cover on bench with padded material between primary cover and bench top.
3. Remove wiring retainer plate. (Ill. 2)
4. Remove three (3) socket head screws. (Ill. 2)
5. Remove stator from primary cover. (Ill. 2)

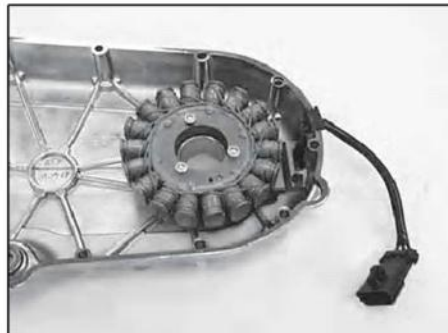


STATOR INSTALLATION

1. Clean primary cover gasket surface thoroughly.
2. Inspect screw holes in primary cover and clean screw holes to remove any residual locking agent.
3. Clean stator mounting surface on stator and primary cover.
4. Place stator in primary cover taking care to route wiring harness correctly in the area of the wire retainer plate.
5. Apply Loctite™ 242 to the screw threads.
6. Insert socket head screws and torque to 12 Nm (100 lb-in.)

TORQUE: Stator Screws

12 Nm (100 inch lbs.)



7. Install wiring retainer plate.
8. Install wire grommet into groove in primary cover.
9. Install primary cover (short screw is placed in the hole just behind the shift shaft). Refer to page 9.10.

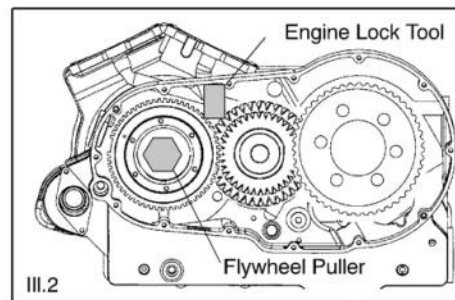
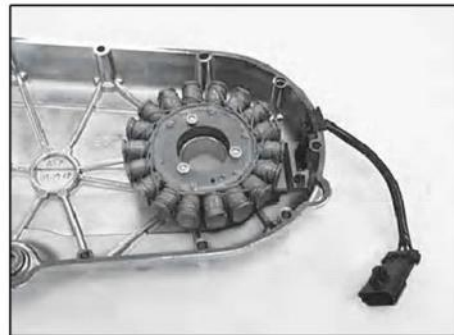
FLYWHEEL REMOVAL

1. Remove primary cover. (Refer to page 9.7)
2. Lock engine with engine lock tool between primary drive gear and crankcase as shown. (III. 2)

Engine lock tool PV-43502-A

3. Remove flywheel retaining bolt.
4. Install flywheel puller onto flywheel. Tighten the puller bolt to remove flywheel. (III. 2)

Flywheel puller PV-43533

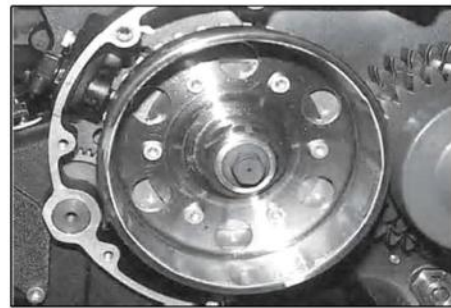


FLYWHEEL INSTALLATION

1. Clean taper of flywheel and crankshaft thoroughly.
2. Inspect condition of woodruff key and key way in flywheel and crankshaft.
3. Install flywheel on crankshaft while aligning woodruff key with key way.
4. Install flywheel washer and bolt. Torque flywheel bolt to specification.

TORQUE:

102 Nm, 75 lb-ft



CHARGING SYSTEM & BATTERY

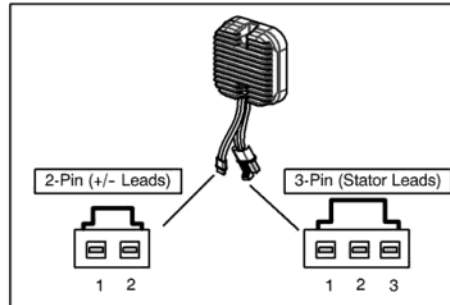
RECTIFIER / REGULATOR INSPECTION & TESTING

NOTE: Check the regulator / rectifier 3-pin and 2-pin connectors as outlined below, and perform battery and charging system inspection and diagnostics provided in this chapter. If other components test correctly, and system output is still above or below specifications, replace the regulator / rectifier.

1. Disconnect 3-pin (stator) connector and 2-pin (+ and -) connector.
2. Inspect male and female pins in the 3-pin connector and the 2-pin connector for the regulator/rectifier. Check for corrosion, loose pins, poor connections, or evidence of overheating or other damage.
3. If the wiring and connectors are undamaged and appear to be clean and tight, inspect the battery, stator, and related wiring.

NOTE: If engine oil is found in the stator connector, drain oil from connector and re-connect. Oil in the connector does not indicate a faulty stator and does not affect charging system function.

NOTE: False readings may be obtained if you touch your fingers to meter lead(s). The readings below are correct for a Fluke™ 73 multimeter. Using other meters may generate readings other than those listed. Semiconductors have different resistance values depending on the voltage applied to them.

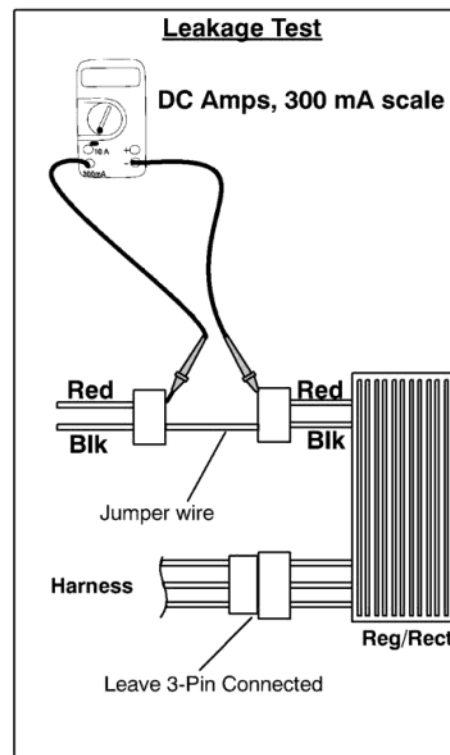


DIODE LEAKAGE TEST

NOTE: Engine must be OFF. Perform this test at the regulator / rectifier 2-Pin connector. Testing at any other point (between battery and battery cable for example) could include leakage not attributable to the Regulator / Rectifier unit.

1. Disconnect the 2-pin connector at voltage regulator / rectifier unit.
2. Install a jumper wire as shown to provide a complete ground path.
3. Connect meter as shown, with red (+) meter lead to the red wire on harness side, and the black meter lead to the red wire on the regulator / rectifier side.
4. Compare leakage to specification below.

Leakage Specification: Less than 1.0 mA



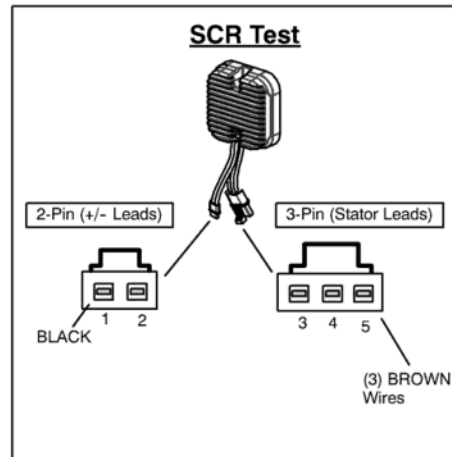
CHARGING SYSTEM & BATTERY

RECTIFIER / REGULATOR INSPECTION (Cont)

SCR TEST

NOTE: This test must be conducted with the 2-Pin and 3-Pin connectors disconnected from the system.

1. Remove the (2) regulator/rectifier mounting screws.
2. Cut the tie strap to access the 2-Pin connector.
3. Disconnect both 2-Pin and 3-Pin connector.
4. Set the multi-meter to the Diode Test function.
5. Place the black meter lead in Pin 1 (Black wire). Place the red meter lead alternately in Pin 3, Pin 4, and Pin 5. There should be no continuity indicated.
6. Reverse the meter leads (red meter lead to pin 1, and black meter lead to pins 3, 4, and 5 alternately). There should be no continuity indicated.
7. Check between all combinations of the 3 Brown leads (Pins 3, 4, and 5) in both directions to each other. There should be no continuity indicated.



SCR Test Specification: OPEN CIRCUIT

RECTIFIER TEST

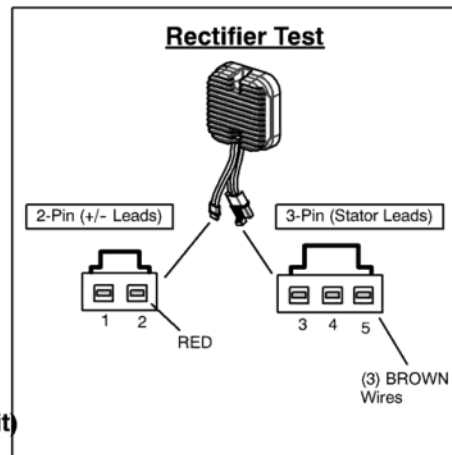
NOTE: This test must be conducted with the 2-Pin and 3-Pin connectors disconnected from the system.

1. Follow Steps 1-4 of the SCR Test above.
2. Place the black meter lead in Pin 2 (Red wire). Place the red meter lead alternately in Pin 3, Pin 4, and Pin 5. There should be continuity indicated (diode junction).
3. Reverse the meter leads (red meter lead to pin 2, and black meter lead to pins 3, 4, and 5 alternately). There should be no continuity indicated.

Rectifier Test Specification:

Step 2 of Test - Diode Junction (Continuity)

Step 3 of Test - No Diode Junction (Open Circuit)



CHARGING SYSTEM & BATTERY

RECTIFIER / REGULATOR REPLACEMENT

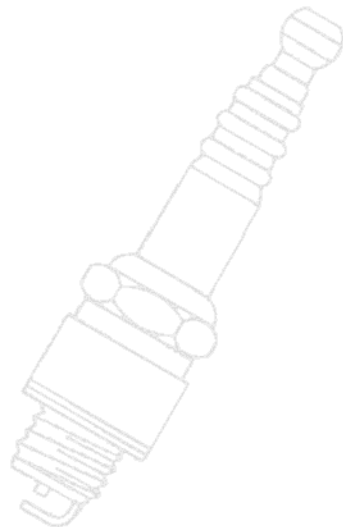
1. Cut the tie strap (A) on wire harness.
2. Lift the locking tab and disconnect the 3-pin connector.
3. Remove the (2) regulator/rectifier mounting screws.
4. Cut the tie strap that secures the 2-pin connector harness to the mounting bracket.
5. Lift the locking tab and disconnect the 2-Pin connector.
6. Remove attachment bolts and regulator / rectifier assembly.
7. Installation steps are done in the reverse order of removal. Be sure mounting bracket is clean and all connections are clean and tight.



CHAPTER 17

IGNITION

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| FASTENER TORQUE SPECIFICATIONS | 17.2 |
| SPECIAL TOOLS | 17.2 |
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17

GENERAL

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.

CAUTION

Some procedures call for the engine to be run in order to warm the engine to operating temperature. If this is done the exhaust pipes can "blue" if a cooling air stream is not provided by means of a shop fan directed at the exhaust system (particularly the head pipes).

CAUTION

Follow the instructions closely when troubleshooting items in this section. Some electrical components can be damaged if they are connected or disconnected while the ignition 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.

CAUTION

Parts containing semi-conductors can be easily damaged if handled carelessly. Do not drop or subject the electronic components to shock loads.

CAUTION

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 it offers a way to determine if spark is occurring when the engine is running.
- * Poor connections are the most common cause of ignition problems. Make sure to inspect all connections before doing extensive ignition system troubleshooting.
- * Make sure the battery is fully charged and that the charging system is operating correctly. A weak battery may not be able to turn the engine fast enough to produce any or adequate spark, and can easily complicate the troubleshooting process.

SPECIFICATIONS

| IGNITION SYSTEM | | |
|---------------------------------------|-----------|---|
| Item | | Specifications |
| Spark Plug | | 2002-2003 NGK CR7EB 2004 NGK CPR6EA-9 |
| Spark Plug Gap | | 0.8 mm (.032") |
| Ignition Coil Resistance | Primary | 0.4 - 0.6 ohms |
| | Secondary | 5400 ohms \pm 10% (Without Plug Cap) 11 K ohms \pm 10% (With Plug Cap) |
| | Plug Cap | 5.6 ohms \pm 10% |
| Crankshaft Position Sensor Resistance | | 1450 to 1800 ohms |

IGNITION

FASTENER TORQUE SPECIFICATIONS

| Fastener Torque Specifications - Ignition System | | | |
|--|-----------|----------------------|--------------------|
| Description | Torque Nm | Torque lb-ft (in-lb) | Notes |
| Spark Plug | 16 Nm | 12 lb-ft | Apply Anti-Seize |
| Ignition Coil to Frame | 11 Nm | (100 in-lbs) | |
| Timing Gear Bolts: Crank-shaft Position Wheel | 13 Nm | (115 in-lbs) | Apply Loctite™ 262 |
| Flywheel Bolt | 102 Nm | 75 lb-ft | |

SPECIAL TOOLS

| SPECIAL TOOL | PART NUMBER |
|------------------------------|-------------|
| Connector Test Adapter Kit | PV-43526 |
| Fluke 73™ Digital Multimeter | PV-43546 |
| Inductive Timing Light | PV-43537 |

IGNITION SYSTEM TROUBLESHOOTING FLOW CHART

Before troubleshooting the ignition system, ensure that the engine stop switch is in the run position, that the battery is fully charged, the engine is in neutral and the fuses are not blown.

CAUTION:

Don't forget the spark plugs! The Ignition System Troubleshooting flow chart (and the accompanying text) is designed to help you troubleshoot ignition system problems. It will not lead you to faulty or fouled spark plugs. Always inspect spark plug condition **first** (and replace if necessary) when troubleshooting ignition system problems.

Be sure that the spark plugs are the correct heat range and are the specified resistor spark plugs. Non-resistor spark plugs can introduce electrical problems due to increased (RFI) Radio Frequency Interference.

WARNING

Extremely high voltage is present on the secondary side of the ignition system. Do not touch the ignition coil, wires or spark plugs during test procedures.

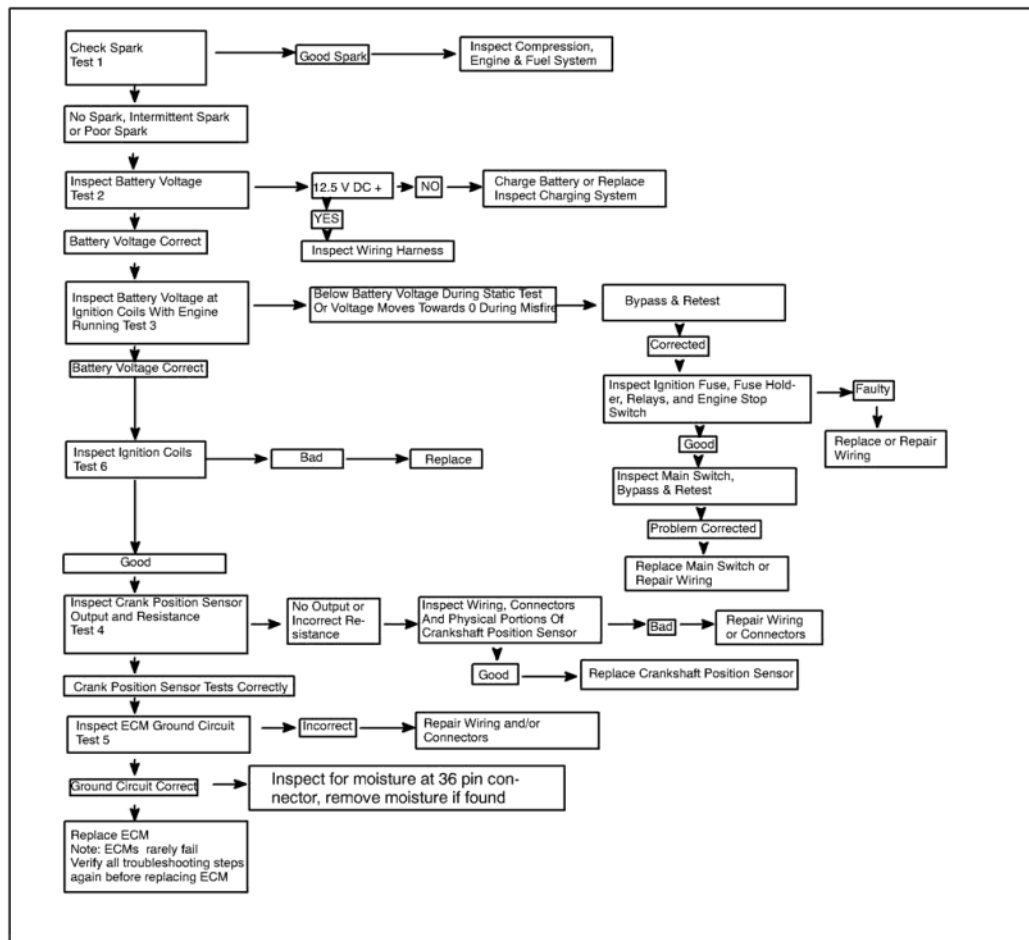
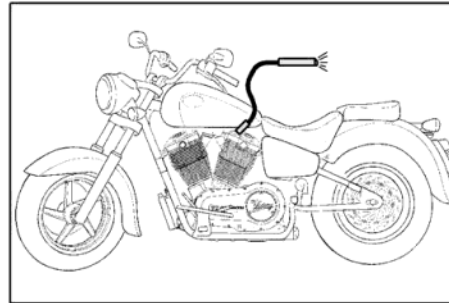
17.2

SPARK INSPECTION: TEST 1

1. Connect an inductive timing light to one spark plug wire.

Inductive timing light PV-33277-A

2. Turn on ignition stop switch and ignition switch.
3. Shift transmission into neutral and pull in clutch lever.
4. Depress starter button and observe timing light.
5. Determine if timing light flashes without interruption for both cylinders.
6. If timing light flashes consistently for both cylinders, the chances of an ignition related problem is remote. Inspect engine compression (refer to chapter 3) and inspect fuel system functioning (refer to chapter 5).



IGNITION

SPARK INSPECTION: TEST 1 (cont.)

7. Repeat test for other cylinder.
8. If timing light does not flash consistently for one or both cylinders, go to battery voltage inspection (Test 2).

However, keep the following points about timing lights in mind:

- * There is a threshold voltage and amperage requirement for timing lights below which they will not trigger and therefore, not flash.
- * **Badly fouled spark plugs** will drop secondary **voltage so low** that the **timing light will** not trigger and therefore, **not flash**.
- * With no current flowing (open secondary side of the ignition coil) the timing light will not flash.
- * A plug cap not making a connection to the plug wire is one example of an open secondary.

CAUTION:

Do not attempt to remove the spark plug caps from the spark plug secondary leads. The spark plug caps are molded to the plug wires and are only available as an assembly. The specifications given include the resistance of the spark plug caps.

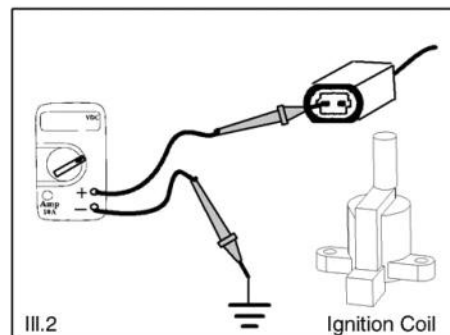
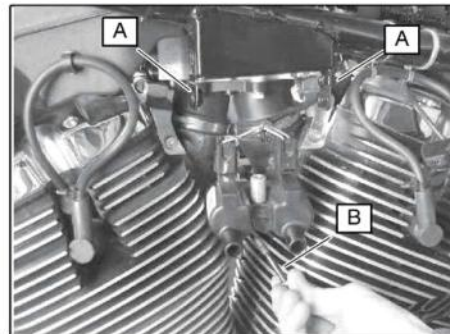
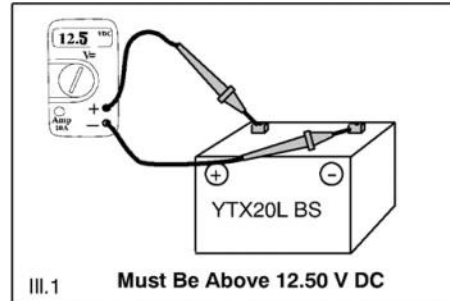
- * Low battery voltage, and therefore slow cranking speeds, may not turn the engine over fast enough for the ignition system to function.

BATTERY VOLTAGE INSPECTION: Test 2

1. Remove seat, frame side covers, and fuel tank.
2. Set Digital Multimeter (DMM) to DC Volts position.
3. Inspect battery voltage. (Ill. 1)
4. If the battery voltage is below 12.5 V DC charge or replace the battery with a fully charged battery. Refer to chapter 16 for battery inspection, battery charging and charging system inspection.

NOTE: When operating the starter with a low battery, the voltage available for the ignition coils can drop below the minimum required to produce spark. Do not confuse this problem with an ignition system problem.

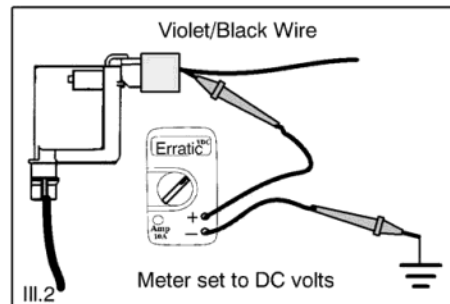
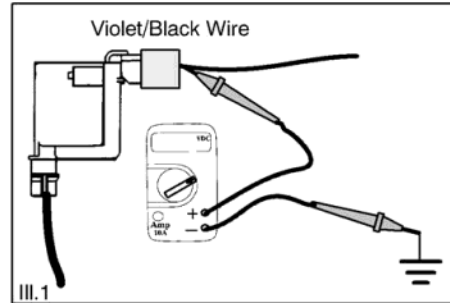
5. Remove ignition switch cover by pulling straight outward.
6. Remove ignition switch bracket bolts and bracket (A).
7. Remove ignition coil bracket bolt (B).
8. Disconnect primary side of ignition coil by pushing the tab.
9. Connect red meter lead to violet/black or violet/green wire at ignition coil connector. (Ill. 2)
10. Connect black meter lead to negative battery post. Ill. 1.
11. Turn ignition switch and ignition stop switch on.
12. With the lights and switches on, a good battery will deliver a minimum of 10.5 V DC to the ignition coils.
13. If voltage reading is less than 10.5 V DC, perform a battery load test (refer to ch 16).
14. If battery is within specifications and voltage reading at ignition coil(s) is below specification, there is resistance in the circuit between the ignition coil(s) and battery. The resistance, and consequent low voltage, will reduce spark voltage.
15. Connect black meter lead to negative battery post.
16. Trace circuit between ignition coil(s) and battery with the positive meter lead at each connector until battery voltage is found. Some place between the point where battery voltage is found and the ignition coil(s) is a loose, corroded or broken wire or connector. Inspect the wiring, relays, fuses, fuse connections, main switch, engine stop switch and all connections. Repair as needed to eliminate voltage drop.



IGNITION

BATTERY VOLTAGE INSPECTION (engine misfires): Test 3

1. Remove fuel tank .
2. Set Digital Multimeter (DMM) to DC volts position.
3. Connect red meter lead to the violet/black wire at the ignition coil(s). (III. 1)
4. Connect black meter lead to the negative battery post. (III. 1)
5. Turn on ignition stop switch and ignition switch.
6. Shift transmission into neutral and pull in clutch lever.
7. Start motorcycle and increase engine rpm until misfire occurs.
8. If the DMM display falls quickly towards 0 and is erratic during the misfire, there is a problem with the circuit supplying battery voltage to the ignition coil(s). Some place between battery and ignition coil(s) is a loose, corroded or broken wire or connector. Inspect the wiring, relays, fuses, fuse connections, main switch, engine stop switch and all connections. Repair as needed. (III. 2)
9. If the DMM steadily displays battery voltage during all tests, the circuit supplying battery voltage to the the ignition coil(s) is not at fault.
10. A quick test to verify that battery voltage is not reaching the ignition coil(s) is to use a jumper wire to jump from the positive post of the battery to the battery supply wire at the ignition coil(s).
11. Try to start the engine or operate the engine in the RPM range where the mis-fire occurs.
12. If problem is corrected, this verifies wiring harness and/or components between the ignition coil(s) and battery need repair. Repair as needed to eliminate voltage drop.

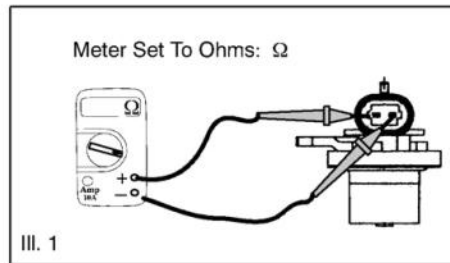


CRANK POSITION SENSOR RESISTANCE INSPECTION: Test 4

1. Disconnect crankshaft position sensor leads.
2. Visually inspect the sensor wire harness for loose or broken wires or connectors.
3. Set DMM to Ohms scale.
4. Measure crank position sensor resistance and compare to specification. (Ill. 1)

Specification: 1450-1800Ω @ 25°C, 77°F

5. Remove crank position sensor from crankcase.
6. Visually inspect the center pole of the crank position sensor for damage or metal particles clinging to the magnet.
7. If the crank position sensor is damaged, remove the primary cover and inspect the flywheel timing gear. Refer to Chapter 9 for primary cover removal. Refer to Chapter 16 for flywheel removal.



CRANK POSITION SENSOR AC OUTPUT Test 4A

CAUTION:

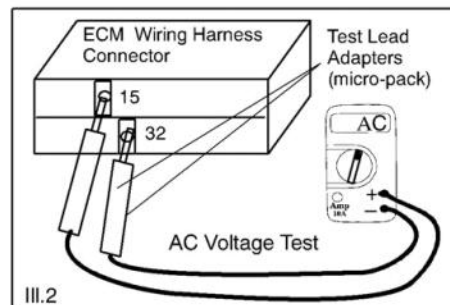
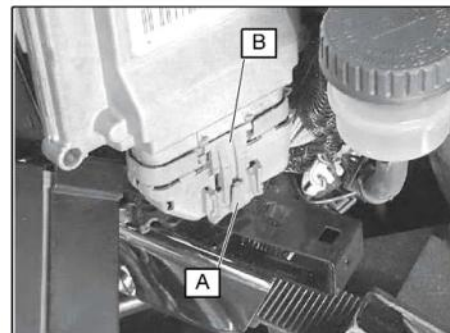
This test requires reading voltages at ECM connector. Once ECM connector has been disconnected, do not touch pins on ECM. Static electricity from your body can easily damage ECM.

Do not attempt to perform tests on ECM. Tests are done on wiring harness side of ECM connector.

NOTE: A connector test adapter kit is necessary. Use of other means to probe necessary pins can easily damage the ECM connector and cause a poor connection.

Test lead kit PV-43526

1. Remove right side frame cover.
2. Lift tab on front of fuse box and slide fusebox rearward and out of bracket.
3. Slide lock tab down (A) and lift tab (B) to remove ECM connector.
4. Locate the #15 pin and #32 pin in the harness connector. Set DMM to AC volts scale.
5. Place one lead of the DMM in female pin #15 & the other DMM lead into female pin #32 of the connector (**not the ECM**). Ill. 2.
6. Turn engine over with electric starter and observe DMM display. (Ill. 2)



IGNITION

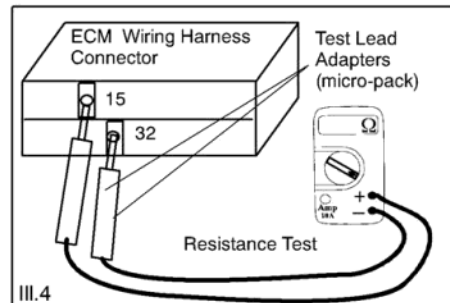
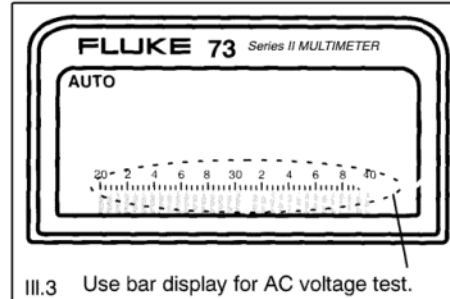
CRANK POSITION SENSOR AC OUTPUT Test 4A (cont.)

7. With the spark plugs in the engine the voltage reading will be erratic due to the low rpm and pulsing nature of the signal. The meter display will be erroneous. Watch the bars at the bottom of the display to determine if a signal exists. Any fluctuating AC signal is correct for this test. (III. 2)

NOTE: The bar display at the bottom of the display window on a Fluke™ 73 DMM updates 10 times faster than the numeric display. (III. 3)

8. This test can also be done with the spark plugs removed. Remove spark plugs from engine. Install spark plugs into spark plug caps and ground spark plugs.
9. Measure the AC voltage signal from the crank position sensor while turning engine over using electric starter with spark plugs out and compare to specification.
10. A resistance test of the CPS can also be performed from the connector. (III.4)

**Specification: 3 V AC \pm 10%
(Spark Plugs Removed)**



GROUND CIRCUIT INSPECTION: Test 5

1. Set the DMM to read DC volts.
2. Connect the red meter lead to the positive (+) post of the battery.
3. Connect the black meter lead to several bare metal places on frame, engine and wiring harness ground connections while observing the meter reading at each point.
4. At each ground test point, the meter should read battery voltage.
5. Low voltage indicates resistance. Corrosion, paint, loose or damaged connections or broken wires are possible problem areas.
6. Refer to the wiring diagram to locate all ground connections for the wiring harness. Clean the battery terminals thoroughly and apply a thin coat of dielectric grease. The battery ground cable is attached to the frame at the left passenger footpeg mount. This connection must be clean and tight.

IGNITION COIL INSPECTION: Test 6

1. Remove ignition coil. Refer to page 17.10
2. Turn ignition switch **OFF**.
3. Disconnect ignition coil primary wire connector.
4. Disconnect spark plug caps from plugs.

CAUTION:

Do not attempt to remove the spark plug caps from the spark plug secondary leads. The spark plug caps are molded to the plug wires and are only available as an assembly. The specifications given include the resistance of the spark plug caps.

5. Set the DMM to the ohms scale.
6. Measure ignition coil primary winding resistance.
7. Repeat primary winding resistance test for other coil.

Specification: 0.4-0.55 Ω

8. Connect red lead of DMM to one of the primary terminals.
9. Connect black lead of DMM to the spark plug terminal within the spark plug cap; observe the resistance reading.

Specification: 10.15 K Ω \pm 10%

CAUTION:

Most DMM are auto ranging and will automatically set themselves to the appropriate scale. Do not fail to look for the "K" or "M" on the meter display when taking any resistance measurements.

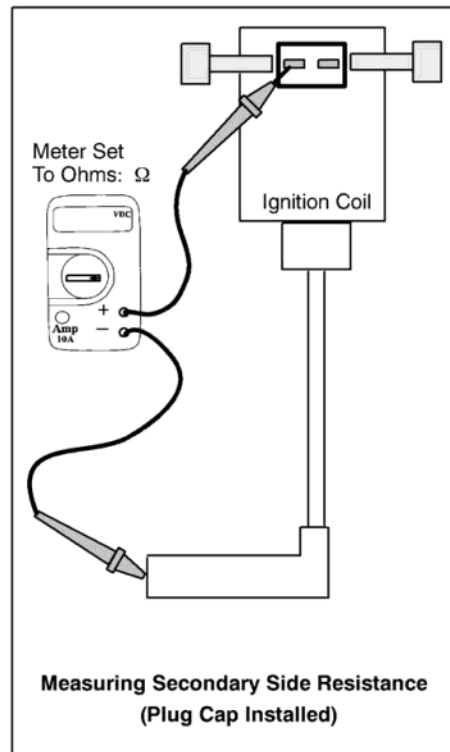
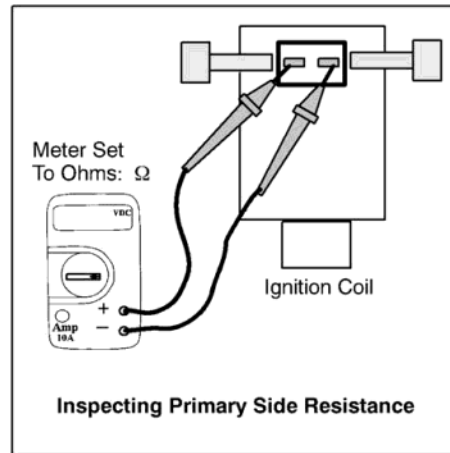
10. If the suspected coil tests correctly, but motorcycle has an intermittent miss after it warms up, heat coil with a hair dryer or heat gun and retest the coil.

CAUTION:

Do not heat coil to more than 200° F.

11. Cracks in the coil's insulation may enlarge enough to be detected when the coil is at operating temperature.

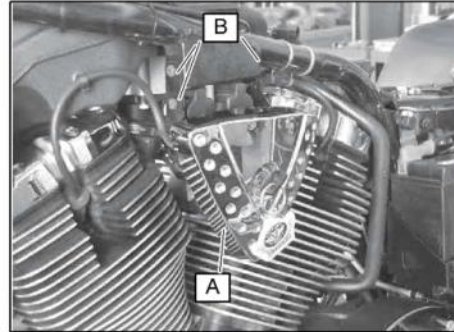
NOTE: Specific readings are unimportant when looking for a change in the meter's reading when heating the coil. The resistance will change considerably even with a good coil due to the resistance properties of wire when subjected to temperature changes. Attempting to find a dead short or complete open is the purpose of this test, not specific resistance readings.



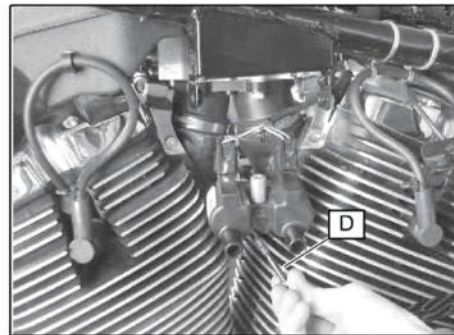
IGNITION

IGNITION COIL REMOVAL

1. Turn ignition switch **OFF** and remove key.
2. Remove fuel tank (Chapter 5) seat, and side covers (Chapter 3).
3. Remove ignition switch cover (A) by pulling straight outward.
4. Remove ignition switch mounting bracket bolts (B).



5. Remove ignition coil bracket bolt (D).
6. Disconnect ignition coil primary winding connector by pushing the tab in and pulling connector away from coil.
7. Remove ignition coil.



IGNITION COIL INSTALLATION

1. Installation procedure is the reverse of removal procedures.
2. Apply light film of dielectric grease to primary winding terminals.

IGNITION SWITCH REMOVAL

1. Follow steps 1 through 3 of ignition coil removal.
2. Disconnect ignition switch from the main wire harness on right side of motorcycle by pushing the tab and pulling connector apart.



FLYWHEEL TIMING GEAR REMOVAL

1. Remove flywheel (refer to ch 16).
2. Remove flywheel adaptor (timing gear) bolts. (A)
3. Remove flywheel adaptor.

FLYWHEEL ADAPTOR (TIMING GEAR) INSTALLATION

1. Align adaptor with flywheel.

NOTE: Keyway of flywheel (B) must line up with mark or "T" (C) on flywheel adaptor when adaptor is properly installed.

2. Install screws and torque to specification. Apply Loctite 262 threadlock to fasteners.

TORQUE:

13 Nm, 115 in-lb

Loctite™ 262

3. Install flywheel. (refer to ch 16)
4. Install primary cover. (refer to ch 9)

ECM CIRCUIT TESTS

1. The majority of tests necessary for ignition system troubleshooting can be performed at main connector for ECM.
2. Extreme care must be taken not to introduce problems while doing the troubleshooting procedures.

NOTE: A connector test adapter kit is necessary. Use of other means to probe the necessary pins can easily damage the ECM connector.

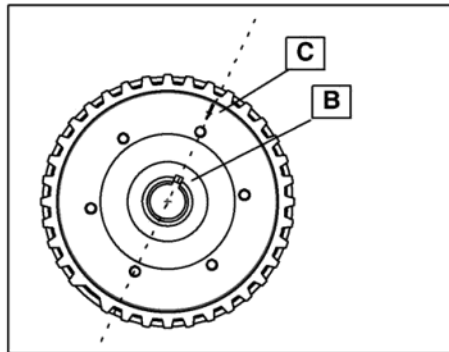
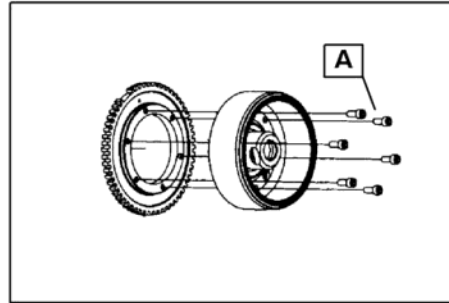
Test lead kit PV-43526

CAUTION:

Once the ECM connector has been disconnected, do not touch the pins on the ECM. Static electricity from your body can easily damage ECM

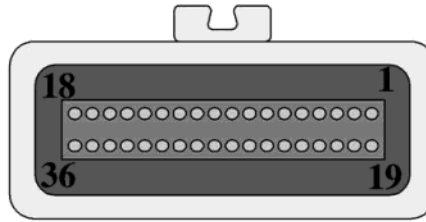
Do not attempt to perform tests on ECM. Tests are done on wiring harness side of ECM connector.

3. The ECM connector is marked with numbers at one end on both sides. Determining the correct pin(s) is easily accomplished by counting the terminals.
4. Use the information on the following page to perform tests at ECM connector.



IGNITION

ECM CONNECTOR MAP



| ECM CONNECTOR FRONT VIEW | | | | | | | | | | | | | | | | | |
|--|------|---------------------|-----------------------------------|--------------------------------------|------------------------|-----------------------------|--------------------------------|---|-------------------------|---------------------------|-----------------------------|-----------------------------|----------------------------|----------------------------|---------------------------|-----------------------------|-----------------------------------|
| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| W/GN #2 CYL (REAR) PRIMARY COIL WIRE | OPEN | OPEN | BK CRANK POSITION SENSOR | BN/GN SENSOR VOLTAGE | OR/BN MAP SENSOR | OR/BU OIL TEMP SENDER | OR/GN AIR TEMP SENDER | GN/BN SPEED SENSOR & MFD Pin #8 | GY/BK DIAG PIN #7 | BN/R SYSTEM VOLTAGE | VIO/PK Sensor Voltage | VIO/PK SYSTEM VOLTAGE | BK/VIO SYSTEM GROUND | BK/VIO SYSTEM GROUND | OPEN | GY FUEL PUMP RELAY | W/GY INJECTOR #2 (REAR) |
| BN = Brown BU = Blue GN = Green BK = Black GY = Grey OR = Orange PK = Pink R = Red TRANS = Transparent VIO = Violet W = White Y = Yellow | | | | | | | | | | | | | | | | | |
| 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |
| W/BK #1 CYL (FRONT) PRIMARY COIL WIRE | OPEN | GN ECM GROUND | OPEN | TRANS CRANK POSITION SENSOR | OPEN | BU/Y | OR/Y TPS | OPEN | OPEN | OPEN | R 12VDC POWER | GY/R DIAG PIN #13 | OPEN | OPEN | BK/OR TO MFD PIN#16 | GN/W TO MFD PIN#15 | W/BU INJECTOR #1 (FRONT) |
| VERIFY TERMINAL PINS ARE NOT LOOSE IN CONNECTOR AND WIRE CONNECTION TO TERMINAL IS PIN IS SECURE. BACK OF CONNECTOR IS NUMBERED AT THE PIN SLOT AS SHOWN ABOVE. | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

ECM HARNESS / CONNECTOR TESTING

| COMPONENT | METER SETTING | TEST CONNECTIONS | SPECIFICATIONS ±10% @ Room Temp. 70° F/ 21° C |
|----------------------------------|---------------|--|---|
| #1 FUEL INJECTOR | OHMS | Pin #19 to Pin #7 | 15 ohms / No cont. to ground |
| #2 FUEL INJECTOR | OHMS | Pin #1 to Pin #7 | 15 ohms / No cont. to ground |
| #1 IGNITION COIL (FRONT CYL.) | OHMS | Pin #36 to plug cap of front ignition coil. | 11K ohms |
| #2 IGNITION COIL (REAR CYL.) | OHMS | Pin #18 to plug cap of rear ignition coil. | 11K ohms |
| CRANK POSITION SENSOR | OHMS | Pin #15 to #32 | 1500 ohms ± 100 ohms |
| CRANK POSITION SENSOR | AC VOLTAGE | Pin #15 to #32 | Spark plugs out: 3V AC Spark plugs in: Any fluctuating AC signal. |
| AIR TEMP. SENSOR | OHMS | Pin #11 to #14 | 3.15K ohms |
| OIL TEMP. SENSOR | OHMS | Pin #12 to #14 | 12.3K ohms |
| THROTTLE POSITION SENSOR | OHMS | Pin #29 to #8 | 3.7 - 5K ohms throttle closed 1130 ohms throttle open |
| TPS | OHMS | Pin #29 to #14 | 1130 ohms throttle closed 3.7 to 5K ohms throttle open |
| TPS | OHMS | Pin #8 to #14 | 3.7 - 5K ohms NOTE: Reading will not change with throttle position |
| MAP SENSOR | OHMS | Pin # 8 to #13 | 5.4K ohms |

17.12

CHAPTER 18

ELECTRIC STARTER

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ELECTRIC STARTER

GENERAL

WARNING

Always disconnect the battery (negative terminal first) before servicing the starter motor.

GENERAL CAUTIONS TO OBSERVE WHEN WORKING ON STARTER SYSTEM

- Inspect the condition of the battery before troubleshooting the starter system. A weak battery may not be able to turn the engine over or turn the engine over fast enough to supply ignition voltage.

STARTER SPECIFICATIONS

| ELECTRIC STARTER & STARTER CLUTCH | | |
|--|---|----------------------------|
| Item | Standard | Service Limit |
| Starter Motor Brush Length | 13 mm \pm 0.5mm (0.512 \pm 0.020") | 6.5 mm (0.255") |
| Starter Motor Operating Amp Draw | 90-120 Amps | Not Applicable |
| Starter Motor No Load Amp Draw (Bench Test) | 30-40 Amps after initial surge. | Not Applicable |
| Starter Slip Clutch Break-Away Torque | 50 lb-ft when new | 25-35 lb-ft after break-in |
| Battery Voltage, No Load | Above 12.5 V DC | Not Applicable |
| Voltage Drop Allowed For Each Connection On Positive Circuit | 0.2 V DC (200 millivolts) | Not Applicable |
| Voltage Drop Allowed For Each Connection On Negative Circuit | 0.2 V DC (200 millivolts) | Not Applicable |
| Total Voltage Drop Allowed On Positive Side Of Starter | 0.3 V DC (300 millivolts) | Not Applicable |
| Total Voltage Drop Allowed On Negative Side Of Starter | 0.3 V DC (300 millivolts) | Not Applicable |
| Resistance Between Any Two Commutator Bars | Continuity (0 Ohms) | Not Applicable |
| Resistance Between Commutator And Armature Shaft | Infinity (OL on Fluke™ 73) | Not Applicable |
| Resistance Between Battery Input Terminal & Insulated Brushes | Continuity (0 Ohms) | Not Applicable |
| Resistance Between Battery Input Terminal & Starter Motor Case | Infinity (OL on Fluke™ 73) | Not Applicable |

SPECIFICATIONS

| Torque Specifications - Starter | | |
|---|-----------|--------------------------------|
| Description | Torque Nm | Torque lb-ft (in-lb) |
| Flywheel Bolt | 102 Nm | 75 lb-ft |
| Exciter Ring Bolts: Crankshaft Position Wheel | 13 Nm | (115 in-lb) Loctite™ 262 |
| Crankshaft Gear Bolts | 41 Nm | 30 lb-ft Loctite™ 262 |
| Starter Motor to Engine Case | 30 Nm | 22 lb-ft |
| Electrical Terminal to Starter | 11 Nm | (100 in-lb) |
| Starter Motor Assembly Bolts | 10 Nm | (85 in-lb) |
| Bearing Cover Bolts | 11 Nm | (100 in-lb) |
| Neutral Switch | 11 Nm | (100 in-lb) Apply Pipe Sealant |

18.1

ELECTRIC STARTER

SPECIAL TOOLS

| SPECIAL TOOL | PART NUMBER |
|------------------------------------|-------------|
| Digital Multi-Meter | PV-43546 |
| Optional Amp Meter Inductive Clamp | PV-39617 |
| Flywheel Puller | PV-43533 |
| Engine Stop Tool | PV-43502 |

TROUBLESHOOTING FLOW CHART MENU

| Symptom | Possible Cause | Refer To: |
|--|---|---|
| Starter motor will not turn when transmission is in neutral, but will turn if clutch is pulled in. | Neutral Safety Switch Circuit is not functioning correctly. | Tests 2A&2B |
| Starter motor will not turn when the transmission is in gear with the clutch pulled in, but will turn when the transmission is in neutral. | Clutch Safety Switch Circuit is not functioning correctly. | Test 2C |
| Starter motor will not turn regardless if engine is in neutral and the clutch is pulled in. | Go to Troubleshooting Flow Chart One (1) | Go to Troubleshooting Flow Chart One (1) |
| Starter motor turns slowly. Engine may or may not start. | Go to Troubleshooting Flow Chart Two (2) | Go to Troubleshooting Flow Chart Two (2) |
| Starter motor turns, but engine does not turn. | Go to Troubleshooting Flow Chart Three (3) | Go to Troubleshooting Flow Chart Three (3) |
| Starter motor turns at normal speed, but engine does not start. | Ignition Problem Engine Problem Fuel Delivery Problem | Chapter 17 Chapter 7,8,9,10 Chapter 5 |

TROUBLESHOOTING FLOW CHART ONE (1)

WARNING

Ensure that motorcycle is secure and transmission is in neutral for all tests.

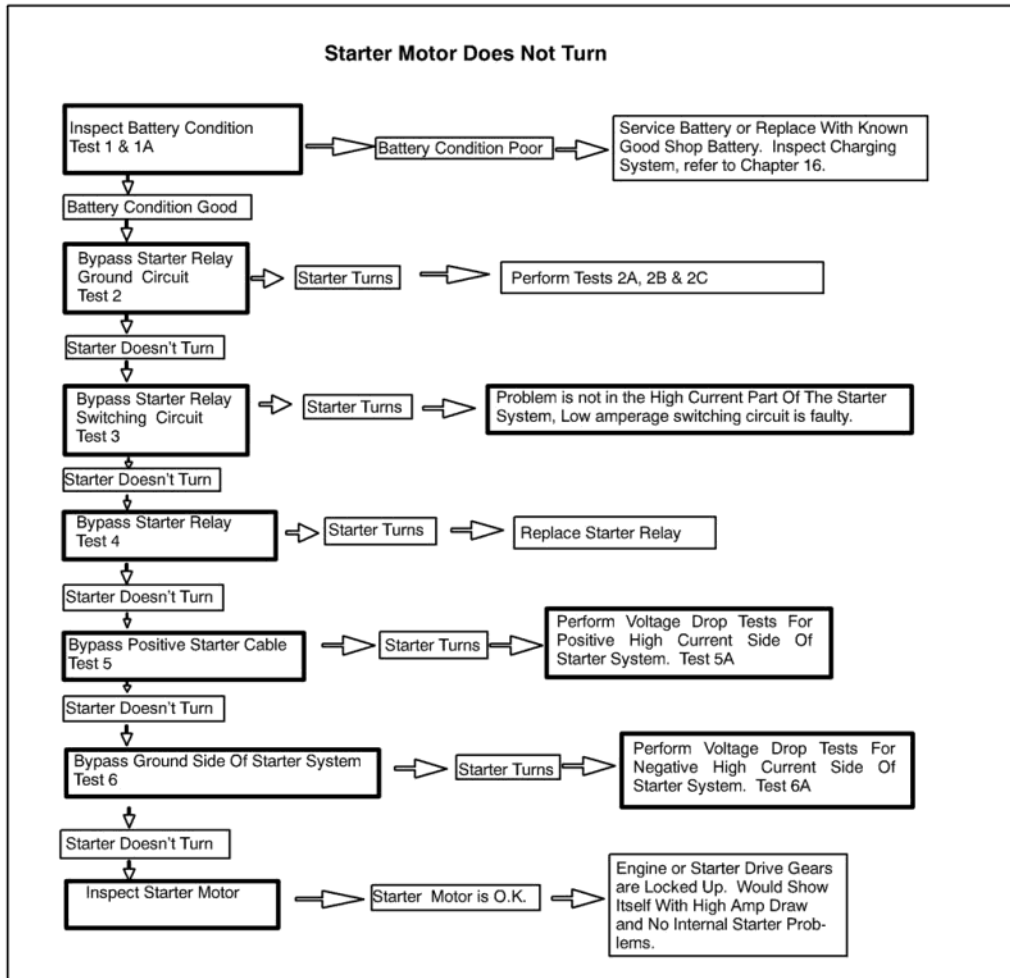
CAUTION:

Inspect fuses and make sure battery is fully charged before inspecting starter system.

TROUBLESHOOTING FLOW CHART TWO (2)

NOTE: These procedures require a Digital Multimeter and High Amp capacity ammeter, a shunt, or an inductive ammeter clamp and a DMM.

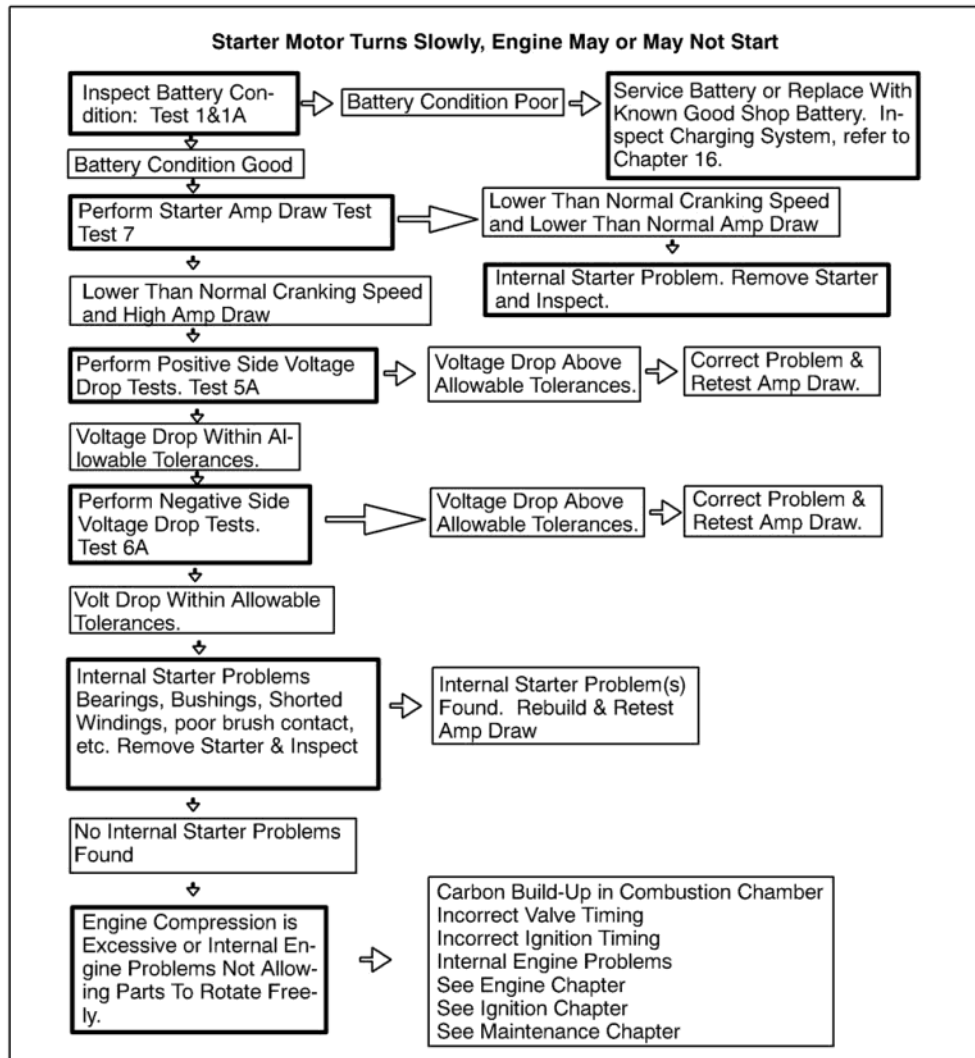
18.2



TROUBLESHOOTING FLOW CHART THREE (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. | Starter Motor is Running Backwards. | Starter Motor Case Assembled Incorrectly. Battery Terminals Are Connected Incorrectly. |
| | Starter Clutch Is Damaged. | Refer To Procedure Chapter 18. |
| | Starter starter slip Clutch Is Damaged. There will be a substantial squealing noise if the starter slip clutch is slipping. | Refer To Procedure Chapter 18. |
| | Starter Gears Are Damaged | Refer To Procedure Chapter 18. |

ELECTRIC STARTER

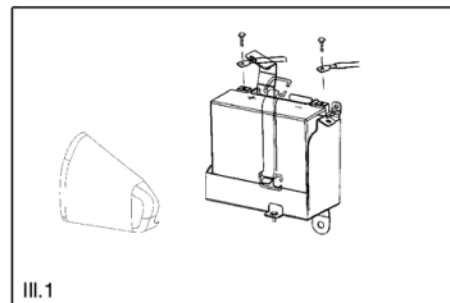


BATTERY INSPECTION & CHARGING PROCEDURES: Test 1

1. Remove left frame cover
2. Measure battery voltage with a digital multimeter. Voltage reading should be above 12.5 V DC. If the battery voltage is lower than 12.5 V DC the battery must be charged according to the instructions given below.

CAUTION:

Remove battery from the motorcycle before charging battery, refer to Chapter 2.



18.4

BATTERY INSPECTION & CHARGING PROCEDURES: Test 1 (cont.)

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

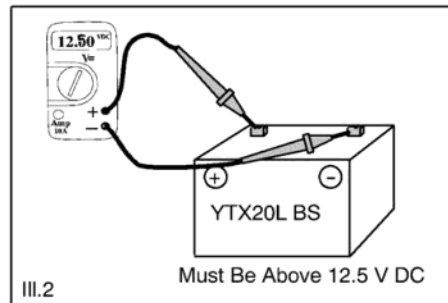
3. Charge battery at 1.8 amps for 5 to 10 hours.

Specification: 1.8 A for 5-10 hours

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

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

NOTE: If battery measures below specifications inspect the charging system. Refer to chapter 16.

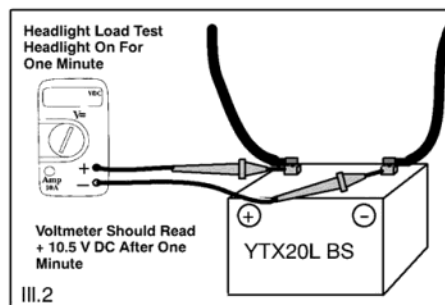


BATTERY LOAD TEST: Test 1 A

1. Load test battery using a commercially available battery load tester. Follow the battery load tester manufacturer instructions.

NOTE: Although not as conclusive, the following test can be used to direct troubleshooting efforts if a battery load tester is not readily available.

2. Charge battery (see procedure).
3. Install battery and connect battery terminals, refer to Chapter 16.
4. Connect a digital multimeter to battery and keep it connected for duration of test.
5. Turn ignition key on and move the head light high beam switch to High Beam for 1 minute (without the engine running).
6. Turn ignition off. Measure battery voltage.
7. If the battery voltage drops below 10.5 V DC the battery should be charged again and the test repeated.



ELECTRIC STARTER

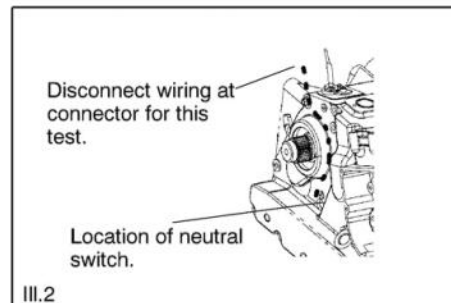
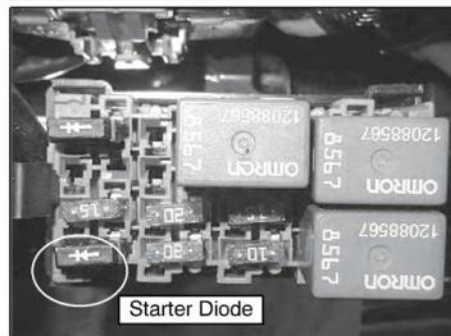
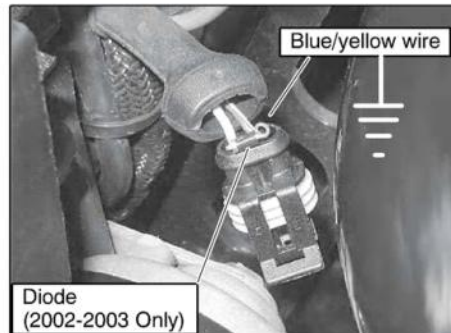
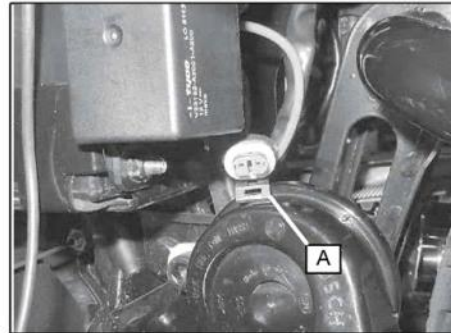
STARTER RELAY GROUND CIRCUIT: Test 2

⚠ WARNING

Ensure that motorcycle is secure and that transmission is in neutral for the following inspection.

NOTE: Placing the transmission in neutral or operating the clutch lever provides a ground path for the low current side of the starter relay. This test will temporarily bypass these components.

1. Disconnect the 2-pin connector (A) from bottom of starter relay.
2. Slide boot back from connector and attach a small jumper wire from the blue/yellow wire to ground.
3. Reconnect the 2-pin connector.
4. Turn on ignition switch on and place engine stop switch in run position.
5. Attempt to start the motorcycle.
6. If starter turns, the problem is in the clutch switch, neutral switch or wiring harness between starter relay and engine ground.



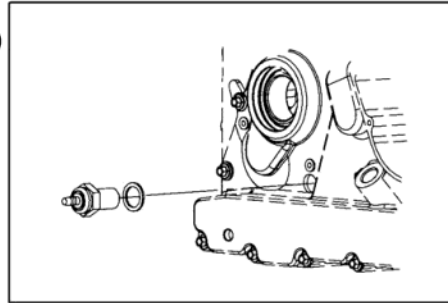
NEUTRAL SWITCH INSPECTION: Test 2A

The symptom of a faulty neutral switch circuit is:

- Starter motor will not operate when transmission is in neutral.
 - Starter will operate when clutch is pulled in.
1. Turn ignition switch on and place engine stop switch in the run position.
 2. Place the transmission in neutral.
 3. Observe neutral indicator light.
 4. The neutral indicator should be on.
 5. If the neutral indicator is not on and the transmission is in neutral, disconnect neutral switch wire lead and connect it to a ground. This should light the neutral indicator if the neutral switch is at fault (continue for additional switch testing or replace neutral switch and test operation).
 6. Position the DMM to Ohms scale.
 7. Place one lead of the DMM on the terminal at the neutral switch.
 8. Place the other lead on a good engine ground.
 9. Shift transmission in and out of neutral.

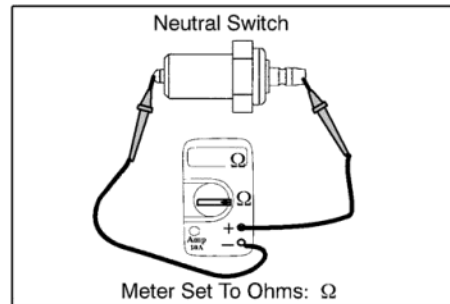
NEUTRAL SWITCH INSPECTION: Test 2A (cont.)

10. The DMM should display infinity (O.L. on a Fluke™ 73) when the transmission is in gear and continuity to ground when the transmission is in neutral.
11. Replace neutral switch as necessary.
12. If the neutral switch is working correctly and the neutral indicator did not light with the transmission in neutral; inspect the neutral lamp (approx. 13 Ω) and circuit wiring for an open/short circuit. Repair wiring as required.



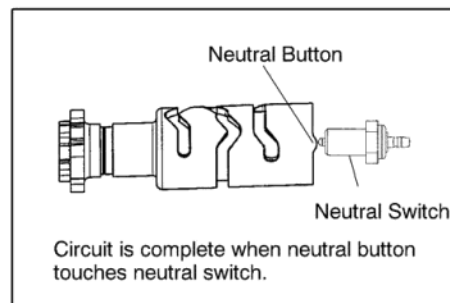
NEUTRAL SWITCH REMOVAL & BENCH TESTING: Test 2B

1. Drain engine oil, refer to Chapter 2.
2. Disconnect the neutral switch wire.
3. Remove neutral switch and sealing washer.
4. Position the DMM to Ohms scale.
5. Place one lead on the wire terminal of the neutral switch.
6. Place the other lead on the plunger of the neutral switch.
7. The meter should read continuity or very low resistance (less than 1 Ω) regardless of plunger position.
8. Depress the plunger, meter should read very low resistance (less than 1 Ω).



NOTE: The neutral switch is a spring loaded plunger mechanism designed to provide a path to ground for the neutral light and starter relay circuit when the transmission is in neutral (plunger makes contact with shift drum lobe).

9. Operate the plunger a few times to ensure the switch is operating properly.
10. Replace neutral switch as required.
11. If the neutral switch tests good, yet the system does not function properly, inspect the following:
 - Turn rear wheel to ensure the transmission is in neutral.
 - The switch plunger is stuck in its retracted position.
 - The shift cam lobe is worn off.



NEUTRAL SWITCH INSTALLATION

1. Place a new sealing washer on the neutral switch.
2. Install switch and tighten to specification.
3. Attach neutral switch wire to terminal on neutral switch.
4. Fill engine with oil, refer to Chapter 3.
5. Inspect operation of neutral switch.
6. Install front sprocket components, refer to Chapter 6 & 11.

ELECTRIC STARTER

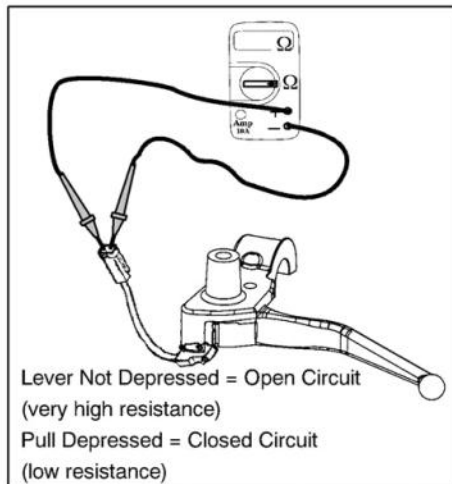
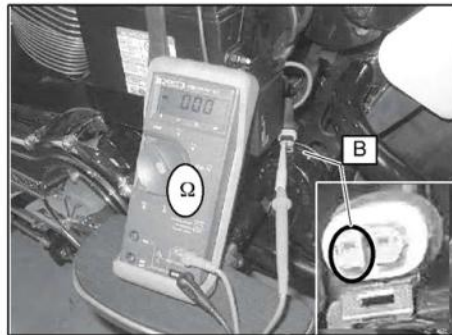
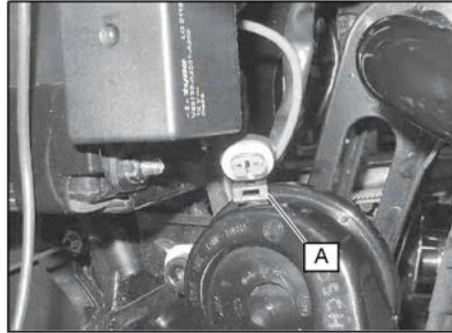
CLUTCH SWITCH CIRCUIT: Test 2C

The symptom of a faulty clutch switch circuit is:

- Starter motor will not operate when transmission is in gear with the clutch lever pulled in. Starter will turn when transmission is in neutral.

NOTE: The clutch switch makes an audible click at the beginning of the clutch lever travel. This is a good indication that the clutch switch is working but using an ohm meter is the best test. A faulty switch will set a code in the ECM, but will not set a CH ENG light.

1. Place the transmission in neutral.
2. Remove left side cover.
3. Disconnect switch connector at starter relay (carefully pull lock tab (A) down, and push connector away from relay to disconnect.)
4. Set DMM to Ohms (Ω).
5. Connect red (+) lead of DMM to the blue/yellow wire (B) of starter relay wiring harness connector as shown at right, using a test probe from Victory Connector Test Kit PV 43526.
6. Connect DMM black lead to battery negative post.
7. Operate clutch lever while observing meter display.
8. Pull in clutch lever. The meter should display continuity to ground or very low resistance (less than 1 ohm).
9. Release clutch lever, meter should display infinity (O.L. on Fluke™ 73).
10. If clutch switch does not test as described inspect clutch switch, clutch switch wiring or mounting of switch to clutch lever for fault as described below.
11. Disconnect clutch switch wiring connector.
12. Connect ohmmeter across terminals of clutch switch. Test for continuity when clutch lever is pulled toward handlebar. Test for open circuit when clutch lever is released.
13. If the clutch switch now operates correctly, the wiring between this point and the previous test point is at fault and must be corrected.
14. If the clutch switch still does not operate correctly, inspect the mounting of the switch.
15. If the switch is mounted correctly and physically operates but does not open and close electrically. Replace the clutch switch and test.

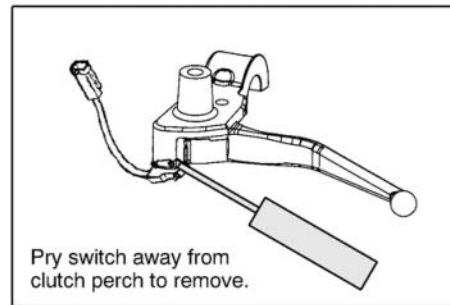


CLUTCH SWITCH REMOVAL

1. Disconnect wiring connector.
2. Pull clutch lever towards handlebars and secure in this position.
3. Place small screwdriver between switch body and clutch perch.
4. Carefully pry switch away from clutch perch.

CLUTCH SWITCH INSTALLATION

1. Make sure clutch handle is pulled toward handlebars and secured there during the installation process.
2. Align switch locking tab with clutch perch.
3. Firmly press switch into place.
4. Connect wiring connector.
5. Release clutch handle.

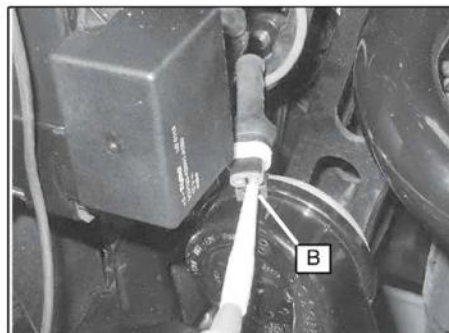
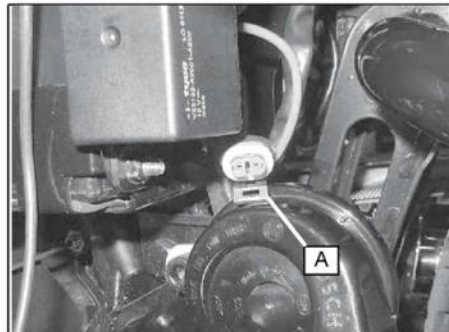


STARTER RELAY POSITIVE CIRCUIT: Test 3

WARNING

Secure motorcycle and place transmission in neutral for the following test.

1. Place the transmission in neutral.
2. Remove left side cover.
3. Disconnect switch connector at starter (pull lock tab (A) down and push connector away from relay to disconnect.)
4. Set DMM to DC Volts.
5. Check battery voltage by testing across battery terminals. Note the voltage reading (should be above 12 DC volts.)
6. Connect red (+) lead of DMM to the yellow/white wire (B) of starter relay wiring harness connector as shown at right, using a test probe from Victory Connector Test Kit PV 43526.
7. Connect DMM black lead to battery negative post.
8. Turn ignition key ON and Kill Switch to RUN position.
9. Press starter button. Battery voltage should be displayed on meter if power supply circuit to relay is OK. If voltage is more than .2 volts below battery voltage, inspect the power supply circuit.



ELECTRIC STARTER

STARTER RELAY BYPASS: Test 4

⚠ WARNING

Secure motorcycle and place transmission in neutral for the following test. Be sure the transmission is in neutral!

⚠ WARNING

The following test involves high current, heat and possible sparks. Wear a face shield and approved safety glasses while doing the following test. Only use the tool recommended to prevent excessive heat and possible burns.

1. Place the transmission in neutral.
2. Remove left frame side cover.
3. Connect one lead of a remote starter switch to one of the terminal posts on the relay.
4. Connect the other lead of the remote starter switch to the other terminal post on the relay.

CAUTION

Do not allow the alligator clips of the remote starter relay switch to touch each other and short out.

Remote starter switch

5. Depress the button on the remote starter relay switch. (Ill. 1)
6. If the starter motor turns over, replace the relay switch.
7. If the starter motor does not operate, go to test 5.

STARTER RELAY TO STARTER MOTOR POSITIVE CABLE BYPASS: Test 5

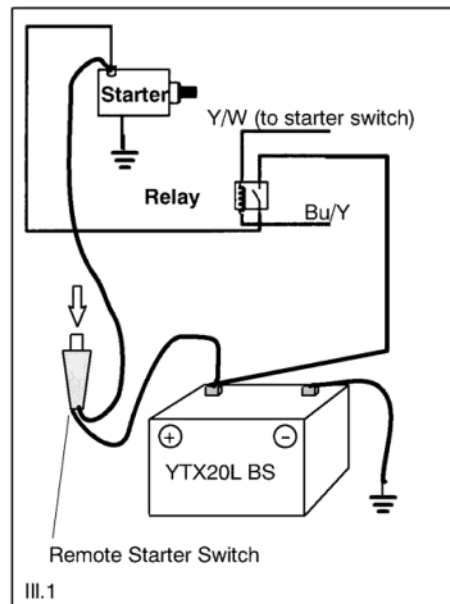
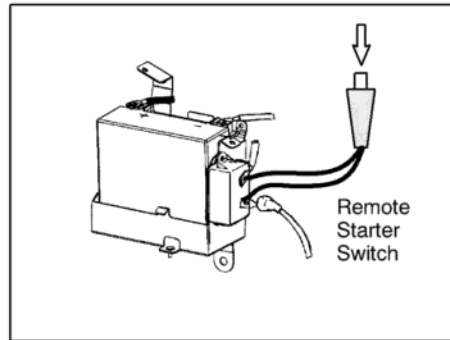
⚠ WARNING

Secure motorcycle and place transmission in neutral for the following test.

⚠ WARNING

The following test involves high current, heat and possible sparks. Wear a face shield and approved safety glasses while doing the following test.

1. Place the transmission in neutral.
2. Remove frame side cover.
3. Connect one clamp of a heavy-duty, automotive remote starter switch to the positive terminal lug at the starter.
4. Connect the other clamp of the remote starter switch to the positive side of the battery.



STARTER RELAY POSITIVE CABLE BYPASS: Test 5 (cont.)

WARNING

Do not allow any part of the jumper cable clamp to touch the chassis or any other ground. Be sure transmission is in neutral.

5. Make sure transmission is in neutral, key switch off and stop switch off.
6. Pull in clutch lever and depress the remote starter switch momentarily.
7. If starter turns, there is excessive resistance in the positive, high current side of the starter system. Go to test 5A (Positive Side Voltage Drop Test).
8. If starter does not turn, go to Negative Cable Bypass (Test 6).

POSITIVE SIDE VOLTAGE DROP TEST: (Test 5A)

Starter motor does not turn or turns slowly when the starter relay is bypassed. Starter motor works correctly when performing the starter relay positive cable bypass as described in Test 5.

CAUTION

The ignition system must be disabled when doing voltage drop tests, if the engine starts it will be difficult to measure voltage drop. To disable the ignition system quickly and safely, observe the following steps.

1. Remove spark plug caps.
2. Install test spark plugs into plug caps.
3. Ground spark plugs against engine.

| POSITIVE SIDE VOLTAGE DROP TESTS | | |
|--------------------------------------|---------------|---------------------------|
| Location | Steps | Allowable Voltage Drop |
| Battery (+) To Starter (+) | 1 through 8 | 0.3 Volts DC (300 mV DC) |
| Battery (+) to Battery Side of Relay | 9 through 17 | 0.2 Volts DC (200 mV DC)* |
| Across Relay | 18 through 22 | 0.2 Volts DC (200 mV DC)* |
| Starter (+) to Starter Side of Relay | 23 through 31 | 0.2 Volts DC (200 mV DC)* |

NOTE: *The total voltage drop equal to the voltage drop between the battery (+) to starter (+). The total voltage drop must not exceed 0.3 Volts DC.

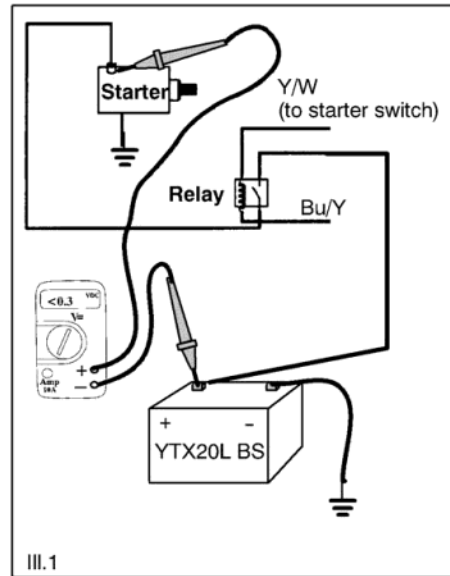
CAUTION

Only operate 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 test to prevent damage to starter motor.

ELECTRIC STARTER

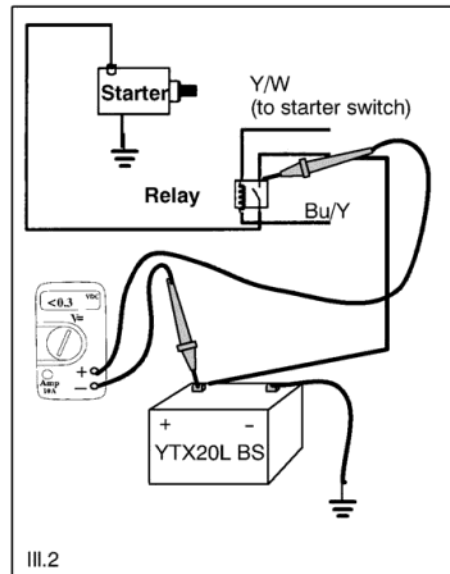
POSITIVE SIDE VOLTAGE DROP TEST: (Test 5A, cont.)

4. Place transmission in neutral.
5. Remove left frame cover.
6. Set DMM to DC Volts.
7. Place one lead of DMM to positive battery post. (III. 1)
8. Place the other lead of the DMM to starter motor positive terminal screw. (III. 1)
9. Turn ignition switch on, turn engine stop switch to run position. Pull in clutch lever.
10. Operate the starter normally (no jumper cables in place) and observe meter display.
11. If DMM reads more than 0.3 Volts DC when the starter motor is engaged, it indicates that there is excessive resistance in the starter's battery positive path. Continue with the following tests to isolate each section of the positive path and observe the voltage drop with DMM leads placed as indicated.



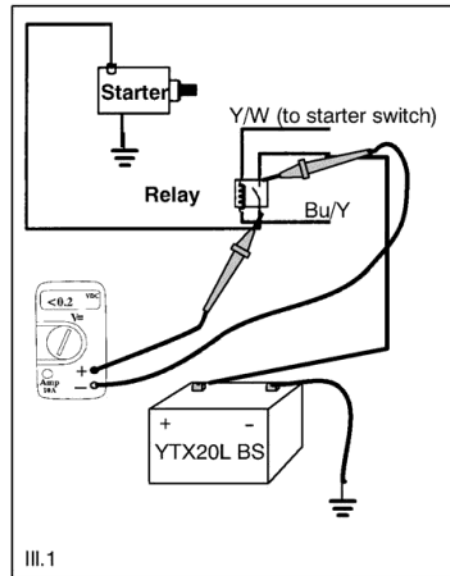
12. Place one lead of DMM to positive battery post. Ensure that the DMM is set to read DC Volts. (III. 2)
13. Place the other lead of the DMM to the relay terminal leading to the battery. (III. 2)
14. Engage starter and observe meter display, it should read less than 0.2 Volts DC (200 mV DC).
15. If voltage drop is observed, the cable, connection at the battery or connection at the relay is causing resistance and must be corrected.
16. Inspect cable ends for corrosion where cable is connected to terminal lugs.
17. Remove cable. Set the DMM to read Ohms.
18. 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.
19. 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.

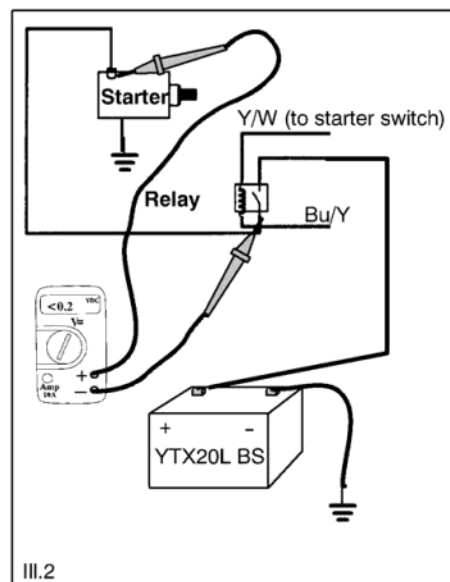


POSITIVE SIDE VOLTAGE DROP TEST: (Test 5A, cont.)

20. 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.
21. Place one lead of DMM to battery side of relay. Reset DMM to read DC Volts if necessary. (III. 1)
22. Place other lead to the starter motor side of relay. (III. 1)
23. Engage starter and observe meter display; it should read less than 0.2 Volts DC (200 mV DC).
24. If voltage drop is observed, remove cables and clean cable terminals and relay terminals. Reattach cables. Retest voltage drop.
25. If voltage drop is still observed through the relay, the resistance is in the relay. High current has burned the switch contacts and the relay needs to be replaced.



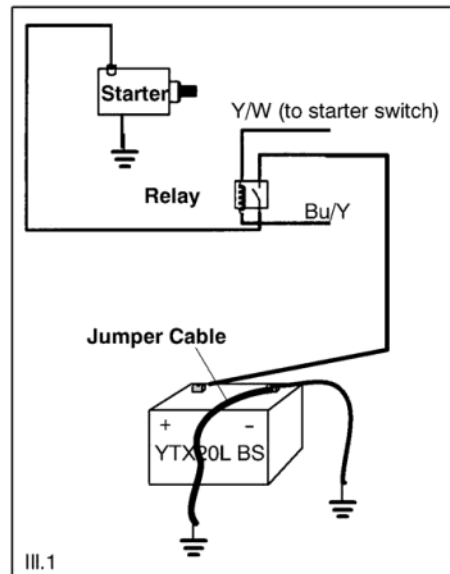
26. Place one lead of the DMM to the starter motor side of the relay. Ensure that the DMM is set to read Volts DC. (III. 2)
27. Place the other lead of DMM to the starter motor positive terminal. (III. 2)
28. Engage the starter and observe meter display.
29. If voltage drop is observed, the cable connection at the relay or connection at the starter motor is causing resistance and must be corrected.
30. Inspect the cable ends for corrosion where the cable is connected to the terminal lugs.
31. Remove the cable. Set DMM to read Ohms.
32. Place DMM leads at both ends of the cable and measure the cable's resistance. The resistance should be 0 ohms. Replace the cable if necessary. Remember to subtract test lead resistance.
33. Inspect the starter cable lug and relay lug for corrosion or looseness.
34. 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.



ELECTRIC STARTER

NEGATIVE CABLE BYPASS (Test 6 of Flow Chart Troubleshooting)

1. Place transmission in neutral.
2. Remove left side frame cover.
3. Connect one clamp of an automotive type jumper cable (heavy gauge jumper cable) to battery negative post.
4. Connect the other end of jumper cable to a good ground location on starter motor body.
5. Make sure transmission is in neutral. Turn ignition key and stop switch on. Pull in clutch lever and attempt to start motorcycle.
6. If the starter turns, there is excessive resistance in the negative, high current side of the starter system. Go to test 6A (Negative Side Voltage Drop Test).
7. If starter does not turn and all troubleshooting steps have led to this test, remove and inspect starter motor, refer to procedure.



ELECTRIC STARTER

NEGATIVE SIDE VOLTAGE DROP TEST (Test 6A)

| NEGATIVE SIDE VOLTAGE DROP TESTS | | |
|---|---------------|---------------------------|
| Location | Steps | Allowable Voltage Drop |
| Battery (-) To Starter Body(-) | 1 through 8 | 0.3 Volts DC (300 mV DC) |
| Battery (-) to Battery Cable Ground Connection At Frame | 9 through 17 | 0.2 Volts DC (200 mV DC)* |
| Battery Cable Ground Connection To Starter Body (-) | 18 through 24 | 0.2 Volts DC (200 mV DC)* |

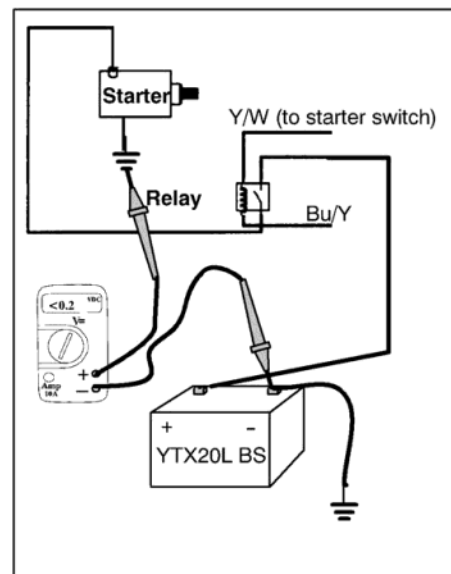
NOTE: *The total voltage drop of these two items will equal to the voltage drop between the battery (-) to starter body (-). The total voltage drop must not exceed 0.3 Volts DC.

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.

Disable the ignition system so engine will not start during this test.

- Remove spark plug caps.
 - Install test spark plugs into plug caps.
 - Ground spark plugs against engine.
1. Place transmission in neutral.
 2. Remove left frame cover.
 3. Set DMM to DC Volts.
 4. Place one lead of DMM to negative battery post.
 5. Place the other lead of the DMM to a clean ground on starter motor body.
 6. Turn on ignition switch and engine stop switch to run position. Pull in clutch lever.
 7. Operate starter normally (no jumper cables in place) and observe meter display.



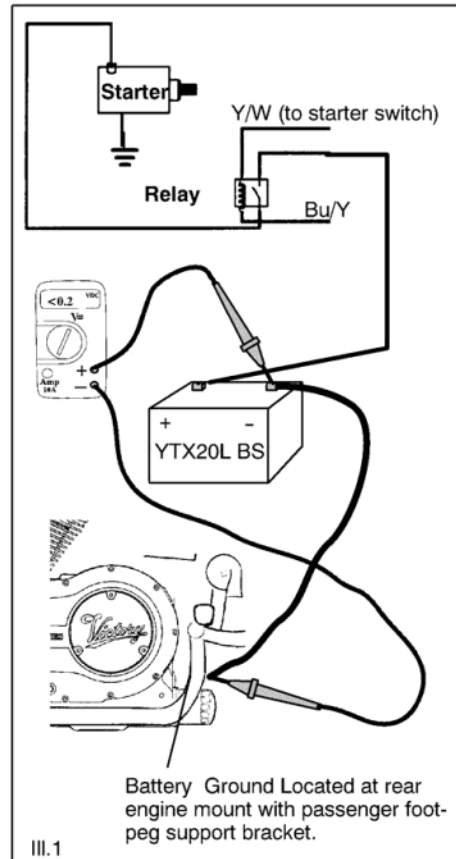
ELECTRIC STARTER

NEGATIVE SIDE VOLTAGE DROP TEST (Test 6A, cont.)

8. If the DMM reads more than 0.3 Volts DC when the starter motor is engaged, it indicates that there is excessive resistance in the starter's battery negative path. Continue with the following tests to isolate each section of the negative path and observe the voltage drop with DMM leads placed as indicated.
9. Place one lead of the DMM to the negative battery post. Ensure that the DMM is set to read DC Volts.
10. Place the other lead of the DMM to the battery cable engine ground connection.
11. Engage the starter and observe the meter display, it should read less than 0.2 Volts DC (200 mV DC).
12. If voltage drop is observed, the cable, connection at the battery, connection at the engine or mounting surface of the starter motor body is causing resistance and must be corrected.
13. Inspect the cable ends for corrosion where cable is connected to battery or engine.
14. Remove the cable. Set the DMM to read Ohms.
15. Place the DMM leads at both ends of the cable and measure the cable's resistance. The resistance should be 0 ohms. Remember to subtract meter lead resistance. Replace the cable if necessary.
16. Inspect the battery post, battery cable lug and engine battery cable mount for corrosion or looseness.

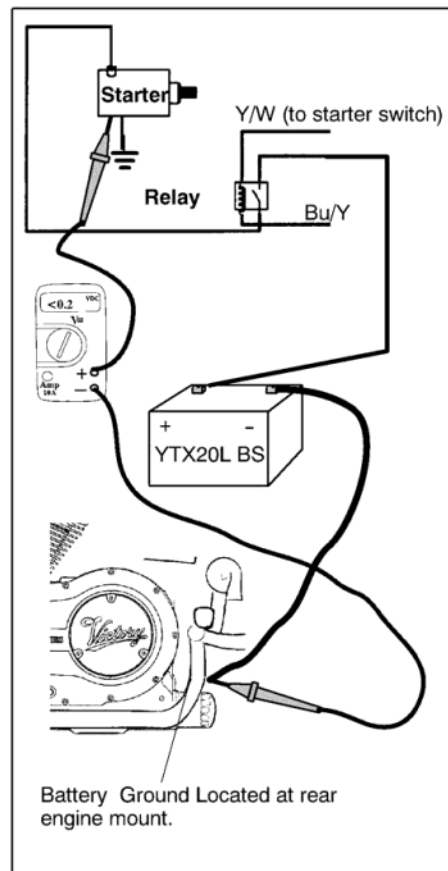
NOTE: Corrosion has resistance that limits or stops the flow of current to the starter motor.

17. 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.



NEGATIVE SIDE VOLTAGE DROP TEST (Test 6A, cont.)

18. Place one lead of DMM to battery cable mount at engine. Reset the DMM to read DC Volts if necessary.
19. Place the other lead on starter motor body.
20. Engage the starter and observe the meter display, it should read less than 0.2 Volts DC (200 mV DC).
21. If voltage drop is observed, there is resistance between the battery cable connection at engine and the mounting surfaces of the starter motor. While this would be unusual, it is possible.
22. Remove and clean the connection between ground battery cable and engine.
23. Remove the starter and ensure that the starter is making firm contact with engine. Ensure that the starter mounting bolts are tight.
24. 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.



ELECTRIC STARTER

STARTER AMP DRAW TEST: (Test 7)

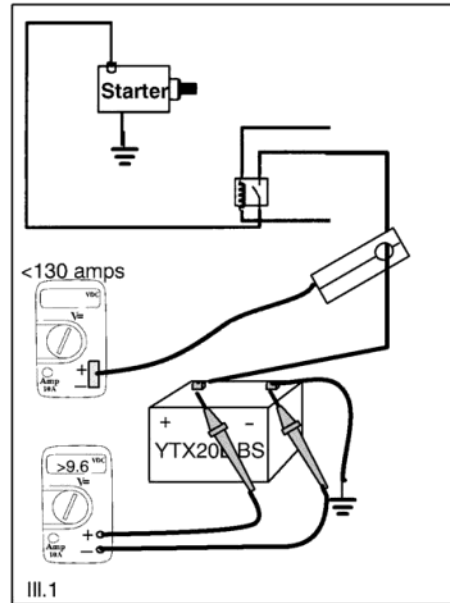
⚠ WARNING

Do not allow any part of the jumper cable clamp to touch the chassis or any other ground.

CAUTION

Disable the ignition system so that the engine will not start during this test.

- Remove spark plug caps.
 - Install test spark plugs into plug caps.
 - Ground spark plugs against engine.
1. Inspect the battery (see procedure). Charge or replace battery as necessary before proceeding.
 2. Place transmission in neutral.
 3. Position an inductive ammeter clamp on battery positive cable. (Ill. 1)
 4. Set DMM to Volts DC scale and connect red lead of meter to positive post of battery. (Ill. 1)
 5. Connect black lead of meter to negative post of battery. (Ill. 1)
 6. Turn ignition switch on and observe ammeter. It should register negative amps. If it does not, turn the ammeter probe around.
 7. Make sure ignition switch is on, engine stop switch is in the run position, transmission is in neutral, clutch lever pulled in and that the ignition system is disabled.
 8. Press starter switch and crank starter for about 5 seconds and observe both meters and the tachometer.
 9. The battery voltage should remain above 9.6 volts.
 10. The amperage draw of the starter should not exceed 130 amps.



The possible combinations are as follows:

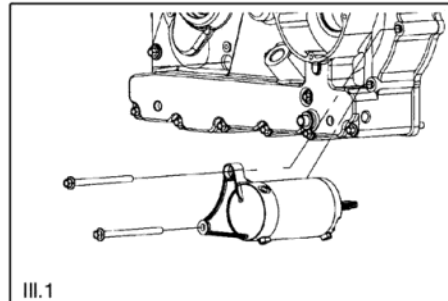
| STARTER AMP DRAW RESULTS (Good Battery Condition Verified) | | | |
|--|-------------------------|----------------------|---|
| Amperage Draw | Battery Voltage | Engine RPM | Possible Problem |
| 90 to 120 amps | 9.6 Volts DC or Greater | Greater Than 400 rpm | Normal |
| Less Than 90 amps | 9.6 Volts DC or Greater | Less Than 400 rpm | Internal starter problems |
| Greater Than 130 amps | Less Than 9.6 Volts DC | Less Than 400 rpm | Inspect for voltage drops on positive or negative side of starter circuit. |
| Greater Than 130 amps | Less Than 9.6 Volts DC | Less Than 400 rpm | Voltage drops within acceptable limits. Remove starter & inspect. |
| Greater Than 130 amps | Less Than 9.6 Volts DC | Less Than 400 rpm | Voltage drops within acceptable limits. No internal starter problem. Engine compression is excessive or internal engine problems not allowing parts to rotate freely. |

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 exhaust system. (Refer to Chapter 3)
2. Remove regulator/rectifier assembly.
3. Remove relay cable from starter.
4. Place drain pan under starter.
5. Remove the 2 starter motor mounting bolts and remove starter.



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. Place starter into the engine case while aligning the starter mounting lugs as closely as possible during the installation process. (III. 2)
2. Rotate the starter to align starter mounting lugs with bolt holes in engine cases. (III. 2)
3. Install starter mounting bolts and tighten to specification. (III. 2)

TORQUE:

30 Nm (22 lb-ft)

4. Connect starter motor cable and cable nut. Torque cable nut to specification.

TORQUE:

11 Nm (100 in-lb)

5. Install regulator/rectifier assembly. (III. 3)

TORQUE:

13 Nm (115 in-lb)

6. Install exhaust system. Refer to Chapter 3.
7. Connect negative battery cable.

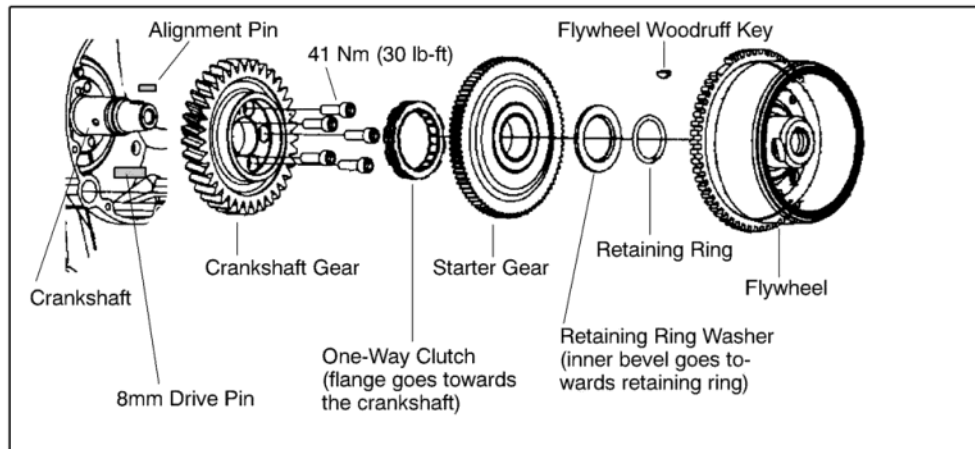
ELECTRIC STARTER

STARTER CLUTCH REMOVAL

WARNING

Make sure that the ignition switch is turned off and that the negative cable is disconnected from the battery before starting procedure.

1. Remove primary cover. (refer to Chapter 9)
2. Remove flywheel. (refer to Chapter 9)
3. Remove retaining ring and washer.
4. Remove starter drive gear.
5. Remove one-way clutch.



STARTER ONE WAY CLUTCH INSPECTION

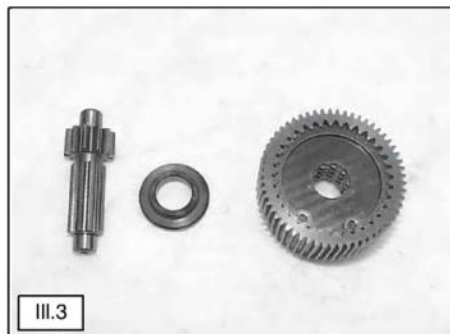
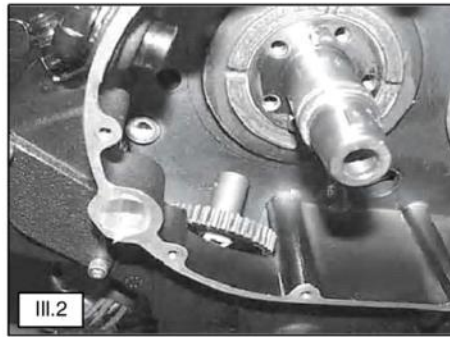
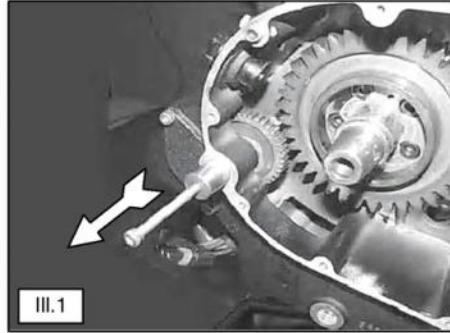
1. Place one-way clutch into primary drive gear.

NOTE: Flange of one-way clutch goes towards the crankshaft.

2. Place starter drive gear into one-way clutch.
3. Observe that the driven gear turns smoothly in the clockwise direction and locks up in the counterclockwise direction.
4. Inspect one-way clutch contact surfaces for abnormal wear, sticking or abnormal movement or damage.
5. Inspect starter gear inner contact surface for damage.
6. Inspect starter driven gear roller contact surface for damage.

STARTER IDLER GEAR REMOVAL

1. Remove primary cover. (refer to Chapter 9)
2. Remove bearing cover for starter slip clutch.
3. Remove clutch. (refer Chapter 9)
4. Remove flywheel. (refer to Chapter 9)
5. Remove starter gear. (refer to Chapter 9)
6. Remove torque compensator. (refer to Chapter 9)
7. Remove starter motor from crankcase (see page 18.19).
8. Remove idler gear shaft. (III. 1)
9. Rotate engine counter-clockwise and position idler gear down and towards the rear of engine.
10. Remove retaining ring and washer.
11. Remove crankshaft gear. (III. 2)
12. Remove idler gear.
13. Remove starter slip clutch shaft and spacer. (III. 3)
14. Remove starter slip clutch. (III. 3)



ELECTRIC STARTER

STARTER SLIP CLUTCH INSPECTION

1. Secure slip clutch in vise equipped with soft jaws.
2. Insert shaft into slip clutch.
3. Place 19mm, 12 point socket on to gear teeth.
4. Use a beam type torque wrench and attempt to turn shaft.



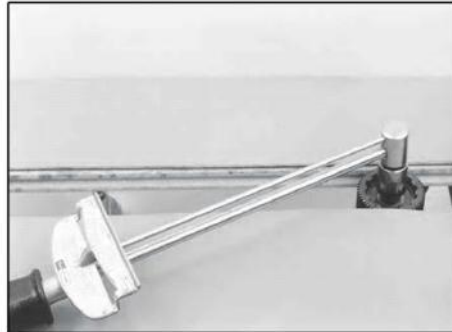
5. Observe torque reading on torque wrench when clutch begins to slip.

Specification: 40-57 Nm (30-42 lb-ft)

6. Rotate the cover bearing with your fingers observing for rough or sticky movement. Replace if necessary.

STARTER SLIP CLUTCH COVER BEARING REMOVAL

1. Place blind bearing puller into bore of bearing.
2. Remove bearing.



STARTER SLIP CLUTCH COVER BEARING INSTALLATION

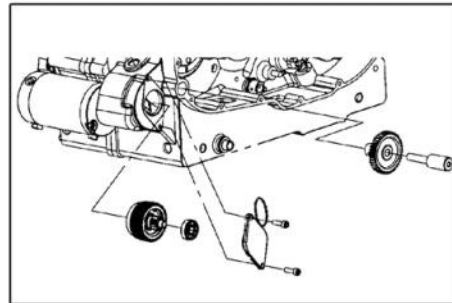
1. Lubricate O.D. of bearing with grease.

Victory All Purpose Grease: 2872187

2. Place bearing in cover and set assembly into press.
3. Using appropriate driver, press bearing into place until it seats.

STARTER SLIP CLUTCH COVER INSTALLATION

1. Install new gasket on slip clutch cover.
2. Install bearing cover and tighten screws to specification.



TORQUE:

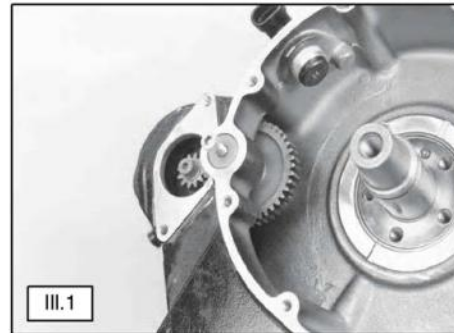
10 Nm (85 in-lb)

STARTER IDLER GEAR INSTALLATION

1. Apply a thin film of grease to starter slip clutch shaft.

Victory All Purpose Grease: 2872187

2. Install starter slip clutch and shaft. (III. 1)
3. Apply thin film of grease to starter idler gear shaft.
4. Temporarily install idler gear and idler gear shaft.
5. Apply a thin film of grease to the crankcase where primary gear rides.
6. Install primary gear pins.



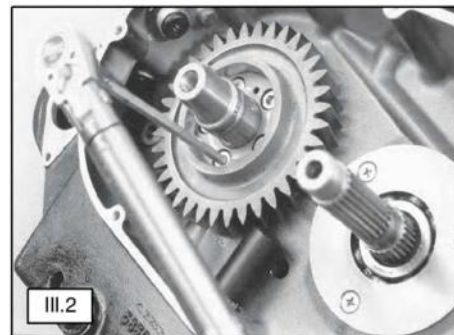
CAUTION

Make sure alignment and drive pin are in place during assembly.

7. Install primary gear. (III. 2)
8. Apply Loctite™ 262 in the primary drive gear mounting bolt holes. Clean and install primary gear bolts, torque to specification. (III. 2)

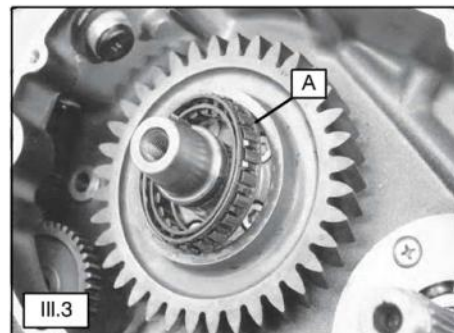
TORQUE:

**41 Nm (30 lb-ft)
Loctite 262**



9. Remove idler gear shaft and let idler gear fall down and towards the rear of the engine. (III. 3)
10. Install one-way clutch with flange (A) towards crankshaft. (III. 3)

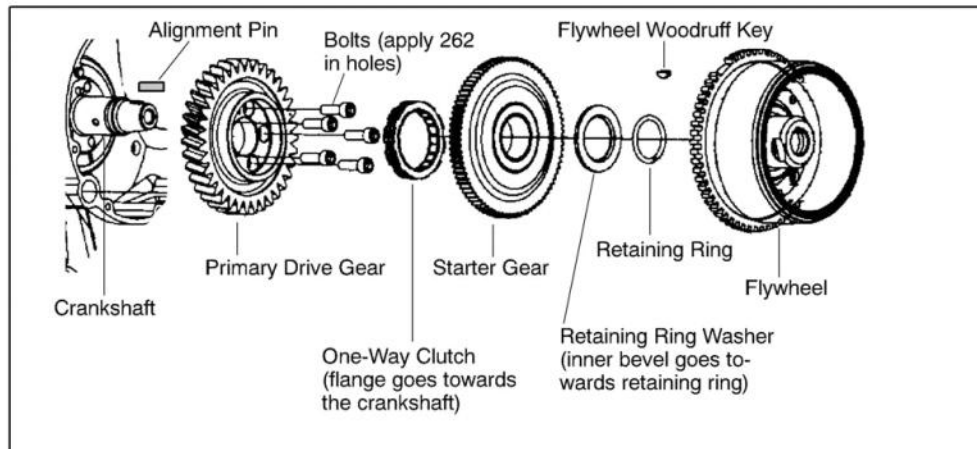
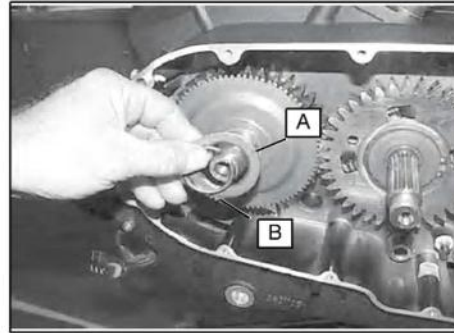
NOTE: Install one-way clutch by first lubricating it with oil and then placing it into position and rotating it. While rotating the clutch, push each clutch pin in so it falls into place. Continue doing so until the one-way clutch can be fully seated with light hand pressure.



ELECTRIC STARTER

STARTER IDLER GEAR INSTALLATION (cont.)

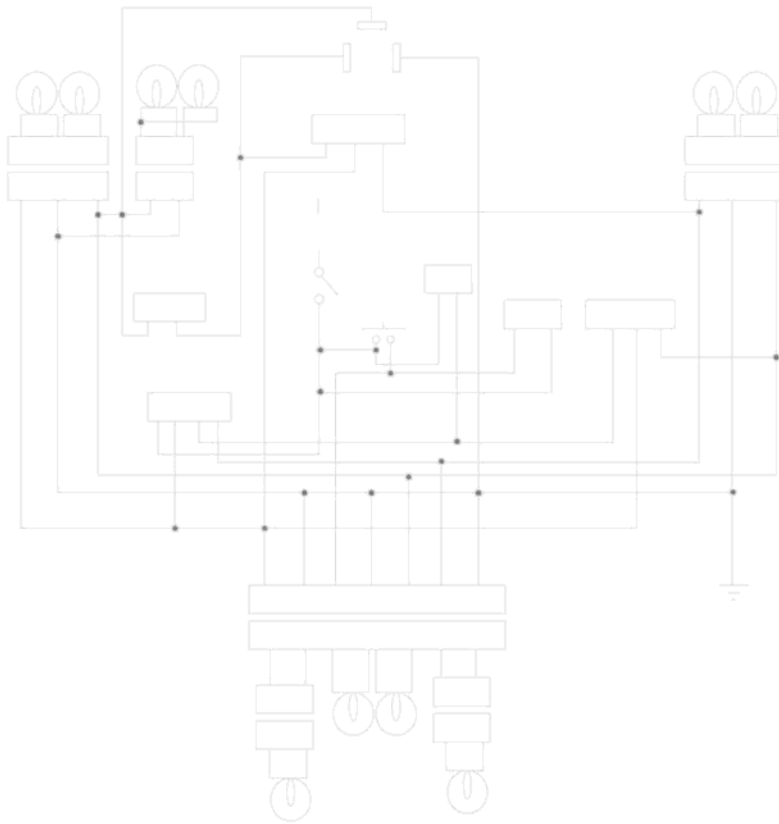
11. Install starter driven gear.
12. Observe that the driven gear turns smoothly in the clockwise direction and locks up in the counterclockwise direction.
13. Install starter drive gear washer (A).
14. Install **new** retaining ring (B).
15. Install torque compensator (refer to Chapter 9).
16. Install flywheel key.
17. Thoroughly clean taper of crankshaft and flywheel.
18. Install washer & flywheel bolt and torque to specification.
19. Roll idler gear into position and install idler gear shaft.
20. Install electric starter.
21. Install clutch (refer to Chapter 9).
22. Install cover for starter slip clutch.
23. Install primary cover (refer to Chapter 9).



CHAPTER 19

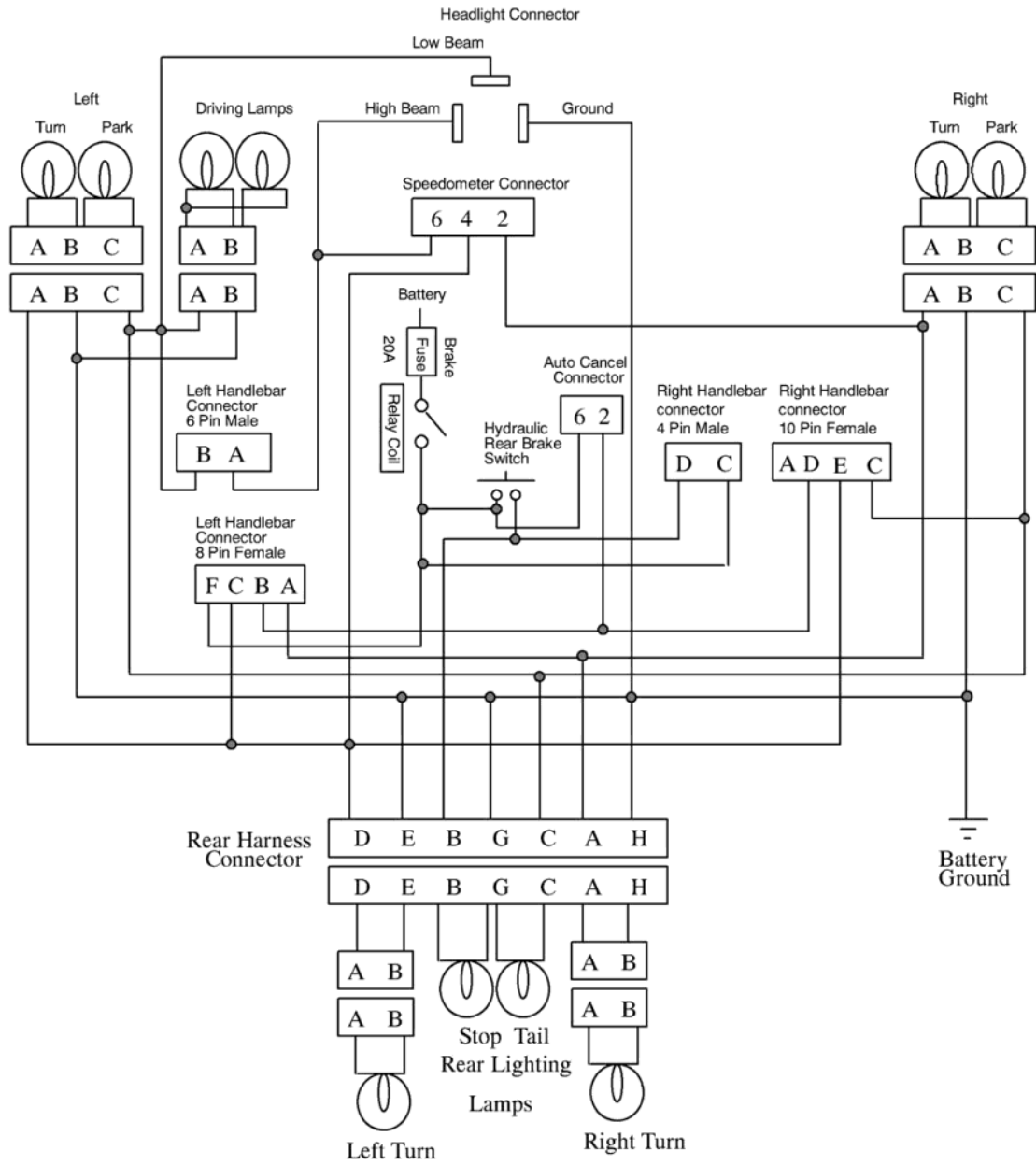
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LIGHTING WIRING DIAGRAM

Lighting System Wiring Diagram



LIGHTING SYSTEMS

AUTOMATIC TURN SIGNAL CANCEL SYSTEM

Turn signals automatically cancel depending upon vehicle speed. Turn signals will not automatically cancel when the vehicle is not moving. Signals flash for a longer period of time when the vehicle is moving slow and a shorter period of time when the vehicle is moving fast. Test the turn signal auto cancel function at higher speeds where the signal flash time is relatively short.

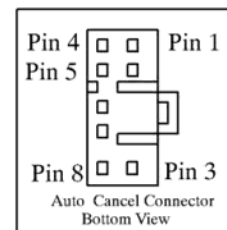
The auto cancel unit is located under the right side frame cover. The turn signal and hazard signal systems utilize the same non-serviceable flasher relay, which is built into the auto cancel unit.

TURN SIGNAL SET/ RESET SWITCH FUNCTION

The auto cancel unit receives input from the turn signal switch. Holding the turn signal switch in the right or left turn position will continuously reset the turn signal flasher and it will not auto cancel. **VERIFY ALL WIRING HARNESS CONNECTIONS AT THE SPEEDOMETER, AUTO CANCEL UNIT, AND SPEED SENSOR. WIRES MUST BE TIGHT TO THE TERMINAL AND THE TERMINAL MUST BE TIGHT IN THE CONNECTOR.**

SET / RESET TEST

1. Unplug the connector from the auto cancel unit (under right side frame cover).
2. Set digital multimeter to test continuity or resistance.
3. Test for open circuit from Pin 4 to Pin 5.
4. Press and hold the turn signal switch in either direction.
5. Test for continuity from Pin 4 to Pin 5.



AUTOMATIC TURN SIGNAL CANCEL SYSTEM (Cont.)**VEHICLE SPEED SENSOR TEST (Speed sensor to speedometer signal)**

NOTE: If the speedometer needle indication appears normal, do not test the vehicle speed sensor. An accurate reading on the speedometer indicates that the vehicle speed sensor and related wiring is functioning properly. Perform the following tests only if the turn signals do not auto-cancel. For non-auto cancel problems, such as turn signals that do not flash, check all related connectors (and the pins / sockets inside them) to be sure wiring path is complete.

1. Unplug speed sensor connector (sensor connector is strapped to the frame, at the rear of the drive sprocket cover, and below the front lower corner of the right side cover.)
2. Attach the special adaptor (used for all 2001-current models) to the Speedometer Signal Tester PV-43544.
3. Connect the speedometer signal tester to the sensor wire harness.
4. Rotate rear wheel slowly by rolling the motorcycle forward, or elevate and support the rear of the vehicle in a safe manner so the wheel can be rotated.
5. If the vehicle speed sensor is functioning, the test light will alternate on and off corresponding to rear wheel rpm.

Speedometer Signal Tester PV-43544; Speedometer Signal Tester Adaptor 2001-Current

6. If a signal is present at the sensor, verify there is continuity on Green/Brown wire from speed sensor harness connector (PIN B) to speedometer (Pin 8).
7. Test speedometer output to auto cancel unit if turn signals still do not auto-cancel.

VEHICLE SPEED INPUT SIGNAL (Speedometer to auto-cancel unit signal)

The auto cancel unit receives an input signal from the vehicle speed sensor *through* the speedometer. Turn signals will not automatically cancel without a vehicle speed input signal. Connectors must be plugged in to test for the speed input signal.

Vehicle Speed Signal Test (Signal from speedometer to auto cancel unit)

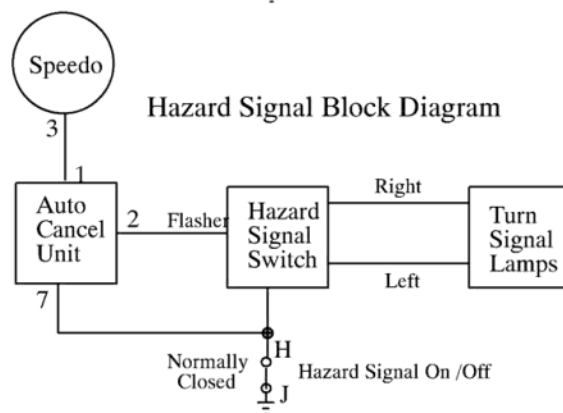
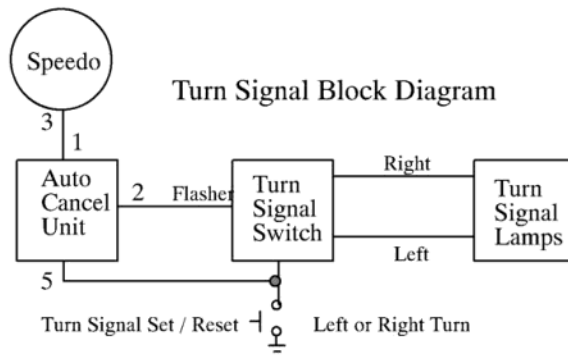
1. Test DC volts at pin 1 on the auto cancel unit. Connector plugged in, ignition key on.
2. Elevate and support rear of vehicle in a safe manner so wheel can be rotated.
3. Set digital multimeter to measure DC voltage.
4. Pierce the insulation of the wire leading to the auto cancel unit connector Pin 1 with the red meter probe (connector must be plugged in and the wire insulation must be pierced by the meter probe). Connect black meter probe to battery ground.
5. Turn ignition key on and rotate rear wheel slowly (while probing the wire leading to pin 1).
6. Voltage should alternate between 0.6V and 5V if a speed signal is present.
7. If no speed input signal is present at the auto cancel unit, replace the speedometer.
8. If speed signal input output is present, replace the auto-cancel unit.
9. Seal any pierced holes to prevent oxidation of the wire.

LIGHTING SYSTEMS

AUTO CANCEL / HAZARD SYSTEM BLOCK DIAGRAM

Auto Cancel Unit Connector Pin Outs

| | | | |
|------------------------|-----------|-----|---|
| Auto Cancel Unit | green/yel | A 1 | Speed Input (From Speedometer Pin 3) |
| | blu | B 2 | Flasher Output |
| | brn | C 3 | Park Position Input (From Ignition Switch) |
| | blk | D 4 | Battery Ground |
| | wht | E 5 | Turn Signal Set / Reset Input (Momentary Ground to Set / Reset) |
| | pink/yel | F 6 | Ignition "ON" Input |
| | pink/blk | G 7 | Hazard Set / Reset Input (Normally Closed Switch to Ground) |
| | pink/wht | H 8 | Battery Voltage |



SPEEDOMETER CONNECTOR PIN DESCRIPTIONS

| Pin Number | Description | Pin Number | Description |
|------------|---------------------------------------|------------|---------------------------|
| 8 ⇒ | Vehicle Speed Sensor In | 16 ⇒ | Check Engine Indicator In |
| 7 ⇒ | Fuel Level Signal In | 15 ⇒ | Tachometer Signal In |
| 6 ⇒ | Hi Beam Indicator In | 14 ⇒ | Oil Warning Indicator In |
| 5 ⇒ | Neutral Indicator In | 13 ⇒ | Open |
| 4 ⇒ | Left Turn Indicator In | 12 ⇒ | Battery |
| 3 ⇒ | Vehicle Speed Out To Auto Cancel Unit | 11 ⇒ | Ignition |
| 2 ⇒ | Right Turn Indicator In | 10 ⇒ | Ground |
| 1 ⇒ | Set Switch | 9 ⇒ | Mode Switch |

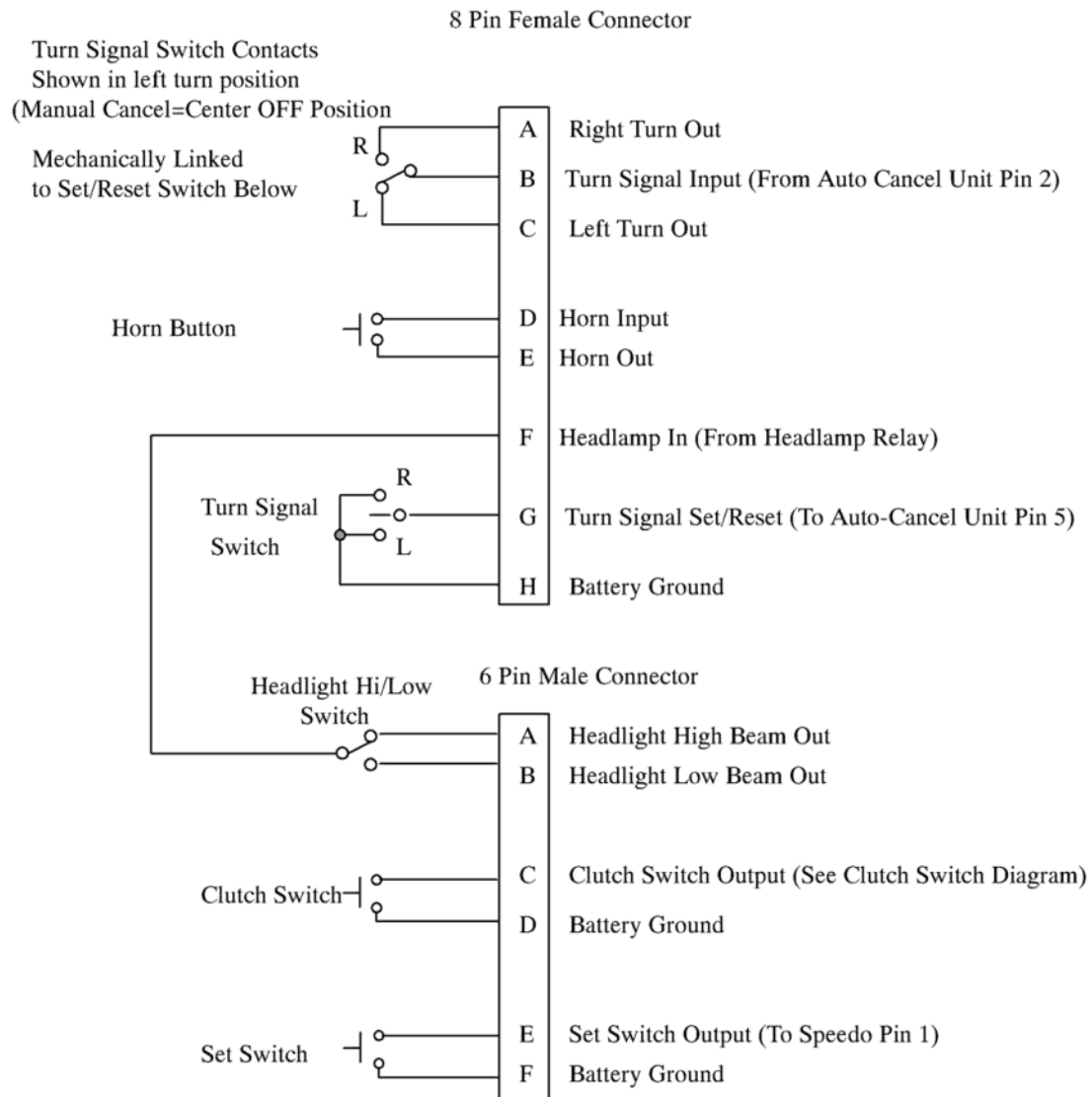
SPEEDOMETER SIGNAL DESCRIPTIONS

| Pin | Signal Description |
|-----|--|
| 1 | Continuity to Ground When Set Switch is Pressed |
| 2 | Right Turn Indicator Lamp Input (DC voltage) |
| 3 | Square Wave Signal Output (0 to 5V DC) from speedo to auto cancel unit |
| 4 | Left Turn Indicator Lamp Input (DC voltage) |
| 5 | Neutral Indicator Lamp Input (neutral switch provides a ground to light indicator) |
| 6 | High Beam Indicator (high beam switch provides battery voltage to light indicator) |
| 7 | Fuel Level Signal (DC voltage range depending upon fuel level) |
| 8 | Pulse Frequency Modulated Signal From Vehicle Speed Sensor |
| 9 | Continuity to Ground When Mode Switch is Pressed |
| 10 | Battery Ground |
| 11 | Battery Voltage When Ignition Switch is ON |
| 12 | Battery Voltage |
| 13 | No Connection |
| 14 | Oil Warning Indicator (oil pressure sender provides ground when pressure is low) |
| 15 | Tachometer Input Signal (square wave from ECM) |
| 16 | Check Engine Voltage Signal from ECM flashes Check Engine Indicator |

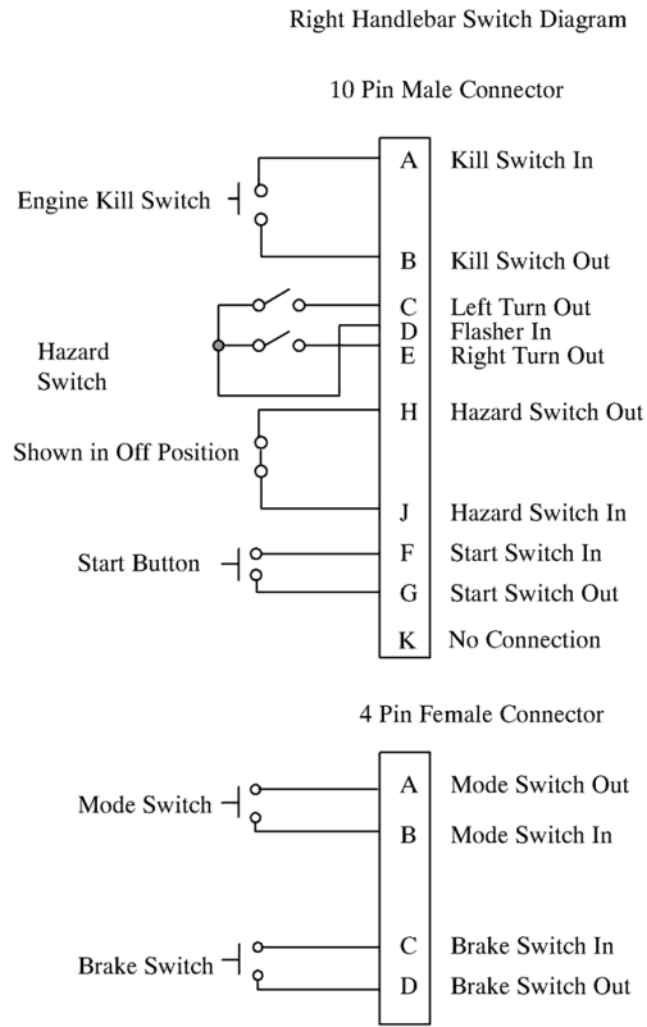
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LEFT HANDLEBAR SWITCH WIRING DIAGRAM

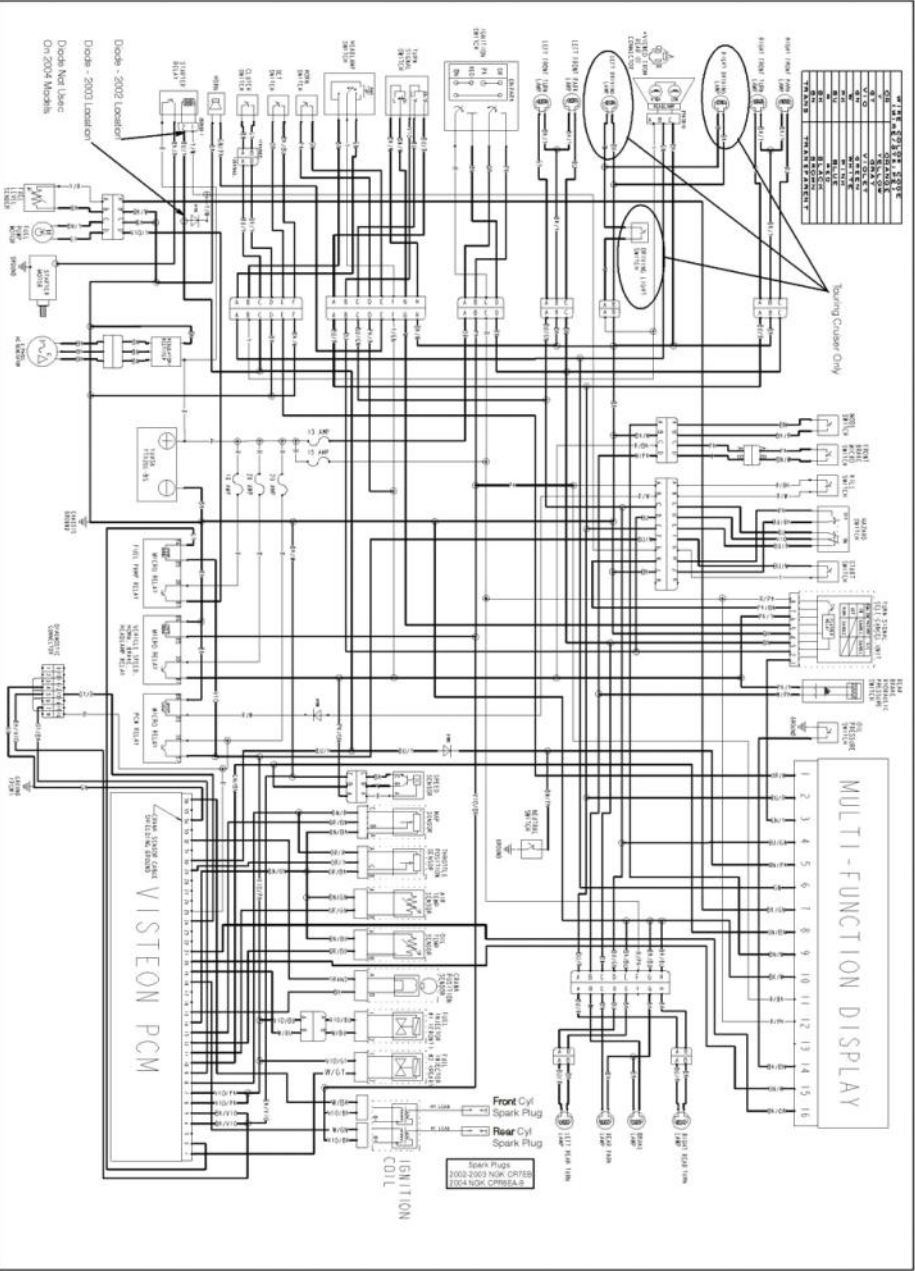
Left Handlebar Switch Diagram



RIGHT HANDLEBAR SWITCH WIRING DIAGRAM



2002-2004 STANDARD, DELUXE, CLASSIC CRUISER, TOURING CRUISER WIRING DIAGRAM



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