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# SECTION 1 - GENERAL INFORMATION

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## General Specifications\*

### (400/400 TBX/400 TRV - Automatic Transmission)

| CARBURETOR                                                  |                                                                                                       |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Type                                                        | Keihin CVK34                                                                                          |
| Main Jet                                                    | 142 - VP<br>140 - FIS                                                                                 |
| Slow Jet                                                    | 38                                                                                                    |
| Pilot Screw Setting (turns)                                 | 1 3/8 - VP<br>1 1/8 - FIS                                                                             |
| Jet Needle                                                  | NAZG                                                                                                  |
| Idle RPM (engine warm)                                      | 1250-1350                                                                                             |
| Starter Jet                                                 | 75                                                                                                    |
| Float Arm Height                                            | 17 mm (0.7 in.)                                                                                       |
| Throttle Cable Free-Play (at lever)                         | 3-6 mm (1/8-1/4 in.)                                                                                  |
| ELECTRICAL                                                  |                                                                                                       |
| Ignition Timing                                             | 10° BTDC @ 1500 RPM                                                                                   |
| Spark Plug Type                                             | NGK CR7E                                                                                              |
| Spark Plug Gap                                              | 0.7-0.8 mm (0.028-0.032 in.)                                                                          |
| Spark Plug Cap                                              | 8000-12,000 ohms                                                                                      |
| Ignition Coil Resistance (primary)<br>(secondary)           | Less than 1 ohm (terminal to ground)<br>5200-7800 ohms (high tension - plug cap removed - to ground)  |
| Ignition Coil Peak Voltage (primary/CDI)                    | 250-375 volts (terminal to ground)                                                                    |
| Magneto Coil Resistance (trigger)<br>(source)<br>(charging) | 160-240 ohms (green to blue)<br>Less than 1 ohm (yellow to white)<br>Less than 1 ohm (black to black) |
| Magneto Coil Peak Voltage (trigger)<br>(source)             | 5.04-7.56 volts (green to blue)<br>0.7-1.05 volts (yellow to white)                                   |
| Stator Coil Output (no load)                                | 60 AC volts @ 5000 RPM (black to black #1)<br>(black to black #2)                                     |
| Magneto Output (approx)                                     | 220W @ 5000 RPM                                                                                       |
| CHASSIS                                                     |                                                                                                       |
| Brake Type                                                  | Hydraulic w/Brake Lever Lock and Auxiliary Brake                                                      |
| Tire Size                                                   | Front - 25 x 8-12<br>Rear - 25 x 10-12 - VP<br>Rear - 25 x 10-12 - FIS                                |
| Tire Inflation Pressure                                     | 0.35 kg/cm <sup>2</sup> (5 psi)                                                                       |

| MISCELLANY                          |                                                                                                   |
|-------------------------------------|---------------------------------------------------------------------------------------------------|
| Gas Tank Capacity (rated)           | 17.98 L (4.75 U.S. gal.) - VP<br>24.6 L (6.5 U.S. gal.) - FIS<br>20.8 L (5.5 U.S. gal.) - TBX/TRV |
| Reserve Capacity                    | 2.46 L (0.65 U.S. gal.) - VP                                                                      |
| Rear Drive Capacity                 | 275 ml (9.3 fl oz) - VP***<br>250 ml (8.5 fl oz) - FIS**                                          |
| Differential Capacity (front - 4x4) | 275 ml (9.3 fl oz) - VP**/FIS***                                                                  |
| Engine Oil Capacity                 | 3.08 L (3.25 U.S. qt)                                                                             |
| Gasoline (recommended)              | 87 Octane Regular Unleaded                                                                        |
| Engine Oil (recommended)            | SAE 10W-40                                                                                        |
| Differential/Rear Drive Lubricant   | SAE Approved 80W-90 Hypoid                                                                        |
| Drive Belt Width                    | 28.5 mm (1.12 in.)                                                                                |
| Brake Fluid                         | DOT 4                                                                                             |
| Taillight/Brakelight                | 12V/8W/27W                                                                                        |
| Headlight                           | 12V/37W (2) - 400/400 TRV<br>12V/27W (2) - 400 TBX                                                |

\* Specifications subject to change without notice.

\*\* One inch below filler plug threads.

\*\*\* At the oil level plug threads.

## General Specifications\*

### (400 - Manual Transmission)

| CARBURETOR                                                  |                                                                                                       |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Type                                                        | Keihin CVK34                                                                                          |
| Main Jet                                                    | 142 - VP<br>140 - FIS                                                                                 |
| Slow Jet                                                    | 38                                                                                                    |
| Pilot Screw Setting (turns)                                 | 1 3/8 - VP<br>1 1/8 - FIS                                                                             |
| Jet Needle                                                  | NAZG                                                                                                  |
| Idle RPM (engine warm)                                      | 1250-1350                                                                                             |
| Starter Jet                                                 | 75                                                                                                    |
| Float Arm Height                                            | 17 mm (0.7 in.)                                                                                       |
| Throttle Cable Free-Play (at lever)                         | 3-6 mm (1/8-1/4 in.)                                                                                  |
| ELECTRICAL                                                  |                                                                                                       |
| Ignition Timing                                             | 10° BTDC @ 1500 RPM                                                                                   |
| Spark Plug Type                                             | NGK CR7E                                                                                              |
| Spark Plug Gap                                              | 0.7-0.8 mm (0.028-0.032 in.)                                                                          |
| Spark Plug Cap                                              | 8000-12,000 ohms                                                                                      |
| Ignition Coil Resistance (primary)<br>(secondary)           | Less than 1 ohm (terminal to ground)<br>5200-7800 ohms (high tension - plug cap removed - to ground)  |
| Ignition Coil Peak Voltage (primary/ CDI)                   | 250-375 volts (terminal to ground)                                                                    |
| Magneto Coil Resistance (trigger)<br>(source)<br>(charging) | 160-240 ohms (green to blue)<br>Less than 1 ohm (yellow to white)<br>Less than 1 ohm (black to black) |
| Magneto Coil Peak Voltage (trigger)<br>(source)             | 5.04-7.56 volts (green to blue)<br>0.7-1.05 volts (yellow to white)                                   |
| Stator Coil Output (no load)                                | 60 AC volts @ 5000 RPM (black to black #1)<br>(black to black #2)                                     |
| Magneto Output (approx)                                     | 220 W @ 5000 RPM                                                                                      |
| CHASSIS                                                     |                                                                                                       |
| Brake Type                                                  | Hydraulic w/Brake Lever Lock and Auxiliary Brake                                                      |
| Tire Size                                                   | Front - 25 x 8-12<br>Rear - 25 x 10-12 - VP<br>Rear - 25 x 10-12 - FIS                                |
| Tire Inflation Pressure                                     | 0.35 kg/cm <sup>2</sup> (5 psi)                                                                       |

| MISCELLANY                          |                                                               |
|-------------------------------------|---------------------------------------------------------------|
| Gas Tank Capacity (rated)           | 17.98 L (4.75 U.S. gal.) - VP<br>24.6 L (6.5 U.S. gal.) - FIS |
| Reserve Capacity                    | 2.46 L (0.65 U.S. gal.) - VP                                  |
| Rear Drive Capacity                 | 275 ml (9.3 fl oz) - VP***<br>250 ml (8.5 fl oz) - FIS**      |
| Differential Capacity (front - 4x4) | 275 ml (9.3 fl oz) - VP**/ FIS***                             |
| Engine Oil Capacity                 | 3.08 L (3.25 U.S. qt)                                         |
| Gasoline (recommended)              | 87 Octane Regular Unleaded                                    |
| Engine Oil (recommended)            | SAE 10W-40                                                    |
| Differential/Rear Drive Lubricant   | SAE Approved 80W-90 Hypoid                                    |
| Brake Fluid                         | DOT 4                                                         |
| Taillight/Brakelight                | 12V/8W/27W                                                    |
| Headlight                           | 12V/37W (2)                                                   |

\* Specifications subject to change without notice.

\*\* One inch below filler plug threads.

\*\*\* At the oil level plug threads.

1

## General Specifications\*

### (500 - Manual Transmission)

#### CARBURETOR

|                                     |                      |
|-------------------------------------|----------------------|
| Type                                | Keihin CVK36         |
| Main Jet                            | 138                  |
| Slow Jet                            | 40                   |
| Pilot Screw Setting (turns)         | 1 3/4                |
| Jet Needle                          | NFKG                 |
| Idle RPM (engine warm)              | 1250-1350            |
| Starter Jet                         | 85                   |
| Float Arm Height                    | 17 mm (0.7 in.)      |
| Throttle Cable Free-Play (at lever) | 3-6 mm (1/8-1/4 in.) |

#### ELECTRICAL

|                                          |                                                                |
|------------------------------------------|----------------------------------------------------------------|
| Ignition Timing                          | 10° BTDC @ 1500 RPM                                            |
| Spark Plug Type                          | NGK CR6E                                                       |
| Spark Plug Gap                           | 0.7-0.8 mm (0.028-0.032 in.)                                   |
| Spark Plug Cap                           | 8000-12,000 ohms                                               |
| Ignition Coil Resistance (primary)       | Less than 1 ohm (terminal to ground)                           |
| (secondary)                              | 5200-7800 ohms (high tension - plug cap removed - to ground)   |
| Ignition Coil Peak Voltage (primary/CDI) | 140-215 volts (terminal to ground)                             |
| Magneto Coil Resistance (trigger)        | 160-240 ohms (green to blue)                                   |
| (source)                                 | Less than 1 ohm (yellow to white)                              |
| (charging)                               | Less than 1 ohm (black to black)                               |
| Magneto Coil Peak Voltage (trigger)      | 4.2-6.3 volts (green to blue)                                  |
| (source)                                 | 0.40-0.62 volt (yellow to white)                               |
| Stator Coil Output (no load)             | 60 AC volts @ 5000 RPM (black to black #1) (black to black #2) |
| Magneto Output (approx)                  | 325W @ 5000 RPM                                                |

#### CHASSIS

|                         |                                                  |
|-------------------------|--------------------------------------------------|
| Brake Type              | Hydraulic w/Brake Lever Lock and Auxiliary Brake |
| Tire Size               | Front - 25 x 8-12<br>Rear - 25 x 11-12           |
| Tire Inflation Pressure | 0.35 kg/cm <sup>2</sup> (5 psi)                  |

#### MISCELLANY

|                                   |                            |
|-----------------------------------|----------------------------|
| Gas Tank Capacity (rated)         | 24.6 L (6.5 U.S. gal.)     |
| Coolant Capacity                  | 2.9 L (3.0 U.S. qt)        |
| Differential Capacity             | 275 ml (9.3 fl oz)**       |
| Rear Drive Capacity               | 250 ml (8.5 fl oz)***      |
| Engine Oil Capacity               | 3.4 L (3.5 U.S. qt)        |
| Gasoline (recommended)            | 87 Octane Regular Unleaded |
| Engine Oil (recommended)          | SAE 10W-40                 |
| Differential/Rear Drive Lubricant | SAE Approved 80W-90 Hypoid |
| Brake Fluid                       | DOT 4                      |
| Taillight/Brakelight              | 12V/8W/27W                 |
| Headlight                         | 12V/27W (2)                |

\* Specifications subject to change without notice.

\*\* At the oil level plug threads.

\*\*\* At the filler plug threads.

## General Specifications\*

### (500/500 TBX/500 TRV - Automatic Transmission)

| CARBURETOR                                |                                                                |
|-------------------------------------------|----------------------------------------------------------------|
| Type                                      | Keihin CVK36                                                   |
| Main Jet                                  | 138                                                            |
| Slow Jet                                  | 40                                                             |
| Pilot Screw Setting (turns)               | 1 3/4                                                          |
| Jet Needle                                | NFKG                                                           |
| Idle RPM (engine warm)                    | 1250-1350                                                      |
| Starter Jet                               | 85                                                             |
| Float Arm Height                          | 17 mm (0.7 in.)                                                |
| Throttle Cable Free-Play (at lever)       | 3 -6 mm (1/8-1/4 in.)                                          |
| ELECTRICAL                                |                                                                |
| Ignition Timing                           | 10° BTDC @ 1500 RPM                                            |
| Spark Plug Type                           | NGK CR6E                                                       |
| Spark Plug Gap                            | 0.7-0.8 mm (0.028-0.032 in.)                                   |
| Spark Plug Cap                            | 8000-12,000 ohms                                               |
| Ignition Coil Resistance (primary)        | Less than 1 ohm (terminal to ground)                           |
| (secondary)                               | 5200-7800 ohms (high tension - plug cap removed - to ground)   |
| Ignition Coil Peak Voltage (primary/ CDI) | 140-215 volts (terminal to ground)                             |
| Magneto Coil Resistance (trigger)         | 160-240 ohms (green to blue)                                   |
| (source)                                  | Less than 1 ohm (yellow to white)                              |
| (charging)                                | Less than 1 ohm (black to black)                               |
| Magneto Coil Peak Voltage (trigger)       | 4.2-6.3 volts (green to blue)                                  |
| (source)                                  | 0.40-0.62 volt (yellow to white)                               |
| Stator Coil Output (no load)              | 60 AC volts @ 5000 RPM (black to black #1) (black to black #2) |
| Magneto Output (approx)                   | 325W @ 5000 RPM                                                |

| CHASSIS                           |                                                         |
|-----------------------------------|---------------------------------------------------------|
| Brake Type                        | Hydraulic w/Brake Lever Lock and Auxiliary Brake        |
| Tire Size                         | Front - 25 x 8-12<br>Rear - 25 x 11-12                  |
| Tire Inflation Pressure           | 0.35 kg/cm <sup>2</sup> (5 psi)                         |
| MISCELLANY                        |                                                         |
| Gas Tank Capacity (rated)         | 24.6 L (6.5 U.S. gal.)/<br>20.8 L (5.5 U.S. gal.) - TBX |
| Coolant Capacity                  | 2.9 L (3.0 U.S. qt)                                     |
| Differential Capacity             | 275 ml (9.3 fl oz)**                                    |
| Rear Drive Capacity               | 250 ml (8.5 fl oz)***                                   |
| Engine Oil Capacity               | 2.5 L (2.6 U.S. qt)                                     |
| Gasoline (recommended)            | 87 Octane Regular Unleaded                              |
| Engine Oil (recommended)          | SAE 10W-40                                              |
| Differential/Rear Drive Lubricant | SAE Approved 80W-90 Hypoid                              |
| Drive Belt Width (minimum)        | 38 mm (1.33 in.)                                        |
| Brake Fluid                       | DOT 4                                                   |
| Taillight/Brakelight              | 12V/8W/27W                                              |
| Headlight                         | 12V/27W (2)                                             |

\* Specifications subject to change without notice.

\*\* At the oil level plug threads.

\*\*\* At the filler plug threads.

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## General Specifications\*

### (650 H1)

| CARBURETOR                                            |                                                                                                       |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Type                                                  | Keihin CVK40                                                                                          |
| Main Jet                                              | 138                                                                                                   |
| Slow Jet                                              | 40                                                                                                    |
| Pilot Screw Setting (turns)                           | 2                                                                                                     |
| Jet Needle                                            | NFKN                                                                                                  |
| Idle RPM (engine warm)                                | 1250-1350                                                                                             |
| Starter Jet                                           | 85                                                                                                    |
| Float Arm Height                                      | 17 mm (0.7 in.)                                                                                       |
| Throttle Cable Free-Play (at lever)                   | 3-6 mm (1/8-1/4 in.)                                                                                  |
| ELECTRICAL                                            |                                                                                                       |
| Ignition Timing                                       | 10° BTDC @ 1500 RPM                                                                                   |
| Spark Plug Type                                       | NGK CR6E                                                                                              |
| Spark Plug Gap                                        | 0.7-0.8 mm (0.028-0.032 in.)                                                                          |
| Spark Plug Cap                                        | 8000-12,000 ohms                                                                                      |
| Ignition Coil Resistance (primary) (secondary)        | Less than 1 ohm (terminal to ground)<br>5200-7800 ohms (high tension - plug cap removed - to ground)  |
| Ignition Coil Peak Voltage (primary/ CDI)             | 142.4-213.6 volts (terminal to ground)                                                                |
| Magneto Coil Resistance (trigger) (source) (charging) | 160-240 ohms (green to blue)<br>Less than 1 ohm (yellow to white)<br>Less than 1 ohm (black to black) |
| Magneto Coil Peak Voltage (trigger) (source)          | 4.2-6.3 volts (green to blue)<br>0.40-0.62 volt (yellow to white)                                     |
| Stator Coil Output (no load)                          | 60 AC volts @ 5000 RPM (black to black #1)<br>(black to black #2)                                     |
| Magneto Output (approx)                               | 325W @ 5000 RPM                                                                                       |

| CHASSIS                           |                                                  |
|-----------------------------------|--------------------------------------------------|
| Brake Type                        | Hydraulic w/Brake Lever Lock and Auxiliary Brake |
| Tire Size                         | Front - 25 x 8-12<br>Rear - 25 x 11-12           |
| Tire Inflation Pressure           | 0.35 kg/cm² (5 psi)                              |
| MISCELLANY                        |                                                  |
| Gas Tank Capacity (rated)         | 24.6 L (6.5 U.S. gal.)                           |
| Coolant Capacity                  | 2.9 L (3.0 U.S. qt)                              |
| Differential Capacity             | 275 ml (9.3 fl oz)**                             |
| Rear Drive Capacity               | 250 ml (8.5 fl oz)***                            |
| Engine Oil Capacity               | 3.4 L (3.5 U.S. qt)                              |
| Gasoline (recommended)            | 87 Octane Regular Unleaded                       |
| Engine Oil (recommended)          | SAE 10W-40                                       |
| Differential/Rear Drive Lubricant | SAE Approved 80W-90 Hypoid                       |
| Belt Width                        | 35.5 mm (1.40 in.)                               |
| Brake Fluid                       | DOT 4                                            |
| Taillight/Brakelight              | 12V/8W/27W                                       |
| Headlight                         | 12V/27W (2)                                      |

\* Specifications subject to change without notice.

\*\* At the oil level plug threads.

\*\*\* At the filler plug threads.

## General Specifications\*

(650 V-Twin)

| CARBURETOR                                              |                                                                                                                         |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Type                                                    | Keihin CVKR-D32 (2)                                                                                                     |
| Main Jet                                                | 122 - Standard<br>118 - California                                                                                      |
| Slow Jet                                                | 40                                                                                                                      |
| Pilot Screw Setting (turns)                             | 2 1/4 (front)<br>2 1/2 (rear)                                                                                           |
| Jet Needle                                              | NBZP                                                                                                                    |
| Idle RPM<br>(engine warm)                               | 1050-1150                                                                                                               |
| Starter Jet                                             | 100                                                                                                                     |
| Float Arm<br>Height                                     | 4 mm (0.16 in.)                                                                                                         |
| Throttle Cable Free-Play (at<br>lever)                  | 3-6 mm (1/8-1/4 in.)                                                                                                    |
| ELECTRICAL                                              |                                                                                                                         |
| Spark Plug Type                                         | NGK CR7E                                                                                                                |
| Spark Plug Gap                                          | 0.7-0.8 mm<br>(0.028-0.032 in.)                                                                                         |
| Spark Plug Cap                                          | 4750-6250 ohms                                                                                                          |
| Ignition Coil<br>Resistance<br>(primary)<br>(secondary) | Less than 1 ohm<br>(terminal (+) to terminal (-))<br>3800-5800 ohms<br>(high tension - plug cap<br>removed - to ground) |
| Ignition Coil<br>Peak Voltage<br>(primary/<br>CDI)      | 100 volts or more<br>(wire (+) to ground)                                                                               |
| Magneto Coil<br>Resistance<br>(trigger)<br>(charging)   | 110-140 ohms<br>(blue to black/white)<br>Less than 1 ohm<br>(black to black)                                            |
| Magneto Coil<br>Peak Voltage<br>(trigger)               | 3.6 volts or more<br>(blue to black/white)                                                                              |
| Stator Coil Out-<br>put<br>(no load)                    | 39-59 AC volts @ 3000<br>RPM<br>(black to black #1)<br>(black to black #2)                                              |

| CHASSIS                           |                                                     |
|-----------------------------------|-----------------------------------------------------|
| Brake Type                        | Hydraulic w/Brake Lever<br>Lock and Auxiliary Brake |
| Tire Size                         | Front - 26 x 8-12<br>Rear - 26 x 11-12              |
| Tire Inflation Pressure           | 0.35 kg/cm <sup>2</sup> (5 psi)                     |
| MISCELLANY                        |                                                     |
| Gas Tank Capacity (rated)         | 24.6 L (6.5 U.S. gal.)                              |
| Coolant Capacity                  | 2.7 L (2.8 U.S. qt)                                 |
| Differential Capacity             | 275 ml (9.3 fl oz)**                                |
| Rear Drive Capacity               | 250 ml (8.5 fl oz)***                               |
| Engine Oil Capacity               | 1.75 L (1.85 U.S. qt)                               |
| Gasoline (recommended)            | 87 Octane Regular<br>Unleaded                       |
| Engine Oil (recommended)          | SAE 10W-40                                          |
| Differential/Rear Drive Lubricant | SAE Approved<br>80W-90 Hypoid                       |
| Drive Belt Width (minimum)        | 30.3 mm (1.19 in.)                                  |
| Brake Fluid                       | DOT 4                                               |
| Taillight/Brakelight              | 12V/8W/27W                                          |
| Headlight                         | 12V/27W (2)                                         |

\* Specifications subject to change without notice.

\*\* One inch below plug threads.

\*\*\* At the plug threads.

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## Break-In Procedure

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A new ATV and an overhauled ATV engine require a “break-in” period. The first 10 hours (or 200 miles) are most critical to the life of this ATV. Proper operation during this break-in period will help assure maximum life and performance from the ATV.

During the first 10 hours (or 200 miles) of operation, always use less than 1/2 throttle. Varying the engine RPM during the break-in period allows the components to “load” (aiding the mating process) and then “unload” (allowing components to cool). Although it is essential to place some stress on the engine components during break-in, care should be taken not to overload the engine too often. Do not pull a trailer or carry heavy loads during the 10-hour break-in period.

When the engine starts, allow it to warm up properly. Idle the engine several minutes until the engine has reached normal operating temperature. Do not idle the engine for excessively long periods of time.

During the break-in period, a maximum of 1/2 throttle is recommended; however, brief full-throttle accelerations and variations in driving speeds contribute to good engine break-in.

During the break-in period (or whenever the brake pads are replaced), the hydraulic brake pads must be burnished. Slow disc-speed hydraulic brakes must be properly burnished in order to achieve maximum stopping power.

### CAUTION

**BRAKE PADS MUST BE BURNISHED TO ACHIEVE FULL BRAKING EFFECTIVENESS.** Braking distance will be extended until brake pads are properly burnished.

**TO PROPERLY BURNISH THE BRAKES, USE FOLLOWING PROCEDURE:**

- Choose an area sufficiently large to safely accelerate ATV to 30 mph and to brake to a stop.
- Accelerate to 30 mph; then compress brake lever to decelerate to 0-5 mph.
- Repeat procedure five times until brakes are burnished.
- This procedure burnishes the brake pads, stabilizes the pad material, and extends the life of the brake pads.

### WARNING

**Do not attempt sudden stops or put the ATV into a situation where a sudden stop will be required until the brake pads are properly burnished.**

■ **NOTE:** Do not be reluctant to heat up the brake pads during the burnishing procedure.

After the completion of the break-in period, the engine oil and oil filter should be changed. Other maintenance after break-in should include checking of all prescribed adjustments and tightening of all fasteners.

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## Gasoline - Oil - Lubricant

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### RECOMMENDED GASOLINE

The recommended gasoline to use is 87 minimum octane regular unleaded. In many areas, oxygenates (either ethanol or MTBE) are added to the gasoline. Oxygenated gasolines containing up to 10% ethanol, 5% methane, or 5% MTBE are acceptable gasolines.

When using ethanol blended gasoline, it is not necessary to add a gasoline antifreeze since ethanol will prevent the accumulation of moisture in the fuel system.

### CAUTION

**Do not use white gas. Only Arctic Cat approved gasoline additives should be used.**

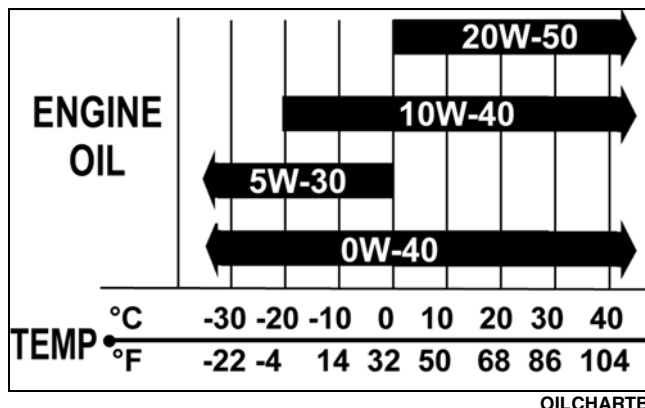
### RECOMMENDED ENGINE/TRANSMISSION OIL

### CAUTION

**Any oil used in place of the recommended oil could cause serious engine damage. Do not use oils which contain graphite or molybdenum additives. These oils can adversely affect clutch operation. Also, not recommended are racing, vegetable, non-detergent, and castor-based oils.**

The recommended oil to use is Arctic Cat 4-Cycle Engine Oil (p/n 0436-005) or an equivalent oil which is rated SE, SF, or SG under API service classification. These oils meet all of the lubrication requirements of the Arctic Cat ATV engine. The recommended engine oil viscosity is SAE 10W-40. Ambient temperature should determine the correct weight of oil. See the following viscosity chart for details.





## RECOMMENDED FRONT DIFFERENTIAL/REAR DRIVE LUBRICANT

The recommended lubricant is Arctic Cat Gear Lube (p/n 0436-007) or an equivalent gear lube which is SAE approved 80W-90 hypoid. This lubricant meets all of the lubrication requirements of the Arctic Cat ATV front differentials and rear drives.

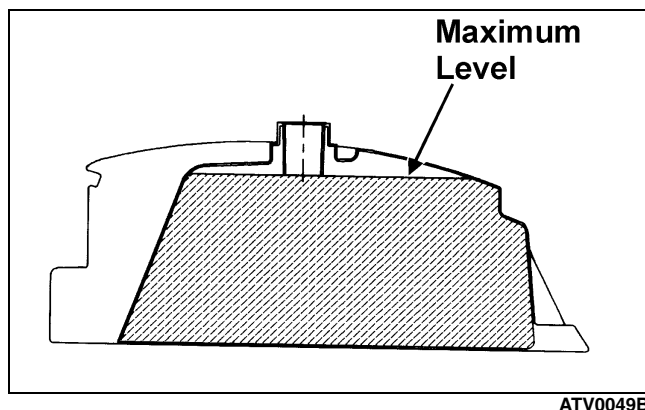
### CAUTION

Any lubricant used in place of the recommended lubricant could cause serious front differential/rear drive damage.

## FILLING GAS TANK

### WARNING

Always fill the gas tank in a well-ventilated area. Never add fuel to the ATV gas tank near any open flames or with the engine running. DO NOT SMOKE while filling the gas tank.



Since gasoline expands as its temperature rises, the gas tank must be filled to its rated capacity only. Expansion room must be maintained in the tank particularly if the tank is filled with cold gasoline and then moved to a warm area.

### WARNING

Do not overflow gasoline when filling the gas tank. A fire hazard could materialize. Always allow the engine to cool before filling the gas tank.

Tighten the gas tank cap securely after filling the tank.

### WARNING

Do not over-fill the gas tank.

1

## Genuine Parts

When replacement of parts is necessary, use only genuine Arctic Cat ATV parts. They are precision-made to ensure high quality and correct fit. Refer to the appropriate Illustrated Parts Manual for the correct part number, quantity, and description.

## Preparation For Storage

### CAUTION

Prior to storing the ATV, it must be properly serviced to prevent rusting and component deterioration.

Arctic Cat recommends the following procedure to prepare the ATV for storage.

1. Clean the seat cushion (cover and base) with a damp cloth and allow it to dry.
2. Clean the ATV thoroughly by washing dirt, oil, grass, and other foreign matter from the entire ATV. Allow the ATV to dry thoroughly. DO NOT get water into any part of the engine or air intake.

3. Either drain the gas tank or add Fuel Stabilizer (p/n 0638-165) to the gas in the gas tank. Remove the air filter housing cover and air filter. Start the engine and allow it to idle; then using Arctic Cat Engine Storage Preserver (p/n 0636-177), rapidly inject the preserver into the air filter opening for a period of 10 to 20 seconds; then stop the engine. Install the air filter and housing cover.

**⚠ CAUTION**

**If the interior of the air filter housing is dirty, clean the area before starting the engine.**

4. Drain the carburetor float chamber.
5. Plug the exhaust hole in the exhaust system with a clean cloth.
6. Apply light oil to the upper steering post bushing and plungers of the shock absorbers.
7. Tighten all nuts, bolts, cap screws, and screws. Make sure rivets holding components together are tight. Replace all loose rivets. Care must be taken that all calibrated nuts, cap screws, and bolts are tightened to specifications.
8. On liquid cooled models, fill the cooling system to the bottom of the stand pipe in the radiator neck with properly mixed coolant.
9. Disconnect the battery cables; then remove the battery, clean the battery posts and cables, and store in a clean, dry area.
10. Store the ATV indoors in a level position.

**⚠ CAUTION**

**Avoid storing outside in direct sunlight and avoid using a plastic cover as moisture will collect on the ATV causing rusting.**

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## Preparation After Storage

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Taking the ATV out of storage and correctly preparing it will assure many miles and hours of trouble-free riding. Arctic Cat recommends the following procedure to prepare the ATV.

1. Clean the ATV thoroughly.
2. Clean the engine. Remove the cloth from the exhaust system.

3. Check all control wires and cables for signs of wear or fraying. Replace if necessary.
4. Change the engine/transmission oil and filter.
5. On liquid cooled models, check the coolant level and add properly mixed coolant as necessary.
6. Charge the battery; then install. Connect the battery cables.

**⚠ CAUTION**

**The ignition switch must be in the OFF position prior to installing the battery or damage may occur to the ignition system.**

**⚠ CAUTION**

**Connect the positive battery cable first; then the negative.**

7. Check the entire brake systems (fluid level, pads, etc.), all controls, headlights, taillight, brakelight, and headlight aim; adjust or replace as necessary.
8. Tighten all nuts, bolts, cap screws, and screws making sure all calibrated nuts, cap screws, and bolts are tightened to specifications.
9. Check tire pressure. Inflate to recommended pressure as necessary.
10. Make sure the steering moves freely and does not bind.
11. Check the spark plug. Clean or replace as necessary.
12. Follow the recommendations found in the pre-start inspection.

# SECTION 2 - PERIODIC MAINTENANCE/TUNE-UP

2

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# Periodic Maintenance Chart

A = Adjust  
C = Clean  
D = Drain

I = Inspect  
L = Lubricate  
R = Replace

| Item                                                                                                          | Initial Service After Break-In (First Mo or 100 Mi) | Every Day | Every Month or Every 100 Miles | Every 3 Months or Every 300 Miles | Every 6 Months or Every 500 Miles | Every Year or Every 1500 Miles | As Needed            |
|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------|--------------------------------|-----------------------------------|-----------------------------------|--------------------------------|----------------------|
| Battery                                                                                                       | I                                                   |           | I                              |                                   |                                   |                                | C                    |
| Fuses                                                                                                         |                                                     |           |                                | I                                 |                                   |                                | R                    |
| Air Filter/Drain Tube                                                                                         | I                                                   | I         | C*                             |                                   |                                   |                                | R                    |
| Valve/Tappet Clearance                                                                                        | I                                                   |           |                                |                                   | I                                 |                                | A                    |
| Engine Compression                                                                                            |                                                     |           |                                |                                   |                                   | I                              |                      |
| Spark Plug                                                                                                    | I                                                   |           |                                | I                                 |                                   |                                | R (4000 Mi or 18 Mo) |
| Muffler/Spark Arrester                                                                                        |                                                     |           |                                |                                   | C                                 |                                | R                    |
| Gas/Vent Hoses                                                                                                | I                                                   | I         |                                |                                   |                                   |                                | R (2 Yrs)            |
| Gas Tank Valve (VP)                                                                                           |                                                     |           |                                |                                   |                                   | I                              | C                    |
| Throttle Cable                                                                                                | I                                                   | I         |                                |                                   | C-L                               |                                | A-R                  |
| Carb Float Chamber                                                                                            |                                                     |           |                                | D*                                |                                   |                                |                      |
| Engine RPM (Idle)                                                                                             | I                                                   |           |                                |                                   | I                                 |                                | A                    |
| Engine-Transmission Oil Level                                                                                 |                                                     | I         |                                |                                   |                                   |                                | A                    |
| Engine-Transmission Oil/Filter                                                                                | R                                                   |           |                                | R*                                |                                   |                                | R                    |
| Oil Strainer                                                                                                  | I                                                   |           |                                |                                   | I                                 |                                | C                    |
| Front Differential/Rear Drive Lubricant                                                                       | I                                                   |           |                                |                                   |                                   |                                | R (4 Yrs)            |
| Clutch (Manual)                                                                                               | I                                                   |           |                                |                                   | I                                 |                                | A                    |
| Tires/Air Pressure                                                                                            | I                                                   |           |                                | I                                 |                                   |                                | R                    |
| Steering Components                                                                                           | I                                                   | I         |                                | I                                 |                                   |                                | R                    |
| V-Belt (Automatic)                                                                                            | I                                                   |           |                                |                                   | I                                 |                                | R                    |
| Suspension (Ball joint boots, drive axle boots front and rear, tie rods, differential and rear drive bellows) | I                                                   |           |                                | I*                                |                                   |                                | R                    |
| Nuts/Cap Screws/Screws                                                                                        | I                                                   |           |                                | I                                 | I                                 |                                | A                    |
| Ignition Timing                                                                                               |                                                     |           |                                |                                   |                                   | I                              |                      |
| Headlight/Taillight-Brakelight                                                                                | I                                                   | I         |                                |                                   |                                   |                                | R                    |
| Switches                                                                                                      | I                                                   | I         |                                |                                   |                                   |                                | R                    |
| Reverse Shift Lever                                                                                           |                                                     |           |                                |                                   | I                                 |                                | A-L                  |
| Choke Cable (650 V-Twin)                                                                                      | I                                                   |           |                                | I                                 | C-L                               |                                | R                    |
| Recoil Starter                                                                                                |                                                     | I         |                                |                                   |                                   |                                | C-R                  |
| Handlebar Grips                                                                                               |                                                     | I         |                                |                                   |                                   |                                | R                    |
| Handlebars                                                                                                    | I                                                   | I         |                                |                                   |                                   |                                | R                    |
| Gauges/Indicators                                                                                             | I                                                   | I         |                                |                                   |                                   |                                | R                    |
| Frame/Welds/Racks                                                                                             | I                                                   |           | I                              |                                   | I                                 |                                |                      |
| Electrical Connections                                                                                        |                                                     |           |                                |                                   | I                                 |                                | C                    |
| Complete Brake System (Hydraulic & Auxiliary)                                                                 | I                                                   | I         |                                | C                                 |                                   |                                | L-R                  |
| Brake Pads                                                                                                    | I                                                   |           |                                | I*                                |                                   |                                | R                    |
| Brake Fluid                                                                                                   | I                                                   |           |                                | I                                 |                                   |                                | R (2 Yrs)            |
| Brake Hoses                                                                                                   | I                                                   |           |                                | I                                 |                                   |                                | R (4 Yrs)            |
| Coolant/Cooling System                                                                                        | I                                                   |           | I                              |                                   |                                   |                                | R (2 Yrs)            |

\* Service/Inspect more frequently when operating in adverse conditions.

## Lubrication Points

It is advisable to lubricate certain components periodically to ensure free movement. Apply light oil to the components using the following list as reference.

- A. Throttle Lever Pivot/Cable Ends
- B. Brake Lever Pivot/Cable Ends
- C. Auxiliary Brake Cable Ends
- D. Choke Cable Upper End (650 V-Twin)
- E. Reverse Lever Cable End (If Applicable)
- F. Idle RPM Screw (Carburetor)

## Battery



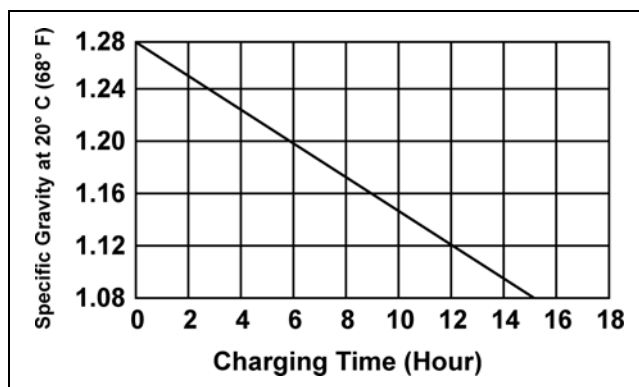
AF879D

The level of the battery fluid must be kept between the upper and lower level lines at all times. If the level drops below the lower level line, add only **distilled water** until it reaches upper level line.

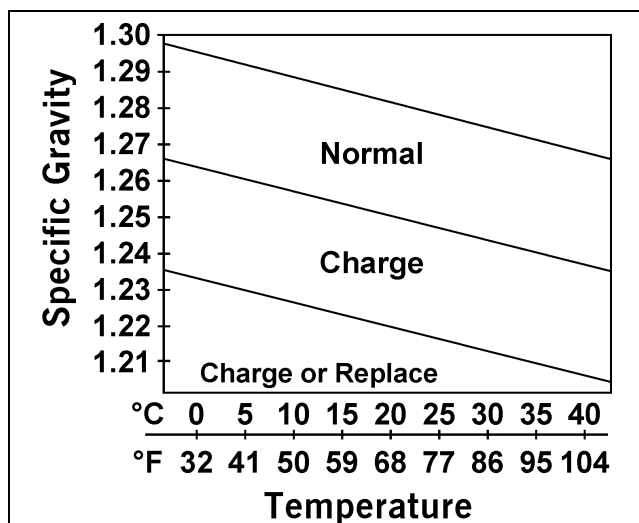
### **⚠ WARNING**

**Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.**

If the battery is discharged, remove the battery from the ATV and charge the battery at the standard charging rate of 1.5A x 10 hr.



CHARGTIM



CHARGE

To remove and charge the battery, use the following procedure.

### **⚠ WARNING**

Anytime service is performed on a battery, the following must be observed: keep sparks, open flame, cigarettes, or any other flame away. Always wear safety glasses. Protect skin and clothing when handling a battery. When servicing battery in enclosed space, keep the area well-ventilated. Make sure battery venting is not obstructed.

1. Remove the battery hold-down bracket.
2. Remove the negative battery cable; then remove the positive cable and the battery vent tube. Remove the battery from the ATV. Care should be taken not to damage the vent tube.

### **⚠ WARNING**

Avoid spillage and contact with skin, eyes, and clothing.

### **⚠ CAUTION**

Do not charge the battery while it is in the ATV with the battery terminals connected.

3. Remove the vent plugs; then (if necessary) fill the battery with **distilled water** to the upper level indicated on the battery.
4. Trickle charge the battery at 1.4 amps for 10 hours.

### ⚠ CAUTION

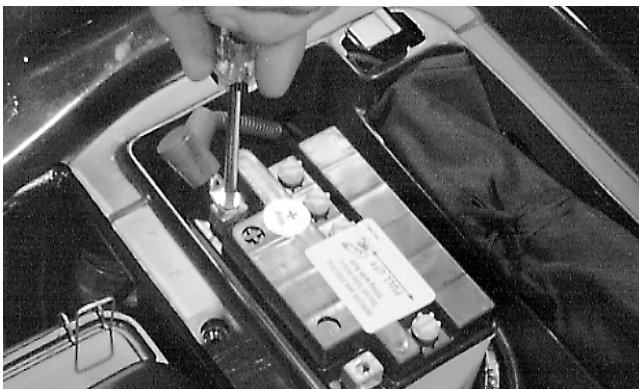
**Never exceed the standard charging rate.**

5. After charging, check fluid level and fill with distilled water as necessary; then install vent plugs.

### ⚠ CAUTION

**Before installing the battery, make sure the ignition switch is in the OFF position.**

6. Place the battery into position in the ATV and secure with the hold-down bracket.
7. Attach the vent tube and check the vent tube to make sure it is not crimped or obstructed in any way and that it is properly routed through and secured to the frame.
8. Connect cables to the proper terminals: positive cable to the positive terminal (+) and negative cable to the negative terminal (-). Connect the negative cable last.



AF733D

### ⚠ CAUTION

**Connecting cables in reverse (positive to negative and negative to positive) can cause serious damage to the electrical system.**

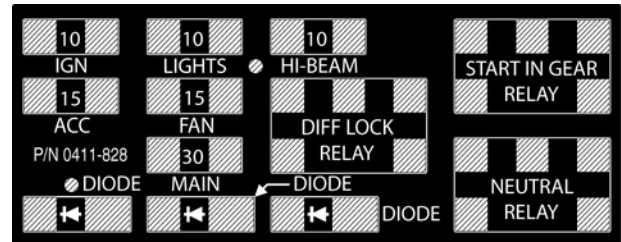
## FUSES

The fuses are located in a power distribution module under the seat.

If there is any type of electrical system failure, always check the fuses first.

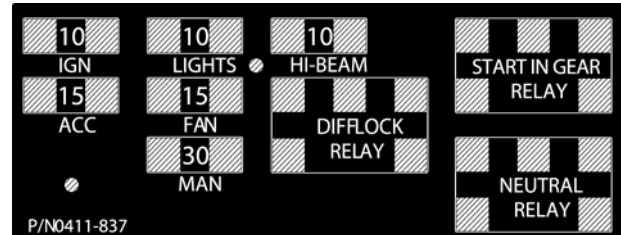
■ **NOTE:** To remove the fuse, compress the locking tabs on either side of the fuse case and lift out.

### 400/500/500 TBX/FIS Auto



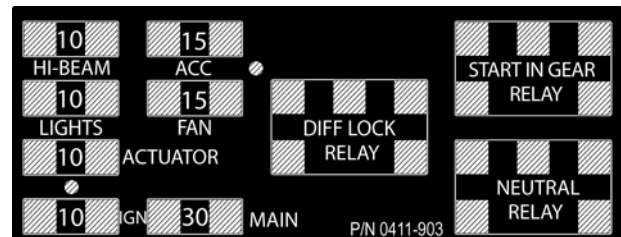
0411-828

### 400 FIS Manual/500 Manual



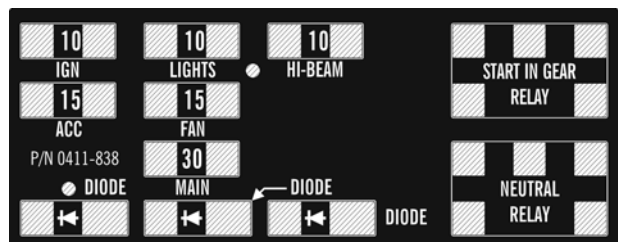
0411-837

### 650 V-Twin



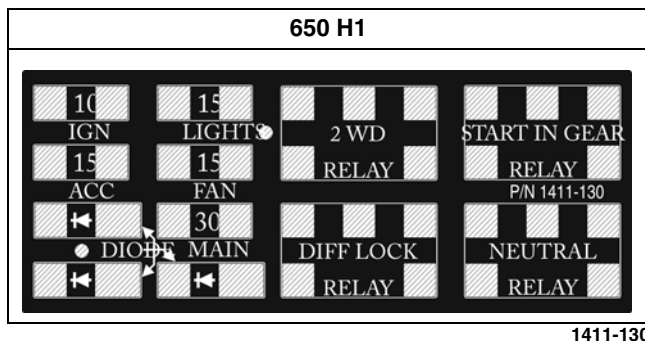
0411-903

### TRV/VP/400 TBX



0411-838





### CAUTION

Always replace a blown fuse with a fuse of the same type and rating.

## Air Cleaner/Filter (400 VP)

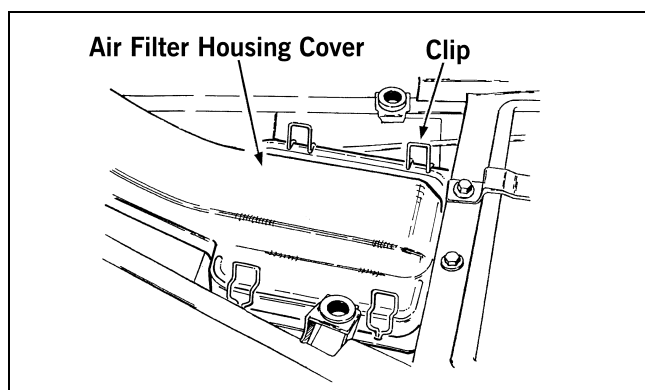
The air filter inside the air filter housing must be kept clean to provide good engine power and gas mileage. If the ATV is used under normal conditions, service the filter at the intervals specified. If operated in dusty, wet, or muddy conditions, inspect and service the filter more frequently. Use the following procedure to remove the filter and inspect and/or clean it.

### CLEANING AND INSPECTING FILTER

### CAUTION

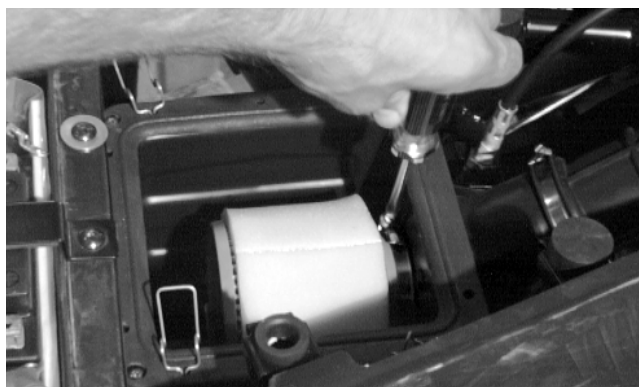
Failure to inspect the air filter frequently if the vehicle is used in dusty, wet, or muddy conditions can damage the engine.

1. Remove the seat.
2. Remove the air filter housing cover from the retaining clips.



733-444A

3. Loosen the clamp; then remove the filter.



AF640DA



CD087

4. Fill a wash pan larger than the filter with a non-flammable cleaning solvent; then dip the filter in the solvent and wash it.

■ **NOTE:** Foam Filter Cleaner (p/n 0436-194) and Foam Filter Oil (p/n 0436-195) are available from Arctic Cat.

5. Dry the filter.
6. Put the filter in a plastic bag; then pour in air filter oil and work the filter.

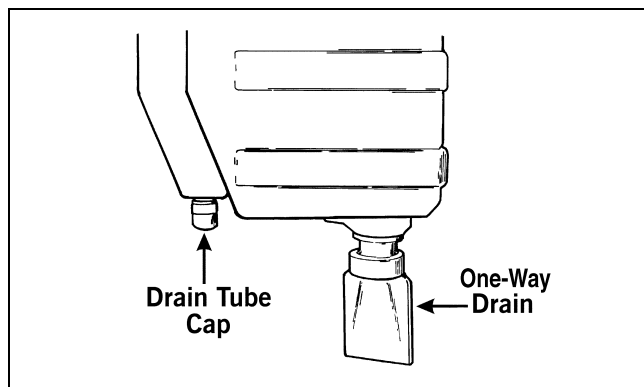
### CAUTION

A torn air filter can cause damage to the ATV engine. Dirt and dust may get inside the engine if the element is torn. Carefully examine the element for tears before and after cleaning it. Replace the element with a new one if it is torn.

7. Clean any dirt or debris from inside the air cleaner. Be sure no dirt enters the carburetor.
8. Place the filter in the air filter housing making sure it is properly in position and properly seated and secure with the clamp.
9. Install the air filter housing cover and secure with the retaining clips; then install the seat making sure the seat is properly secured.

## CHECKING/DRAINING DRAIN TUBE

1. Periodically check the drain tube for gasoline or oil accumulation. If noticed, remove the drain tube cap from beneath the front housing, drain the gasoline or oil into a suitable container, and install and secure the tube cap.
2. Inspect one-way drain beneath the main housing for debris and for proper sealing.



ATV0087A

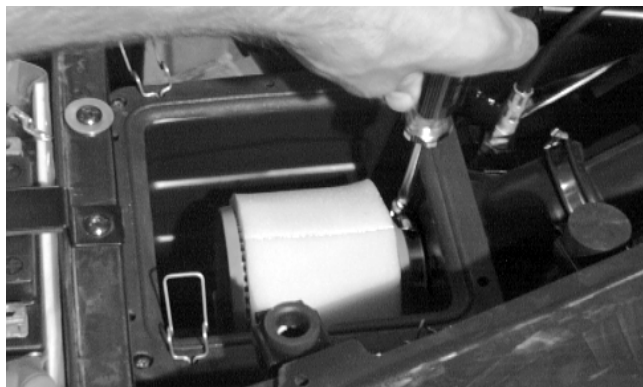
## REMOVING AIR CLEANER

1. Remove the seat.
2. Remove the air cleaner cover from the retaining clips.



AL645D

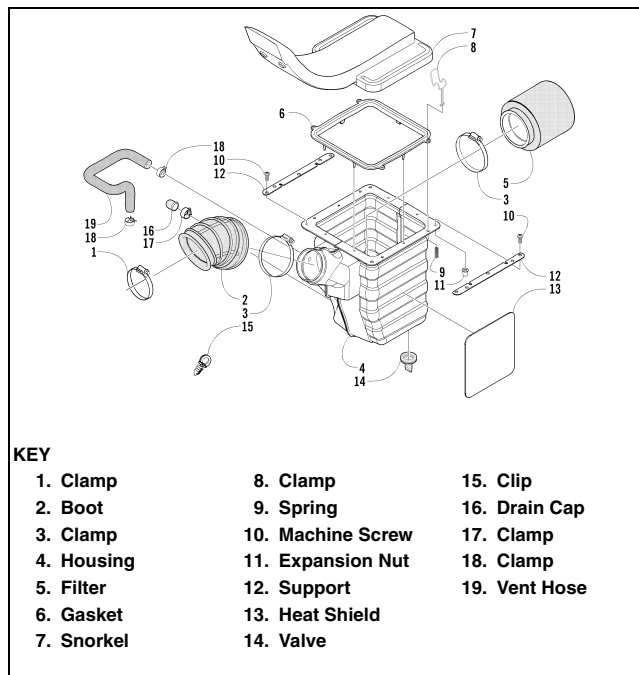
3. Loosen the clamp and remove the filter.



AF640DA

4. Loosen the clamp securing the air cleaner to the front boot; then loosen the clamp securing the air cleaner to the rear filter sleeve.
5. Remove the machine screws securing the air cleaner to the flange support and frame.
6. Remove the air cleaner from the frame.

## INSTALLING

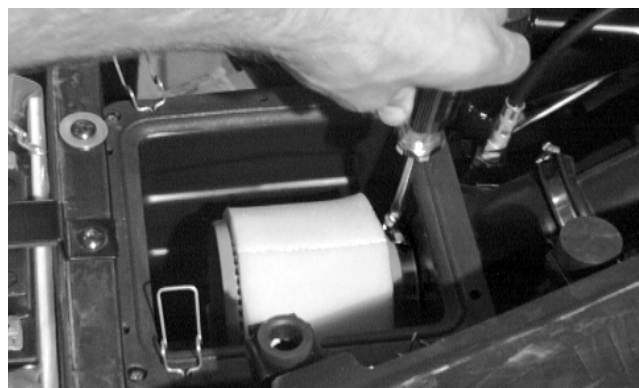


### KEY

- |            |                   |               |
|------------|-------------------|---------------|
| 1. Clamp   | 8. Clamp          | 15. Clip      |
| 2. Boot    | 9. Spring         | 16. Drain Cap |
| 3. Clamp   | 10. Machine Screw | 17. Clamp     |
| 4. Housing | 11. Expansion Nut | 18. Clamp     |
| 5. Filter  | 12. Support       | 19. Vent Hose |
| 6. Gasket  | 13. Heat Shield   |               |
| 7. Snorkel | 14. Valve         |               |

0738-385

1. Place the air cleaner into the frame.
2. Install the machine screws securing the air cleaner to the flange support and frame.
3. Install the rear filter sleeve onto the air cleaner; then tighten the clamp securely.
4. Install the front boot onto the air cleaner; then tighten the clamp securely.
5. Install the filter with foam wrap into the air cleaner; then tighten the clamp securely.



AF640DA



6. Place the air cleaner cover into position and secure with the retaining clips.



7. Install the seat making sure the seat is properly secured.

## Air Cleaner/Filter

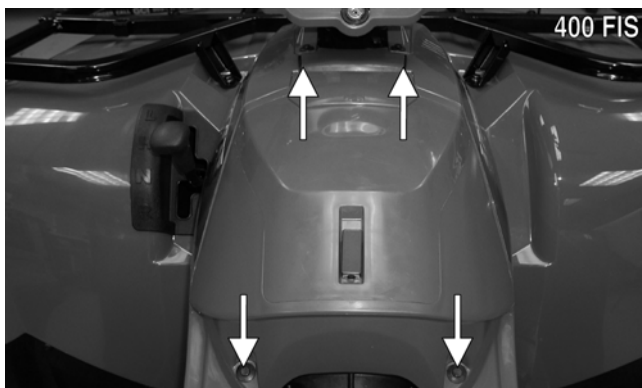
The air filter inside the air filter housing must be kept clean to provide good engine power and gas mileage. If the ATV is used under normal conditions, service the filter at the intervals specified. If operated in dusty, wet, or muddy conditions, inspect and service the filter more frequently. Use the following procedure to remove the filter and inspect and/or clean it.

### CLEANING AND INSPECTING FILTER

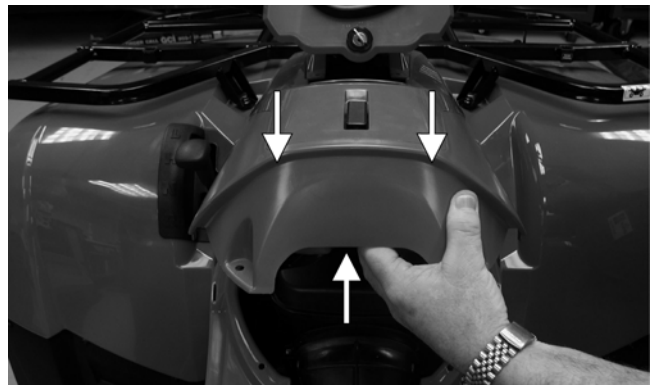
#### ⚠ CAUTION

Failure to inspect the air filter frequently if the vehicle is used in dusty, wet, or muddy conditions can damage the engine.

1. Remove the seat; then remove the appropriate reinstallable rivets securing the storage compartment.



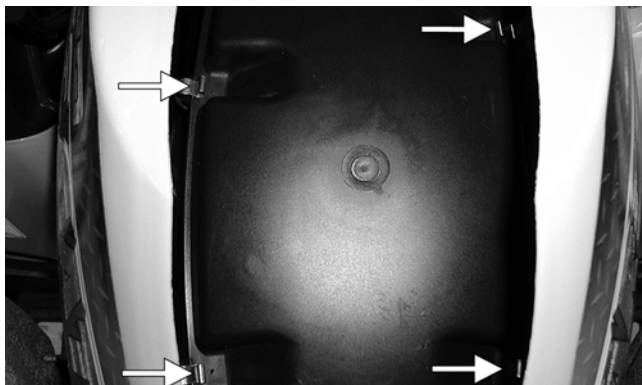
2. On the 400 FIS, remove the storage compartment assembly by elevating the rear of the compartment, moving it rearward, and lifting it off.



3. On the 500/650 H1/650 V-Twin, raise the storage compartment cover; then slide the cover forward and off the compartment. Remove the storage compartment.



4. Unsnap the four spring-clip fasteners; then remove the air filter cover.



CD675A

5. Remove the air filter/filter screen assembly and separate the foam filter from the screen.



CD674



CD747

6. Fill a wash pan larger than the filter with a non-flammable cleaning solvent; then dip the filter in the solvent and wash it.

■ **NOTE:** Foam Filter Cleaner (p/n 0436-194) and Foam Filter Oil (p/n 0436-195) are available from Arctic Cat.

7. Dry the filter.

8. Put the filter in a plastic bag; then pour in air filter oil and work the filter. Reattach the filter to the filter screen.

### **CAUTION**

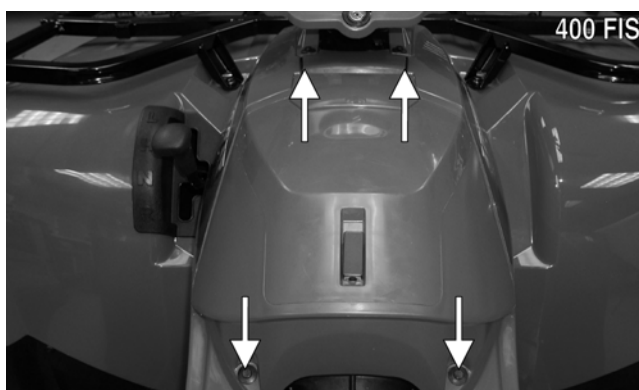
A torn air filter can cause damage to the ATV engine. Dirt and dust may get inside the engine if the element is torn. Carefully examine the element for tears before and after cleaning it. Replace the element with a new one if it is torn.

9. Clean any dirt or debris from inside the air cleaner. Be sure no dirt enters the carburetors.
10. Place the filter assembly in the air filter housing making sure it is properly positioned and properly seated with the filter screen down.



CD674

11. Install the air filter housing cover and secure with the retaining clips.
12. Install the storage compartment; then secure with the reinstallable rivets.

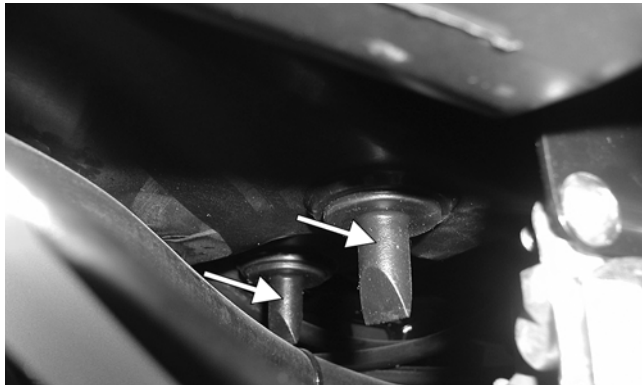


CF145B



## CHECKING AND CLEANING DRAINS

1. Inspect one-way drains beneath the main housing for debris and for proper sealing.



2. Replace any one-way drain that is cracked or shows any signs of hardening or deterioration.

### CAUTION

The one-way drain to the right is the clean air section of the filter housing. Any leak of this one-way drain will allow dirt into the engine intake causing severe engine damage.

3. Wipe any accumulation of oil or gas from the filter housing and one-way drains.

## Valve/Tappet Clearance (Feeler Gauge Procedure)

■ **NOTE:** For the 650 V-Twin, see Valve/Tappet Clearance (650 V-Twin) in this section.

To check and adjust valve/tappet clearance, use the following procedure.

■ **NOTE:** On the 400 VP, the seat assembly, side panels, and gas tank must be removed for this procedure.

1. Remove the timing inspection plug; then remove the tappet covers (for more detailed information, see Section 3 - Servicing Top-Side Components).
2. Rotate the crankshaft to the TDC position on the compression stroke.

■ **NOTE:** At this point, the rocker arms and adjuster screws must not have pressure on them.

3. Using a feeler gauge, check each valve/tappet clearance. If clearance is not within specifications, loosen the jam nut and rotate the tappet adjuster screw until the clearance is within specifications. Tighten each jam nut securely after completing the adjustment.

2

### CAUTION

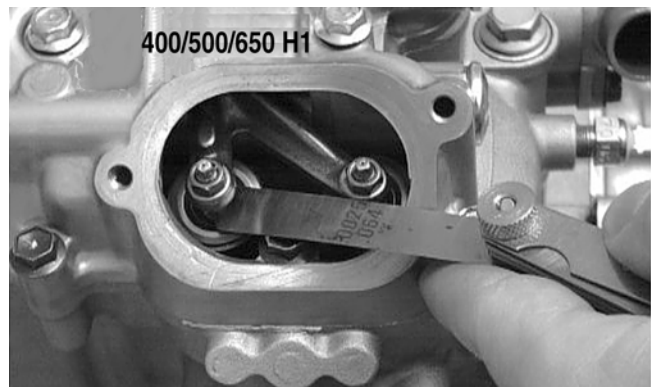
The feeler gauge must be positioned at the same angle as the valve and valve adjuster for an accurate measurement of clearance. Failure to measure the valve clearance accurately could cause valve component damage.

#### VALVE/TAPPET CLEARANCE (400/500)

|               |                                |
|---------------|--------------------------------|
| Intake        | 0.05-0.10 mm (0.002-0.004 in.) |
| Exhaust (400) | 0.22-0.27 mm (0.009-0.011 in.) |
| Exhaust (500) | 0.17-0.22 mm (0.007-0.009 in.) |

#### VALVE/TAPPET CLEARANCE (650 H1)

|         |                       |
|---------|-----------------------|
| Intake  | 0.1016 mm (0.004 in.) |
| Exhaust | 0.1524 mm (0.006 in.) |



4. Install the timing inspection plug.
5. Place the two tappet covers into position making sure the proper cap screws are with the proper cover. Tighten the cap screws securely.



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## Valve/Tappet Clearance

### (Valve Adjuster Procedure)

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■ **NOTE:** For the 650 V-Twin, see Valve/Tappet Clearance (650 V-Twin) in this section.

To check and adjust valve/tappet clearance, use the following procedure.

■ **NOTE:** On the 400 VP, the seat assembly, side panels, and gas tank must be removed for this procedure.

■ **NOTE:** On the TBX/500/650 H1, the seat, storage compartment cover assembly, compartment box, air filter/filter housing, and left-side/right-side splash panels must be removed for this procedure.

1. Remove the timing inspection plug; then remove the tappet covers (for more detailed information, see Section 3 - Servicing Top-Side Components).

2. Rotate the crankshaft to the TDC position on the compression stroke.

■ **NOTE:** At this point, the rocker arms and adjuster screws must not have pressure on them.

■ **NOTE:** Use Valve Clearance Adjuster (p/n 0444-078) for this procedure.

3. Place the valve adjuster onto the jam nut securing the tappet adjuster screw; then rotate the valve adjuster dial clockwise until the end is seated in the tappet adjuster screw.

4. While holding the valve adjuster dial in place, use the valve adjuster handle and loosen the jam nut; then rotate the tappet adjuster screw clockwise until friction is felt.

5. Align the valve adjuster handle with one of the marks on the valve adjuster dial.

6. While holding the valve adjuster handle in place, rotate the valve adjuster dial counterclockwise until proper valve/tappet clearance is attained.

■ **NOTE:** Refer to the appropriate specifications in Feeler Gauge Procedure sub-section for the proper valve/tappet clearance.

■ **NOTE:** Rotating the valve adjuster dial counterclockwise will open the valve/tappet clearance by 0.05 mm (0.002 in.) per mark.

7. While holding the adjuster dial at the proper clearance setting, tighten the jam nut securely with the valve adjuster handle.

8. Place the two tappet covers with O-rings into position; then tighten the covers securely.



CF005

9. Install the spark plug; then install the timing inspection plug.

---

## Valve/Tappet Clearance

### (650 V-Twin - Feeler Gauge Procedure)

---

To check and adjust valve/tappet clearance, use the following procedure.

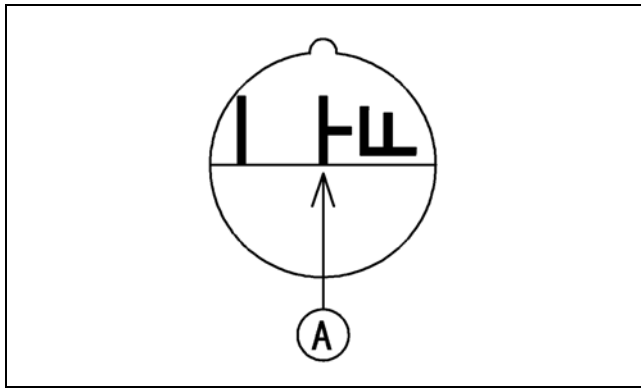
■ **NOTE:** The seat, air filter housing, front fenders, front inner covers, and side panels must be removed for this procedure.

1. Remove the cap screws securing the recoil starter; then remove the recoil starter assembly.

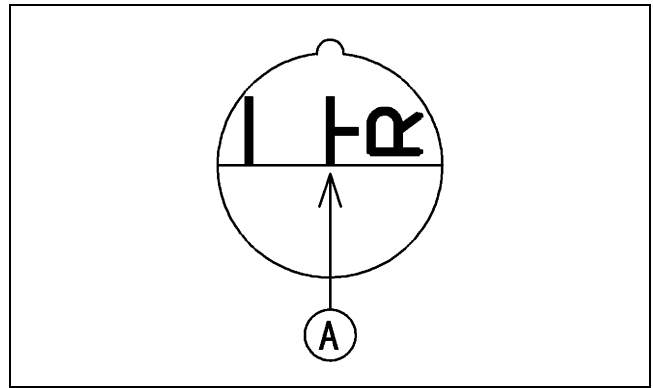
2. Remove the timing inspection plug; then remove the four tappet covers (for more detailed information, see Section 3 - Servicing Top-Side Components).

3. Rotate the crankshaft counterclockwise to the TDC position on the compression stroke indicated by the TF mark (A) on the flywheel. TF is top dead center front.

■ **NOTE:** At this point, the rocker arms and adjuster screws on the front cylinder must not have pressure on them.

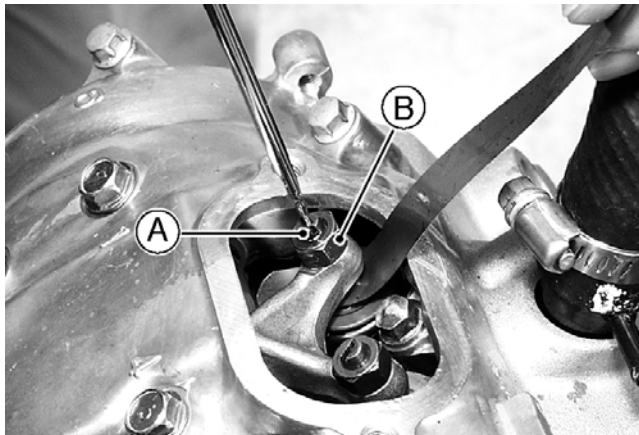


ATV2057B



ATV2058B

4. Using a feeler gauge, check each valve/tappet clearance. If clearance is not within specifications, loosen jam nut (B) and rotate the tappet adjuster screw (A) until the clearance is within specifications. Tighten each jam nut to specifications after completing the adjustment.



KX227

### CAUTION

The feeler gauge must be positioned at the same angle as the valve and valve adjuster for an accurate measurement of clearance. Failure to measure the valve clearance accurately could cause valve component damage.

#### VALVE/TAPPET CLEARANCE (650 V-Twin)

|         |                                  |
|---------|----------------------------------|
| Intake  | 0.10-0.15 mm (0.0039-0.0059 in.) |
| Exhaust | 0.20-0.25 mm (0.0079-0.0098 in.) |

5. Rotate the crankshaft counterclockwise until the TR mark (A) aligns in the timing hole. Repeat steps 3-4 for the rear cylinder.

6. Install the timing inspection plug.
7. Place the four tappet covers into position. Tighten the cap screws securely.
8. Install the recoil starter assembly and tighten the cap screws securely.
9. Install the air filter housing, front inner covers, front fenders, and side panels; then install the seat and make sure it locks securely.

2

## Valve/Tappet Clearance (650 V-Twin - Valve Adjuster Procedure)

To check and adjust valve/tappet clearance, use the following procedure.

■ **NOTE:** The seat, air filter housing, front fenders, front inner covers, and side panels must be removed for this procedure.

1. Remove the cap screws securing the recoil starter; then remove the recoil starter assembly.
2. Remove the timing inspection plug; then remove the four tappet covers (for more detailed information, see Section 3 - Servicing Top-Side Components).
3. Rotate the crankshaft counterclockwise to the TDC position on the compression stroke indicated by the TF mark on the flywheel. TF is top dead center front.

■ **NOTE:** At this point, the rocker arms and adjuster screws must not have pressure on them.

■ **NOTE:** Use Valve Gap Adjuster (p/n 0444-092) for this procedure.

4. Place the valve adjuster onto the jam nut securing the tappet adjuster screw; then rotate the valve adjuster dial clockwise until the end is seated in the tappet adjuster screw.
  5. While holding the valve adjuster dial in place, use the valve adjuster handle and loosen the jam nut; then rotate the tappet adjuster screw clockwise until friction is felt.
  6. Align the valve adjuster handle with one of the marks on the valve adjuster dial.
  7. While holding the valve adjuster handle in place, rotate the valve adjuster dial counterclockwise until proper valve/tappet clearance is attained.
- **NOTE:** Refer to the appropriate specifications in **Feeler Gauge Procedure** sub-section for the proper valve/tappet clearance.
- **NOTE:** Rotating the valve adjuster dial counterclockwise will open the valve/tappet clearance by 0.07 mm (0.003 in.) per mark.
8. While holding the adjuster dial at the proper clearance setting, tighten the jam nut securely with the valve adjuster handle; then tighten the jam nuts to specifications.
  9. Rotate the crankshaft counterclockwise until the TR mark aligns in the timing hole; then repeat steps 4-8 for the rear cylinder.
  10. Install the timing inspection plug; then install the four tappet covers and tighten securely.
  11. Install the recoil starter assembly and tighten the cap screws securely.
  12. Install the air filter housing, front inner covers, front fenders, and side panels; then install the seat and make sure it locks securely.

---

## Testing Engine Compression

---

To test engine compression, use the following procedure.

1. Remove the high tension lead from the spark plug(s).

2. Using compressed air, blow any debris from around the spark plug(s).

### **WARNING**

**Always wear safety glasses when using compressed air.**

3. Remove the spark plug(s); then attach the high tension lead to the plug(s) and ground the plug(s) on the cylinder head well away from the spark plug hole.

■ **NOTE:** On the 650 V-Twin, both spark plugs must be removed.

4. Attach the Compression Gauge (p/n 0444-096).

■ **NOTE:** The engine must be warm and the battery must be fully charged for this test.

5. While holding the throttle lever in the full-open position, crank the engine over with the electric starter until the gauge shows a peak reading (five to 10 compression strokes).

■ **NOTE:** For the 400, the compression should be within a range of 95-115 psi in the full-open throttle position. For the 500/650 H1, the compression should be within a range of 70-85 psi in the full-open throttle position. For the 650 V-Twin, the compression should be within a range of 45-80 psi in the full-open throttle position.

6. If compression is abnormally low, inspect the following items.

- A. Verify starter cranks engine over.
- B. Gauge is functioning properly.
- C. Throttle lever in the full-open position.
- D. Valve/tappet clearance correct.
- E. Valve bent or burned.
- F. Valve seat burned.

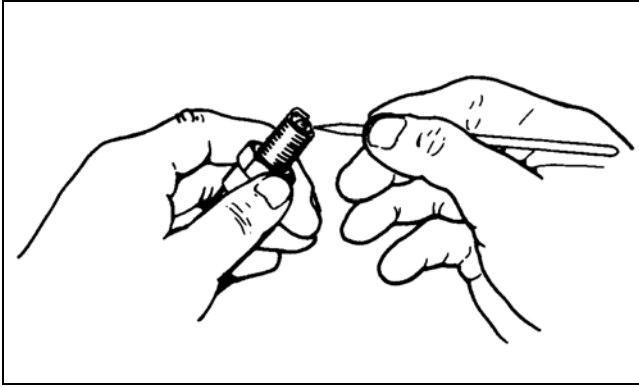
■ **NOTE:** To service valves, see Section 3.

7. Pour 29.5 ml (1 fl oz) of oil into the spark plug hole, reattach the gauge, and retest compression.
8. If compression is now evident, service the piston rings (see Section 3).



## Spark Plug

A light brown insulator indicates that a plug is correct. A white or dark insulator indicates that the engine may need to be serviced or the carburetor may need to be adjusted. To maintain a hot, strong spark, keep the plug free of carbon.

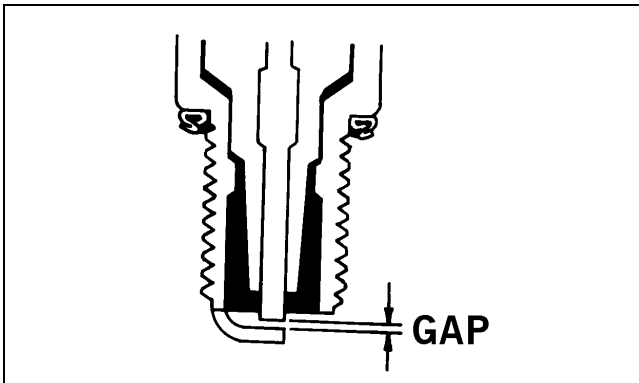


ATV-0051

### CAUTION

Before removing a spark plug, be sure to clean the area around the spark plug. Dirt could enter engine when removing or installing the spark plug.

Adjust the gap to 0.7 - 0.8 mm (0.028 - 0.032 in.) for proper ignition. Use a feeler gauge to check the gap.



ATV0052B

When installing the spark plug, be sure to tighten it securely. A new spark plug should be tightened 1/2 turn once the washer contacts the cylinder head. A used spark plug should be tightened 1/8 - 1/4 turn once the washer contacts the cylinder head.

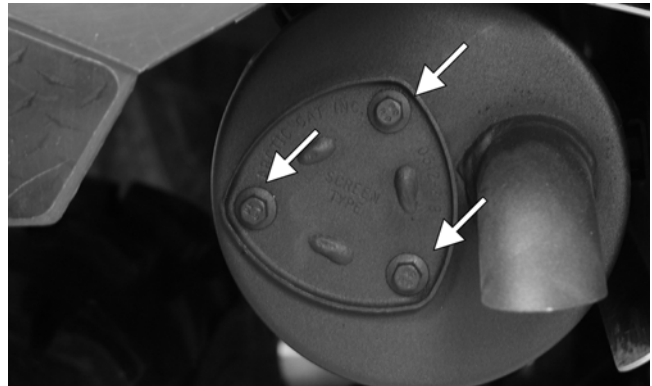
## Muffler/Spark Arrester

The muffler has a spark arrester which must be periodically cleaned. At the intervals shown in the Periodic Maintenance Chart, clean the spark arrester using the following procedure.

### WARNING

Wait until the muffler cools to avoid burns.

1. Remove the three cap screws securing the spark arrester assembly to the muffler; then loosen and remove the arrester.

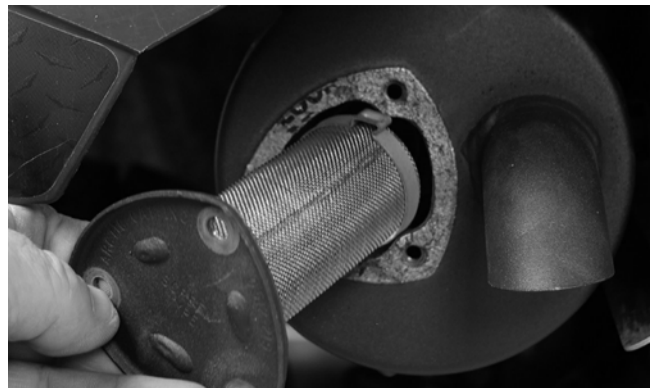


CF105A

2. Using a suitable brush, clean the carbon deposits from the screen taking care not to damage the screen.

■ **NOTE:** If the screen or gasket is damaged in any way, it must be replaced.

3. Install the spark arrester assembly with gasket; then secure with the three cap screws. Tighten to 0.6 kg-m (4.0 ft-lb).



CF104

2

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## Gas/Vent Hoses

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Replace the gas hose every two years. Damage from aging may not always be visible. Do not bend or obstruct the routing of the carburetor vent hose. Make certain that the vent hose is securely connected to the carburetor and the opposite end is always open.

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## Adjusting Throttle Cable

---

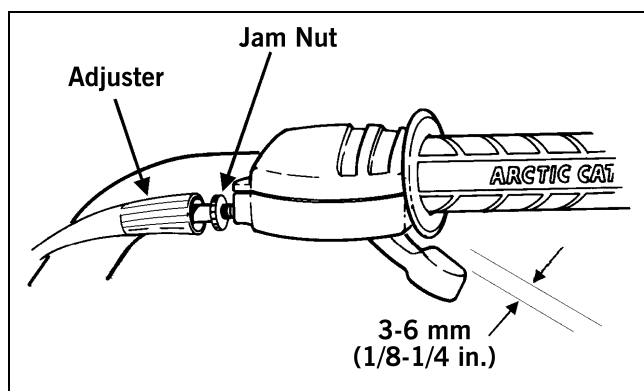
To adjust the throttle cable free-play, follow this procedure.

1. Slide the rubber boot away; then loosen the jam nut from the throttle cable adjuster.



AL611D

2. Turn the adjuster until the throttle cable has proper free-play of 3-6 mm (1/8 - 1/4 in.) at the lever.



ATV-0047

3. Tighten the jam nut against the throttle cable adjuster securely; then slide the rubber boot over the adjuster.

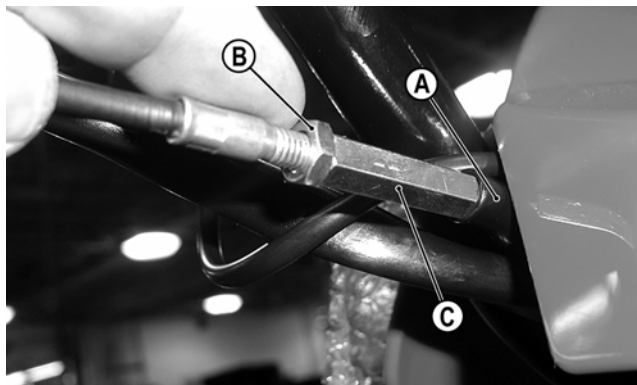
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## Adjusting Choke Cable (650 V-Twin)

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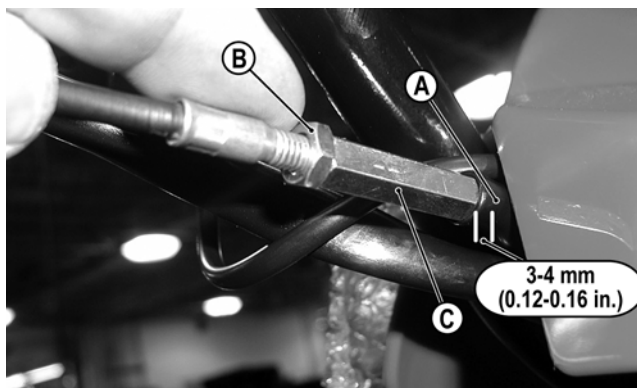
To adjust the choke cable for proper free-play, follow this procedure.

1. Slide the rubber boot (A) off the choke cable; then loosen jam nut (B).



CD560A

2. Turn the adjuster (C) until proper free-play of 3-4 mm (0.12-0.16 in.) is attained at the end of the adjuster.



CD560B

3. Tighten the jam nut securely against the end of the adjuster; then slide the rubber boot over the adjuster.

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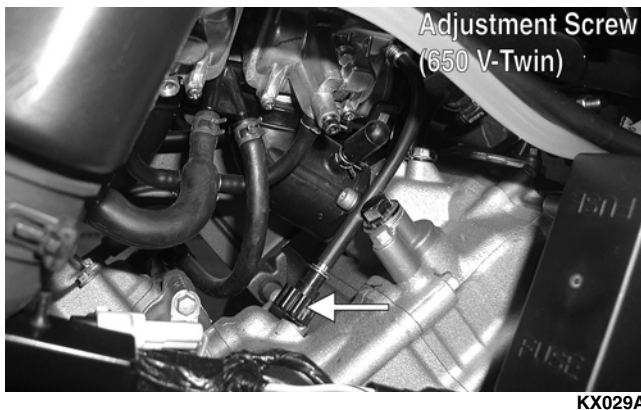
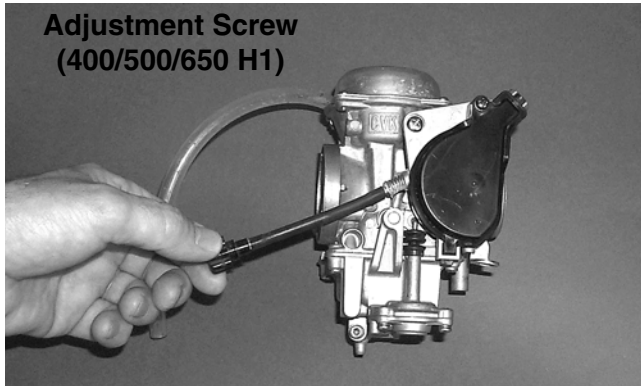
## Adjusting Engine RPM (Idle)

---

To properly adjust the idle RPM, a tachometer is necessary. To adjust idle RPM, use the following procedure.

■ **NOTE:** The idle adjustment screw is located on the right-hand side of the carburetor.

1. With the transmission in neutral, start the engine and warm it up to normal operating temperature.
2. Turn the idle adjustment screw clockwise one turn past the recommended RPM setting; then turn it counterclockwise to the correct RPM setting.



| IDLE RPM       |           |
|----------------|-----------|
| MODEL          | RPM       |
| 400/500/650 H1 | 1250-1350 |
| 650 V-Twin     | 1050-1150 |

### ⚠ WARNING

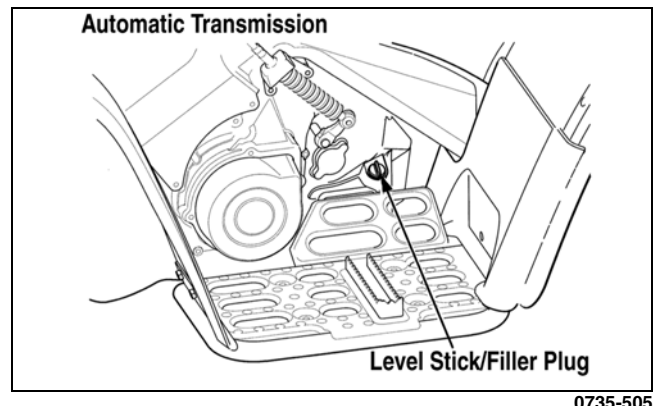
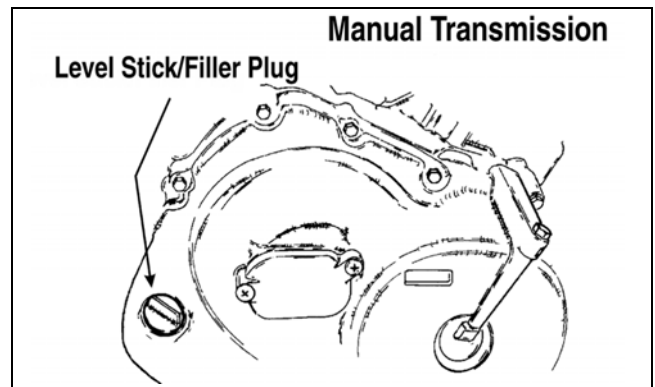
Adjust the idle to the correct RPM. Make sure the engine is at normal operating temperature before adjusting the idle RPM.

## Engine/Transmission Oil - Filter - Strainer

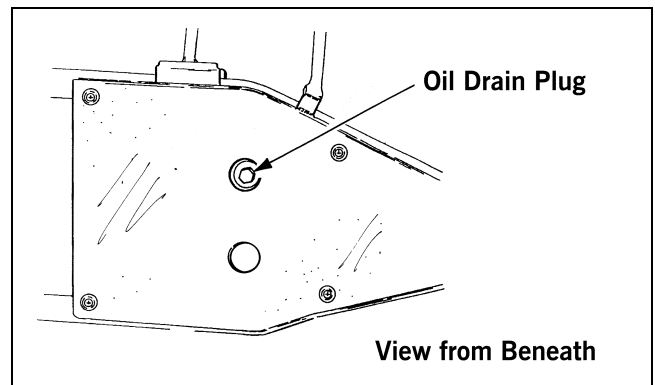
### OIL - FILTER

Change the engine oil and oil filter at the scheduled intervals. The engine should always be warm when the oil is changed so the oil will drain easily and completely.

1. Park the ATV on level ground.
2. Remove the oil level stick/filler plug.



3. Remove the drain plug from the bottom of the engine and drain the oil into a drain pan.



4. On the 400/500, remove the oil filter plug from the filter mounting boss (located on the front side of the transmission case) and allow the filter to drain completely. Install the plug and tighten securely.
5. On the 650 V-Twin, remove the left-front inner fender panel.
6. Using the Oil Filter Wrench (p/n 0444-042) and a suitable wrench, remove the old oil filter.

■ **NOTE:** Clean up any excess oil after removing the filter.

7. Apply oil to a new filter O-ring and check to make sure it is positioned correctly; then install the new oil filter. Tighten securely.

■ **NOTE:** Install a new O-ring each time the filter is replaced.

8. Install the engine drain plug and tighten to specifications. Pour the specified amount of the recommended oil in the filler hole. Install the oil level stick/filler plug.

**CAUTION**

Any oil used in place of the recommended oil could cause serious engine damage. Do not use oils which contain graphite or molybdenum additives. These oils can adversely affect clutch operation. Also, not recommended are racing, vegetable, non-detergent, and castor-based oils.

9. Start the engine (while the ATV is outside on level ground) and allow it to idle for a few minutes.
10. Turn the engine off and wait approximately one minute.
11. Unscrew the oil level stick and wipe it with a clean cloth.
12. Install the oil level stick until the threads touch engine case.

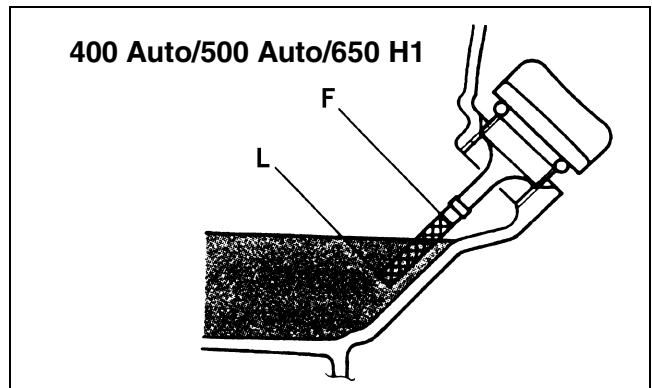
■ **NOTE:** On the 400 auto/500 auto/650 H1, the oil level stick should not be threaded into the case for checking the oil level.

■ **NOTE:** On the 650 V-Twin, the oil level stick should be threaded into the case for checking the oil level.

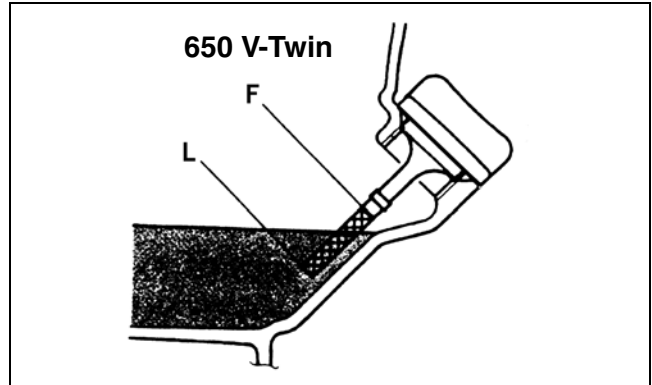
13. Remove the oil level stick; the engine oil level should be above the illustrated “L” mark but not higher than the illustrated “F” mark.

**CAUTION**

Do not over-fill the engine with oil. Always make sure that the oil level is above the “L” mark but not higher than the “F” mark.



ATV-0100



ATV0100A

14. Inspect the area around the drain plug and oil filter for leaks.

## STRAINER

■ **NOTE:** For servicing the oil strainer on the 650 V-Twin, see Center Crankcase Components in Section 3.

To check the oil strainer, use the following procedure.

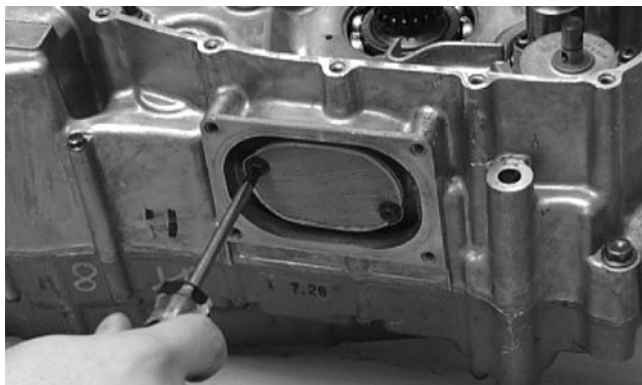
1. Remove the skid plate.
2. Remove the cap screws securing the oil strainer cap; then remove the cap. Account for the O-ring.



CC091D

3. Remove the two Phillips-head cap screws securing the strainer.

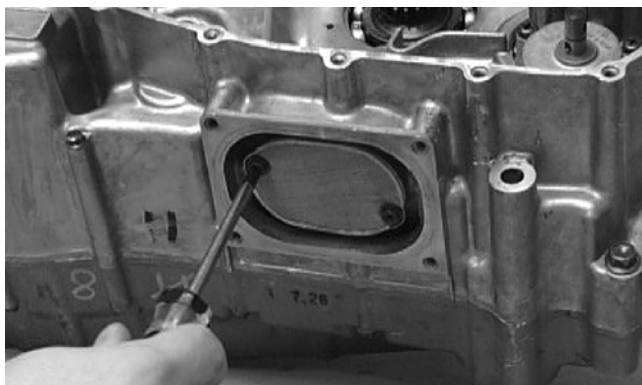




CC163D

■ **NOTE:** To service oil strainer, see Section 3.

4. Place the oil strainer into position beneath the crankcase and secure with the Phillips-head cap screws. Tighten securely.



CC163D

5. Place the strainer cap into position on the strainer making sure the O-ring is properly installed; then secure with the cap screws. Tighten securely.



CC091D

6. Install the skid plate.

## Front Differential/Rear Drive Lubricant

Check and change the lubricant according to the Periodic Maintenance Chart. When changing the lubricant, use approved SAE 80W-90 hypoid gear lube. To check lubricant, use the following procedure.

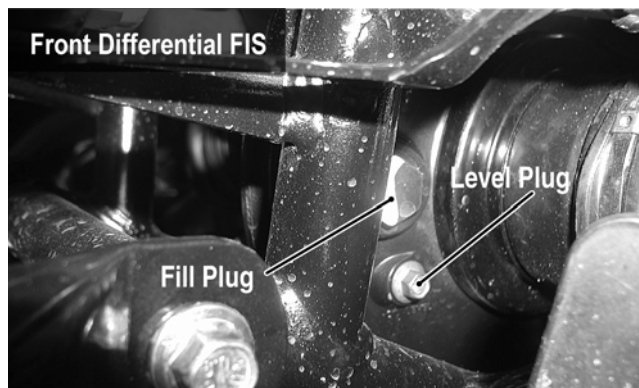
1. On FIS models, remove the rear drive filler plug; the lubricant level should be 1 in. below the threads of the plug. If low, add SAE approved 80W-90 hypoid gear lube as necessary.
2. On ACT models, remove the rear drive inspection plug; the lubricant level should be at the threads of the plug. If low, add SAE approved 80W-90 hypoid gear lube as necessary.

2



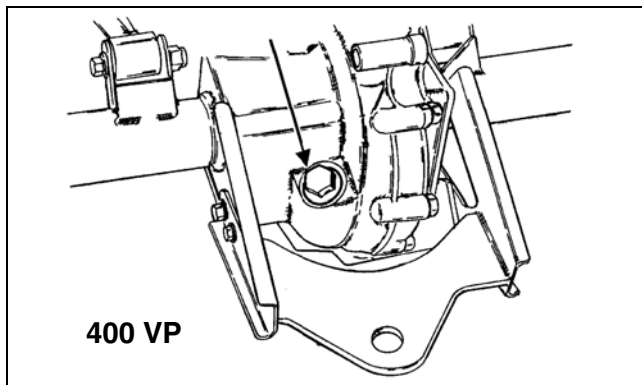
To change the lubricant, use the following procedure.

1. Place the ATV on level ground.
2. Remove each oil filler plug.

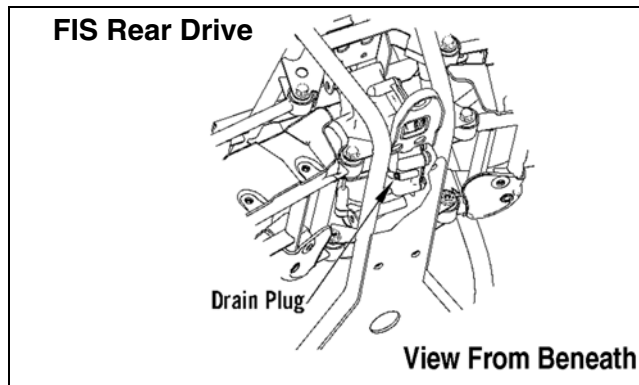


AL677A

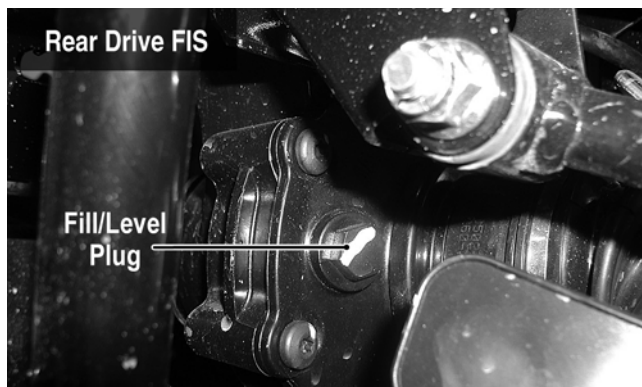




ATV-0077



737-651A



AL678A

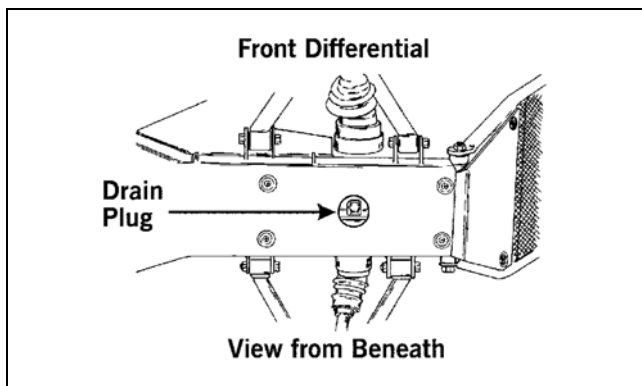
3. Drain the oil into a drain pan by removing in turn the drain plug from each.

4. After all the oil has been drained, install the drain plugs and tighten to specifications.
5. Pour the appropriate amount of recommended oil into the filler hole.
6. Install the filler plugs.

■ **NOTE:** If the differential/rear drive oil is contaminated with water, inspect the drain plug, filler plug, and/or bladder.

### ⚠ CAUTION

Water entering the outer end of the axle will not be able to enter the rear drive unless the seals are damaged.

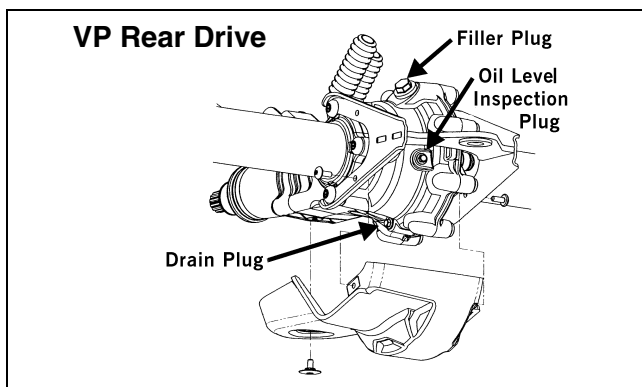


ATV0082A

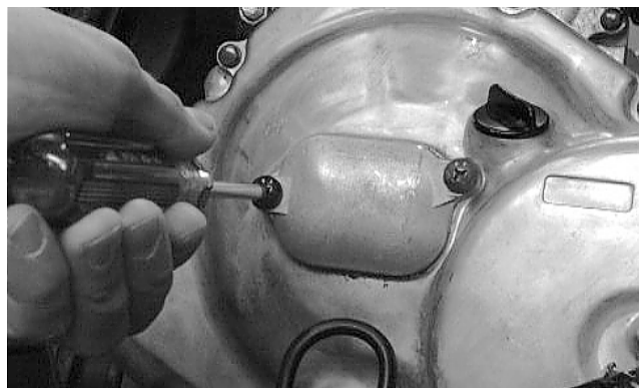
## Adjusting Clutch (400/500 Manual Transmission)

To adjust the clutch, use the following procedure.

1. Using an impact driver, remove the screws securing the cover and remove the cover. Account for the O-ring.

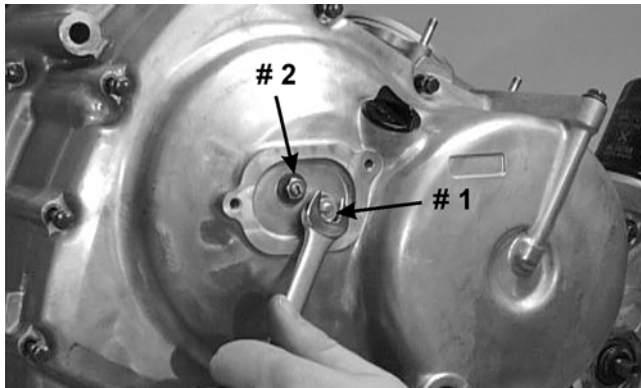


ATV-1096



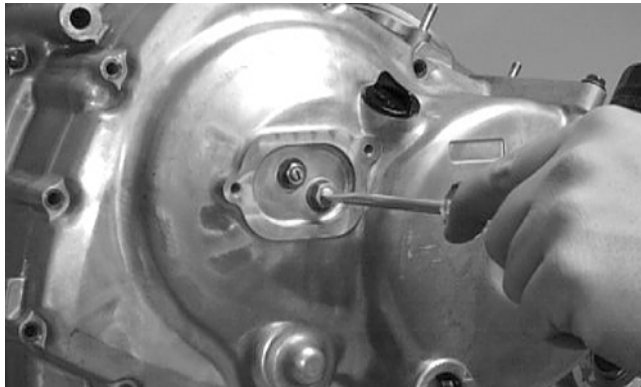
AM600D

2. Loosen the jam nuts securing adjustment screw #1 (forward) and adjustment screw #2 (rearward).



CC037D

3. Rotate adjustment screw #1 counterclockwise until it stops.



CC038D

4. Rotate adjustment screw #2 alternately clockwise and counterclockwise to ensure free movement without binding; then lock the jam nut securing adjustment screw #2.
5. Rotate adjustment screw #1 clockwise 1/8 turn; then lock the jam nut securing adjustment screw #1.

■ **NOTE:** At this point the clutch should be adjusted correctly. Test to ensure accurate adjustment.

6. Install the cover making sure the O-ring is properly positioned; then secure with the screws.

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## Tires

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### TIRE SIZES

The ATV is equipped with low-pressure tubeless tires of the size and type listed. Do not under any circumstances substitute tires of a different type or size.

### **WARNING**

**Always use the size and type of tires specified.  
Always maintain proper tire inflation pressure.**

### TIRE INFLATION PRESSURE

Front and rear tire inflation pressure should be 0.35 kg-cm<sup>2</sup> (5.0 psi).

A low-pressure gauge is provided in the tool kit to measure the air pressure in the tires. Check the air pressure in all tires before each use of the ATV.

2

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## Steering Components

---

The following steering components should be inspected periodically to ensure safe and proper operation.

- A. Handlebar grips not worn, broken, or loose.
- B. Handlebar not bent, cracked, and has equal and complete full-left and full-right capability.
- C. Steering post bearing assembly/bearing housing not broken, worn, or binding.
- D. Ball joints not worn, cracked, or damaged.
- E. Tie rods not bent or cracked.
- F. Knuckles not worn, cracked, or damaged.
- G. Cotter pins not damaged or missing.

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## Driveshaft/Coupling

---

The following drive system components should be inspected periodically to ensure proper operation.

- A. Spline lateral movement (slop).

- B. Coupling cracked, damaged, or worn.

---

## Suspension/Shock Absorbers/Bushings

---

The following suspension system components should be inspected periodically to ensure proper operation.

- A. Shock absorber rods bent, pitted, or damaged.
- B. Rubber damper cracked, broken, or missing.
- C. Shock absorber body damaged, punctured, or leaking.
- D. Shock absorber eyelets broken, bent, or cracked.
- E. Shock absorber eyelet bushings worn, deteriorated, cracked, or missing.
- F. Shock absorber spring broken or sagging.

---

## Nuts/Bolts/Cap Screws

---

Tighten all nuts, bolts, and cap screws. Make sure rivets holding components together are tight. Replace all loose rivets. Care must be taken that all calibrated nuts, bolts, and cap screws are tightened to specifications. For proper torque values, see Section 10.

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## Ignition Timing

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■ **NOTE:** On the 650 V-Twin to verify ignition timing, see Ignition Timing (650 V-Twin) in Section 5.

The ignition timing cannot be adjusted; however, verifying ignition timing can aid in troubleshooting other components. To verify ignition timing, use the following procedure.

1. Attach the Timing Light (p/n 0644-197) to the spark plug high tension lead; then remove the timing inspection plug from the left-side crankcase cover.

2. Using the Arctic Cat Engine Tachometer (p/n 0644-275), start the engine and run at the recommended RPM; ignition timing should be the recommended degrees BTDC.

| IGNITION TIMING |                 |
|-----------------|-----------------|
| MODEL           | TIMING/RPM      |
| 400             | 10° BTDC @ 1500 |
| 500             | 10° BTDC @ 1500 |
| 650 H1          | 10° BTDC @ 1500 |

3. Install the timing inspection plug.

If ignition timing cannot be verified, the rotor may be damaged, the key may be sheared, the trigger coil bracket may be bent or damaged, or the CDI unit may be faulty.

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## Headlight/Taillight-Brakelight

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Each time the ATV is used, lights should be checked for proper function. Rotate the ignition switch to the lights position; the headlights and taillight should illuminate. Test the brakelight by compressing the brake lever. The brakelight should illuminate.

### HEADLIGHT

■ **NOTE:** The bulb portion of the headlight is fragile. **HANDLE WITH CARE.** When replacing the headlight bulb, do not touch the glass portion of the bulb. If the glass is touched, it must be cleaned with a dry cloth before installing. Skin oil residue on the bulb will shorten the life of the bulb.

### WARNING

**Do not attempt to remove the bulb when it is hot. Severe burns may result.**

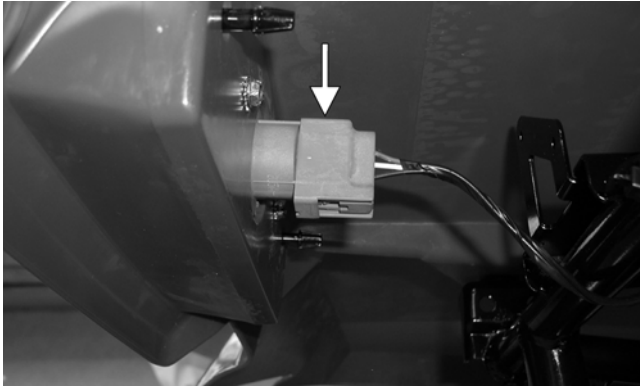
To replace the headlight bulb, use the following procedure.

1. Remove the wiring harness connector from the back of the headlight.
2. Grasp the bulb housing, turn it counterclockwise, and remove the bulb.
3. Install the new bulb into the housing and rotate it completely clockwise.
4. Install the wiring harness connector.

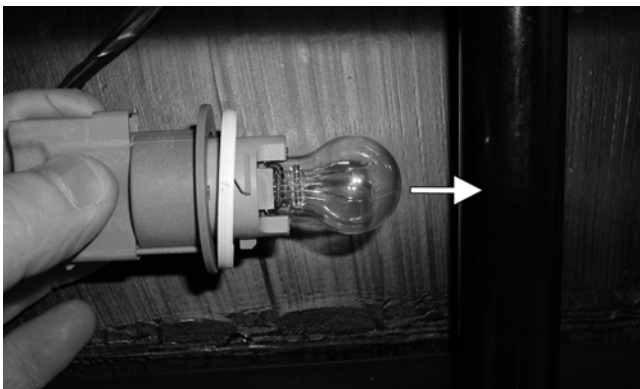
## TAILLIGHT-BRAKELIGHT

To replace the taillight-brakelight bulb, use the following procedure.

1. Turn the bulb socket assembly counterclockwise and remove from the housing.



2. Pull the bulb straight out of the socket; then insert a new bulb.



3. Insert the bulb socket assembly into the housing and turn it clockwise to secure.

## CHECKING/ADJUSTING HEADLIGHT AIM

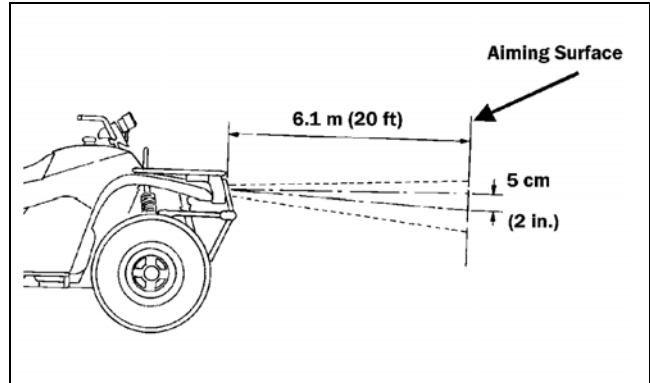
The headlights can be adjusted vertically and horizontally. The geometric center of the HIGH beam light zone is to be used for vertical and horizontal aiming.

1. Position the ATV on a level floor so the headlights are approximately 6.1 m (20 ft) from an aiming surface (wall or similar aiming surface).

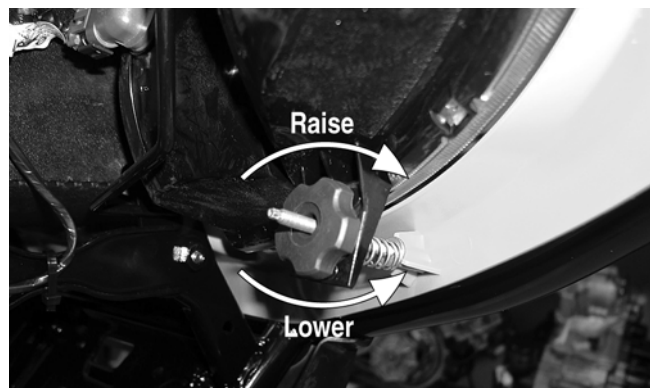
■ **NOTE:** There should be an average operating load on the ATV when adjusting the headlight aim.

2. Measure the distance from the floor to the mid-point of each headlight.
3. Using the measurements obtained in step 2, make horizontal marks on the aiming surface.

4. Make vertical marks which intersect the horizontal marks on the aiming surface directly in front of the headlights.
5. Switch on the lights. Make sure the HIGH beam is on. DO NOT USE LOW BEAM.
6. Observe each headlight beam aim. Proper aim is when the most intense beam is centered on the vertical mark 5 cm (2 in.) below the horizontal mark on the aiming surface.



7. Adjust each headlight by turning the adjuster knob clockwise to raise the beam or counterclockwise to lower the beam.



---

## Switches

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Each time the ATV is used, switches should be checked for proper operation. Use the following list for reference.

- A. Ignition switch — engine will start.
- B. Emergency stop switch — engine will stop.



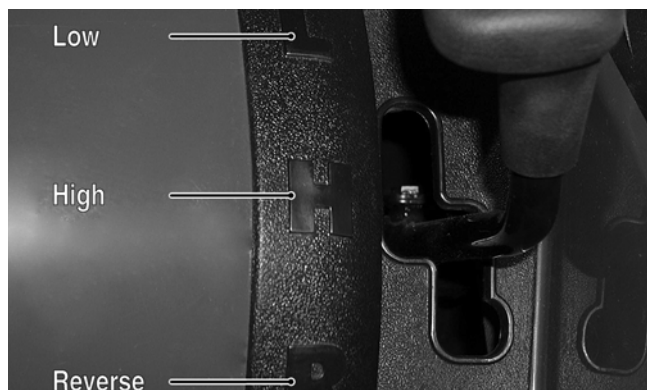
- C. Reverse switch — reverse indicator light illuminates.
- D. Hi/Lo switch — headlight beam bright and dim.
- E. Brake switches — rear brakelight illuminates.

---

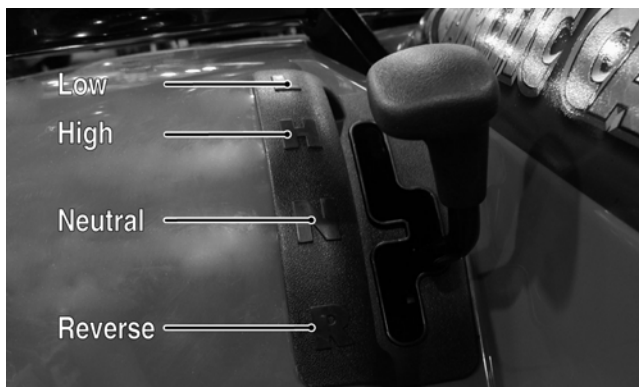
## Reverse Shift Lever

---

### CHECKING ADJUSTMENT



CF150A



CF130A

Stop the ATV completely and shift the transmission into the R position. The reverse gear indicator light should be illuminated.

### **WARNING**

**Never shift the ATV into reverse gear when the ATV is moving as it could cause the ATV to stop suddenly throwing the operator from the ATV.**

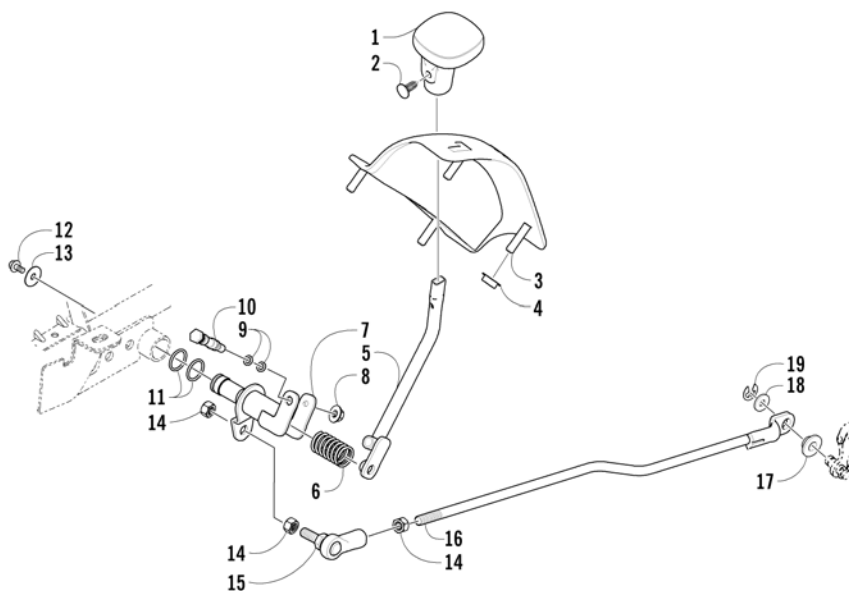
If the reverse light does not illuminate when shifted to the reverse position, the switch may be faulty, the fuse may be blown, the bulb may be faulty, a connection may be loose or corroded, or the lever may need adjusting. To adjust, proceed to Adjusting Shift Lever.

### ADJUSTING SHIFT LEVER

#### KEY

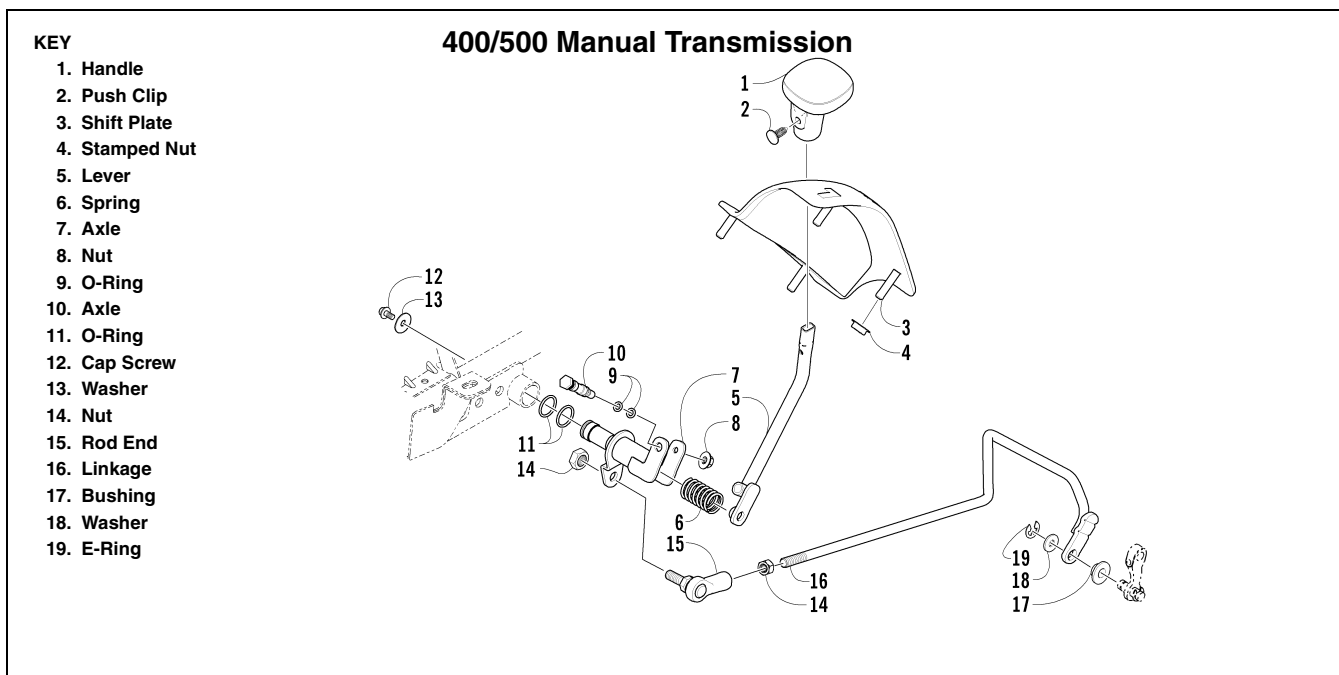
- 1. Handle
- 2. Push Clip
- 3. Shift Plate
- 4. Stamped Nut
- 5. Lever
- 6. Spring
- 7. Axle
- 8. Nut
- 9. O-Ring
- 10. Axle
- 11. O-Ring
- 12. Cap Screw
- 13. Washer
- 14. Nut
- 15. Rod End
- 16. Linkage
- 17. Bushing
- 18. Washer
- 19. E-Ring

#### 400/500 Automatic Transmission/650 H1

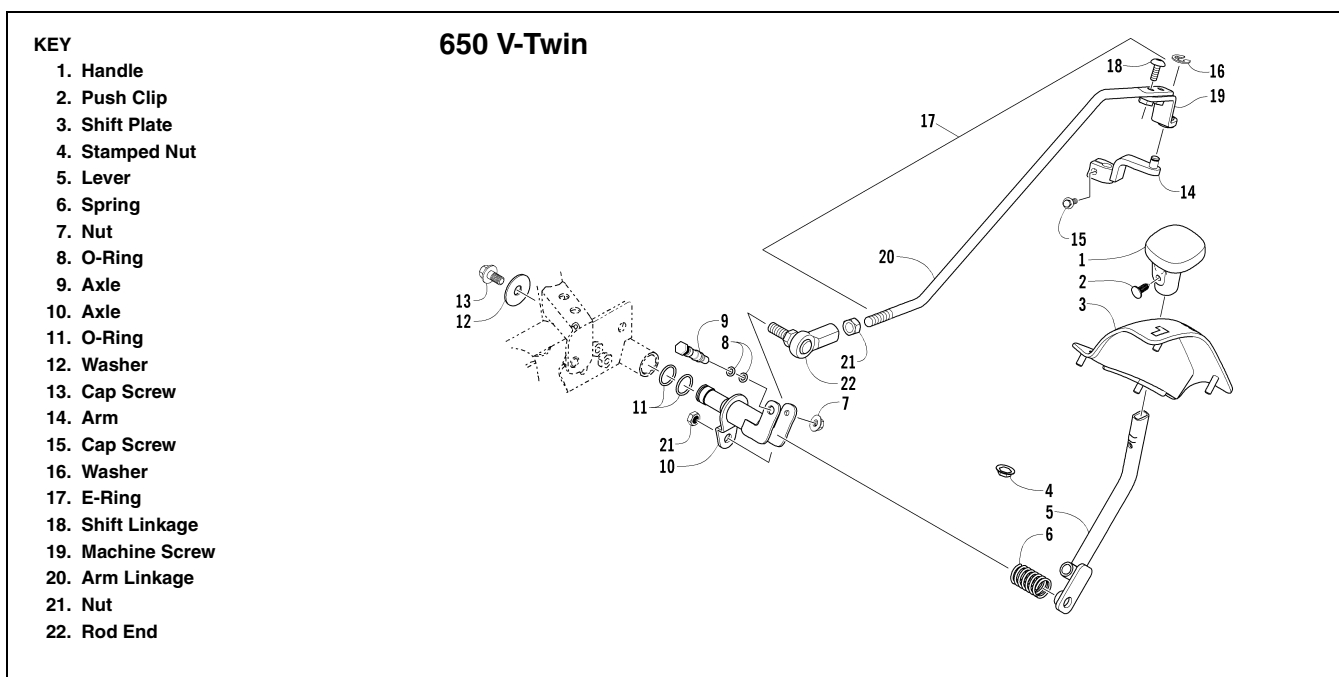


0739-701





0739-739



0739-824

2

1. Place the shift lever in the R position.

2. Remove the seat.

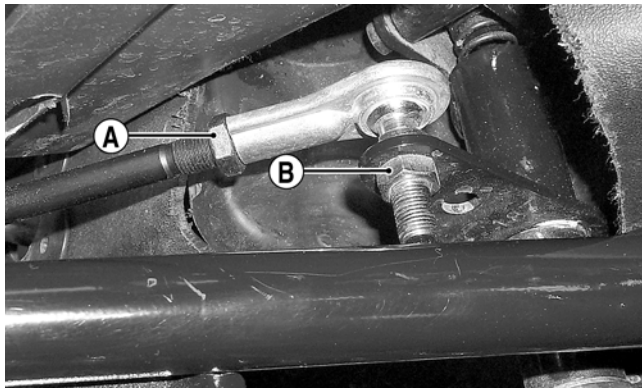
■ **NOTE: Step 3 is for all models except the 650 V-Twin. For the 650 V-Twin, proceed to step 4.**

3A. On the TBX/500/650 H1, remove the left-side splash panel.



CD685

B. Loosen shift rod end jam nut (A).



AF941A

C. Using two open-end wrenches, remove lock nut (B) securing the shift rod to the upper shift axle. Discard the lock nut.

■ **NOTE:** Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.

D. Push the upper shift axle down completely.

E. Rotate the shift rod end as necessary to align its threaded shaft with the hole in the upper shift axle. Secure with a new lock nut (B). Tighten securely.

F. Tighten jam nut (A) to secure the adjustment.

G. On the TBX/TRV/500/650 H1, install the left-side splash panel.

H. Install the seat.

4A. On the 650 V-Twin, loosen the two torx-head screws on the slotted section of the linkage.



CD717

B. Hold the shift lever in the R position and make sure the shift arm is in the full-forward detent position; then tighten the two torx-head screws securely.



CD716A

C. Verify correct shifting operation; then install the seat.

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## Frame/Welds/Racks

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The frame, welds, and racks should be checked periodically for damage, bends, cracks, deterioration, broken components, and missing components. If replacement or repair constitutes removal, see Section 8.

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## Electrical Connections

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The electrical connections should be checked periodically for proper function. In case of an electrical failure, check fuses, connections (for tightness, corrosion, damage), and/or bulbs. If an electrical component needs to be tested for proper function, see Section 5.

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## Hydraulic Brake Systems

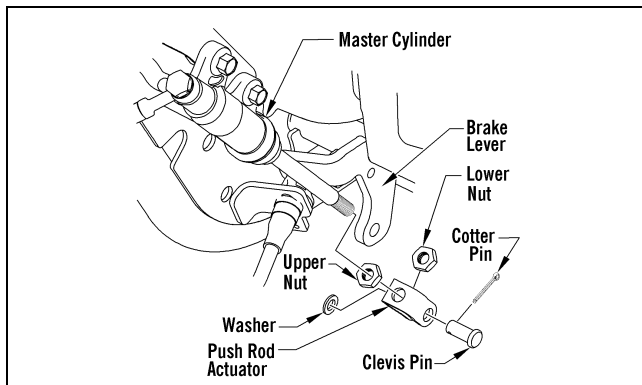
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### ADJUSTING LINKAGE

■ **NOTE:** Prior to attempting to bleed the hydraulic auxiliary brake (remote reservoir type), the linkage must be checked for proper adjustment.

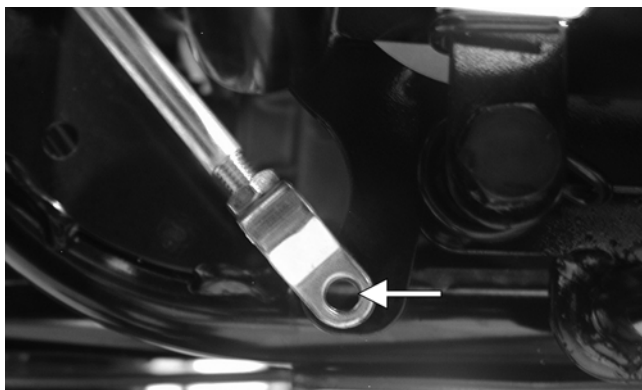
To adjust linkage, use the following procedure.

1. Remove the cotter pin and washer; then remove the clevis pin.



0739-542

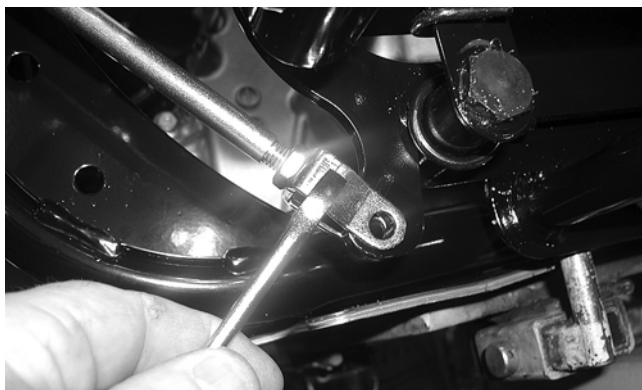
2. Making sure the brake pedal is fully released and against the stop, check that the holes in the push-rod actuator align with the hole in the pedal lever.



CD473A

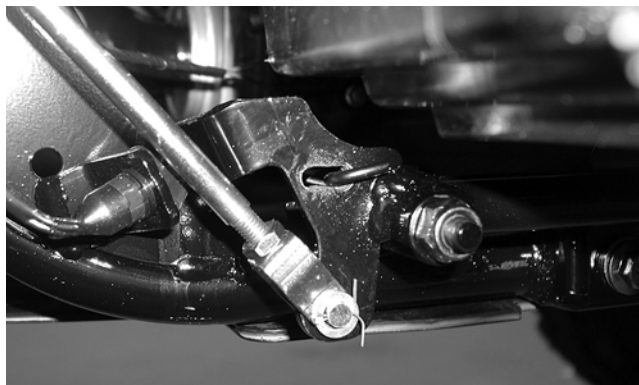
■ **NOTE:** If the holes align, no adjustment is necessary; proceed to step 4.

3. If the holes are not aligned, loosen the upper nut and rotate the push-rod and lower nut until the holes align; then hold the actuator and lower nut and tighten the upper nut securely.



CD476

4. Verify proper alignment; then install the clevis pin, washer, and a new cotter pin.



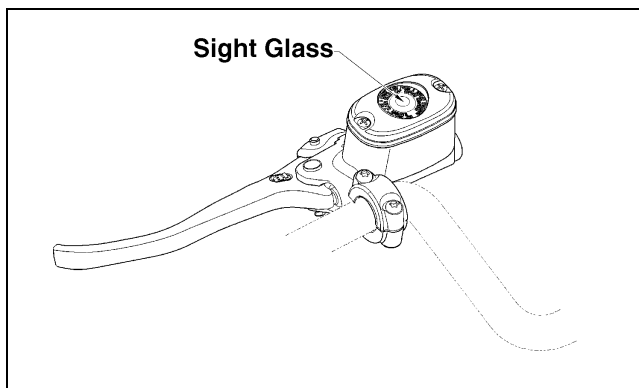
CD713

## CHECKING/BLEEDING

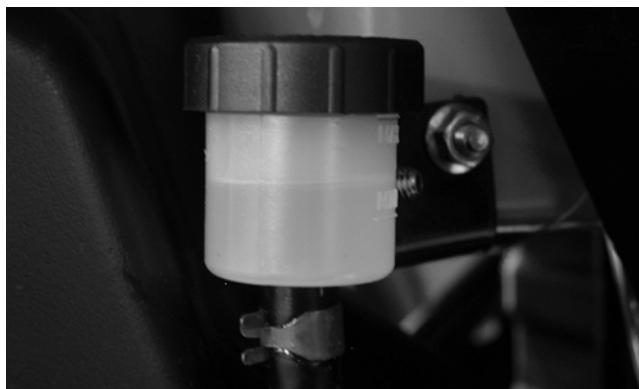
The hydraulic brake systems have been filled and bled at the factory. To check and/or bleed a hydraulic brake system, use the following procedure.

**2**

1. With the master cylinder in a level position, check the fluid level in the reservoir. If the level in the reservoir is not visible in the sight glass, add DOT 4 brake fluid.



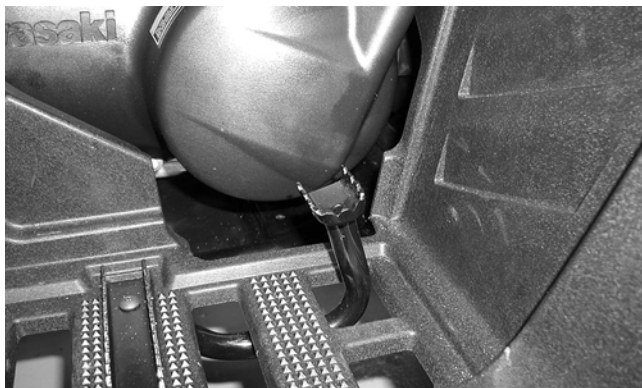
738-420A



AL681

2. Compress the brake lever/pedal several times to check for a firm brake. If the brake is not firm, the system must be bled.





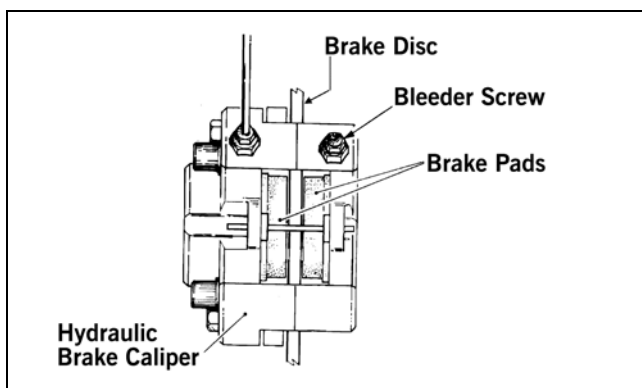
CD711

3. To bleed the brake system, use the following procedure.

- A. Remove the cover and fill the reservoir with DOT 4 Brake Fluid (p/n 1639-799).
- B. Install and secure the cover; then slowly compress the brake lever several times.
- C. Remove the protective cap, install one end of a clear hose onto one FRONT bleeder screw, and direct the other end into a container; then while holding slight pressure on the brake lever, open the bleeder screw and watch for air bubbles. Close the bleeder screw before releasing the brake lever. Repeat this procedure until no air bubbles are present.



AF637D



730-434B

■ **NOTE:** During the bleeding procedure, watch the reservoir sight glass very closely to make sure there is always a sufficient amount of brake fluid. When the sight glass changes from dark to light, refill the reservoir before the bleeding procedure is continued. Failure to maintain a sufficient amount of fluid in the reservoir will result in air in the system.

D. Repeat step C until the brake lever is firm.

E. At this point, perform step B, C, and D on the other FRONT bleeder screw; then move to the REAR bleeder screw and follow the same procedure.

4. Carefully check the entire hydraulic brake system that all hose connections are tight, the bleed screws are tight, the protective caps are installed, and no leakage is present.

#### **CAUTION**

This hydraulic brake system is designed to use DOT 4 brake fluid only. If brake fluid must be added, care must be taken as brake fluid is very corrosive to painted surfaces.

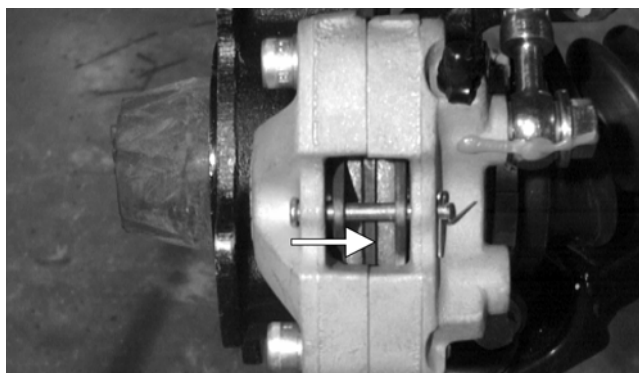
### **INSPECTING HOSES**

Carefully inspect the hydraulic brake hoses for cracks or other damage. If found, the brake hoses must be replaced.

### **CHECKING/REPLACING PADS**

The clearance between the brake pads and brake discs is adjusted automatically as the brake pads wear. The only maintenance that is required is replacement of the brake pads when they show excessive wear. Check the thickness of each of the brake pads as follows.

1. Remove a front wheel.
2. Measure the thickness of each brake pad.



AF739DB

3. If thickness of either brake pad is less than 3.2 mm (0.125 in.), the brake pads must be replaced.

■ **NOTE:** The brake pads should be replaced as a set.

4. To replace the brake pads, use the following procedure.

A. Remove the wheel.

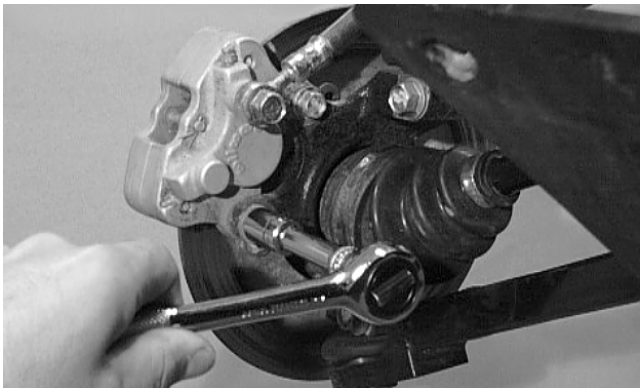
B. Remove the cap screws securing the caliper holder to the knuckle; then remove the pads.



PR237

C. Install the new brake pads.

D. Secure the caliper to the knuckle and/or axle housing with the cap screws. Tighten to specifications.



AF615D

E. Install the wheel. Tighten to specifications.

5. Burnish the brake pads (see Burnishing Brake Pads in this section).

---

## Burnishing Brake Pads

---

Brake pads (both hydraulic and auxiliary) must be burnished to achieve full braking effectiveness. Braking distance will be extended until brake pads are properly burnished. To properly burnish the brake pads, use the following procedure.

### **WARNING**

**Failure to properly burnish the brake pads could lead to premature brake pad wear or brake loss. Brake loss can result in severe injury.**

1. Choose an area large enough to safely accelerate the ATV to 30 mph and to brake to a stop.
2. Accelerate to 30 mph; then compress brake lever or apply the auxiliary brake to decelerate to 0-5 mph.
3. Repeat procedure on each brake system five times until brake pads are burnished.
4. Adjust the auxiliary brake (if necessary).
5. Verify that the brakelight illuminates when the hand lever is compressed or the brake pedal is depressed.

**2**

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## Coolant (500/650 H1/650 V-Twin)

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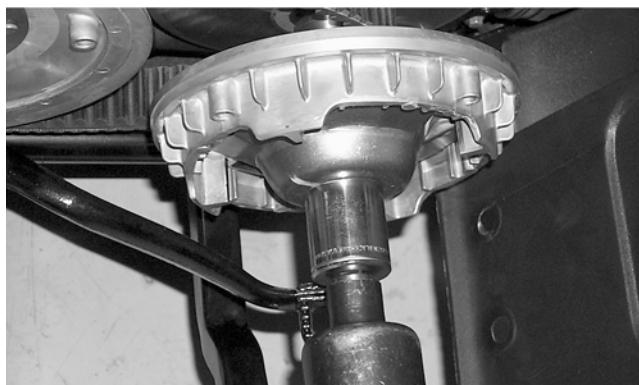
The cooling system should be inspected daily for leakage and damage. Also, the coolant level should be checked periodically.

When filling the cooling system, use premixed Arctic Cat Antifreeze (p/n 0638-395). While the cooling system is being filled, air pockets may develop; therefore, run the engine for five minutes after the initial fill, shut the engine off, and then fill the cooling system to the bottom of the stand pipe in the radiator neck.





AN604D



CC546



### CAUTION

After operating the ATV for the initial 5-10 minutes, stop the engine, allow the engine to cool down, and check the coolant level. Add coolant as necessary.

## Checking/Replacing V-Belt (400/500/650 H1)

### REMOVING

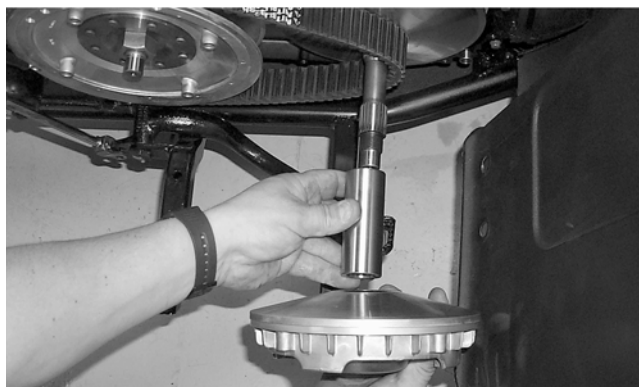
1. Remove the right-side footrest (see Section 8).
2. Remove the cap screws securing the V-belt cover noting the location of the different-lengthed cap screws for installing purposes; then using a rubber mallet, gently tap on the cover tabs to loosen the cover. Remove the cover.

■ **NOTE:** Note the location of the main engine ground wire for installing purposes.



CD078

3. Remove the nut securing the movable drive face; then remove the face. Account for the spacer.



CC547

4. Remove the V-belt.



CC550

### INSTALLING

1. Spread the faces of the driven clutch by pushing the inner face toward the engine while turning it counterclockwise; then when the faces are separated, insert a wedge (approximately 3/8 in. thick) between the faces. Release the inner face.



CC549

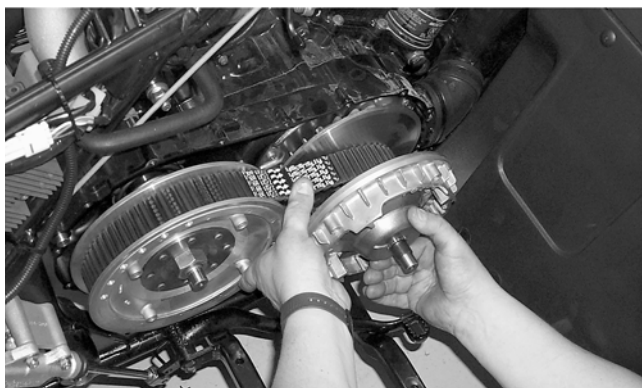
2. Place the V-belt into position on the driven clutch and over the front shaft.



CC550

■ **NOTE:** The arrow on the V-belt should point forward.

3. Pinch the V-belt together near its center and slide the spacer and movable drive face onto the driveshaft. Secure the drive face with a nut. Tighten the nut to specifications.

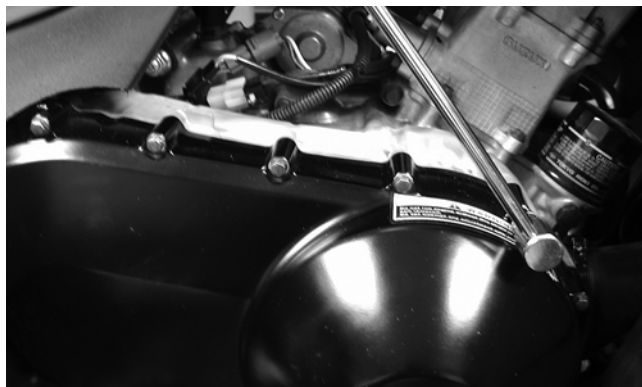


CC552

■ **NOTE:** At this point, the wedge can be removed from between the driven clutch faces.

4. Rotate the V-belt and clutches until the V-belt is flush with the top of the driven clutch.

5. Place the V-belt cover gasket into position; then install the cover and secure with the cap screws making sure the different-lengthed cap screws are in their proper location. Tighten the cap screws to specifications.



CD083

■ **NOTE:** Make sure the main engine ground wire is installed and secured in the proper location.

6. Secure the front fender to the footrest with the two cap screws. Tighten securely.
7. Install the right-side footrest (see Section 8).

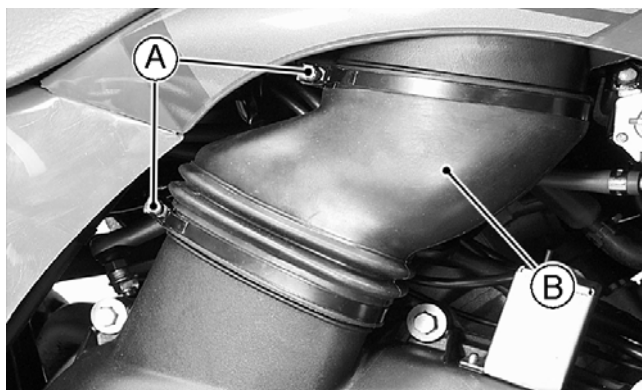
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## Checking/Replacing V-Belt (650 V-Twin)

---

### REMOVING

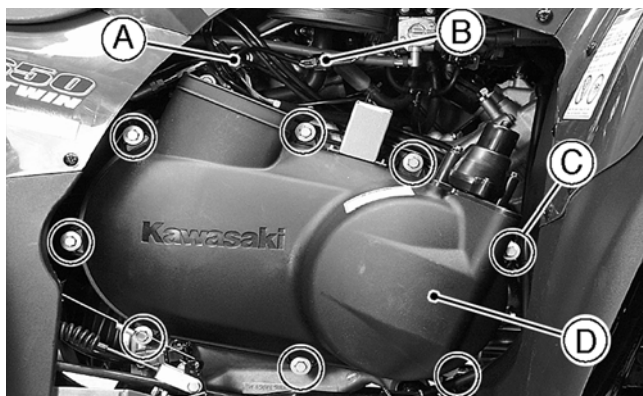
1. Make sure that the ignition switch is in the off position; then remove the clamps (A) and air duct (B).



KX229

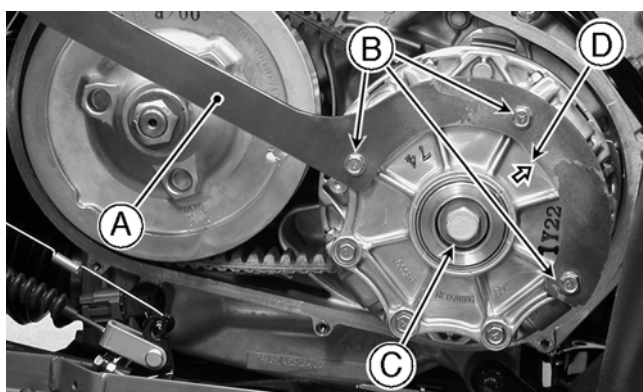
2. Remove the actuator lead (A) and the Belt Failure Detection Switch lead (B); then remove the cap screws (C) securing the V-belt cover. Remove the cover (D).





KX230

3. Remove the three cover bolts (B) in the positions shown and install an appropriate drive clutch holder (A) as shown. Note the holder's relative position to the arrow mark (D).

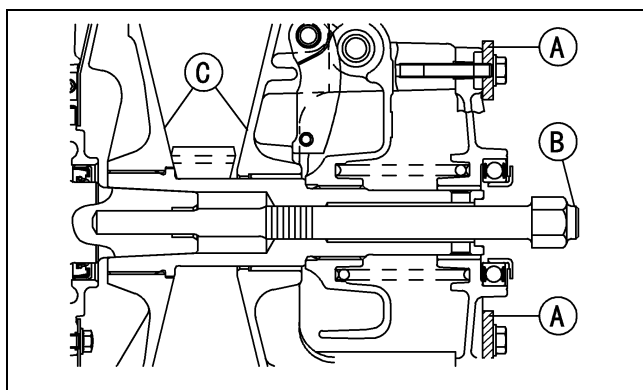


KX231

### CAUTION

Be sure to install the three bolts in the specified positions or the tapped holes will be damaged.

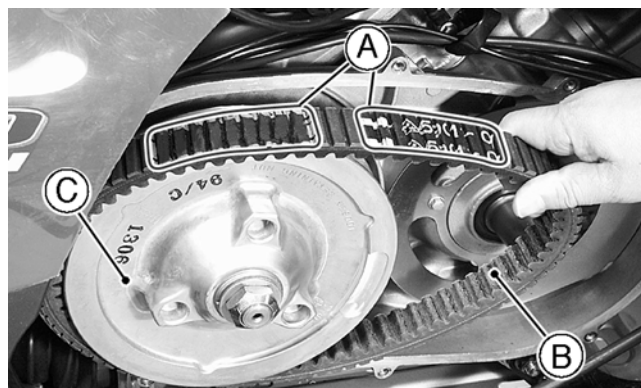
4. Remove the drive clutch cap screw (C) (left-hand threads) and account for two washers and a stepped washer.
5. Remove the drive clutch (C) from the crankshaft using an appropriate clutch puller tool (B) and turning it clockwise while holding the drive clutch with the drive clutch holder (A).



ATV2059

■ **NOTE:** Before removing the belt, note the markings (A) (or mark the belt using tape or marker) in order to reinstall in the same direction as previously installed.

6. Lift the belt (B) off the driven pulley (C).

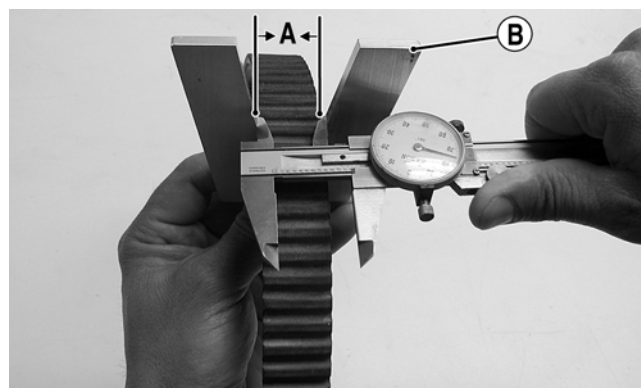


KX232

■ **NOTE:** Inspection of the belt is required every 100 hours or 1100 miles. More frequent inspection is required if the ATV is operated in adverse conditions.

## INSPECTING

1. Measure the belt width (A) at several locations using Drive Belt Gauge (p/n 0444-177) (B) and a calipers.



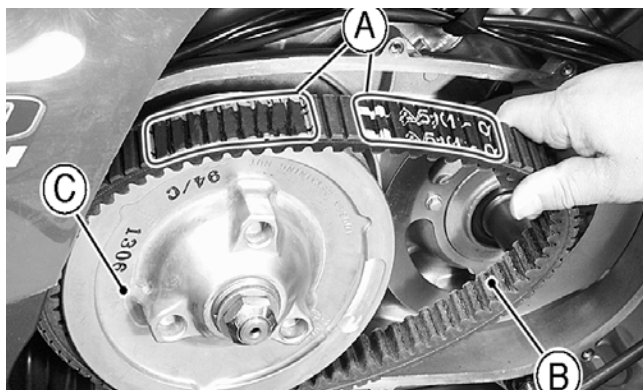
KX583A

2. If belt width is below the service limit of 28.8 mm (1.13 in.) or there is damage to the belt, it must be replaced.

## INSTALLING

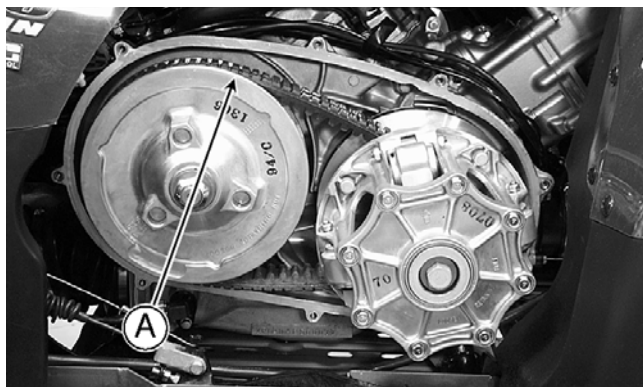
■ **NOTE:** Be sure to install the belt in the same direction as originally installed. When installing a new belt, direct the top of the lettering (A) toward the engine.

1. Loop the belt (B) over the driven pulley (C); then install the drive clutch and tighten to specifications.



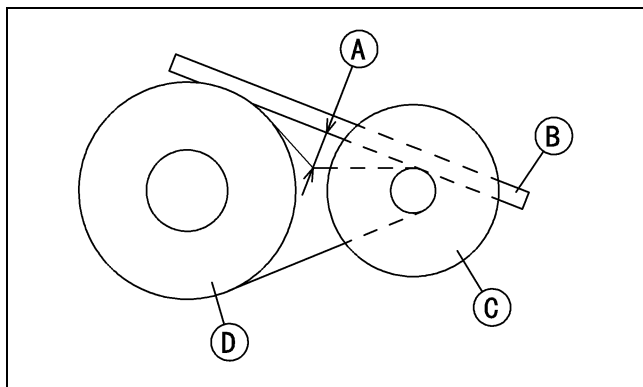
KX232

■ **NOTE:** Make sure the belt is at the top of the driven pulley (A) before checking belt deflection.



KX233

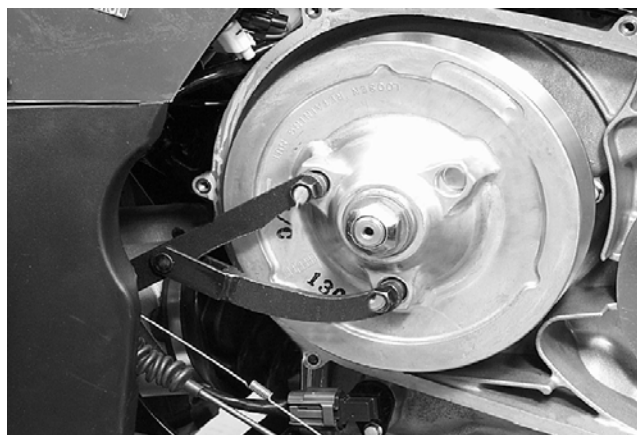
2. Place a straightedge (B) on top of the belt between the drive clutch (C) and the driven pulley (D); then using a ruler, check the belt deflection (A). Use a maximum force of 6 kg (13 lb) on the ruler. Standard belt deflection is 22-27 mm (0.87-1.06 in.).



ATV2061

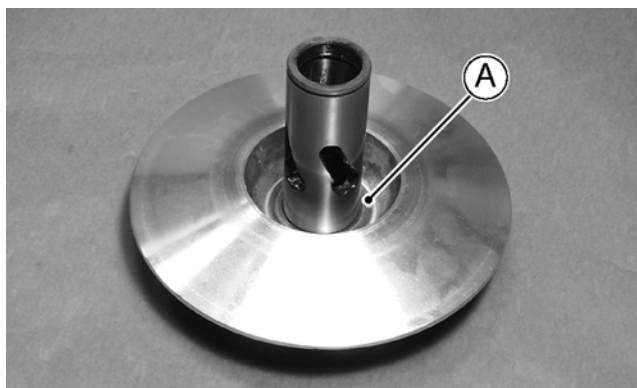
■ **NOTE:** If belt deflection is out of specifications, proceed to step 3. If belt deflection is within specifications, proceed to step 8.

3. Using an appropriate holder, hold the driven pulley; then remove the driven pulley nut and the driven pulley.



KX246A

4. Disassemble the driven pulley. See Section 3, Servicing Right-Side Components, steps 1-5.
5. Remove the shims (A) and measure the shim pack thickness.



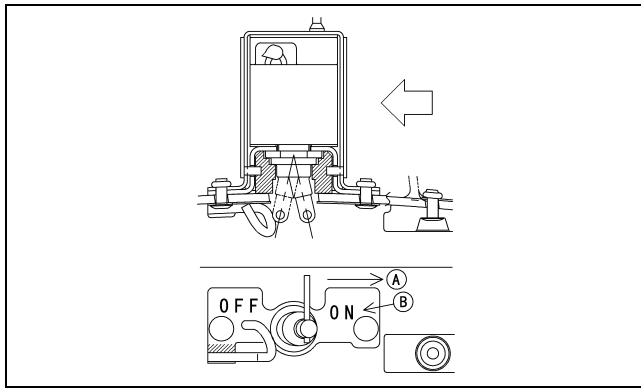
KX568

6. Increase the shim pack thickness to increase belt deflection and decrease the shim pack thickness to decrease belt deflection.

■ **NOTE:** For each 0.1 mm (0.004 in.) of shim pack change, belt deflection will change by approximately 1.45 mm (0.057 in.). Shims are available in the following sizes: 0.6 mm (0.024 in.), 0.8 mm (0.031 in.), 1.0 mm (0.039 in.), and 1.4 mm (0.055 in.).

7. Assemble the driven pulley (see Section 3, Servicing Right-Side Components, steps 1-5); then install the driven pulley, V-belt, and drive clutch and verify that belt deflection is within specifications.
8. Check the position of the Belt Failure Detection Switch (A) and reset to the ON position (B).

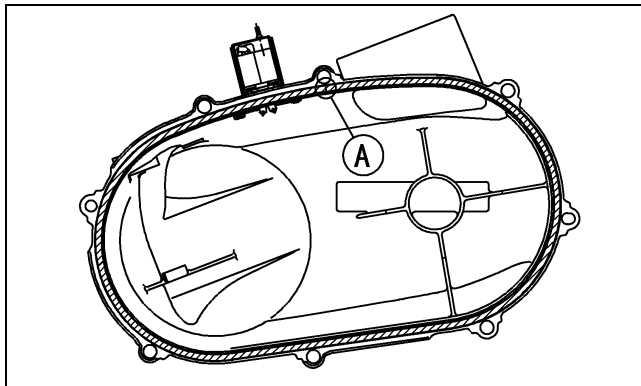




ATV2062A

■ **NOTE:** If the Belt Failure Detection Switch has been tripped to the OFF position, the V-belt cover and switch assembly must be replaced and the V-Belt Failure Mode Clearing procedure (see Section 5) must be performed.

9. Install the cover seal into the V-belt cover with the glue joint (A) as shown; then install the V-belt cover and tighten the cap screws to specifications.



ATV2063

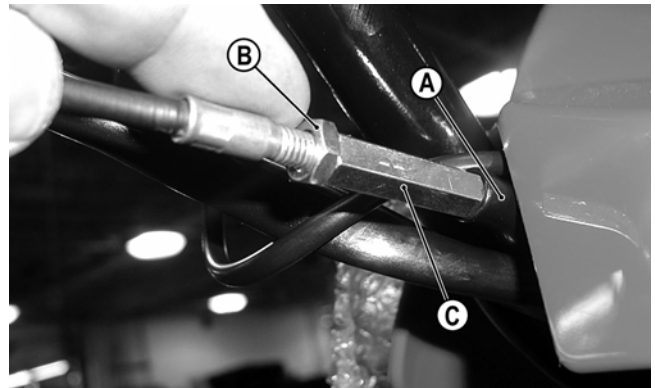
10. Connect the actuator lead and the Belt Failure Detection Switch lead; then install the air duct and secure with the clamps.

## Adjusting Differential Lock Cable

If the differential or differential lock system has been serviced, the differential lock cable should be checked and/or adjusted for proper free-play.

To adjust the cable, use the following procedure:

1. Locate the in-line adjuster on the cable near the differential lock lever; then slide the rubber boot (A) off the adjuster and loosen the jam nut (B).



CD560A

2. Turn the adjuster (C) until approximately 6.35 mm (1/4 in.) of free-play can be measured at the end of the differential lock lever.
3. Check the operation of the differential lock; then tighten jam nut (B) securely against the adjuster.

# SECTION 3 - ENGINE/TRANSMISSION

3

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## Engine/Transmission

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This section has been organized into sub-sections which show a progression for the complete servicing of the Arctic Cat ATV engine/transmission.

To service the center crankcase halves, the engine/transmission must be removed from the frame.

To service top-side, left-side, and right-side components, the engine/transmission does not have to be removed from the frame.

■ **NOTE:** Arctic Cat recommends the use of new gaskets, lock nuts, and seals and lubricating all internal components when servicing the engine/transmission.

■ **NOTE:** Some photographs and illustrations used in this section are used for clarity purposes only and are not designed to depict actual conditions.

## Specifications\*

### (400 - Automatic Transmission)

#### VALVES AND GUIDES

|                                                             |                                        |                                                                                |
|-------------------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------|
| Valve Face Diameter                                         | (intake)<br>(exhaust)                  | 30.6 mm (1.20 in.)<br>27.0 mm (1.06 in.)                                       |
| Valve/Tappet Clearance                                      | (intake)<br>(cold engine)<br>(exhaust) | 0.05-0.10 mm<br>(0.002-0.004 in.)<br>0.22-0.27 mm<br>(0.009-0.011 in.)         |
| Valve Guide/<br>Stem Clearance                              | (intake)<br>(exhaust)                  | 0.010-0.037 mm<br>(0.0004-0.0015 in.)<br>0.030-0.057 mm<br>(0.0012-0.0022 in.) |
| Valve Guide/Valve<br>Stem Deflection<br>(wobble deflection) | (max)                                  | 0.35 mm (0.014 in.)                                                            |
| Valve Guide Inside Diameter                                 |                                        | 5.000-5.012 mm<br>(0.1969-0.1973 in.)                                          |
| Valve Stem Outside<br>Diameter                              | (intake)<br>(exhaust)                  | 4.975-4.990 mm<br>(0.1959-0.1965 in.)<br>4.955-4.970 mm<br>(0.1951-0.1957 in.) |
| Valve Stem Runout                                           | (max)                                  | 0.05 mm (0.002 in.)                                                            |
| Valve Head Thickness                                        | (min)                                  | 0.5 mm (0.02 in.)                                                              |
| Valve Stem End Length                                       | (min)                                  | 2.3 mm (0.09 in.)                                                              |
| Valve Face/Seat Width                                       |                                        | 0.9-1.1 mm<br>(0.035-0.043 in.)                                                |
| Valve Seat Angle                                            | (intake)<br>(exhaust)                  | 45°<br>45°                                                                     |
| Valve Face Radial<br>Runout                                 | (max)                                  | 0.03 mm (0.001 in.)                                                            |
| Valve Spring Free<br>Length (min)                           |                                        | 38.8 mm (1.53 in.)                                                             |
| Valve Spring Tension<br>@ 32.5 mm (1.28 in.)                | (outer)                                | 18.6-21.4 kg (41-47 lb)                                                        |

#### CAMSHAFT AND CYLINDER HEAD

|                                      |                                |                                                                                    |
|--------------------------------------|--------------------------------|------------------------------------------------------------------------------------|
| Cam Lobe Height                      | (intake)<br>(min)<br>(exhaust) | 32.830 mm (1.293 in.)<br>32.830 mm (1.293 in.)                                     |
| Camshaft Jour-<br>nal Oil Clearance  | (max)                          | 0.15 mm (0.0059 in.)                                                               |
| Camshaft Jour-<br>nal Holder Inside  | (right & center)<br>(left)     | 22.012-22.025 mm<br>(0.8666-0.8671 in.)<br>17.512-17.525 mm<br>(0.6894-0.6900 in.) |
| Camshaft Journal<br>Outside Diameter | (right & center)<br>(left)     | 21.959-21.980 mm<br>(0.8645-0.8654 in.)<br>17.466-17.484 mm<br>(0.6876-0.6883 in.) |
| Camshaft Runout                      | (max)                          | 0.10 mm (0.004 in.)                                                                |
| Rocker Arm<br>Inside Diameter        |                                | 12.000-12.018 mm<br>(0.472-0.473 in.)                                              |
| Rocker Arm Shaft Outside Diameter    |                                | 11.973-11.984 mm<br>(0.4714-0.4718 in.)                                            |
| Cylinder Head<br>Distortion          | (max)                          | 0.05 mm (0.002 in.)                                                                |
| Cylinder Head<br>Cover Distortion    | (max)                          | 0.05 mm (0.002 in.)                                                                |

#### CYLINDER, PISTON, AND RINGS

|                                                   |                          |                                                                                                                   |
|---------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------|
| Piston Skirt/Cylinder<br>Clearance                |                          | 0.060-0.073 mm<br>(0.0024-0.0029 in.)                                                                             |
| Cylinder Bore                                     |                          | 82.000-82.015 mm<br>(3.2283-3.2289 in.)                                                                           |
| Piston Diameter<br>15 mm (0.6 in.) from Skirt End |                          | 81.930-81.945 mm<br>(3.2256-3.2262 in.)                                                                           |
| Piston Ring<br>Free End Gap (min)                 | (1st Ring)<br>(2nd Ring) | 8.9 mm<br>(0.3504 in.)<br>8.3 mm<br>(0.3268 in.)                                                                  |
| Bore x Stroke                                     |                          | 82 x 71.2 mm<br>(3.29 x 2.80 in.)                                                                                 |
| Cylinder Trueness                                 | (max)                    | 0.05 mm (0.002 in.)                                                                                               |
| Piston Ring End Gap -<br>Installed                |                          | 0.33-0.61 mm<br>(0.013-0.024 in.)                                                                                 |
| Piston Ring to Groove<br>Clearance (max)          | (1st)<br>(2nd)           | 0.180 mm<br>(0.0071 in.)<br>0.150 mm<br>(0.0059 in.)                                                              |
| Piston Ring Groove<br>Width                       | (1st)<br>(2nd)<br>(oil)  | 1.01-1.03 mm<br>(0.0398-0.0406 in.)<br>1.01-1.03 mm<br>(0.0398-0.0406 in.)<br>2.01-2.03 mm<br>(0.0791-0.0799 in.) |
| Piston Ring Thickness                             | (1st)<br>(2nd)           | 0.97-0.99 mm<br>(0.0381-0.0389 in.)<br>0.97-0.99 mm<br>(0.0381-0.0389 in.)                                        |
| Piston Pin Bore                                   | (max)                    | 20.03 mm (0.789 in.)                                                                                              |
| Piston Pin Outside<br>Diameter                    | (min)                    | 19.98 mm (0.787 in.)                                                                                              |

#### CRANKSHAFT

|                                                       |                          |                                            |
|-------------------------------------------------------|--------------------------|--------------------------------------------|
| Connecting Rod<br>(small end inside diameter)         | (max)                    | 20.04 mm<br>(0.7889 in.)                   |
| Connecting Rod<br>(big end side-to-side)              |                          | 0.10-0.55 mm<br>(0.004-0.022 in.)          |
| Connecting Rod<br>(big end width)                     |                          | 21.95-22.00 mm<br>(0.8642-0.8661 in.)      |
| Connecting Rod<br>(small end deflection)              | (max)                    | 3 mm (0.12 in.)                            |
| Crankshaft (web-to-web)                               |                          | 59.9-60.1 mm<br>(2.358-2.366 in.)          |
| Crankshaft Runout (max)                               |                          | 0.08 mm (0.003 in.)                        |
| Oil Pressure at 60°C<br>(140°F) @ 3000 RPM            | (above)<br>(below)       | 1.1 kg/cm² (16 psi)<br>1.5 kg/cm² (21 psi) |
| Cooling Fan<br>Thermo-Switch<br>Operating Temperature | (off → on)<br>(on → off) | 120°C (248°F)<br>110°C (230°F)             |
| Engine Oil<br>Thermo-Switch<br>Operating Temperature  | (off → on)<br>(on → off) | 160°C (320°F)<br>140°C (284°F)             |

\* Specifications subject to change without notice.



## Specifications\*

### (400 - Manual Transmission)

#### VALVES AND GUIDES

|                                                             |                                        |                                                                                |
|-------------------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------|
| Valve Face Diameter                                         | (intake)<br>(exhaust)                  | 30.6 mm (1.20 in.)<br>27.0 mm (1.06 in.)                                       |
| Valve/Tappet Clearance                                      | (intake)<br>(cold engine)<br>(exhaust) | 0.05-0.10 mm<br>(0.002-0.004 in.)<br>0.22-0.27 mm<br>(0.009-0.011 in.)         |
| Valve Guide/<br>Stem Clearance                              | (intake)<br>(exhaust)                  | 0.010-0.037 mm<br>(0.0004-0.0015 in.)<br>0.030-0.057 mm<br>(0.0012-0.0022 in.) |
| Valve Guide/Valve<br>Stem Deflection<br>(wobble deflection) | (max)                                  | 0.35 mm (0.014 in.)                                                            |
| Valve Guide Inside Diameter                                 |                                        | 5.000-5.012 mm<br>(0.1969-0.1973 in.)                                          |
| Valve Stem Outside<br>Diameter                              | (intake)<br>(exhaust)                  | 4.975-4.990 mm<br>(0.1959-0.1965 in.)<br>4.955-4.970 mm<br>(0.1951-0.1957 in.) |
| Valve Stem Runout                                           | (max)                                  | 0.05 mm (0.002 in.)                                                            |
| Valve Head Thickness                                        | (min)                                  | 0.5 mm (0.02 in.)                                                              |
| Valve Stem End<br>Length                                    | (min)                                  | 2.3 mm (0.09 in.)                                                              |
| Valve Face/Seat Width                                       |                                        | 0.9-1.1 mm (0.035-0.043 in.)                                                   |
| Valve Seat Angle                                            | (intake)<br>(exhaust)                  | 45°<br>45°                                                                     |
| Valve Face Radial<br>Runout                                 | (max)                                  | 0.03 mm (0.001 in.)                                                            |
| Valve Spring Free<br>Length (min)                           |                                        | 38.8 mm (1.53 in.)                                                             |
| Valve Spring Tension<br>@ 32.5 mm (1.28 in.)                | (outer)                                | 18.6-21.4 kg (41-47 lb)                                                        |

#### CAMSHAFT AND CYLINDER HEAD

|                                      |                                |                                                                                    |
|--------------------------------------|--------------------------------|------------------------------------------------------------------------------------|
| Cam Lobe Height                      | (intake)<br>(min)<br>(exhaust) | 32.830 mm (1.293 in.)<br>32.830 mm (1.293 in.)                                     |
| Camshaft Journal<br>Oil Clearance    | (max)                          | 0.15 mm (0.0059 in.)                                                               |
| Camshaft Journal<br>Holder Inside    | (right & center)<br>(left)     | 22.012-22.025 mm<br>(0.8666-0.8671 in.)<br>17.512-17.525 mm<br>(0.6894-0.6900 in.) |
| Camshaft Journal<br>Outside Diameter | (right & center)<br>(left)     | 21.959-21.980 mm<br>(0.8645-0.8654 in.)<br>17.466-17.484 mm<br>(0.6876-0.6883 in.) |
| Camshaft Runout                      | (max)                          | 0.10 mm (0.004 in.)                                                                |
| Rocker Arm Inside<br>Diameter        |                                | 12.000-12.018 mm<br>(0.472-0.473 in.)                                              |
| Rocker Arm Shaft Outside Diameter    |                                | 11.973-11.984 mm<br>(0.4714-0.4718 in.)                                            |
| Cylinder Head Dis-<br>tortion        | (max)                          | 0.05 mm (0.002 in.)                                                                |
| Cylinder Head<br>Cover Distortion    | (max)                          | 0.05 mm (0.002 in.)                                                                |

#### CYLINDER, PISTON, AND RINGS

|                                                   |                          |                                                                                                                   |
|---------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------|
| Piston Skirt/Cylinder<br>Clearance                |                          | 0.060-0.073 mm<br>(0.0024-0.0029 in.)                                                                             |
| Cylinder Bore                                     |                          | 82.000-82.015 mm<br>(3.2283-3.2289 in.)                                                                           |
| Piston Diameter<br>15 mm (0.6 in.) from Skirt End |                          | 81.930-81.945 mm<br>(3.2256-3.2262 in.)                                                                           |
| Piston Ring<br>Free End Gap (min)                 | (1st Ring)<br>(2nd Ring) | 8.9 mm<br>(0.3504 in.)<br>8.3 mm<br>(0.3268 in.)                                                                  |
| Bore x Stroke                                     |                          | 82 x 71.2 mm<br>(3.29 x 2.80 in.)                                                                                 |
| Cylinder Trueness                                 | (max)                    | 0.05 mm (0.002 in.)                                                                                               |
| Piston Ring End Gap -<br>Installed                |                          | 0.33-0.61 mm<br>(0.013-0.024 in.)                                                                                 |
| Piston Ring to Groove<br>Clearance (max)          | (1st)<br>(2nd)           | 0.180 mm<br>(0.0071 in.)<br>0.150 mm<br>(0.0059 in.)                                                              |
| Piston Ring Groove Width                          | (1st)<br>(2nd)<br>(oil)  | 1.01-1.03 mm<br>(0.0398-0.0406 in.)<br>1.01-1.03 mm<br>(0.0398-0.0406 in.)<br>2.01-2.03 mm<br>(0.0791-0.0799 in.) |
| Piston Ring Thickness                             | (1st)<br>(2nd)           | 0.97-0.99 mm<br>(0.0381-0.0389 in.)<br>0.97-0.99 mm<br>(0.0381-0.0389 in.)                                        |
| Piston Pin Bore                                   | (max)                    | 20.03 mm (0.789 in.)                                                                                              |
| Piston Pin Outside Diam-<br>eter                  | (min)                    | 19.98 mm (0.787 in.)                                                                                              |

#### CRANKSHAFT

|                                                       |                          |                                           |
|-------------------------------------------------------|--------------------------|-------------------------------------------|
| Connecting Rod<br>(small end inside diameter)         | (max)                    | 20.04 mm<br>(0.7889 in.)                  |
| Connecting Rod<br>(big end side-to-side)              |                          | 0.10-0.55 mm<br>(0.004-0.022 in.)         |
| Connecting Rod<br>(big end width)                     |                          | 21.95-22.00 mm<br>(0.8642-0.8661 in.)     |
| Connecting Rod<br>(small end deflection)              | (max)                    | 3 mm (0.12 in.)                           |
| Crankshaft (web-to-web)                               |                          | 59.9-60.1 mm<br>(2.358-2.366 in.)         |
| Crankshaft Runout (max)                               |                          | 0.08 mm (0.003 in.)                       |
| Oil Pressure at 60°C<br>(140°F) @ 3000 RPM            | (above)<br>(below)       | 0.6 kg/cm² (9 psi)<br>1.0 kg/cm² (14 psi) |
| Cooling Fan<br>Thermo-Switch<br>Operating Temperature | (off → on)<br>(on → off) | 120°C (248°F)<br>110°C (230°F)            |
| Engine Oil<br>Thermo-Switch<br>Operating Temperature  | (off → on)<br>(on → off) | 160°C (320°F)<br>140°C (284°F)            |

| CLUTCH                                                       |                                                                 |                                                                                                                 |
|--------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Clutch Release Screw                                         |                                                                 | 1/8 turn back                                                                                                   |
| Drive Plate (fiber) Thick-<br>ness                           | (min)                                                           | 2.62 mm (0.103 in.)                                                                                             |
| Drive Plate (fiber) Tab                                      |                                                                 | 13.25-13.95 mm<br>(0.52-0.55 in.)                                                                               |
| Driven Plate (warpage)                                       | (max)                                                           | 0.1 mm (0.004 in.)                                                                                              |
| Clutch Spring Length                                         | (min)                                                           | 33.7 mm (1.33 in.)                                                                                              |
| Clutch Wheel<br>Inside Diameter                              |                                                                 | 140.0-140.2 mm<br>(5.511-5.520 in.)                                                                             |
| Starter Clutch Shoe                                          |                                                                 | No groove at any part                                                                                           |
| Clutch Engagement                                            | RPM                                                             | 1700 ± 200                                                                                                      |
| Clutch Lock-Up                                               | RPM                                                             | 3400 - 4000                                                                                                     |
| Primary Reduction Ratio                                      |                                                                 | 2.392 (67/28)                                                                                                   |
| Secondary Reduction<br>Ratio                                 |                                                                 | 1.133 (17/15)                                                                                                   |
| Final Reduction Ratio                                        | (front)<br>(rear)                                               | 3.6 (36/10)<br>3.6 (36/10)                                                                                      |
| Secondary - Transmission<br>Reduction Ratio                  | (low)<br>(high)                                                 | 2.435 (35/13 x 19/21)<br>1.296 (35/27)                                                                          |
| Gear Ratios                                                  | (1st)<br>(2nd)<br>(3rd)<br>(4th)<br>(5th)<br>(reverse)          | 3.083 (37/12)<br>1.933 (29/15)<br>1.388 (25/18)<br>1.095 (23/21)<br>0.913 (21/23)<br>2.833 (34/12)              |
| Engine Fork to Groove<br>(side clearance)                    |                                                                 | 0.1-0.3 mm<br>(0.004-0.012 in.)                                                                                 |
| Secondary Transmission<br>Fork to Groove (side<br>clearance) |                                                                 | 0.1-0.3 mm<br>(0.004-0.012 in.)                                                                                 |
| Reverse Fork to Groove<br>(side clearance)                   |                                                                 | 0.1-0.3 mm<br>(0.004-0.012 in.)                                                                                 |
| Shift Fork Groove Width                                      | (#1 and<br>#2)<br><br>(secondary transmission)<br><br>(reverse) | 4.5-4.6 mm<br>(0.177-0.181 in.)<br><br>5.45-5.55 mm<br>(0.215-0.219 in.)<br><br>4.0-4.1 mm<br>(0.157-0.161 in.) |
| Shift Fork Thickness                                         | (#1 and<br>#2)<br><br>(secondary transmission)<br><br>(reverse) | 4.3-4.4 mm<br>(0.169-0.173 in.)<br><br>5.3-5.4 mm<br>(0.209-0.213 in.)<br><br>3.8-3.9 mm<br>(0.150-0.154 in.)   |

\* Specifications subject to change without notice.

## Specifications\*

### (500 - Automatic Transmission)

#### VALVES AND GUIDES

|                                                             |                       |                                                                                |
|-------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------|
| Valve Face Diameter                                         | (intake)<br>(exhaust) | 30.6 mm (1.20 in.)<br>27.0 mm (1.06 in.)                                       |
| Valve/Tappet Clearance<br>(cold engine)                     | (intake)<br>(exhaust) | 0.05-0.10 mm<br>(0.002-0.004 in.)<br>0.17-0.22 mm<br>(0.007-0.009 in.)         |
| Valve Guide/<br>Stem Clearance                              | (intake)<br>(exhaust) | 0.010-0.037 mm<br>(0.0004-0.0015 in.)<br>0.030-0.057 mm<br>(0.0012-0.0022 in.) |
| Valve Guide/Valve<br>Stem Deflection<br>(wobble deflection) | (max)                 | 0.35 mm (0.014 in.)                                                            |
| Valve Guide Inside Diameter                                 |                       | 5.000-5.012 mm<br>(0.1969-0.1973 in.)                                          |
| Valve Stem Outside<br>Diameter                              | (intake)<br>(exhaust) | 4.975-4.990 mm<br>(0.1959-0.1965 in.)<br>4.955-4.970 mm<br>(0.1951-0.1957 in.) |
| Valve Stem Runout                                           | (max)                 | 0.05 mm (0.002 in.)                                                            |
| Valve Head Thickness                                        | (min)                 | 0.5 mm (0.02 in.)                                                              |
| Valve Stem End Length                                       | (min)                 | 2.3 mm (0.09 in.)                                                              |
| Valve Face/Seat Width                                       |                       | 0.9-1.1 mm<br>(0.035-0.043 in.)                                                |
| Valve Seat Angle                                            | (intake)<br>(exhaust) | 45°<br>45°                                                                     |
| Valve Face Radial<br>Runout                                 | (max)                 | 0.03 mm (0.001 in.)                                                            |
| Valve Spring Free<br>Length (min)                           |                       | 38.8 mm (1.53 in.)                                                             |
| Valve Spring Tension<br>@ 31.5 mm (1.24 in.)                | (outer)               | 18.6-21.4 kg (41-47 lb)                                                        |

#### CAMSHAFT AND CYLINDER HEAD

|                                      |                            |                                                                                    |
|--------------------------------------|----------------------------|------------------------------------------------------------------------------------|
| Cam Lobe Height<br>(min)             | (intake)<br>(exhaust)      | 33.13 mm (1.304 in.)<br>33.20 mm (1.307 in.)                                       |
| Camshaft Journal Oil<br>Clearance    | (max)                      | 0.15 mm (0.0059 in.)                                                               |
| Camshaft Journal<br>Holder Inside    | (right & center)<br>(left) | 22.012-22.025 mm<br>(0.8666-0.8671 in.)<br>17.512-17.525 mm<br>(0.6894-0.6900 in.) |
| Camshaft Journal<br>Outside Diameter | (right & center)<br>(left) | 21.959-21.980 mm<br>(0.8645-0.8654 in.)<br>17.466-17.484 mm<br>(0.6876-0.6883 in.) |
| Camshaft Runout                      | (max)                      | 0.10 mm (0.004 in.)                                                                |
| Rocker Arm Inside<br>Diameter        |                            | 12.000-12.018 mm<br>(0.472-0.473 in.)                                              |
| Rocker Arm Shaft Outside Diameter    |                            | 11.973-11.984 mm<br>(0.4714-0.4718 in.)                                            |
| Cylinder Head Dis-<br>tortion        | (max)                      | 0.05 mm (0.002 in.)                                                                |
| Cylinder Head Cover<br>Distortion    | (max)                      | 0.05 mm (0.002 in.)                                                                |

#### CYLINDER, PISTON, AND RINGS

|                                                   |                          |                                                                                                                   |
|---------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------|
| Piston Skirt/Cylinder<br>Clearance                |                          | 0.030-0.040 mm<br>(0.0011-0.0015 in.)                                                                             |
| Cylinder Bore                                     |                          | 87.500-87.515 mm<br>(3.4448-3.4454 in.)                                                                           |
| Piston Diameter<br>15 mm (0.6 in.) from Skirt End |                          | 87.465-87.480 mm<br>(3.4435-3.4440 in.)                                                                           |
| Piston Ring<br>Free End Gap (min)                 | (1st Ring)<br>(2nd Ring) | 9.0 mm<br>(0.35 in.)<br>9.5 mm<br>(0.37 in.)                                                                      |
| Bore x Stroke                                     |                          | 87.5 x 82 mm<br>(3.40 x 3.22 in.)                                                                                 |
| Cylinder Trueness                                 | (max)                    | 0.05 mm (0.002 in.)                                                                                               |
| Piston Ring End Gap -<br>Installed                |                          | 0.35-0.63 mm<br>(0.014-0.025 in.)                                                                                 |
| Piston Ring to Groove<br>Clearance (max)          | (1st)<br>(2nd)           | 0.180 mm<br>(0.0071 in.)<br>0.150 mm<br>(0.0059 in.)                                                              |
| Piston Ring Groove Width                          | (1st)<br>(2nd)<br>(oil)  | 1.01-1.03 mm<br>(0.0398-0.0406 in.)<br>1.21-1.23 mm<br>(0.0476-0.0484 in.)<br>2.51-2.53 mm<br>(0.0988-0.0996 in.) |
| Piston Ring Thickness                             | (1st)<br>(2nd)           | 0.97-0.99 mm<br>(0.0382-0.0389 in.)<br>1.17-1.19 mm<br>(0.046-0.047 in.)                                          |
| Piston Pin Bore                                   | (max)                    | 23.03 mm (0.907 in.)                                                                                              |
| Piston Pin Outside Diam-<br>eter                  | (min)                    | 22.98 mm (0.905 in.)                                                                                              |

#### CRANKSHAFT

|                                                          |                                      |                                            |
|----------------------------------------------------------|--------------------------------------|--------------------------------------------|
| Connecting Rod<br>(small end inside diameter)            | (max)                                | 23.04 mm<br>(0.9070 in.)                   |
| Connecting Rod<br>(big end side-to-side)                 |                                      | 0.10-0.65 mm<br>(0.0039-0.0256 in.)        |
| Connecting Rod<br>(big end width)                        |                                      | 24.95-25.00 mm<br>(0.9822-0.9842 in.)      |
| Connecting Rod<br>(small end deflection)                 | (max)                                | 3 mm (0.12 in.)                            |
| Crankshaft (web-to-web)                                  |                                      | 70.9-70.1 mm<br>(2.796-2.804 in.)          |
| Crankshaft Runout (max)                                  |                                      | 0.08 mm (0.003 in.)                        |
| Oil Pressure at 60°C<br>(140°F) @ 3000 RPM               | (above)<br>(below)                   | 1.3 kg/cm² (18 psi)<br>1.7 kg/cm² (24 psi) |
| Cooling Fan<br>Thermo-Switch<br>Operating Temperature    | (off → on)<br>(on → off)             | 88°C (190°F)<br>82°C (180°F) (min)         |
| Engine Coolant<br>Thermo-Switch<br>Operating Temperature | (off → on)<br>(on → off)<br>(Approx) | 115°C (239°F)<br>108°C (226°F)             |

\* Specifications subject to change without notice.

## Specifications\*

### (500 - Manual Transmission)

#### VALVES AND GUIDES

|                                                             |                       |                                                                                |
|-------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------|
| Valve Face Diameter                                         | (intake)<br>(exhaust) | 30.6 mm (1.20 in.)<br>27.0 mm (1.06 in.)                                       |
| Valve/Tappet Clearance<br>(cold engine)                     | (intake)<br>(exhaust) | 0.05-0.10 mm<br>(0.002-0.004 in.)<br>0.17-0.22 mm<br>(0.007-0.009 in.)         |
| Valve Guide/<br>Stem Clearance                              | (intake)<br>(exhaust) | 0.010-0.037 mm<br>(0.0004-0.0015 in.)<br>0.030-0.057 mm<br>(0.0012-0.0022 in.) |
| Valve Guide/Valve<br>Stem Deflection<br>(wobble deflection) | (max)                 | 0.35 mm (0.014 in.)                                                            |
| Valve Guide Inside Diameter                                 |                       | 5.000-5.012 mm<br>(0.1969-0.1973 in.)                                          |
| Valve Stem Outside Diameter                                 | (intake)<br>(exhaust) | 4.975-4.990 mm<br>(0.1959-0.1965 in.)<br>4.955-4.970 mm<br>(0.1951-0.1957 in.) |
| Valve Stem Runout                                           | (max)                 | 0.05 mm (0.002 in.)                                                            |
| Valve Head Thickness                                        | (min)                 | 0.5 mm (0.02 in.)                                                              |
| Valve Stem End Length                                       | (min)                 | 1.7 mm (0.067 in.)                                                             |
| Valve Face/Seat Width                                       |                       | 0.9-1.1 mm<br>(0.035-0.043 in.)                                                |
| Valve Seat Angle                                            | (intake)<br>(exhaust) | 45°<br>45°                                                                     |
| Valve Face Radial Runout                                    | (max)                 | 0.03 mm (0.001 in.)                                                            |
| Valve Spring Free Length<br>(min)                           |                       | 38.8 mm (1.53 in.)                                                             |
| Valve Spring Tension<br>@ 31.5 mm (1.24 in.)                | (outer)               | 18.2-21.0 kg<br>(40.1-46.3 lb)                                                 |

#### CAMSHAFT AND CYLINDER HEAD

|                                      |                            |                                                                                    |
|--------------------------------------|----------------------------|------------------------------------------------------------------------------------|
| Cam Lobe Height<br>(min)             | (intake)<br>(exhaust)      | 33.13 mm (1.304 in.)<br>33.20 mm (1.307 in.)                                       |
| Camshaft Journal Oil<br>Clearance    | (max)                      | 0.15 mm (0.0059 in.)                                                               |
| Camshaft Journal<br>Holder Inside    | (right & center)<br>(left) | 22.012-22.025 mm<br>(0.8666-0.8671 in.)<br>17.512-17.525 mm<br>(0.6894-0.6900 in.) |
| Camshaft Journal<br>Outside Diameter | (right & center)<br>(left) | 21.959-21.980 mm<br>(0.8645-0.8654 in.)<br>17.466-17.484 mm<br>(0.6876-0.6883 in.) |
| Camshaft Runout                      | (max)                      | 0.10 mm (0.004 in.)                                                                |
| Rocker Arm Inside<br>Diameter        |                            | 12.000-12.018 mm<br>(0.472-0.473 in.)                                              |
| Rocker Arm Shaft Outside Diameter    |                            | 11.973-11.984 mm<br>(0.4714-0.4718 in.)                                            |
| Cylinder Head Dis-<br>tortion        | (max)                      | 0.05 mm (0.002 in.)                                                                |
| Cylinder Head Cover<br>Distortion    | (max)                      | 0.05 mm (0.002 in.)                                                                |

#### CYLINDER, PISTON, AND RINGS

|                                                   |                          |                                                                                                                   |
|---------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------|
| Piston Skirt/Cylinder<br>Clearance                |                          | 0.030-0.040 mm<br>(0.0011-0.0015 in.)                                                                             |
| Cylinder Bore                                     |                          | 87.500-87.515 mm<br>(3.4448-3.4454 in.)                                                                           |
| Piston Diameter<br>15 mm (0.6 in.) from Skirt End |                          | 87.465-87.480 mm<br>(3.4435-3.4440 in.)                                                                           |
| Piston Ring<br>Free End Gap (min)                 | (1st Ring)<br>(2nd Ring) | 9.0 mm<br>(0.35 in.)<br>9.5 mm<br>(0.37 in.)                                                                      |
| Bore x Stroke                                     |                          | 87.5 x 82 mm<br>(3.40 x 3.22 in.)                                                                                 |
| Cylinder Trueness                                 | (max)                    | 0.05 mm (0.002 in.)                                                                                               |
| Piston Ring End Gap -<br>Installed                |                          | 0.35-0.63 mm<br>(0.014-0.025 in.)                                                                                 |
| Piston Ring to Groove<br>Clearance (max)          | (1st)<br>(2nd)           | 0.180 mm<br>(0.0071 in.)<br>0.150 mm<br>(0.0059 in.)                                                              |
| Piston Ring Groove Width                          | (1st)<br>(2nd)<br>(oil)  | 1.01-1.03 mm<br>(0.0398-0.0406 in.)<br>1.21-1.23 mm<br>(0.0476-0.0484 in.)<br>2.51-2.53 mm<br>(0.0988-0.0996 in.) |
| Piston Ring Thickness                             | (1st)<br>(2nd)           | 0.97-0.99 mm<br>(0.0382-0.0389 in.)<br>1.17-1.19 mm<br>(0.046-0.047 in.)                                          |
| Piston Pin Bore                                   | (max)                    | 23.03 mm (0.907 in.)                                                                                              |
| Piston Pin Outside Diam-<br>eter                  | (min)                    | 22.98 mm (0.905 in.)                                                                                              |

#### CRANKSHAFT

|                                               |                    |                                            |
|-----------------------------------------------|--------------------|--------------------------------------------|
| Connecting Rod<br>(small end inside diameter) | (max)              | 23.04 mm<br>(0.9070 in.)                   |
| Connecting Rod<br>(big end side-to-side)      |                    | 0.10-0.65 mm<br>(0.0039-0.0256 in.)        |
| Connecting Rod<br>(big end width)             |                    | 24.95-25.00 mm<br>(0.9822-0.9842 in.)      |
| Connecting Rod<br>(small end deflection)      | (max)              | 3 mm (0.12 in.)                            |
| Crankshaft (web-to-web)                       |                    | 70.9-70.1 mm<br>(2.796-2.804 in.)          |
| Crankshaft Runout (max)                       |                    | 0.08 mm (0.003 in.)                        |
| Oil Pressure at 60°C<br>(140°F) @ 3000 RPM    | (above)<br>(below) | 1.2 kg/cm² (17 psi)<br>1.6 kg/cm² (23 psi) |

3



| CLUTCH                                                 |                                                              |                                                                                                        |
|--------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Clutch Release Screw                                   |                                                              | 1/4-1/2 turn back                                                                                      |
| Drive Plate (fiber) Thickness                          | (min)                                                        | 2.82 mm (0.1110 in.)                                                                                   |
| Drive Plate (fiber) Tab                                | (min)                                                        | 2.9 mm (0.507 in.)                                                                                     |
| Driven Plate (warpage)                                 | (max)                                                        | 0.1 mm (0.004 in.)                                                                                     |
| Clutch Spring Length                                   | (min)                                                        | 35.6 mm (1.40 in.)                                                                                     |
| Clutch Wheel Inside Diameter                           |                                                              | 140.0-140.2 mm (5.511-5.520 in.)                                                                       |
| Starter Clutch Shoe                                    |                                                              | No groove at any part                                                                                  |
| Clutch Engagement                                      | RPM                                                          | 1700 ± 200                                                                                             |
| Clutch Lock-Up                                         | RPM                                                          | 3700 ± 300                                                                                             |
| Primary Reduction Ratio                                |                                                              | 2.032 (63/31)                                                                                          |
| Secondary Reduction Ratio                              |                                                              | 1.133 (17/15)                                                                                          |
| Final Reduction Ratio                                  | (front)<br>(rear)                                            | 3.6 (36/10)<br>3.6 (36/10)                                                                             |
| Secondary - Transmission Reduction Ratio               | (low)<br><br>(high)                                          | 2.419 (22/23 x 27/17 x 43/27)<br>1.592 (43/27)                                                         |
| Gear Ratios                                            | (1st)<br>(2nd)<br>(3rd)<br>(4th)<br>(5th)<br>(reverse)       | 3.09 (34/11)<br>1.75 (28/16)<br>1.2 (24/20)<br>0.875 (21/24)<br>0.724 (21/29)<br>2.636 (24/11 x 29/24) |
| Engine Fork to Groove (side clearance)                 |                                                              | 0.1-0.3 mm (0.004-0.012 in.)                                                                           |
| Secondary Transmission Fork to Groove (side clearance) |                                                              | 0.1-0.3 mm (0.004-0.012 in.)                                                                           |
| Reverse Fork to Groove (side clearance)                |                                                              | 0.1-0.3 mm (0.004-0.012 in.)                                                                           |
| Shift Fork Groove Width                                | (#1 and #2)<br><br>(secondary transmission)<br><br>(reverse) | 5.5-5.6 mm (0.217-0.220 in.)<br>5.5-5.6 mm (0.217-0.220 in.)<br>5.0-5.1 mm (0.197-0.201 in.)           |
| Shift Fork Thickness                                   | (#1 and #2)<br><br>(secondary transmission)<br><br>(reverse) | 5.3-5.4 mm (0.209-0.213 in.)<br>5.3-5.4 mm (0.209-0.213 in.)<br>4.8-4.9 mm (0.189-0.193 in.)           |
| Thermostat Valve Opening Temperature                   |                                                              | 73.5-76.5°C (164-170°F)                                                                                |
| Thermostat Valve Lift                                  |                                                              | Over 3 mm (0.12 in.) @ 90°C (194°F)                                                                    |
| Cooling Fan Thermo-Switch Operating Temperature        | (off → on)<br>(on → off)                                     | 88°C (190°F)<br>82°C (180°F) (min)                                                                     |
| Engine Coolant Thermo-Switch Operating Temperature     | (off → on)<br>(on → off)<br>(Approx)                         | 115°C (239°F)<br>108°C (226°F)                                                                         |

\* Specifications subject to change without notice.

## Specifications\*

### (650 H1)

#### VALVES AND GUIDES

|                                                         |                       |                                                                                |
|---------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------|
| Valve Face Diameter                                     | (intake)<br>(exhaust) | 31.6 mm (1.24 in.)<br>27.9 mm (1.10 in.)                                       |
| Valve/Tappet Clearance<br>(cold engine)                 | (intake)<br>(exhaust) | 0.1016 mm (0.004 in.)<br>0.1524 mm (0.006 in.)                                 |
| Valve Guide/Stem<br>Clearance                           | (intake)<br>(exhaust) | 0.013 mm<br>(0.0005 in.)<br>0.013 mm<br>(0.0005 in.)                           |
| Valve Guide/Valve<br>Stem Deflection<br>(wobble method) | (max)                 | 0.35 mm (0.014 in.)                                                            |
| Valve Guide Inside Diameter                             |                       | 5.000-5.012 mm<br>(0.1969-0.1973 in.)                                          |
| Valve Stem Outside<br>Diameter                          | (intake)<br>(exhaust) | 4.972-4.987 mm<br>(0.1957-0.1963 in.)<br>4.972-4.987 mm<br>(0.1957-0.1963 in.) |
| Valve Stem Runout                                       | (max)                 | 0.1 mm (0.0039 in.)                                                            |
| Valve Head Thickness                                    | (min)                 | 2.3 mm (0.0906 in.)                                                            |
| Valve Stem End Length                                   | (min)                 | 3.97 mm (0.156 in.)                                                            |
| Valve Face/Seat Width                                   | (intake)<br>(exhaust) | 2.25 mm (0.0886 in.)<br>2.60 mm (0.1024 in.)                                   |
| Valve Seat Angle                                        | (intake)<br>(exhaust) | 45° 15'-45° 30'<br>45° 15'-45° 30'                                             |
| Valve Face Radial Runout                                | (max)                 | 0.2 mm (0.0079 in.)                                                            |
| Valve Spring Free<br>Length                             | (min)                 | 38.7 mm (1.524 in.)                                                            |
| Valve Spring Tension<br>@ 31.5 mm (1.24 in.)            | (outer)               | 19.0 kg (42 lb)                                                                |

#### CAMSHAFT AND CYLINDER HEAD

|                                               |                            |                                                                                |
|-----------------------------------------------|----------------------------|--------------------------------------------------------------------------------|
| Cam Lobe Height (min)                         | (intake)<br>(exhaust)      | 13.97 mm (0.55 in.)<br>13.97 mm (0.55 in.)                                     |
| Camshaft Journal Oil<br>Clearance             | (max)                      | 0.04 mm (0.0016 in.)                                                           |
| Camshaft Journal<br>Holder Inside<br>Diameter | (right & center)<br>(left) | 21.98-22.04 mm<br>(0.8654-0.8677 in.)<br>17.48-17.53 mm<br>(0.6882-0.6902 in.) |
| Camshaft Journal<br>Outside Diameter          | (right & center)<br>(left) | 21.96-21.98 mm<br>(0.8646-0.8654 in.)<br>17.47-17.48 mm<br>(0.6878-0.6882 in.) |
| Camshaft Runout                               | (max)                      | 0.05 mm (0.002 in.)                                                            |
| Rocker Arm Inside Diameter                    |                            | 12.000-12.018 mm<br>(0.4724-0.4731 in.)                                        |
| Rocker Arm Shaft Outside<br>Diameter          |                            | 11.97-11.98 mm<br>(0.4713-0.4717 in.)                                          |
| Cylinder Head Distortion                      | (max)                      | 0.05 mm (0.002 in.)                                                            |
| Cylinder Head Cover<br>Distortion             | (max)                      | 0.05 mm (0.002 in.)                                                            |

#### CYLINDER, PISTON, AND RINGS

|                                          |                         |                                                                                                                       |
|------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Piston Skirt/Cylinder Clearance          |                         | 0.045 mm (0.0018 in.)                                                                                                 |
| Cylinder Bore                            |                         | 98 mm (3.858 in.)                                                                                                     |
| Piston Diameter                          |                         | 97.948-97.962 mm<br>(3.856-3.857 in.)                                                                                 |
| Piston Ring                              | (1st ring)              | 12.5 mm (0.492 in.)                                                                                                   |
| Free End Gap                             | (2nd ring)              | 12.5 mm (0.492 in.)                                                                                                   |
| Bore x Stroke                            |                         | 97.9 x 85 mm<br>(3.86 x 3.35 in.)                                                                                     |
| Cylinder Trueness                        | (max)                   | 0.01 mm (0.004 in.)                                                                                                   |
| Piston Ring End Gap<br>- Installed       |                         | 0.36 mm (0.014 in.)                                                                                                   |
| Piston Ring to Groove<br>Clearance (max) | (1st)<br>(2nd)          | 0.03 mm<br>(0.0012 in.)<br>0.03 mm<br>(0.0012 in.)                                                                    |
| Piston Ring Groove<br>Width              | (1st)<br>(2nd)<br>(oil) | 1.202-1.204 mm<br>(0.0473-0.0474 in.)<br>1.202-1.204 mm<br>(0.0473-0.0474 in.)<br>2.01-2.03 mm<br>(0.0791-0.0799 in.) |
| Piston Ring Thickness                    | (1st)<br>(2nd)          | 1.970-1.990 mm<br>(0.0776-0.0783 in.)<br>1.970-1.990 mm<br>(0.0776-0.0783 in.)                                        |
| Piston Pin Bore                          | (max)                   | 23.0 mm (0.9055 in.)                                                                                                  |
| Piston Pin Outside<br>Diameter           | (min)                   | 22.99 mm (0.9051 in.)                                                                                                 |

#### CRANKSHAFT

|                                                             |          |                                 |
|-------------------------------------------------------------|----------|---------------------------------|
| Connecting Rod<br>(small end inside diameter)               | (max)    | 23.021 mm<br>(0.9063 in.)       |
| Connecting Rod<br>(big end side-to-side)                    |          | 0.6 mm (0.024 in.)              |
| Connecting Rod (big end width)                              |          | 25 mm (0.9843 in.)              |
| Connecting Rod @ 150 mm (5.9 in.)<br>(small end deflection) | (max)    | 0.3 mm (0.0118 in.)             |
| Crankshaft (web-to-web)                                     |          | 71 mm (2.79 in.)                |
| Crankshaft Runout                                           | (max)    | 0.03 mm (0.0012 in.)            |
| Oil Pressure at 60°C<br>(140°F) @ 3000 RPM                  |          | 1.40-2.46 kg/cm²<br>(20-35 psi) |
| Cooling Fan                                                 | (off→on) | 90°C (194°F)                    |
| Thermo-Switch                                               | (on→off) | 75°C (167°F)                    |
| Operating Temperature                                       |          |                                 |
| Engine Coolant                                              | (off→on) | 115°C (239°F)                   |
| Thermo-Switch                                               | (on→off) | 108°C (226°F)                   |
| Operating Temperature                                       | (Approx) |                                 |

\* Specifications subject to change without notice.

## Specifications\*

### (650 V-Twin)

#### VALVES AND GUIDES

|                                                      |           |                                       |
|------------------------------------------------------|-----------|---------------------------------------|
| Valve Face Diameter                                  | (intake)  | 29.4-29.6 mm<br>(1.157-1.165 in.)     |
|                                                      | (exhaust) | 25.2-25.4 mm<br>(0.992-1.000 in.)     |
| Valve/Tappet Clearance<br>(cold engine)              | (intake)  | 0.10-0.15 mm<br>(0.0039-0.0059 in.)   |
|                                                      | (exhaust) | 0.20-0.25 mm<br>(0.0079-0.0098 in.)   |
| Valve Guide/Valve Stem<br>Deflection (wobble method) | (intake)  | 0.03-0.11 mm<br>(0.0012-0.0043 in.)   |
|                                                      | (exhaust) | 0.09-0.17 mm<br>(0.0035-0.0067 in.)   |
| Valve Guide Inside Diameter                          |           | 5.000-5.012 mm<br>(0.1969-0.1973 in.) |
| Valve Stem Outside Diameter                          | (intake)  | 4.975-4.990 mm<br>(0.1959-0.1965 in.) |
|                                                      | (exhaust) | 4.955-4.970 mm<br>(0.1951-0.1957 in.) |
| Valve Stem Runout                                    | (max)     | 0.05 mm (0.002 in.)                   |
| Valve Head Thickness<br>(min)                        | (intake)  | 0.5 mm (0.020 in.)                    |
|                                                      | (exhaust) | 0.8 mm (0.031 in.)                    |
| Valve Face/Seat Width                                |           | 0.5-1.0 mm<br>(0.020-0.040 in.)       |
| Valve Seat Angle                                     | (intake)  | 45°/32°/60°                           |
|                                                      | (exhaust) | 45°/32°/60°                           |
| Valve Spring Free Length<br>(min)                    | (min)     | 41.3 mm (1.63 in.)                    |

#### CAMSHAFT AND CYLINDER HEAD

|                                            |                |                                         |
|--------------------------------------------|----------------|-----------------------------------------|
| Cam Lobe Height                            | (intake)       | 35.52 mm<br>(1.398 in.)                 |
|                                            | (exhaust)      | 35.26 mm<br>(1.388 in.)                 |
| Camshaft Journal Oil<br>Clearance          | 22 mm<br>(max) | 0.15 mm<br>(0.0059 in.)                 |
|                                            | 18 mm<br>(max) | 0.14 mm (0.0055 in.)                    |
| Camshaft Journal Holder<br>Inside Diameter | 22 mm          | 22.000-22.026 mm<br>(0.8661-0.8670 in.) |
|                                            | 18 mm          | 18.000-18.018 mm<br>(0.7087-0.7094 in.) |
| Camshaft Journal<br>Outside Diameter       | 22 mm          | 21.959-21.980 mm<br>(0.8645-0.8654 in.) |
|                                            | 18 mm          | 17.966-17.984 mm<br>(0.7073-0.7080 in.) |
| Camshaft Runout                            | (max)          | 0.10 mm (0.004 in.)                     |
| Rocker Arm Inside Diameter                 |                | 12.000-12.018 mm<br>(0.472-0.473 in.)   |
| Rocker Arm Shaft<br>Outside Diameter       |                | 11.973-11.984 mm<br>(0.4714-0.4718 in.) |
| Cylinder Head Distortion                   | (max)          | 0.05 mm (0.002 in.)                     |
| Cylinder Head Cover Distortion             | (max)          | 0.05 mm (0.002 in.)                     |

#### CYLINDER, PISTON, AND RINGS

|                                                   |       |                                       |
|---------------------------------------------------|-------|---------------------------------------|
| Piston Skirt/Cylinder Clearance                   |       | 0.030-0.040 mm<br>(0.0011-0.0015 in.) |
| Cylinder Bore                                     |       | 79.994-80.006 mm<br>(3.149-3.150 in.) |
| Piston Diameter 15 mm<br>(0.6 in.) from Skirt End |       | 79.949-79.964 mm<br>(3.147-3.148 in.) |
| Cylinder Trueness                                 | (max) | 0.05 mm (0.002 in.)                   |
| Piston Ring End Gap -<br>Installed                | (1st) | 0.20 -0.30 mm<br>(0.0079-0.0118 in.)  |
|                                                   | (2nd) | 0.30-0.45 mm<br>(0.0118-0.0177 in.)   |
|                                                   | (oil) | 0.20-0.70 mm<br>(0.0079-0.0276 in.)   |
| Bore x Stroke                                     |       | 79.9 x 63 mm<br>(3.14 x 2.48 in.)     |
| Piston Ring to Groove<br>Clearance                | (1st) | 0.040-0.080 mm<br>(0.0016-0.0032 in.) |
|                                                   | (2nd) | 0.030-0.070 mm<br>(0.0012-0.0028 in.) |
| Piston Ring Groove Width                          | (1st) | 1.030-1.050 mm<br>(0.0405-0.0413 in.) |
|                                                   | (2nd) | 1.020-1.040 mm<br>(0.0402-0.0409 in.) |
| Piston Ring Thickness                             | (1st) | 0.97-0.99 mm<br>(0.0382-0.0390 in.)   |
|                                                   | (2nd) | 0.97-0.99 mm<br>(0.0382-0.0390 in.)   |

#### CRANKSHAFT

|                                                               |                                       |                                                                                                                         |
|---------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Connecting Rod<br>(big end inside diameter)                   | Marking:<br>(None)<br>Marking:<br>(O) | 43.000-43.016 mm<br>(1.6929-1.6935 in.)<br>43.009-43.016 mm<br>(1.6933-1.6935 in.)                                      |
| Connecting Rod<br>(big end side-to-side)                      |                                       | 0.16-0.46 mm<br>(0.0063-0.0181 in.)                                                                                     |
| Connecting Rod<br>(big end brown bearing<br>insert thickness) | Brown<br>Yellow<br>Green              | 1.482-1.486 mm<br>(0.0583-0.0585 in.)<br>1.486-1.490 mm<br>(0.0585-0.0588 in.)<br>1.490-1.494 mm<br>(0.0586-0.0588 in.) |
| Connecting Rod Bend                                           | (max)                                 | 0.2 mm - per 100<br>mm<br>(0.008 in. - per 3.94<br>in.)                                                                 |
| Crank Pin (diameter)                                          | Marking:<br>(None)<br>Marking:<br>(O) | 39.984-39.992 mm<br>(1.5742-1.5745 in.)<br>39.993-40.000 mm<br>(1.5745-1.5748 in.)                                      |
| Crankshaft Runout                                             | (max)                                 | 0.10 mm<br>(0.0039 in.)                                                                                                 |

#### CONNECTING ROD - BIG END BEARING SELECTION

| Rod Marking | Crank Pin<br>Marking | Bearing Insert           |
|-------------|----------------------|--------------------------|
| None        | O                    | Brown (p/n<br>3201-293)  |
| None        | None                 | Yellow (p/n<br>3201-294) |
| O           | O                    | Yellow (p/n<br>3201-294) |
| O           | None                 | Green (p/n<br>3201-295)  |

\* Specifications subject to change without notice.

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## Removing Engine/ Transmission

Many service procedures can be performed without removing the engine/transmission from the frame. Closely observe the note introducing each sub-section for this important information.

### AT THIS POINT

If the technician's objective is to service/replace left-side cover oil seals (3), front output joint oil seal (1), rear output joint oil seal (1), and/or the oil strainer (from beneath the engine/transmission), the engine/transmission does not have to be removed from the frame.

Secure the ATV on a support stand to elevate the wheels.

### WARNING

Make sure the ATV is solidly supported on the support stand to avoid injury.

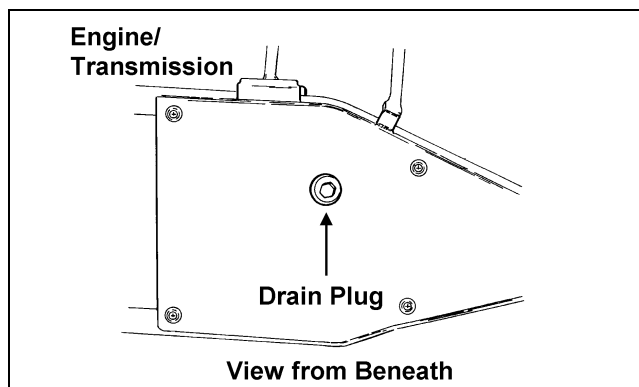
1. Remove the seat.

2. Remove the negative cable from the battery; then remove the positive cable. Remove the battery vent hose; then remove the battery.

### CAUTION

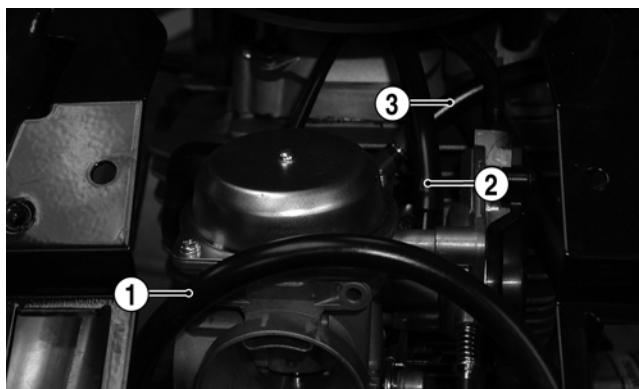
Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.

3. Remove the front and rear racks (see Section 8).
4. Remove the storage compartment and the steering post access panel (see Section 8).
5. Drain the oil from beneath the engine/transmission.



ATV-0109

6. Remove the front and rear fender panels (see Section 8).
7. On VP models, turn the gas tank valve to the OFF position; then remove the fuel hose and vent hose. On FIS models, disconnect fuel hose (1), carburetor vent hose (2), and the fuel pump vacuum hose (3) from the carburetor.



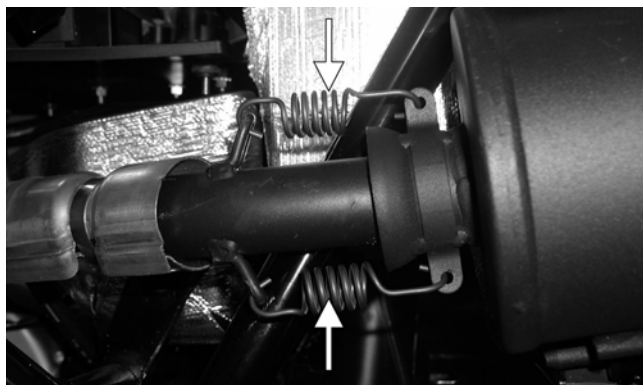
CF178A

8. On VP models, remove the gas tank.
9. On VP models, remove the hardware securing the intake housing to the frame.
10. Disconnect the crankcase vent hose from the air cleaner housing. Remove the clamp securing the air intake hose to the carburetor; then remove the housing.



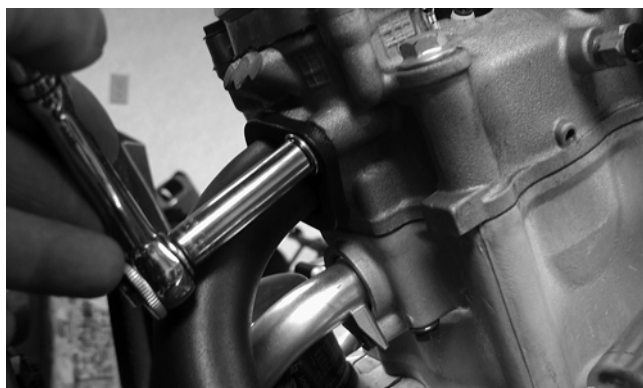
■ **NOTE:** On FIS models, the air cleaner intake duct must be removed prior to removing the air cleaner housing.

11. Remove the exhaust springs at the juncture in front of the muffler; then slide the muffler rearward off the mounting lugs.



CF138A

12. Remove the exhaust pipe and account for the exhaust seal.



CD803

13. Remove the pinch screw and lock nut securing the gear shift lever; then remove the gear shift lever from the shaft on the engine.



CD003



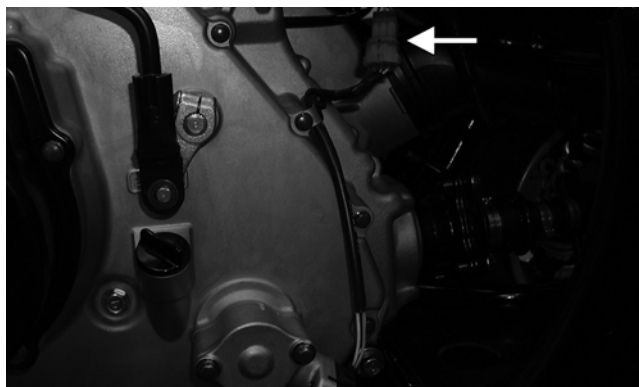
CC934

14. Remove the E-clip securing the reverse/high/low shift linkage; then remove the linkage. Account for the bushing and washer.



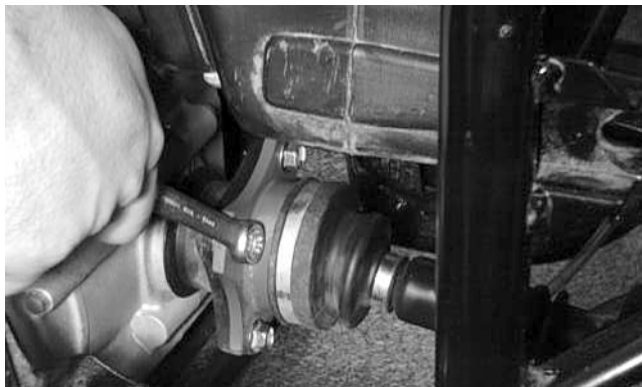
CC935

15. On the FIS models, disconnect the speed sensor lead from the wiring harness.



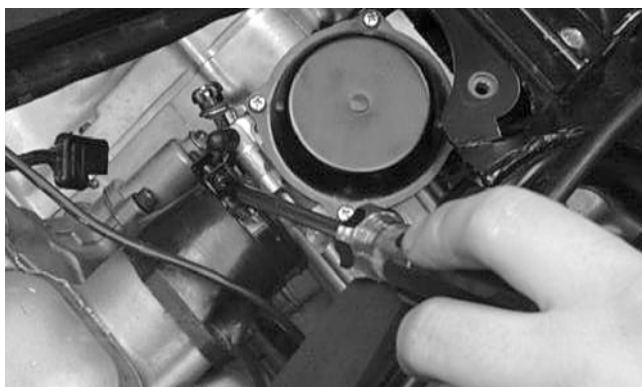
CF172A

16. Remove the four cap screws securing the rear output joint to the transmission and push the shaft rearward as far as possible.



CC119D

17. Detach the carburetor from the intake boot; then secure the carburetor assembly away from the engine.



CC120D

■ **NOTE:** Use cable ties or tape to secure the carburetor assembly above the handlebar to keep it from interfering with the removal procedure.

18. Remove the clamps securing the two oil cooler hoses to the engine; then disconnect the hoses.

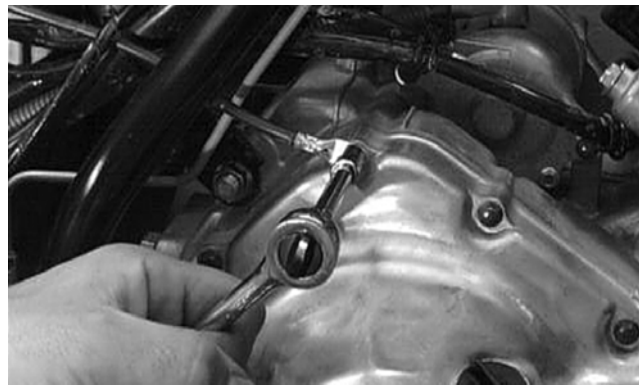


CC937

■ **NOTE:** After disconnecting the oil cooler hoses, plug them to prevent leakage from the cooler.

19. Disconnect the high tension lead from the spark plug. At the ignition coil, remove the cap screw, nut, and the two wire leads; then remove the coil.

20. Disconnect the battery ground (negative) cable from the crankcase cover; then disconnect the positive cable from the starter motor.



AR600D



AR604D

21. Disconnect the following electrical components: voltage regulator, CDI, indicator lights, and the two wire leads for the oil temperature sensors.



CF165





CF164A

22. Loosen the clamp on the crankcase breather vent hose; then disconnect the hose and remove it.

23. Remove the engine/transmission mounting fasteners in the following sequence:

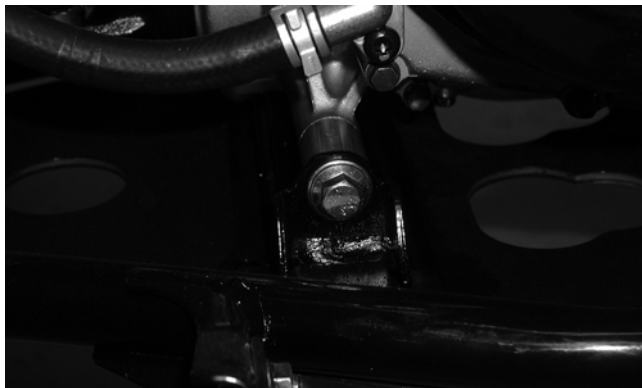
A. Upper front: Two cap screws (inside the bracket) and one cap screw and nut (topside of the engine).

■ **NOTE:** It will be necessary to remove the upper front bracket to remove the engine.



CF177

B. Lower front: One cap screw, nut, spacer, and washer.



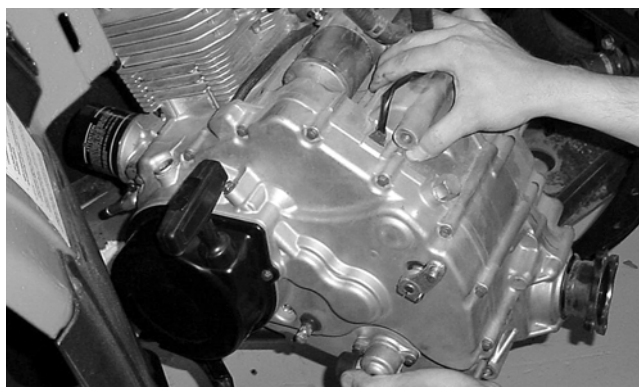
CF175

C. Lower rear: One cap screw and nut with flat washer.



CF176

24. By sliding the rear of the engine out first, remove the engine/transmission from the left side of the frame.



CC940

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## Top-Side Components

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■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### **AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

## Removing Top-Side Components

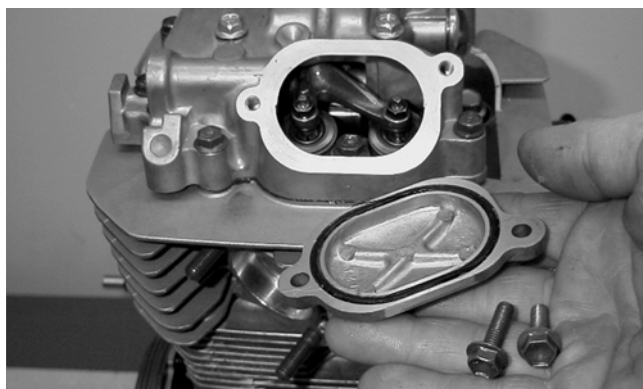
### A. Valve Cover

### B. Cylinder Head

■NOTE: Remove the spark plug and timing inspection plug; then using the recoil starter, rotate the crankshaft to top-dead-center of the compression stroke.

■NOTE: Arctic Cat recommends the use of new gaskets, lock nuts, and seals and lubricating all internal components when servicing the engine/transmission.

1. Remove the cap screws securing the two tappet covers. Remove the two tappet covers. Account for the O-rings.



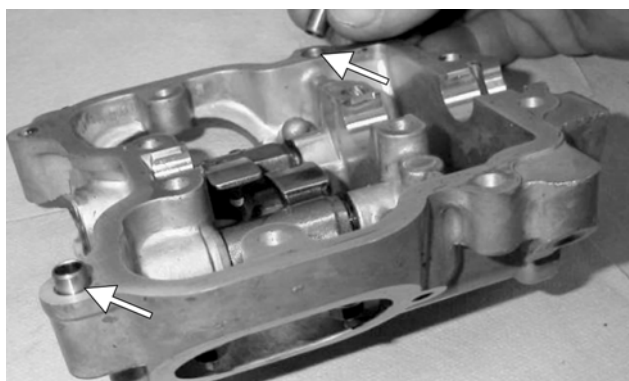
MD1264

■NOTE: Keep the mounting hardware with the covers for assembly purposes or thread them back into the head to keep them separated.

2. Remove the 12 cap screws securing the valve cover to the head; account for the four rubber washers on the top side cap screws. Remove the valve cover. Account for and note the orientation of the cylinder head plug; then remove the plug. Note the location of two alignment pins.



MD1261

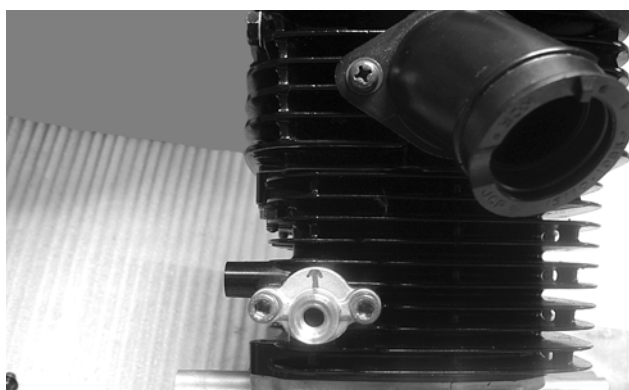


MD1354A

3. Loosen the cap screw on the end of the cam chain tensioner; then remove the two Allen-head cap screws securing the tensioner assembly and remove the assembly. Account for a gasket.



MD1245

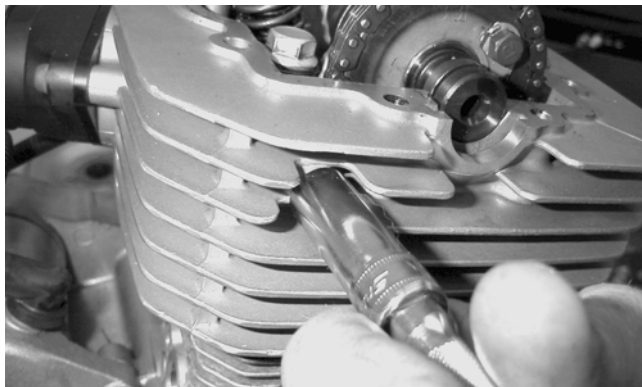


CD382

4. Remove the cam chain tensioner pivot cap screw and washer.

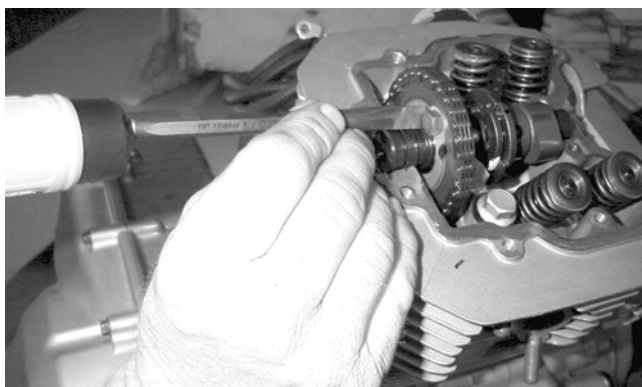
3



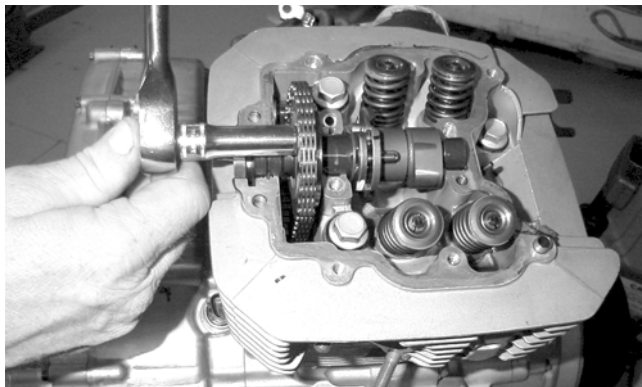


MD1251

5. Bend the washer tabs and remove the two cap screw securing the sprocket to the camshaft.



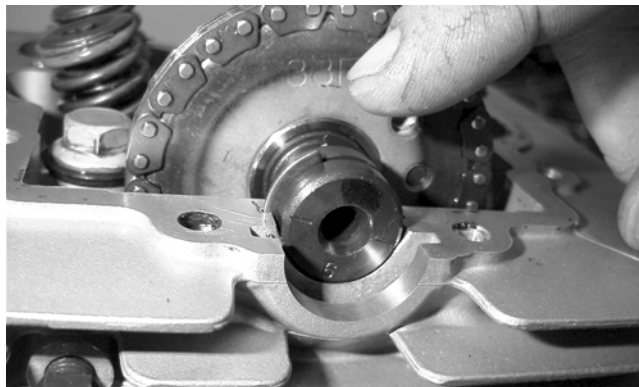
MD1136



MD1137

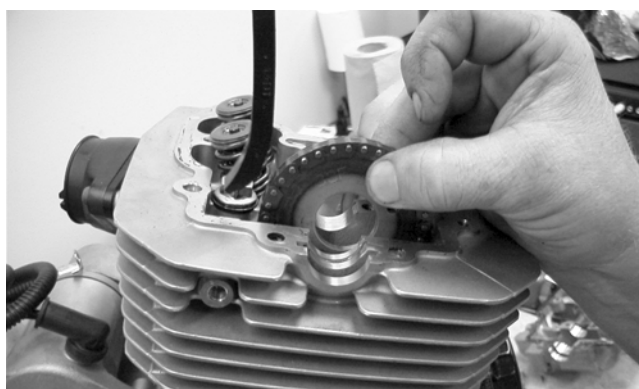
6. Using an awl, rotate the C-ring in its groove until it is out of the cylinder head; then remove the C-ring.

■ **NOTE:** Care should be taken not to drop the C-ring down into the crankcase.



MD1131

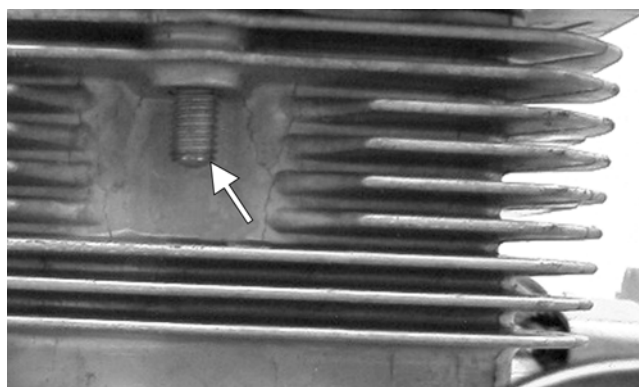
7. Note the timing marks for installing purposes; then drop the sprocket off the camshaft. While holding the chain, slide the sprocket and camshaft out of the cylinder head. Account for an alignment pin.



MD1132

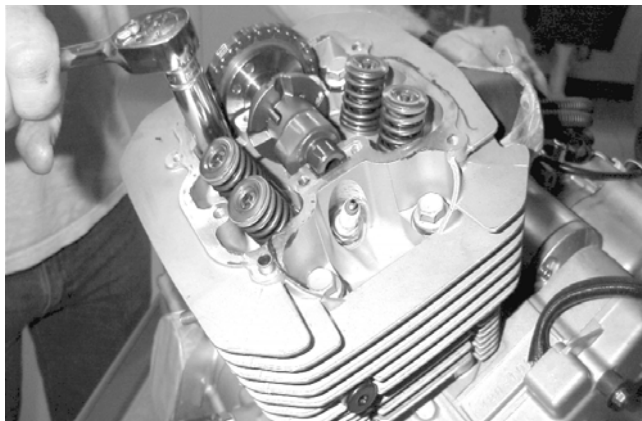
■ **NOTE:** Loop the chain over the cylinder and secure it with a wire to keep it from falling into the crankcase.

8. Remove the cam chain tensioner by lifting it from the chain cavity; then remove the two lower nuts securing the cylinder head to the cylinder, one in front and one in rear.



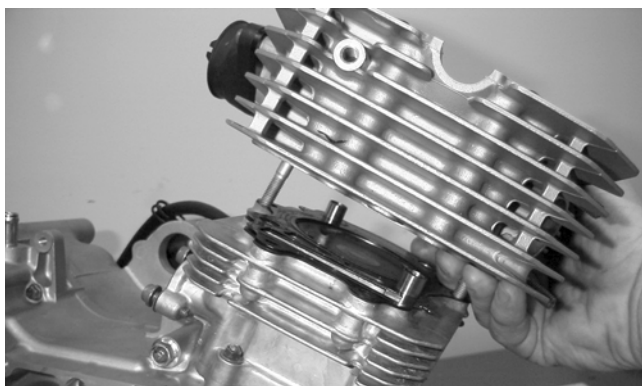
MC1192

9. Remove the four cylinder head cap screws and washers. Note that the two cap screws on the right side of the cylinder head nearest the cam sprocket are longer than the two cap screws on the left (spark plug) side.



MD1167

10. Remove the cylinder head from the cylinder, remove the gasket, and account for two alignment pins.



MD1163

**AT THIS POINT**

To service valves and cylinder head, see Servicing Top-Side Components sub-section.

11. Remove the cam chain guide.

**AT THIS POINT**

To inspect cam chain guide, see Servicing Top-Side Components sub-section.

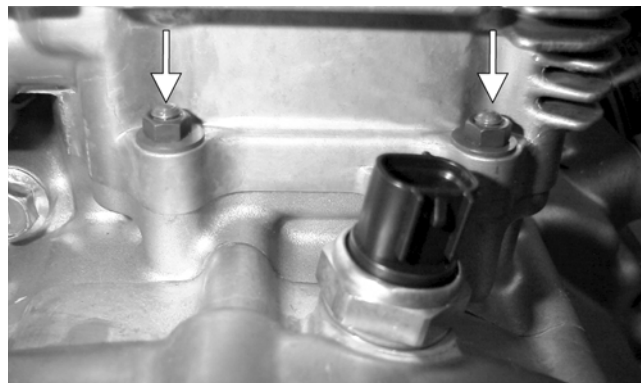


MD1173

## C. Cylinder D. Piston

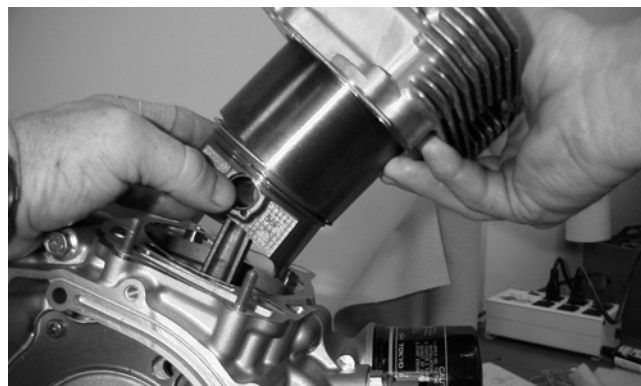
■ **NOTE:** Steps 1-11 in the preceding sub-section must precede this procedure.

12. Remove the two nuts securing the right side of the cylinder to the right-side crankcase half. Account for the washers.



MD1226A

13. Lift the cylinder off the crankcase taking care not to allow the piston to drop against the crankcase. Account for the gasket and two alignment pins.



MD1214

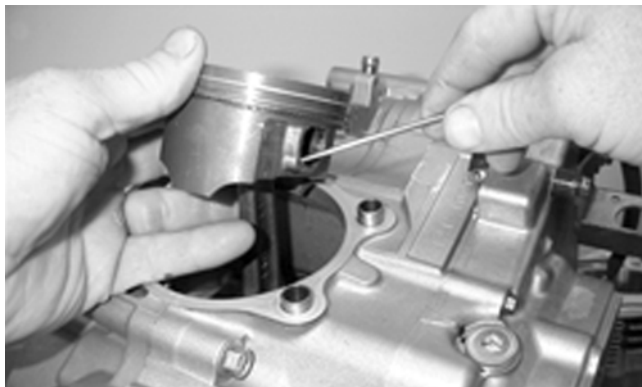
**AT THIS POINT**

To service cylinder, see Servicing Top-Side Components sub-section.

**CAUTION**

When removing the cylinder, be sure to support the piston to prevent damage to the crankcase and piston.

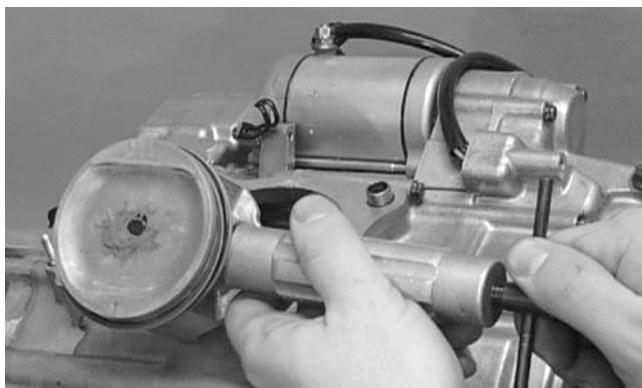
14. Using an awl, remove one piston-pin circlip. Take care not to drop it into the crankcase.



MD1213

15. Using the Piston-Pin Puller (p/n 0644-328), remove the piston pin. Account for the opposite-side circlip. Remove the piston.

■ **NOTE:** It is advisable to remove the opposite-side circlip prior to using the puller.



MD1219

■ **NOTE:** Support the connecting rod with rubber bands to avoid damaging the rod or install the Connecting Rod Holder (p/n 0444-006).

### **CAUTION**

Do not allow the connecting rod to go down inside the crankcase. If the rod is down inside the crankcase and the crankshaft is rotated, severe damage will result.

■ **NOTE:** If the existing rings will not be replaced with new rings, note the location of each ring for proper installation. When replacing with new rings, replace as a complete set only. If the piston rings must be removed, remove them in this sequence.

- A. Starting with the top ring, slide one end of the ring out of the ring-groove.
- B. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

### **AT THIS POINT**

To service piston, see Servicing Top-Side Components sub-section.

### **AT THIS POINT**

To service center crankcase components only, proceed to Removing Left-Side Components.

## Left-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### **AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

## Removing Left-Side Components

### A. Cover/Stator Assembly

1. Remove the two cap screws securing the starter to the crankcase; then remove the starter.
2. Remove the four cap screws securing the recoil cover to the left-side cover; then remove recoil cover.



CC942

3. Remove the flange nut securing the starter cup to the crankshaft; then remove the starter cup. Account for the O-ring inside the cup.





CC943

4. Remove the gear shift stopper (located above the hi/low shift shaft). Account for the washer, spring, and stopper.



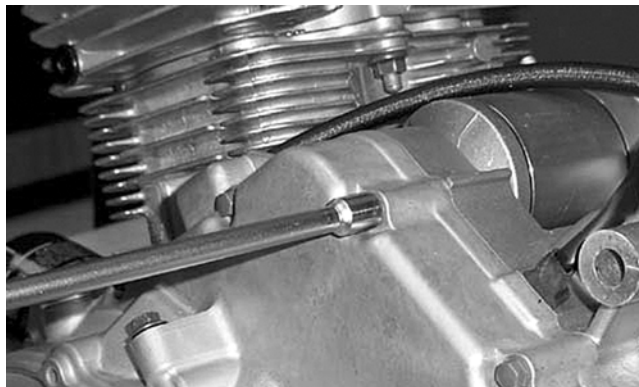
CC944

■ **NOTE:** On the FIS models, remove the two cap screws securing the speed sensor housing; then remove the housing. Account for the gasket.

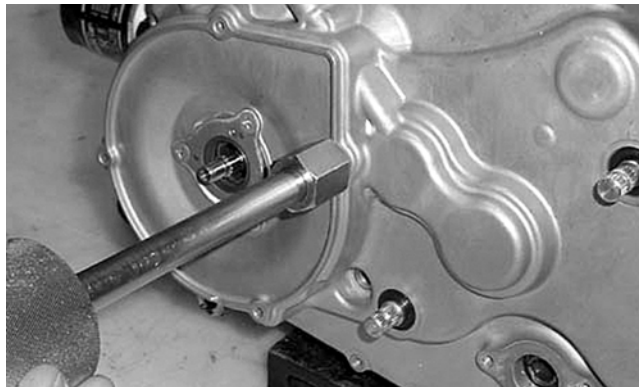


CF109

5. Remove the cap screws securing the left-side cover to the crankcase (fifteen 6 mm and one 8 mm); then using a slide hammer w/6 mm Adapter (p/n 0644-310), remove the left-side cover.



CC945



CC946

■ **NOTE:** Inspect the inside of the left-side cover for any shaft washers and spacers that may have come off with the cover. Make sure they are returned to their respective shafts. Also, make sure the alignment pins are in place.

## **B. Rotor/Flywheel**

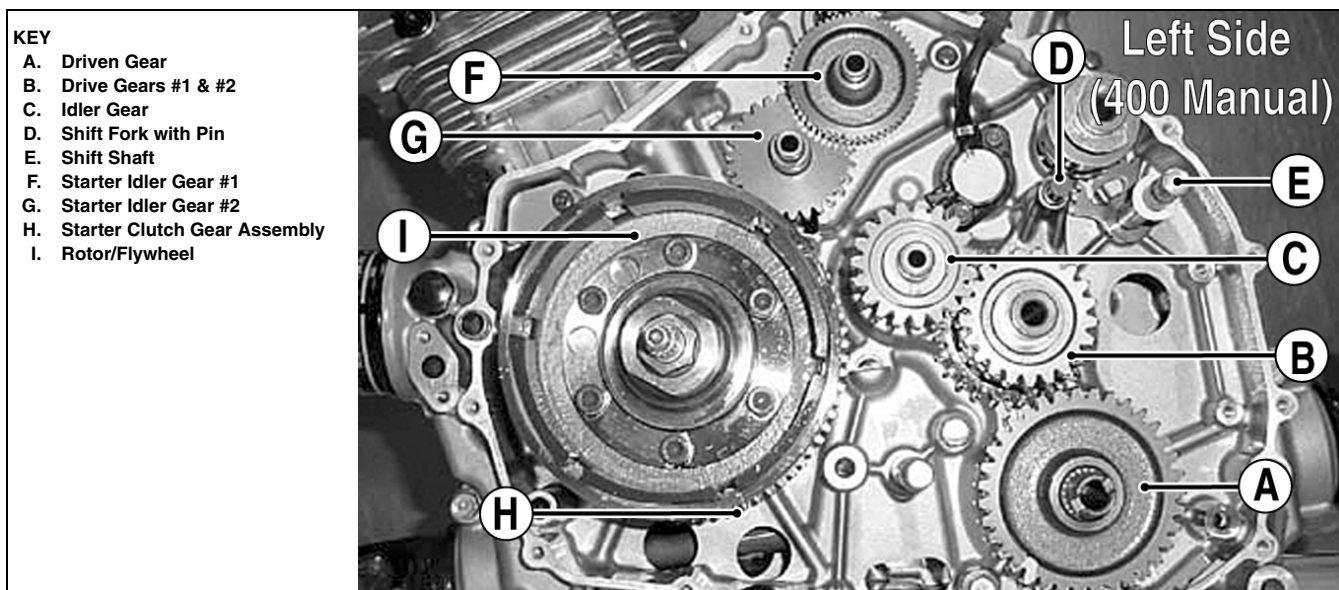
### **C. Idle Gear Assembly**

■ **NOTE:** Steps 1-5 in the preceding sub-section must precede this procedure.

■ **NOTE:** For steps 6-14, refer to illustration CC948B.

■ **NOTE:** To aid in installing, it is recommended that the assemblies are kept together and **IN ORDER**.





6. Remove the nut securing the rotor/flywheel (I) to the crankshaft; then install the crankshaft protector.



CC514D

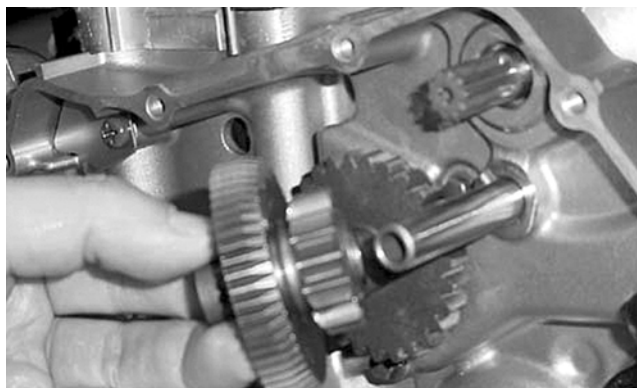
7. Using the Magneto Rotor Remover (p/n 0444-075), remove the rotor/flywheel assembly from the crankshaft. Account for the key; then remove the starter clutch gear assembly (H) w/washer.

■ **NOTE:** Care must be taken that the remover is threaded all the way onto the rotor/flywheel.

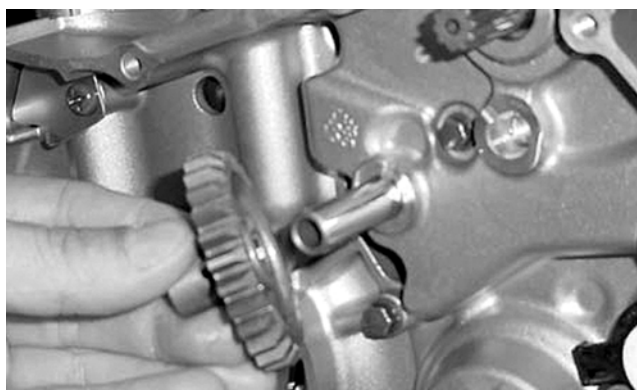


CC949

8. Remove the starter idler gears (F & G) from the crankcase; then remove the pin.

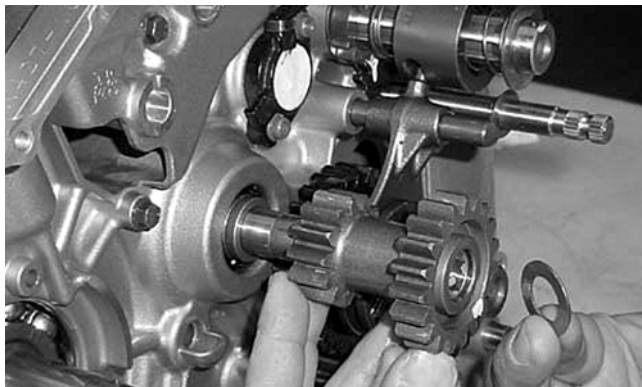


CC950



CC951

9. Remove the idler gear (C). Account for a washer and a spacer.



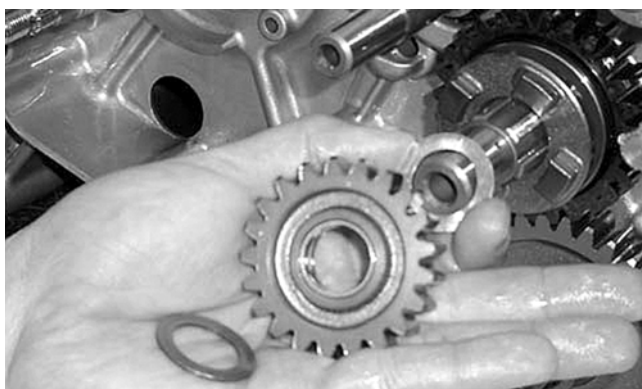
CC952

10. Remove the shift fork and pin (D).



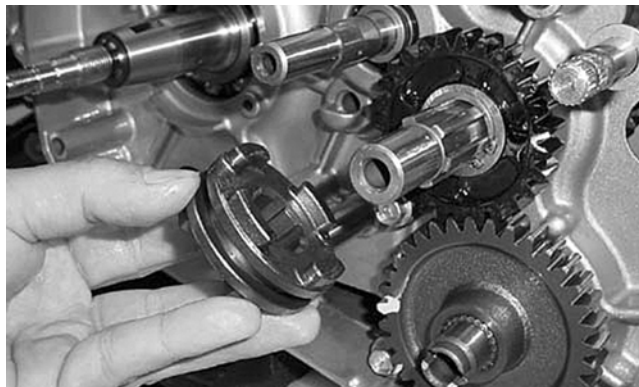
CC953

11. Remove drive gear #2 (B). Account for washers on both sides of the gear.



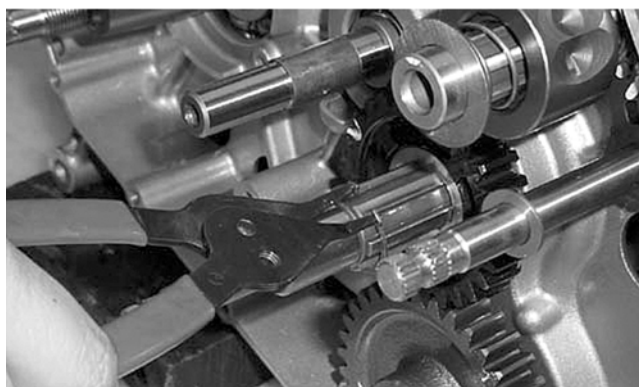
CC954

12. Remove the sliding dog from the driveshaft.

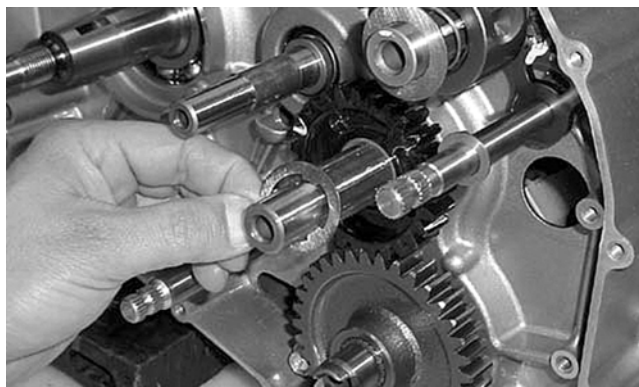


CC966

13. Remove the circlip, washer, and drive gear #1 (B) from the driveshaft; then account for the bushing and the spacer.



CC955



CC956

■ **NOTE:** Note the orientation of the oil holes on the driveshaft and bushing for installing purposes.

3



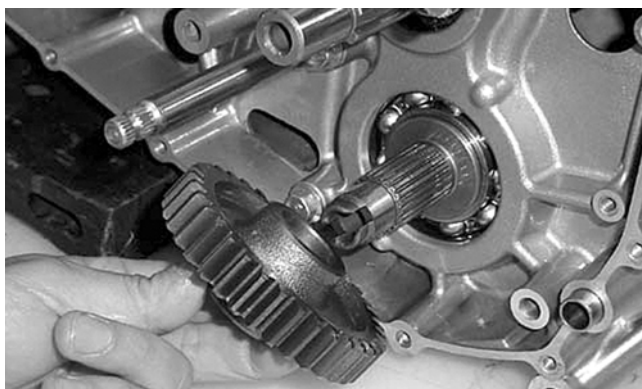


CD552



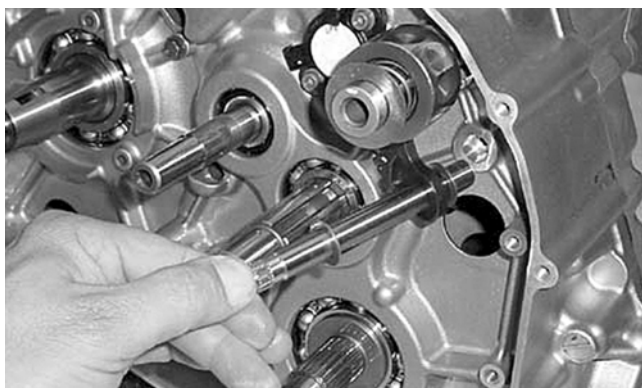
CC958

14. Remove driven gear (A) from the output shaft.



CC959

15. Remove the gear shift shaft. Account for two shims.

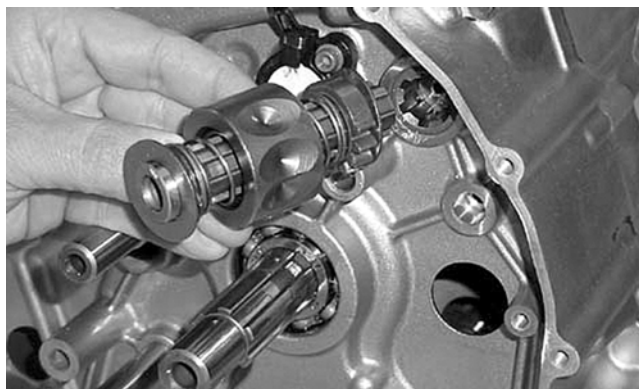


CC960



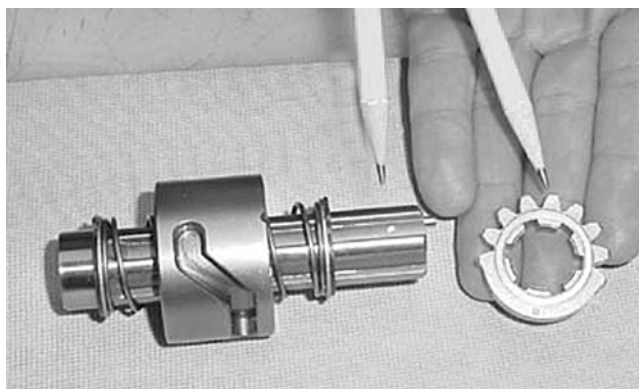
CC961

16. Remove the secondary stopper camshaft assembly. Account for the two shims.



CC962

■ **NOTE:** Note the alignment dots on the cam plate and camshaft for installing purposes.

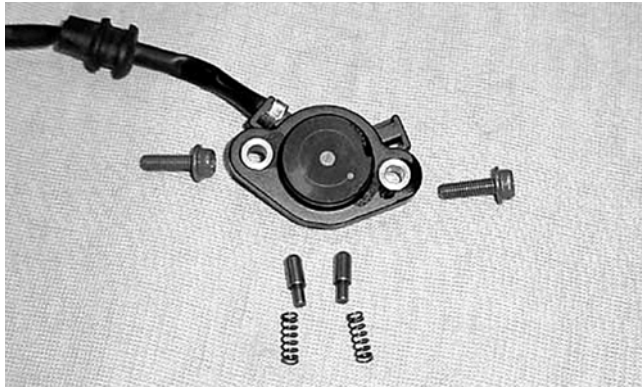


CC963

17. Remove the Allen-head cap screws from the neutral switch base; then remove the switch. Account for the two contacts and springs.



CC964



CC965

### AT THIS POINT

To service center crankcase components only, proceed to Removing Right-Side Components.

## Right-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### AT THIS POINT

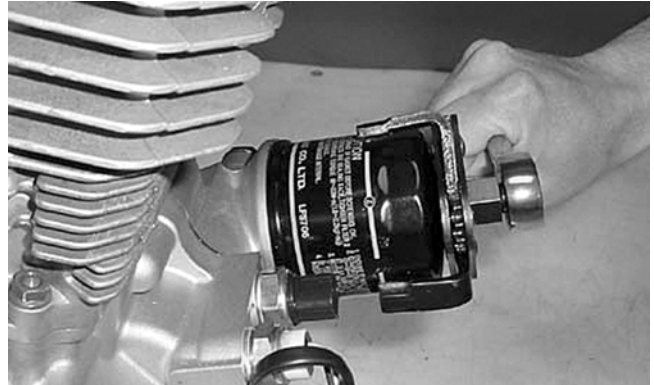
To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

## Removing Right-Side Components

### A. Oil Filter

1. Using Oil Filter Wrench (p/n 0644-389), remove the oil filter.



CC967

2. If the engine has not been removed, lay the ATV on its left side; then remove the cap screws securing the right-side cover to the crankcase. Remove the cover. Account for the gasket and for two alignment pins.



CC968

■ **NOTE:** When removing the right-side cover, account for the release roller guide that it does not fall and cause damage.





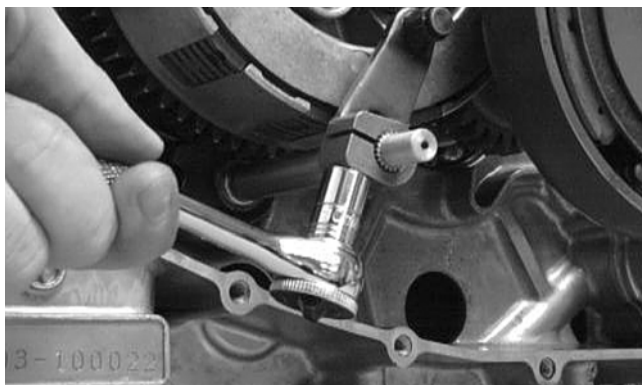
CC070D

**B. Primary Clutch Shoe**  
**C. Primary Clutch**  
**D. Starter Clutch Housing**

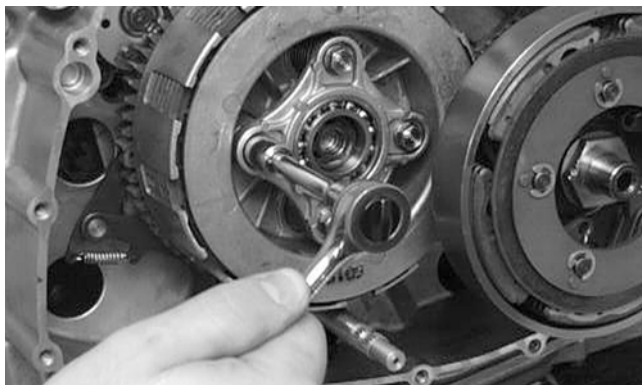
■ **NOTE:** Steps 1-2 in the preceding sub-section must precede this procedure.

3. Remove the cap screw securing the clutch release arm and remove the arm; then in a crisscross pattern, remove the four cap screws securing the clutch release roller assembly.

■ **NOTE:** Scribe a reference mark with a marker on the arm and shaft to aid in installing.



CC073D



CC074D

4. Remove the release roller assembly. Account for four springs.

5. Remove the starter clutch-shoe nut (left-hand threads) and washer from the driveshaft; then using a primary clutch shoe remover, remove the clutch shoe.



**CAUTION**

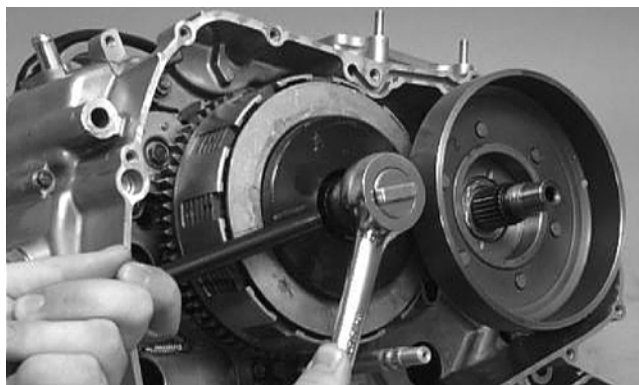
Care must be taken when removing the nut; it has "left-hand" threads.

6. Remove the primary drive one-way clutch from the starter clutch housing. Note the word OUTSIDE stamped on the clutch for assembly purposes.



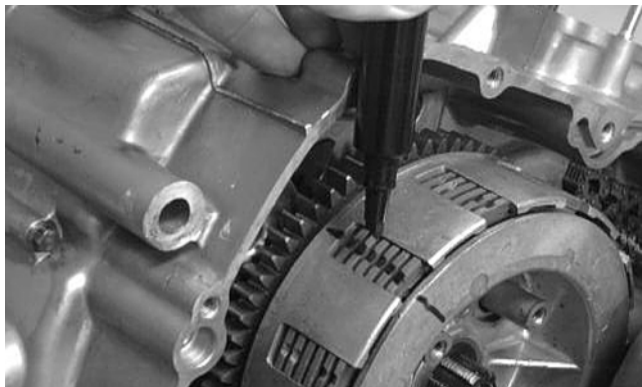
CF043

7. Using the Clutch Sleeve Hub Holder (p/n 0444-007) to hold the clutch sleeve hub, remove the nut and washer.



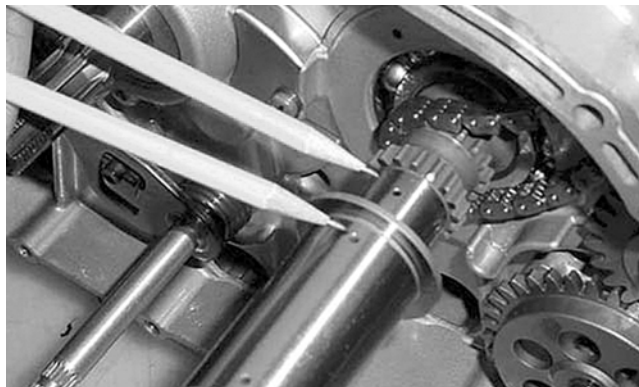
CC076D

8. Scribe a line across the primary clutch assembly to aid in installing.



CC077D

9. Simultaneously, remove the primary clutch assembly and starter clutch housing from their respective shafts. Account for the shims and washers.



CC970

10. Remove the nut and washer securing the oil pump drive gear to the crank balancer shaft; then remove the gear and account for the pin, gear, washer, and nut.

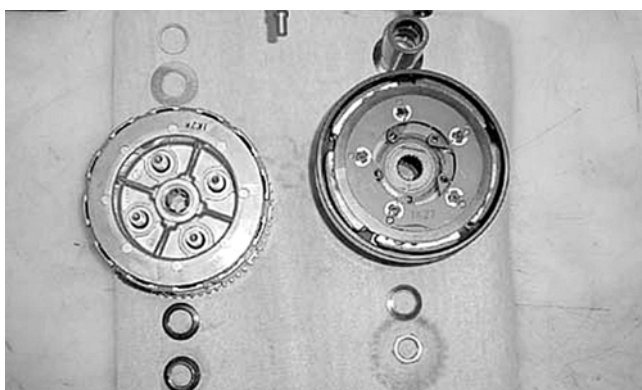
■ **NOTE:** Note that the raised hub of the gear is directed inward for installing purposes.



CC078D



CC971



CC969

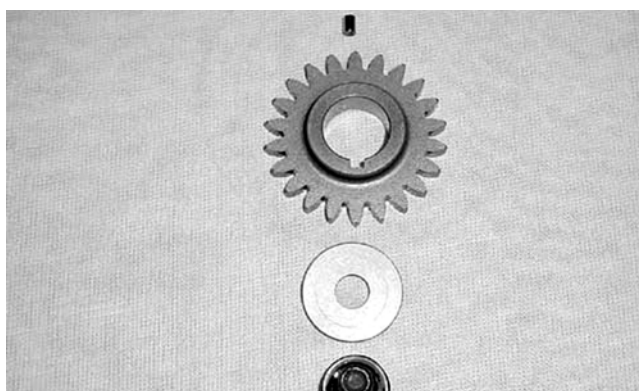
### 👉 AT THIS POINT

To service clutch components, see Servicing Right-Side Components sub-section.

#### E. Gear Shift Cam Plate/Guide F. Oil Pump/Oil Strainer

■ **NOTE:** Steps 1-9 in the preceding sub-sections must precede this procedure.

■ **NOTE:** Note that the bushings on the crankshaft are directional and that the oil holes align for installing purposes.

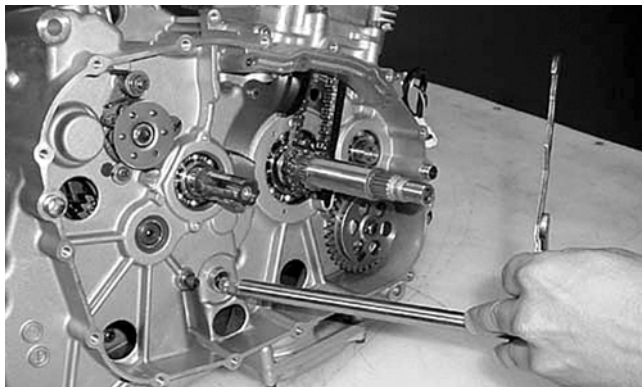


CC972

11. Remove the gear shift shaft from the crankcase.

3





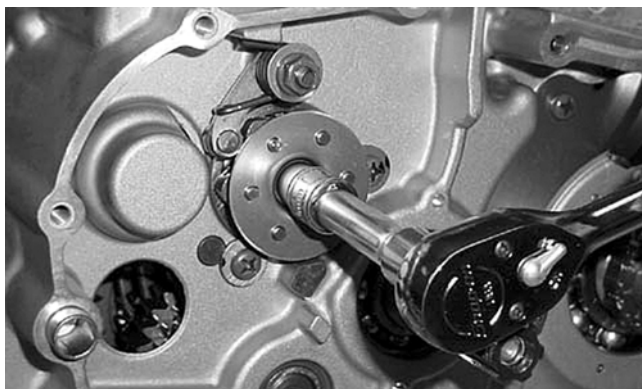
CC973

12. Release the tension from the gear shift cam stopper arm spring.



CC974

13. Remove the cap screw securing the gear shift cam plate and guide to the gear shift cam; then remove the cam plate and guide. Account for the guide and five pins.



CC975

**CAUTION**

If servicing of the engine/transmission is due to a lubrication-related problem, replace the oil pump.

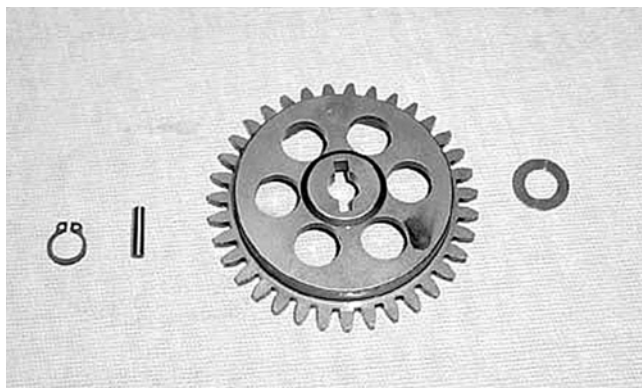
■ **NOTE:** For general servicing, it is advisable to disassemble, clean, and inspect the oil pump. If any wear or damage is suspected, replace the oil pump.

14. Remove the circlip securing the oil pump driven gear; then remove the gear. Account for the pin and the washer.

■ **NOTE:** Always use a new circlip when installing the oil pump driven gear.

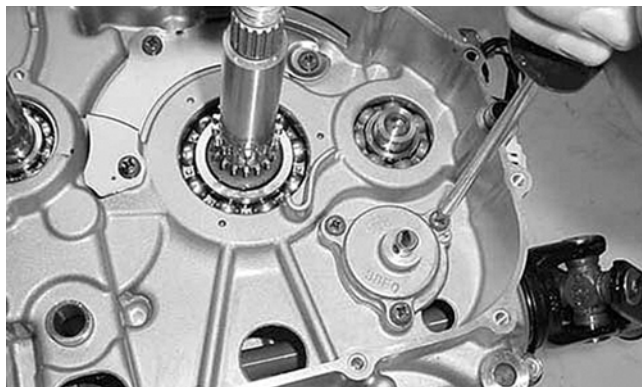


CC976



CC977

15. Remove the three Phillips-head screws securing the oil pump; then remove the oil pump.



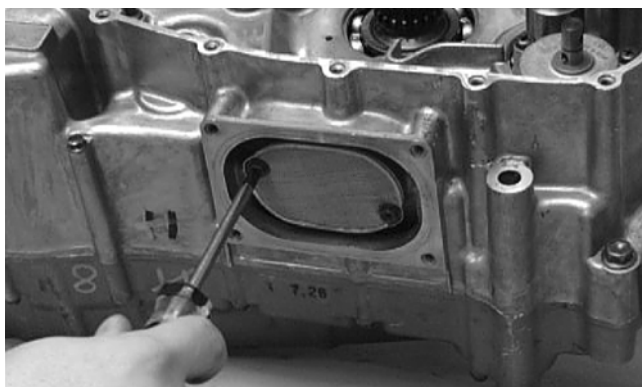
CC978

16. Remove the cap screws securing the oil strainer cap; then remove the cap. Account for the O-ring.



CC091D

17. Remove the two Phillips-head cap screws securing the strainer.



CC163D

### AT THIS POINT

To service center crankcase components only, proceed to Separating Crankcase Halves.

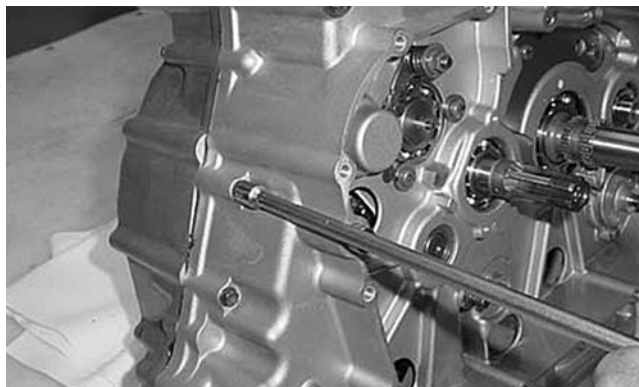
## Center Crankcase Components

■ **NOTE:** This procedure cannot be done with the engine/transmission in the frame. Complete Removing procedures for Top-Side, Left-Side, and Right-Side must precede this procedure.

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

## Separating Crankcase Halves

1. Remove the five right-side 6 mm cap screws (one from inside the case) securing the crankcase halves; then remove the seven left-side 6 mm cap screws. Note the location of the different-lengthed cap screws and a wiring form.



CC979



CC980

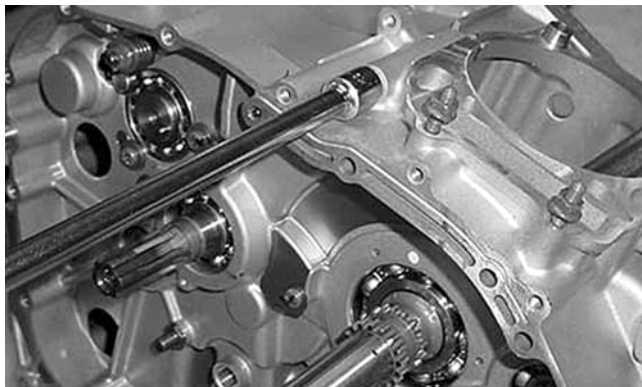
2. Remove the four left-side 8 mm cap screws (two from inside the case) securing the crankcase halves. Note the location of the different-lengthed cap screws.



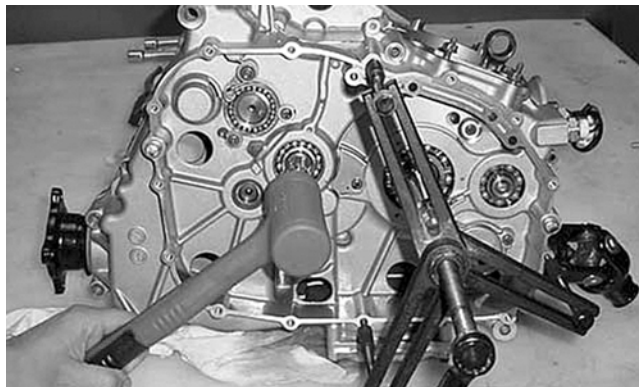
CC981

3. Remove the four right-side 8 mm cap screws securing the crankcase halves.





CC982



CC983

4. Using an appropriate crankcase separator and tapping lightly with a rubber mallet, separate the crankcase halves. Account for two alignment pins, a C-ring, and two washers.

■ **NOTE:** To keep the shaft/gear assemblies intact for identification, tap the shafts toward the left-side crankcase half when separating the halves.



CC984

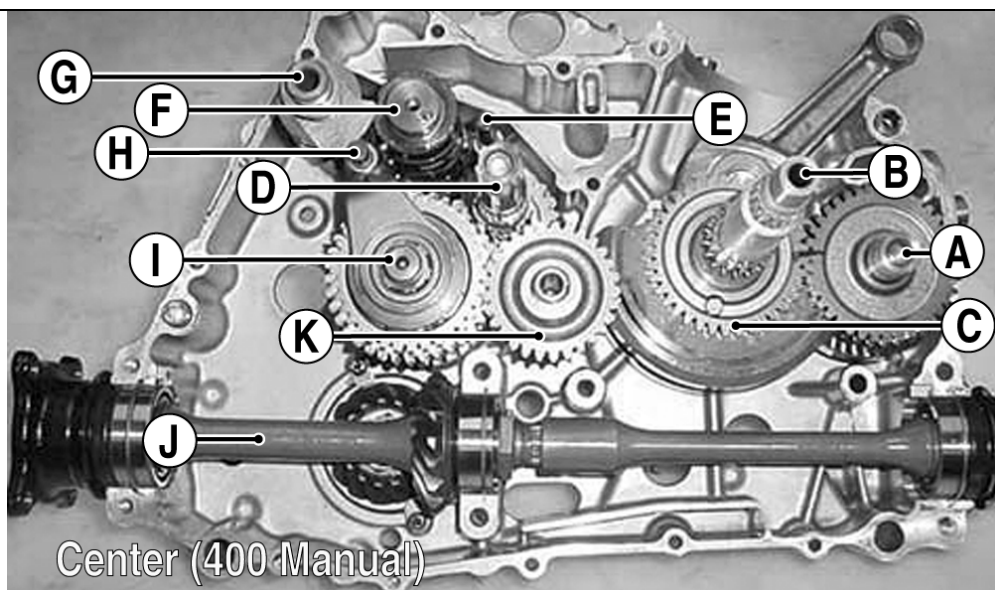
## Disassembling Crankcase Half

■ **NOTE:** To aid in assembling, it is recommended that the assemblies are kept together and IN ORDER.

■ **NOTE:** For steps 1-10, refer to illustration CC985B.

### KEY

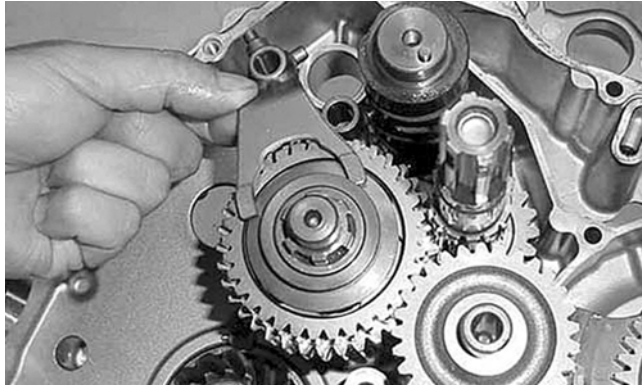
- A. Crank Balancer Assembly
- B. Crankshaft
- C. Balancer Drive Gear with Pin
- D. Countershaft Assembly
- E. Shift Shaft with Fork
- F. Gear Shift Cam
- G. Reverse Shift Cam
- H. Shift Shaft with 3 Forks
- I. Driveshaft Assembly
- J. Output Shaft Assembly
- K. Reverse Idle Gear



Center (400 Manual)

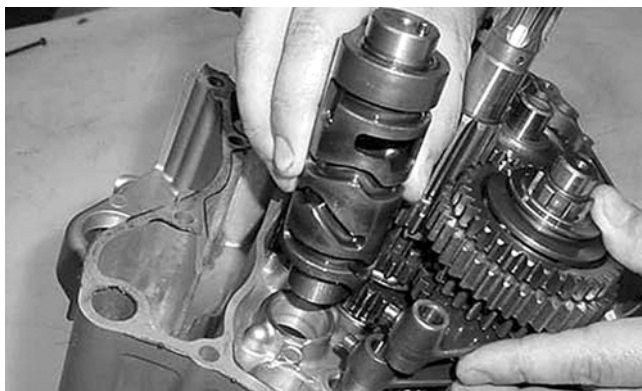
CC985B

1. Remove the output shaft assembly (J).
2. Remove the two shift shafts (E and H).
3. Remove the reverse shift cam (G) and spacer.
4. Disengage four forks from the gear shift cam (F); then remove the reverse shifter fork.



CC986

5. Remove the gear shift cam (F).



CC987

6. Remove the three remaining forks noting their positions for assembling purposes.

### **AT THIS POINT**

**To service gear shift forks, see Servicing Center Crankcase Components sub-section.**

7. Remove the reverse idle gear (K) w/shaft. Account for the bushing, two washers, and the circlip.
8. Simultaneously, remove the driveshaft assembly (I) and countershaft assembly (D).

### **AT THIS POINT**

**To service the driveshaft and/or countershaft, see Servicing Center Crankcase Components sub-section.**

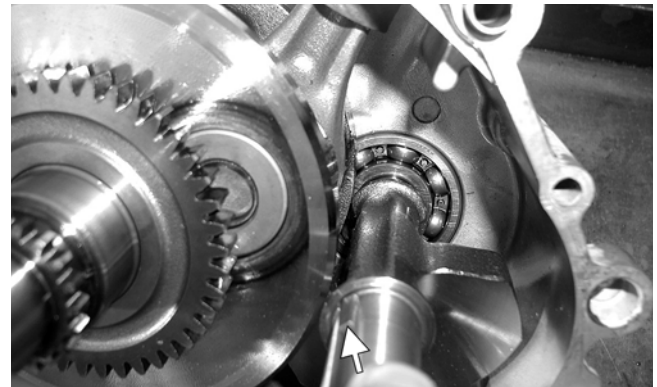
■ **NOTE:** For efficiency, if the driveshaft and/or countershaft are not being serviced, it is preferable to leave them assembled. The technician should use discretion and sound judgment.

■ **NOTE:** Note the alignment marks on the crank balancer driven gear and balancer drive gear to aid in assembly.



CC166D

9. Remove the driven gear from the crank balancer assembly (A). Account for a key.



CD832A

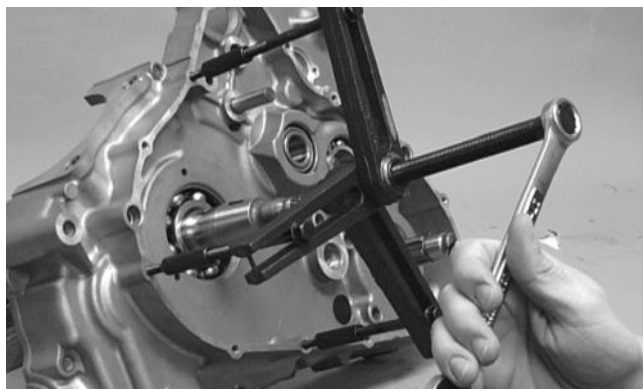
■ **NOTE:** Note that the shoulder of the gear is directed to the outside for assembling purposes.

10. Remove the crank balancer assembly (A).

■ **NOTE:** When removing the crank balancer assembly, rotate the crankshaft counterweight away from the crank balancer assembly counterweight.

11. Using an appropriate crankshaft remover, push the crankshaft assembly out of the crankcase.





CC115D

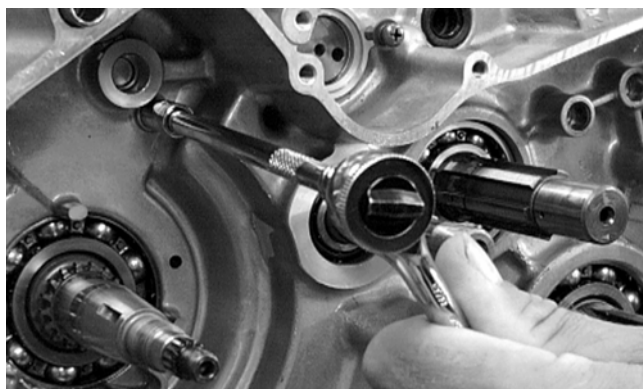
### **AT THIS POINT**

To service crankshaft assembly, see Servicing Center Crankcase Components sub-section.

### **CAUTION**

Do not remove the remaining output shaft assembly unless absolutely necessary. If the shaft is removed, the shaft nut must be replaced with a new one and the shaft must be re-shimmed.

12. To remove the output shaft and gear, remove the nut, slide the gear off the shaft (account for a shim or shims), and drive the shaft out with a plastic mallet (account for a shim or shims).



CC482D

## **Table of Contents** **(Servicing Components)**

■ **NOTE:** Critical engine/transmission specifications are located at the beginning of this section.

|                                                          |      |
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## **Servicing Top-Side Components**

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

### **VALVE ASSEMBLY**

When servicing valve assembly, inspect valve seats, valve stems, valve faces, and valve stem ends for pits, burn marks, or other signs of abnormal wear.

■ **NOTE:** Whenever a valve is out of tolerance, it must be replaced.

### **Cleaning/Inspecting Valve Cover**

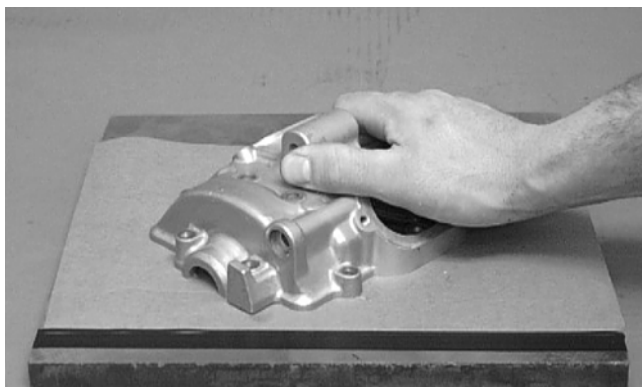
■ **NOTE:** If the valve cover cannot be trued, the cylinder head assembly must be replaced.

1. Wash the valve cover in parts-cleaning solvent.

2. Place the valve cover on the Surface Plate (p/n 0644-016) covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the valve cover in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the valve cover in a figure eight motion until a uniform bright metallic finish is attained.

**CAUTION**

Do not remove an excessive amount of the sealing surface or damage to the camshaft will result. Always check camshaft clearance when resurfacing the valve cover.



CC130D

**CAUTION**

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.

### Removing Valves

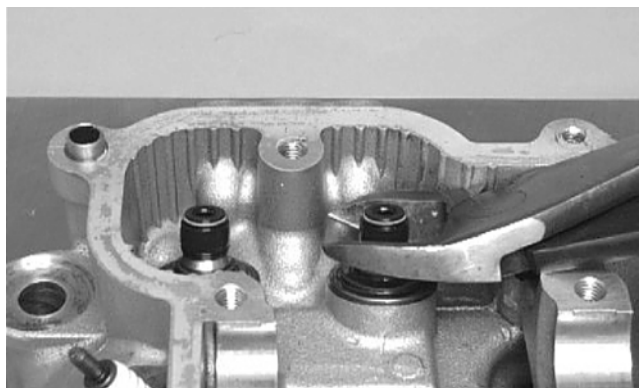
■ **NOTE:** Keep all valves and valve components as a set. Note the original location of each valve set for use during installation. Return each valve set to its original location during installation.

1. Using a valve spring compressor, compress the valve springs and remove the valve cotters. Account for an upper spring retainer.

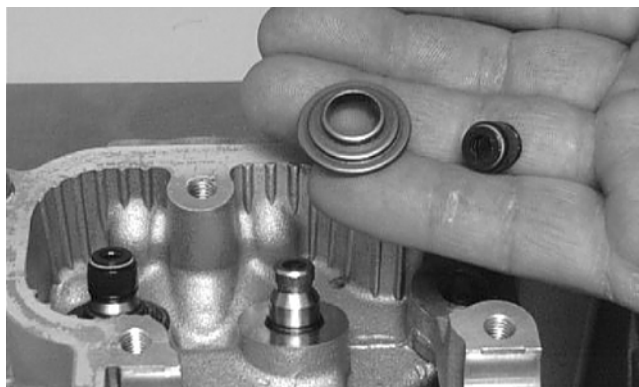


CC994

2. Remove the valve seal and the lower remaining spring seat. Discard the valve seal.



CC134D



CC136D

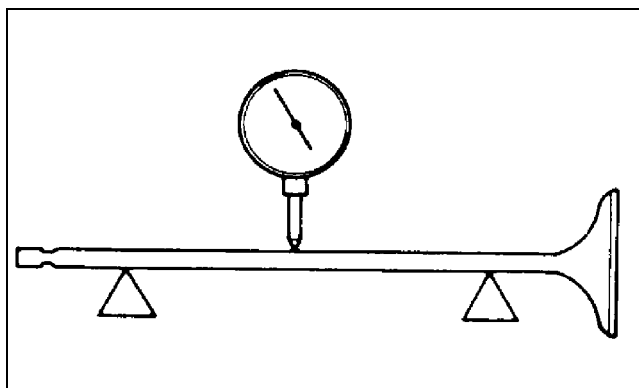
3

■ **NOTE:** The valve seals must be replaced.

3. Remove the valve springs; then invert the cylinder head and remove the valves.

### Measuring Valve Stem Runout

1. Support each valve stem end with the V Blocks (p/n 0644-022); then check the valve stem runout using a dial indicator.



ATV-1082

2. Maximum runout must not exceed specifications.

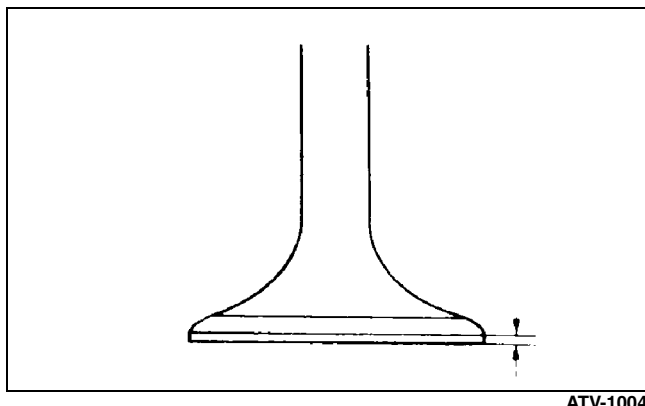


### Measuring Valve Stem Outside Diameter

1. Using a micrometer, measure the valve stem outside diameter.
2. Acceptable diameter range (intake valve) must be within specifications.
3. Acceptable diameter range (exhaust valve) must be within specifications.

### Measuring Valve Face/Seat Width

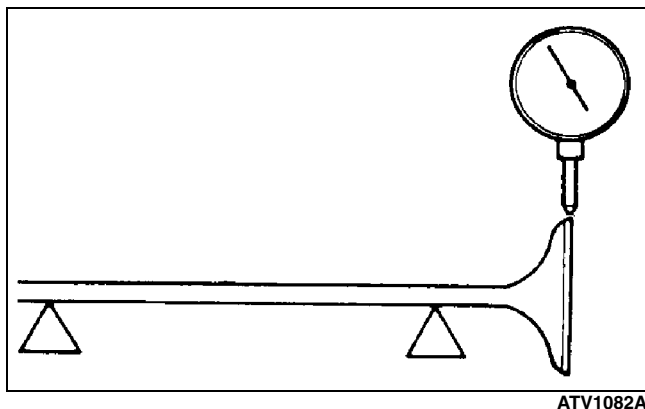
1. Using a micrometer, measure the width of the valve face.



2. Acceptable width range must be within specifications.

### Measuring Valve Face Radial Runout

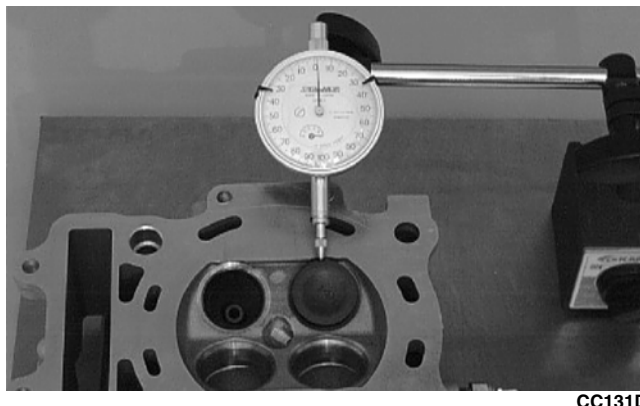
1. Mount a dial indicator on the surface plate; then place the valve stem on a set of V blocks.
2. Position the dial indicator contact point on the outside edge of the valve face; then zero the indicator.



3. Rotate the valve in the V blocks.
4. Maximum runout must not exceed specifications.

### Measuring Valve Guide/Valve Stem Deflection (Wobble Method)

1. Mount a dial indicator and base on the surface plate; then place the cylinder head on the surface plate.
2. Install the valve into the cylinder head; then position the dial indicator contact point against the outside edge of the valve face. Zero the indicator.



3. Push the valve from side to side; then from top to bottom.
4. Maximum "wobble" deflection must not exceed specifications.

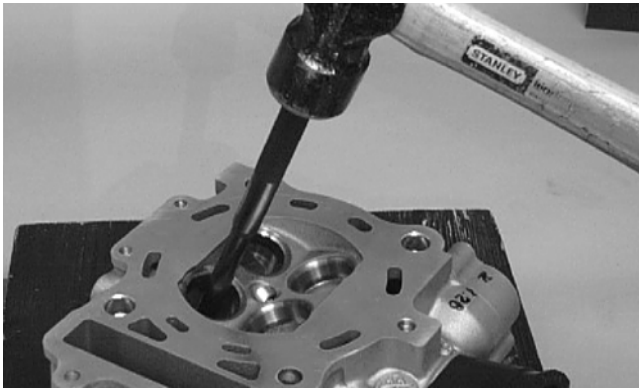
### Measuring Valve Guide (Inside Diameter)

1. Insert a snap gauge 1/2 way down into each valve guide bore; then remove the gauge and measure it with a micrometer.
2. Acceptable inside diameter range must be within specifications.
3. If a valve guide is out of tolerance, it must be replaced.

### Replacing Valve Guide

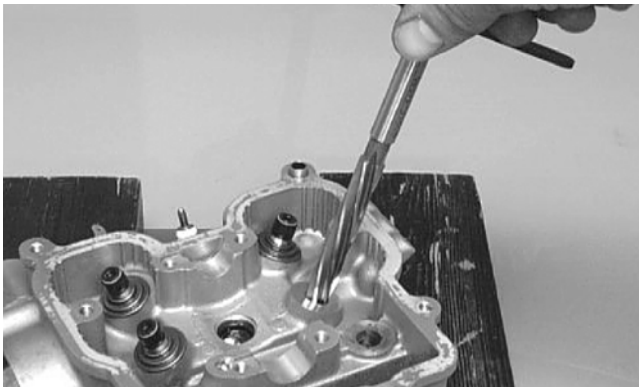
■ **NOTE:** If a valve guide is worn or damaged, it must be replaced.

1. If a valve guide needs replacing, insert a valve guide remover into the valve seat side of the valve guide. Using a hammer, gently drive the valve guide out of the cylinder head.



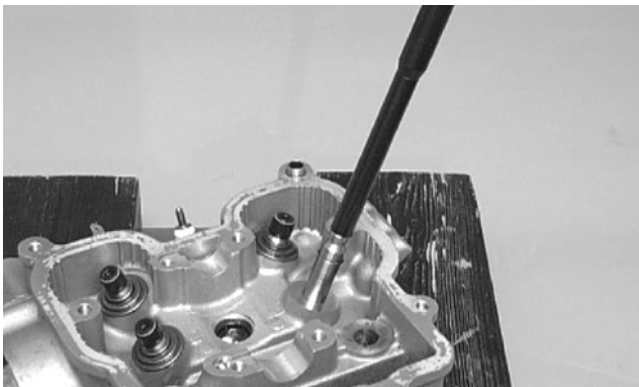
CC137D

2. Using the Standard Valve Guide Reamer (p/n 0444-017), remove any burrs or tight areas from the valve guide journals.



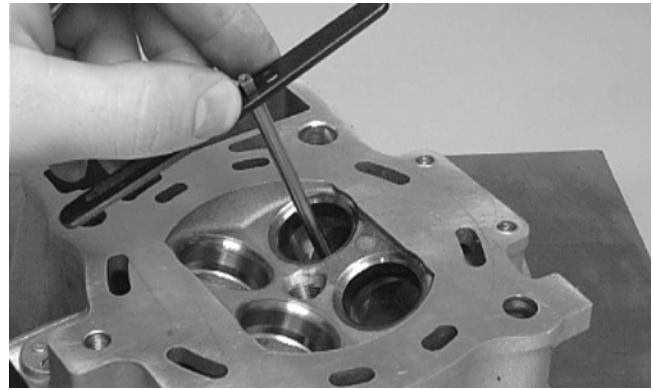
CC142D

3. To install a valve guide, use a valve guide installer and gently drive a valve guide with a retaining clip into the bore from the valve spring side until the retaining clip just contacts the cylinder head.



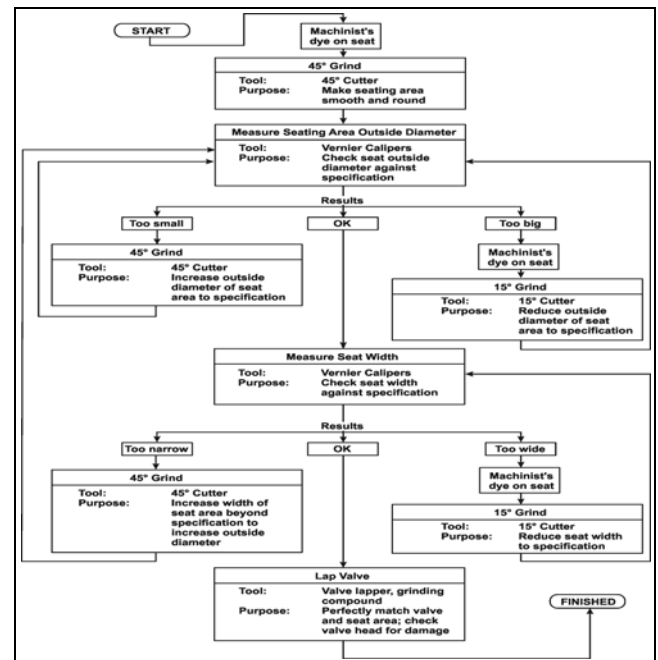
CC143D

4. After installing the guide, use the standard valve guide reamer to remove all burrs and tight areas that may remain in each valve guide.



CC138D

## Valve Seat/Guide Servicing Flow Chart



ATV-0107

## Grinding Valve Seats

■ **NOTE:** If the valve seat is beyond servicing, the cylinder head must be replaced.

1. Insert an exhaust valve seat pilot shaft into an exhaust valve guide. Slide an exhaust valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the exhaust valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining exhaust valve.



CC139D

### Measuring Rocker Arm (Inside Diameter)

1. Using a dial calipers, measure the inside diameter of the rocker arm.
2. Acceptable inside diameter range must be within specifications.

### Measuring Rocker Arm Shaft (Outside Diameter)

1. Using a micrometer, measure the outside diameter of the rocker arm shaft.
2. Acceptable outside diameter range must be within specifications.

### Installing Valves

1. Apply grease to the inside surface of the valve seals; then place a lower spring seat and valve guide seal over each valve guide.

2. Insert an intake valve seat pilot shaft into one of the intake valve guides. Slide the intake valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the intake valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining intake valve.

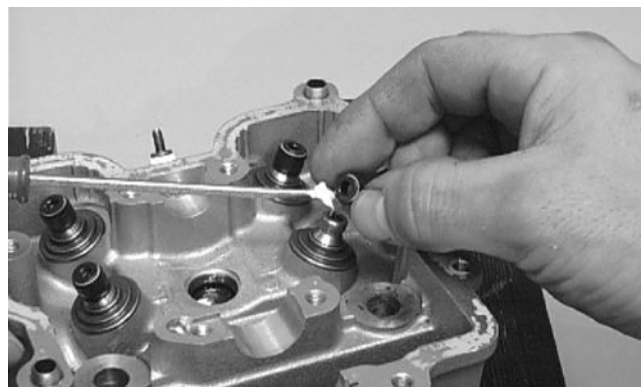


CC140D

### Lapping Valves

■ **NOTE:** Do not grind the valves. If a valve is damaged, it must be replaced.

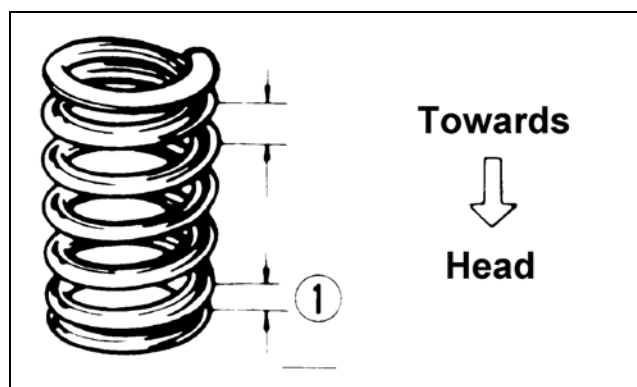
1. Remove all carbon from the valves.
2. Lubricate each valve stem with light oil; then apply a small amount of valve lapping compound to the entire seating face of each valve.
3. Attach the suction cup of a valve lapping tool to the head of the valve.
4. Rotate the valve until the valve and seat are evenly polished.
5. Clean all compound residue from the valve and seat.



CC144D

2. Insert each valve into its original valve location.
3. Install the valve springs with the painted end of the spring facing away from the cylinder head.

■ **NOTE:** If the painted end is not visible, install the ends of the springs with the closest coils toward the head.



ATV-1011A

4. Place a spring retainer over the valve springs; then using the valve spring compressor, compress the valve springs and install the valve cotters.



CC994

## PISTON ASSEMBLY

■ **NOTE:** Whenever a piston, rings, or pin are out of tolerance, they must be replaced.

### Cleaning/Inspecting Piston

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the dome of the piston.
2. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
3. Inspect the piston for seizure marks or scuffing. Repair with #400 grit wet-or-dry sandpaper and water or honing oil.

■ **NOTE:** If scuffing or seizure marks are too deep to correct with the sandpaper, replace the piston.

4. Inspect the perimeter of each piston for signs of excessive “blowby.” Excessive “blowby” indicates worn piston rings or an out-of-round cylinder.

### Removing Piston Rings

1. Starting with the top ring, slide one end of the ring out of the ring-groove.



CC400D

2. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

■ **NOTE:** If the existing rings will not be replaced with new ones, note the location of each ring for proper installation. When installing new rings, install as a complete set only.

### Cleaning/Inspecting Piston Rings

1. Take an old piston ring and snap it into two pieces; then grind the end of the old ring to a 45° angle and to a sharp edge.
2. Using the sharpened ring as a tool, clean carbon from the ring-grooves. Be sure to position the ring with its tapered side up.

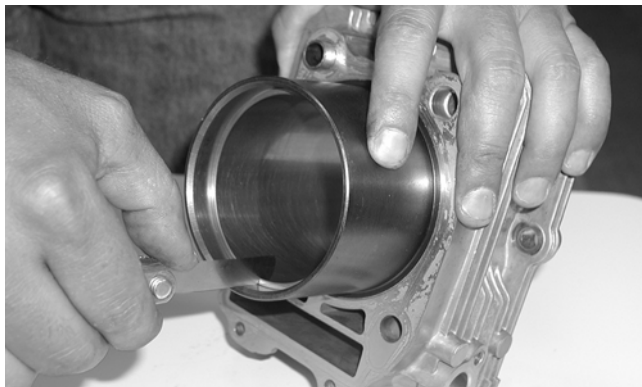
#### **CAUTION**

Improper cleaning of the ring-grooves by the use of the wrong type of ring-groove cleaner will result in severe damage to the piston.

### Measuring Piston-Ring End Gap (Installed)

1. Place each piston ring in the wear portion of the cylinder. Use the piston to position each ring squarely in the cylinder.
2. Using a feeler gauge, measure each piston-ring end gap. Acceptable ring end gap must be within specifications.

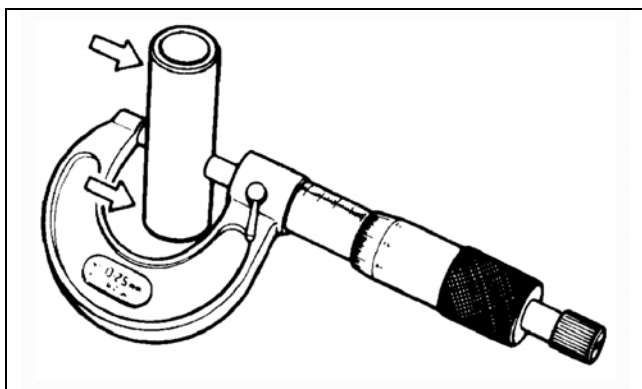




CC995

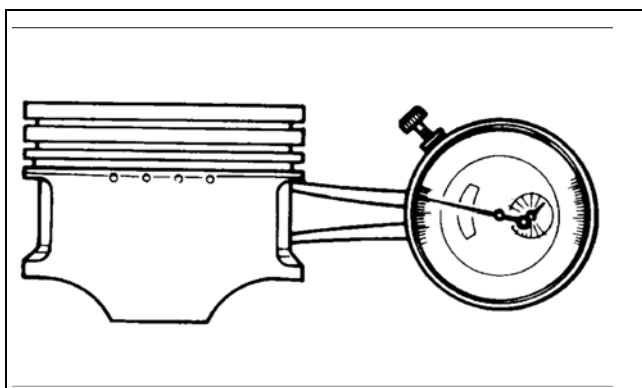
### Measuring Piston Pin (Outside Diameter) and Piston-Pin Bore

1. Measure the piston pin outside diameter at each end and in the center. If measurement is not within specifications, the piston pin must be replaced.



ATV-1070

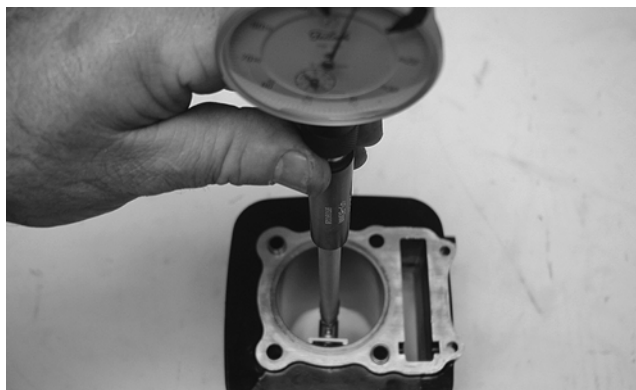
2. Insert an inside dial indicator into the piston-pin bore. The diameter must not exceed specifications. Take two measurements to ensure accuracy.



ATV-1069

### Measuring Piston Skirt/ Cylinder Clearance

1. Measure the cylinder front to back in six places.



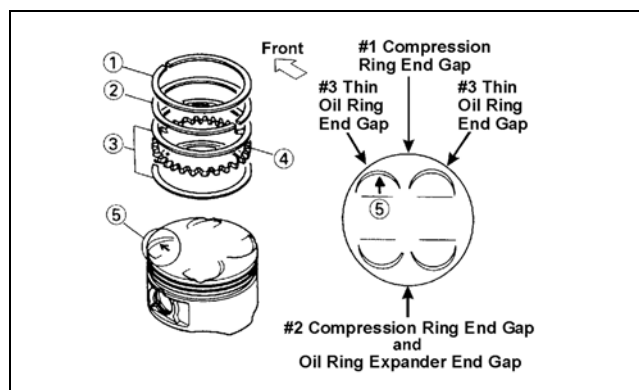
CD325

2. Measure the corresponding piston diameter at a point 15 mm (0.6 in.) above the piston skirt at a right angle to the piston-pin bore. Subtract this measurement from the measurement in step 1. The difference (clearance) must be within specifications.

### Installing Piston Rings

1. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.

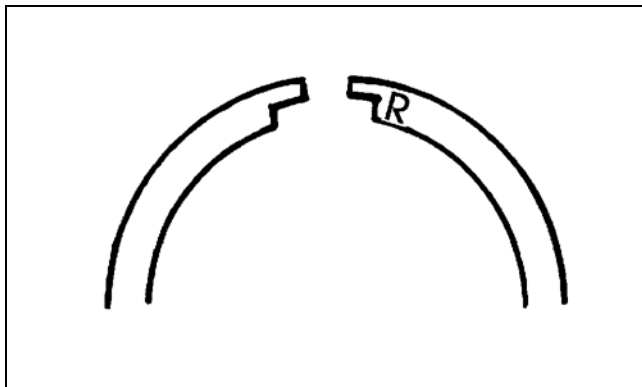
■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.



ATV-1085B

2. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston (see illustration).

■ **NOTE:** The chrome (silver) ring should be installed in the top position.



726-306A

**CAUTION**

Incorrect installation of the piston rings will result in engine damage.

### CYLINDER/CYLINDER HEAD ASSEMBLY

■ **NOTE:** If the cylinder/cylinder head assembly cannot be trued, they must be replaced.

### Cleaning/Inspecting Cylinder Head

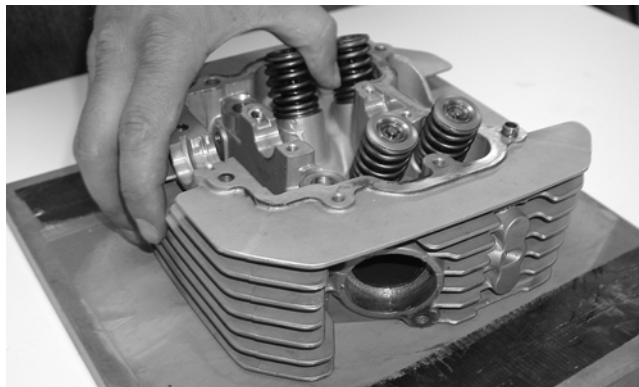
**CAUTION**

The cylinder head studs must be removed for this procedure.

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the combustion chamber being careful not to nick, scrape, or damage the combustion chamber or the sealing surface.
2. Inspect the spark plug hole for any damaged threads. Repair damaged threads using a "heli-coil" insert.
3. Place the cylinder head on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder head in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder head in a figure eight motion until a uniform bright metallic finish is attained.

**CAUTION**

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



CC996

### Measuring Cylinder Head Distortion

1. Remove any carbon buildup in the combustion chamber.
2. Lay a straightedge across the cylinder head; then using a feeler gauge, check the distortion factor between the head and the straightedge.
3. Maximum distortion must not exceed specifications.

3



CC141D

### Cleaning/Inspecting Cylinder

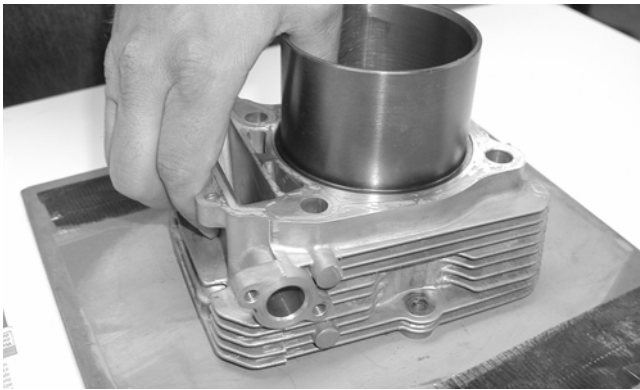
1. Wash the cylinder in parts-cleaning solvent.
2. Inspect the cylinder for pitting, scoring, scuffing, warpage, and corrosion. If marks are found, repair the surface using a cylinder hone (see Honing Cylinder in this sub-section).

3. Place the cylinder on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder in a figure eight motion until a uniform bright metallic finish is attained.



### CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



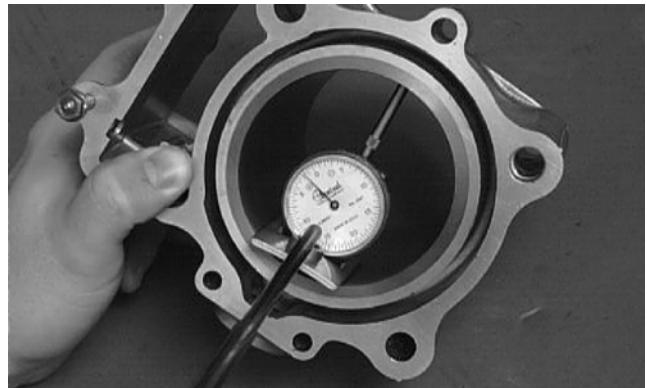
CC997

## Inspecting Cam Chain Guide

1. Inspect cam chain guide for cuts, tears, breaks, or chips.
2. If the chain guide is damaged, it must be replaced.

## Honing Cylinder

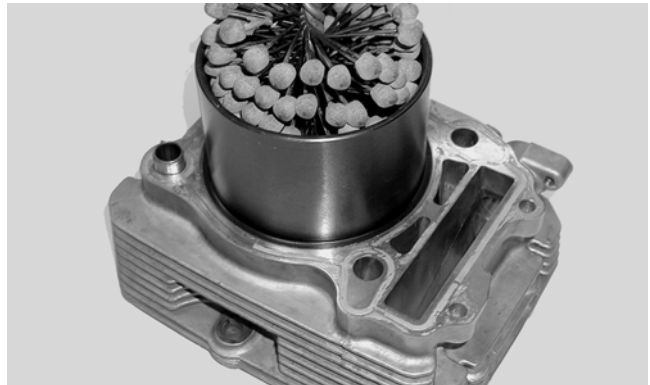
1. Using a slide gauge and a dial indicator or a snap gauge, measure the cylinder bore diameter in three locations from top to bottom and again from top to bottom at 90° from the first measurements for a total of six measurements. The trueness (out-of-roundness) is the difference between the highest and lowest reading. Maximum trueness (out-of-roundness) must not exceed specifications.



CC127D

2. Wash the cylinder in parts-cleaning solvent.
3. Inspect the cylinder for pitting, scoring, scuffing, and corrosion. If marks are found, repair the surface using a ball hone.

■ **NOTE:** To produce the proper 60° cross-hatch pattern, use a low RPM drill (600 RPM) at the rate of 30 strokes per minute. If honing oil is not available, use a lightweight petroleum-based oil. Thoroughly clean cylinder after honing using soap and hot water. Dry with compressed air; then immediately apply oil to the cylinder bore. If the bore is severely damaged or gouged, replace the cylinder.

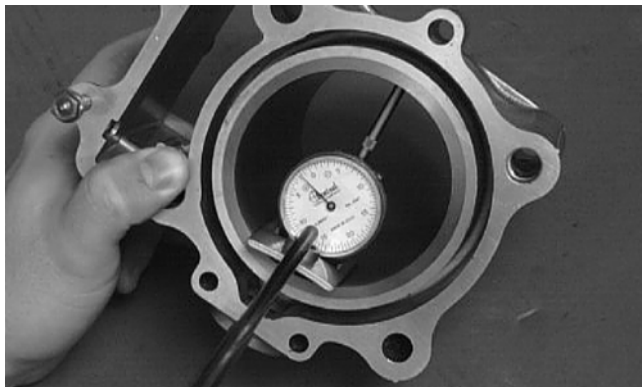


CC998

4. If any measurement exceeds the limit, bore the cylinder and install an oversized piston or replace the cylinder.

■ **NOTE:** Oversized piston and rings are available in 0.50 mm (0.020 in.) only.



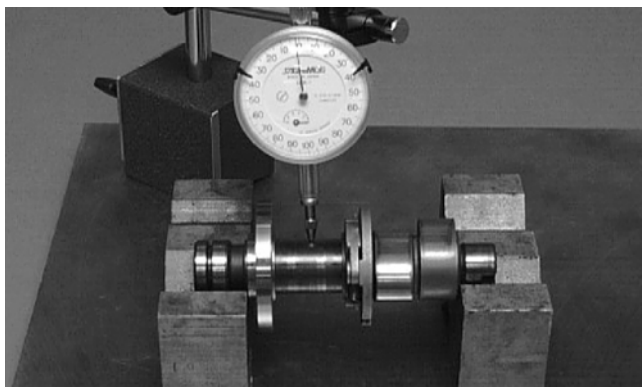


CC127D

## Measuring Camshaft Runout

■ **NOTE:** If the camshaft is out of tolerance, it must be replaced.

1. Place the camshaft on a set of V blocks; then position the dial indicator contact point against the shaft and zero the indicator.

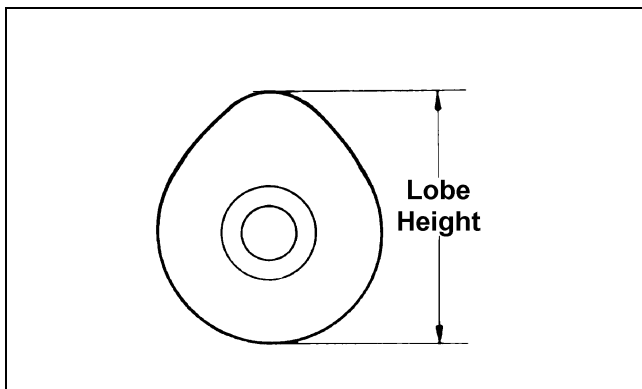


CC283D

2. Rotate the camshaft and note runout; maximum tolerance must not exceed specifications.

## Measuring Camshaft Lobe Height

1. Using a calipers, measure each cam lobe height.



ATV1013A

2. The lobe heights must not exceed minimum specifications.

## Inspecting Camshaft Bearing Journal

1. Inspect the bearing journal for scoring, seizure marks, or pitting.
2. If excessive scoring, seizure marks, or pitting is found, the cylinder head assembly must be replaced.

## Measuring Camshaft to Cylinder Head Clearance

1. Remove the adjuster screws and jam nuts.



CC005D

2. Place a strip of plasti-gauge in each of the camshaft lands in the cylinder head.
3. Place the valve cover on the cylinder head and secure with the valve cover cap screws. Tighten securely.

■ **NOTE:** Do not rotate the camshaft when measuring clearance.

4. Remove the cap screws securing the valve cover to the cylinder; then remove the valve cover and camshaft.



MD1261

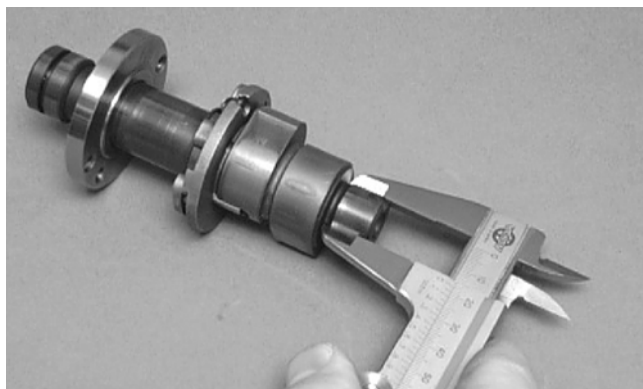
5. Match the width of the plasti-gauge with the chart found on the plasti-gauge packaging to determine camshaft to cylinder head and valve cover clearance.





CC145D

6. If clearance is excessive, measure the journals of the camshaft.

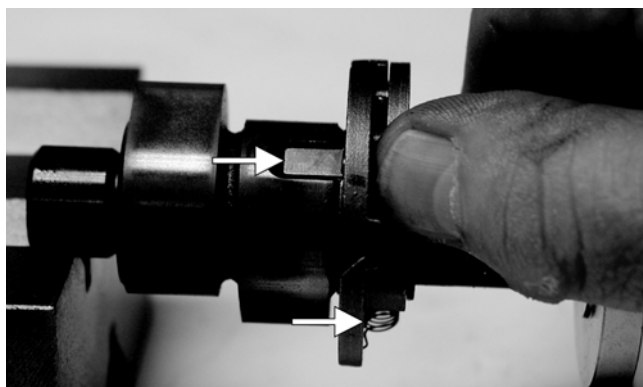


CC287D

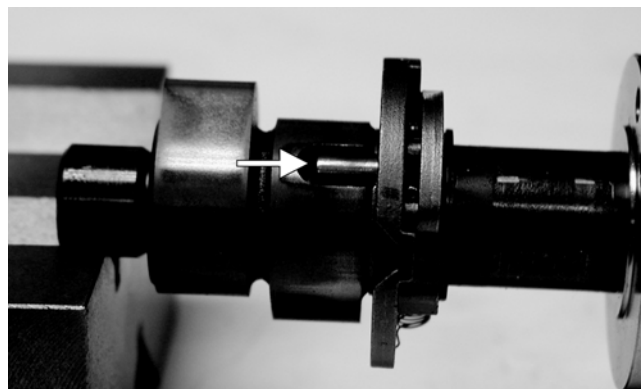
■ **NOTE:** If the journals are worn, replace the camshaft; then measure the clearance again. If it is still out of tolerance, replace the cylinder head.

### Inspecting Camshaft Spring/Drive Pin

1. Inspect the spring and drive pin for damage.



CF061A



CF060A

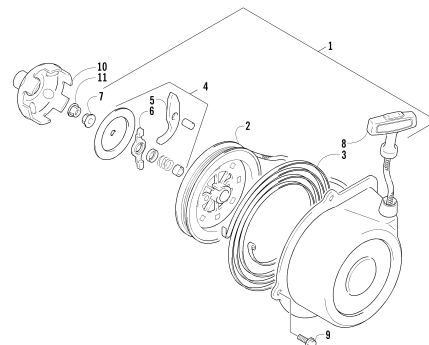
2. If damaged, the camshaft must be replaced.

## Servicing Left-Side Components

### RECOIL STARTER

#### KEY

1. Recoil Starter Assy
2. Reel
3. Spiral Spring
4. Ratchet Assy
5. Ratchet
6. Ratchet Guide
7. Nut
8. Rope Assy
9. Cap Screw
10. Starter Cup
11. Nut



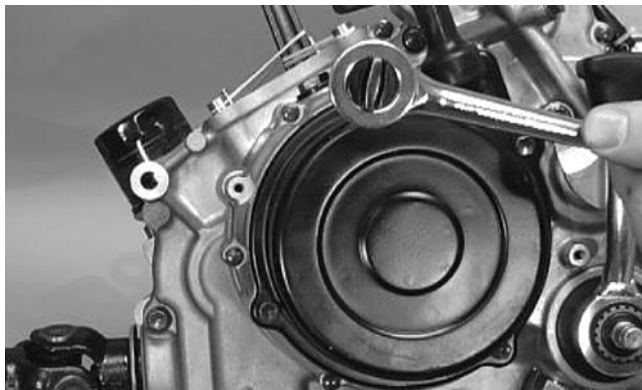
0737-034

#### **⚠ WARNING**

Always wear safety glasses when servicing the recoil starter.

### Removing/Disassembling

1. Remove the cap screws securing the recoil starter assembly to the left-side cover; then remove the starter.



CC039D

**⚠ WARNING**

During the disassembly procedure, continuous downward pressure must be exerted on the reel so it does not accidentally disengage and cause injury.

2. Rotate the reel counterclockwise until the notch of the reel is near the rope guide in the case. Guide the rope into the notch and slowly allow the reel to retract until all spiral spring tension is released.



B600D

**⚠ CAUTION**

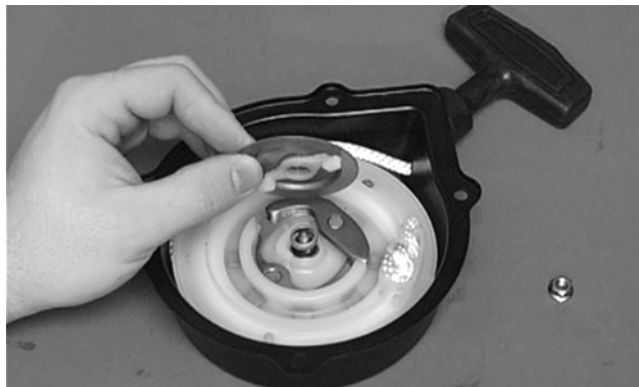
During the disassembly procedure, make sure all spring tension is released before continuing.

3. Remove the nut.



B601D

4. Slowly release the friction plate and lift the plate with ratchet guide free of the recoil case; then remove the ratchet guide from the friction plate.



B602D

5. Remove the spring cover, spring, and shaft.



B603D

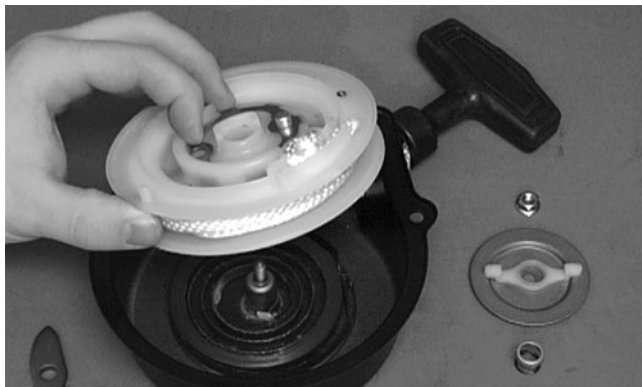
6. Remove the ratchet and account for the pin.



B604D

7. Carefully lift the reel free of the case making sure the spiral spring does not accidentally disengage from the case.

**3**



B605D

### **WARNING**

**Care must be taken when lifting the reel free of the case. Wear safety glasses to avoid injury.**

8. Remove the protective cover from the starter handle and pull the rope out of the handle; then untie the knot in the rope and remove the handle.

■ **NOTE:** Do not remove the spiral spring unless replacement is necessary. It should be visually inspected in place to save time. If replacement is necessary, follow steps 9-10.

9. Remove the spiral spring from the case by lifting the spring end up and out. Hold the remainder of the spring with thumbs and alternately release each thumb to allow the spring to gradually release from the case.
10. Unwind the rope from the reel and remove the rope.

### **Cleaning and Inspecting**

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all components.
2. Inspect the springs and ratchet for wear or damage.
3. Inspect the reel and case for cracks or damage.
4. Inspect the shaft for wear, cracks, or damage.
5. Inspect the rope for breaks or fraying.
6. Inspect the spiral spring for cracks, crystallization, or abnormal bends.
7. Inspect the handle for damage, cracks, or deterioration.

### **Assembling/Installing**

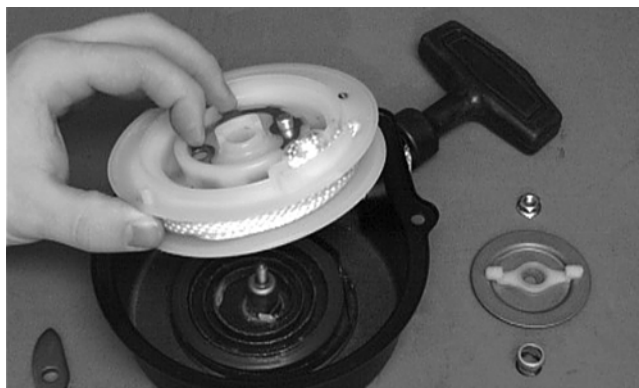
1. If removed, insert the spiral spring into the case with the outer end of the spring around the mounting lug in the case; then wind it in a counterclockwise direction until the complete spring is installed.

■ **NOTE:** The spiral spring must seat evenly in the recoil case.



B606D

2. Insert the rope through the hole in the reel and tie a knot in the end; then wrap the rope counterclockwise around the reel leaving approximately 50 cm (20 in.) of rope free of the reel.
3. Apply low-temperature grease to the spring and hub.
4. Thread the end of the rope through the guide hole of the case; then thread the rope through the handle and secure it with a double knot. Install the protective cover into the handle.
5. Align the inner hook of the spiral spring with the notch in the reel.



B605D

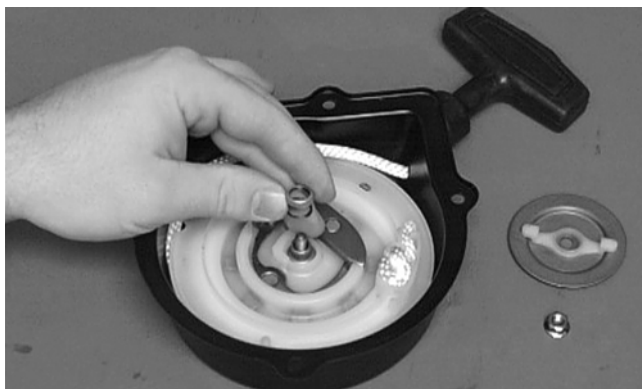
6. Install the ratchet onto its pin making sure the end is properly installed on the reel.





B604D

7. Install the shaft, spring, and the spring cover.



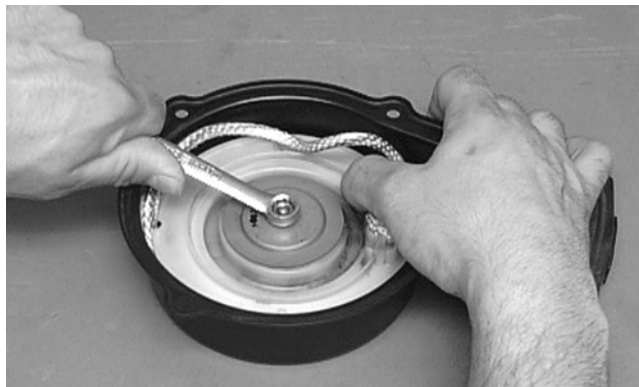
B603D

8. Install the friction plate with the ratchet guide fitting into the ratchet.



B602D

9. While pushing down on the reel, install the nut. Tighten securely.



B601D

10. With the 50 cm (20 in.) of rope exposed, hook the rope in the notch of the reel.

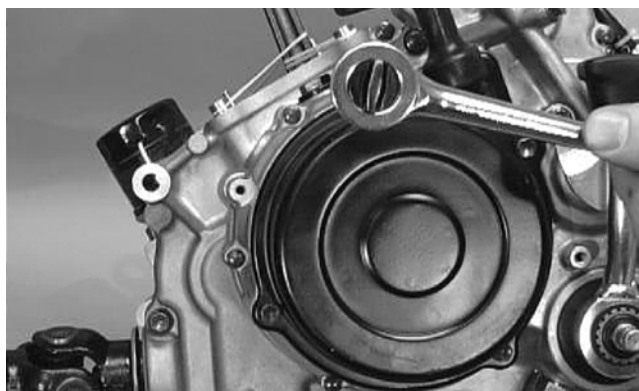
11. Rotate the reel four turns counterclockwise; then release the rope from the notch and allow the rope to retract.

12. Pull the rope out two or three times to check for correct tension.

■ **NOTE:** Increasing the rotations in step 11 will increase spring tension.

13. Place the recoil starter assembly into position on the left-side cover; then tighten the cap screws to specifications.

3



CC039D

### MEASURING SHIFT FORK (Thickness)

■ **NOTE:** Whenever a shift fork is out of tolerance, replacement is necessary.

1. Using a calipers, in turn measure the thickness of the machined tip of each shift fork.



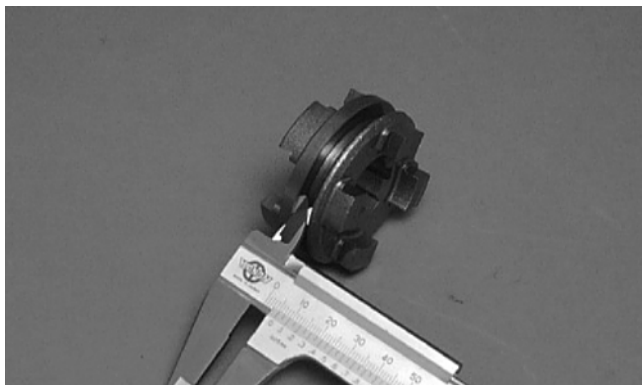


CC296D

2. Shift fork thickness must be within specifications.

### MEASURING SHIFT FORK GROOVE (Width)

1. Using a calipers, in turn measure the width of each shift fork groove.



CC288D

2. Shift fork groove width must be within specifications.

### MEASURING SHIFT FORK TO GROOVE (Side Clearance)

1. In turn, insert each shift fork into its groove.
2. Using a feeler gauge, measure the clearance between the shift fork and the groove.



CC292D

3. Shift fork to groove side clearance must be within specifications.

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## Servicing Right-Side Components

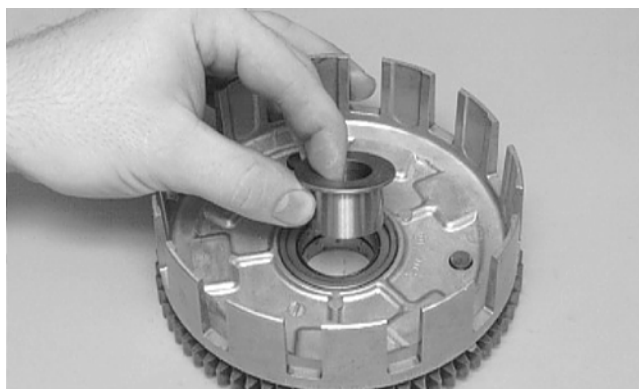
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■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

### PRIMARY CLUTCH ASSEMBLY (Inspecting/Measuring/Assembling)

■ **NOTE:** Prior to inspecting and measuring components, it is recommended that all components be removed from the primary gear assembly and be cleaned.

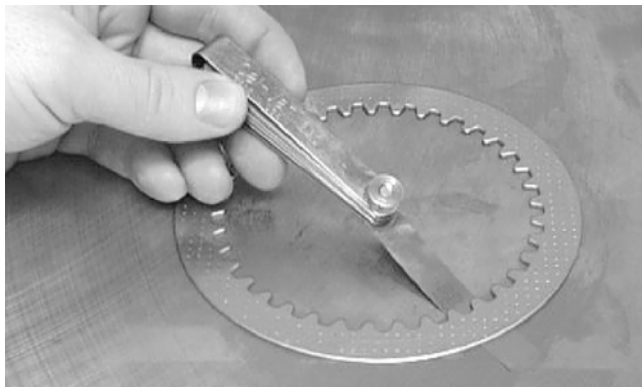
■ **NOTE:** When removing components from the primary gear assembly, account for the bushing that fits into the primary gear.



CC239D

### Inspecting/Measuring Clutch Driven Plate Warpage

1. Inspect each driven plate for warpage and burn marks.
2. In turn place each driven plate on the surface plate; then using a feeler gauge, measure warpage in several locations.

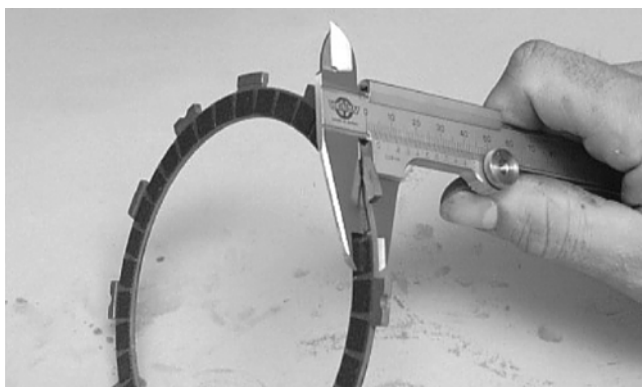


CC245D

3. Maximum driven plate warpage must not exceed specifications.

### Measuring Clutch Drive Plate (Fiber) Thickness

1. Using a calipers, in turn measure the thickness of each drive plate in several locations.



CC243D

2. Drive plate thickness must not exceed minimum specifications.
3. If the fiber plate tabs are damaged, the plate must be replaced.
4. Inspect the clutch sleeve hub for grooves or notches. If grooves or notches are present, replace the hub.

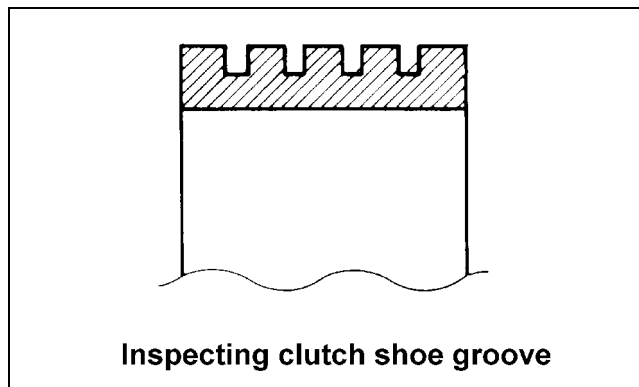
### Inspecting Centrifugal Clutch Shoe

1. Inspect the clutch shoe for uneven wear, chips, cracks, or discoloration.
2. Inspect the depth of the grooves in the clutch shoes. If any shoe is worn to the bottom of the groove, replace the complete set.



#### CAUTION

Always replace clutch shoes as a complete set or severe imbalance could occur.



Inspecting clutch shoe groove

ATV1014

### Inspecting Centrifugal Clutch Housing

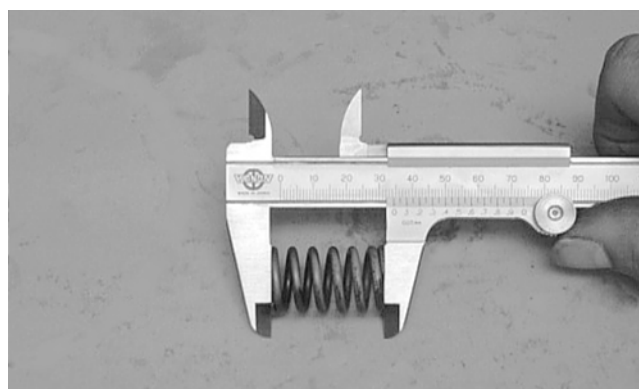
1. Inspect the clutch housing for burns, marks, scuffs, cracks, scratches, or uneven wear.
2. If the housing is damaged in any way, the housing must be replaced.

### Inspecting Primary One-Way Drive

1. Insert the drive into the clutch housing.
2. Rotate the inner race by hand and verify the inner race rotates only one direction.
3. If the inner race is locked in place or rotates both directions, the drive assembly must be replaced.

### Measuring Clutch Spring Length

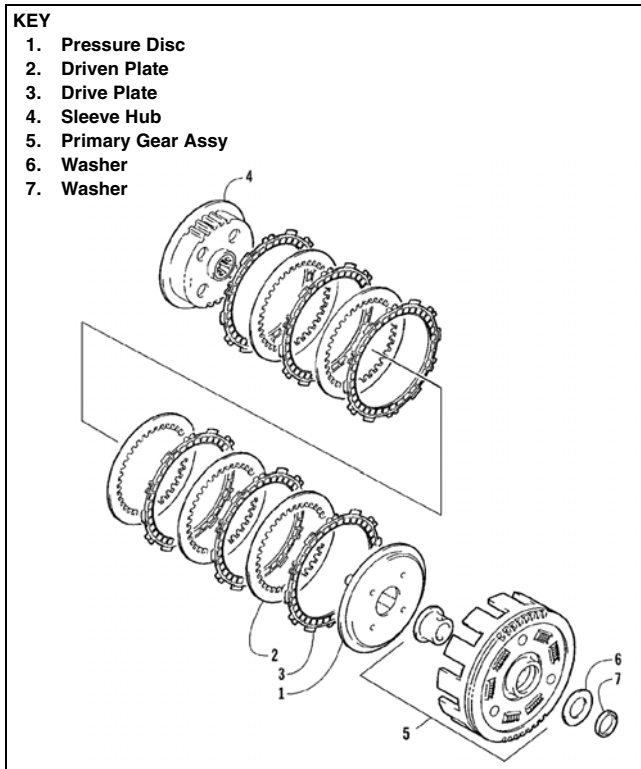
1. Using a calipers, measure the overall free length of the clutch spring.



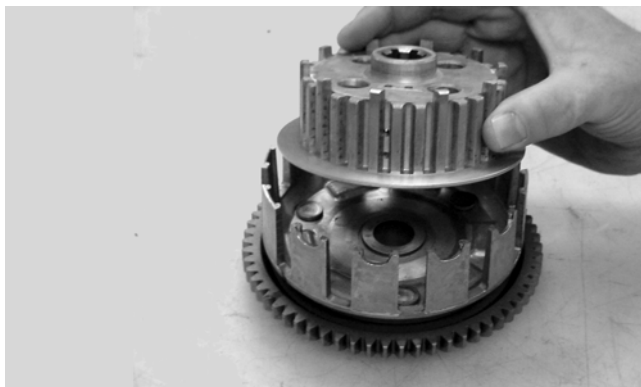
CC247D

2. Overall length must not exceed minimum specifications.

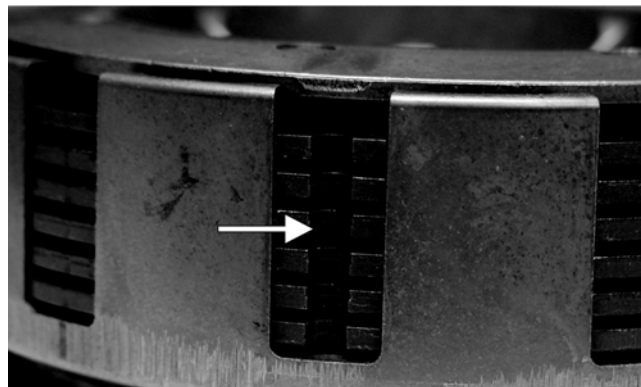
## Assembling Primary Clutch



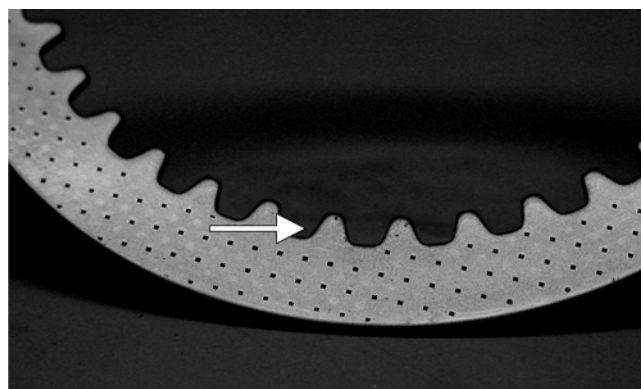
1. Place the clutch hub upside down into the primary gear assembly.



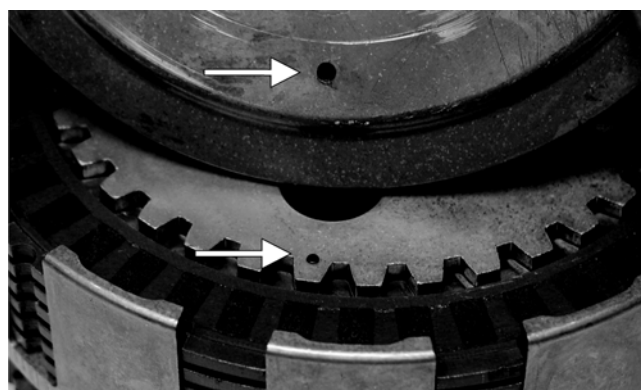
2. Alternately install the drive plates and driven plates onto the hub (starting and ending with a drive plate) making sure the tabs with the notches are all in line with each other.



■ **NOTE:** When installing the driven plates for ease of installation, make sure they are placed onto the hub with the rounded side of the plates directed down.

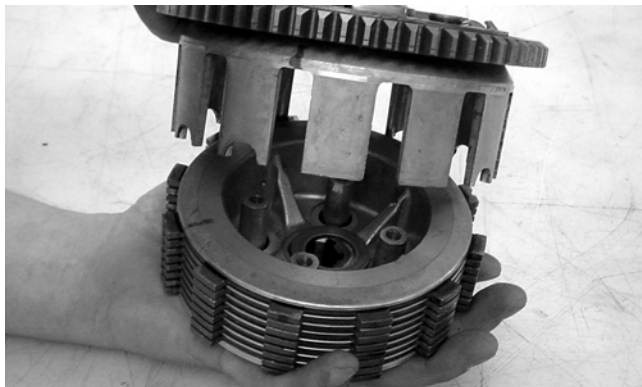


3. Install the pressure plate onto the hub making sure the alignment dots are correctly positioned.



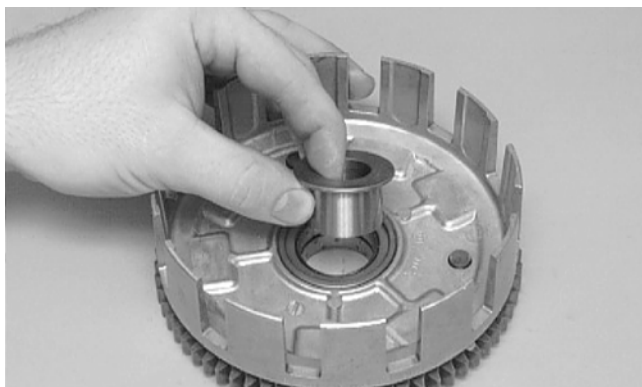
4. Place the primary gear assembly w/clutch hub assembly in one hand, place the other hand on top of the clutch hub assembly, and flip the assembly over; then lift the primary gear assembly off the clutch hub assembly being careful not to disturb the drive plate notched tab orientation.





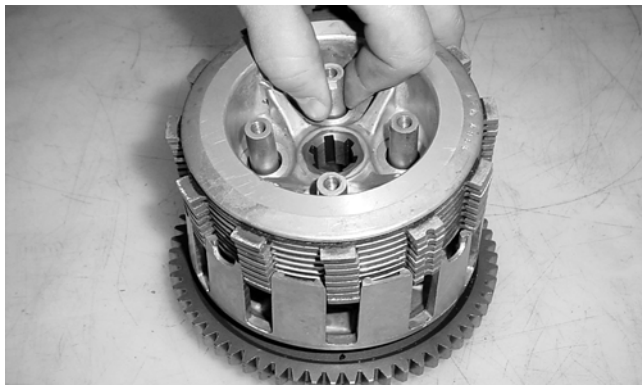
CC924

5. Place the primary gear assembly on a clean, flat surface; then install the primary washer into the assembly.



CC239D

6. Place the clutch hub assembly into the primary gear assembly.



CC926



### CAUTION

The clutch hub and the pressure plate must be seated in the proper position. If any of the incorrect positions are used, the hub and plate will have clearance between them and they will not operate properly.

■ **NOTE:** The primary clutch assembly is now completely assembled for installation.

## INSPECTING OIL PUMP

1. Inspect the pump for damage.
2. It is inadvisable to remove the screw securing the pump halves. If the oil pump is damaged, it must be replaced.



CC446D

3

## Servicing Center Crankcase Components

■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

### SECONDARY GEARS

■ **NOTE:** When checking and correcting secondary gear backlash and tooth contact, the universal joint must be secured to the front shaft or false measurements will occur.

### Checking Backlash

■ **NOTE:** The rear shaft and bevel gear must be removed for this procedure. Also, always start with the original shims on the rear shaft.

1. Place the left-side crankcase cover onto the left-side crankcase half to prevent runoff of the secondary transmission output shaft.
2. Install the secondary driven output shaft assembly onto the crankcase.
3. Mount the indicator tip of the dial indicator on the secondary driven bevel gear.
4. While rocking the driven bevel gear back and forth, note the maximum backlash reading on the gauge.
5. Acceptable backlash range is 0.05-0.33 mm (0.002-0.013 in.).



## Correcting Backlash

■ **NOTE:** If backlash measurement is within the acceptable range, no correction is necessary.

1. If backlash measurement is less than specified, remove an existing shim, measure it, and install a new thinner shim.
2. If backlash measurement is more than specified, remove an existing shim, measure it, and install a thicker shim.

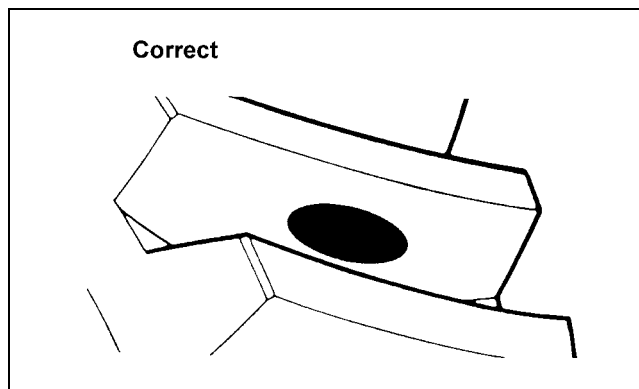
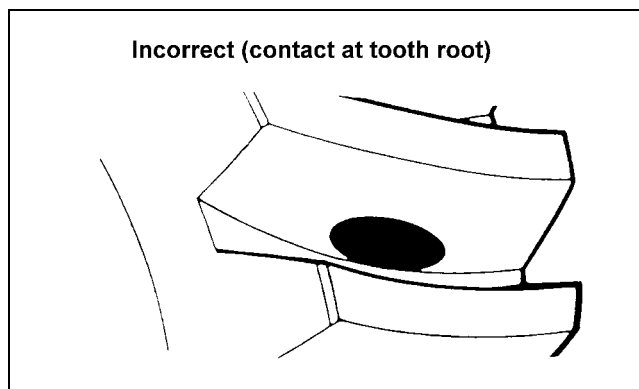
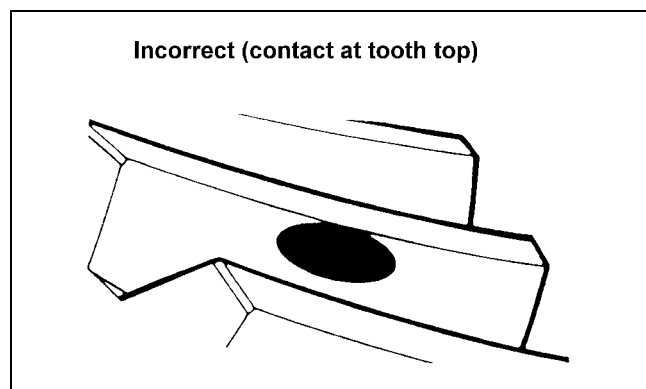
■ **NOTE:** Continue to remove, measure, and install until backlash measurement is within tolerance. Note the following chart.

| Backlash Measurement                 | Shim Correction         |
|--------------------------------------|-------------------------|
| Under 0.05 mm<br>(0.002 in.)         | Decrease Shim Thickness |
| At 0.05-0.33 mm<br>(0.002-0.013 in.) | No Correction Required  |
| Over 0.33 mm<br>(0.013 in.)          | Increase Shim Thickness |

## Checking Tooth Contact

■ **NOTE:** After correcting backlash of the secondary driven bevel gear, it is necessary to check tooth contact.

1. Remove the secondary driven output shaft assembly from the left-side crankcase half.
2. Clean the secondary driven bevel gear teeth of old oil and grease residue.
3. Apply a thin, even coat of a machinist-layout dye to several teeth of the gear.
4. Install the secondary driven output shaft assembly.
5. Rotate the secondary driven bevel gear several revolutions in both directions.
6. Examine the tooth contact pattern in the dye and compare the pattern to the illustrations.



## Correcting Tooth Contact

■ **NOTE:** If tooth contact pattern is comparable to the correct pattern illustration, no correction is necessary.

1. If tooth contact pattern is comparable to an incorrect pattern, correct tooth contact according to the following chart.

| Tooth Contact    | Shim Correction         |
|------------------|-------------------------|
| Contacts at Top  | Decrease Shim Thickness |
| Contacts at Root | Increase Shim Thickness |

■ **NOTE:** To correct tooth contact, steps 1 and 2 (with NOTE) of "Correcting Backlash" must be followed and the above "Tooth Contact/Shim Correction" chart must be consulted.

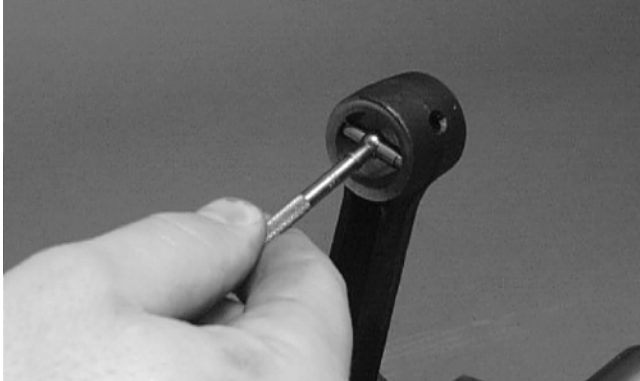
### CAUTION

After correcting tooth contact, backlash must again be checked and corrected (if necessary). Continue the correcting backlash/correcting tooth contact procedures until they are both within tolerance values.

## CRANKSHAFT ASSEMBLY

### Measuring Connecting Rod (Small End Inside Diameter)

1. Insert a snap gauge into the upper connecting rod small end bore; then remove the gauge and measure it with micrometer.



CC290D

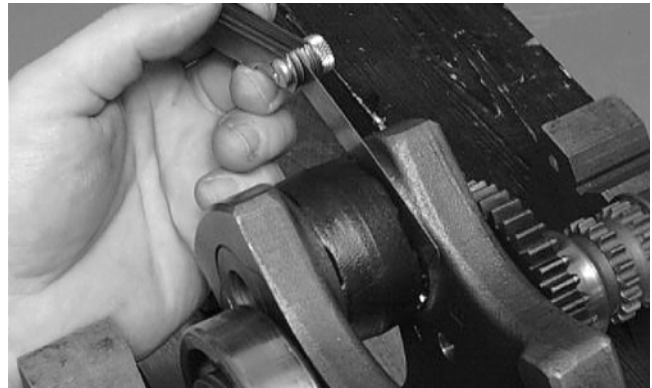
2. Maximum diameter must not exceed specifications.

### Measuring Connecting Rod (Small End Deflection)

1. Place the crankshaft on a set of V-blocks and mount a dial indicator and base on the surface plate. Position the indicator contact point against the center of the connecting rod small end journal.
2. Zero the indicator and push the small end of the connecting rod away from the dial indicator.
3. Maximum deflection must not exceed specifications.

### Measuring Connecting Rod (Big End Side-to-Side)

1. Push the lower end of the connecting rod to one side of the crankshaft journal.
2. Using a feeler gauge, measure the gap between the connecting rod and crankshaft journal.



CC289D

3. Acceptable gap range must be within specifications.

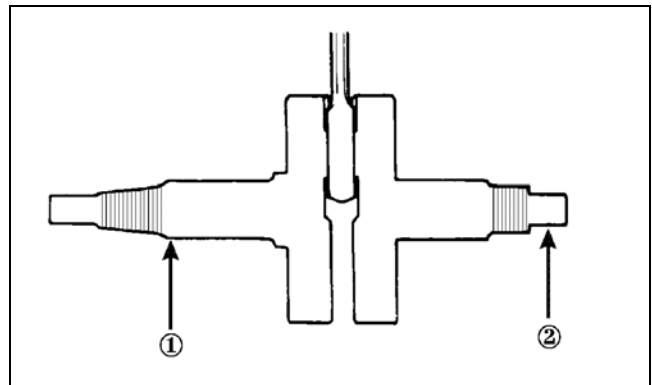
### Measuring Connecting Rod (Big End Width)

1. Using a calipers, measure the width of the connecting rod at the big-end bearing.
2. Acceptable width range must be within specifications.

3

### Measuring Crankshaft (Runout)

1. Place the crankshaft on a set of V blocks.
2. Mount a dial indicator and base on the surface plate. Position the indicator contact at point 1 of the crankshaft.



ATV-1074

3. Zero the indicator and rotate the crankshaft slowly.

#### CAUTION

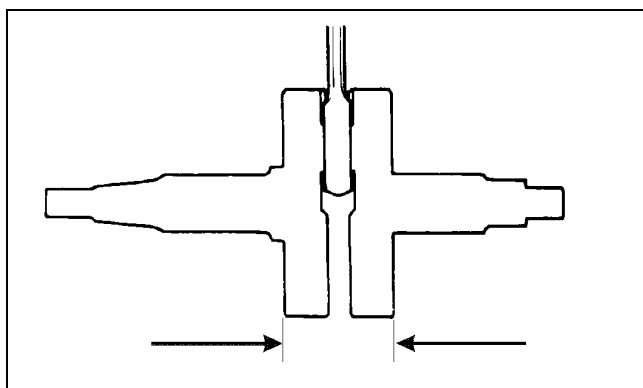
Care should be taken to support the connecting rod when rotating the crankshaft.

4. Maximum runout must not exceed specifications.

■ **NOTE:** Proceed to check runout on the other end of the crankshaft by positioning the indicator contact at point 2 and following steps 2-4.

## Measuring Crankshaft (Web-to-Web)

1. Using a calipers, measure the distance from the outside edge of one web to the outside edge of the other web.



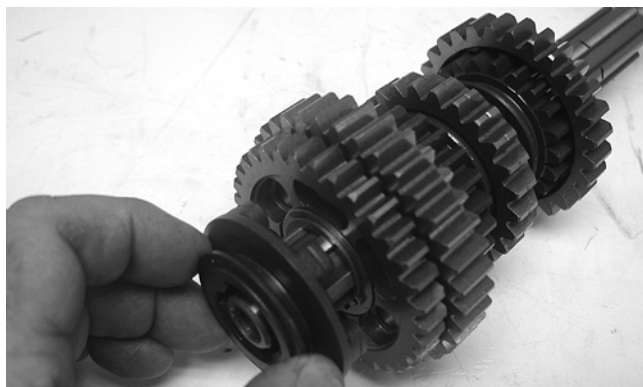
ATV-1017

2. Acceptable width range must be within specifications.

## DRIVESHAFT

### Disassembling

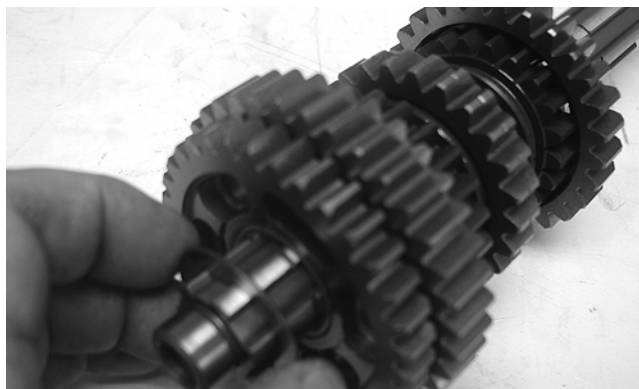
1. In order, remove the reverse dog, circlip, washer, reverse driven gear, and bushing from the driveshaft.



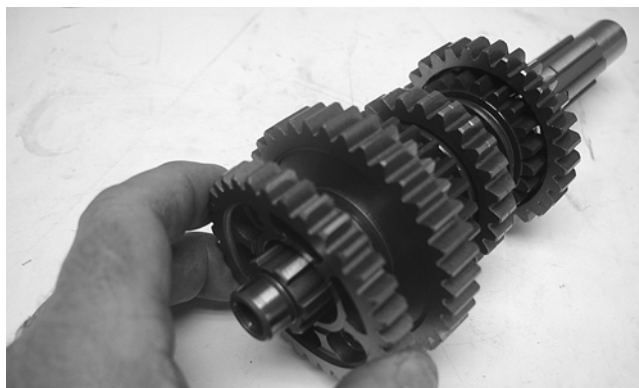
CD331



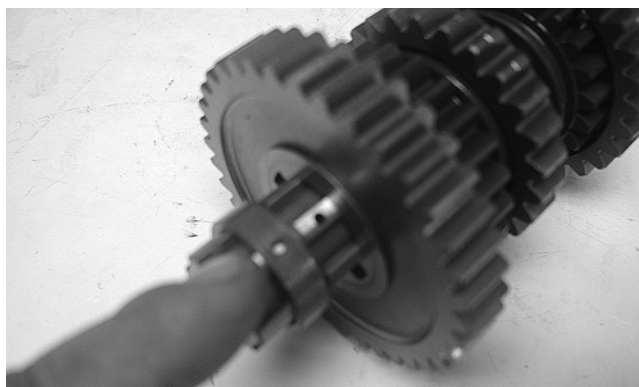
CD333



CD335



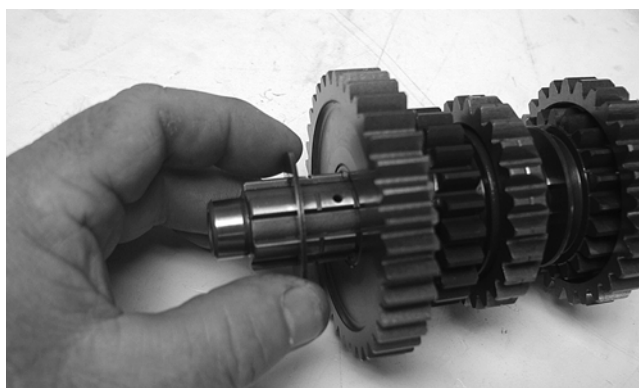
CD336



CD337

■ **NOTE:** The teeth on the bushing must face the 1st driven gear.

2. Remove the 1st driven washer (right side); then remove the 1st driven gear from the driveshaft.



CD339





CD341

3. Remove the 1st driven bushing; then remove the 1st driven washer (left side) from the shoulder of the splined shaft. Remove the 4th driven circlip.



CD342



CD343



CD344

4. Remove the 4th driven gear from the driveshaft. Note the four small dogs facing toward the 3rd driven gear for assembling purposes.



CD345

5. Remove the 3rd driven circlip; then remove the 3rd driven lock washer (right side) from the driveshaft.



CD346

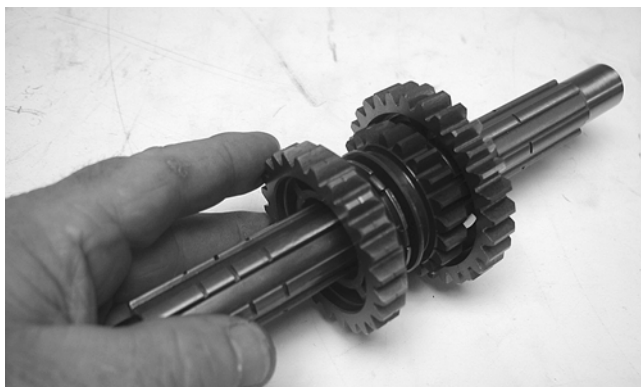


CD348

6. Remove the 3rd driven gear from the driveshaft.

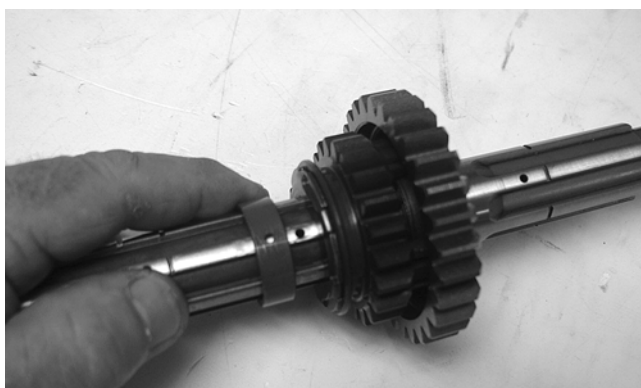
3





CD349

7. Remove the 3rd driven bushing from the driveshaft. Note the location of the oil feed hole in the bushing and the matching oil supply hole in the driveshaft for assembling purposes.



CD351

8. Remove the 3rd driven lock washer (left side) from the driveshaft. Note the tabs facing toward the 5th driven gear for assembling purposes.



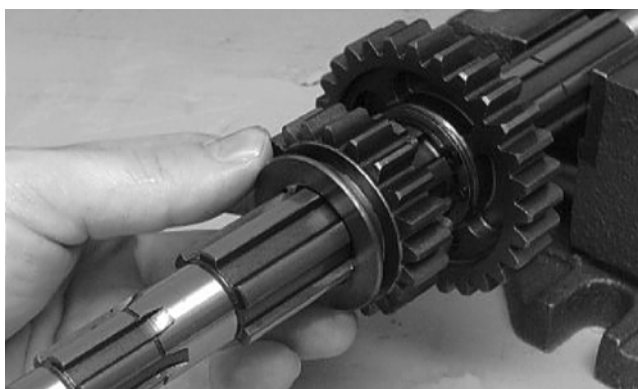
CD352

9. Remove the next 3rd driven lock washer (left side) by rotating it out of the groove. Note the groove closest to the 5th driven gear for assembling purposes.



CD354

10. Remove the 5th driven gear from the driveshaft.

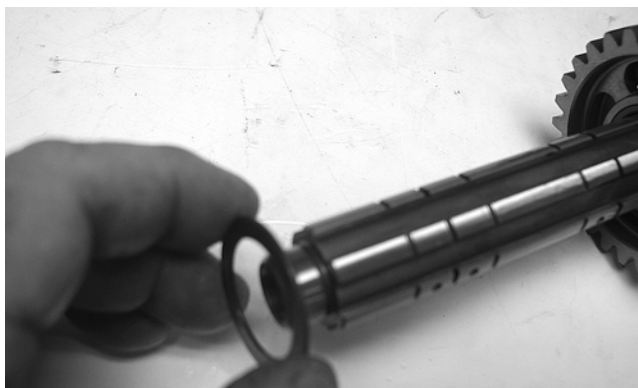


CC210D

11. In order, remove the 2nd driven circlip, washer, gear, and bushing from the driveshaft.



CD356



CD357



CD358



CD359

1. In order, install the 2nd driven bushing, gear, washer, and circlip onto the driveshaft.



CD359



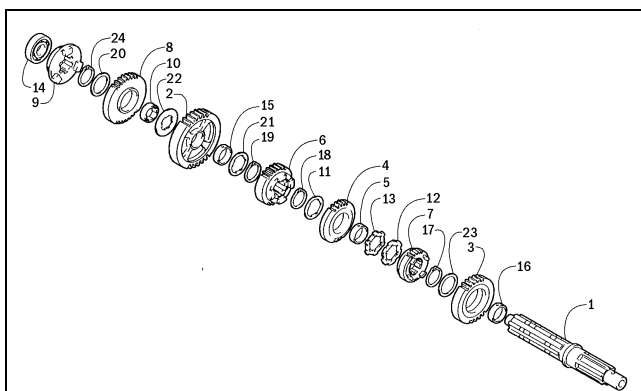
CD358

3

### AT THIS POINT

To service secondary gears, see Servicing Center Crankcase Components in this sub-section.

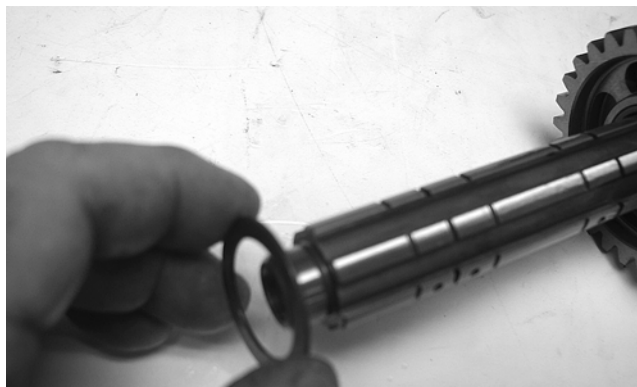
## Assembling



### KEY

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| 1. Driveshaft                      | 13. 3rd Driven Lock Washer - Left |
| 2. 1st Driven Gear                 | 14. Driveshaft Bearing            |
| 3. 2nd Driven Gear                 | 15. 1st Driven Bushing            |
| 4. 3rd Driven Gear                 | 16. 2nd Driven Bushing            |
| 5. 3rd Driven Bushing              | 17. 2nd Driven Circlip            |
| 6. 4th Driven Gear                 | 18. 3rd Driven Circlip            |
| 7. 5th Driven Gear                 | 19. 4th Driven Circlip            |
| 8. Reverse Driven Gear             | 20. Reverse Driven Washer         |
| 9. Reverse Dog                     | 21. 1st Driven Washer - Left      |
| 10. Reverse Driven Bushing         | 22. 1st Driven Washer - Right     |
| 11. 3rd Driven Lock Washer - Right | 23. 2nd Driven Washer             |
| 12. 3rd Driven Lock Washer - Left  | 24. Reverse Driven Circlip        |

737-733A



CD357



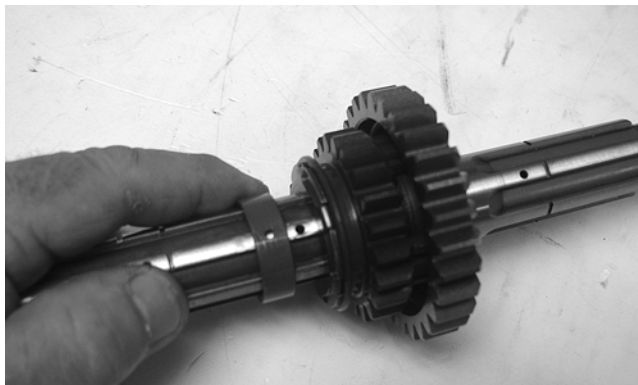
CD356

2. Install the 5th driven gear onto the driveshaft.



CD355

3. Install the 3rd driven lock washer (left side). Lock it into the groove closest to the 5th driven gear (as noted in disassembling) by rotating it when it is in the groove.



CD351

**CAUTION**

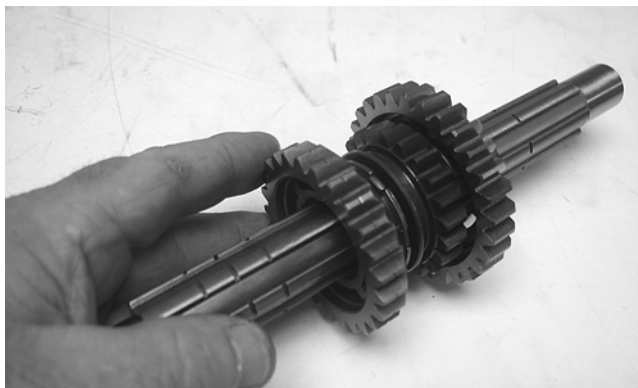
It is very important to assure the oil feed hole in the bushing and oil supply hole in the driveshaft align. If not aligned, engine damage will result.

6. In order, install the 3rd driven gear, lock washer (right side), and circlip onto the driveshaft.



CD354

4. Install the next 3rd driven lock washer (left side) onto the driveshaft making sure the tabs are facing toward the 5th driven gear. Make sure the tabs intertwine with the first 3rd driven lock washer.



CD349



CD352

5. Install the 3rd driven bushing onto the driveshaft making sure the oil feed hole in the bushing aligns with the appropriate oil supply hole in the driveshaft (as noted in disassembling).



CD348





CD346

7. Install the 4th driven gear onto the driveshaft making sure the four small dogs are facing toward the 3rd driven gear as noted in disassembling; then secure with the circlip.



CD343

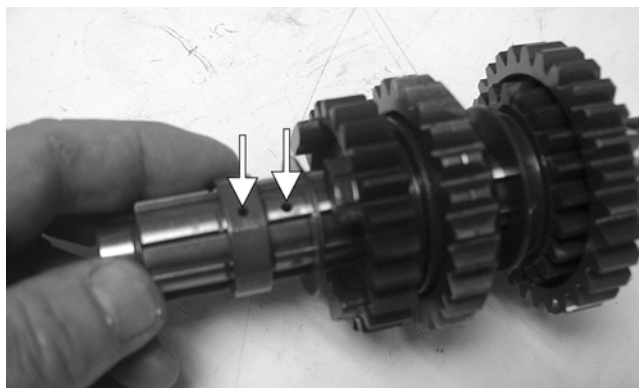


CD345



CD344

8. Install the 1st driven washer (left side) onto the shoulder of the splined shaft; then install the 1st driven bushing and gear.



CD342A



CD341

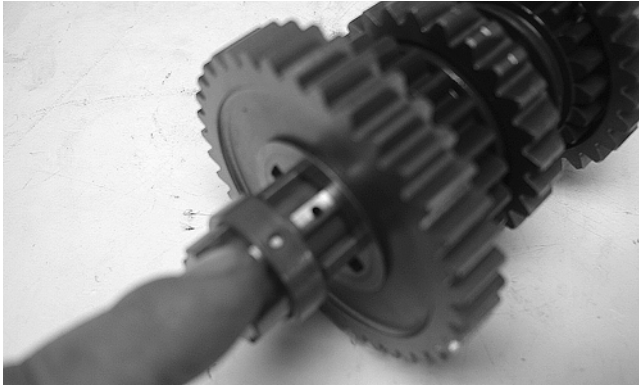
9. Install the 1st driven washer (right side) on the shaft making sure it lines up with the groove in the shaft; then turn the washer locking it on the shaft.



CD340



10. Slide the reverse driven bushing onto the shaft making sure the oil port in the bushing aligns with the oil port on the shaft.



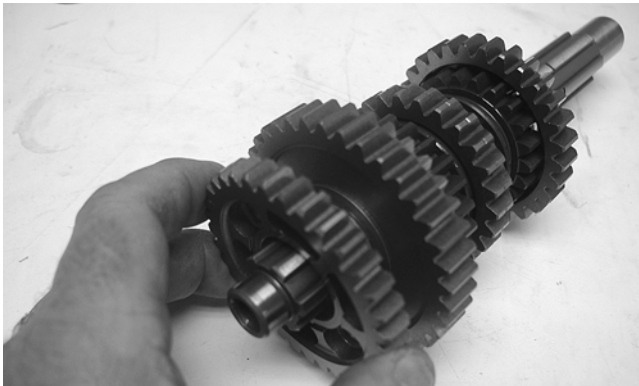
CD337



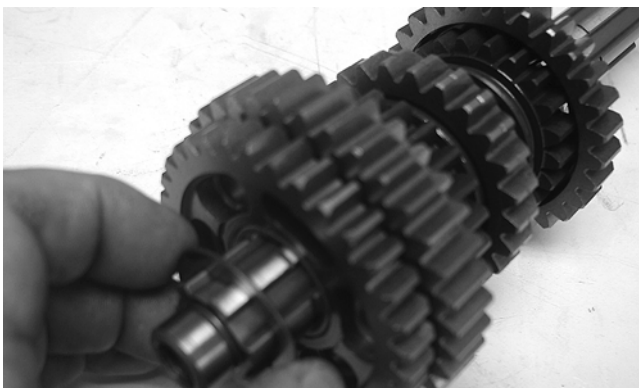
### CAUTION

Failure to align the oil ports will result in serious engine damage.

11. In order, install the reverse driven gear, washer, circlip, and reverse dog onto the driveshaft.



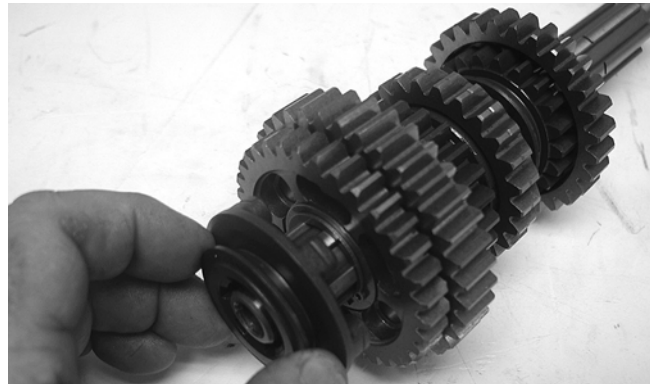
CD336



CD335



CD334



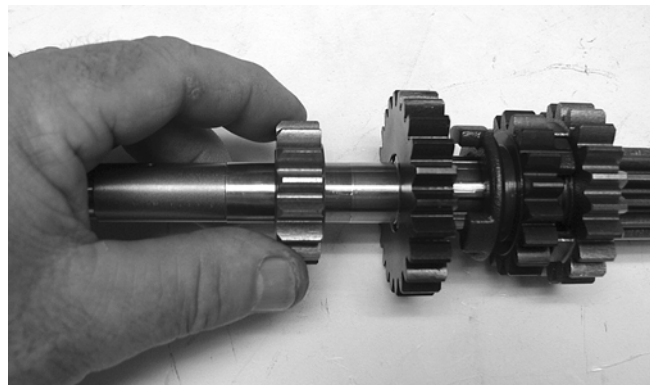
CD331

■ **NOTE:** The driveshaft is now completely assembled for installation.

## COUNTERSHAFT

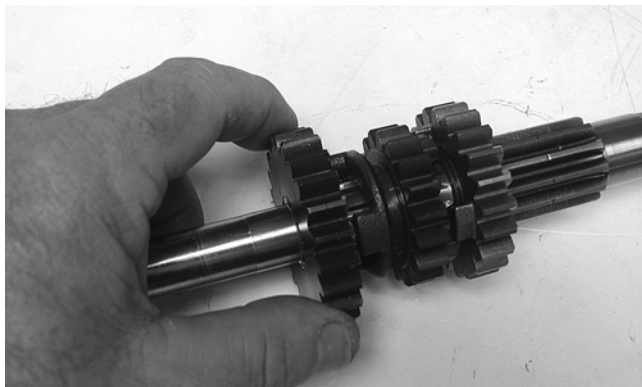
### Disassembling

1. Remove the 2nd drive gear from the countershaft.



CD395

2. Remove the 5th drive gear from the countershaft.



CD396

3. Remove the 5th drive washer and 5th drive circlip from the countershaft.

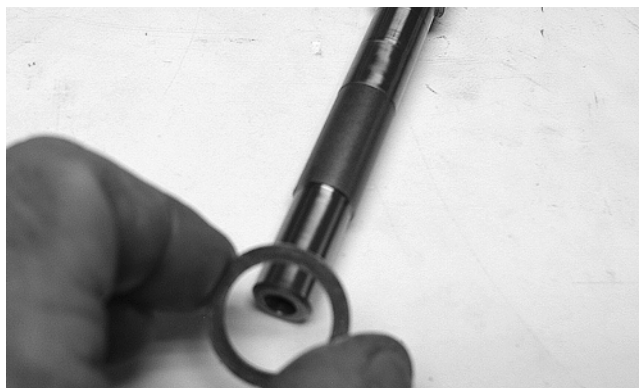


CD405

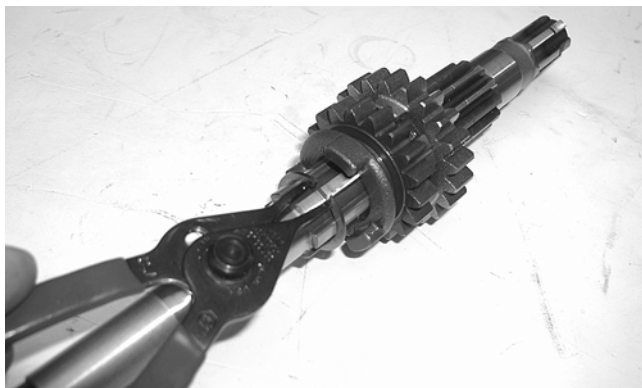
6. Remove the other 4th drive washer from the countershaft.



CD397



CD408

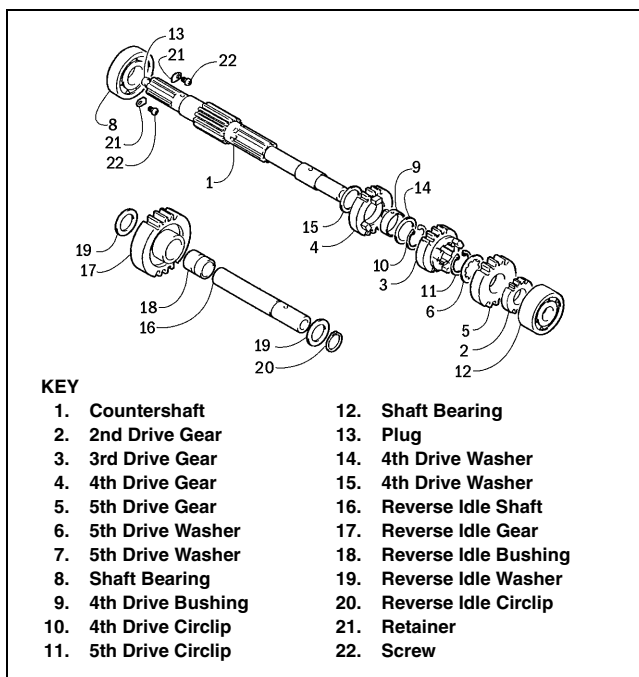


CD400

4. Remove the 3rd drive gear from the countershaft.

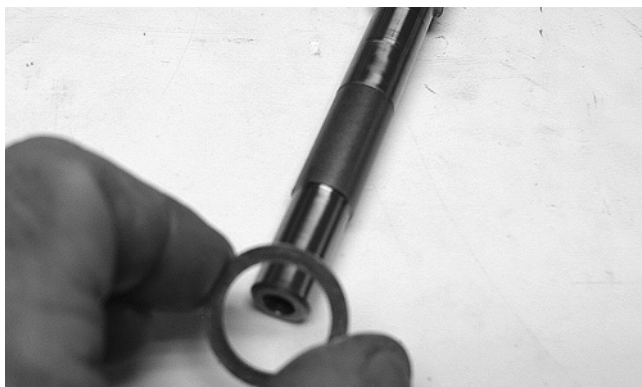
5. Remove the 4th drive circlip securing the 4th drive gear on the countershaft; then remove the first 4th drive washer and 4th drive gear. Account for the bushing.

## Assembling



737-733B

1. Install the 4th drive washer onto the countershaft.



CD408

2. Install the 4th drive gear making sure the bushing is in position; then install the other 4th drive washer onto the countershaft. Secure with the circlip.

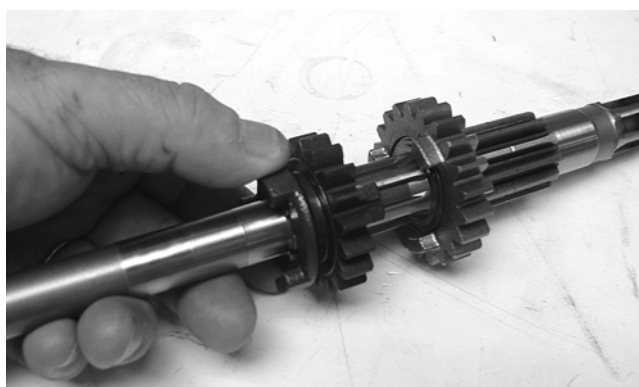


CD405

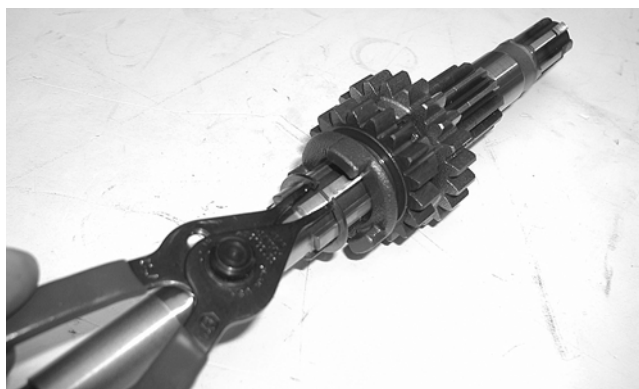


CD406

3. Install the 3rd drive gear; then install the 5th drive circlip onto the countershaft.



CD401

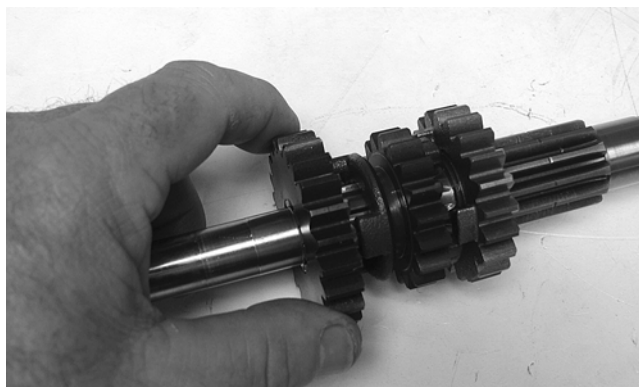


CD400

4. Install the 5th drive washer and 5th drive gear onto the countershaft.



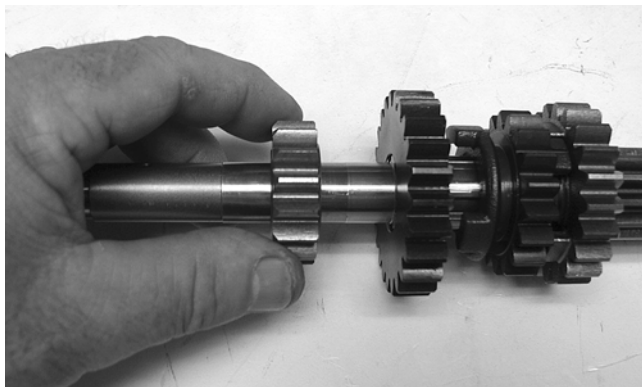
CD397



CD396

5. Install the 2nd drive gear onto the countershaft.





CD395

■ **NOTE:** The countershaft is now completely assembled for installation.

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## Assembling Crankcase Half

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■ **NOTE:** For ease of assembly, install components on the left-side crankcase half.

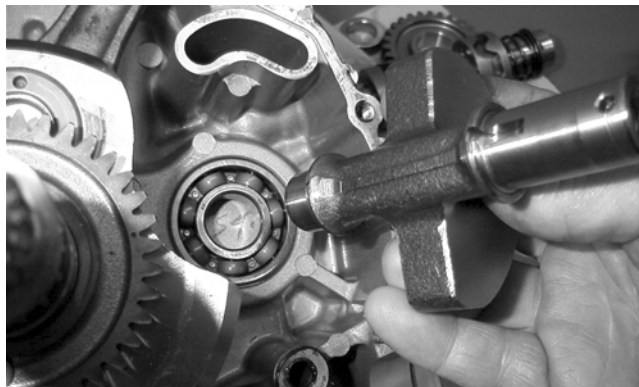
■ **NOTE:** If the output shaft and gear were removed, make sure that the proper shim is installed.

1. To install the output shaft and gear, place the shaft into position with proper shims, slide the gear onto the shaft, and secure with a new nut tightened to specifications.
2. Apply a liberal amount of engine oil to the crankshaft bearing. Using a propane torch, heat the bearing until the oil begins to smoke; then slide the crankshaft assembly into place. Install the crank balancer.



MD1334

■ **NOTE:** If heating the bearing is not possible, the crankshaft can be installed using a crankshaft installing tool.



MD1024

3. With the key in position, slide the driven gear onto the crank balancer making sure the timing marks are aligned.



CD832A



CC167D



CC166D

3

4. Place the bearing C-ring into position in the crankcase; then install the front shaft (4x4) and rear shaft assemblies.

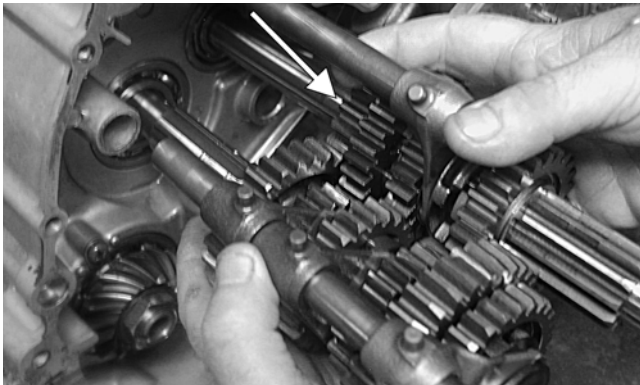
**⚠ CAUTION**

The bearing pins must be positioned into the crankcase.



CD267

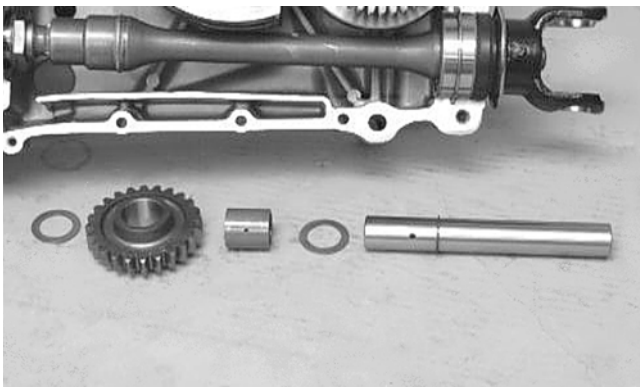
5. Simultaneously, install the driveshaft and countershaft assemblies making sure the washer is on the countershaft.



CD232A

6. Install the reverse idle shaft with circlip making sure the oil hole in the shaft is facing downward; then install a washer, bushing, reverse idle gear, and a washer.

■ **NOTE:** The reverse idle gear is directional. Care must be taken that it is installed correctly.

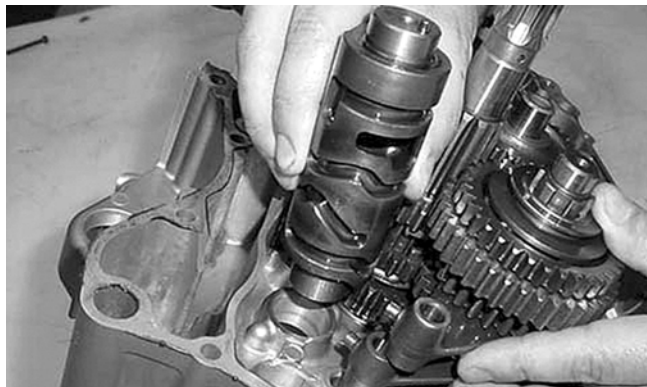


CC231D

7. Place each of the four shift forks into its respective gear or dog as noted during disassembling; then install the gear shift cam.

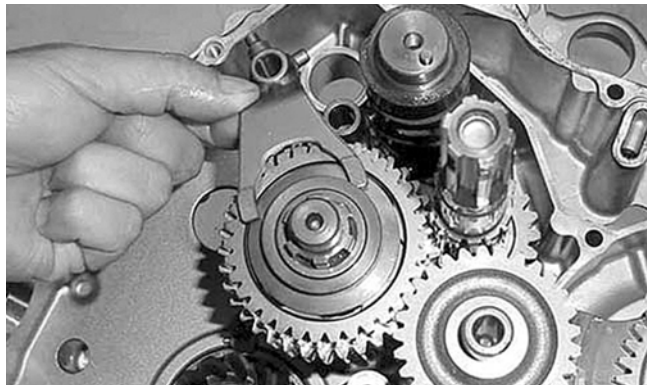


CD232



CC987

8. Engage the four forks to the gear shift cam; then install the reverse shift cam and spacer.



CC986

■ **NOTE:** For proper assembling, the cam lock plate must engage the shift cam cutaway.





CC988

9. Install the two gear shift fork shafts; then verify that the two crankcase half alignment pins are in place.

■ **NOTE:** Prior to joining crankcase halves, turn the shift cam to ensure all gears shift properly.

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## Joining Crankcase Halves

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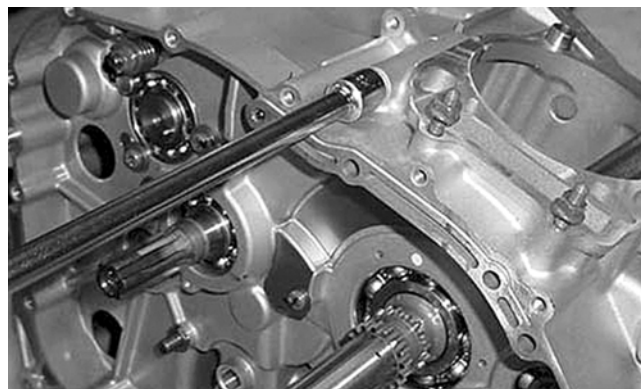
1. Verify that the shim washer is on the idler shaft; then apply Three Bond Sealant (p/n 0636-070) to the mating surfaces. Place the right-side half onto the left-side half.



CC102D

2. Using a plastic mallet, lightly tap the case halves together until cap screws can be installed.
3. From the right side, install the four case half 8 mm cap screws; then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.



CC982

4. From the left side, install the three case half 8 mm cap screws (two inside the case); then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.



CC981

5. From the left side, install the seven case half 6 mm cap screws; then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

6. From the right side, install the five case half 6 mm cap screws (one inside the case); then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

7. In a crisscross/case-to-case pattern, tighten the 8 mm cap screws (from steps 3-4) until the halves are correctly joined; then tighten to specifications.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

8. In a crisscross/case-to-case pattern, tighten the 6 mm cap screws (from steps 5-6) to specifications.

3



■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

**⚠ CAUTION**

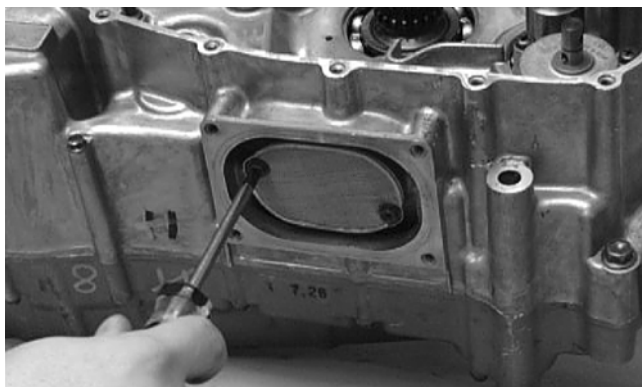
After completing center crankcase components, proceed to Installing Right-Side Components, to Installing Left-Side Components, and to Installing Top-Side Components.

## Installing Right-Side Components

### A. Oil Strainer/Oil Pump

### B. Gear Shift Shaft

1. Place the oil strainer with a new O-ring into position beneath the crankcase and tighten securely with the Phillips-head cap screws.



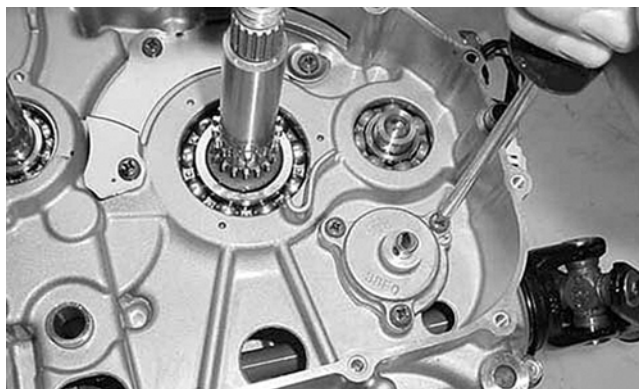
CC163D

2. Place the strainer cap into position on the strainer making sure the O-ring is properly installed and secure with the cap screws; then install and tighten the oil drain plug to specifications.



CC091D

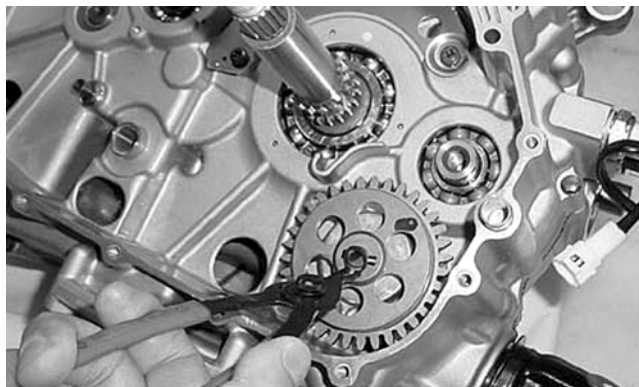
3. Place the oil pump into position in the crankcase and secure with the three Phillips-head screws coated with blue Loctite #243. Tighten to specifications.



CC978

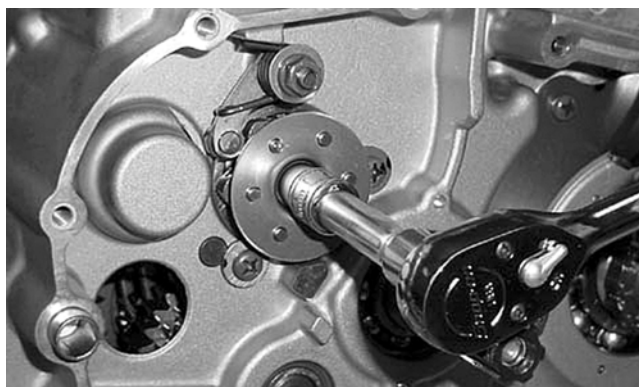
4. Place the washer and pin into position on the oil pump shaft, install the oil pump driven gear, and secure with the circlip.

■ **NOTE:** Always use a new circlip when installing the driven gear.



CC976

5. Place the gear shift cam plate and guide onto the gear shift cam making sure the alignment pin was installed. Secure assembly with the cap screw coated with blue Loctite #243. Tighten securely.



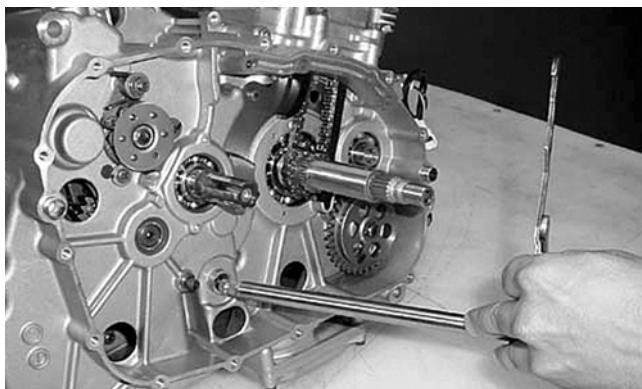
CC975

6. Attach the spring to the gear shift cam stopper arm.



CC974

7. Install the gear shift shaft.

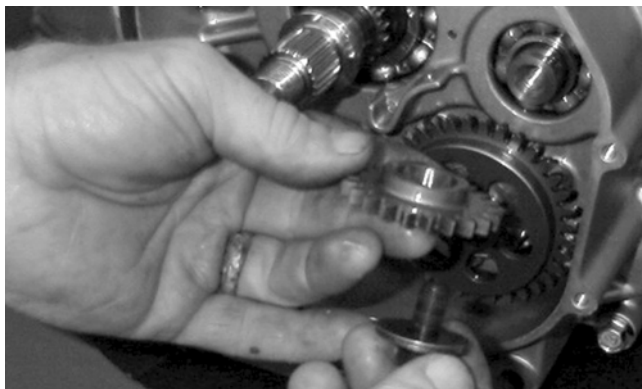


CC973

**C. Primary Driven Gear**  
**D. Primary Clutch**  
**E. Starter Clutch Shoe**

■ **NOTE:** Steps 1-7 in the preceding sub-section must precede this procedure.

8. Install the spacer, pin, and oil pump drive gear onto the crank balancer shaft making sure the shoulder of the drive gear is facing inward toward the crankcase; then secure with the washer and nut (threads coated with red Loctite #271) tightened to specifications.

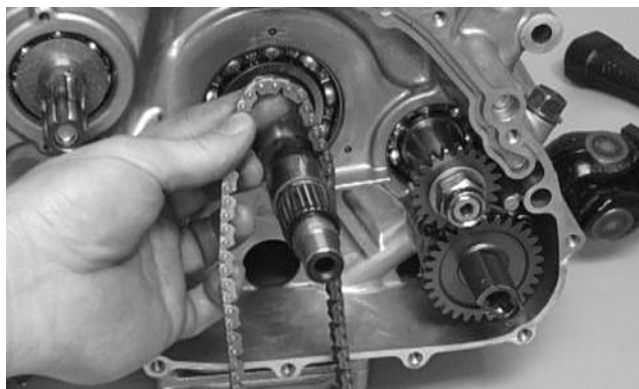


MD1017



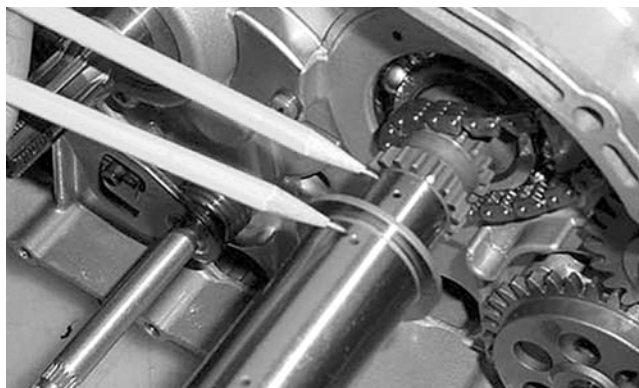
CD447

9. Place the chain into the crankcase; then secure it from the top side with a wire for ease of installing.



CC079D

10. Install the primary driven washers and shims onto the driveshaft and crankshaft.



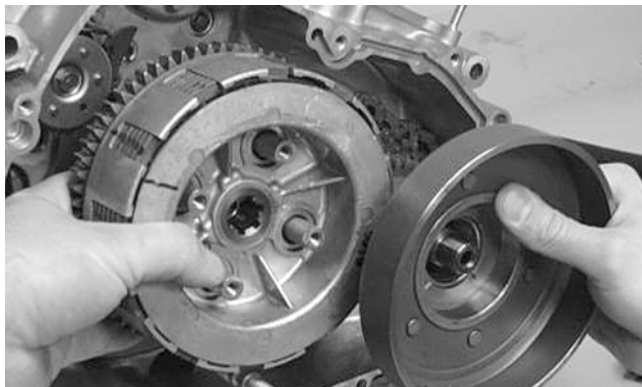
CC970

**⚠ CAUTION**

The clutch sleeve hub and the clutch pressure plate must be seated in the proper position. If any of the incorrect positions are used, the hub and plate will have clearance between them and they will not operate properly.

11. Simultaneously, place the primary clutch assembly and the starter clutch housing on their respective shafts making sure the sleeve is properly positioned in the primary assembly.





CC078D

■ **NOTE:** After placing the primary clutch assembly onto the shaft, pull out on the pressure plate tower to ensure the pressure plate has engaged the clutch hub properly and make sure the plates (drive and driven) are brought together tightly prior to tightening the nut securing the clutch assembly.

12. Using a clutch sleeve hub holder, install the nut and washer. Tighten to specifications.

■ **NOTE:** The washer is directional. Care must be taken to install it correctly.



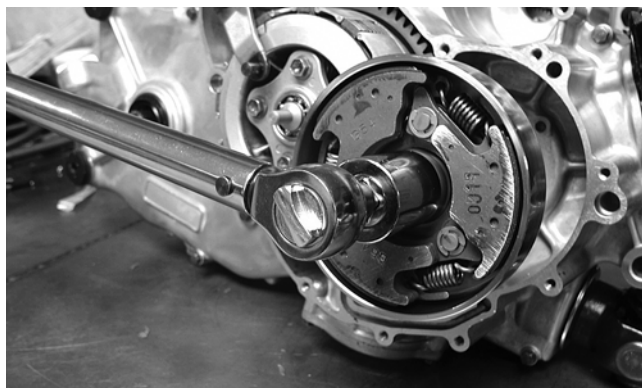
CD448

13. Place the primary drive one-way clutch into the starter clutch housing noting the word OUT-SIDE for proper placement.



CF043

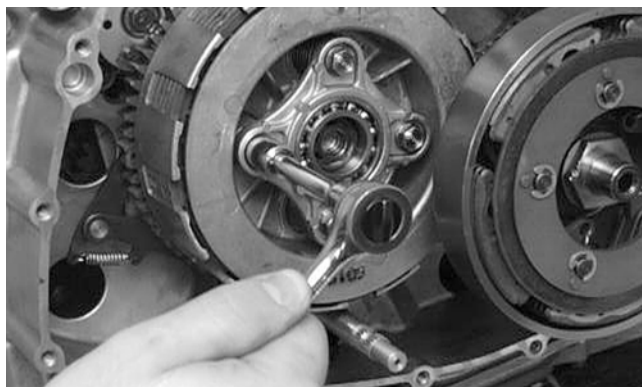
14. Install the starter clutch shoe and washer; then secure with the starter clutch-shoe nut (left-hand threads). Tighten to specifications; then using a center punch, stake the nut.



CD440

15. Install the release roller assembly making sure the four springs are in position; then using a crisscross pattern, tighten the four cap screws securely.

■ **NOTE:** Tighten the four roller assembly cap screws in a crisscross pattern making sure there is no clearance between the clutch plates when secured.



CC074D

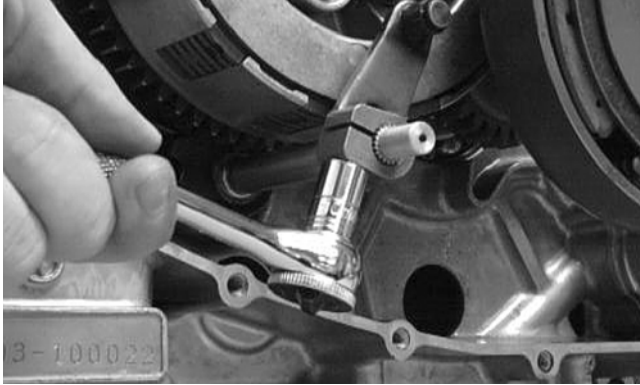
16. Install the clutch release arm and release roller guide making sure the release roller and guide are aligned.



CD166A



17. Secure the clutch release arm with the cap screw coated with blue Loctite #243. Tighten securely.



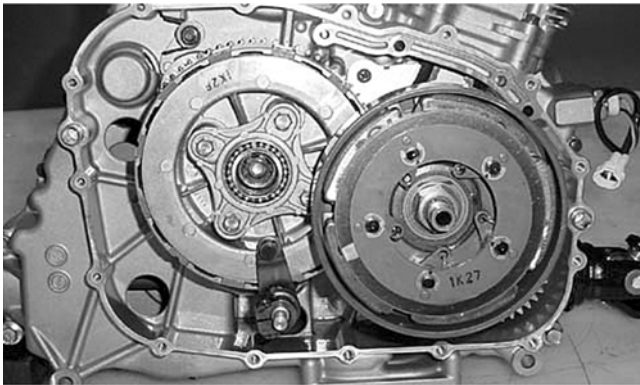
CC073D

## F. Oil Filter

■ **NOTE:** Steps 1-17 of the preceding sub-sections must precede this procedure.

■ **NOTE:** Lubricate all internal components with 10W-40 oil prior to installing the right-side cover.

■ **NOTE:** Care should be taken that the alignment pins are installed in the right-side cover.



CC989

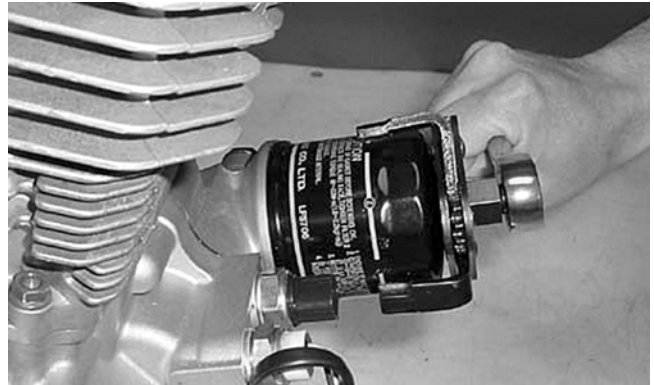
18. Place the gasket and right-side cover into position making sure the release roller guide remains correctly positioned; then install the fifteen cap screws.



CD441

19. Tighten the cap screws in a crisscross pattern to specifications.

20. Using the oil filter wrench, install a new oil filter.



CC967

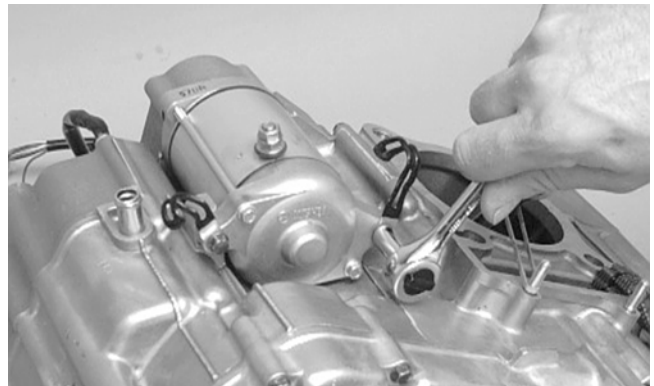
## Installing Left-Side Components

3

### A. Idle Gear Assembly

### B. Magneto Rotor

1. Place the starter into position on the crankcase and secure with the cap screws. Note the position of the wiring form.



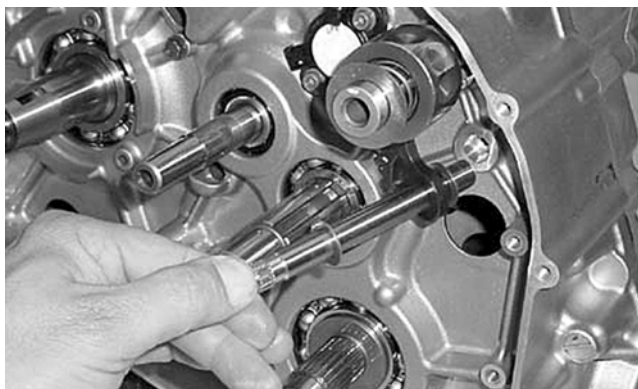
CC065D

2. Place the neutral switch base assembly into position making sure the two neutral contacts and springs are inside the case and properly positioned. Secure with Allen-head screws.



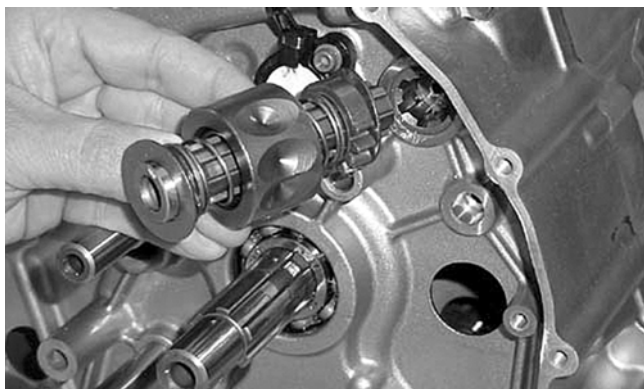
CC964

3. Install the secondary stopper camshaft w/one inner shim and one outer shim.



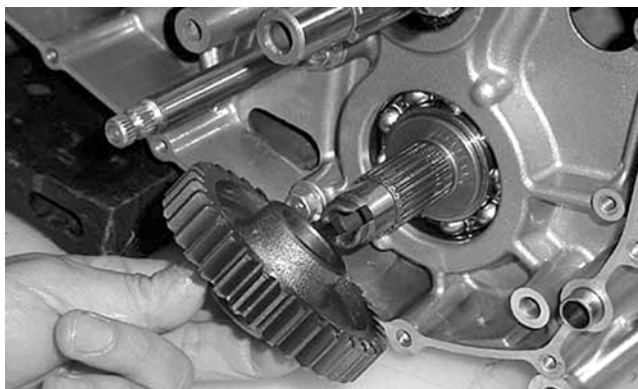
CC960

5. Install the driven gear onto the output shaft.



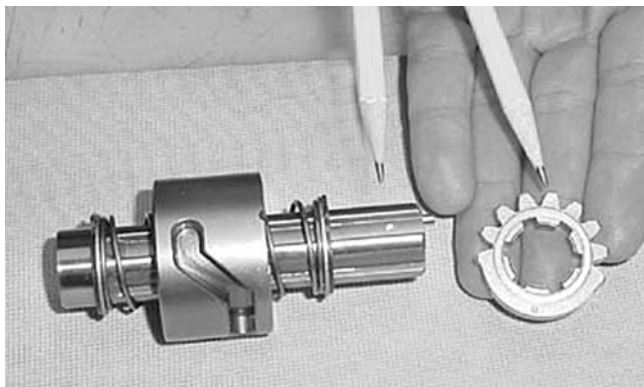
CC962

■ **NOTE:** Care must be taken that the alignment dots on the camshaft plate and the camshaft are properly aligned.



CC959

6. Place the bushing and washer onto the drive-shaft making sure the oil hole of the bushing aligns with the oil hole of the driveshaft.



CC963

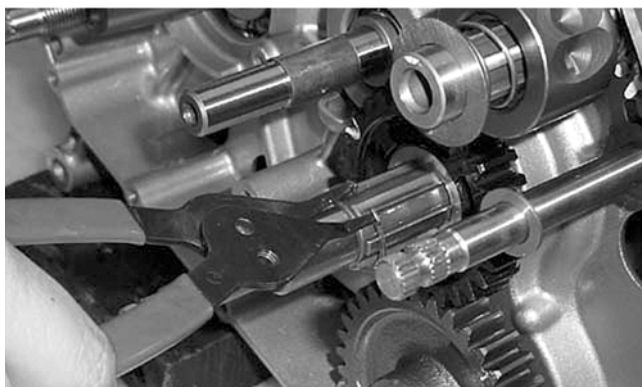
4. Install the gear shift shaft w/one inner washer and one outer washer.



CD552

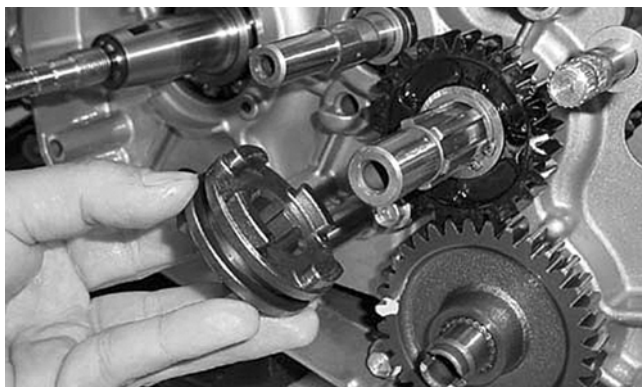
7. In turn on the driveshaft, install drive gear #1 and a washer; then secure with the circlip.



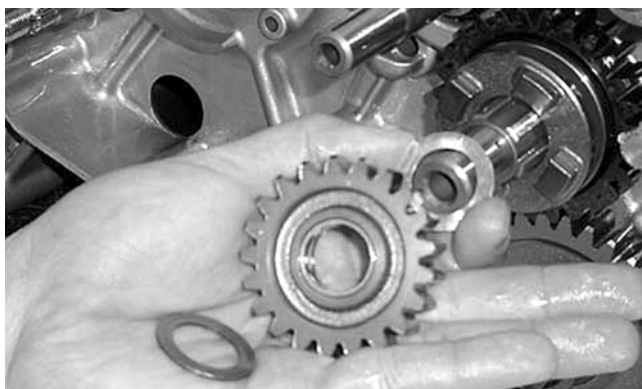


CC955

8. Place the select sliding dog gear onto the drive-shaft; then place a washer, drive gear #2, and another washer onto the driveshaft.



CC966



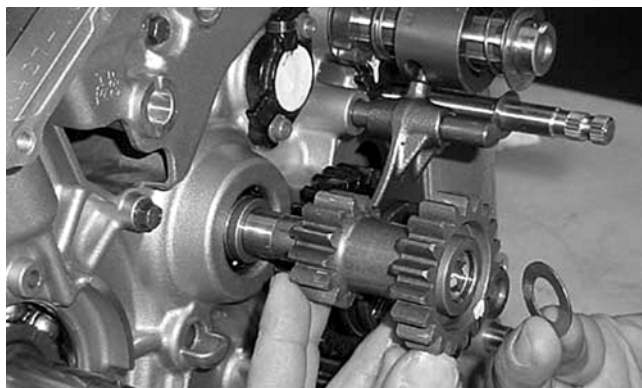
CC954

9. Place the gear shift fork into the sliding dog; then install the gear shift fork shaft.



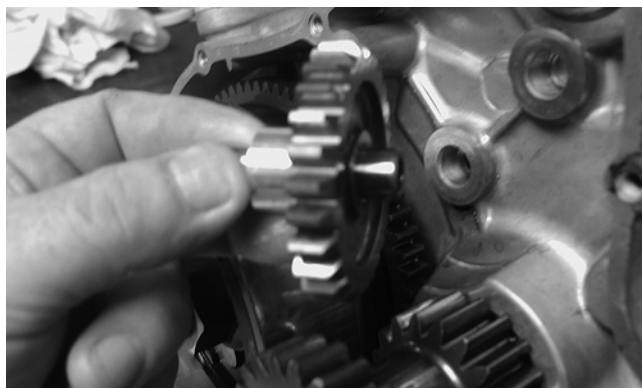
CC953

10. Install the drive idler gear with one spacer and one washer.



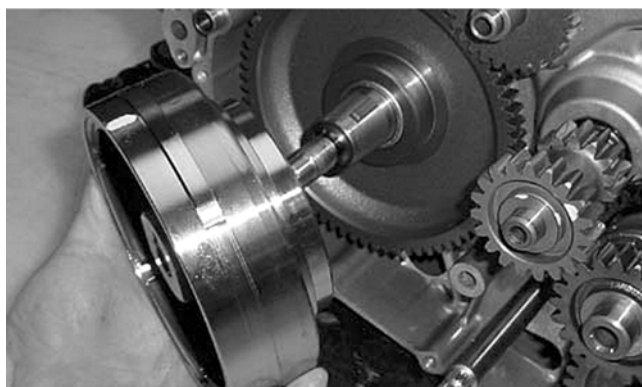
CC952

11. Install starter idler gear #2 and shaft with the chamfered side directed toward the crankcase.



CD140

12. Install the starter clutch gear assembly onto the crankshaft. Place the key into its notch. Place the magneto rotor into position on the crankshaft; then install the magneto rotor nut on the crankshaft and tighten until the rotor is properly seated. Tighten to specifications.



CC991

3

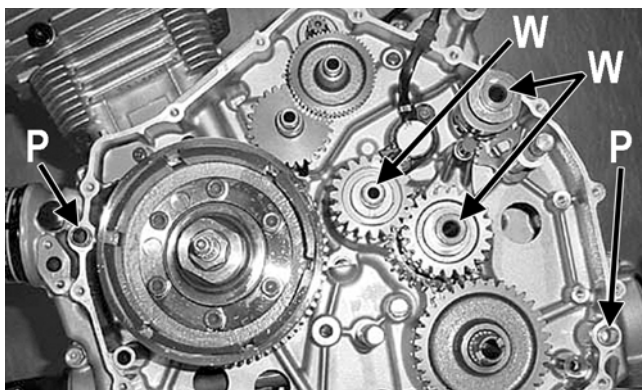




CC990

13. Install the two alignment pins into the left crankcase half.

■ **NOTE:** Make sure that three washers and two alignment pins are in place.



CC948A

### C. Cover

### D. Speedometer Drive

### E. Hi/Low Shifter Assembly

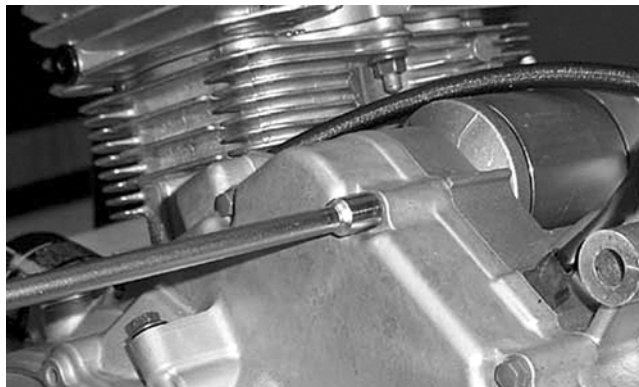
### F. Recoil Starter

■ **NOTE:** Steps 1-13 in the preceding sub-section must precede this procedure.

14. Place the gasket and left-side cover into position on the crankcase.

■ **NOTE:** It may be necessary to push or pull the splined Hi/Low range shift shaft to establish cover/crankcase mating.

15. Install the fifteen 6 mm cap screws and one 8 mm cap screw to secure the left-side cover. Only finger-tighten at this time.



CC945

16. Place the gear shift stopper w/spring and washer into position above the hi/low shift shaft making sure the spring and stopper are correctly positioned. Tighten to specifications.



CC993

17. On the FIS models, place the speed sensor into position and secure with the two cap screws. Tighten securely.

### ⚠ CAUTION

Make sure the speedometer gear and output shaft gear match up during assembly.



CF109

18. Place the starter cup into position on the crankshaft making sure a new, lubricated O-ring is inside the cup. Tighten the flange nut to specifications.



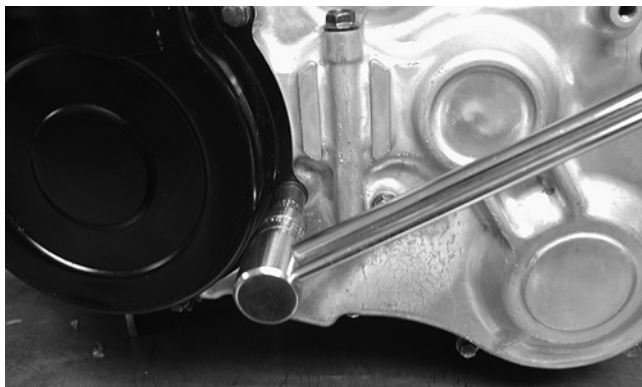
CC943

19. In a crisscross pattern, tighten the cap screws (from step 15) to specifications.



CD429

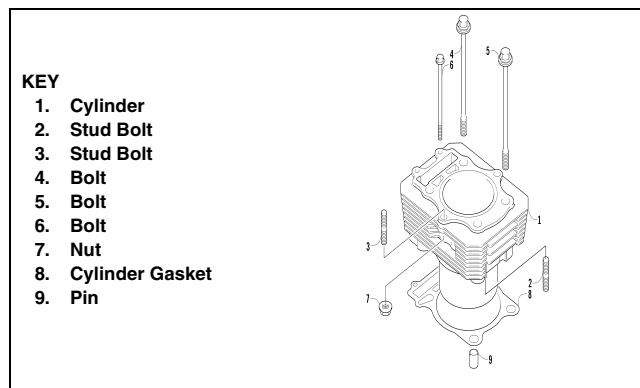
20. Place the recoil starter assembly into position on the left-side cover; then tighten four cap screws to specifications.



CD431

## Installing Top-Side Components

### A. Piston B. Cylinder



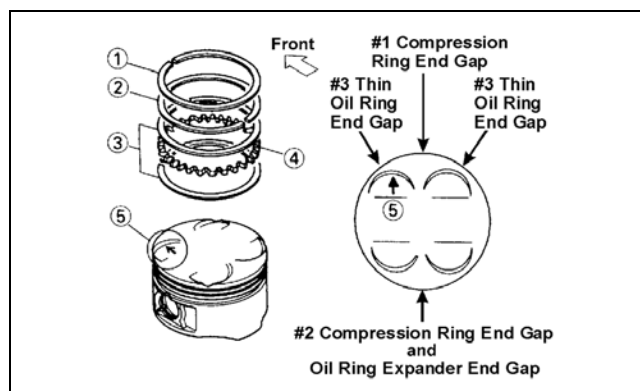
0737-039

3

■ **NOTE:** If the piston rings were removed, install them in this sequence.

A. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.

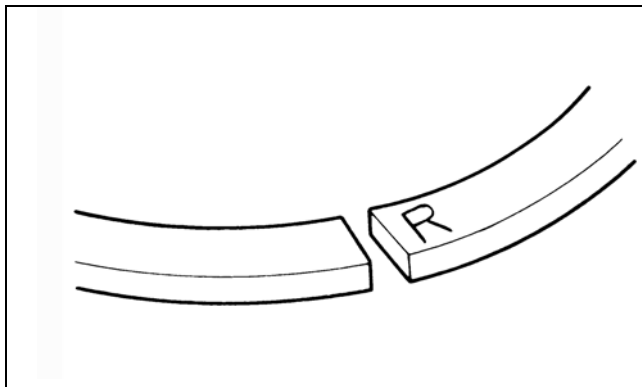
■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.



ATV-1085B

B. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston (see illustration).

■ **NOTE:** The chrome (silver) ring should be installed in the top position.



ATV-1024

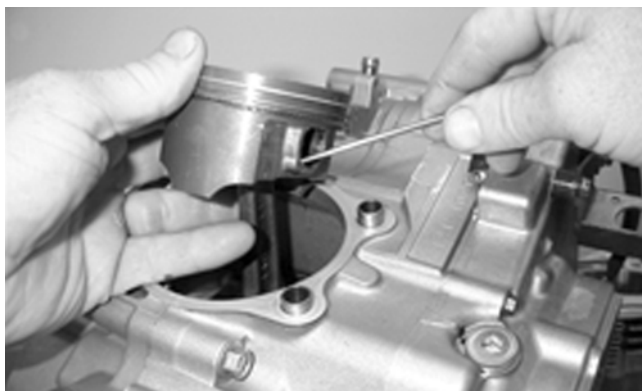


### CAUTION

**Incorrect installation of the piston rings will result in engine damage.**

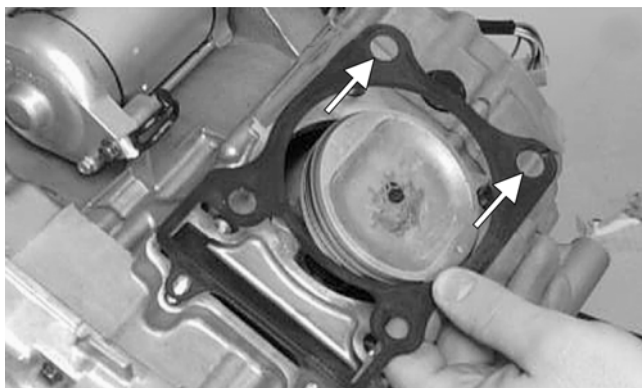
1. Install the piston on the connecting rod making sure there is a circlip on each side and the open end of the circlip is directed upwards or downwards.

■ **NOTE:** The piston should be installed so the arrow points toward the exhaust.



MD1213

2. Place the two alignment pins into position. Place the cylinder gasket into position; then place a piston holder (or suitable substitute) beneath the piston skirt and square the piston in respect to the crankcase.



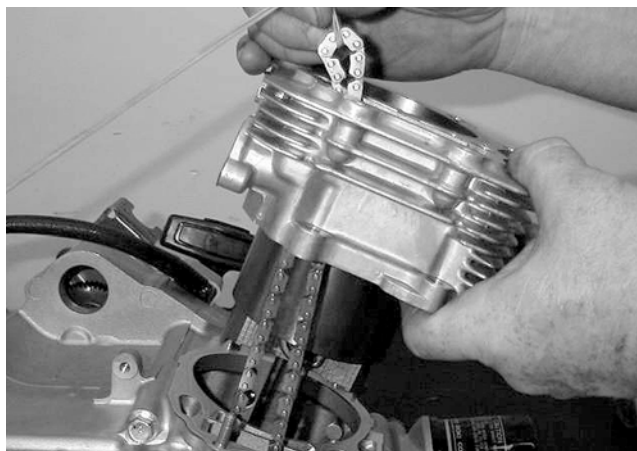
MD1344

3. Lubricate the inside wall of the cylinder; then using a ring compressor or the fingers, compress the rings and slide the cylinder over the piston. Route the cam chain up through the cylinder cam chain housing; then remove the piston holder and seat the cylinder firmly on the crankcase.



### CAUTION

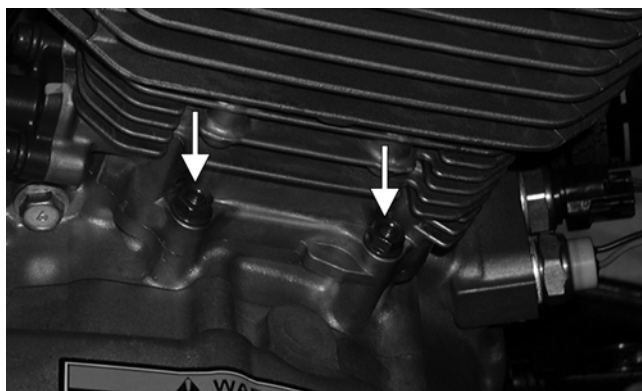
**The cylinder should slide on easily. Do not force the cylinder or damage to the piston, rings, cylinder, or crankshaft assembly may occur.**



MD1345

4. Loosely install the two nuts with washers which secure the right-side of the cylinder to the right-side crankcase half.

■ **NOTE:** The two cylinder-to-crankcase nuts will be tightened in step 9.

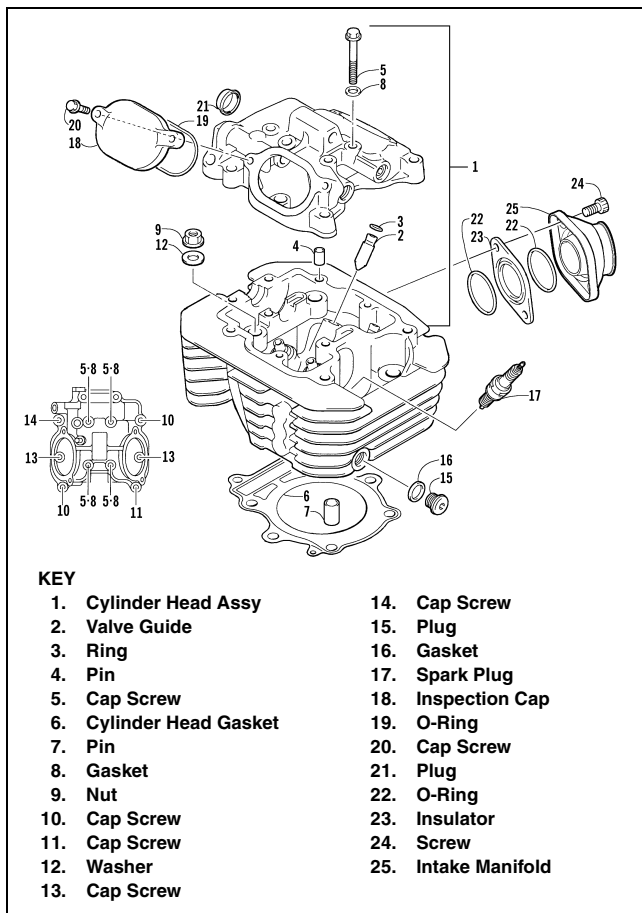


CF162A



## C. Cylinder Head

### D. Valve Cover



0737-038

■ **NOTE:** Steps 1-4 in the preceding sub-section must precede this procedure.

5. While keeping tension on the cam chain, place the chain guide into the cylinder.

### **CAUTION**

Care should be taken that the bottom of the chain guide is secured in the crankcase boss.

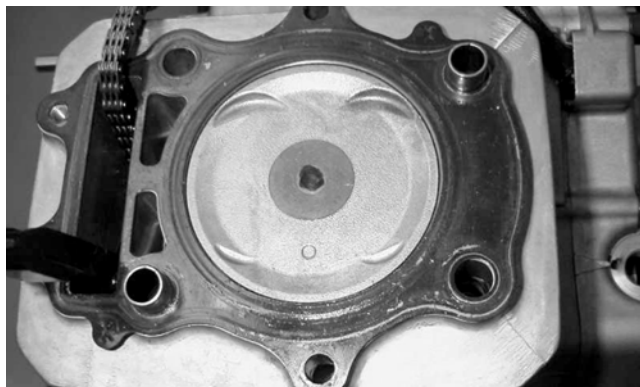


MD1349

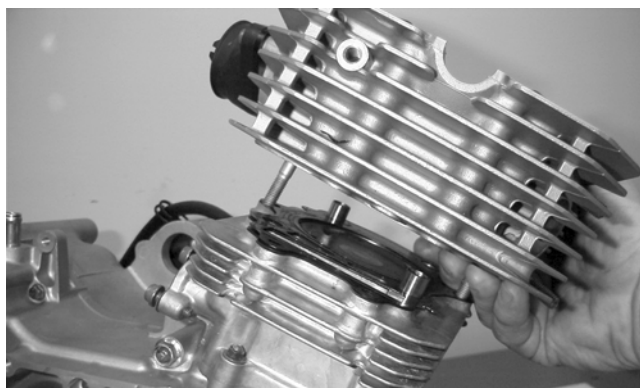
6. Place the head gasket into position on the cylinder. Place the alignment pins into position; then place the head assembly into position on the cylinder making sure the cam chain is routed through the chain cavity.

### **CAUTION**

Keep tension on the cam chain to avoid damaging the crankcase boss.

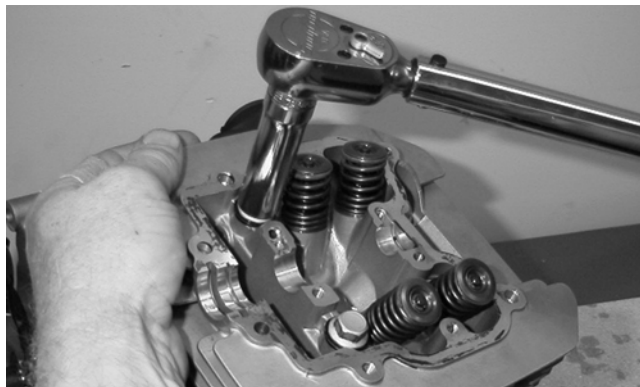


MD1347



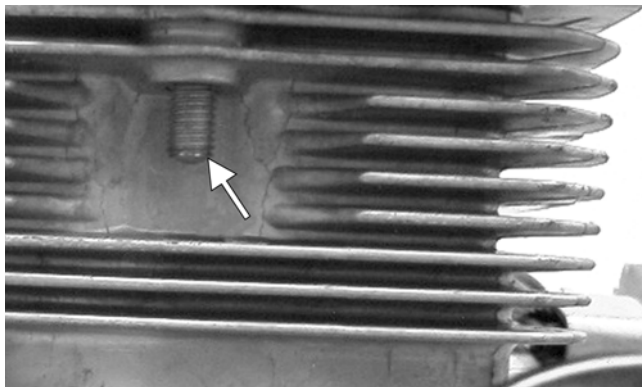
MD1163

7. Install the four cylinder head cap screws with washers. Note that the two cap screws on the right side of the cylinder head nearest the cam sprocket are longer than the two cap screws on the left (spark plug) side. Tighten only until snug.



MD1270

8. Install the two lower nuts securing the cylinder head to the cylinder, one in front and one in rear. Tighten only until snug.



MD1192

9. In a crisscross pattern, tighten the four cylinder head cap screws (from step 7) to specifications; then tighten the nuts (from step 8) to specifications. Tighten the cylinder-to-crankcase nuts (from step 4) to specifications.
10. With the timing inspection plug removed and the chain held tight, rotate the crankshaft until the piston is at top-dead-center.
11. Install the rear cam chain tensioner guide into the cylinder head. Install the pivot cap screw and washer.

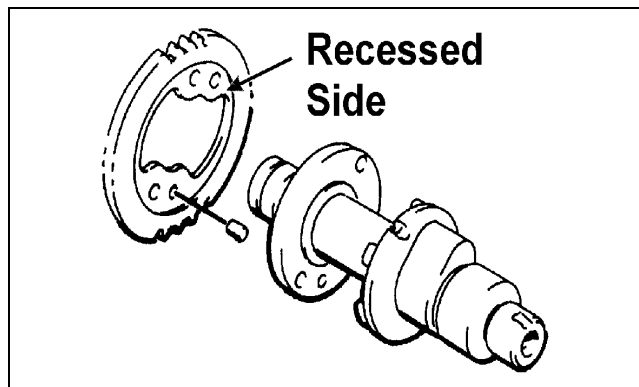


CD383

12. With the alignment pin installed in the camshaft and the cam lobes directed down (toward the piston), place the camshaft in position and verify that the timing mark on the magneto is visible through the inspection plug and that the timing marks on the camshaft sprocket are parallel with the valve cover mating surface.

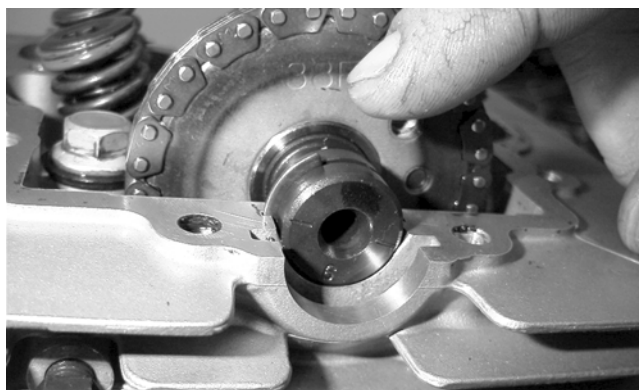
■ **NOTE:** When the camshaft assembly is seated, make sure the alignment pin in the camshaft aligns with the smallest hole in the sprocket.

13. Loosely place the cam sprocket (with the recessed side facing the camshaft lobes) onto the camshaft and place it into position with the cam chain over the sprocket.



732-307B

14. Place the C-ring into position in its groove in the cylinder head.



MD1131

■ **NOTE:** At this point, oil the camshaft bearings, cam lobes, and the three seating journals on the cylinder.

■ **NOTE:** Note the position of the alignment marks on the end of the camshaft. They must be parallel with the valve cover mating surface. If rotating the camshaft is necessary for alignment, do not allow the chain and sprocket to rotate and be sure the cam lobes end up in the down position.

15. When the camshaft assembly is seated, ensure the following.

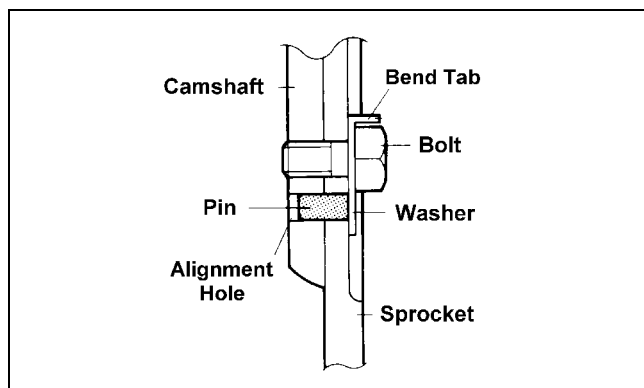
- A. Piston still at top-dead-center.
- B. Camshaft lobes directed down (toward the piston).
- C. Camshaft alignment marks parallel to the valve cover mating surface.
- D. Recessed side of the sprocket directed toward the cam lobes.
- E. Camshaft alignment pin and sprocket alignment hole (smallest) are aligned.

### ⚠ CAUTION

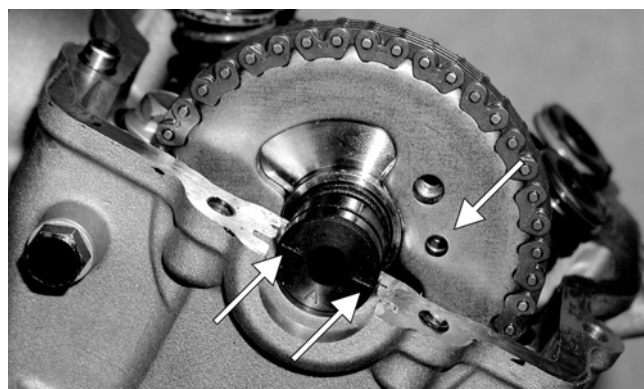
If any of the above factors are not as stated, go back to step 10 and carefully proceed.



16. Place the tab washer onto the sprocket making sure it covers the pin in the alignment hole.



ATV-1027



CF030B



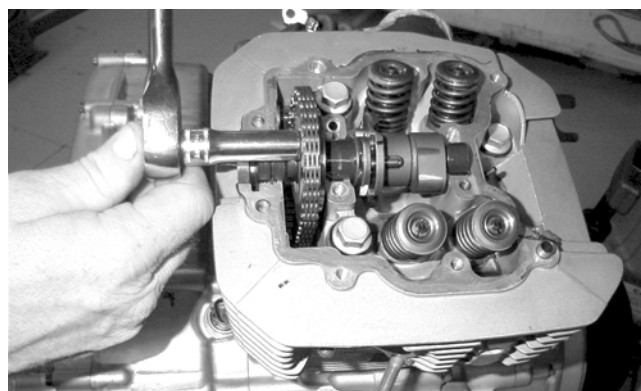
### CAUTION

Care must be taken that the tab washer is installed correctly to cover the alignment hole on the sprocket. If the alignment pin falls out, severe engine damage will result.

17. Apply red Loctite #271 to the first cap screw securing the sprocket and tab washer to the camshaft; then install the cap screw. Tighten cap screw only until snug.

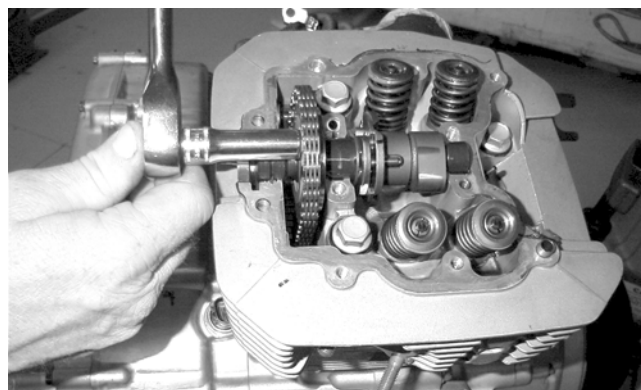


CC404D



MD1137

18. Rotate the crankshaft until the second cap screw securing the sprocket to the camshaft can be installed; then install the cap screw (threads coated with red Loctite #271). Tighten to specifications; then bend the tab to secure the cap screw.



MD1137

19. Rotate the crankshaft until the first cap screw securing the sprocket to the camshaft (from step 17) can be addressed; then install the cap screw. Tighten to specifications; then bend the tab to secure the cap screw.
20. Install the cylinder head plug in the cylinder head with the open end facing the camshaft.
21. Remove the cap screw from the end of the chain tensioner; then account for the plunger, spring, and O-ring.



MD1248

3



22. Depress the spring-loaded lock and push the plunger into the tensioner.



MD1146

23. Place the chain tensioner adjuster assembly and gasket into position on the cylinder making sure the ratchet side is facing toward the top of the cylinder and secure with the two Allen-head screws.



MD1254

24. Install the cap screw and spring into the end of the chain tensioner. Tighten securely.

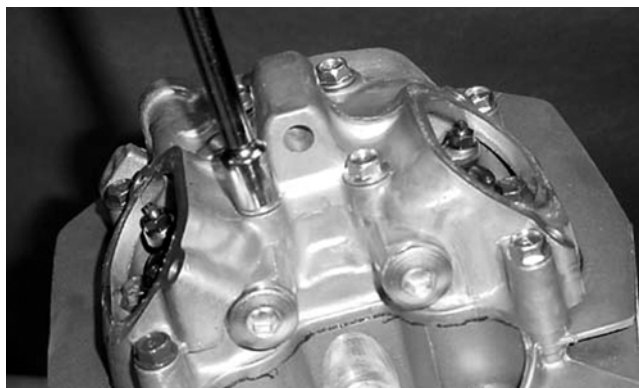


MD1245

25. Loosen the adjuster screw jam nuts; then loosen the adjuster screws on the rocker arms in the valve cover.
26. Apply a thin coat of Three Bond Sealant (p/n 0636-070) to the mating surface of the valve cover. Place the valve cover into position making sure the two alignment pins are properly positioned.

■ **NOTE:** At this point, the rocker arms and adjuster screws must not have pressure on them.

27. Install the four top-side cap screws with rubber washers; then install the remaining cap screws. Tighten only until snug.



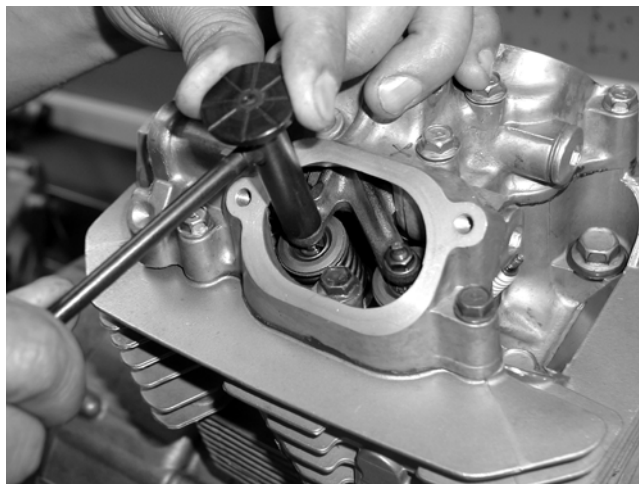
CC999

28. In a crisscross pattern starting from the center and working outward, tighten the cap screws (from step 27) to specifications.

29. Adjust valve/tappet clearance using the following procedure.

■ **NOTE:** Use Valve Clearance Adjuster (p/n 0444-078) for this procedure.

- A. Turn the engine over until the piston reaches top dead center on the compression stroke.
- B. Place the valve adjuster onto the jam nut securing the tappet adjuster screw; then rotate the valve adjuster dial clockwise until the end is seated in the tappet adjuster screw.



CD001

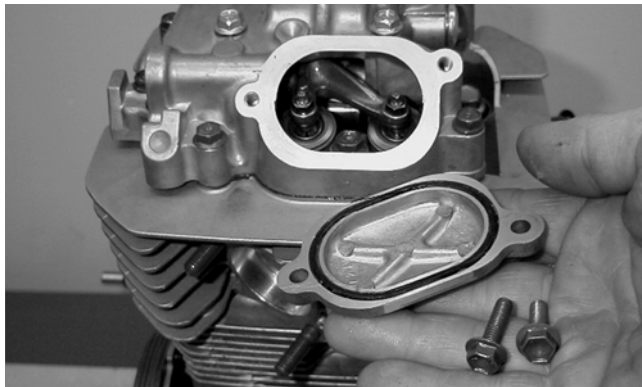
- C. While holding the valve adjuster dial in place, use the valve adjuster handle and loosen the jam nut; then rotate the tappet adjuster screw clockwise until friction is felt.
- D. Align the valve adjuster handle with one of the marks on the valve adjuster dial.

E. While holding the valve adjuster handle in place, rotate the valve adjuster dial counterclockwise until specified valve/tappet clearance is attained.

■ **NOTE:** Rotating the valve adjuster dial counterclockwise will open the valve/tappet clearance by 0.05 mm (0.002 in.) per mark.

F. While holding the adjuster dial at the proper clearance setting, tighten the jam nut securely with the valve adjuster handle.

30. Place the two tappet covers into position; then install and tighten the cap screws securely.



MD1264

31. If removed, install the spark plug and tighten to specifications.

---

## Installing Engine/Transmission

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■ **NOTE:** Arctic Cat recommends that new gaskets and O-rings be installed whenever servicing the ATV.

1. From the left side, place the engine/transmission into the frame; then move it rearward as far as possible.
2. Raise the rear of the engine enough to engage the front driveshaft into the splines of the front drive output yoke; then slide the engine forward as far as possible.



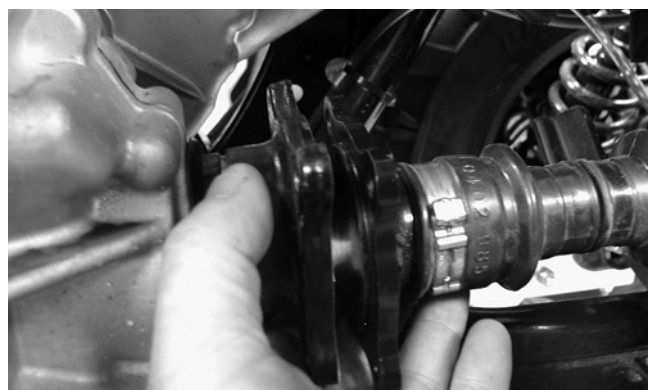
CD818

3. Raise the rear of the engine and place a block under it; then install the propeller shaft and output flange into the rear drive coupler.



CD821

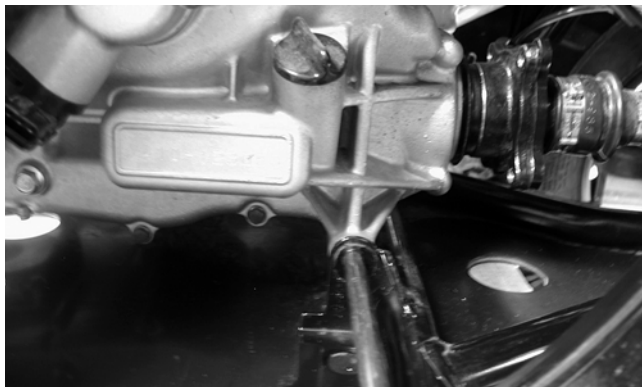
4. Remove the block from beneath the engine; then align the rear drive flanges and secure with four cap screws. Tighten to specifications.



CD824

5. Install the lower rear engine mounting through-bolt, spacer, and washer; then install the lower front engine mounting through-bolt, spacer, and washer. Secure with the flange nuts. Tighten to specifications.





CD809

6. Install the upper engine mounting brackets to the frame with two cap screws; then install the through-bolt and flange nut. Tighten all hardware to specifications.



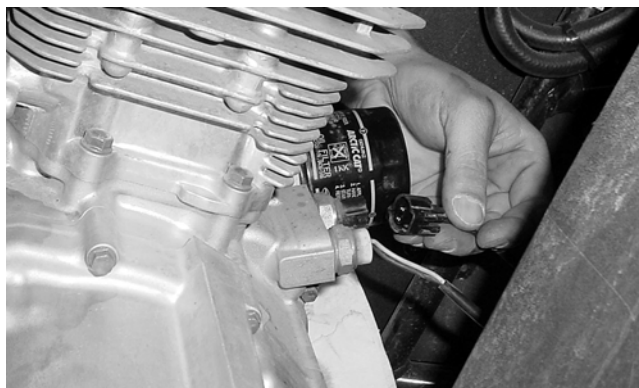
CC937

9. Connect the following electrical components: two wire leads for the oil temperature and oil pressure sensors, indicator lights, CDI, and voltage regulator.



CD806

7. Connect the crankcase breather vent hose and secure with the clamp.



CC939



CC938

10. Connect the positive cable to the starter motor and install the protective boot.



CC122D

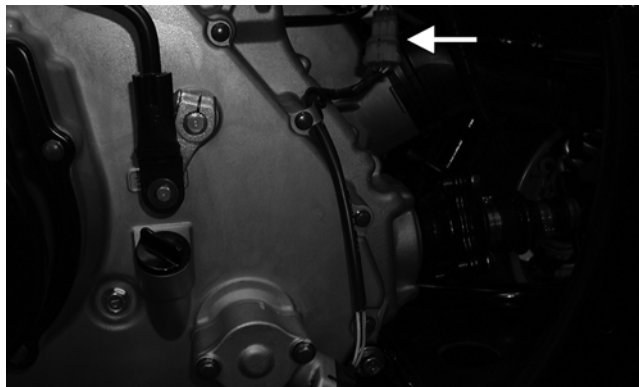
8. Connect the oil cooler hoses to the engine and secure with the clamps.





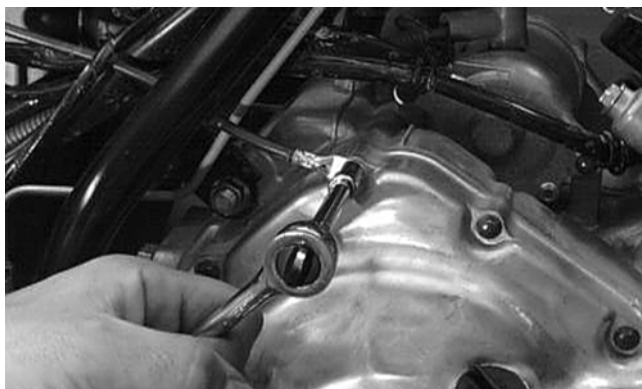
AR604D

11. Connect the battery ground (negative) cable to the crankcase cover.



CF172A

16. Place the reverse/high/low shift linkage w/bushing and washer onto the engine shift shaft and secure with the E-clip.



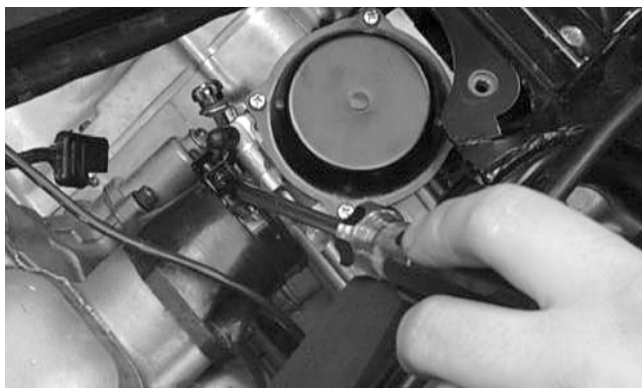
AR600D

12. Install the coil and connect the two wires; then install the high tension lead on the spark plug.
13. Install the carburetor assembly and secure the intake manifold and air inlet boot.



CC935

17. Place the gear shift lever into position on the shaft on the engine; then secure with the pinch screw and lock nut.



CC120D

14. Route the two vent hoses through the slots in the frame.
15. On the FIS models, connect the speed sensor lead to the wiring harness.



CC934

18. Install the air filter housing; then connect the crankcase breather and the inlet air duct. Secure with the clamps.



CD785

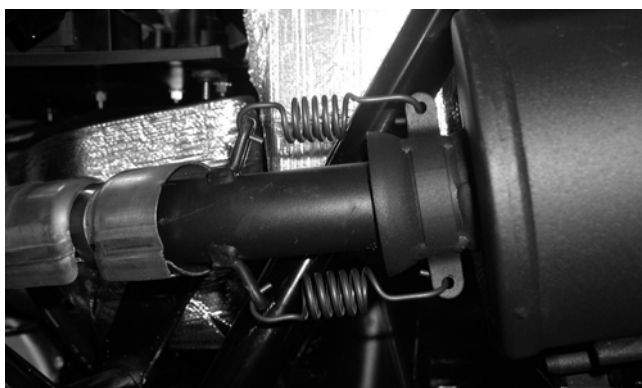


CD787

19. Install the exhaust pipe and secure with two cap screws; then install the muffler onto the frame brackets and secure with exhaust springs.

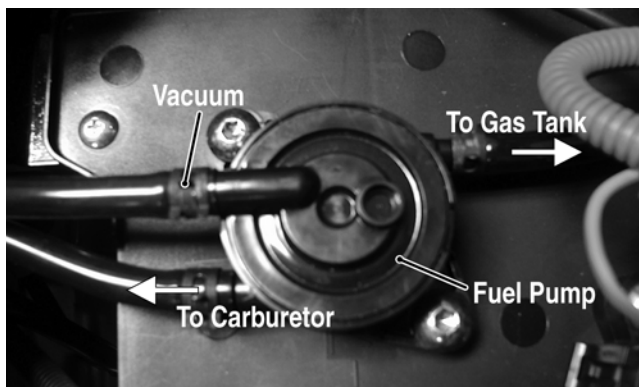


CF137



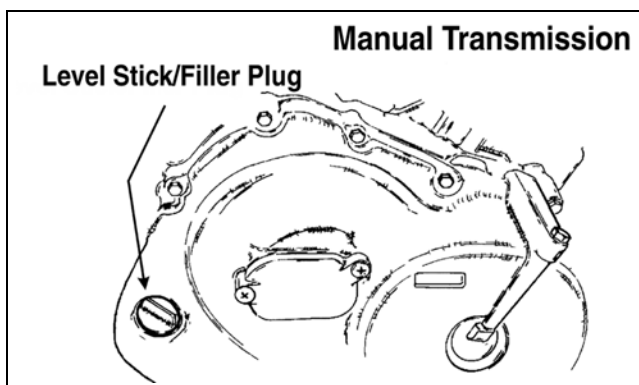
CF138

20. Connect the gas hose to the fuel pump; then connect the vacuum hose. Secure with hose clamps.



CD766A

21. Install the front and rear fender panels and the front and rear racks (see Section 8).
22. On VP models, install the gas tank (see Section 4).
23. Install the storage compartment and steering post access panel; then secure with reinstallable rivets.
24. Install the battery in the tray, install the vent hose. Connect the positive battery cable; then connect the negative cable. Install the battery cover/tool tray.
25. Install the seat.
26. Pour the correct amount of recommended oil into the engine/transmission filler hole; install the filler plug.



ATV-0075

### **CAUTION**

If the engine had a major overhaul or if any major part was replaced, proper engine break-in procedures must be followed (see Section 1). If the proper engine break-in procedures are not followed, severe engine damage may result.

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## Removing Engine/Transmission

Many service procedures can be performed without removing the engine/transmission from the frame. Closely observe the note introducing each sub-section for this important information.

### AT THIS POINT

If the technician's objective is to service/replace left-side cover oil seals (3), front output joint oil seal (1), rear output joint oil seal (1), and/or the oil strainer (from beneath the engine/transmission), the engine/transmission does not have to be removed from the frame.

Secure the ATV on a support stand to elevate the wheels.

### WARNING

Make sure the ATV is solidly supported on the support stand to avoid injury.

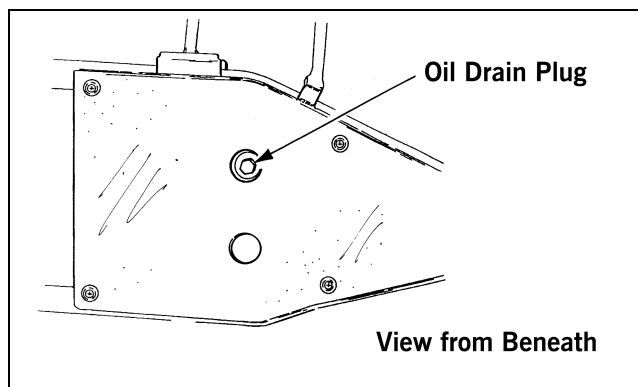
1. Remove the seat; then remove the battery cover/tool tray.

2. Remove the negative cable from the battery; then remove the positive cable. Remove the battery vent hose; then remove the battery.

### CAUTION

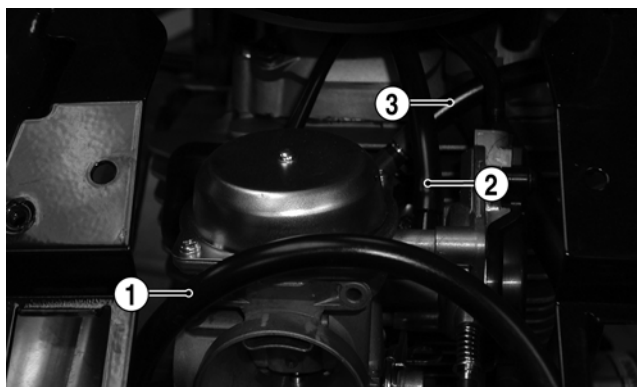
Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.

3. Remove the front and rear racks (see Section 8).
4. Remove the storage compartment and the steering post access panel (see Section 8).
5. Drain the oil from beneath the engine/transmission.



733-441A

6. Remove the front and rear fender panels (see Section 8).
7. On the VP models, turn the gas tank valve to the OFF position; then remove the fuel hose and vent hose. On the FIS models, disconnect the fuel hose (1), carburetor vent hose (2), and the fuel pump vacuum hose (3) from the carburetor.



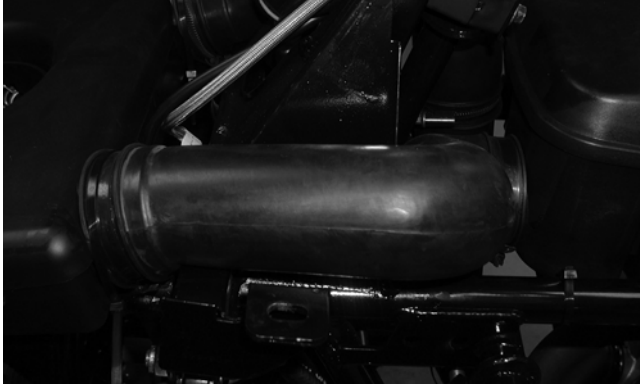
CF178A

8. Remove the gas tank.
9. On the VP models, remove the hardware securing the air cleaner housing to the frame.



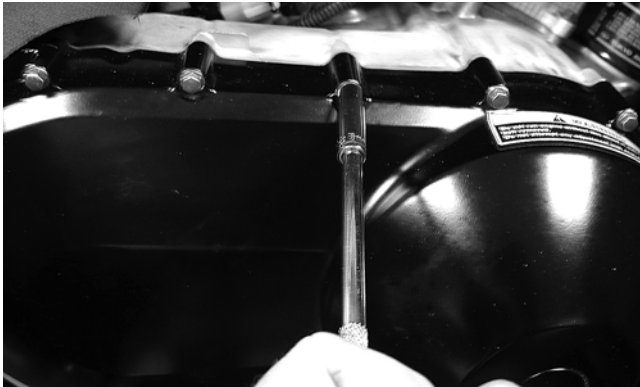
10. Disconnect the crankcase vent hose from the air cleaner housing. Remove the clamp securing the air intake hose to the carburetor; then remove the air cleaner housing.

■ **NOTE:** On FIS models, the air cleaner intake duct must be removed prior to removing the air cleaner housing.



CF181

11. Remove the clamps securing the cooling ducts to the V-belt housing.
12. Remove the cooling ducts from the V-belt cover.



CD078

13. Remove the cap screws securing the left-side foot peg to the footrest.



CD781

14. Loosen the clamp securing the carburetor to the intake; then route the carburetor assembly up and away from the engine.

15. Remove the E-clip securing the shift rod to the engine shift arm; then allow the shift rod to hang by the pivot axle bolt.



AF962

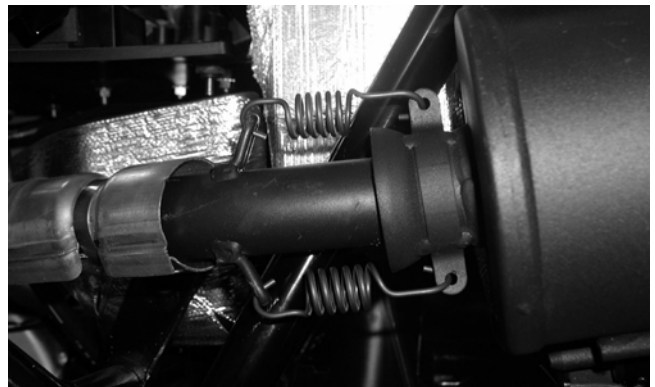
16. Remove the cap screws securing the two oil fittings to the crankcase; then route the hoses away from the engine. Account for two O-rings.



CF174

■ **NOTE:** There will be a substantial amount of oil draining from the oil hoses when removing. Place a drain pan beneath the hoses prior to removing the cap screws.

17. Remove the two cap screws securing the exhaust pipe to the engine; then remove the exhaust springs from the muffler at the juncture in front of the muffler.



CF138

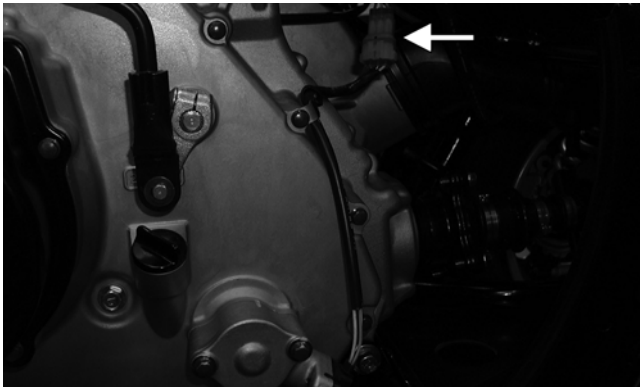
18. Remove the four cap screws securing the rear output shaft to the transmission; then push the shaft to the rear as far as possible.



CD085

■ **NOTE:** It is advisable to lock the brake when loosening the cap screws securing the rear drive-shaft.

19. Remove the positive cable from the starter motor and route it out of the way.
20. On the TBX model, remove the speedometer cable from the speedometer gear housing. On FIS models, disconnect the speed sensor lead from the wiring harness.



CF172A

21. Disconnect the stator-to-rectifier/regulator connector.
22. Remove the temperature sensor wires from the engine.

■ **NOTE:** There are two temperature sensors.



CC939

23. Remove the two cap screws securing the front upper engine mount to the frame.



CF177

24. Remove the cap screw and flange nut securing the upper engine bracket to the engine; then remove the bracket.
25. Remove the spark plug wire from the spark plug.
26. Remove the shift indicator connector from the main wiring harness.
27. Remove the cap screw securing the engine ground wire to the engine.
28. Remove the two engine mounting through-bolts. Account for a spacer on the lower front bolt.



CF193



CF194

29. Slightly raise the front of the engine to disengage the front driveshaft from the front output yoke.



CD096

30. Remove the engine from the left side by moving the engine forward while raising the engine in the rear and rotating the engine clockwise. The engine will come out the left side of the frame.

## Top-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### AT THIS POINT

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

## Removing Top-Side Components

### A. Valve Cover

### B. Cylinder Head

■ **NOTE:** Remove the spark plug and timing inspection plug; then using the recoil starter, rotate the crankshaft to top-dead-center of the compression stroke.

■ **NOTE:** Arctic Cat recommends the use of new gaskets, lock nuts, and seals and lubricating all internal components when servicing the engine/transmission.

1. Remove the cap screws securing the two tappet covers. Remove the two tappet covers. Account for the O-rings.



MD1264

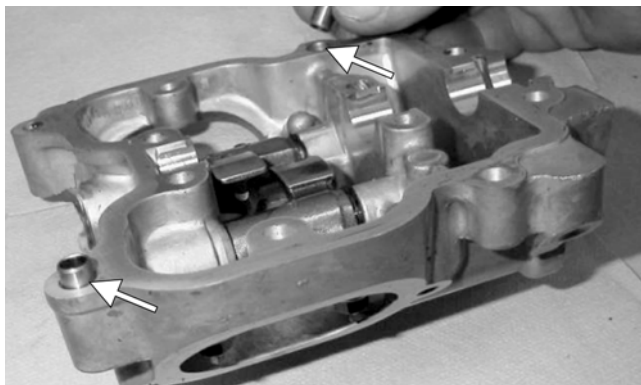
■ **NOTE:** Keep the mounting hardware with the covers for assembly purposes.

2. Remove the 12 valve cover cap screws. Note the rubber washers on the four top-side cap screws; remove the valve cover. Note the orientation of the cylinder head plug and remove it. Note the location of the two alignment pins.



MD1261





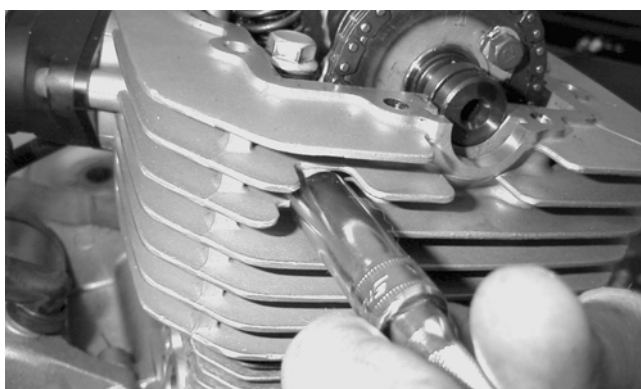
MD1354A

3. Loosen the cap screw on the end of the cam chain tensioner; then remove the two Allen-head screws securing the cam chain tensioner assembly. Remove the tensioner assembly and gasket.



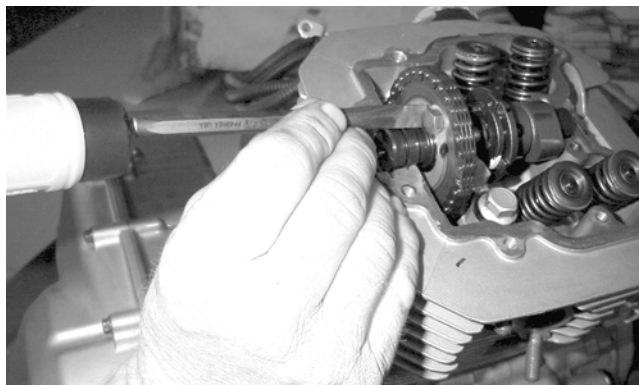
MD1245

4. Remove the cam chain tensioner pivot cap screw and washer.

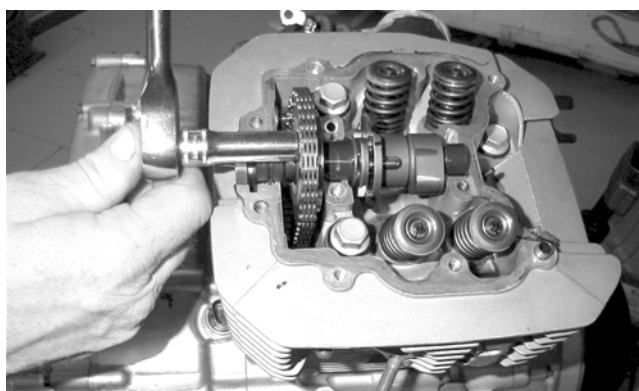


MD1251

5. Bend the washer tabs and remove the two cap screws securing the sprocket to the camshaft.



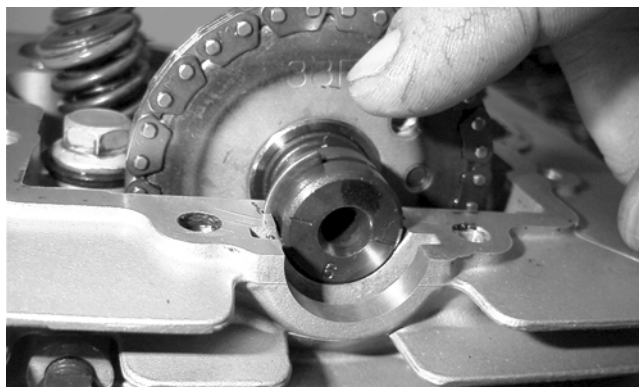
MD1136



MD1137

6. Using an awl, rotate the C-ring in its groove until it is out of the cylinder head; then remove the C-ring.

■ **NOTE:** Care should be taken not to drop the C-ring down into the crankcase.

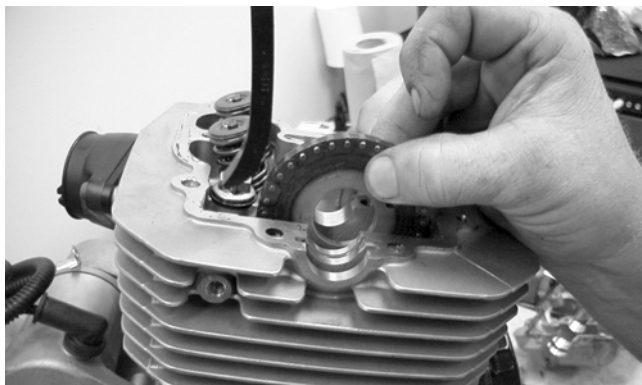


MD1131

7. Noting the timing marks for installing purposes, drop the sprocket off the camshaft. While holding the cam chain, slide the sprocket and camshaft out of the cylinder head. Account for an alignment pin.

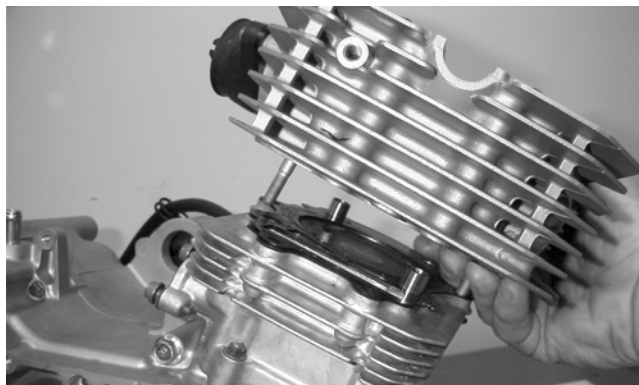
■ **NOTE:** Loop the chain over the cylinder and secure it with a wire to keep it from falling into the crankcase.

3



MD1132

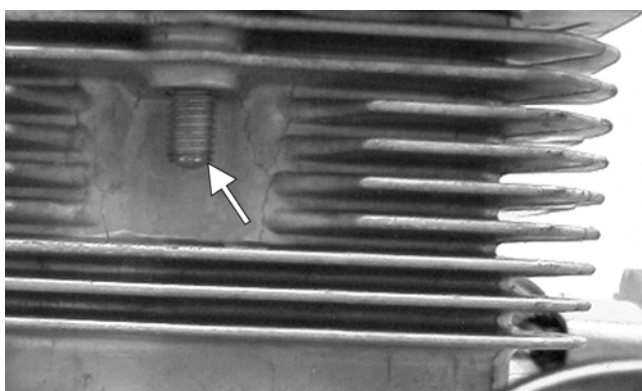
8. Remove the cam chain tensioner by lifting it from the chain cavity; then remove the two lower nuts securing the cylinder head to the cylinder, one in front and one in rear.



MD1163

### **AT THIS POINT**

To service valves and cylinder head, see Servicing Top-Side Components sub-section.



MD1192

9. Remove the four cylinder head cap screws and washers. Note that the two cap screws on the right side of the cylinder head nearest the cam sprocket are longer than the two cap screws on the left (spark plug) side.

### **AT THIS POINT**

To inspect cam chain guide, see Servicing Top-Side Components sub-section.



MD1173



CD211

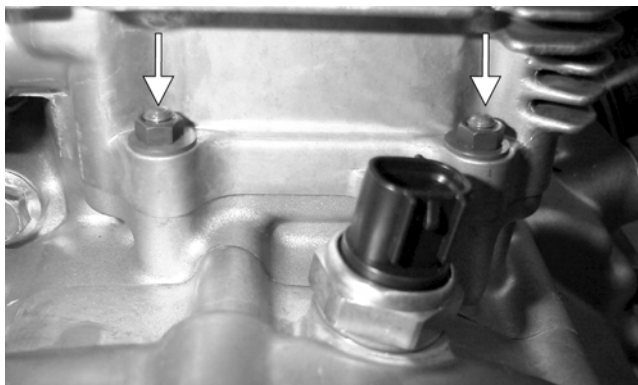
10. Remove the cylinder head from the cylinder, remove the gasket, and account for two alignment pins.

## **C. Cylinder** **D. Piston**

■ **NOTE:** Steps 1-11 in the preceding sub-section must precede this procedure.

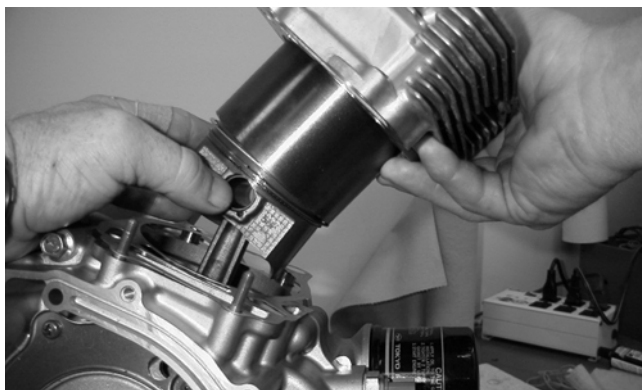
12. Remove the two nuts securing the right side of the cylinder to the right-side crankcase half. Account for the washers.





MD1226A

13. Lift the cylinder off the crankcase taking care not to allow the piston to drop against the crankcase. Account for the gasket and two alignment pins.



MD1214

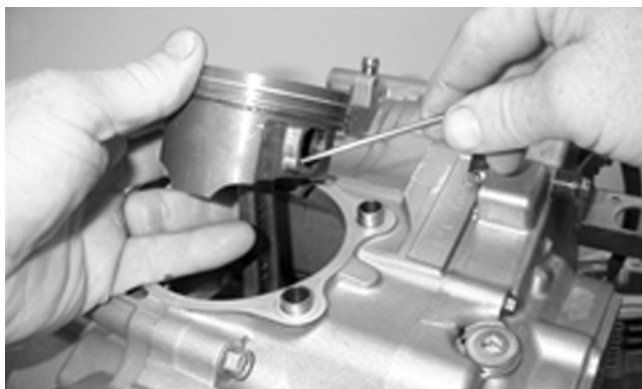
### AT THIS POINT

To service cylinder, see Servicing Top-Side Components sub-section.

### CAUTION

When removing the cylinder, be sure to support the piston to prevent damage to the crankcase and piston.

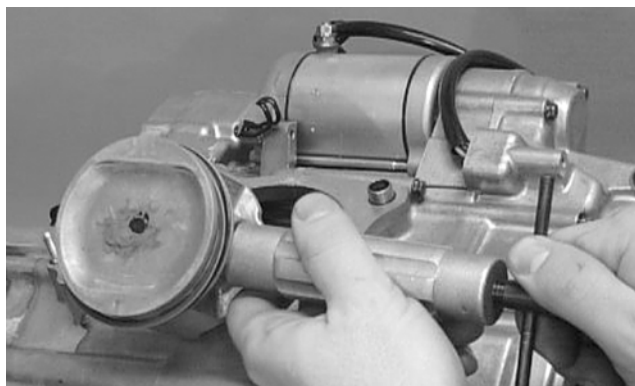
14. Using an awl, remove one piston-pin circlip. Take care not to drop it into the crankcase.



MD1213

15. Using Piston-Pin Puller (p/n 0644-328), remove the piston pin. Account for the opposite-side circlip. Remove the piston.

■ **NOTE:** It is advisable to remove the opposite-side circlip prior to using the puller.



MD1219

■ **NOTE:** Support the connecting rod with rubber bands to avoid damaging the rod or install a connecting rod holder.

### CAUTION

Do not allow the connecting rod to go down inside the crankcase. If the rod is down inside the crankcase and the crankshaft is rotated, severe damage will result.

■ **NOTE:** If the existing rings will not be replaced with new rings, note the location of each ring for proper installation. When replacing with new rings, replace as a complete set only. If the piston rings must be removed, remove them in this sequence.



MD1211

- A. Starting with the top ring, slide one end of the ring out of the ring-groove.



- B. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

**👉 AT THIS POINT**

To service piston, see Servicing Top-Side Components sub-section.

**👉 AT THIS POINT**

To service center crankcase components only, proceed to Removing Left-Side Components.

## Left-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

**👉 AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

## Removing Left-Side Components

### A. Recoil Starter

### B. Starter Cup

### C. Cover/Stator Assembly

1. Remove the four recoil starter cover cap screws. Remove the recoil starter assembly noting the location of the single washer. Note the condition of the recoil cover gasket. Replace if damaged.

**👉 AT THIS POINT**

To service the recoil starter, see Servicing Left-Side Components sub-section.

2. Remove the flange nut securing the starter cup to the crankshaft; then remove the starter cup. Account for the O-ring inside the cup.

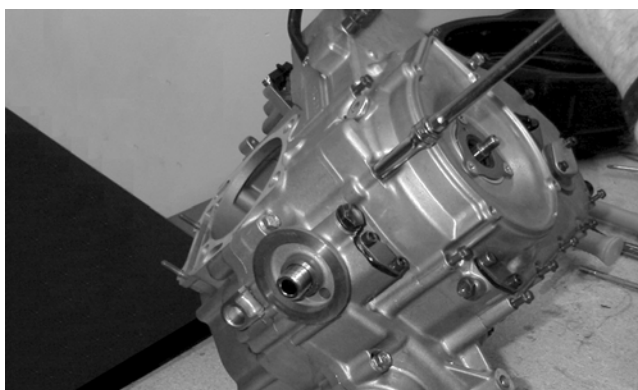


MD1303



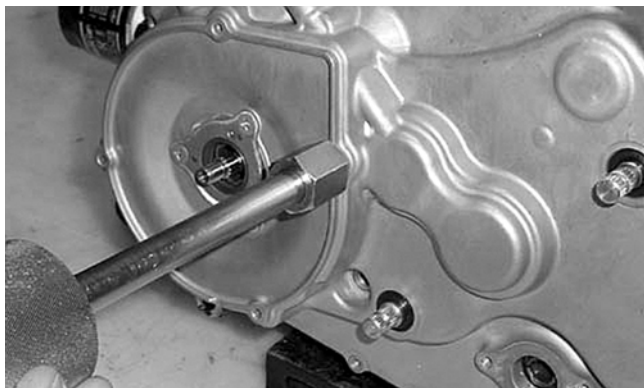
MD1304

3. Lay the engine/transmission on its right side. Remove the 15 left-side cover-to-crankcase mounting cap screws noting the location of the 8 mm cap screw with the washer near the middle of the left-side cover. Keep the different-lengthed 6 mm cap screws in order for installing purposes.



MD1186

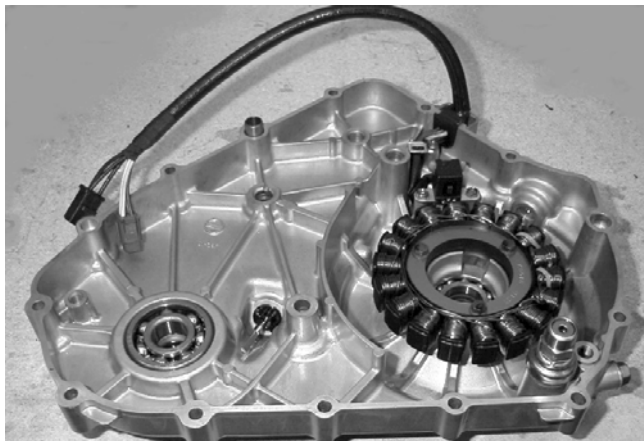
4. Using Side Case Puller (p/n 0644-262) and the 6 mm adapter, remove the left-side cover w/stator assembly. Note the condition of the gasket. Replace if necessary. Account for the two alignment pins and the position of the shifter bracket for installing purposes.



CC946



MD1365



MD1188

■ **NOTE:** Inspect the inside of the left-side cover for any shaft washers that may have come off with the cover. Make sure they are returned to their respective shafts and that the starter idler gear spacer is on the shaft or in the cover.

#### **D. Rotor/Flywheel**

#### **E. Starter Motor**

■ **NOTE:** Steps 1-4 in the preceding sub-section must precede this procedure.

5. Remove the rotor/flywheel nut.



MD1194

6. Install the crankshaft protector.

**⚠ CAUTION**

Care must be taken that the remover is fully threaded onto the rotor/flywheel or damage may occur.

7. Using Magneto Rotor Remover (p/n 0444-075), break the rotor/flywheel assembly loose from the crankshaft. Remove the remover, the crankshaft protector, the rotor/flywheel, and the starter clutch gear. Account for the key.

**3**



MD1368



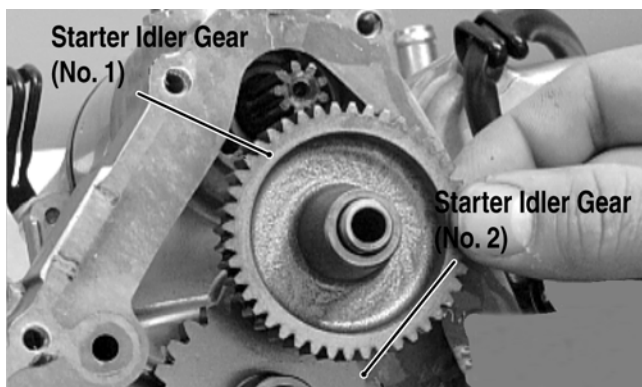
MD1369





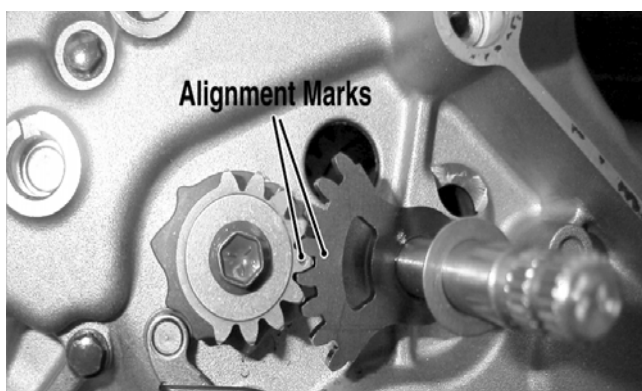
MD1370

8. Remove the starter idler gear (No. 1) and starter idler gear (No. 2).



MD1305

9. Remove the gear shift shaft assembly and washer from the left-side crankcase. Note the positions of the alignment marks and washer for installing purposes; then release the cam stopper spring tension.



MD1239

10. Remove the shift detent cam. Note position of spacer for installing purposes.
11. Remove the cam stopper assembly.
12. Remove the spacer from the driveshaft noting the direction of the stepped side for installing purposes.



MD1224

13. Remove two starter motor cap screws.



MD1078

14. Remove starter motor by tapping lightly with a mallet.
15. Using an impact screwdriver, remove the three Phillips-head screws holding the crankshaft bearing retainer. Remove the crankshaft bearing retainer.



MD1122



## Right-Side Components

### AT THIS POINT

To service center crankcase components only, proceed to Removing Right-Side Components.

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### AT THIS POINT

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

## Removing Right-Side Components

- A. V-Belt Cover**
- B. Driven Pulley**
- C. Clutch Cover**

1. If the engine is still in the frame, turn the gas tank valve to the OFF position. Remove the cap screws securing the right-side V-belt cover to the clutch cover. Remove the cover. Note the locations of the long cap screws and the two wire forms. Account for the gasket and for two alignment pins.

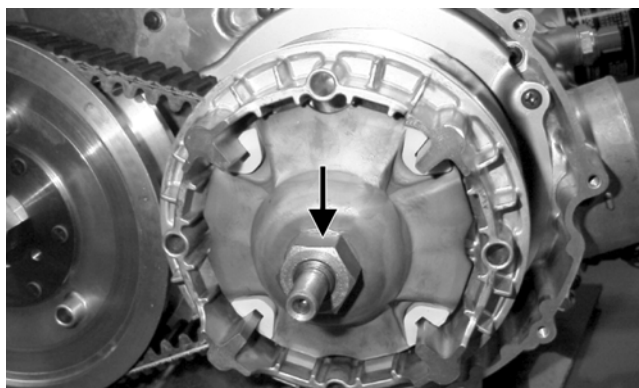


MD1306



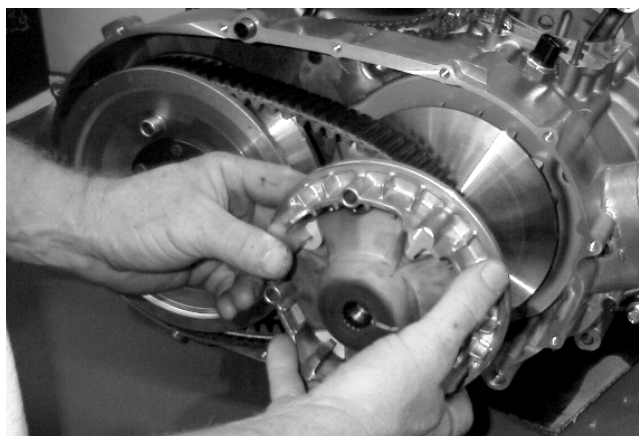
MD1307

2. Mark the movable drive face and the fixed drive face for installing purposes; then remove the nut holding the movable drive face onto the crankshaft.



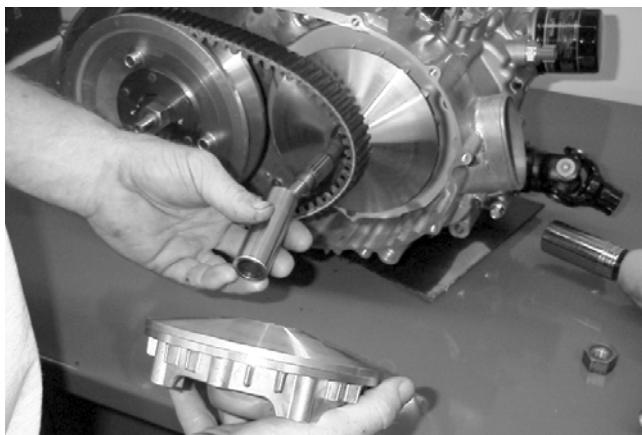
MD1033

3. Remove the movable drive face and spacer. Account for the eight movable drive face rollers and outer drive face cover.



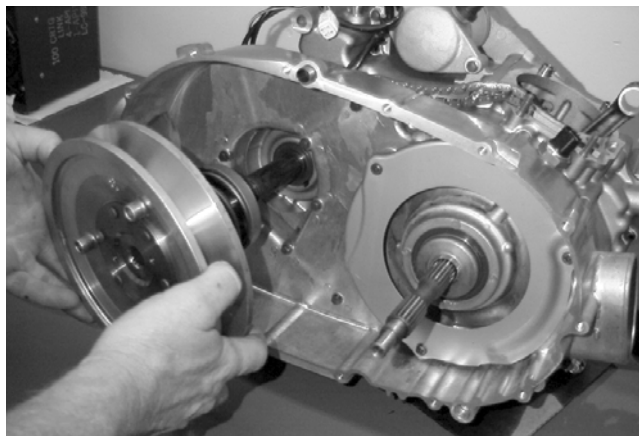
MD1035

3

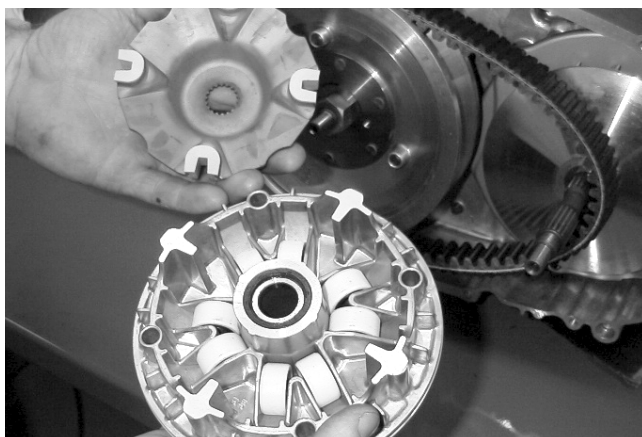


MD1034

6. Remove the nut holding the driven pulley assembly; then remove the driven pulley assembly.



MD1068



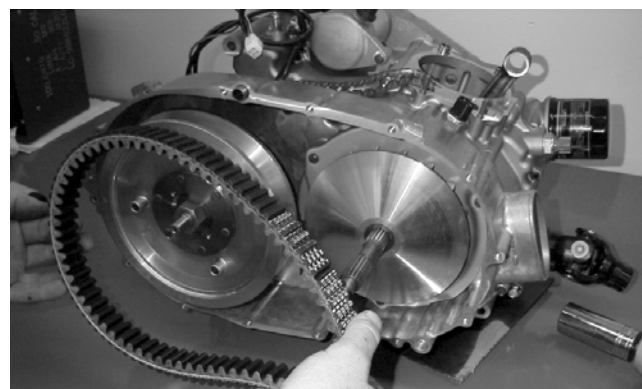
MD1036

4. Remove the V-belt.



MD1092

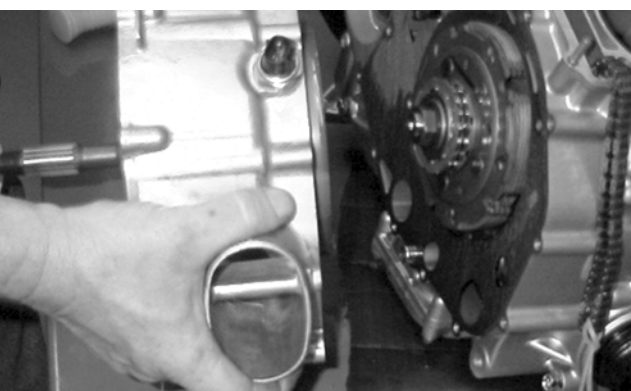
7. Using an impact screwdriver, remove the three Phillips-head cap screws holding the air intake plate. Remove the air intake plate.



MD1118

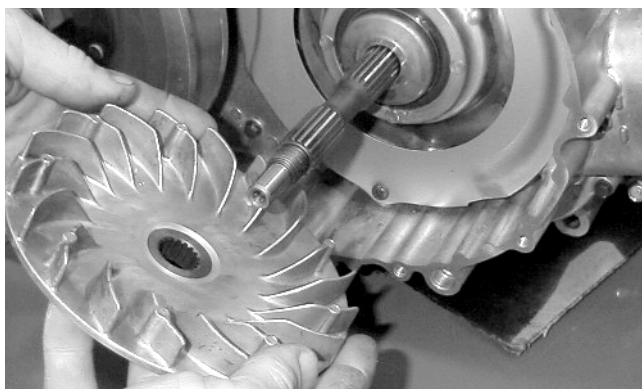
5. Remove the fixed drive face.

8. Remove the cap screws holding the clutch cover onto the right-side crankcase half. Note the positions of the different-lengthed cap screws for installing purposes.



MD1115

9. Using a rubber mallet, loosen the clutch cover; then pull it away from the right-side crankcase half. Account for two alignment pins and gasket.

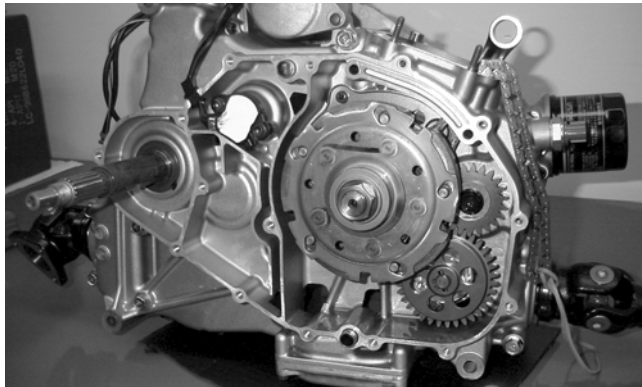


MD1094



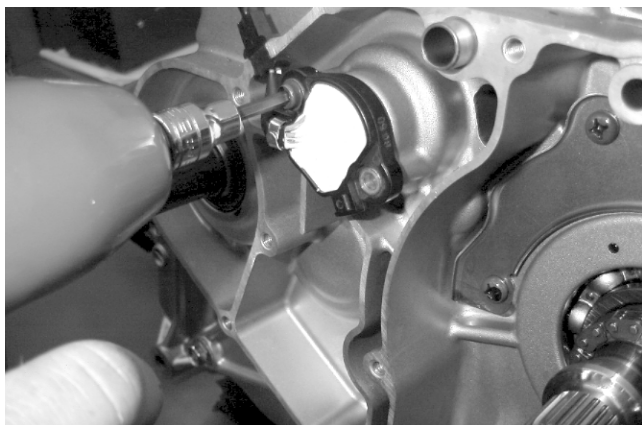
**D. Gear Position Switch  
E. Centrifugal Clutch Assembly  
F. Oil Pump Drive Gear  
G. Oil Pump Driven Gear**

■ **NOTE:** Steps 1-9 in the preceding sub-section must precede this procedure.



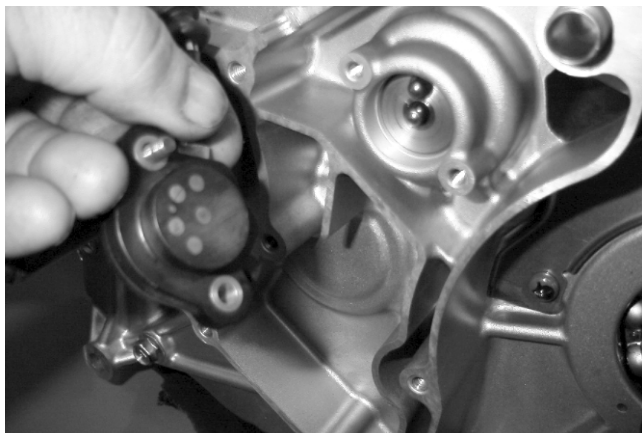
MD1072

10. Remove the cap screws holding the gear position indicator switch onto the right-side crank-case half.



MD1041

11. Remove the gear position indicator switch. Account for two contact pins and two springs.



MD1040



MD1043

12. Remove the one-way sprag clutch noting the direction of the green dot or the stamp tag OUT-SIDE for installing purposes.

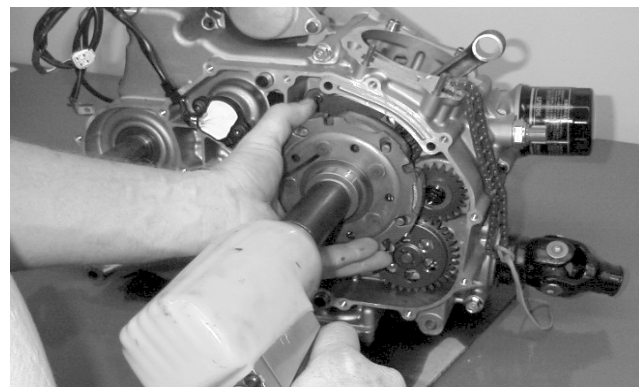


MD1286

13. Remove the left-hand threaded nut holding the centrifugal clutch assembly.

**⚠ CAUTION**

Care must be taken when removing the nut; it has "left-hand" threads.



MD1014

**3**





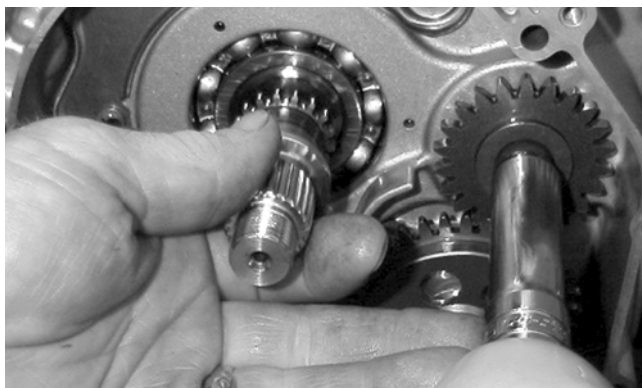
MD1016

14. Remove the cam chain.



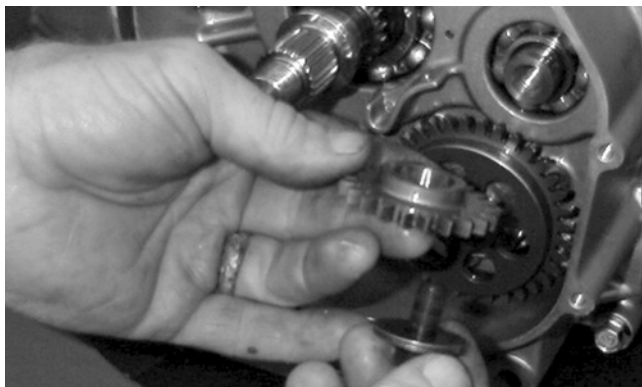
MD1335

15. Remove the oil pump drive gear cap screw.



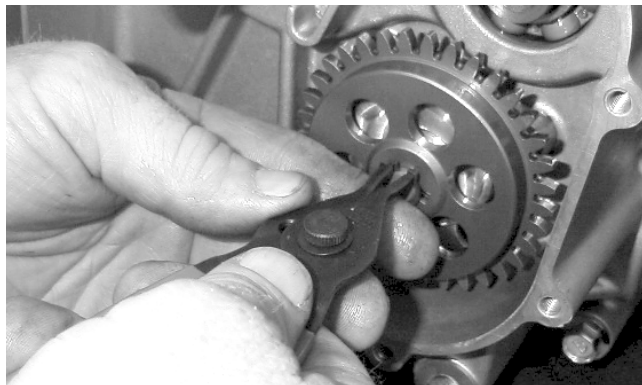
MD1018

16. Remove oil pump drive gear. Account for the pin.



MD1017

17. Remove the snap ring holding the oil pump driven gear.



MD1019

■ **NOTE:** Always use a new snap ring when installing the oil pump driven gear.

18. Remove oil pump driven gear. Account for the pin.



MD1020

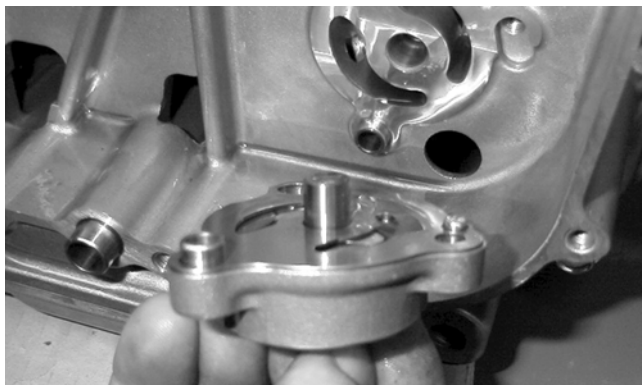
### **AT THIS POINT**

To service clutch components, see Servicing Right-Side Components sub-section.

## **H. Oil Pump/Oil Strainer**

■ **NOTE:** Steps 1-18 in the preceding sub-sections must precede this procedure.

19. Remove three Phillips-head screws holding the oil pump and remove the oil pump. Account for two alignment pins.



MD1060

20. Remove the four cap screws securing the oil strainer cover; then remove the Phillips-head screws securing the oil strainer. Account for the O-ring.

■ **NOTE:** Note the directional arrow for installing purposes.



MD1207

### **AT THIS POINT**

To service center crankcase components only, proceed to Separating Crankcase Halves.

## Center Crankcase Components

■ **NOTE:** This procedure cannot be done with the engine/transmission in the frame. Complete Removing procedures for Top-Side, Left-Side, and Right-Side must precede this procedure.

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

## Separating Crankcase Halves

3

1. Remove the left-side and right-side cap screws securing the crankcase halves noting the position of the different-sized cap screws for joining purposes.



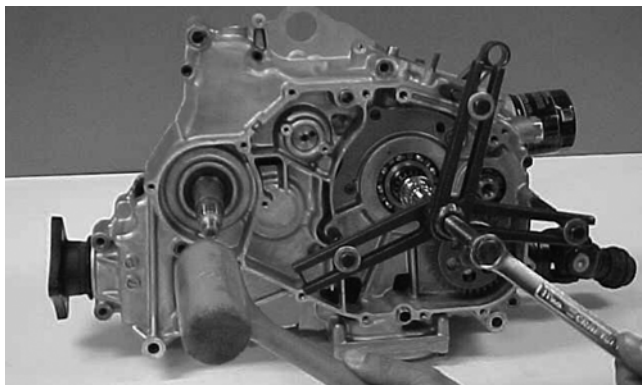
MD1006



MD1012

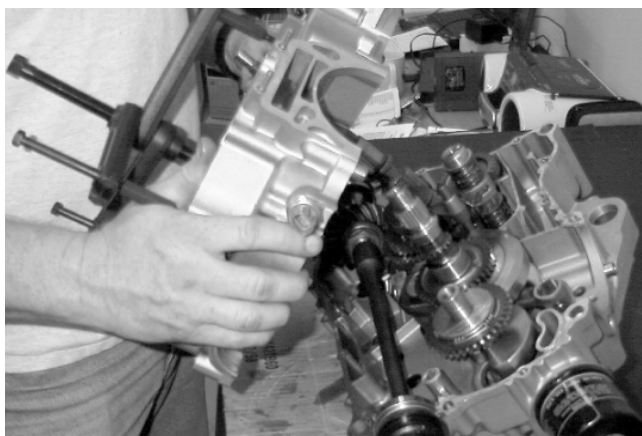
2. Using Crankcase Separator/Crankshaft Remover (p/n 0444-009) and tapping lightly with a rubber mallet, separate the crankcase halves. Account for two alignment pins.





CC869

■ **NOTE:** To keep the shaft/gear assemblies intact for identification, tap the shafts toward the left-side crankcase half when separating the halves.



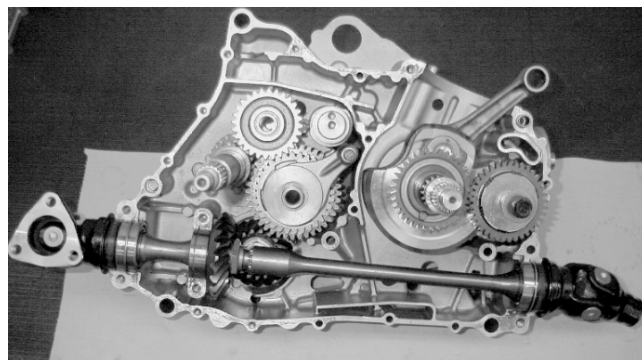
MD1313

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## Disassembling Crankcase Half

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1. Remove the secondary and primary driveshaft assemblies. Account for the bearing alignment C-ring on the bearing boss next to the pinion gear.



MD1317

■ **NOTE:** Note the location of the bearing alignment pin on the secondary output shaft.

2. Remove the reverse idler gear, spacer, and sleeve. Account for the washers.



MD1325



CC870

3. Remove the driveshaft.



MD1326

4. Remove the shift fork shaft and the outer shift fork.





MD1327

5. Remove snap ring and gear from the output side of the gear cluster. Remove the gear cluster and the inner shift fork together. Account for snap ring, gear, and washer.



MD1328

6. Noting the position of the two holes on the end, remove the shift cam assembly. Account for inner and outer washers.



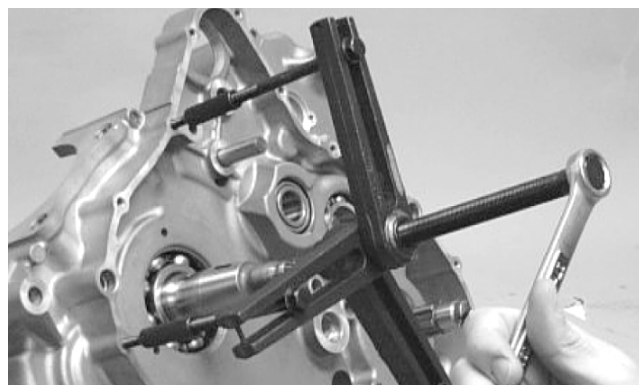
MD1329

7. Remove the counterbalance gear. Account for the key.
8. Remove the counterbalance shaft.



MD1024

9. Using Crankcase Separator/Crankshaft Remover (p/n 0444-009), remove the crankshaft.



MD1330



### CAUTION

**Do not remove the remaining output shaft assembly unless absolutely necessary. If the shaft is removed, the shaft nut must be replaced with a new one and the shaft must be re-shimmed.**

10. Remove the secondary drive gear/secondary driven gear retaining nut. From inside the crankcase using a rubber mallet, drive out the output shaft assembly. Account for the output shaft, a shim, a washer, and the nut.



### AT THIS POINT

**To service crankshaft assembly, see Servicing Center Crankcase Components sub-section.**

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## Table of Contents

### (Servicing Components)

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■ **NOTE:** Critical engine/transmission specifications are located at the beginning of this section.

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## Servicing Top-Side Components

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■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

### VALVE ASSEMBLY

When servicing valve assembly, inspect valve seats, valve stems, valve faces, and valve stem ends for pits, burn marks, or other signs of abnormal wear.

■ **NOTE:** Whenever a valve is out of tolerance, it must be replaced.

### Cleaning/Inspecting Valve Cover

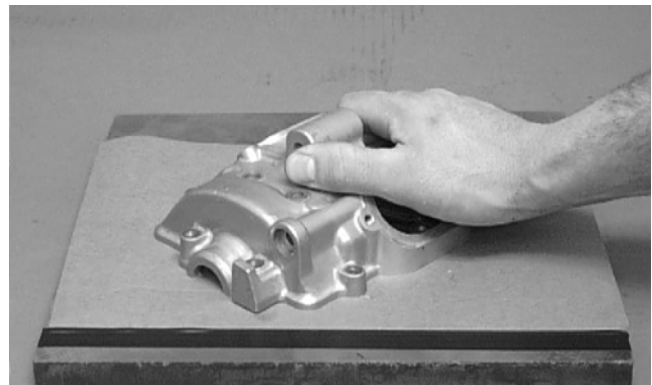
■ **NOTE:** If the valve cover cannot be trued, the cylinder head assembly must be replaced.

1. Wash the valve cover in parts-cleaning solvent.

2. Place the valve cover on the Surface Plate (p/n 0644-016) covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the valve cover in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the valve cover in a figure eight motion until a uniform bright metallic finish is attained.

#### CAUTION

**Do not remove an excessive amount of the sealing surface or damage to the camshaft will result. Always check camshaft clearance when resurfacing the valve cover.**



CC130D

#### CAUTION

**Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.**

### Removing Valves

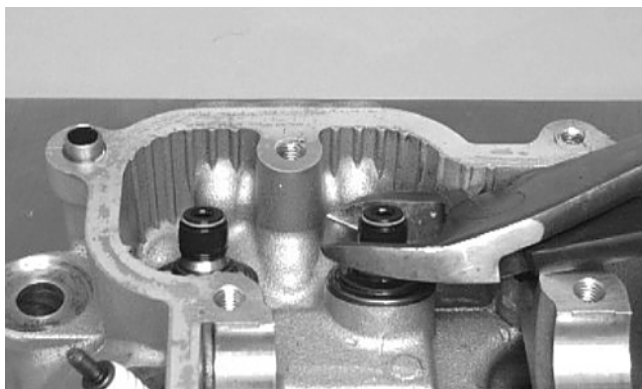
■ **NOTE:** Keep all valves and valve components as a set. Note the original location of each valve set for use during installation. Return each valve set to its original location during installation.

1. Using a valve spring compressor, compress the valve springs and remove the valve cotters. Account for an upper spring retainer.

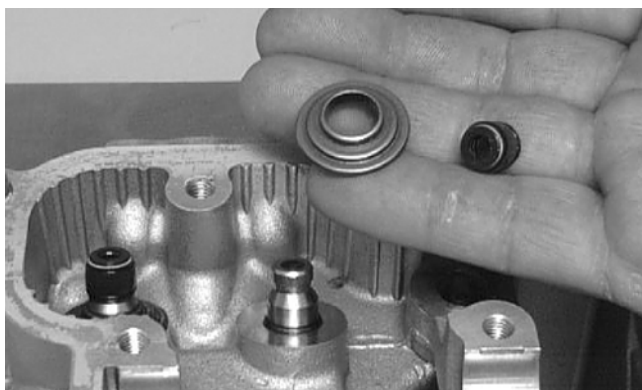


CC994

2. Remove the valve seal and the lower remaining spring seat. Discard the valve seal.



CC134D



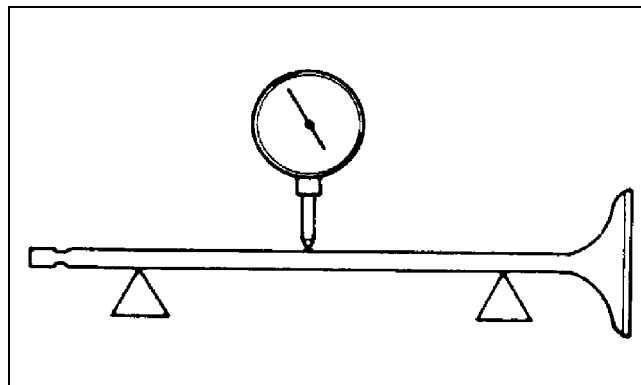
CC136D

■ **NOTE:** The valve seals must be replaced.

3. Remove the valve springs; then invert the cylinder head and remove the valves.

### Measuring Valve Stem Runout

1. Support each valve stem end with the V Blocks (p/n 0644-022); then check the valve stem runout using a dial indicator.



ATV-1082

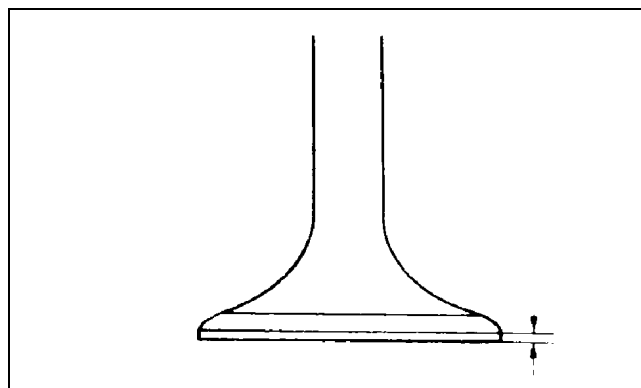
2. Maximum runout must not exceed specifications.

### Measuring Valve Stem Outside Diameter

1. Using a micrometer, measure the valve stem outside diameter.
2. Acceptable diameter range (intake valve) must be within specifications.
3. Acceptable diameter range (exhaust valve) must be within specifications.

### Measuring Valve Face/Seat Width

1. Using a micrometer, measure the width of the valve face.



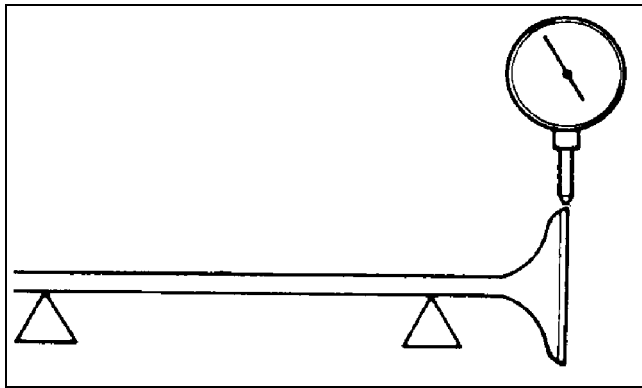
ATV-1004

2. Acceptable width range must be within specifications.

### Measuring Valve Face Radial Runout

1. Mount a dial indicator on the surface plate; then place the valve stem on a set of V blocks.
2. Position the dial indicator contact point on the outside edge of the valve face; then zero the indicator.



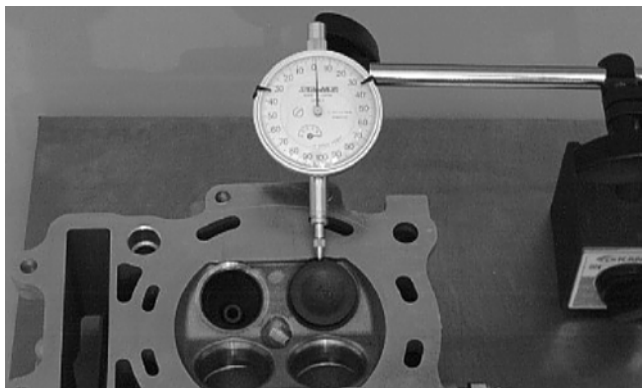


ATV1082A

3. Rotate the valve in the V blocks.
4. Maximum runout must not exceed specifications.

### Measuring Valve Guide/Valve Stem Deflection (Wobble Method)

1. Mount a dial indicator and base on the surface plate; then place the cylinder head on the surface plate.
2. Install the valve into the cylinder head; then position the dial indicator contact point against the outside edge of the valve face. Zero the indicator.



CC131D

3. Push the valve from side to side; then from top to bottom.
4. Maximum "wobble" deflection must not exceed specifications.

### Measuring Valve Guide (Inside Diameter)

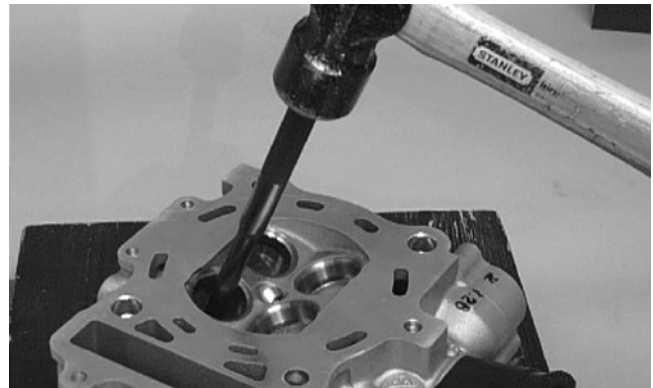
1. Insert a snap gauge 1/2 way down into each valve guide bore; then remove the gauge and measure it with a micrometer.
2. Acceptable inside diameter range must be within specifications.

3. If a valve guide is out of tolerance, it must be replaced.

### Replacing Valve Guide

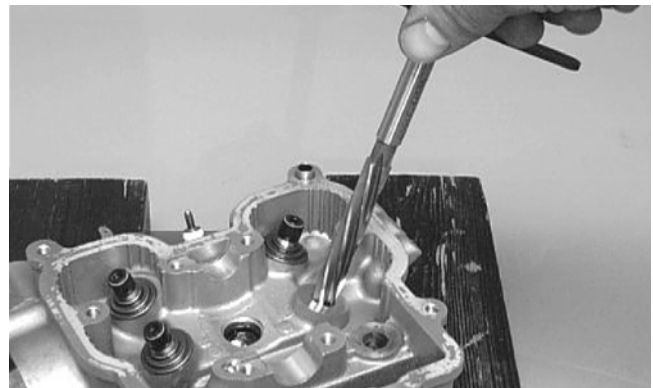
■ **NOTE:** If a valve guide is worn or damaged, it must be replaced.

1. If a valve guide needs replacing, insert a valve guide remover into the valve seat side of the valve guide. Using a hammer, gently drive the valve guide out of the cylinder head.



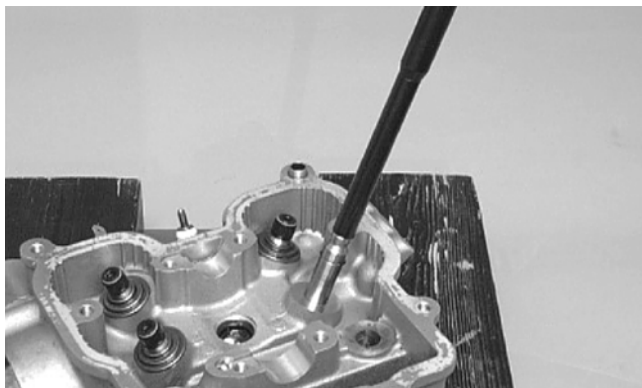
CC137D

2. Using the Standard Valve Guide Reamer (p/n 0444-017), remove any burrs or tight areas from the valve guide journals.



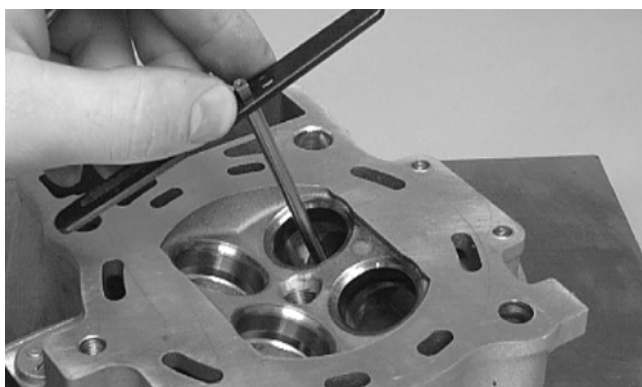
CC142D

3. To install a valve guide, use a valve guide installer and gently drive a valve guide with a retaining clip into the bore from the valve spring side until the retaining clip just contacts the cylinder head.



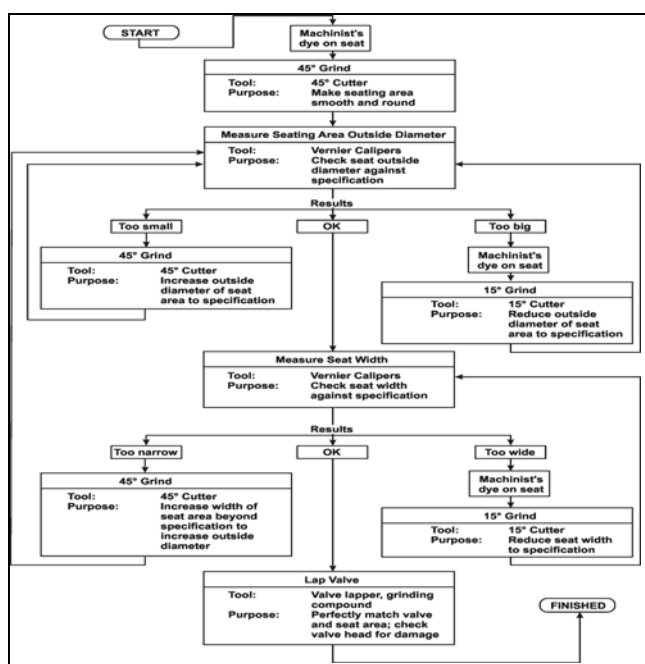
CC143D

4. After installing the guide, use the standard valve guide reamer to remove all burrs and tight areas that may remain in each valve guide.



CC138D

## Valve Seat/Guide Servicing Flow Chart



ATV-0107

## Grinding Valve Seats

■ **NOTE:** If the valve seat is beyond servicing, the cylinder head must be replaced.

1. Insert an exhaust valve seat pilot shaft into an exhaust valve guide. Slide an exhaust valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the exhaust valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining exhaust valve.



CC139D

2. Insert an intake valve seat pilot shaft into one of the intake valve guides. Slide the intake valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the intake valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining intake valve.



CC140D

## Lapping Valves

■ **NOTE:** Do not grind the valves. If a valve is damaged, it must be replaced.

1. Remove all carbon from the valves.

2. Lubricate each valve stem with light oil; then apply a small amount of valve lapping compound to the entire seating face of each valve.
3. Attach the suction cup of a valve lapping tool to the head of the valve.
4. Rotate the valve until the valve and seat are evenly polished.
5. Clean all compound residue from the valve and seat.

### Measuring Rocker Arm (Inside Diameter)

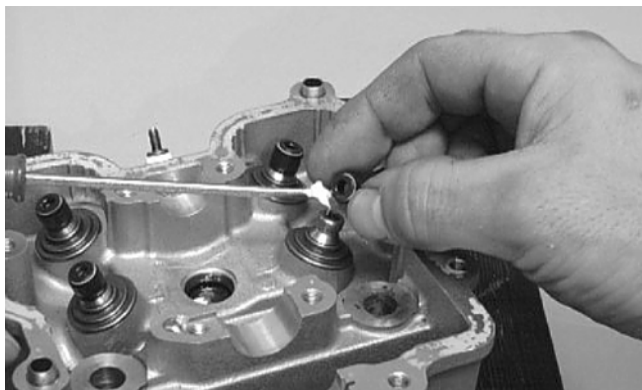
1. Using a dial calipers, measure the inside diameter of the rocker arm.
2. Acceptable inside diameter range must be within specifications.

### Measuring Rocker Arm Shaft (Outside Diameter)

1. Using a micrometer, measure the outside diameter of the rocker arm shaft.
2. Acceptable outside diameter range must be within specifications.

### Installing Valves

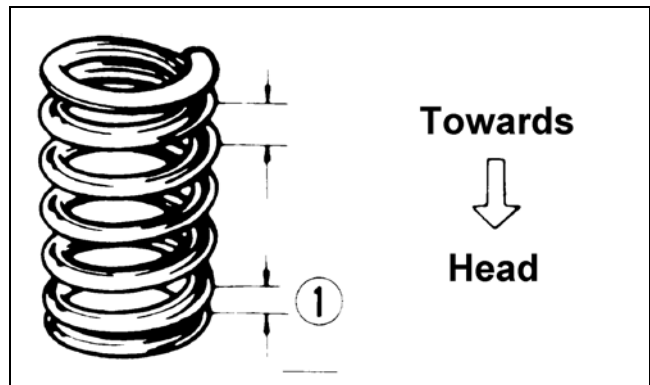
1. Apply grease to the inside surface of the valve seals; then place a lower spring seat and valve guide seal over each valve guide.



CC144D

2. Insert each valve into its original valve location.
3. Install the valve springs with the painted end of the spring facing away from the cylinder head.

■ **NOTE:** If the painted end is not visible, install the ends of the springs with the closest coils toward the head.



ATV-1011A

4. Place a spring retainer over the valve springs; then using the valve spring compressor, compress the valve springs and install the valve cotters.



CC994

### PISTON ASSEMBLY

■ **NOTE:** Whenever a piston, rings, or pin are out of tolerance, they must be replaced.

### Cleaning/Inspecting Piston

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the dome of the piston.
2. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
3. Inspect the piston for seizure marks or scuffing. Repair with #400 grit wet-or-dry sandpaper and water or honing oil.

■ **NOTE:** If scuffing or seizure marks are too deep to correct with the sandpaper, replace the piston.

4. Inspect the perimeter of each piston for signs of excessive "blowby." Excessive "blowby" indicates worn piston rings or an out-of-round cylinder.



## Removing Piston Rings

1. Starting with the top ring, slide one end of the ring out of the ring-groove.



CC400D

2. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

■ **NOTE:** If the existing rings will not be replaced with new ones, note the location of each ring for proper installation. When installing new rings, install as a complete set only.

## Cleaning/Inspecting Piston Rings

1. Take an old piston ring and snap it into two pieces; then grind the end of the old ring to a 45° angle and to a sharp edge.
2. Using the sharpened ring as a tool, clean carbon from the ring-grooves. Be sure to position the ring with its tapered side up.

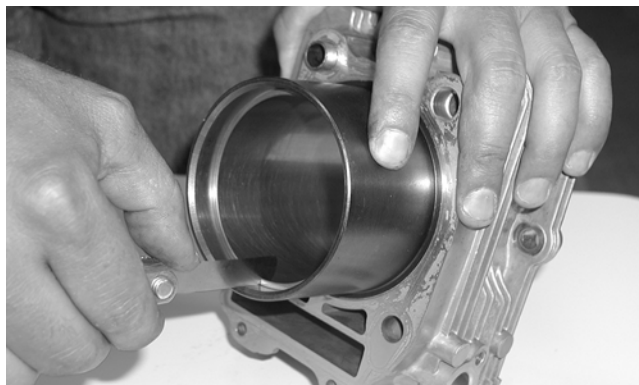


### CAUTION

Improper cleaning of the ring-grooves by the use of the wrong type of ring-groove cleaner will result in severe damage to the piston.

## Measuring Piston-Ring End Gap (Installed)

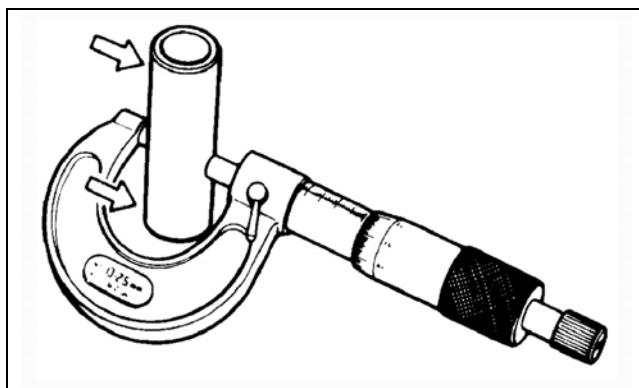
1. Place each piston ring in the wear portion of the cylinder. Use the piston to position each ring squarely in the cylinder.
2. Using a feeler gauge, measure each piston-ring end gap. Acceptable ring end gap must not exceed specifications.



CC995

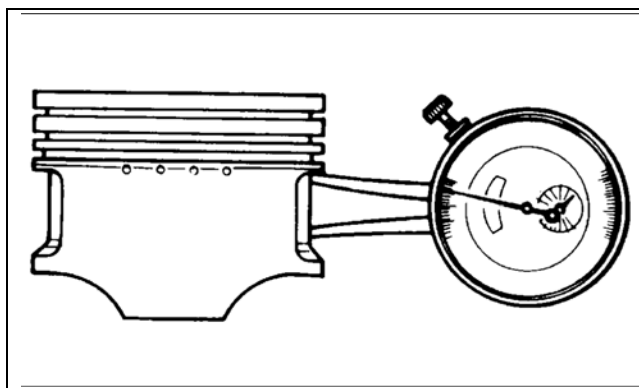
## Measuring Piston Pin (Outside Diameter) and Piston-Pin Bore

1. Measure the piston pin outside diameter at each end and in the center. If measurement is not within specifications, the piston pin must be replaced.



ATV-1070

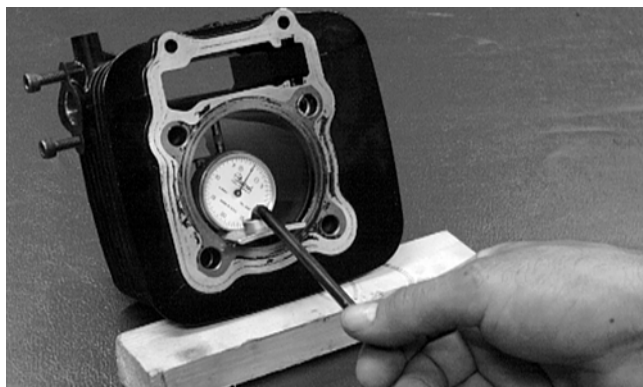
2. Insert an inside dial indicator into the piston-pin bore. The diameter must not exceed specifications. Take two measurements to ensure accuracy.



ATV-1069

## Measuring Piston Skirt/ Cylinder Clearance

1. Measure the cylinder front to back in six places.



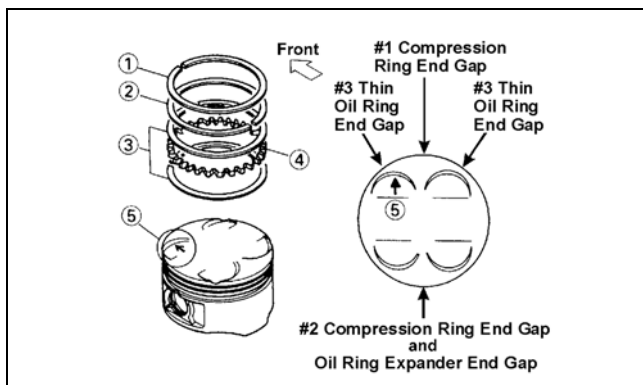
CC397D

2. Measure the corresponding piston diameter at a point 15 mm (0.6 in.) above the piston skirt at a right angle to the piston-pin bore. Subtract this measurement from the measurement in step 1. The difference (clearance) must be within specifications.

## Installing Piston Rings

1. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.

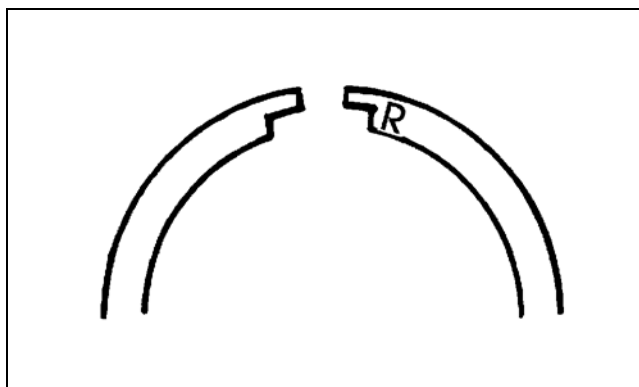
■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.



ATV-1085B

2. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston according to the illustration.

■ **NOTE:** The chrome (silver) ring should be installed in the top position.



726-306A

### ⚠ CAUTION

Incorrect installation of the piston rings will result in engine damage.

## CYLINDER/CYLINDER HEAD ASSEMBLY

■ **NOTE:** If the cylinder/cylinder head assembly cannot be trued, they must be replaced.

## Cleaning/Inspecting Cylinder Head

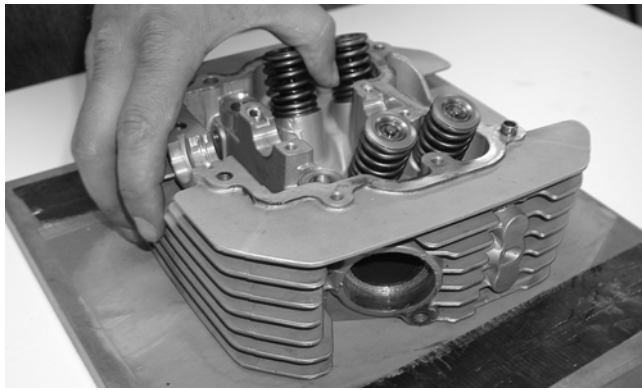
### ⚠ CAUTION

The cylinder head studs must be removed for this procedure.

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the combustion chamber being careful not to nick, scrape, or damage the combustion chamber or the sealing surface.
2. Inspect the spark plug hole for any damaged threads. Repair damaged threads using a "heli-coil" insert.
3. Place the cylinder head on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder head in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder head in a figure eight motion until a uniform bright metallic finish is attained.

### ⚠ CAUTION

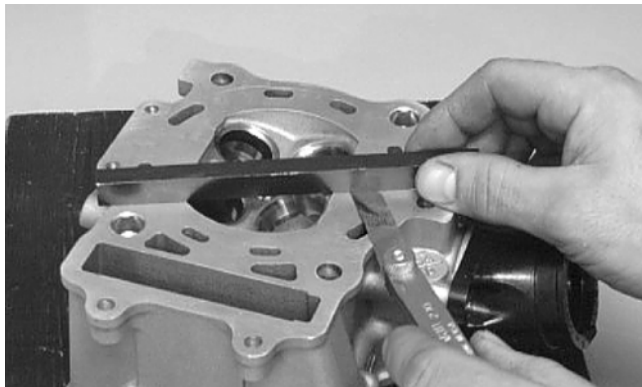
Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



CC996

### Measuring Cylinder Head Distortion

1. Remove any carbon buildup in the combustion chamber.
2. Lay a straightedge across the cylinder head; then using a feeler gauge, check the distortion factor between the head and the straightedge.
3. Maximum distortion must not exceed specifications.



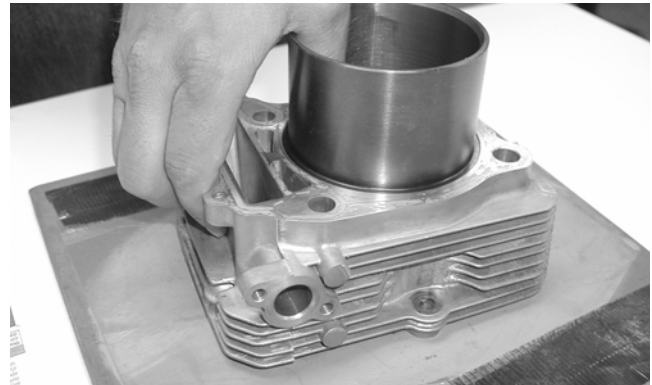
CC141D

### Cleaning/Inspecting Cylinder

1. Wash the cylinder in parts-cleaning solvent.
2. Inspect the cylinder for pitting, scoring, scuffing, warpage, and corrosion. If marks are found, repair the surface using a cylinder hone (see Honing Cylinder in this sub-section).
3. Place the cylinder on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder in a figure eight motion until a uniform bright metallic finish is attained.

**CAUTION**

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



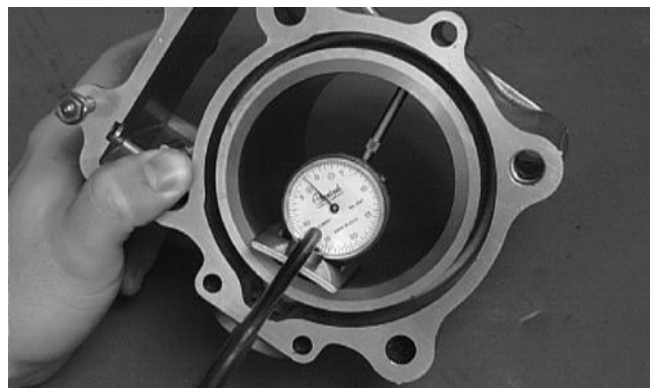
CC997

### Inspecting Cam Chain Guide

1. Inspect cam chain guide for cuts, tears, breaks, or chips.
2. If the chain guide is damaged, it must be replaced.

### Honing Cylinder

1. Using a slide gauge and a dial indicator or a snap gauge, measure the cylinder bore diameter in three locations from top to bottom and again from top to bottom at 90° from the first measurements for a total of six measurements. The trueness (out-of-roundness) is the difference between the highest and lowest reading. Maximum trueness (out-of-roundness) must not exceed specifications.



CC127D

2. Wash the cylinder in parts-cleaning solvent.
3. Inspect the cylinder for pitting, scoring, scuffing, and corrosion. If marks are found, repair the surface using a ball hone.



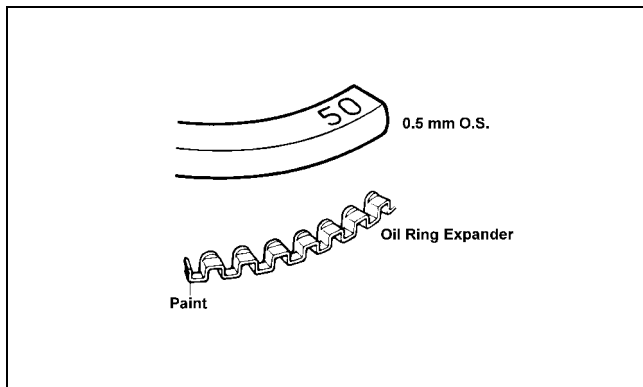
■ **NOTE:** To produce the proper 60° cross-hatch pattern, use a low RPM drill (600 RPM) at the rate of 30 strokes per minute. If honing oil is not available, use a lightweight petroleum-based oil. Thoroughly clean cylinder after honing using soap and hot water. Dry with compressed air; then immediately apply oil to the cylinder bore. If the bore is severely damaged or gouged, replace the cylinder.



CC390D

4. If any measurement exceeds the limit, bore the cylinder and install an oversized piston or replace the cylinder.

■ **NOTE:** Oversized piston and rings are available. The oversized piston and rings are marked for identification.

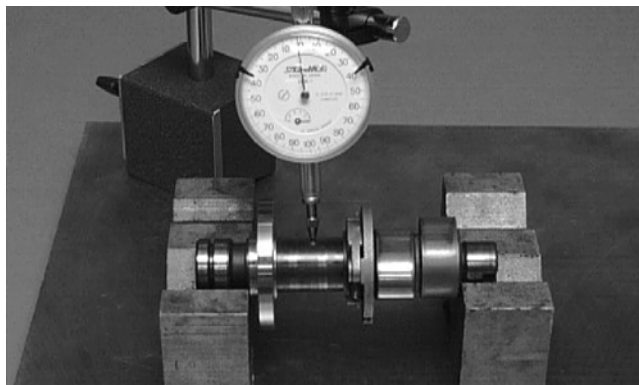


ATV-1068A

### Measuring Camshaft Runout

■ **NOTE:** If the camshaft is out of tolerance, it must be replaced.

1. Place the camshaft on a set of V blocks; then position the dial indicator contact point against the shaft and zero the indicator.

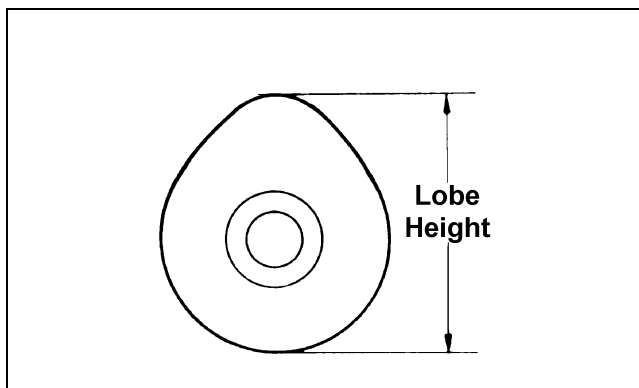


CC283D

2. Rotate the camshaft and note runout; maximum tolerance must not exceed specifications.

### Measuring Camshaft Lobe Height

1. Using a calipers, measure each cam lobe height.



ATV1013A

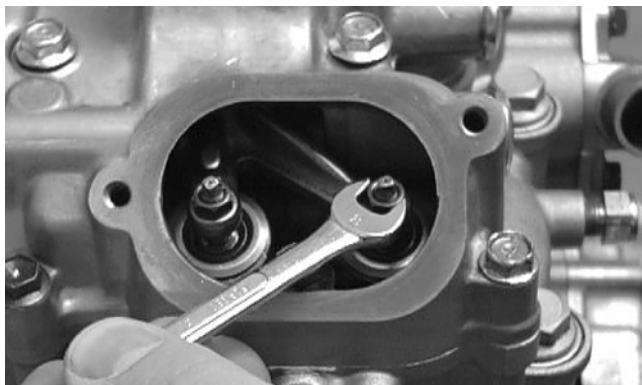
2. The lobe heights must not exceed minimum specifications.

### Inspecting Camshaft Bearing Journal

1. Inspect the bearing journal for scoring, seizure marks, or pitting.
2. If excessive scoring, seizure marks, or pitting is found, the cylinder head assembly must be replaced.

### Measuring Camshaft to Cylinder Head Clearance

1. Remove the adjuster screws and jam nuts.



CC005D

2. Place a strip of plasti-gauge in each of the camshaft lands in the cylinder head.
3. Place the valve cover on the cylinder head and secure with the valve cover cap screws. Tighten securely.

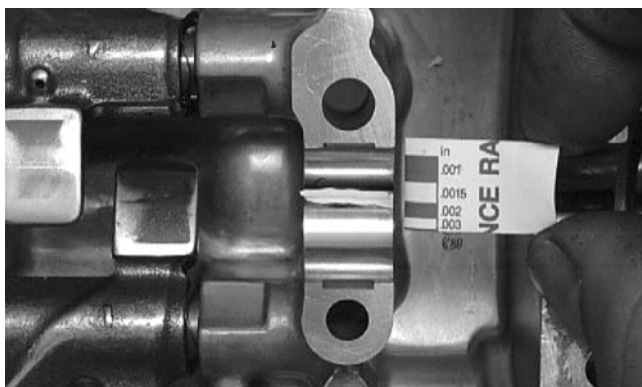
■ **NOTE:** Do not rotate the camshaft when measuring clearance.

4. Remove the cap screws securing the valve cover to the cylinder; then remove the valve cover and camshaft.



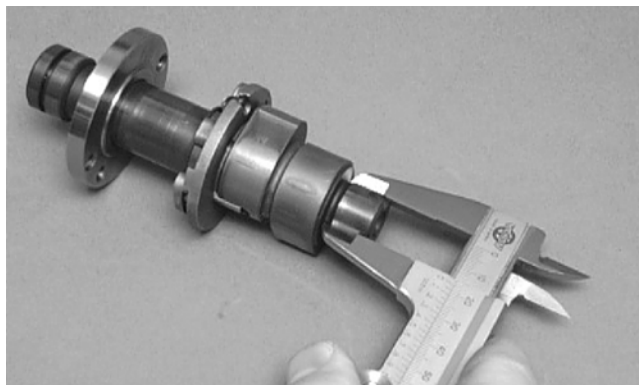
MD1261

5. Match the width of the plasti-gauge with the chart found on the plasti-gauge packaging to determine camshaft to cylinder head and valve cover clearance.



CC145D

6. If clearance is excessive, measure the journals of the camshaft.



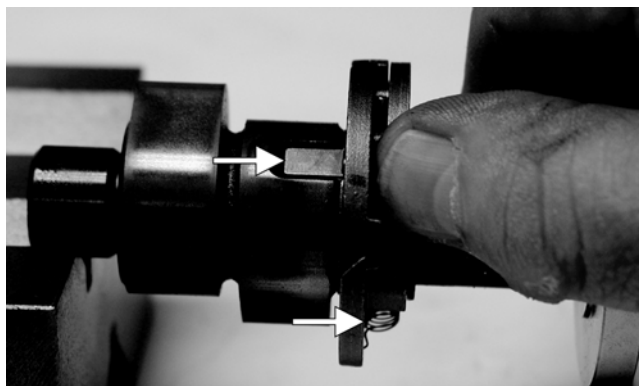
CC287D

■ **NOTE:** If the journals are worn, replace the camshaft; then measure the clearance again. If it is still out of tolerance, replace the cylinder head.

### Inspecting Camshaft Spring/Drive Pin

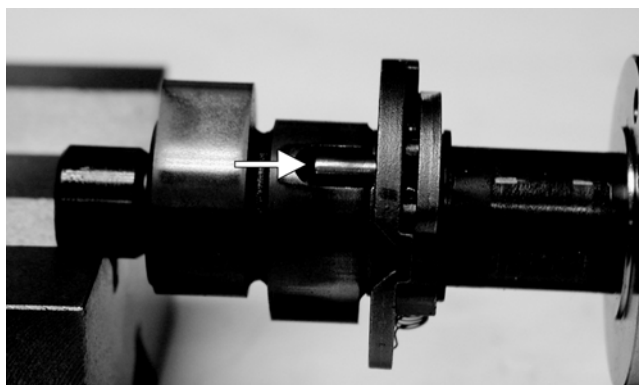
1. Inspect the spring and unloader pin for damage.

3



CF061A

■ **NOTE:** With the weight extended, the unloader pin should be flat-side out; with the weight retracted, the unloader pin should be round-side out.



CF060A

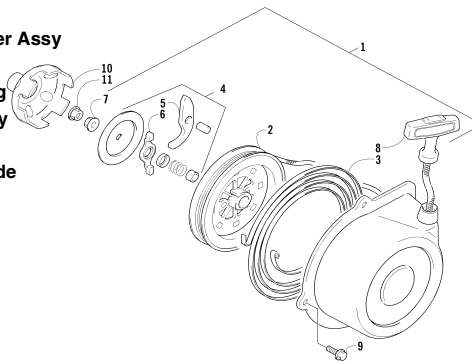
2. If damaged, the camshaft must be replaced.

## Servicing Left-Side Components

### RECOIL STARTER

#### KEY

1. Recoil Starter Assy
2. Reel
3. Spiral Spring
4. Ratchet Assy
5. Ratchet
6. Ratchet Guide
7. Nut
8. Rope Assy
9. Cap Screw
10. Starter Cup
11. Nut



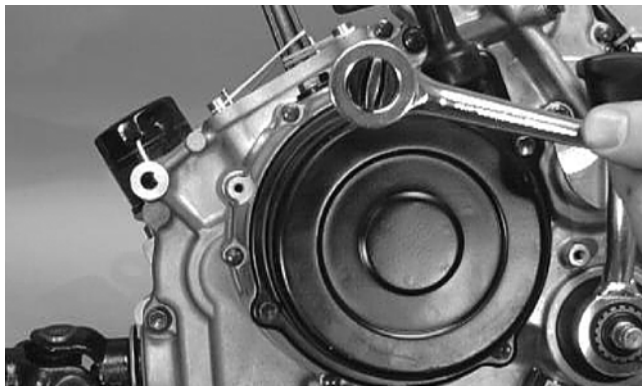
0737-034

#### **WARNING**

Always wear safety glasses when servicing the recoil starter.

### Removing/Disassembling

1. Remove the cap screws securing the recoil starter assembly to the left-side cover; then remove the starter.

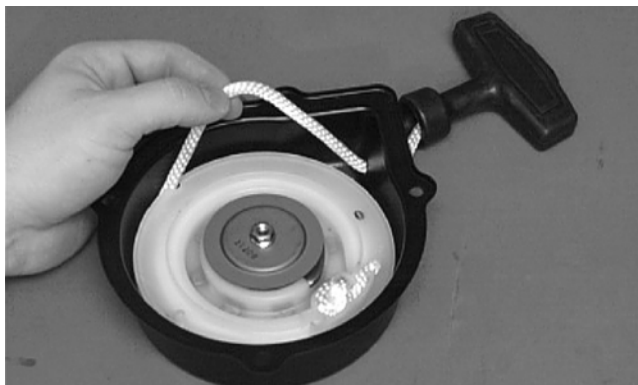


CC039D

#### **WARNING**

During the disassembly procedure, continuous downward pressure must be exerted on the reel so it does not accidentally disengage and cause injury.

2. Rotate the reel counterclockwise until the notch of the reel is near the rope guide in the case. Guide the rope into the notch and slowly allow the reel to retract until all spiral spring tension is released.

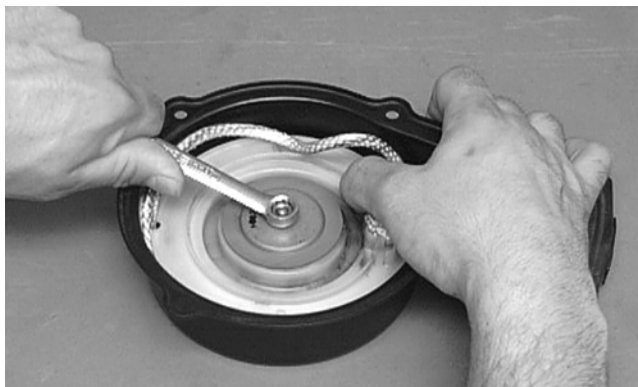


B600D

#### **CAUTION**

During the disassembly procedure, make sure all spring tension is released before continuing.

3. Remove the nut.



B601D

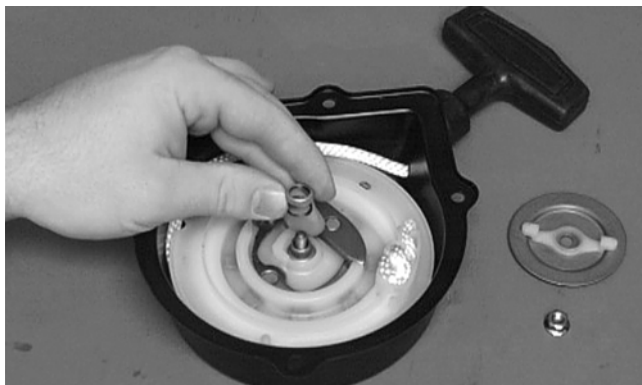
4. Slowly release the friction plate and lift the plate with ratchet guide free of the recoil case; then remove the ratchet guide from the friction plate.



B602D

5. Remove the spring cover, spring, and shaft.





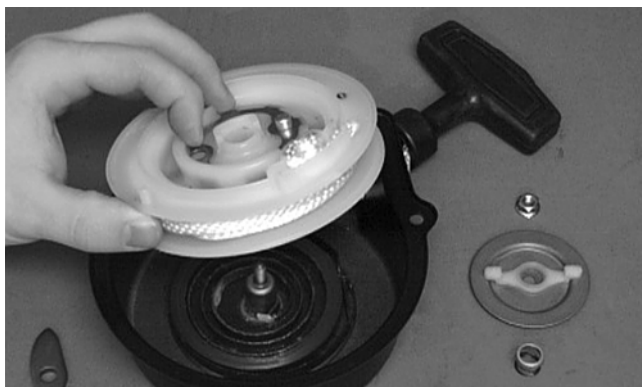
B603D

6. Remove the ratchet and account for the pin.



B604D

7. Carefully lift the reel free of the case making sure the spiral spring does not accidentally disengage from the case.



B605D

### **WARNING**

Care must be taken when lifting the reel free of the case. Wear safety glasses to avoid injury.

8. Remove the protective cover from the starter handle and pull the rope out of the handle; then untie the knot in the rope and remove the handle.

■ **NOTE:** Do not remove the spiral spring unless replacement is necessary. It should be visually inspected in place to save time. If replacement is necessary, follow steps 9-10.

9. Remove the spiral spring from the case by lifting the spring end up and out. Hold the remainder of the spring with thumbs and alternately release each thumb to allow the spring to gradually release from the case.

10. Unwind the rope from the reel and remove the rope.

### **Cleaning and Inspecting**

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all components.
2. Inspect the springs and ratchet for wear or damage.
3. Inspect the reel and case for cracks or damage.
4. Inspect the shaft for wear, cracks, or damage.
5. Inspect the rope for breaks or fraying.
6. Inspect the spiral spring for cracks, crystallization, or abnormal bends.
7. Inspect the handle for damage, cracks, or deterioration.

### **Assembling/Installing**

1. If removed, insert the spiral spring into the case with the outer end of the spring around the mounting lug in the case; then wind it in a counterclockwise direction until the complete spring is installed.

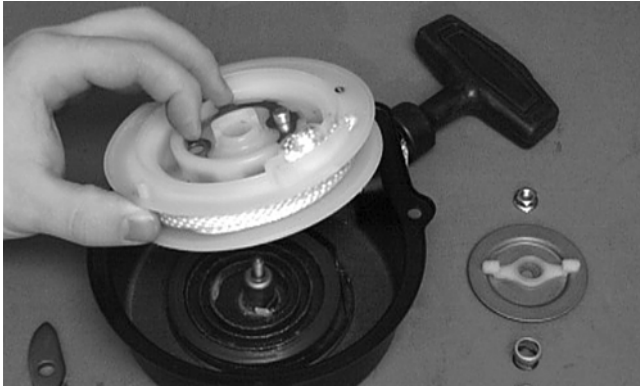
■ **NOTE:** The spiral spring must seat evenly in the recoil case.



B606D

2. Insert the rope through the hole in the reel and tie a knot in the end; then wrap the rope counterclockwise around the reel leaving approximately 50 cm (20 in.) of rope free of the reel.

3. Apply low-temperature grease to the spring and hub.
4. Thread the end of the rope through the guide hole of the case; then thread the rope through the handle and secure it with a double knot. Install the protective cover into the handle.
5. Align the inner hook of the spiral spring with the notch in the reel.



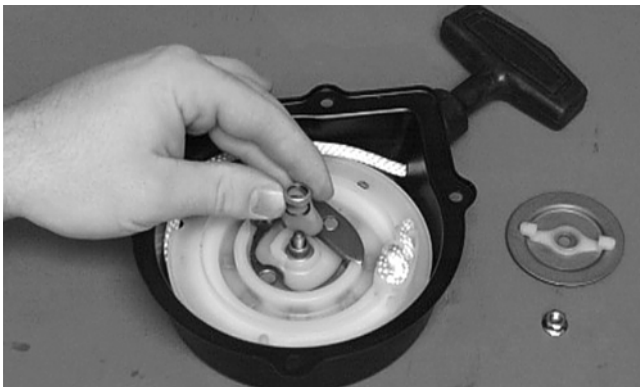
B605D

6. Install the ratchet onto its pin making sure the end is properly installed on the reel.



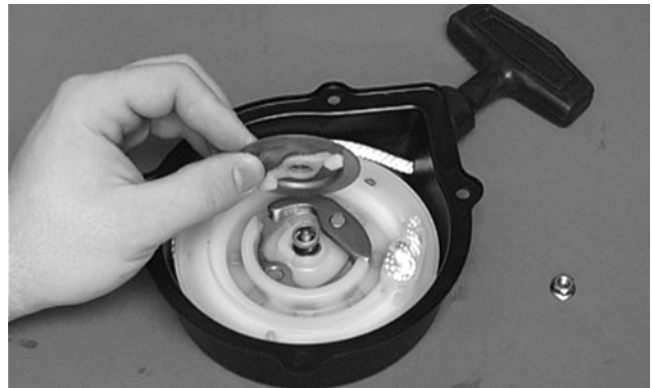
B604D

7. Install the shaft, spring, and the spring cover.



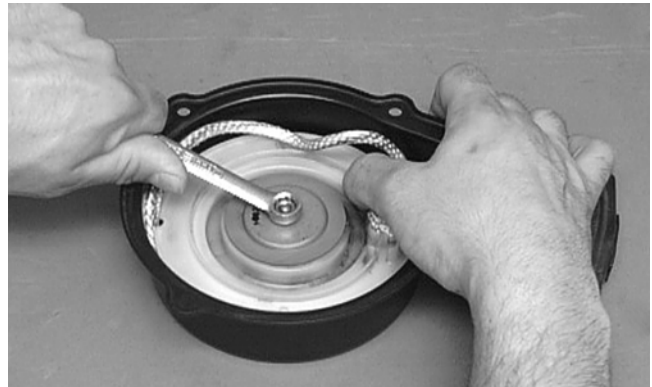
B603D

8. Install the friction plate with the ratchet guide fitting into the ratchet.



B602D

9. While pushing down on the reel, install the nut. Tighten securely.



B601D

10. With the 50 cm (20 in.) of rope exposed, hook the rope in the notch of the reel.
11. Rotate the reel four turns counterclockwise; then release the rope from the notch and allow the rope to retract.

12. Pull the rope out two or three times to check for correct tension.

■ **NOTE:** Increasing the rotations in step 11 will increase spring tension.

13. Place the recoil starter assembly into position on the left-side cover; then tighten the cap screws to specifications.

## Servicing Right-Side Components

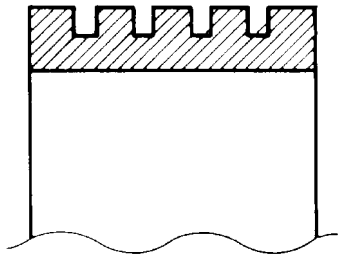
■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

### INSPECTING CENTRIFUGAL CLUTCH SHOE

1. Inspect the clutch shoe for uneven wear, chips, cracks, or discoloration.
2. Inspect the depth of the grooves in the clutch shoes. If any shoe is worn to the bottom of the groove, replace the complete set.

#### **CAUTION**

Always replace clutch shoes as a complete set or severe imbalance could occur.



Inspecting clutch shoe groove

ATV1014

### INSPECTING CENTRIFUGAL CLUTCH HOUSING

1. Inspect the clutch housing for burns, marks, scuffs, cracks, scratches, or uneven wear.
2. If the housing is damaged in any way, the housing must be replaced.

### INSPECTING PRIMARY ONE-WAY DRIVE

1. Insert the drive into the clutch housing.
2. Rotate the inner race by hand and verify the inner race rotates only one direction.
3. If the inner race is locked in place or rotates both directions, the drive assembly must be replaced.

## INSPECTING OIL PUMP

1. Inspect the pump for damage.
2. It is inadvisable to remove the screw securing the pump halves. If the oil pump is damaged, it must be replaced.



CC446D

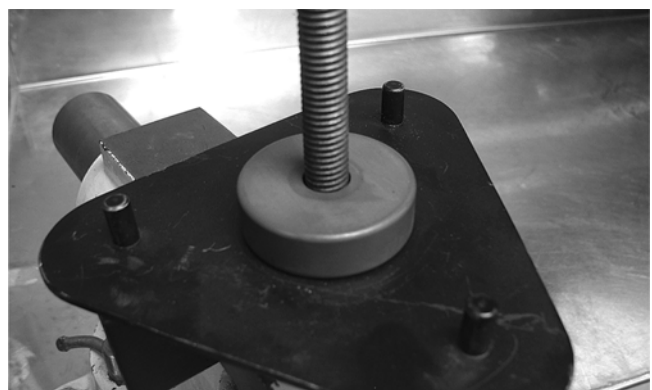
## DRIVEN PULLEY ASSEMBLY

### Disassembling

#### **WARNING**

This procedure involves relaxing a compressed spring assembly. **DO NOT** attempt disassembling without the proper tools.

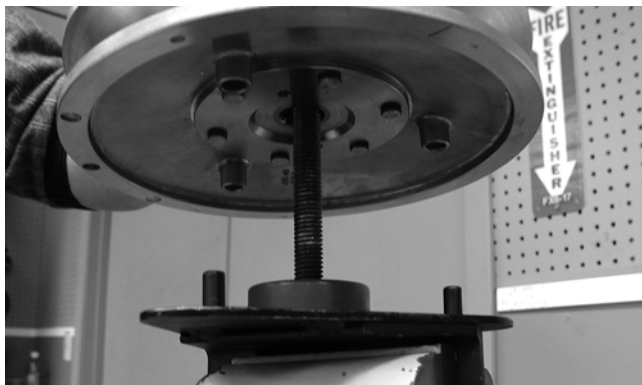
1. Secure Driven Pulley Compressor (p/n 0444-140) in a suitable holding fixture such as a bench vise; then remove the wing nut, holding handle, flat washer, and pilot bushing leaving the large spacer on the compressor tool base.



CD047

2. Place the driven pulley assembly onto the compressor tool base engaging the dowel pins into appropriate holes in the fixed face of the assembly.





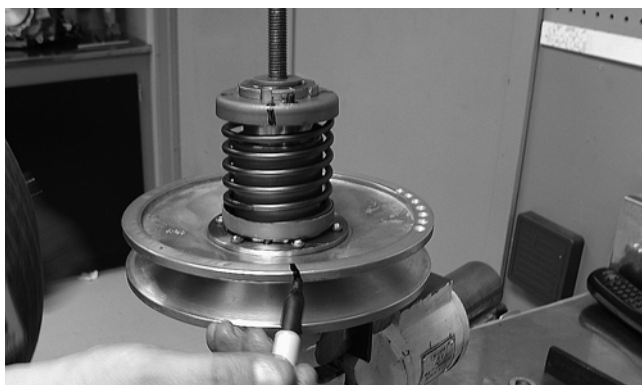
CD048

3. Install the pilot bushing with the machined end directed down; then fit the bushing into the pulley hub.



CD067

4. Using a suitable marking pen, make alignment marks on the fixed face spring holder and both pulley faces.



CD049

5. Place the holding handle on the spring holder fitting the two dowel pins into the spring holder face; then install a flat washer and the wing nut. Turn the wing nut down until resistance is felt.

■ **NOTE:** Do not use the wing nut to compress the spring further.



CD050

### **WARNING**

The spring assembly is under pressure. Extreme care must be taken when relaxing the spring. Always wear safety glasses. Use proper tools only.

6. Using a spanner and suitable breaker bar, loosen the notched-ring nut; then spin the nut free of the hub.



CD051

7. Firmly hold the handle and slowly turn the wing nut counterclockwise to relax the spring.

■ **NOTE:** There will be a tendency for the handle to rotate clockwise approximately  $\frac{1}{4}$  turn as the spring holder clears the flats or hub. This is due to a slight counterclockwise preload on the spring.



CD052

8. Release the preload slowly; then continue to relax the spring until the wing nut is flush with the end of the threads.
9. Firmly holding the spring and spring holder, remove the wing nut; then remove the spring.



CD053

10. Using a thin pry-bar or screwdriver, work the movable face sleeve upward and free of the O-rings; then remove the sleeve.



CD054

11. Remove the three pins and spacers from the cam slots in the movable face; then remove the movable face.



CF091



CD056

## Inspecting

1. Inspect the pulley faces for wear, galling, or grooving.
2. Inspect the O-rings on the movable face for nicks, tears, or swelling.



CF092A

3. Inspect two grease seals in the movable face for nicks, cuts, or damage.



CF095A

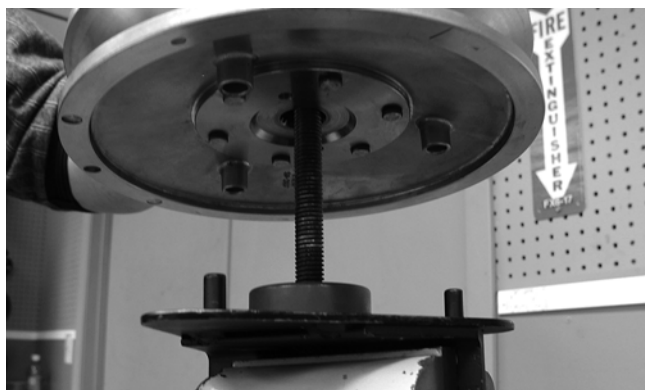
4. Inspect the pins and bushings for wear, flat spots, looseness, or cracking.

3

## Assembling

1. Place the fixed face of the driven pulley on the pulley compressor base making sure the dowel pins are engaged in the appropriate holes in the pulley face.

■ **NOTE:** Make sure the spacer is on the base or damage to the fixed face will occur when the spring is compressed.



CD048

2. Apply multi-purpose grease to the O-rings and grease seals on the movable face; then install on the fixed face making sure the alignment marks are properly aligned.



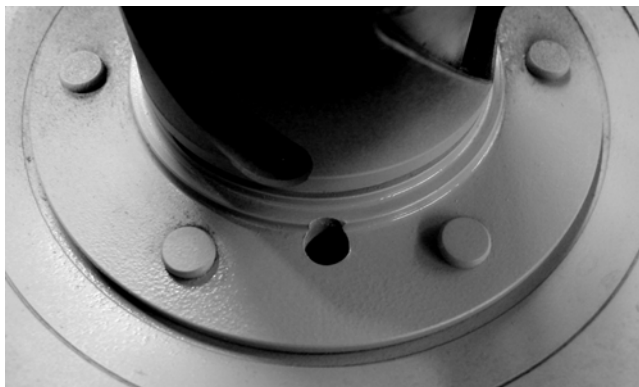
CD060

3. Install the three pins and spacers into the fixed face hub; then pack the cam slots in the movable face with multi-purpose grease.



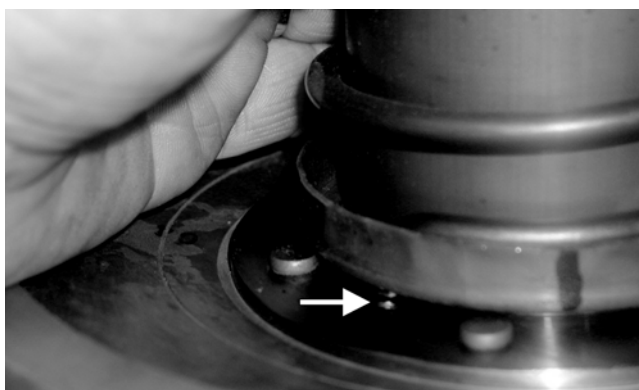
CD061

4. Install the movable face sleeve aligning the hole in the spring seat with the spring anchor hole in the movable face.



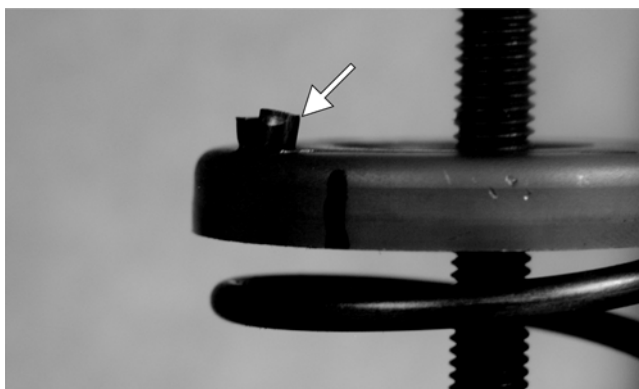
CF097

5. Install the spring over the hub and movable face sleeve; then insert the end of the spring through the sleeve and into the spring anchor hole in the movable face.



CF089A

6. Place the spring holder on the spring engaging the spring end with the appropriate anchor hole.



CF087A

7. Assemble the notched-ring nut, spring holding handle, one flat washer, and the wing nut in order on the pulley compressor bolt; then thread the wing nut onto the bolt.





CD052

8. Compress the spring until the spring holder nears the threads on the fixed face hub; then using the handle, wind the spring holder counterclockwise to align the flats of the spring holder and hub.



CD052A

9. Continue compressing the spring while guiding the spring holder onto the hub. When a slight resistance is felt, stop turning the wing nut.
10. Install the nut (threads coated with red Loctite #271); then tighten the nut to specification using the spanner and a torque wrench.



CD066

11. Remove the wing nut, washer, and holding handle; then remove the driven pulley from the pulley compressor.

## Servicing Center Crankcase Components

■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

### SECONDARY GEARS

■ **NOTE:** When checking and correcting secondary gear backlash and tooth contact, the universal joint must be secured to the front shaft or false measurements will occur.

### Checking Backlash

■ **NOTE:** The rear shaft and bevel gear must be removed for this procedure. Also, always start with the original shims on the rear shaft.

3

1. Place the left-side crankcase cover onto the left-side crankcase half to prevent runout of the secondary transmission output shaft.
2. Install the secondary driven output shaft assembly onto the crankcase.
3. Mount the indicator tip of the dial indicator on the secondary driven bevel gear.
4. While rocking the driven bevel gear back and forth, note the maximum backlash reading on the gauge.
5. Acceptable backlash range is 0.05-0.33 mm (0.002-0.013 in.).

### Correcting Backlash

■ **NOTE:** If backlash measurement is within the acceptable range, no correction is necessary.

1. If backlash measurement is less than specified, remove an existing shim, measure it, and install a new thinner shim.
2. If backlash measurement is more than specified, remove an existing shim, measure it, and install a thicker shim.

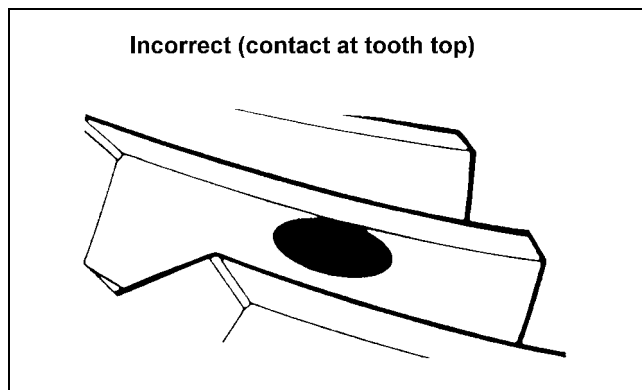
■ **NOTE:** Continue to remove, measure, and install until backlash measurement is within tolerance. Note the following chart.

| Backlash Measurement              | Shim Correction         |
|-----------------------------------|-------------------------|
| Under 0.05 mm (0.002 in.)         | Decrease Shim Thickness |
| At 0.05-0.33 mm (0.002-0.013 in.) | No Correction Required  |
| Over 0.33 mm (0.013 in.)          | Increase Shim Thickness |

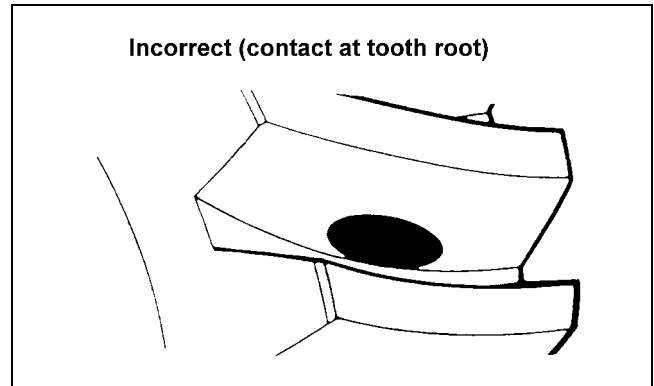
## Checking Tooth Contact

■ **NOTE:** After correcting backlash of the secondary driven bevel gear, it is necessary to check tooth contact.

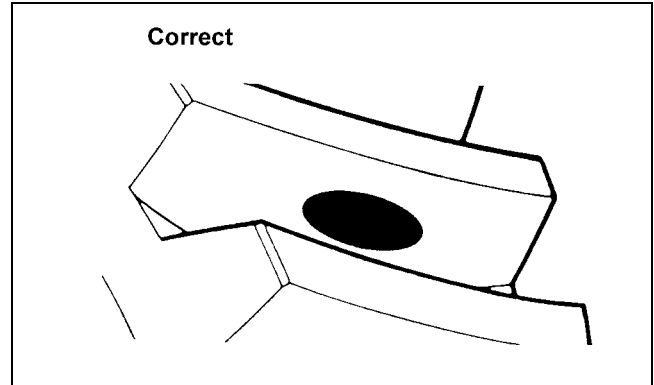
1. Remove the secondary driven output shaft assembly from the left-side crankcase half.
2. Clean the secondary driven bevel gear teeth of old oil and grease residue.
3. Apply a thin, even coat of a machinist-layout dye to several teeth of the gear.
4. Install the secondary driven output shaft assembly.
5. Rotate the secondary driven bevel gear several revolutions in both directions.
6. Examine the tooth contact pattern in the dye and compare the pattern to the illustrations.



ATV-0103



ATV-0105



ATV-0104

## Correcting Tooth Contact

■ **NOTE:** If tooth contact pattern is comparable to the correct pattern illustration, no correction is necessary.

1. If tooth contact pattern is comparable to an incorrect pattern, correct tooth contact according to the following chart.

| Tooth Contact    | Shim Correction         |
|------------------|-------------------------|
| Contacts at Top  | Decrease Shim Thickness |
| Contacts at Root | Increase Shim Thickness |

■ **NOTE:** To correct tooth contact, steps 1 and 2 (with NOTE) of "Correcting Backlash" must be followed and the above "Tooth Contact/Shim Correction" chart must be consulted.



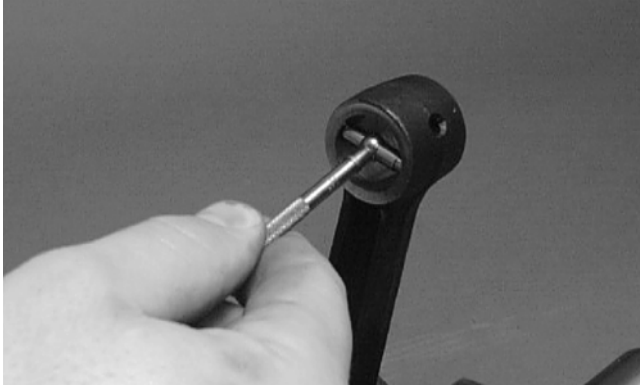
### CAUTION

After correcting tooth contact, backlash must again be checked and corrected (if necessary). Continue the correcting backlash/correcting tooth contact procedures until they are both within tolerance values.

## CRANKSHAFT ASSEMBLY

### Measuring Connecting Rod (Small End Inside Diameter)

1. Insert a snap gauge into the upper connecting rod small end bore; then remove the gauge and measure it with micrometer.



CC290D

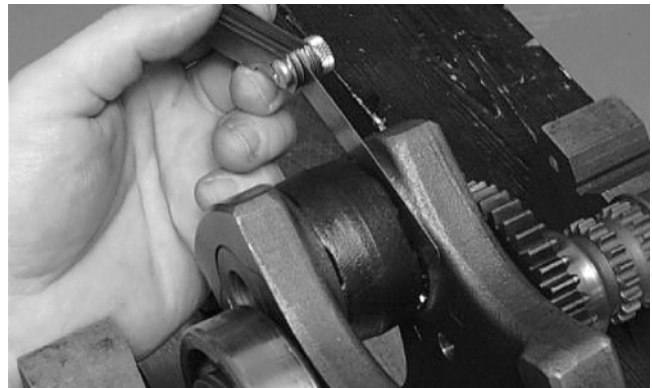
2. Maximum diameter must not exceed specifications.

### Measuring Connecting Rod (Small End Deflection)

1. Place the crankshaft on a set of V-blocks and mount a dial indicator and base on the surface plate. Position the indicator contact point against the center of the connecting rod small end journal.
2. Zero the indicator and push the small end of the connecting rod away from the dial indicator.
3. Maximum deflection must not exceed specifications.

### Measuring Connecting Rod (Big End Side-to-Side)

1. Push the lower end of the connecting rod to one side of the crankshaft journal.
2. Using a feeler gauge, measure the gap between the connecting rod and crankshaft journal.



CC289D

3. Acceptable gap range must be within specifications.

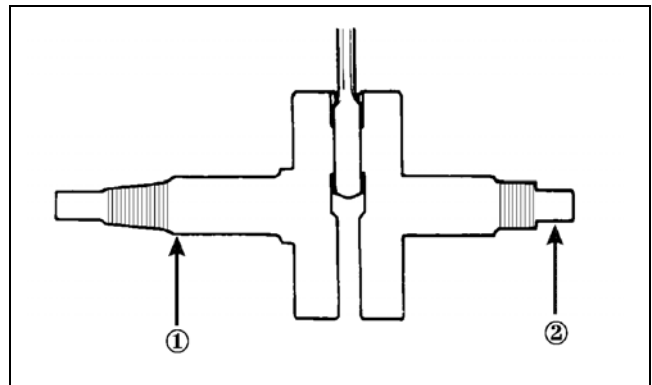
### Measuring Connecting Rod (Big End Width)

1. Using a calipers, measure the width of the connecting rod at the big-end bearing.
2. Acceptable width range must be within specifications.

3

### Measuring Crankshaft (Runout)

1. Place the crankshaft on a set of V blocks.
2. Mount a dial indicator and base on the surface plate. Position the indicator contact at point 1 of the crankshaft.



ATV-1074

3. Zero the indicator and rotate the crankshaft slowly.

#### CAUTION

Care should be taken to support the connecting rod when rotating the crankshaft.

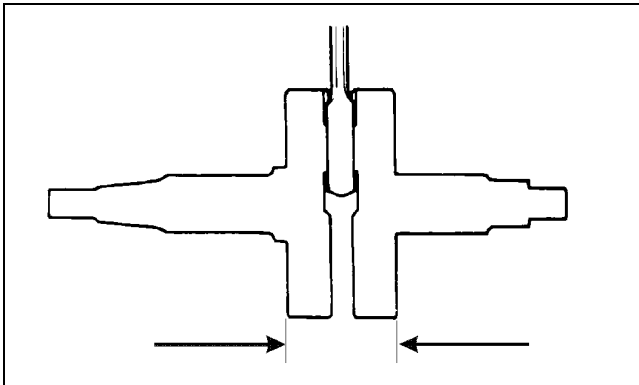
4. Maximum runout must not exceed specifications.

■ **NOTE:** Proceed to check runout on the other end of the crankshaft by positioning the indicator contact at point 2 and following steps 2-4.



## Measuring Crankshaft (Web-to-Web)

1. Using a calipers, measure the distance from the outside edge of one web to the outside edge of the other web.



ATV-1017

2. Acceptable width range must be within specifications.

## COUNTERSHAFT

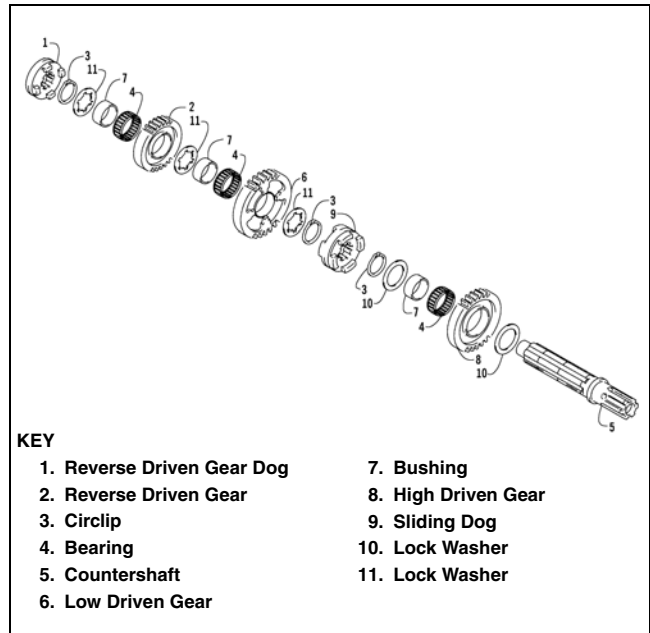
### ⚠ CAUTION

When disassembling the countershaft, care must be taken to note the direction each major component (dog, gear) faces. If a major component is installed facing the wrong direction, transmission damage may occur and/or the transmission will malfunction. In either case, complete disassembly and assembly will be required.

### Disassembling

1. Remove the reverse driven gear dog; then remove the circlip securing the reverse driven gear.
2. Remove the reverse driven gear and account for the washer, bushing, and bearing.
3. Remove the low driven gear washer; then remove the low driven gear. Account for the bushing and bearing.
4. Remove the washer; then remove the circlip securing the sliding dog. Remove the sliding dog.
5. Remove the high driven gear circlip; then remove the high driven gear. Account for the washer, bushing, and bearing.

## Assembling



### KEY

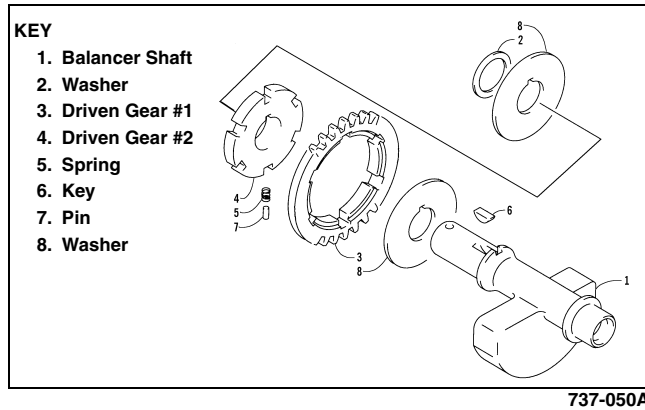
- |                            |                     |
|----------------------------|---------------------|
| 1. Reverse Driven Gear Dog | 7. Bushing          |
| 2. Reverse Driven Gear     | 8. High Driven Gear |
| 3. Circlip                 | 9. Sliding Dog      |
| 4. Bearing                 | 10. Lock Washer     |
| 5. Countershaft            | 11. Lock Washer     |
| 6. Low Driven Gear         |                     |

737-053A

1. Place the high driven gear onto the countershaft making sure the bearing, bushing, and washer are properly positioned. Secure with the circlip.
2. Place the sliding dog onto the countershaft; then secure with the circlip. Place the washer next to the circlip.
3. Place the low driven gear onto the countershaft making sure the bearing and bushing are properly positioned; then place the washer onto the shaft.
4. Place the reverse driven gear onto the countershaft making sure the bearing, bushing, and washer are properly positioned; then secure with the circlip.
5. Place the reverse driven gear dog onto the countershaft; then secure with the circlip.

■ **NOTE:** The countershaft is now completely assembled for installation.

## CRANK BALANCER DRIVEN GEAR



### Disassembling

1. Remove the small and large washers from the balancer shaft.
2. Note the position of the alignment marks for assembling purposes; then remove driven gear #1 with driven gear #2. Account for pins and springs.
3. Remove driven gear #2 from gear #1; then account for a large washer and a key.

### Inspecting

1. Inspect the gear, pins, and keyway for wear.
2. Inspect the springs for damage or fatigue.

### Assembling

1. Place driven gear #2 into driven gear #1; then align the alignment marks of driven gear #1 and driven gear #2.
2. Using a pair of needle-nose pliers, insert each spring part way into the slot; then install a pin and push the spring/pin assembly into the slot.
3. Place the key and the large washer into position on the balancer shaft.
4. Place the driven gear #1 assembly onto the balancer shaft; then place the large and small washers onto the shaft.

■ **NOTE:** The crank balancer/driven gear assembly is now completely assembled for installation.

## Assembling Crankcase Half

■ **NOTE:** For ease of assembly, install components on the right-side crankcase half.

■ **NOTE:** If the output shaft was removed, make sure that the proper shim is installed.

1. Install the output shaft into the crankcase making sure the two gears, shim, washer, and nut are in the correct order.



3



2. Apply red Loctite #271 to the threads of the output shaft. Install and tighten the nut specifications. Using a punch, peen the nut.



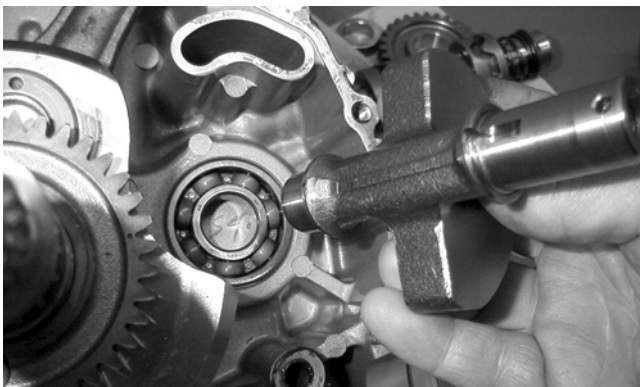
3. Apply a liberal amount of oil to the crankshaft bearing. Using a propane torch, heat the bearing until the oil begins to smoke; then slide the crankshaft assembly into place.



MD1334

■ **NOTE:** If heating the bearing is not possible, the crankshaft can be installed using a crankshaft installer.

4. Rotate the crankshaft so the counterweight is toward the rear of the engine. Install the counterbalance shaft.



MD1024

5. Keeping the counterbalance gear timing mark aligned with the one on the crankshaft gear, install the key and the counterbalance gear.



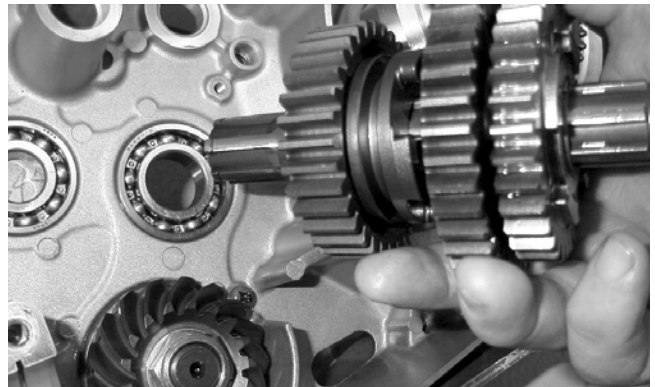
CC166D

6. Keeping the two holes facing up, install the shift cam and inner and outer washers.

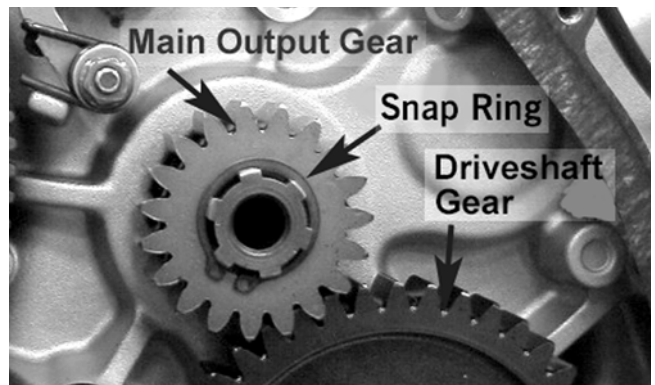


MD1329

7. Align the inner shift fork with the gear cluster and with the inner washer in place, install the gear cluster and inner shift fork. While holding the gear cluster in place, install the washer, gear, and snap ring.



MD1032



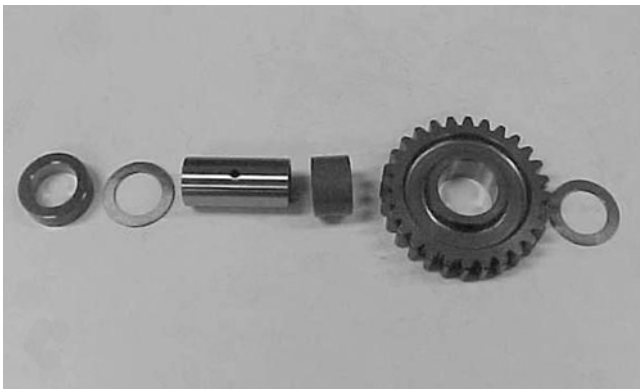
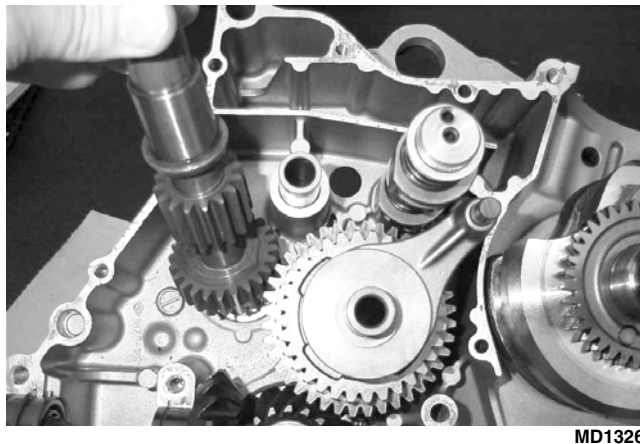
MD1198

8. Install the outer shift fork and the shift fork shaft.





9. Install the input driveshaft.

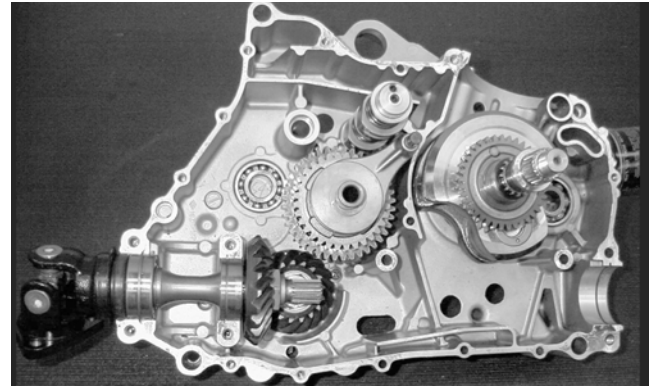


10. Install the washer, spacer, sleeve, reverse idler gear, and washer.



11. Install the secondary and primary driveshaft assemblies. Account for the bearing alignment C-ring on the bearing boss next to the pinion gear.

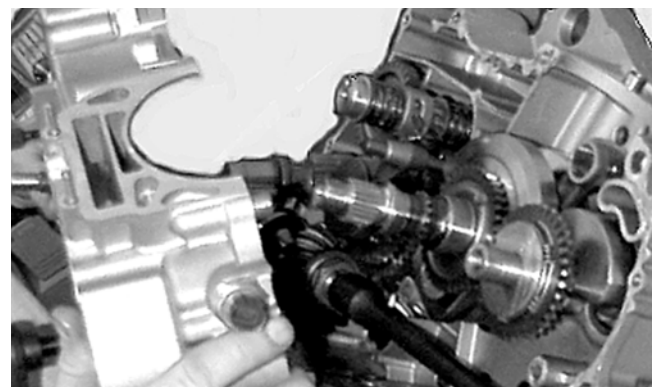
■ **NOTE:** Align the bearing alignment pin on the secondary output shaft.



3

## Joining Crankcase Halves

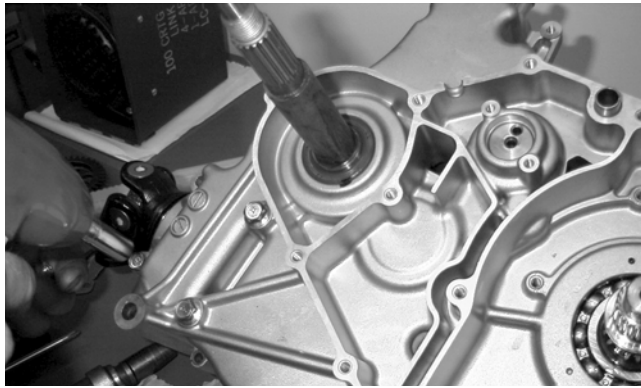
1. Verify that the two alignment pins are in place and that both case halves are clean and grease free. Apply Three Bond Sealant (p/n 0636-070) to the mating surfaces. Place the right-side half onto the left-side half.



2. Using a plastic mallet, lightly tap the case halves together until cap screws can be installed.

3. From the right side, install the crankcase cap screws noting the location of the different-sized cap screws; then tighten only until snug.

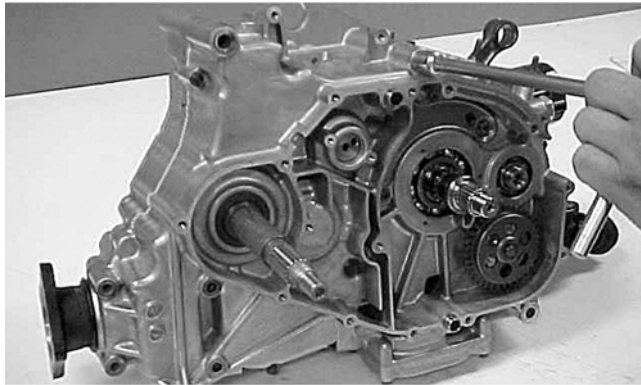
■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs while tightening the cap screws.



MD1008

4. From the left side, install the remaining crankcase cap screws; then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs while tightening the cap screws.



CC871

5. In a crisscross/case-to-case pattern, tighten the 8 mm cap screws until the halves are correctly joined; then tighten to specifications.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

6. In a crisscross/case-to-case pattern, tighten the 6 mm cap screws to specifications.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

### **AT THIS POINT**

After completing center crankcase components, proceed to Installing Right-Side Components, to Installing Left-Side Components, and to Installing Top-Side Components.

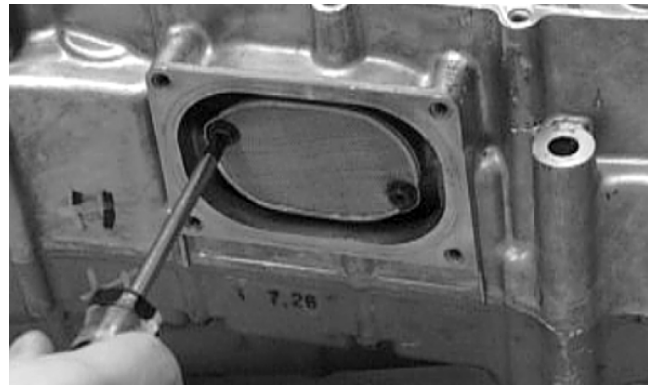
## Installing Right-Side Components

### A. Oil Strainer/Oil Pump

1. Place the oil strainer and new O-ring into position beneath the crankcase. Tighten the Phillips-head screws (coated with red Loctite #271) securely.

### **CAUTION**

The legs of the strainer must be directed out.



MD1337

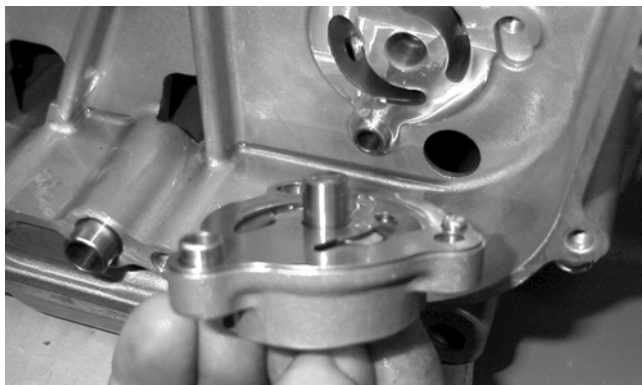
2. Noting the directional arrow from removing, place the strainer cover into position on the crankcase making sure the O-ring is properly installed and secure with the four cap screws; then tighten the oil drain plug to specifications.



MD1208

3. Place two alignment pins and the oil pump into position on the crankcase and secure with the Phillips-head screws coated with blue Loctite #243. Tighten to specifications.





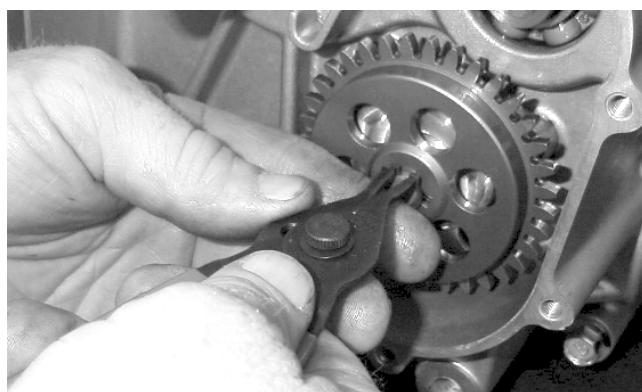
MD1060

4. Place the pin into position on the oil pump shaft, install the oil pump driven gear making sure the recessed side of the gear is directed inward, and secure with a new snap ring.

■ **NOTE:** Always use a new snap ring when installing the oil pump driven gear.



MD1020

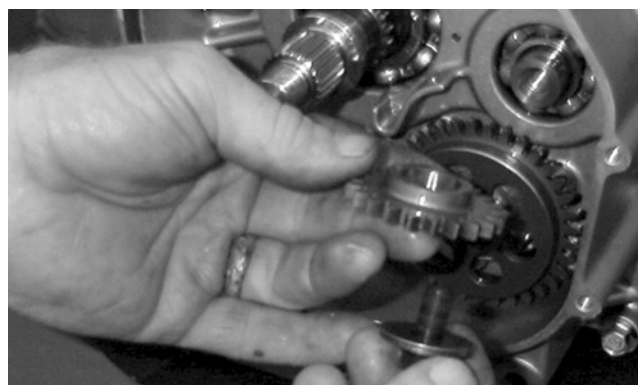


MD1019

5. Install the cam chain.

■ **NOTE:** Keep tension on the cam chain to avoid damaging the crankcase boss.

6. Place the pin into position, install the oil pump drive gear, and tighten the cap screw (coated with red Loctite #271) securely.



MD1017



MD1018

7. Install the clutch shoe assembly on the crankshaft; then install the flange nut (left-hand thread). Tighten to specifications.

■ **NOTE:** The flat side of the flange nut should be directed towards the clutch shoe.

### **CAUTION**

Care must be taken when installing the flange nut; it has "left-hand" threads.

8. Install the one-way sprag clutch making sure that the green dot or the stamp tag **OUTSIDE** is directed away from the crankcase.



MD1286

9. Install gear position indicator switch contact pins and springs into the end of the shift shaft.





MD1043

10. Install gear position indicator switch making sure the O-ring is well-oiled and properly positioned. Tighten cap screws securely.



MD1040

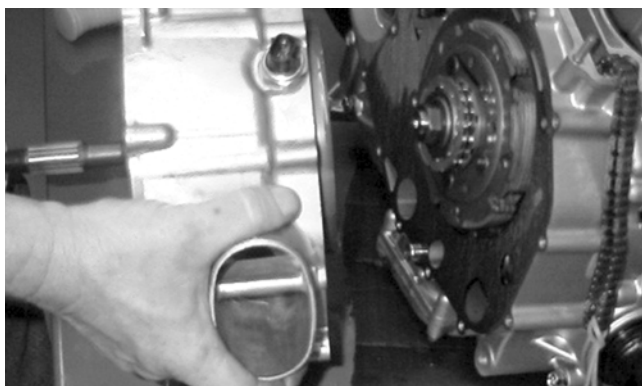
## **B. Clutch Cover**

## **C. Fixed Drive Face**

## **D. Movable Drive Face**

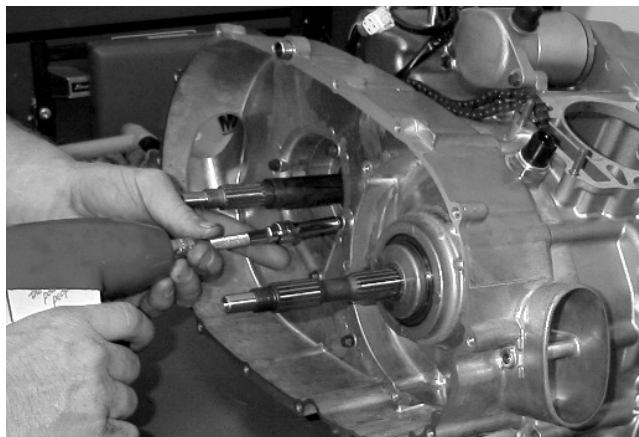
■ **NOTE:** Steps 1-10 in the preceding sub-section must precede this procedure.

11. Install two alignment pins and place the clutch cover gasket into position. Install the clutch cover.



MD1115

12. Tighten the clutch cover cap screws to specifications.



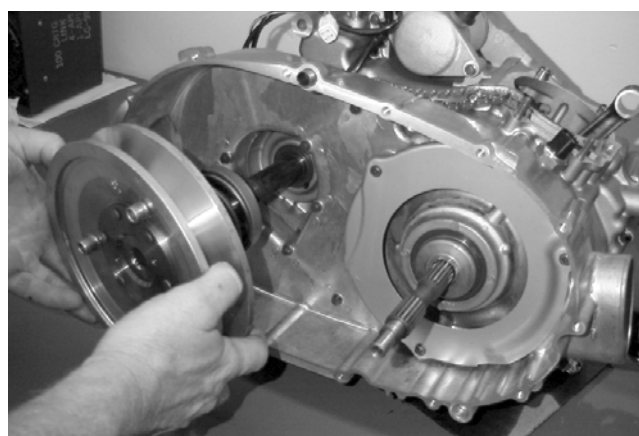
MD1117

13. Install the air intake plate. Apply red Loctite #271 to the threads of the three Phillips-head cap screws; then install and tighten securely.

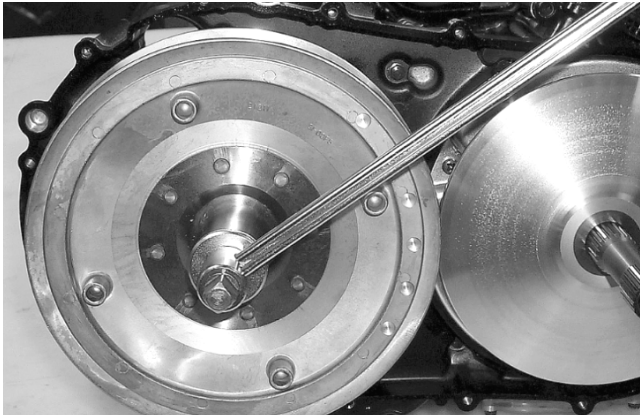


MD1342

14. Place the driven pulley assembly into position and secure with the nut (threads coated with red Loctite #271). Tighten to specifications.



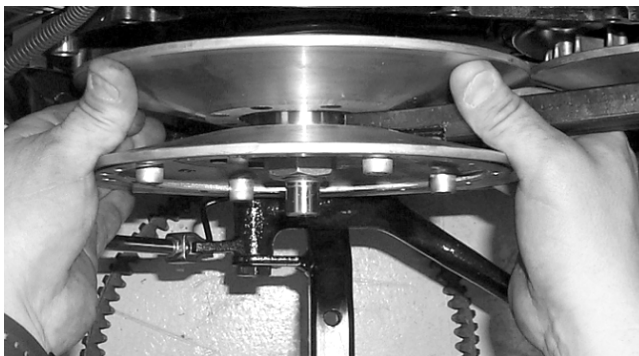
MD1068



MD1339

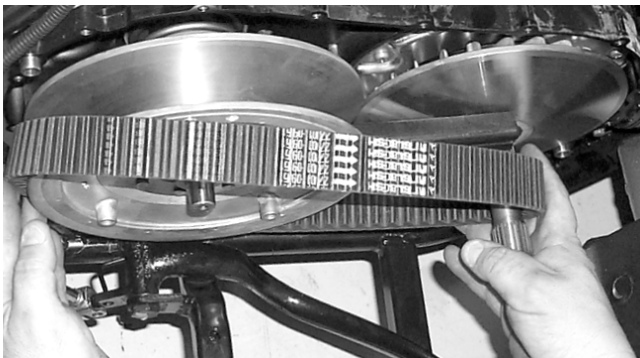
15. Slide the fixed drive face assembly onto the front shaft.

16. Spread the faces of the driven pulley by pushing the inner face toward the engine while turning it counterclockwise; then when the faces are separated, insert a wedge (approximately 3/8 in. thick) between the faces. Release the inner face.



MD1340

17. Place the V-belt into position on the driven pulley and over the front shaft.



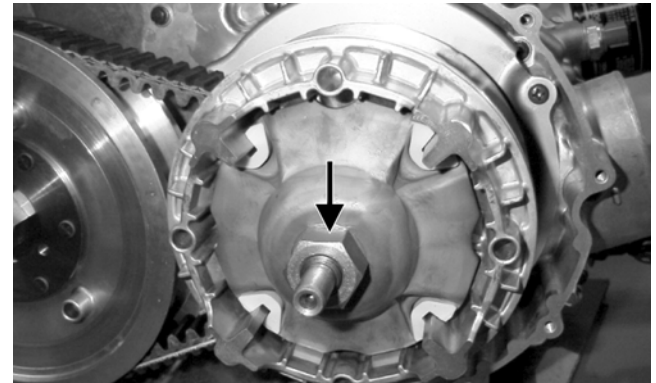
MD1341

■ **NOTE:** The arrows on the V-belt should point forward.

18. Making sure the eight movable drive face rollers are in position, pinch the V-belt together near its center and slide the spacer and movable drive face onto the shaft. Coat the threads of the nut with red Loctite #271 and secure the movable drive face. Tighten the nut to specifications.



MD1338



MD1033

■ **NOTE:** At this point, the wedge can be removed from between the driven pulley faces.

19. Rotate the V-belt and drive/driven assemblies until the V-belt is flush with the top of the driven pulley.

20. Install two alignment pins and place the V-belt cover gasket into position on the clutch cover. Install the V-belt cover noting the position of the long cap screws and rubber washer and two wire forms. In a crisscross pattern, tighten cap screws to specifications.



MD1306

3



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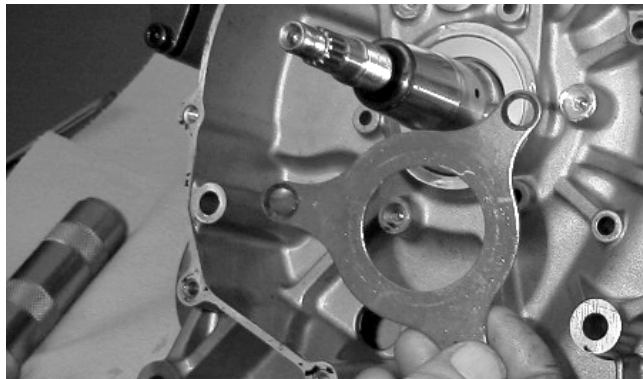
## Installing Left-Side Components

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### A. Starter Idler Gears

### B. Rotor/Flywheel

1. Place the crankshaft bearing retainer into position. Apply red Loctite #271 to the three Phillips-head screws. Install and tighten the three Phillips-head screws securely.



MD1122

2. Install the starter motor and tighten the two cap screws securely.
3. Install the driveshaft spacer making sure the stepped side is to the inside.



MD1224

4. Install the shift detent cam making sure the spacer is properly positioned.



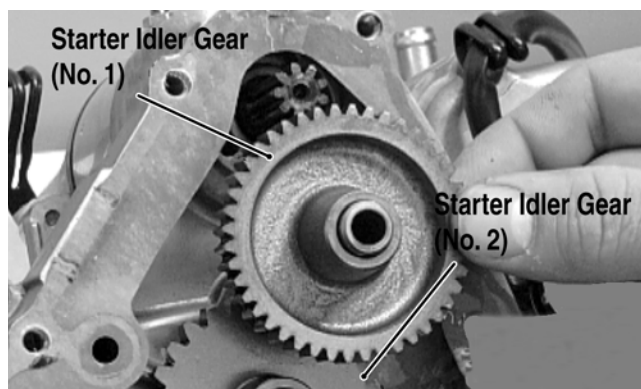
MD1086

5. Install the cam stopper assembly.
6. Install the gear shift shaft assembly and washer making sure to align the alignment marks.



MD1239

7. Install starter idler gear (No. 1) and starter idler gear (No. 2).



MD1305

8. Place the key into its notch; then slide the rotor/flywheel (with the ring gear in place) over the crankshaft. Tighten the nut to specifications.

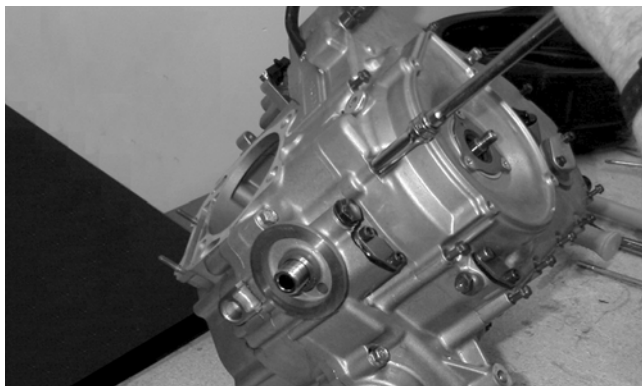
### C. Cover

### D. Recoil Starter

■ **NOTE:** Steps 1-8 in the preceding sub-section must precede this procedure.



9. Install two alignment pins and place the left-side cover gasket into position. Install the left-side cover. Noting the different-lengthed 6 mm cap screws, the position of the shifter bracket, and the location of the long cap screw with the washer, tighten cap screws only until snug.



MD1186

10. Install the starter cup making sure that the O-ring is in place inside the starter cup. Tighten the nut w/lock washer to specifications.



MD1304



MD1303

11. Tighten the cap screws (from step 9) in a criss-cross pattern to specifications.
12. Place the gasket, recoil starter assembly, and cover into position on the left-side cover making sure the single washer is properly positioned; then install and tighten the four cap screws to specifications.

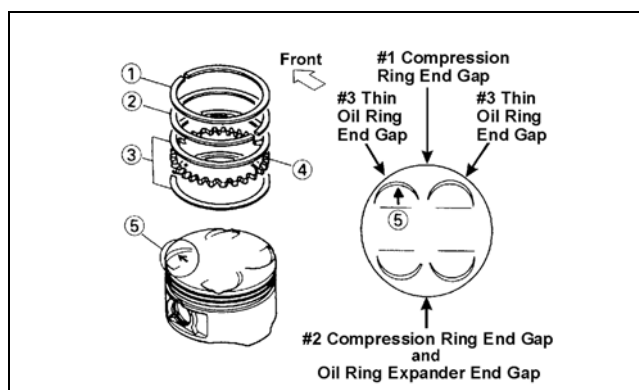
## Installing Top-Side Components

### A. Piston

### B. Cylinder

■ **NOTE:** If the piston rings were removed, install them in this sequence.

- A. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.



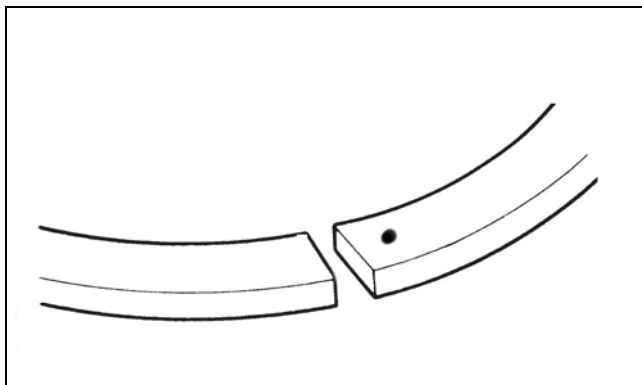
ATV-1085B

■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.

- B. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston according to the illustration.

■ **NOTE:** The chrome (silver) ring should be installed in the top position.

3



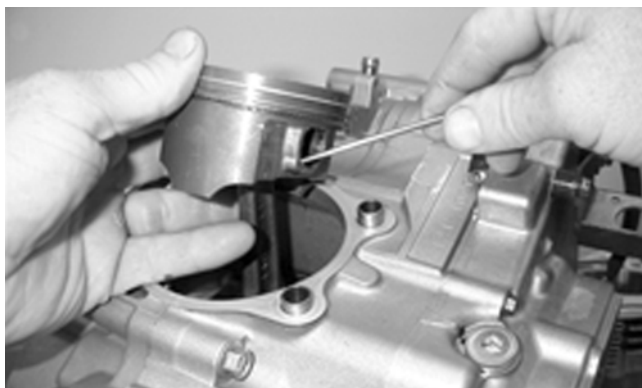
MD1343

### ⚠ CAUTION

**Incorrect installation of the piston rings will result in engine damage.**

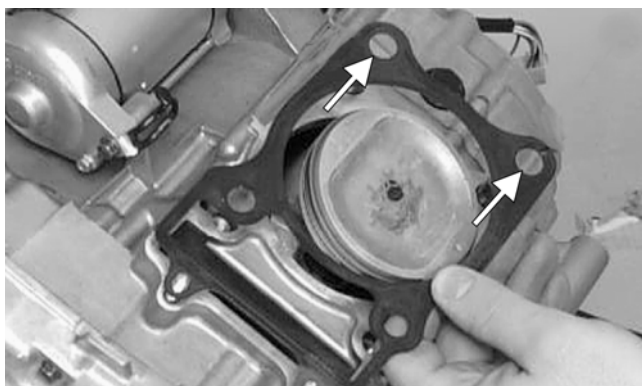
1. Install the piston on the connecting rod making sure there is a circlip on each side and the open end of the circlip is directed upwards or downwards.

■ **NOTE:** The piston should be installed so the arrow points towards the exhaust.



MD1213

2. Place the two alignment pins into position. Place the cylinder gasket into position; then place a piston holder (or suitable substitute) beneath the piston skirt and square the piston in respect to the crankcase.

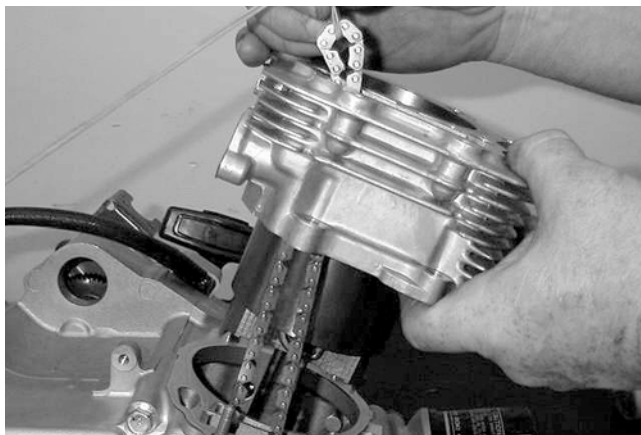


MD1344

3. Lubricate the inside wall of the cylinder; then using a ring compressor or the fingers, compress the rings and slide the cylinder over the piston. Route the cam chain up through the cylinder cam chain housing; then remove the piston holder and seat the cylinder firmly on the crankcase.

### ⚠ CAUTION

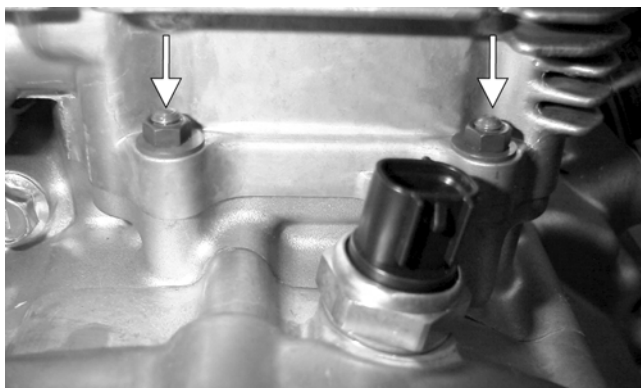
**The cylinder should slide on easily. Do not force the cylinder or damage to the piston, rings, cylinder, or crankshaft assembly may occur.**



MD1345

4. Loosely install the two nuts with washers which secure the cylinder to the right-side crankcase half.

■ **NOTE:** The two cylinder-to-crankcase nuts will be tightened in step 9.



MD1226A

## C. Cylinder Head D. Valve Cover

■ **NOTE:** Steps 1-4 in the preceding sub-section must precede this procedure.

5. While keeping tension on the cam chain, place the front cam chain guide into the cylinder.

**⚠ CAUTION**

Care should be taken that the bottom of the chain guide is secured in the crankcase boss.

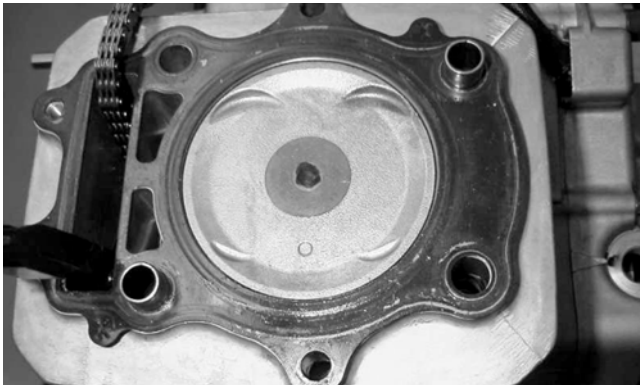


MD1349

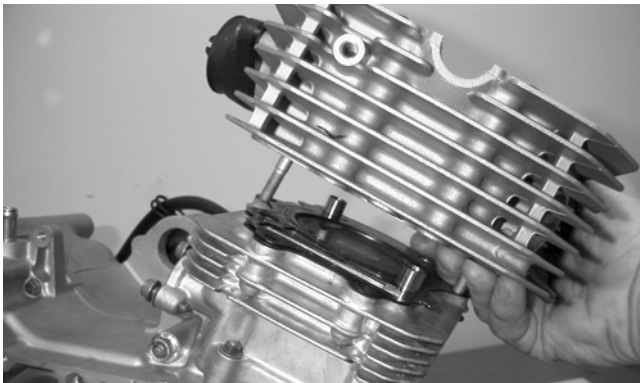
6. Place the head gasket into position on the cylinder. Place the alignment pins into position; then place the head assembly into position on the cylinder making sure the cam chain is routed through the chain cavity.

**⚠ CAUTION**

Keep tension on the cam chain to avoid damaging the crankcase boss.

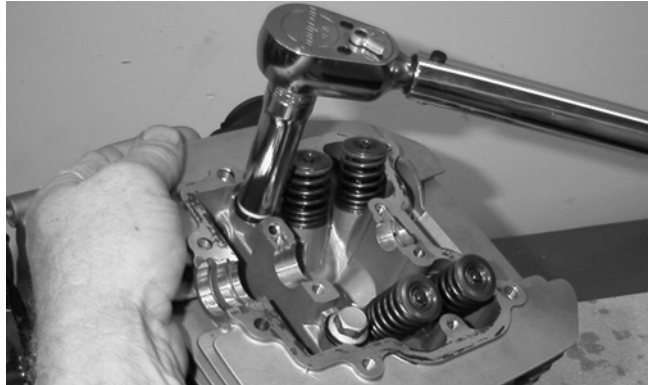


MD1347



MD1163

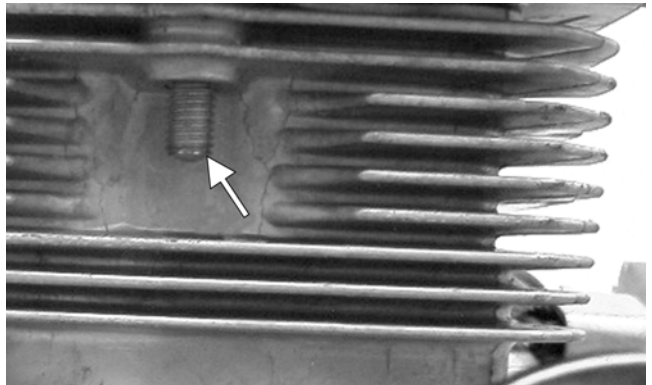
7. Install the four cylinder head cap screws with washers. Note that the two cap screws on the right side of the cylinder head nearest the cam sprocket are longer than the two cap screws on the left (spark plug) side. Tighten only until snug.



MD1270

8. Install the two lower nuts securing the cylinder head to the cylinder, one in front and one in rear.

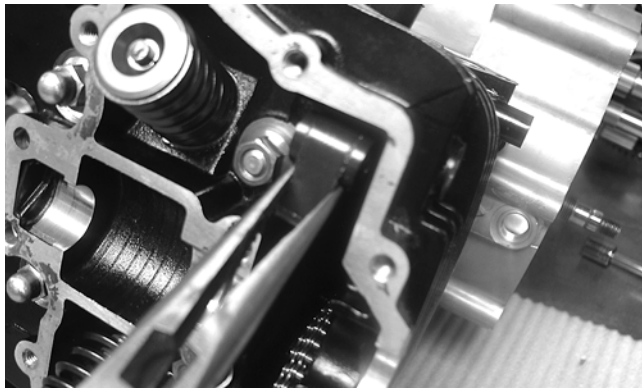
**3**



MD1192

9. In a crisscross pattern, tighten the four cylinder head cap screws (from step 7) to specifications. Tighten the two lower cylinder head nuts (from step 8) to specifications and the cylinder-to-crankcase nuts (from step 4) to specifications.
10. With the timing inspection plug removed and the cam chain held tight, rotate the crankshaft until the piston is at top-dead-center.
11. While holding the cam chain sprocket to the side, install the rear cam chain tensioner guide into the cylinder head. Install the pivot cap screw and washer.



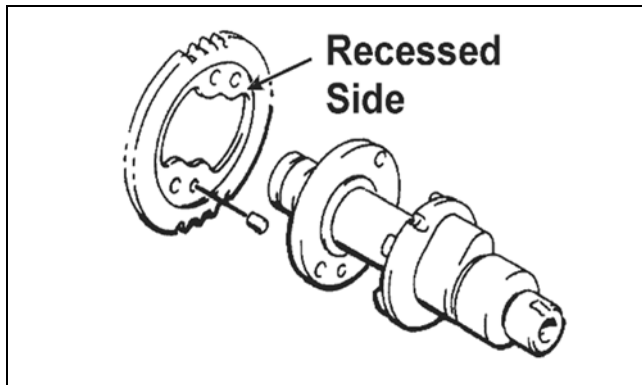


CD383

12. With the alignment pin installed in the camshaft and the cam lobes directed down (toward the piston), place the camshaft in position and verify that the timing mark on the magneto is visible through the inspection plug and that the timing marks on the camshaft sprocket are parallel with the valve cover mating surface.

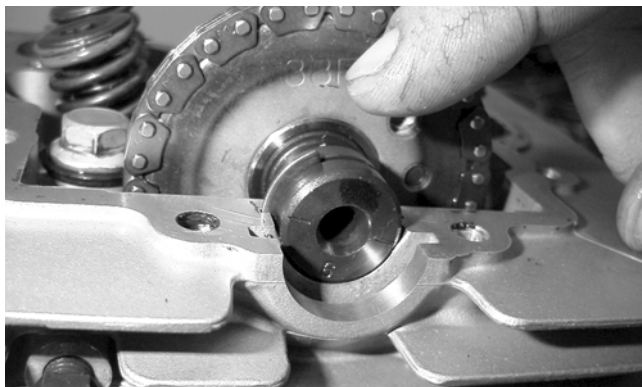
■ **NOTE:** When the camshaft assembly is seated, make sure the alignment pin in the camshaft aligns with the smallest hole in the sprocket.

13. With the alignment pin installed in the camshaft, loosely place the cam sprocket (with the recessed side facing the camshaft lobes) onto the camshaft and place it into position with the cam chain over the sprocket.



MD1359

14. Place the C-ring into position in its groove in the cylinder head.



MD1131

■ **NOTE:** At this point, oil the camshaft bearings, cam lobes, and the three seating journals on the cylinder.

■ **NOTE:** Note the position of the alignment marks on the end of the camshaft. They must be parallel with the valve cover mating surface. If rotating the camshaft is necessary for alignment, do not allow the chain and sprocket to rotate and be sure the cam lobes end up in the down position.

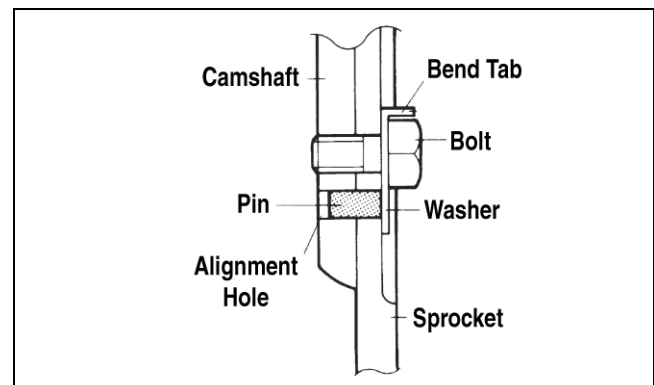
15. When the camshaft assembly is seated, ensure the following.

- A. Piston still at top-dead-center.
- B. Camshaft lobes directed down (toward the piston).
- C. Camshaft alignment marks parallel to the valve cover mating surface.
- D. Recessed side of the sprocket directed toward the cam lobes.
- E. Camshaft alignment pin and sprocket alignment hole (smallest) are aligned.

**CAUTION**

If any of the above factors are not as stated, go back to step 13 and carefully proceed.

16. Place the tab washer onto the sprocket making sure it covers the pin in the alignment hole.



MD1363

**CAUTION**

Care must be taken that the tab washer is installed correctly to cover the alignment hole on the sprocket. If the alignment pin falls out, severe engine damage will result.

17. Apply red Loctite #271 to the first cap screw securing the sprocket and tab washer to the camshaft; then install the cap screw and tab washer. Tighten cap screw only until snug.

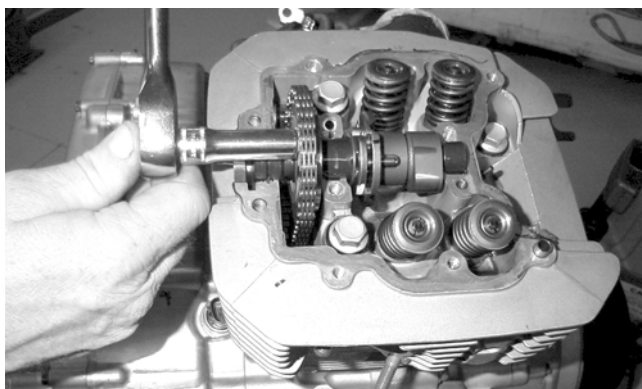


CC404D



MD1248

22. Depress the spring-loaded lock and push the plunger into the tensioner.



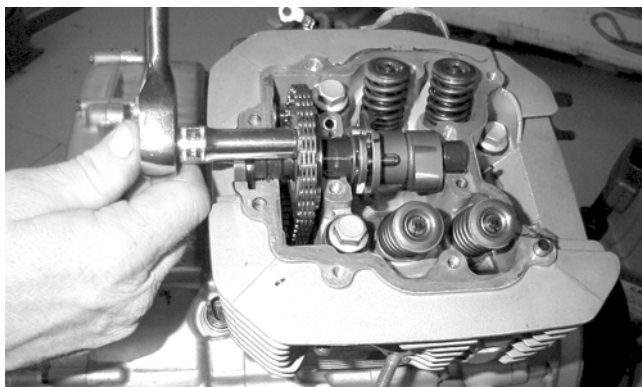
MD1137

18. Rotate the crankshaft until the second cap screw securing the sprocket to the camshaft can be installed; then install the cap screw (threads coated with red Loctite #271). Tighten to specifications; then bend the tab to secure the cap screw.



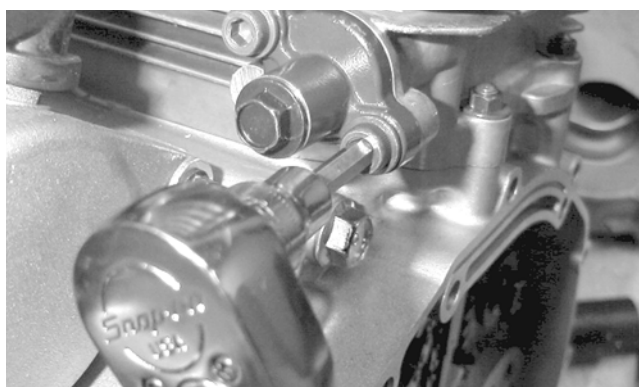
MD1146

23. Place the cam chain tensioner assembly and gasket into the cylinder making sure the ratchet side is facing toward the top of the cylinder and secure with the two Allen-head screws.



MD1137

19. Rotate the crankshaft until the first cap screw (from step 17) securing the sprocket to the camshaft can be addressed; then tighten to specifications. Bend the tab to secure the cap screw.



MD1254

24. Install the cap screw and spring into the end of the cam chain tensioner. Tighten securely.

20. Install the cylinder head plug with the cupped end facing the camshaft and the opening directed downwards.

21. Remove the cap screw from the end of the chain tensioner. Account for the plunger, spring, and O-ring.



MD1245

25. Loosen the adjuster screw jam nuts; then loosen the adjuster screws on the rocker arms in the valve cover.

26. Apply a thin coat of Three Bond Sealant (p/n 0636-070) to the mating surface of the valve cover; then place the valve cover into position. Note that the two alignment pins are properly positioned.

■ **NOTE:** At this point, the rocker arms and adjuster screws must not have pressure on them.

27. Install the four top-side cap screws with rubber washers; then install the remaining cap screws. Tighten only until snug.



MD1261

28. In a crisscross pattern starting from the center and working outward, tighten the cap screws (from step 27) to specifications.

29. Adjust valve/tappet clearance using the following procedure.

■ **NOTE:** Use Valve Clearance Adjuster (p/n 0444-078) for this procedure.

A. Turn the engine over until the piston reaches top-dead-center on the compression stroke.

B. Place the valve adjuster onto the jam nut securing the tappet adjuster screw; then rotate the valve adjuster dial clockwise until the end is seated in the tappet adjuster screw.

C. While holding the valve adjuster dial in place, use the valve adjuster handle and loosen the jam nut; then rotate the tappet adjuster screw clockwise until friction is felt.



CD001

D. Align the valve adjuster handle with one of the marks on the valve adjuster dial.

E. While holding the valve adjuster handle in place, rotate the valve adjuster dial counter-clockwise until specified valve/tappet clearance is attained.

■ **NOTE:** Rotating the valve adjuster dial counter-clockwise will open the valve/tappet clearance by 0.05 mm (0.002 in.) per mark.

F. While holding the adjuster dial at the proper clearance setting, tighten the jam nut securely with the valve adjuster handle.

30. Place the two tappet covers with O-rings into position; then install and tighten the cap screws securely.



MD1264

31. Install the spark plug and tighten to specifications; then install the timing inspection plug.



## Installing Engine/Transmission

■ **NOTE:** Arctic Cat recommends that new gaskets and O-rings be installed whenever servicing the ATV.

1. From the left side, place the engine/transmission into the frame; then slide the engine rearward as far as possible.
2. Slightly raise the rear of the engine and engage the front drive coupler into the splines of the front drive output yoke; then slide the engine forward as far as possible.



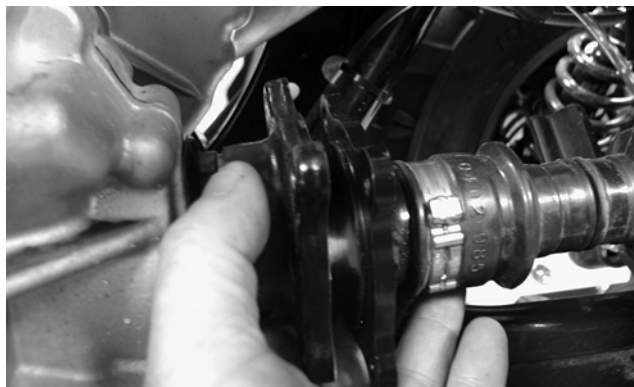
CD818

3. Raise the rear of the engine and place a block beneath it; then install the propeller shaft and output flange into the rear drive coupler.



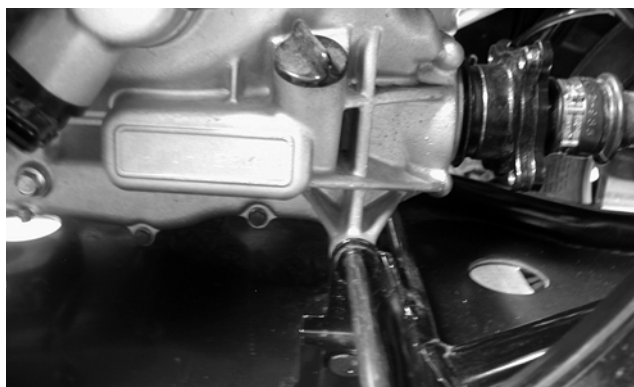
CD821

4. Remove the block from beneath the engine; then align the rear drive flanges and secure with four cap screws. Tighten to specifications.



CD824

5. Secure the upper engine mounts to the frame with the cap screws. Tighten only until snug.
6. Install two engine mounting through-bolts, two bushings, and two washers; then tighten the through-bolt flange nuts to specifications. Tighten the upper engine mount cap screws (from step 5) to specifications.



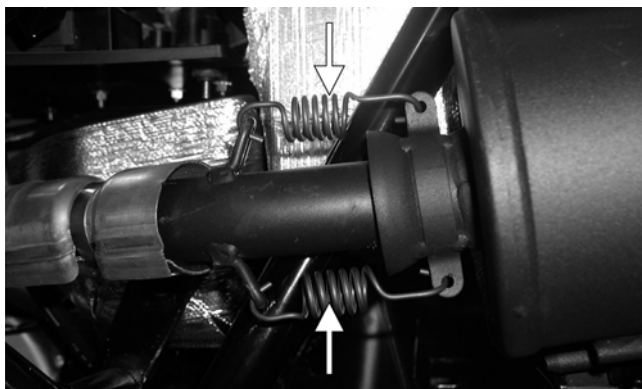
CD809

7. Secure the upper engine bracket to the engine with the existing cap screw and flange nut. Tighten to specifications.
8. Secure the exhaust pipe to the engine with two cap screws; then install the muffler and the exhaust springs.



CC941

3

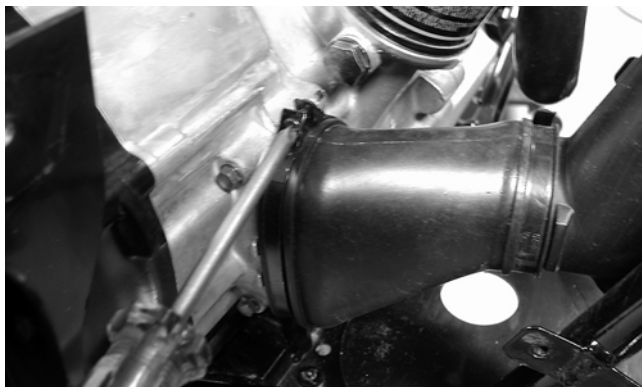


CF138A

9. Install the cooling ducts with clamps and tighten the clamps securely.



CD515



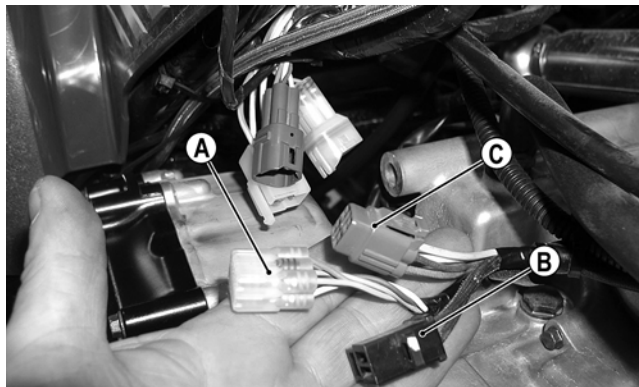
CD793

10. Secure the engine ground wire to the engine with a cap screw. Tighten to specifications.



CD810

11. Connect the gear position indicator connector (A), stator connector (B), and the CDI connector (C) to the main wiring harness.



CD797A

12. Connect the temperature sensor leads to the main wiring harness.

13. Secure the wires to the frame with nylon ties.

14. Connect the speed sensor lead to the wiring harness.

15. Secure the positive cable to the starter motor.

16. Secure all wiring to the frame and upper engine bracket with cable ties.

17. Secure the two oil hoses to the engine.

18. Secure the crankcase vent hose to the air cleaner housing; then secure the inlet boot and carburetor to the air cleaner housing.

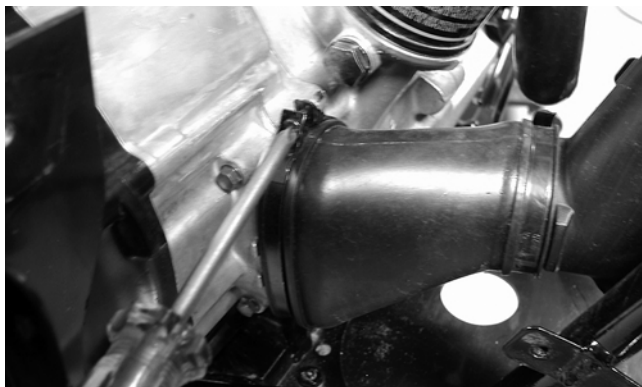


CD787





CD785



CD793

19. Secure the shift rod to the engine with a new E-clip.



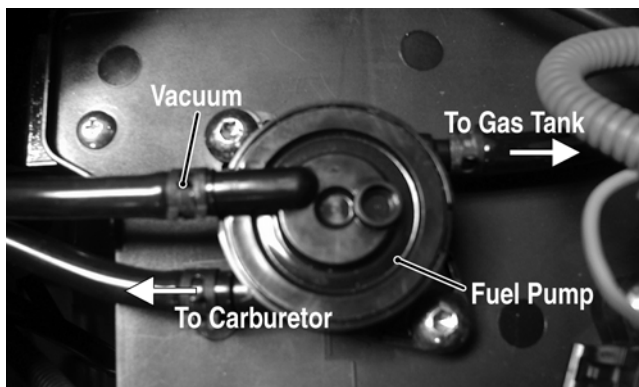
CD774

20. Install the front and rear body panels; then install the front and rear racks (see Section 8).
21. Install the left-side foot peg to the footrest. Tighten securely.



CD782

22. Connect the hose to the fuel pump; then connect the vacuum hose and secure with hose clamps.



CD766A

23. Place the storage compartment into position; then install the reinstallable rivets.
24. Place the battery into position in the battery compartment; then install the battery cables and vent hose. Secure with the battery cover.

**CAUTION**

Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.

25. Add proper amounts of engine/transmission oil.
26. Install the seat.



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## Removing Engine/ Transmission

Many service procedures can be performed without removing the engine/transmission from the frame. Closely observe the note introducing each sub-section for this important information.

### AT THIS POINT

If the technician's objective is to service/replace left-side cover oil seals (3), front output joint oil seal (1), rear output joint oil seal (1), and/or the oil strainer (from beneath the engine/transmission), the engine/transmission does not have to be removed from the frame.

Secure the ATV on a support stand to elevate the wheels.

### WARNING

Make sure the ATV is solidly supported on the support stand to avoid injury.

1. Remove the seat.
2. Remove the negative cable from the battery; then remove the positive cable. Remove the battery and the battery vent hose; then remove the battery.

### CAUTION

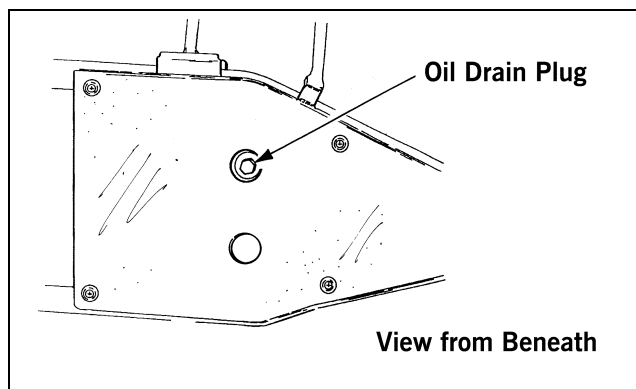
Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.

3. Remove the radiator access cover, steering post cover, and storage compartment cover assembly; then remove the storage compartment box.
4. Remove the reinstallable rivets securing the side panels; then remove the panels.

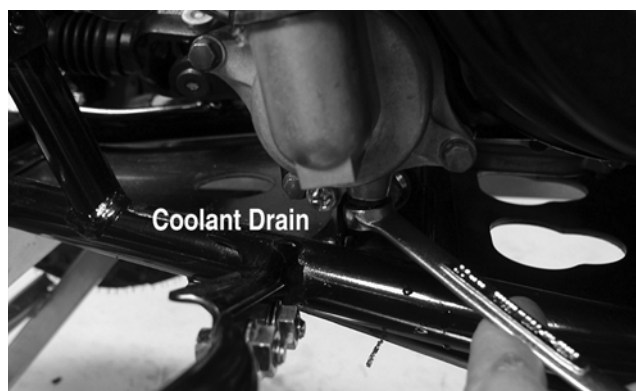


CD683A

5. Remove the instrument pod; then remove the front rack and front body panel (see Section 8).
6. Drain the oil from beneath the engine/transmission; then drain the coolant.



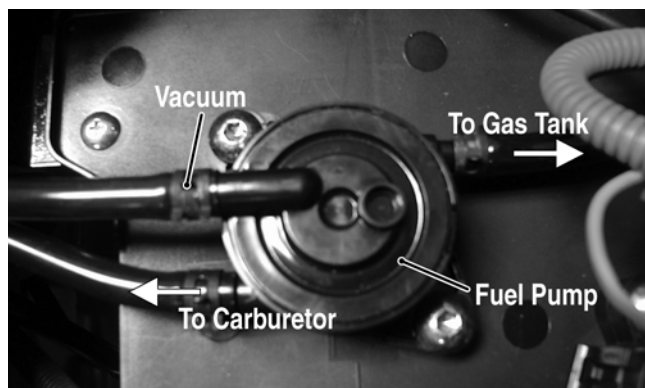
733-441A



CD799A

7. Remove the air filter (see Section 2).

8. Remove the vacuum hose and the fuel-pump-to-carburetor hose.



CD766A

9. Loosen the clamp securing the air intake duct to the air filter housing.



CD785

10. Disconnect the crankcase vent hose from the air filter housing. Remove the clamp securing the carburetor intake duct to the air filter housing; then remove the air filter housing.



CD787



CD786

11. Remove the clamp securing the cooling duct boot to the V-belt housing; then remove the cooling duct boot from the V-belt housing outlet.



CD793



CD515A

12. Remove the left-side foot peg and footwell (see Section 8).

3



CD782

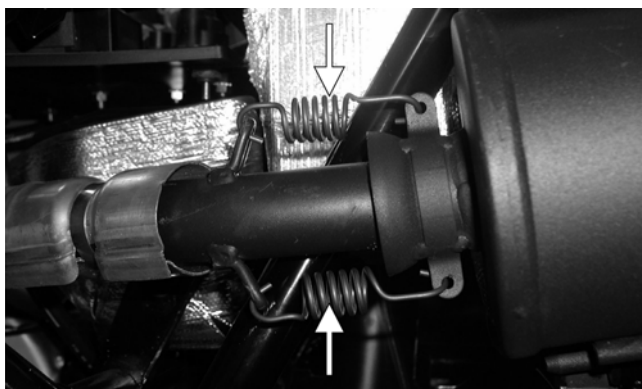
13. Secure the carburetor assembly up and away from the engine.

14. Remove the E-clip securing the shift rod to the engine shift arm; then allow the shift rod to swing forward and hang straight down from the shift lever.



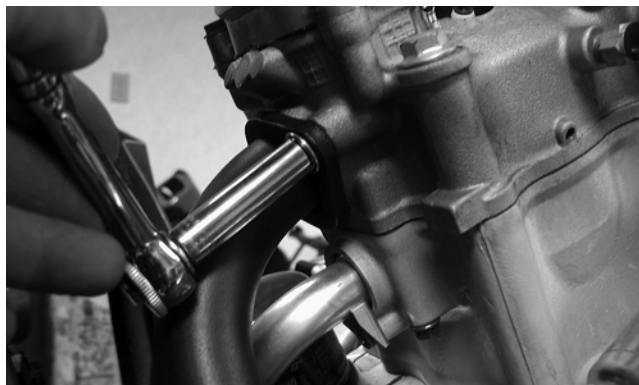
CD774

15. Remove the springs securing the muffler to the exhaust pipe; then remove the muffler. Account for the two exhaust springs.



CF138A

16. Remove the two cap screws securing the exhaust pipe to the cylinder head; then remove the pipe.



CD803

17. Remove the two coolant hoses from the engine; then route the hoses out of the way.

18. Remove the cap screws securing the rear drive-shaft/output flange to the rear output joint flange.



CD805

■ **NOTE:** It is advisable to lock the brake when loosening the cap screws securing the rear drive-shaft.

19. Remove the positive cable from the starter motor and route it out of the way.



CD796

20. Disconnect the speed sensor connector from the sensor housing.





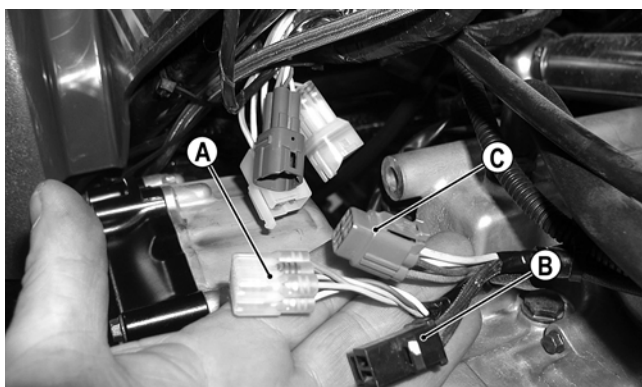
CD794

21. On the right-side, disconnect the gear position indicator connector (A), stator connector (B), and the CDI connector (C).



CD806

24. Remove the cap screw and flange nut securing the upper engine bracket to the engine; then remove the bracket.



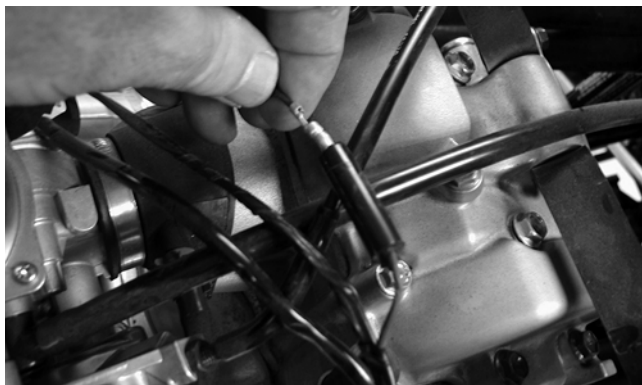
CD797A

22. Disconnect the temperature sensor lead from the wiring harness.



CD807

25. Remove the spark plug wire from the spark plug; then remove the coil from the frame.



CD788

23. Remove the two cap screws securing the upper engine mount to the frame.



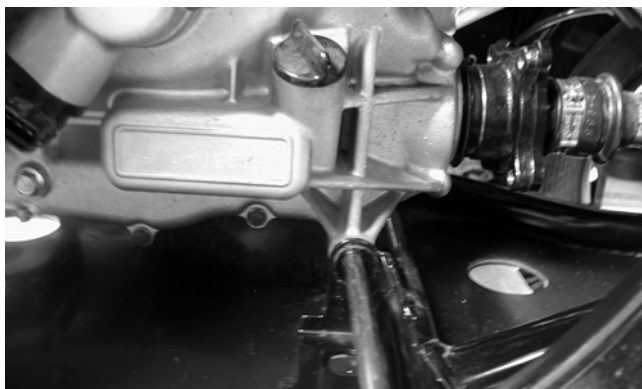
CD814

26. Remove the cap screw securing the engine ground wire to the engine.



CD810

27. Remove the two engine mounting through-bolts. Account for a washer and a spacer on the bolts.



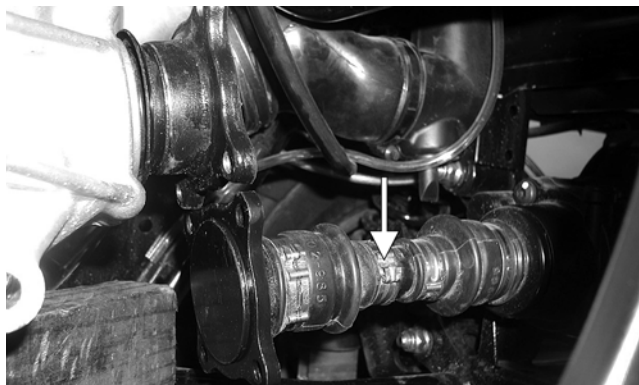
CD809

28. Raise the rear of the engine enough to allow the rear output flange to clear the output flange joint. Block the engine up in this position.

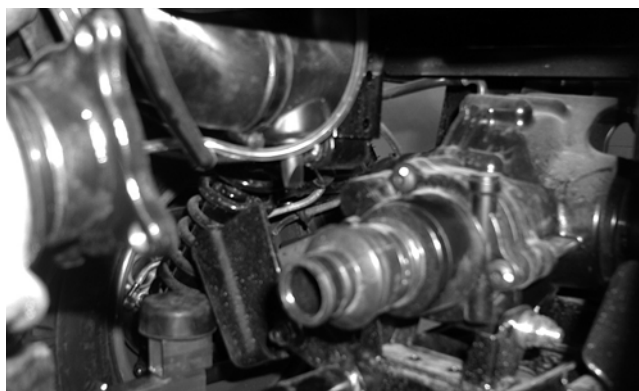


CD811

29. Remove the first small boot clamp; then remove the output flange and driveshaft from the rear drive coupler.



CD812A



CD813

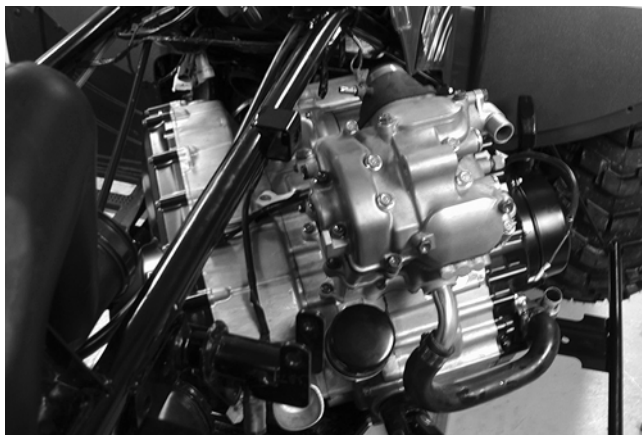
30. Remove the block from under the engine and lower the engine; then remove the boot clamp from the front output drive yoke.



CD818

31. Move the engine to the rear enough to allow the front driveshaft to clear the front output yoke; then move the engine forward and to the left. The engine will come out the left side of the frame.





CD773



CC001D

■ **NOTE:** Keep the mounting hardware with the covers for assembly purposes or thread them back into the head to keep them separated.

---

## Top-Side Components

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■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### AT THIS POINT

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

2. Remove the 12 cap screws securing the valve cover to the head; account for the four rubber washers on the top side cap screws. Remove the valve cover. Account for and note the orientation of the cylinder head plug. Note the location of two alignment pins.

**3**



CD205

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## Removing Top-Side Components

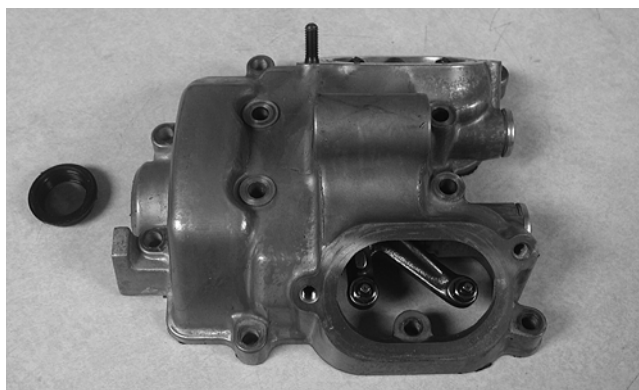
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### A. Valve Cover

### B. Cylinder Head

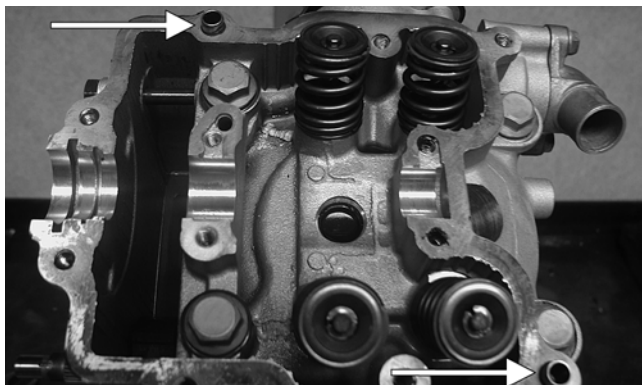
■ **NOTE:** Remove the spark plug and timing inspection plug; then using the recoil starter, rotate the crankshaft to top-dead-center of the compression stroke.

1. Remove the two tappet covers.



CD206





CD211A

3. Loosen the cap screw on the end of the tensioner; then remove the two Allen-head cap screws securing the tensioner adjuster assembly and remove the assembly. Account for a gasket.



CC009D

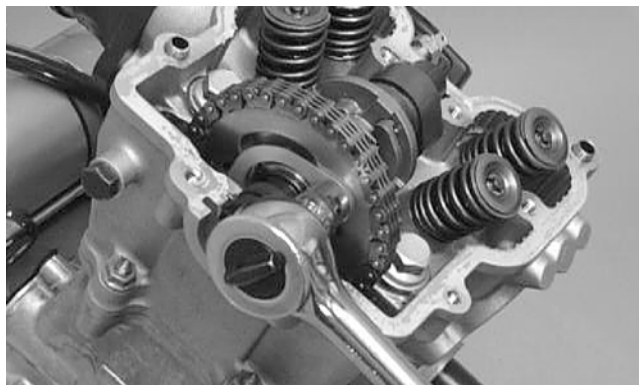
4. Using an awl, rotate the C-ring in its groove until it is out of the cylinder head; then remove the C-ring.

■ **NOTE:** Care should be taken not to drop the C-ring down into the crankcase.



CC012D

5. Bend the washer tabs down and remove the two cap screws securing the sprocket to the camshaft; then drop the sprocket off the camshaft.



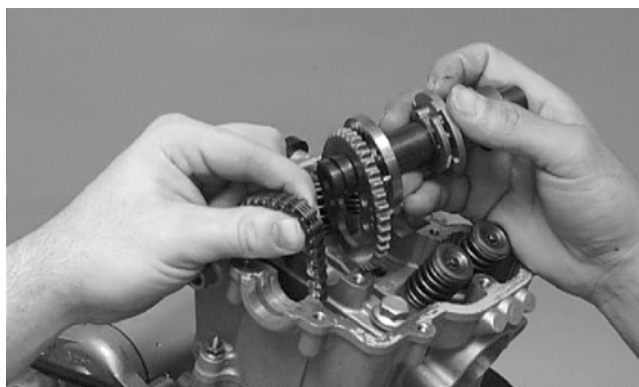
CC013D

6. Remove the cap screw securing the chain tensioner (account for a washer); then remove the tensioner.



CC014D

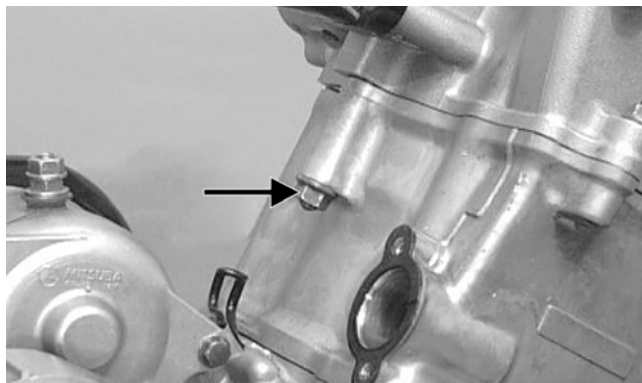
7. While holding the chain, slide the sprocket and camshaft out of the cylinder head.



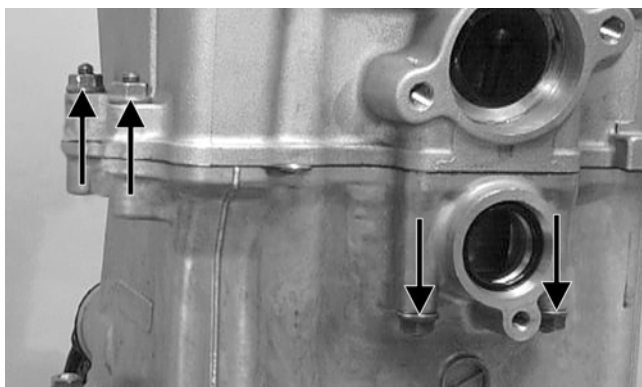
CC266D

■ **NOTE:** Loop the chain over the cylinder and secure it to keep it from falling into the crankcase.

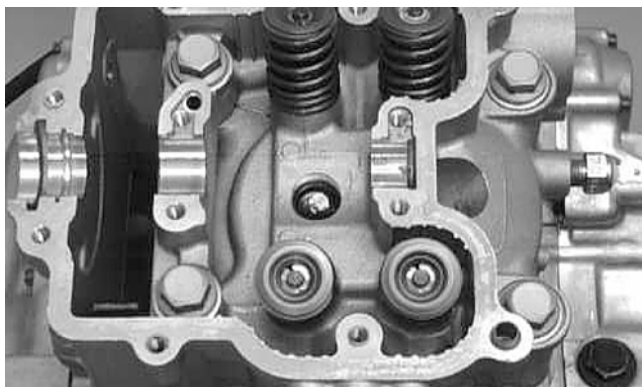
8. Remove the five nuts securing the cylinder head to the cylinder; then remove the four cylinder head cap screws with copper washers (note location of the different-sized cap screws and nuts).



CC017D

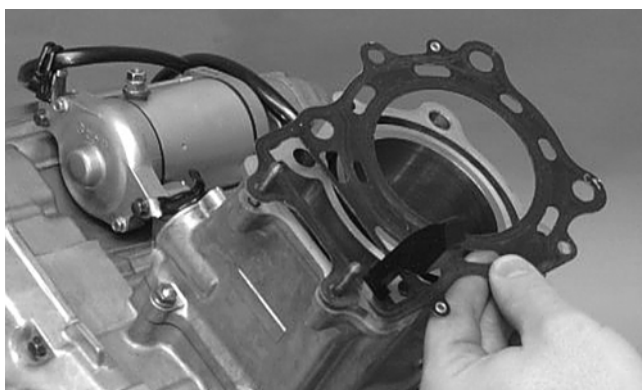


CC018D



CC016D

9. Remove the cylinder head from the cylinder, remove the gasket, and account for two alignment pins; then remove the cam chain guide.



CC020D

### **AT THIS POINT**

To service valves and cylinder head, see Servicing Top-Side Components sub-section.

### **AT THIS POINT**

To inspect cam chain guide, see Servicing Top-Side Components sub-section.



CC022D

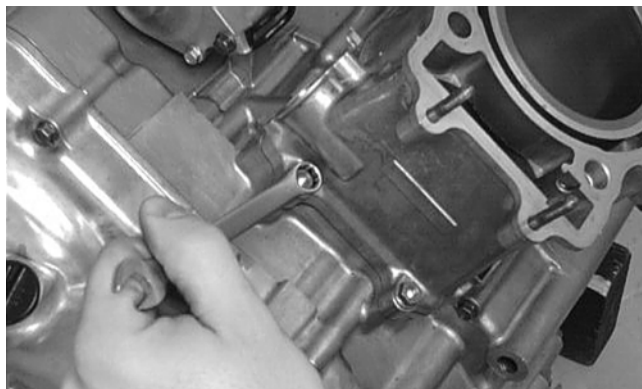
**3**

## **C. Cylinder**

### **D. Piston**

■ **NOTE:** Steps 1-9 in the preceding sub-section must precede this procedure.

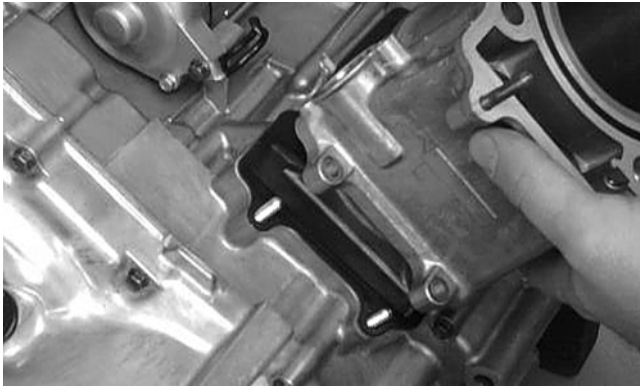
10. Loosen the clamp securing the coolant hose to the union; then detach the hose.
11. Remove the two nuts securing the cylinder to the crankcase.



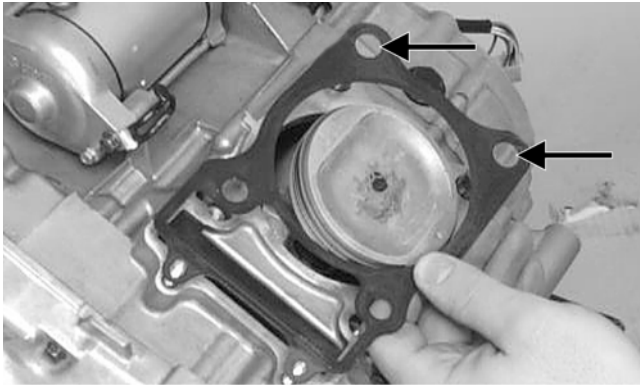
CC023D

12. Lift the cylinder off the crankcase taking care not to allow the piston to drop against the crankcase. Account for the gasket and two alignment pins.

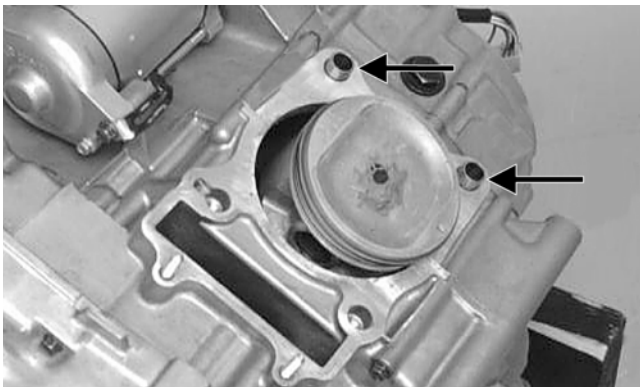




CC024D



CC025D



CC026D

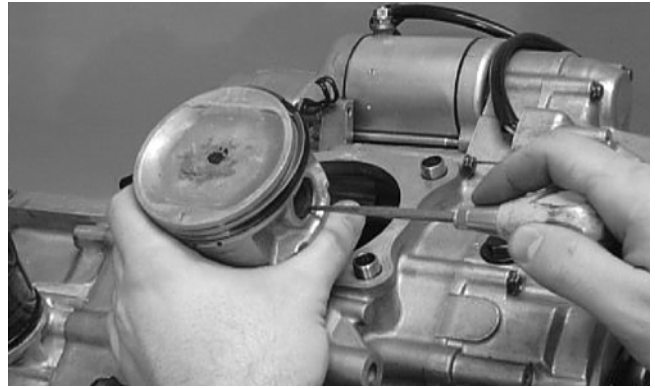
### **AT THIS POINT**

To service cylinder, see Servicing Top-Side Components sub-section.

### **CAUTION**

When removing the cylinder, be sure to support the piston to prevent damage to the crankcase and piston.

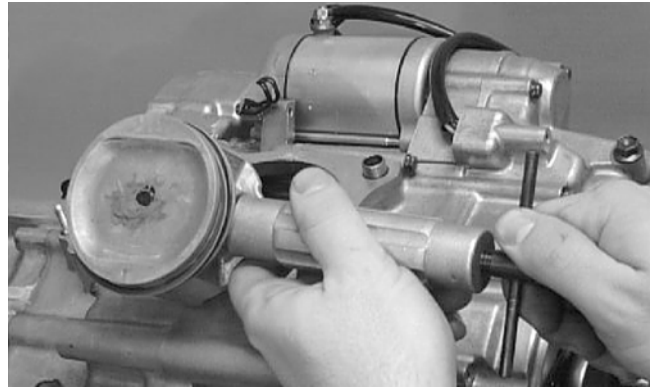
13. Using an awl, remove one piston-pin circlip.



CC032D

14. Using the Piston-Pin Puller (p/n 0644-328), remove the piston pin. Account for the opposite-side circlip. Remove the piston.

■ **NOTE:** It is advisable to remove the opposite-side circlip prior to using the puller.



CC033D

■ **NOTE:** Support the connecting rod with rubber bands to avoid damaging the rod or install the Connecting Rod Holder (p/n 0444-006).

### **CAUTION**

Do not allow the connecting rod to go down inside the crankcase. If the rod is down inside the crankcase and the crankshaft is rotated, severe damage will result.

■ **NOTE:** If the existing rings will not be replaced with new rings, note the location of each ring for proper installation. When replacing with new rings, replace as a complete set only. If the piston rings must be removed, remove them in this sequence.

A. Starting with the top ring, slide one end of the ring out of the ring-groove.



- B. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

**👉 AT THIS POINT**

To service piston, see Servicing Top-Side Components sub-section.

**👉 AT THIS POINT**

To service center crankcase components only, proceed to Removing Left-Side Components.

---

## Left-Side Components

---

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

**👉 AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

---

## Removing Left-Side Components

---

- A. Recoil Starter**
- B. Water Pump**
- C. Cover**
- D. Rotor/Flywheel**

1. Remove the four cap screws securing the recoil starter assembly to the left-side cover; then remove the recoil starter. Account for the gasket.

**👉 AT THIS POINT**

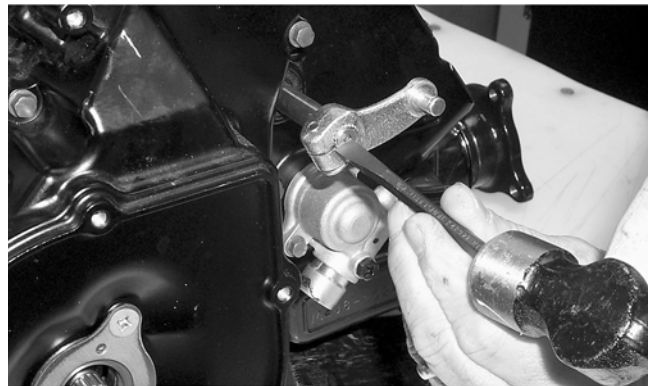
To service the recoil starter, see Servicing Left-Side Components sub-section.

2. Remove the flange nut securing the starter cup to the crankshaft; then remove the starter cup. Account for the O-ring inside the cup.



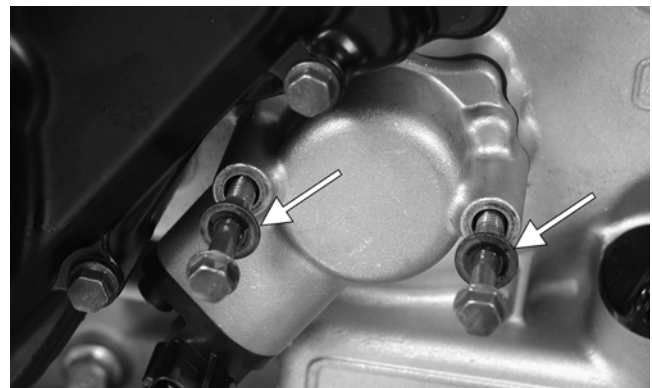
CD925A

3. Using a cold chisel, scribe a mark showing the relative position of the shift arm to the shift arm shaft to aid in installing; then remove the shift arm.



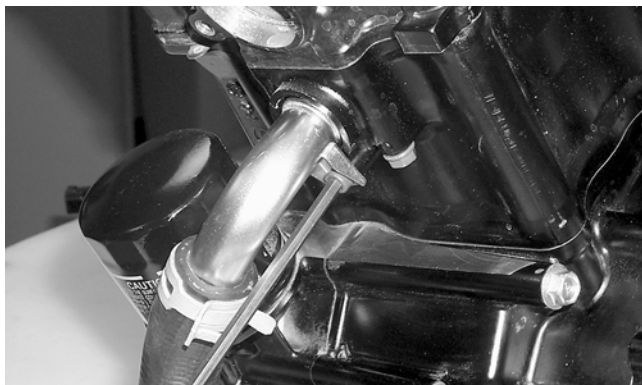
CC621

4. Remove the two cap screws securing the speed sensor housing; then remove the housing. Account for the gasket and two seal washers.



CD920A

5. Loosen the clamps securing the coolant hose to the water pump; then remove the crossover tube from the cylinder head. Account for an O-ring.



CC620

6. Remove the two cap screws securing the water pump to the engine; then remove the water pump.



CC623

### **AT THIS POINT**

To service the water pump, see Section 4.

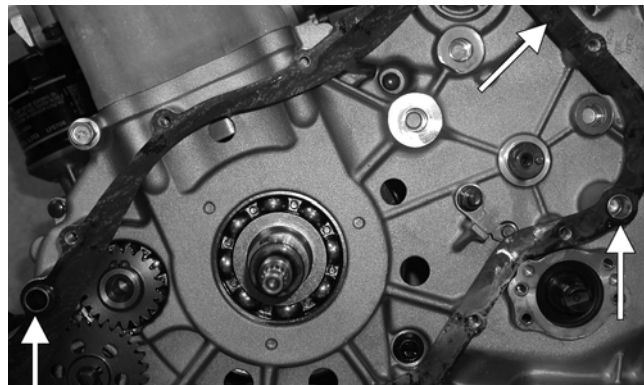
7. Remove the 13 cap screws securing the left-side cover to the crankcase noting the location of the different-sized cap screws for installing purposes.



CC626

8. Using Side Case Puller (p/n 0644-262), remove the side cover. Account for a gasket and two alignment pins.

■ **NOTE:** Inspect the inside of the left-side cover for any shaft washers that may have come off with the cover. Make sure they are returned to their respective shafts and that the starter idler gear spacer is on the shaft or in the cover.

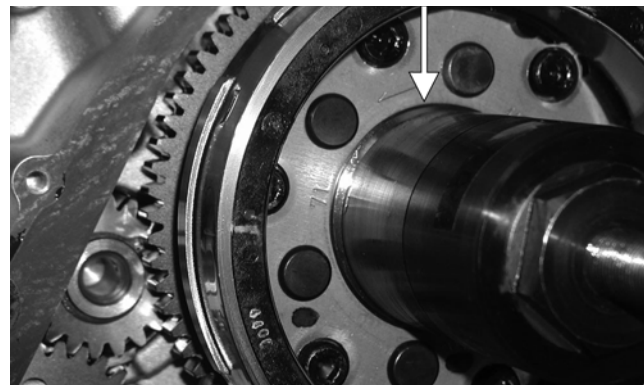


CD942A

9. Remove the nut securing the magneto rotor to the crankshaft; then install the magneto rotor puller adapter.

■ **NOTE:** The puller has left-hand threads.

10. Using Magneto Rotor Remover Set (p/n 0444-075), remove the rotor/flywheel assembly from the crankshaft. Account for the key; then remove the starter clutch gear assembly and washer.



CD939A



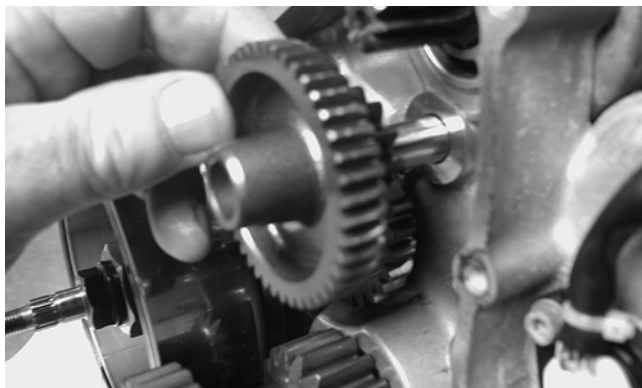
CD940A



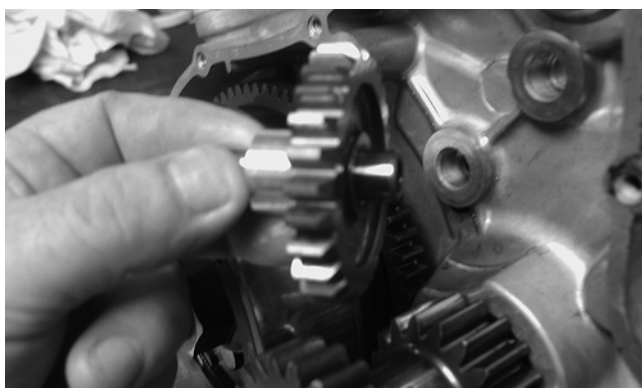
### **AT THIS POINT**

To service the magneto assembly, see Section 5.

11. Remove the two starter gears from the crankcase noting the direction of the beveled side of the gears for installing purposes; then remove the two starter gear shafts.

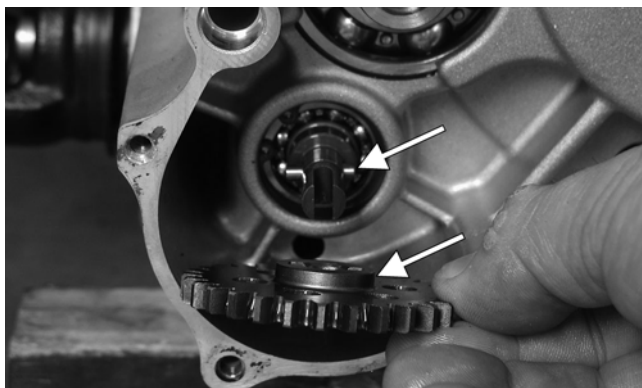


CD136



CD140

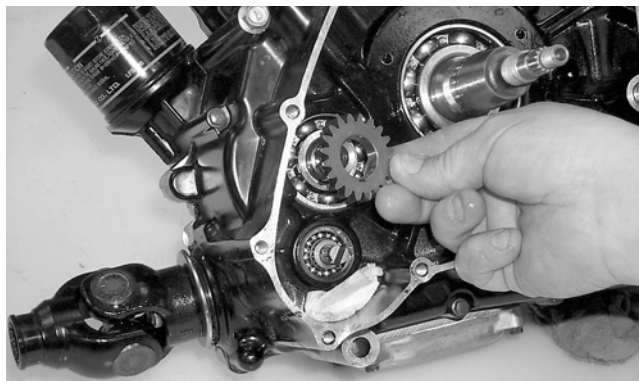
12. Remove the snap ring securing the water pump driven gear; then remove the gear noting the direction of the sides of the gear for installing purposes. Account for the driven gear alignment pin.



CD952A

■ **NOTE:** There is an oil passage beneath the driven gear/drive gear assembly. This passage should be plugged prior to removing the driven gear and drive gear. Failure to do so could result in the loss of an alignment pin into the crankcase.

13. Remove the snap ring securing the water pump drive gear; then remove the gear noting the direction of the sides of the gear for installing purposes. Account for the drive gear alignment pin.



CC641

3

## **Right-Side Components**

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### **AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.



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## Removing Right-Side Components

---

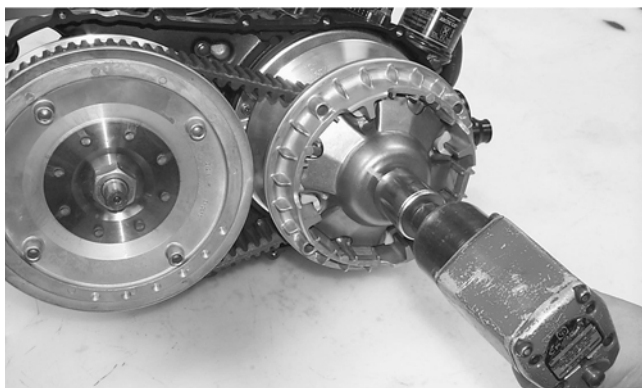
- A. V-Belt Cover**
- B. Driven Pulley**
- C. Clutch Cover**

1. Remove the cap screws securing the V-belt cover noting the location of the different-lengthed cap screws for installing purposes; then using a rubber mallet, gently tap on the cover tabs to loosen the cover.

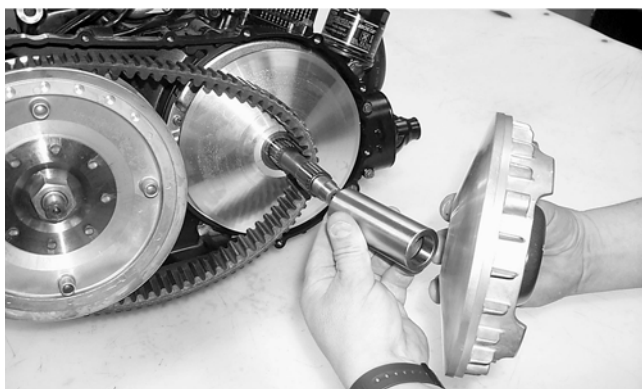


CD079

2. Remove the nut securing the movable drive face; then remove the face. Account for a spacer.



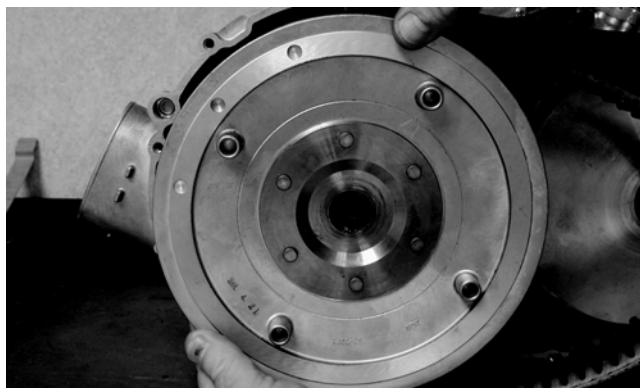
CC581



CC582

3. Remove the V-belt.

4. Remove the nut securing the fixed driven assembly; then remove the assembly.



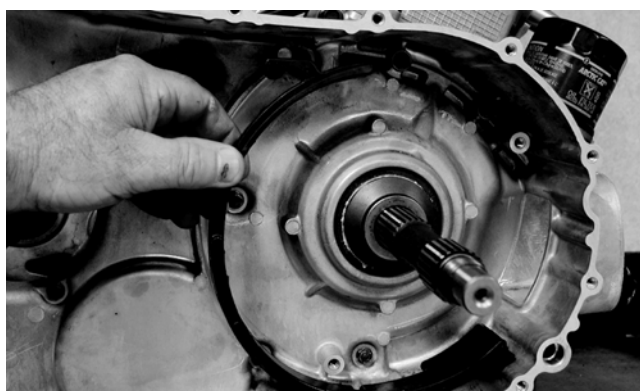
CD968

5. Remove the fixed drive face.

6. Using an impact driver, remove the cap screws securing the air intake plate; then remove the plate cushion.



CD970

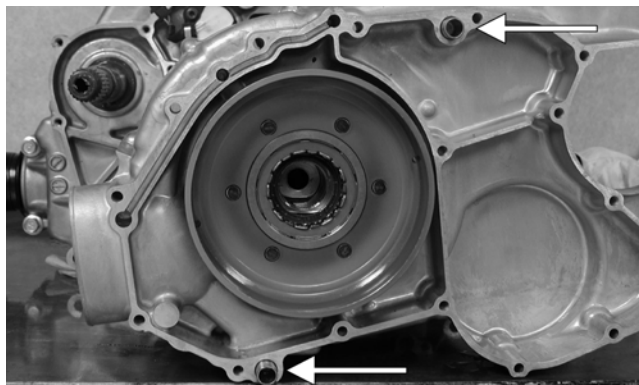


CD971

7. Remove the cap screws securing the clutch cover. Note the location of the different-lengthed cap screws for installing purposes. Using a rubber mallet, carefully remove the cover. Account for two alignment pins.



CD973A



CD974A



### CAUTION

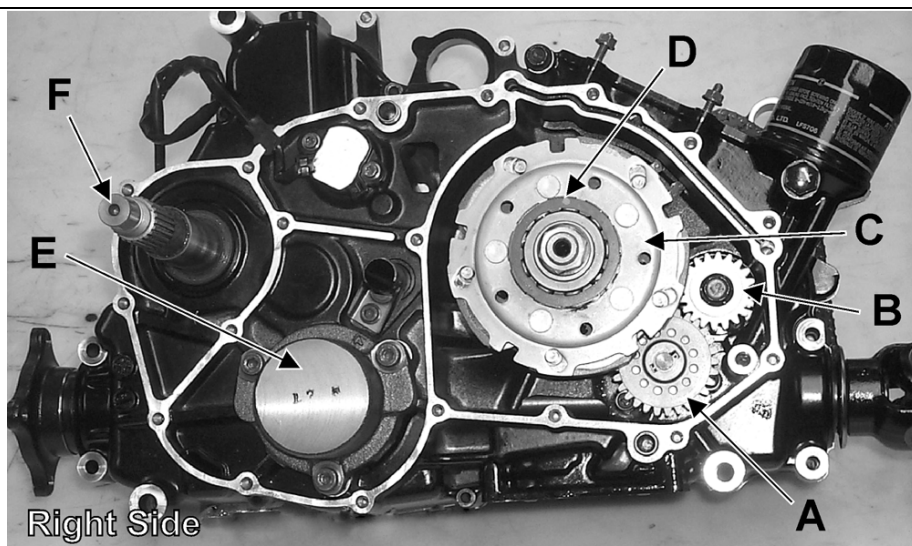
Care must be taken when removing the cover so the cover gasket is not damaged.

■ NOTE: For steps 8-14, refer to illustration CC829B.

■ NOTE: To aid in installing, it is recommended that the assemblies are kept together and IN ORDER.

#### KEY

- A. Oil Pump Driven Gear
- B. Oil Pump Drive Gear
- C. Clutch Shoe Assembly
- D. One-Way Clutch  
(Green Dot MUST Show)
- E. Final Drive Carrier Bearing Housing
- F. Input Shaft



CC829B

3

8. Remove the one-way clutch (D) from the clutch housing. Note the location of the green alignment dot (or the word OUTSIDE) for installing purposes.
9. Using a hydraulic press, remove the clutch housing assembly from the clutch cover. Account for the left fixed drive spacer and an O-ring inside the fixed drive spacer.



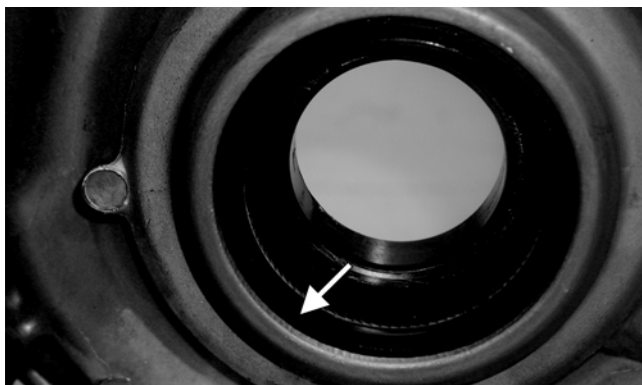
CF085





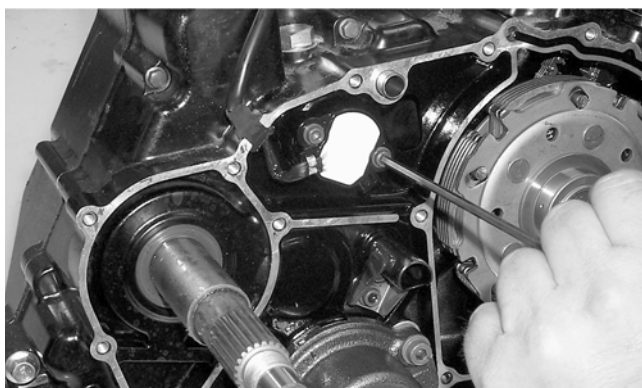
CC596

■ **NOTE:** Account for and inspect the clutch housing seal.



CF088A

10. Remove the two Allen-head screws securing the shift indicator sending unit; then remove the unit. Account for two neutral contact pins and two springs.



CC602

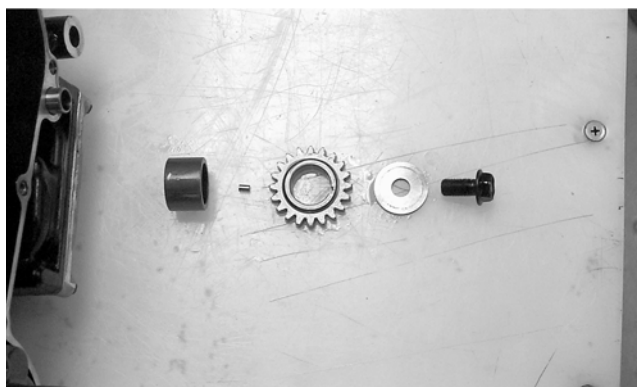


CC603

11. Remove the nut (left-hand threads) securing the clutch shoe assembly (C). Account for a washer.

■ **NOTE:** The washer is also directional. The flat side of the washer must face toward the clutch assembly when installing.

12. Remove the cap screw securing the oil pump drive gear (B). Account for a cap screw, washer, pin, and spacer.



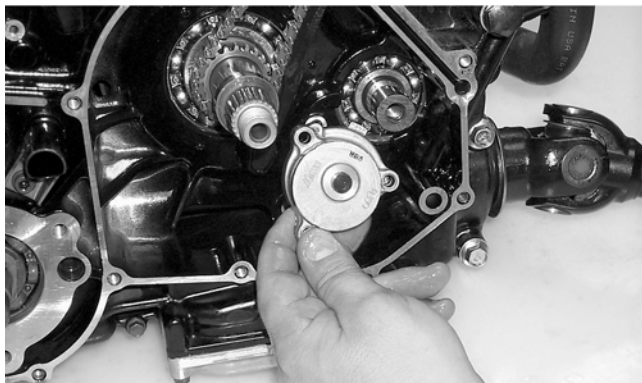
CC606

13. Using an impact driver, remove the Allen-head screws securing the final drive carrier bearing housing (E); then remove the housing and account for two alignment pins.

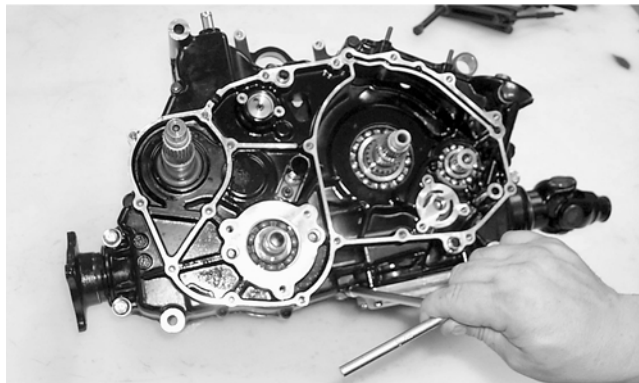
14. Remove the snap ring securing the oil pump driven gear (A); then remove the gear noting the direction of the sides of the gear for installing purposes. Account for a pin and a washer.

15. Using an impact driver, remove the three Phillips-head screws securing the oil pump; then remove the pump.





CC613



CC664

---

## Center Crankcase Components

---

■ **NOTE:** This procedure cannot be done with the engine/transmission in the frame. Complete Removing procedures for Top-Side, Left-Side, and Right-Side must precede this procedure.

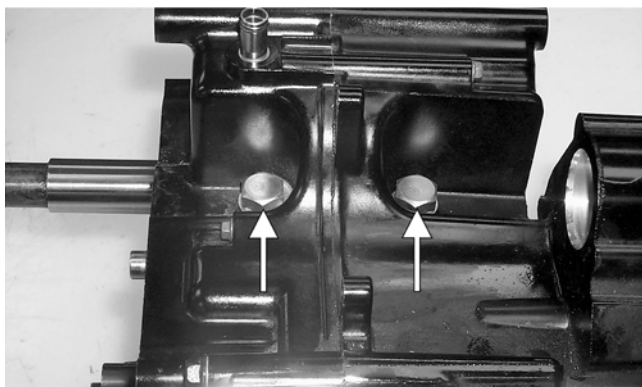
■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

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## Separating Crankcase Halves

---

1. Remove the two shift cam stoppers from the top of the crankcase.



CC661A

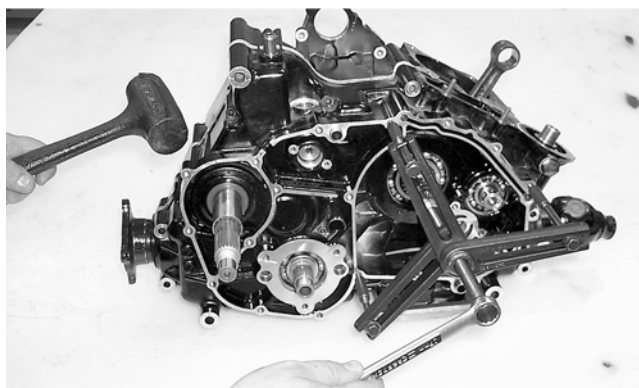
2. Remove the right-side cap screws securing the crankcase halves. Note the location of the different-lengthed cap screws.



CC663

4. Using the Crankcase Separator/Crankshaft Remover (p/n 0444-009) and tapping lightly with a rubber mallet, separate the crankcase halves. Account for two alignment pins.

■ **NOTE:** To keep the shaft/gear assemblies intact for identification, tap the shafts toward the left-side crankcase half when separating the halves.



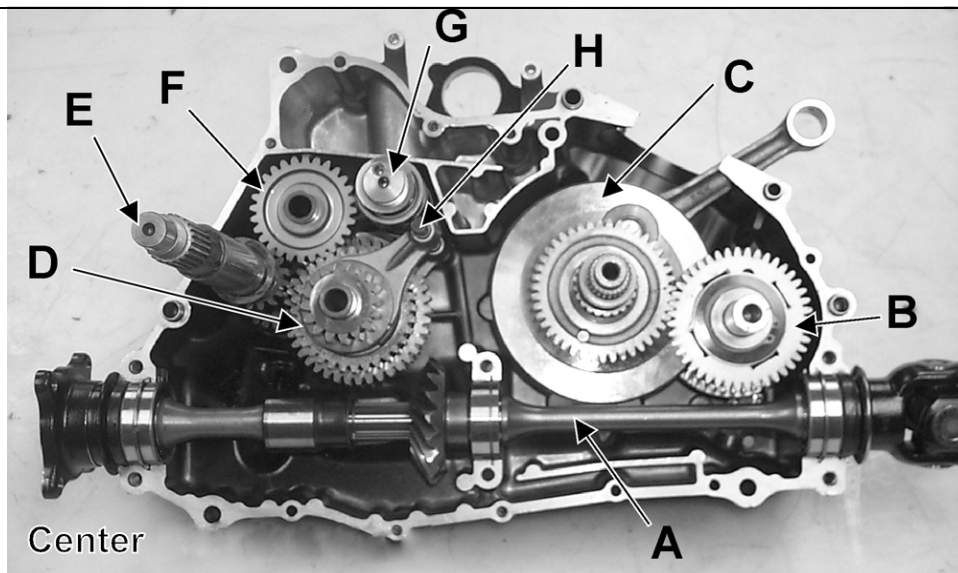
CC665

## Disassembling Crankcase Half

■ **NOTE:** For steps 1-7, refer to illustration CC821B.

### KEY

- A. Secondary Driven Shaft Assembly
- B. Crank Balancer Assembly
- C. Crankshaft
- D. Countershaft Assembly
- E. Driveshaft
- F. Reverse Idler Gear Assembly
- G. Gear Shift Shaft
- H. Shift Shaft with 2 Forks



CC821B

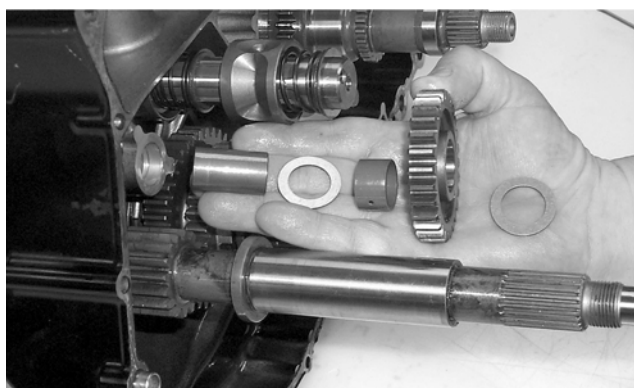
■ **NOTE:** To aid in installing, it is recommended that the assemblies be kept together and IN ORDER.

1. Remove the secondary driven shaft assembly (A) noting the location of the bearing locating pins. Account for the bearing C-ring.



CD267

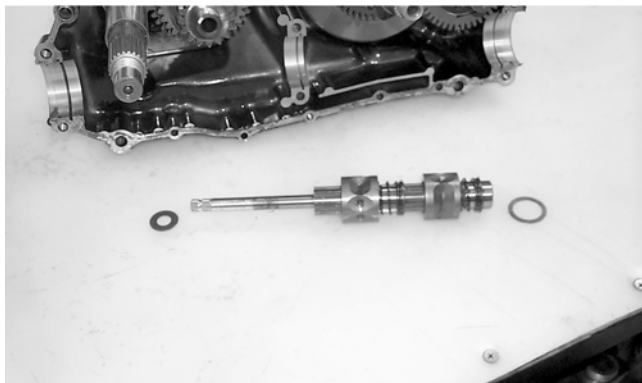
2. Remove the reverse idler gear assembly (F). Account for all washers, shaft, bushing, and the gear.



CC668

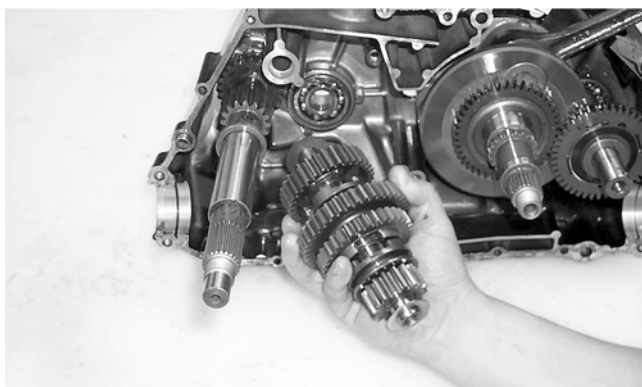
3. Remove the shift shaft (H); then remove the two forks taking note of the direction of the tabs on the forks for assembling purposes.
4. Remove the gear shift shaft (G) noting the location of the two holes on the end of the shaft. Account for two washers.





CC672

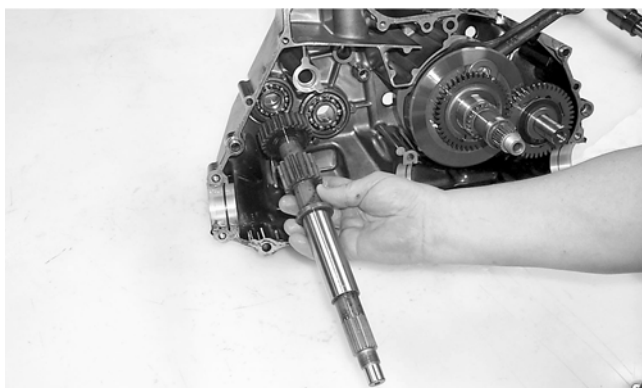
5. Remove the countershaft assembly (D). Account for a washer on each end of the countershaft.



CC674

■ **NOTE:** Do not disassemble the countershaft assembly unless necessary. If necessary, see Servicing Center Crankcase Components sub-section.

6. Using a rubber mallet, tap on the crankcase to remove the driveshaft.



CC675

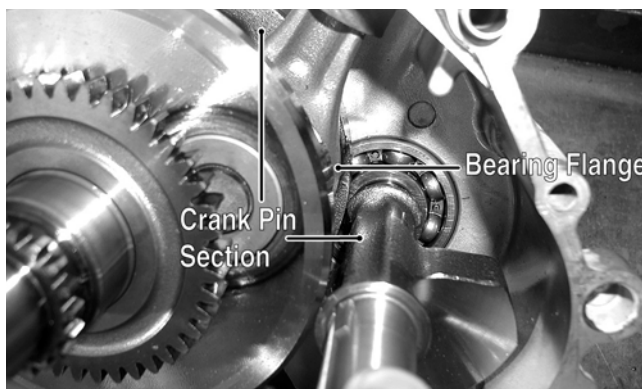
7. Note the alignment dots on the crank balancer assembly (B) gear and crankshaft (C) gear for assembling purposes; then slide the crank balancer gear off the crank balancer. Account for the key in the keyway.



CD826

8. Remove the crank balancer.

■ **NOTE:** There is a flat spot on the crank balancer bearing flange to allow clearance past the crankshaft.

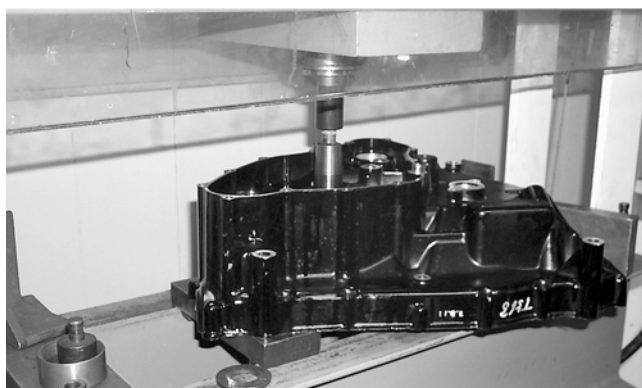


CD832B

9. Remove the snap ring securing the water pump driven gear shaft.

10. Using a hydraulic press, remove the crankshaft assembly.

■ **NOTE:** Use a protective end cap to prevent damage to the crankshaft threads.



CC680

11. Remove the cap screws securing the oil strainer cap; then remove the cap. Account for the cap O-ring.





CC681

12. Remove the two cap screws securing the oil strainer; then remove the strainer.



CC682

### ⚠ CAUTION

Do not remove the remaining output shaft assembly unless absolutely necessary. If the shaft is removed, the shaft nut must be replaced with a new one and the shaft must be re-shimmed.

13. To remove the assembly, remove the nut securing the secondary drive gear and secondary driven gear; then from the inside of the crankcase using a rubber mallet, remove the output shaft assembly. Account for the output shaft, two gears, a shim, a washer, and the nut.



CC686

## Table of Contents (Servicing Components)

■ **NOTE:** Critical engine/transmission specifications are located at the beginning of this section.

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## Servicing Top-Side Components

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

### VALVE ASSEMBLY

When servicing valve assembly, inspect valve seats, valve stems, valve faces, and valve stem ends for pits, burn marks, or other signs of abnormal wear.

■ **NOTE:** Whenever a valve is out of tolerance, it must be replaced.

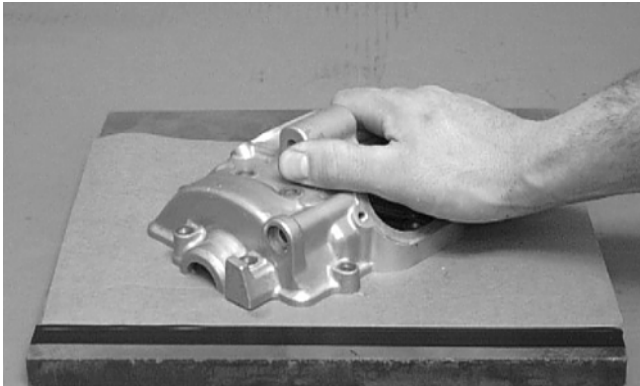
### Cleaning/Inspecting Valve Cover

■ **NOTE:** If the valve cover cannot be trued, the cylinder head assembly must be replaced.

1. Wash the valve cover in parts-cleaning solvent.
2. Place the valve cover on the Surface Plate (p/n 0644-016) covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the valve cover in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the valve cover in a figure eight motion until a uniform bright metallic finish is attained.

**⚠ CAUTION**

Do not remove an excessive amount of the sealing surface or damage to the camshaft will result. Always check camshaft clearance when resurfacing the valve cover.



CC130D

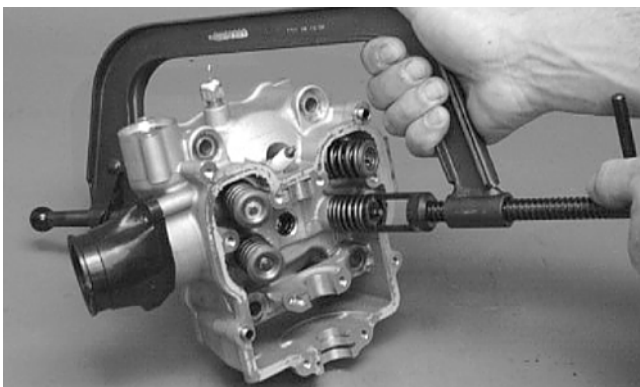
**⚠ CAUTION**

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.

### Removing Valves

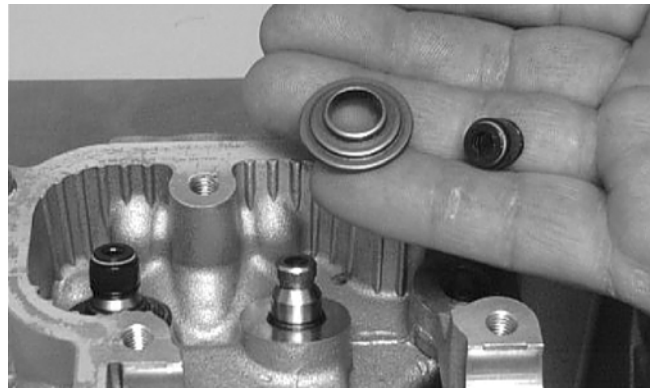
■ **NOTE:** Keep all valves and valve components as a set. Note the original location of each valve set for use during installation. Return each valve set to its original location during installation.

1. Using a valve spring compressor, compress the valve springs and remove the valve cotters. Account for an upper spring retainer.



CC132D

2. Remove the valve seal and the lower remaining spring seat. Discard the valve seal.



CC136D

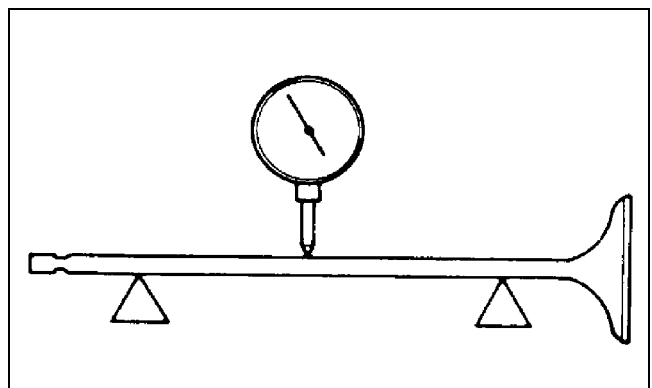
■ **NOTE:** The valve seals must be replaced.

3. Remove the valve springs; then invert the cylinder head and remove the valves.

### Measuring Valve Stem Runout

1. Support each valve stem end with the V Blocks (p/n 0644-022); then check the valve stem runout using a dial indicator.

**3**



ATV-1082

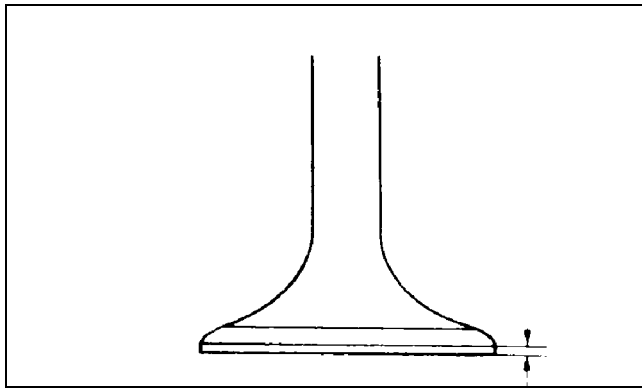
2. Maximum runout must not exceed specifications.

### Measuring Valve Stem Outside Diameter

1. Using a micrometer, measure the valve stem outside diameter.
2. Acceptable diameter range (intake valve) must be within specifications.
3. Acceptable diameter range (exhaust valve) must be within specifications.

### Measuring Valve Face/Seat Width

1. Using a micrometer, measure the width of the valve face.

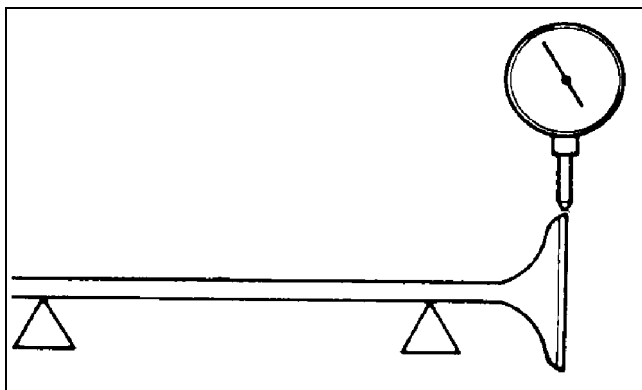


ATV-1004

2. Acceptable width range must be within specifications.

### Measuring Valve Face Radial Runout

1. Mount a dial indicator on the surface plate; then place the valve stem on a set of V blocks.
2. Position the dial indicator contact point on the outside edge of the valve face; then zero the indicator.

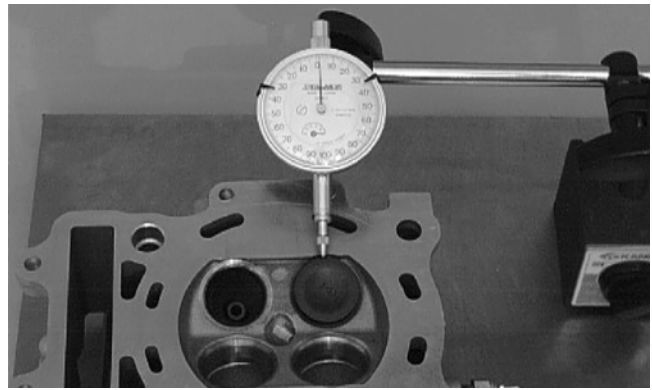


ATV1082A

3. Rotate the valve in the V blocks.
4. Maximum runout must not exceed specifications.

### Measuring Valve Guide/Valve Stem Deflection (Wobble Method)

1. Mount a dial indicator and base on the surface plate; then place the cylinder head on the surface plate.
2. Install the valve into the cylinder head; then position the dial indicator contact point against the outside edge of the valve face. Zero the indicator.



CC131D

3. Push the valve from side to side; then from top to bottom.
4. Maximum "wobble" deflection must not exceed specifications.

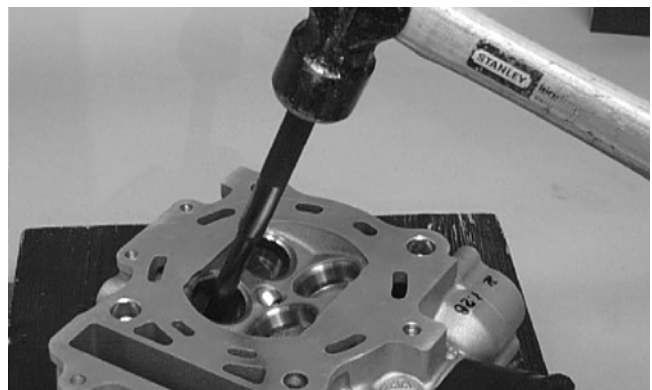
### Measuring Valve Guide (Inside Diameter)

1. Insert a snap gauge 1/2 way down into each valve guide bore; then remove the gauge and measure it with a micrometer.
2. Acceptable inside diameter range must be within specifications.
3. If a valve guide is out of tolerance, it must be replaced.

### Replacing Valve Guide

■ **NOTE:** If a valve guide is worn or damaged, it must be replaced.

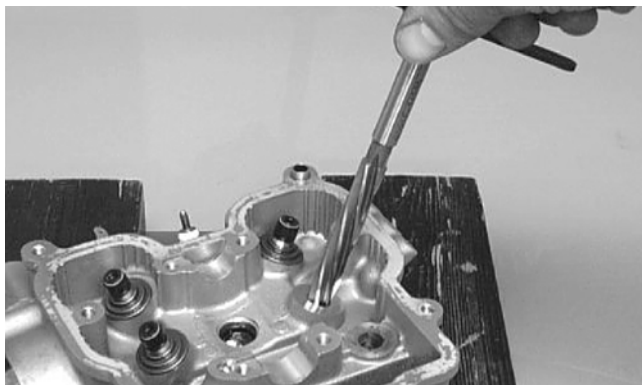
1. If a valve guide needs replacing, insert a valve guide remover into the valve seat side of the valve guide. Using a hammer, gently drive the valve guide out of the cylinder head.



CC137D

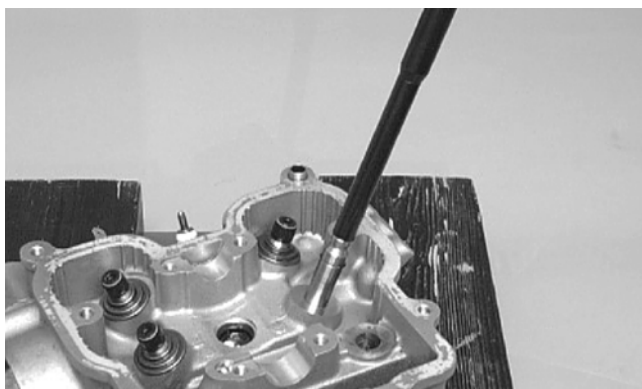
2. Using the Standard Valve Guide Reamer (p/n 0444-017), remove any burrs or tight areas from the valve guide journals.





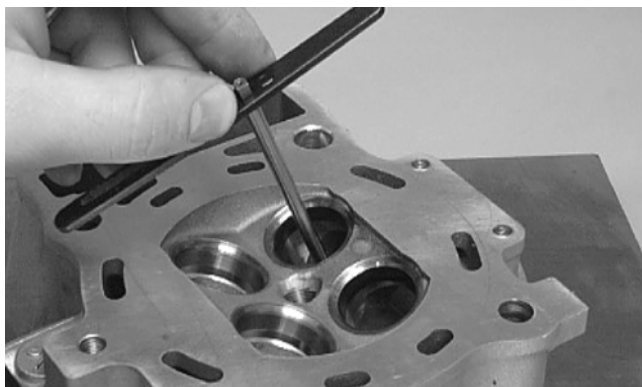
CC142D

3. To install a valve guide, use a valve guide installer and gently drive a valve guide with a retaining clip into the bore from the valve spring side until the retaining clip just contacts the cylinder head.



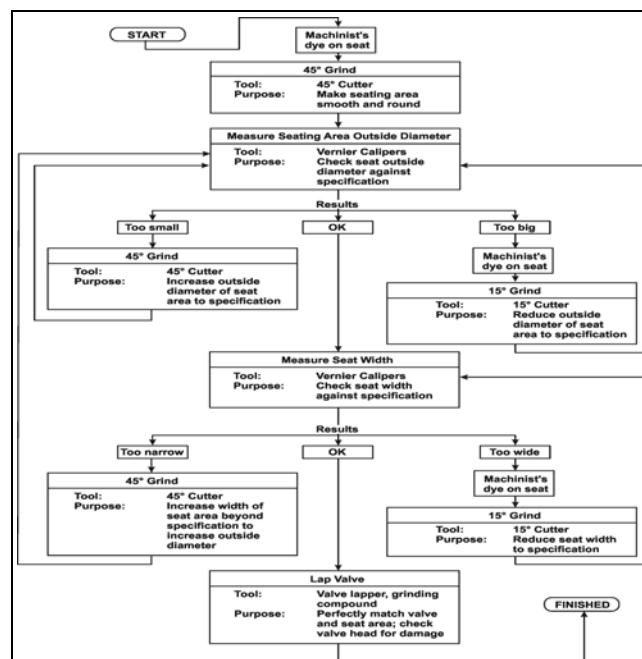
CC143D

4. After installing the guide, use the standard valve guide reamer to remove all burrs and tight areas that may remain in each valve guide.



CC138D

## Valve Seat/Guide Servicing Flow Chart



ATV-0107

## Grinding Valve Seats

■ **NOTE:** If the valve seat is beyond servicing, the cylinder head must be replaced.

1. Insert an exhaust valve seat pilot shaft into an exhaust valve guide. Slide an exhaust valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the exhaust valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining exhaust valve seat.



CC139D

2. Insert an intake valve seat pilot shaft into one of the intake valve guides. Slide the intake valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the intake valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining intake valve seat.



CC140D

## Lapping Valves

■ **NOTE:** Do not grind the valves. If a valve is damaged, it must be replaced.

1. Remove all carbon from the valves.
2. Lubricate each valve stem with light oil; then apply a small amount of valve lapping compound to the entire seating face of each valve.
3. Attach the suction cup of a valve lapping tool to the head of the valve.
4. Rotate the valve until the valve and seat are evenly polished.
5. Clean all compound residue from the valve and seat.

## Measuring Rocker Arm (Inside Diameter)

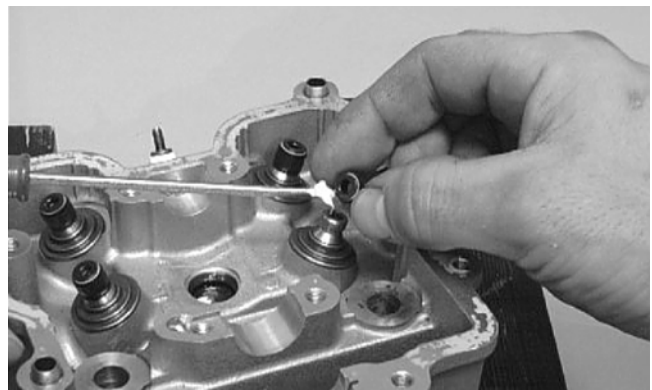
1. Using a dial calipers, measure the inside diameter of the rocker arm.
2. Acceptable inside diameter range must be within specifications.

## Measuring Rocker Arm Shaft (Outside Diameter)

1. Using a micrometer, measure the outside diameter of the rocker arm shaft.
2. Acceptable outside diameter range must be within specifications.

## Installing Valves

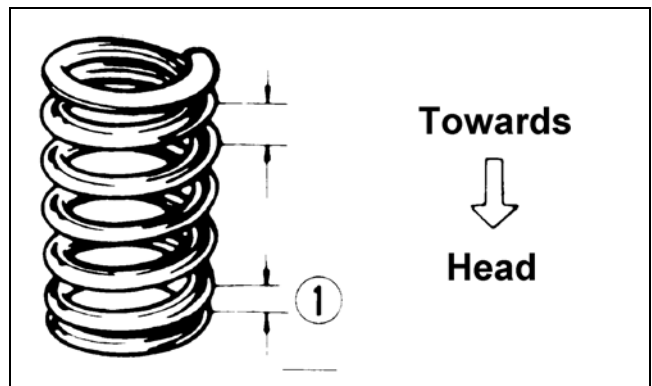
1. Apply grease to the inside surface of the valve seals; then place a lower spring seat and valve guide seal over each valve guide.



CC144D

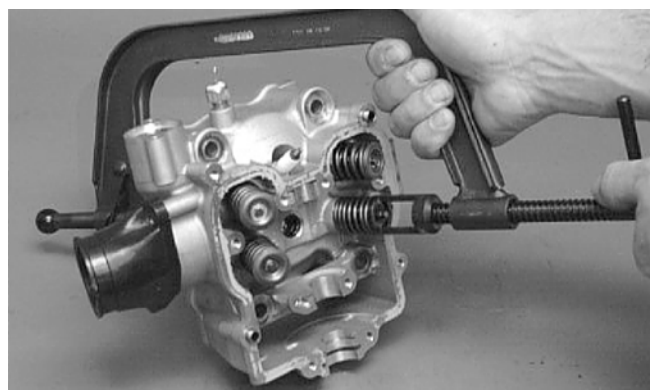
2. Insert each valve into its original valve location.
3. Install the valve springs with the painted end of the spring facing away from the cylinder head.

■ **NOTE:** If the painted end is not visible, install the ends of the springs with the closest coils toward the head.



ATV-1011A

4. Place a spring retainer over the valve springs; then using the valve spring compressor, compress the valve springs and install the valve cotters.



CC132D

## PISTON ASSEMBLY

■ **NOTE:** Whenever a piston, rings, or pin are out of tolerance, they must be replaced.

### Cleaning/Inspecting Piston

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the dome of the piston.
2. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
3. Inspect the piston for seizure marks or scuffing. Repair with #400 grit wet-or-dry sandpaper and water or honing oil.

■ **NOTE:** If scuffing or seizure marks are too deep to correct with the sandpaper, replace the piston.

4. Inspect the perimeter of each piston for signs of excessive "blowby." Excessive "blowby" indicates worn piston rings or an out-of-round cylinder.

### Removing Piston Rings

1. Starting with the top ring, slide one end of the ring out of the ring-groove.



CC400D

2. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

■ **NOTE:** If the existing rings will not be replaced with new ones, note the location of each ring for proper installation. When installing new rings, install as a complete set only.

### Cleaning/Inspecting Piston Rings

1. Take an old piston ring and snap it into two pieces; then grind the end of the old ring to a 45° angle and to a sharp edge.

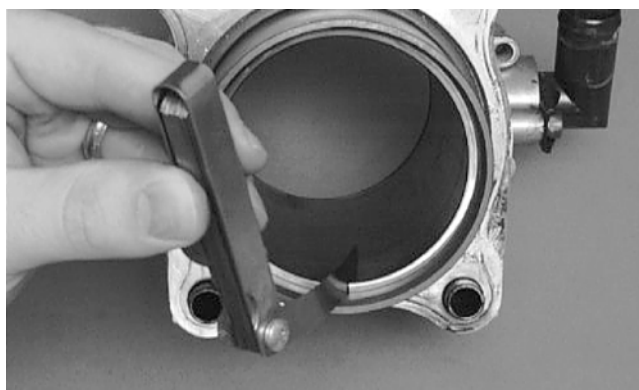
2. Using the sharpened ring as a tool, clean carbon from the ring-grooves. Be sure to position the ring with its tapered side up.

#### ⚠ CAUTION

Improper cleaning of the ring-grooves by the use of the wrong type of ring-groove cleaner will result in severe damage to the piston.

### Measuring Piston-Ring End Gap (Installed)

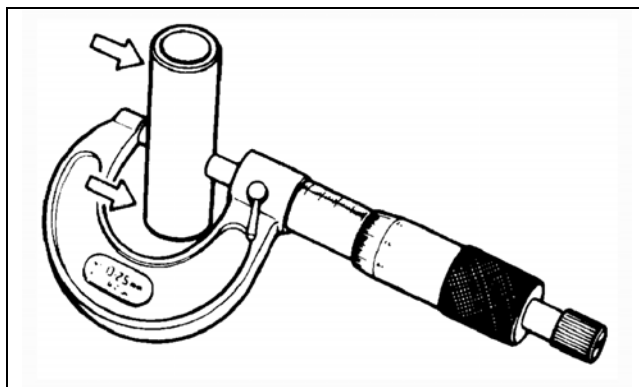
1. Place each compression ring in the wear portion of the cylinder. Use the piston to position each ring squarely in the cylinder.
2. Using a feeler gauge, measure each piston-ring end gap. Acceptable ring end gap must be within specifications.



CC280D

### Measuring Piston Pin (Outside Diameter) and Piston-Pin Bore

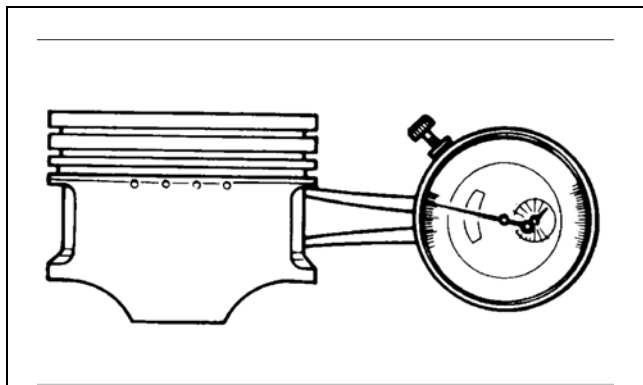
1. Measure the piston pin outside diameter at each end and in the center. If measurement is not within specifications, the piston pin must be replaced.



ATV-1070

2. Insert an inside dial indicator into the piston-pin bore. The diameter must not exceed specifications. Take two measurements to ensure accuracy.

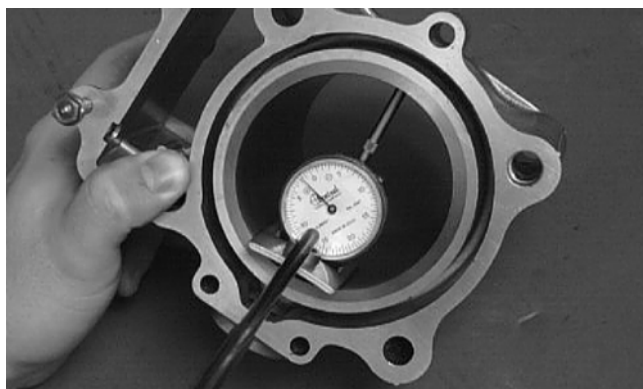




ATV-1069

## Measuring Piston Skirt/ Cylinder Clearance

1. Measure the cylinder front to back in six places.

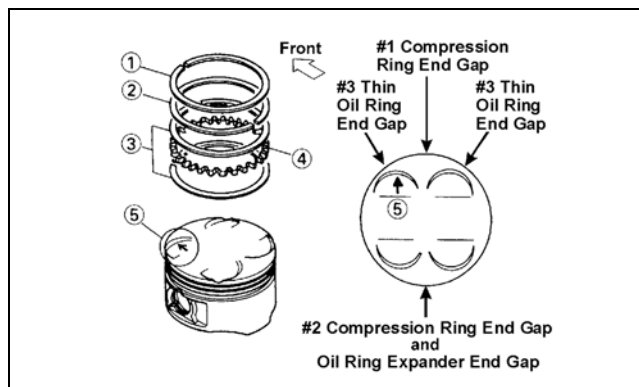


CC127D

2. Measure the corresponding piston diameter at a point 15 mm (0.6 in.) above the piston skirt at a right angle to the piston-pin bore. Subtract this measurement from the measurement in step 1. The difference (clearance) must be within specifications.

## Installing Piston Rings

1. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.

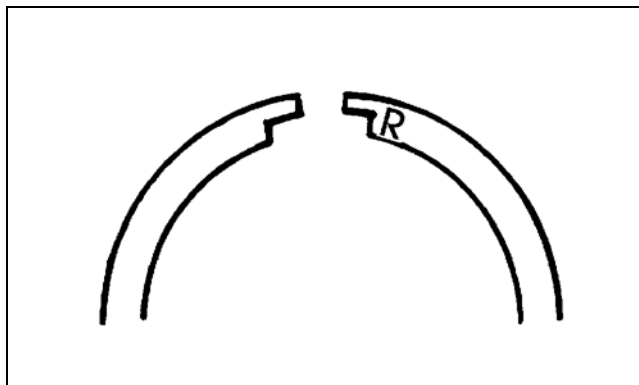


ATV-1085B

■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.

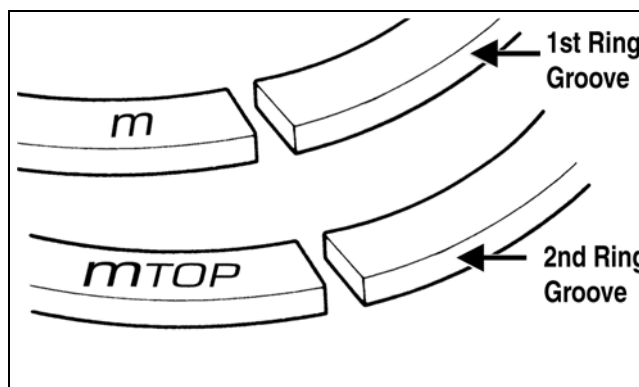
2. On the 500, install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston (see illustration).

■ **NOTE:** The chrome (silver) ring should be installed in the top position.



726-306A

On the 650 H1, the ring with the orientation mark (M TOP) should be installed in the second (middle) groove and the ring with the orientation mark (M) should be installed in the first (top) groove.



ATV-1024A

**⚠ CAUTION**

Incorrect installation of the piston rings will result in engine damage.

## CYLINDER/CYLINDER HEAD ASSEMBLY

■ **NOTE:** If the cylinder/cylinder head assembly cannot be trued, they must be replaced.

### Cleaning/Inspecting Cylinder Head

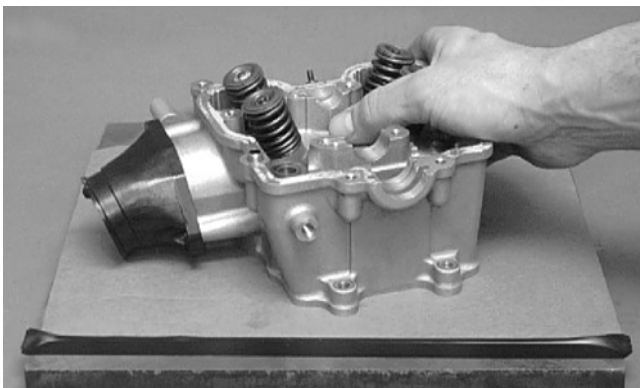
**⚠ CAUTION**

The cylinder head studs must be removed for this procedure.

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the combustion chamber being careful not to nick, scrape, or damage the combustion chamber or the sealing surface.
2. Inspect the spark plug hole for any damaged threads. Repair damaged threads using a “heli-coil” insert.
3. Place the cylinder head on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder head in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder head in a figure eight motion until a uniform bright metallic finish is attained.

**⚠ CAUTION**

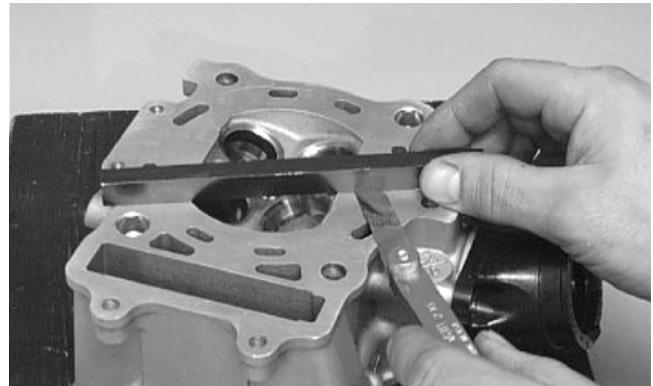
Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



CC128D

## Measuring Cylinder Head Distortion

1. Remove any carbon buildup in the combustion chamber.
2. Lay a straightedge across the cylinder head; then using a feeler gauge, check the distortion factor between the head and the straightedge.
3. Maximum distortion must not exceed specifications.



CC141D

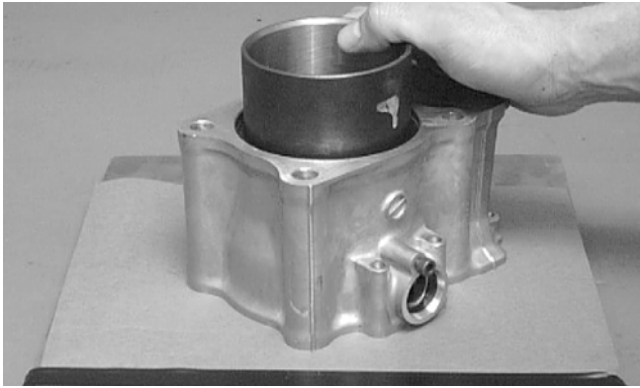
**3**

### Cleaning/Inspecting Cylinder

1. Wash the cylinder in parts-cleaning solvent.
2. Inspect the cylinder for pitting, scoring, scuffing, warpage, and corrosion. If marks are found, repair the surface using a cylinder hone (see Honing Cylinder in this sub-section).
3. Place the cylinder on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder in a figure eight motion until a uniform bright metallic finish is attained.

**⚠ CAUTION**

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



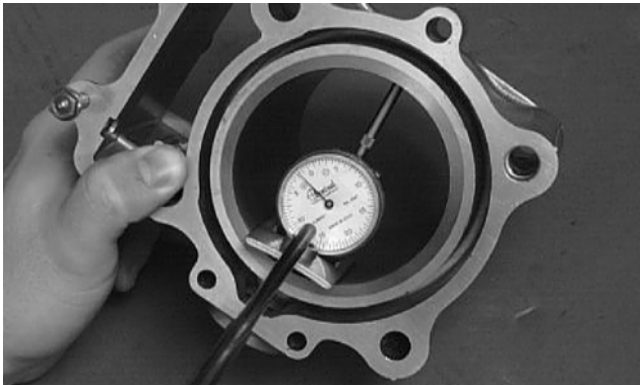
CC129D

### Inspecting Cam Chain Guide

1. Inspect cam chain guide for cuts, tears, breaks, or chips.
2. If the chain guide is damaged, it must be replaced.

### Honing Cylinder

1. Using a slide gauge and a dial indicator or a snap gauge, measure the cylinder bore diameter in three locations from top to bottom and again from top to bottom at 90° from the first measurements for a total of six measurements. The trueness (out-of-roundness) is the difference between the highest and lowest reading. Maximum trueness (out-of-roundness) must not exceed specifications.



CC127D

2. Wash the cylinder in parts-cleaning solvent.
3. Inspect the cylinder for pitting, scoring, scuffing, and corrosion. If marks are found, repair the surface using a ball hone.

■ **NOTE:** To produce the proper 60° cross-hatch pattern, use a low RPM drill (600 RPM) at the rate of 30 strokes per minute. If honing oil is not available, use a lightweight petroleum-based oil. Thoroughly clean cylinder after honing using soap and hot water. Dry with compressed air; then immediately apply oil to the cylinder bore. If the bore is severely damaged or gouged, replace the cylinder.



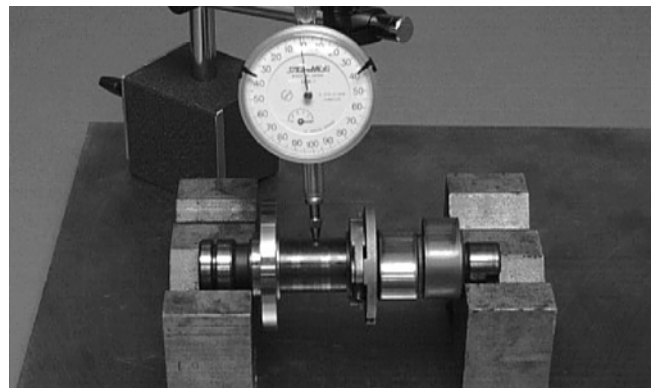
CC390D

4. If any measurement exceeds the limit, replace the cylinder and piston.

### Measuring Camshaft Runout

■ **NOTE:** If the camshaft is out of tolerance, it must be replaced.

1. Place the camshaft on a set of V blocks; then position the dial indicator contact point against the shaft and zero the indicator.



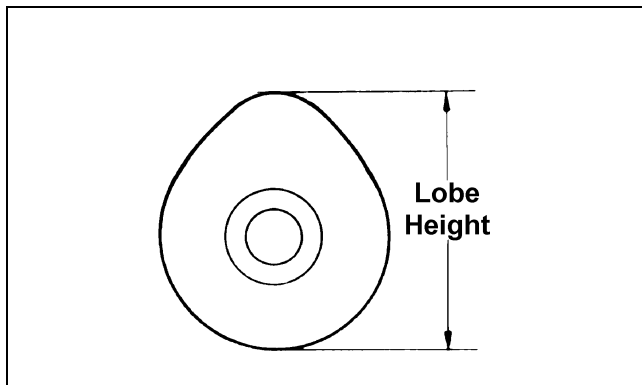
CC283D

2. Rotate the camshaft and note runout; maximum tolerance must not exceed specifications.

### Measuring Camshaft Lobe Height

1. Using a calipers, measure each cam lobe height.





ATV1013A

2. The lobe heights must not exceed minimum specifications.

### Inspecting Camshaft Bearing Journal

1. Inspect the bearing journal for scoring, seizure marks, or pitting.
2. If excessive scoring, seizure marks, or pitting is found, the cylinder head assembly must be replaced.

### Measuring Camshaft to Cylinder Head Clearance

1. Remove the adjuster screws and jam nuts.

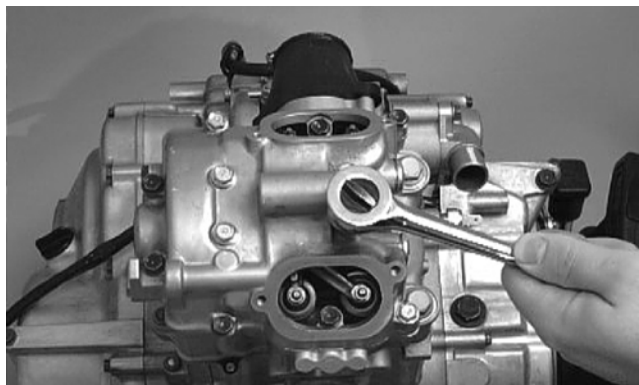


CC005D

2. Place a strip of plasti-gauge in each of the camshaft lands in the cylinder head.
3. Place the valve cover on the cylinder head and secure with the valve cover cap screws. Tighten securely.

■ **NOTE:** Do not rotate the camshaft when measuring clearance.

4. Remove the cap screws securing the valve cover to the cylinder; then remove the valve cover and camshaft.



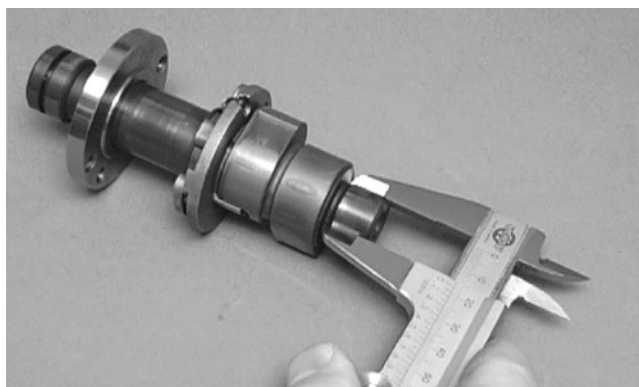
CC003D

5. Match the width of the plasti-gauge with the chart found on the plasti-gauge packaging to determine camshaft to cylinder head and valve cover clearance.



CC145D

6. If clearance is excessive, measure the journals of the camshaft.

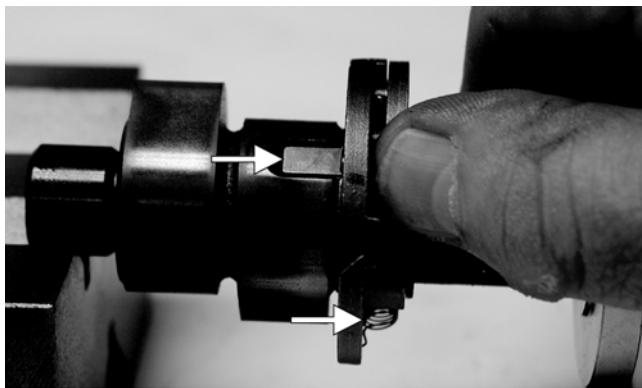


CC287D

■ **NOTE:** If the journals are worn, replace the camshaft; then measure the clearance again. If it is still out of tolerance, replace the cylinder head.

### Inspecting Camshaft Spring/Drive Pin

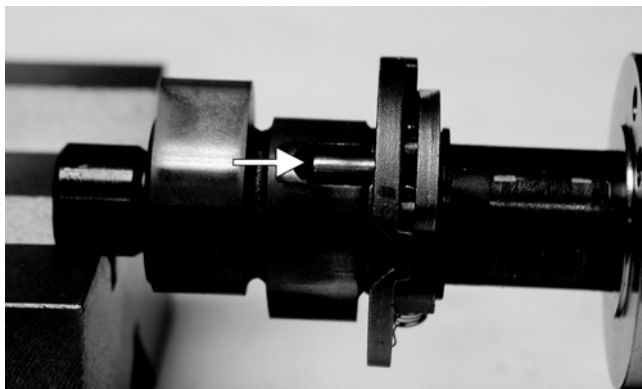
1. Inspect the spring and drive pin for damage.



CF061A



CC039D



CF060A

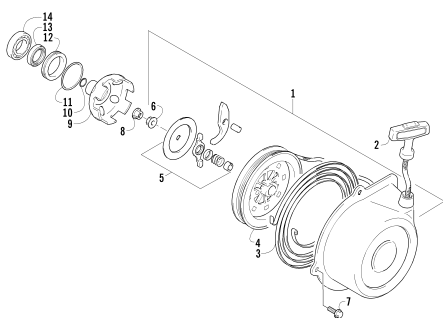
2. If damaged, the camshaft must be replaced.

## Servicing Left-Side Components

### RECOIL STARTER

#### KEY

1. Recoil Starter Assy
2. Rope Assy
3. Spiral Spring
4. Reel
5. Ratchet Assy
6. Nut
7. Cap Screw
8. Nut
9. Starter Cup
10. O-Ring
11. O-Ring
12. Spacer
13. Oil Seal
14. Bearing



0737-764

### Removing/Disassembling

1. Remove the cap screws securing the recoil starter assembly to the left-side cover; then remove the starter.

**⚠ WARNING**

During the disassembly procedure, continuous downward pressure must be exerted on the reel so it does not accidentally disengage and cause injury.

2. Rotate the reel counterclockwise until the notch of the reel is near the rope guide in the case. Guide the rope into the notch and slowly allow the reel to retract until all spiral spring tension is released.

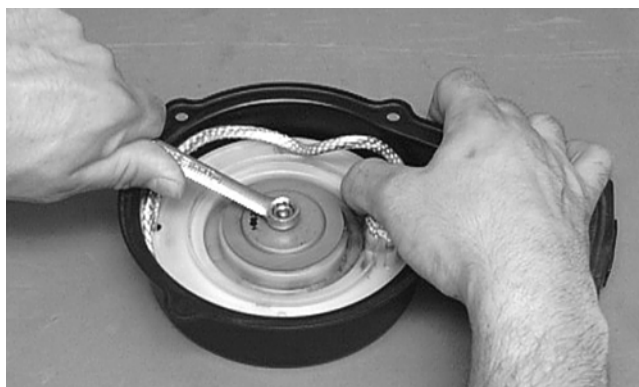


B600D

**⚠ CAUTION**

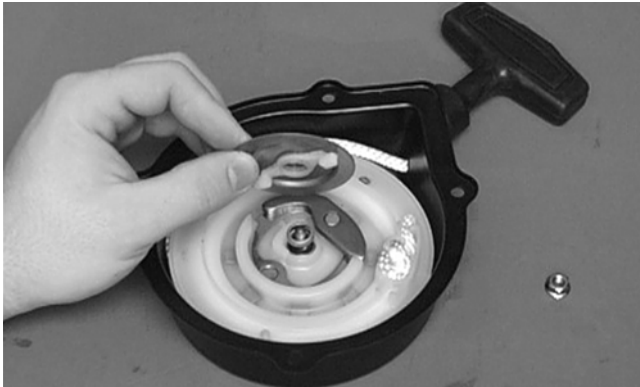
During the disassembly procedure, make sure all spring tension is released before continuing.

3. Remove the nut.



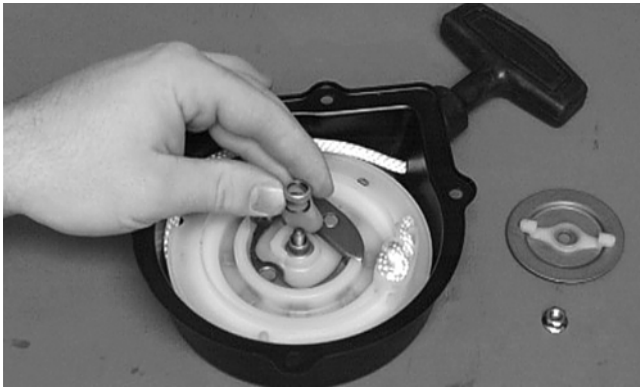
B601D

4. Slowly release the friction plate and lift the plate with ratchet guide free of the recoil case; then remove the ratchet guide from the friction plate.



B602D

5. Remove the spring, collar, and friction spring.



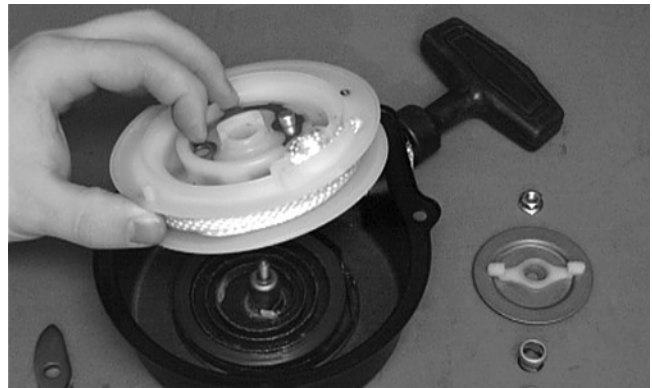
B603D

6. Remove the ratchet and account for the pin.



B604D

7. Carefully lift the reel from the case making sure the spiral spring does not accidentally disengage from the case.



B605D

### **WARNING**

**Care must be taken when lifting the reel free of the case. Wear safety glasses to avoid injury.**

8. Remove the protective cover from the starter handle and pull the rope out of the handle; then untie the knot in the rope and remove the handle.

**3**

■ **NOTE:** Do not remove the spiral spring unless replacement is necessary. It should be visually inspected in place to save time. If replacement is necessary, follow steps 9-10.

9. Remove the spring from the case by lifting the spring end up and out. Hold the remainder of the spring with thumbs and alternately release each thumb to allow the spring to gradually release from the case.

10. Unwind the rope from the reel and remove the rope.

### **Cleaning and Inspecting**

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all components.
2. Inspect the springs and ratchet for wear or damage.
3. Inspect the reel and case for cracks or damage.
4. Inspect the shaft for wear, cracks, or damage.
5. Inspect the rope for breaks or fraying.
6. Inspect the spiral spring for cracks, crystallization, or abnormal bends.
7. Inspect the handle for damage, cracks, or deterioration.



## Assembling/Installing

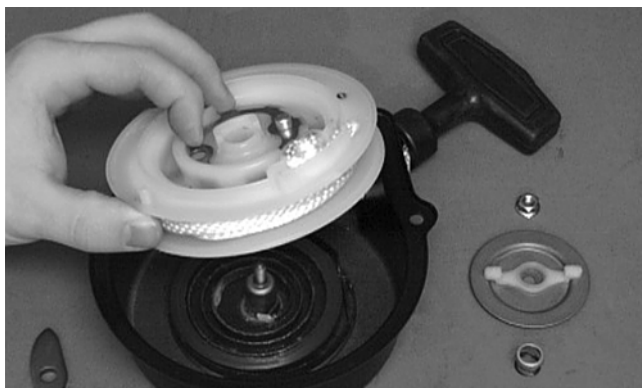
1. If removed, insert the spiral spring into the case with the outer end of the spring around the mounting lug in the case; then wind it in a counterclockwise direction until the complete spring is installed.

■ **NOTE:** The spiral spring must seat evenly in the recoil case.



B606D

2. Insert the rope through the hole in the reel and tie a knot in the end; then wrap the rope counterclockwise around the reel leaving approximately 50 cm (20 in.) of rope free of the reel.
3. Apply low-temperature grease to the spring and hub.
4. Thread the end of the rope through the guide hole of the case; then thread the rope through the handle and secure it with a double knot. Install the protective cover into the handle.
5. Align the inner hook of the spiral spring with the notch in the reel.



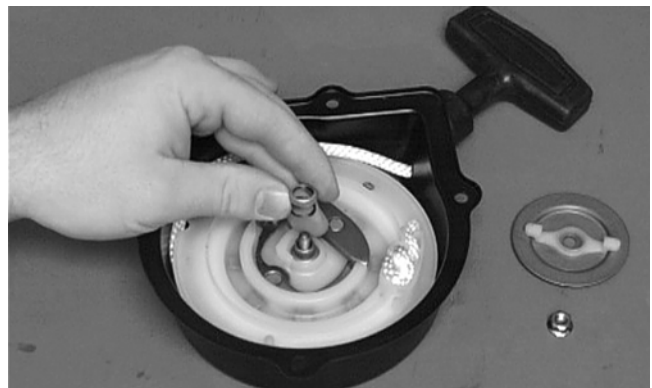
B605D

6. Install the ratchet making sure the end is properly installed on the reel.



B604D

7. Install the friction spring and the spring cover.



B603D

8. Install the friction plate with the ratchet guide fitting into the ratchet.



B602D

9. While pushing down on the reel, install the nut. Tighten securely.

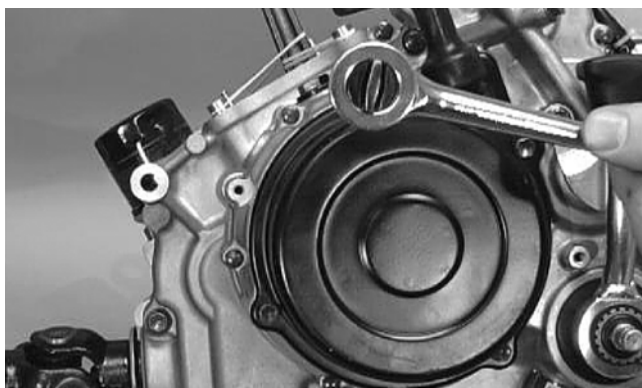


B601D

10. With the 50 cm (20 in.) of rope exposed, hook the rope in the notch of the reel.
11. Rotate the reel four turns counterclockwise; then release the rope from the notch and allow the rope to retract.
12. Pull the rope out two or three times to check for correct tension.

■ **NOTE:** Increasing the rotations in step 11 will increase spring tension.

13. Place the recoil starter assembly into position on the left-side cover; then tighten the cap screws to specifications.



CC039D

## Servicing Right-Side Components

■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

### INSPECTING CENTRIFUGAL CLUTCH SHOE

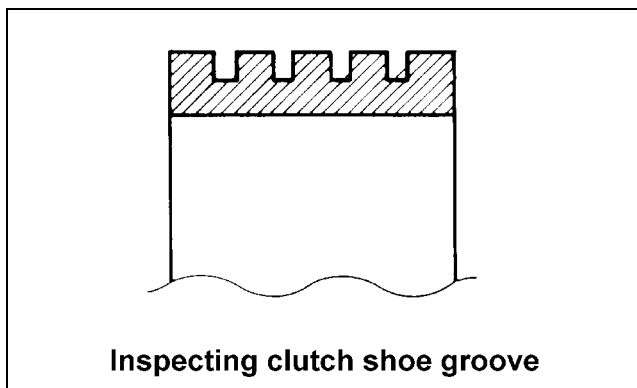
1. Inspect the clutch shoes for uneven wear, chips, cracks, or discoloration. If any shoe is damaged, replace the complete set.
2. Inspect the clutch shoes for wear or damage. If any shoe is worn to the bottom of the groove, replace the complete set.



#### CAUTION

Always replace the clutch shoes as a complete set or severe imbalance could occur.

3



ATV1014

### INSPECTING CLUTCH HOUSING

1. Inspect the clutch housing for burns, grooving, cracks, or uneven wear.
2. If the housing is damaged in any way, the housing must be replaced.

### INSPECTING PRIMARY ONE-WAY DRIVE

1. Insert the drive into the clutch housing.
2. Rotate the inner race by hand and verify the inner race rotates only one direction.
3. If the inner race is locked in place or rotates both directions, the drive assembly must be replaced.

## INSPECTING OIL PUMP

1. Inspect the pump for damage.
2. It is inadvisable to remove the screw securing the pump halves. If the oil pump is damaged, it must be replaced.



CC446D

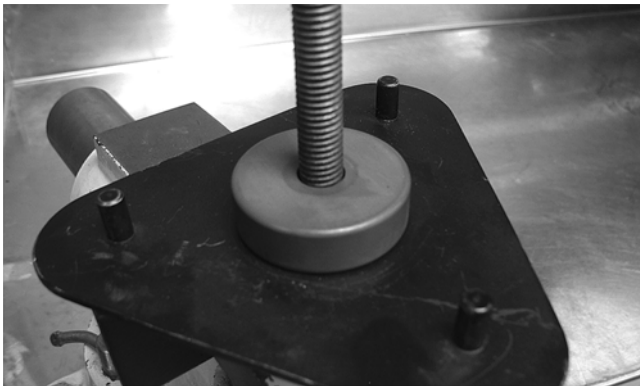
## DRIVEN PULLEY ASSEMBLY

### Disassembling

#### **WARNING**

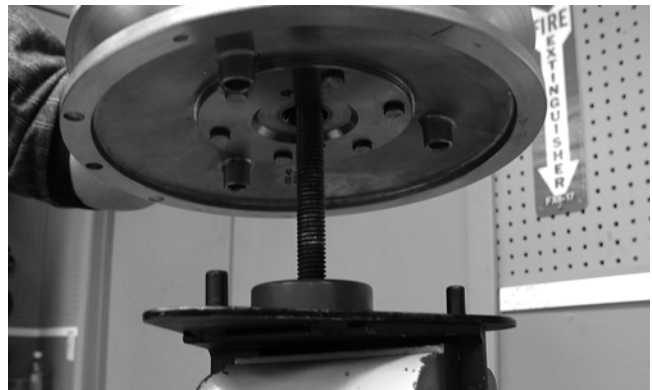
This procedure involves relaxing a compressed spring assembly. **DO NOT** attempt disassembling without the proper tools.

1. Secure Driven Pulley Compressor (p/n 0444-121) in a suitable holding fixture such as a bench vise; then remove the wing nut, holding handle, flat washer, and pilot bushing leaving the large spacer on the compressor tool base.



CD047

2. Place the driven pulley assembly onto the compressor tool base engaging the dowel pins into appropriate holes in the fixed face of the assembly.



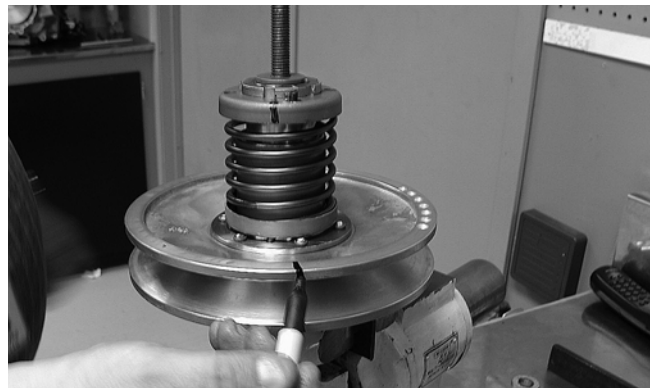
CD048

3. Install the pilot bushing with the machined end directed down; then fit the bushing into the pulley hub.



CD067

4. Using a suitable marking pen, make alignment marks on the fixed face spring holder and both pulley faces.



CD049

5. Place the holding handle on the spring holder fitting the two dowel pins into the spring holder face; then install a flat washer and the wing nut. Turn the wing nut down until resistance is felt.

■ **NOTE:** Do not use the wing nut to compress the spring further.





CD050

**⚠ WARNING**

The spring assembly is under pressure. Extreme care must be taken when relaxing the spring. Always wear safety glasses. Use proper tools only.

6. Using a spanner and suitable breaker bar, loosen the notched-ring nut; then spin the nut free of the hub.



CD051

7. Firmly hold the handle and slowly turn the wing nut counterclockwise to relax the spring.

■ **NOTE:** There will be a tendency for the handle to rotate clockwise approximately  $\frac{1}{4}$  turn as the spring holder clears the flats or hub. This is due to a slight counterclockwise preload on the spring.



CD052

8. Release the preload slowly; then continue to relax the spring until the wing nut is flush with the end of the threads.
9. Firmly holding the spring and spring holder, remove the wing nut; then remove the spring.



CD053

10. Using a thin pry-bar or screwdriver, work the movable face sleeve upward and free of the O-rings; then remove the sleeve.

**3**

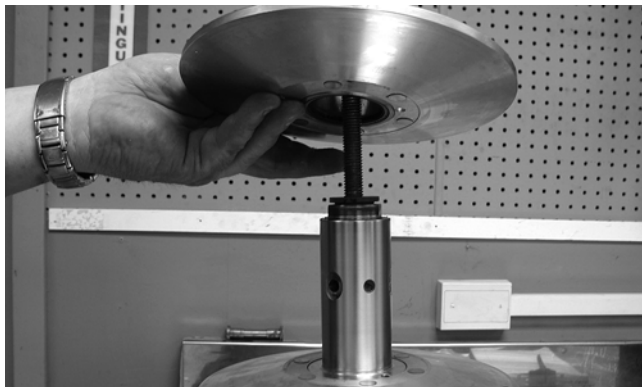


CD054

11. Remove the four pins and spacers from the cam slots in the movable face; then remove the movable face.



CF091



CD056

## Inspecting

1. Inspect the pulley faces for wear, galling, or grooving.
2. Inspect the O-rings on the movable face for nicks, tears, or swelling.



CF092A

3. Inspect two grease seals in the movable face for nicks, cuts, or damage.



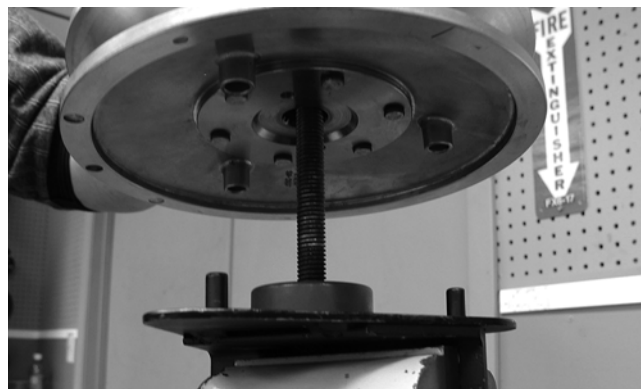
CF095A

4. Inspect the pins and bushings for wear, flat spots, looseness, or cracking.

## Assembling

1. Place the fixed face of the driven pulley on the pulley compressor base making sure the dowel pins are engaged in the appropriate holes in the pulley face.

■ **NOTE:** Make sure the spacer is on the base or damage to the fixed face will occur when the spring is compressed.



CD048

2. Apply multi-purpose grease to the O-rings and grease seals on the movable face; then install on the fixed face making sure the alignment marks are properly aligned.



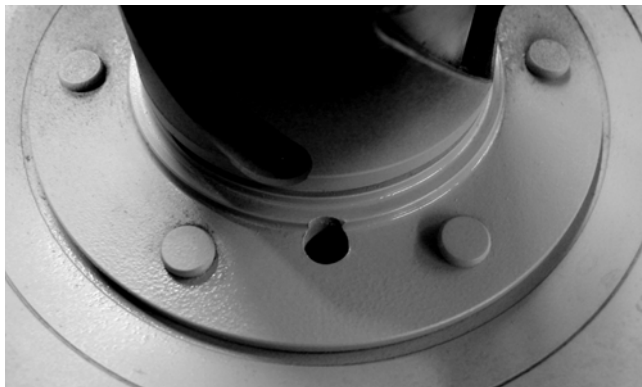
CD060

3. Install the four pins and spacers into the fixed face hub; then pack the cam slots in the movable face with multi-purpose grease.



CF095A

4. Install the movable face sleeve aligning the hole in the spring seat with the spring anchor hole in the movable face.



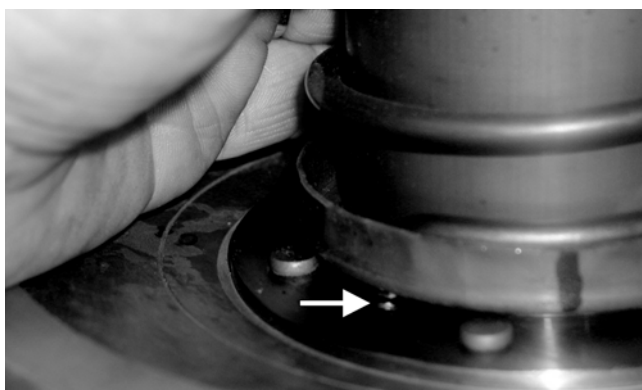
CF097

5. Install the spring over the hub and movable face sleeve; then insert the end of the spring through the sleeve and into the spring anchor hole in the movable face.



CD052

8. Compress the spring until the spring holder nears the threads on the fixed face hub; then using the handle, wind the spring holder counterclockwise to align the flats of the spring holder and hub.



CF089A

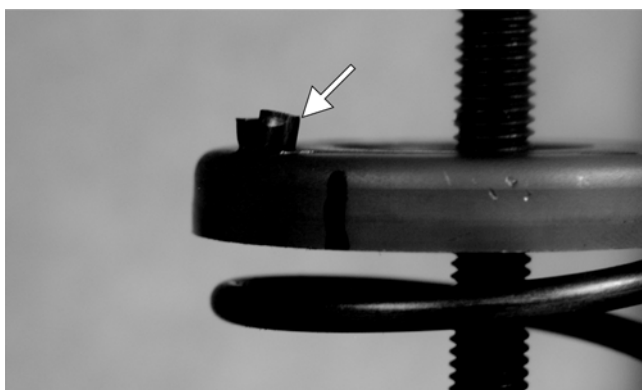
6. Place the spring holder on the spring engaging the spring end with the appropriate anchor hole.



CD052A

9. Continue compressing the spring while guiding the spring holder onto the hub. When a slight resistance is felt, stop turning the wing nut.

10. Install the nut (threads coated with red Loctite #271); then tighten the nut to specification using the spanner and a torque wrench.



CF087A

7. Assemble the notched-ring nut, spring holding handle, one flat washer, and the wing nut in order on the pulley compressor bolt; then thread the wing nut onto the bolt.



CD066

11. Remove the wing nut, washer, and holding handle; then remove the driven pulley from the pulley compressor.

3



## Servicing Center Crankcase Components

■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

### SECONDARY GEARS

■ **NOTE:** When checking and correcting secondary gear backlash and tooth contact, the universal joint must be secured to the front shaft or false measurements will occur.

### Checking Backlash

■ **NOTE:** The rear shaft and bevel gear must be removed for this procedure. Also, always start with the original shims on the rear shaft.

1. Place the left-side crankcase cover onto the left-side crankcase half to prevent runout of the secondary transmission output shaft.
2. Install the secondary driven output shaft assembly onto the crankcase.
3. Mount the dial indicator so the tip is contacting a tooth on the secondary driven bevel gear.
4. While rocking the driven bevel gear back and forth, note the maximum backlash reading on the gauge.
5. Acceptable backlash range is 0.05-0.33 mm (0.002-0.013 in.).

### Correcting Backlash

■ **NOTE:** If backlash measurement is within the acceptable range, no correction is necessary.

1. If backlash measurement is less than specified, remove an existing shim, measure it, and install a new thinner shim.
2. If backlash measurement is more than specified, remove an existing shim, measure it, and install a thicker shim.

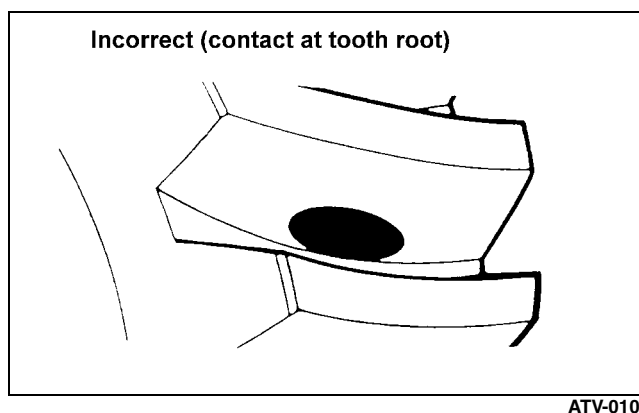
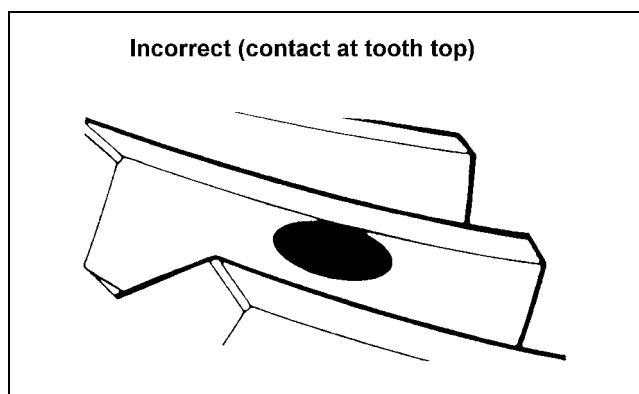
■ **NOTE:** Continue to remove, measure, and install until backlash measurement is within tolerance. Note the following chart.

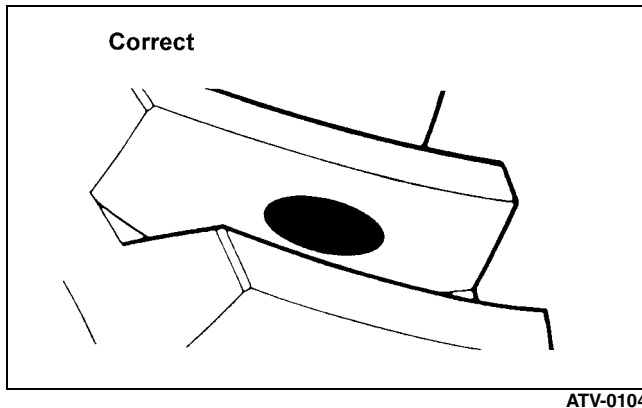
| Backlash Measurement              | Shim Correction         |
|-----------------------------------|-------------------------|
| Under 0.05 mm (0.002 in.)         | Decrease Shim Thickness |
| At 0.05-0.33 mm (0.002-0.013 in.) | No Correction Required  |
| Over 0.33 mm (0.013 in.)          | Increase Shim Thickness |

### Checking Tooth Contact

■ **NOTE:** After correcting backlash of the secondary driven bevel gear, it is necessary to check tooth contact.

1. Remove the secondary driven output shaft assembly from the left-side crankcase half.
2. Clean the secondary driven bevel gear teeth of old oil and grease residue.
3. Apply a thin, even coat of a machinist-layout dye to several teeth of the gear.
4. Install the secondary driven output shaft assembly.
5. Rotate the secondary driven bevel gear several revolutions in both directions.
6. Examine the tooth contact pattern in the dye and compare the pattern to the illustrations.





## Correcting Tooth Contact

■ **NOTE:** If tooth contact pattern is comparable to the correct pattern illustration, no correction is necessary.

1. If tooth contact pattern is comparable to an incorrect pattern, correct tooth contact according to the following chart.

| Tooth Contact    | Shim Correction         |
|------------------|-------------------------|
| Contacts at Top  | Decrease Shim Thickness |
| Contacts at Root | Increase Shim Thickness |

■ **NOTE:** To correct tooth contact, steps 1 and 2 (with NOTE) of “Correcting Backlash” must be followed and the above “Tooth Contact/Shim Correction” chart must be consulted.

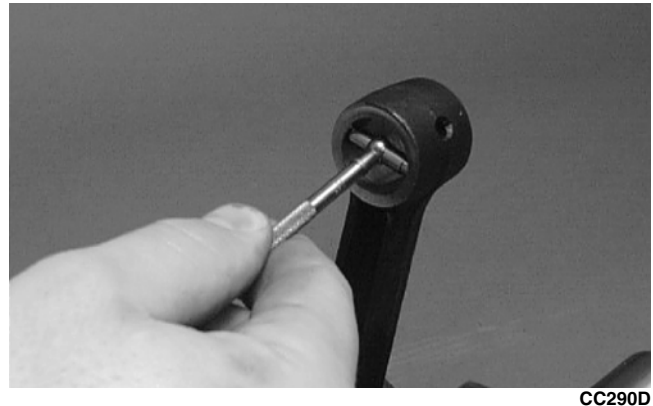
**⚠ CAUTION**

After correcting tooth contact, backlash must again be checked and corrected (if necessary). Continue the correcting backlash/correcting tooth contact procedures until they are both within tolerance values.

## CRANKSHAFT ASSEMBLY

### Measuring Connecting Rod (Small End Inside Diameter)

1. Insert a snap gauge into the upper connecting rod small end bore; then remove the gauge and measure it with micrometer.



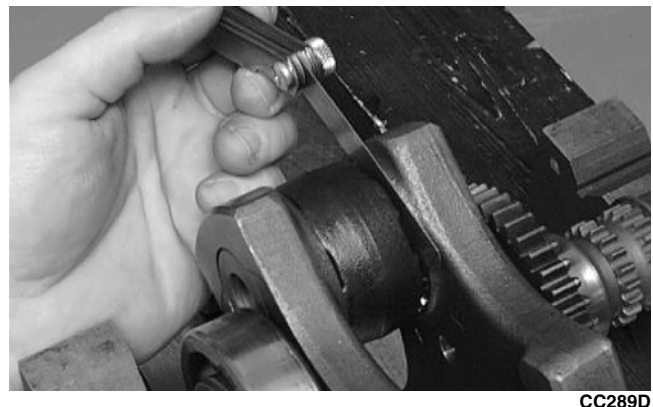
2. Maximum diameter must not exceed specifications.

### Measuring Connecting Rod (Small End Deflection)

1. Place the crankshaft on a set of V-blocks and mount a dial indicator and base on the surface plate. Position the indicator contact point against the center of the connecting rod small end journal.
2. Zero the indicator and push the small end of the connecting rod away from the dial indicator.
3. Maximum deflection must not exceed specifications.

### Measuring Connecting Rod (Big End Side-to-Side)

1. Push the lower end of the connecting rod to one side of the crankshaft journal.
2. Using a feeler gauge, measure the gap between the connecting rod and crankshaft journal.



3. Acceptable gap range must be within specifications.

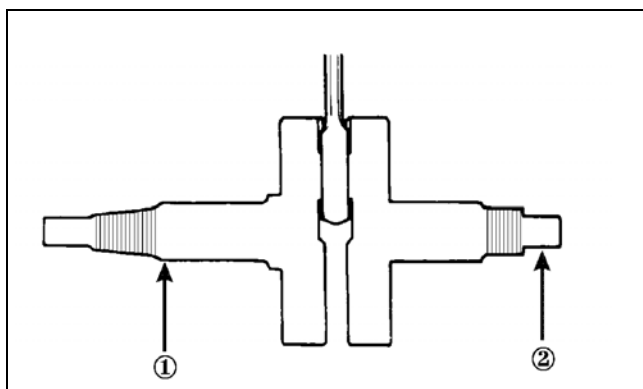
**3**

## Measuring Connecting Rod (Big End Width)

1. Using a calipers, measure the width of the connecting rod at the big-end bearing.
2. Acceptable width range must be within specifications.

## Measuring Crankshaft (Runout)

1. Place the crankshaft on a set of V blocks.
2. Mount a dial indicator and base on the surface plate. Position the indicator contact at point 1 of the crankshaft.



3. Zero the indicator and rotate the crankshaft slowly.

### CAUTION

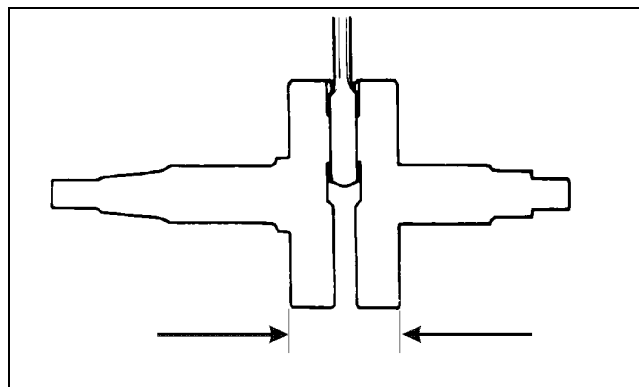
Care should be taken to support the connecting rod when rotating the crankshaft.

4. Maximum runout must not exceed specifications.

■ **NOTE:** Proceed to check runout on the other end of the crankshaft by positioning the indicator contact at point 2 and following steps 2-4.

## Measuring Crankshaft (Web-to-Web)

1. Using a calipers, measure the distance from the outside edge of one web to the outside edge of the other web.



2. Acceptable width range must be within specifications.

## COUNTERSHAFT

### CAUTION

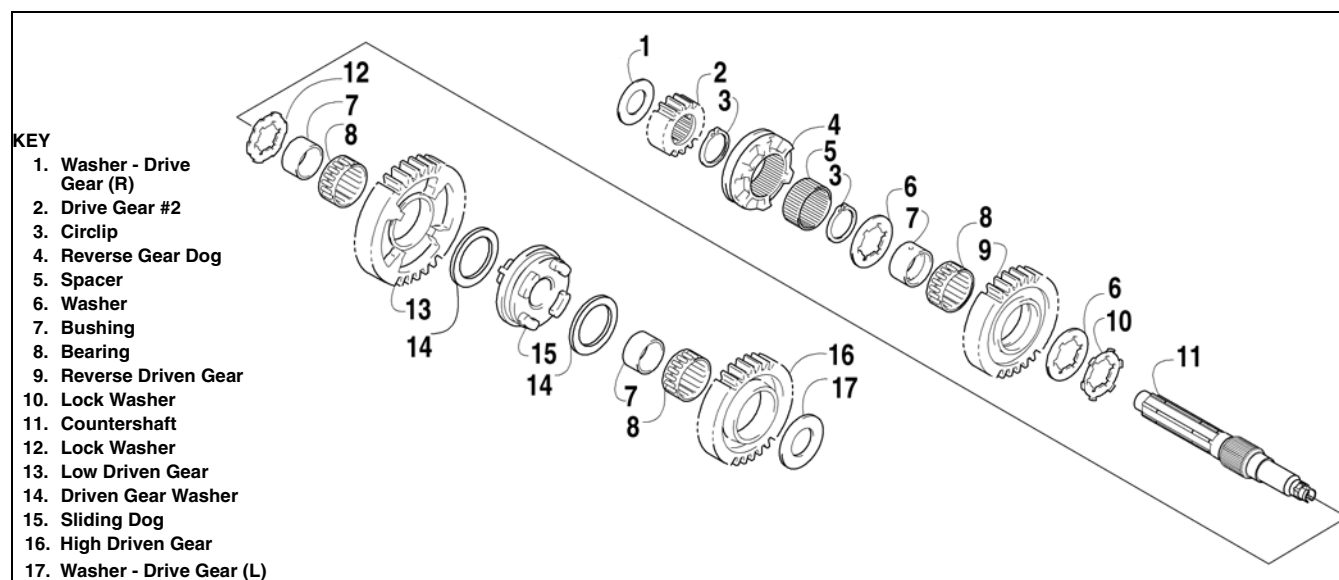
When disassembling the countershaft, care must be taken to note the direction each major component (dog, gear) faces. If a major component is installed facing the wrong direction, transmission damage may occur and/or the transmission will malfunction. In either case, complete disassembly and assembly will be required.

## Disassembling

1. Remove drive gear #2; then remove the circlip securing the reverse gear dog.
2. Remove the reverse gear dog; then remove the circlip securing the reverse driven gear.
3. Remove the reverse driven gear and account for the washer, bushing, and bearing.
4. Remove the low driven gear washer and lock washers; then remove the low driven gear. Account for the bushing and bearing.
5. Remove the washer; then remove the circlip securing the sliding dog. Remove the sliding dog.
6. Remove the high driven gear circlip; then remove the high driven gear. Account for the washer, bushing, and bearing.



## Assembling



738-929A

3

1. Place the high driven gear onto the countershaft making sure the bearing, bushing, and washer are properly positioned. Secure with the circlip.
2. Place the sliding dog onto the countershaft; then secure with the circlip. Place the washer next to the circlip.
3. Place the low driven gear onto the countershaft making sure the bearing and bushing are properly positioned; then place the lock washers and washer onto the shaft.
4. Place the reverse driven gear onto the countershaft making sure the bearing, bushing, and washer are properly positioned; then secure with the circlip.
5. Place the reverse gear dog onto the countershaft; then secure with the circlip.
6. Place drive gear #2 onto the countershaft.

■ **NOTE:** When installing the countershaft assembly, account for the washer on each end of the shaft.



CC686

■ **NOTE:** The beveled side of the secondary drive gear must face upward.

2. Apply red Loctite #271 to the threads of the output shaft; then secure with the nut. Tighten nut to specifications; then using a punch, peen the nut.

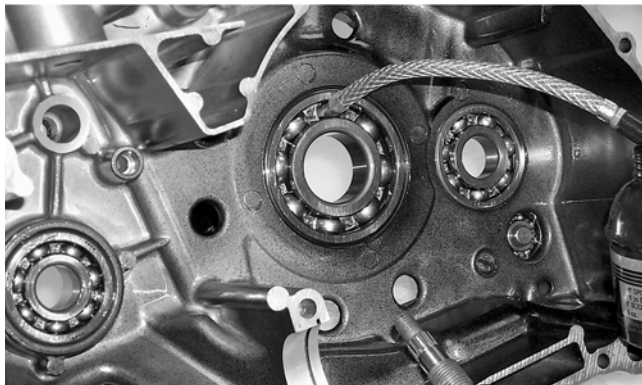


CC687

## Assembling Crankcase Half

1. Install the output shaft assembly into the crankcase making sure the two gears, shim, washer, and nut are properly sequenced.

3. Apply a liberal amount of engine oil to the crankshaft bearing. Using a propane torch, heat the bearing until the oil begins to smoke; then slide the crankshaft assembly into place.

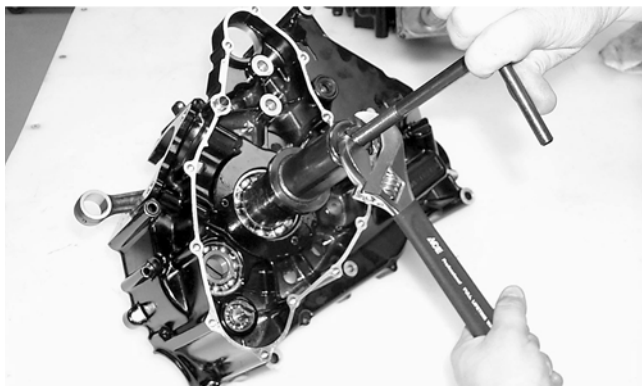


CC688



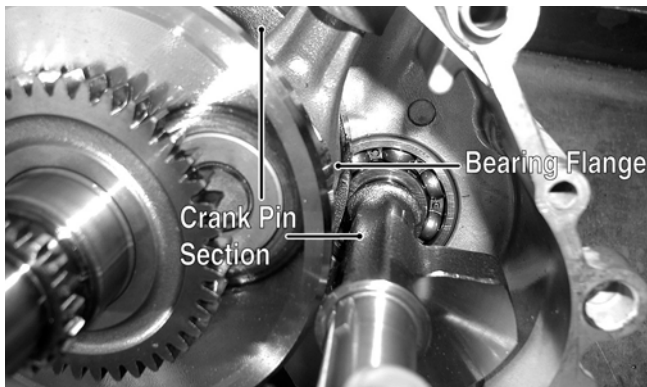
CC689

■ **NOTE:** If heating the bearing is not possible, the crankshaft can be installed using a crankshaft installing tool.



CC690

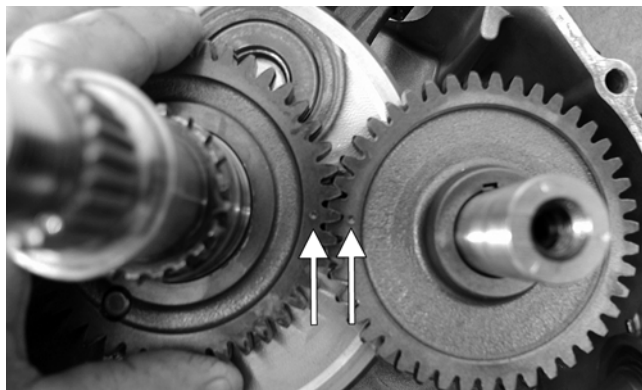
4. Install the crank balancer.



CD832B

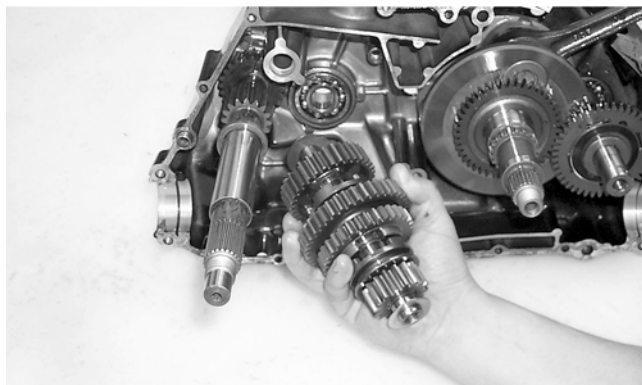
■ **NOTE:** It will be necessary to rotate the crank balancer until the counterweight is facing away from the crankshaft; then rotate the crankshaft clockwise into the journal area to allow the crank balancer to be fully seated.

5. Place the key into the crank balancer keyway; then install the crank balancer gear making sure the alignment dots on the crank balancer gear and the crankshaft gear align.



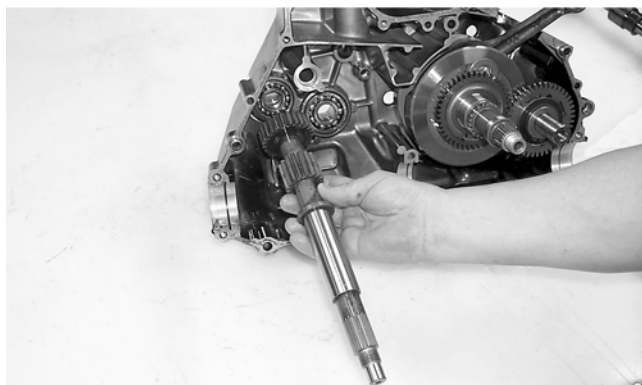
CD826A

6. Place a washer on each end of the countershaft assembly; then install the assembly.



CC674

7. Install the driveshaft.



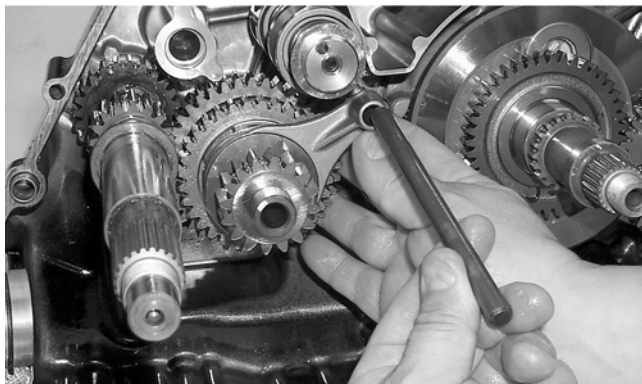
CC675

8. Place a washer on each end of the gear shift shaft; then install the shaft assembly making sure the two holes on the end of the shaft are positioned vertically.



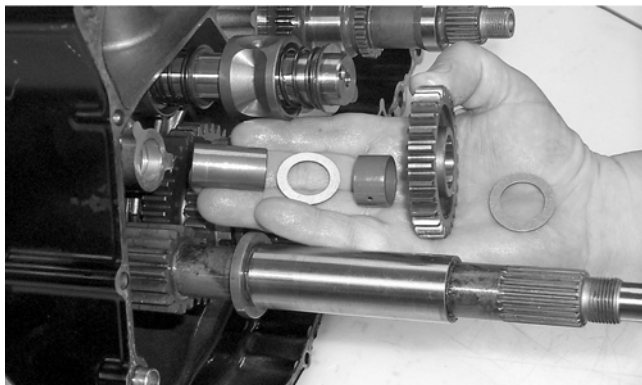
9. Insert the two shift forks into the sliding dogs noting the direction of the tabs from disassembling; then install the shift fork shaft.

■ **NOTE:** Make sure the shift fork tabs face upward and that they are properly seated into the shift cams.



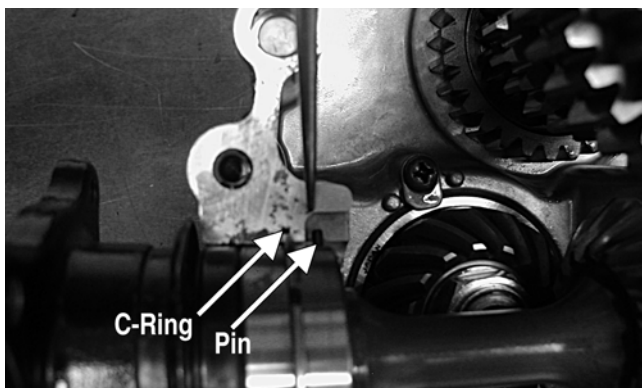
CC669

10. Install the reverse idler gear assembly noting the positioning of the two washers, gear, bushing, and shaft.



CC668

11. Install the front and rear secondary driven shaft assemblies into the left side of the crankcase making sure the bearing locating pins are facing upward and the bearing C-ring is fully seated in the crankcase.



CD268A

12. Place the oil strainer into position; then secure with the two screws.



CC682

13. Place the oil strainer cap into position making sure the O-ring is in position; then secure the cap with cap screws. Tighten securely.

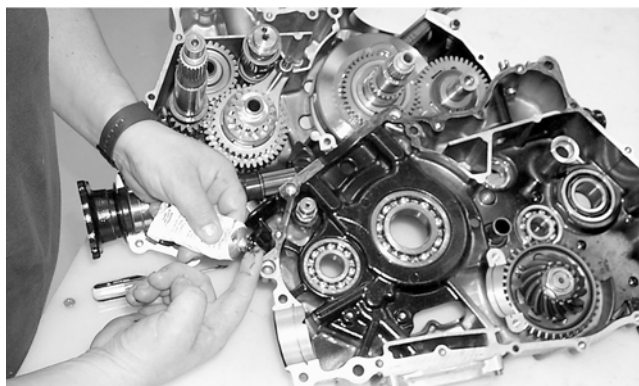


CC681

3

## Joining Crankcase Halves

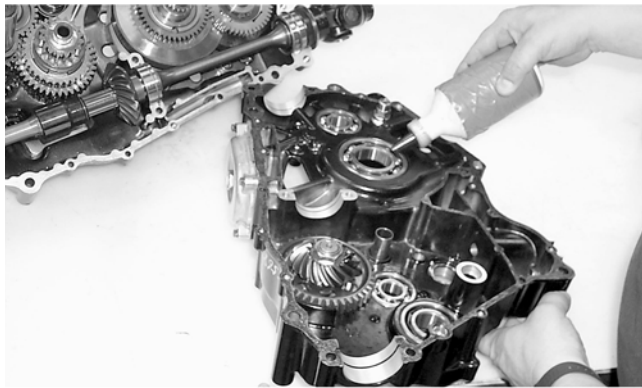
1. Apply High-Temp Sealant (p/n 0636-069) to the left-side mating surface.



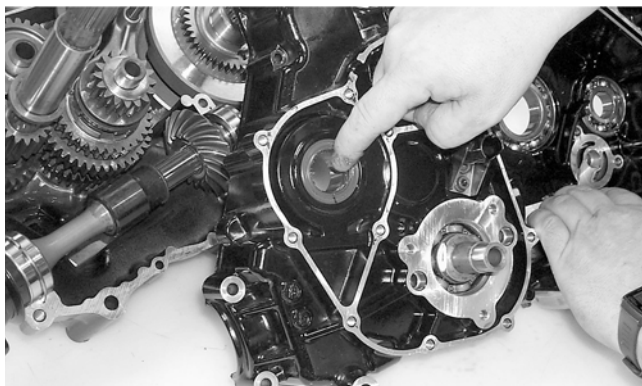
CC693

2. Lightly oil all bearings and grease all shafts in the right-side crankcase.





CC694



CC696

3. Using a propane torch, heat the right-side crankshaft bearing until the oil begins to smoke; then join the two crankcase halves.



CC695

4. Using a plastic mallet, lightly tap the case halves together until cap screws can be installed.
5. From the right side, install the 8 mm cap screws; then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

6. From the left side, install the remaining 8 mm cap screws (two inside the case); then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

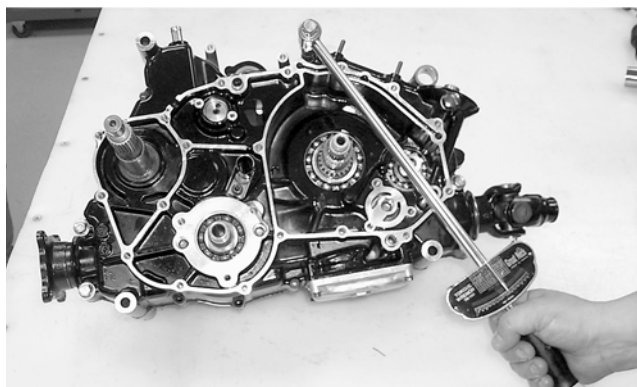
7. From the left side, install the eight case half 6 mm cap screws; then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

8. From the right side, install the 6 mm cap screws; then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

9. In a crisscross/case-to-case pattern, tighten the 8 mm cap screws (from steps 5-6) until the halves are correctly joined; then tighten to specifications.



CC697

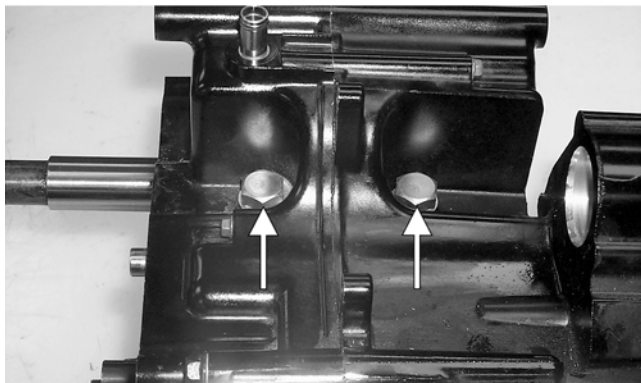
■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

10. In a crisscross/case-to-case pattern, tighten the 6 mm cap screws (from steps 7-8) to specifications.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

11. Using a liberal amount of grease, assemble the shift cam stoppers; then install them into the top of the engine.

■ **NOTE:** The grease will hold the springs and cam stoppers in position while installing the assemblies into the engine.



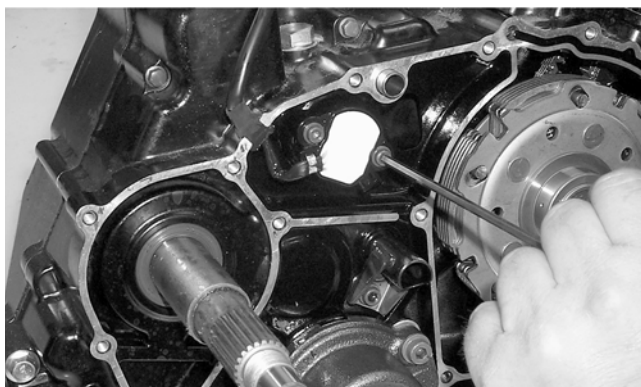
CC661A

### AT THIS POINT

After completing center crankcase components, proceed to Installing Right-Side Components, to Installing Left-Side Components, and to Installing Top-Side Components.

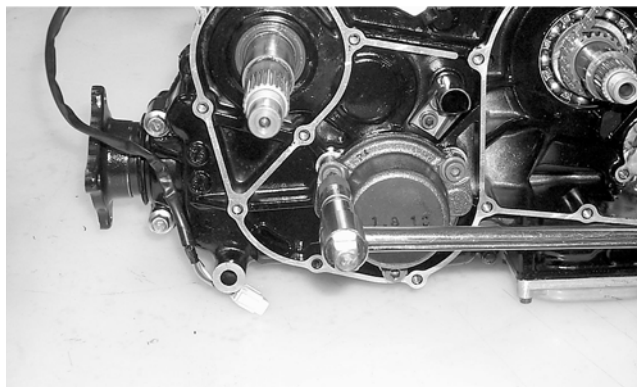
## Installing Right-Side Components

1. Install the shift indicator sending unit making sure the two neutral contact pins and the two springs are properly positioned. Tighten the Allen-head screws securely.



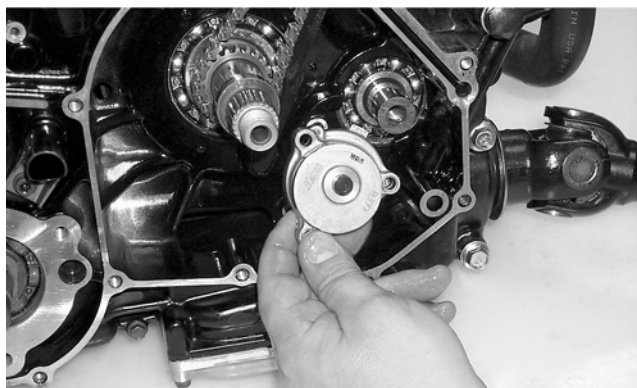
CC602

2. Install the secondary shaft bearing housing making sure the two alignment pins are properly positioned. Tighten the Allen-head screws securely.



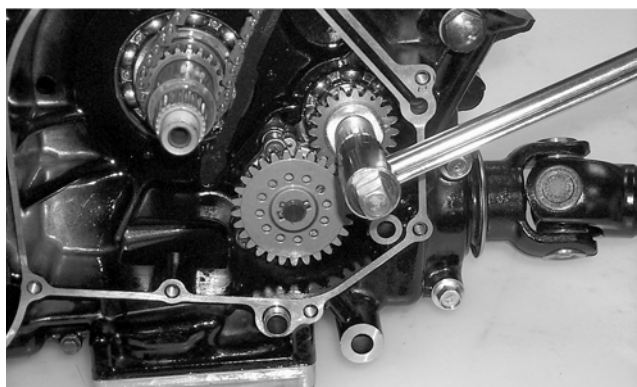
CC711

3. Install the oil pump onto the engine; then tighten the Phillips-head screws securely.



CC613

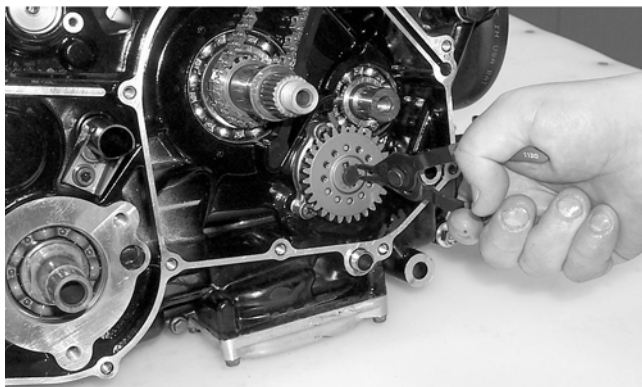
4. Install the oil pump drive gear spacer onto the crank balancer shaft. Grease the pin and insert it into the shaft; then install the drive gear making sure the raised side of the gear is facing toward the inside. Secure the gear with the cap screw (threads coated with red Loctite #271) and the washer. Tighten the cap screw to specifications.



CC712

5. Grease the driven gear pin and insert it into the oil pump shaft; then install the driven gear (noting the direction of the sides of the gear from removing). Secure with a snap ring.





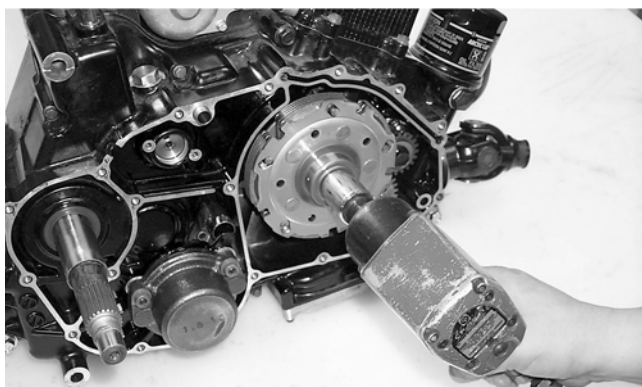
CC609

■ **NOTE:** When installed correctly, the sides of the drive and driven gears will be flush with each other.

6. Install the clutch shoe assembly and secure with the washer (with the flat side facing the assembly as noted in removing) and the nut (threads coated with red Loctite #271). Tighten to specifications.

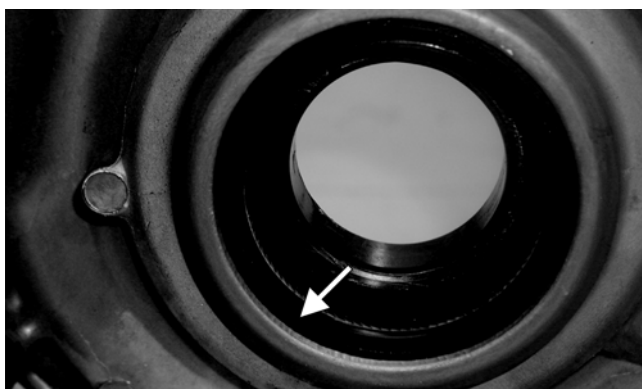
**⚠ CAUTION**

Care must be taken that the directional washer be installed correctly and note that the nut has left-hand threads.



CC604

7. Lightly grease the clutch housing seal; then insert the left fixed drive spacer.

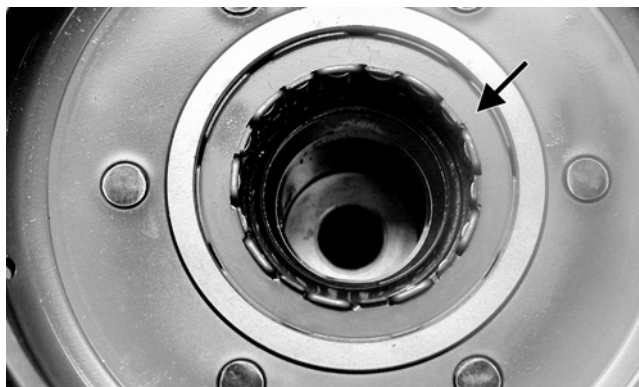


CF088A



CF086

8. Install the clutch cover alignment pins into the crankcase, apply oil to the cover gasket, and install the gasket onto the crankcase.
9. Apply grease to the outer edges of the clutch housing; then from inside the clutch cover, install the clutch housing into the cover using a rubber mallet.
10. Install the one-way clutch onto the clutch shoe assembly.



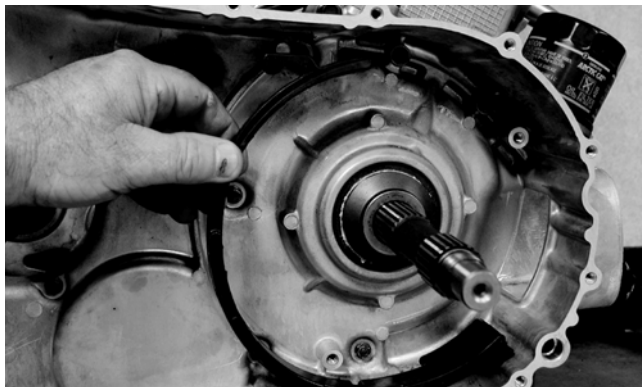
CF084A

**⚠ CAUTION**

When installed correctly, the green alignment dot (or the word OUTSIDE) on the one-way clutch DOES NOT SHOW.

11. Place the clutch cover/clutch housing assembly into position on the crankcase; then secure with the cap screws making sure the different-lengthed cap screws are in their proper location. Tighten to specifications.
12. Place the air intake plate cushion into position; then install the air intake plate. Tighten the cap screws (threads treated with a small amount of red Loctite #271) securely.



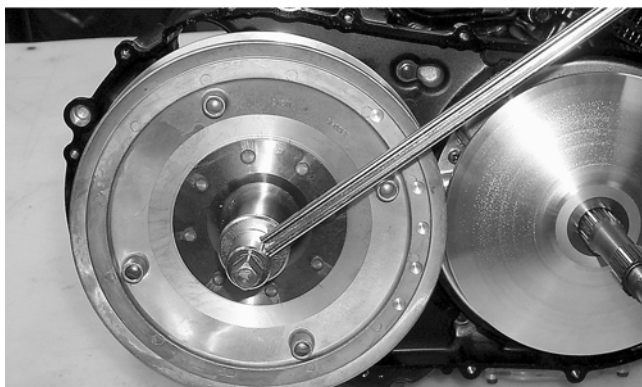


CD971



CD970

13. Place the driven pulley assembly into position and secure with the nut. Tighten to specifications.



CC726

14. Slide the fixed drive face onto the shaft.
15. Spread the faces of the driven pulley by pushing the inner face toward the engine while turning it counterclockwise; then when the faces are separated, insert a wedge (approximately 3/8 in. thick) between the faces. Release the inner face.



CC549

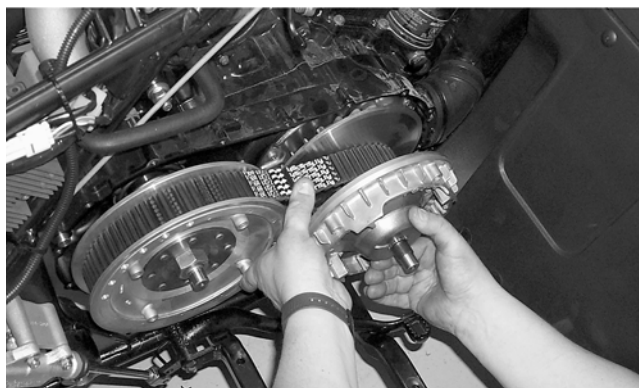
16. Place the V-belt into position on the driven pulley and over the front shaft.



CC550

- **NOTE:** The arrows on the V-belt should point forward.

17. Pinch the V-belt together near its center and slide the spacer and movable drive face onto the shaft. Secure the drive face with a nut (threads coated with red Loctite #271). Tighten the nut to specifications.



CC552

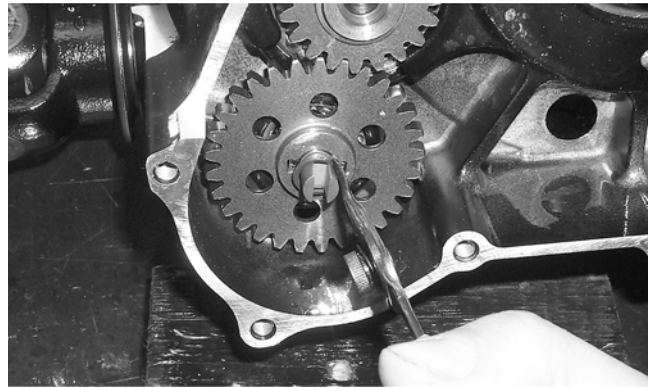
- **NOTE:** At this point, the wedge can be removed from between the driven pulley faces.

18. Rotate the V-belt and drive/driven assemblies until the V-belt is flush with the top of the driven pulley.

19. Place the V-belt cover gasket into position; then install the cover and secure with the cap screws making sure the different-lengthed cap screws are in their proper location. Tighten the cap screws to specifications.



CD083

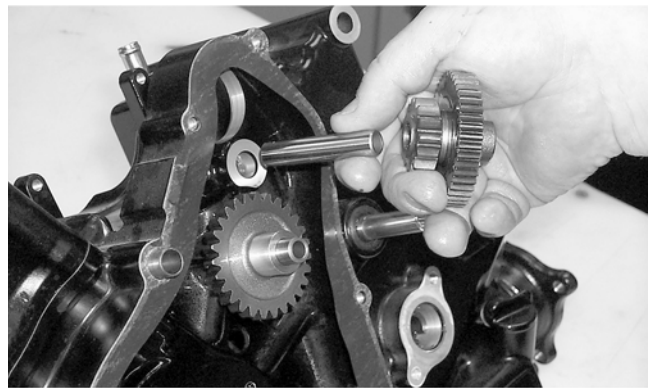


CC845

■ **NOTE:** The sharp side of the snap ring should be facing outward.

■ **NOTE:** Once the gears are secured, remove the oil passage plug from the crankcase.

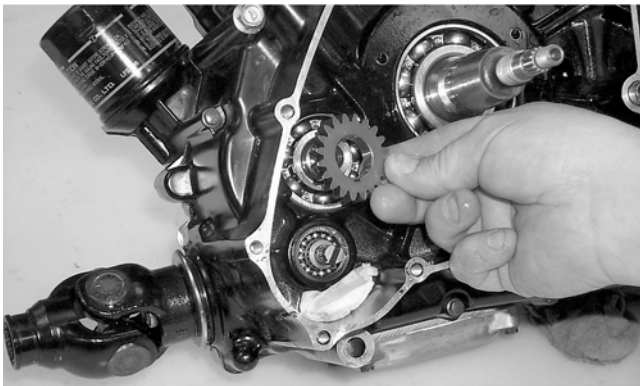
3. Install the two starter gear shafts; then install the two starter gears (with the beveled side of the intermediate gear facing inward as noted in removing).



CC636

■ **NOTE:** Plug the oil passage in the crankcase housing prior to installing the drive gear/driven gear assembly to prevent loss of an alignment pin.

1. Install the water pump drive gear alignment pin and the drive gear (with the flat side of the gear facing outward as noted in removing); then secure with the snap ring.



CC641

■ **NOTE:** The sharp side of the snap ring should be facing outward.

2. Install the water pump driven gear alignment pin and the driven gear (with the beveled side of the gear facing outward as noted in removing); then secure with the snap ring.

4. In order on the crankshaft, install a washer, ring gear, key, and the magneto rotor. Secure with the nut (threads coated with red Loctite #271). Tighten to specifications.

5. Lubricate the magneto cover gasket with fresh engine oil; then place it into position on the two dowel pins.

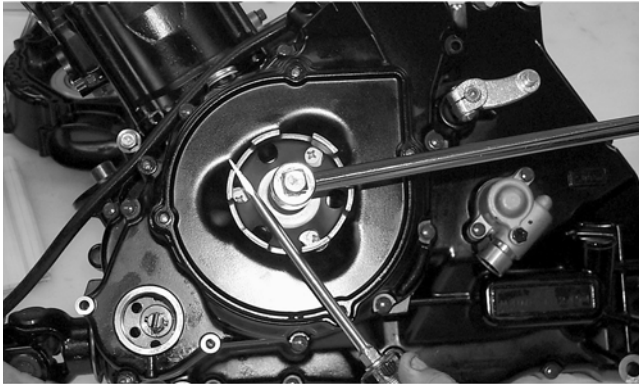


CC629

## Installing Left-Side Components

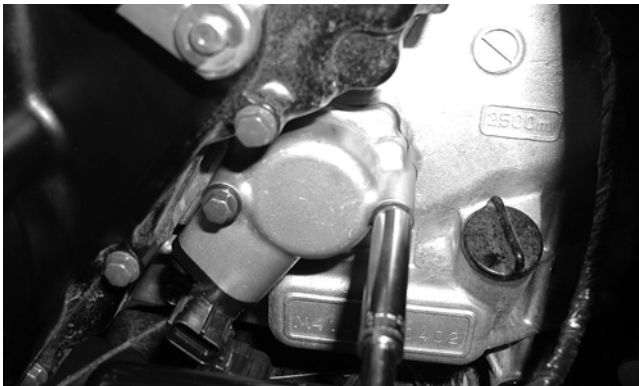


6. Install the magneto cover and secure with the cap screws. Tighten only until snug.
7. Place the starter cup into position on the crankshaft making sure a new, lubricated O-ring is inside the cup. Tighten the flange nut to specifications.



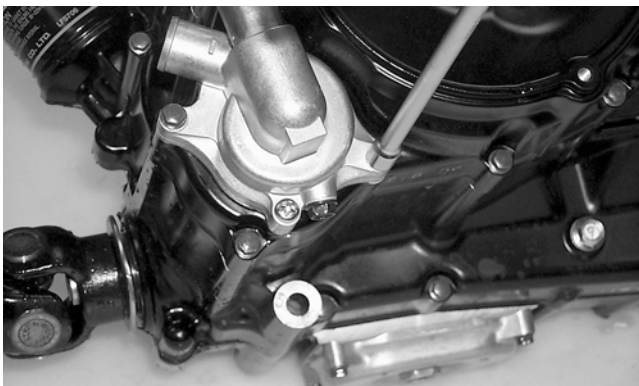
CC710

8. Tighten the cap screws (from step 6) to specifications.
9. Place the speed sensor housing and gasket into position and secure with the two cap screws. Tighten securely.



CD069

10. Place the water pump into position and secure with two cap screws. Tighten securely.

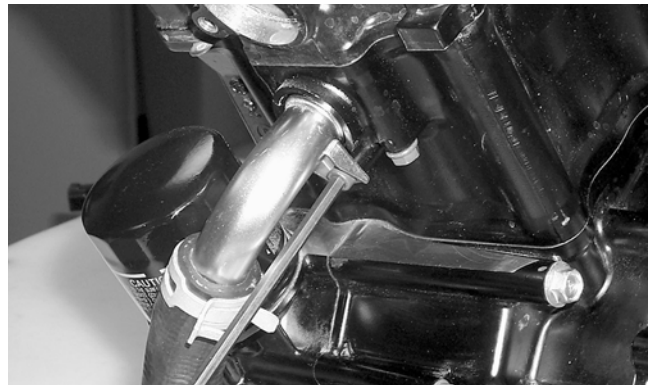


CC623

11. Install the crossover tube on the water pump and cylinder head making sure the O-ring is properly positioned.



CC619



CC620

12. Install the shift arm on the shift arm shaft making sure the scribed marks (from removing) are aligned. Tighten securely.
13. Place the gasket and recoil starter assembly into position on the left-side cover; then tighten four cap screws to specifications.

3

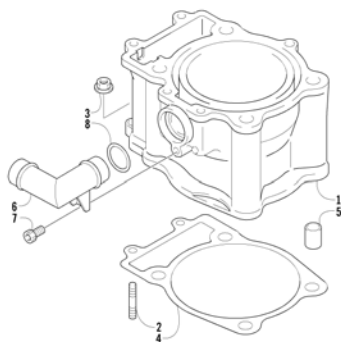


## Installing Top-Side Components

### A. Piston B. Cylinder

#### KEY

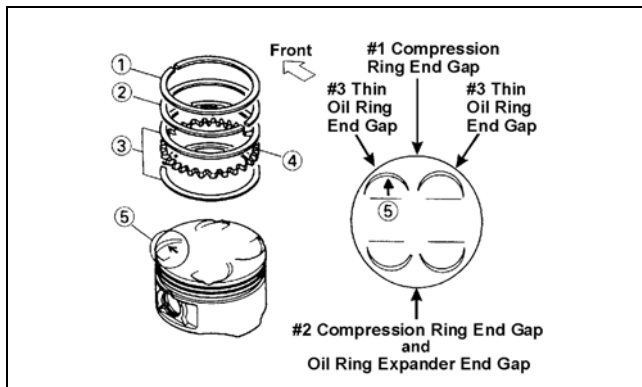
1. Cylinder
2. Stud Bolt
3. Nut
4. Cylinder Gasket
5. Pin
6. Water Hose Union
7. Cap Screw
8. O-Ring



0732-301

■ **NOTE:** If the piston rings were removed, install them in this sequence.

- A. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.

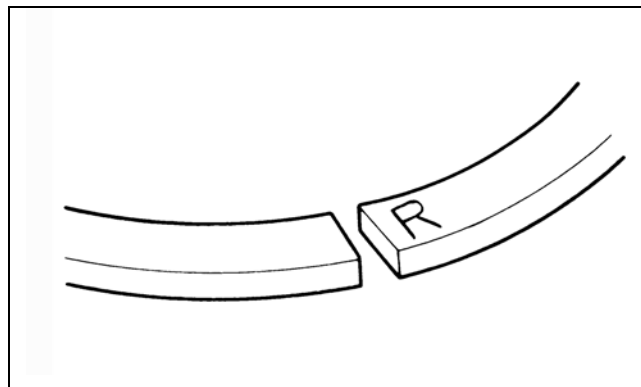


ATV-1085B

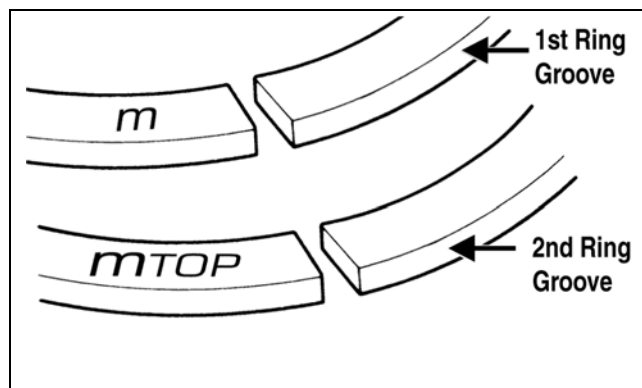
■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.

- B. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston (see illustration).

■ **NOTE:** On the 500, the chrome (silver) ring should be installed in the top position. On the 650 H1, the ring with the orientation mark (MTOP) should be installed in the second (middle) groove and the ring with the orientation mark (M) should be installed in the first (top) groove.



ATV-1024



ATV-1024A

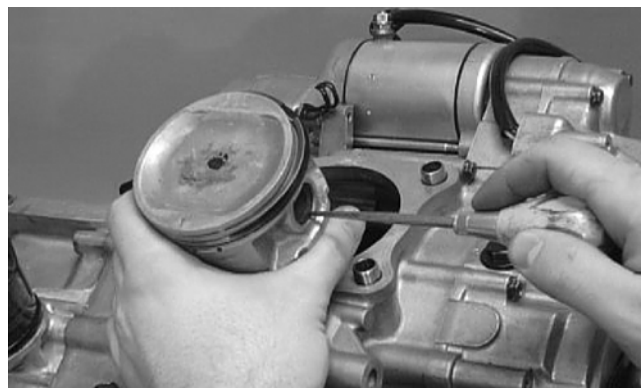


#### CAUTION

Incorrect installation of the piston rings will result in engine damage.

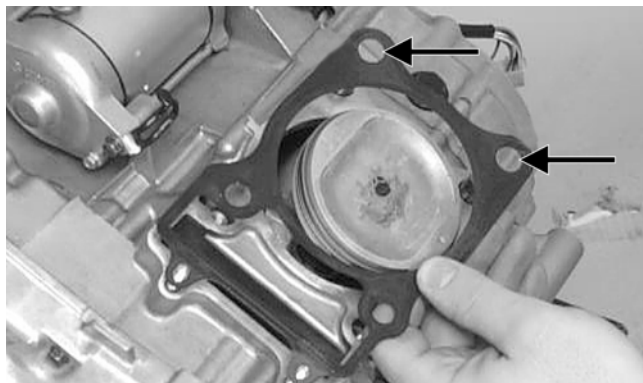
1. Install the piston on the connecting rod making sure there is a circlip on each side and the open end of the circlip faces upwards.

■ **NOTE:** The piston should be installed so the arrow points toward the exhaust.



CC032D

2. Place the two alignment pins into position. Place the cylinder gasket into position; then place a piston holder (or suitable substitute) beneath the piston skirt and square the piston in respect to the crankcase.



CC025D

3. Lubricate the inside wall of the cylinder; then using a ring compressor or the fingers, compress the rings and slide the cylinder over the piston. Route the cam chain up through the cylinder cam chain housing; then remove the piston holder and seat the cylinder firmly on the crankcase.

### ⚠ CAUTION

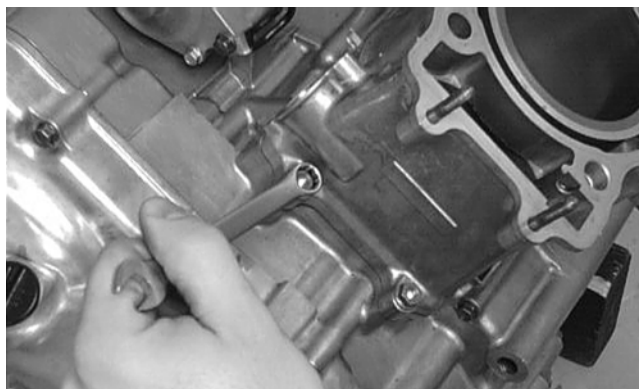
The cylinder should slide on easily. Do not force the cylinder or damage to the piston, rings, cylinder, or crankshaft assembly may occur.



CC024D

4. Loosely install the two nuts which secure the cylinder to the crankcase.

■ **NOTE:** The two cylinder-to-crankcase nuts will be tightened in step 10.

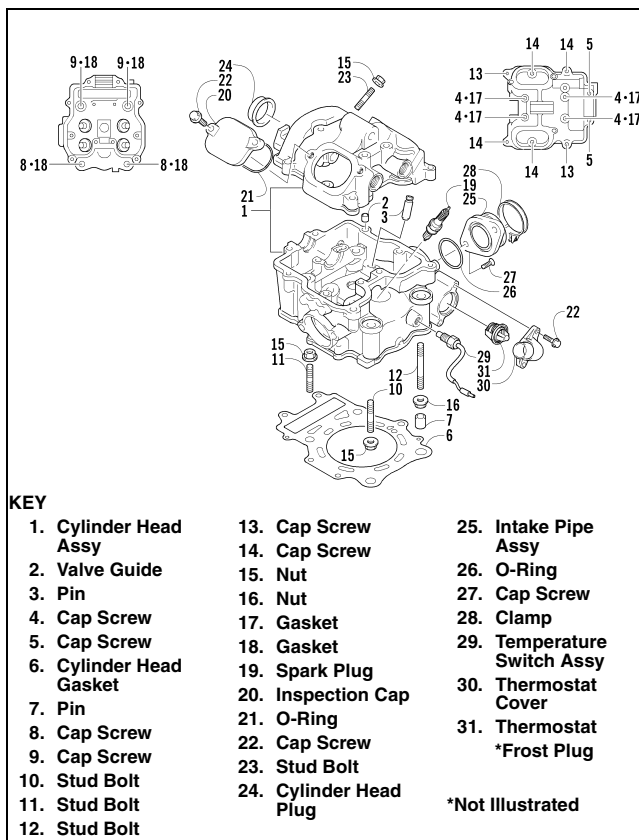


CC023D

5. Install the coolant hose onto the crankcase union and tighten the clamp.

## C. Cylinder Head

## D. Valve Cover



### KEY

|                         |                        |                             |
|-------------------------|------------------------|-----------------------------|
| 1. Cylinder Head Assy   | 13. Cap Screw          | 25. Intake Pipe Assy        |
| 2. Valve Guide          | 14. Cap Screw          | 26. O-Ring                  |
| 3. Pin                  | 15. Nut                | 27. Cap Screw               |
| 4. Cap Screw            | 16. Nut                | 28. Clamp                   |
| 5. Cap Screw            | 17. Gasket             | 29. Temperature Switch Assy |
| 6. Cylinder Head Gasket | 18. Gasket             | 30. Thermostat Cover        |
| 7. Pin                  | 19. Spark Plug         | 31. Thermostat *Frost Plug  |
| 8. Cap Screw            | 20. Inspection Cap     |                             |
| 9. Cap Screw            | 21. O-Ring             |                             |
| 10. Stud Bolt           | 22. Cap Screw          |                             |
| 11. Stud Bolt           | 23. Stud Bolt          |                             |
| 12. Stud Bolt           | 24. Cylinder Head Plug |                             |

\*Not Illustrated

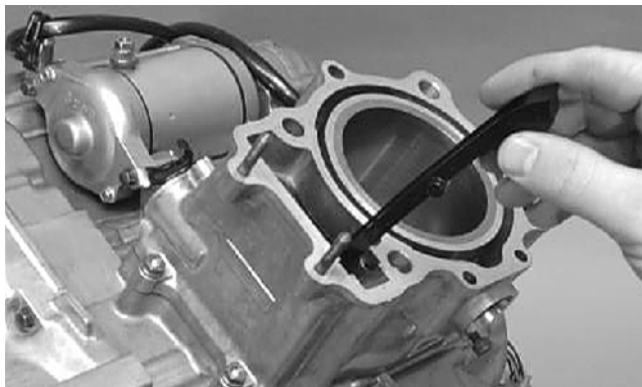
0737-755

■ **NOTE:** Steps 1-5 in the preceding sub-section must precede this procedure.

6. Place the chain guide into the cylinder.

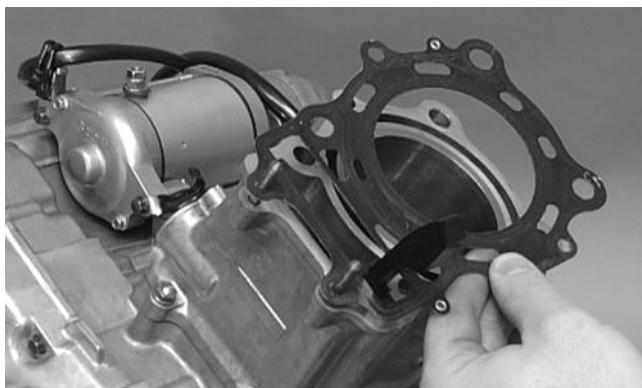
### ⚠ CAUTION

Care should be taken that the bottom of the chain guide is secured in the crankcase boss.

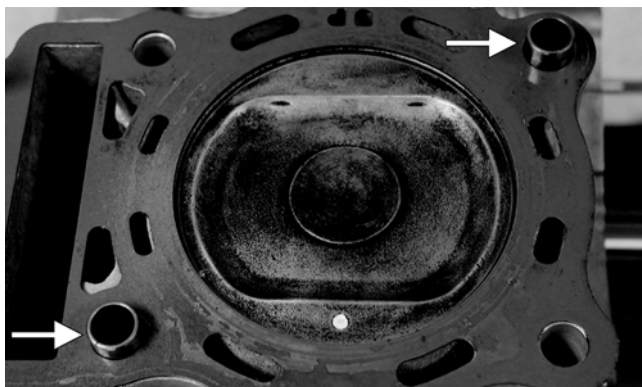


CC022D

7. Place the head gasket into position on the cylinder. Place the alignment pins into position; then place the head assembly into position on the cylinder.

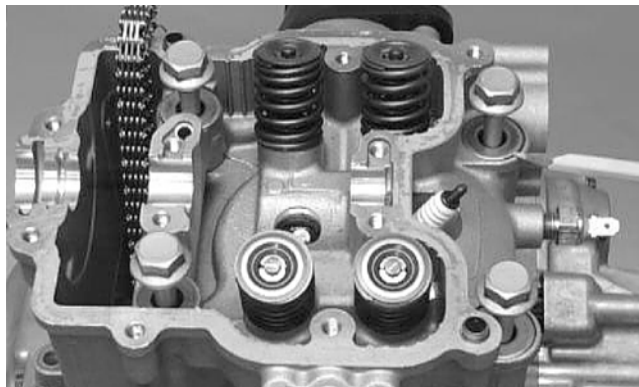


CC020D



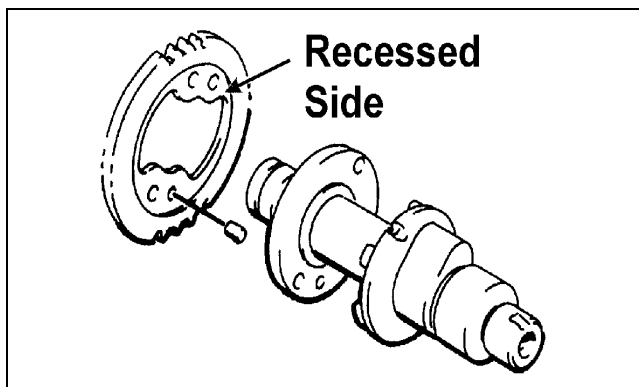
CF057A

8. Install the four cylinder head cap screws with copper washers (note the locations of the different-lengthed cap screws). Tighten only until snug.



CC272D

9. Loosely install the five cylinder head nuts.
10. In a crisscross pattern, tighten the four cylinder head cap screws (from step 8) to 3.8 kg-m (27.5 ft-lb) 500 models, 5.5 kg-m (40 ft-lb) 650 H1; then tighten the 8 mm nut (from step 9) to 2.5 kg-m (18 ft-lb). Using a crisscross pattern, tighten the 6 mm nuts (from step 9) to 1.1 kg-m (8 ft-lb). Tighten the two cylinder-to- crankcase nuts (from step 4) securely.
11. With the timing inspection plug removed and the chain held tight, rotate the crankshaft until the piston is at top-dead-center.
12. With the alignment pin installed in the camshaft, loosely place the cam sprocket (with the recessed side facing the cam shaft lobes) onto the camshaft. At this point, do not "seat" the sprocket onto the shaft.

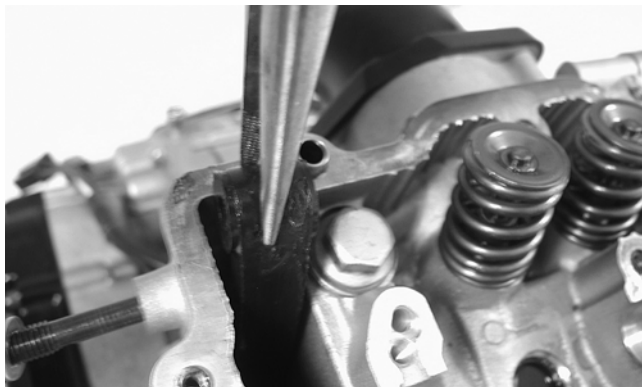


732-307B

■ **NOTE:** At this point, oil the camshaft bearings, cam lobes, and the three seating journals on the cylinder.

13. While holding the cam chain sprocket to the side, install the rear cam chain tensioner guide into the cylinder head. Install the pivot cap screw and washer.

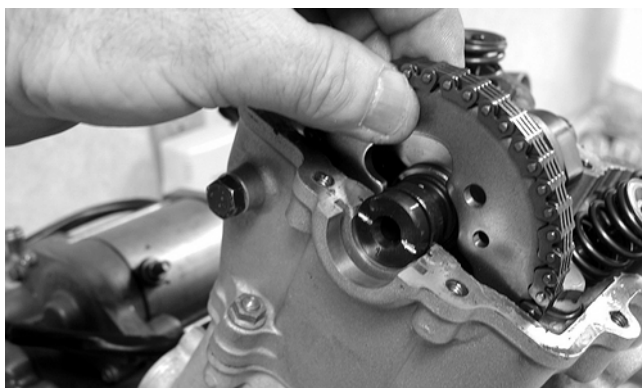




CD461

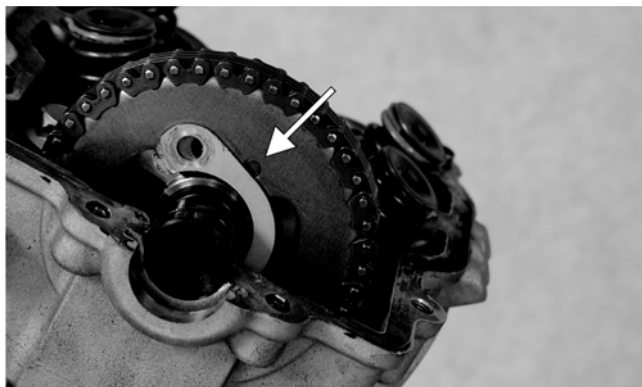
14. With the cam lobes directed down (toward the piston), maneuver the camshaft/sprocket assembly through the chain and towards its seating position; then loop the chain over the sprocket.

■ **NOTE:** Note the position of the alignment marks on the end of the camshaft. They must be parallel with the valve cover mating surface. If rotating the camshaft is necessary for alignment, do not allow the chain and sprocket to rotate and be sure the cam lobes end up in the down position.



CD463

15. Seat the cam sprocket onto the camshaft making sure the alignment pin in the camshaft aligns with the smallest hole in the sprocket; then place the camshaft/sprocket assembly onto the cylinder ensuring the following.



CF013A

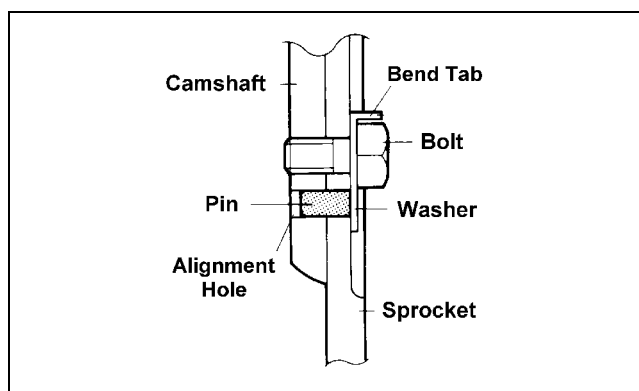
A. Piston still at top-dead-center.

- B. Camshaft lobes directed down (toward the piston).
- C. Camshaft alignment marks parallel to the valve cover mating surface.
- D. Recessed side of the sprocket directed toward the cam lobes.
- E. Camshaft alignment pin and sprocket alignment hole (smallest) are aligned.

**CAUTION**

If any of the above factors are not as stated, go back to step 11 and carefully proceed.

16. Place the tab-washer onto the sprocket making sure it covers the pin in the alignment hole.



ATV1027

**CAUTION**

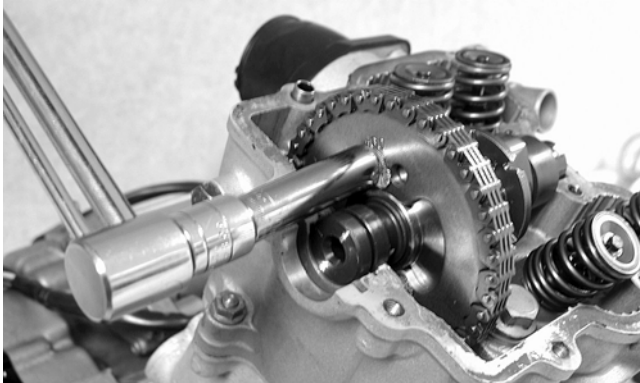
Care must be taken that the tab-washer is installed correctly to cover the alignment hole on the sprocket. If the alignment pin falls out, severe engine damage will result.

17. Install the first cap screw (threads coated with red Loctite #271) securing the sprocket and tab-washer to the camshaft. Tighten only until snug.



CD464

18. Rotate the crankshaft until the second cap screw securing the sprocket to the camshaft can be installed; then install the cap screw (threads coated with red Loctite #271) and tighten to specifications. Bend the tab to secure the cap screw.



CD465

19. Rotate the crankshaft until the first cap screw (from step 17) can be addressed; then tighten to specifications. Bend the tab to secure the cap screw.



CD466

20. Place the C-ring into position in its groove in the cylinder head.

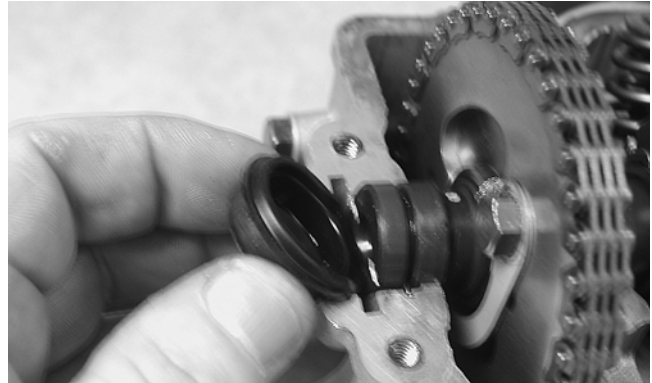


CC012D

21. Install the cylinder head plug in the cylinder head with the open end facing downward and toward the inside.

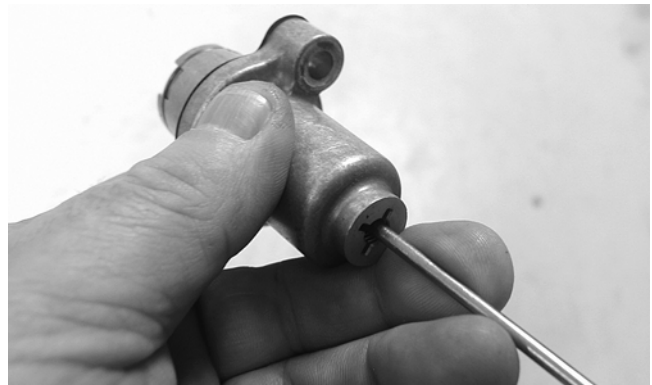
**CAUTION**

The open end of the plug must be positioned downward.



CD468

22. Remove the cap screw from the end of the chain tensioner; then using a flat-blade screwdriver, rotate the adjuster screw inside the tensioner clockwise until the screw bottoms.

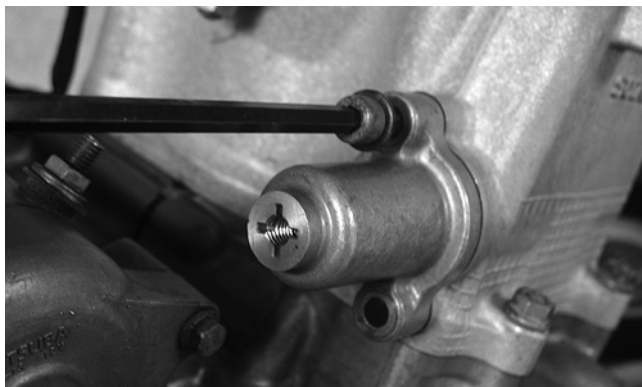


CD501

■ **NOTE:** The adjuster shaft will be drawn into the tensioner as the adjuster screw is rotated clockwise. The adjuster shaft tension will be released in step 24.

23. Place the chain tensioner adjuster assembly and gasket into position on the cylinder and secure with the two Allen-head cap screws.





CD469

24. Using a flat-blade screwdriver, rotate the adjuster screw inside the tensioner counter-clockwise until all tension is released; then install the cap screw into the end of the chain tensioner.

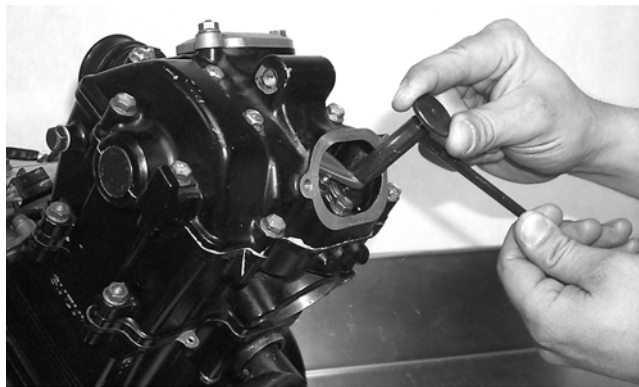


CD470



CD471

25. Loosen the four adjuster screw jam nuts; then loosen the four adjuster screws on the rocker arms in the valve cover.



CC528D

26. Apply a thin coat of Three Bond Sealant (p/n 0636-070) to the mating surfaces of the cylinder head and valve cover.

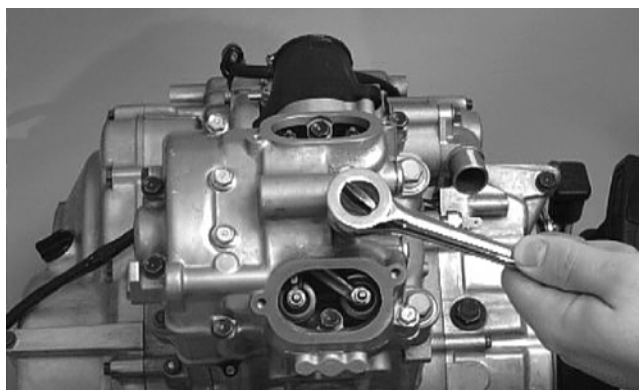


CC275D

27. Place the valve cover into position.

■ **NOTE:** At this point, the rocker arms and adjuster screws must not have pressure on them.

28. Install the four top side cap screws with rubber washers; then install the remaining cap screws. Tighten only until snug.



CC003D

29. In a crisscross pattern starting from the center and working outward, tighten the cap screws securely.

30. Adjust valve/tappet clearance using the following procedure.



■ **NOTE:** Use Valve Clearance Adjuster (p/n 0444-078) for this procedure.

- A. Turn the engine over until the piston reaches top dead center on the compression stroke.
- B. Place the valve adjuster onto the jam nut securing the tappet adjuster screw; then rotate the valve adjuster dial clockwise until the end is seated in the tappet adjuster screw.
- C. While holding the valve adjuster dial in place, use the valve adjuster handle and loosen the jam nut; then rotate the tappet adjuster screw clockwise until friction is felt.
- D. Align the valve adjuster handle with one of the marks on the valve adjuster dial.
- E. While holding the valve adjuster handle in place, rotate the valve adjuster dial counter-clockwise until specified valve/tappet clearance is attained.

■ **NOTE:** Rotating the valve adjuster dial counter-clockwise will open the valve/tappet clearance by 0.05 mm (0.002 in.) per mark.

- F. While holding the adjuster dial at the proper clearance setting, tighten the jam nut securely with the valve adjuster handle.
31. Place the two tappet covers into position making sure the proper cap screws are with the proper cover. Tighten the cap screws securely.



CC001D

32. If removed, install the spark plug. Tighten to specifications.

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## Installing Engine/Transmission

---

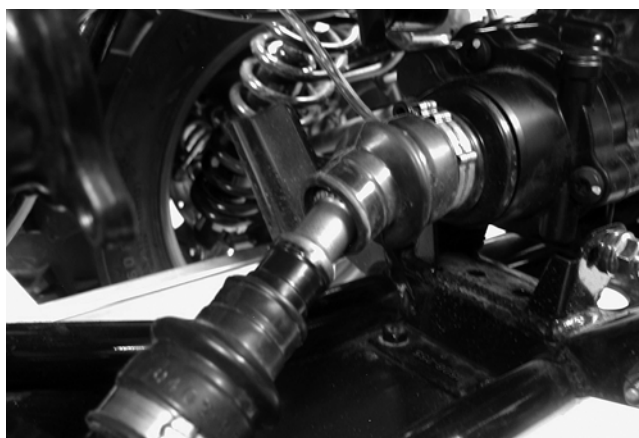
■ **NOTE:** Arctic Cat recommends that new gaskets and O-rings be installed whenever servicing the ATV.

1. From the left side, place the engine/transmission into the frame; then slide the engine rearward as far as possible.
2. Slightly raise the rear of the engine and engage the front drive coupler into the splines of the front drive output yoke; then slide the engine forward as far as possible.



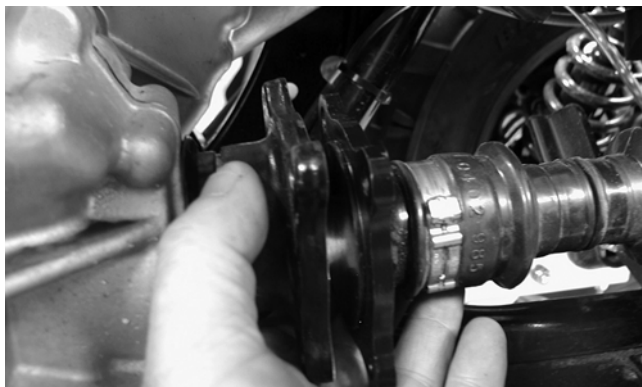
CD818

3. Raise the rear of the engine and place a block beneath it; then install the propeller shaft and output flange into the rear drive coupler.



CD821

4. Remove the block from beneath the engine; then align the rear drive flanges and secure with four cap screws. Tighten to specifications.

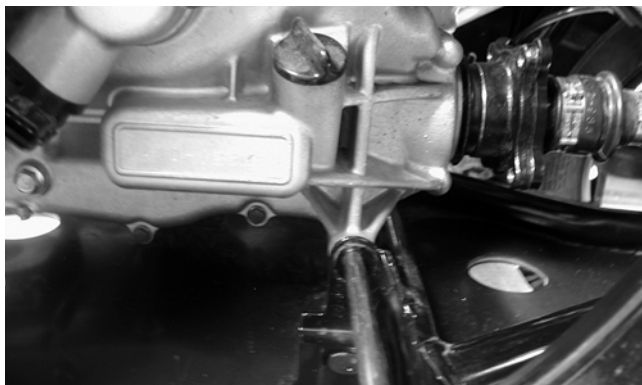


CD824



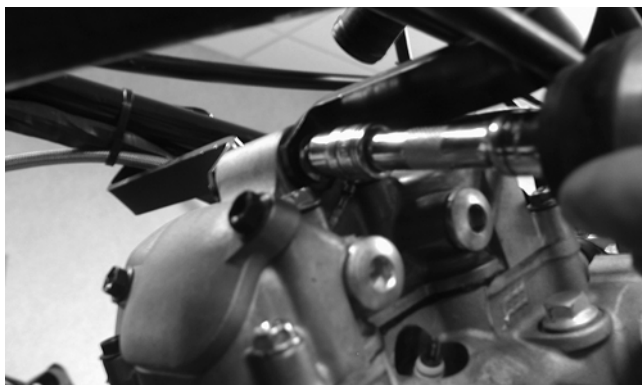
CD803

5. Secure the upper engine mounts to the frame with the cap screws. Tighten only until snug.
6. Install two engine mounting through-bolts, two bushings, and two washers; then tighten the through-bolt flange nuts to specifications. Tighten the upper engine mount cap screws (from step 5) to specifications.



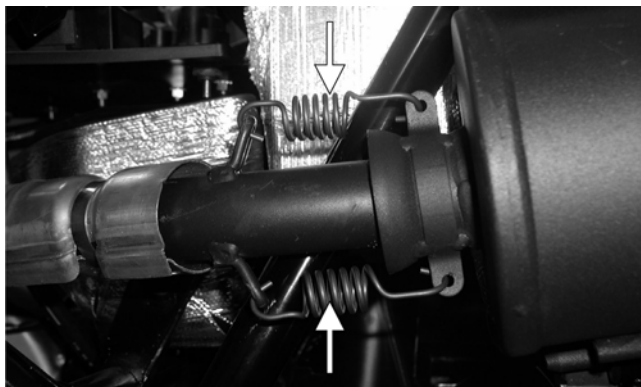
CD809

7. Secure the upper engine bracket to the engine with the existing cap screw and flange nut. Tighten to specifications.



CD807

8. Secure the exhaust pipe to the engine with two cap screws making sure the mounting brackets engage the frame grommets; then install the muffler and tighten all mounting hardware to specifications.



CF138A

9. Install the cooling ducts with clamps and tighten the clamps securely.



CD515



CD793

10. Secure the engine ground wire to the engine with a cap screw. Tighten to specifications.



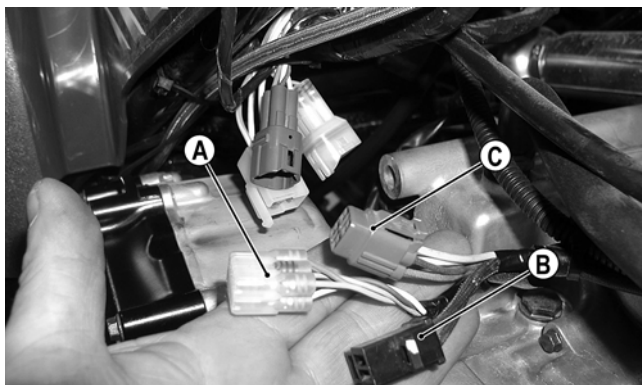


CD810



CD787

11. Connect the gear position indicator connector (A), stator connector (B), and the CDI connector (C) to the main wiring harness.



CD797A



CD785

12. Connect the temperature sensor wire to the main wiring harness.
13. Secure the wires to the frame with nylon ties.
14. Connect the speed sensor connector to the housing.
15. Secure the positive cable to the starter motor.
16. Secure all wiring to the frame and upper engine bracket with cable ties.
17. Secure the two coolant/oil hoses to the engine.
18. Secure the crankcase vent hose to the air cleaner housing; then secure the inlet boot and carburetor to the air cleaner housing.



CD793

19. Secure the shift rod to the engine with a new E-clip.



CD774

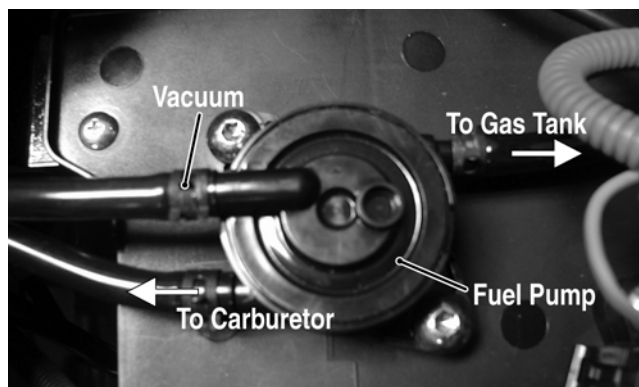


20. Place the left-side footwell and foot peg in position on the frame; then secure with existing hardware. Tighten to specifications.



CD782

21. Install the front body panel with existing hardware (see Section 8).
22. Connect the hose to the fuel pump; then connect the vacuum hose and secure with hose clamps.



CD766A

23. Place the side panels into position; then install the reinstallable rivets.
24. Place the battery into position in the battery compartment; then install the battery cables and vent hose. Secure with the battery cover.

**CAUTION**

**Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.**

**3**

25. Add proper amounts of engine/transmission oil and coolant.
26. Install the seat.

## Table of Contents (500 - Manual Transmission)

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## Removing Engine/ Transmission

Many service procedures can be performed without removing the engine/transmission from the frame. Closely observe the note introducing each sub-section for this important information.

### AT THIS POINT

If the technician's objective is to service/replace left-side cover oil seals (3), front output joint oil seal (1), rear output joint oil seal (1), and/or the oil strainer (from beneath the engine/transmission), the engine/transmission does not have to be removed from the frame.

Secure the ATV on a support stand to elevate the wheels.

### WARNING

Make sure the ATV is solidly supported on the support stand to avoid injury.

1. Remove the seat.
2. Remove the negative cable from the battery; then remove the positive cable. Remove the battery vent hose; then remove the battery.

### CAUTION

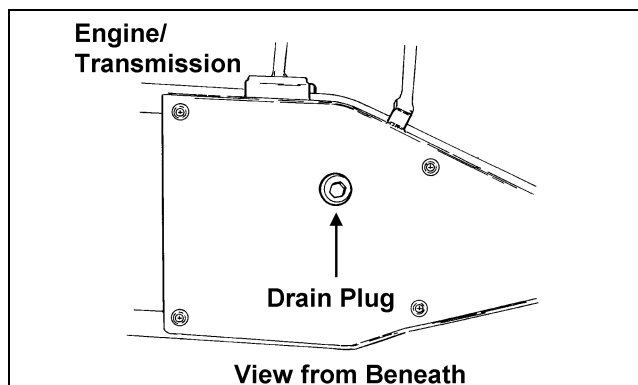
Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.

3. Remove the radiator access cover, steering post cover, and storage compartment cover assembly; then remove the storage compartment box.
4. Remove the reinstallable rivets securing the side panels; then remove the panels.

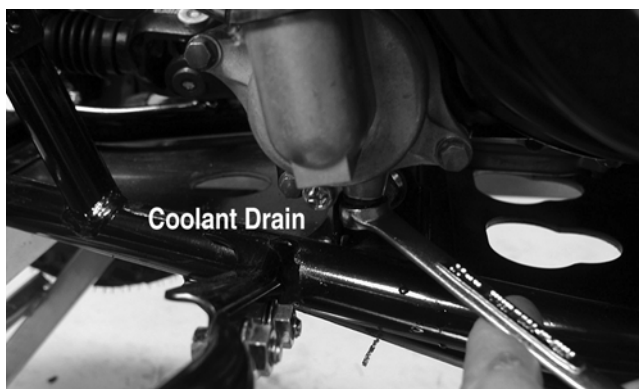


CD683A

5. Remove the instrument pod; then remove the front rack and front body panel (see Section 8).
6. Drain the oil from beneath the engine/transmission; then drain the cooling system.



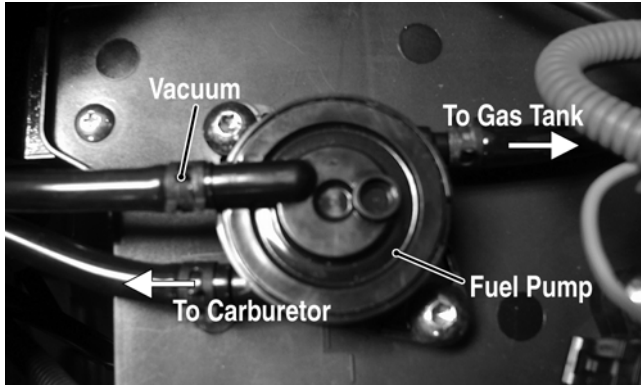
ATV-0109



CD799A

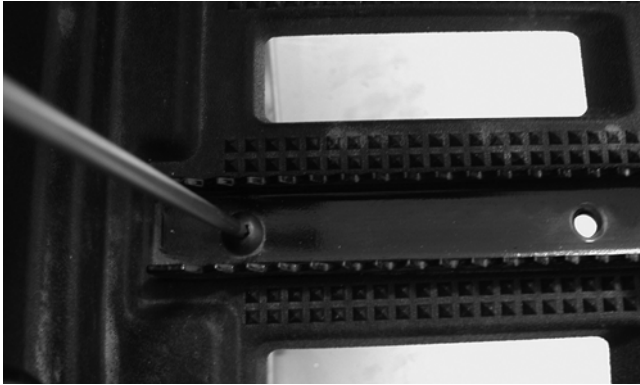
7. Remove the air filter (see Section 2).

8. Remove the vacuum hose and the fuel-pump-to-carburetor hose.



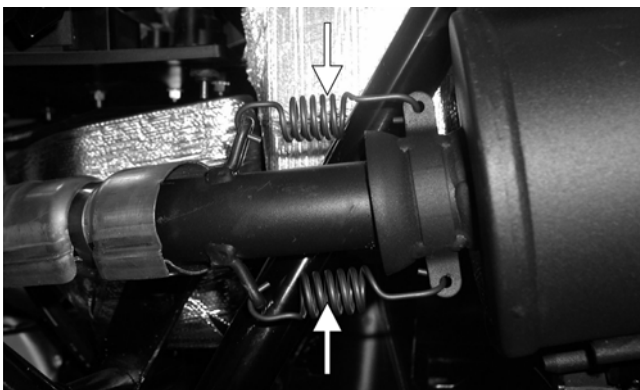
CD766A

9. Remove the cap screws securing the left-side foot peg and footwell to the footrest; then remove the footwell.



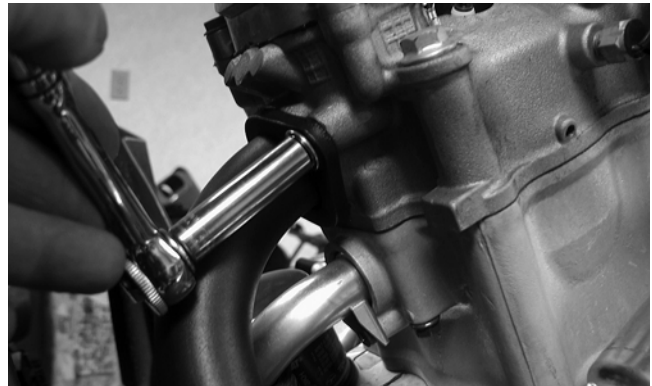
CD782

10. Remove the springs securing the muffler to the exhaust pipe; then remove the muffler. Account for two exhaust springs.



CF138A

11. Remove the cap screws securing the exhaust pipe to the head; then remove the exhaust pipe.



CD803

12. Remove the E-clip securing the shift rod to the engine shift arm; then allow the shift rod to swing forward and hang straight down from the shift lever.
13. Disconnect the speed sensor connector from the sensor housing.
14. Remove the four cap screws securing the rear output joint to the transmission and push the shaft away from the transmission.

3



CD805

15. Loosen the clamp securing the air intake duct to the air filter housing.



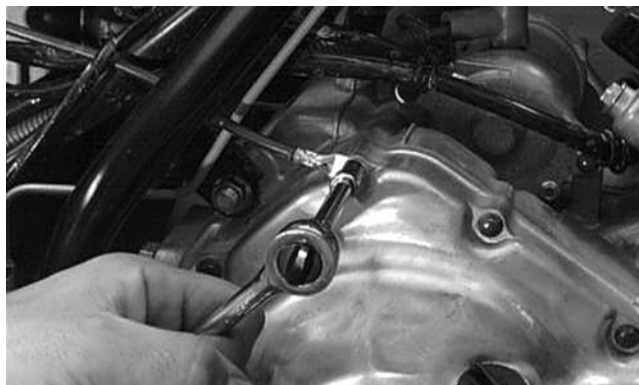
CD785

16. Disconnect the crankcase vent hose from the air filter housing. Loosen the clamp securing the carburetor intake duct to the air filter housing; then remove the housing.





CD787



AR600D



CD786

17. Remove the clamp securing the upper coolant hose to the thermostat housing; then disconnect the hose.



AR604D

20. Remove the clamp securing the lower coolant hose to the water pump housing; then disconnect the hose.



CC335D

18. Disconnect the high tension lead from the spark plug; then remove the coil.
19. Disconnect the battery ground (negative) cable from the crankcase cover; then disconnect the positive cable from the starter motor.



CC334D

21. Loosen the clamp on the crankcase breather vent hose; then remove the hose.



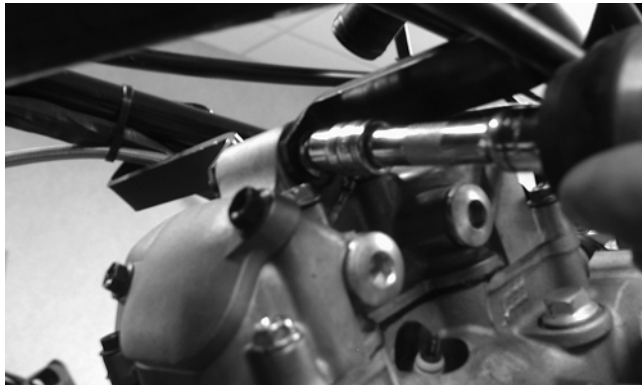
CC122D

22. Remove the engine/transmission mounting fasteners in the following sequence:

A. Upper: Two cap screws (bracket to frame) and one cap screw and nut (topside of the engine).



CD806



CD807

B. Lower front: One cap screw, nut, spacer, and washer.



CC123D

C. Lower rear: One cap screw, nut, spacer, and washer.



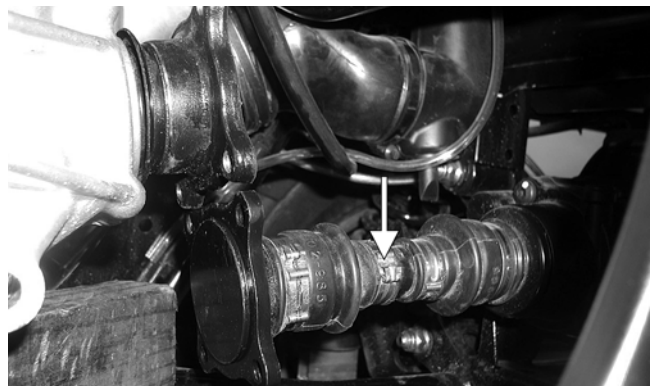
CC126D

23. Raise the rear of the engine enough to allow the rear output flange to clear the output flange joint. Place a block beneath the engine in this position.



CD811

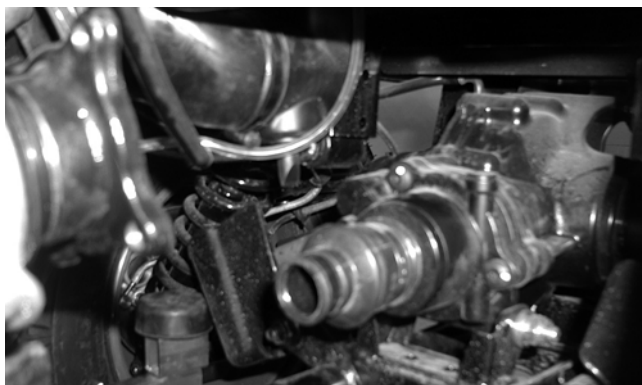
24. Remove the first small boot clamp; then slide the output flange and driveshaft out of the rear coupler.



CD812A

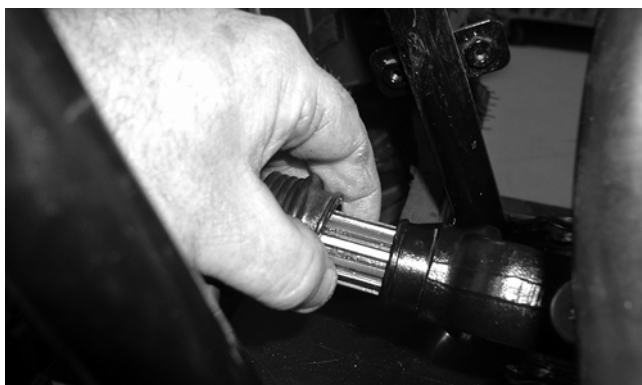
3





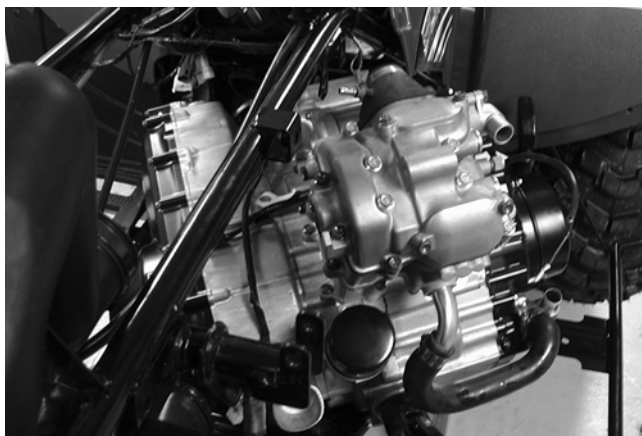
CD813

25. Remove the block and lower the rear of the engine; then remove the boot clamp on the front output drive yoke.



CD817

26. Move the engine to the rear enough to allow the front drive coupler to clear the front output yoke; then move the engine forward and to the left. Remove the engine from the left-side of the frame.



CD773

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## Top-Side Components

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■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### **AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

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## Removing Top-Side Components

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### **A. Valve Cover**

### **B. Cylinder Head**

■ **NOTE:** Remove the spark plug and timing inspection plug; then using the recoil starter, rotate the crankshaft to top-dead-center of the compression stroke.

1. Remove the two tappet covers.



CC001D

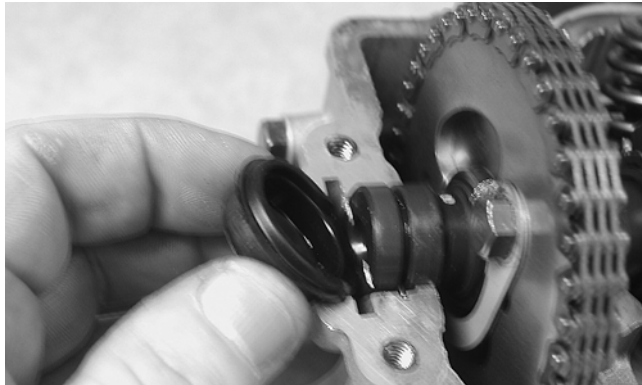
■ **NOTE:** Keep the mounting hardware with the covers for assembly purposes or thread them back into the head to keep them separated.



2. Remove the 12 cap screws securing the valve cover to the head; account for the four rubber washers on the top side cap screws. Remove the valve cover. Account for and note the orientation of the cylinder head plug. Note the location of two alignment pins.



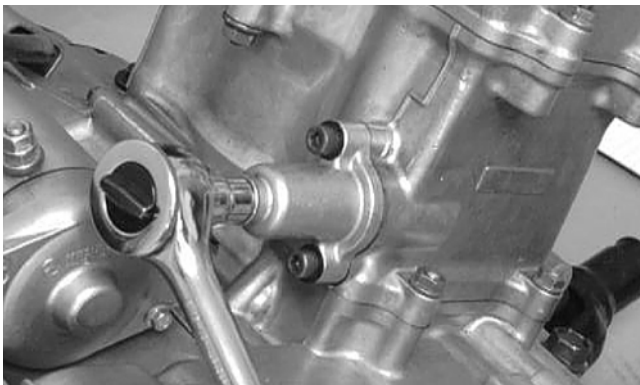
CD205



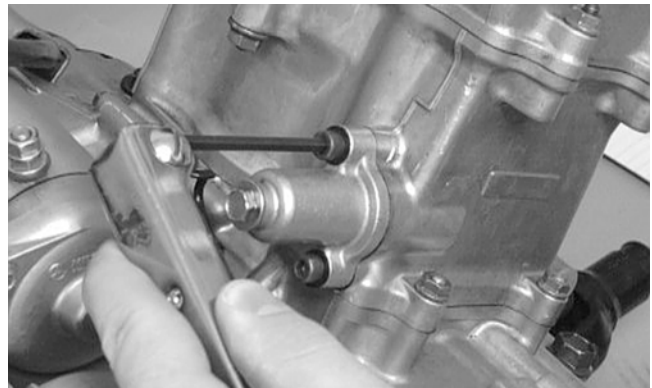
CD468

■ **NOTE:** Note that the opening of the head plug must be directed to the 6 o'clock position.

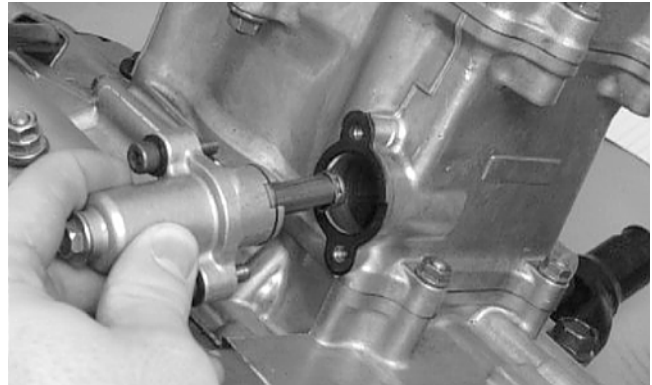
3. Loosen the cap screw on the end of the tensioner; then remove the two Allen-head cap screws securing the tensioner adjuster assembly and remove the assembly. Account for a gasket.



CC009D



CC010D



CC011D

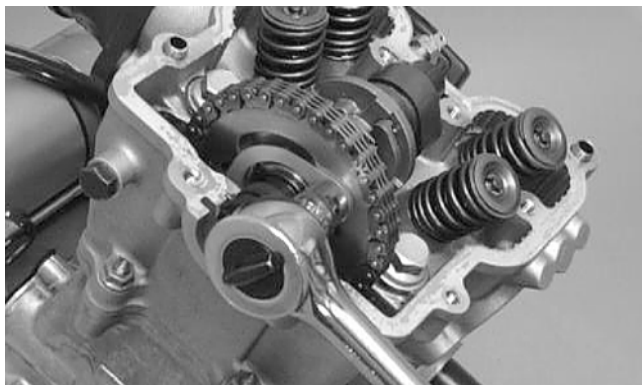
4. Using an awl, rotate the C-ring in its groove until it is out of the cylinder head; then remove the C-ring.

■ **NOTE:** Care should be taken not to drop the C-ring down into the crankcase.

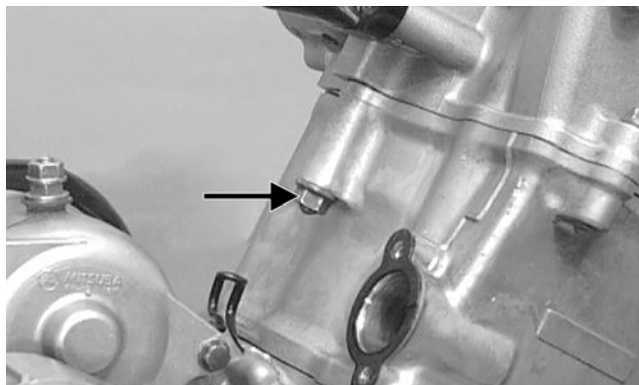


CC012D

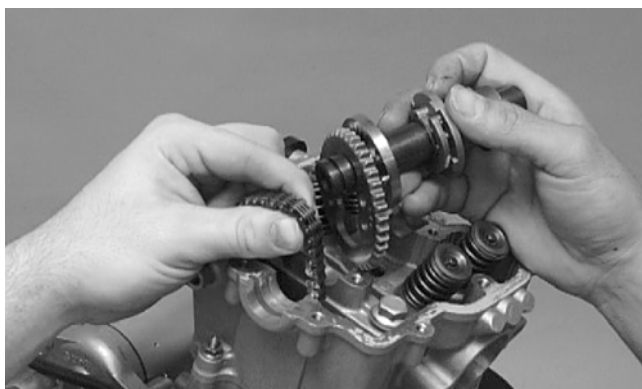
5. Bend the washer tabs and remove the two cap screws securing the sprocket to the camshaft; then drop the sprocket off the camshaft. While holding the chain, slide the sprocket and camshaft out of the cylinder head.



CC013D



CC017D



CC266D

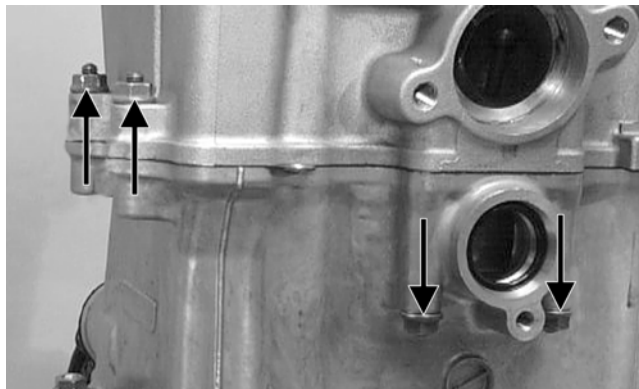
■ **NOTE:** Loop the chain over the cylinder and secure it to keep it from falling into the crankcase.

6. Remove the cap screw securing the chain tensioner (account for a washer); then remove the tensioner.

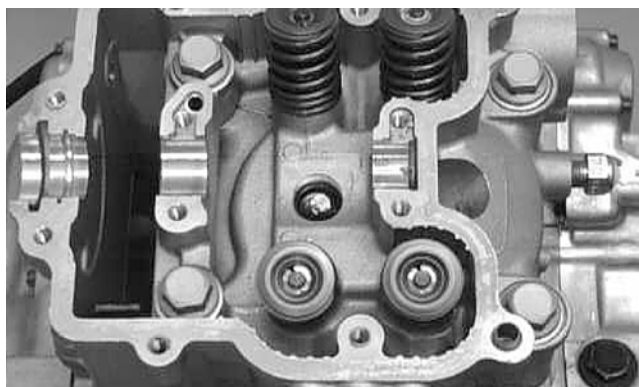


CC014D

7. Remove the five nuts securing the cylinder head to the cylinder; then remove the four cylinder head cap screws with copper washers (note location of the different-sized cap screws and nuts).

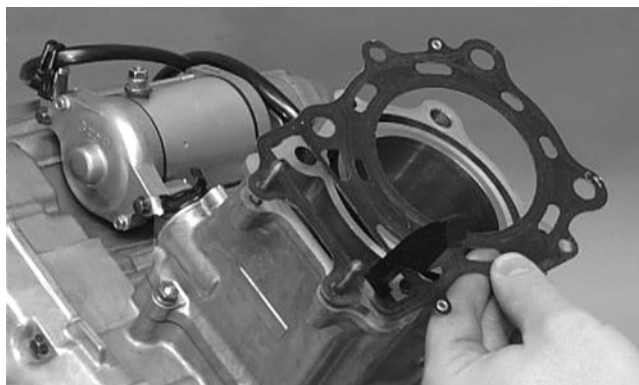


CC018D



CC016D

8. Remove the cylinder head from the cylinder, remove the gasket, and account for two alignment pins.



CC020D



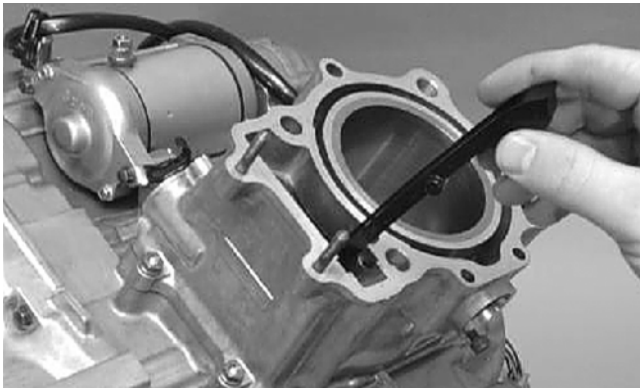
**👉 AT THIS POINT**

To service valves and cylinder head, see Servicing Top-Side Components sub-section.

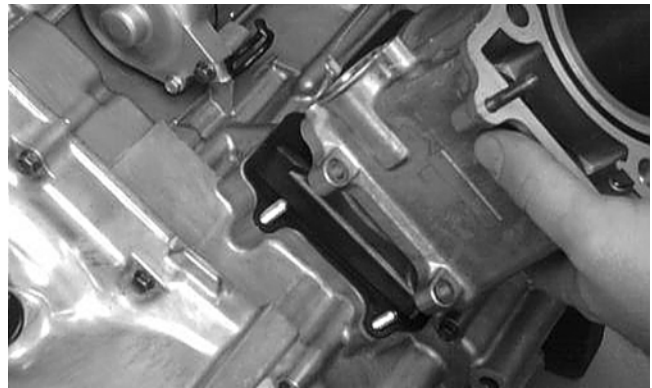
9. Remove the cam chain guide.

**👉 AT THIS POINT**

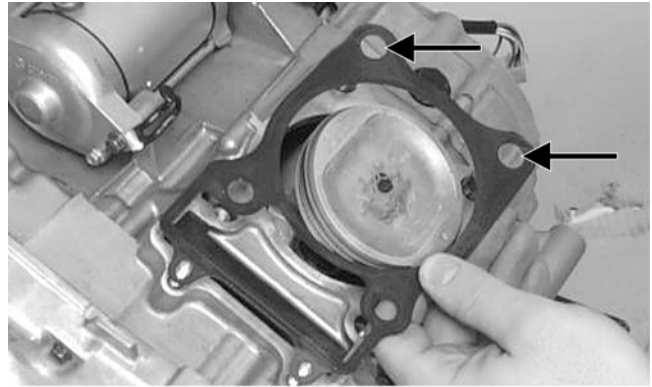
To inspect cam chain guide, see Servicing Top-Side Components sub-section.



CC022D



CC024D

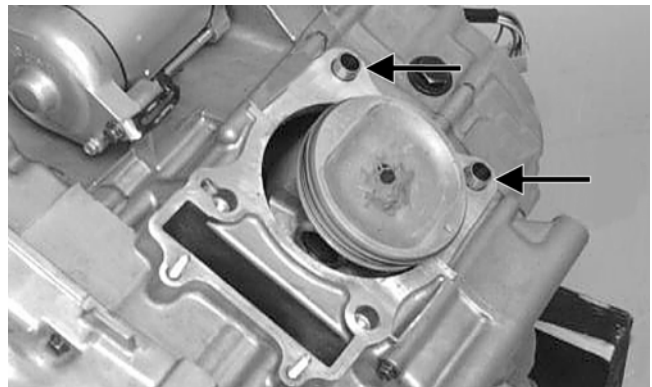


CC025D

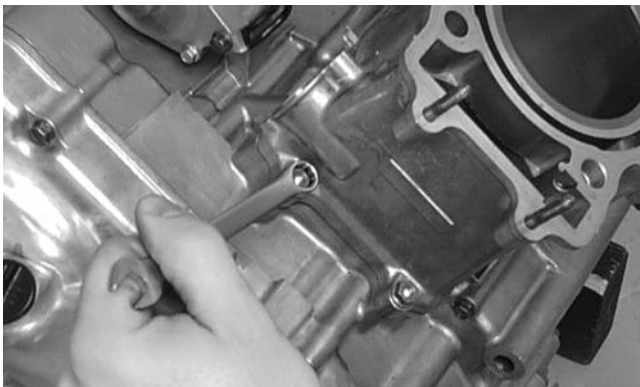
**C. Cylinder**  
**D. Piston**

■ **NOTE:** Steps 1-9 in the preceding sub-section must precede this procedure.

10. Loosen the clamp securing the coolant hose to the union; then detach the hose.
11. Remove the two nuts securing the cylinder to the crankcase.



CC026D



CC023D

12. Lift the cylinder off the crankcase taking care not to allow the piston to drop against the crankcase. Account for the gasket and two alignment pins.

**👉 AT THIS POINT**

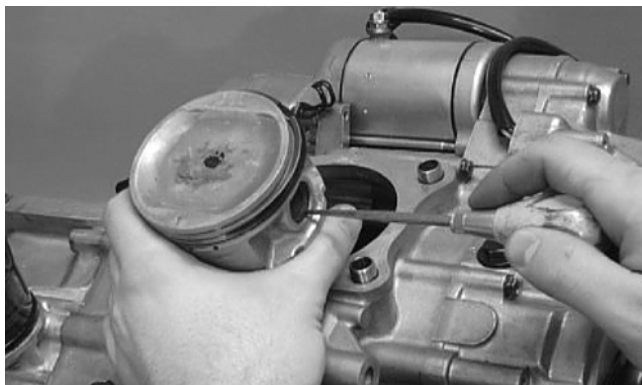
To service cylinder, see Servicing Top-Side Components sub-section.

**⚠ CAUTION**

When removing the cylinder, be sure to support the piston to prevent damage to the crankcase and piston.

13. Using an awl, remove one piston-pin circlip.

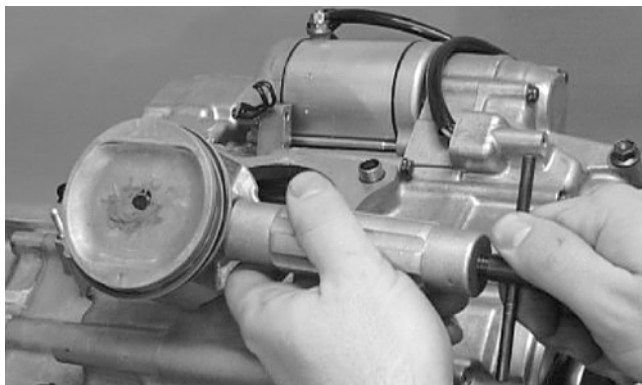




CC032D

14. Using the Piston-Pin Puller (p/n 0644-328), remove the piston pin. Account for the opposite-side circlip. Remove the piston.

■ **NOTE:** It is advisable to remove the opposite-side circlip prior to using the puller.



CC033D

■ **NOTE:** Support the connecting rod with rubber bands to avoid damaging the rod or install the Connecting Rod Holder (p/n 0444-006).



### CAUTION

Do not allow the connecting rod to go down inside the crankcase. If the rod is down inside the crankcase and the crankshaft is rotated, severe damage will result.

■ **NOTE:** If the existing rings will not be replaced with new rings, note the location of each ring for proper installation. When replacing with new rings, replace as a complete set only. If the piston rings must be removed, remove them in this sequence.

A. Starting with the top ring, slide one end of the ring out of the ring-groove.

B. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

### AT THIS POINT

To service piston, see Servicing Top-Side Components sub-section.

### AT THIS POINT

To service center crankcase components only, proceed to Removing Left-Side Components.

## Left-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### AT THIS POINT

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

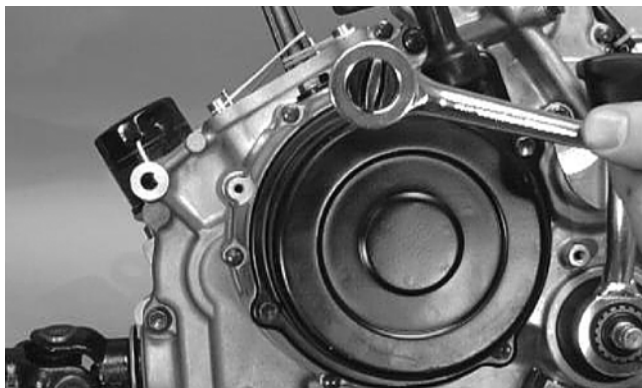
## Removing Left-Side Components

- A. Recoil Starter
- B. Hi/Low Shifter Assembly
- C. Speed Sensor Housing
- D. Cover

1. Remove the cap screws securing the recoil starter assembly to the left-side cover; then remove the recoil starter.

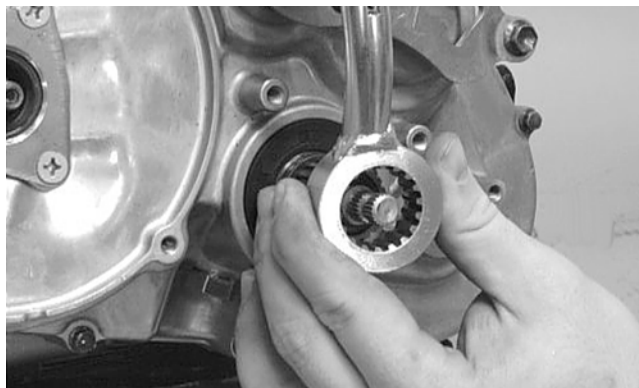
### AT THIS POINT

To service the recoil starter, see Servicing Left-Side Components sub-section.



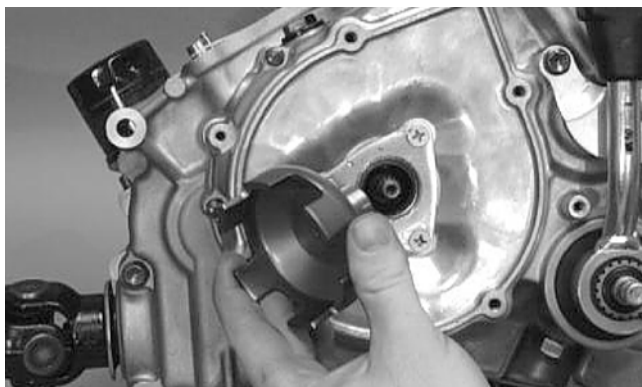
CC039D

2. Remove the flange nut securing the starter cup to the crankshaft; then remove the starter cup. Account for the O-ring inside the cup.



CC045D

4. Remove the inside circlip.



CC041D

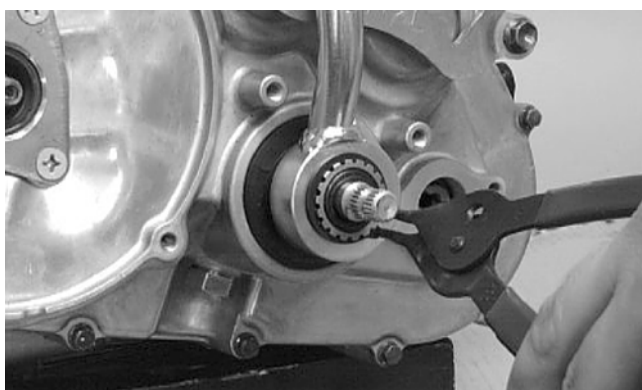
3. Put the shift lever into the hi-range position and remove the circlip from the hi/low range shift shaft; then remove the shift lever.

■ **NOTE:** It will be necessary to lift slightly on the shift lever to remove it from the shaft and plate.

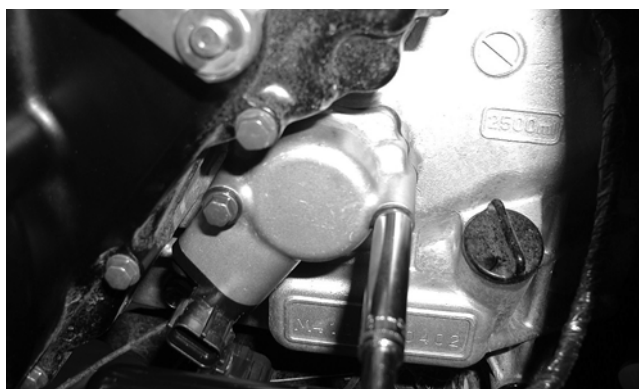


CC046D

5. Remove the two cap screws securing the speed sensor housing; then remove the housing. Account for the gasket.



CC044D



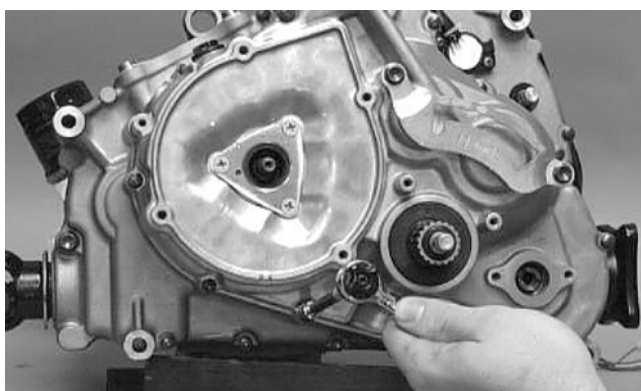
CD069

6. Remove the shift stop housing assembly from beneath the shift shaft housing. Account for the stopper and spring.



CC054D

7. Remove the fourteen cap screws securing the left-side cover to the crankcase and note the location of the long cap screw with rubber washer.



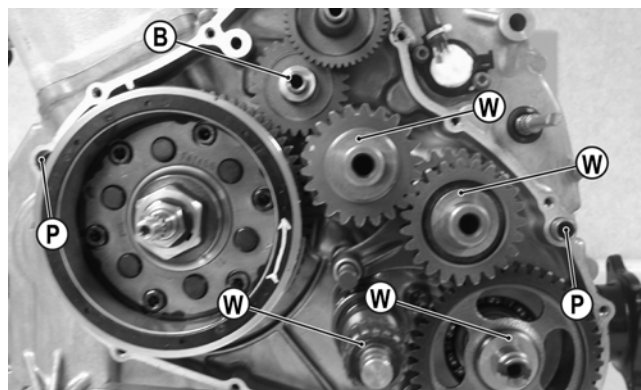
CC047D



CF037A

8. Using Side Case Puller (p/n 0644-262), remove the side cover. Account for a gasket, two alignment pins, and an idle gear limiter bushing.

■ **NOTE:** Inspect the inside of the left-side cover for the four shaft washers that may have come off with the cover. The three gear shaft washers are identical and interchangeable. The shift shaft washer is a larger diameter. Keep the washers with their respective shafts for installing purposes.



CD134A

## E. Rotor/Flywheel

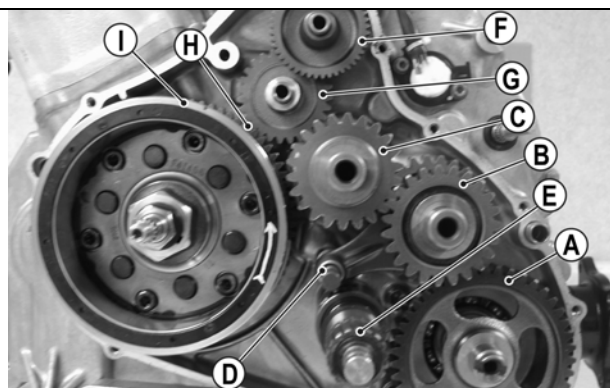
## F. Idle Gear Assembly

■ **NOTE:** Steps 1-8 in the preceding sub-section must precede this procedure.

■ **NOTE:** For steps 9-18, refer to illustration CD134B.

### KEY

- A. Output Shaft with Driven Gear
- B. Drive Gears #1 & #2
- C. Idle Gear
- D. Shift Fork with Shaft
- E. Shift Shaft Assembly
- F. Starter Gear Assembly
- G. Starter Idler Gear
- H. Starter Clutch Gear Assembly
- I. Rotor/Flywheel

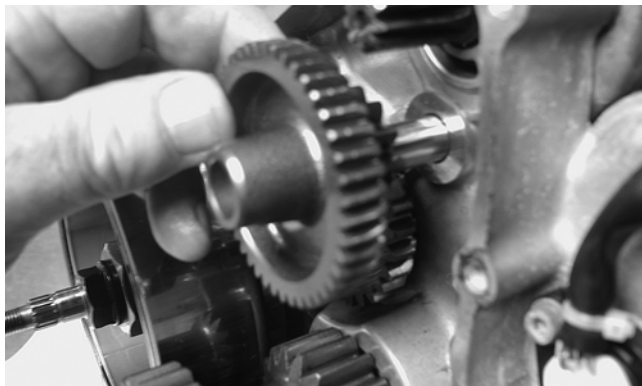


CD134B

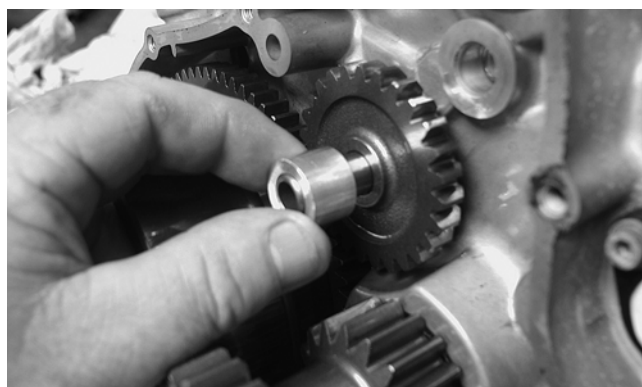


■ **NOTE:** To aid in installing, it is recommended that the assemblies are kept together and IN ORDER.

9. Remove the starter gear assembly (F) from the crankcase; then remove the starter idler gear (G) and spacer.



CD136



CD138

10. Remove the idle gear (C), washer, and spacer from the countershaft.



CD141

11. Remove the #2 drive gear (B), washer, and the select sliding dog gear from the driveshaft. Account for a bushing and a washer.

**AT THIS POINT**

To service shift fork, see Servicing Left-Side Components sub-section.

12. Remove the shift fork shaft (D) from the crankcase boss; then remove the shift fork from the shaft. Remove the shift shaft assembly (E) from the fixed shaft. Account for the left shaft washer.



CD146



CD147



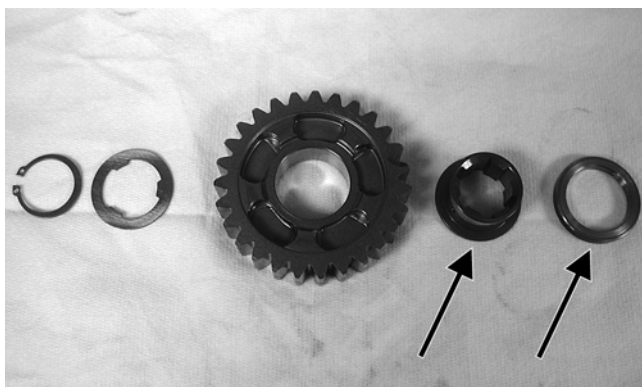
CD152

13. Remove the circlip and washer from the drive shaft; then remove the #1 drive gear (B). Account for a splined bushing and a spacer.

3



CC059D



CD154A

14. Remove the washer and driven gear (A) from the output shaft; then account for the bushing.

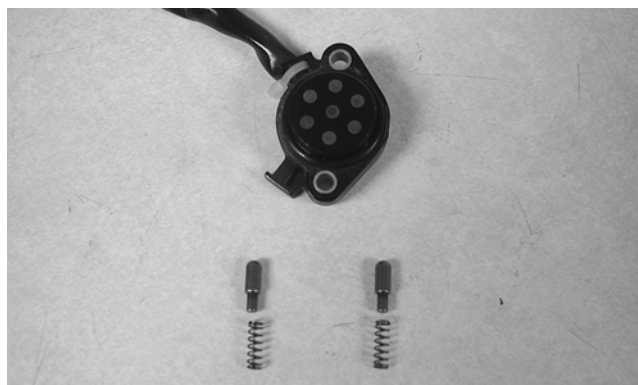


CD149



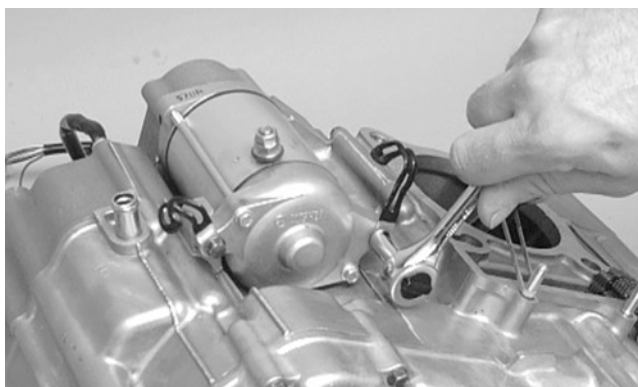
CD150

15. Remove the Allen-head screws securing the shift-indicator sending unit; then remove the sending unit. Account for an O-ring, two contacts, and two springs.



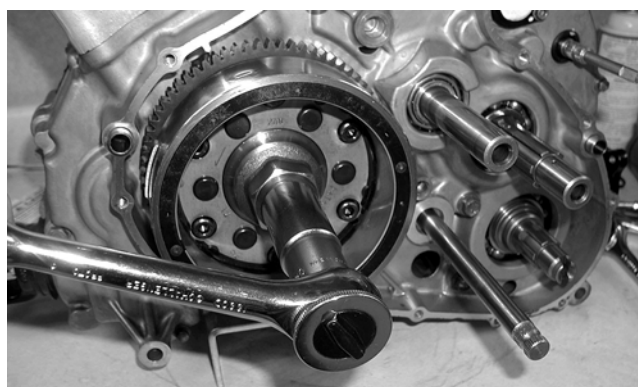
CD159

16. Remove the two cap screws securing the starter to the crankcase; then remove the starter. Account for the wiring forms.



CC065D

17. Remove the nut securing the rotor/flywheel (I) to the crankshaft; then install the magneto rotor remover adapter.



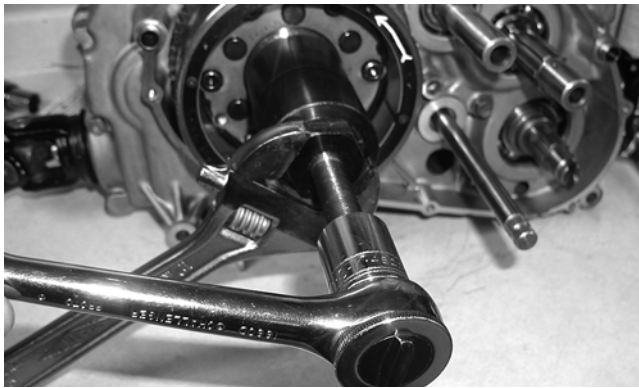
CD562





CD549

18. Using Magneto Rotor Remover (p/n 0444-075), remove the rotor/flywheel assembly from the crankshaft. Account for the key; then remove the starter clutch gear assembly (H) and thrust washer.



CD550



CD155

### **AT THIS POINT**

To service center crankcase components only, proceed to Removing Right-Side Components.

## Right-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### **AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

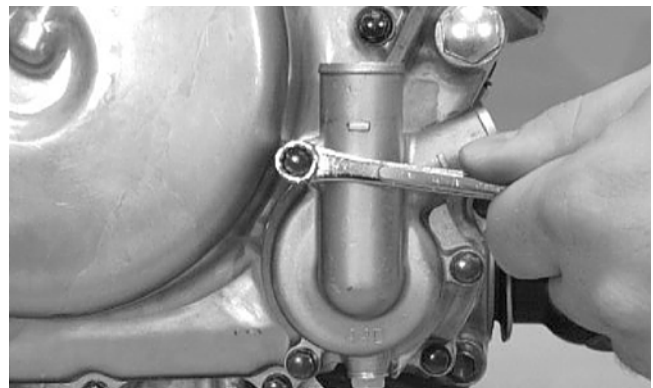
## Removing Right-Side Components

**3**

### **A. Oil Filter**

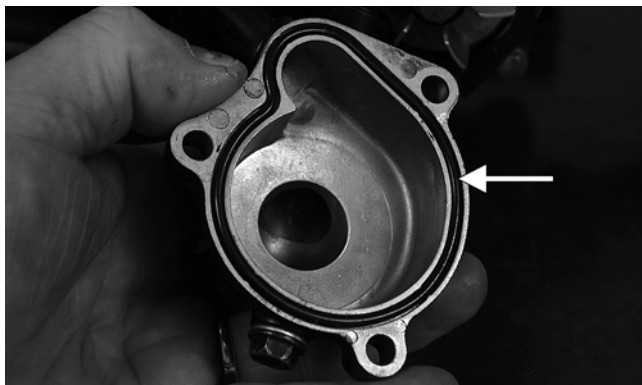
### **B. Water Pump**

1. Remove the clamp securing the coolant hose to the water pump; then remove the hose.
2. Using the Oil Filter Wrench (p/n 0644-389), remove the oil filter.
3. Remove the three cap screws securing the water pump cover to the right-side cover; then remove the water pump cover. Account for the O-ring.



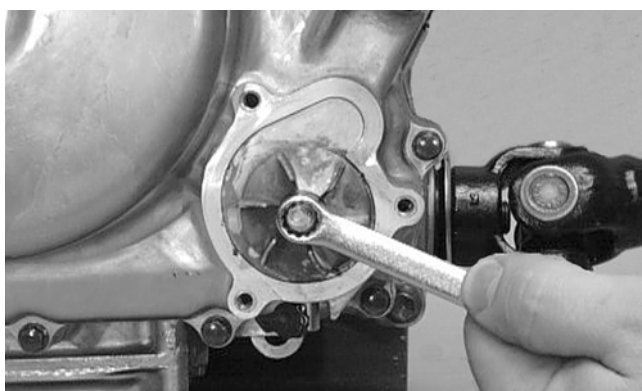
CC027D



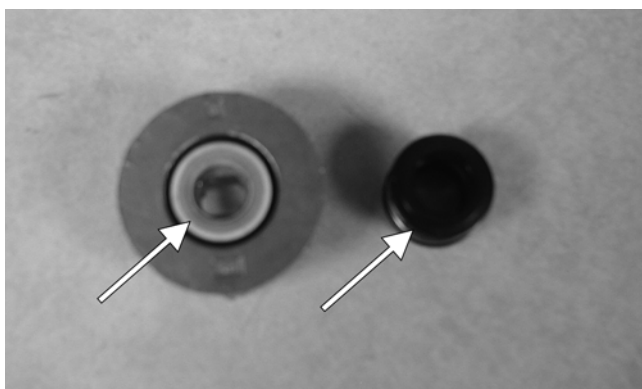


CF066A

4. Remove the cap screw securing the impeller to the impeller shaft; then remove the impeller. Account for the rubber retainer and porcelain seal.

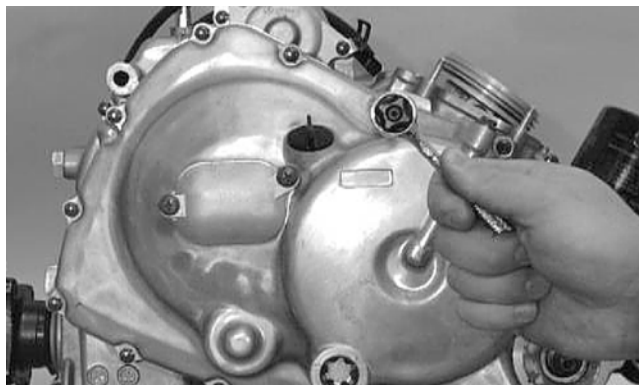


CC029D



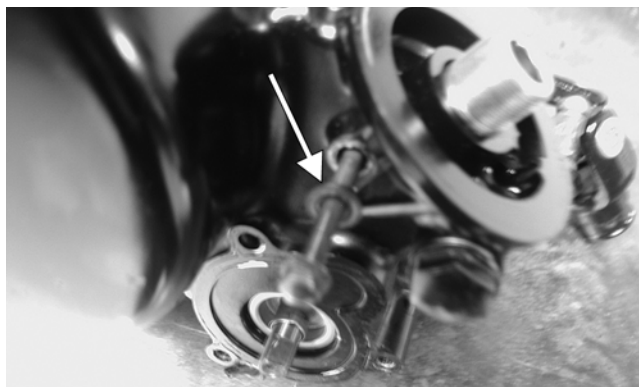
CD163A

5. Remove the fifteen cap screws securing the right-side cover to the crankcase. Remove the cover. Note the location of the long cap screw and rubber washer. Account for the gasket and for two alignment pins.



CC034D

■ **NOTE:** The water pump housing does not have to be removed when removing the right-side cover.



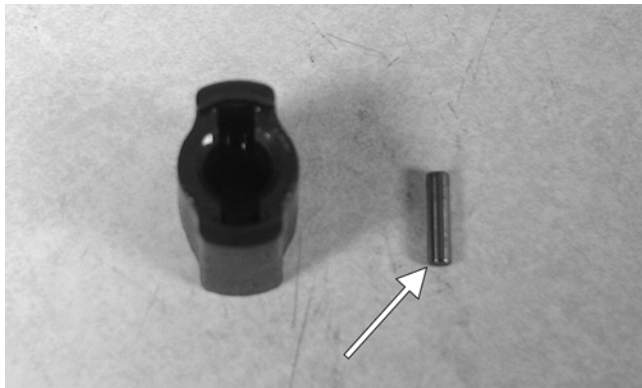
CD164A

■ **NOTE:** When removing the right-side cover, account for the release roller guide that it does not fall and cause damage.



CC070D

6. Remove the water pump drive joint from the water pump shaft. Account for the pin.



CD168A

### C. Primary Drive Clutch Shoe

### D. Primary Driven Clutch

### E. Primary Drive Clutch Housing

■ **NOTE:** Steps 1-6 in the preceding sub-section must precede this procedure.

7. Remove the reverse cam stopper housing and gasket and account for a stopper and spring.

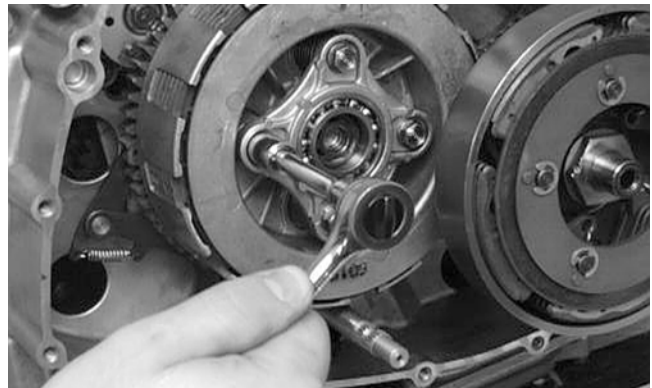


CC069D

8. Remove the clutch release arm and washer; then in a crisscross pattern, remove the four cap screws securing the clutch release roller assembly.



CD171



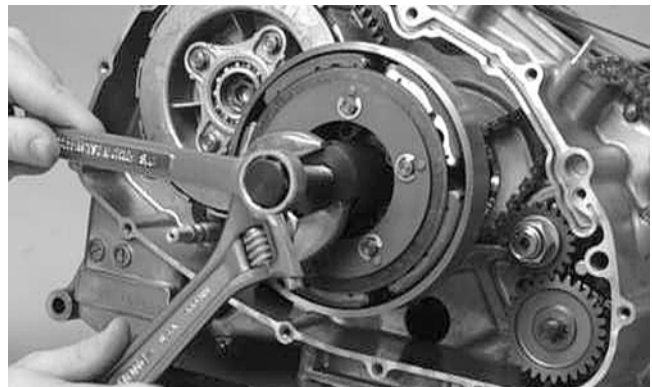
CC074D

9. Remove the release plate. Account for four springs.
10. Remove the primary drive clutch-shoe nut (left-hand threads) and washer from the drive-shaft; then using a primary clutch shoe remover, remove the clutch shoe.

### ⚠ CAUTION

Care must be taken when removing the nut; it has "left-hand" threads.

3



CC072D

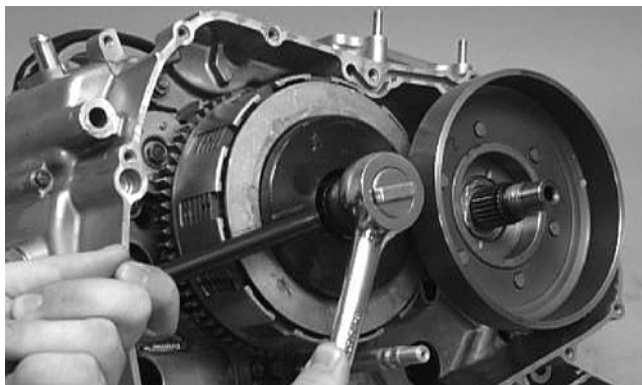
11. Remove the primary drive one-way clutch from the primary drive clutch housing. Note the word OUTSIDE stamped on the clutch for installing purposes.



CF043

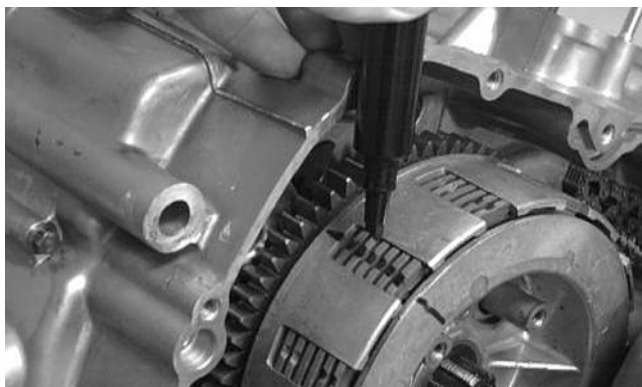
12. Using the Clutch Sleeve Hub Holder (p/n 0444-007) to hold the clutch sleeve hub, remove the nut and washer.





CC076D

13. Scribe a line across the primary driven clutch assembly to aid in assembling.



CC077D

14. Simultaneously, remove the primary driven clutch assembly and primary drive clutch housing from their respective shafts. Account for the sleeve and washers.



CC078D

### **AT THIS POINT**

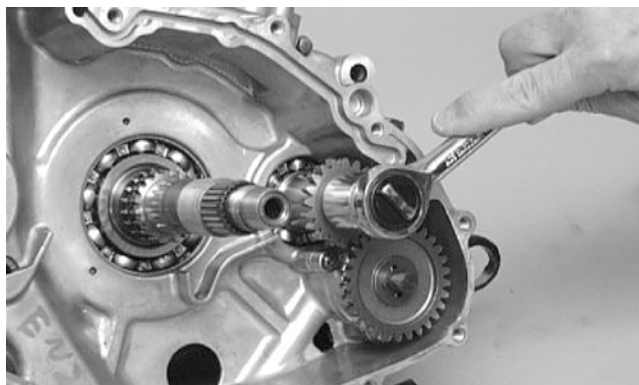
To service clutch components, see Servicing Right-Side Components sub-section.

## **F. Gear Shift Cam Plate/Guide G. Oil Pump/Oil Strainer**

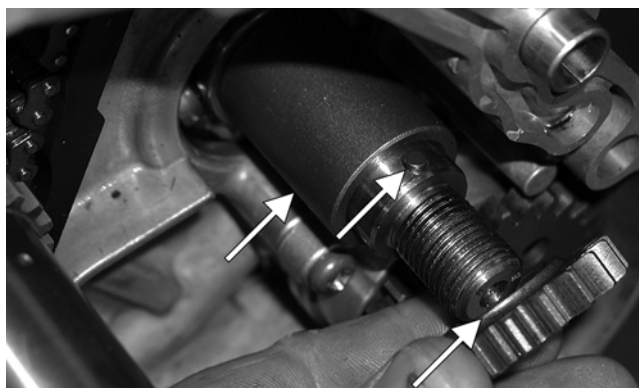
■ **NOTE:** Steps 1-14 in the preceding sub-sections must precede this procedure.

15. Remove the cam chain from the crankcase.

16. Remove the nut and washer securing the oil pump drive gear to the crank balancer shaft; then remove the gear and account for the pin and the spacer.



CC080D



CF070A

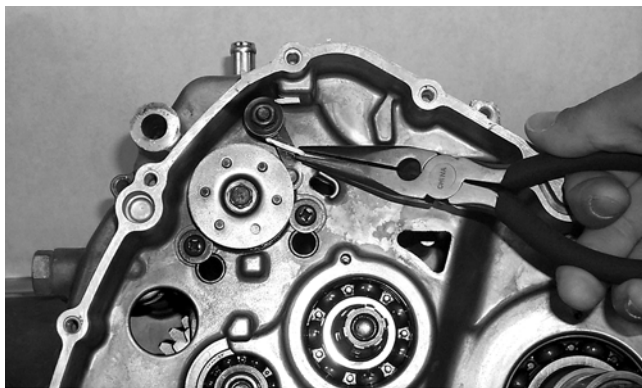
17. Remove the gear shift shaft from the crankcase.



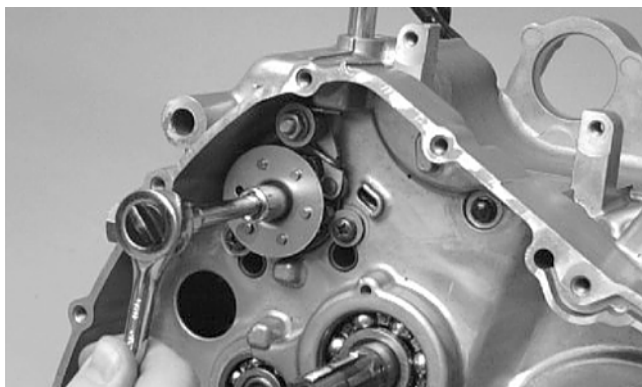
CC085D

18. Release the tension from the gear shift cam stopper arm spring.





19. Remove the cap screw securing the gear shift cam plate and guide to the gear shift cam; then remove the cam plate and guide.

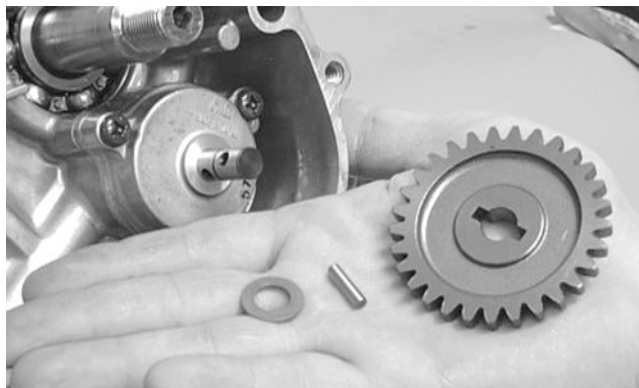
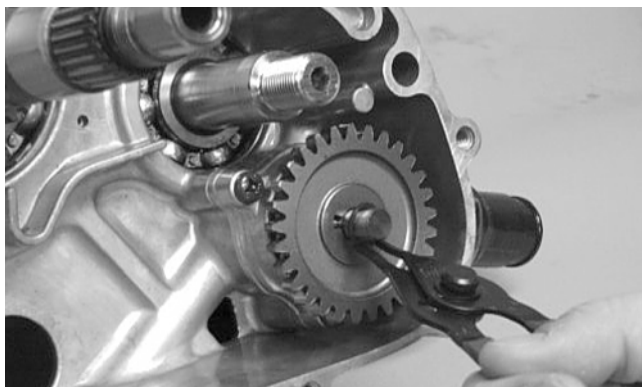


**CAUTION**

If servicing of the engine/transmission is due to a lubrication-related problem, replace the oil pump.

■ **NOTE:** For general servicing, it is advisable to disassemble, clean, and inspect the oil pump. If any wear or damage is suspected, replace the oil pump.

20. Remove the circlip securing the oil pump driven gear; then remove the gear. Account for the pin and the washer.



21. Remove the three Phillips-head screws securing the oil pump; then remove the oil pump.

■ **NOTE:** It may be necessary to use an impact driver to loosen the screws.

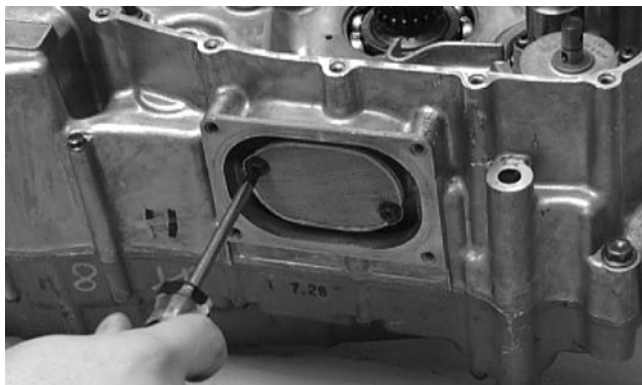


22. Remove the cap screws securing the oil strainer cap; then remove the cap. Account for the O-ring.



23. Remove the two Phillips-head cap screws securing the strainer.

3



CC163D

### AT THIS POINT

To service center crankcase components only, proceed to Separating Crankcase Halves.

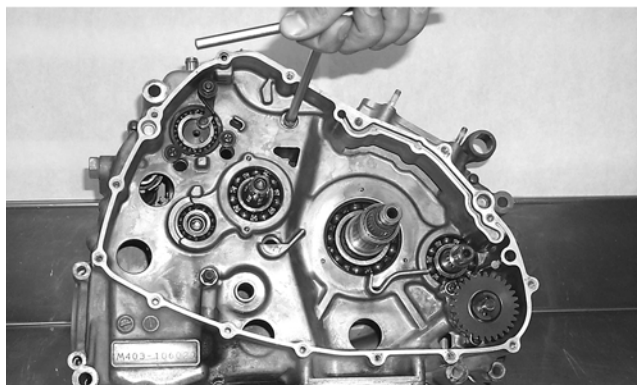
## Center Crankcase Components

■ **NOTE:** This procedure cannot be done with the engine/transmission in the frame. Complete Removing procedures for Top-Side, Left-Side, and Right-Side must precede this procedure.

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

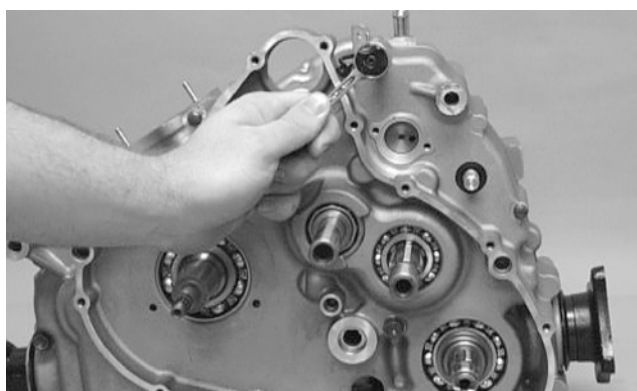
## Separating Crankcase Halves

1. Remove the five right-side 6 mm cap screws (one from inside the case) securing the crankcase halves. Note the location of the different-lengthed cap screws.



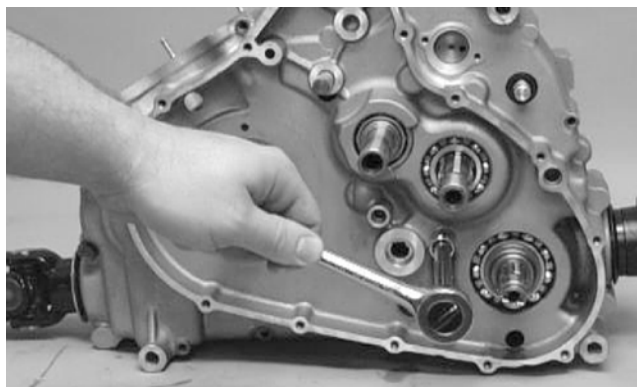
CC530D

2. Remove the seven left-side 6 mm cap screws securing the crankcase halves. Note the location of the wiring form. Note the location of the different-lengthed cap screws.



CC096D

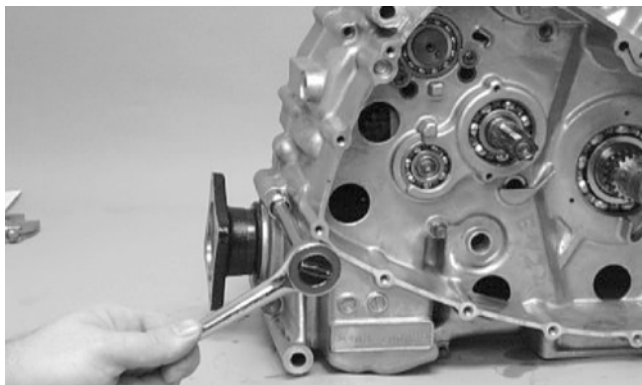
3. Remove the three left-side 8 mm cap screws (two from inside the case) securing the crankcase halves. Note the location of the different-lengthed cap screws.



CC097D

4. Remove the three right-side 8 mm cap screws securing the crankcase halves.

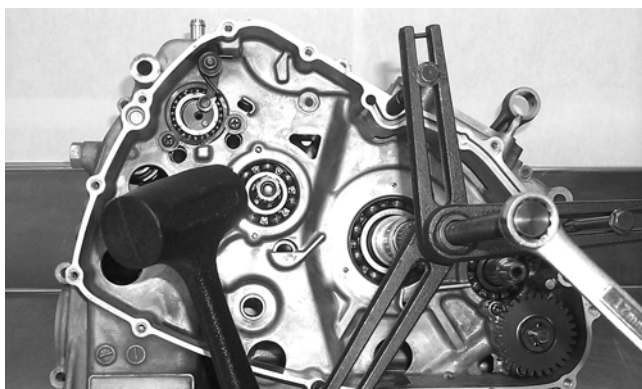




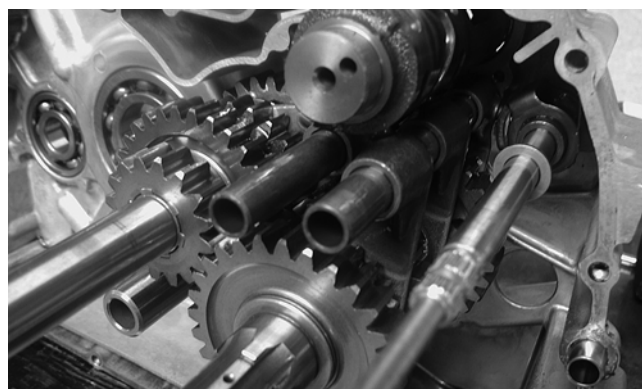
CC098D

5. Using the Crankcase Separator/Crankshaft Remover (p/n 0444-009) and tapping lightly with a rubber mallet, separate the crankcase halves. Account for two alignment pins, an O-ring, and a washer.

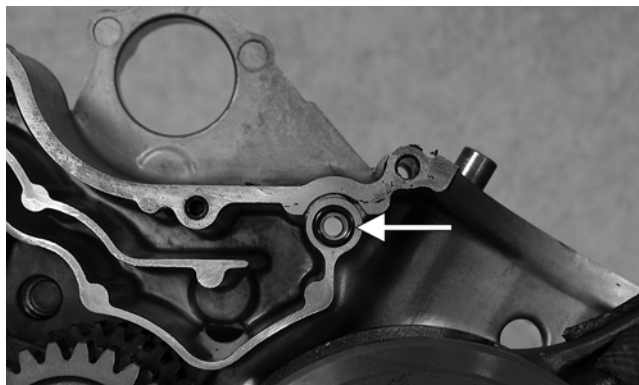
■ **NOTE:** To keep the shaft/gear assemblies intact for identification, tap the shafts toward the left-side crankcase half when separating the halves.



CC099D



CD227



CF078A



CC102D

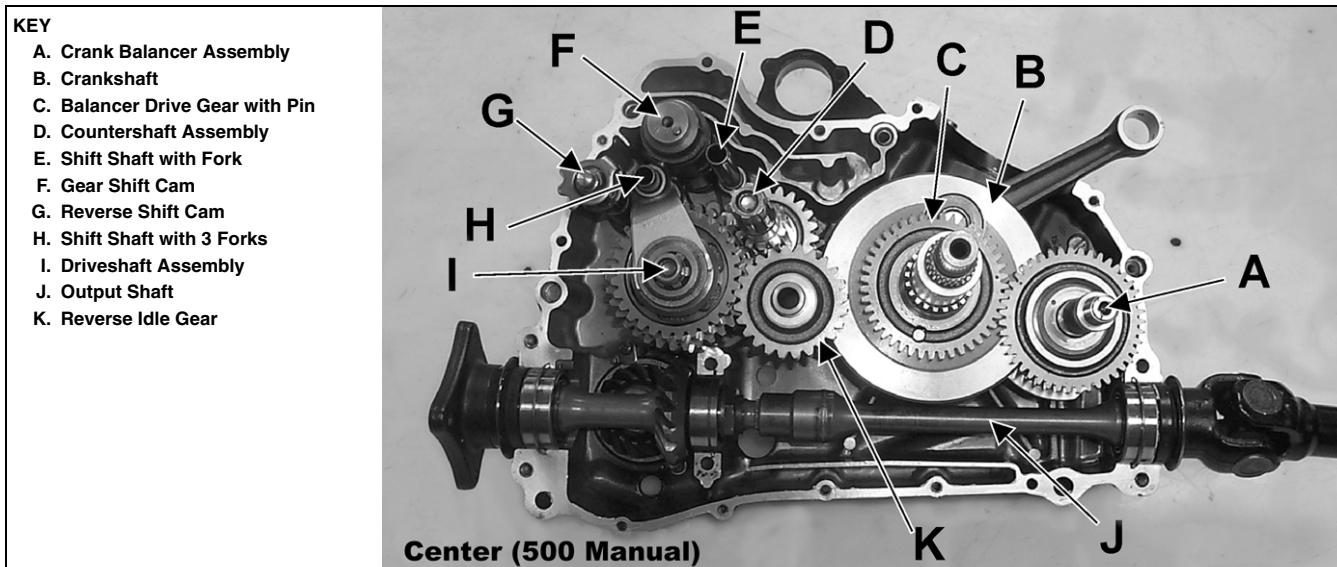
3

## Disassembling Crankcase Half

■ **NOTE:** For steps 1-10, refer to illustration CC803C.

■ **NOTE:** To aid in assembling, it is recommended that the assemblies are kept together and IN ORDER.





1. Remove the two shift shafts (E and H).
2. Remove the reverse shift cam (G) and spacer.
3. Disengage four forks from the gear shift cam (F); then remove the reverse shifter fork.



4. Remove the gear shift cam (F).



5. Remove the three remaining forks noting their positions for assembling purposes.

**AT THIS POINT**

To service gear shift forks, see Servicing Center Crankcase Components sub-section.

6. Remove the reverse idle gear (K) w/shaft. Account for the bushing, two washers, and the circlip.
7. Simultaneously, remove the driveshaft assembly (I) and countershaft assembly (D). Account for the washer on the countershaft.

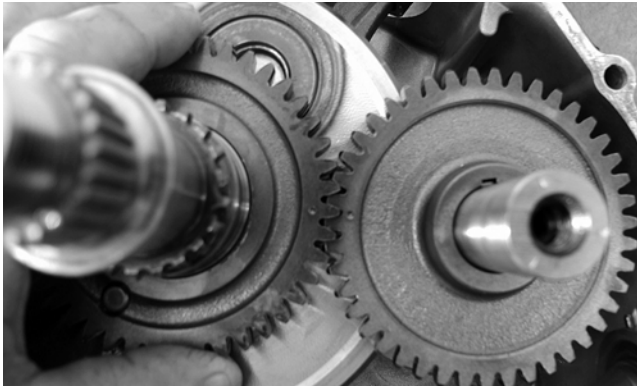
**AT THIS POINT**

To service the driveshaft and/or countershaft, see Servicing Center Crankcase Components sub-section.

■ **NOTE:** For efficiency, if the driveshaft and/or countershaft are not being serviced, it is preferable to leave them assembled. The technician should use discretion and sound judgment.

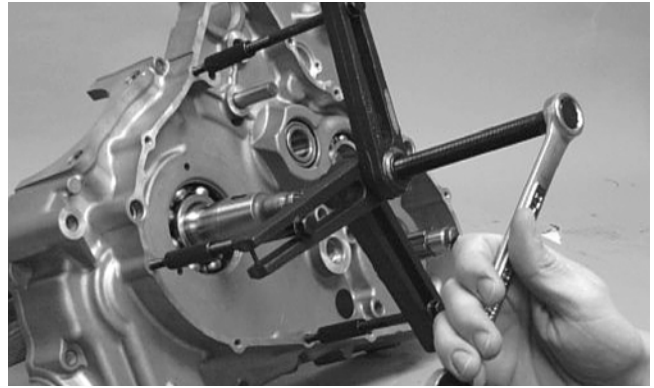
8. Remove the front output shaft (J) and rear shaft assemblies. Account for the bearing C-ring.

■ **NOTE:** Note the alignment marks on the crank balancer driven gear and balancer drive gear to aid in assembly.



CD826

9. Remove the driven gear from the crank balancer assembly (A). Account for a key.



CC115D

### AT THIS POINT

To service crankshaft assembly, see Servicing Center Crankcase Components sub-section.

### CAUTION

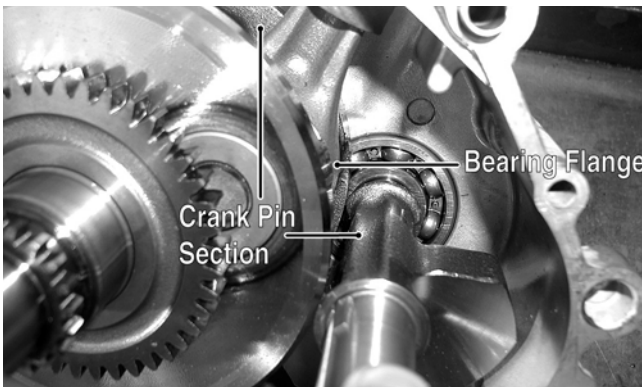
Do not remove the remaining output shaft assembly unless absolutely necessary. If the shaft is removed, the shaft nut must be replaced with a new one and the shaft must be re-shimmed.

3



CD832

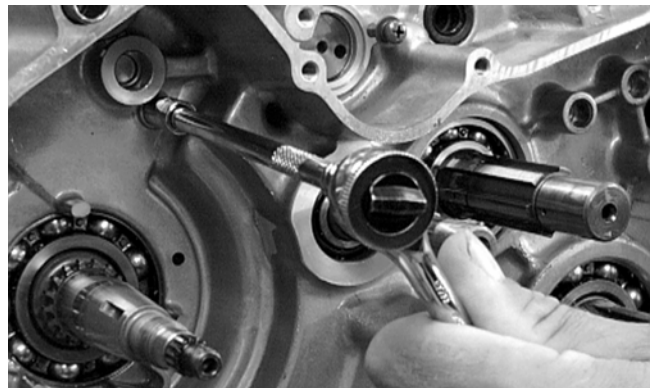
10. Remove the crank balancer assembly (A).



CD832B

■ **NOTE:** There is a flat spot on the crank balancer to allow clearance past the crankshaft.

11. Using the Crankcase Separator/Crankshaft Remover (p/n 0444-009), push the crankshaft assembly out of the crankcase.



CC482D

## Table of Contents (Servicing Components)

■ **NOTE:** Critical engine/transmission specifications are located at the beginning of this section.

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## Servicing Top-Side Components

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

### VALVE ASSEMBLY

When servicing valve assembly, inspect valve seats, valve stems, valve faces, and valve stem ends for pits, burn marks, or other signs of abnormal wear.

■ **NOTE:** Whenever a valve is out of tolerance, it must be replaced.

### Cleaning/Inspecting Valve Cover

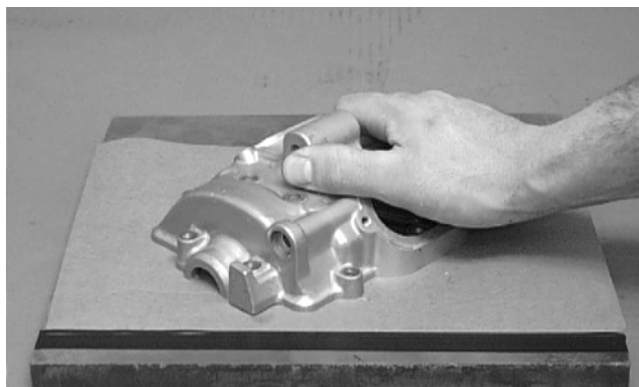
■ **NOTE:** If the valve cover cannot be trued, the cylinder head assembly must be replaced.

1. Wash the valve cover in parts-cleaning solvent.

2. Place the valve cover on the Surface Plate (p/n 0644-016) covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the valve cover in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the valve cover in a figure eight motion until a uniform bright metallic finish is attained.

### ⚠ CAUTION

**Do not remove an excessive amount of the sealing surface or damage to the camshaft will result. Always check camshaft clearance when resurfacing the valve cover.**



CC130D

### ⚠ CAUTION

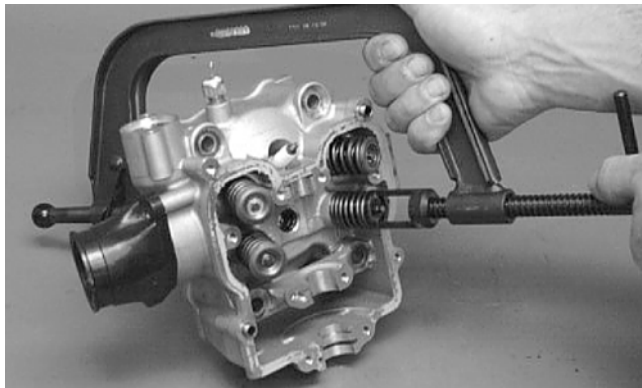
**Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.**

### Removing Valves

■ **NOTE:** Keep all valves and valve components as a set. Note the original location of each valve set for use during installation. Return each valve set to its original location during installation.

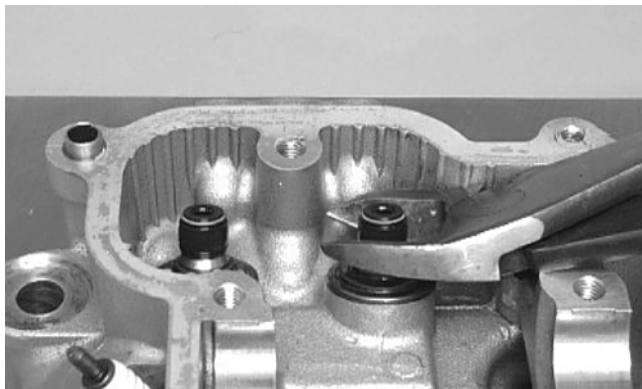
1. Using a valve spring compressor, compress the valve springs and remove the valve cotters. Account for an upper spring retainer.



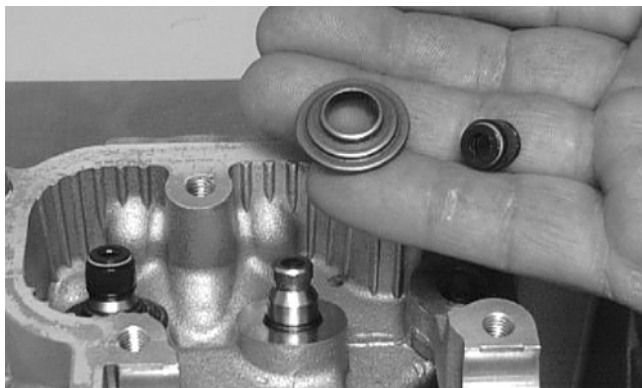


CC132D

2. Remove the valve seal and the lower remaining spring seat. Discard the valve seal.



CC134D



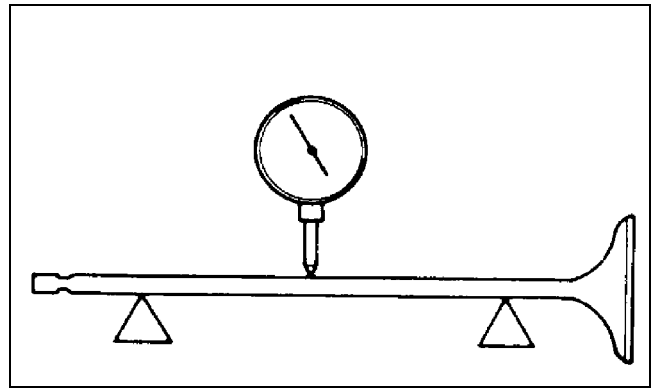
CC136D

■ **NOTE:** The valve seals must be replaced.

3. Remove the valve springs; then invert the cylinder head and remove the valves.

### Measuring Valve Stem Runout

1. Support each valve stem end with the V Blocks (p/n 0644-022); then check the valve stem runout using a dial indicator.



ATV-1082

2. Maximum runout must not exceed specifications.

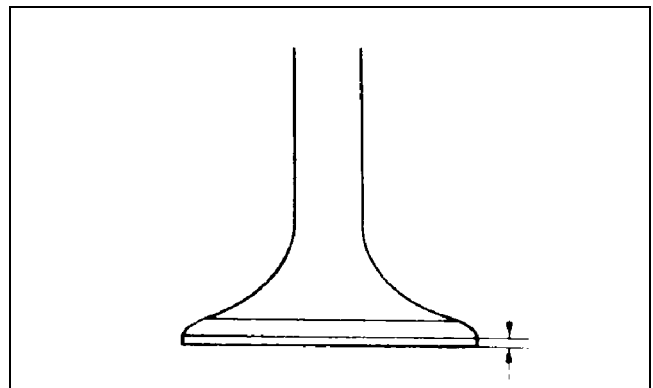
### Measuring Valve Stem Outside Diameter

1. Using a micrometer, measure the valve stem outside diameter.
2. Acceptable diameter range (intake valve) must be within specifications.
3. Acceptable diameter range (exhaust valve) must be within specifications.

3

### Measuring Valve Face/Seat Width

1. Using a micrometer, measure the width of the valve face.

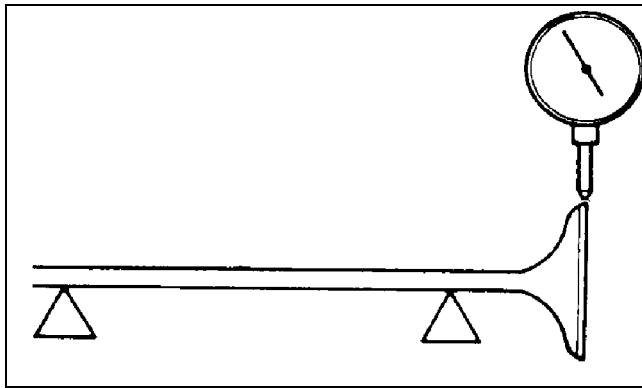


ATV-1004

2. Acceptable width range must be within specifications.

### Measuring Valve Face Radial Runout

1. Mount a dial indicator on the surface plate; then place the valve stem on a set of V blocks.
2. Position the dial indicator contact point on the outside edge of the valve face; then zero the indicator.

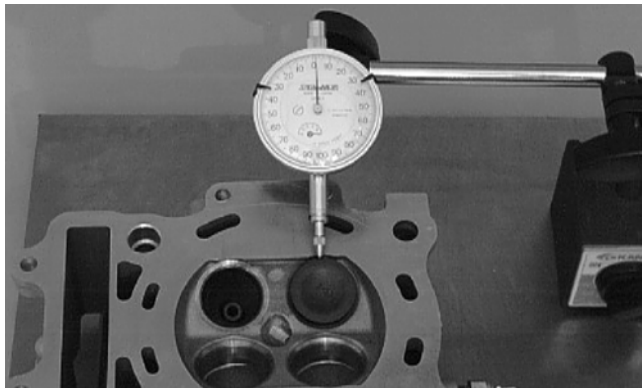


ATV1082A

3. Rotate the valve in the V blocks.
4. Maximum runout must not exceed specifications.

### Measuring Valve Guide/Valve Stem Deflection (Wobble Method)

1. Mount a dial indicator and base on the surface plate; then place the cylinder head on the surface plate.
2. Install the valve into the cylinder head; then position the dial indicator contact point against the outside edge of the valve face. Zero the indicator.



CC131D

3. Push the valve from side to side; then from top to bottom.
4. Maximum "wobble" deflection must not exceed specifications.

### Measuring Valve Guide (Inside Diameter)

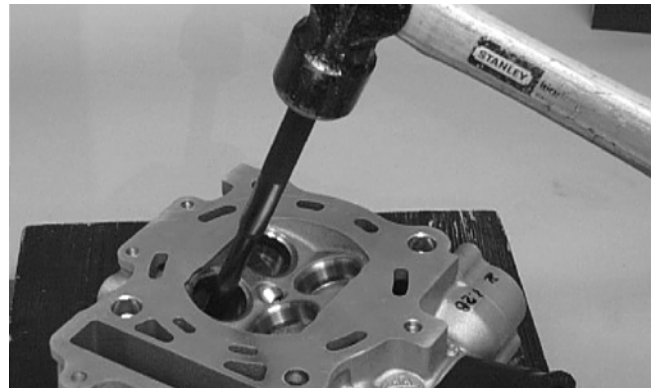
1. Insert a snap gauge 1/2 way down into each valve guide bore; then remove the gauge and measure it with a micrometer.
2. Acceptable inside diameter range must be within specifications.

3. If a valve guide is out of tolerance, it must be replaced.

### Replacing Valve Guide

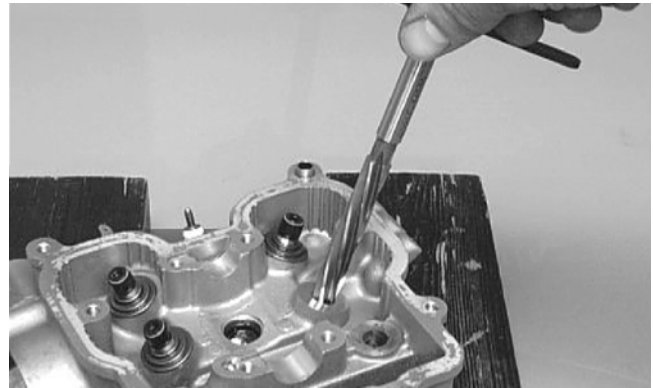
■ **NOTE:** If a valve guide is worn or damaged, it must be replaced.

1. If a valve guide needs replacing, insert a valve guide remover into the valve seat side of the valve guide. Using a hammer, gently drive the valve guide out of the cylinder head.



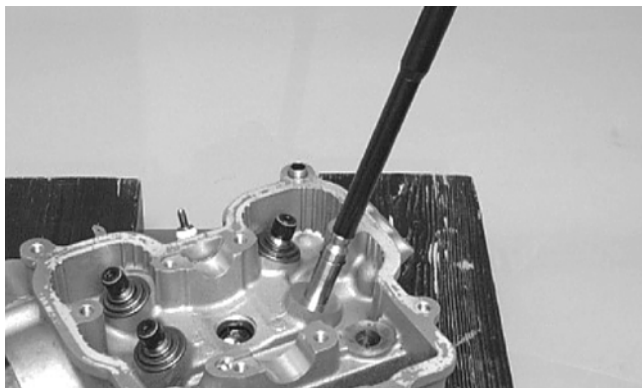
CC137D

2. Using the Standard Valve Guide Reamer (p/n 0444-017), remove any burrs or tight areas from the valve guide journals.



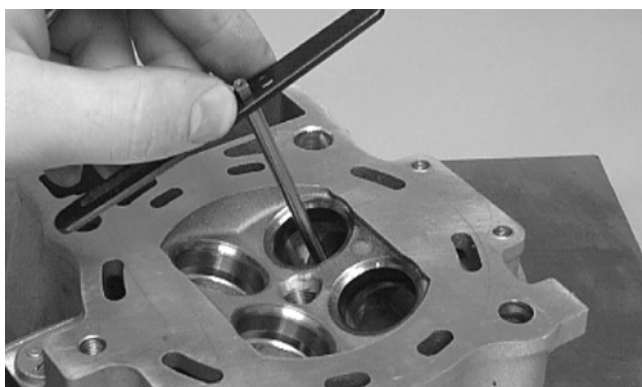
CC142D

3. To install a valve guide, use a valve guide installer and gently drive a valve guide with a retaining clip into the bore from the valve spring side until the retaining clip just contacts the cylinder head.



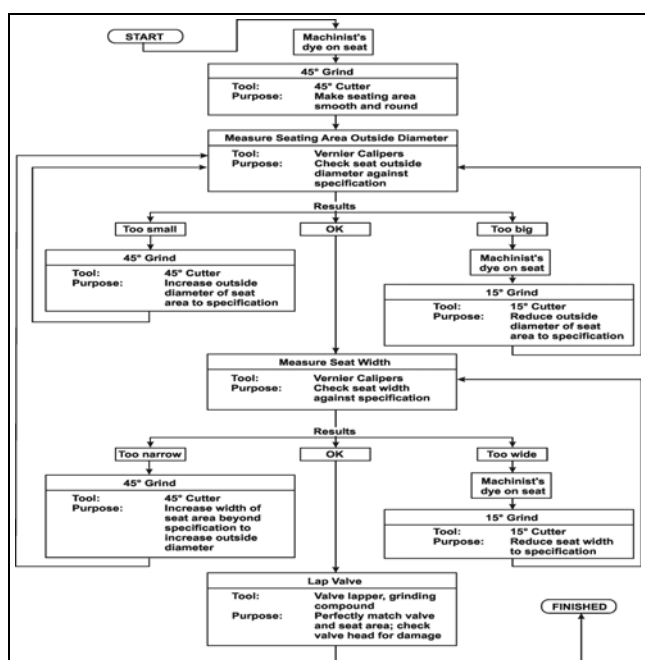
CC143D

4. After installing the guide, use the standard valve guide reamer to remove all burrs and tight areas that may remain in each valve guide.



CC138D

## Valve Seat/Guide Servicing Flow Chart



ATV-0107

## Grinding Valve Seats

■ **NOTE:** If the valve seat is beyond servicing, the cylinder head must be replaced.

1. Insert an exhaust valve seat pilot shaft into an exhaust valve guide. Slide an exhaust valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the exhaust valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining exhaust valve.



CC139D

2. Insert an intake valve seat pilot shaft into one of the intake valve guides. Slide the intake valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the intake valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining intake valve.



CC140D

## Lapping Valves

■ **NOTE:** Do not grind the valves. If a valve is damaged, it must be replaced.

1. Remove all carbon from the valves.



2. Lubricate each valve stem with light oil; then apply a small amount of valve lapping compound to the entire seating face of each valve.
3. Attach the suction cup of a valve lapping tool to the head of the valve.
4. Rotate the valve until the valve and seat are evenly polished.
5. Clean all compound residue from the valve and seat.

### Measuring Rocker Arm (Inside Diameter)

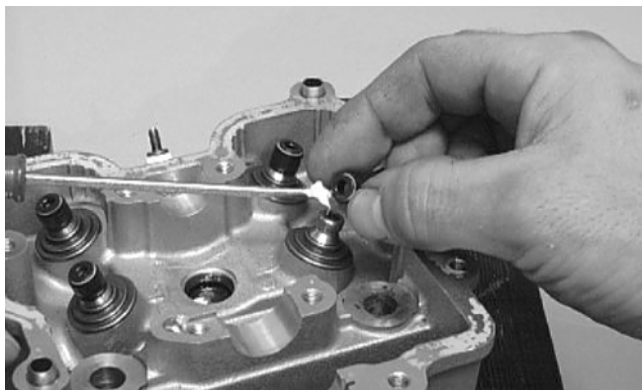
1. Using a dial calipers, measure the inside diameter of the rocker arm.
2. Acceptable inside diameter range must be within specifications.

### Measuring Rocker Arm Shaft (Outside Diameter)

1. Using a micrometer, measure the outside diameter of the rocker arm shaft.
2. Acceptable outside diameter range must be within specifications.

### Installing Valves

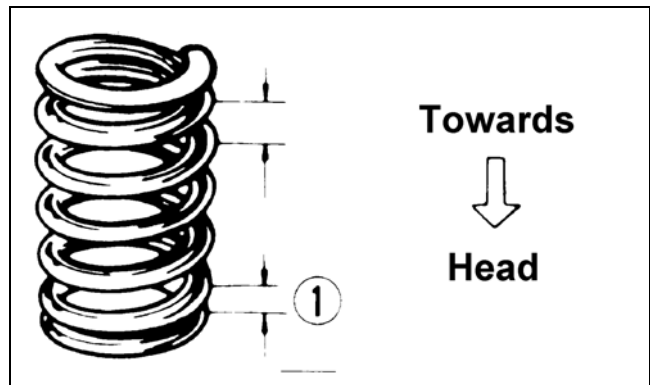
1. Apply grease to the inside surface of the valve seals; then place a lower spring seat and valve guide seal over each valve guide.



CC144D

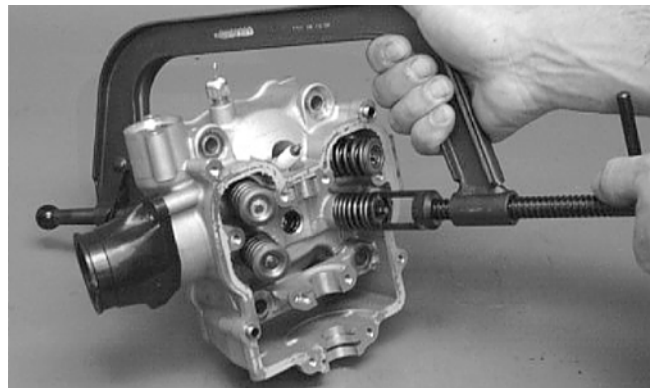
2. Insert each valve into its original valve location.
3. Install the valve springs with the painted end of the spring facing away from the cylinder head.

■ **NOTE:** If the painted end is not visible, install the ends of the springs with the closest coils toward the head.



ATV-1011A

4. Place a spring retainer over the valve springs; then using the valve spring compressor, compress the valve springs and install the valve cotters.



CC132D

### PISTON ASSEMBLY

■ **NOTE:** Whenever a piston, rings, or pin are out of tolerance, they must be replaced.

### Cleaning/Inspecting Piston

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the dome of the piston.
2. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
3. Inspect the piston for seizure marks or scuffing. Repair with #400 grit wet-or-dry sandpaper and water or honing oil.

■ **NOTE:** If scuffing or seizure marks are too deep to correct with the sandpaper, replace the piston.

4. Inspect the perimeter of each piston for signs of excessive "blowby." Excessive "blowby" indicates worn piston rings or an out-of-round cylinder.

## Removing Piston Rings

1. Starting with the top ring, slide one end of the ring out of the ring-groove.



CC400D

2. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

■ **NOTE:** If the existing rings will not be replaced with new ones, note the location of each ring for proper installation. When installing new rings, install as a complete set only.

## Cleaning/Inspecting Piston Rings

1. Take an old piston ring and snap it into two pieces; then grind the end of the old ring to a 45° angle and to a sharp edge.
2. Using the sharpened ring as a tool, clean carbon from the ring-grooves. Be sure to position the ring with its tapered side up.

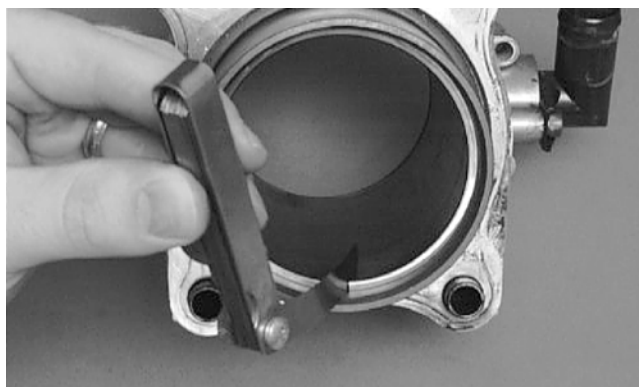


### CAUTION

Improper cleaning of the ring-grooves by the use of the wrong type of ring-groove cleaner will result in severe damage to the piston.

## Measuring Piston-Ring End Gap (Installed)

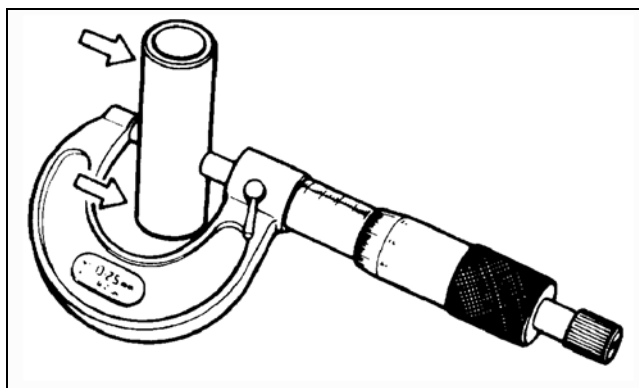
1. Place each piston ring in the wear portion of the cylinder. Use the piston to position each ring squarely in the cylinder.
2. Using a feeler gauge, measure each piston-ring end gap. Acceptable ring end gap must be within specifications.



CC280D

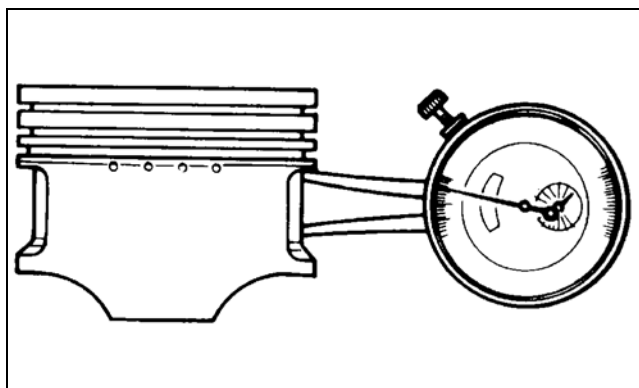
## Measuring Piston Pin (Outside Diameter) and Piston-Pin Bore

1. Measure the piston pin outside diameter at each end and in the center. If measurement is not within specifications, the piston pin must be replaced.



ATV-1070

2. Insert an inside dial indicator into the piston-pin bore. The diameter must not exceed specifications. Take two measurements to ensure accuracy.



ATV-1069

## Measuring Piston Skirt/ Cylinder Clearance

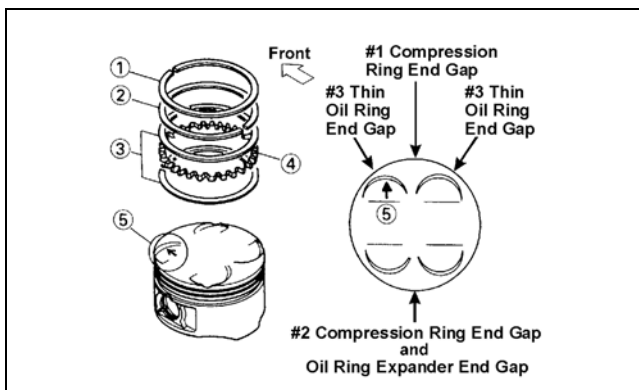
1. Measure the cylinder front to back in six places.

2. Measure the corresponding piston diameter at a point 15 mm (0.6 in.) above the piston skirt at a right angle to the piston-pin bore. Subtract this measurement from the measurement in step 1. The difference (clearance) must be within specifications.

### Installing Piston Rings

1. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.

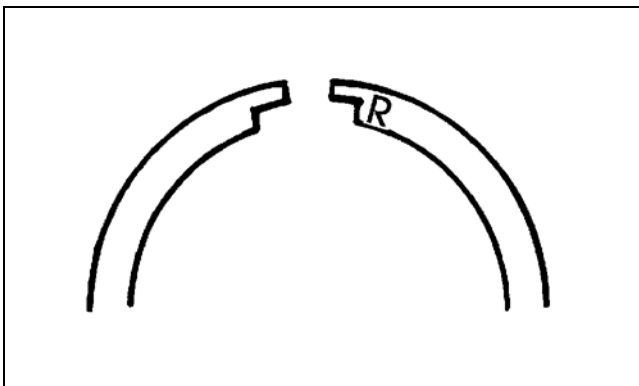
■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.



ATV-1085B

2. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston (see illustration).

■ **NOTE:** The chrome (silver) ring should be installed in the top position.



726-306A

### CAUTION

Incorrect installation of the piston rings will result in engine damage.

## CYLINDER/CYLINDER HEAD ASSEMBLY

■ **NOTE:** If the cylinder/cylinder head assembly cannot be trued, they must be replaced.

### Cleaning/Inspecting Cylinder Head

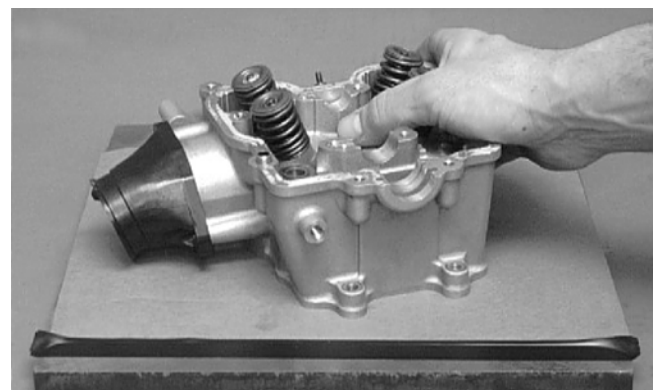
#### CAUTION

The cylinder head studs must be removed for this procedure.

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the combustion chamber being careful not to nick, scrape, or damage the combustion chamber or the sealing surface.
2. Inspect the spark plug hole for any damaged threads. Repair damaged threads using a "heli-coil" insert.
3. Place the cylinder head on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder head in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder head in a figure eight motion until a uniform bright metallic finish is attained.

#### CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



CC128D

### Measuring Cylinder Head Distortion

1. Remove any carbon buildup in the combustion chamber.



2. Lay a straightedge across the cylinder head; then using a feeler gauge, check the distortion factor between the head and the straightedge.
3. Maximum distortion must not exceed specifications.



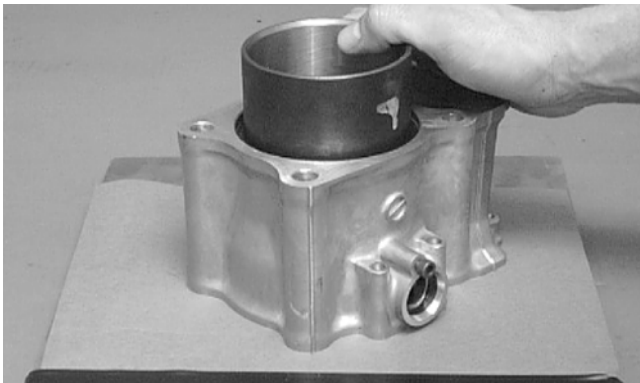
CC141D

### Cleaning/Inspecting Cylinder

1. Wash the cylinder in parts-cleaning solvent.
2. Inspect the cylinder for pitting, scoring, scuffing, warpage, and corrosion. If marks are found, repair the surface using a cylinder hone (see Honing Cylinder in this sub-section).
3. Place the cylinder on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder in a figure eight motion until a uniform bright metallic finish is attained.

#### CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



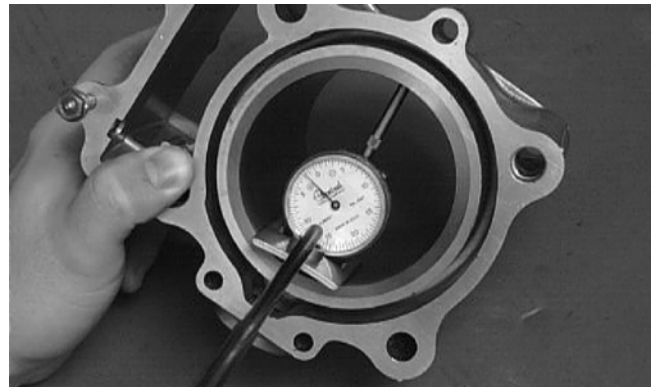
CC129D

### Inspecting Cam Chain Guide

1. Inspect cam chain guide for cuts, tears, breaks, or chips.
2. If the chain guide is damaged, it must be replaced.

### Honing Cylinder

1. Using a slide gauge and a dial indicator or a snap gauge, measure the cylinder bore diameter in three locations from top to bottom and again from top to bottom at 90° from the first measurements for a total of six measurements. The trueness (out-of-roundness) is the difference between the highest and lowest reading. Maximum trueness (out-of-roundness) must not exceed specifications.



CC127D

2. Wash the cylinder in parts-cleaning solvent.
3. Inspect the cylinder for pitting, scoring, scuffing, and corrosion. If marks are found, repair the surface using a ball hone.

■ **NOTE:** To produce the proper 60° cross-hatch pattern, use a low RPM drill (600 RPM) at the rate of 30 strokes per minute. If honing oil is not available, use a lightweight petroleum-based oil. Thoroughly clean cylinder after honing using soap and hot water. Dry with compressed air; then immediately apply oil to the cylinder bore. If the bore is severely damaged or gouged, replace the cylinder.



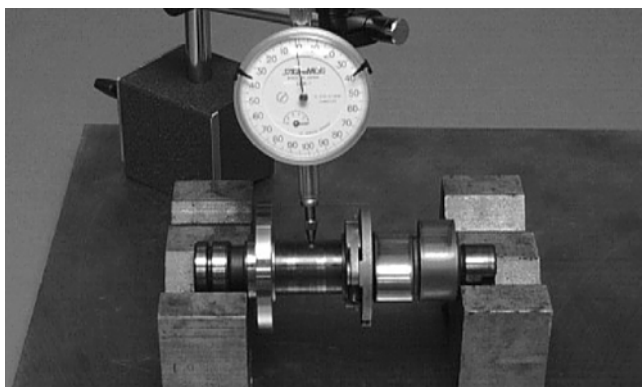
CC390D

4. If any measurement exceeds specifications, replace the cylinder.

### Measuring Camshaft Runout

■ **NOTE:** If the camshaft is out of tolerance, it must be replaced.

1. Place the camshaft on a set of V blocks; then position the dial indicator contact point against the shaft and zero the indicator.

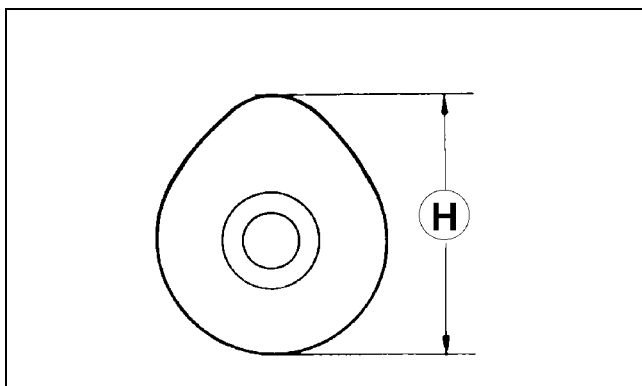


CC283D

2. Rotate the camshaft and note runout; maximum tolerance must not exceed specifications.

### Measuring Camshaft Lobe Height

1. Using a calipers, measure each cam lobe height.



ATV1013A

2. The lobe heights must not exceed minimum specifications.

### Inspecting Camshaft Bearing Journal

1. Inspect the bearing journal for scoring, seizure marks, or pitting.
2. If excessive scoring, seizure marks, or pitting is found, the cylinder head assembly must be replaced.

### Measuring Camshaft to Cylinder Head Clearance

1. Remove the adjuster screws and jam nuts.

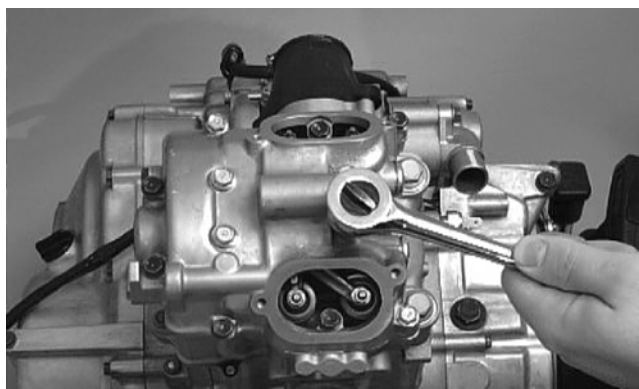


CC005D

2. Place a strip of plasti-gauge in each of the camshaft lands in the cylinder head.
3. Place the valve cover on the cylinder head and secure with the valve cover cap screws. Tighten securely.

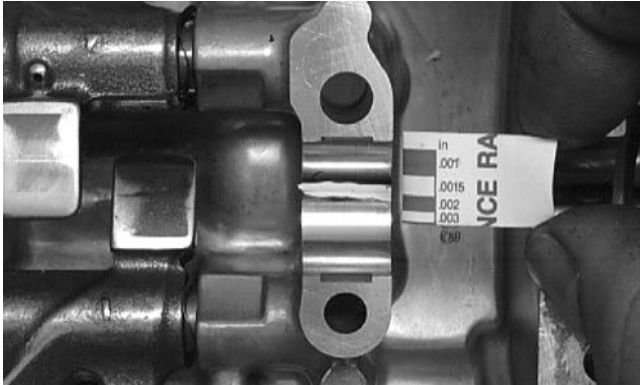
■ **NOTE:** Do not rotate the camshaft when measuring clearance.

4. Remove the cap screws securing the valve cover to the cylinder; then remove the valve cover and camshaft.



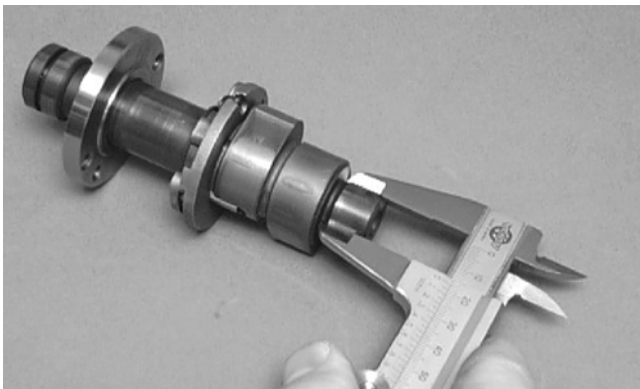
CC003D

- Match the width of the plasti-gauge with the chart found on the plasti-gauge packaging to determine camshaft to cylinder head and valve cover clearance.



CC145D

- If clearance is excessive, measure the journals of the camshaft.

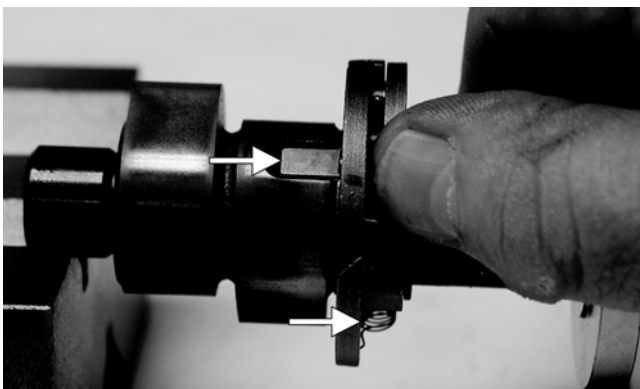


CC287D

■ **NOTE:** If the journals are worn, replace the camshaft; then measure the clearance again. If it is still out of tolerance, replace the cylinder head.

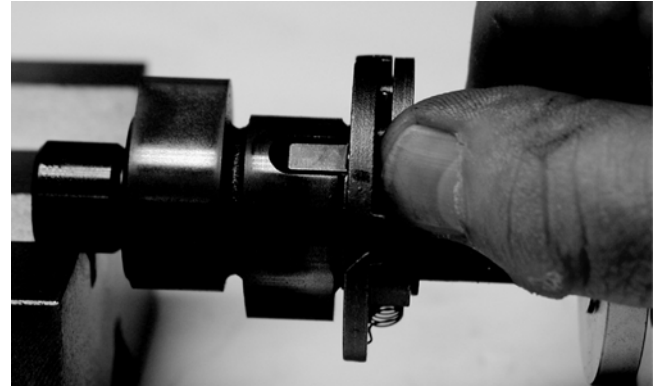
### Inspecting Camshaft Automatic Decompression Spring/Unloader Assembly

- Inspect the spring, weights, and unloader for damage and freedom of movement.



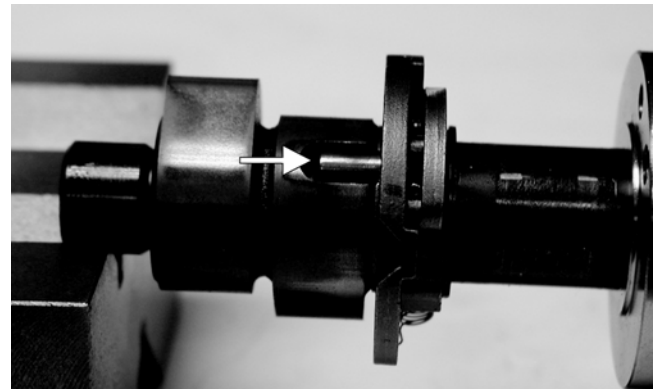
CF061A

■ **NOTE:** With the weight extended, the unloader flat should be even with the camshaft journal.



CF061

■ **NOTE:** When the weight is released, the spring should return the assembly to the “unload” position with the unloader extending above the camshaft journal.



CF060A

- If damaged, the camshaft must be replaced.

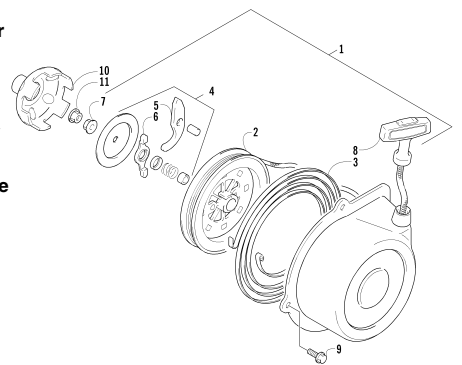
3

## Servicing Left-Side Components

### RECOIL STARTER

#### KEY

- Recoil Starter Assy
- Reel
- Spiral Spring
- Ratchet Assy
- Ratchet
- Ratchet Guide
- Nut
- Rope Assy
- Cap Screw
- Starter Cup
- Nut



0737-034

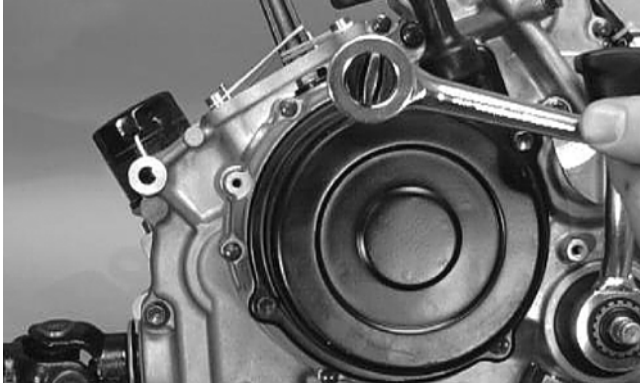


**⚠ WARNING**

Always wear safety glasses when servicing the recoil starter.

**Removing/Disassembling**

1. Remove the cap screws securing the recoil starter assembly to the left-side cover; then remove the starter.

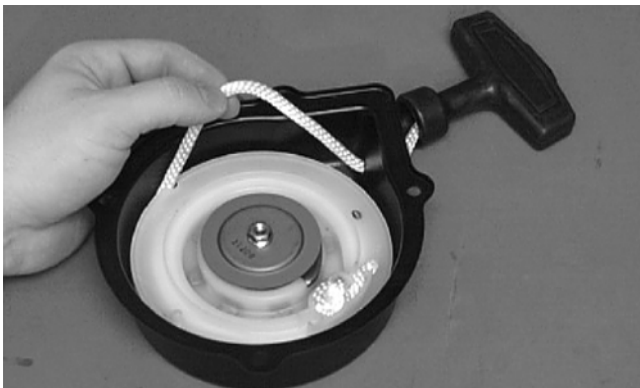


CC039D

**⚠ WARNING**

During the disassembly procedure, continuous downward pressure must be exerted on the reel so it does not accidentally disengage and cause injury.

2. Rotate the reel counterclockwise until the notch of the reel is near the rope guide in the case. Guide the rope into the notch and slowly allow the reel to retract until all spiral spring tension is released.

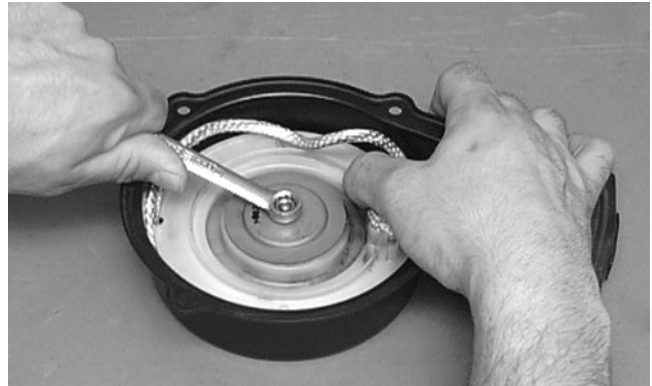


B600D

**⚠ CAUTION**

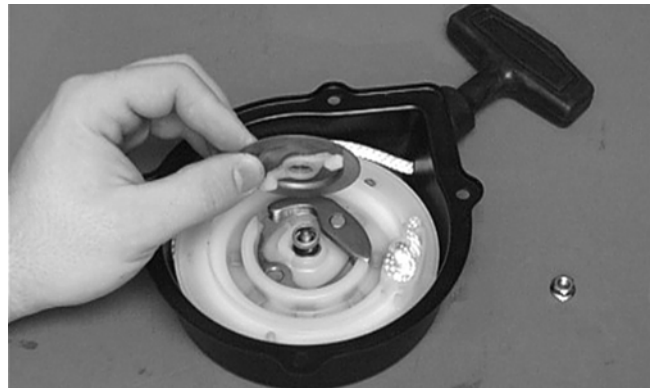
During the disassembly procedure, make sure all spring tension is released before continuing.

3. Remove the nut.



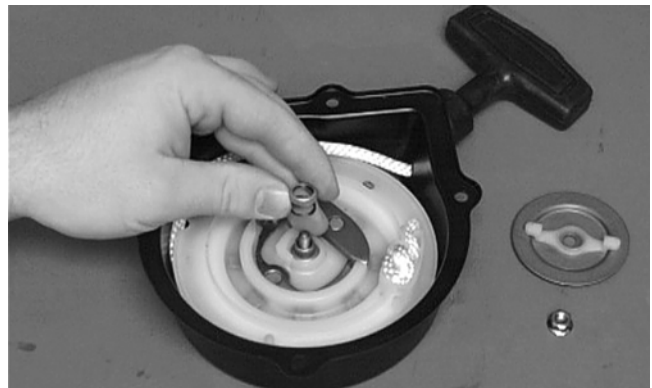
B601D

4. Slowly release the friction plate and lift the plate with ratchet guide free of the recoil case; then remove the ratchet guide from the friction plate.



B602D

5. Remove the spring cover, spring, and shaft.



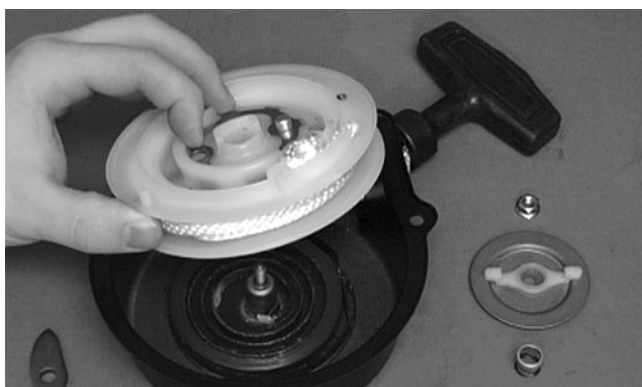
B603D

6. Remove the ratchet and account for the pin.



B604D

7. Carefully lift the reel from the case making sure the spring does not accidentally disengage from the case.



B605D

### **WARNING**

Care must be taken when lifting the recoil free of the case. Wear safety glasses to avoid injury.

8. Remove the protective cover from the starter handle and pull the rope out of the handle; then untie the knot in the rope and remove the handle.

■ **NOTE:** Do not remove the spiral spring unless replacement is necessary. It should be visually inspected in place to save time. If replacement is necessary, follow steps 9-10.

9. Remove the spiral spring from the case by lifting the spring end up and out. Hold the remainder of the spring with thumbs and alternately release each thumb to allow the spring to gradually release from the case.
10. Unwind the rope from the reel and remove the rope.

## **Cleaning and Inspecting**

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all components.
2. Inspect the springs and ratchet for wear or damage.
3. Inspect the reel and case for cracks or damage.
4. Inspect the shaft for wear, cracks, or damage.
5. Inspect the rope for breaks or fraying.
6. Inspect the spiral spring for cracks, crystallization, or abnormal bends.
7. Inspect the handle for damage, cracks, or deterioration.

## **Assembling/Installing**

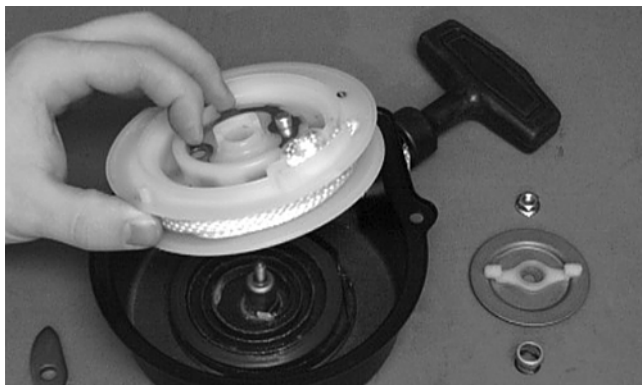
1. If removed, insert the spiral spring into the case with the outer end of the spring around the mounting lug in the case; then wind it in a counterclockwise direction until the complete spring is installed.

■ **NOTE:** The spiral spring must seat evenly in the recoil case.



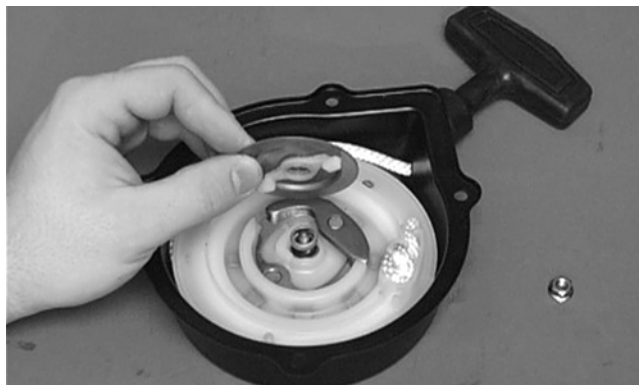
B606D

2. Insert the rope through the hole in the reel and tie a knot in the end; then wrap the rope counterclockwise around the reel leaving approximately 50 cm (20 in.) of rope free of the reel.
3. Apply low-temperature grease to the spring and hub.
4. Thread the end of the rope through the guide hole of the case; then thread the rope through the handle and secure it with a double knot. Install the protective cover into the handle.
5. Align the inner hook of the spiral spring with the notch in the reel.



B605D

6. Install the ratchet onto its spring making sure the end is properly installed on the reel.



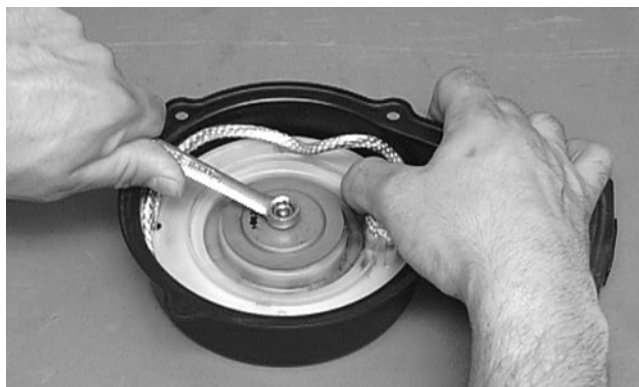
B602D

9. While pushing down on the reel, install the nut. Tighten securely.



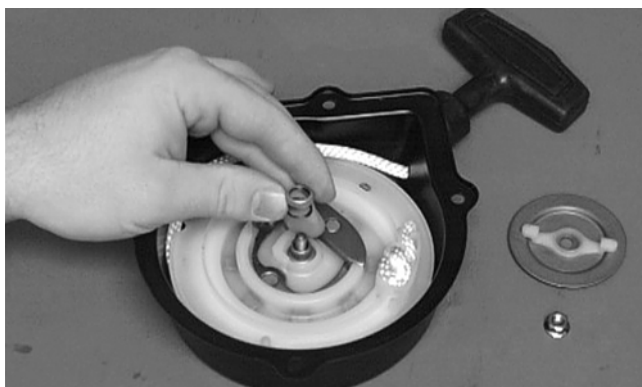
B604D

7. Install the shaft, spring, and the spring cover.



B601D

10. With the 50 cm (20 in.) of rope exposed, hook the rope in the notch of the reel.



B603D

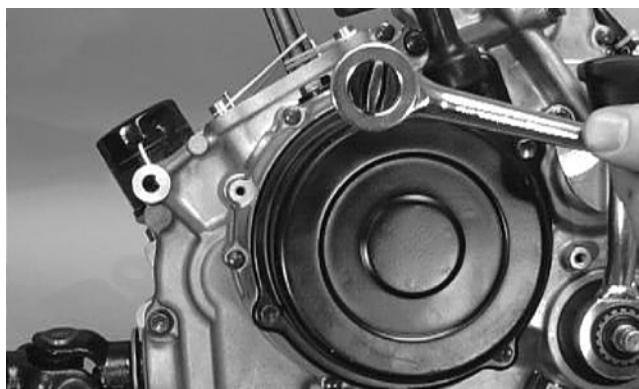
8. Install the friction plate with the ratchet guide fitting into the ratchet.

11. Rotate the reel four turns counterclockwise; then release the rope from the notch and allow the rope to retract.

12. Pull the rope out two or three times to check for correct tension.

■ **NOTE:** Increasing the rotations in step 11 will increase spring tension.

13. Place the recoil starter assembly into position on the left-side cover; then tighten the cap screws to specifications.



CC039D



## MEASURING SHIFT FORK (Thickness)

■ **NOTE:** Whenever a shift fork is out of tolerance, replacement is necessary.

1. Using a calipers, in turn measure the thickness of the machined tip of each shift fork.

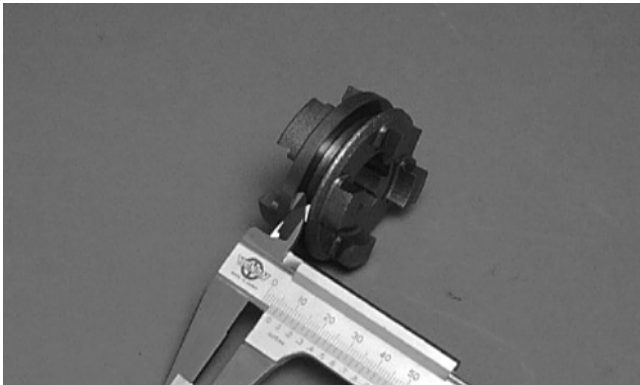


CC296D

2. Shift fork thickness must be within specifications.

## MEASURING SHIFT FORK GROOVE (Width)

1. Using a calipers, in turn measure the width of each shift fork groove.

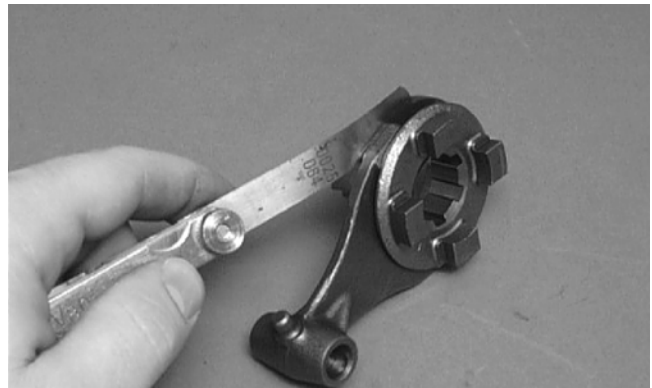


CC288D

2. Shift fork groove width must be within specifications.

## MEASURING SHIFT FORK TO GROOVE (Side Clearance)

1. In turn, insert each shift fork into its groove.
2. Using a feeler gauge, measure the clearance between the shift fork and the groove.



CC292D

3. Shift fork to groove side clearance must be within specifications.

## Servicing Right-Side Components

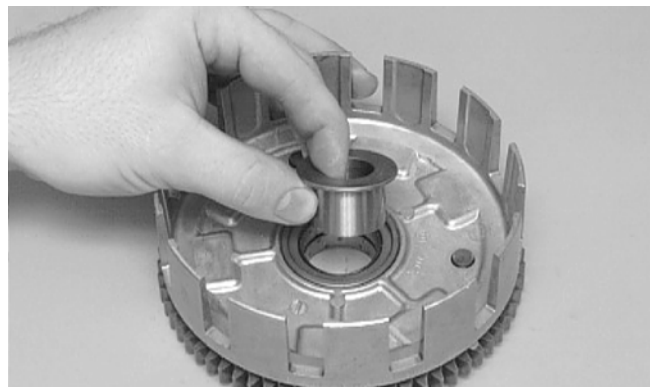
3

■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

### PRIMARY CLUTCH ASSEMBLY (Inspecting/Measuring/Assembling)

■ **NOTE:** Prior to inspecting and measuring components, it is recommended that all components be removed from the primary gear assembly and be cleaned.

■ **NOTE:** When removing components from the primary gear assembly, account for the bushing that fits into the primary gear.

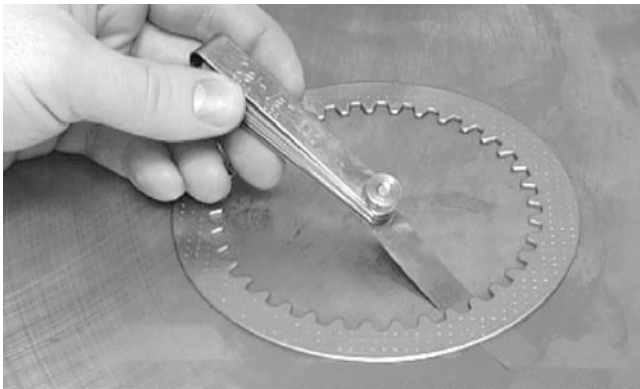


CC239D

### Inspecting/Measuring Clutch Driven Plate Warpage

1. Inspect each driven plate for warpage and burn marks.

2. In turn place each driven plate on the surface plate; then using a feeler gauge, measure warpage in several locations.

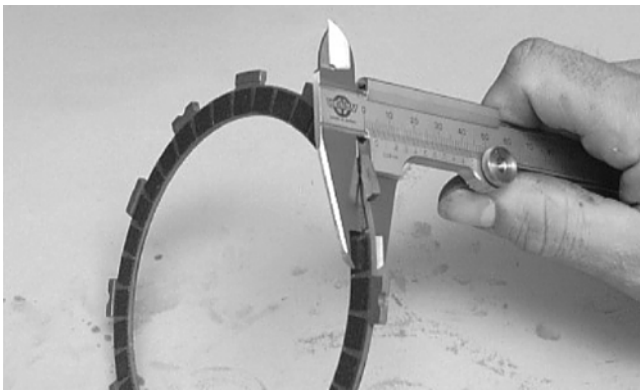


CC245D

3. Maximum driven plate warpage must not exceed specifications.

### Measuring Clutch Drive Plate (Fiber) Thickness

1. Using a calipers, in turn measure the thickness of each drive plate in several locations.



CC243D

2. Drive plate thickness must be within minimum specifications.
3. If the fiber plate tabs are damaged, the plate must be replaced.
4. Inspect the clutch sleeve hub for grooves or notches. If grooves or notches are present, replace the hub.

### Inspecting Centrifugal Clutch Shoe

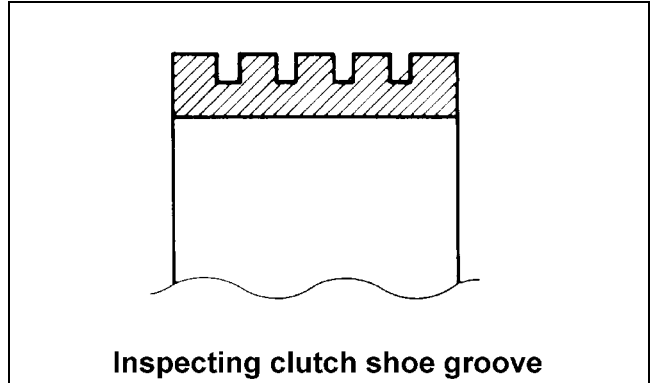
1. Inspect the clutch shoe for uneven wear, chips, cracks, or discoloration.

2. Inspect the depth of the grooves in the clutch shoes. If any shoe is worn to the bottom of the groove, replace the complete set.



### CAUTION

Always replace clutch shoes as a complete set or severe imbalance could occur.



ATV1014

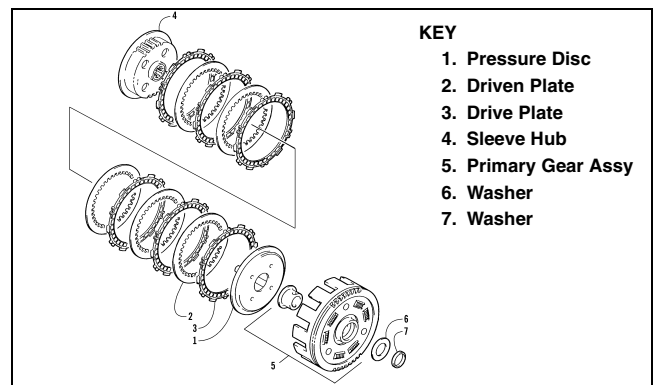
### Inspecting Centrifugal Clutch Housing

1. Inspect the clutch housing for burns, marks, scuffs, cracks, scratches, or uneven wear.
2. If the housing is damaged in any way, the housing must be replaced.

### Inspecting Primary One-Way Drive

1. Insert the drive into the centrifugal clutch housing.
2. Rotate the inner race by hand and verify the inner race rotates only one direction.
3. If the inner race is locked in place or rotates both directions, the drive assembly must be replaced.

### Assembling Primary Clutch

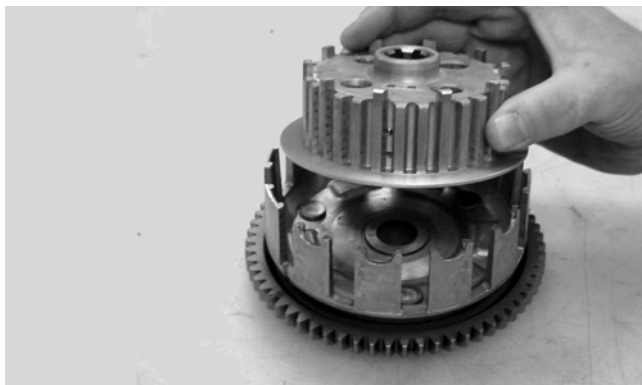


#### KEY

1. Pressure Disc
2. Driven Plate
3. Drive Plate
4. Sleeve Hub
5. Primary Gear Assy
6. Washer
7. Washer

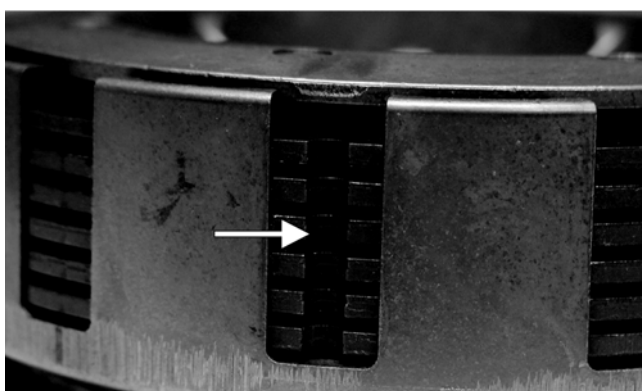
737-731A

1. Place the clutch hub upside down into the primary gear assembly.



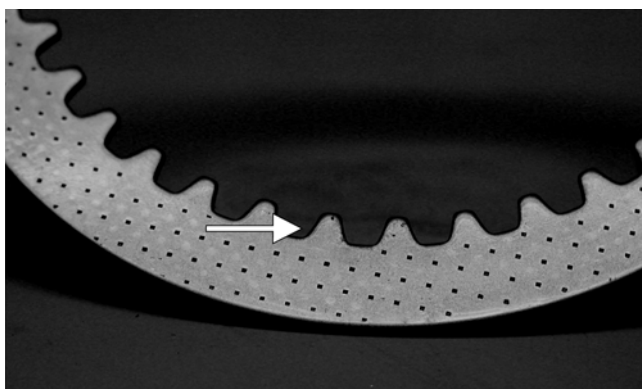
CC920

2. Alternately install the drive plates and driven plates onto the hub (starting with and ending with a drive plate) making sure the tabs with the notches are all in line with each other.



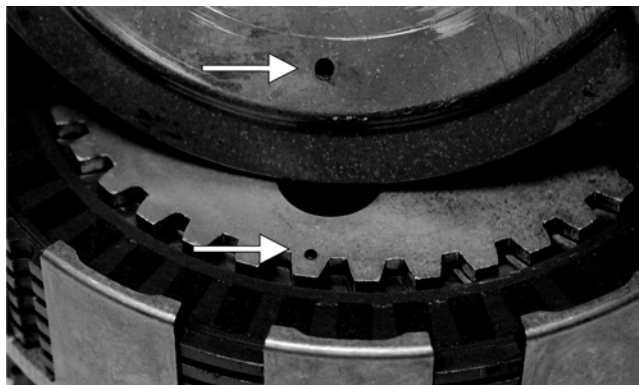
CF044A

■ **NOTE:** When installing the driven plates for ease of installation, make sure they are placed onto the hub with the rounded side of the plates directed down.



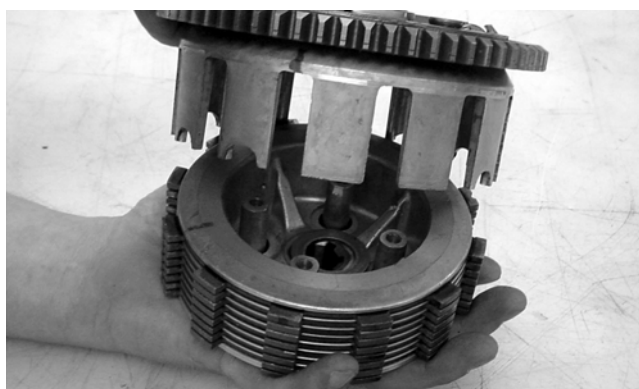
CF045A

3. Install the pressure plate onto the hub making sure the alignment dots are correctly positioned.



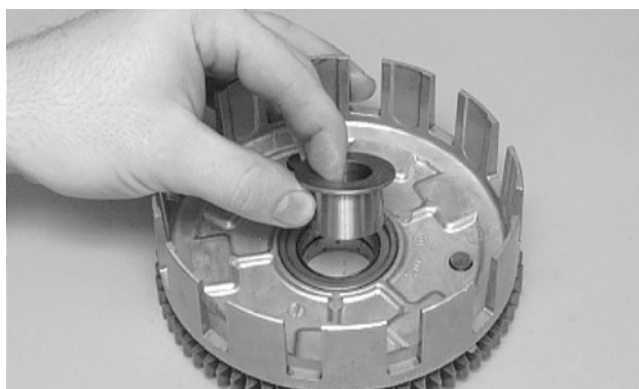
CF047A

4. Place the primary gear assembly w/clutch hub assembly in one hand, place the other hand on top of the clutch hub assembly, and flip the assembly over; then lift the primary gear assembly off the clutch hub assembly being careful not to disturb the drive plate notched tab orientation.



CC924

5. Place the primary gear assembly on a clean, flat surface; then install the primary washer into the assembly.

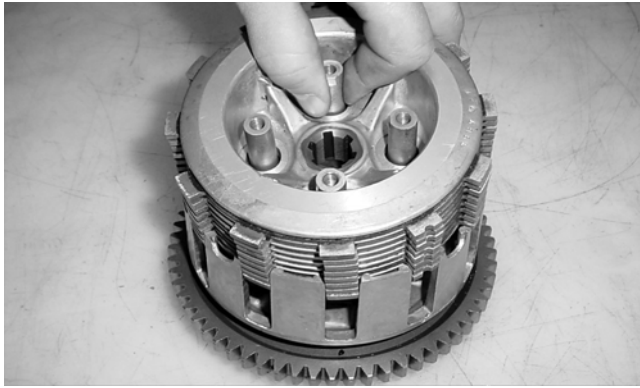


CC239D

6. Place the clutch hub assembly into the primary gear assembly.

3





CC926

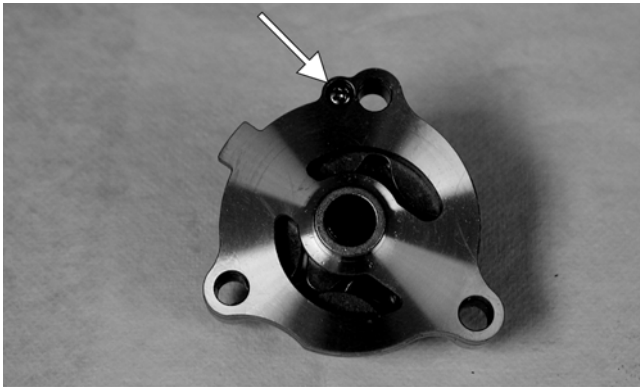
### **CAUTION**

The clutch hub and the pressure plate must be seated in the proper position. If any of the incorrect positions are used, the hub and plate will have clearance between them and they will not operate properly.

■ **NOTE:** The primary clutch assembly is now completely assembled for installation.

## **INSPECTING OIL PUMP**

1. Inspect the pump for damage.
2. It is inadvisable to remove the screw securing the pump halves. If the oil pump is damaged, it must be replaced.



CD989A

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## **Servicing Center Crankcase Components**

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■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

## **SECONDARY GEARS**

■ **NOTE:** When checking and correcting secondary gear backlash and tooth contact, the universal joint must be secured to the front shaft or false measurements will occur.

### **Checking Backlash**

■ **NOTE:** The rear shaft and bevel gear must be removed for this procedure. Also, always start with the original shims on the rear shaft.

1. Place the left-side crankcase cover onto the left-side crankcase half to prevent runout of the secondary transmission output shaft.
2. Install the secondary driven output shaft assembly onto the crankcase.
3. Mount the indicator tip of the dial indicator on the secondary driven bevel gear.
4. While rocking the driven bevel gear back and forth, note the maximum backlash reading on the gauge.
5. Acceptable backlash range is 0.05-0.33 mm (0.002-0.013 in.).

### **Correcting Backlash**

■ **NOTE:** If backlash measurement is within the acceptable range, no correction is necessary.

1. If backlash measurement is less than specified, remove an existing shim, measure it, and install a new thinner shim.
2. If backlash measurement is more than specified, remove an existing shim, measure it, and install a thicker shim.

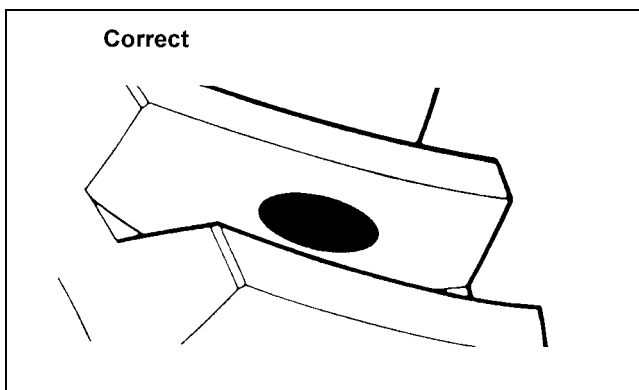
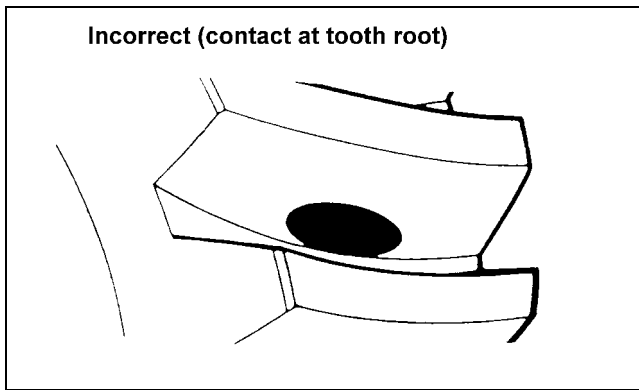
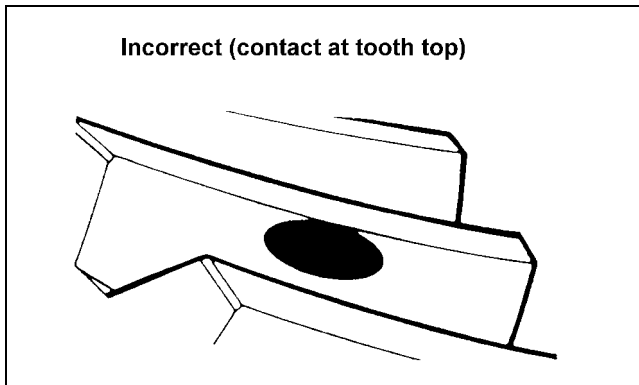
■ **NOTE:** Continue to remove, measure, and install until backlash measurement is within tolerance. Note the following chart.

| Backlash Measurement              | Shim Correction         |
|-----------------------------------|-------------------------|
| Under 0.05 mm (0.002 in.)         | Decrease Shim Thickness |
| At 0.05-0.33 mm (0.002-0.013 in.) | No Correction Required  |
| Over 0.33 mm (0.013 in.)          | Increase Shim Thickness |

### **Checking Tooth Contact**

■ **NOTE:** After correcting backlash of the secondary driven bevel gear, it is necessary to check tooth contact.

1. Remove the secondary driven output shaft assembly from the left-side crankcase half.
2. Clean the secondary driven bevel gear teeth of old oil and grease residue.
3. Apply a thin, even coat of a machinist-layout dye to several teeth of the gear.
4. Install the secondary driven output shaft assembly.
5. Rotate the secondary driven bevel gear several revolutions in both directions.
6. Examine the tooth contact pattern in the dye and compare the pattern to the illustrations.



## Correcting Tooth Contact

■ **NOTE:** If tooth contact pattern is comparable to the correct pattern illustration, no correction is necessary.

1. If tooth contact pattern is comparable to an incorrect pattern, correct tooth contact according to the following chart.

| Tooth Contact    | Shim Correction         |
|------------------|-------------------------|
| Contacts at Top  | Decrease Shim Thickness |
| Contacts at Root | Increase Shim Thickness |

■ **NOTE:** To correct tooth contact, steps 1 and 2 (with NOTE) of “Correcting Backlash” must be followed and the above “Tooth Contact/Shim Correction” chart must be consulted.

**⚠ CAUTION**

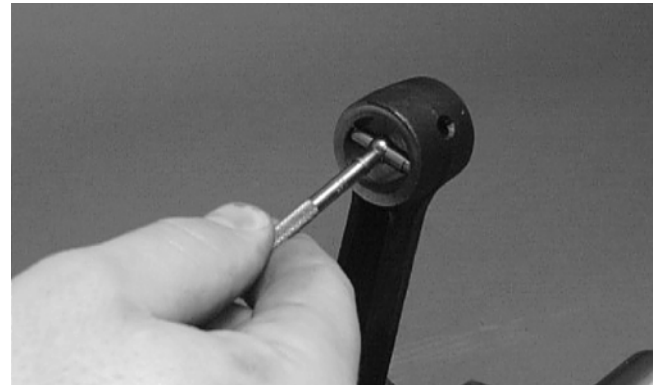
After correcting tooth contact, backlash must again be checked and corrected (if necessary). Continue the correcting backlash/correcting tooth contact procedures until they are both within tolerance values.

**3**

## CRANKSHAFT ASSEMBLY

### Measuring Connecting Rod (Small End Inside Diameter)

1. Insert a snap gauge into the upper connecting rod small end bore; then remove the gauge and measure it with micrometer.



2. Maximum diameter must not exceed specifications.

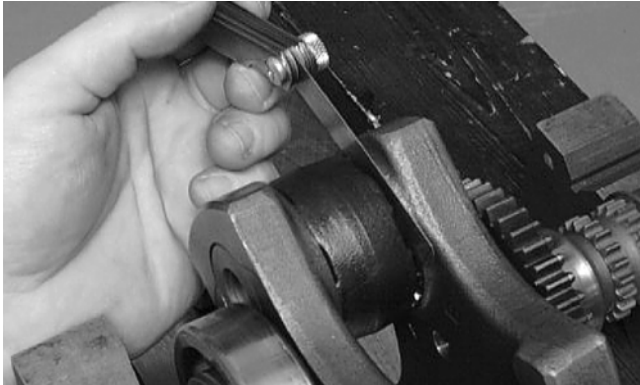
### Measuring Connecting Rod (Small End Deflection)

1. Place the crankshaft on a set of V-blocks and mount a dial indicator and base on the surface plate. Position the indicator contact point against the center of the connecting rod small end journal.

2. Zero the indicator and push the small end of the connecting rod away from the dial indicator.
3. Maximum deflection must not exceed specifications.

### Measuring Connecting Rod (Big End Side-to-Side)

1. Push the lower end of the connecting rod to one side of the crankshaft journal.
2. Using a feeler gauge, measure the gap between the connecting rod and crankshaft journal.



CC289D

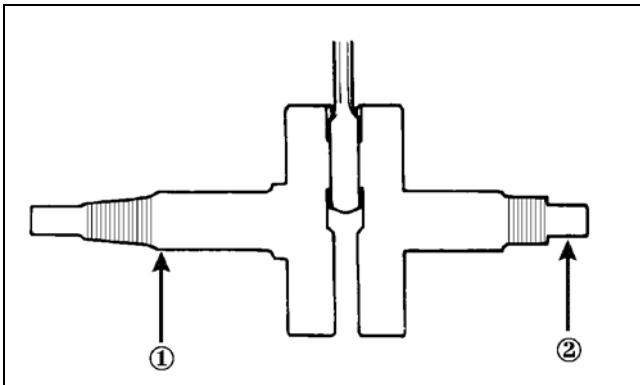
3. Acceptable gap range must be within specifications.

### Measuring Connecting Rod (Big End Width)

1. Using a calipers, measure the width of the connecting rod at the big-end bearing.
2. Acceptable width range must be within specifications.

### Measuring Crankshaft (Runout)

1. Place the crankshaft on a set of V blocks.
2. Mount a dial indicator and base on the surface plate. Position the indicator contact at point 1 of the crankshaft.



ATV-1074

3. Zero the indicator and rotate the crankshaft slowly.

### CAUTION

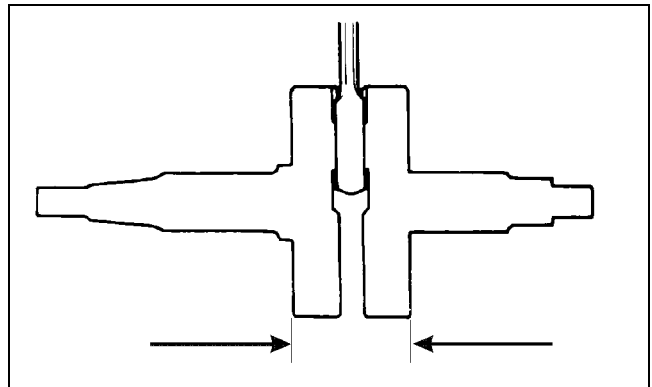
Care should be taken to support the connecting rod when rotating the crankshaft.

4. Maximum runout must not exceed specifications.

■ **NOTE:** Proceed to check runout on the other end of the crankshaft by positioning the indicator contact at point 2 and following steps 2-4.

### Measuring Crankshaft (Web-to-Web)

1. Using a calipers, measure the distance from the outside edge of one web to the outside edge of the other web.



ATV-1017

2. Acceptable width range must be within specifications.

## DRIVESHAFT

### Disassembling

1. In order, remove the reverse dog, circlip, washer, reverse driven gear, and bushing from the driveshaft.

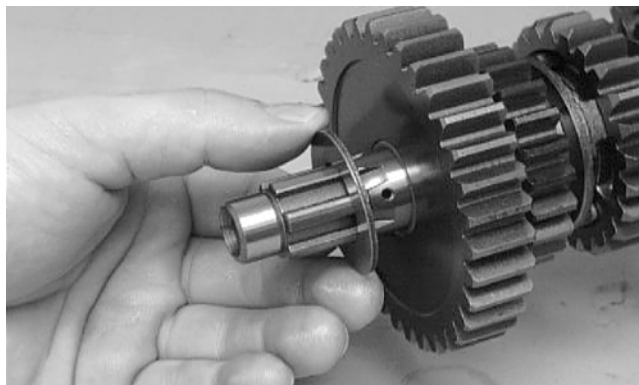


CC228D





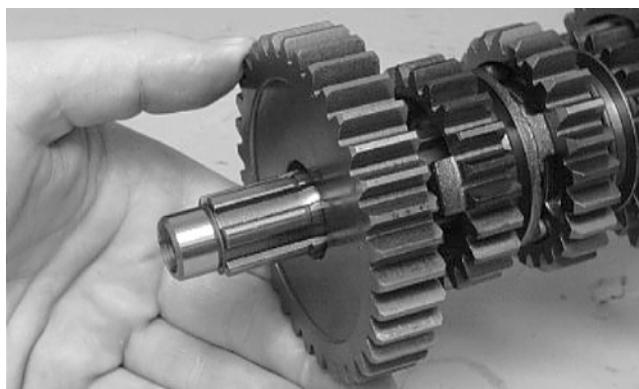
CC227D



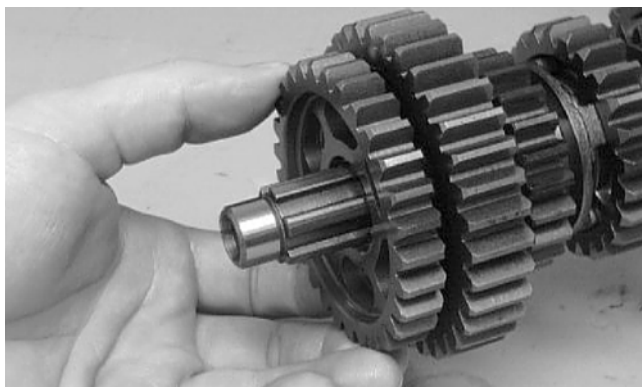
CC223D



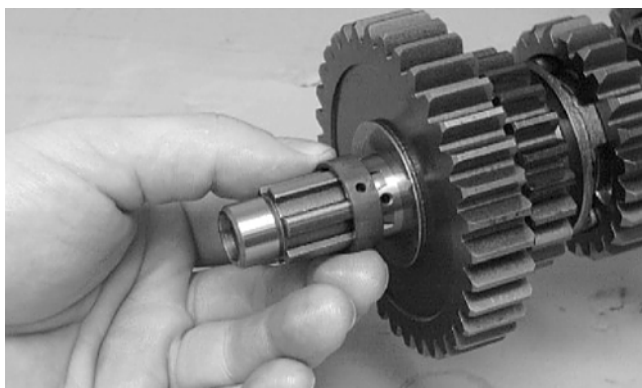
CC226D



CC222D



CC225D



CC224D

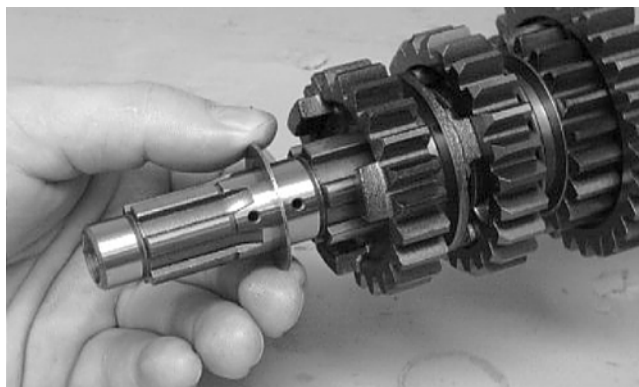
■ **NOTE:** The teeth on the bushing must face the 1st driven gear.

2. Remove the 1st driven washer (right side); then remove the 1st driven gear from the driveshaft.

3. Remove the 1st driven bushing; then remove the 1st driven washer (left side) from the shoulder of the splined shaft. Remove the 4th driven cir-clip.

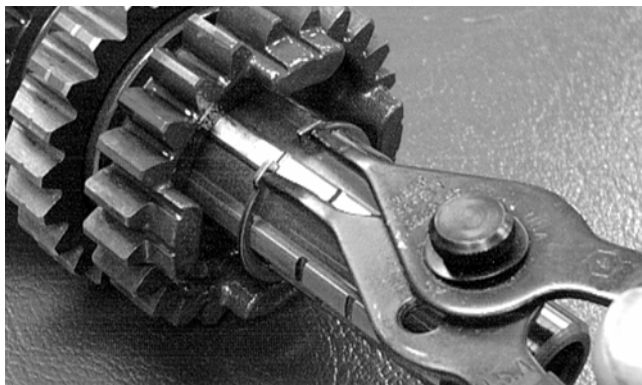


CC221D

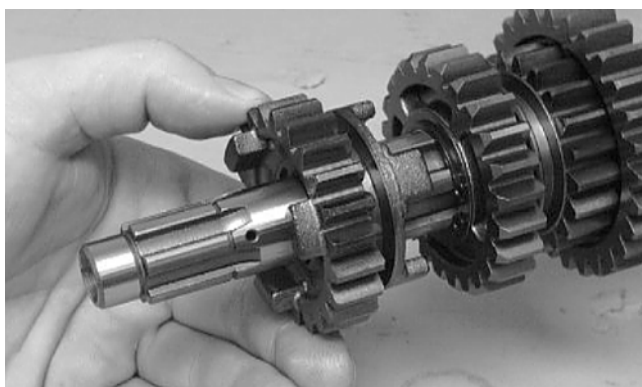


CC220D

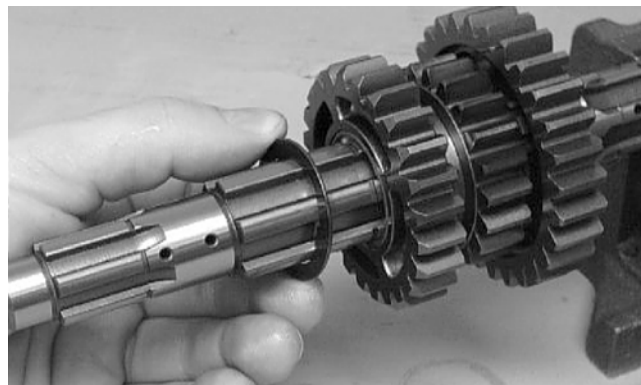
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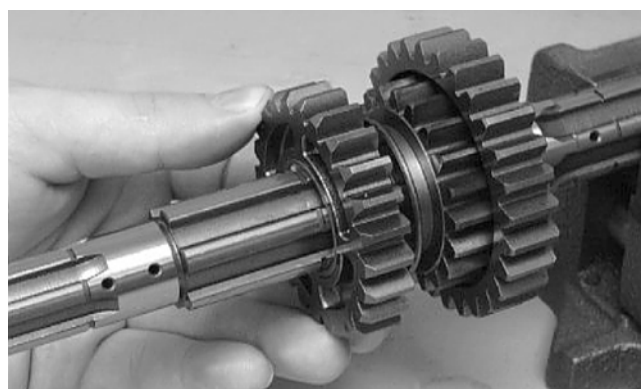
4. Remove the 4th driven gear from the driveshaft. Note the four small dogs facing toward the 3rd driven gear for assembling purposes.



5. Remove the 3rd driven circlip; then remove the 3rd driven lock washer (right side) from the driveshaft.



6. Remove the 3rd driven gear from the driveshaft.

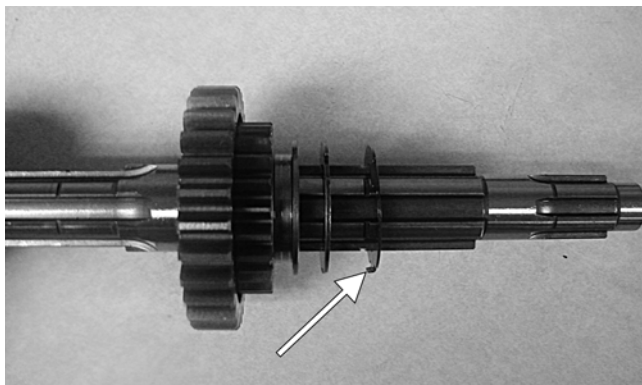


7. Remove the 3rd driven bushing from the drive-shaft. Note the location of the oil feed hole in the bushing and the matching oil supply hole in the driveshaft for assembling purposes.



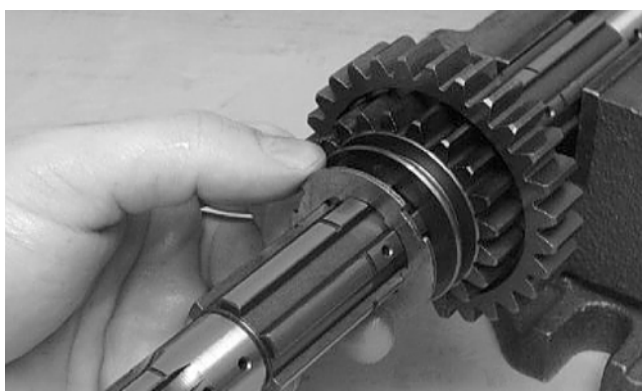
8. Remove the 3rd driven lock washer (left side) from the driveshaft. Note the tabs facing toward the 5th driven gear for assembling purposes.





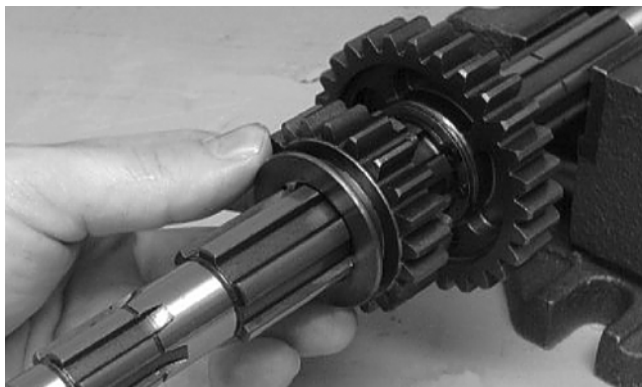
CD247A

9. Remove the next 3rd driven lock washer (left side) by rotating it out of the groove. Note the groove closest to the 5th driven gear for assembling purposes.



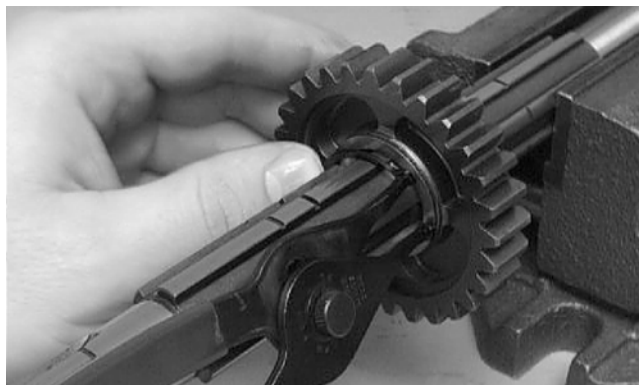
CC211D

10. Remove the 5th driven gear from the driveshaft.

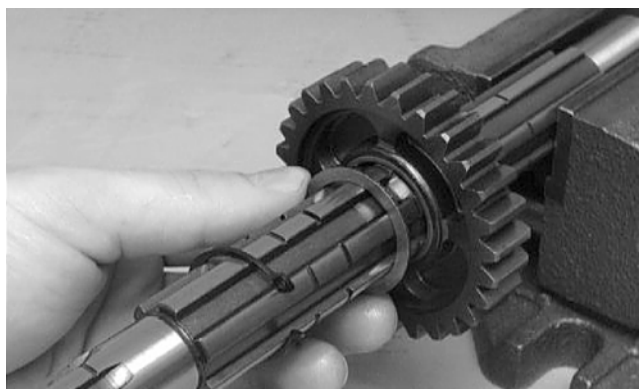


CC210D

11. In order, remove the 2nd driven circlip, washer, gear, and bushing from the driveshaft.



CC209D



CC208D



CC207D



CC206D

3

### AT THIS POINT

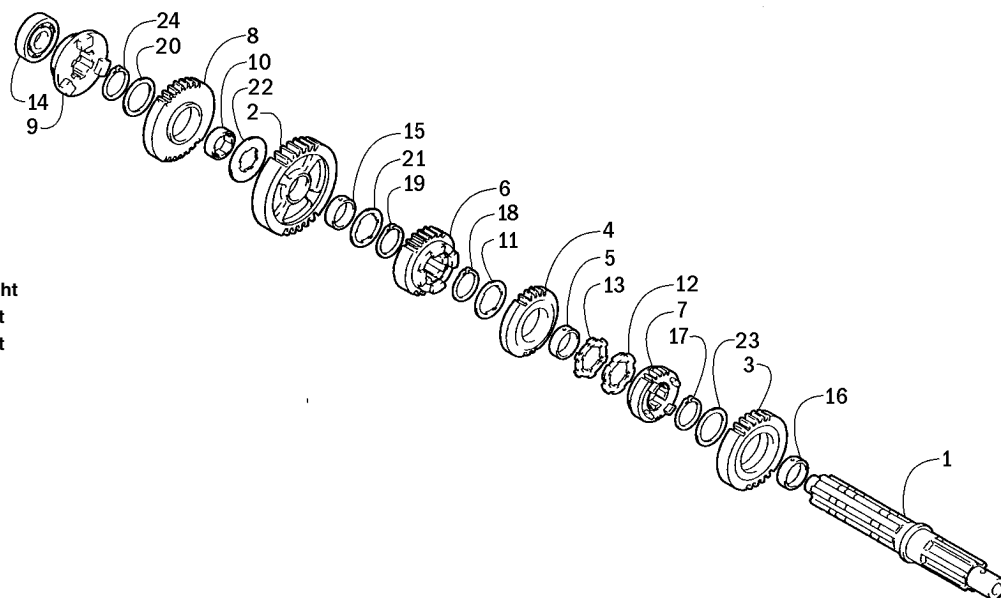
To service secondary gears, see Servicing Center Crankcase Components in this sub-section.



## Assembling

### KEY

1. Driveshaft
2. 1st Driven Gear
3. 2nd Driven Gear
4. 3rd Driven Gear
5. 3rd Driven Bushing
6. 4th Driven Gear
7. 5th Driven Gear
8. Reverse Driven Gear
9. Reverse Dog
10. Reverse Driven Bushing
11. 3rd Driven Lock Washer - Right
12. 3rd Driven Lock Washer - Left
13. 3rd Driven Lock Washer - Left
14. Driveshaft Bearing
15. 1st Driven Bushing
16. 2nd Driven Bushing
17. 2nd Driven Circlip
18. 3rd Driven Circlip
19. 4th Driven Circlip
20. Reverse Driven Washer
21. 1st Driven Washer - Left
22. 1st Driven Washer - Right
23. 2nd Driven Washer
24. Reverse Driven Circlip

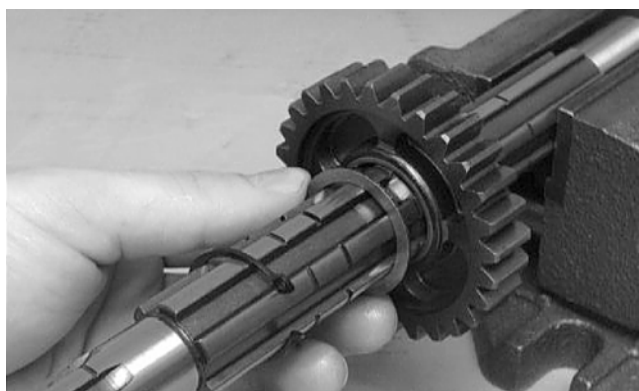


737-733A

1. In order, install the 2nd driven bushing, gear, washer, and circlip onto the driveshaft.



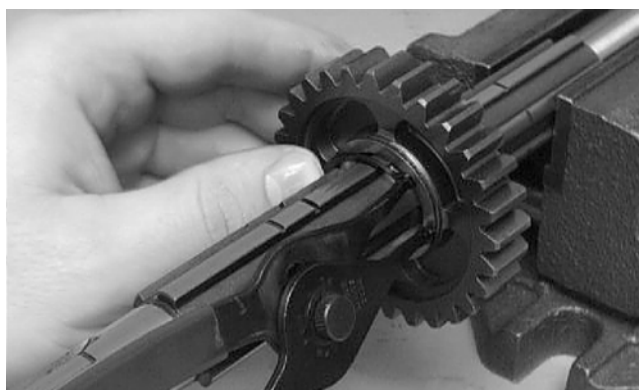
CC206D



CC208D

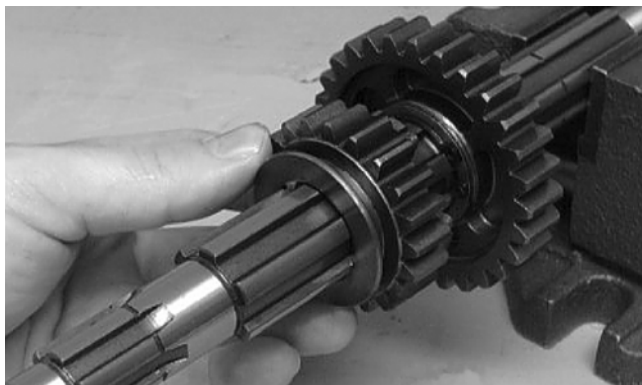


CC207D



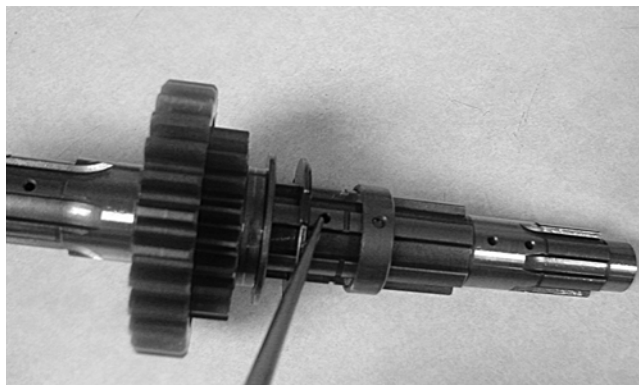
CC209D

2. Install the 5th driven gear onto the driveshaft.



CC210D

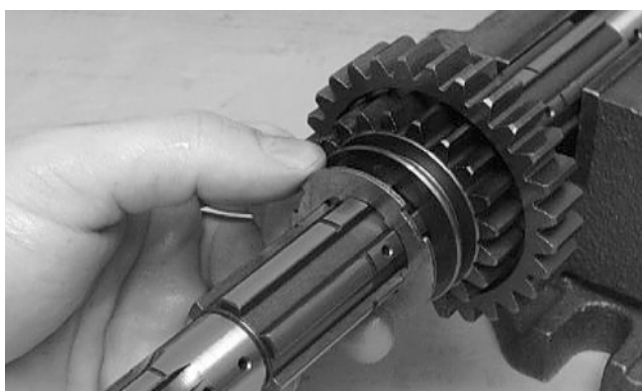
3. Install the 3rd driven lock washer (left side). Lock it into the groove closest to the 5th driven gear (as noted in disassembling) by rotating it when it is in the groove.



CD248

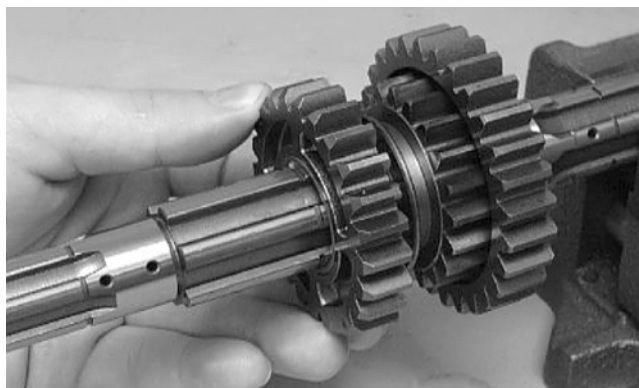
**CAUTION**

It is very important to assure the oil feed hole in the bushing and oil supply hole in the driveshaft align. If not aligned, engine damage will result.

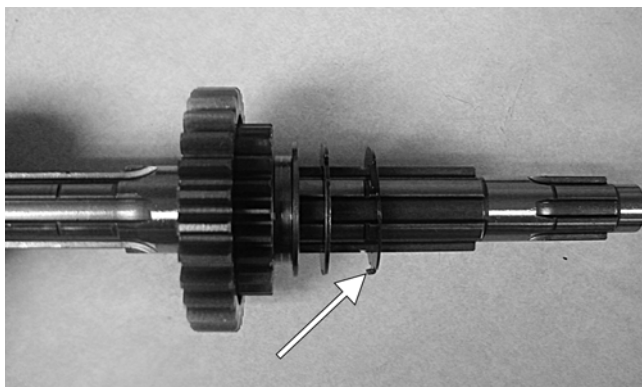


CC211D

4. Install the next 3rd driven lock washer (left side) onto the driveshaft making sure the tabs are facing toward the 5th driven gear. Make sure the tabs intertwine with the 3rd driven lock washer.

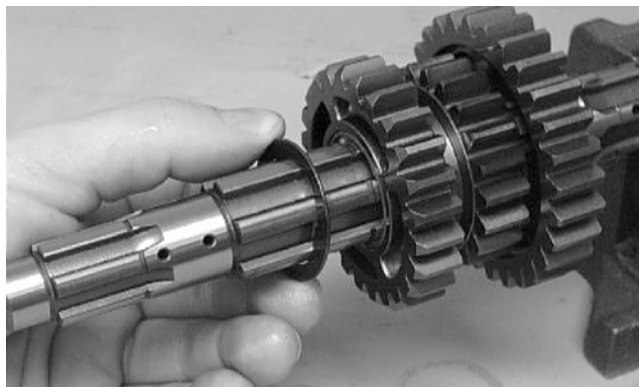


CC214D



CD247A

5. Install the 3rd driven bushing onto the driveshaft making sure the oil feed hole in the bushing aligns with the appropriate oil supply hole in the driveshaft (as noted in disassembling).



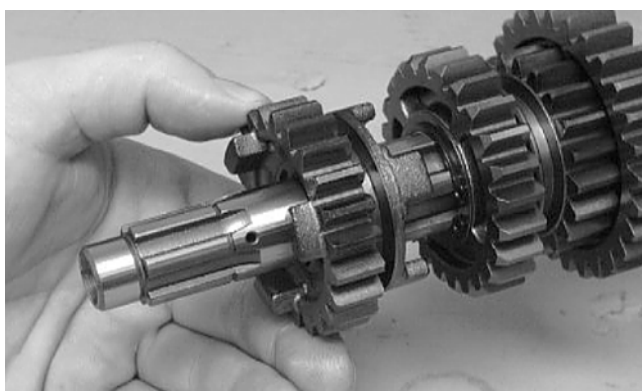
CC215D

3



CC216D

7. Install the 4th driven gear onto the driveshaft making sure the four small dogs are facing toward the 3rd driven gear as noted in disassembling; then secure with the circlip.

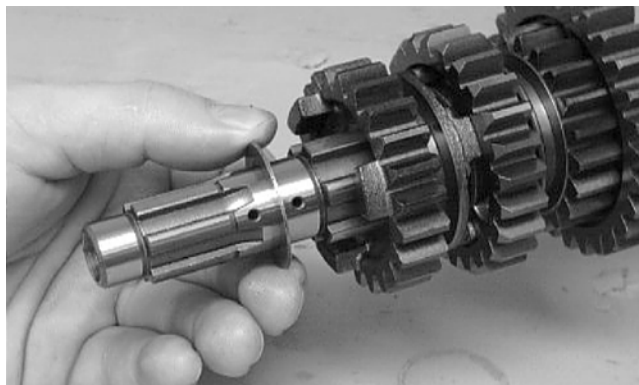


CC219D



CC508D

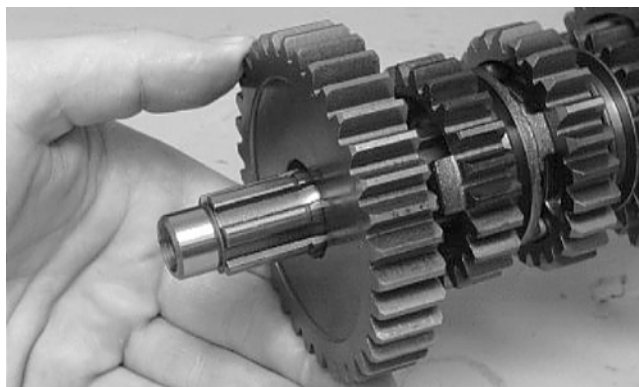
8. Install the 1st driven washer (left side) onto the shoulder of the splined shaft; then install the 1st driven bushing and gear.



CC220D

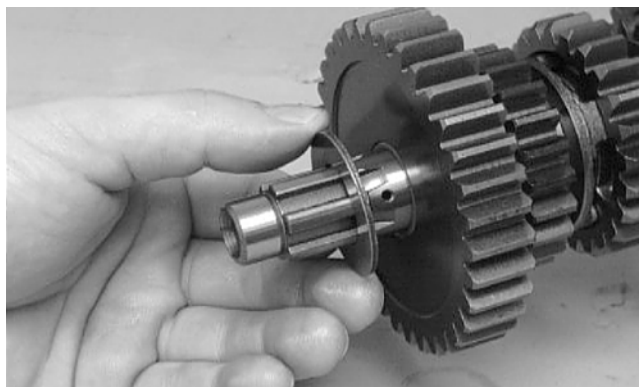


CC221D



CC222D

9. Install the 1st driven washer (right side) on the shaft making sure it lines up with the groove in the shaft; then turn the washer locking it on the shaft.



CC223D



10. Slide the reverse driven gear bushing onto the shaft making sure the oil port in the bushing aligns with the oil port on the shaft.



CC842

**CAUTION**

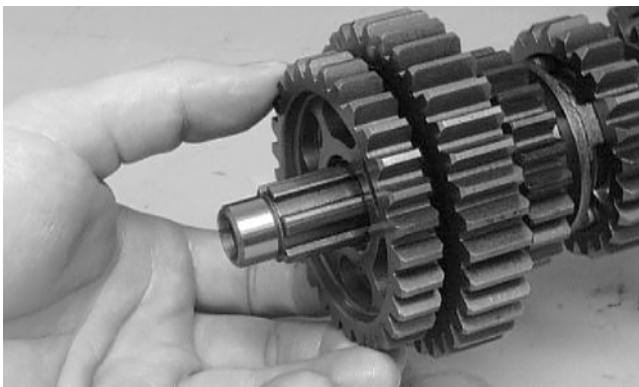
Failure to align the oil ports will result in serious engine damage.

11. Move the washer in the shaft groove until the notches in the washer align with the tabs on the bushing; then slide the bushing up tight against the washer.



CC843

12. In order, install the reverse driven gear, washer, circlip, and reverse dog onto the driveshaft.



CC225D



CC226D



CC227D



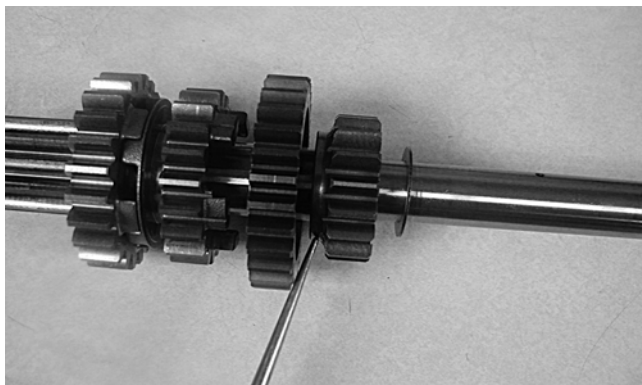
CC228D

■ **NOTE:** The driveshaft is now completely assembled for installation.

## COUNTERSHAFT

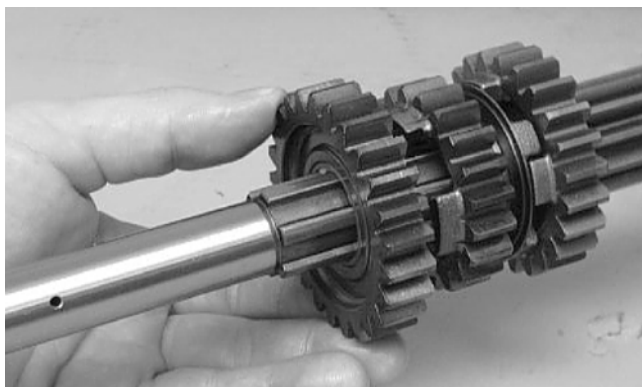
### Disassembling

1. Remove the 2nd drive gear and washer from the countershaft.



CD242

2. Remove the 5th drive gear from the countershaft.



CC203D

3. Remove the 5th drive washer and 5th drive circlip from the countershaft.

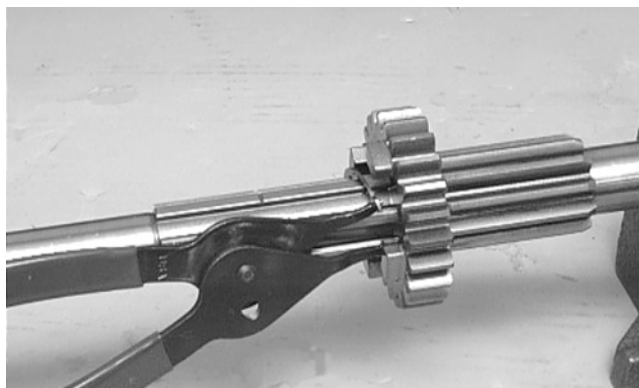


CC201D



CC200D

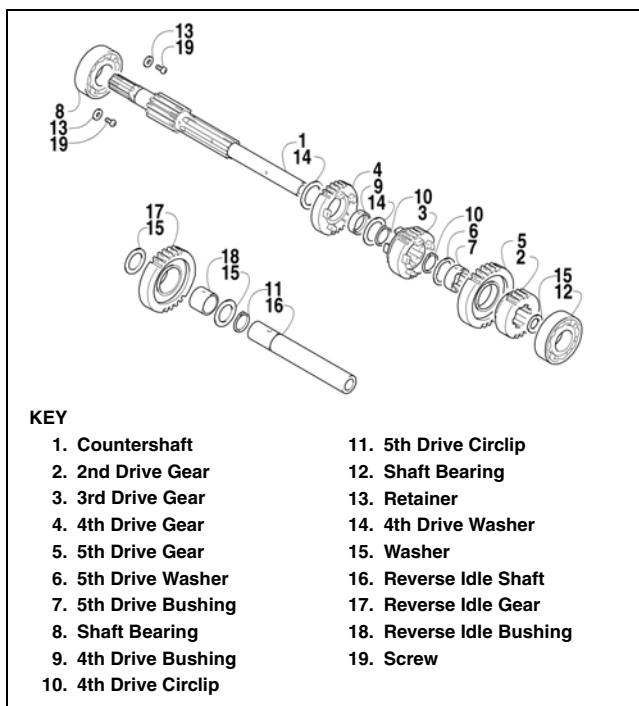
4. Remove the 3rd drive gear from the countershaft.
5. Remove the 4th drive circlip securing the 4th drive gear on the countershaft; then remove the first 4th drive washer and 4th drive gear. Account for the bushing.



CC199D

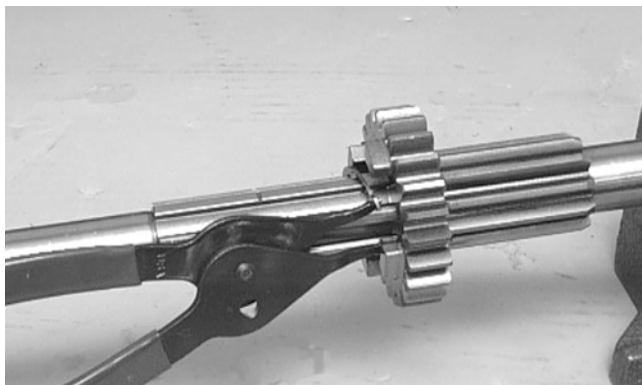
6. Remove the other 4th drive washer from the countershaft.

## Assembling



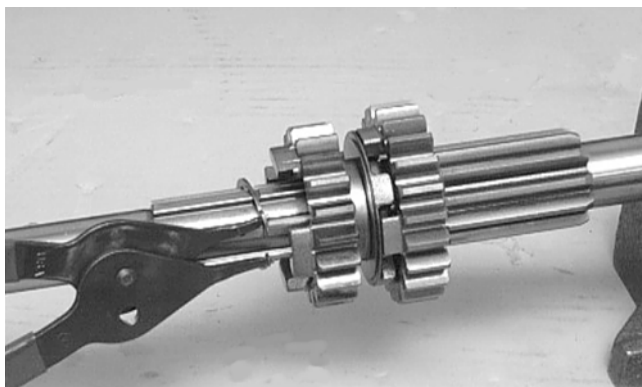
738-294A

1. Install the 4th drive washer onto the countershaft.
2. Install the 4th drive gear making sure the bushing is in position; then install the other 4th drive washer onto the countershaft. Secure with the circlip.



CC199D

3. Install the 3rd drive gear; then install the 5th drive circlip onto the countershaft.



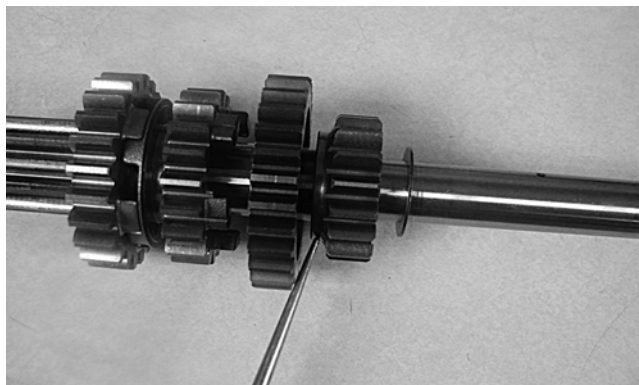
CC200D

4. Install the 5th drive washer and 5th drive gear onto the countershaft.



CC201D

5. Install the 2nd drive gear and washer onto the countershaft.



CD242

■ **NOTE:** The countershaft is now completely assembled for installation.

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## Assembling Crankcase Half

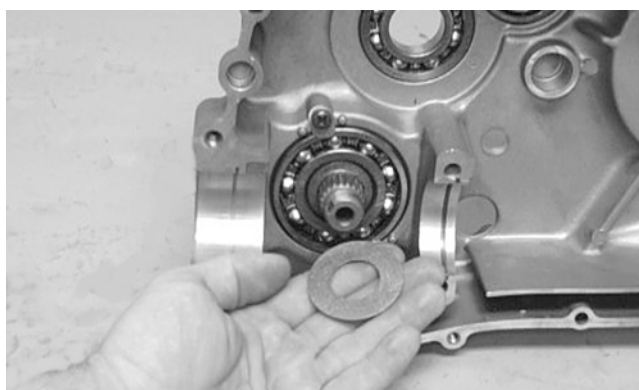
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3

■ **NOTE:** For ease of assembly, install components on the left-side crankcase half.

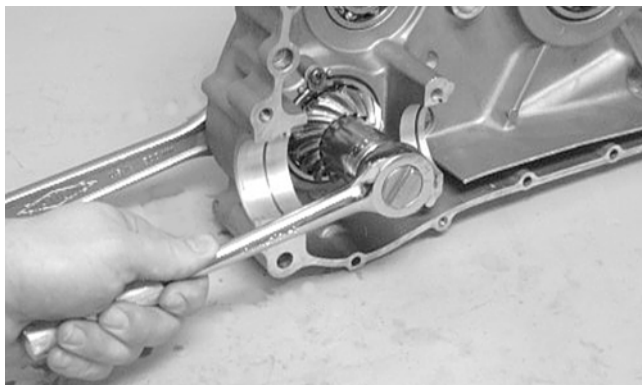
■ **NOTE:** If the output shaft and gear were removed, make sure that the proper shim is installed.

1. To install the output shaft and gear, place the shaft into position with proper shims, slide the gear onto the shaft, and secure with a new nut tightened to specifications.



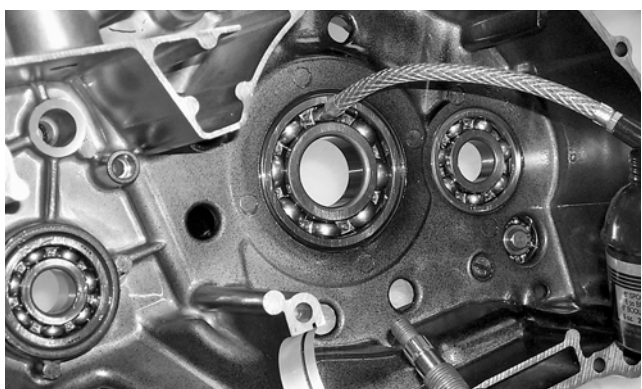
CC117D





CC116D

2. Apply a liberal amount of engine oil to the crankshaft bearing. Using a propane torch, heat the bearing until the oil begins to smoke; then slide the crankshaft assembly into place.



CC688



CC689

■ **NOTE:** If heating the bearing is not possible, the crankshaft can be installed using a crankshaft installing tool.

3. Install the crank balancer.

■ **NOTE:** It will be necessary to rotate the crank balancer until the counterweight is directed away from the crankshaft; then rotate the crankshaft clockwise into the journal area to allow the balancer to be fully seated.



CD832A

4. With the key in position, slide the driven gear onto the crank balancer making sure the timing marks are aligned.

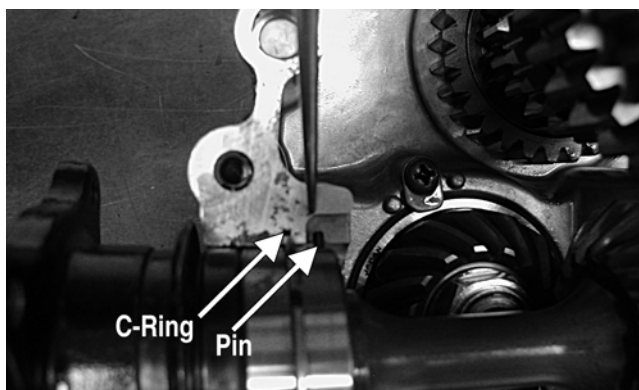


CD826

5. Place the bearing C-ring into position in the crankcase; then install the front output shaft and rear shaft assemblies.

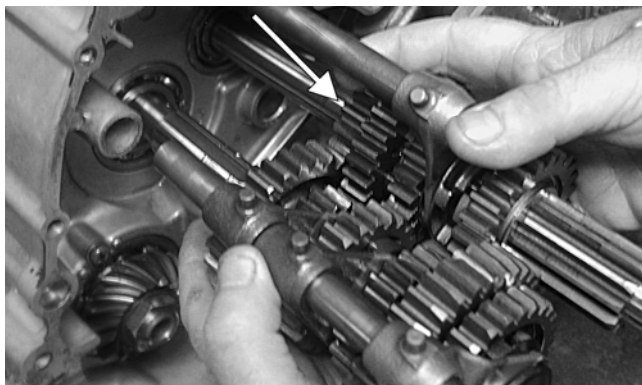
### **CAUTION**

The bearing pins must be positioned into the crankcase correctly or damage to the crankcase may occur.



CD268A

6. Simultaneously, install the driveshaft and countershaft assemblies making sure the washer is on the countershaft.

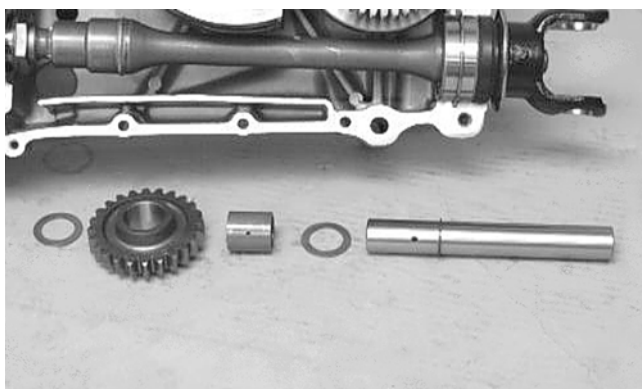


CD232A

7. Install the reverse idle shaft with circlip making sure the oil hole in the shaft is facing downward; then install a washer, bushing, reverse idle gear, and a washer.

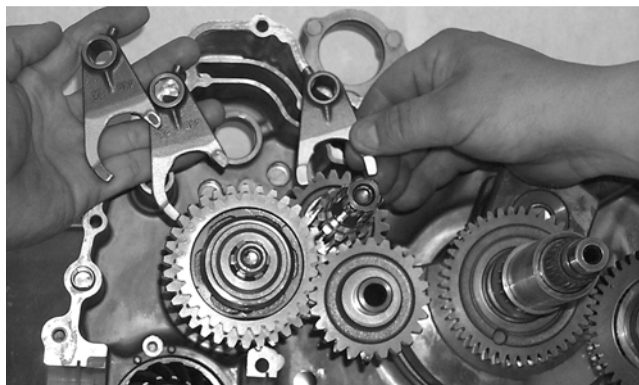


CF055



CC231D

8. Place each of the four shift forks into its respective gear or dog as noted during disassembling; then install the gear shift cam.



CC107D

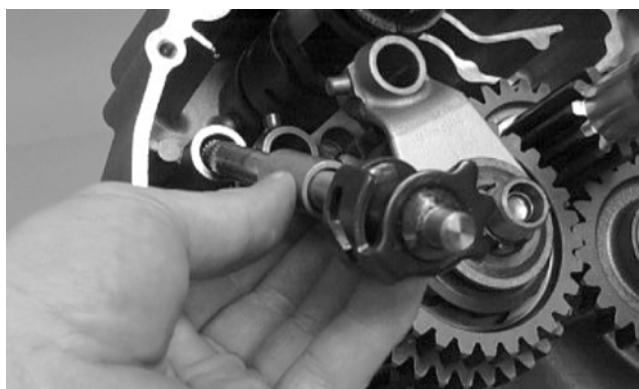


CC106D

9. Engage the four forks to the gear shift cam; then install the reverse shift cam and spacer.



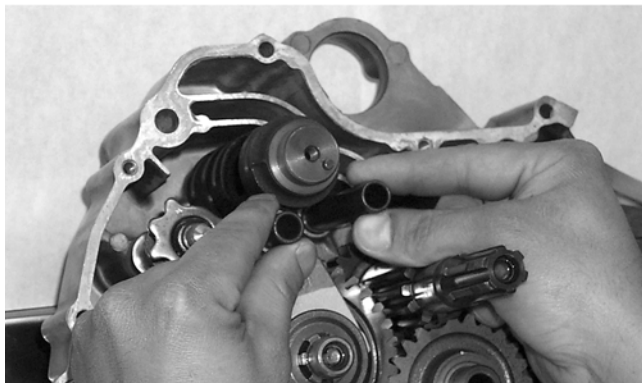
CC105D



CC103D

10. Install the two gear shift shafts; then verify that the two crankcase half alignment pins are in place.





CC104D

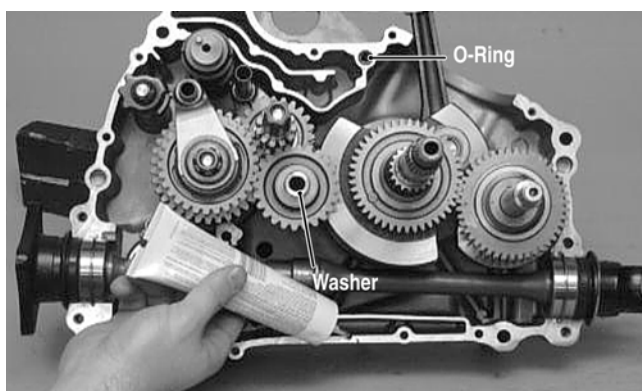
■ **NOTE:** Prior to joining crankcase halves, turn the shift cam to ensure all gears shift properly.

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## Joining Crankcase Halves

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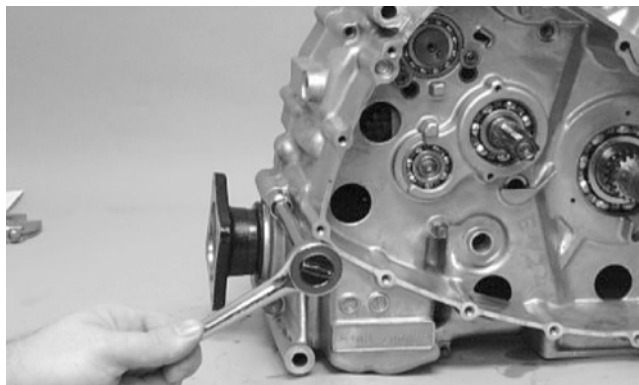
1. Place the O-ring in the left-side crankcase half and verify that the washer is on the idler shaft; then apply Three Bond Sealant (p/n 0636-070) to the mating surfaces. Place the right-side half onto the left-side half.



CC234DA

2. Using a plastic mallet, lightly tap the case halves together until cap screws can be installed.
3. From the left side, install the three case half 8 mm cap screws (two inside the case); then tighten only until snug.

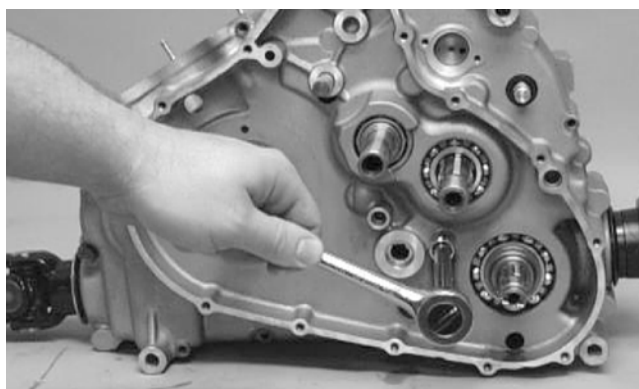
■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.



CC098D

4. From the right side, install the three case half 8 mm cap screws; then tighten only until snug.

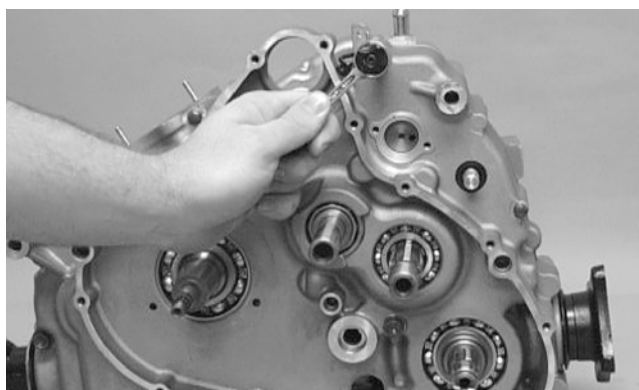
■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.



CC097D

5. From the left side, install the seven case half 6 mm cap screws noting the location of the wiring form; then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

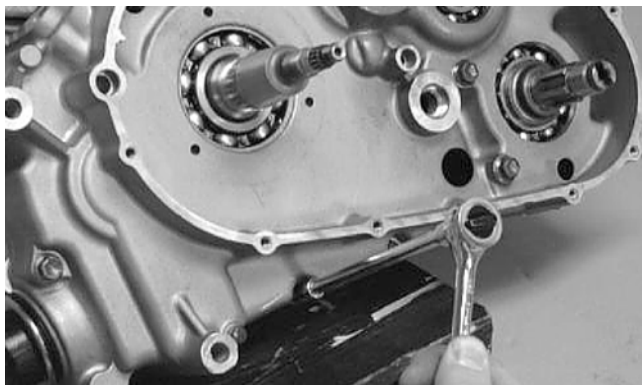


CC096D

6. From the right side, install the five case half 6 mm cap screws (one inside the case); then tighten only until snug.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.





CC095D

7. In a crisscross/case-to-case pattern, tighten the 8 mm cap screws (from steps 3-4) until the halves are correctly joined; then tighten to specifications.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

8. In a crisscross/case-to-case pattern, tighten the 6 mm cap screws (from steps 5-6) to specifications.

■ **NOTE:** Rotate the shafts back and forth to ensure no binding or sticking occurs.

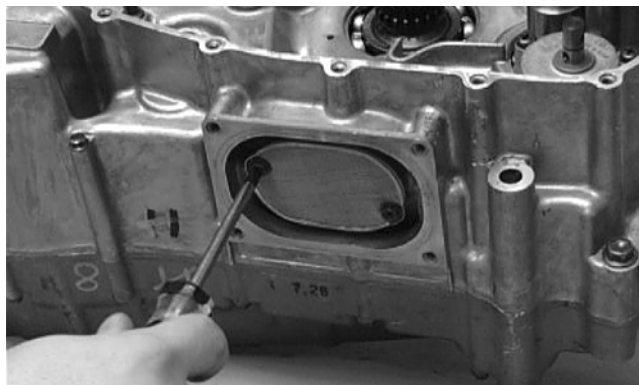
**CAUTION**

After completing center crankcase components, proceed to Installing Right-Side Components, to Installing Left-Side Components, and to Installing Top-Side Components.

## Installing Right-Side Components

### A. Oil Strainer/Oil Pump B. Gear Shift Shaft

1. Place the oil strainer into position beneath the crankcase and tighten securely with the Phillips-head cap screws.



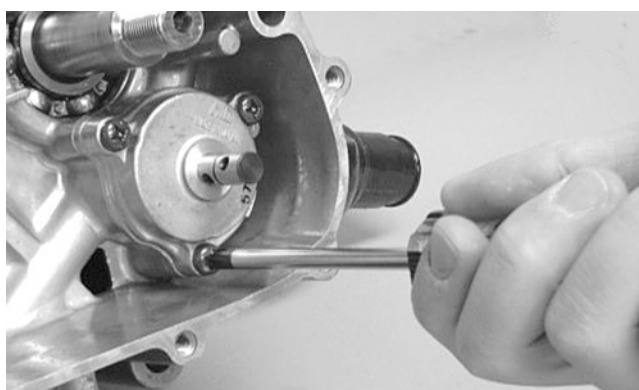
CC163D

2. Place the strainer cap into position on the strainer making sure a new O-ring is properly installed and secure with the cap screws; then install and tighten the oil drain plug to specifications.



CC091D

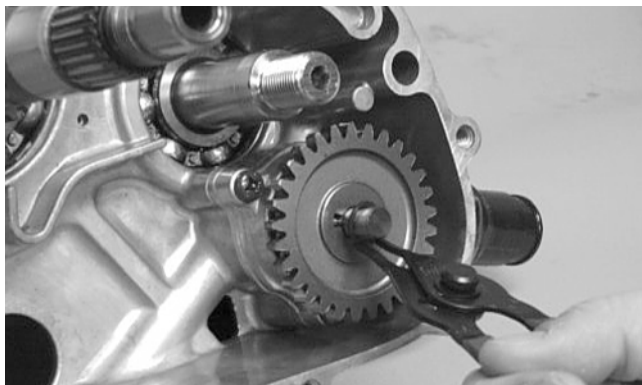
3. Place the oil pump into position in the crankcase and secure with the three Phillips-head screws coated with blue Loctite #243. Tighten to specifications.



CC090D

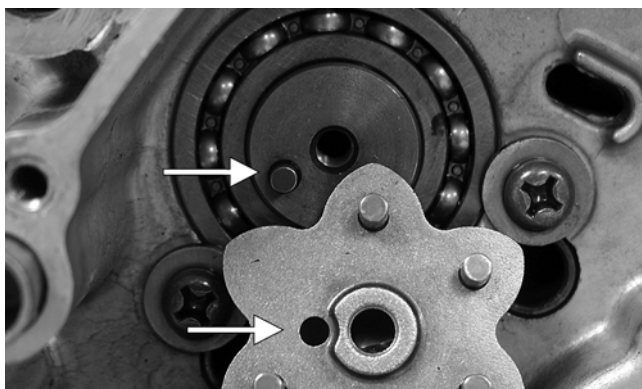
4. Place the pin and washer into position on the oil pump shaft, install the oil pump driven gear, and secure with the circlip.

3

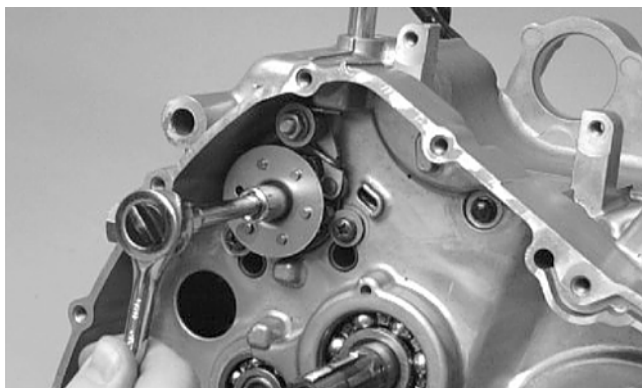


CC088D

5. Place the gear shift cam plate and guide onto the gear shift cam making sure the alignment pin was installed. Secure assembly with the cap screw coated with blue Loctite #243. Tighten securely.

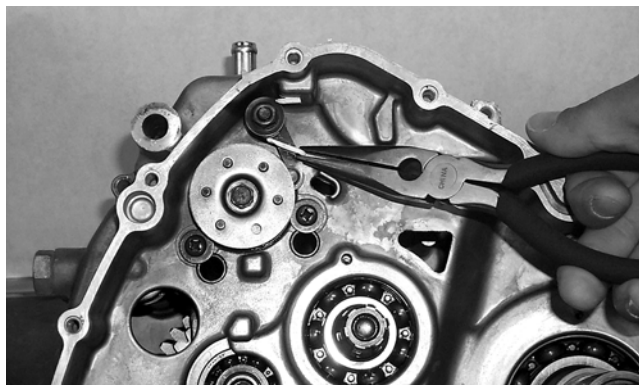


CF073A

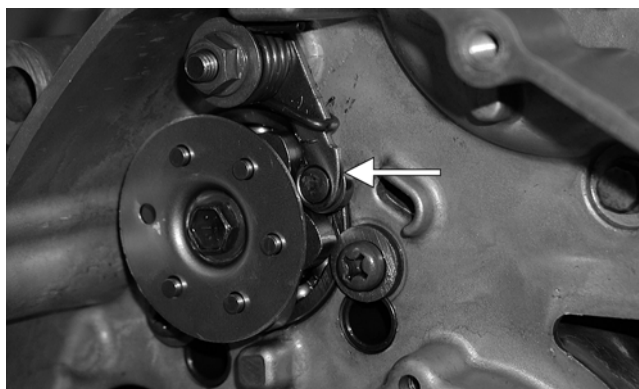


CC164D

6. Attach the spring to the gear shift cam stopper arm.



CC086D



CF072A

7. Install the gear shift shaft.



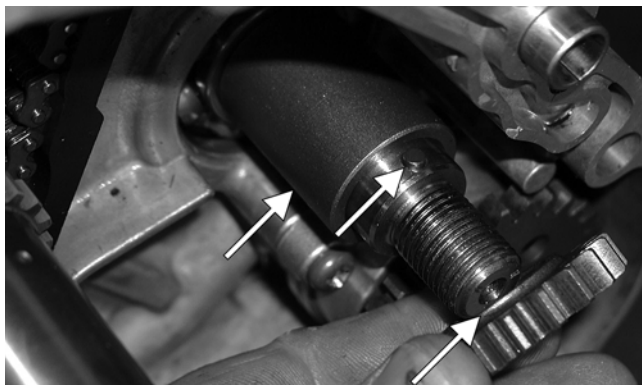
CC085D

**C. Primary Driven Gear**  
**D. Primary Driven Clutch**  
**E. Primary Drive Clutch Shoe**

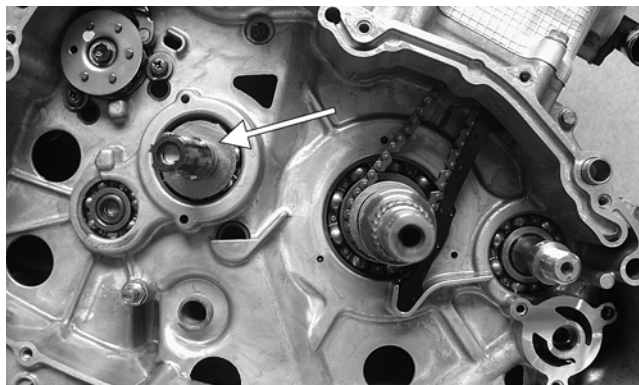
■ **NOTE:** Steps 1-7 in the preceding sub-section must precede this procedure.

8. Install the spacer, pin, and oil pump drive gear onto the crank balancer shaft making sure the shoulder of the drive gear is facing inward toward the crankcase; then secure with the washer and nut tightened to specifications.





CF070A

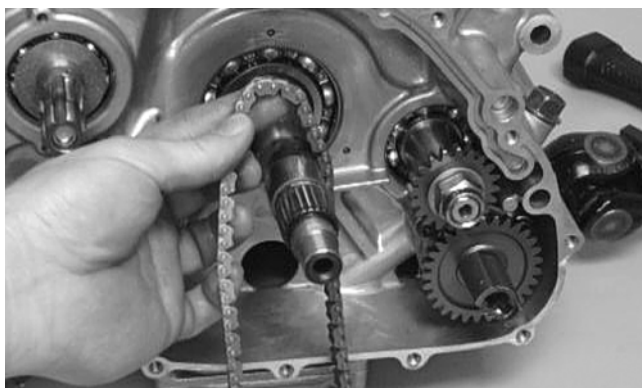


CD198B



CD481

9. Place the chain into the crankcase; then secure it from the top side with a wire for ease of assembling.



CC079D

10. Install the primary driven washers onto the driveshaft and crankshaft.

**CAUTION**

The clutch sleeve hub and the pressure plate must be seated in the proper position. If any of the incorrect positions are used, the hub and plate will have clearance between them and they will not operate properly.

11. Simultaneously, place the primary clutch assembly and the starter clutch housing on their respective shafts making sure the sleeve is properly positioned in the primary assembly.



CC078D

■ **NOTE:** Note the alignment mark scribed on the primary driven gear assembly during disassembly.

12. Using the Clutch Sleeve Hub Holder (p/n 0444-007), install the nut and washer. Tighten to specifications.

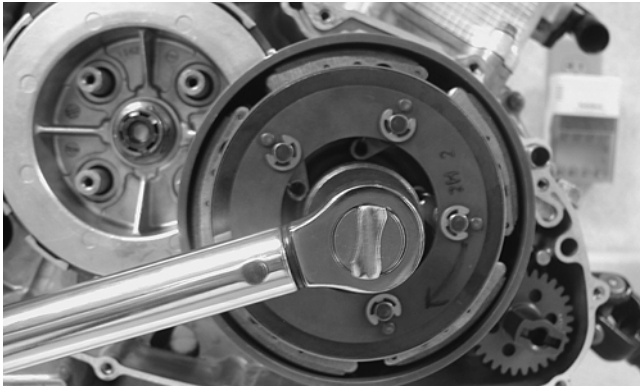


CD479

3



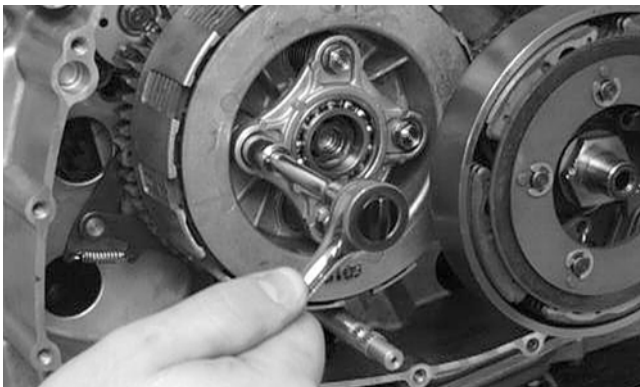
13. Place the primary drive one-way clutch into the starter clutch housing noting the word OUT-SIDE for proper placement.



CD482

14. Install the clutch shoe and washer; then secure with the starter clutch shoe nut (left-hand threads). Tighten to specifications; then using a center punch, stake the nut.
15. Install the release roller assembly making sure the four springs are in position; then using a crisscross pattern, tighten the four cap screws securely.

■ **NOTE:** Tighten the four roller assembly cap screws in a crisscross pattern making sure there is no clearance between the clutch plates when secured.



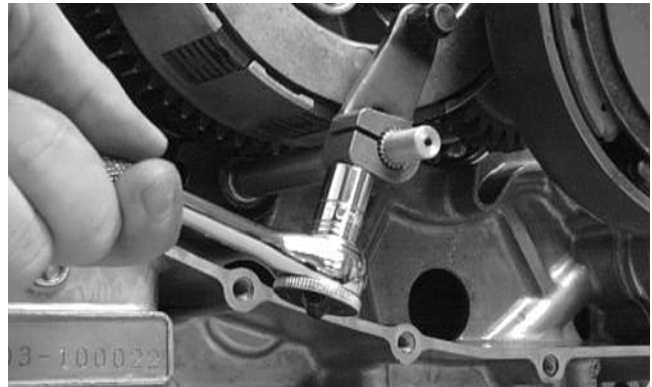
CC074D

16. Install the clutch release arm and release roller guide making sure the release roller and guide are aligned.



CD166A

17. Secure the clutch release arm with the cap screw coated with blue Loctite #243. Tighten securely.



CC073D

18. Install the reverse cam stopper housing and gasket making sure the stopper and spring are correctly positioned. Tighten to specifications.



CD494

## F. Water Pump

## G. Oil Filter

■ **NOTE:** Steps 1-18 of the preceding sub-sections must precede this procedure.

■ **NOTE:** Lubricate all internal components with 10W-40 oil prior to installing the right-side cover.

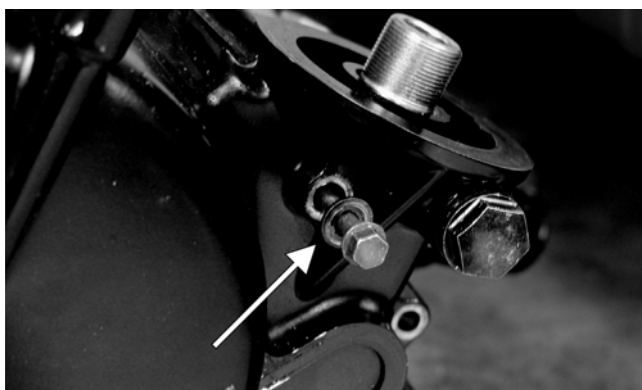
19. Place the water pump drive joint into position on the water pump shaft making sure the pin is properly positioned.



CF067

■ **NOTE:** Care should be taken that the alignment pins are installed in the right-side cover.

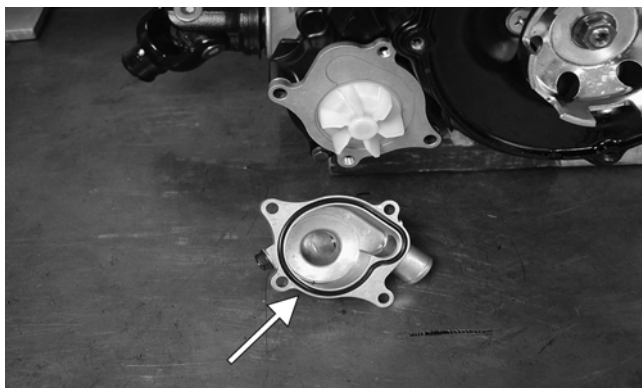
20. Place the gasket and right-side cover into position making sure the release roller guide remains correctly positioned and that the water pump drive adapter aligns; then install the fifteen cap screws. Note the proper location of the long cap screw with rubber washer.



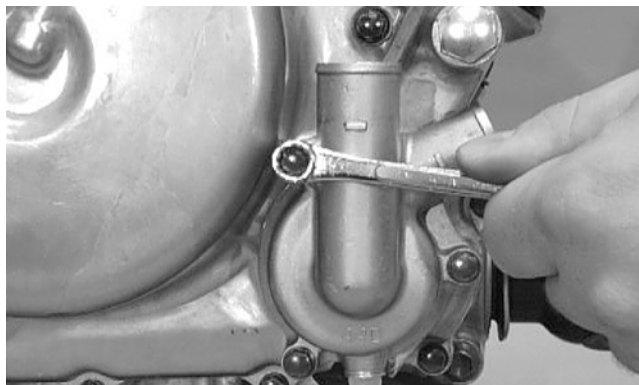
CF039A

21. Tighten the cap screws in a crisscross pattern to specifications.

22. Place the water pump cover onto the right-side cover making sure the new O-ring is properly positioned. Tighten securely with the three cap screws.



CD910A



CC027D

23. Using the oil filter wrench, install a new oil filter.



CC067D

24. Install the coolant hose on the water pump and secure with the clamp.

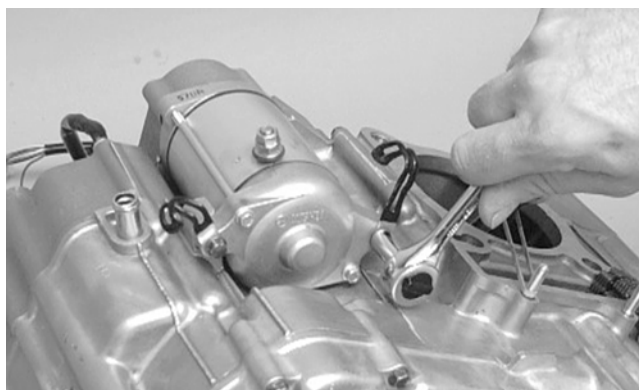
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## Installing Left-Side Components

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### A. Idle Gear Assembly B. Magneto Rotor

1. Place the starter into position on the crankcase and secure with the cap screws. Note the position of the wiring form.

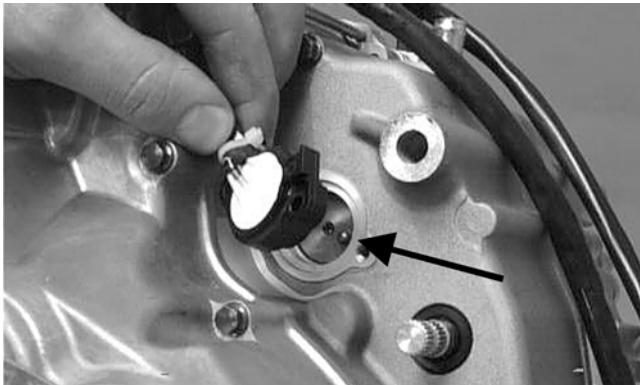


CC065D

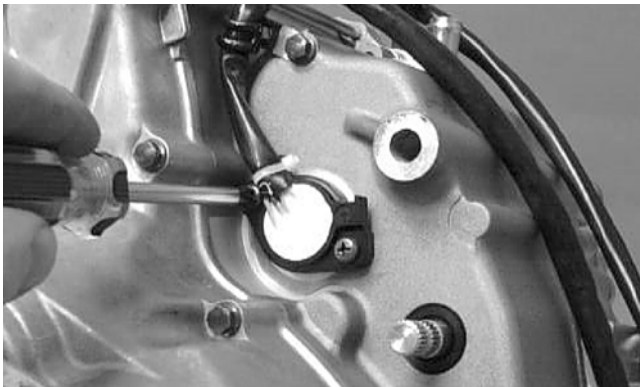
3



2. Place the shift-indicator sending unit into position making sure the contacts and springs are inside the case and a well-oiled O-ring is properly positioned. Secure with Phillips-head screws.

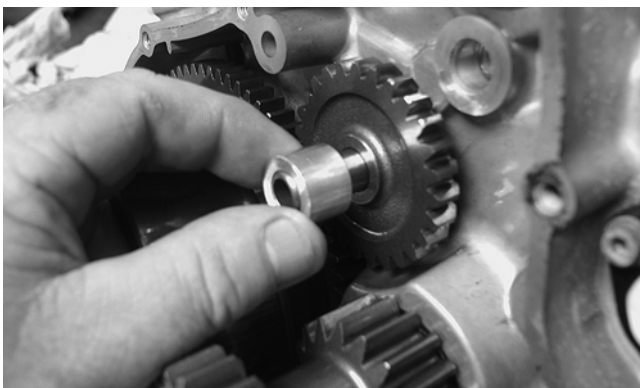


CC049D



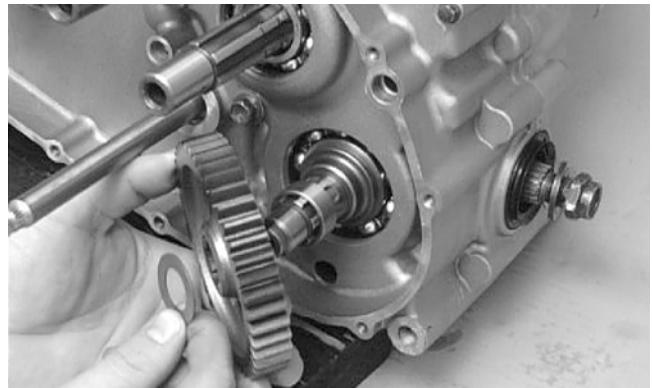
CC048D

3. Install the starter idle gear pin into the crankcase; then with the beveled side of the idle gear facing the crankcase, install the idle gear and spacer.



CD138

4. Place the bushing onto the output shaft; then install the driven gear and washer.



CC063D

5. Install the spacer onto the driveshaft.



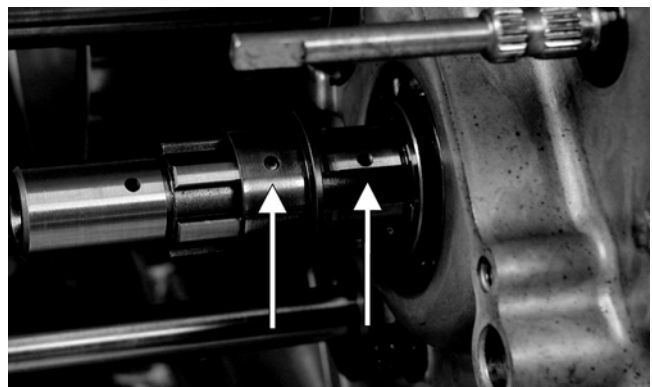
CC258D

6. Place the splined bushing onto the driveshaft making sure the oil hole of the splined bushing aligns with the oil hole of the driveshaft.



### CAUTION

It is important that the oil holes in the splined bushing and driveshaft align. If they are not aligned, major damage will occur from lack of lubrication.



CF038A

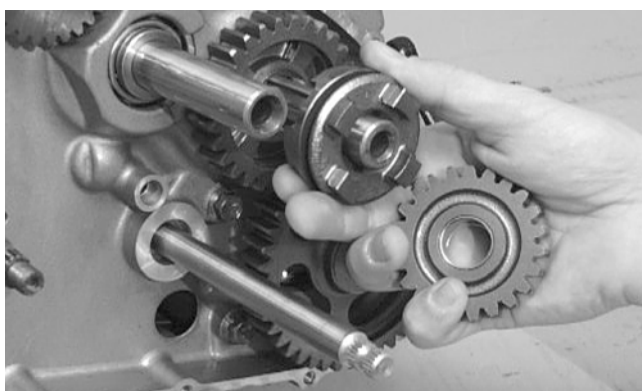
7. In turn on the driveshaft, install the #1 drive gear and washer; then secure with the circlip.





CC059D

8. Place the select sliding dog gear and washer onto the driveshaft; then place the #2 drive gear onto the driveshaft making sure the bushing and washer follow on the driveshaft.

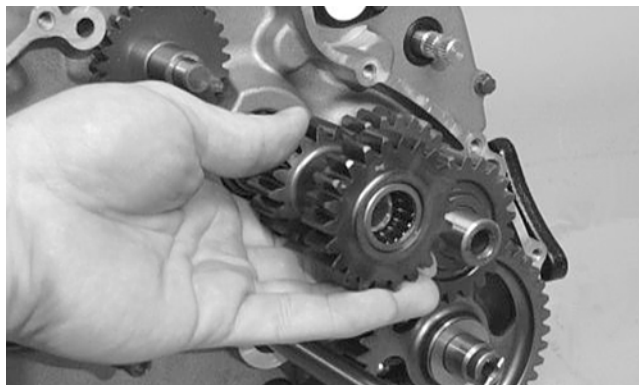


CC061D

9. Place the idle gear spacer and idle gear onto the countershaft.

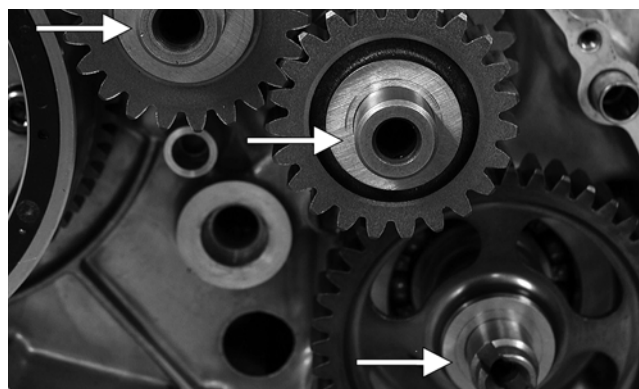


CC262D



CC060D

10. Place a washer on the driveshaft, the countershaft, and the driven shaft.



CF075A

11. With the slot in the shift shaft assembly facing upward, place the assembly on the fixed shaft.



CD147

12. Place the left shaft washer on the shift shaft.



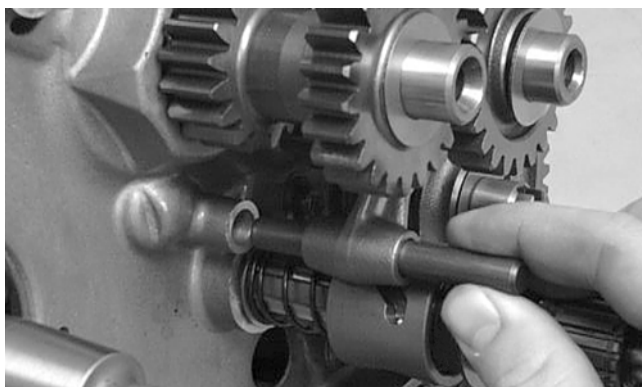
CC333D

13. With the shift fork peg positioned in the shift shaft assembly slot, install the shift fork in the select sliding dog gear.



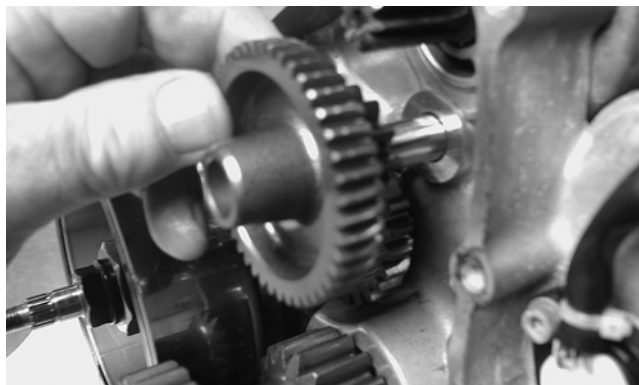
CC329D

14. Slide the shift fork shaft through the shift fork and into the crankcase boss.



CC330D

15. Insert the pin into the starter gear assembly boss in the crankcase; then install starter idler gear #1.



CD136

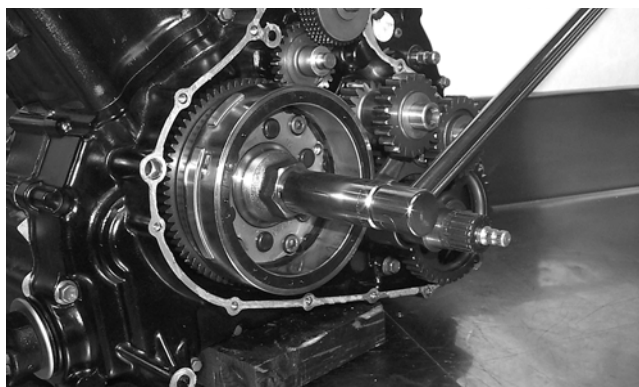
16. Place a washer on each end of the starter gear assembly and install in the crankcase.

17. Place a thrust washer onto the crankshaft; then install the starter clutch gear assembly onto the crankshaft. Place the key into its notch.



CD155

18. Place the rotor/flywheel into position on the crankshaft; then install the nut on the crankshaft and tighten until the rotor/flywheel is properly seated. Tighten to specifications.

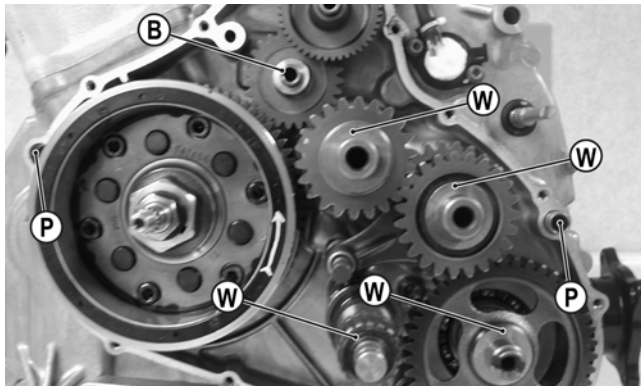


CC147D

19. Install the two alignment pins into the left crankcase half.

■ **NOTE:** Make sure that four washers, one bushing, and two alignment pins are in place.





CD134A

**C. Cover**

**D. Speed Sensor Housing**

**E. Hi/Low Shifter Assembly**

**F. Recoil Starter**

■ **NOTE:** Steps 1-19 in the preceding sub-section must precede this procedure.

20. Place the gasket and left-side cover into position on the crankcase.

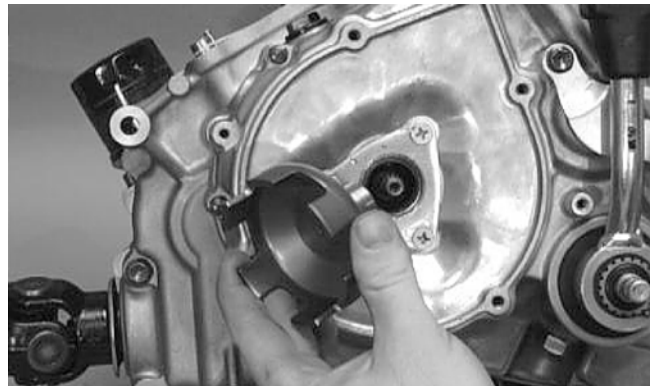
■ **NOTE:** It may be necessary to push or pull the splined Hi/Low range shift shaft to establish cover/crankcase mating.

21. Install the fourteen cap screws to secure the left-side cover. Do not tighten at this time. Note the location of the long cap screw with rubber washer.



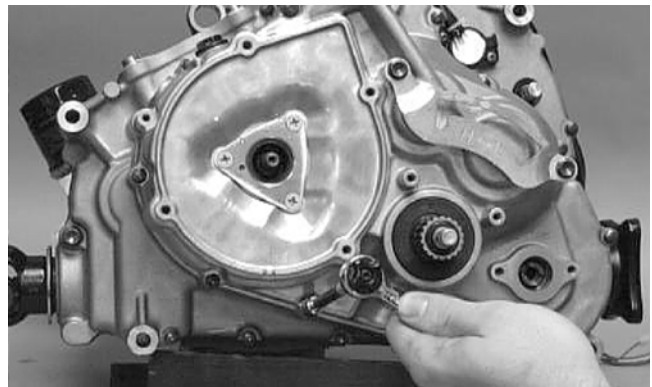
CF037A

22. Place the starter cup into position on the crankshaft making sure a new, lubricated O-ring is inside the cup. Tighten the flange nut to specifications.



CC041D

23. In a crisscross pattern, tighten the cap screws (from step 21) to specifications.



CC047D

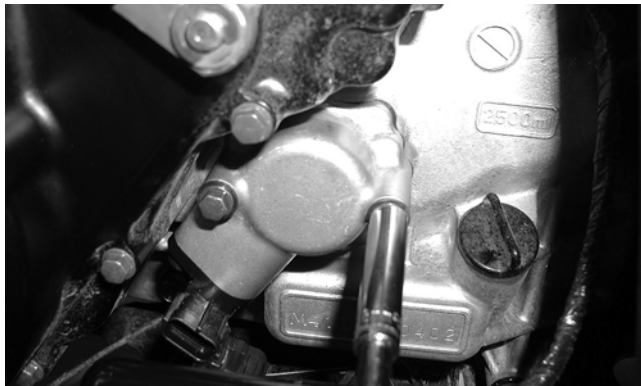
24. Place the shift stop housing assembly into position beneath the shift shaft housing making sure the spring and stopper are correctly positioned. Tighten to specifications.



CC054D

25. Place the speed sensor housing and gasket into position and secure with the two cap screws. Tighten securely.

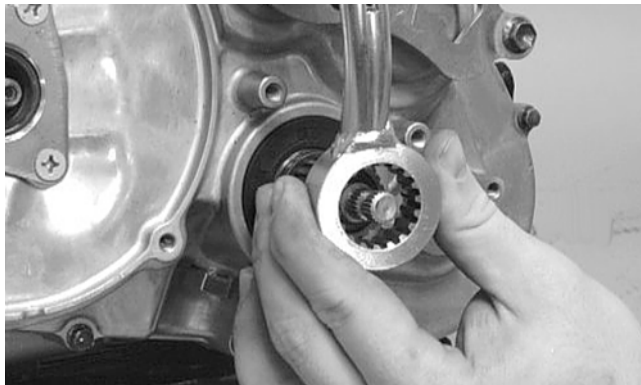




CD069

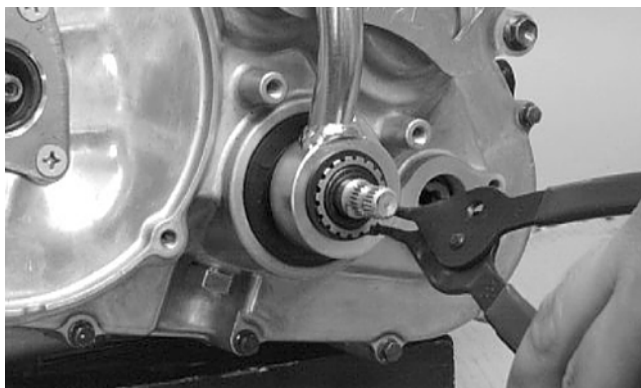
26. Install the inside circlip onto the hi/low range shift shaft with the sharp side of the circlip facing the engine; then place the shift lever assembly part way onto the shaft.

■ **NOTE:** Position the shift lever part way onto the splines and verify the subtransmission is in hi range. If not, shift into hi range.



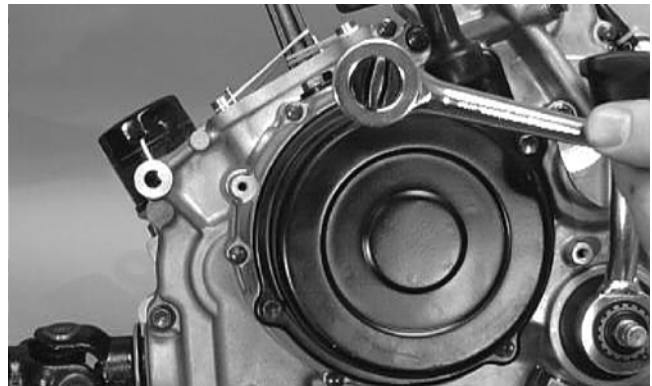
CC045D

27. Pull up on the hi/low shift T-handle and guide the T-handle stop pin into the hi range lever stop plate slot; then slide the shift lever assembly the rest of the way onto the shift shaft. Secure with the outer circlip making sure the sharp side of the circlip faces away from the hi/low-range lever.



CC044D

28. Place the recoil starter assembly into position on the left-side cover; then tighten four cap screws to specifications.



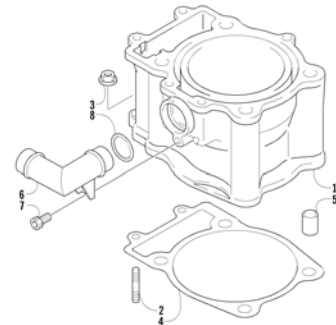
CC039D

## Installing Top-Side Components

### A. Piston B. Cylinder

#### KEY

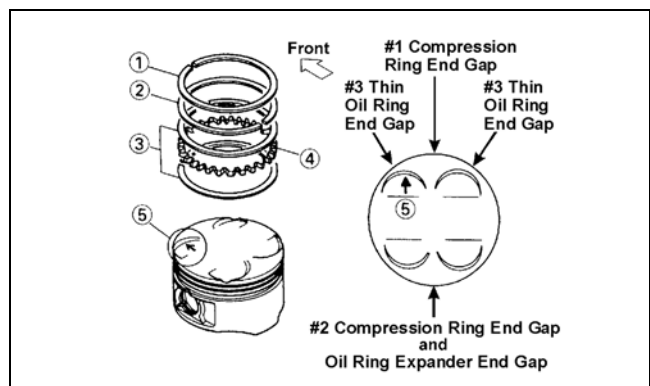
1. Cylinder
2. Stud Bolt
3. Nut
4. Cylinder Gasket
5. Pin
6. Water Hose Union
7. Cap Screw
8. O-Ring



0732-301

■ **NOTE:** If the piston rings were removed, install them in this sequence.

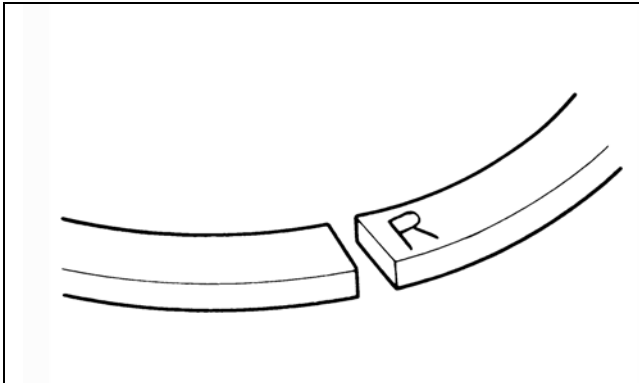
A. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap.



ATV-1085B

B. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.

■ **NOTE:** Note the direction of the exhaust side of the piston (5) for correct ring end gap orientation.



ATV-1024

C. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston (see illustration).

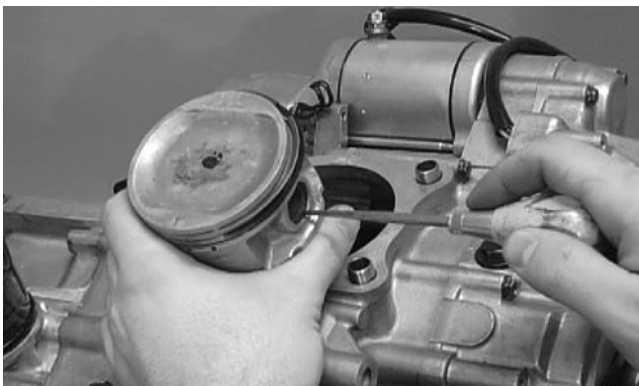
■ **NOTE:** The chrome (silver) ring should be installed in the top position.

**CAUTION**

Incorrect installation of the piston rings will result in engine damage.

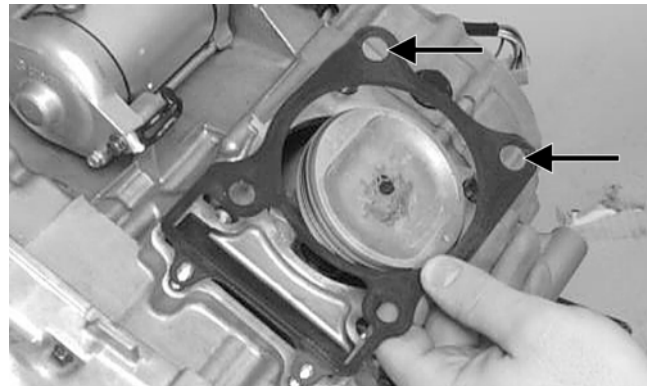
1. Install the piston on the connecting rod making sure there is a circlip on each side and the open end of the circlip faces upwards.

■ **NOTE:** The piston should be installed so the arrow points toward the exhaust.



CC032D

2. Place the two alignment pins into position. Place the cylinder gasket into position; then place a piston holder (or suitable substitute) beneath the piston skirt and square the piston in respect to the crankcase.



CC025D

3. Lubricate the inside wall of the cylinder; then using a ring compressor or the fingers, compress the rings and slide the cylinder over the piston. Route the cam chain up through the cylinder cam chain housing; then remove the piston holder and seat the cylinder firmly on the crankcase.

**CAUTION**

The cylinder should slide on easily. Do not force the cylinder or damage to the piston, rings, cylinder, or crankshaft assembly may occur.

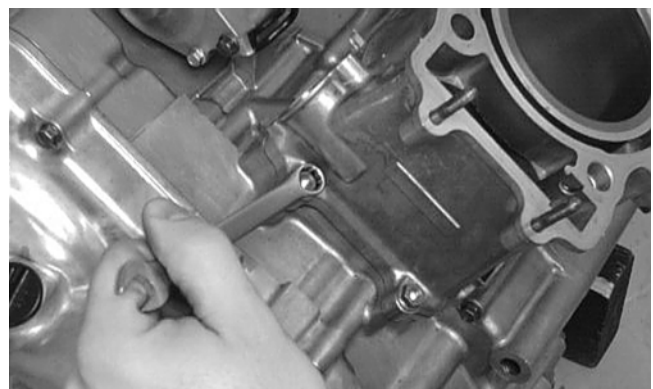
3



CC024D

4. Loosely install the two nuts which secure the cylinder to the crankcase.

■ **NOTE:** The two cylinder-to-crankcase nuts will be tightened in step 10.

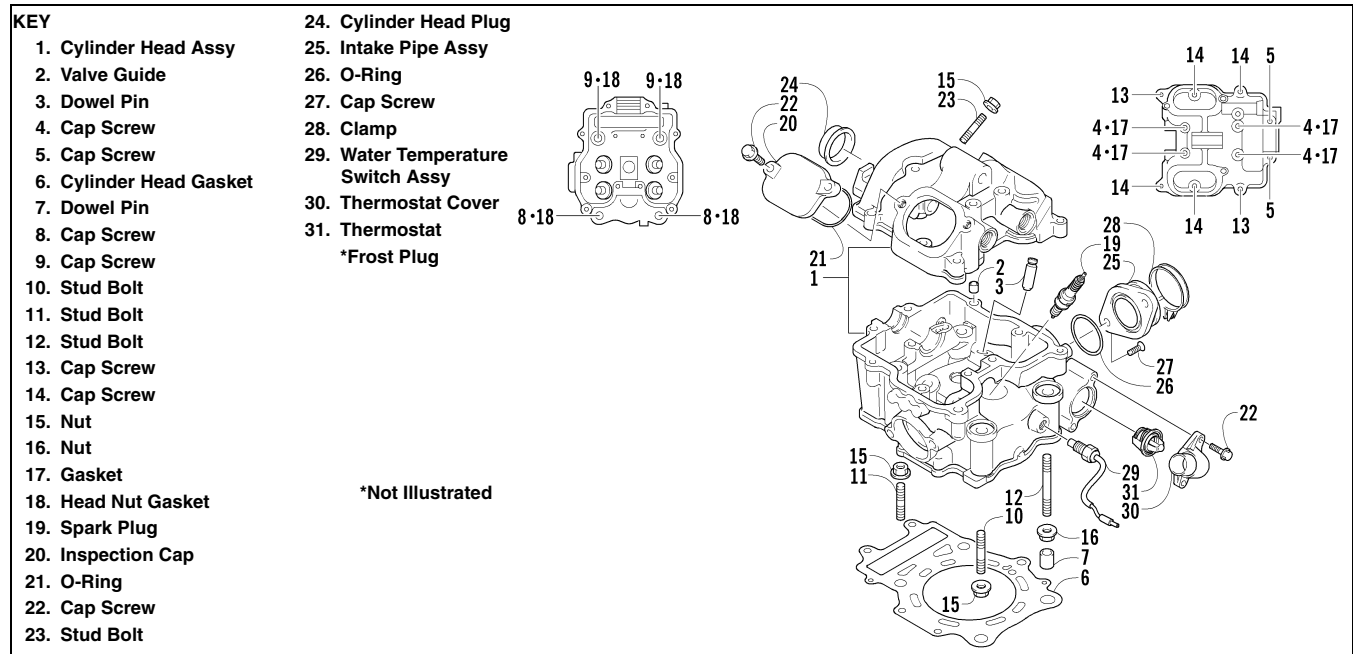


CC023D

5. Install the coolant hose onto the crankcase union and tighten the clamp.

## C. Cylinder Head

### D. Valve Cover



0737-755

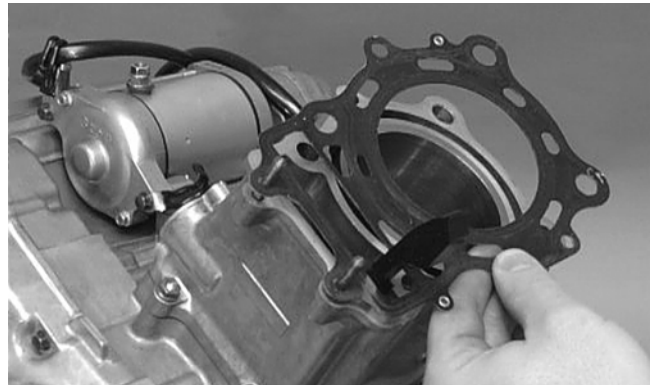
■ **NOTE:** Steps 1-5 in the preceding sub-section must precede this procedure.

6. Place the chain guide into the cylinder.

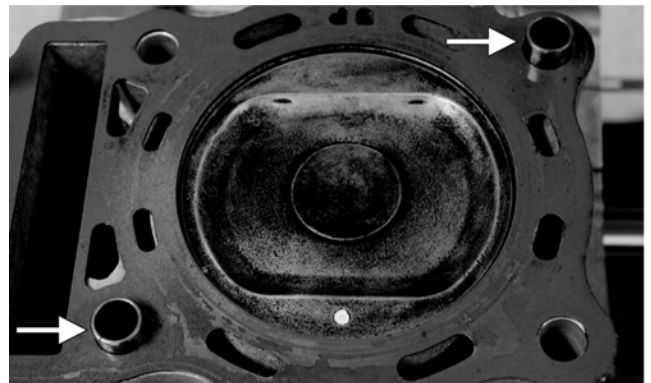


CC022D

7. Place the head gasket into position on the cylinder. Place the alignment pins into position; then place the head assembly into position on the cylinder.



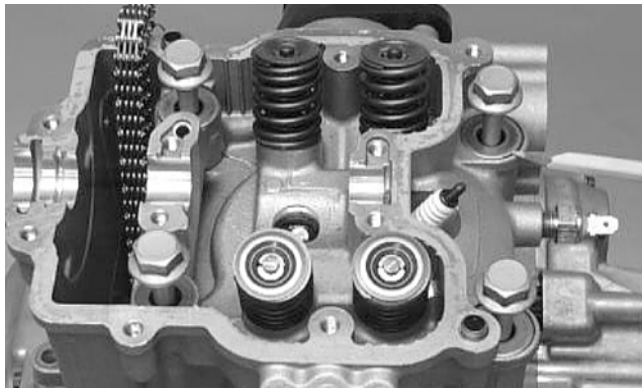
CC020D



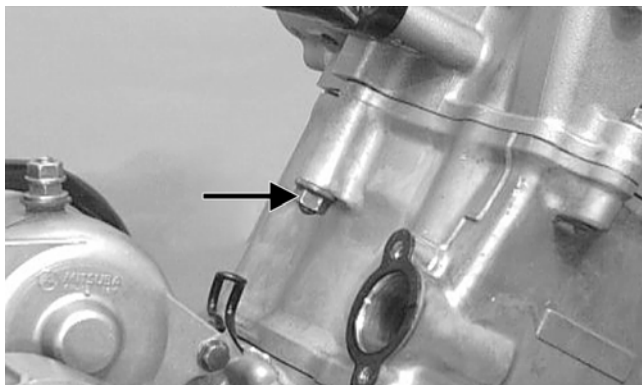
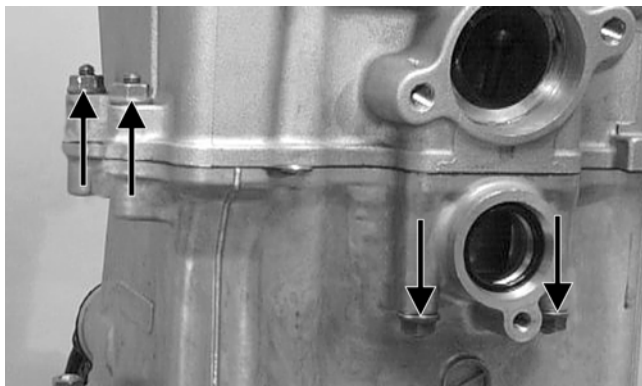
CF057A

8. Install the four cylinder head cap screws with copper washers (note the locations of the different-lengthed cap screws). Tighten only until snug.





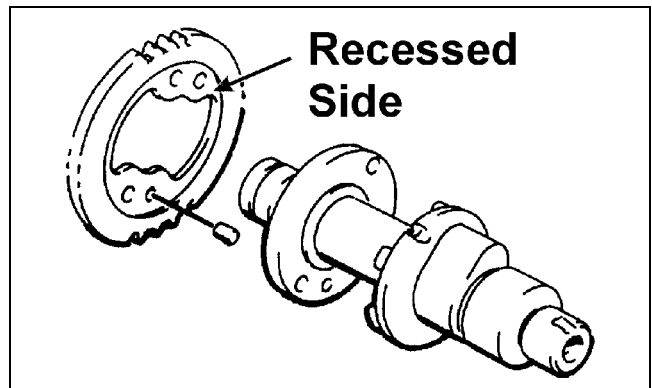
9. Loosely install the five cylinder head nuts.



10. In a crisscross pattern, tighten the four cylinder head cap screws (from step 8) to 3.8 kg-m (27.5 ft-lb); then tighten the 8 mm nut (from step 9) to 2.5 kg-m (18 ft-lb). Using a crisscross pattern, tighten the four 6 mm nuts (from step 9) to 1.1 kg-m (8 ft-lb). Tighten the two cylinder-to-crankcase nuts (from step 4) securely.

11. With the timing inspection plug removed and the chain held tight, rotate the crankshaft until the piston is at top-dead-center.

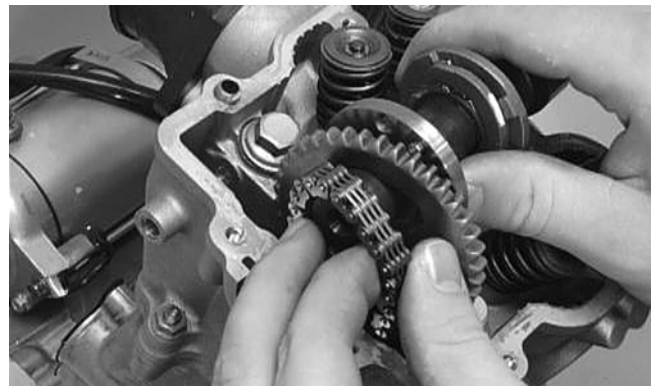
12. With the alignment pin installed in the camshaft, loosely place the cam sprocket (with the recessed side facing the cam shaft lobes) onto the camshaft. At this point, do not "seat" the sprocket onto the shaft.



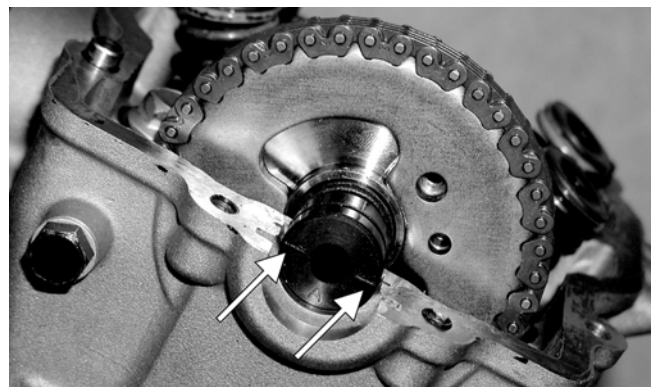
■ **NOTE:** At this point, oil the camshaft bearings, cam lobes, and the three seating journals on the cylinder.

13. With the cam lobes directed down (toward the piston), maneuver the camshaft/sprocket assembly through the chain and towards its seating position; then loop the chain over the sprocket.

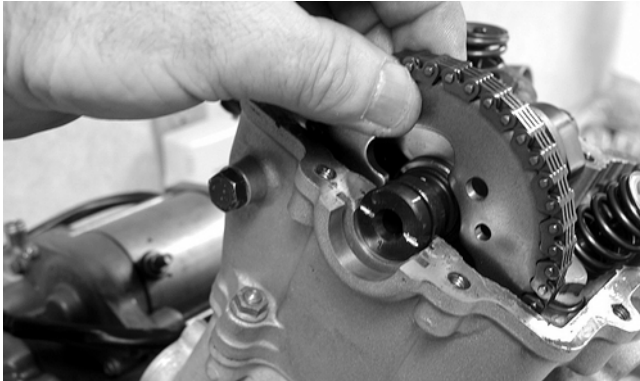
3



■ **NOTE:** Note the position of the alignment marks on the end of the camshaft. They must be parallel with the valve cover mating surface. If rotating the camshaft is necessary for alignment, do not allow the chain and sprocket to rotate and be sure the cam lobes end up in the down position.



14. Seat the cam sprocket onto the camshaft making sure the alignment pin in the camshaft aligns with the smallest hole in the sprocket; then place the camshaft/sprocket assembly onto the cylinder ensuring the following.



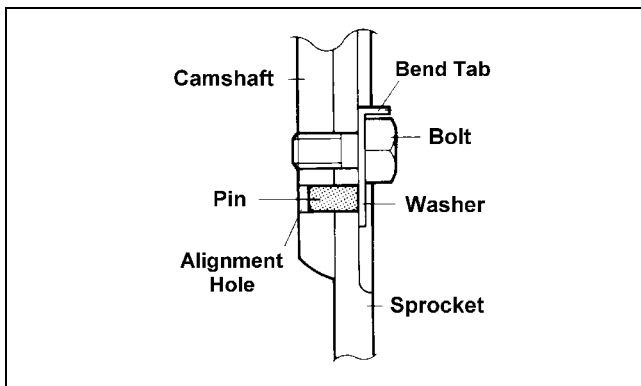
CD463

- A. Piston still at top-dead-center.
- B. Camshaft lobes directed down (toward the piston).
- C. Camshaft alignment marks parallel to the valve cover mating surface.
- D. Recessed side of the sprocket directed toward the cam lobes.
- E. Camshaft alignment pin and sprocket alignment hole (smallest) are aligned.

**CAUTION**

If any of the above factors are not as stated, go back to step 11 and carefully proceed.

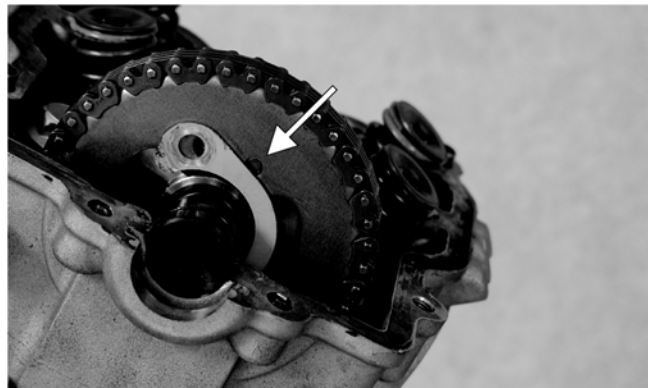
15. Place the tab-washer onto the sprocket making sure it covers the pin in the alignment hole.



ATV-1027

**CAUTION**

Care must be taken that the tab-washer is installed correctly to cover the alignment hole on the sprocket. If the alignment pin falls out, severe engine damage will result.



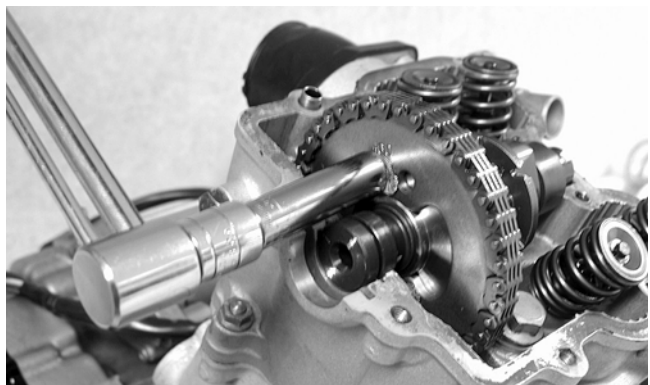
CF013A

16. Install the first cap screw (threads coated with red Loctite #271) securing the sprocket and tab-washer to the camshaft. Tighten only until snug.



CD464

17. Rotate the crankshaft until the second cap screw securing the sprocket to the camshaft can be installed; then install the cap screw (threads coated with red Loctite #271) and tighten to specifications. Bend the tab to secure the cap screw.



CD465

18. Rotate the crankshaft until the first cap screw (from step 16) securing the sprocket to the camshaft can be addressed; then tighten to specifications. Bend the tab to secure the cap screw.

19. Place the C-ring into position in its groove in the cylinder.





CC012D

20. Install the cylinder head plug in the cylinder head with the opening of the plug directed downward and toward the inside.

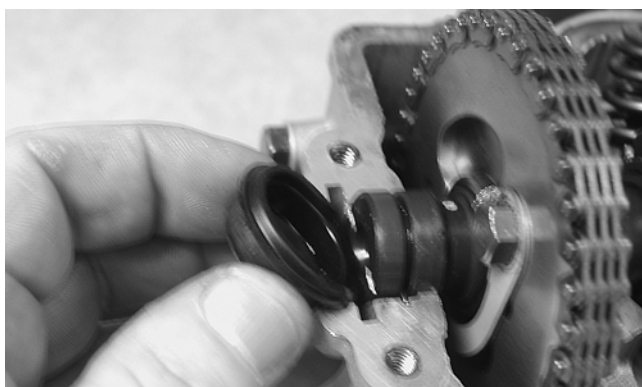


CD501

- **NOTE:** The adjuster shaft will be drawn into the tensioner as the adjuster screw is rotated clockwise. The adjuster shaft tension will be released in step 24.

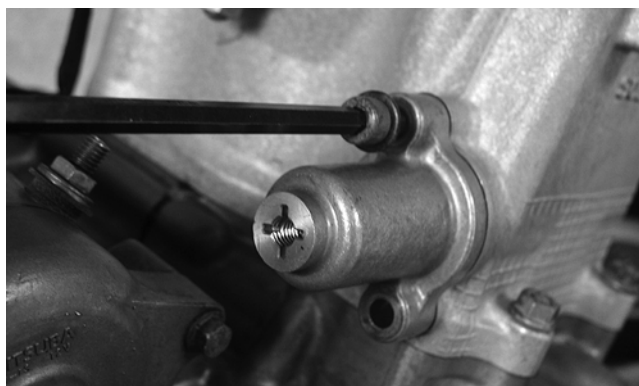
23. Place the chain tensioner adjuster assembly and gasket into position on the cylinder and secure with the two Allen-head cap screws.

3



CD468

21. Place the cam chain tensioner guide into position and secure with the cap screw and washer.

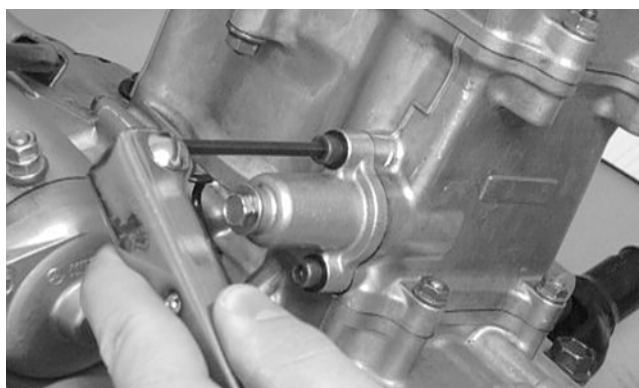


CD469



CC014D

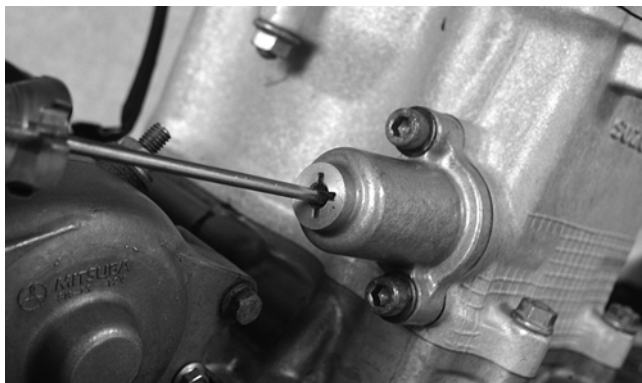
22. Remove the cap screw from the end of the chain tensioner; then using a flat-blade screwdriver, rotate the adjuster screw inside the tensioner clockwise until the screw bottoms.



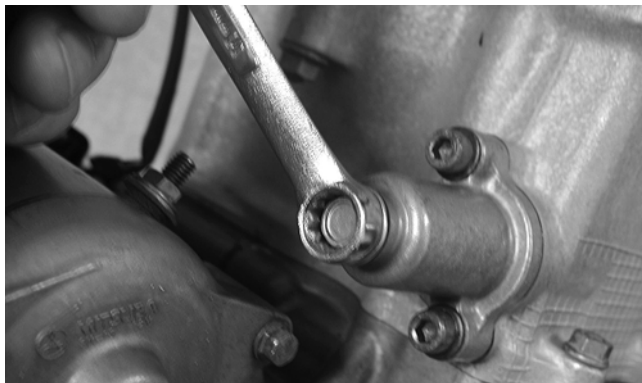
CC010D

24. Using a flat-blade screwdriver, rotate the adjuster screw inside the tensioner counter-clockwise until all tension is released; then install the cap screw into the end of the chain tensioner.





CD470



CD471

25. Loosen the four adjuster screw jam nuts; then loosen the four adjuster screws on the rocker arms in the valve cover.

26. Apply a thin coat of Three Bond Sealant (p/n 0636-070) to the mating surfaces of the cylinder head and valve cover.

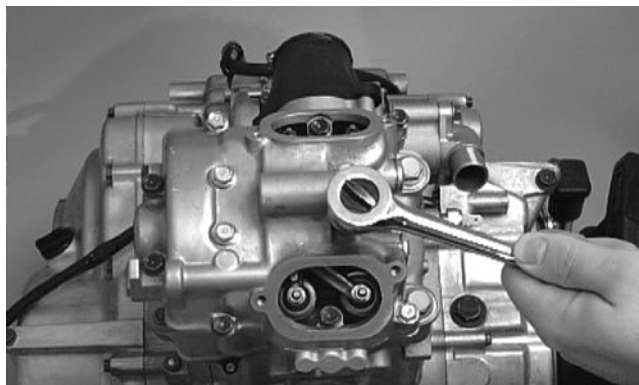


CC275D

27. Place the valve cover into position.

■ **NOTE:** At this point, the rocker arms and adjuster screws must not have pressure on them.

28. Install the four top side valve cover cap screws with rubber washers; then install the remaining cap screws. Tighten only until snug.



CC003D

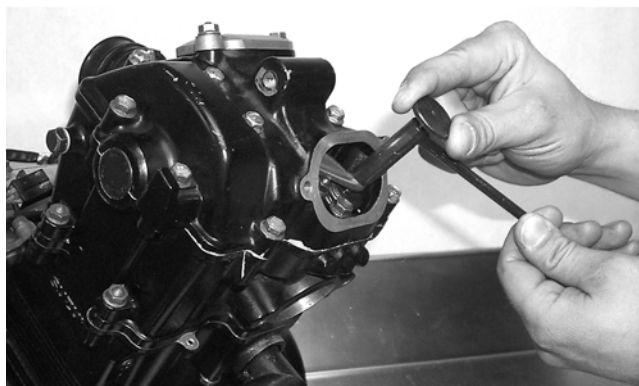
29. In a crisscross pattern starting from the center and working outward, tighten the cap screws (from step 28) securely.

30. Adjust valve/tappet clearance using the following procedure.

■ **NOTE:** Use Valve Clearance Adjuster (p/n 0444-078) for this procedure.

A. Turn the engine over until the piston reaches top dead center on the compression stroke.

B. Place the valve adjuster onto the jam nut securing the tappet adjuster screw; then rotate the valve adjuster dial clockwise until the end is seated in the tappet adjuster screw.



CC528D

C. While holding the valve adjuster dial in place, use the valve adjuster handle and loosen the jam nut; then rotate the tappet adjuster screw clockwise until friction is felt.

D. Align the valve adjuster handle with one of the marks on the valve adjuster dial.

E. While holding the valve adjuster handle in place, rotate the valve adjuster dial counter-clockwise until specified valve/tappet clearance is attained.

■ **NOTE:** Rotating the valve adjuster dial counter-clockwise will open the valve/tappet clearance by 0.05 mm (0.002 in.) per mark.

F. While holding the adjuster dial at the proper clearance setting, tighten the jam nut securely with the valve adjuster handle.

31. Place the two tappet covers into position making sure the proper cap screws are with the proper cover. Tighten the cap screws securely.



CC001D

32. If removed, install the spark plug and tighten to specifications.

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## Installing Engine/Transmission

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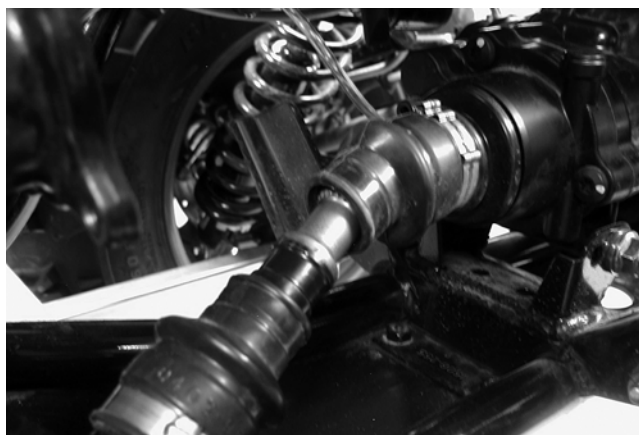
■ **NOTE:** Arctic Cat recommends that new gaskets and O-rings be installed whenever servicing the ATV.

1. From the left side, place the engine/transmission into the frame; then move it rearward as far as possible.
2. Raise the rear of the engine enough to engage the front driveshaft into the splines of the front drive output yoke; then slide the engine forward as far as possible.



CD818

3. Raise the rear of the engine and place a block under it; then install the propeller shaft and output flange into the rear drive coupler.



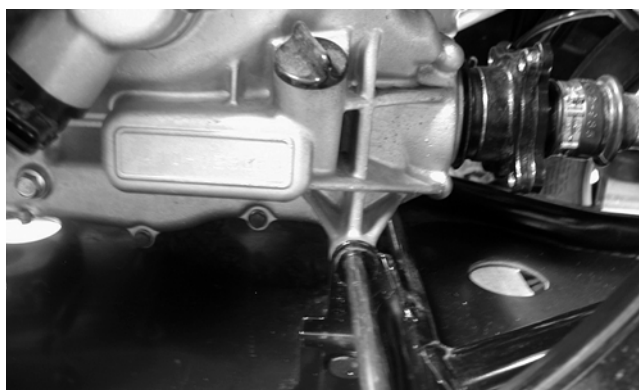
CD821

4. Remove the block from beneath the engine; then align the rear drive flanges and secure with four cap screws. Tighten to specifications.



CD824

5. Install the lower rear engine mounting through-bolt, spacer, and washer; then install the lower front engine mounting through-bolt, spacer, and washer. Secure with the flange nuts. Tighten to specifications.



CD809

6. Install the upper engine mounting brackets to the frame with two cap screws; then install the through-bolt and flange nut. Tighten all hardware to specifications.





CD806



AR604D

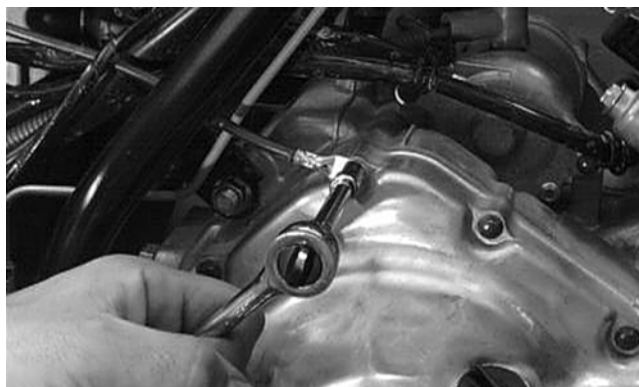
10. Connect the battery ground (negative) cable to the crankcase cover.



CD807

7. Connect the crankcase breather vent hose and secure with the clamp.

8. Connect the lower coolant hose to the water pump housing and secure with the clamp.



AR600D

11. Install the coil and secure with two cap screws; then install the high tension lead on the spark plug.



CC124D

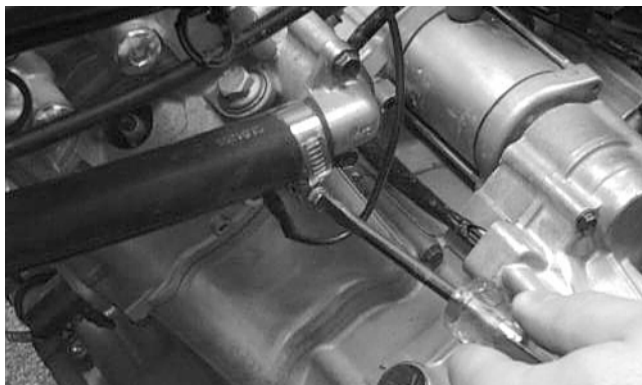
9. Connect the positive cable to the starter motor and install the protective boot.



CD814

12. Connect the upper coolant hose to the thermostat housing and secure with the clamp.





CC121D

13. Install the air filter housing; then connect the crankcase breather and the inlet air duct. Secure with the clamps.



CD785



CD787

14. Position the carburetor into the intake pipe and secure with the clamp; then connect the carburetor boot to the air filter housing. Secure with the clamp.



CD790



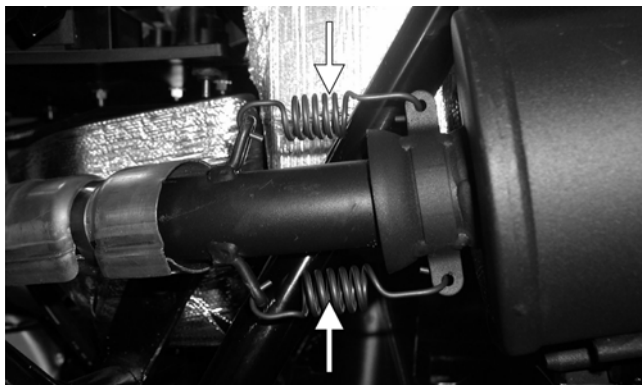
CD786

15. Connect the speed sensor connector to the sensor housing.

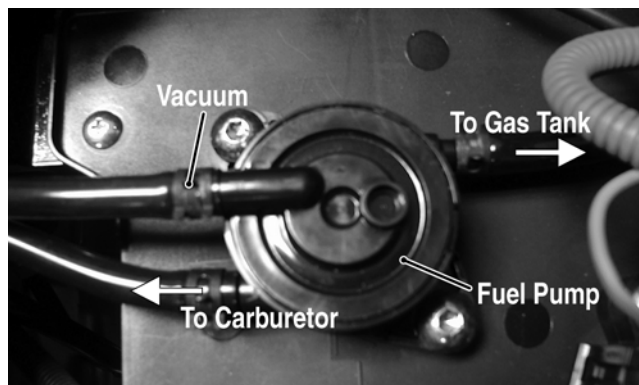


CD794

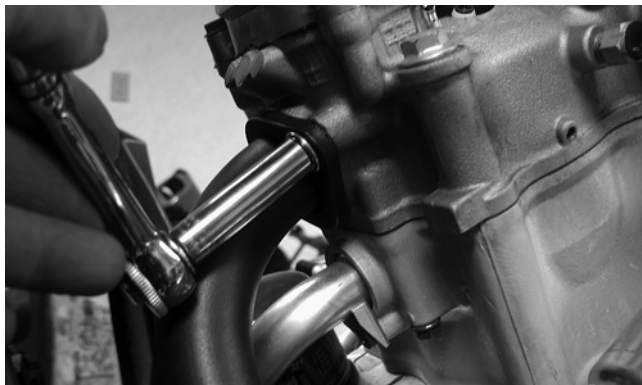
16. Install the exhaust pipe and secure with two cap screws making sure the mounting brackets engage the frame grommets; then install the muffler with the springs. Tighten all hardware to specifications.



CF138A



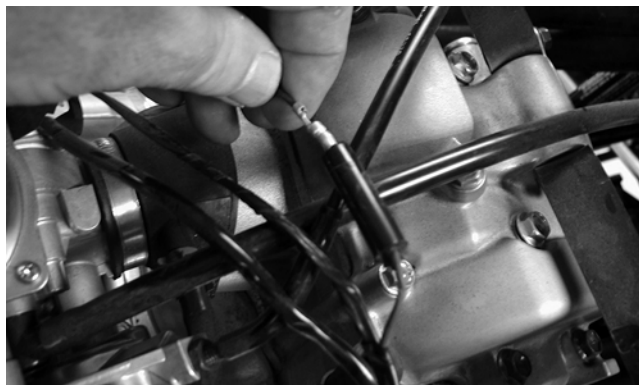
CD766A



CD803

17. Swing the shift rod back into position on the engine shift arm; then secure with the E-clip.

18. Place the left-side footwell and foot peg into position on the footrest. Secure with two cap screws. Tighten to specifications.



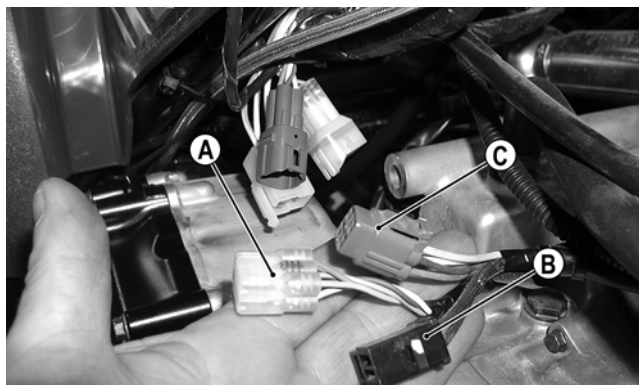
CD788

21. Connect the gear position indicator connector (A), stator connector (B), and the CDI connector (C) to the main harness.



CD782

19. Connect the gas hose to the fuel pump; then connect the vacuum hose. Secure with hose clamps.



CD797A

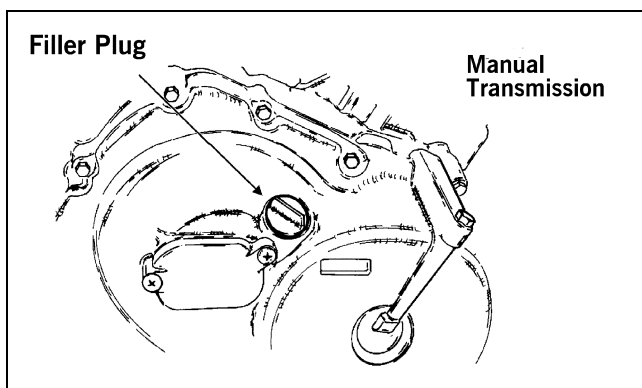
22. Install the front body panel and the front rack (see Section 8).

23. Place the side panels into position; then install the reinstallable rivets.



CD683A

24. Install the battery connecting the positive cable first; then the negative cable.
25. Pour the correct amount of recommended oil into the engine/transmission filler hole; install the filler plug.



ATV-0108

26. Pour 2.9 L (3 U.S. qt) of premixed Arctic Cat Antifreeze (p/n 0638-395) into the cooling system. Allow coolant to settle and then fill to the bottom of the stand pipe in the radiator neck.



AN604D

27. Install the seat making sure it "locks" into position.

### **CAUTION**

If the engine had a major overhaul or if any major part was replaced, proper engine break-in procedures must be followed (see Section 1). If the proper engine break-in procedures are not followed, severe engine damage may result.

## **Table of Contents (650 V-Twin)**

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**3**

## **Removing Engine/ Transmission**

Many service procedures can be performed without removing the engine/transmission from the frame. Closely observe the note introducing each sub-section for this important information.

■ **NOTE:** For ease of removal of components, it is advisable to remove front and rear racks, fenders, and side panels prior to engine removal.

### **AT THIS POINT**

If the technician's objective is to service/replace recoil starter, alternator/rotor flywheel, stator, pick-up coil, starter torque limiter, primary cam chain, water pump impeller/seal, starter clutch, and starter clutch gear, the engine/transmission does not have to be removed from the frame.

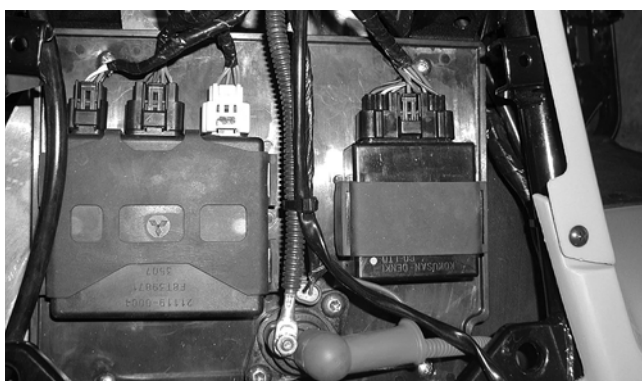


Secure the ATV on a support stand to elevate the wheels.

**⚠ WARNING**

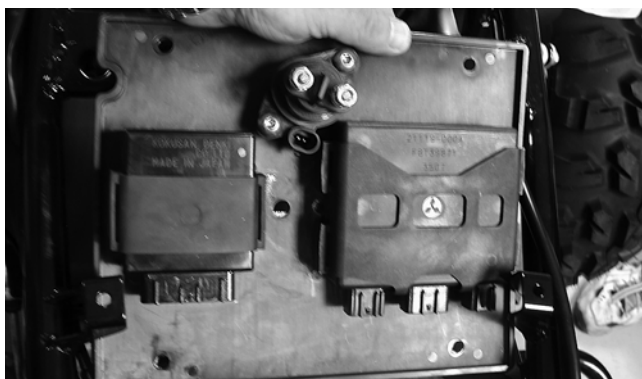
**Make sure the ATV is solidly supported on the support stand to avoid injury.**

1. Remove the seat.
2. Remove the negative cable from the battery; then remove the positive cable. Remove the battery cover and the battery vent hose; then remove the battery.
3. Disconnect the wiring on the starter relay; then disconnect the CDI unit and the engine brake actuator control connectors.



KX074

4. Remove the four screws securing the electronics mounting tray; then remove the entire assembly.



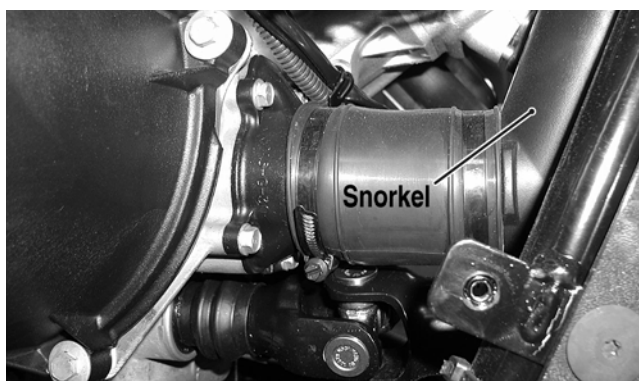
KX130

5. Drain the coolant from the cooling system; then drain the oil from the engine/transmission.



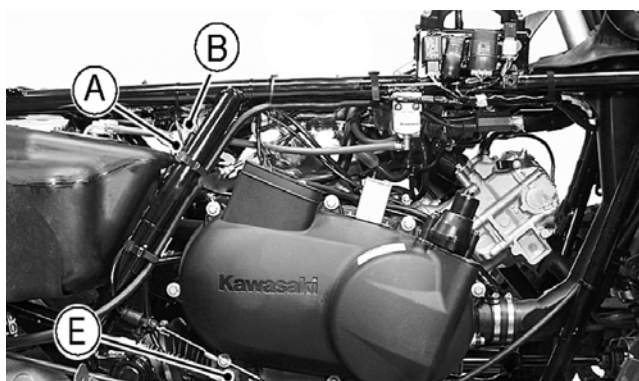
KX036A

6. Remove the reinstallable rivets securing the right-side and left-side panels; then remove the panels.
7. Remove the radiator access cover, steering post cover, and storage compartment cover assembly; then remove the storage compartment box.
8. Remove the instrument pod; then remove the front rack and front body panel (see Section 8).
9. Remove the front V-belt cooling snorkel; then remove the rear V-belt cooling boot.



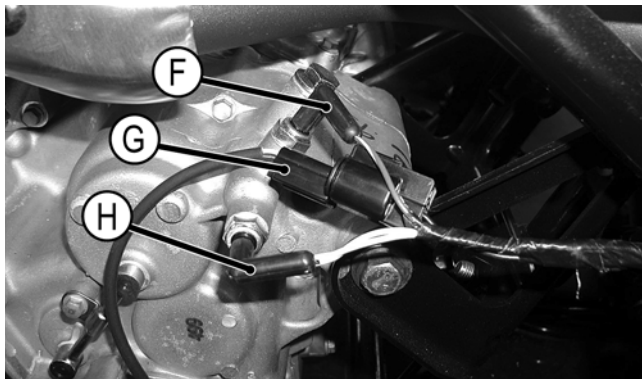
KX101A

10. Disconnect the alternator lead connector (A); then disconnect the pick-up coil lead (B) and the speed sensor connector (E).



KX234B

11. Remove the neutral position connector (F) and reverse position connector (H); then disconnect the forward and reverse detection sensor lead (G).



KX075A

12. Remove the front and rear spark plug caps; then remove the oil pressure sending unit lead (I).



KX046A

13. Remove the left-side foot peg and footwell.



KX104

14. Loosen the carburetor intake boot clamp (J); then remove the two coolant hoses (K).



KX025D

15. Remove the throttle cover from the front carburetor; then disconnect the throttle cable.



KX136

16. Lift the carburetors above the frame and tie to the handlebar; then cover the carburetor openings with duct tape or other suitable material.



KX121



### CAUTION

If hardware items or other foreign objects are ingested by the engine on start-up, severe engine damage will occur.

17. Remove the cap screws securing the rear exhaust pipe to the head; then remove the three bolts securing the heat shield to the frame.

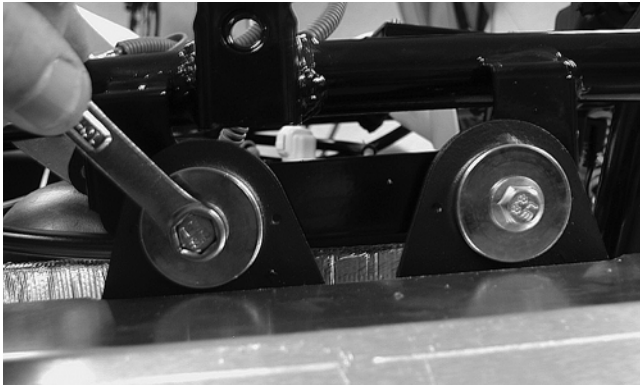


KX141

3

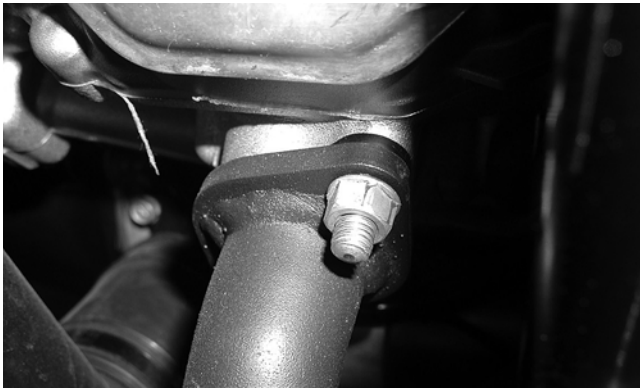


18. Loosen the muffler clamp; then remove two mounting bolts securing the muffler to the frame. Remove the muffler assembly accounting for one ring gasket and one exhaust pipe bushing seal.



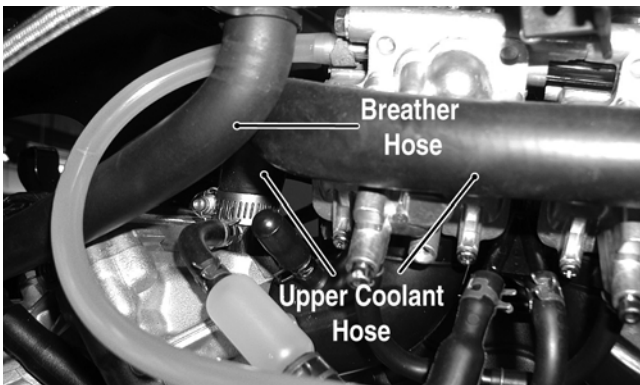
KX126

19. Remove the front exhaust pipe accounting for the ring gasket.

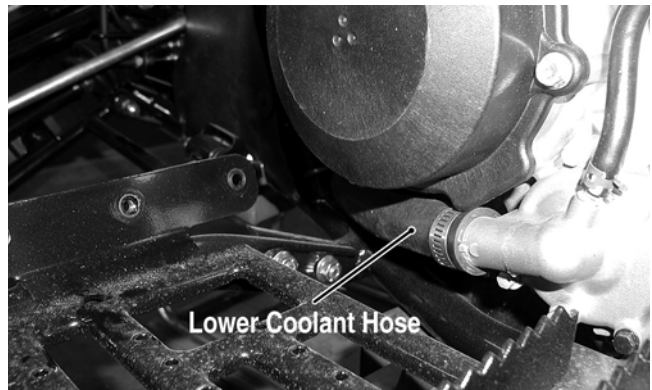


KX067

20. Remove the two upper coolant hoses and the breather hose; then remove the lower coolant hose.



KX086A



KX117A

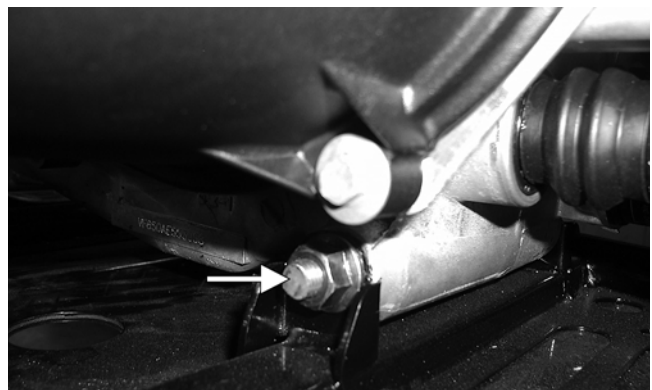
21. Remove the rear engine mount through-bolt; then remove the rear engine mount brackets from the frame.

■ **NOTE:** Removing the brackets will allow the engine to be moved rearward enough to release the front drive coupler.



KX090A

22. Remove the front lower engine mount through-bolt.



KX089A

23. Raise the rear of the engine and maneuver forward to release the rear drive coupler; then lower the rear and shift the engine to the rear to release the front drive coupler.

■ **NOTE:** This will require an assistant to hold cables and lines clear and to assist in maneuvering the engine/transmission assembly out of the frame.



24. Remove the engine/transmission assembly from the left side of the frame.

■ **NOTE:** Tape over or cap all open hoses, lines, and vents to prevent contamination. Make sure that the gas tank valve is in the OFF position and the tank cap is securely tightened.

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## Left-Side Components

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■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### AT THIS POINT

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

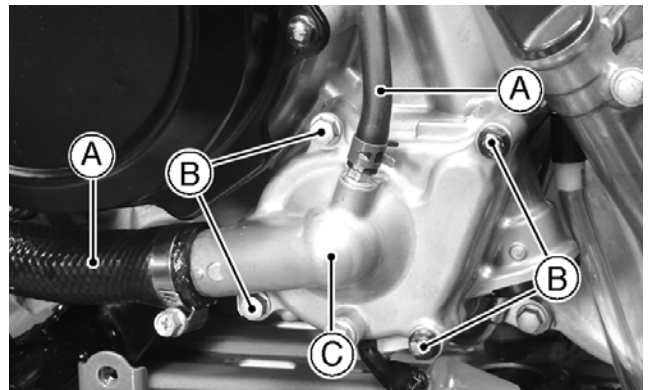
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## Removing Left-Side Components

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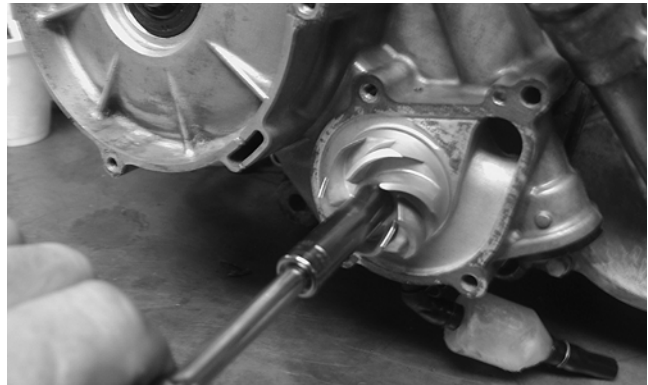
- A. Recoil Starter**
- B. Water Pump**
- C. Cover**
- D. Rotor/Flywheel**
- E. Stator**
- F. Starter Torque Limiter**
- G. Starter Clutch/Clutch Gear**
- H. Oil Pump**

1. Remove the four cap screws securing the recoil starter assembly to the left-side cover; then remove the recoil starter. Account for the gasket.
2. Drain the cooling system including the coolant reserve tank; then remove the coolant hoses (A), four cap screws (B), and the water pump cover (C). Account for the gasket.



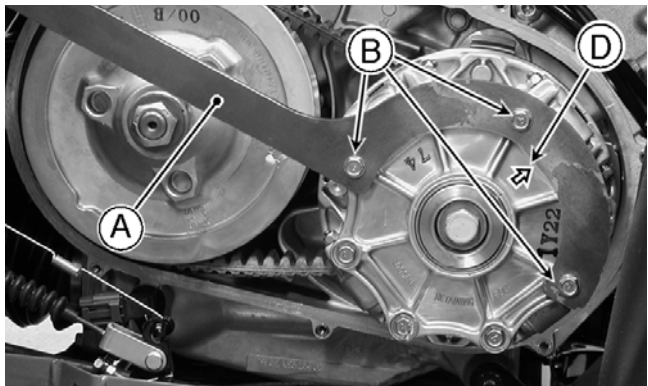
KX235

3. Remove the water pump impeller.



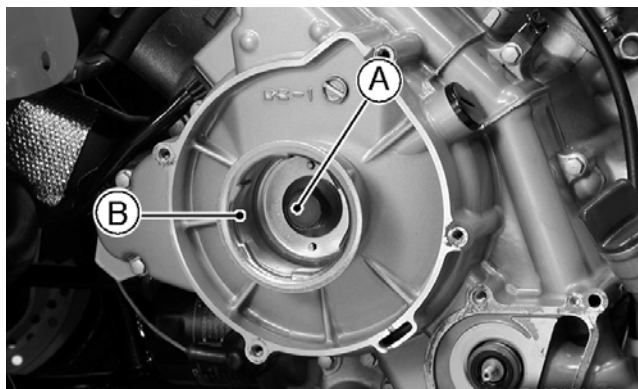
KX40D

4. Remove the V-belt cover (See Removing Right-Side Components); then remove the three clutch cover bolts (B) noting the arrow (D) and attach the clutch holding tool (A).



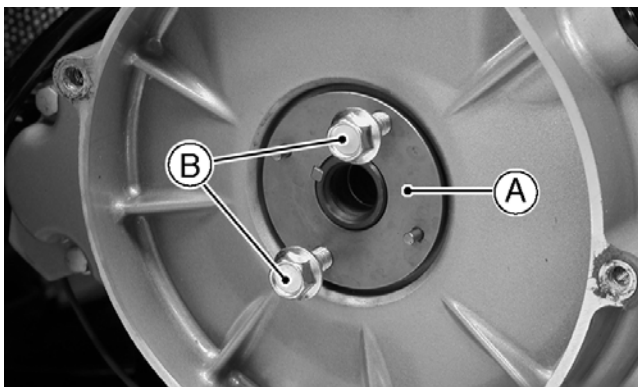
KX236A

5. Hold the clutch stationary while (from the opposite side) loosening the rotor/flywheel cap screw (A); then remove the cap screw and the starter cup (B). Account for the O-ring.

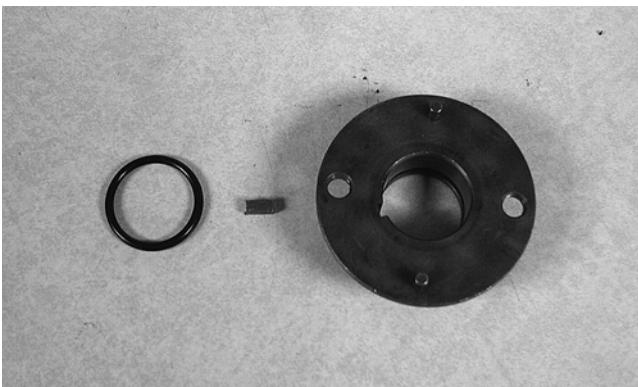


KX237

6. Place an oil pan under the left side of the engine; then install two 6 mm cap screws (B) into the collar (A) and remove the collar.

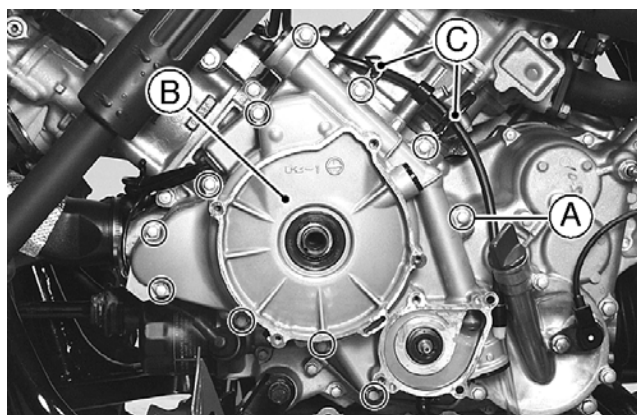


KX238



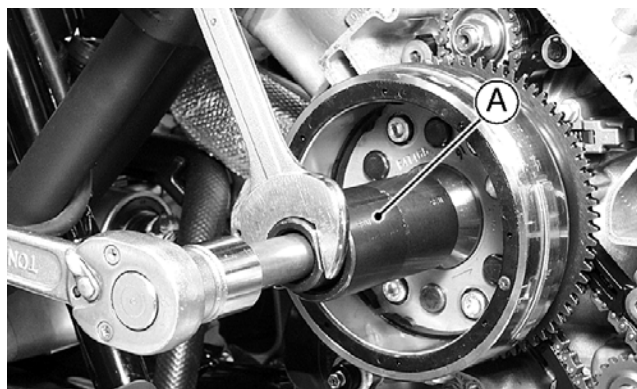
KX409

7. Disconnect the alternator and pick-up coil lead connectors; then remove the alternator cover cap screws (A), alternator cover (B), and the two clamps (C). Account for two alignment pins and a gasket.



KX239

8. Remove the ball bearing; then thread the flywheel puller (A) into the rotor/flywheel.



KX240

9. Hold the puller with a suitable wrench and turn the puller screw in to remove the rotor/flywheel. Account for the key.

### CAUTION

If the rotor is difficult to remove, turn the screw while tapping on the end of the puller screw. Do not strike the rotor/flywheel as a sharp blow can cause magnets to lose strength.

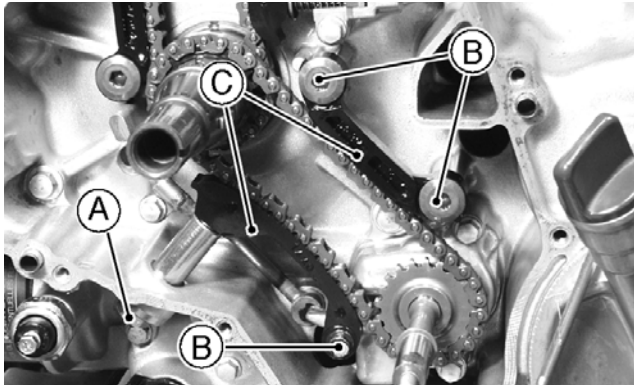
10. Remove the starter torque limiter; then remove the starter gear.



KX412



11. Remove the oil pump drive chain tensioner bolt (A); then remove the chain guide bolts (B) and collar and the chain guides (C). Account for a pin, spring, and O-ring with the chain tensioner bolt.

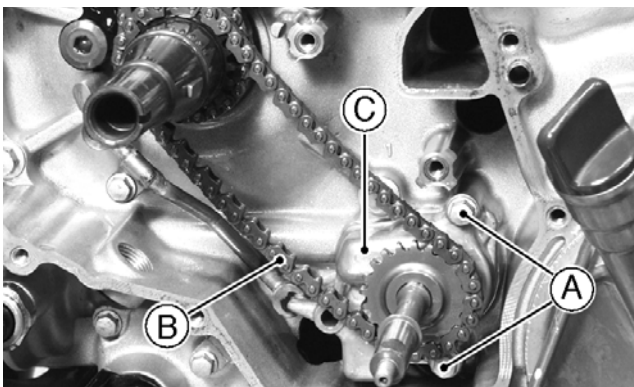


KX242



KX413

12. Remove the cap screws securing the oil pump (A); then remove the oil pump drive chain (B) and oil pump assembly (C). Account for the chain tensioner, chain, and two alignment pins.



KX243

## Right-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### **AT THIS POINT**

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

**3**

## Removing Right-Side Components

- A. V-Belt Cover**
- B. Driven Pulley**
- C. Clutch Assembly**

### **WARNING**

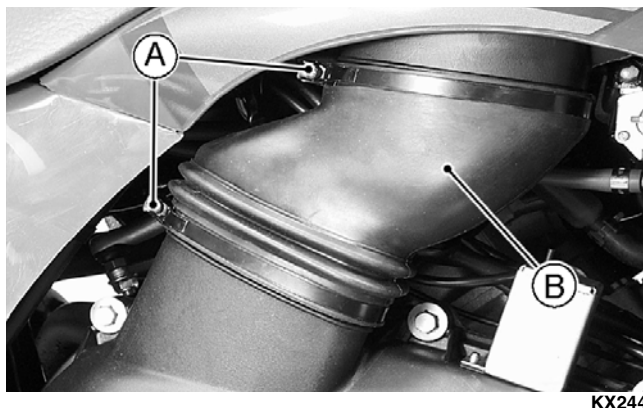
Imbalance of clutch or driven pulley or excessive RPM could cause component failure resulting in severe injury or death. These components are precision balanced and designed to operate within certain RPM limits. Disassembling, assembling, and servicing procedures of clutch and driven pulley must be followed closely. Any modifications that increase RPM may cause failure.

### **CAUTION**

Do not turn the ignition switch ON while the V-belt cover is removed. This will cause the learning control of the engine brake control to operate and the engine brake actuator may be damaged.

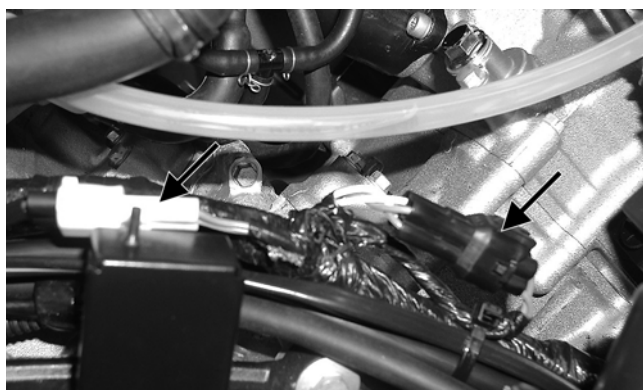
1. Turn the ignition switch to the OFF position and remove the ignition key.
2. Loosen the two clamps (A) securing the air duct boot (B); then remove the boot.





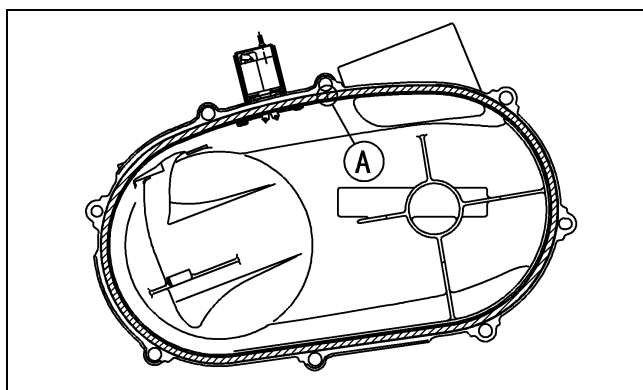
KX244

3. Disconnect the belt failure detection connector and the engine brake actuator lead; then remove the cap screws securing the V-belt cover to the crankcase.



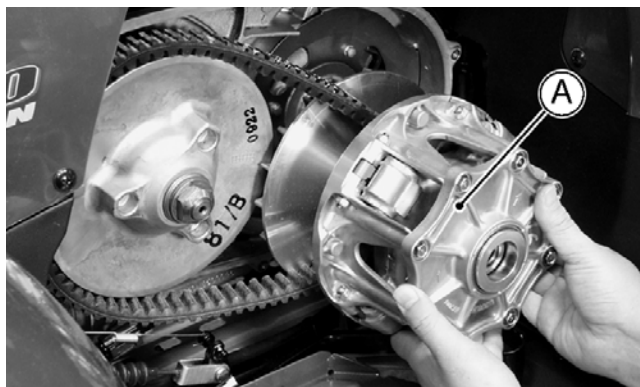
KX138A

4. Remove the V-belt cover accounting for the seal. Note the position of the glue joint (A).

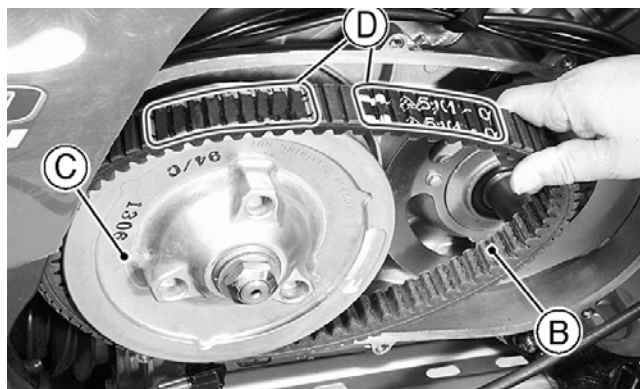


ATV2064

5. Remove the cap screw (left-hand threads) securing the clutch assembly.
6. Using an appropriate clutch puller, remove the clutch assembly (A); then lift the V-belt (B) off the driven pulley (C). Note the direction of the printed information (D) on the belt or mark the belt for correct installation. See Section 2 for procedure.

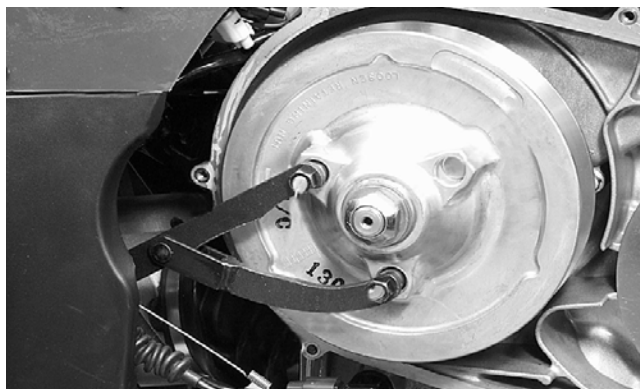


KX245



KX232A

7. Hold the driven pulley with an appropriate holder; then remove the driven pulley nut and the driven pulley.



KX246A

## Top-Side Components

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

### AT THIS POINT

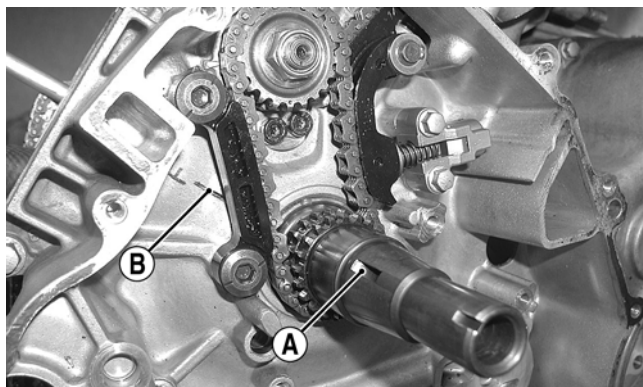
To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE:** The engine/transmission does not have to be removed from the frame for this procedure.

## Removing Top-Side Components

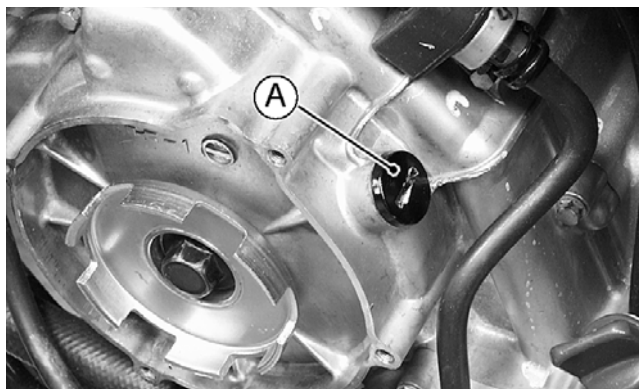
### A. Valve Covers B. Cylinder Heads

■ **NOTE:** If the left-side components have been removed, align the keyway (A) in the crankshaft with the embossed line (B) on the crankcase.

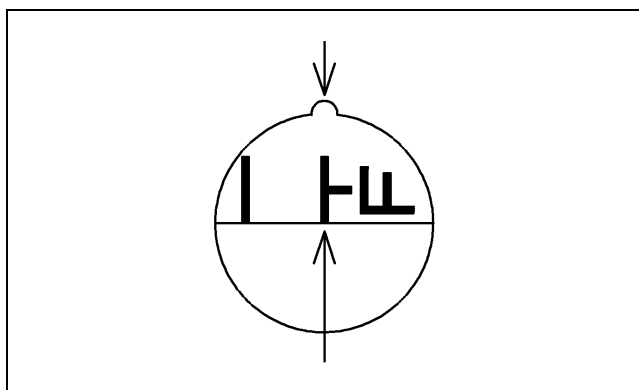


KX530A

■ **NOTE:** If the left-side components have not been removed, remove the spark plugs and timing inspection plug (A); then using the recoil starter, rotate the crankshaft to top-dead-center (TDC) of the compression stroke of the front cylinder. TF is top-dead-center front.



KX247



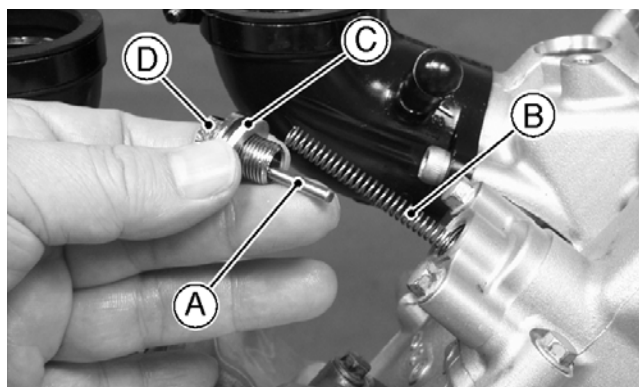
ATV2057A

1. Remove the two tappet covers. Account for two gasket rings.

### CAUTION

Be sure the crankshaft is on TDC of the compression stroke of the front cylinder or valve damage could occur.

2. Remove front and rear camshaft chain tensioners by first removing the spring cap (D). Account for one washer (C), one spring (B), and one guide rod (A) for each tensioner.

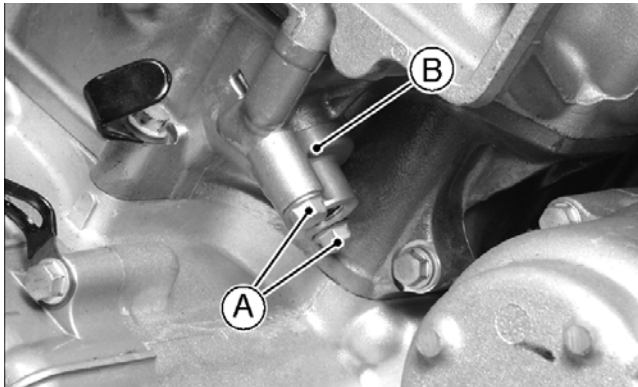


KX248

### CAUTION

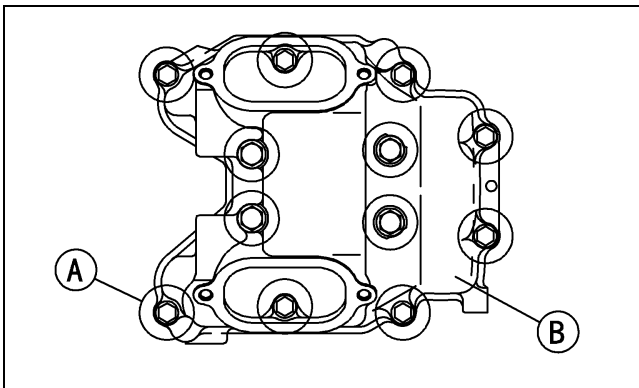
This is a ratchet-type chain tensioner and must be completely removed and reset if the mounting bolts are loosened. Retightening the mounting bolts after loosening will cause damage to the tensioner and camshaft chain.

3. Remove the cap screws (A); then remove the cam chain tensioner (B). Repeat for the second cylinder.



KX249

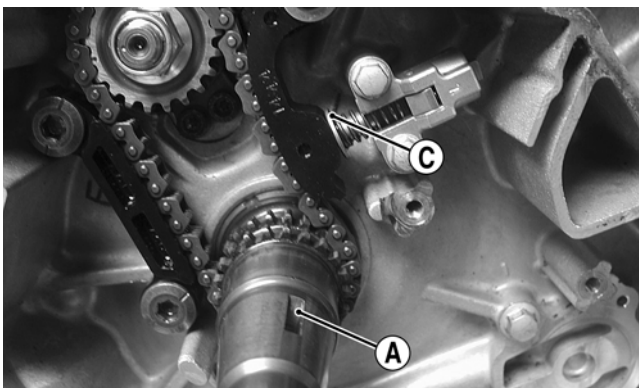
4. Remove the cap screws (A) securing the front rocker case to the head; then remove the front rocker case (B).



ATV2065

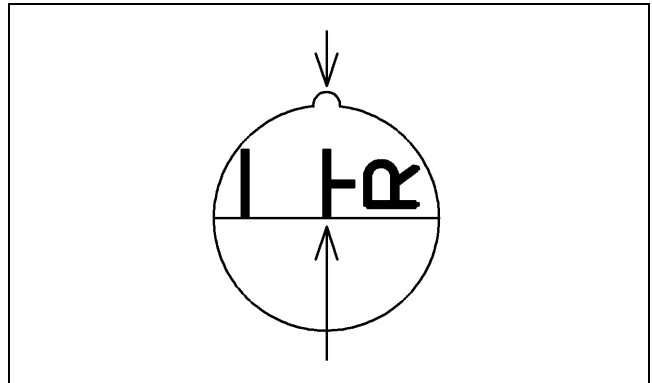
■ **NOTE:** Leave the camshaft and camshaft chain installed until the rear rocker case is removed or the cam chain will have to be supported while rotating the crankshaft.

■ **NOTE:** If the left-side components have been removed, align the keyway (A) in the crankshaft with the embossed line (C) on the crankcase.



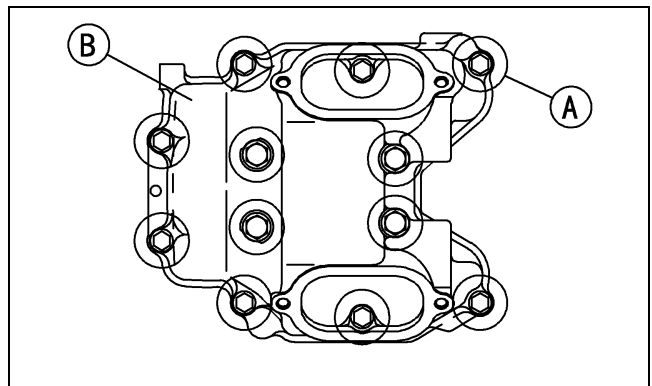
KX528A

5. If the left-side components have not been removed, rotate the crankshaft counterclockwise to position the rear cylinder at TDC on the compression stroke; then remove the two tappet covers. Account for two gasket rings. TR is top-dead-center rear.



ATV2058A

6. Remove the cap screws (A) securing the rear rocker case to the head; then remove the rear rocker case (B).



ATV2066

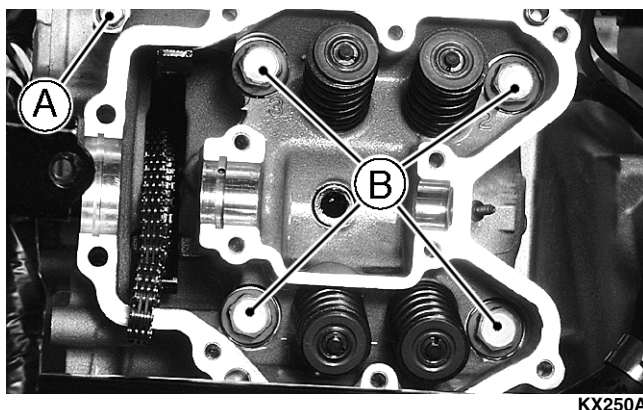
7. Remove the front camshaft and support the cam chain; then remove the rear camshaft and support the rear cam chain.

### **CAUTION**

**Do not rotate the crankshaft without keeping tension on the camshaft chains or engine damage could occur.**

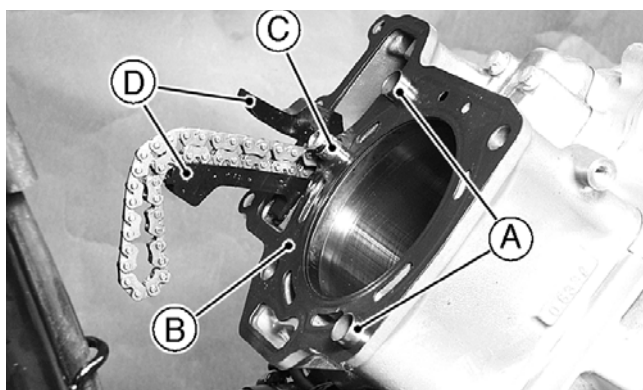
8. Remove the 6 mm cylinder head cap screw (A); then remove front 10 mm cap screws (B) and washers.





KX250A

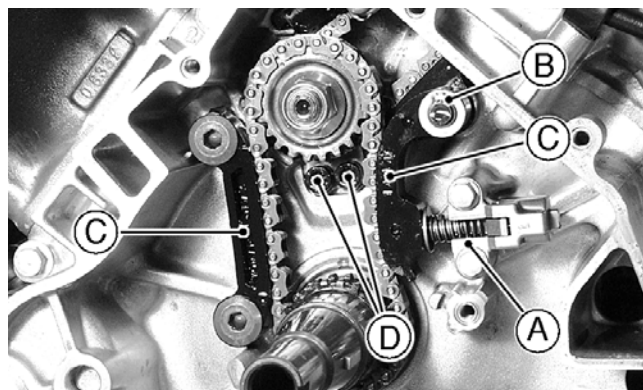
9. Remove the front cylinder head assembly and account for two alignment pins (A), cylinder head gasket (B), oil pipe (C), and camshaft chain guides (D). Repeat steps 8 and 9 for the rear cylinder head.



KX255

10. Remove the intermediate shaft chain tensioner (A); then remove the circlip (B) and washer.

11. Remove the intermediate shaft chain guides (C); then remove the two Allen-head cap screws (D). Account for the intermediate cam drive position plate.

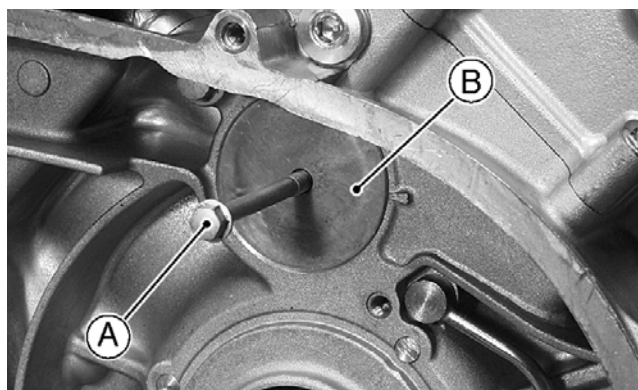


KX251



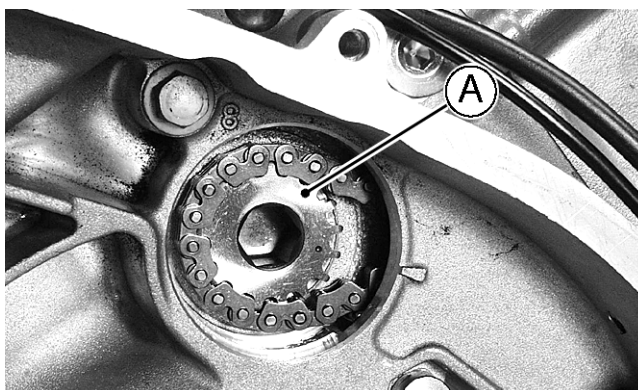
KX452

12. Install a 6 mm cap screw (A) in the tapped hole of the front camshaft drive gear cover (B) and remove the cover. Account for one O-ring.



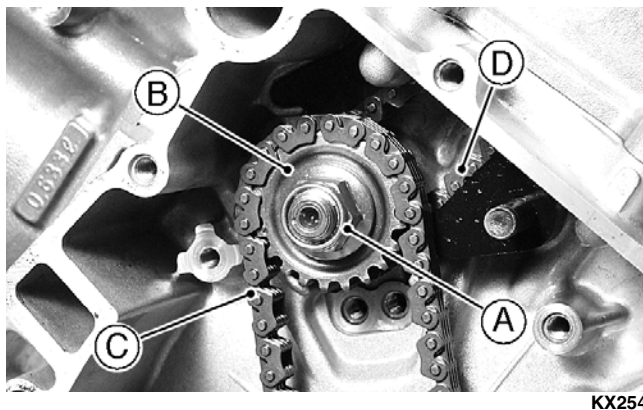
KX252

13. Hold the intermediate shaft (A) with an Allen wrench.



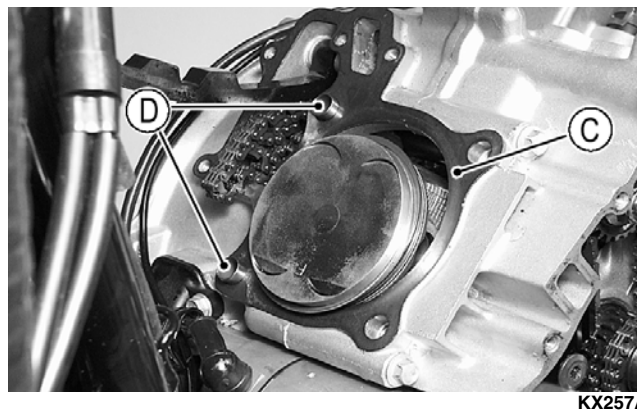
KX253

14. Remove the intermediate shaft sprocket nut (A); then remove the sprocket (B), drive chain (C), and the rear camshaft drive chain (D).



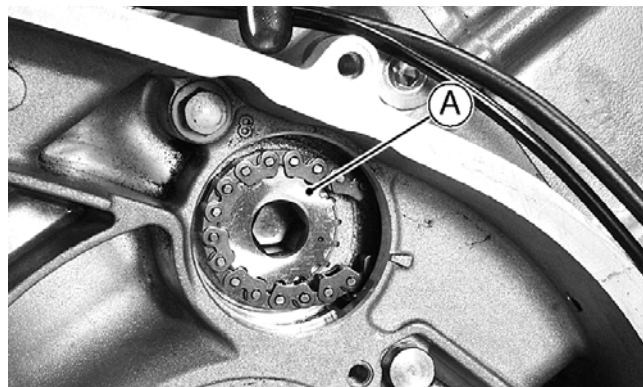
KX254

15. Remove the front camshaft drive chain from the intermediate sprocket (A) on the right side; then remove the shaft from the engine.



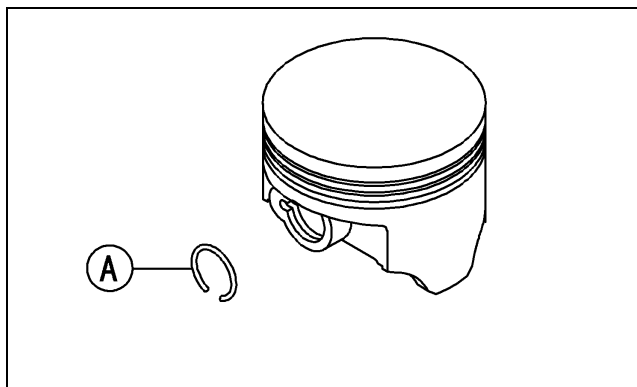
KX257A

17. Place a clean, lint-free cloth under the piston; then remove the piston pin retainer rings (A).



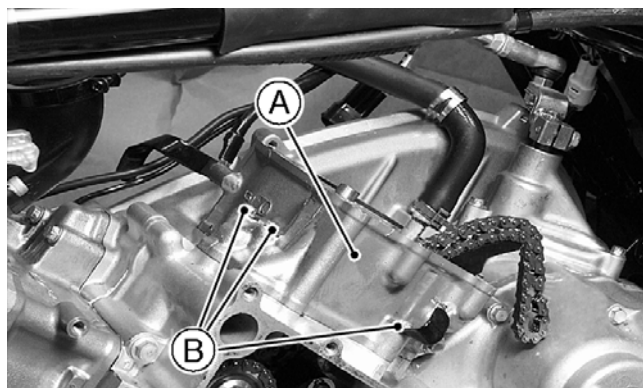
KX253

16. Remove the cylinder bolts (B); then remove the front cylinder (A). Account for the base gasket (C) and alignment pins (D). Repeat this step for the rear cylinder.

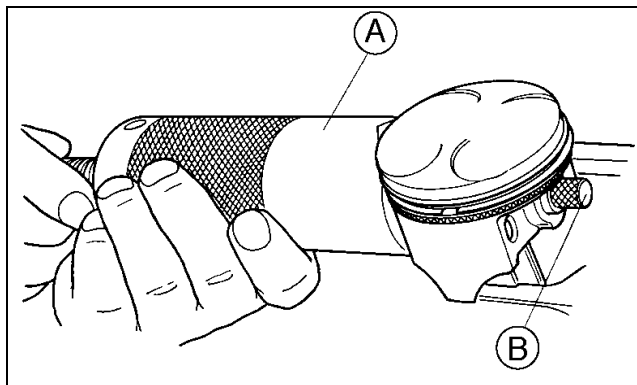


ATV2067

18. Using a piston pin puller (A), remove the piston pins (B); then remove the pistons from the connecting rods.



KX256A



ATV2068

### ⚠ CAUTION

The connecting rods must be wrapped or suspended to avoid metal-to-metal contact with the crankcase. If the rods or crankcase are nicked or chipped, severe engine damage will occur.





KX456

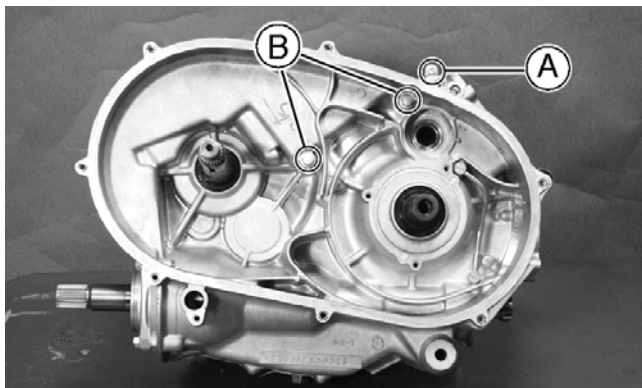
## Center Crankcase Components

■ **NOTE:** This procedure cannot be done with the engine/transmission in the frame. Complete Removing procedures for Left-Side, Right-Side, and Top-Side must precede this procedure.

■ **NOTE:** For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

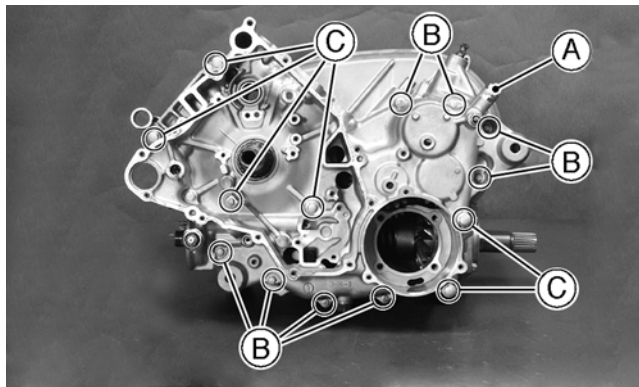
## Separating Crankcase Halves

1. Remove the right crankcase bolts (A = 6 mm) (B = 8 mm).



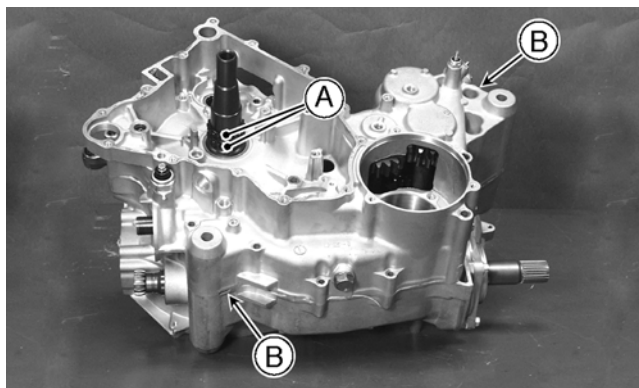
KX258

2. Remove the shift shaft positioning bolt (A) accounting for a washer, spring, and ball; then remove the left crankcase bolts (B = 6 mm) (C = 8 mm).



KX259

3. Wrap tape on the sprockets (A) to protect the crankshaft bushing in the case; then using pry points (B), separate the crankcase and lift off the left side.



KX260

■ **NOTE:** The right and left crankcase halves are machined as an assembled set; therefore, they must be replaced as a set.

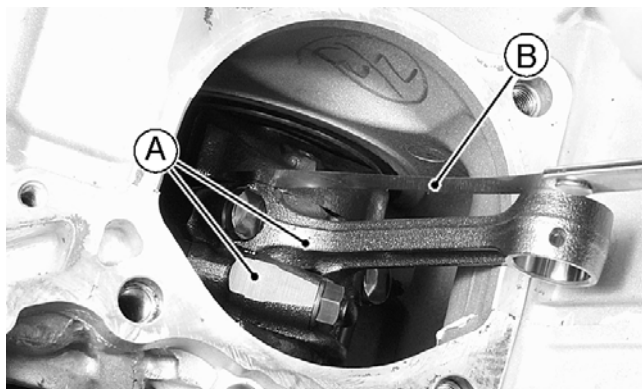
## Disassembling Crankcase Half

1. Using a press, remove the crankshaft from the right case; then mark matching marks on the connecting rods and end caps.

### AT THIS POINT

Connecting rod side clearance (A) should be measured with a feeler gauge (B) before disassembling as connecting rods have to be installed for this measurement. Maximum serviceable side clearance is 0.7 mm (0.028 in.). Connecting rods or crankshaft will have to be replaced if measurement exceeds specification.



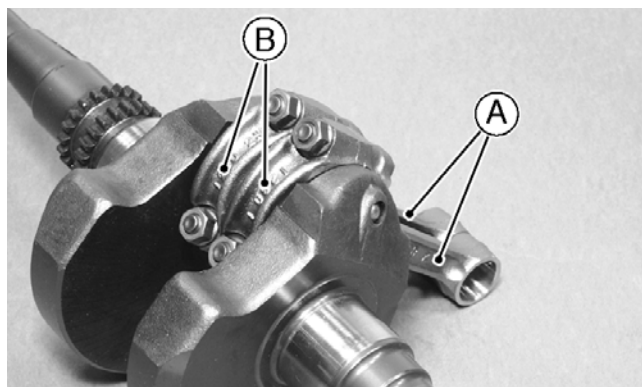


KX261

**CAUTION**

Connecting rods are machined with the big end caps installed. Severe engine damage will result if the caps are not installed on their respective rods.

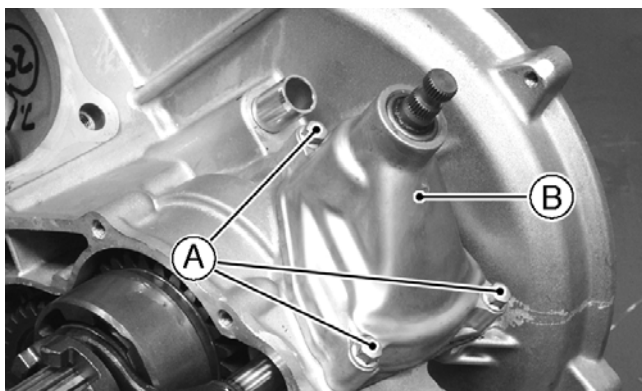
2. Remove the connecting rod nuts; then remove the connecting rods (A) and caps (B).



KX262

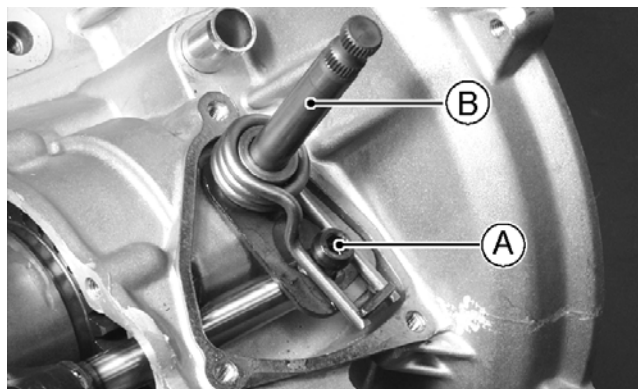
■ **NOTE:** Connecting rod cap should be immediately installed on its connecting rod to prevent a mismatch.

3. Remove the three cap screws (A); then remove the shift shaft cover (B).



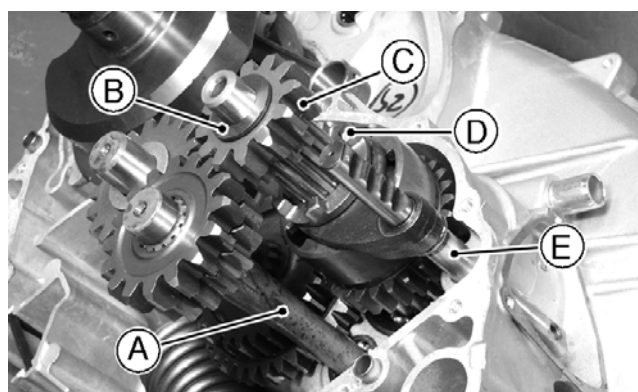
KX263

4. Remove the shift shaft spring anchor (A); then remove the shift shaft (B).



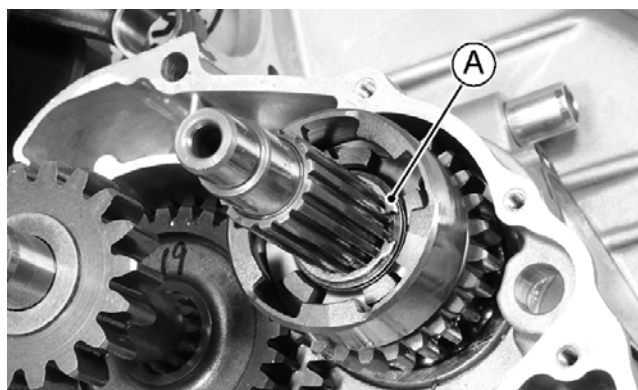
KX264

5. Remove the spacer (B) and reverse drive gear (C) accounting for a needle bearing and spacer; then remove the reverse idler shaft (A), shifter (D), and shift rod (E).



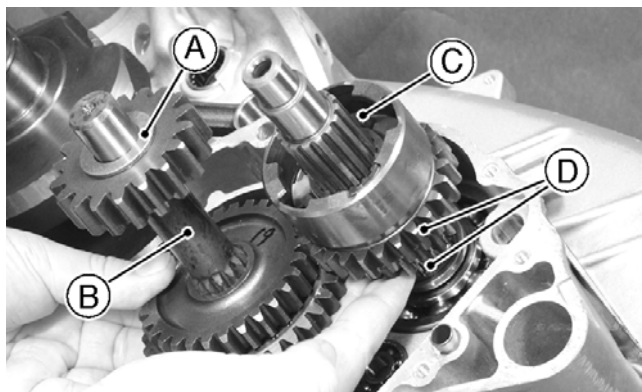
KX265

6. Remove the circlip (A).



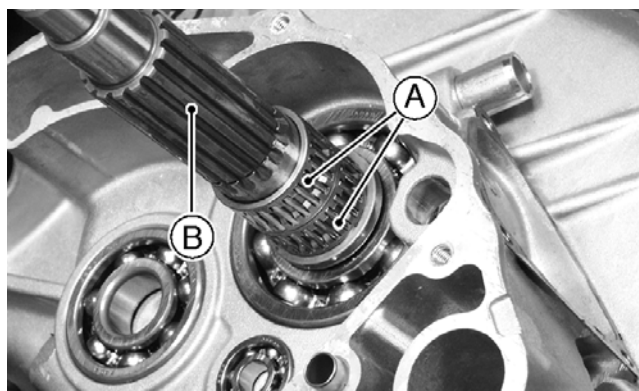
KX266

7. Remove the spacer (A), idler gear assembly (B), and washers and spacer (C); then remove low and high range gears (D).



KX267

8. Remove the two needle bearings (A); then using a press, remove the driven shaft (B).



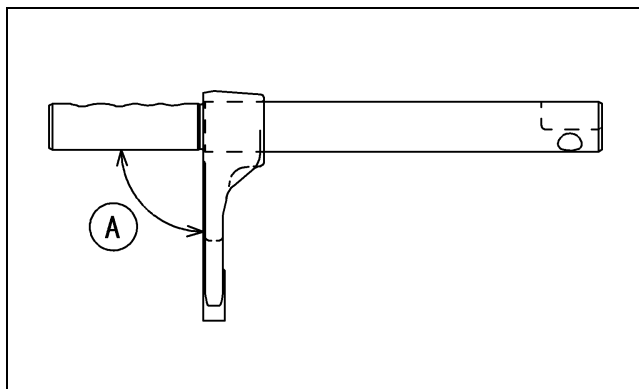
KX268

■ **NOTE:** Check all parts including gears, shifter, gear dogs, and splines. Replace chipped, damaged, or worn parts.



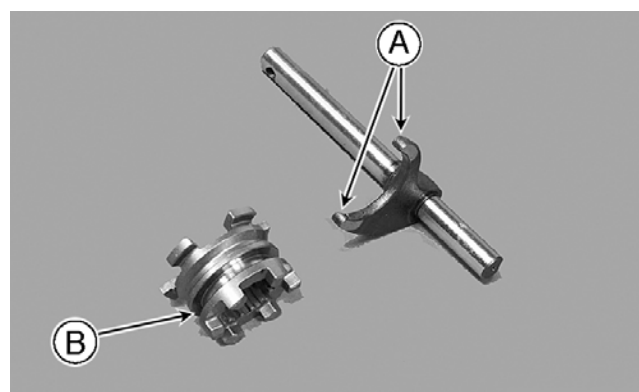
KX269

9. Check angle (A) for shift fork bending. It must be 90°.



ATV2069

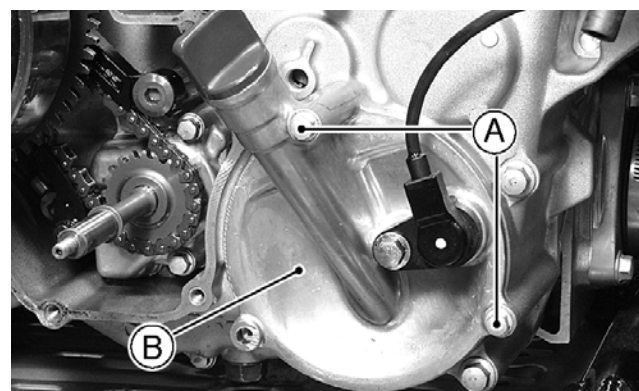
10. Measure the thickness of the shift fork at (A); then measure the shifter groove width (B). If they are out of specification, they must be replaced.



KX270

### REMOVING OUTPUT DRIVE/DRIVEN BEVEL GEAR ASSEMBLY

1. Remove the oil pipe, cap screws (A), and the output drive bevel gear cover (B).

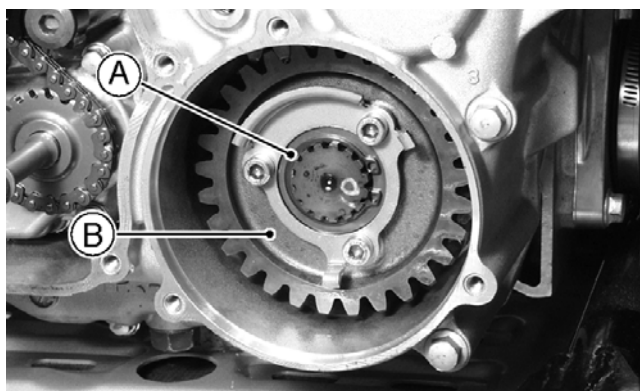


KX271

2. Remove circlip (A); then remove the output drive idler gear (B).

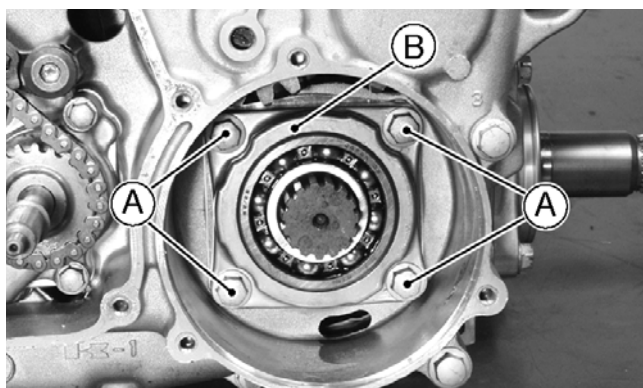
3





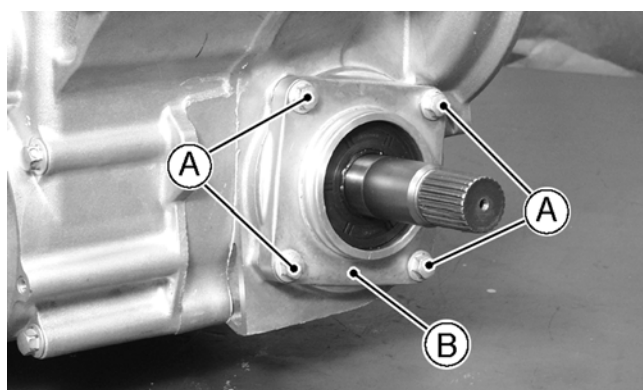
KX272

3. Remove the cap screws (A) securing the output drive bevel gear housing; then remove the housing (B).

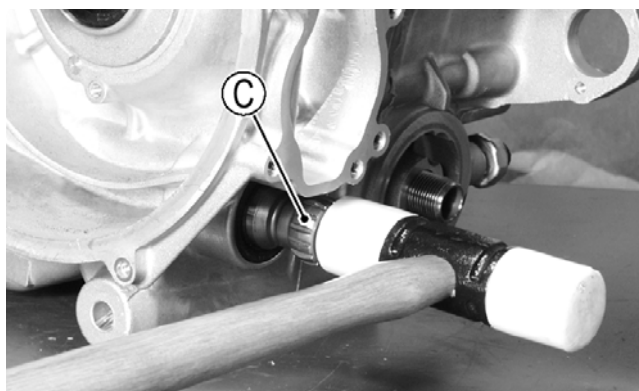


KX273

4. Remove four cap screws (A) securing the output driven bevel gear housing (B); then tap lightly on the front of the output driven bevel gear shaft (C) using a plastic mallet. The output driven bevel gear and housing come off with the shaft assembly.

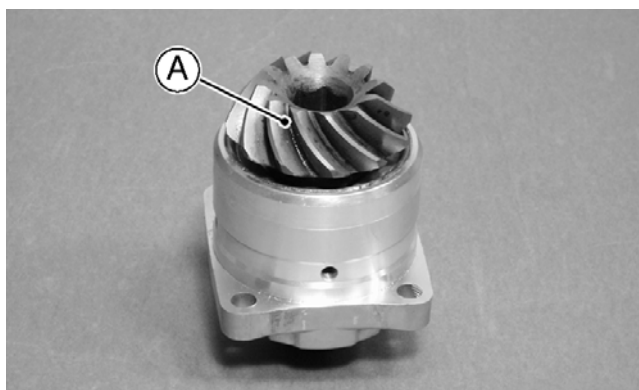


KX274

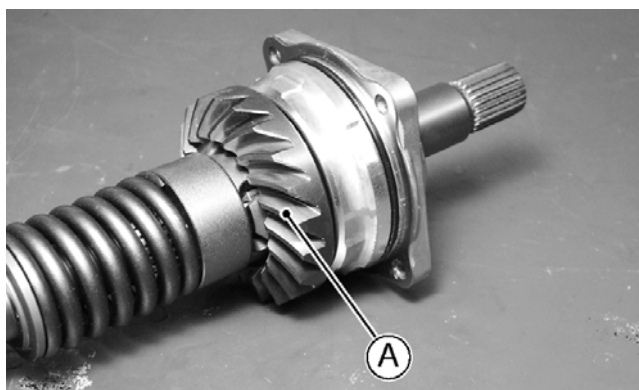


KX275A

■ **NOTE:** Check the bevel gears (A) for scoring, chipping, or abnormal gear patterns; then check the bearings by rotating the drive and driven gears. If no abnormalities are detected, set the assemblies aside for installation. Do not remove from housings.



KX276



KX277

■ **NOTE:** For disassembling and servicing, refer to Servicing Center Crankcase Components, this section.



## Table of Contents (Servicing Components)

■ **NOTE:** Critical engine/transmission specifications are located at the beginning of this section.

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## Servicing Top-Side Components

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

### VALVE ASSEMBLY

When servicing valve assembly, inspect valve seats, valve stems, valve faces, and valve stem ends for pits, burn marks, or other signs of abnormal wear.

■ **NOTE:** Whenever a valve is out of tolerance, it must be replaced.

### Cleaning/Inspecting Rocker Case

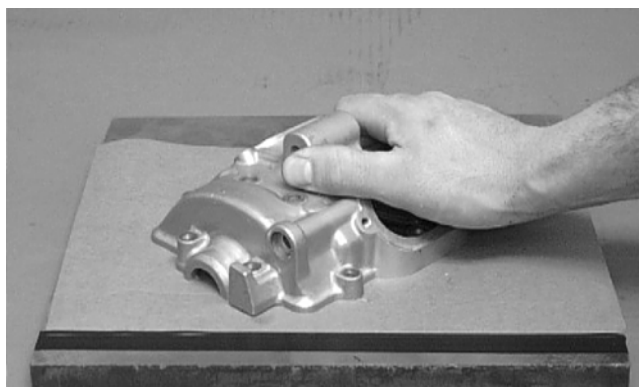
■ **NOTE:** If the rocker case cannot be trued, the cylinder head assembly must be replaced.

1. Wash the rocker case in parts-cleaning solvent.

2. Place the rocker case on the Surface Plate (p/n 0644-016) covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the rocker case in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the rocker case in a figure eight motion until a uniform bright metallic finish is attained.

### ⚠ CAUTION

Do not remove an excessive amount of the sealing surface or damage to the camshaft will result. Always check camshaft clearance when resurfacing the rocker case.



CC130D

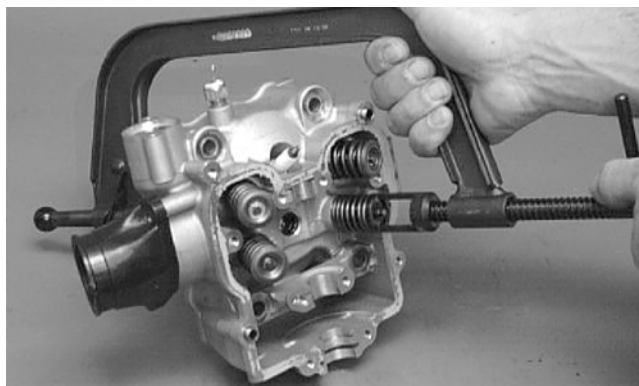
### ⚠ CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.

### Removing Valves

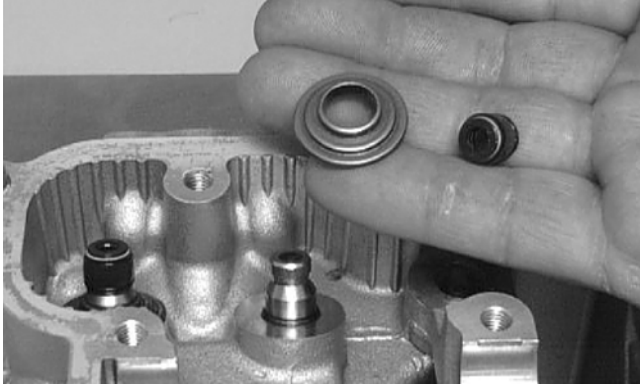
■ **NOTE:** Keep all valves and valve components as a set. Note the original location of each valve set for use during installation. Return each valve set to its original location during installation.

1. Using a valve spring compressor, compress the valve springs and remove the valve cotters. Account for an upper spring retainer.



CC132D

2. Remove the valve seal and the lower remaining spring seat. Discard the valve seal.

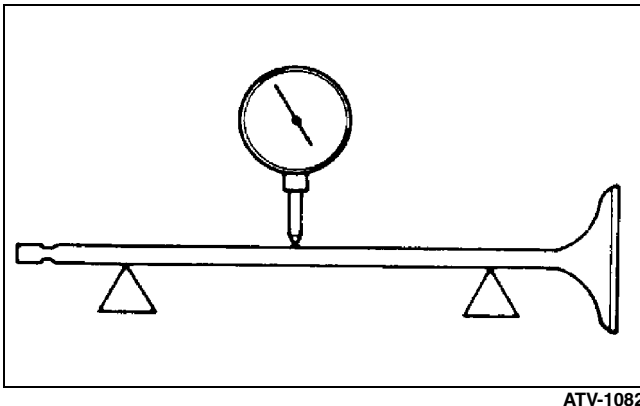


■ **NOTE:** The valve seals must be replaced.

3. Remove the valve springs; then invert the cylinder head and remove the valves.

### Measuring Valve Stem Runout

1. Support each valve stem end with the V Blocks (p/n 0644-022); then check the valve stem runout using a dial indicator.



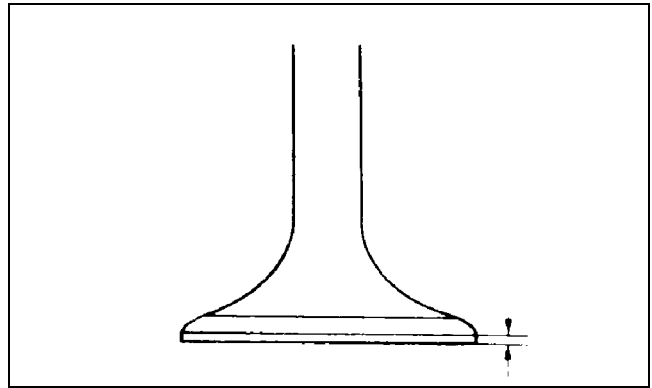
2. Maximum runout must not exceed specifications.

### Measuring Valve Stem Outside Diameter

1. Using a micrometer, measure the valve stem outside diameter.
2. Acceptable diameter range (intake valve) must be within specifications.
3. Acceptable diameter range (exhaust valve) must be within specifications.

### Measuring Valve Face/Seat Width

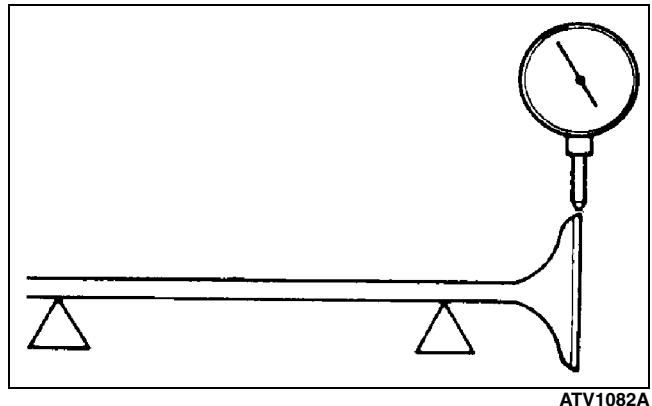
1. Using a micrometer, measure the width of the valve face.



2. Acceptable width range must be within specifications.

### Measuring Valve Face Radial Runout

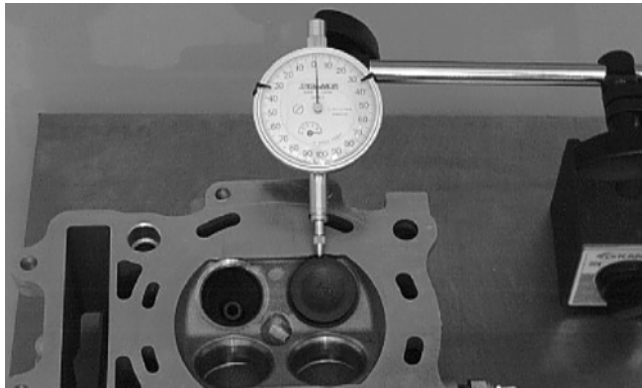
1. Mount a dial indicator on the surface plate; then place the valve stem on a set of V blocks.
2. Position the dial indicator contact point on the outside edge of the valve face; then zero the indicator.



3. Rotate the valve in the V blocks.
4. Maximum runout must not exceed specifications.

### Measuring Valve Guide/Valve Stem Deflection (Wobble Method)

1. Mount a dial indicator and base on the surface plate; then place the cylinder head on the surface plate.
2. Install the valve into the cylinder head; then position the dial indicator contact point against the outside edge of the valve face. Zero the indicator.



CC131D

3. Push the valve from side to side; then from top to bottom.
4. Maximum “wobble” deflection must not exceed specifications.

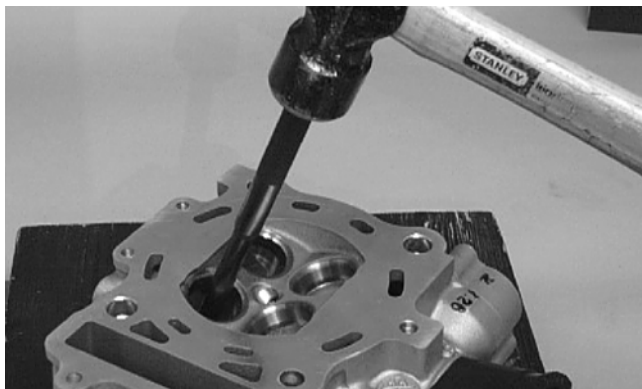
### Measuring Valve Guide (Inside Diameter)

1. Insert a snap gauge 1/2 way down into each valve guide bore; then remove the gauge and measure it with a micrometer.
2. Acceptable inside diameter range must be within specifications.
3. If a valve guide is out of tolerance, it must be replaced.

### Replacing Valve Guide

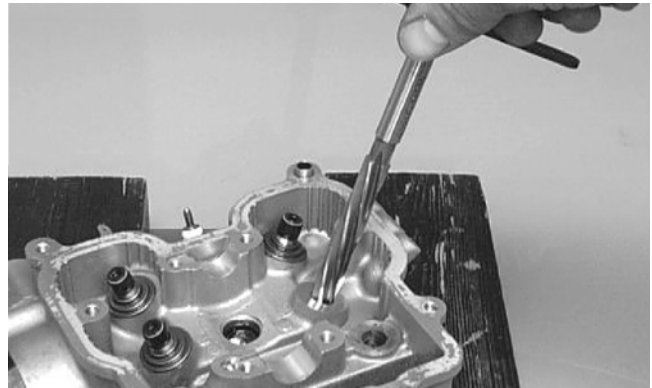
■ **NOTE:** If a valve guide is worn or damaged, it must be replaced.

1. If a valve guide needs replacing, insert a valve guide remover into the valve seat side of the valve guide. Using a hammer, gently drive the valve guide out of the cylinder head.



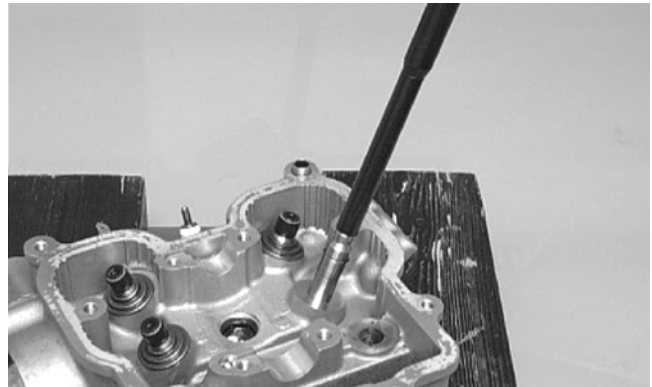
CC137D

2. Using the Standard Valve Guide Reamer (p/n 0444-017), remove any burrs or tight areas from the valve guide journals.



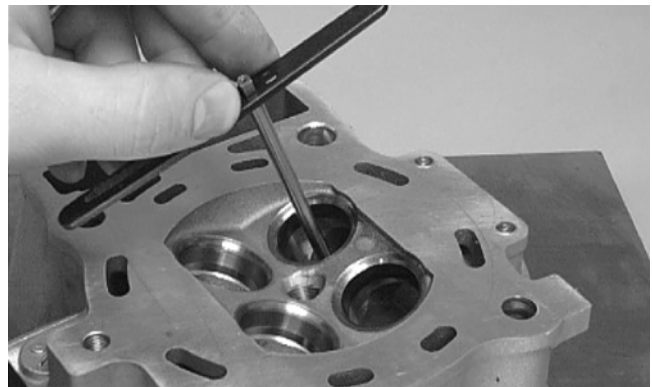
CC142D

3. To install a valve guide, use a valve guide installer and gently drive a valve guide with a retaining clip into the bore from the valve spring side until the retaining clip just contacts the cylinder head.



CC143D

4. After installing the guide, use the standard valve guide reamer to remove all burrs and tight areas that may remain in each valve guide.

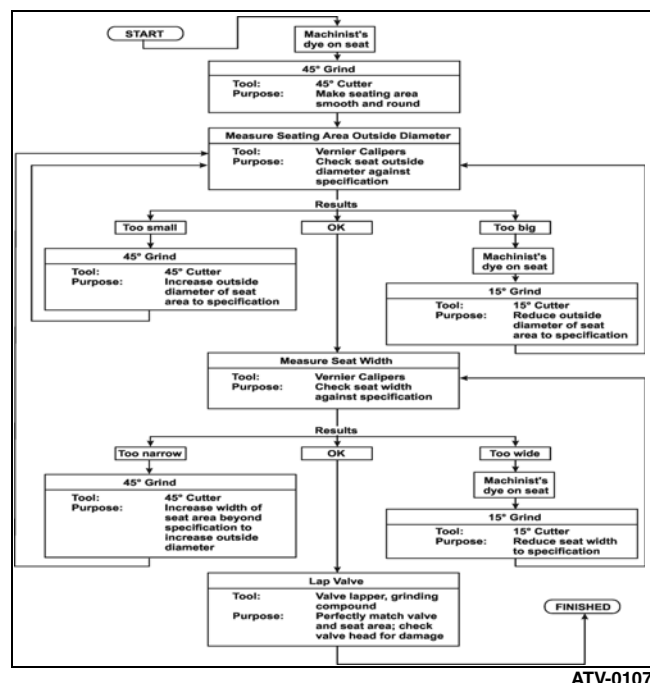


CC138D

3



## Valve Seat/Guide Servicing Flow Chart



## Grinding Valve Seats

■ **NOTE:** If the valve seat is beyond servicing, the cylinder head must be replaced.

1. Insert an exhaust valve seat pilot shaft into an exhaust valve guide. Slide an exhaust valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the exhaust valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining exhaust valve.



CC139D

2. Insert an intake valve seat pilot shaft into one of the intake valve guides. Slide the intake valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the intake valve seat until within specifications.

■ **NOTE:** Repeat procedure on the remaining intake valve.



CC140D

## Lapping Valves

■ **NOTE:** Do not grind the valves. If a valve is damaged, it must be replaced.

1. Remove all carbon from the valves.
2. Lubricate each valve stem with light oil; then apply a small amount of valve lapping compound to the entire seating face of each valve.
3. Attach the suction cup of a valve lapping tool to the head of the valve.
4. Rotate the valve until the valve and seat are evenly polished.
5. Clean all compound residue from the valve and seat.

## Measuring Rocker Arm (Inside Diameter)

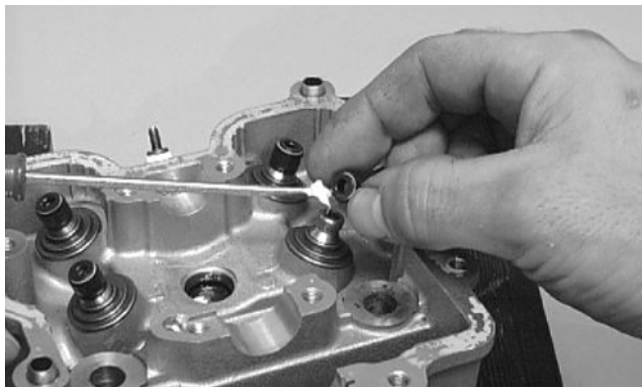
1. Using a dial calipers, measure the inside diameter of the rocker arm.
2. Acceptable inside diameter range must be within specifications.

## Measuring Rocker Arm Shaft (Outside Diameter)

1. Using a micrometer, measure the outside diameter of the rocker arm shaft.
2. Acceptable outside diameter range must be within specifications.

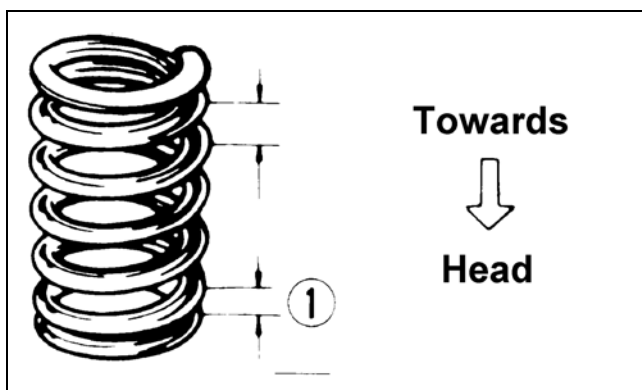
## Installing Valves

1. Apply grease to the inside surface of the valve seals; then place a lower spring seat and valve guide seal over each valve guide.



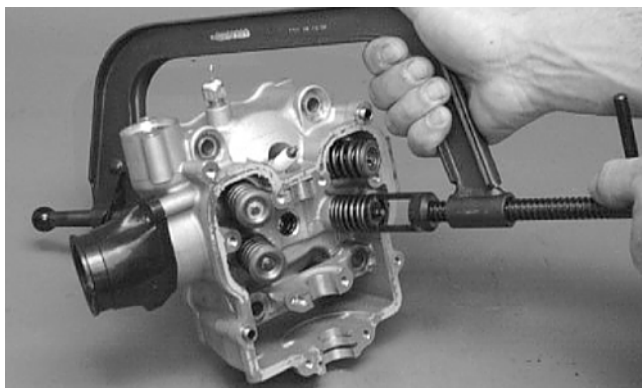
CC144D

2. Insert each valve into its original valve location.
3. Install the valve spring with closest coils (1) toward the head.



ATV-1011A

4. Place a spring retainer over the valve springs; then using the valve spring compressor, compress the valve springs and install the valve cotters.



CC132D

## PISTON ASSEMBLY

■ **NOTE:** Whenever a piston, rings, or pin is out of tolerance, it must be replaced.

### Cleaning/Inspecting Piston

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the dome of the piston.

2. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
3. Inspect the piston for seizure marks or scuffing. Repair with #400 grit wet-or-dry sandpaper and water or honing oil.

■ **NOTE:** If scuffing or seizure marks are too deep to correct with the sandpaper, replace the piston.

4. Inspect the perimeter of each piston for signs of excessive "blowby." Excessive "blowby" indicates worn piston rings or an out-of-round cylinder.

## Removing Piston Rings

1. Starting with the top ring, slide one end of the ring out of the ring-groove.



CC400D

2. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

■ **NOTE:** If the existing rings will not be replaced with new ones, note the location of each ring for proper installation. When installing new rings, install as a complete set only.

## Cleaning/Inspecting Piston Rings

1. Take an old piston ring and snap it into two pieces; then grind the end of the old ring to a 45° angle and to a sharp edge.
2. Using the sharpened ring as a tool, clean carbon from the ring-grooves. Be sure to position the ring with its tapered side up.

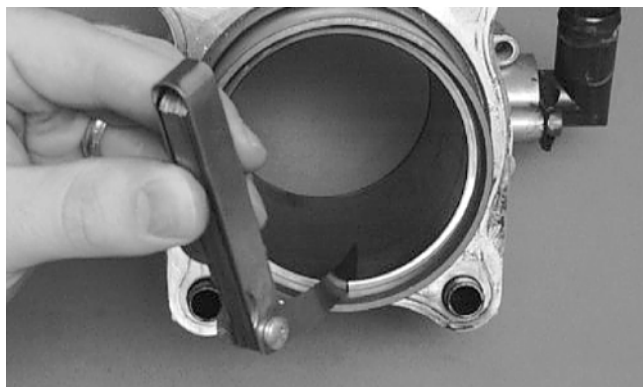
### ⚠ CAUTION

Improper cleaning of the ring-grooves by the use of the wrong type of ring-groove cleaner will result in severe damage to the piston.

## Measuring Piston-Ring End Gap (Installed)

1. Place each piston ring in the wear portion of the cylinder. Use the piston to position each ring squarely in the cylinder.

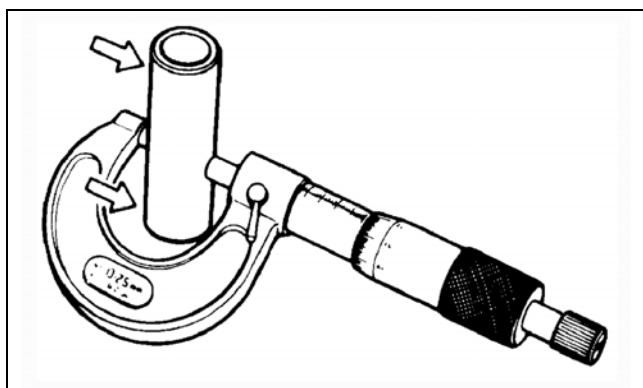
- Using a feeler gauge, measure each piston-ring end gap. Acceptable ring end gap must be within specifications.



CC280D

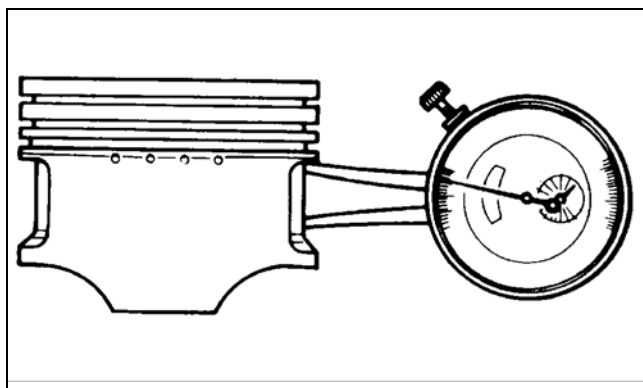
### Measuring Piston Pin (Outside Diameter) and Piston-Pin Bore

- Measure the piston pin outside diameter at each end and in the center. If measurement is not within specifications, the piston pin must be replaced.



ATV-1070

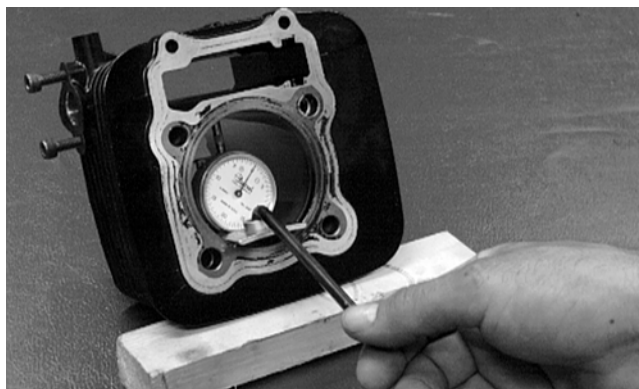
- Insert an inside dial indicator into the piston-pin bore. The diameter must not exceed specifications. Take two measurements to ensure accuracy.



ATV-1069

### Measuring Piston Skirt/ Cylinder Clearance

- Measure the cylinder front to back in six places.

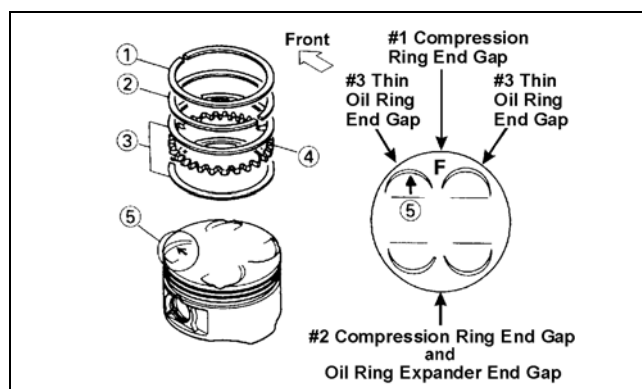


CC397D

- Measure the corresponding piston diameter at a point 15 mm (0.6 in.) above the piston skirt at a right angle to the piston-pin bore. Subtract this measurement from the measurement in step 1. The difference (clearance) must be within specifications.

### Installing Piston Rings

- Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration. An F is stamped on the piston to indicate front.

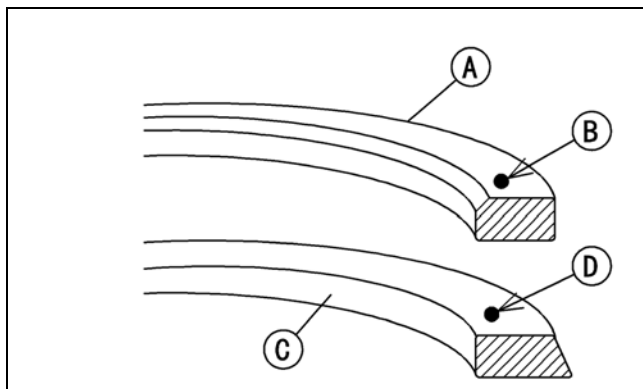


ATV-1085C

■ **NOTE:** Note the direction of the front (F) of the piston (5) for correct ring end gap orientation.

- Install compression ring #2 (C) so the "RN" mark (D) is up; then install the top compression ring #1 (A) so the "R" mark (B) is up (see illustration).





ATV2098

**CAUTION**

Incorrect installation of the piston rings will result in engine damage.

## CYLINDER/CYLINDER HEAD ASSEMBLY

■ **NOTE:** If the cylinder/cylinder head assembly cannot be trued, they must be replaced.

### Cleaning/Inspecting Cylinder Head

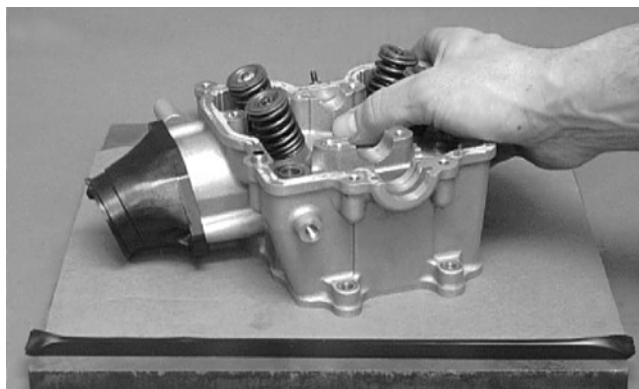
**CAUTION**

The cylinder head studs must be removed for this procedure.

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the combustion chamber being careful not to nick, scrape, or damage the combustion chamber or the sealing surface.
2. Inspect the spark plug hole for any damaged threads. Repair damaged threads using a "heli-coil" insert.
3. Place the cylinder head on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder head in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder head in a figure eight motion until a uniform bright metallic finish is attained.

**CAUTION**

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



CC128D

### Measuring Cylinder Head Distortion

1. Remove any carbon buildup in the combustion chamber.
2. Lay a straightedge across the cylinder head; then using a feeler gauge, check the distortion factor between the head and the straightedge.
3. Maximum distortion must not exceed specifications.

**3**



CC141D

### Cleaning/Inspecting Cylinder

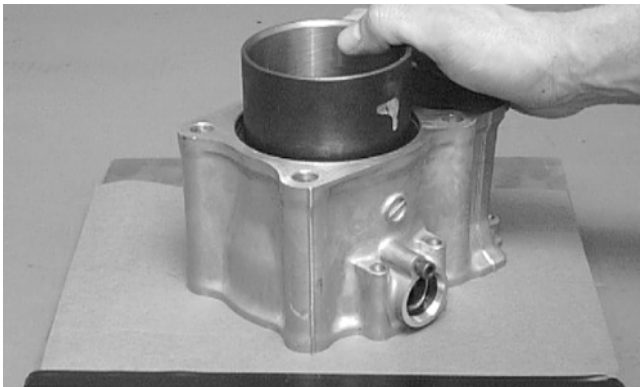
1. Wash the cylinder in parts-cleaning solvent.
2. Inspect the cylinder for pitting, scoring, scuffing, warpage, and corrosion. If marks are found, repair the surface using a cylinder hone (see Honing Cylinder in this sub-section).

3. Place the cylinder on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder in a figure eight motion until a uniform bright metallic finish is attained.



### CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



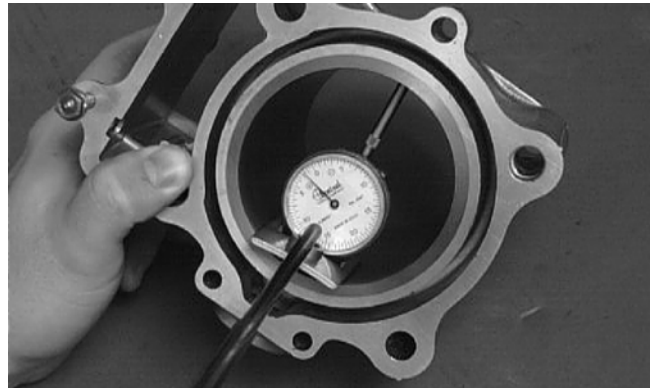
CC129D

## Inspecting Cam Chain Guide

1. Inspect cam chain guide for cuts, tears, breaks, or chips.
2. If the chain guide is damaged, it must be replaced.

## Honing Cylinder

1. Using a slide gauge and a dial indicator or a snap gauge, measure the cylinder bore diameter in three locations from top to bottom and again from top to bottom at 90° from the first measurements for a total of six measurements. The trueness (out-of-roundness) is the difference between the highest and lowest reading. Maximum trueness (out-of-roundness) must not exceed specifications.



CC127D

2. Wash the cylinder in parts-cleaning solvent.
3. Inspect the cylinder for pitting, scoring, scuffing, and corrosion. If marks are found, repair the surface using a ball hone.

■ **NOTE:** To produce the proper 60° cross-hatch pattern, use a low RPM drill (600 RPM) at the rate of 30 strokes per minute. If honing oil is not available, use a lightweight petroleum-based oil. Thoroughly clean cylinder after honing using soap and hot water. Dry with compressed air; then immediately apply oil to the cylinder bore. If the bore is severely damaged or gouged, replace the cylinder.



CC390D

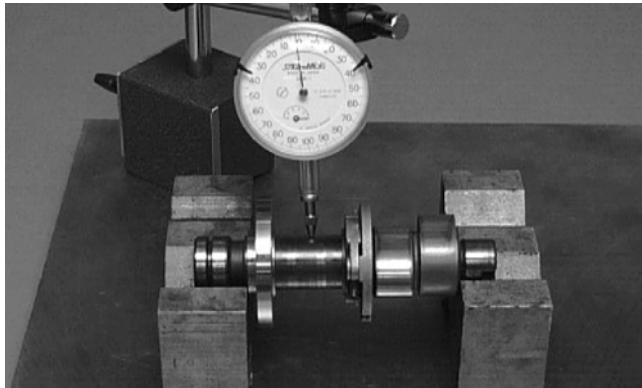
4. If any measurement exceeds the limit, bore or replace the cylinder to accommodate an oversized piston and rings.

■ **NOTE:** Oversized piston and rings are available in 0.50 mm (0.020 in.) only.

## Measuring Camshaft Runout

■ **NOTE:** If the camshaft is out of tolerance, it must be replaced.

1. Place the camshaft on a set of V blocks; then position the dial indicator contact point against the shaft and zero the indicator.

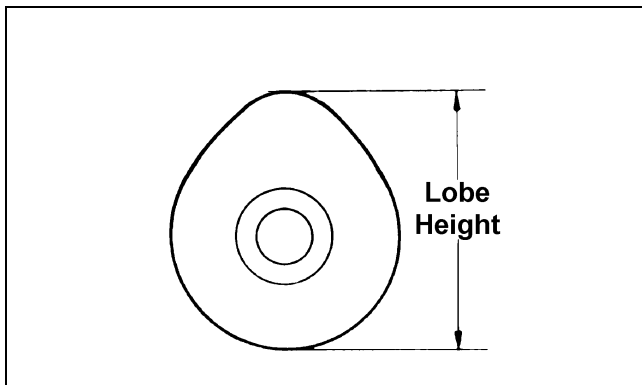


CC283D

2. Rotate the camshaft and note runout; maximum tolerance must not exceed specifications.

### Measuring Camshaft Lobe Height

1. Using a calipers, measure each cam lobe height.



ATV1013A

2. The lobe heights must not exceed minimum specifications.

### Inspecting Camshaft Bearing Journal

1. Inspect the bearing journal for scoring, seizure marks, or pitting.
2. If excessive scoring, seizure marks, or pitting is found, the cylinder head assembly must be replaced.

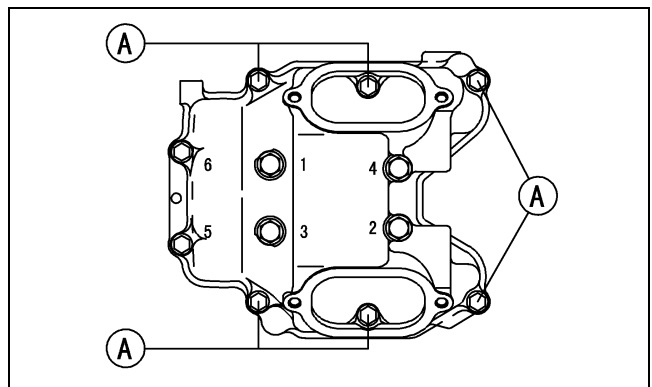
### Measuring Camshaft to Cylinder Head Clearance

1. Remove the adjuster screws and jam nuts.



CC005D

2. Place a strip of plastigauge in each of the camshaft lands in the cylinder head.
3. Place the rocker case on the cylinder head and secure with the rocker case cap screws. Tighten in correct sequence to specifications.



ATV2070

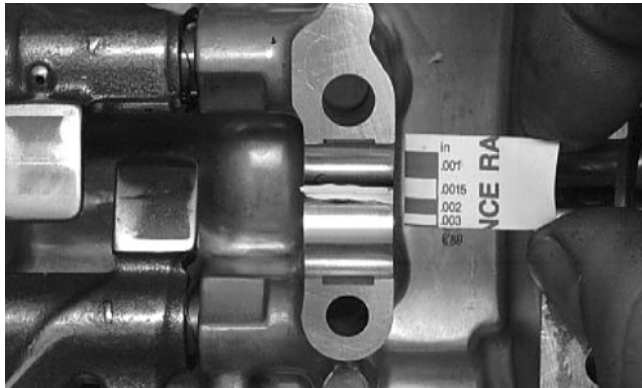
■ **NOTE:** Tighten cap screws 1-4 with washers to 0.9 kg-m (6.5 ft-lb), cap screws 5-6 to 1.0 kg-m (7 ft-lb), and cap screws (A) to 1.0 kg-m (7 ft-lb).

■ **NOTE:** Do not rotate the camshaft when measuring clearance.

4. Remove the cap screws securing the rocker case to the cylinder; then remove the rocker case and camshaft.
5. Match the width of the plastigauge with the chart found on the plastigauge packaging to determine camshaft to cylinder head and rocker case clearance.

3





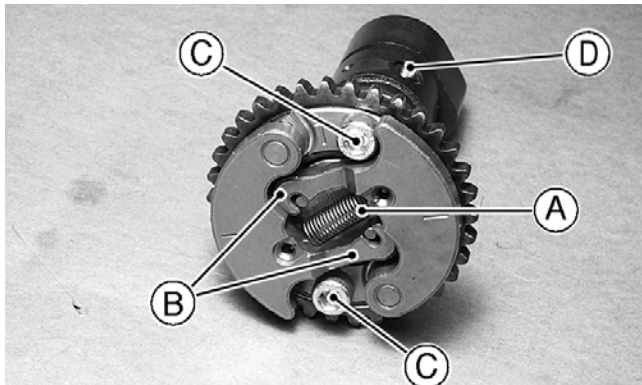
CC145D

6. If clearance is excessive, measure the journals of the camshaft.

■ **NOTE:** If the journals are worn, replace the camshaft; then measure the clearance again. If it is still out of tolerance, replace the cylinder head.

### Inspecting Automatic Compression Release

1. Check that the weights (B) are in the retracted position. If the weights are extended, check the spring (A) for distortion or breakage or pivot pins (C) for binding.



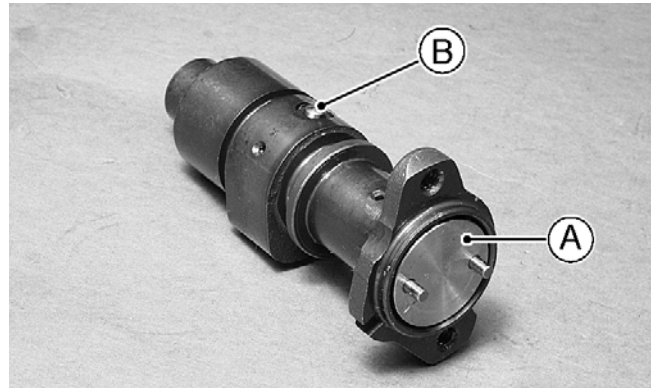
KX278A

2. Manually extend the weights. The pin (D) should retract and the weights should move without binding and return when released. Pin (D) should extend when the weights are released.

■ **NOTE:** If any binding or resistance other than the spring tension is felt, the automatic compression release must be replaced.

3. Check that the shaft (A) rotates and the pin (B) is not broken, chipped, or worn flat.

■ **NOTE:** Do not remove shaft (A) or pin (B) as they are not serviceable and cannot be reassembled. The camshaft assembly must be replaced if any defects are found.



KX279

## Servicing Left-Side Components

### RECOIL STARTER

■ **NOTE:** The recoil starter is a non-serviceable component. If it is damaged or if it does not function properly, it must be replaced as a complete unit.

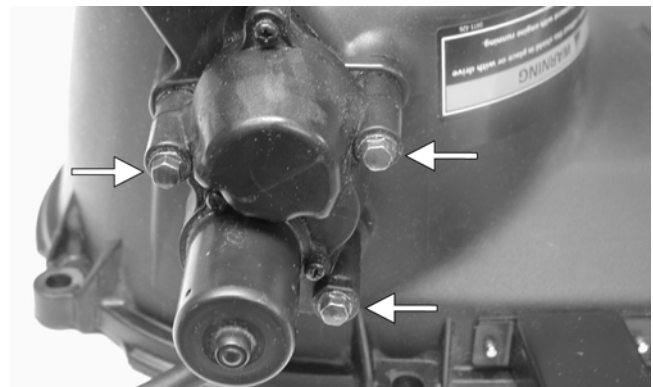
## Servicing Right-Side Components

■ **NOTE:** Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.

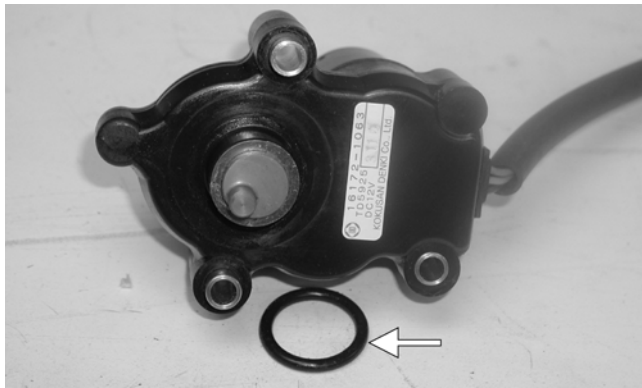
### V-BELT COVER

#### Disassembling

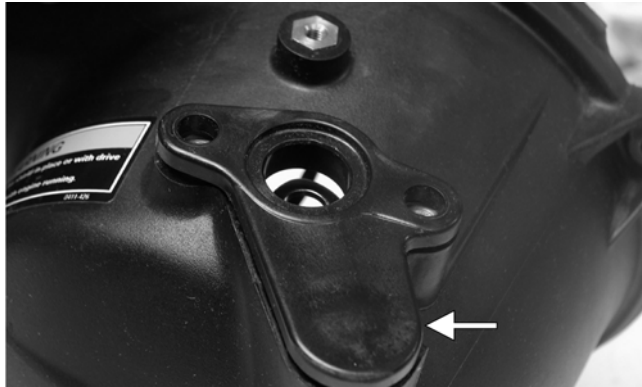
1. Remove the three cap screws securing the engine brake actuator to the V-belt cover; then remove the actuator assembly and engine brake cover. Account for an O-ring and a seal.



KX604A



KX602A

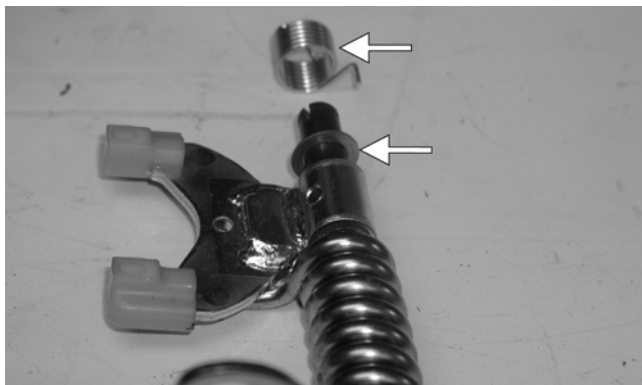


KX597A

2. Remove the circlip from the actuator lever shaft; then remove the actuator lever assembly through the opening in the top of the V-belt cover. Account for a spring and a washer.



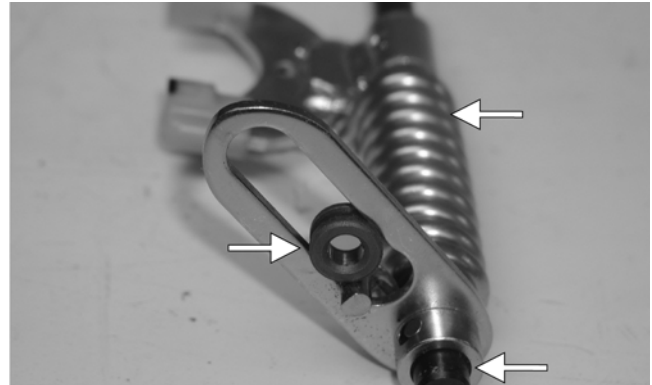
KX601



KX595A

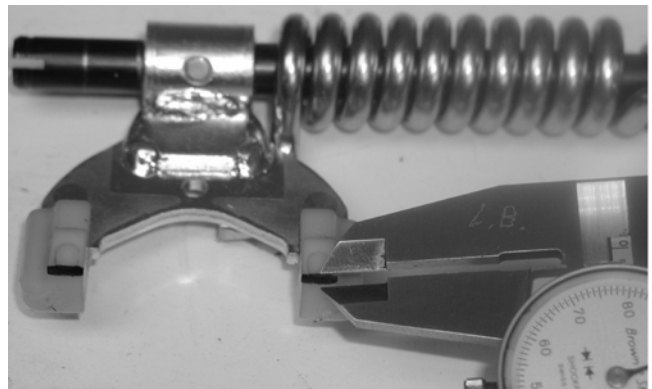
## Inspecting

1. Inspect the actuator lever assembly for worn or bent shaft, broken spring, or damaged roller. Replace if excessive wear or damage is detected.



KX589A

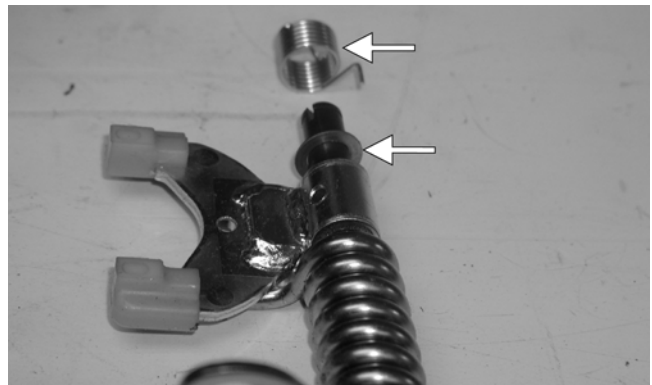
2. Using a calipers, measure the width of the contact point of the plastic guide shoes. If the width is greater than 6 mm (0.24 in.), the actuator lever assembly must be replaced.



KX591

## Assembling

1. Install the actuator lever assembly into the V-belt housing making sure the washer is installed on the shaft; then install the spring and secure with the circlip.

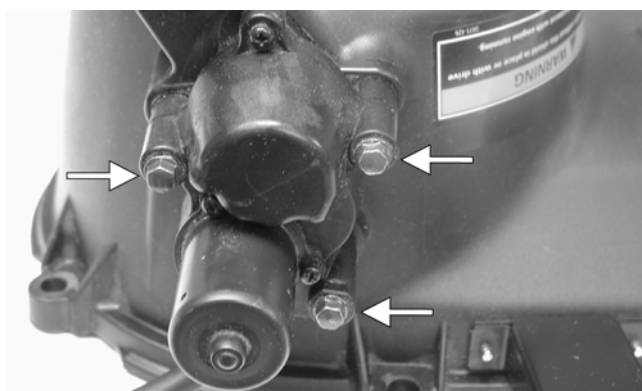


KX595A



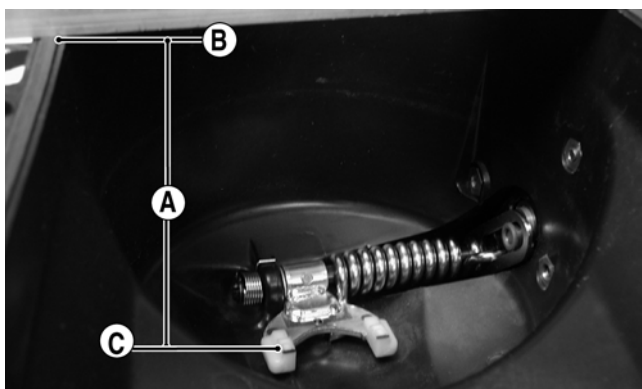
KX601

2. Install the engine brake cover making sure the seal is not damaged; then install the engine brake actuator and secure with three cap screws. Tighten securely.



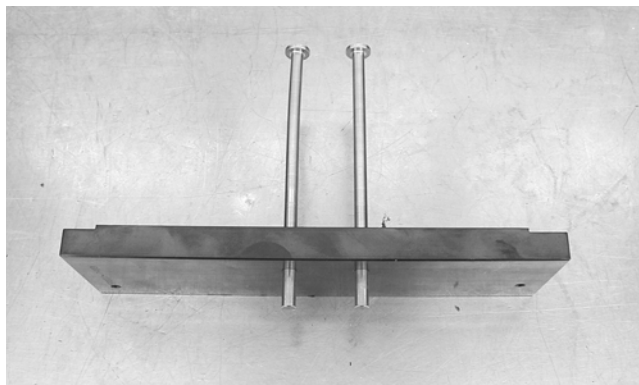
KX604A

3. Measure the installation length (A) of the actuator lever assembly between the V-belt cover lip (B) and the plastic tips (C) on the actuator using the following procedure.



KX586A

- A. Install Actuator Lever Measurement Plate (p/n 0444-185) and Rods (p/n 0443-406) onto the V-belt cover; then install and tighten the two cover bolts.



CD904



CD897

- B. Rest the rod ends on the plastic actuator lever tips; then using a calipers, measure the recess between the plate and rods.

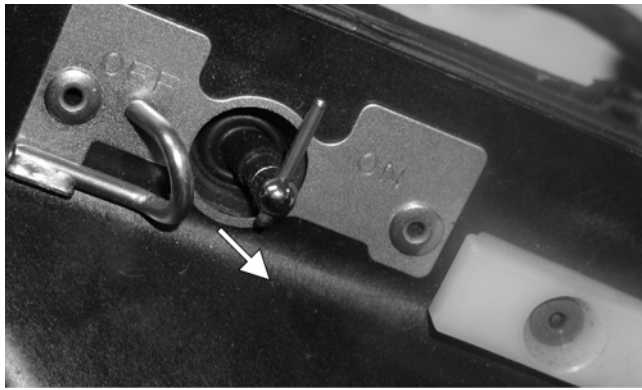


CD899

- C. If the measurement is less than 1.33 mm (0.052 in.), install the yellow actuator lever assembly (p/n 3201-427). If the measurement is more than 2.47 mm (0.097 in.), install the green actuator lever assembly (p/n 3201-428). If the measurement is not within the specified length after the actuator lever assembly is replaced, install the V-belt cover assembly and install the uncolored actuator lever assembly (p/n 3201-429).

4. Ensure the V-belt cover seal is securely seated in the groove and the belt failure detection switch is set to the normal position.





KX588A

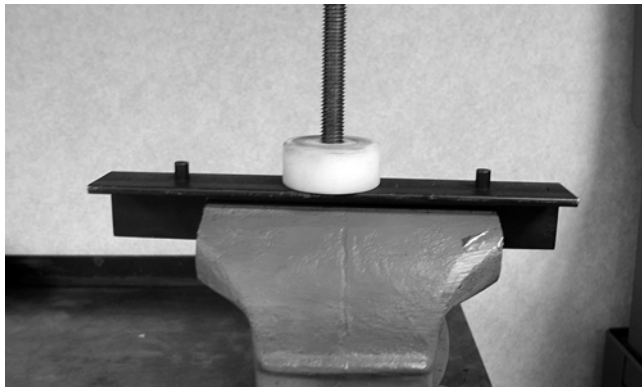
## DRIVEN PULLEY ASSEMBLY

### Disassembling

#### ⚠ WARNING

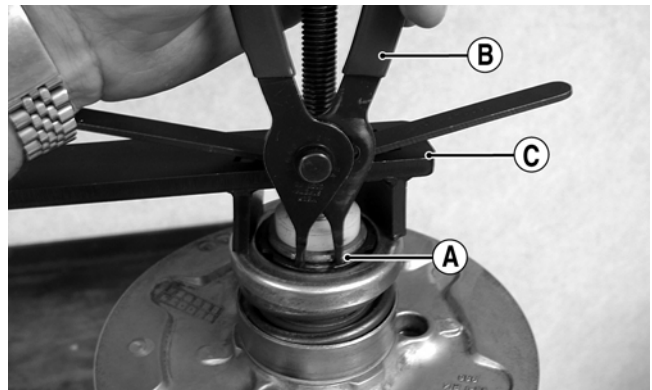
This procedure involves relaxing a compressed spring assembly. DO NOT attempt disassembling without the proper tools.

1. Secure Driven Pulley Compressor (p/n 0444-121) in a suitable holding fixture such as a bench vise.



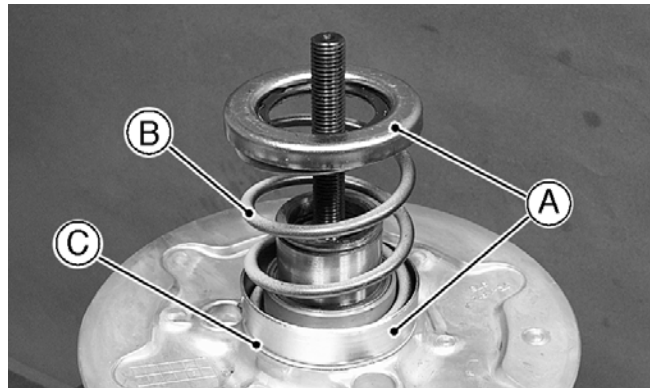
KX571

2. Place the driven pulley assembly onto the compressor tool base.
3. Tighten the nut against Spring Holder (p/n 0444-162) (C) to compress the springs; then using a circlip pliers (B), remove the circlip (A).



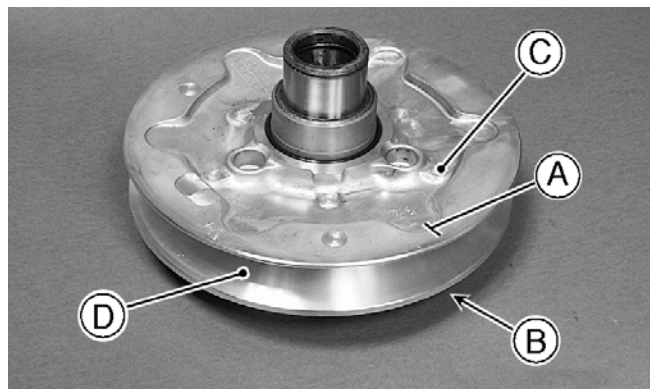
KX573A

4. Relax the spring by removing the nut and spring holder; then remove the spring seats (A), spring (B), and thrust plate (C).



KX281

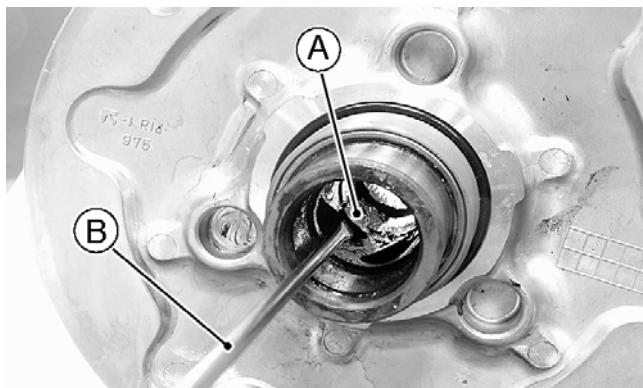
5. Make matching marks (A) and (B) on the movable sheave (C) and stationary sheave (D) to allow installation in the same position.



KX282

6. Wipe out excessive grease; then using a standard tip screwdriver (B), dislodge the four guide pins (A).

3



KX283

7. Remove the spacers; then thoroughly clean all parts in a high flash-point solvent.

### Inspecting

1. Inspect the pulley faces for wear, galling, or grooving.
2. Inspect the O-rings on the stationary face for nicks, tears, or swelling.



KX577A

3. Inspect two grease seals in the movable face for nicks, cuts, or damage.



KX575A

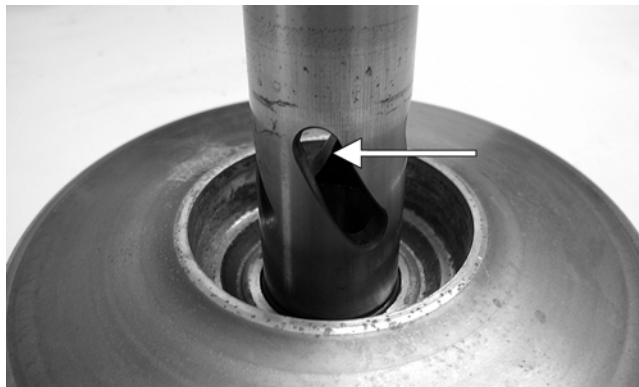


KX576A

4. Inspect the pins, bushings, and cam slots for wear, flat spots, looseness, or cracking.



KX579



KX578A

### Assembling

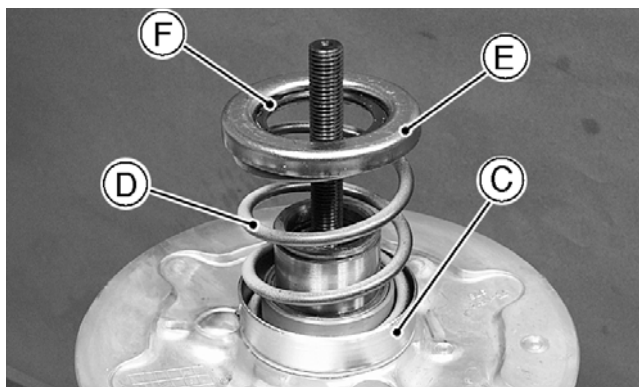
1. Apply multi-purpose grease to the O-rings and grease seals on the movable face; then install on the fixed face making sure the alignment marks are properly aligned and the spacers are in position.
2. Install the four pins into the fixed face hub; then pack the cam slots in the movable face with multi-purpose grease.

■ **NOTE:** Installation of the pins can be simplified by applying a multi-purpose grease on the blade of a screwdriver, placing the pin onto the grease, and installing the pin into the appropriate slot; then filling the slot with grease to retain the pin in the slot.





KX580

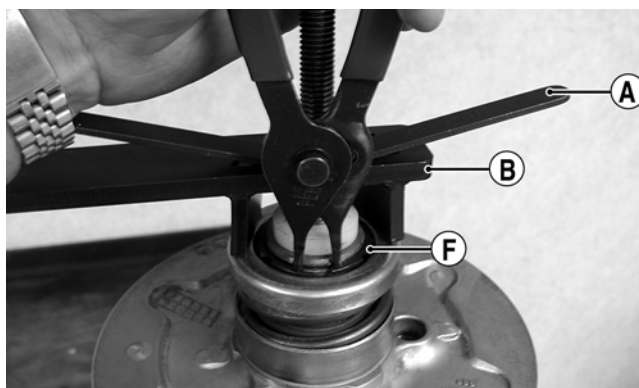


KX284A



KX581

3. Place the assembled faces of the driven pulley on the pulley compressor base.



KX573B

5. Loosen the nut and remove the spring holder; then remove the driven pulley assembly from the driven pulley compressor.



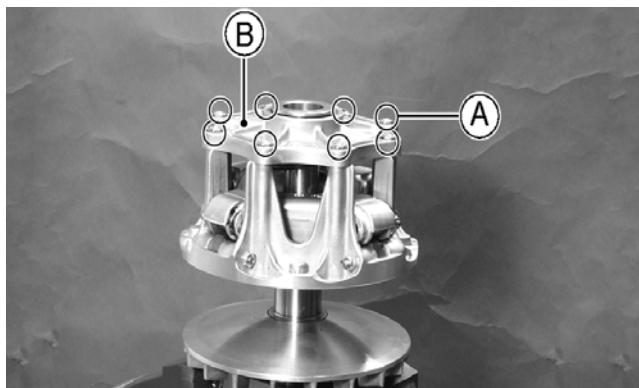
KX582

4. Install the spring seat (C), spring (D), spring seat (E), and circlip (F); then attach the spring holder (B) and tighten nut (A) until the circlip (F) can be installed.

## DRIVE CLUTCH ASSEMBLY

### Disassembling

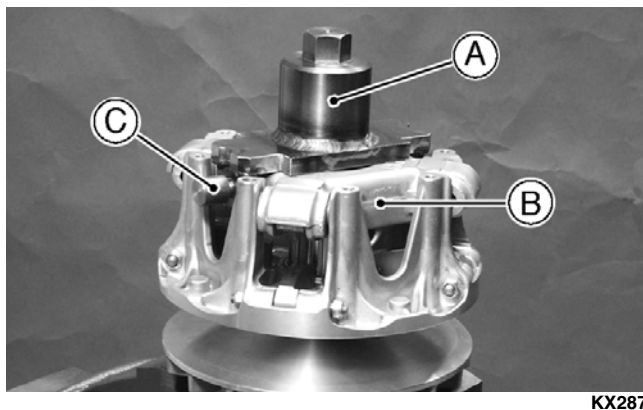
1. Hold the drive clutch holder in a suitable vise; then set the clutch on the holder engaging the holding pins with the clutch back.
2. Remove the drive clutch cover bolts (A); then remove the clutch cover (B). Account for the spring and spacers.



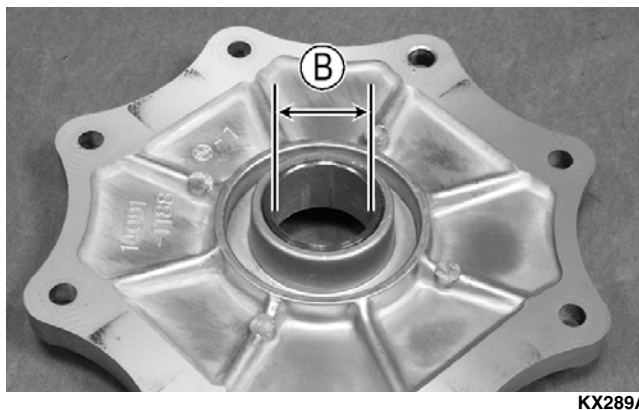
KX286

3. Place the spider wrench (A) on the spider (B) and tighten the bolt (C); then turn the wrench clockwise and remove the spider with the movable sheave.



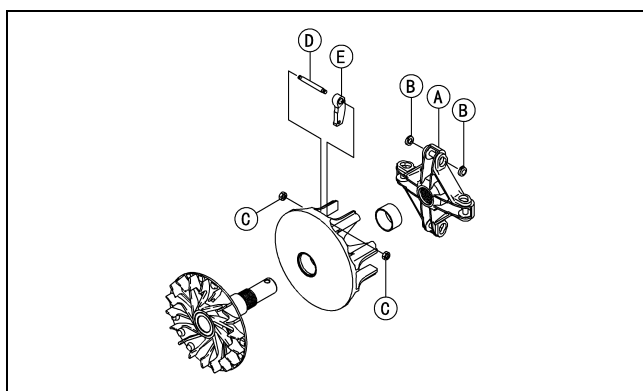


KX287

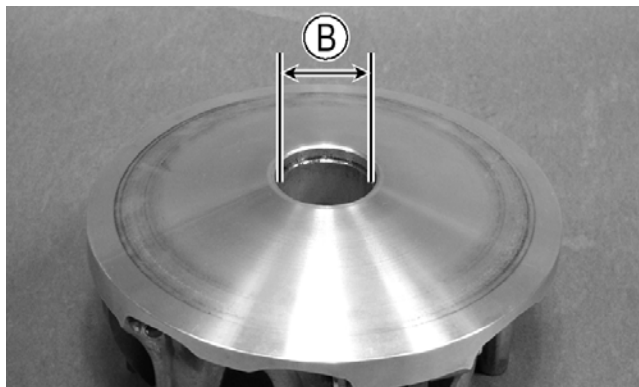


KX289A

4. Remove the shoes (B), nuts (C), ramp weight pins (D), and ramp weights (E) from the spider (A); then clean all parts thoroughly in a high flash-point solvent.



ATV2071A



KX290A

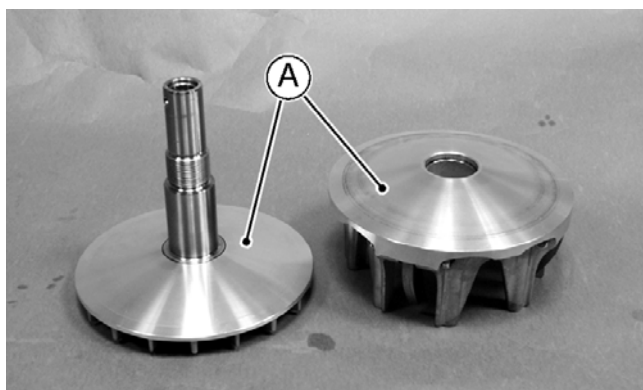
2. Inspect spider shoes (A) for wear or damage. If any are damaged, replace the complete set.

## Inspecting

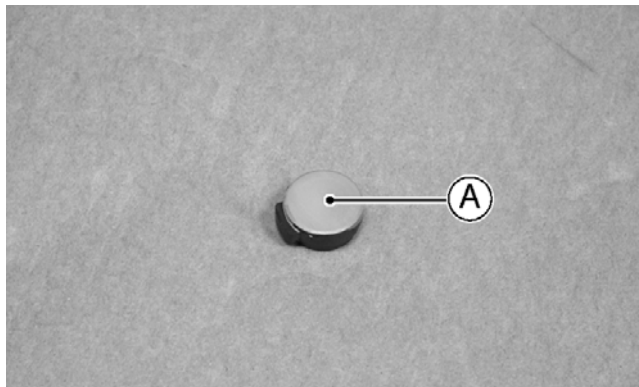
### ⚠ WARNING

Inspect all rotating parts carefully for cracks, loose bolts, chips, or nicks. Clutches and driven pulleys rotate at high speeds and can break up with explosive force causing severe injury or death.

1. Inspect the sheave faces (A) for cracks, galling, or hollowing; then check all bushings (B).

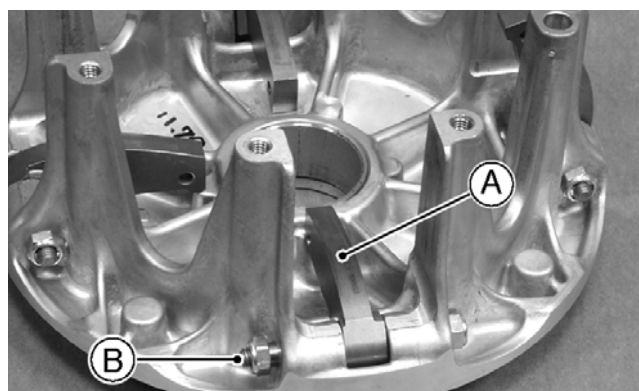


KX288



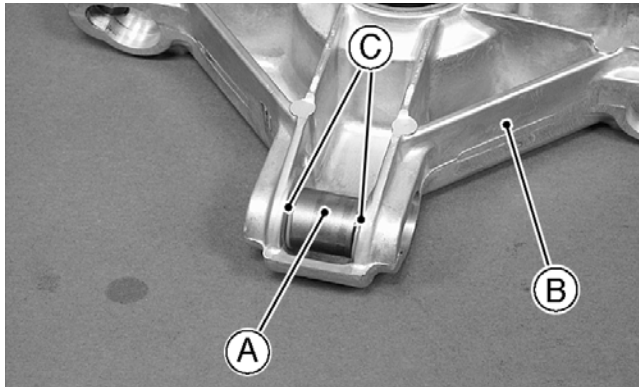
KX291

3. Inspect the ramp weights (A) and pins (B) in the movable sheave. Replace any worn parts.



KX292

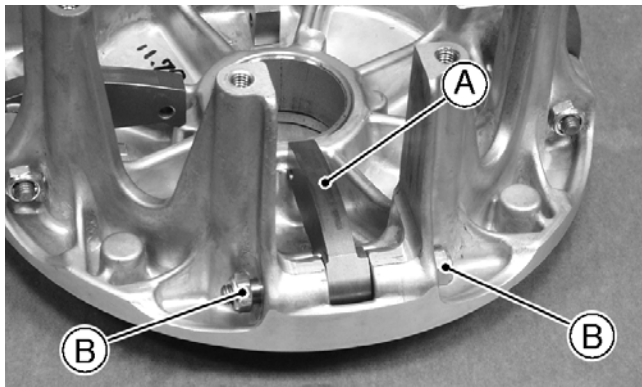
4. Inspect the rollers (A) and washers (C) in the spider. If they are worn, replace the spider assembly (B).



KX293

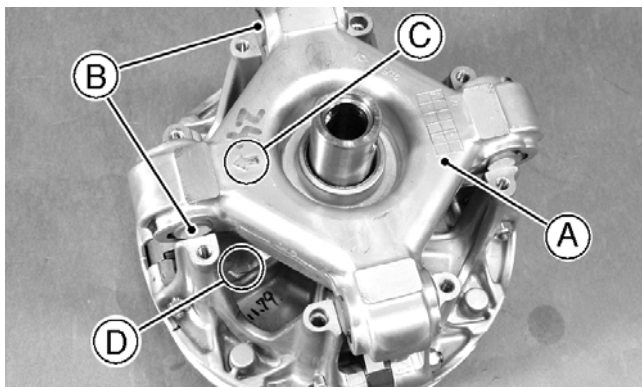
### Assembling

1. Install the ramp weights (A) and tighten nuts (B) to specifications; then check that the ramp weights swing freely.



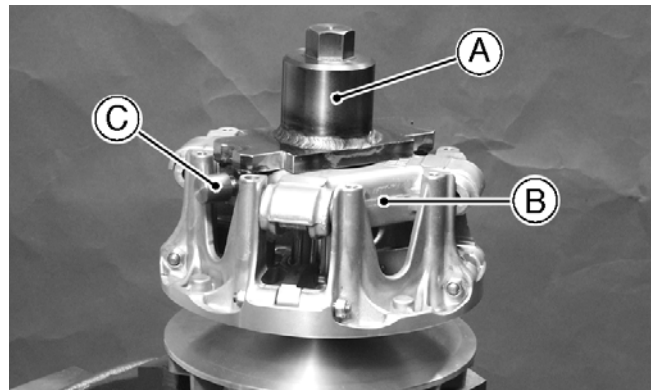
KX294

2. Place the fixed sheave on the clutch holder; then install the movable sheave, spider (A) and shoes (B) aligning the arrow (C) with the arrow (D) on the movable sheave.



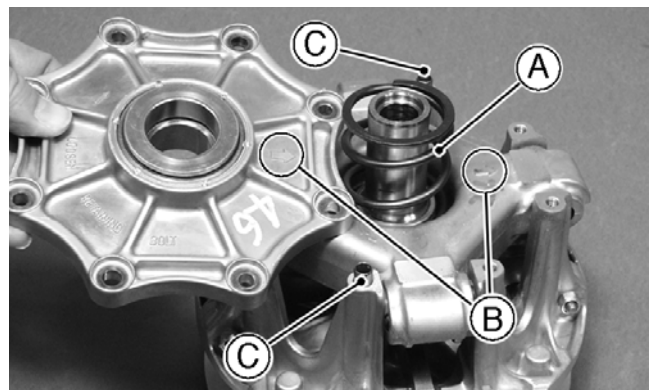
KX295

3. Install the spider wrench (A) on the spider (B) and tighten bolt (C); then tighten spider counter-clockwise to specifications.



KX296

4. Install the spring spacer in the spider; then install the spring (A) in the spider groove.
5. Install the alignment pins (C); then install the clutch cover aligning the arrows (B) on the clutch cover and spider. Tighten to specifications.



KX297

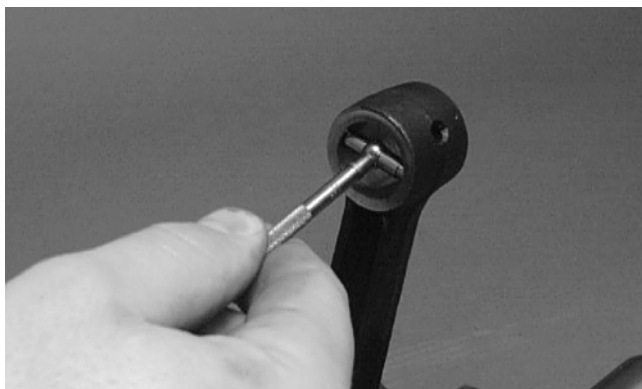
3

## Servicing Center Crankcase Components

### CRANKSHAFT ASSEMBLY

#### Measuring Connecting Rod (Small End Inside Diameter)

1. Insert a snap gauge into the upper connecting rod small end bore; then remove the gauge and measure it with micrometer.

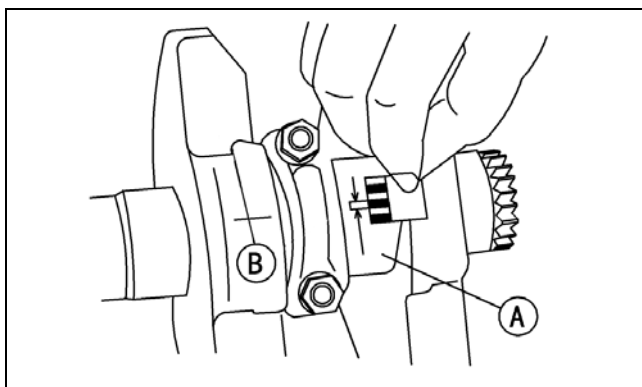


CC290D

2. Maximum diameter must not exceed specifications.

■ **NOTE:** Always tighten connecting rod cap nuts to the specified torque value before making any measurements.

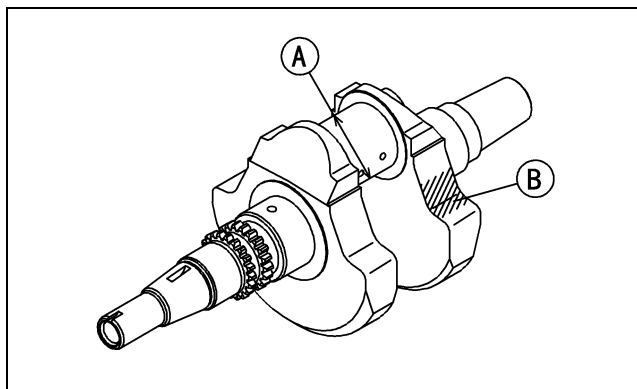
3. Measure the connecting rod big end insert to crank pin clearance using plastigauge. Check the clearance (A) by reading the width (B) with the gauge provided. Clearance must be within specifications. Do not move the connecting rod with the plastigauge installed.



ATV2072

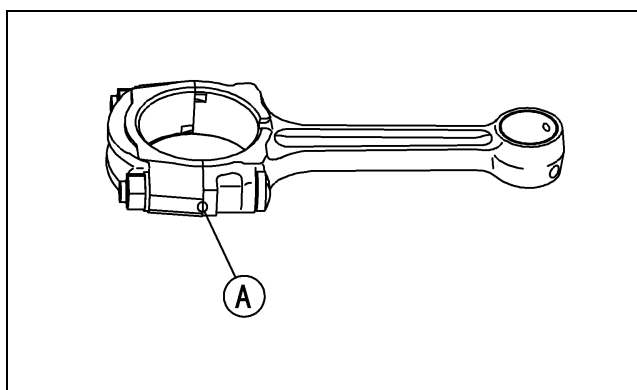
4. Measure the crank pin diameter (A) and check the crankshaft marking (B). If no mark is on the crankshaft, the crank pin diameter should be within specifications. If the crankshaft is marked with "O," crank pin diameter should be within specifications.

■ **NOTE:** If the crank pin diameter does not coincide with the marking, make a new mark that coincides with the measurement.



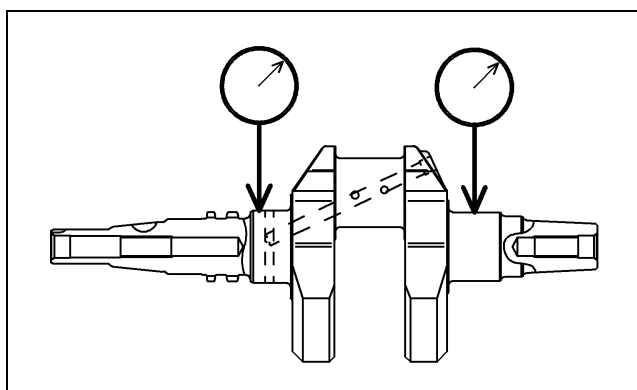
ATV2073

5. Measure the connecting rod big end inside diameter; then check the mark (A) to see if the measurement coincides with the mark. If there is no mark on the connecting rod, the big end inside diameter should be within specifications. If there is an "O," the big end inside diameter should be within specifications.



ATV2074

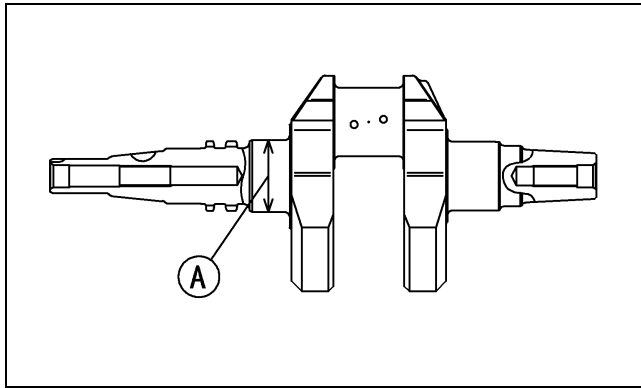
6. Place the crankshaft on a set of V blocks; then mount a dial indicator and base on the surface plate.
7. Slowly turn the crankshaft and note the readings at the points indicated. Crankshaft runout must be less than specifications.



ATV2075

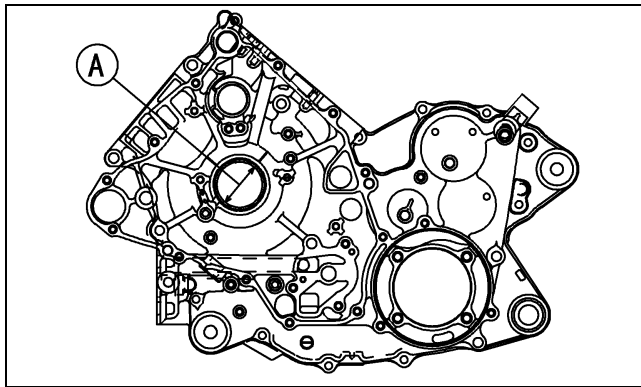
8. Measure the crankshaft main journal (A). It must be greater than specifications.





ATV2076

9. Measure the main bearing bore diameter (A) in the crankcase. It must be less than specifications.



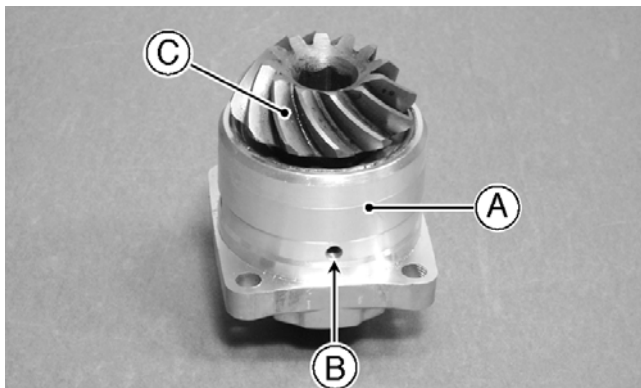
ATV2077

## DISASSEMBLING OUTPUT DRIVE BEVEL GEAR ASSEMBLY

### AT THIS POINT

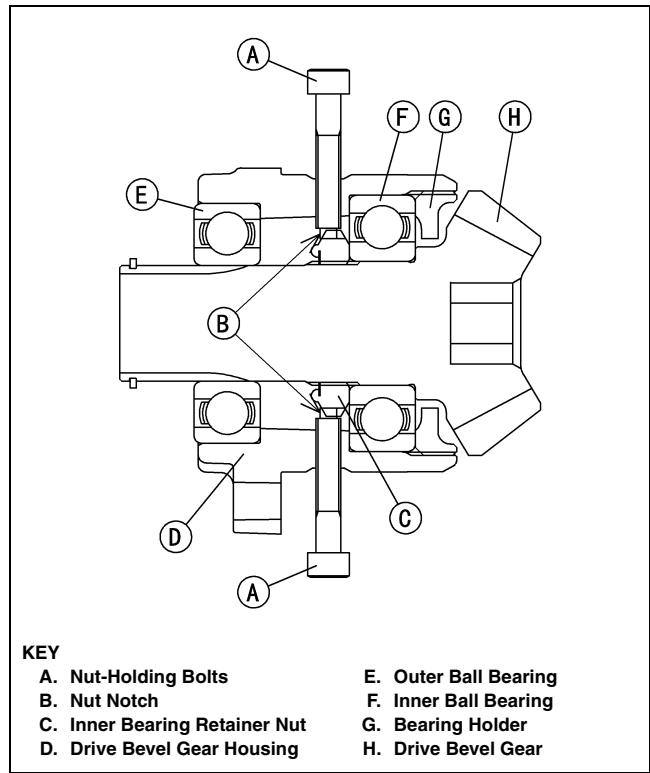
If no abnormal wear, chipping, or bearing roughness is found, proceed to Installing Output Drive/Driven Bevel Gears in this sub-section.

1. Look through the bolt hole (B) in the drive housing (A); then rotate the drive bevel gear (C) until a notch in the inner bearing retainer nut can be seen.



KX298

2. Install and tighten four nut-holding bolts (A) in the four threaded holes. See illustration for location of assembly components.

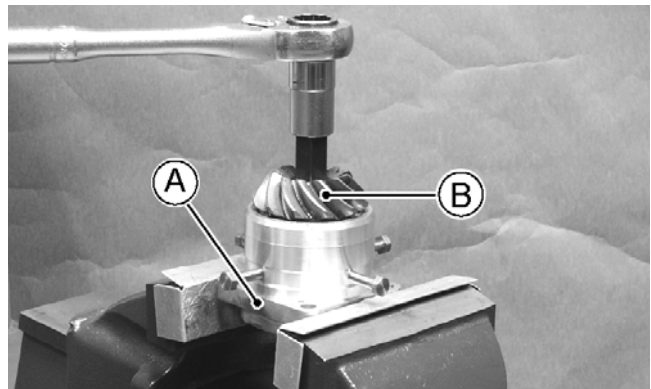


#### KEY

- |                               |                       |
|-------------------------------|-----------------------|
| A. Nut-Holding Bolts          | E. Outer Ball Bearing |
| B. Nut Notch                  | F. Inner Ball Bearing |
| C. Inner Bearing Retainer Nut | G. Bearing Holder     |
| D. Drive Bevel Gear Housing   | H. Drive Bevel Gear   |

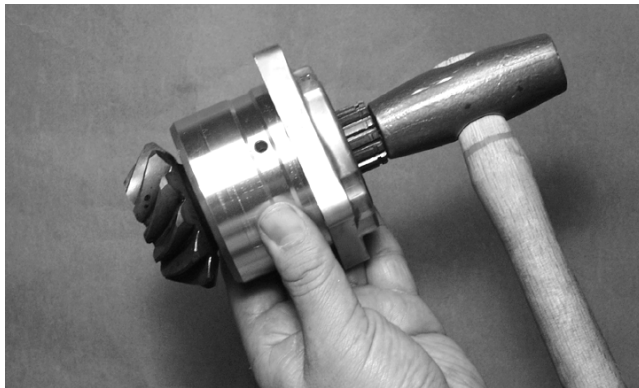
ATV2078

3. Loosen the bevel gear (B) using an Allen wrench while holding the housing (A) in a vise; then continue to turn the bevel gear (about 4-5 turns) until the retainer nut is free of the holding bolts.



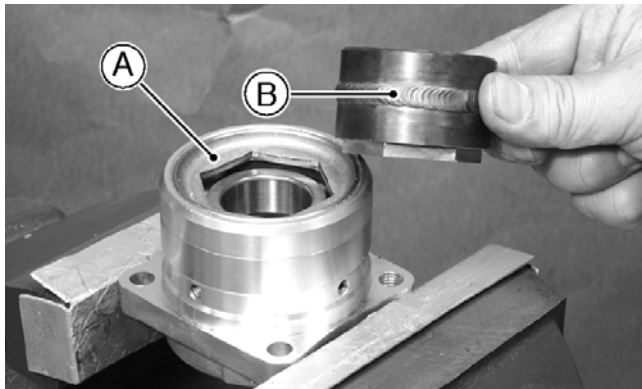
KX299

4. Loosen the holding bolts, removing one; then using a brass or copper mallet, drive the shaft out until the notch of the retainer nut can be seen (see step 1).



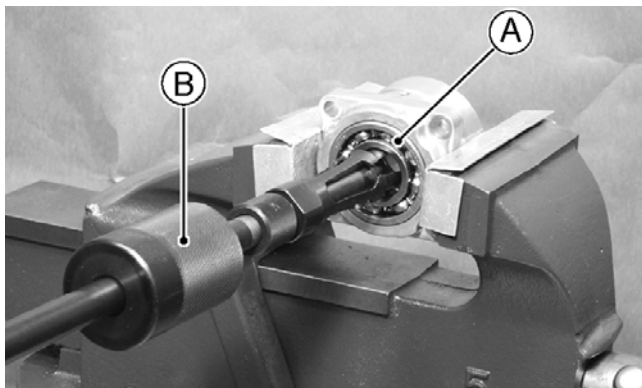
KX300

5. Retighten the holding bolts and repeat steps 1 and 3 until the bevel gear can be removed from the housing; then remove the four holding bolts.
6. Remove the bearing holder (A) using a special hex wrench (B). Apply heat to soften the Loctite.



KX301

7. Remove the outer ball bearing (A) using a suitable seal and bearing remover (B); then remove the retainer nut and the inner ball bearing.



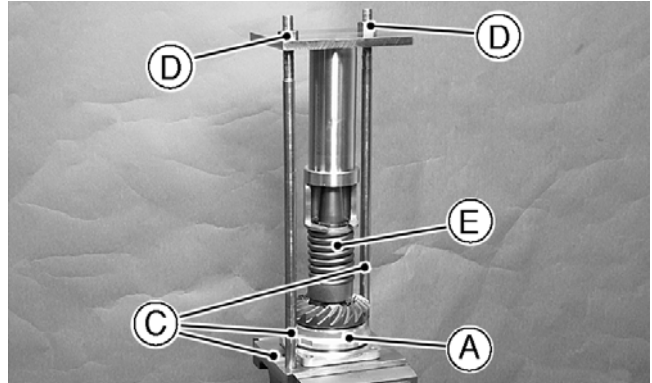
KX302

## DISASSEMBLING OUTPUT DRIVEN BEVEL GEAR ASSEMBLY

### AT THIS POINT

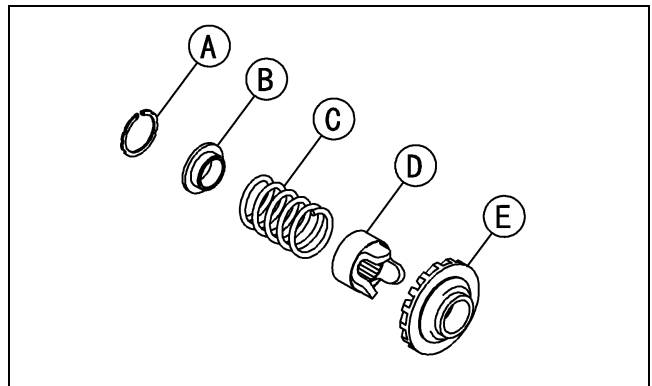
If no abnormal chipping or bearing roughness is found, proceed to Installing Output Drive/Driven Bevel Gears in this sub-section.

1. Secure the driven bevel gear assembly holding/compressing tool (C) in a vise; then set the housing assembly (A) on the holder, tighten holder nuts (D), and compress the damping spring (E).



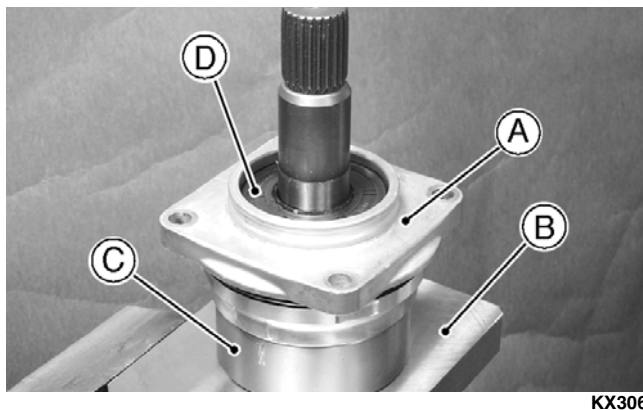
KX304A

2. Remove the circlip (A); then loosen and remove the holder nuts and spring compressor component of the tool.
3. Remove the spring holder (B), spring (C), cam damper (D), and the driven bevel gear (E).



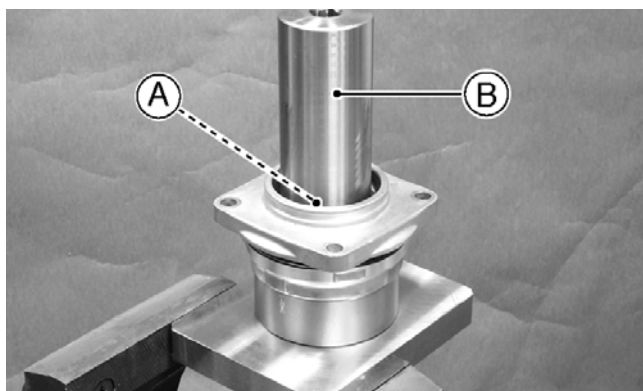
ATV2080

4. Hold the housing assembly (A) with the output shaft holder (B) and spacer (C) in a vise; then remove the oil seal (D).



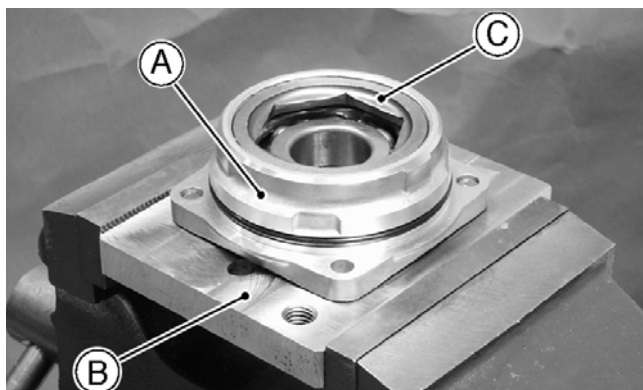
KX306

5. Using a special deep socket (B), remove the output shaft retainer nut (A).

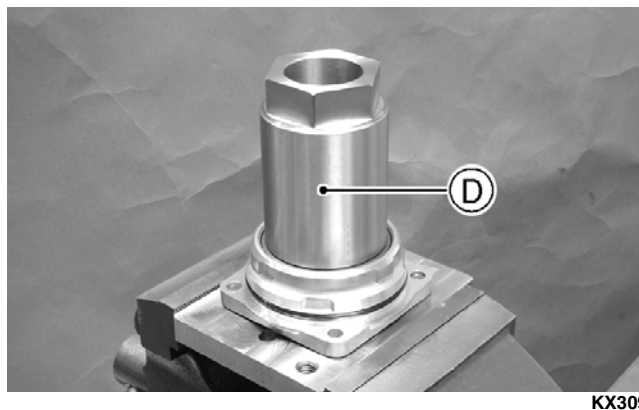


KX307

6. With the housing assembly (A) secured on the holder (B), apply heat to the bearing retainer (C); then using the special hex wrench (D), remove the bearing retainer. Remove the ball bearing from the housing.



KX308



KX309

## Assembling Crankcase Half

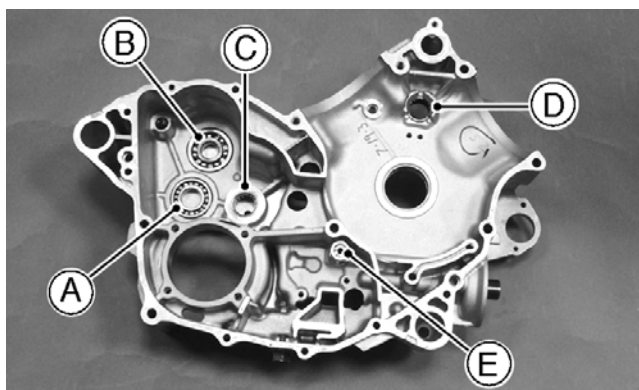
■ **NOTE:** Be sure to clean all parts thoroughly before assembly. Use compressed air to ensure that all oil passages are clear of blockage.

**3**

### ⚠ CAUTION

The crankcase halves are machined together; therefore, they are a matched pair. Using unmatched crankcase halves will result in severe engine damage.

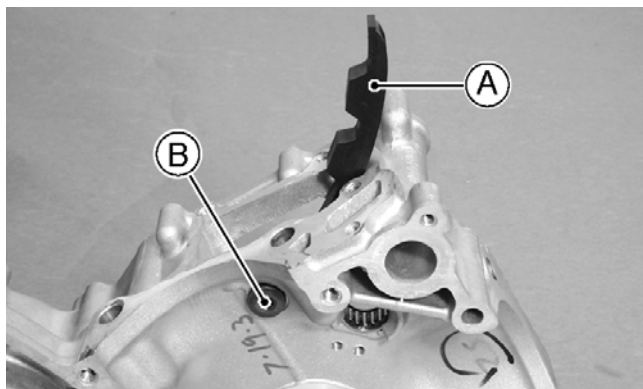
1. Using a press, install ball bearings (A) and (B) into the crankcase making sure that the seal on bearing (B) is directed toward the crankcase; then press in needle bearings (C) and (D) until flush with bore (insert bearing (D) from the outside).
2. Install the oil pressure relief valve (E); then coat all bearings with clean engine oil.



KX310

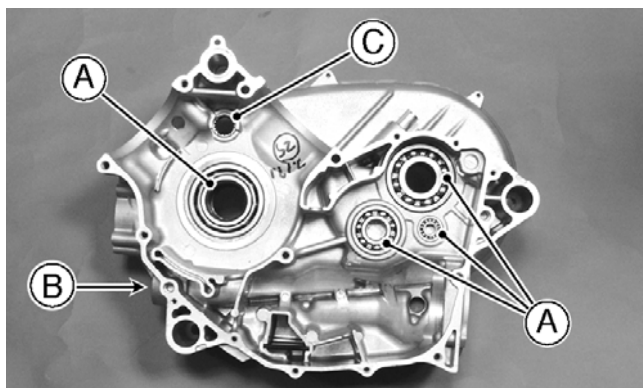
3. Install the rear cylinder camshaft chain guide (A) and tighten bolt (B) to specifications.





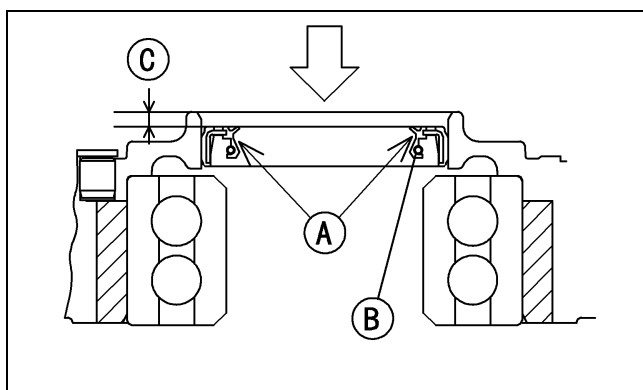
KX311

4. Press ball bearings (A) into the case until they bottom out; then press in needle bearings (B) and (C) until flush with bore (insert bearing (B) from the outside). Coat all bearings with clean engine oil.



KX312

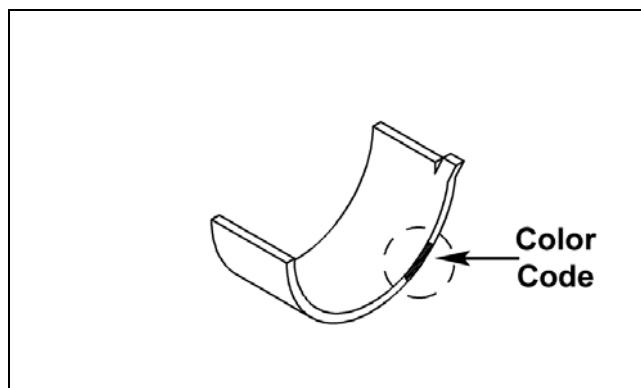
5. Apply grease to the lip (A) of the crankshaft oil seal (B); then press the seal in so that it sits 3 mm (0.12 in.) inward (C) from the end of the housing.



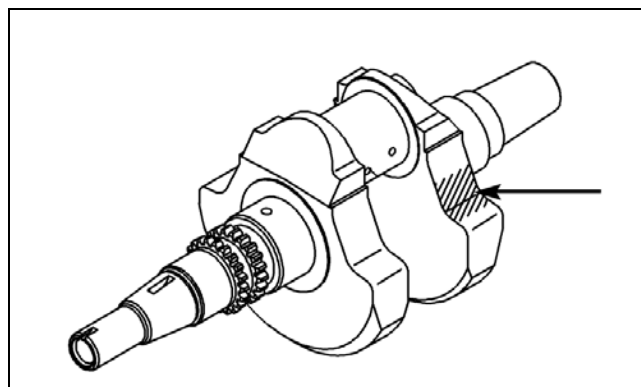
ATV2081

6. Select connecting rod big end inserts using the following chart and the markings on the crankshaft and connecting rod.

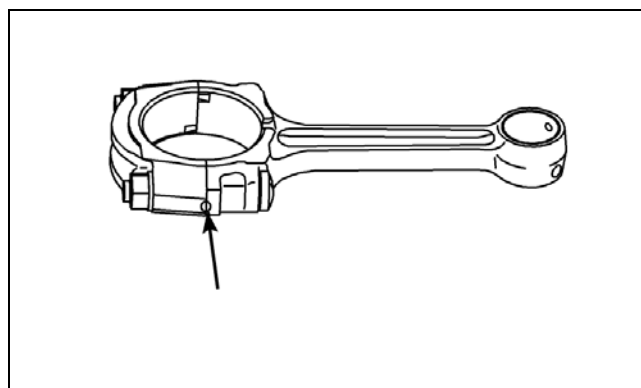
| Big End Bearing Insert Selection      |                         |                |
|---------------------------------------|-------------------------|----------------|
| Con-Rod Big End Bore Diameter Marking | Crank Pin Diameter Mark | Bearing Insert |
|                                       |                         | Size Color     |
| None                                  | ○                       | Brown          |
| None                                  | None                    | Yellow         |
| ○                                     | ○                       |                |
| A                                     | None                    | Green          |



ATV2082A



ATV2073A

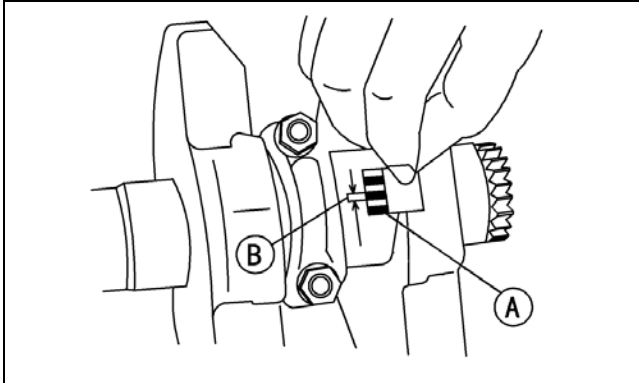


ATV2074A

7. Install the inserts into the connecting rods and caps; then use plastigauge (A) to measure connecting rod/crankshaft clearance (B). Tighten the connecting rod nuts to specifications.

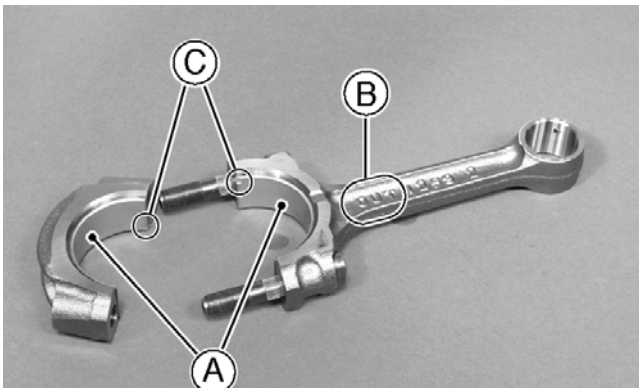
■ **NOTE:** Do not move the connecting rod with plastigauge installed or the reading will be compromised.

8. Remove the connecting rods and read the clearance with the gauge provided. The clearance must be 0.028-0.052 mm (0.0011-0.0020 in.) standard with a maximum service limit of 0.09 mm (0.0035 in.).



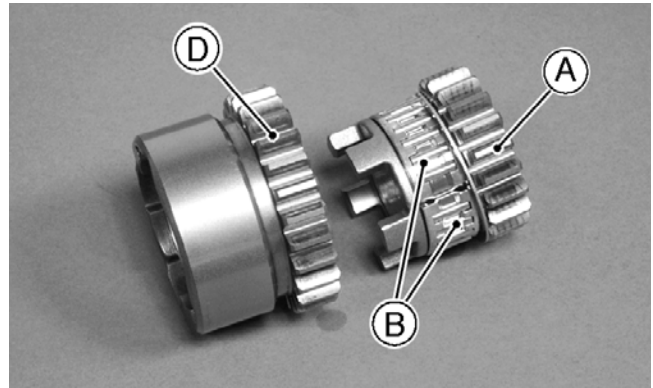
ATV2072A

9. Clean off all traces of plastigauge from the crankshaft and inserts; then assemble on the crankshaft using clean, molybdenum disulfide oil on the inserts (A). Make sure that the "OUT" marks (B) on both connecting rods are directed towards the outside of the crankshaft and the grooves (C) of the cap and connecting rod are on the same side.



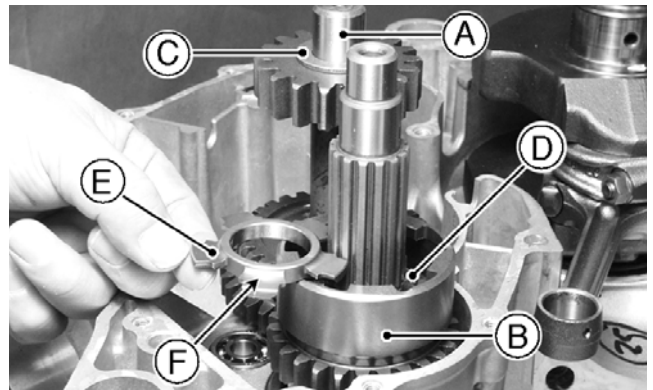
KX313

10. Install the crankshaft assembly in the right crankcase half.
11. Using a press, install the driven shaft in the crankcase until it is bottomed; then install the needle bearings (B) on the low gear (A) along with the high gear (D).



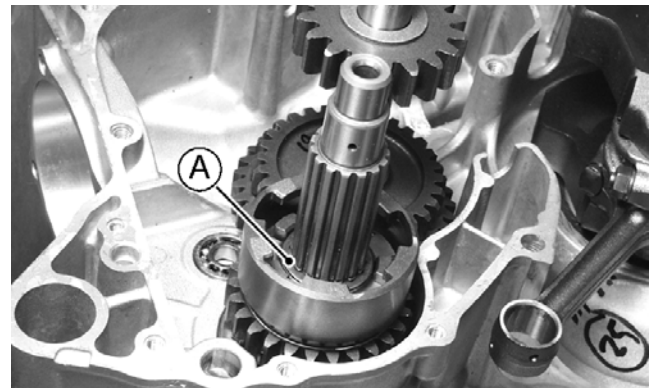
KX314A

12. Install the idler shaft (A) with gear assembly (B), spacer (C), and spacer (D); then install spacer (E) with the stepped side (F) directed outward.



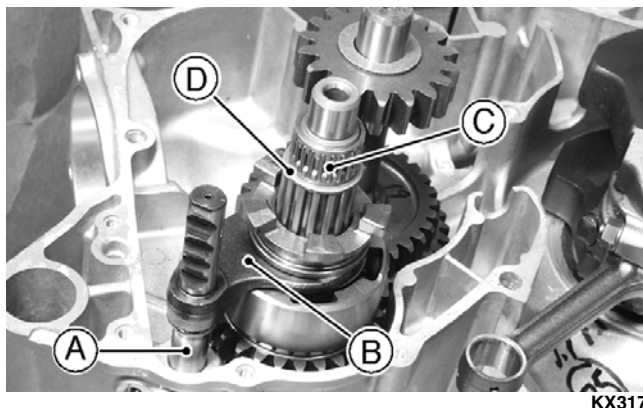
KX315

13. Install a spacer, toothed washer (A), and the circlip on the driven shaft.



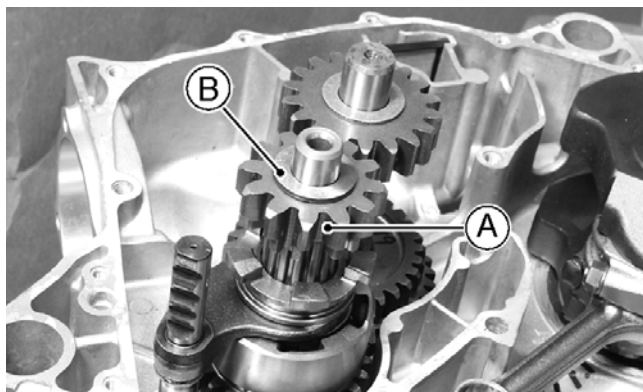
KX316

14. Apply clean engine oil to the shift rod (A), shift fork (B), and needle bearing (C); then install the shift rod with shifter, spacer (D), and needle bearing.

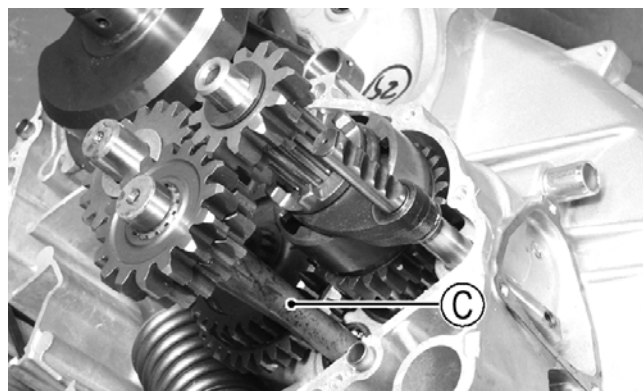


KX317

15. Install reverse idler (C); then install the reverse drive gear (A) and spacer (B).

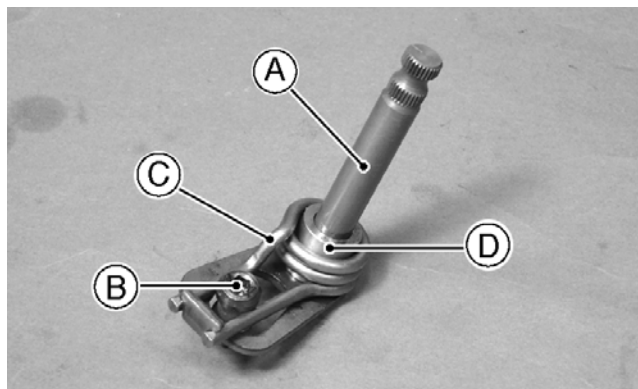


KX318



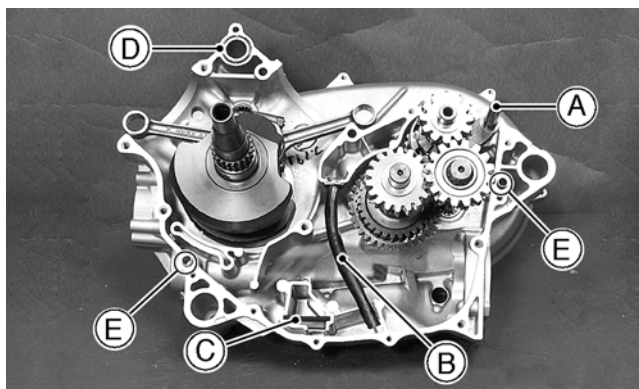
KX319A

16. Apply molybdenum disulfide oil to the shift shaft (A); then install the shift spring (C) and guide (D). Apply red Loctite #271 to the shift shaft spring bolt (B) and tighten to specifications.



KX320

17. Make sure that the crankshaft, transmission shafts and shift shaft (A), oil tube (B), oil screen (C), O-ring (D), and alignment pins (E) are in place in the right crankcase half; then apply clean engine oil to the moving parts and grease to all O-rings and seals.



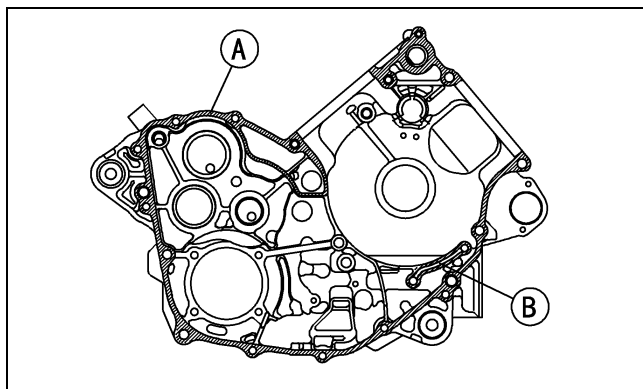
KX321

## Joining Crankcase Halves

- A. Breather Tube**
- B. Positioning Bolt**
- C. Drive Bevel Gear (Assembling)**
- D. Driven Bevel Gear (Assembling)**
- E. Drive/Driven Bevel Gears (Installing)**
- F. Backlash (Adjusting)**
- G. Tooth Contact (Adjusting)**
- H. Camshaft Drive Chains (Installing)**
- I. Intermediate Shaft**

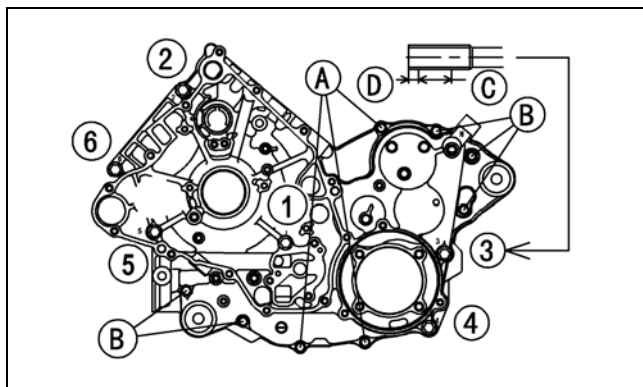
1. Apply Three Bond Sealant (p/n 0636-070) to the mating surface of the left crankcase half (A) being careful to keep sealant out of the oil passage (B); then join the crankcase halves.



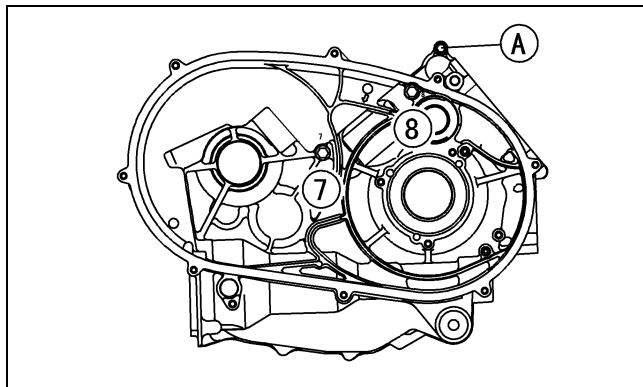


ATV2083

2. Apply blue Loctite #242 to the thread area (C), except tip (D) of left case cap screw (3); then install and tighten the 8 mm cap screws to 2.0 kg-m (14.5 ft-lb) following the tightening sequence 1-8. Tighten the 6 mm crankcase cap screws (A) and (B) to 1.0 kg-m (7 ft-lb).

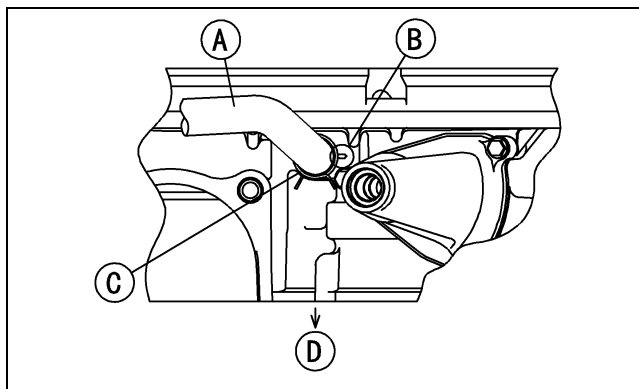


ATV2084A



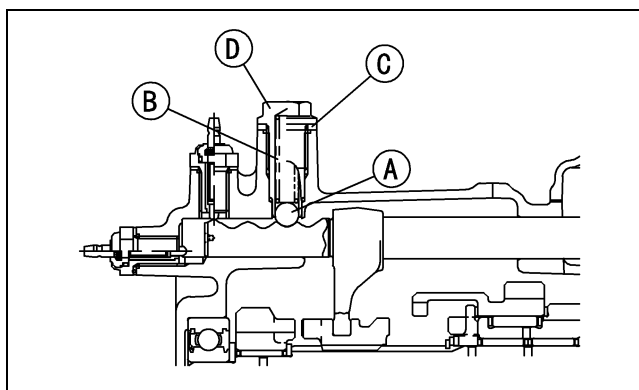
ATV2085

3. Install the breather tube (A) on the crankcase fitting aligning the white line on the tube with the mark (B) on the crankcase; then install the clamp (C) directing the open end toward the left side (D) of the crankcase.



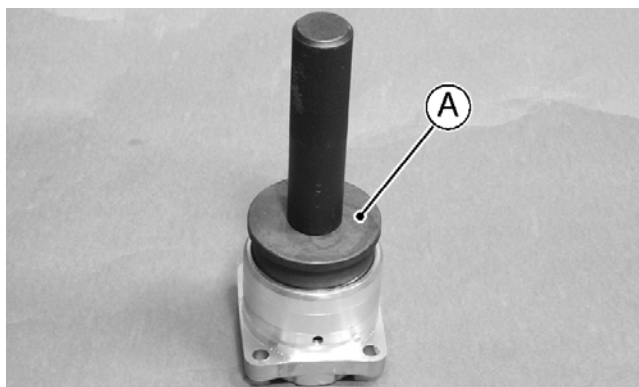
ATV2086

4. Apply grease to the steel ball (A) and spring (B); then install the steel ball, spring, washer (C), and shift shaft positioning bolt (D). Tighten the shift shaft positioning bolt to specifications.



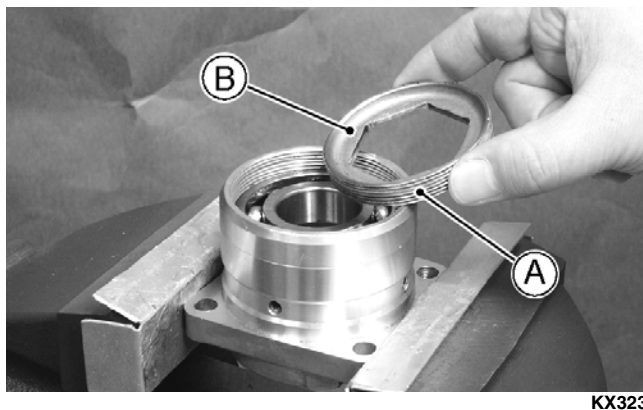
ATV2087

5. Check that the crankshaft and driven shaft turn freely. If any of the shafts don't turn freely, separate the crankcase halves to locate the problem.
6. Using the bearing driver (A), drive the bearing into the housing until it bottoms out.



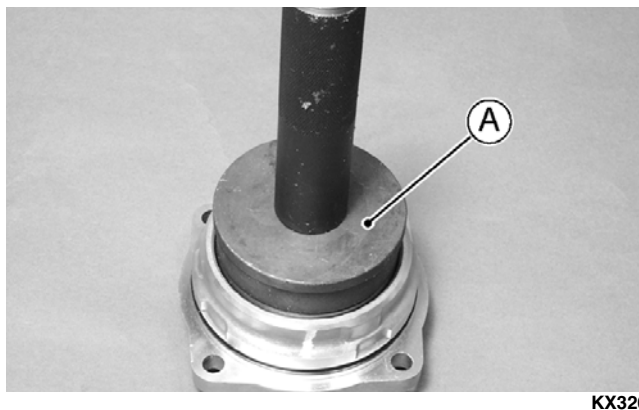
KX322

7. Place the bearing housing into the holding fixture; then apply blue Loctite #242 on the threads of the bearing retainer (A). Install with the dished side (B) directed away from the bearing and tighten to specifications.



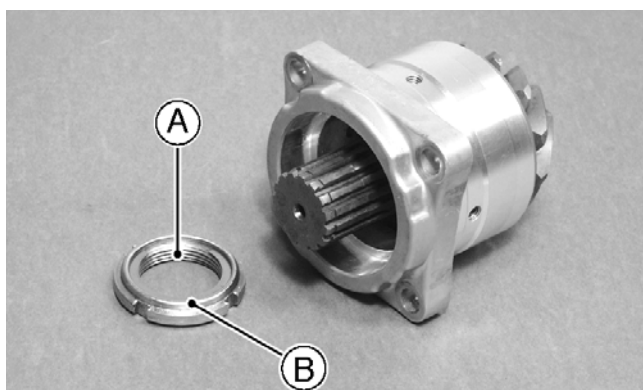
KX323

8. Press the drive bevel gear in until it bottoms; then apply blue Loctite #242 to the threads (A) of the bevel gear retainer nut and with the raised side (B) directed away from the bearing, tighten to specifications.



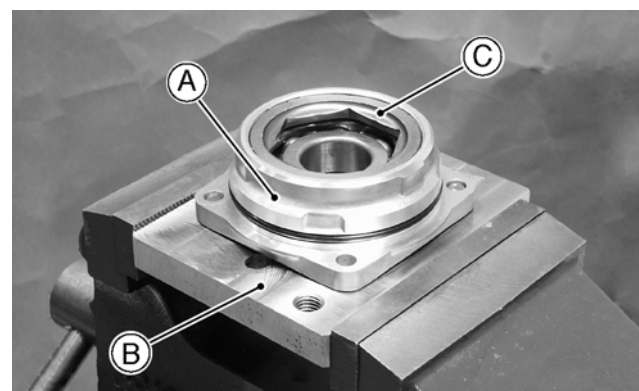
KX326

11. Place the output drive bearing housing (A) into the holding fixture (B); then apply blue Loctite #242 to the threads of the bearing retainer (C). Install the bearing retainer and tighten to specifications.



KX324

9. Press the outer ball bearing in until it is bottomed out.



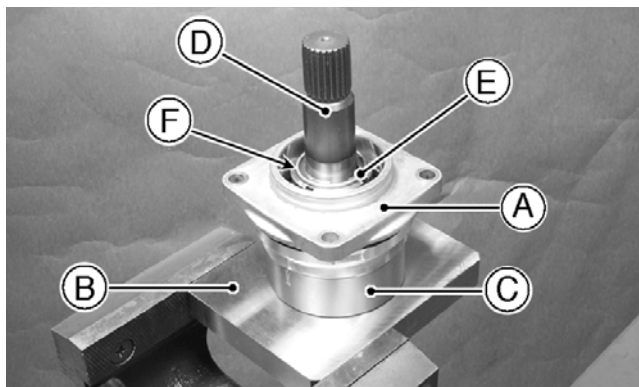
KX327

12. Secure the output shaft holding fixture (B) and spacer (C) in a vise; then hold the housing assembly (A) and install the output shaft (D) in the housing.



KX325A

10. Using the bearing driver (A), drive the bearing into the output drive bearing housing until it bottoms out.

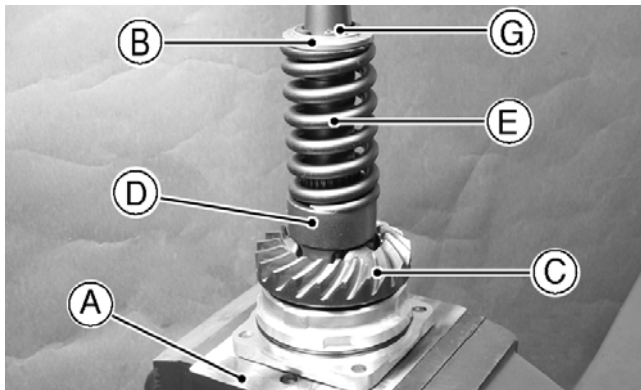


KX328

13. Apply blue Loctite #242 to the threads of the output shaft retainer nut (E) and with the protruding side (F) directed away from the bearing, tighten to specifications.

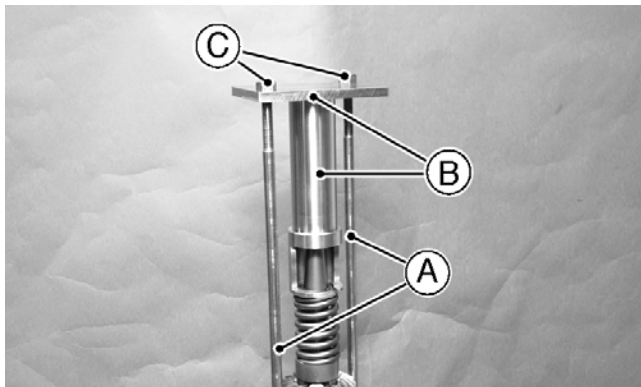
14. Apply grease to the output drive oil seal; then install in the housing being careful not to damage the lip of the seal or distort the seal.

15. Secure the holding fixture (A) in a vise; then install the driven bevel gear (C), cam damper (D), spring (E), spring holder (B), and circlip (G).

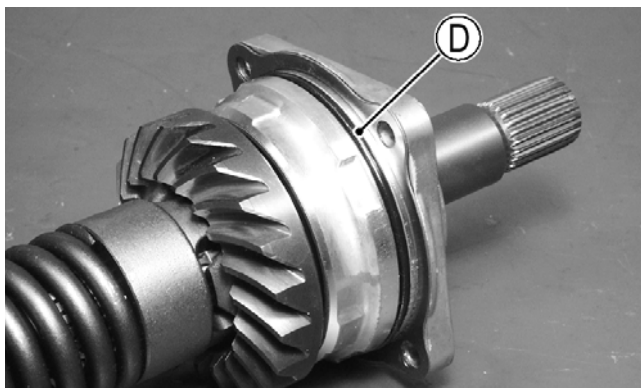


KX329A

16. Install the guide bars (A), spring compressor (B), and nuts (C); then tighten the nuts (C) until the circlip (D) can be installed. After seating the circlip, remove the nuts (C), compressor (B), and guide rods (A). Apply grease to the O-ring seal on the housing.

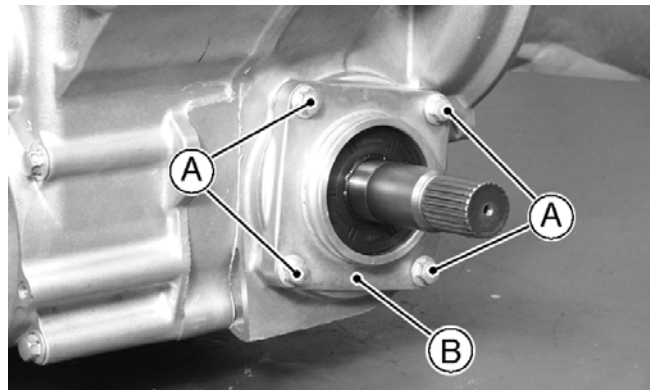


KX330



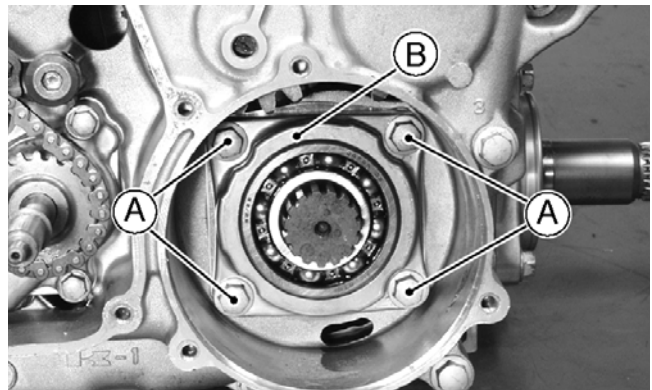
KX331A

17. Install the driven gear assembly (B) in the crankcase; then tighten the four cap screws (A) to specifications.



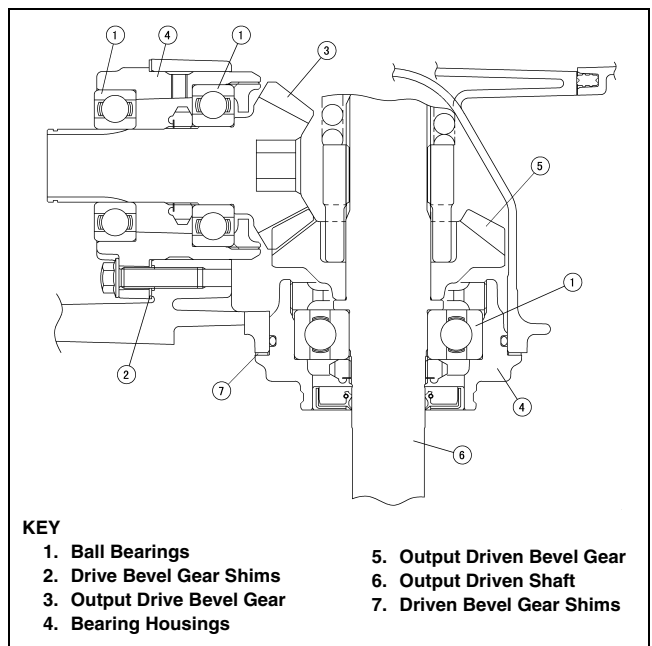
KX332

18. Install the drive bevel gear housing (B); then tighten the four cap screws (A) to specifications.



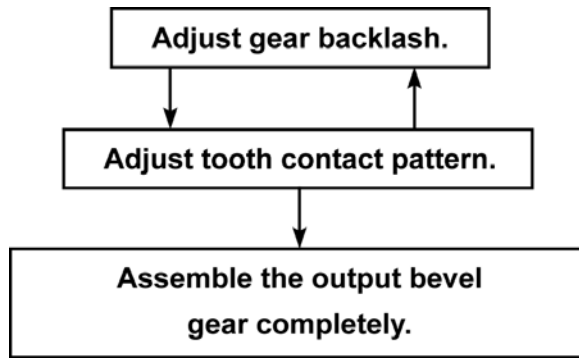
KX333

■ **NOTE:** If any of the output bevel gear (backlash-related) parts have been replaced, the Adjusting Backlash and Adjusting Tooth Contact procedures must be followed.



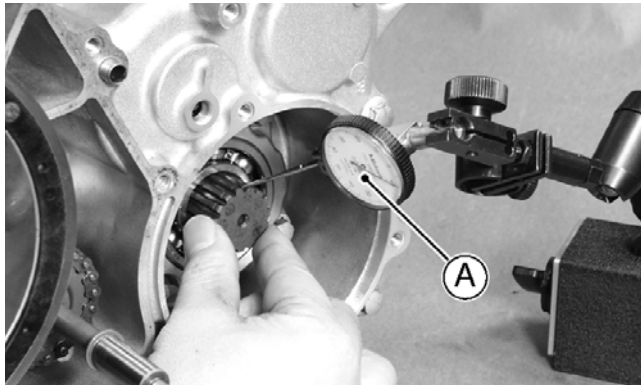
ATV2088





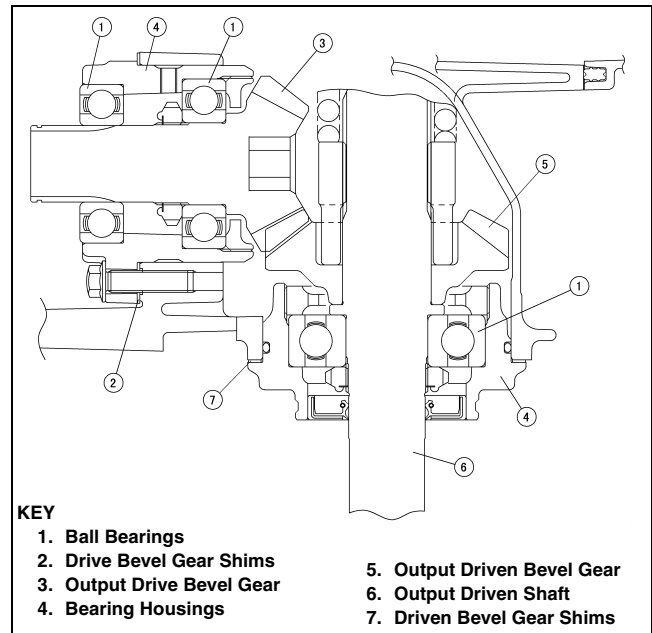
ATV2092

19. Set the dial indicator (A) against the output driveshaft spline groove; then rock the driveshaft slightly until gear lash (play) is taken out in one direction (do not let driven shaft turn). Zero the dial indicator and rock the shaft in the opposite direction until gear contact is made. The new reading is the backlash. It should be between 0.05-0.11 mm (0.0020-0.0043 in.).



KX334

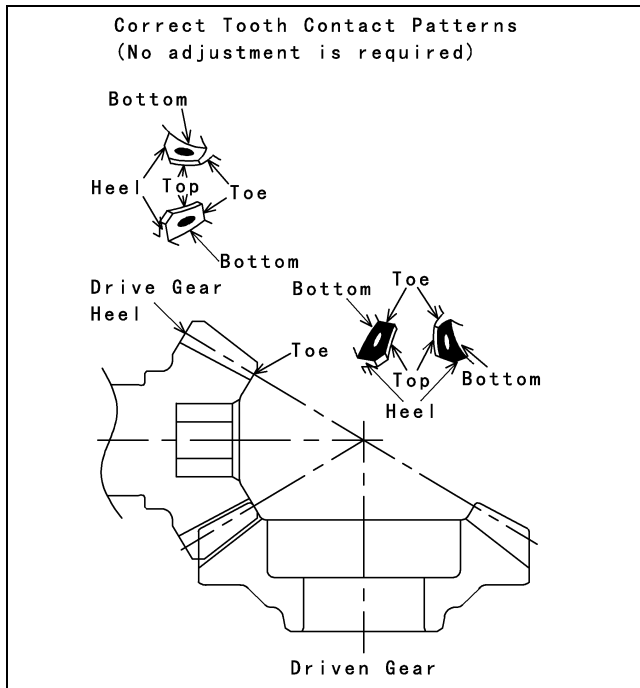
■ **NOTE:** To decrease backlash, decrease the thickness of shims (7). To increase backlash, increase the thickness of shims (7). Make small changes at a time.



ATV2088

| Driven Bevel Gear Shims for Backlash Adjustment |                      |
|-------------------------------------------------|----------------------|
|                                                 | Thickness            |
|                                                 | 0.15 mm (0.006 in.). |
|                                                 | 0.2 mm (0.008 in.).  |
|                                                 | 0.5 mm (0.020 in.).  |
|                                                 | 0.8 mm (0.031 in.).  |
|                                                 | 1.0 mm (0.039 in.).  |
|                                                 | 1.2 mm (0.047 in.).  |

20. Remove the drive bevel gear housing assembly; then clean all oil from the bevel gears. Apply a thin even coat of machinist layout dye on the bevel gears.
21. Rotate the driveshaft several revolutions in both directions while applying resistance to the drive gear. Note the drive and coast contact patterns on the bevel gears.

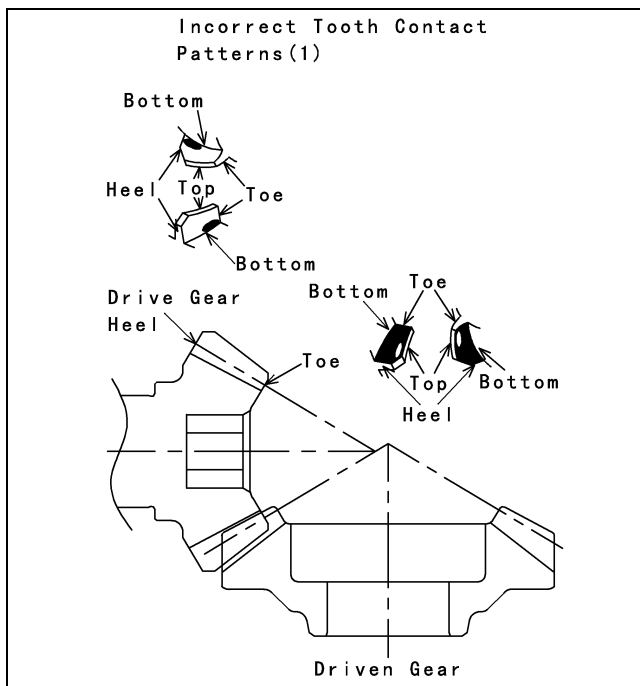


ATV2089

22. Increase or decrease shim thickness on the drive bevel gear housing until the correct contact pattern is obtained.

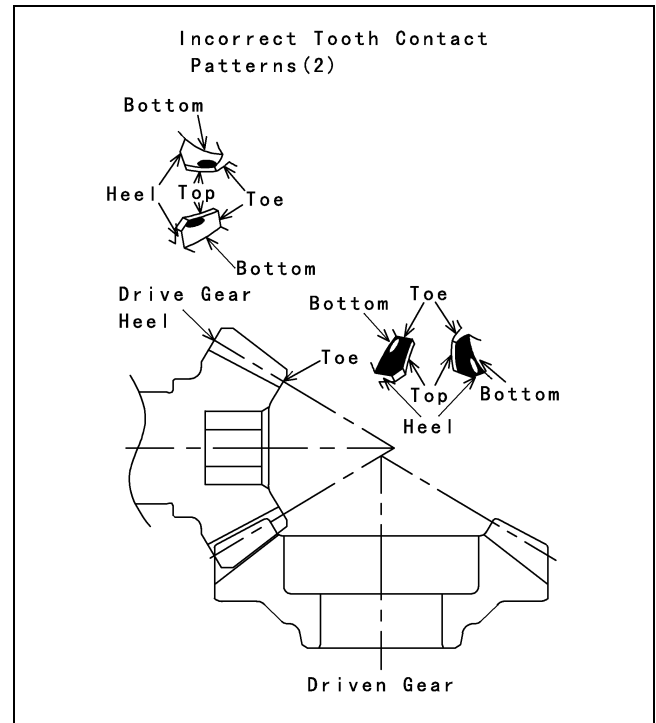
■ **NOTE:** Always check gear backlash after changing any shims.

■ **NOTE:** The following illustration indicates that the drive gear is running too shallow in the set. Decrease drive housing shims and increase driven housing shims.



ATV2090

■ **NOTE:** The following illustration indicates that the drive gear is running too deep in the set. Increase drive housing shims and decrease driven housing shims.

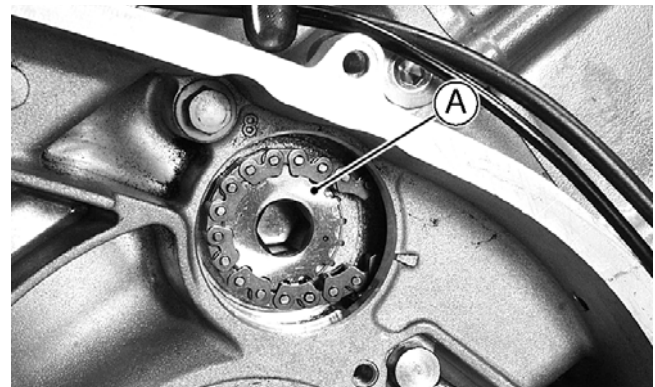


ATV2091

■ **NOTE:** Changing driven housing shims will affect backlash more than contact pattern. Changing drive housing shims will affect contact pattern more than backlash. Always recheck backlash.

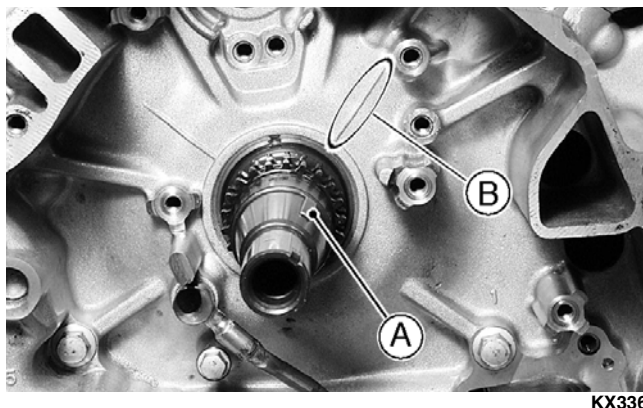
23. After backlash and contact patterns are within specifications, install the bevel gear assemblies in accordance with steps 1 and 2 of this sub-section.

24. From the right side, install the intermediate cam driveshaft (A) and front camshaft chain.

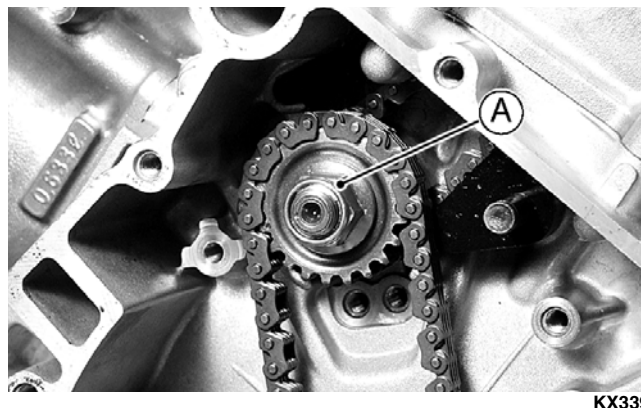


KX335

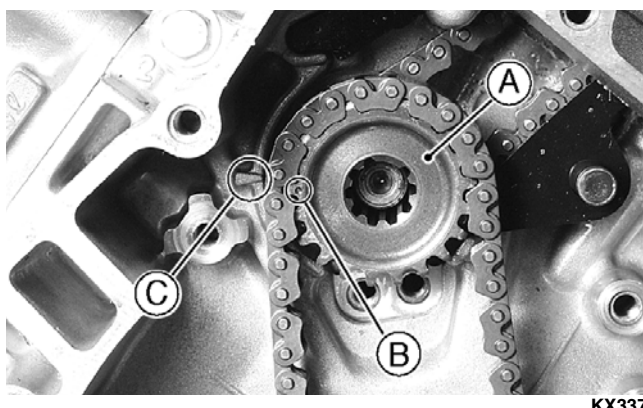
25. Align the keyway (A) with the index line (B) on the crankcase; then install the timing chain and engage the intermediate shaft sprocket.



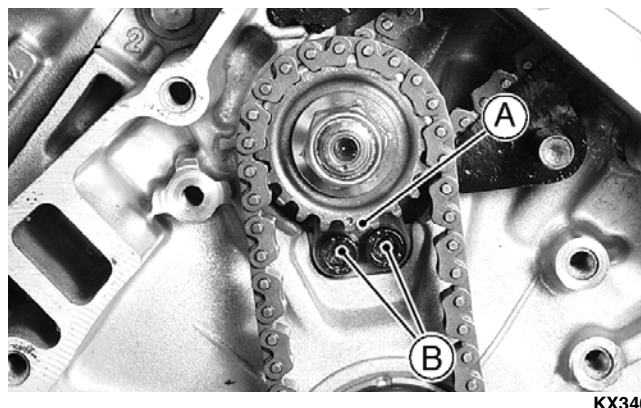
26. Align the punch mark (B) on the intermediate shaft sprocket (A) with the index mark (C) on the crankcase.



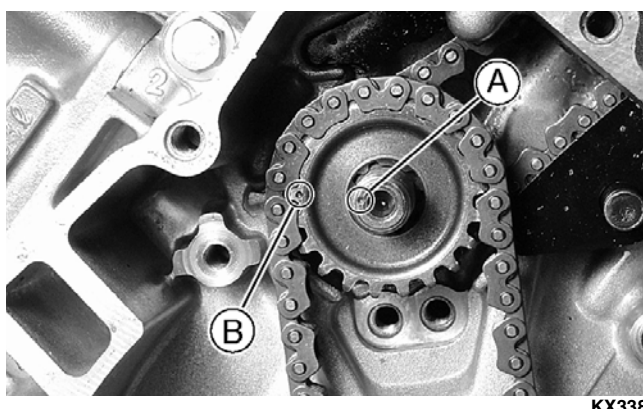
29. Install the position plate (A); then tighten cap screws (B) to specifications.



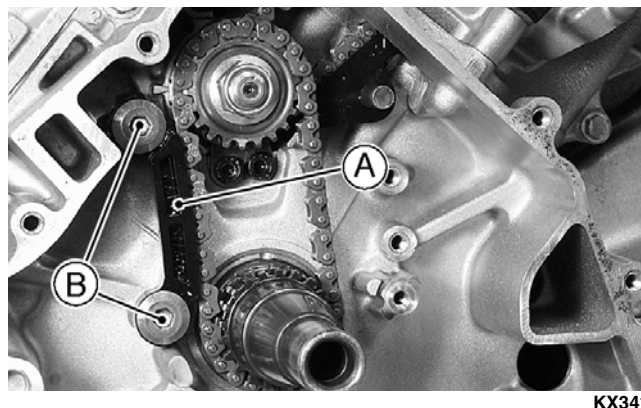
27. Engage the splines of the intermediate drive sprocket and shaft aligning the punch mark (A) on the shaft with the punch mark (B) on the sprocket.



30. Install the front intermediate shaft chain guide (A); then tighten the mounting cap screws (B) to specifications.

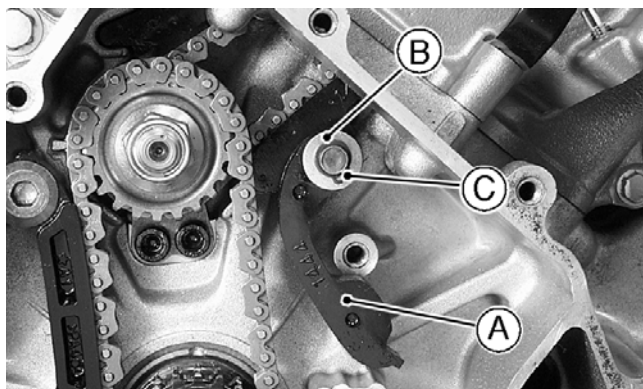


28. Install the nut (A); then hold the intermediate shaft from the right side with an Allen wrench and tighten to specifications.



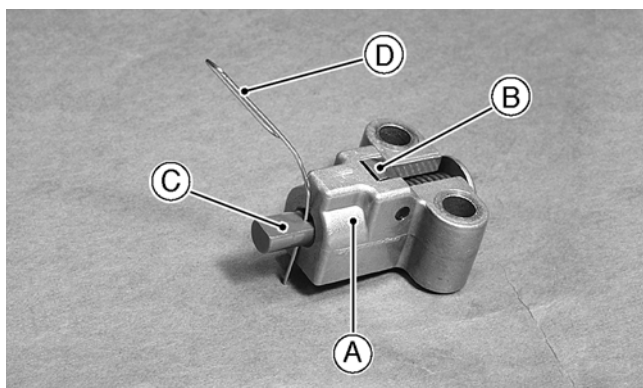
31. Place the rear intermediate chain guide (A) onto the pivot as shown; then secure with a flat washer (B) and circlip (C).





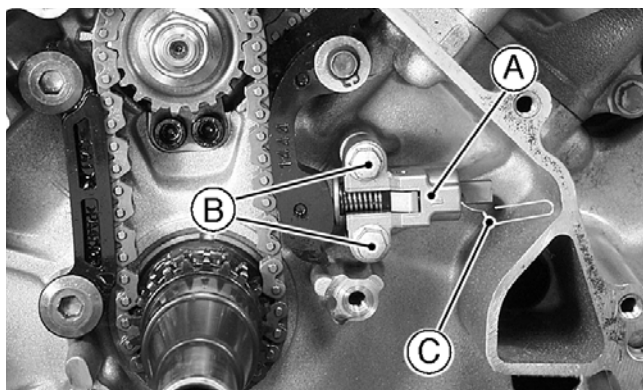
KX342

32. To prepare the intermediate shaft chain tensioner (A) for installation, release the stopper (B); then push the rod (C) into the housing and secure with a piece of wire (D).



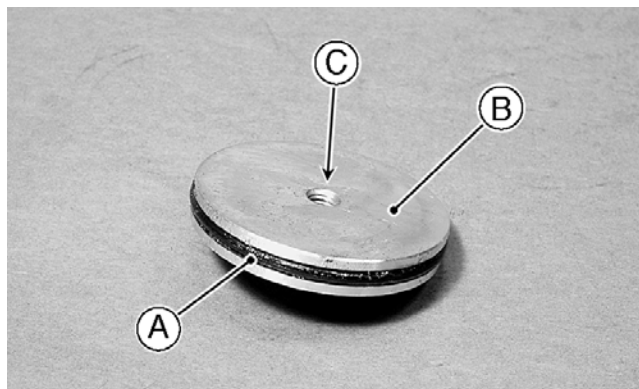
KX343

33. Secure the chain tensioner assembly (A) to the crankcase with cap screws (B); then tighten to specifications and remove the wire (C).



KX344

34. Apply grease to the O-ring (A); then install the cover (B) into the right side of the crankcase with the tapped hole (C) directed outward.



KX345

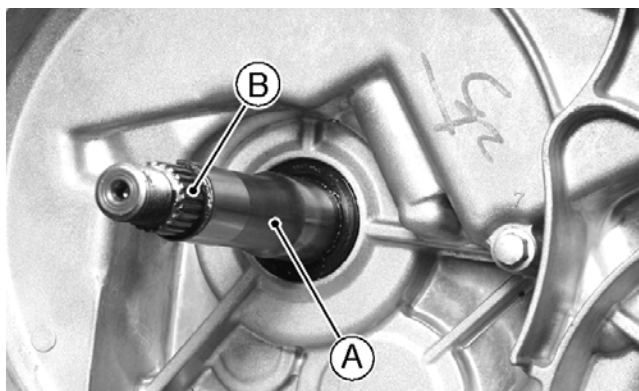
### ⚠ CAUTION

Make sure tension is kept on the front and rear cam chains whenever the crankshaft is rotated. Damage to the crankcase could occur.

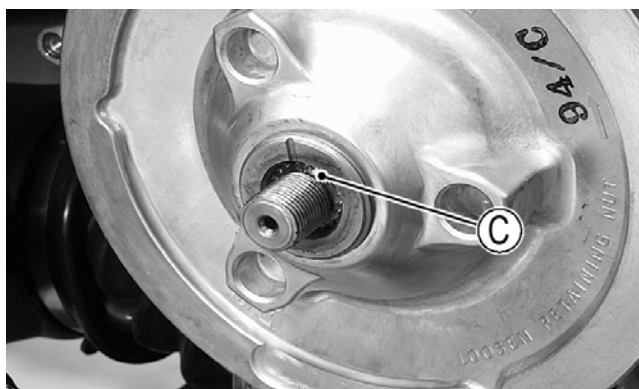
## Installing Right-Side Components

3

1. Install the driven pulley on the transmission driven shaft (A) being careful not to jam the splines (B) with the splines in the pulley (C).

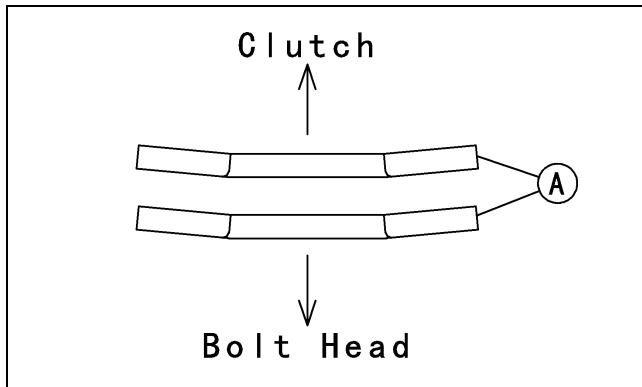


KX346

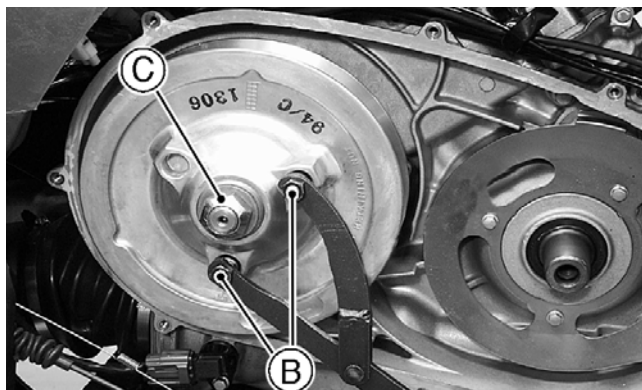


KX347A

2. Install the two bevel washers (A) with the concave side directed towards the driven pulley; then use the pulley holder (B) to hold the driven pulley and tighten the nut (C) to specifications.

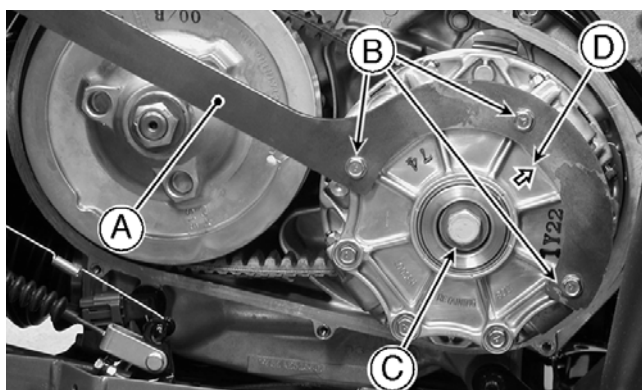


ATV2093



KX348A

3. Loop the belt over the driven pulley; then install the drive clutch with holding tool (A) with cap screws (B) referenced to the arrow (D) and tighten the cap screw (C) (left-hand threads) to specifications.



KX349

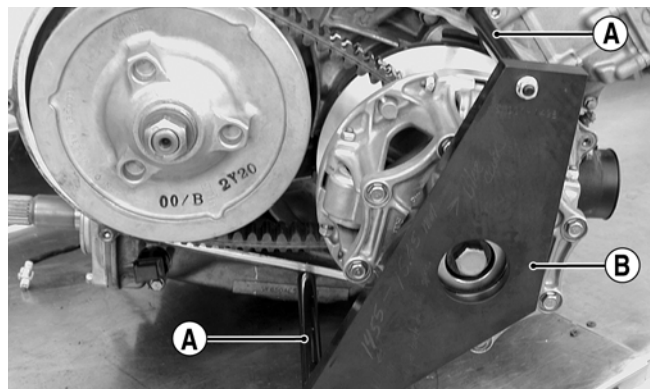
4. Check that drive belt deflection is within specifications (see Section 2).
5. Remove the clutch holding tool (A); then install the three cap screws and tighten the drive clutch cover to specifications using a crisscross pattern.



KX359

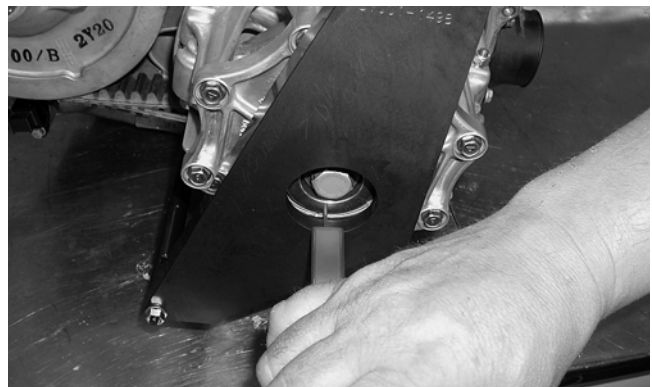
6. Adjust the installation length of the drive clutch using the following procedure.

- A. Install the drive clutch measurement tool legs (A) and plate (B) on the crankcase.



CD900A

- B. Using a depth gauge or a calipers, measure the recess from the plate surface to the clutch collar.



CD902

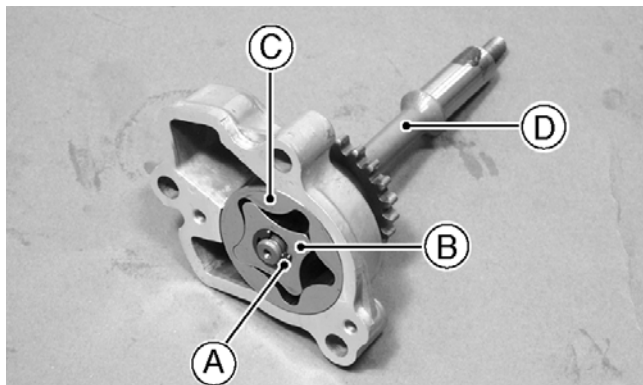
- C. If the measurement is less than 14.55 mm (0.573 in.), install red drive clutch cover (p/n 3201-162). If the measurement is greater than 15.65 mm (0.616 in.), install blue drive clutch cover (p/n 3201-163). If the length cannot be obtained, install the drive clutch assembly.

7. Tighten the clutch cover bolts to specifications using a crisscross pattern.



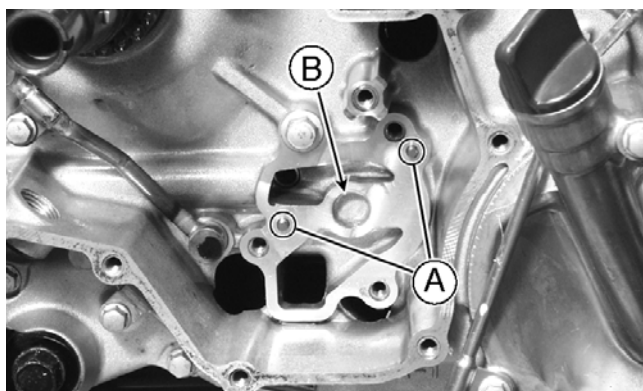
## Installing Left-Side Components

1. Install a new circlip (A) securing the oil pump rotor (B) in rotor (C); then apply clean engine oil to the rotors and shaft (D).



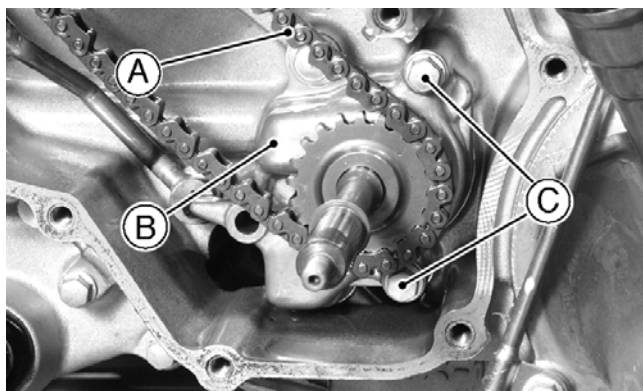
KX350A

2. Make sure that alignment pins (A) are in place and apply clean engine oil to oil port (B).



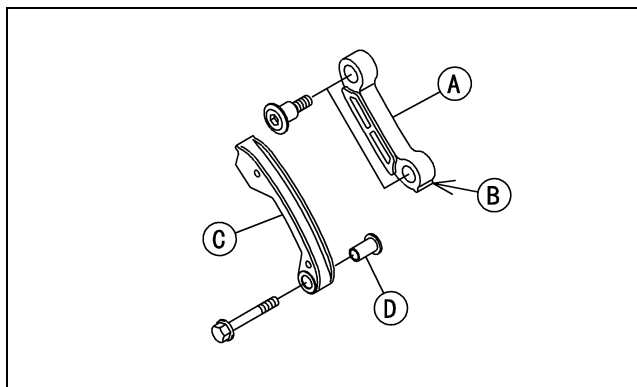
KX351

3. Install the oil pump drive chain (A) with the oil pump assembly (B); then tighten the cap screws (C) to specifications.



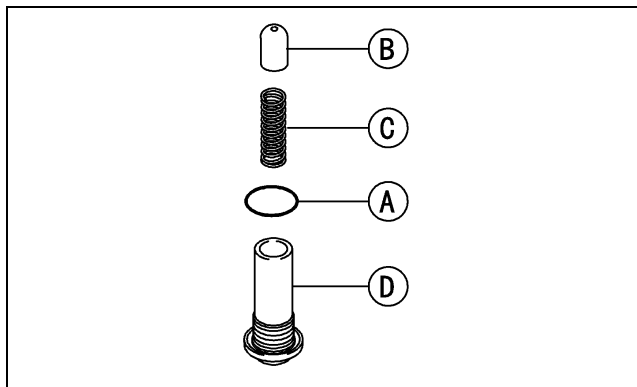
KX352

4. Install the upper chain guide (A) with the tab (B) directed downward; then install the lower chain guide (C) and collar (D). Tighten the chain guide attaching bolts to specifications.



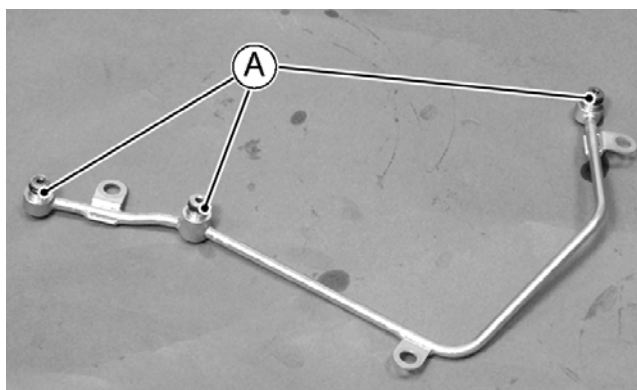
ATV2094

5. Apply grease to the O-ring (A); then install the pin (B), spring (C), and oil pump chain tensioner bolt (D) and tighten to specifications.



ATV2095

6. Install new O-rings (A) on the oil pipe fittings; then apply clean engine oil and install on the crankcase tightening the oil pipe cap screws to specifications.

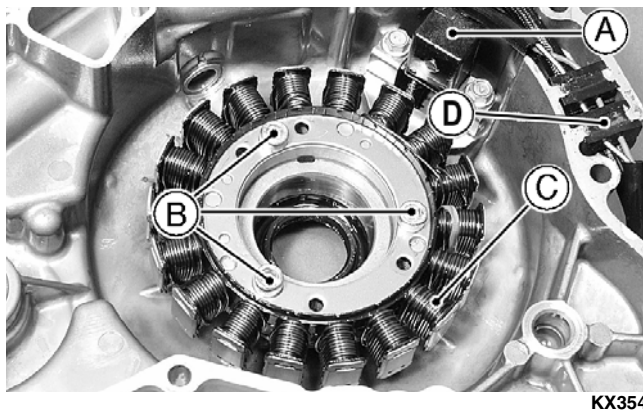


KX353

7. Install the pick-up coil (A) and stator (C) and tighten cap screws (B) to specifications; then install the lead grommets (D) in the alternator cover.

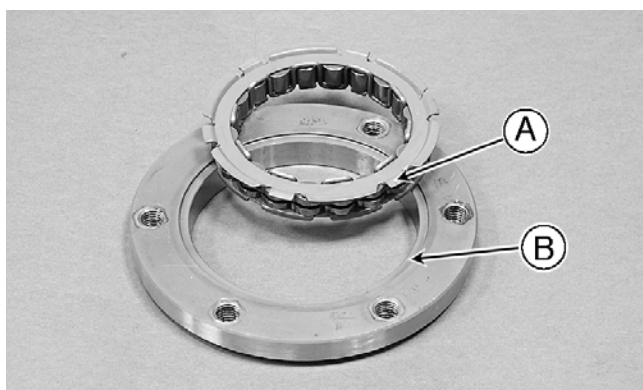
3





KX354

8. Install the one-way clutch so the flange (A) fits on the recess (B) of the race; then install on the rotor/flywheel and attach with the cap screws. Coat threads with blue Loctite #242 and tighten to specifications.



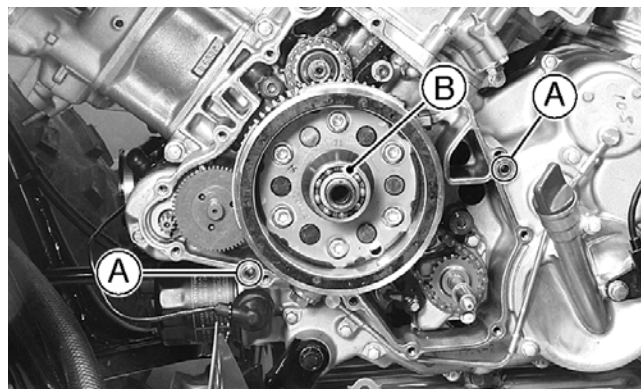
KX355

9. Install the starter clutch gear (C) and torque limiter (A); then wipe the crankshaft and rotor/flywheel mating surfaces clean and install the rotor/flywheel (B) while turning the starter clutch gear.



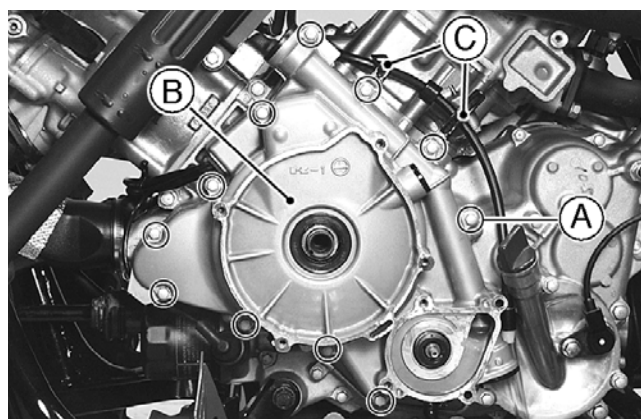
KX356

10. Ensure that the alignment pins (A) are installed; then install the bearing (B).



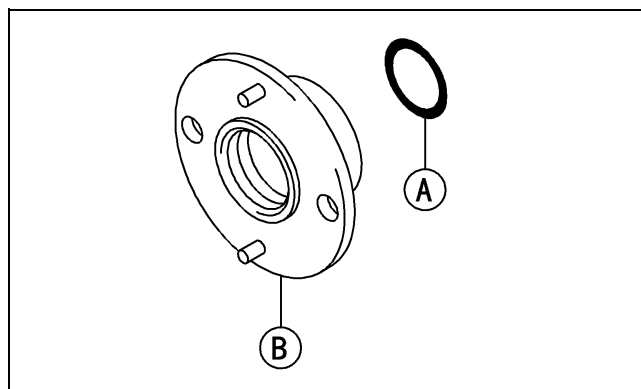
KX357

11. Apply grease to the alternator cover oil seal; then install the cover (B), cover cap screws (A), and clamps (C). Tighten the cap screws to specifications.



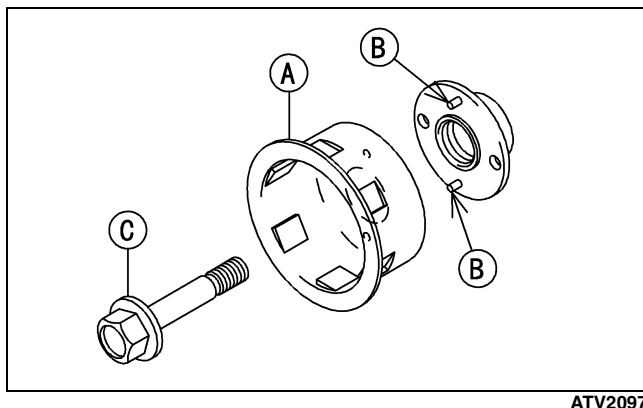
KX358

12. Install a new O-ring (A) in the collar (B); then apply grease to the O-ring and install the collar into the alternator cover.

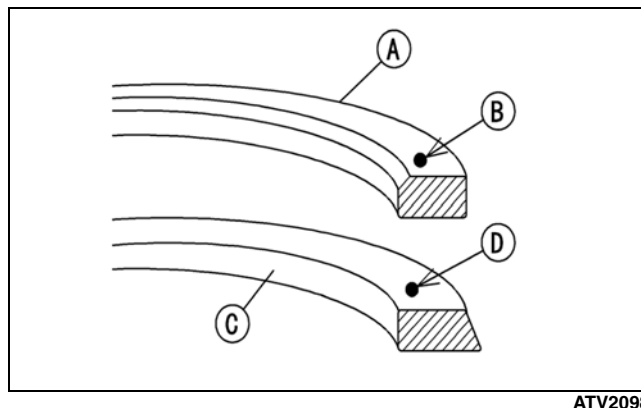


ATV2096

13. Align the holes in the starter cup (A) with the pins (B) in the collar; then hold the drive clutch with the holder and tighten the rotor/flywheel cap screw (C) to specifications.



ATV2097



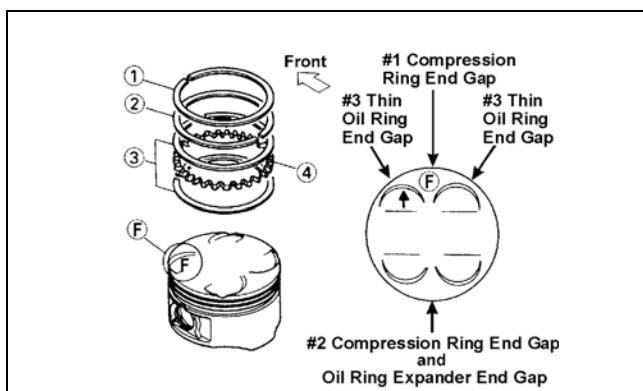
ATV2098

## Installing Top-Side Components

- A. Piston**
- B. Cylinder**
- C. Cylinder Heads**
- D. Camshafts**

■ **NOTE:** If the piston rings were removed, install them in this sequence.

- A. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.



ATV-1085D

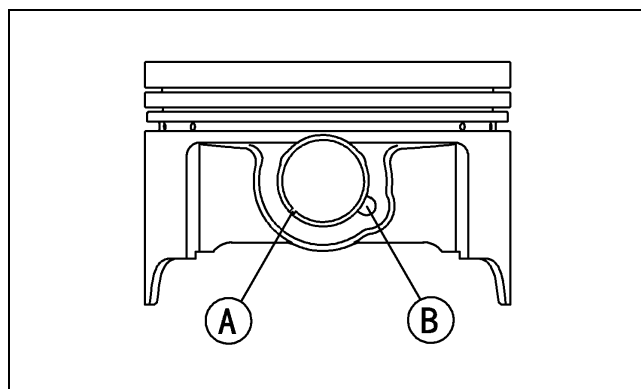
- B. Install compression ring #2 (C) so the "RN" mark (D) is up; then install the top compression ring #1 (A) so the "R" mark (B) is up.

### CAUTION

Incorrect installation of the piston rings will result in engine damage.

1. Install the pistons on the connecting rods making sure there is a circlip on each side and the open end of the circlip (A) does not align with the notch (B) in the piston.

■ **NOTE:** The pistons should be installed so the F is directed toward the front on both front and rear pistons.



ATV2099

■ **NOTE:** When installing the circlips in the piston, compress them only enough to install. Do not over compress.

2. Install two alignment pins (A) for each cylinder; then position a new base gasket (B) as shown.

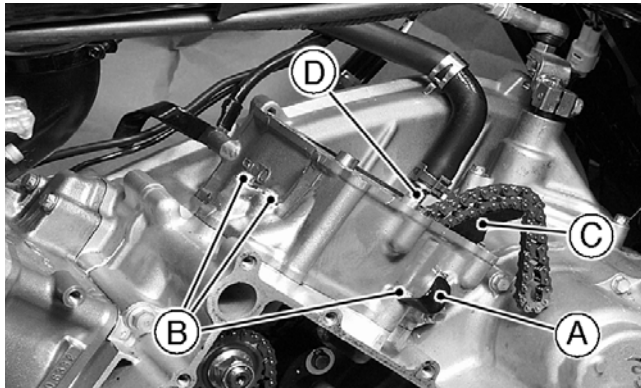


KX360

3

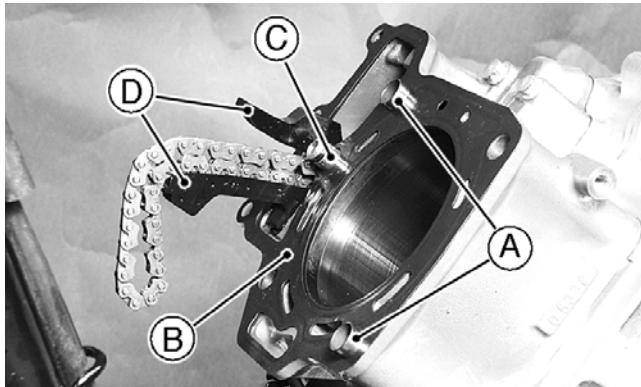


3. Apply clean engine oil to the piston skirts and cylinder walls; then install the cylinders and clamp (A) (rear only) and tighten the cylinder cap screws (B) to specifications. Install the cam chain guide (C) and the oil pipe (D).



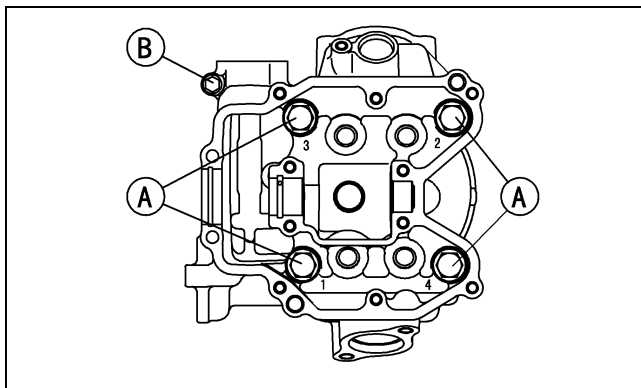
KX361

4. Locate alignment pins (A) as shown; then place a new head gasket (B) into position and install the oil pipe (C) and camshaft chain guides (D).



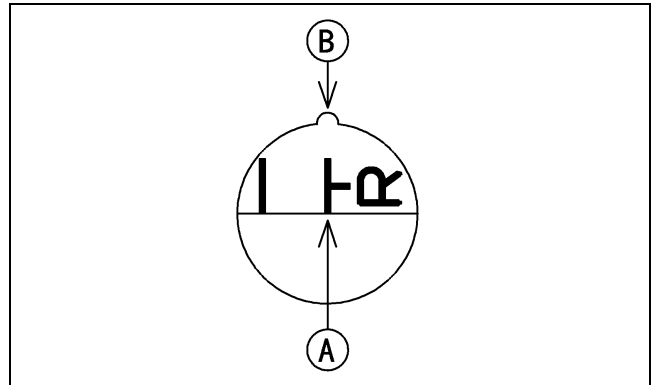
KX362

5. Install the cylinder heads and tighten cap screws (A) in the sequence illustrated to 2.5 kg-m (18 ft-lb); then in the same sequence, tighten to the final value of 5.0 kg-m (36 ft-lb). Tighten cap screw (B) to 1.0 kg-m (7 ft-lb).



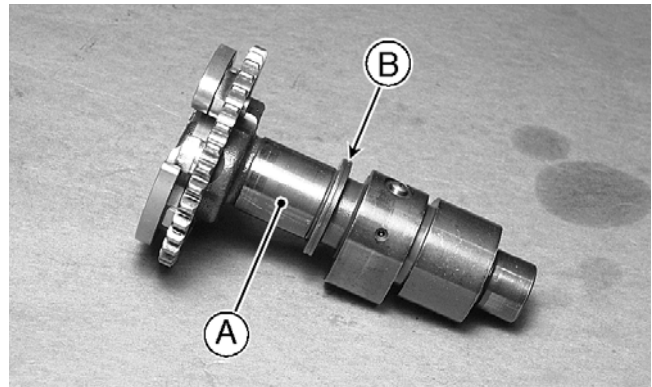
ATV2100

6. Using a wrench on the alternator bolt, turn the crankshaft clockwise to align the "TR" mark (A) with the notch (B) in the inspection window.



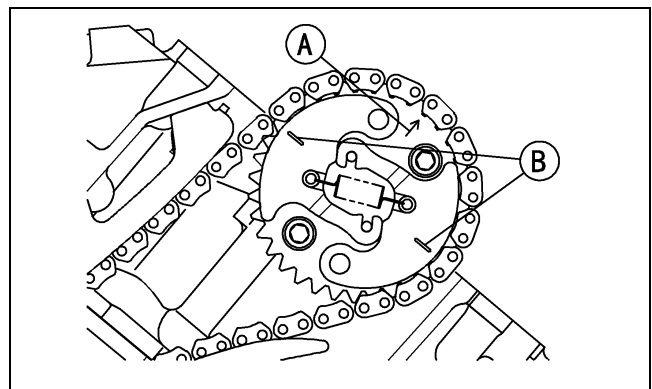
ATV2101

7. Install the rear camshaft (A) identified by the groove (B).



KX363

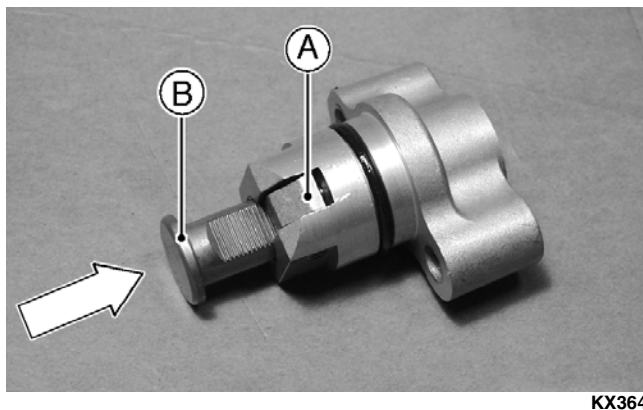
8. Direct the arrow (A) of the rear camshaft upward (left side view); then engage the rear camshaft sprocket with the chain aligning the index marks (B) with the cylinder head upper surface.



ATV2102

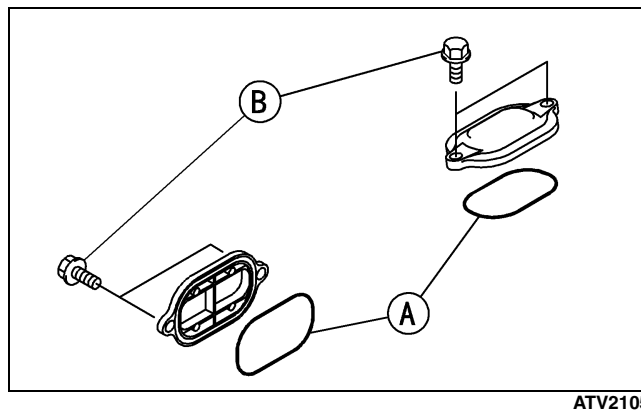
9. Release the ratchet (A) and press the push rod (B) into the camshaft chain tensioner body; then install on the appropriate cylinder and tighten the cap screws to specifications.





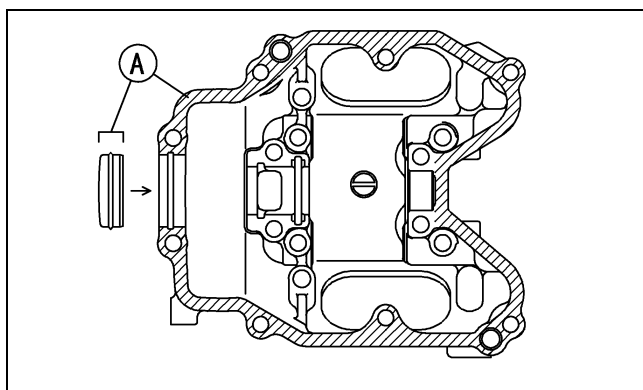
KX364

10. Apply clean engine oil to the camshaft; then apply a thin coat of Three Bond Sealant (p/n 0636-070) (A) to the outer surface of the cap and the upper surface of the cylinder head.



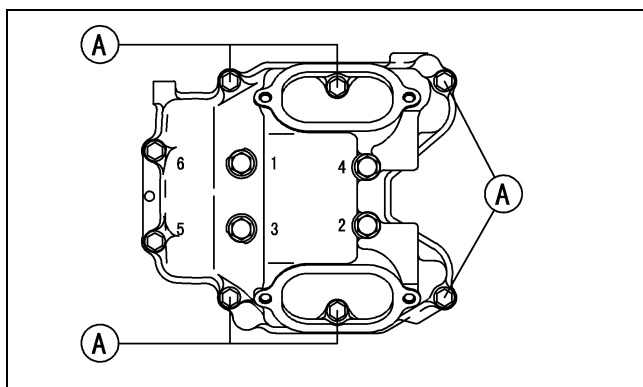
ATV2105

13. Using a wrench on the alternator bolt, turn the crankshaft clockwise 270° and align the "TF" mark (A) with the notch (B) in the inspection window.



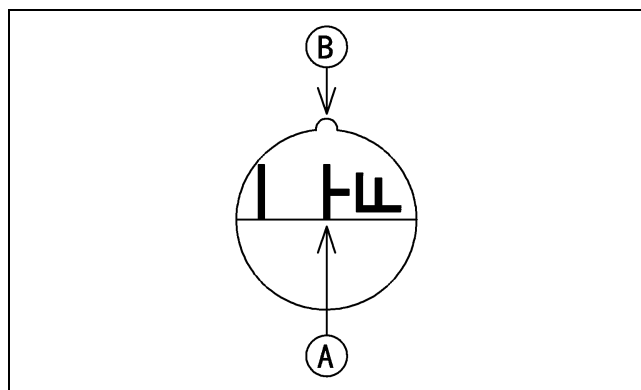
ATV2103

11. Install the rocker case making sure that the rocker arms and adjuster screws do not have pressure on them; then tighten the rocker case cap screws as follows: 1-4 with washers, 0.9 kg-m (6.5 ft-lb); 5 and 6, 1.0 kg-m (6.5 ft-lb); (A) 1.0 kg-m (7.0 ft-lb). Use the illustrated tightening sequence for cap screws 1-6.



ATV2104

12. Adjust valve clearance (See Section 2); then apply grease to O-rings (A) and install the tappet covers. Tighten the cap screws (B) to specifications.

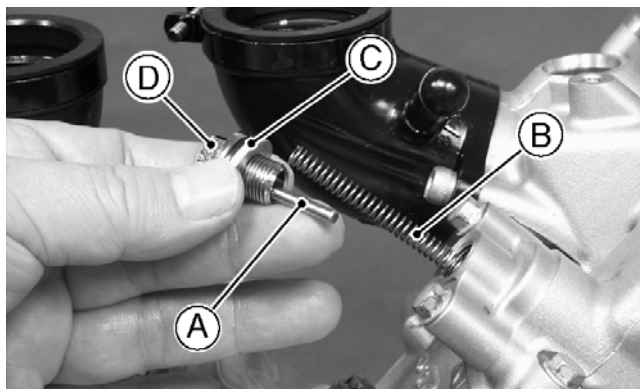


ATV2106

14. Repeat steps 8-12 for the front camshaft.

■ **NOTE:** All views are from the right side for the front camshaft.

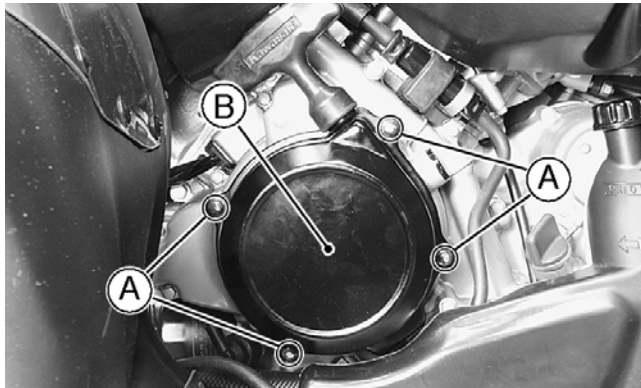
15. Install pin (A), spring (B), washer (C), and chain tensioner cap bolt (D); then tighten cap bolt to specifications.



KX365

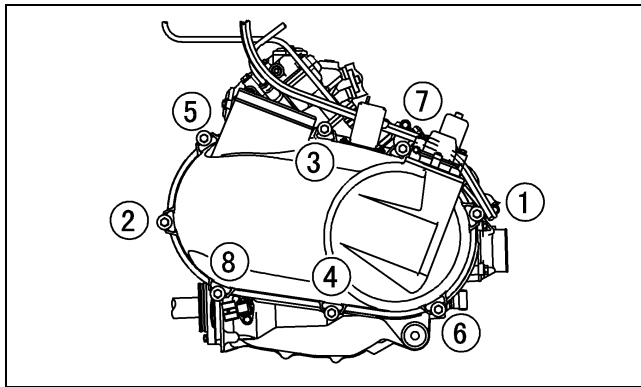
16. Install the spark plugs (if removed) and tighten to specifications.

17. Install the recoil starter assembly (B) and tighten the cap screws (A) to specifications.



KX366

18. Install the V-belt cover; then tighten the cap screws to specifications in the sequence illustrated.



ATV2107

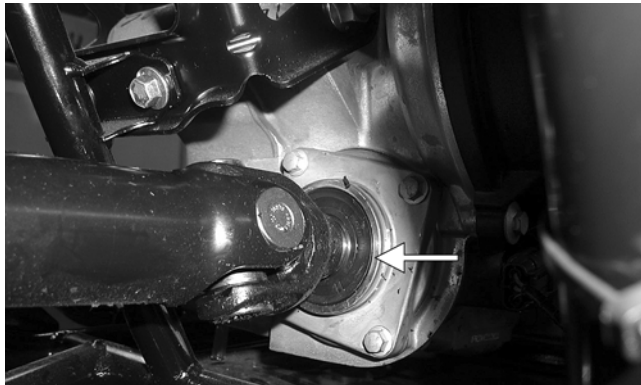
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## Installing Engine/Transmission

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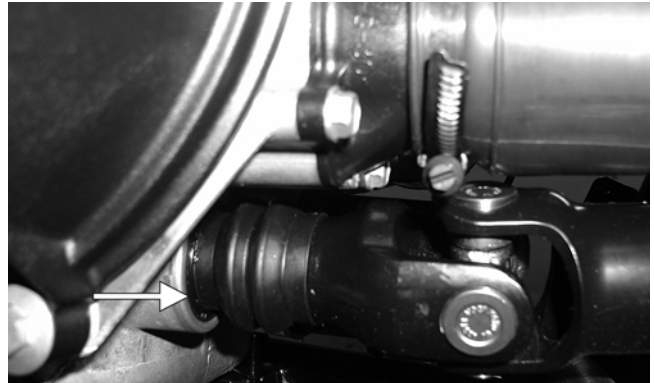
■ **NOTE:** Arctic Cat recommends that new gaskets and O-rings be installed whenever servicing the ATV.

1. Using a suitable lifting device, set the engine/transmission into the frame cradle from the left side; then align the splines of the rear drive shaft coupler and slide the engine/transmission rearward and engage the coupler.



KX078A

2. Raise the front of the engine/transmission sufficiently to enable the front drive coupler to engage the front output shaft; then lower the front of the engine/transmission and engage the coupler. Slide the boot over the yoke.



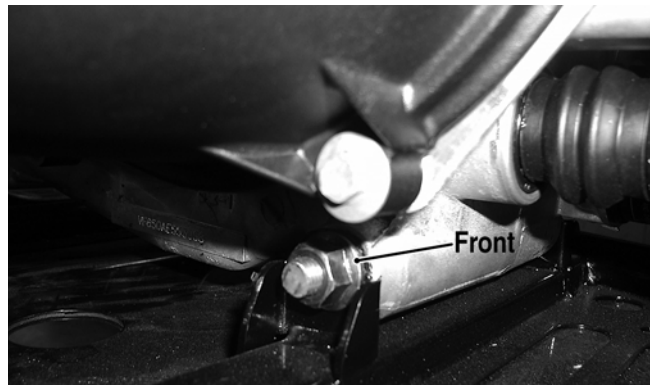
KX088A

3. Install the rear engine mount bracket to the frame. Do not tighten the bolts at this time.



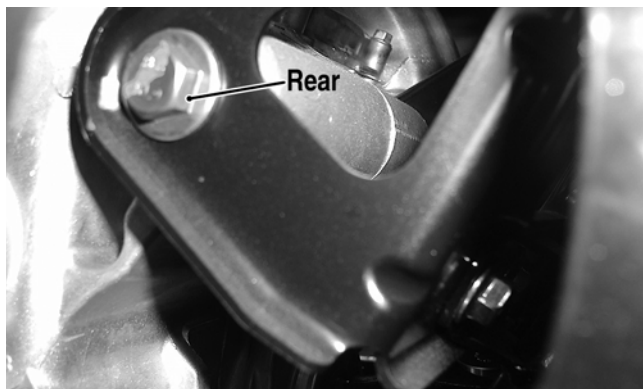
KX090

4. Align the engine with the front mount ears and install the front through-bolt; then install the rear through-bolt.

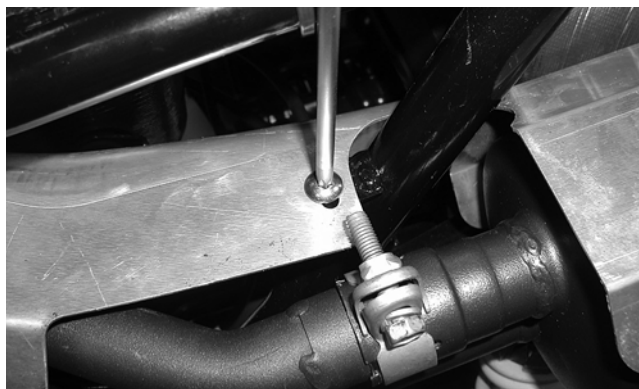


KX089B





KX069A

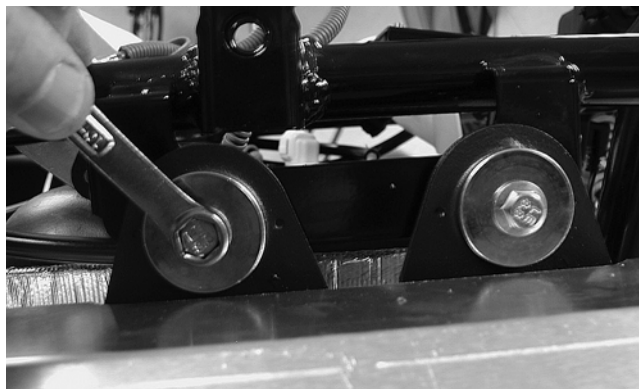


KX123

5. Tighten the rear bracket to frame bolts (from step 3) securely; then install the front and rear through-bolt nuts and tighten to specifications.
6. Install the front exhaust pipe with a new seal ring. Do not tighten the retainer nuts at this time.



KX076



KX126

9. Install the two upper and one lower coolant hoses and tighten the hose clamps securely. Make sure to install the two coolant hoses connected to the carburetors.

7. Install the muffler and rear exhaust pipe assembly with a new seal ring and seal bushings; then evenly tighten all the exhaust pipe retainer nuts to specifications.



KX141



KX086B

8. Install all exhaust system heat shields and tighten the mounting screws securely; then install two muffler mounts, hardware, and bolts and tighten securely.

10. Remove the tape or caps from the intake hoses checking for any dirt, hardware items, or liquids; then install the carburetors into the intake hoses and tighten the clamps securely. Make sure the carburetors are securely seated by rocking side to side after installation.

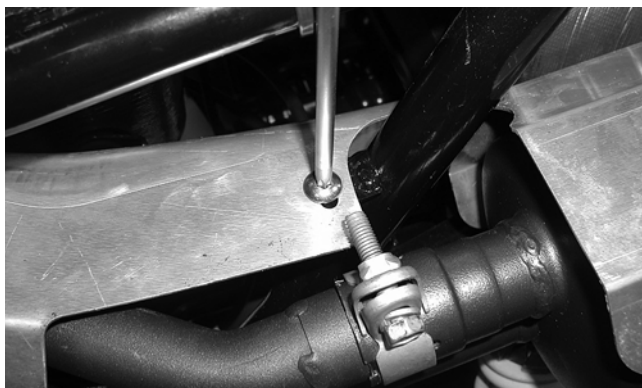
### **CAUTION**

**Make sure to check intake hoses for any foreign matter. Severe engine damage will occur if liquids or hardware items are ingested at start-up.**





KX122



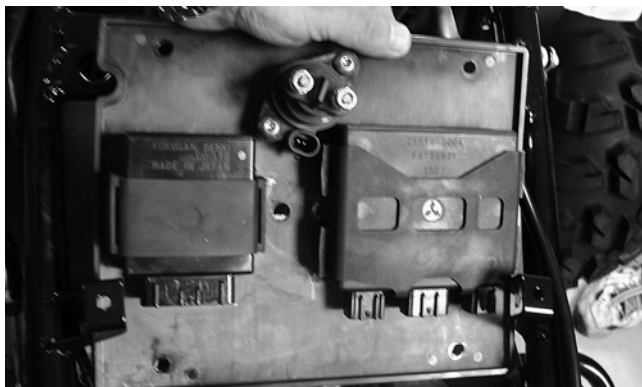
KX123

11. Connect the throttle cable and check for proper free-play; then install the cover and tighten the screw securely.



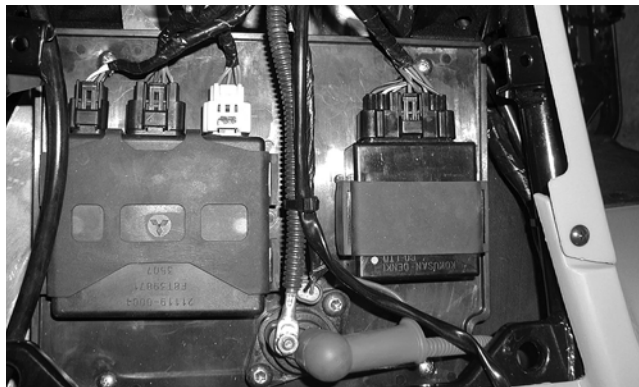
KX136

12. Install the electronics mounting tray with the CDI, starter relay, and EBC module attached; then secure with four mounting screws.



KX130

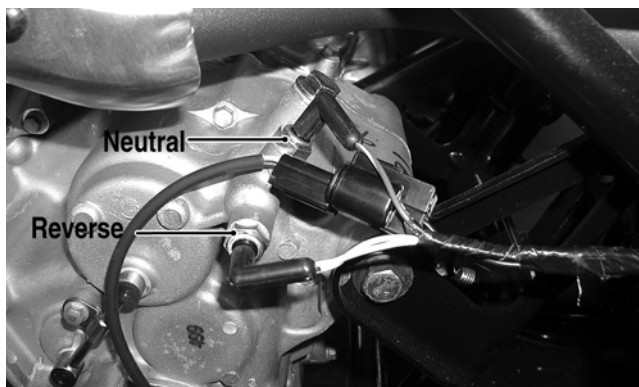
13. Connect the four disconnect plugs as shown; then connect the battery positive cable and starter lead to the starter relay.



KX074

14. Connect the starter cable to the starter lug and tighten securely.

15. Connect the alternator and pick-up coil leads; then attach the reverse indicator lead and neutral indicator lead to the switches.



KX075B

16. Connect the speed sensor, forward/reverse sensor lead, and oil pressure warning lead; then connect the drive belt failure detector lead and the engine brake control servo lead to the main harness. Connect the spark plug wires.

17. Remove the tape from the carburetor inlets checking for any foreign material; then using red Loctite #271, install the lower air cleaner housing and tighten the mounting screws securely.

18. Install the air filter and air filter cover.



KX119



KX118

19. Install the left footrest; then tighten the 10 mm cap screws to specifications and the 8 mm cap screws to specifications.
20. Install all fenders, side panels, and racks that were removed; then install the storage compartment cover.
21. Install the battery by connecting the positive cable first; then connecting the negative cable.
22. Install the seat making sure it is properly secured.
23. Fill with recommended oil and coolant. See Section 2.

# SECTION 4 - FUEL/LUBRICATION/COOLING

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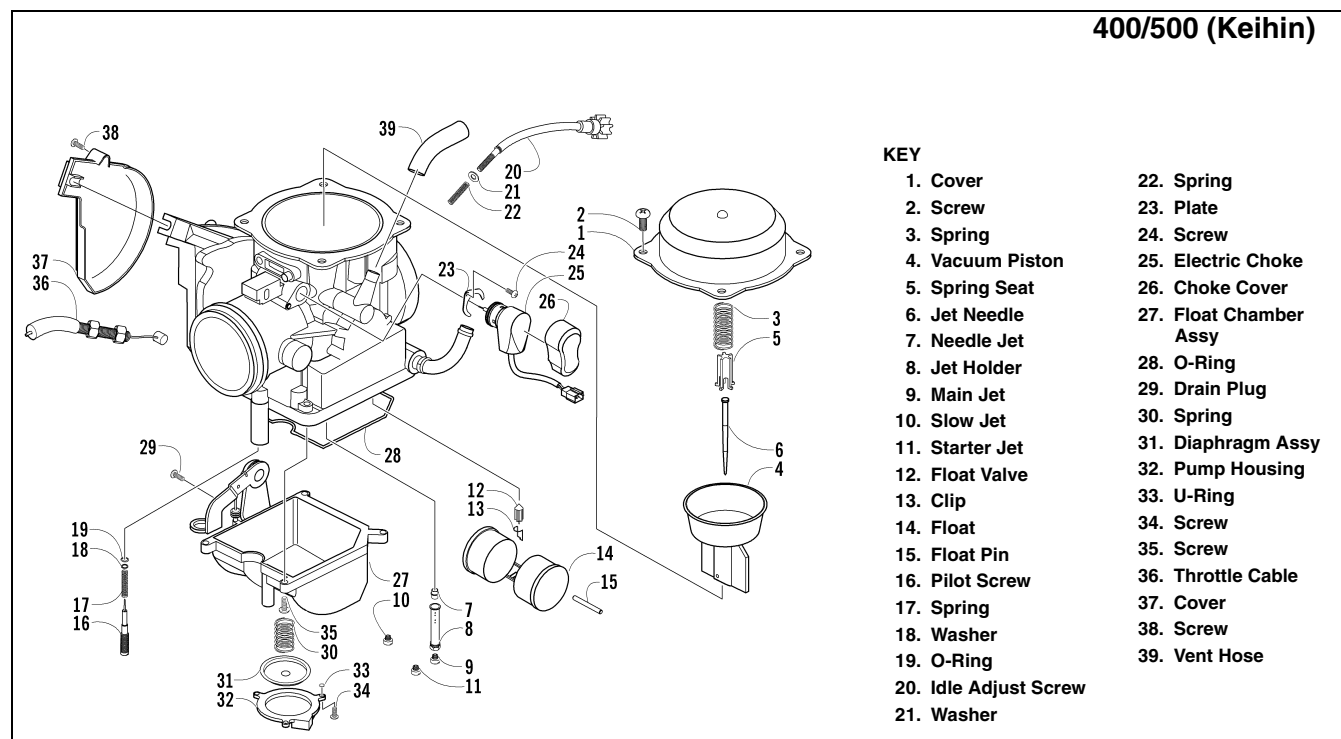


## Carburetor Specifications

| ITEM                                | 400                       | 500                  | 650 H1               | 650 V-Twin                         |
|-------------------------------------|---------------------------|----------------------|----------------------|------------------------------------|
|                                     | Keihin CVK34              | Keihin CVK36         | Keihin CVK40         | Keihin CVKR-D32 (2)                |
| Main Jet                            | 142 - VP<br>140 - FIS     | 138                  | 138                  | 122 (Standard)<br>118 (California) |
| Slow Jet                            | 38                        | 40                   | 40                   | 40                                 |
| Pilot Screw Setting (turns)         | 1 3/8 - VP<br>1 1/8 - FIS | 1 3/4                | 2                    | 2 1/4 (Front)<br>2 1/2 (Rear)      |
| Jet Needle                          | NAZG                      | NFKG                 | NFKN                 | NBZP                               |
| Idle RPM (engine warm)              | 1250-1350                 | 1250-1350            | 1250-1350            | 1050-1150                          |
| Starter Jet                         | 75                        | 85                   | 85                   | 100                                |
| Float Arm Height                    | 17 mm (0.7 in.)           | 17 mm (0.7 in.)      | 17 mm (0.7 in.)      | 4 mm (0.16 in.)                    |
| Throttle Cable Free-Play (at lever) | 3-6 mm (1/8-1/4 in.)      | 3-6 mm (1/8-1/4 in.) | 3-6 mm (1/8-1/4 in.) | 3-6 mm (1/8-1/4 in.)               |
| Choke Cable Free-Play               | N/A                       | N/A                  | N/A                  | 3-6 mm (1/8-1/4 in.)               |

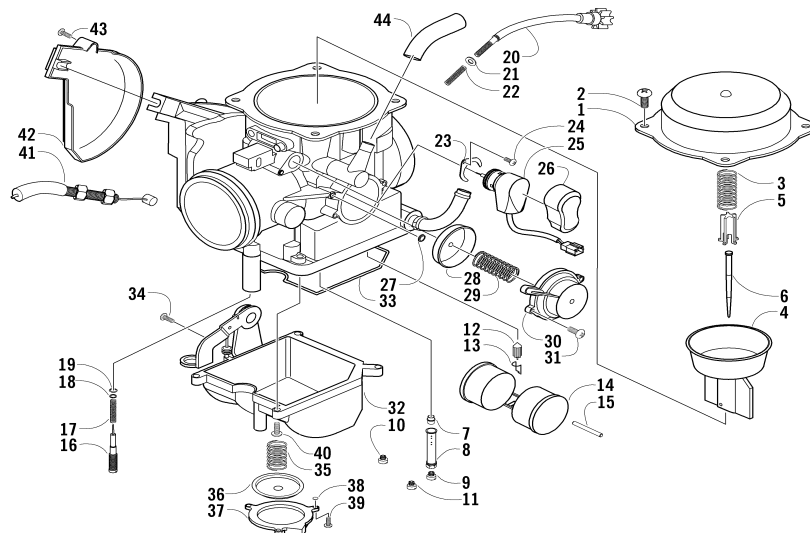
## Carburetor Schematics

### 400/500 (Keihin)



0739-656

## 650 H1 (Keihin)

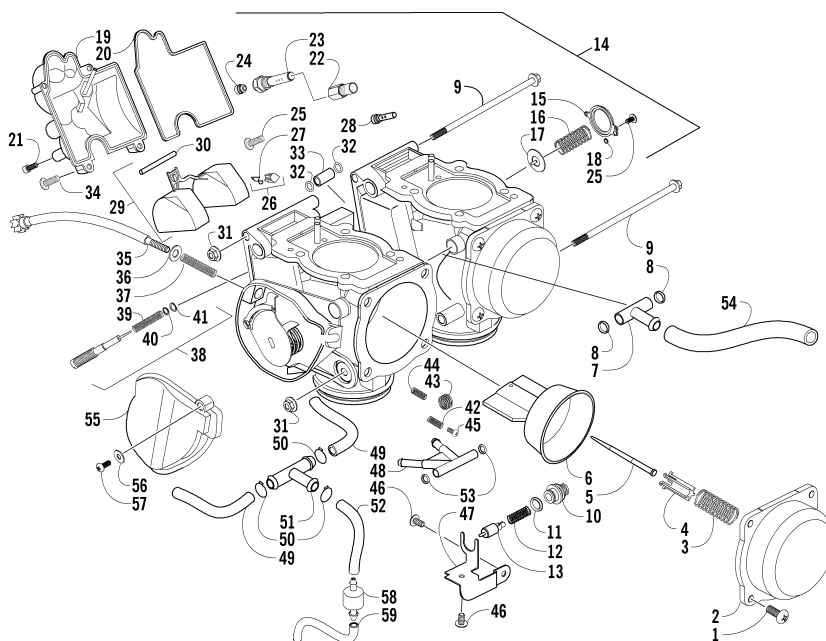


### KEY

- |                       |                        |
|-----------------------|------------------------|
| 1. Cover              | 25. Electric Choke     |
| 2. Screw              | 26. Choke Cover        |
| 3. Spring             | 27. U-Ring             |
| 4. Vacuum Piston      | 28. Diaphragm Assy     |
| 5. Spring Seat        | 29. Spring             |
| 6. Jet Needle         | 30. Cover              |
| 7. Needle Jet         | 31. Screw              |
| 8. Jet Holder         | 32. Float Chamber Assy |
| 9. Main Jet           | 33. O-Ring             |
| 10. Slow Jet          | 34. Drain Plug         |
| 11. Starter Jet       | 35. Spring             |
| 12. Float Valve       | 36. Diaphragm Assy     |
| 13. Clip              | 37. Pump Housing       |
| 14. Float Set         | 38. U-Ring             |
| 15. Float Pin         | 39. Screw              |
| 16. Pilot Screw       | 40. Screw              |
| 17. Spring            | 41. Throttle Cable     |
| 18. Washer            | 42. Cover              |
| 19. O-Ring            | 43. Screw              |
| 20. Idle Adjust Screw | 44. Vent Hose          |
| 21. Washer            |                        |
| 22. Spring            |                        |
| 23. Plate             |                        |
| 24. Screw             |                        |

0738-926

## 650 V-Twin (Keihin)



### KEY

- |                        |                       |
|------------------------|-----------------------|
| 1. Screw               | 30. Float Pin         |
| 2. Cover               | 31. Nut               |
| 3. Spring              | 32. O-Ring            |
| 4. Spring Seat         | 33. Fitting           |
| 5. Jet Needle          | 34. Screw             |
| 6. Piston              | 35. Idle Adjust Screw |
| 7. T-Fitting           | 36. Washer            |
| 8. O-Ring              | 37. Spring            |
| 9. Bolt                | 38. Pilot Screw Assy  |
| 10. Cap                | 39. Spring            |
| 11. O-Ring             | 40. Washer            |
| 12. Spring             | 41. O-Ring            |
| 13. Starter Valve      | 42. Spring            |
| 14. Float Chamber Assy | 43. Spring            |
| 15. Pump Cover         | 44. Spring            |
| 16. Spring             | 45. Stop Screw        |
| 17. Diaphragm Assy     | 46. Screw             |
| 18. O-Ring             | 47. Plate             |
| 19. Float Chamber      | 48. T-Fitting         |
| 20. O-Ring             | 49. Hose              |
| 21. Drain Plug         | 50. Clamp             |
| 22. Jet Holder         | 51. T-Fitting         |
| 23. Needle Jet         | 52. Hose              |
| 24. Main Jet           | 53. O-Ring            |
| 25. Screw              | 54. Hose              |
| 26. Needle Valve       | 55. Cover             |
| 27. Clip               | 56. Washer            |
| 28. Slow Jet           | 57. Machine Screw     |
| 29. Float Assy         | 58. Check Valve       |
|                        | 59. Hose              |

0739-201

4

## Carburetor (400/500/650 H1)

### **WARNING**

Whenever any maintenance or inspection is performed on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

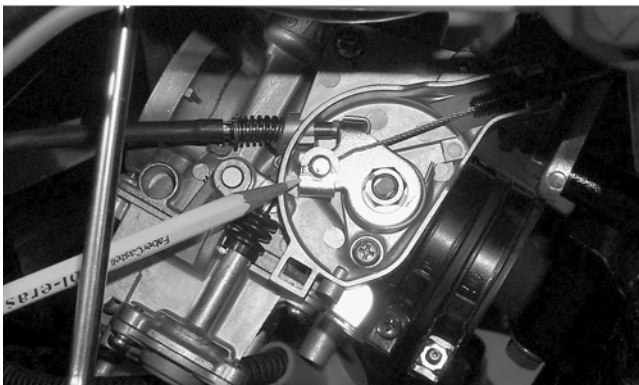
### REMOVING

1. If applicable, turn the gas tank valve to the OFF position.
2. Remove the seat.
3. As necessary to access the carburetor, remove the air-intake snorkel, the air cleaner housing cover, or the air cleaner housing.
4. Disconnect the hose from the carburetor to the gas tank.
5. Loosen the flange clamps; then remove the carburetor from the intake pipe.
6. Remove the screw securing the throttle actuator cover to the carburetor; then remove the cover.



CC743

7. Remove the throttle cable from the actuator arm.



CC742

8. Loosen the outer jam nut securing the throttle cable to the carburetor body; then route the cable out of the way.

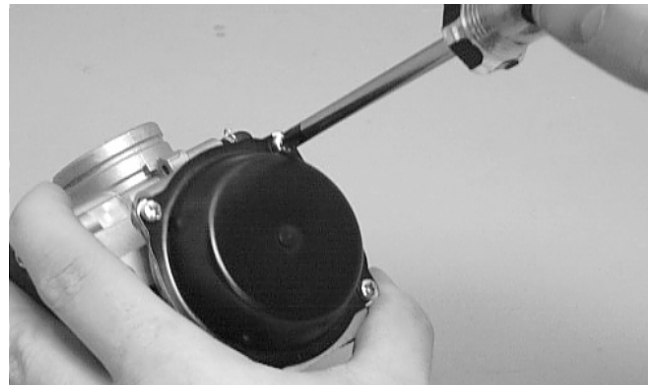


CC741

9. Disconnect the electric choke lead from the wiring harness.
10. Disconnect the vent hose; then remove the carburetor.

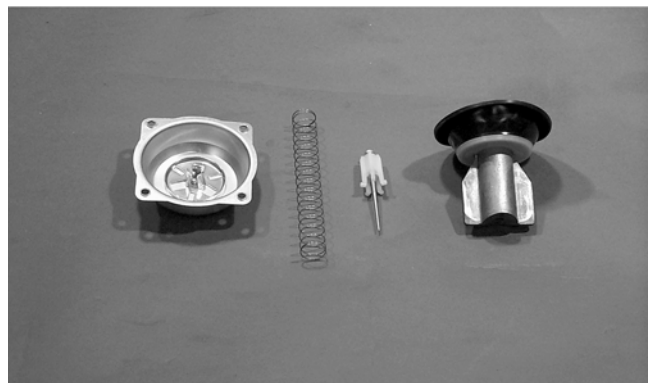
### DISASSEMBLING

1. Remove the four Phillips-head screws securing the top cover; then remove the cover.



CH015D

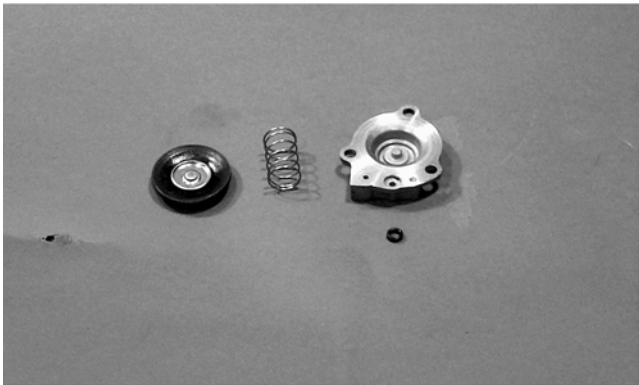
2. Remove the vacuum piston assembly from the carburetor body. Account for a spring, spring seat, and the jet needle.



CC746

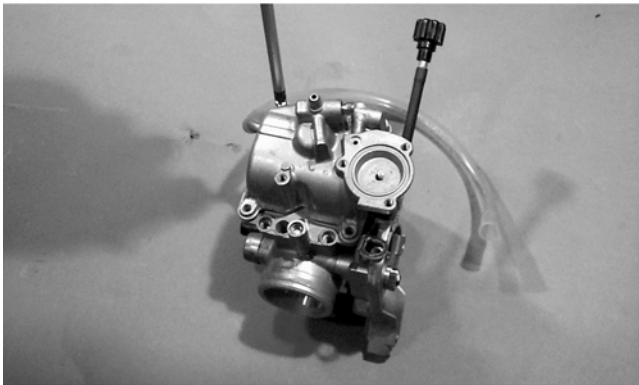


3. Remove the three screws securing the primer housing. Account for the diaphragm assembly, spring, and U-ring (in the housing).

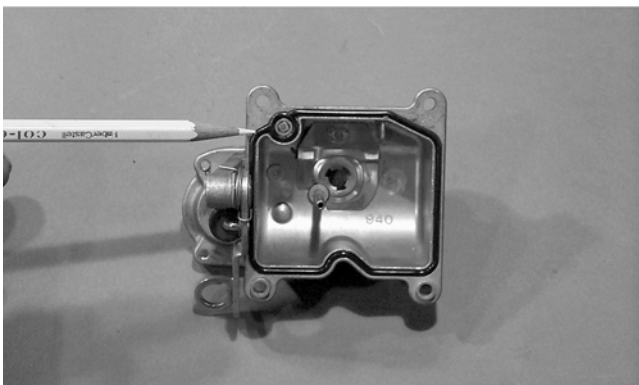


CC748

4. Remove the Phillips-head screws securing the float chamber; then remove the chamber. Account for the O-ring.

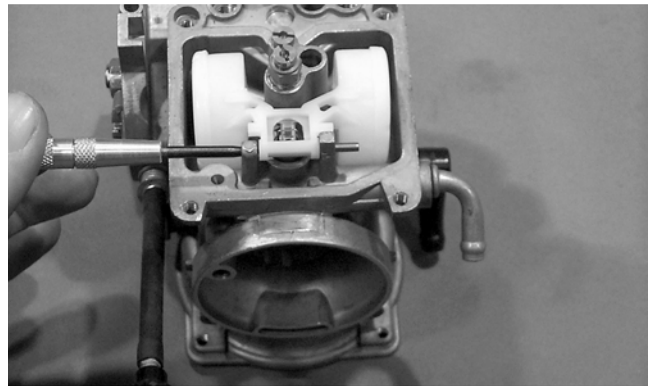


CC749



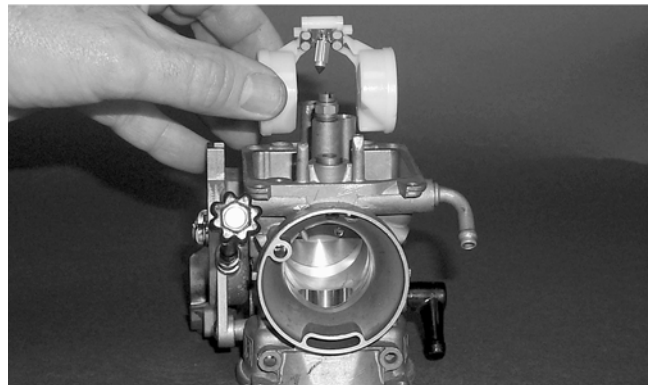
CC750

5. Remove the float pin.



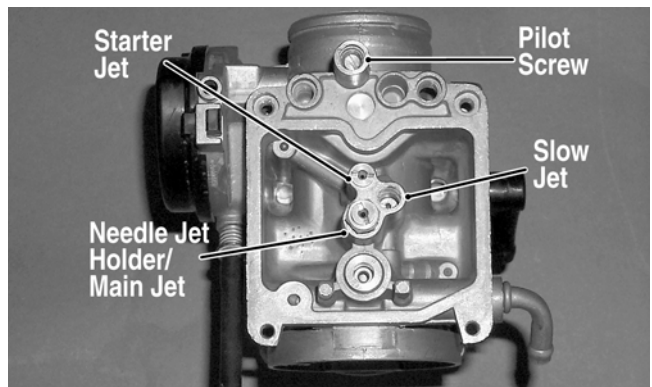
CC752

6. Lift the float assembly from the carburetor. Account for the float needle valve.



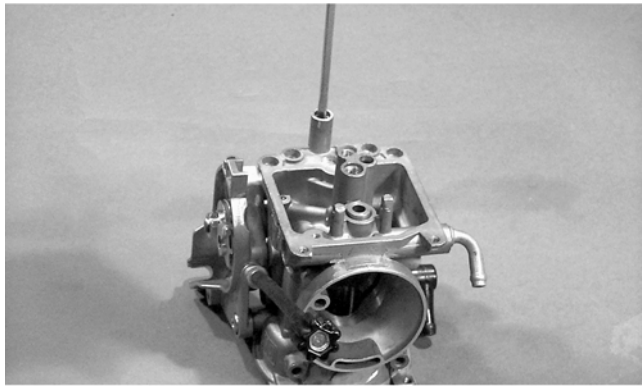
CC753

■ **NOTE:** Note the locations of the jets, pilot screw, and holder for disassembling procedures.



CC761A

7. Secure the needle jet holder with a wrench; then remove the main jet.
8. Remove the needle jet holder; then remove the slow jet and the starter jet.
9. Remove the pilot screw. Account for a spring, washer, and an O-ring.

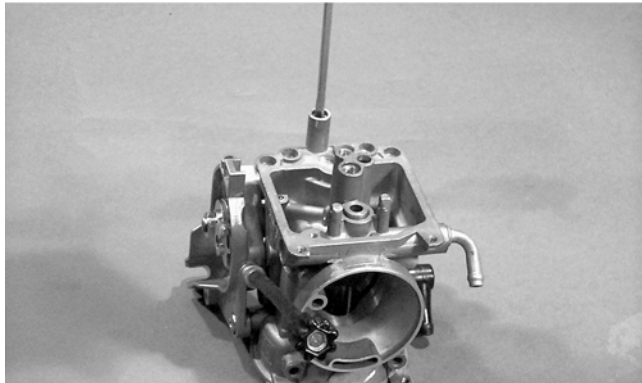


CC758

10. Unscrew and remove the idle speed adjuster assembly. Account for the spring and washer.

## ASSEMBLING

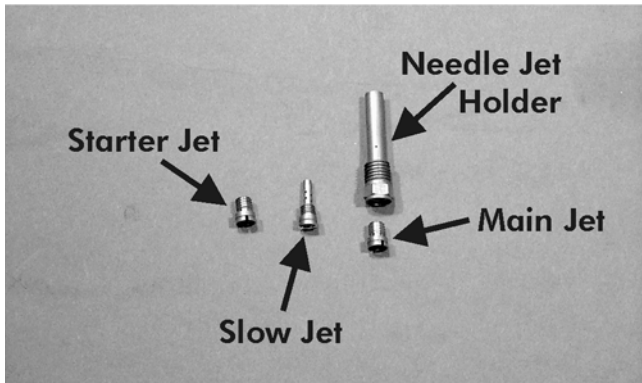
1. Screw the idle speed adjuster into the carburetor making sure the washer and spring are properly positioned.
2. Install the pilot screw, spring, washer, and O-ring.



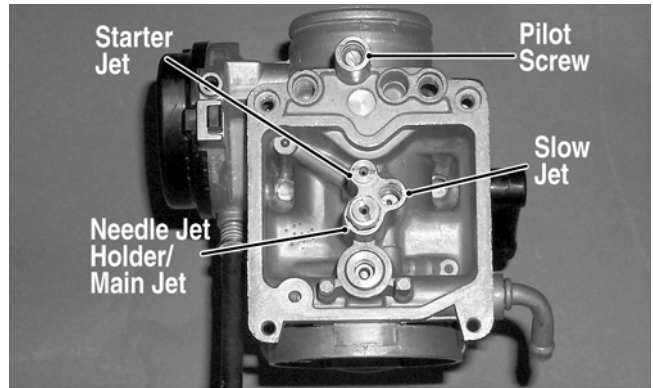
CC758

■ **NOTE:** Turn the pilot screw clockwise until it is lightly seated; then turn it counterclockwise the recommended number of turns as an initial setting.

■ **NOTE:** Note the locations of the jets and holder during assembling procedures.

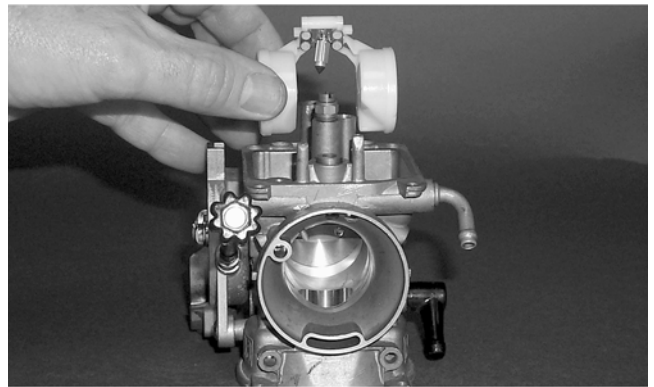


CC759A



CC761A

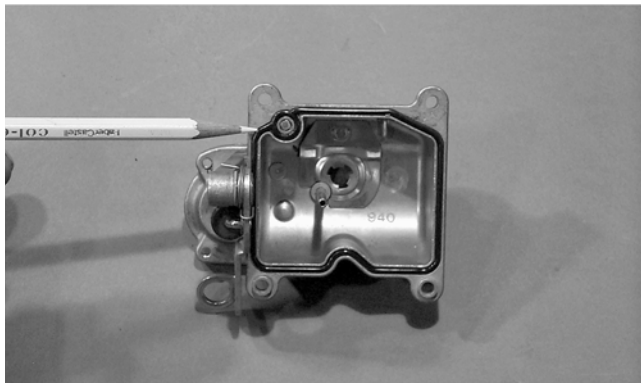
3. Install the slow jet. Tighten securely.
4. Install the main jet into the needle jet holder and tighten securely; then install the needle jet holder assembly into the carburetor and tighten securely.
5. Place the float assembly (with float needle valve) into position and secure to the carburetor with the float pin.



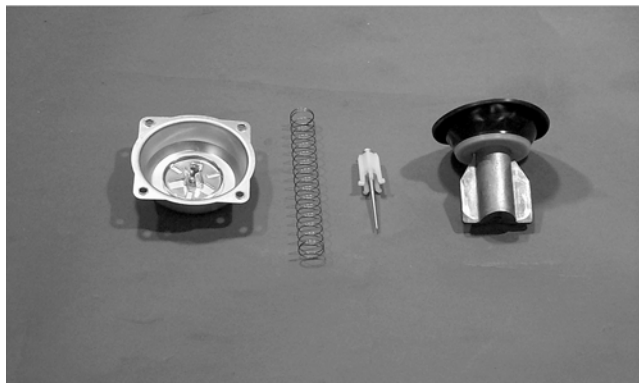
CC753

■ **NOTE:** Check float arm height by placing the carburetor on its side w/float contacting the needle; then measure with a caliper the height when the float arm is in contact with the needle valve. Float arm height should be 17 mm (0.7 in.).

6. Place the float chamber into position making sure the O-ring is properly positioned; then secure with the Phillips-head screws.

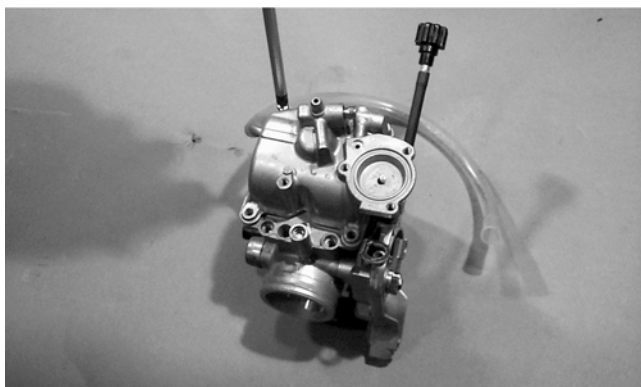


CC750



CC746

9. Place the top cover into position; then secure with the Phillips-head screws. Tighten securely.



CC749

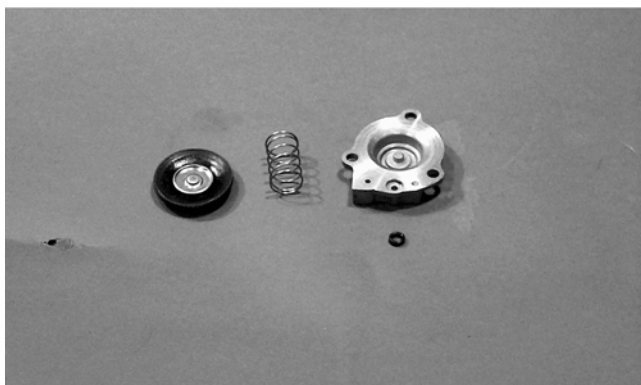
7. Place the U-ring into the primer housing. Position the spring and diaphragm assembly (lip toward the carburetor) onto the carburetor; then secure the assembly with the primer housing and three screws. Tighten securely.



CH015D

## INSTALLING

1. Connect the gas and vent hoses onto the carburetor.
2. Connect the electric choke lead to the wiring harness.



CC748

### ⚠ CAUTION

It is important to press down on the primer housing until it contacts the carburetor to make sure the diaphragm lip is properly seated in the groove in the carburetor. If the diaphragm is not properly seated, leakage will occur.

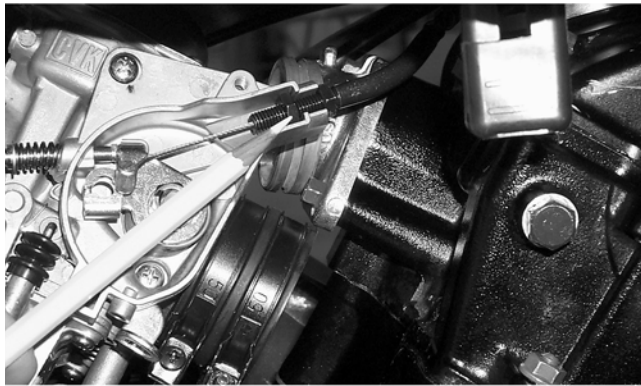
8. Place the jet needle, spring seat, and spring into the vacuum piston; then place the assembly down into the carburetor.



CC740A

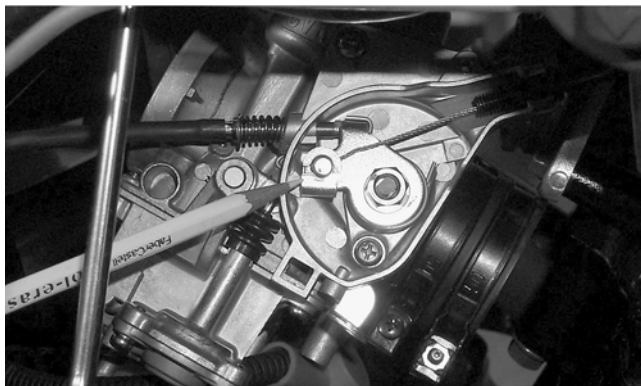
3. Place the throttle cable into position and secure by tightening the outer jam nut.





CC741

4. Connect the throttle cable to the actuator arm.



CC742

5. Place the throttle actuator cover into position on the carburetor; then secure with the screw.



CC743

6. Position the carburetor in the air cleaner boot and intake pipe assembly; then secure with the clamps.
7. Connect the hose at the gas tank valve connection.
8. As necessary, secure the air-intake snorkel, the air cleaner housing cover, or the air cleaner housing.
9. Install the seat; then (if applicable) turn the gas tank valve to the ON position.

## Carburetor (650 V-Twin)

### **WARNING**

Whenever any maintenance or inspection is performed on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

### **TROUBLESHOOTING**

1. Drain float bowls into a clean, clear container. Look for rust particles, water droplets, or other contamination.
2. Momentarily turn the ignition switch to the ON position. Fuel should resume flowing indicating fuel supply to the carburetors is normal.

### **CAUTION**

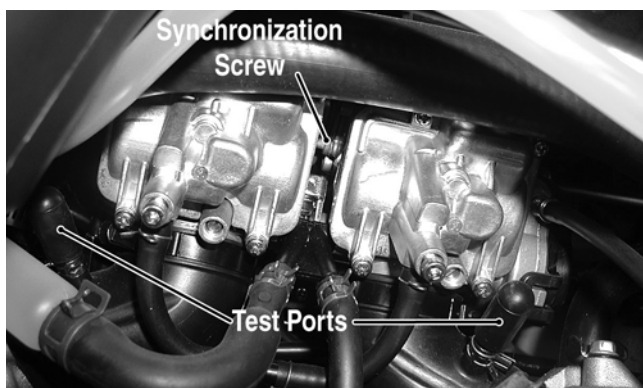
Do not leave ignition switch on as fuel will be pumped to the carburetors and a spill could occur.

3. Dispose of the drained fuel properly; then move the ATV outside or to a properly ventilated engine run area.
4. Start the engine and warm up to operating temperature; then attach a tachometer and adjust the idle RPM to 1050-1150 RPM. Turn the handlebar full left and full right. If RPM changes, check for throttle cable adjustment or improper routing.
5. Rock carburetors from side to side and note RPM. Air leaks will cause RPM to increase. Tighten all clamps, boots, and hoses. Inspect for cracks.
6. Check the air filter housing and air filter for water, fuel, dirt, or other contamination. Wash or replace if necessary.
7. Check pilot adjustment by turning pilot screws in until lightly seated; then back out 2 1/4 turns. If no change in RPM is noted as the screws are turned in, check for an air leak between the carburetor and the cylinder head.



KX025E

8. Check for proper carburetor synchronization by attaching suitable vacuum gauges to the test ports; then start the engine and increase the RPM above idle. The gauges should read within 2 cm/Hg (0.78 in./Hg) of each other. Turn the synchronization screw to equalize vacuum.



KX025C

■ **NOTE:** Idle RPM must be reset any time the synchronization screw is adjusted.

## REMOVING

1. Turn the ignition switch to the OFF position; then remove the ignition switch key.

### **WARNING**

Do not turn the ignition switch to the ON position with the hoses removed. Gasoline will be pumped by the electric fuel pump causing a safety hazard.

2. Remove the seat; then drain the coolant.
3. Remove the storage compartment cover and air filter housing cover; then remove the air filter.
4. Disconnect the gas hoses from the carburetors.

5. Remove the screws securing the lower air filter housing to the carburetors; then remove the lower housing and tape over the carburetor inlets.

### **CAUTION**

Severe engine damage will occur if hardware items or other foreign objects are ingested by the engine on start-up.



KX118



CKX119

6. Remove the screw securing the throttle actuator cover to the front carburetor; then remove the cover.

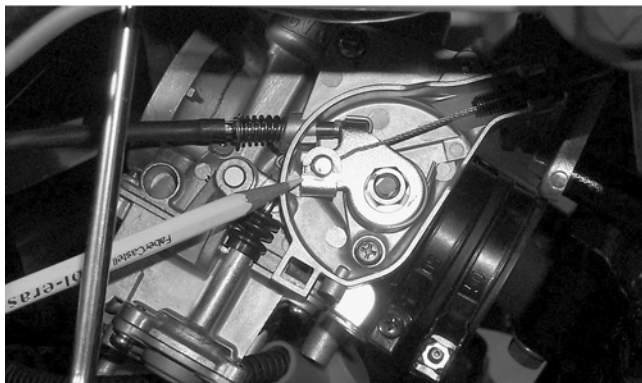


KX136

7. Remove the throttle cable from the actuator arm.

4





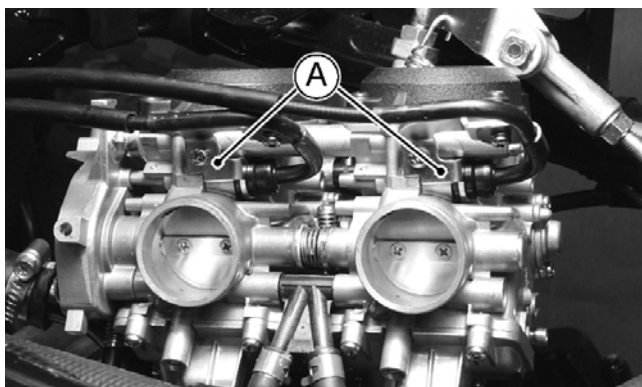
CC742

8. Loosen the outer jam nut securing the throttle cable to the carburetor body; then route the cable out of the way.



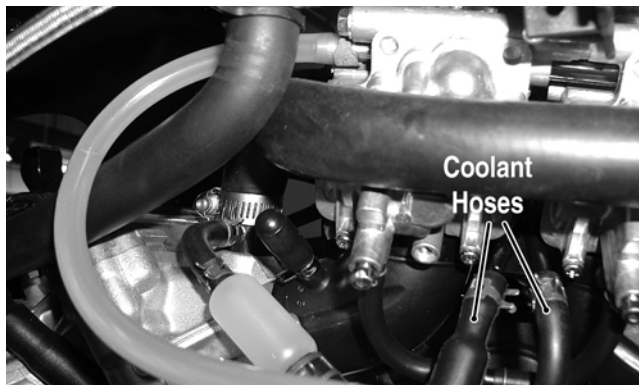
KX137

9. Remove the Phillips-head screws holding the cable end plates (A); then pull out the starter plungers and set aside.



KX367

10. Disconnect the coolant hoses, breather tubes, and intake tubes; then remove the carburetors.



KX086B

11. Use tape to cover and seal the intake tubes.



KX122

### CAUTION

Any objects or liquid entering the intake tubes will fall into the engine causing severe damage if the engine is turned over or started.

## ADJUSTING FLOAT HEIGHT

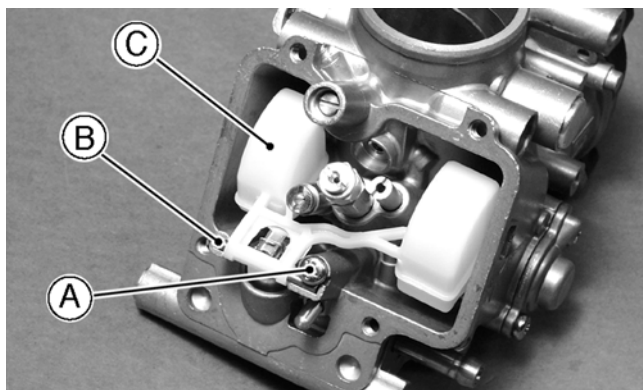
1. Drain all fuel from the carburetors; then remove the screws securing the float chamber and remove the float chamber. Account for four screws and one O-ring gasket.

### WARNING

Whenever any maintenance or inspection is made on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

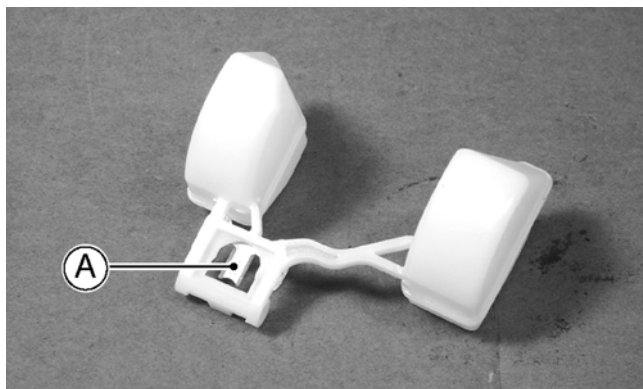
2. Remove the set screw (A); then slide the pivot pin (B) out and remove the float (C).





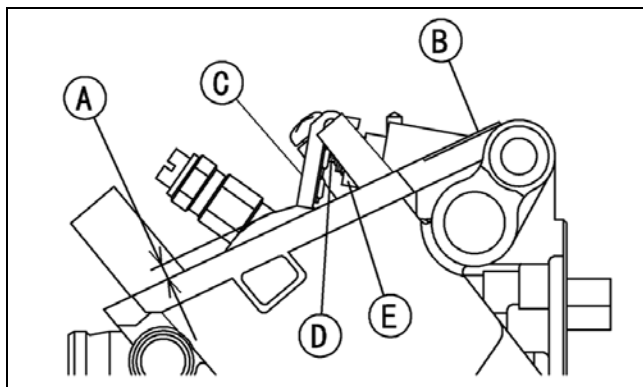
KX368

3. Bend the float valve contact tab (A) slightly to adjust float height.



KX369

4. Measure the float height (A) from the float chamber mating surface (B) by tilting the carburetor so the float valve contact tab (C) just touches the float valve rod (D). The float valve spring (E) must not be compressed. Float height should be 4 mm (0.16 in.).



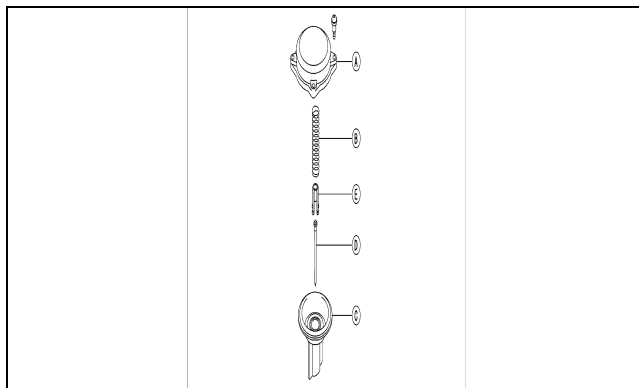
ATV2108

■ **NOTE:** Increasing the float height lowers the fuel level, and decreasing the float height raises the fuel level.

## DISASSEMBLING

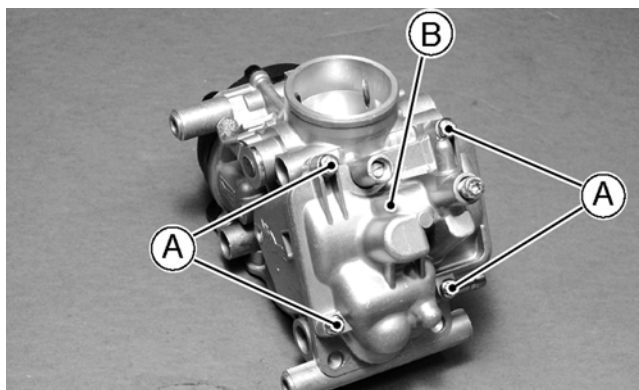
■ **NOTE:** The carburetors do not have to be separated to disassemble.

1. Remove the vacuum chamber cover (A), spring (B), and vacuum piston (C); then remove the jet needle (D) and spring seat (E) from the vacuum piston.



ATV2109

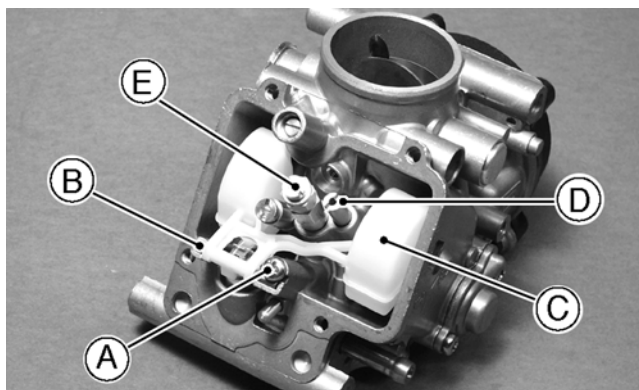
2. Remove the four screws (A) securing the float chamber (B); then remove the float chamber. Account for the O-ring seal.



KX370

■ **NOTE:** Do not remove the pilot screws unless idle problems have been encountered. If pilot screws are removed, the carburetors will have to be synchronized after installation (see Troubleshooting sub-section in this section).

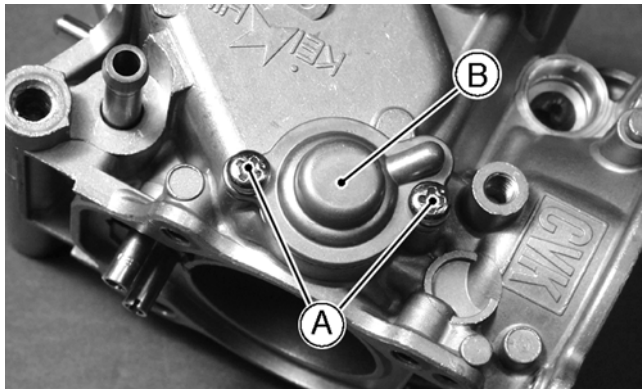
3. Remove set screw (A); then remove the float pivot pin (B), float (C), needle valve, slow jet (D), and main jet (E).



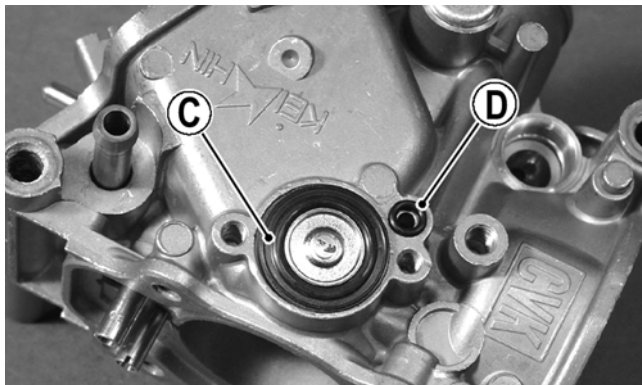
KX371

4

- Remove the screws (A) and pump cover (B) from the carburetor body; then remove the diaphragm (C) and O-ring (D).



KX372



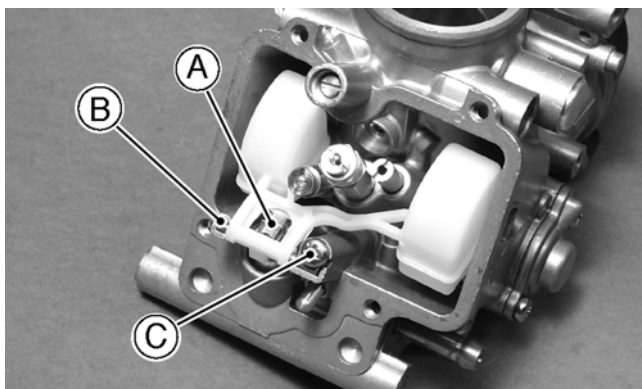
KX373A

## ASSEMBLING

### CAUTION

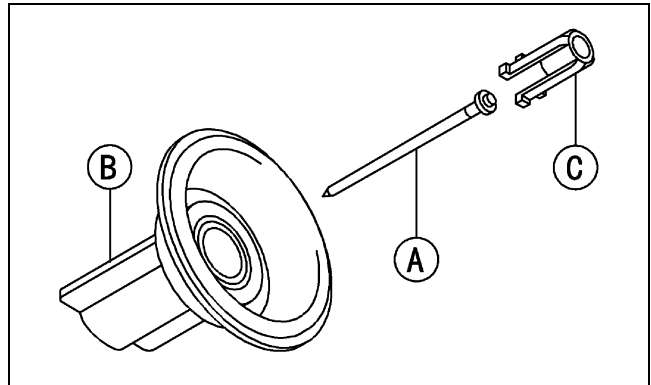
**Do not force or overtighten carburetor jets and fittings. Damage to the jets or carburetor could occur.**

- Install the needle valve into the valve seat and engage and hook the needle hanger (A) onto the float tab; then insert the float pivot pin (B) into the pivot post and tighten the set screw (C).



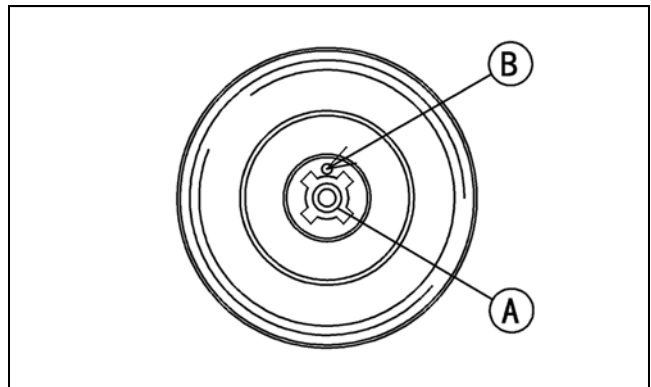
KX374

- Install the main jet and slow jet.
- Insert the jet needle (A) into the vacuum piston (B); then install the spring seat (C) over the needle.



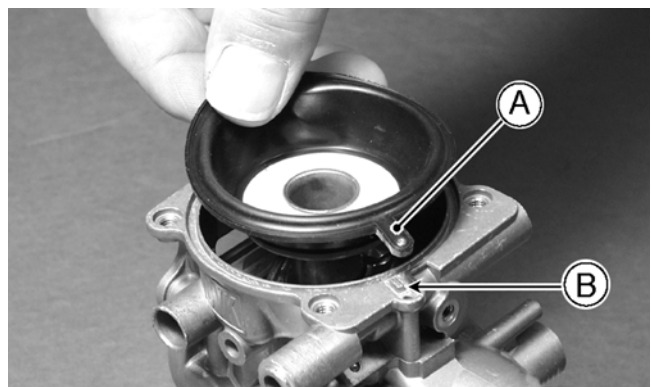
ATV2110

- Turn the spring seat (A) so it does not block the vent hole (B).



ATV2111

- Install the piston into the carburetor body and engage the tab (A) of the diaphragm into the recess (B); then install the spring and vacuum chamber cover. Secure with four screws.

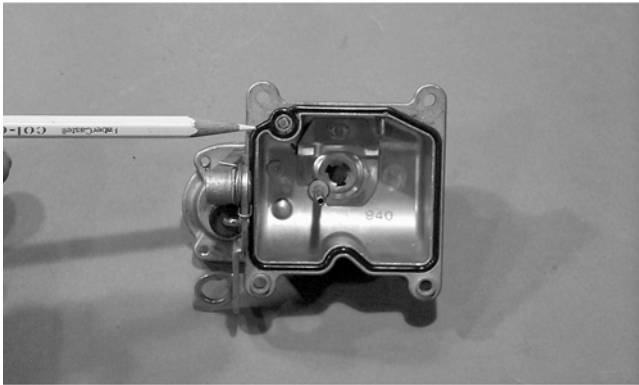


KX375

- Install the pump diaphragm and O-ring; then install the pump cover and secure with two screws.

■ **NOTE:** Check/adjust float height (see **Adjusting Float Height** sub-section in this section). Float arm height should be 4 mm (0.16 in.).

7. Place the float chamber into position making sure the O-ring is properly positioned; then secure with Phillips-head screws.



CC750

## INSTALLING

1. Lay the carburetors on top of the engine; then install the starter plungers and secure with the retainer screws.
2. Connect vent lines; then connect the coolant hoses and secure with appropriate clamps.
3. Remove the tape or covers from the intake tubes and insert the carburetor into the intake tubes making sure they seat properly; then tighten the clamps securely.
4. Connect the throttle cable to the throttle actuator arm; then install the cable into the anchor housing and tighten the nuts securely.
5. Install the actuator housing cover and secure with the screws.
6. Connect the gas hose to the fuel pump; then connect the carburetor float chamber drains and route outlet hose behind engine.
7. Install the air filter housing onto the carburetors and secure with eight cap screws; then install the air filter, filter housing cover, and storage compartment cover.
8. Pour the appropriate amount of coolant into the cooling system; then check for leaks.
9. Check for proper throttle cable and choke cable free-play. Adjust as necessary.
10. Turn the ignition switch to the ON position; then check the gas hose connections, float chamber seals, and chamber vents for leaks.

## Cleaning and Inspecting Carburetor

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

### ⚠ WARNING

When drying components with compressed air, always wear safety glasses.

### ⚠ CAUTION

**DO NOT** place any non-metallic components in parts-cleaning solvent because damage or deterioration will result.

1. Place all metallic components in a wire basket and submerge in carburetor cleaner.
2. Soak for 30 minutes; then rinse with fresh parts-cleaning solvent.
3. Wash all non-metallic components with soap and water. Rinse thoroughly.
4. Dry all components with compressed air only making sure all holes, orifices, and channels are unobstructed.
5. Inspect the carburetor body for cracks, nicks, stripped threads, and any other imperfections in the casting.
6. Inspect the vacuum piston/diaphragm for cracks, imperfections in the casting, or cracks and tears in the rubber.
7. Inspect float for damage.
8. Inspect gasket and O-rings for distortion, tears, or noticeable damage.
9. Inspect tips of the jet needle, pilot screw, and the inlet needle valve for wear, damage, or distortion.
10. Inspect the slow jet and main jet for obstructions or damage.

■ **NOTE:** If the slow jet is obstructed, the mixture will be extremely lean at idle and part-throttle operation.

11. Inspect the plunger assembly/starter valve and seat for wear or damage.



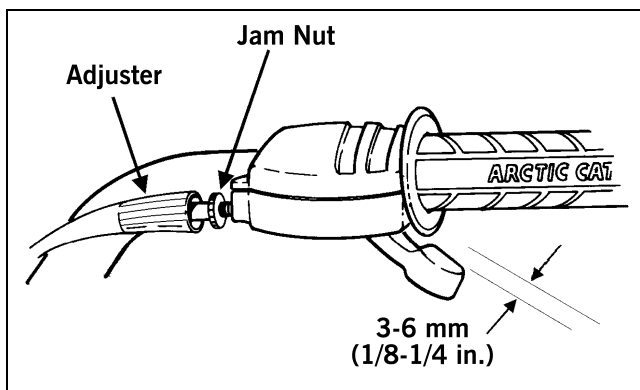
12. Inspect the carburetor mounting flange for damage and tightness.

---

## Throttle Cable Free-Play

---

1. Check throttle cable free-play at the lever; free-play should be as specified.
2. To adjust, slide the rubber boot away from the adjuster located near the throttle lever. Loosen the jam nut and rotate the adjuster in the appropriate direction until proper free-play is attained. Tighten the jam nut against the adjuster; then slide the rubber boot over the adjuster.



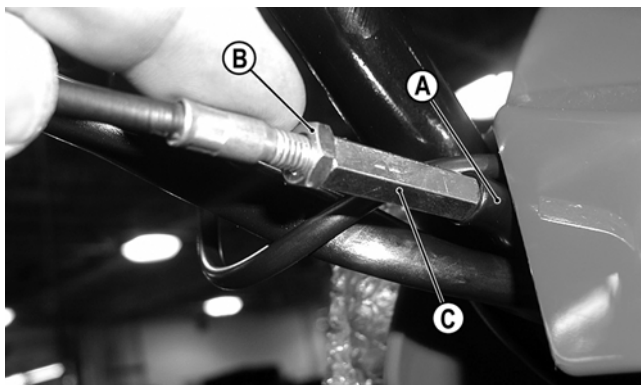
ATV-0047

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## Choke Cable Free-Play (650 V-Twin)

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1. Locate the choke cable adjuster between the choke lever and the gauge pod; then slide the protective sleeve (A) off the adjuster toward the pod.



CD560A

2. Loosen the jam nut (B); then rotate the adjuster (C) to obtain the specified cable free-play at the adjuster.
3. Tighten the jam nut securely; then slide the protective sleeve into place over the adjuster.

■ **NOTE:** The cables are not adjustable at the carburetors.

---

## Engine RPM (Idle)

---

To properly adjust the idle RPM, a tachometer is necessary.

To adjust idle RPM, use the following procedure.

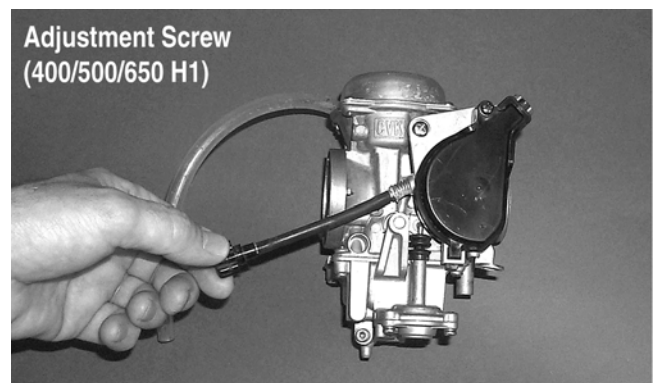
■ **NOTE:** The idle adjustment screw is located on the right-hand side of the carburetor.

1. Start the engine and warm it up to operating temperature.
2. Turn the idle adjustment screw clockwise or counterclockwise until the engine idles at recommended RPM.

### **WARNING**

**Adjust the idle to the correct RPM. Make sure the engine is fully warm before adjusting the idle RPM.**

| Engine Idle RPM |           |
|-----------------|-----------|
| 400/500/650 H1  | 1250-1350 |
| 650 V-Twin      | 1050-1150 |

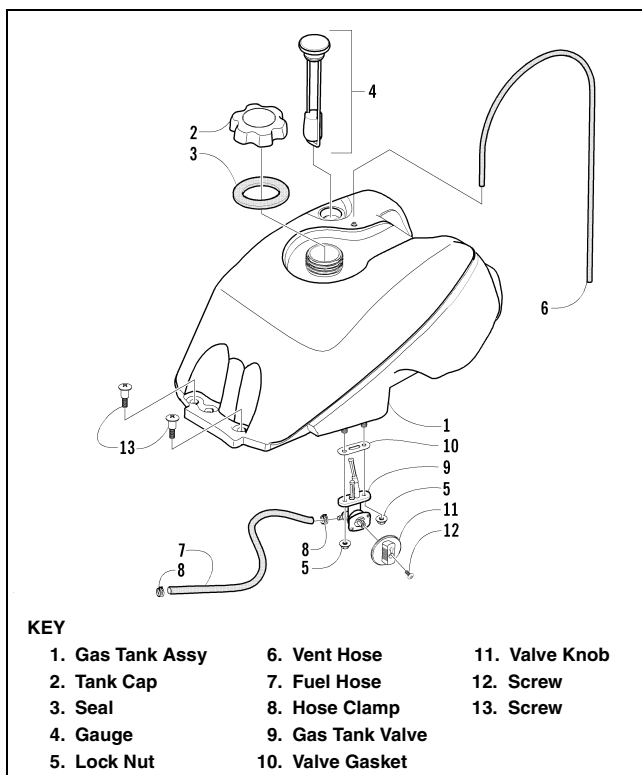


AF920C



KX029A

## Gas Tank (400 VP)



0736-991

### **⚠ WARNING**

Whenever any maintenance or inspection is made on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

### REMOVING

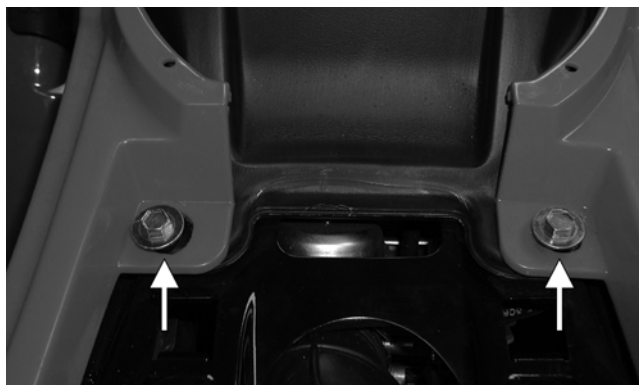
1. Turn the gas tank valve to the OFF position.

2. Remove the seat; then remove the reinstallable rivets securing the steering post cover and the gas tank cover. Remove the covers.
3. Remove the air cleaner housing cover.



4. Disconnect the hose from the carburetor to the gas tank at the tank connection.
5. Cut the tie-down securing the gas hose to the cables and hoses.
6. Remove the two cap screws securing the gas tank to the frame.

**4**



CF201A

7. Remove the vent hose; then spread the plastic body panels sufficiently and remove the gas tank.

### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all gas tank components with parts-cleaning solvent.
2. Inspect all hoses for cracks or leaks.
3. Inspect gas tank valve, tank cap, and tank for leaks, holes, and damaged threads.
4. Inspect the gas gauge for proper operation.

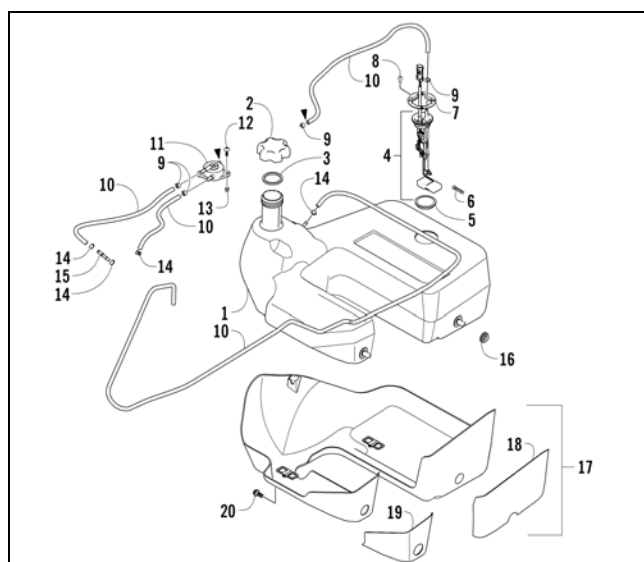
## INSTALLING

1. Place the gas tank into position on the frame; then install the two cap screws. Tighten securely.
2. Connect the gas hose from the carburetor; then secure hose to cables and hoses with a cable tie.
3. Install the air cleaner housing cover.
4. Install the vent hose; then fill the gas tank with gasoline.
5. Turn the gas tank valve to the ON position and inspect for leakage.
6. Install the seat.

---

### Gas Tank (FIS Models)

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#### KEY

- |                   |                   |               |
|-------------------|-------------------|---------------|
| 1. Gas Tank       | 8. Screw          | 15. Fitting   |
| 2. Tank Cap       | 9. Hose Clamp     | 16. Grommet   |
| 3. Gasket         | 10. Hose          | 17. Shield    |
| 4. Sender         | 11. Fuel Pump     | 18. Shield    |
| 5. Seal           | 12. Machine Screw | 19. Shield    |
| 6. Filter         | 13. Lock Nut      | 20. Cap Screw |
| 7. Mounting Plate | 14. Hose Clamp    |               |

0739-695

## ⚠ WARNING

Whenever any maintenance or inspection is made on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

## REMOVING

1. Remove the seat.
2. Remove the rear rack and fenders (see Section 8).
3. Disconnect the hose(s) from the fuel pump to the carburetor(s).
4. Remove the cap screws securing the gas tank to the frame.
5. Disconnect the fuel gauge connector; then remove the gas tank.

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all gas tank components with parts-cleaning solvent.
2. Inspect all hoses for cracks or leaks.
3. Inspect tank cap and tank for leaks, holes, and damaged threads.

## INSTALLING

1. Place the gas tank into position in the frame; then install the cap screws. Tighten securely.
2. Connect the gas hose(s) from the carburetor(s); then connect the fuel gauge connector.
3. Install the vent hose; then fill the gas tank with gasoline.
4. Turn the ignition switch to the ON position (650 V-Twin) or start the engine (on other models) and inspect for leakage.
5. Install the rear fenders and rack (see Section 8); then install the seat making sure it latches securely.

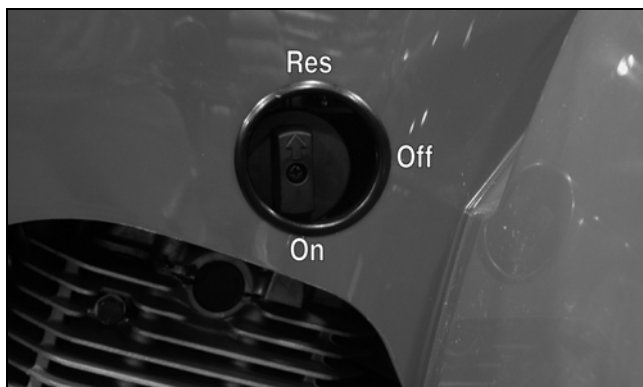
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### Gas Tank Valve (400 VP)

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The ATV has a valve incorporated into the gas tank. There are three positions: ON, RES, and OFF.





CF131A

In the OFF position, the valve will not allow gasoline to flow to the carburetor. In the ON position (the normal operating position), gasoline will flow from the tank to the carburetor. In this position 2.46 l (0.65 U.S. gal.) will remain in the tank as a reserve quantity. Moving the valve to the RES position will allow the operator to use the remaining gasoline in the tank. When turning the valve to any of the three positions, be sure the indicator is pointed directly at the position desired.

## REMOVING/INSPECTING

### **WARNING**

**Drain the gas tank prior to this procedure.**

1. Remove the gas hose from the valve by releasing the spring clamp.
2. Remove the two nuts securing the valve; then remove the valve. Account for the gasket.
3. Inspect the gasket and valve/tank mating surfaces for damage or deterioration.
4. Inspect for and remove any obstructions in the valve.

## INSTALLING

1. Place the valve and gasket into position on the tank and secure with the nuts. Tighten to specifications.
2. Install the gas hose onto the valve with the spring clamp.

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## Gas/Vent Hoses

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Replace the gas hose every two years. Damage from aging may not always be visible. Do not bend or obstruct the routing of the carburetor vent hose. Make certain that the vent hose is securely connected to the carburetor and the opposite end is always open.

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## Electric Fuel Pump (650 V-Twin)

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The electric fuel pump and fuel level sensor are a non-serviceable assembly. If either fails, the fuel pump assembly must be replaced.

■ **NOTE:** For testing the fuel pump, see **Testing Electric Fuel Pump** in this section.

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## Vacuum Pulse Fuel Pump (400 FIS/500/650 H1)

---

The vacuum pulse fuel pump is a non-serviceable assembly. If the pump fails, it must be replaced.

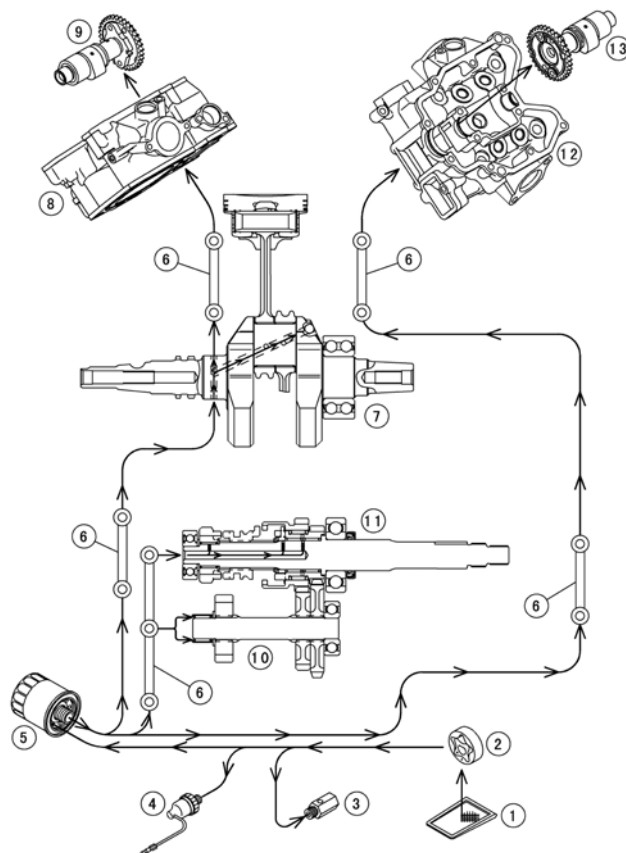
**4**



## 650 V-Twin

### KEY

1. Oil Screen
2. Oil Pump
3. Relief Valve
4. Oil Pressure Switch
5. Oil Filter
6. Oil Pipe
7. Crankshaft
8. Rear Cylinder Head
9. Rear Camshaft
10. Transmission Idle Shaft
11. Transmission Driveshaft
12. Front Cylinder Head
13. Front Camshaft



ATV2112

4

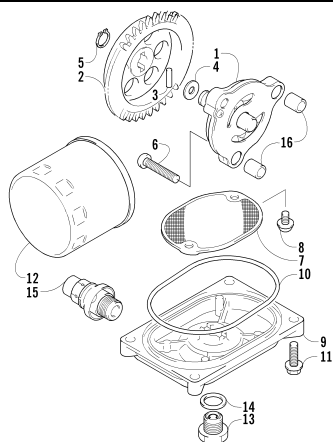
## Oil Filter/Oil Pump

■ **NOTE:** Whenever internal engine components wear excessively or break and whenever oil is contaminated, the oil pump should be disassembled, cleaned and inspected, and serviced as necessary.

### 400

#### KEY

1. Oil Pump
2. Driven Gear
3. Pin
4. Washer
5. Circlip
6. Cap Screw
7. Strainer
8. Cap Screw
9. Cap
10. O-Ring
11. Cap Screw
12. Filter
13. Drain Plug
14. Gasket
15. Oil Relief Valve Assy
16. Pin

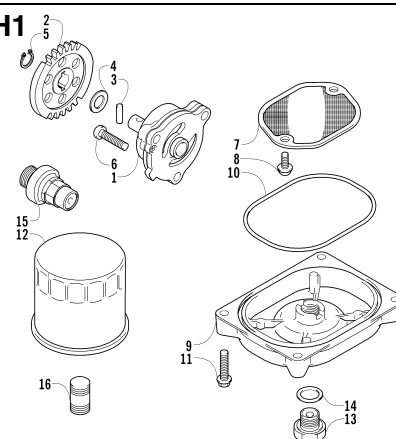


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### 500/650 H1

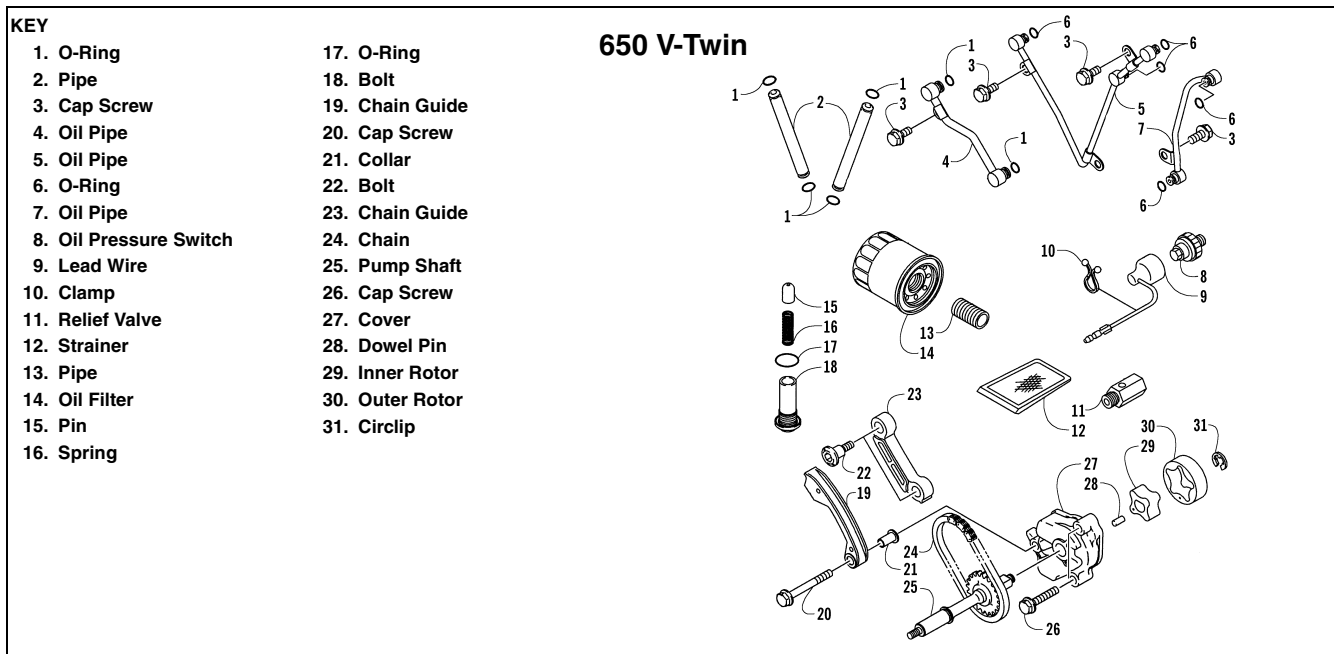
#### KEY

1. Oil Pump
2. Driven Gear
3. Pin
4. Washer
5. Circlip
6. Cap Screw
7. Strainer
8. Cap Screw
9. Cap
10. O-Ring
11. Cap Screw
12. Filter
13. Drain Plug
14. Gasket
15. Oil Relief Valve Assy
16. Oil Filter Union



0738-289





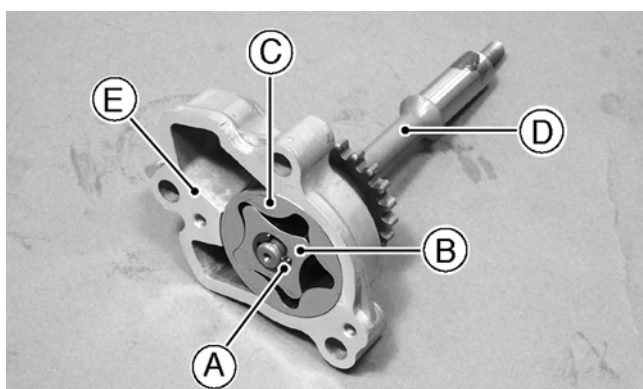
0739-012

## REMOVING/DISASSEMBLING (400/500/650 H1)

1. Remove the oil pump from the engine (see Right-Side Components in Section 3).
2. Remove the Phillips-head screw on the back side of the pump and separate the pump housing and cover. Note the position of the inner and outer rotors and alignment pin for assembly.
3. Remove oil pump components.

## REMOVING/DISASSEMBLING (650 V-Twin)

1. Remove the oil pump from the engine (see Left-Side Components in Section 3).
2. Remove the circlip (A) on the driveshaft; then remove the inner rotor (B), outer rotor (C), oil pump driveshaft (D), and the oil pump housing (E).



KX376

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all oil-pump components.
2. Inspect the rotors for scoring and gouges.
3. Inspect the alignment pin, driveshaft, and driven sprocket for damage.
4. Inspect the pump housing and cover for cracks or damage.

## ASSEMBLING/INSTALLING (400/500/650 H1)

1. Place the rotors into the pump housing making sure the alignment pin is in the groove of the rotor.
2. Place the cover onto the pump housing.
3. Secure the pump with the Phillips-head screw coated with red Loctite #271.
4. Install the oil pump into the engine (see Right-Side Components in Section 3).

## ASSEMBLING/INSTALLING (650 V-Twin)

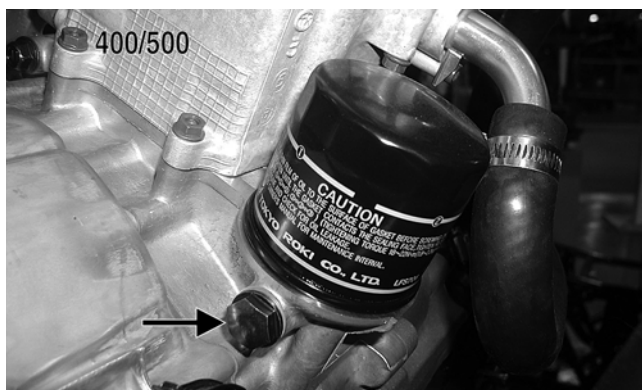
1. Place the shaft into the pump housing; then install the inner and outer rotors and secure with a circlip.

2. Install the oil pump into the engine (see Left-Side Components in Section 3).

## Testing Oil Pump Pressure

■ **NOTE:** The engine must be warmed up to the specified temperature for this test.

1. Connect the Arctic Cat Engine Tachometer (p/n 0644-275) to the engine.
2. Connect the Oil Pressure Gauge (p/n 0444-039) to the oil filter drain plug (400/500), in the oil pressure switch port (650 V-Twin), or to the upper oil cooler hose at the engine (650 H1).



CD457B



PR265B

■ **NOTE:** Some oil seepage may occur when installing the oil pressure gauge. Wipe up oil residue with a cloth.

3. Start the engine and run at the specified RPM.

4. The oil pressure gauge must read as specified.

| 400 (Manual Transmission)      |
|--------------------------------|
| OIL PRESSURE @ 3000 RPM        |
| 0.6-1.0 kg/cm <sup>2</sup>     |
| (9-14 psi)                     |
| Oil Temperature - 60°C (140°F) |

| 400 (Automatic Transmission)   |
|--------------------------------|
| OIL PRESSURE @ 3000 RPM        |
| 1.1-1.5 kg/cm <sup>2</sup>     |
| (16-21 psi)                    |
| Oil Temperature - 60°C (140°F) |

| 500 (Manual Transmission)      |
|--------------------------------|
| OIL PRESSURE @ 3000 RPM        |
| 1.2-1.6 kg/cm <sup>2</sup>     |
| (17-23 psi)                    |
| Oil Temperature - 60°C (140°F) |

| 500 (Automatic Transmission)   |
|--------------------------------|
| OIL PRESSURE @ 3000 RPM        |
| 1.3-1.7 kg/cm <sup>2</sup>     |
| (18-24 psi)                    |
| Oil Temperature - 60°C (140°F) |

| 650 H1                                    |
|-------------------------------------------|
| OIL PRESSURE @ 3000 RPM (From Oil Cooler) |
| 1.40-2.46 kg/cm <sup>2</sup>              |
| (15-25 psi)                               |
| Oil Temperature - 60°C (140°F)            |

| 650 V-Twin                      |
|---------------------------------|
| OIL PRESSURE @ 4500 RPM         |
| 4.6-5.3 kg/cm <sup>2</sup>      |
| (65-75 psi)                     |
| Oil Temperature - 110°C (230°F) |

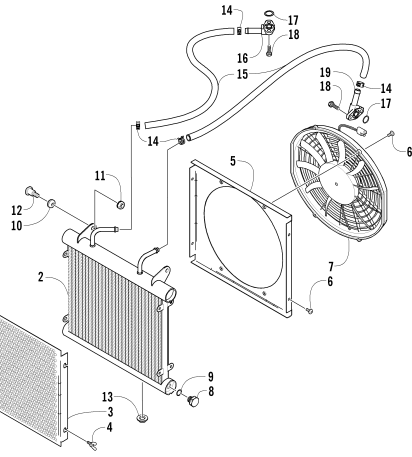
■ **NOTE:** If the oil pressure is lower than specified, check for an oil leak, damaged oil seal, defective oil pump, or restricted oil cooler.

■ **NOTE:** If the oil pressure is higher than specified, check for too heavy engine oil weight (see Section 2), clogged oil passage, clogged oil filter, or improper installation of the oil filter.

## Oil Cooler (400)

### KEY

1. Oil Cooler Assy
2. Oil Cooler
3. Screen
4. Thumb Screw
5. Shroud
6. Machine Screw
7. Fan
8. Drain Plug
9. O-Ring
10. Grommet
11. Nut w/Washer
12. Shoulder Screw
13. Bushing
14. Clamp
15. Hose
16. Fitting
17. O-Ring
18. Cap Screw
19. Fitting



0739-573

### REMOVING

■ **NOTE:** It is not necessary to drain the engine oil for this procedure.

1. Remove the input and output hoses from the fittings on the cooler.

### CAUTION

**Elevate and secure the hoses to avoid oil spillage.**

2. Remove the cap screws securing the oil cooler to the frame. Account for grommets.



AL651D

3. Remove the oil cooler from the frame.

### INSTALLING

1. Place the cooler into position in the frame.
2. Secure the cooler to the frame with the cap screws and grommets.



AL651D

3. Install the hoses onto their respective fittings and secure with the clamps.

## Oil Cooler (650 H1)

### REMOVING

1. Disconnect the oil hoses from the oil cooler located on the back of the radiator.
2. Remove the radiator (see Radiator) in this section.
3. Remove the fan and fan shroud; then separate the oil cooler from the radiator.

### INSTALLING

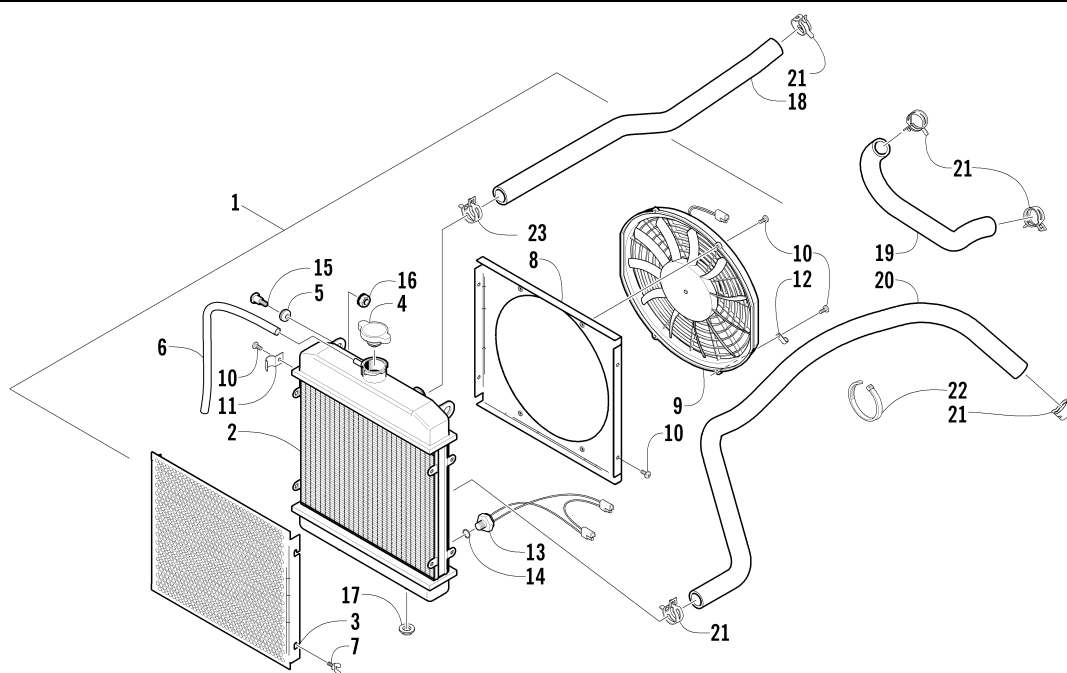
1. Place the oil cooler into position on the radiator and secure with the retainer brackets; then install the fan shroud and fan.
2. Install the radiator (see Radiator) in this section.
3. Connect the oil hoses to the oil cooler and tighten the clamps securely.
4. Warm up the engine and check for leaks; then shut off the engine and check for the proper oil level on the oil level stick. Add sufficient amount of oil to raise the level above the lower level mark.



# Liquid Cooling System (500/650 H1/650 V-Twin)

## KEY

1. Radiator Assy
2. Radiator
3. Radiator Screen
4. Radiator Cap
5. Grommet
6. Vent Hose
7. Thumb Screw
8. Fan Shroud
9. Fan
10. Machine Screw
11. Clamp
12. Clamp
13. Temperature Sender
14. O-Ring
15. Shoulder Screw
16. Nut w/Washer
17. Stem Bushing
18. Coolant Hose
19. Coolant Hose
20. Coolant Hose
21. Hose Clamp
22. Cable Tie



0739-654

The cooling system should be inspected daily for leakage and damage. Also, the coolant level should be checked periodically.

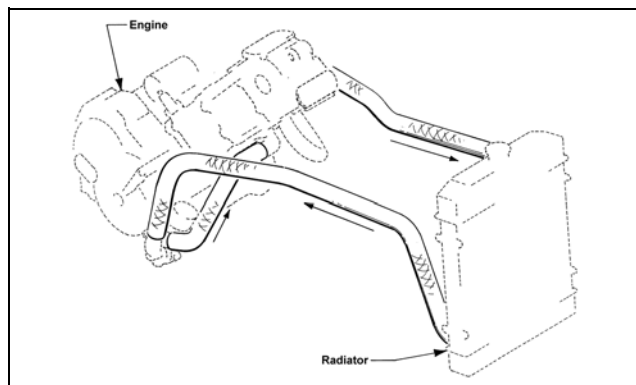
When filling the cooling system, use premixed Arctic Cat Antifreeze (p/n 0638-395). While the cooling system is being filled, air pockets may develop; therefore, run the engine for five minutes after the initial fill, shut the engine off, and then fill the cooling system to the bottom of the stand pipe in the radiator neck.



## CAUTION

After operating the ATV for the initial 5-10 minutes, stop the engine, allow the engine to cool down, and check the coolant level. Add coolant as necessary.

## Radiator

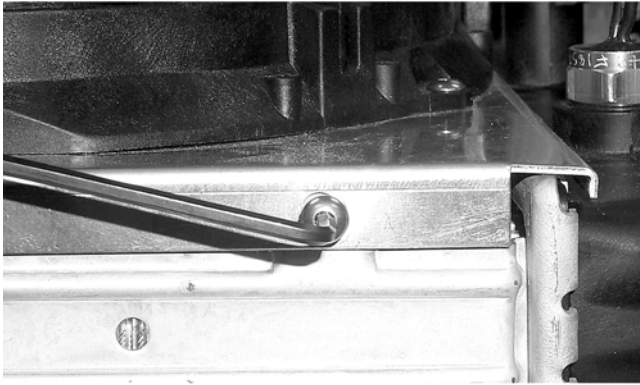


0732-411

## REMOVING

1. Drain the coolant at the engine.
2. Remove the front rack (see Section 8).
3. Remove the front bumper and front fender panel (see Section 8).
4. Remove the upper and lower coolant hoses.
5. Remove the cap screws and nuts securing the radiator to the frame.

6. Disconnect the fan wiring from the main wiring harness; then remove the radiator/fan assembly and account for the grommets and collars.
7. Remove the fan/fan shroud assembly from the radiator.



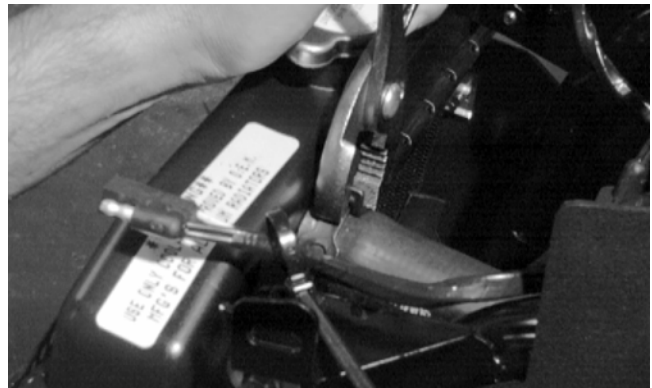
## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Flush the radiator with water to remove any contaminants.
2. Inspect the radiator for leaks and damage.
3. Inspect all hoses for cracks and deterioration.
4. Inspect all fasteners and grommets for damage or wear.

## INSTALLING

1. Position the fan/fan shroud assembly on the radiator; then secure with existing hardware.
2. Place the radiator with grommets and collars into position on the frame; then install the cap screws and nuts. Tighten securely.
3. Install the upper and lower coolant hoses; then secure with hose clamps.



4. Install the front bumper and front fender panel (see Section 8).
5. Install the front rack (see Section 8).
6. Fill the cooling system with the recommended amount of antifreeze. Check for leakage.
7. Connect the fan wiring to the main wiring harness.

---

## Hoses/Thermostat (500/650 H1)

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### REMOVING

1. Drain approximately one qt of coolant from the cooling system.
2. Remove the two cap screws securing the thermostat housing to the cylinder head. Account for an O-ring and a thermostat.

### INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Inspect the thermostat for corrosion, wear, or spring damage.
2. Using the following procedure, inspect the thermostat for proper operation.
  - A. Suspend the thermostat in a container filled with water.
  - B. Heat the water and monitor the temperature with a thermometer.
  - C. The thermostat should start to open at 73.5-76.5°C (164-170°F).

D. If the thermostat does not open, it must be replaced.

3. Inspect all coolant hoses, connections, and clamps for deterioration, cracks, and wear.

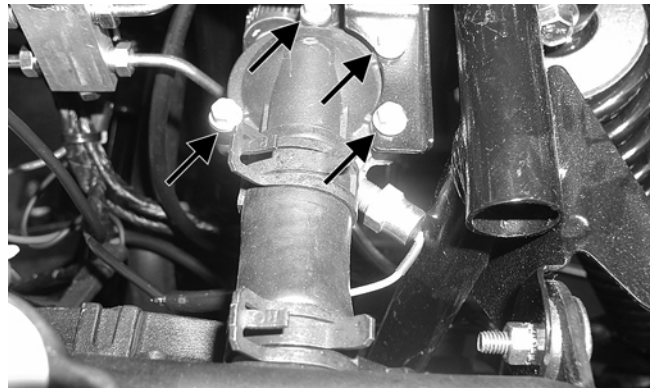
■ **NOTE:** All coolant hoses and clamps should be replaced every four years or 4000 miles.

## INSTALLING

1. Place the thermostat and O-ring into the thermostat housing; then secure the thermostat housing to the cylinder head with the two cap screws.
2. Install the crossover coolant hose onto the water pump and engine water inlet. Secure with the two hose clamps.
3. Slide the upper hose onto the thermostat housing and radiator. Secure with the two hose clamps.
4. Install the lower coolant hose onto the water pump housing and radiator. Secure with the two hose clamps.
5. Fill the cooling system with the recommended amount of antifreeze. Check for leakage.



CC862



KX193A

4. Remove the thermostat and account for the seal.

## INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Inspect the thermostat for corrosion, wear, or spring damage.
2. Using the following procedure, inspect the thermostat for proper operation.
  - A. Suspend the thermostat in a container filled with water.
  - B. Heat the water and monitor the temperature with a thermometer.
  - C. The thermostat should start to open at 69.5-72.5°C (157-162°F).
  - D. If the thermostat does not open, it must be replaced.
3. Inspect all coolant hoses, connections, and clamps for deterioration, cracks, and wear.

■ **NOTE:** All coolant hoses and clamps should be replaced every four years or 4000 miles.

## INSTALLING

1. Place the thermostat and seal into the thermostat housing; then finger-tighten the thermostat housing to the mounting bracket with the two cap screws.
2. Install the remaining two cap screws; then tighten the four cap screws to specifications.
3. Fill the cooling system with the recommended amount of antifreeze. Check for leakage.
4. Install the center splash shield; then install the fenders and front rack.

---

## Hoses/Thermostat (650 V-Twin)

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### REMOVING

1. Remove the front rack and fenders; then remove the center splash shield.
2. Drain the cooling system down approximately one quart.
3. Remove the cap screws securing the thermostat housing to the mounting bracket; then remove the remaining two cap screws and separate the housing and cover.



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## Fan

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### REMOVING

1. Remove the radiator (see Radiator in this section).
2. Remove the fan assembly from the radiator.

### INSTALLING

1. Position the fan assembly on the radiator; then secure with existing hardware.

■ **NOTE:** The fan wiring must be in the upper-right position.

2. Install the radiator (see Radiator in this section).

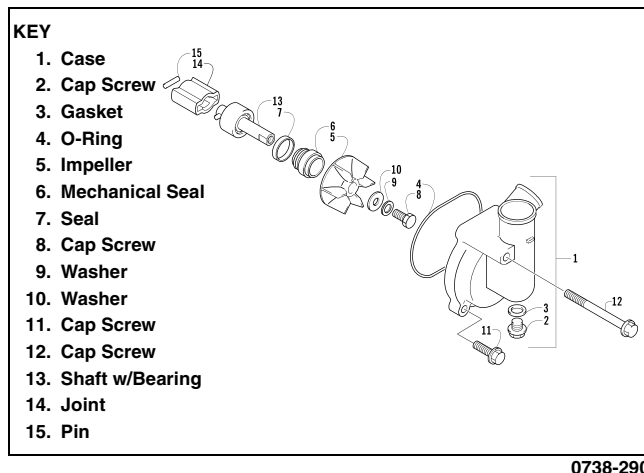
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## Servicing Water Pump (500 - Manual Transmission)

---

### REMOVING/DISASSEMBLING



1. Drain the coolant.
2. Remove the three cap screws securing the water pump case. Note the position of the long cap screw and account for the O-ring.

3. Remove the impeller cap screw, washer, and gasket.

4. Remove the mechanical seal using this procedure.

A. Tap the tip of a small sheet metal screw into the inner-metal edge of the seal.

B. Grip the screw with a pair of vise-grip pliers and pull the seal out. Account for the pump drive seal.

### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all pump components in solvent.
2. Inspect the mechanical seal and pump drive seal for damage.

■ **NOTE:** If the mechanical seal and/or pump drive seal are damaged, they must be replaced as a set.

3. Inspect the impeller for corrosion or damage.

### ASSEMBLING/INSTALLING

■ **NOTE:** Treat seals and O-rings with clean anti-freeze for initial lubrication.

1. Press the mechanical seal with pump drive seal into the impeller by hand.
2. Install the mechanical seal assembly onto the water pump shaft and secure with the cap screw, washer, and gasket. Tighten the cap screw securely.
3. Place the water pump case into position and secure with the three cap screws. Note the position of the long cap screw from removal.
4. Fill the cooling system with the recommended amount of antifreeze.

■ **NOTE:** While the cooling system is being filled, air pockets may develop; therefore, run the engine for five minutes after the initial fill, shut the engine off, and then fill the cooling system.

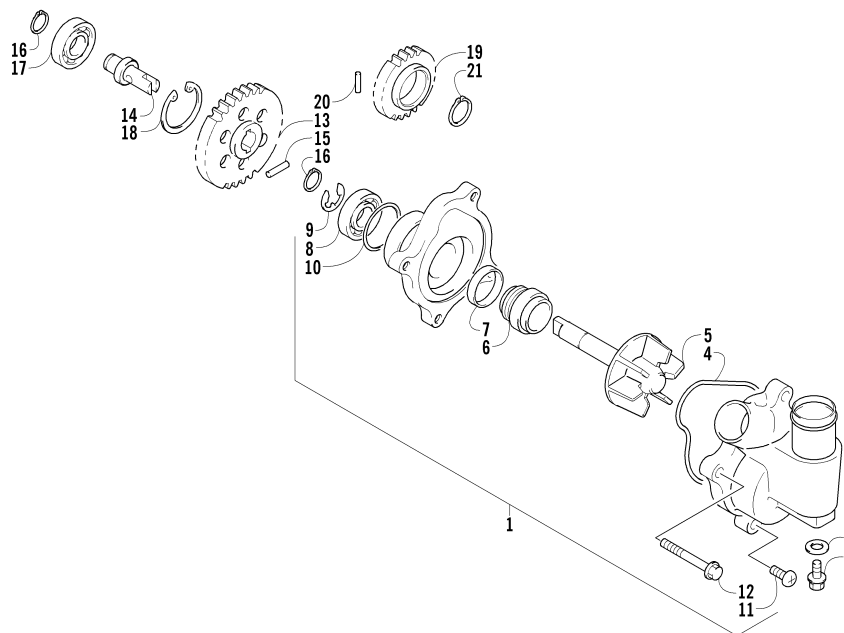
5. Check the entire cooling system for leakage.

## Servicing Water Pump (500/650 H1 - Automatic Transmission)

■ **NOTE:** When servicing the water pump, it will be necessary to install a new Oil Seal and a new Mechanical Seal.

### KEY

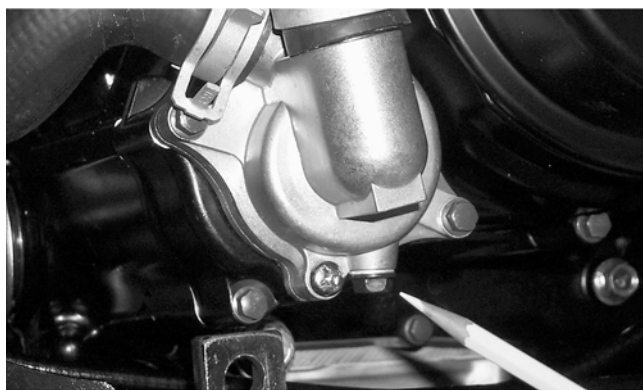
1. Water Pump Assy
2. Cap Screw (Drain)
3. Gasket
4. O-Ring
5. Impeller/Shaft
6. Mechanical Seal
7. Oil Seal
8. Bearing
9. E-Ring
10. O-Ring
11. Screw
12. Cap Screw
13. Driven Gear
14. Shaft
15. Pin
16. Circlip
17. Shaft
18. Circlip
19. Drive Gear
20. Pin
21. Circlip



0737-766

### REMOVING

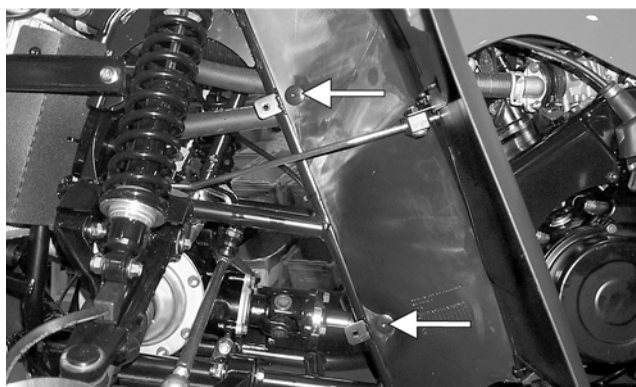
1. Remove the radiator cap; then remove the water pump drain and drain the coolant.



CC789

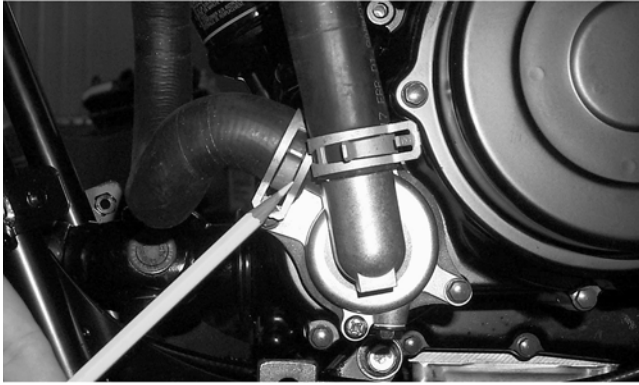
2. Drain the oil from the engine/transmission.
3. Remove the four torx-head cap screws securing the front and rear fenders to the footrest; then remove the four cap screws securing the footrest to the frame. Remove the footrest.

4. From inside the left-front wheel-well, remove the two torx-head cap screws securing the fender to the frame.



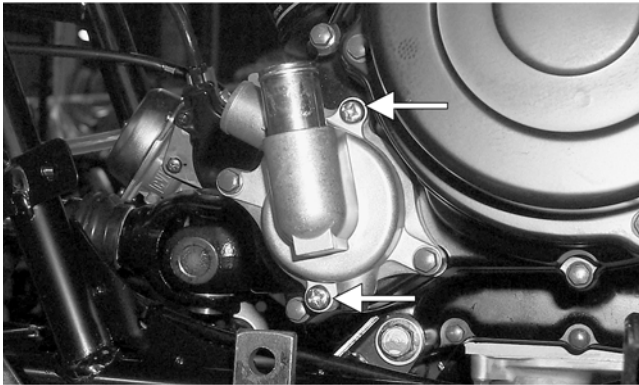
CC788A

5. Compress the tabs on the coolant hose clamps and slide the clamps away from the hose ends approximately 51 mm (2 in.); then remove both hoses from the water pump.



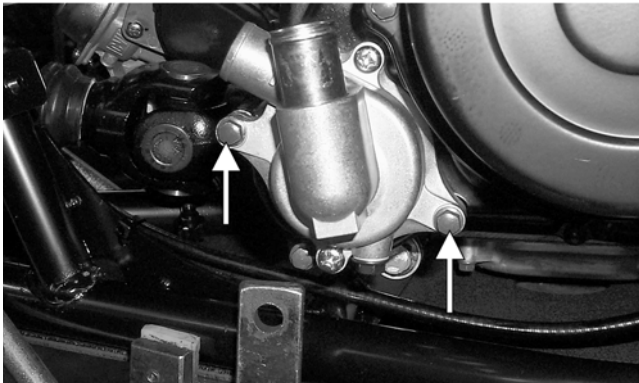
CC784

6. Using an impact driver, loosen but do not remove the two Phillips-head cover screws.



CC785A

7. Remove the two cap screws securing the water pump to the engine; then remove the water pump.

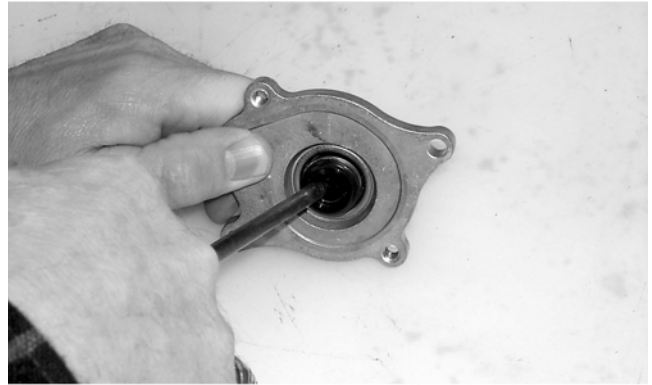


CC786A

## DISASSEMBLING

1. Finish removing the two Phillips-head cap screws securing the cover to the bearing housing; then remove the cover. Account for the O-ring.
2. Remove the E-ring securing the impeller/shaft to the bearing housing; then remove the impeller/shaft.

3. Using Seal Removal Tool (p/n 0644-072), remove the mechanical seal and the oil seal from the bearing housing.



CC772

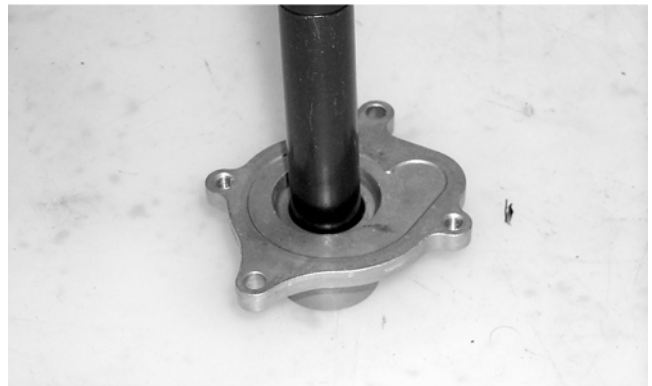
## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all oil-pump components in cleaning solvent.
2. Inspect the impeller/shaft for corrosion or damage.

## ASSEMBLING

1. Place the new oil seal into the bearing housing; then using a seal driver, gently tap the seal down until it is fully seated.



CC778

2. Place the new mechanical seal into the bearing housing; then tap it down until it is fully seated.

■ **NOTE:** A large deep-well socket can be used to drive the seal down evenly.

3. Install the impeller/shaft assembly into the bearing housing; then secure with the E-ring.

■ **NOTE:** Make sure the E-ring is fully seated and the impeller rotates freely.



4. While holding the bearing housing assembly in position on the engine, slowly rotate the impeller until the impeller/shaft engages properly with its slot in the driven shaft.

■ **NOTE:** The bearing housing will be flush with the engine when the two shafts are properly engaged.

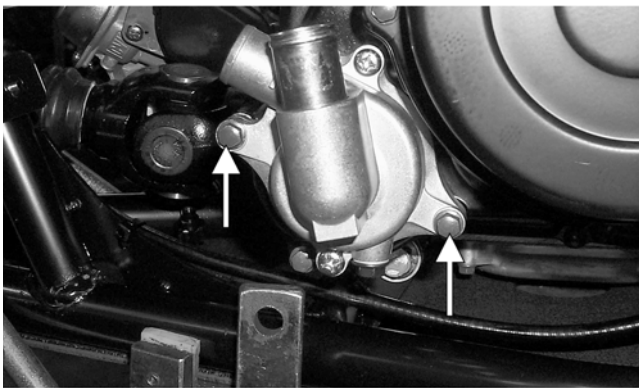
**CAUTION**

Failure to properly engage the two shafts could cause serious engine damage.

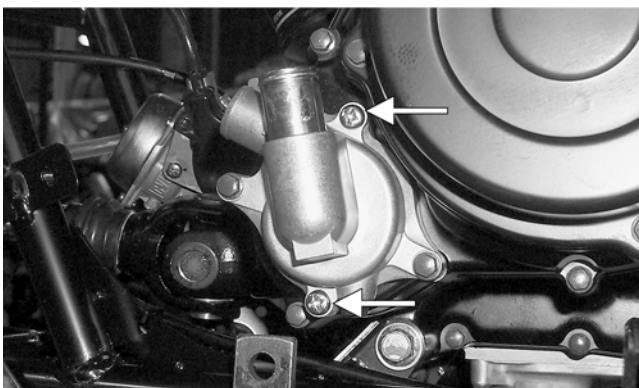
5. With the bearing housing assembly in position on the engine, place the cover (with O-ring installed) into position on the housing; then loosely secure with the two Phillips-head cap screws.

## INSTALLING

1. Secure the water pump to the engine with the two cap screws tightened securely; then tighten the two Phillips-head cap screws securely.

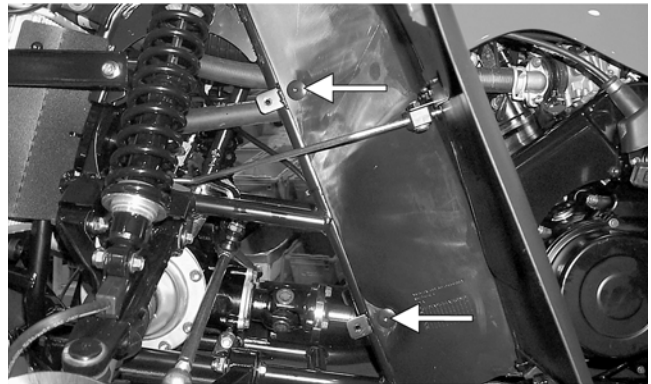


CC786A



CC785A

2. Connect the two coolant hoses to the water pump and secure with the clamps.
3. From inside the left-front wheel-well, secure the fender to the frame with the two torx-head cap screws. Tighten securely.



CC788A

4. Place the footrest into position on the frame and loosely secure with four cap screws; then secure the front and rear fenders to the footrest with the four torx-head cap screws. Tighten the four torx-head cap screws securely; then tighten the remaining cap screws to specifications.

5. Fill the engine/transmission with the proper amount of recommended oil.

6. Fill the cooling system with the proper amount of recommended coolant.

■ **NOTE:** While the cooling system is being filled, air pockets may develop; therefore, run the engine for five minutes after the initial fill, shut the engine off, and then fill the cooling system.

7. Check the entire cooling system for leakage.

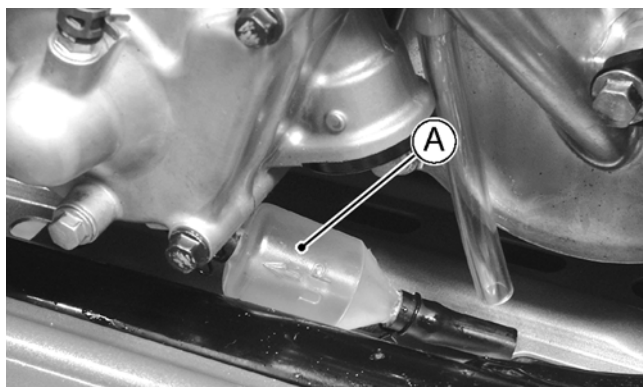
**CAUTION**

After operating the ATV for the initial 5-10 minutes, stop the engine, allow the engine to cool down, and check the coolant level. Add coolant as necessary.

## Water Pump/ Alternator Cover (650 V-Twin)

■ **NOTE:** Check for water pump seal leakage by examining drain catch tank (A).

4

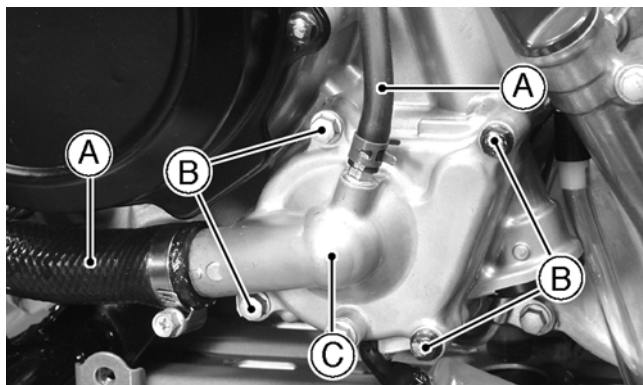


KX383

### AT THIS POINT

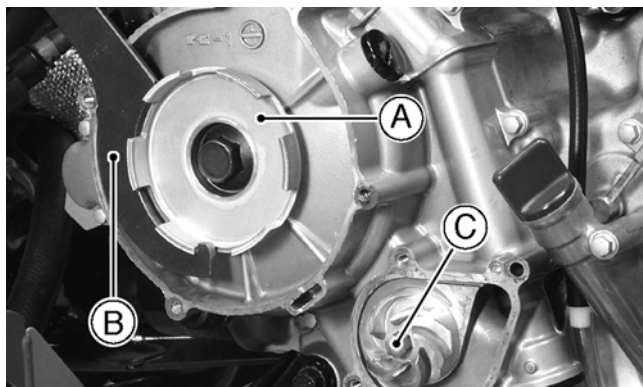
If there is no coolant in the catch tank, proceed to step 1 to inspect the impeller.

1. Drain the coolant; then remove hoses (A), cap screws (B), and the water pump cover (C). Account for the gasket and two alignment pins.



KX378

2. Remove the recoil starter (see Removing Left-Side Components in Section 3); then using a suitable holding wrench (B) to hold the starter cup (A), loosen the impeller (C) by turning counterclockwise.

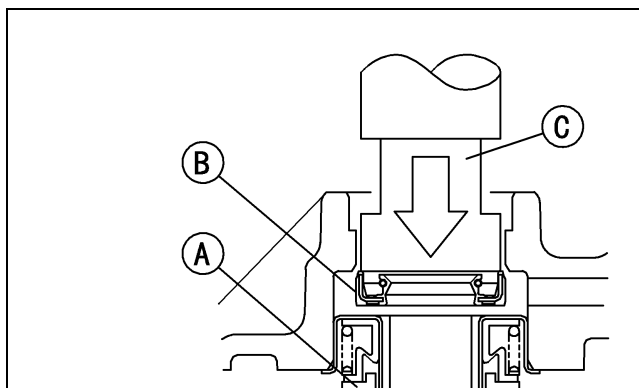


KX379

### AT THIS POINT

If the impeller is corroded or damaged, replace the impeller; then proceed to step 10. If additional service on the water pump/alternator cover is necessary, proceed to step 3.

3. Remove the alternator cover (see Removing Left-Side Components in Section 3); then using a suitable bearing driver, remove the water pump bearing from the alternator cover.
4. Press out the mechanical seal (A) and oil seal (B) from the inside of the alternator cover using bearing driver (C).

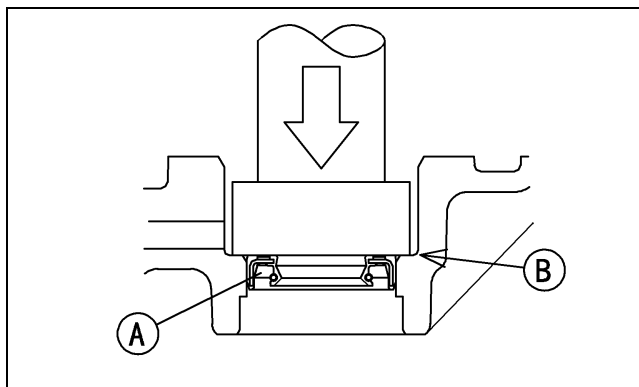


ATV2114

### CAUTION

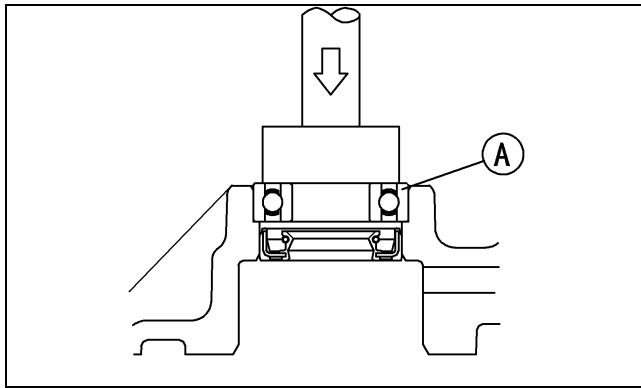
If the mechanical seal, oil seal, or the ball bearing is removed, always replace all three as a set. Be careful not to block the inspection hole with the oil seal. If the inspection hole is blocked, coolant will pass through the oil seal and flow into the crankcase causing severe engine damage.

5. Apply high temp grease to the oil seal lip; then press oil seal (A) from the outside of the alternator cover until flush with (B).

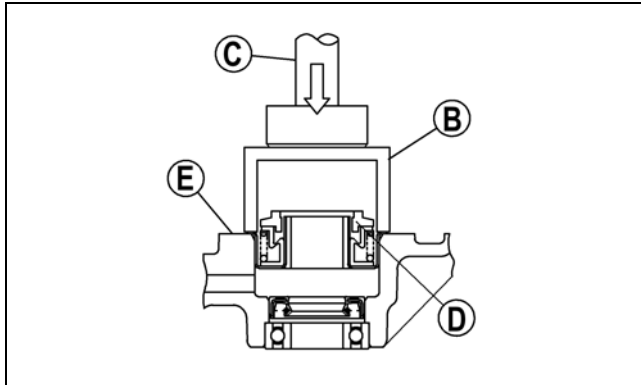


ATV2115

6. Press ball bearing (A) into the alternator cover from the inside until it is bottomed; then using a suitable socket (B) and bearing driver (C), press in a new mechanical seal (D) until the flange stops at (E).

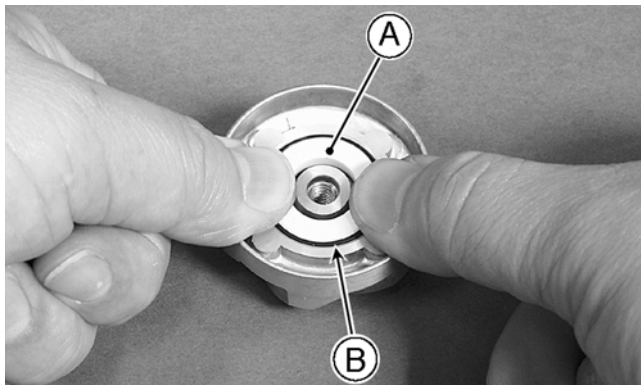


ATV2117



ATV2118A

7. Carefully clean the sliding surfaces of the new mechanical seal with clean solvent; then apply the coolant to the sliding surface to provide initial lubrication.
8. Apply coolant to the surfaces of the rubber seal and sealing seat (A); then press the rubber seal (B) and sealing seat into the impeller until the seat bottoms out.



KX380

9. Install the alternator cover (see Installing Left-Side Components in Section 3); then install the impeller and tighten clockwise to specifications.
10. Make sure that the alignment pins are correctly inserted; then using a new gasket, install the water pump cover and tighten the cap screws to specifications.

11. Install the recoil starter (see Installing Left-Side Components Section 3).
12. Install the coolant hoses onto the pump cover; then fill the cooling system with recommended coolant (see Section 2).

## Testing Electric Fuel Pump (650 V-Twin)

### AT THIS POINT

Prior to removing the electric fuel pump, the following check should be performed to determine that removal is necessary.

### WARNING

Whenever any maintenance or inspection is made on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

4

1. Turn the ignition switch ON and listen for a momentary "whirring" sound of the pump building pressure. If the sound is heard (10 seconds), no electrical checks are necessary. Turn the ignition switch OFF.
2. Disconnect the fuel hose from the pump to the gas tank valve; then install a suitable pressure gauge.



KX192

3. Turn the ignition switch to the ON position. The fuel pressure should build until the pump shuts off. Pressure should read 0.18-0.23 kg-cm<sup>2</sup> (2.6-3.3 psi).
4. If the pump is not running, disconnect the fuel pump/tank sensor connector by reaching under the rear rack from behind.



5. Connect a multimeter to the power supply leads with the red tester lead to the brown wire and the black tester lead to the black/red wire; then turn the ignition switch to the ON position. The meter should read battery voltage. If battery voltage is indicated and the fuel pump does not run, replace the pump assembly. If no battery voltage is indicated, check the CDI and the vehicle tilt sensor.

■ **NOTE:** To test the fuel gauge tank sensor, the fuel pump assembly must be removed.

## REMOVING

1. Remove the rear rack and fenders (see Section 8); then disconnect the power supply/ fuel gauge connector.



KX186

2. Remove the spring clamp; then remove the fuel hose.
3. Remove the screws securing the fuel pump to the gas tank; then make a reference mark on the fuel pump and tank.



KX187

4. Rotate the fuel pump assembly clockwise 90° to allow removal without removing the fuel tank.

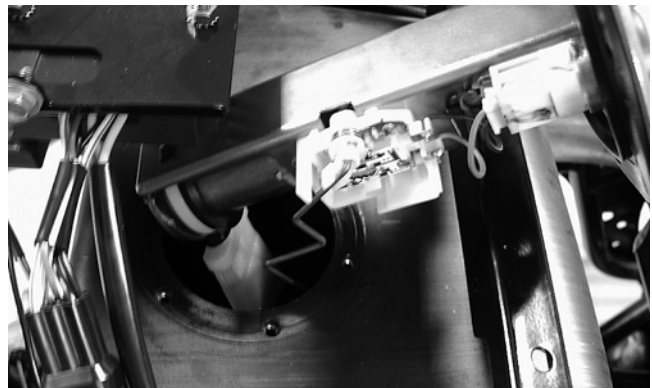


KX188

5. Lift out the fuel pump assembly carefully tilting it forward to clear the voltage regulator; then guide the pump and float lever through the opening in the gas tank.

## CAUTION

Take care not to damage the float or float arm or replacement of the entire assembly will be necessary.



KX190

6. Using duct tape or other suitable means, cover the fuel pump opening.

## INSPECTING

### AT THIS POINT

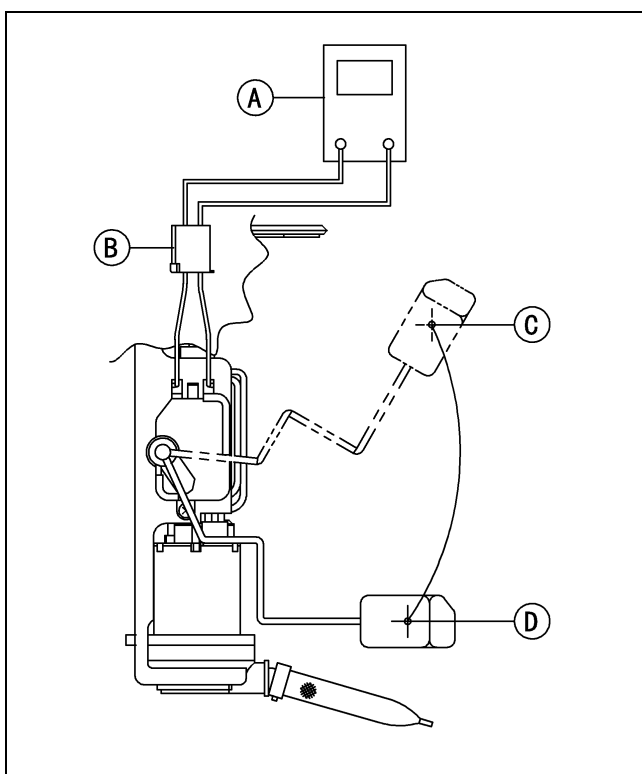
If the pump has failed earlier test and must be replaced, proceed to INSTALLING.

1. Inspect the fuel screen and blow clean with low pressure compressed air.
2. Move the float lever and check for free movement. The float assembly should return to the lower position without force. If not, replace the fuel pump assembly.



KX191

3. Test the fuel gauge tank sensor by connecting a multimeter (A) to the fuel sensor leads (B); then select OHMS. The multimeter should show 120 ohms at full fuel position (C) and 3 ohms at empty fuel position (D).

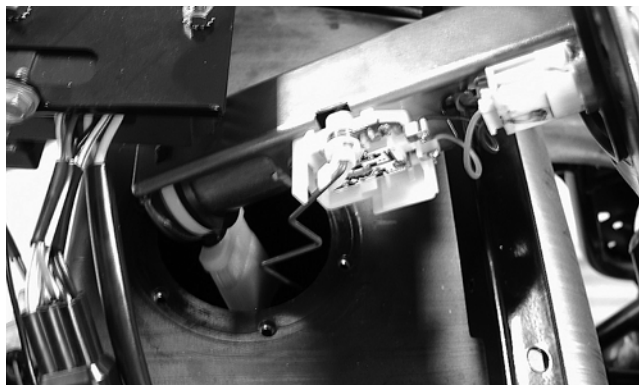


ATV2116

■ **NOTE:** If readings are erratic, clean the resistor wiper and resistor with clean alcohol and retest. If still not correct, replace the fuel pump assembly.

## INSTALLING

1. Mark the new fuel pump with a reference mark in the same location as the removed pump; then place the new gasket on the pump.
2. Remove the material covering the fuel pump opening; then carefully guide the fuel pump into position taking care not to damage the float or float lever.



KX190

3. Rotate the fuel pump counterclockwise 90° or until the match marks align; then install the mounting screws and tighten securely using a crisscross pattern.

■ **NOTE:** It is important to install the fuel pump with the correct orientation to ensure adequate float lever clearance.

4. Connect the wires, fuel hose, and spring clamp; then turn the ignition switch to the ON position. Note that the fuel pump runs momentarily and the fuel gauge indicates the proper fuel level.
5. With the transmission in neutral and brake lever lock engaged, start the engine and check for normal operation. Check for any fuel leaks.
6. Install any wire ties that were removed; then install the rear fenders, rack, and seat making sure the seat locks securely.

4

## Testing Vacuum Pulse Fuel Pump (400 FIS/500/650 H1)

### 👉 AT THIS POINT

Prior to removing the vacuum pulse fuel pump, the following check should be performed to determine that removal is necessary.

### ⚠️ WARNING

Whenever any maintenance or inspection is made on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

1. Disconnect the fuel pump/carburetor hose at the fuel pump; then connect a hose and suitable pressure gauge to the fuel pump output fitting.



CD815

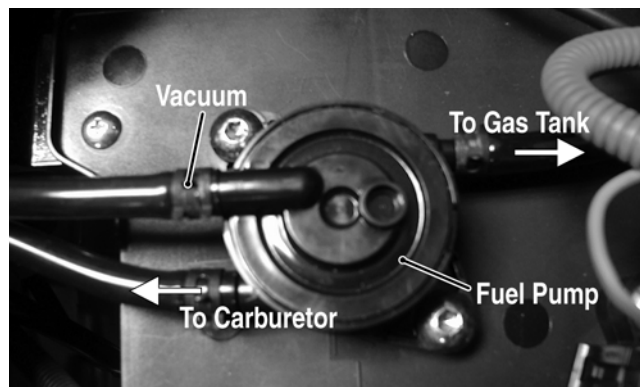


CD816

2. Start the engine. Fuel pump pressure should read 0.18-0.25 kg/cm<sup>2</sup> (2.5-3.5 psi).

## REMOVING

1. Remove the seat; then remove the three clamps securing the gas hoses and vacuum hose and disconnect the hoses.



CD766A

2. Remove the two machine screws and flange nuts securing the fuel pump to the electrical tray; then remove the pump.

## INSTALLING

1. Place the fuel pump into position on the electrical tray; then secure with the machine screws and flange nuts. Tighten securely.
2. Connect two gas hoses and one vacuum hose; then secure with the clamps.



# SECTION 5 - ELECTRICAL SYSTEM

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## Specifications

| 400                        |                                     |                                                                                                                |
|----------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------|
| IGNITION                   |                                     |                                                                                                                |
| Ignition Timing            |                                     | 10° BTDC @ 1500 RPM                                                                                            |
| Spark Plug Type            |                                     | NGK CR7E                                                                                                       |
| Spark Plug Gap             |                                     | 0.7-0.8 mm<br>(0.028-0.032 in.)                                                                                |
| Spark Plug Cap             |                                     | 8000-12,000 ohms                                                                                               |
| Ignition Coil Resistance   | (primary)<br>(secondary)            | Less than 1 ohm<br>(terminal to ground)<br>5200-7800 ohms<br>(high tension - plug cap removed - to ground)     |
| Ignition Coil Peak Voltage | (primary/<br>CDI)                   | 250-375 DC volts<br>(terminal to ground)                                                                       |
| MAGNETO                    |                                     |                                                                                                                |
| Magneto Coil Resistance    | (trigger)<br>(source)<br>(charging) | 160-240 ohms<br>(green to blue)<br>Less than 1 ohm<br>(yellow to white)<br>Less than 1 ohm<br>(black to black) |
| Magneto Coil Peak Voltage  | (trigger)<br>(source)               | 5.04-7.56 volts<br>(green to blue)<br>0.7-1.05 volts<br>(yellow to white)                                      |
| Stator Coil Output         | (no load)                           | 60 AC volts @ 5000 RPM<br>(black to black #1)<br>(black to black #2)                                           |

| 500/650 H1                 |                                     |                                                                                                                |
|----------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------|
| IGNITION                   |                                     |                                                                                                                |
| Ignition Timing            |                                     | 10° BTDC @ 1500 RPM                                                                                            |
| Spark Plug Type            |                                     | NGK CR6E                                                                                                       |
| Spark Plug Gap             |                                     | 0.7-0.8 mm<br>(0.028-0.032 in.)                                                                                |
| Spark Plug Cap             |                                     | 8000-12,000 ohms (500)<br>4000 ohms (650 H1)                                                                   |
| Ignition Coil Resistance   | (primary)<br>(secondary)            | Less than 1 ohm<br>(terminal to ground)<br>5200-7800 ohms<br>(high tension - plug cap removed - to ground)     |
| Ignition Coil Peak Voltage | (primary/<br>CDI)                   | 140.0-215.0 DC volts - 500<br>142.4-213.6 DC volts - 650<br>H1<br>(terminal to ground)                         |
| MAGNETO                    |                                     |                                                                                                                |
| Magneto Coil Resistance    | (trigger)<br>(source)<br>(charging) | 160-240 ohms<br>(green to blue)<br>Less than 1 ohm<br>(yellow to white)<br>Less than 1 ohm<br>(black to black) |
| Magneto Coil Peak Voltage  | (trigger)<br>(source)               | 4.2-6.3 volts<br>(green to blue)<br>0.40-0.62 volt<br>(yellow to white)                                        |
| Stator Coil Output         | (no load)                           | 60 AC volts @ 5000 RPM<br>(black to black #1)<br>(black to black #2)                                           |

| 650 V-Twin                 |                          |                                                                                                                      |
|----------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------|
| IGNITION                   |                          |                                                                                                                      |
| Ignition Timing            |                          | 5° BTDC @ 1100 RPM<br>28° BTDC @ 5000 RPM                                                                            |
| Spark Plug Type            |                          | NGK CR7E                                                                                                             |
| Spark Plug Gap             |                          | 0.7-0.8 mm<br>(0.028-0.032 in.)                                                                                      |
| Spark Plug Cap             |                          | 4750-6250 ohms                                                                                                       |
| Ignition Coil Resistance   | (primary)<br>(secondary) | Less than 1 ohm<br>(terminal (+) to terminal (-))<br>3800-5800 ohms<br>(high tension - plug cap removed - to ground) |
| Ignition Coil Peak Voltage | (primary/<br>CDI)        | 100 volts or more<br>(wire (+) to ground)                                                                            |
| MAGNETO                    |                          |                                                                                                                      |
| Magneto Coil Resistance    | (trigger)<br>(charging)  | 110-140 ohms<br>(blue to black/white)<br>Less than 1 ohm<br>(black to black)                                         |
| Magneto Coil Peak Voltage  | (trigger)                | 3.6 volts or more<br>(blue to black/white)                                                                           |
| Stator Coil Output         | (no load)                | 39-59 AC volts @ 3000<br>RPM<br>(black to black #1)<br>(black to black #2)                                           |

## Battery

### ⚠ WARNING

Anytime service is performed on a battery, the following must be observed: keep sparks, open flame, cigarettes, or any other flame away. Always wear safety glasses. Protect skin and clothing when handling a battery. When servicing battery in enclosed space, keep the area well-ventilated. Make sure venting tube of battery is always open once battery is filled with electrolyte.

1. Remove the battery from the ATV.

### ⚠ WARNING

Remove the negative cable first; then remove the positive cable.

### ⚠ CAUTION

Do not charge the battery while it is in the ATV with the battery terminals connected.

2. Remove the vent plugs; then fill the battery with electrolyte to the UPPER level indicated on the battery.

■ **NOTE:** Electrolyte should be at room temperature before filling. Do not use water or any other liquid to activate a battery.

### **WARNING**

**Electrolyte is a sulfuric acid solution. Avoid spillage and contact with skin, eyes, and clothing.**

3. Allow the battery to stand for 15-30 minutes after filling. Electrolyte level may fall during this time. Refill with electrolyte to UPPER level line.
4. Trickle-charge the battery at 1.4 amps for 8-10 hours.
5. After charging, check electrolyte level and fill with DISTILLED WATER as necessary; then install the vent plugs. Wash off acid spillage with water and dry the battery.

### **CAUTION**

**Before installing the battery, make sure the ignition switch is in the OFF position.**

6. Place the battery into position in the ATV and secure; then connect the vent hose to the battery.
7. Connect cables to the proper terminals: positive cable to the positive terminal (+) and negative cable to the negative terminal (-). Connect the negative cable last.

### **CAUTION**

**Connecting cables in reverse (positive to negative and negative to positive) can cause serious damage to the electrical system.**

8. Check the vent tube to make sure it is not pinched or obstructed in any way and that it is properly routed down through the frame.

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## **RPM Limiter**

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■ **NOTE:** The ATV is equipped with a CDI unit that retards ignition timing when maximum RPM is approached. When the RPM limiter is activated, it could be misinterpreted as a high-speed misfire.

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## **Testing Electrical Components**

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All of the electrical tests should be made using the Fluke Model 73 Multimeter (p/n 0644-191) and when testing peak voltage, the Peak Voltage Reading Adapter (p/n 0644-307) must be used. If any other type of meter is used, readings may vary due to internal circuitry. When troubleshooting a specific component, always verify first that the fuse(s) are good, that the bulb(s) are good, that the connections are clean and tight, that the battery is fully charged, and that all appropriate switches are activated.

■ **NOTE:** For absolute accuracy, all tests should be made at room temperature of 68° F.

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## **Accessory Receptacle/Connector (400/500/650 H1/650 V-Twin)**

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■ **NOTE:** This test procedure is for either the receptacle or the connector.

### **VOLTAGE**

1. Turn the ignition switch to the ON position; then set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the red/white wire or the positive connector; then connect the black tester lead to ground.
3. The meter must show battery voltage.

■ **NOTE:** If the meter shows no battery voltage, troubleshoot the battery, fuse, receptacle, connector, or the main wiring harness.

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## **Brakelight Switch (Auxiliary)**

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The switch connector is the two-prong connector on the brake switch lead above the transmission.

■ **NOTE:** The ignition switch must be in the ON position.



## VOLTAGE (Wiring Harness Side)

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester to the orange wire; then connect the black tester lead to ground.



AR627D

3. The meter must show battery voltage.

■ **NOTE:** If the meter shows no battery voltage, troubleshoot the battery, fuse, switch, or the main wiring harness.

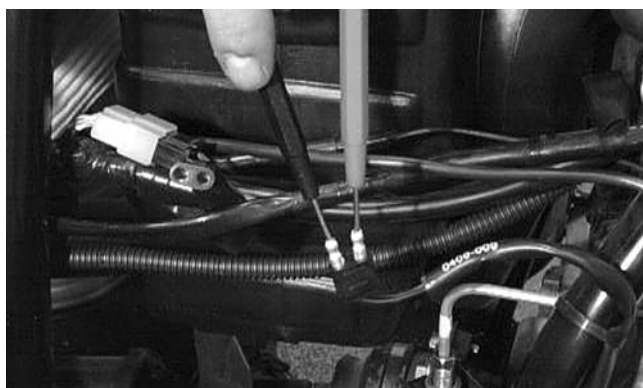
■ **NOTE:** If the meter shows battery voltage, the main wiring harness is good; proceed to test the switch/component, the connector, and the switch wiring harness for resistance.

## RESISTANCE (Switch Connector)

### ⚠ CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to one black wire; then connect the black tester lead to the other black wire.



AR626D

3. When the brake pedal is depressed, the meter must show less than 1 ohm.

■ **NOTE:** If the meter shows more than 1 ohm of resistance, replace the switch.

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## Brakelight Switch (Handlebar Control)

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To access the connector, remove the access panel.

■ **NOTE:** The ignition switch must be in the ON position.

## VOLTAGE (Wiring Harness Connector)

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the orange wire; then connect the black tester lead to ground.



AR622D

3. The meter must show battery voltage.

■ **NOTE:** If the meter shows no battery voltage, troubleshoot the battery, fuse, switch, or the main wiring harness.

■ **NOTE:** If the meter shows battery voltage, the main wiring harness is good; proceed to test the switch/component, the connector, and the switch wiring harness for resistance.

## RESISTANCE (Switch Connector)

### ⚠ CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

■ **NOTE:** The brake lever must be compressed for this test. Also, the ignition switch must be in the OFF position.

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to one black wire; then connect the black tester lead to the other black wire.



AR621D

3. When the lever is compressed, the meter must show less than 1 ohm.

■ **NOTE:** If the meter shows more than 1 ohm of resistance, replace the switch.

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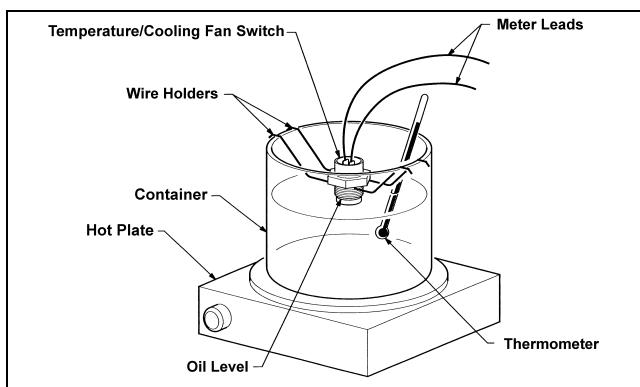
## Oil Temperature and Cooling Fan Switches (400)

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■ **NOTE:** This model has an oil temperature switch and a cooling fan switch.

1. Connect the meter leads (selector in the OHMS position) to the switch contacts.
2. Suspend the switch and a thermometer in a container of oil; then heat the oil.

■ **NOTE:** Neither the switch nor the thermometer should be allowed to touch the bottom of the container or inaccurate readings will occur. Use wire holders to suspend switch and thermometer.



733-554C

3. On the oil temperature switch when the oil temperature reaches 160° C (320° F), the meter should read a closed circuit.
4. On the oil temperature switch, allow the oil to cool, and when the temperature is at (or just before) a temperature of 140° C (284° F), the meter should read an open circuit.
5. On the cooling fan switch when the temperature reaches 120° C (248° F), the meter should read a closed circuit.
6. On the cooling fan switch, allow the oil to cool, and when the temperature is at (or just before) a temperature of 110° C (230° F), the meter should read an open circuit.
7. If the readings are not as indicated, the switch must be replaced.
8. Apply thread tape to the threads of the switch; then install the switch and tighten securely.
9. Connect the switch leads.

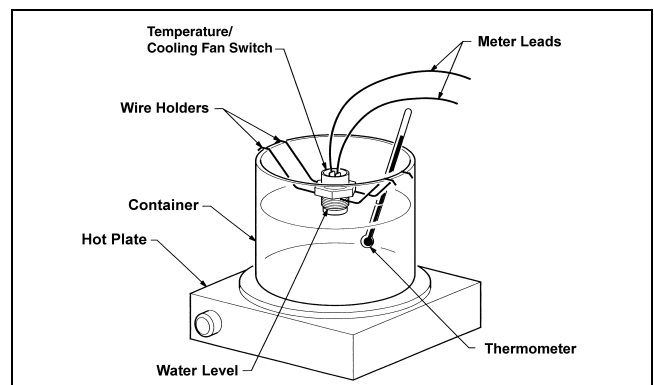
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## Coolant Temperature and Cooling Fan Switches (500/650 H1/650 V-Twin)

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1. Connect the meter leads (selector in the OHMS position) to the switch contacts.
2. Suspend the switch and a thermometer in a container of water; then heat the water.

■ **NOTE:** Neither the switch nor the thermometer should be allowed to touch the bottom of the container or inaccurate readings will occur. Use wire holders to suspend switch and thermometer.



733-554E

3. On the coolant temperature switch when the water temperature reaches 112-118° C (234-244° F), the meter should read a closed circuit.
4. On the coolant temperature switch, allow the water to cool, and when the temperature is within a temperature range of 108-111° C (226-232° F), the meter should read an open circuit.
5. On the cooling fan switch when the temperature reaches 66-68° C (150-155° F), the meter should read a closed circuit.
6. On the cooling fan switch, allow the water to cool, and when the temperature is within a temperature range of 62-65° C (145-149° F), the meter should read an open circuit.
7. If the readings are not as indicated, the switch must be replaced.
8. Install the switch and tighten securely.
9. Connect the switch leads.

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## Fan Motor

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The connector is located behind the fan assembly.

■ **NOTE:** The ignition switch must be in the ON position.

### VOLTAGE (Main Harness Connector to Fan Motor)

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the black/red wire (the black 2-prong at the fan motor); then connect the black tester lead to ground.
3. The meter must show battery voltage.

■ **NOTE:** If the meter shows no battery voltage, troubleshoot the battery, fuse, motor, or the main wiring harness.

■ **NOTE:** If the meter shows battery voltage, the main wiring harness is good. The connector should be checked for resistance.

### RESISTANCE (Fan Motor Connector)

#### **CAUTION**

**Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.**

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the blue wire; then connect the black tester lead to the black wire.



AR645D

3. The meter must show less than 1 ohm.

■ **NOTE:** If the meter shows more than 1 ohm of resistance, troubleshoot or replace the switch/component, the connector, or the switch wiring harness.

■ **NOTE:** To determine if the fan motor is good, connect the blue wire from the fan connector to a 12 volt DC power supply; then connect the black wire from the fan connector to ground. The fan should operate.

#### **CAUTION**

**Care should be taken to keep clear of the fan blades.**

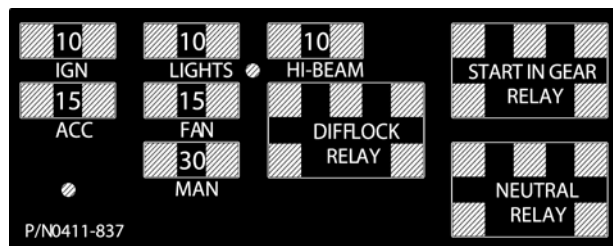


## Fuse Block/Power Distribution Module

The fuses are located in a power distribution module under the seat.

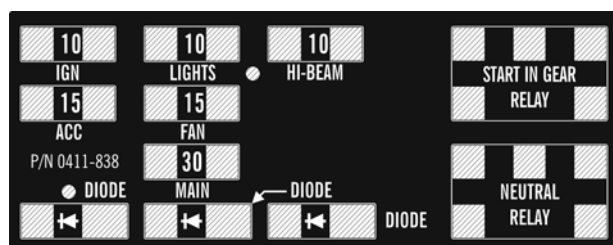
If there is any type of electrical system failure, always check the fuses first.

### 400 FIS/500 (Manual Transmission)



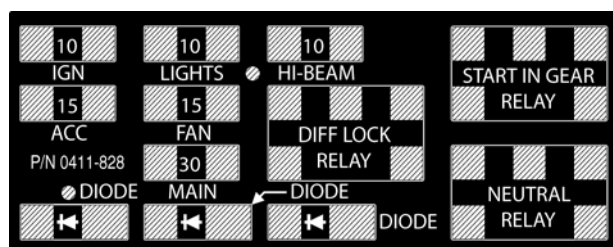
0411-837

### TRV/VP/400 TBX



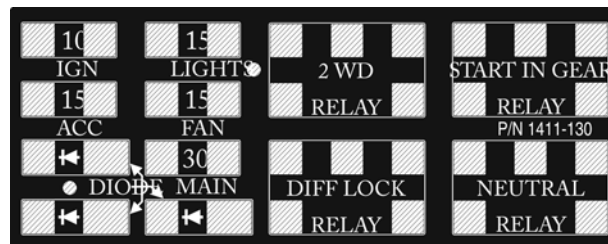
0411-838

### 400 FIS/500/500 TBX (Automatic Transmission)



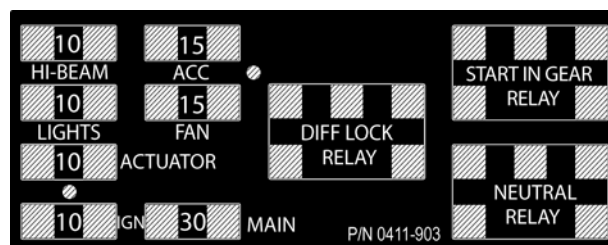
0411-828

### 650 H1



1411-130

### 650 V-Twin



0411-903

■ **NOTE:** The ignition switch must be in the **LIGHTS** position.

1. Remove all fuses from the distribution module.
2. Set the meter selector to the DC Voltage position.
3. Connect the black tester lead to ground.
4. Using the red tester lead, contact each end of the fuse holder connector terminals individually.
5. The meter must show battery voltage from one side of the connector terminal ends.

■ **NOTE:** Battery voltage will be indicated from only one side of the fuse holder connector terminal; the other side will show no voltage.

■ **NOTE:** When testing the HI fuse holder, the headlight dimmer switch must be in the **HI** position; when testing the LIGHTS fuse holder, the headlight dimmer switch can be in either position.

■ **NOTE:** If the meter shows no battery voltage, troubleshoot the battery, switches, distribution module, or the main wiring harness.

5

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## Fuses

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### CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to one spade end of the fuse; then connect the black tester lead to the other spade end.
3. The meter must show less than 1 ohm resistance. If the meter reads open, replace the fuse.

■ **NOTE:** Make sure the fuses are returned to their proper position according to amperage. Refer to the fuse block cover for fuse placement.

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## Ignition Coil

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The ignition coil is on the left-side frame above the engine. To access the coil, the left-side panel (see Section 2) must be removed.

### RESISTANCE

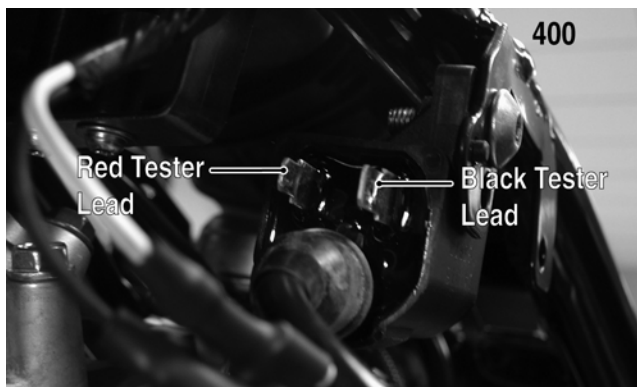
### CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

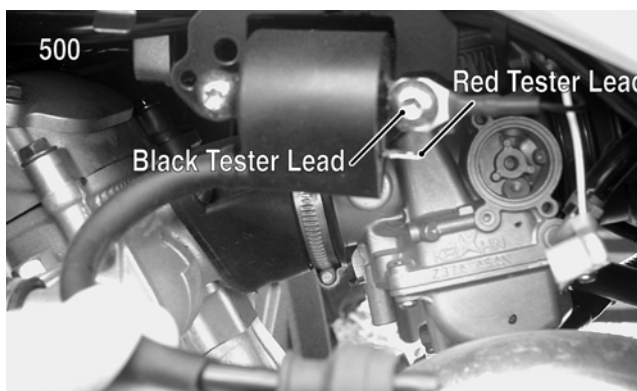
■ **NOTE:** For these tests, the meter selector should be set to the OHMS position and the primary wire(s) should be disconnected.

### Primary Winding

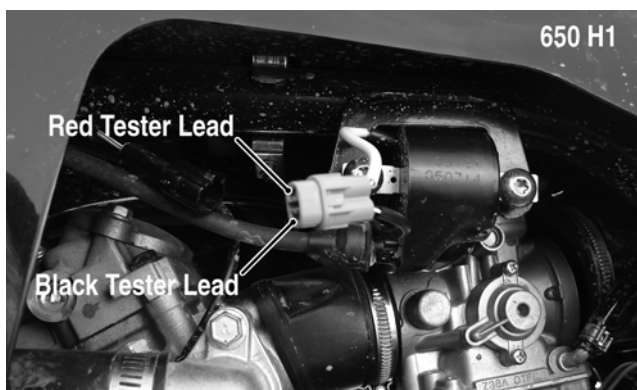
1. Connect the red tester lead to either terminal; then connect the black tester lead to the other terminal or on 500 models, to a suitable ground.



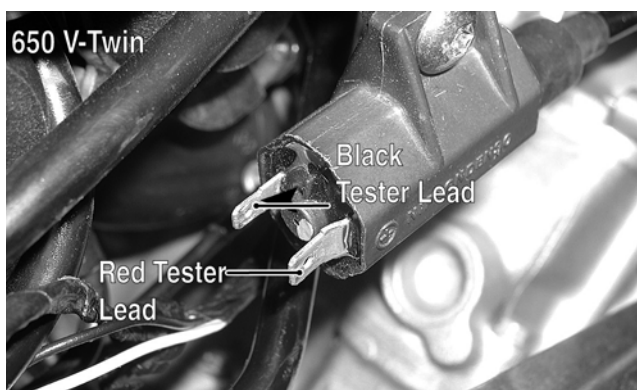
CF202A



CD882B



CF234A



KX201A

2. The meter reading must be within specification.

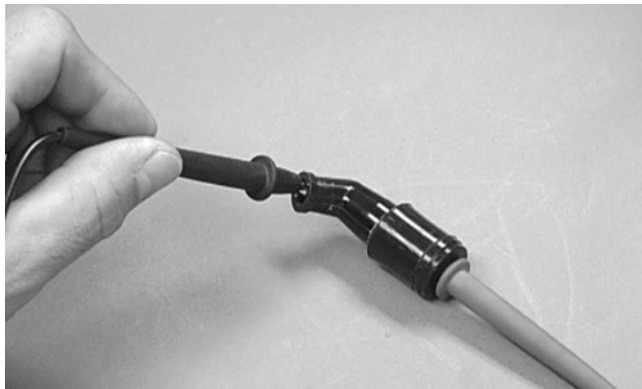
## Secondary Winding

1. Remove the plug cap from the high tension lead; then connect the red tester lead to the high tension lead.
2. On the 400/650 H1/650 V-Twin, connect the black tester lead to either primary connector; on the 500, connect the black tester lead to the coil frame or to the primary connector.
3. The meter reading must be within specification.

■ **NOTE:** If the meter does not show as specified, replace ignition coil.

## Spark Plug Cap

1. Connect the red tester lead to one end of the cap; then connect the black tester lead to the other end of the cap.



AR603D

2. The meter reading must be within specification.

■ **NOTE:** If the meter does not read as specified, replace the spark plug cap.

## PEAK VOLTAGE (400)

■ **NOTE:** All of the peak voltage tests should be made using the Fluke Model 73 Multimeter (p/n 0644-191) with Peak Voltage Reading Adapter (p/n 0644-307). If any other type of tester is used, readings may vary due to internal circuitry.

■ **NOTE:** The battery must be at full charge for these tests.

## Primary/CDI

■ **NOTE:** The CDI is located beneath the seat and fender panel near the battery.

1. Set the meter selector to the DC Voltage position; then disconnect the blue/white primary wire from the coil.

2. Connect the red tester lead to the primary wire; then connect the black tester lead to ground.
3. Crank the engine over using the electric starter.
4. The meter reading must be within specification.

## PEAK VOLTAGE (500/650 H1/650 V-Twin)

■ **NOTE:** All of the peak voltage tests should be made using the Fluke Model 73 Multimeter (p/n 0644-191) with Peak Voltage Reading Adapter (p/n 0644-307). If any other type of tester is used, readings may vary due to internal circuitry.

■ **NOTE:** The battery must be at full charge for these tests.

## Primary/CDI

■ **NOTE:** The CDI is located beneath the seat near the battery.

1. Set the meter selector to the DC Voltage position; then disconnect the blue/white primary wire from the coil.
2. Connect the red tester lead to the primary wire; then connect the black tester lead to ground.
3. Crank the engine over using the electric starter.
4. The meter reading must be within specification.

5

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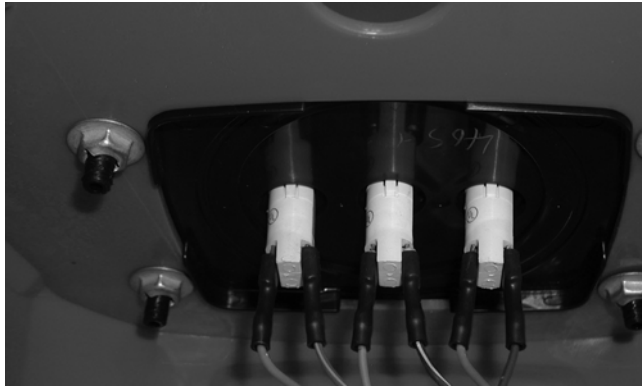
## Indicator Lights (400 VP)

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To access the indicator light connectors for testing purposes, use the following procedure.

1. Remove the two reinstallable rivets and ignition nut securing the instrument pod.
2. Place the instrument pod on the front rack; then disconnect in turn the appropriate connector from the light to be tested.





CF204

■ **NOTE:** For these tests, a 12-volt power supply “jumper” should be used to supply power.

### TEMPERATURE LIGHT

1. Connect the jumper positive wire to the power source terminal on the indicator light connector.
2. Connect the jumper ground wire to the temperature terminal on the indicator light connector.
3. The temperature warning indicator light should illuminate.

### NEUTRAL POSITION LIGHT

1. Connect the jumper positive wire to the power source terminal on the indicator light connector.
2. Connect the jumper ground wire to the neutral terminal on the indicator light connector.
3. The neutral position indicator light should illuminate.

### REVERSE POSITION LIGHT

1. Connect the jumper positive wire to the power source terminal on the indicator light connector.
2. Connect the jumper ground wire to the reverse terminal on the indicator light connector.
3. The reverse position indicator light should illuminate.

■ **NOTE:** If a light fails to illuminate in any one of the indicator light tests, the connector, wiring harness, or a bulb must be replaced.

After testing procedures are completed, use the following procedure.

1. Connect the indicator light connector in turn to the appropriate indicator light.
2. Install the instrument pod and secure with the reinstallable rivets and the ignition nut.

### OIL TEMPERATURE LIGHT VOLTAGE (400)

■ **NOTE:** The ignition switch must be in the ON position, and the test must be performed on the lower side of the switch.

1. Set the meter selector to the DC Voltage position.
2. Disconnect the black oil temperature switch connector from the switch (on the top right side of the engine) and ground the violet wire to the engine. The temperature light should illuminate.
3. Connect the red tester lead to the violet wire (main harness side); then connect the black tester lead to a ground.
4. The meter must show battery voltage.

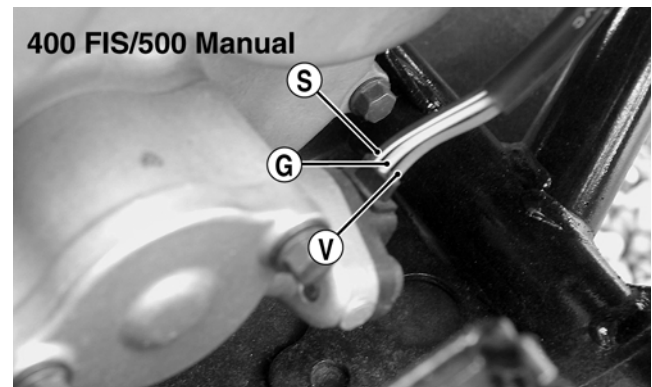
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## Electronic Speedometer Speed Sensor

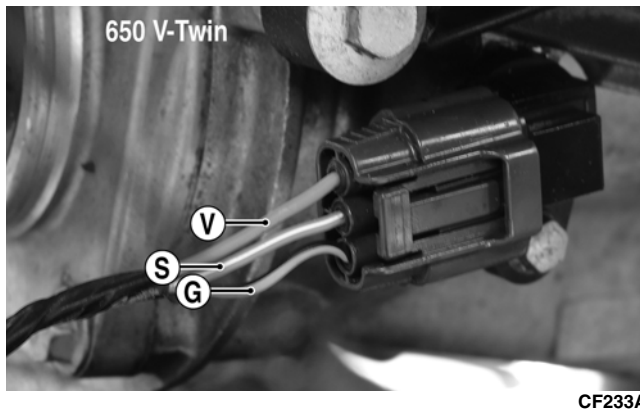
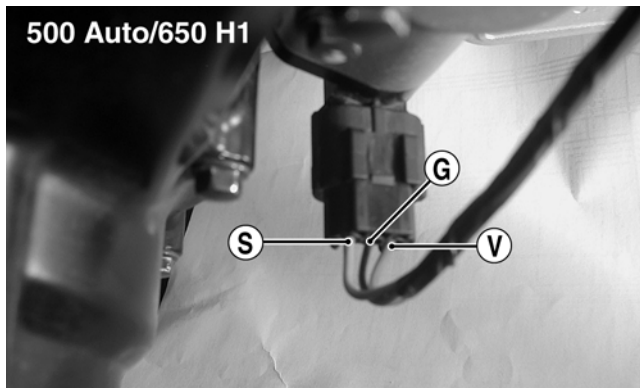
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■ **NOTE:** The following procedure does not include the 400 TBX or the 400 VP models.

■ **NOTE:** Prior to testing the speed sensor, inspect the three-wire connector on the sensor harness (400 FIS/500 manual models) or on the speed sensor (500 auto/650 H1/650 V-Twin models) for contamination, broken pins, and/or corrosion.



CD884A



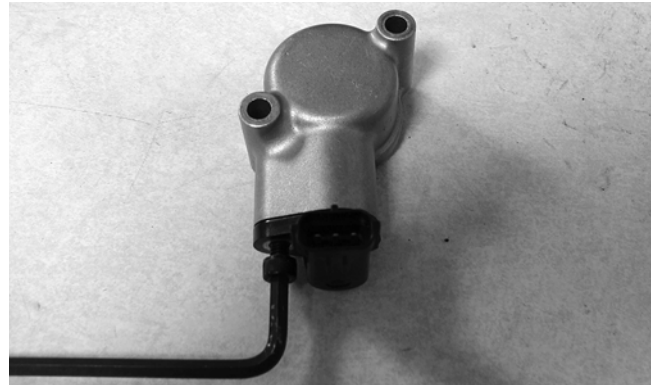
1. Set the meter selector to the DC Voltage position.
2. With appropriate needle adapters on the meter leads, connect the red tester lead to the voltage lead (V); then connect the black tester lead to the ground lead (G).
3. Turn the ignition switch to the ON position.
4. The meter must show 6 DC volts (500 auto/650 H1) or 12 DC volts (400/500 manual/650 V-Twin).
5. Leave the black tester lead connected; then connect the red tester lead to the signal lead (S) pin.
6. Slowly move the ATV forward or backward; the meter must show 0 and 6 DC volts alternately (500/650 H1) or 0 and 12 DC volts alternately (400/500 manual/650 V-Twin).

■ **NOTE:** If the sensor tests are within specifications, the speedometer must be replaced. See Section 9.

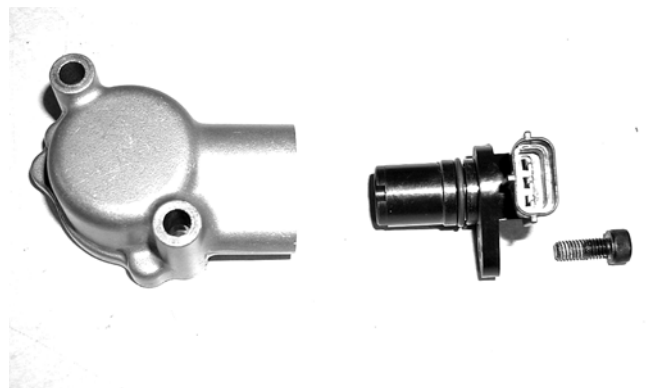
To replace a speed sensor, use the following procedure.

1. Disconnect the three-wire connector from the speed sensor harness or from the speed sensor; then remove the Allen-head cap screw securing the sensor to the sensor housing.

2. Remove the sensor from the sensor housing accounting for an O-ring.



3. Install the new speed sensor into the housing with new O-ring lightly coated with multi-purpose grease; then secure the sensor with the Allen-head cap screw (threads coated with blue Loctite #242). Tighten securely.



5

## Ignition Switch

On the 400/500, the connector is the black three-wire one beneath the steering post cover. On the 650 H1/650 V-Twin, the connector is a four-wire one. To access the connector, the cover must be removed.

### VOLTAGE

■ **NOTE:** Perform this test on the lower side of the connector.

1. Set the meter selector to the DC Voltage position.
2. Connect the red meter lead to the red wire; then connect the black meter lead to ground.
3. Meter must show battery voltage.

■ **NOTE:** If the meter shows no battery voltage, troubleshoot the battery or the main wiring harness.

## RESISTANCE

### CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

■ **NOTE:** Perform this test on the upper side of the connector.

1. Turn the ignition switch to the ON position.
2. Set the meter selector to the OHMS position.
3. Connect the red tester lead to the red wire; then connect the black tester lead to the orange wire (STD) or to the red/black wire (650 H1/650 V-Twin).
4. The meter must show less than 1 ohm.
5. Turn the ignition switch to the LIGHTS position.
6. Connect the red tester lead to the red wire; then connect the black tester lead to the orange wire (STD) or to the red/black wire (650 H1/650 V-Twin).
7. The meter must show less than 1 ohm.
8. Connect the red tester lead to the red wire; then connect the black tester lead to the gray wire.
9. The meter must show less than 1 ohm.
10. With the switch in the OFF position, connect the red tester lead to the red wire and the black tester lead to each of the remaining wires. The meter must show an open circuit on all wires.
11. On the 650 H1/650 V-Twin, connect the red tester lead to the red wire and the black tester lead to the brown wire. With the switch in the ON position, the meter must show 980-1020 ohms.

■ **NOTE:** If the meter shows more than 1 ohm of resistance, troubleshoot or replace the switch/component, the connector, or the switch wiring harness.

## Handlebar Control Switches

The connector is the yellow one next to the steering post. To access the connector, the steering post cover and the right-side fender splash shield must be removed (see Section 8).

■ **NOTE:** These tests should be made on the top side of the connector.

### CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

## RESISTANCE (HI Beam)

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the yellow wire; then connect the black tester lead to the gray wire.
3. With the dimmer switch in the HI position, the meter must show less than 1 ohm.

■ **NOTE:** If the meter shows more than 1 ohm of resistance, troubleshoot or replace the switch/component, the connector, or the switch wiring harness.

## RESISTANCE (LO Beam)

1. Connect the red tester lead to the white wire; then connect the black tester lead to the gray wire.
2. With the dimmer switch in the LO position, the meter must show an open circuit.

■ **NOTE:** If the meter reads resistance, troubleshoot or replace the switch/component, the connector, or the switch wiring harness.

## DIODE (Starter Button)

■ **NOTE:** If voltage is not as specified, check the condition of the battery in the meter prior to replacing the switch. A low battery will result in a low voltage reading during a diode test.

1. Set the meter selector to the Diode position.
2. Connect the red tester lead to the orange/white wire; then connect the black tester lead to the yellow/green wire.



3. With the starter button depressed, the meter must show 0.5 - 0.7 DC volts.
4. With the starter button released, the meter must show 0 DC volts.
5. Connect the red tester lead to the yellow/green wire; then connect the black tester lead to the orange/white wire.
6. With the starter button depressed, the meter must show 0 DC volts.

■ **NOTE:** If the meter does not show as specified, replace the switch/component, connector, or switch harness.

### **RESISTANCE (Emergency Stop)**

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the orange wire; then connect the black tester lead to the orange/white wire.
3. With the switch in the OFF position, the meter must show an open circuit.
4. With the switch in the RUN position, the meter must show less than 1 ohm.

■ **NOTE:** If the meter shows more than 1 ohm of resistance, troubleshoot or replace the switch/component, the connector, or the switch wiring harness.

### **RESISTANCE (Reverse Override)**

The connector is the four-prong white one next to the steering post. To access the connector, the front rack and front fenders must be removed (see Section 8).

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to one red/yellow wire (red/white wire on some models); then connect the black tester wire to the other red/yellow wire (red wire on some models). The meter must show less than 1 ohm.
3. Depress and hold the reverse override button. The meter must show an open circuit.
4. Connect the red tester lead to the blue wire (blue/white wire on some models); then connect the black meter lead to the black wire (blue wire on some models). The meter must show an open circuit.
5. Depress and hold the reverse override button. The meter must show less than 1 ohm.

■ **NOTE:** If the meter does not show as specified, replace the switch/component, connector, or switch harness.

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## **Front Drive Selector Switch**

**(400 FIS/500/650 H1/650 V-Twin)**

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The connector is the two-wire black snap-lock one in front of the steering post. To access the connector, the cover must be removed.

■ **NOTE:** Resistance tests should be made with the connector disconnected and on the selector-side of the connector.

### **RESISTANCE**

#### **CAUTION**

**Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.**

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the red wire; then connect the black tester lead to the white wire.
3. With the selector switch in the 2WD position, the meter must show a closed circuit.
4. With the selector switch in the 4WD position, the meter must show an open circuit.

■ **NOTE:** If the meter does not show as specified, replace the front drive selector switch.

### **VOLTAGE**

■ **NOTE:** The battery must be connected when performing voltage tests.

1. Set the meter selector to the DC Voltage position.
2. Connect the black tester lead to the negative battery terminal.
3. Connect the red tester lead to the red wire on the harness side of the connector.
4. Turn the ignition switch to the RUN position.
5. The meter must show 12 DC volts.

■ **NOTE:** If the meter shows other than specified, check the harness, connector, 30 amp fuse, and battery connections.

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## Front Drive Selector Actuator

(400 FIS/500/650 H1/650 V-Twin)

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■ **NOTE:** With the engine stopped and the ignition switch in the ON position, a momentary “whirring” sound must be noticeable each time the selector switch is moved to 2WD and 4WD. Test the switch, 30 amp fuse, and wiring connections prior to testing the actuator.

■ **NOTE:** The differential must be in the unlocked position for this procedure.

### VOLTAGE

1. Select the 2WD position on the front drive selector switch; then disconnect the three-prong connector on the actuator wiring harness.
2. With the ignition switch in the OFF position, connect the black tester lead to the black wire in the supply harness; then connect the red tester lead to the orange wire in the supply harness.
3. Turn the ignition switch to the ON position. The meter must show 12 DC volts.
4. Connect the red tester lead to the white/red wire in the supply harness. The meter must show 12 DC volts.
5. Select the 4WD position on the front drive selector switch; then connect the red tester lead to the white/red wire in the supply harness. The meter must show 0 DC volts.
6. Connect the red tester lead to the orange wire in the supply harness. The meter must show 12 DC volts.

■ **NOTE:** If the voltage readings are as specified and the actuator does not function correctly, replace the actuator (see Section 6).

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## Differential Lock Switch

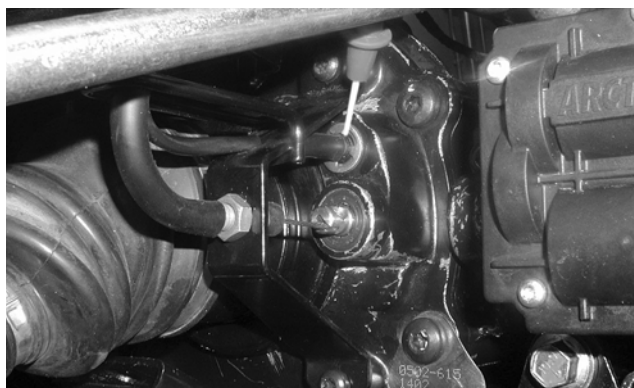
(400 FIS/500/650 H1/650 V-Twin)

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■ **NOTE:** The following procedure does not include the TRV models or the VP models.

### VOLTAGE

1. Select DC Voltage on the multimeter; then connect the red tester lead to the switch terminal (leaving the wire connected) and the black tester lead to ground.



CD575

2. Turn the ignition switch to the ON position. The meter must show 12 DC volts.

■ **NOTE:** If no voltage is indicated, check the wiring harness, fuse, or battery connections.

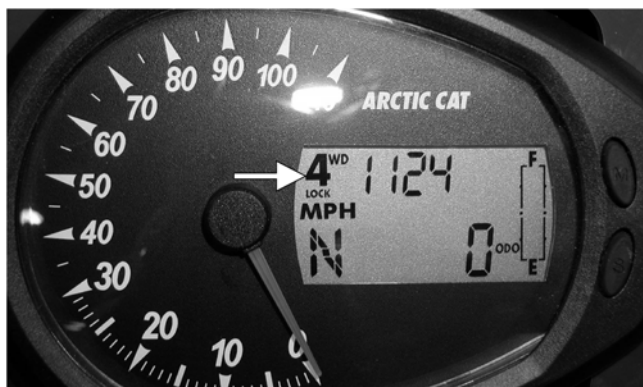
3. Select the lock position on the differential. The meter should drop to 0 volts, and the front drive selector actuator switch should operate to engage 4-wheel drive.

■ **NOTE:** It may be necessary to rock the ATV slightly to engage the differential lock fully.

■ **NOTE:** The 4WD and the LOCK icons on the speedometer should illuminate.



CD576



CF094C

4. If the differential lock engages (front wheels locked) and the voltage does not drop to 0, the switch is faulty and must be cleaned or replaced.

## Magneto Coils (400/500/650 H1)

### VOLTAGE (Stator Coil - Regulated Output)

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the positive battery post; then connect the black tester lead to the negative battery post.
3. With the engine running at a constant 5000 RPM (with the headlights on), the meter must show 14-15.5 DC volts.

#### ⚠ CAUTION

Do not run the engine at high RPM for more than 10 seconds.

■ **NOTE:** If voltage is lower than specified, test stator coil - no load.

### VOLTAGE (Stator Coil - No Load)

The connector is the black and white one on the right side of the engine just above the brake cable adjuster.

■ **NOTE:** Test the connector that comes from the engine.

1. Set the meter selector to the AC Voltage position.
2. Test between the three black wires for a total of three tests.

3. With the engine running at the specified RPM, all wire tests must show 60 A.C. volts.

#### ⚠ CAUTION

Do not run the engine at high RPM for more than 10 seconds.

■ **NOTE:** If both stator coil tests failed, check all connections, etc., and test again. If no voltage is present, replace the stator assembly.

### RESISTANCE (Stator Coil)

#### ⚠ CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

1. Set the meter selector to OHMS position.
2. Test between the three black wires for a total of three tests.
3. The meter reading must be within specification.

### RESISTANCE (Trigger Coil)

#### ⚠ CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the green wire; then connect the black tester lead to the blue wire. The meter reading must be within specification.

### RESISTANCE (Source Coil)

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the yellow wire; then connect the black tester lead to the white wire.
3. The meter reading must be within specification.

■ **NOTE:** If the meter shows other than specified in any resistance test, replace the stator assembly.

### PEAK VOLTAGE (400)

■ **NOTE:** All of the peak voltage tests should be made using the Fluke Model 73 Multimeter (p/n 0644-191) with Peak Voltage Reading Adapter (p/n 0644-307). If any other type of tester is used, readings may vary due to internal circuitry.



■ **NOTE:** The battery must be at full charge for these tests.

### **Magneto Coil (Trigger)**

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the green wire; then connect the black tester lead to the blue wire.
3. Crank the engine over using the electric starter.
4. The meter reading must be within specification.

### **Magneto Coil (Source)**

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the yellow wire; then connect the black tester lead to the white wire.
3. Crank the engine over using the electric starter.
4. The meter reading must be within specification.

### **PEAK VOLTAGE (500/650 H1)**

■ **NOTE:** All of the peak voltage tests should be made using the Fluke Model 73 Multimeter (p/n 0644-191) with Peak Voltage Reading Adapter (p/n 0644-307). If any other type of tester is used, readings may vary due to internal circuitry.

■ **NOTE:** The battery must be at full charge for these tests.

### **Magneto Coil (Trigger)**

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the green wire; then connect the black tester lead to the blue wire.
3. Crank the engine over using the electric starter.
4. The meter reading must be within specification.

### **Magneto Coil (Source)**

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the yellow wire; then connect the black tester lead to the white wire.

3. Crank the engine over using the electric starter.
4. The meter reading must be within specification.

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## **Magneto Coils (650 V-Twin)**

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### **VOLTAGE (Regulator/Rectifier - Output)**

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the positive battery post; then connect the black tester lead to the negative battery post.
3. With the engine running at a constant 5000 RPM (with the headlights on), the meter must show 14-15 DC volts.

#### **⚠ CAUTION**

**Do not run the engine at high RPM for more than 10 seconds.**

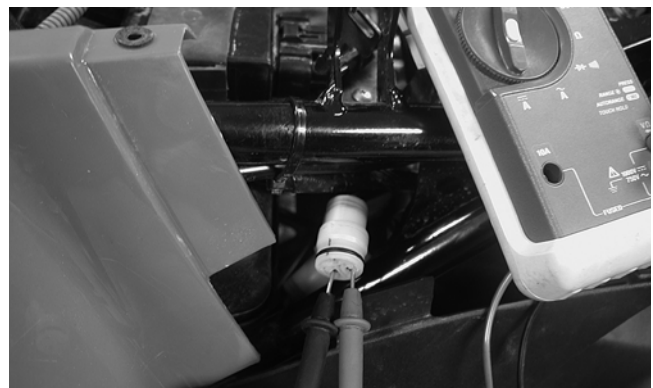
■ **NOTE:** If voltage is lower than specified, test stator coil - no load.

### **VOLTAGE (Stator Coil - No Load)**

The connector is the white one on the right side behind the engine.

■ **NOTE:** Test the connector that comes from the engine.

1. Set the meter selector to the A.C. Voltage position.
2. Test between the three black wires for a total of three tests.



KX387

3. With the engine running at a constant 3000 RPM, all wire tests must be within specifications.

**CAUTION**

Do not run the engine at high RPM for more than 10 seconds.

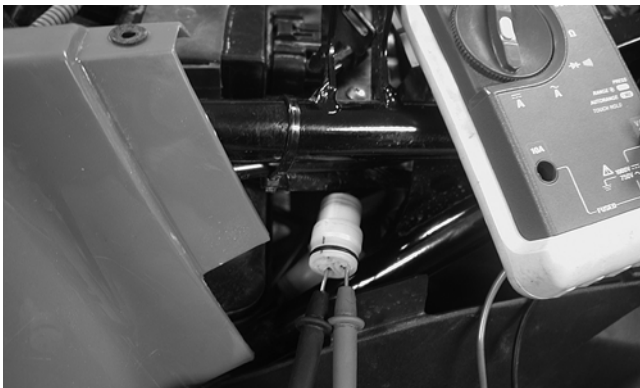
■ **NOTE:** If both stator coil tests failed, check all connections, etc., and test again. If no voltage is present, replace the stator assembly.

### RESISTANCE (Stator Coil)

**CAUTION**

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

1. Set the meter selector to OHMS position.
2. Test between the three black wires for a total of three tests.



KX387

3. The meter reading must be within specification.

### RESISTANCE (Trigger Coil)

**CAUTION**

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the black/white wire; then connect the black tester lead to the blue wire. The meter reading must be within specification.

### PEAK VOLTAGE

■ **NOTE:** All of the peak voltage tests should be made using the Fluke Model 73 Multimeter (p/n 0644-191) with Peak Voltage Reading Adapter (p/n 0644-307). If any other type of tester is used, readings may vary due to internal circuitry.

■ **NOTE:** The battery must be at full charge for these tests.

### Magneto Coil (Trigger)

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the black/white wire; then connect the black tester lead to the blue wire.
3. Crank the engine over using the electric starter.
4. The meter reading must be within specification.

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## Starter Motor

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### REMOVING/DISASSEMBLING

1. Disconnect the battery.

**CAUTION**

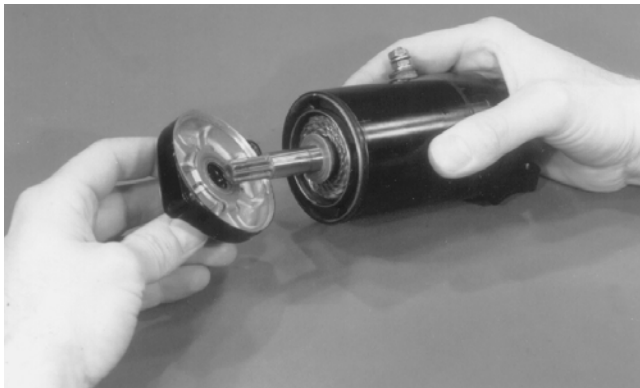
Always disconnect the negative battery cable from the battery first; then disconnect the positive cable.

2. Remove the nut securing the positive cable to the starter; then remove the cable from the starter.
3. Remove the two cap screws securing the starter to the crankcase; then remove the starter. Account for the wiring forms and an O-ring.
4. For assembly purposes, scribe a line across the outside of the starter assembly.



AR652D

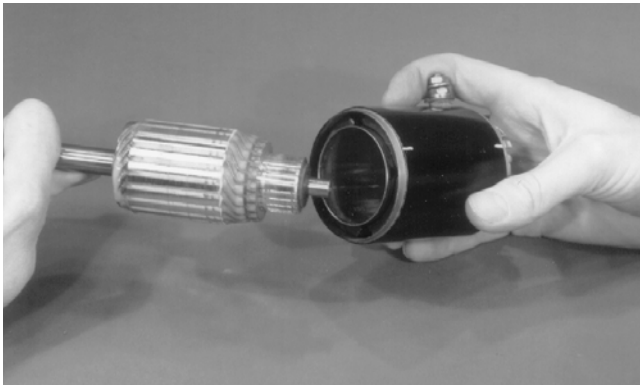
5. Remove the two long starter cap screws securing the starter components.
6. Remove the front cover from the starter housing and armature shaft. Account for a seal protector and three washers.



BC003

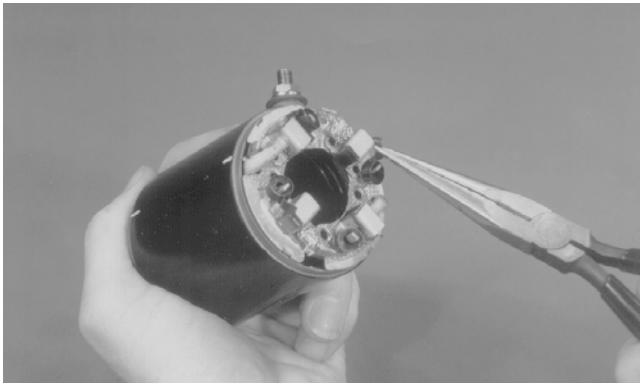
7. Remove the rear cover.

8. Slide the armature free of the starter housing.



BC006

9. Bend the two positive brushes outward; then remove the brush holder.

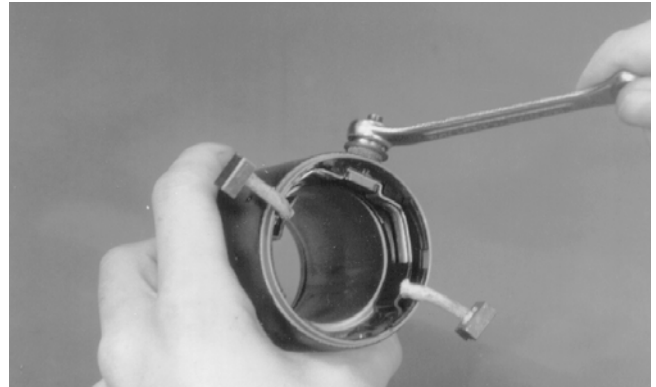


BC007



BC010

10. Remove the nut from the positive post. Account for the lock washer, flat washer, a fiber washer, and an O-ring.



BC008

11. Remove the positive brush assembly from the starter housing.



BC009

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Thoroughly clean all components except the armature and brushes in parts-cleaning solvent; then dry with compressed air.

### **CAUTION**

**Do not wash the armature and brushes in any kind of solvent. Use only compressed air and a clean dry, lint-free cloth.**

2. Inspect all threaded areas for damage or stripped threads.

3. Inspect the brush holder assembly and brushes for damage or wear. Using a caliper, measure the length of the brushes. If brush measurement is less than 10.1 mm (0.40 in.), replace with new brushes and brush springs as a set.

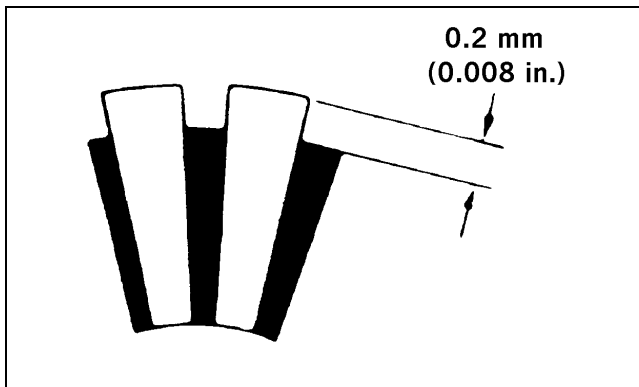


4. Inspect the brush leads for cracks, wear, or fraying. If any of these conditions exist, replace with new brushes and brush springs as a set.
5. Inspect the rear cover bushing for wear.
6. Inspect the front cover bearing for wear.
7. Inspect the brass commutator end of the armature for any discolored spots or damage. If the commutator is lightly discolored or damaged, the armature must be replaced. This is a molded commutator and turning it down in a lathe should not be attempted.

**CAUTION**

Do not use emery cloth to clean the commutator as emery particles will become imbedded in the brass commutator resulting in a short circuit. Use only #200 grit sandpaper.

8. Inspect the commutator end of the armature for buildup in the grooves. Carefully remove any buildup by undercutting using a thinly ground hacksaw blade. Do not undercut any deeper than the original groove which can be seen by looking at the end of the commutator.
9. Using a caliper, measure the undercut. Maximum undercut groove must be 0.2 mm (0.008 in.).



ATV-1054

**CAUTION**

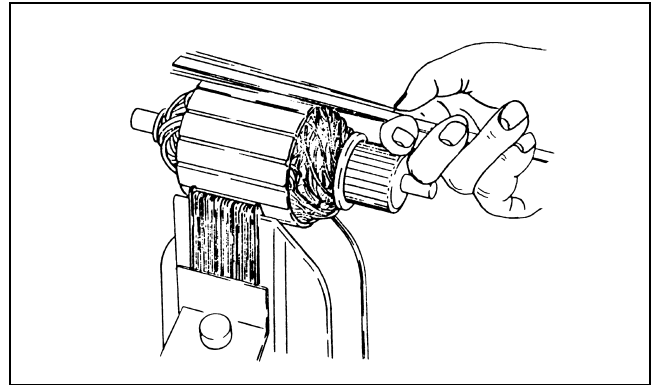
Buildup in the grooves must be removed to prevent any chance of an electrical arc between individual sections of the commutator.

10. Inspect the commutator for shorting using a multimeter and the following procedure.
  - A. Set the selector to the OHMS position.
  - B. Touch the black lead to the armature shaft.

- C. Using the red tester lead, probe the commutator end of the armature. The meter indicator should not change. If the indicator shows resistance, the armature is shorted and must be replaced.

11. Inspect the armature for shorting using a “growler” and the following procedure.

- A. Place the armature in the “growler.”
  - B. While holding a metal strip on the armature, rotate the armature an entire revolution. If the metal strip vibrates at any point on the armature, the armature is shorted and must be replaced.



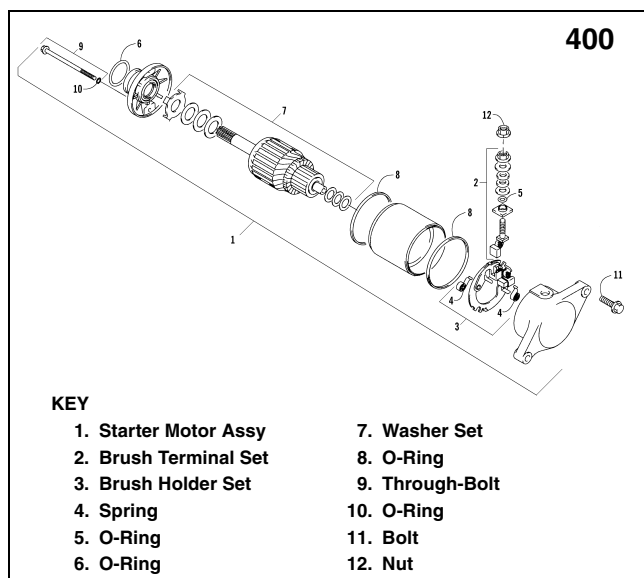
0725-653

12. Inspect the ground brushes to make sure they are properly grounded. Use a multimeter and the following procedure.

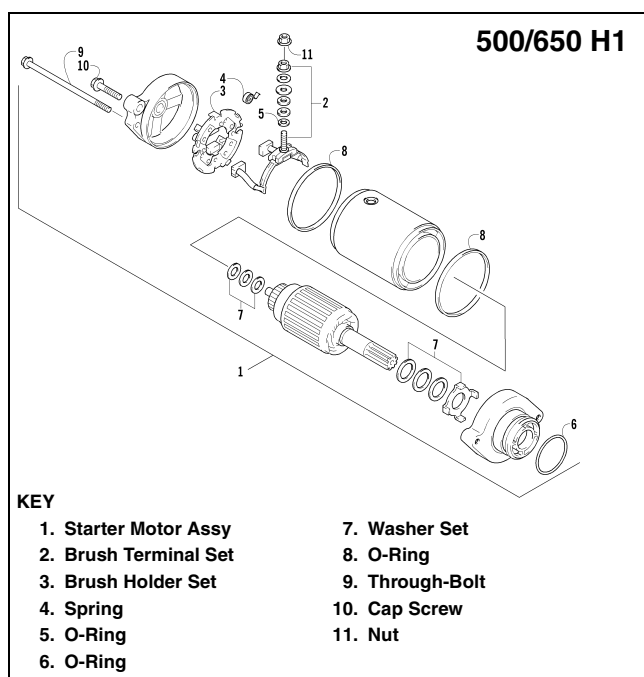
- A. Set the selector to the OHMS position.
  - B. Touch the black tester lead to a ground brush.
  - C. Touch the red tester lead to the brush holder assembly.

■ **NOTE:** If no resistance is indicated, check the ground connection for tightness and for cleanliness. If there is still no meter indication, replace the brush assembly.

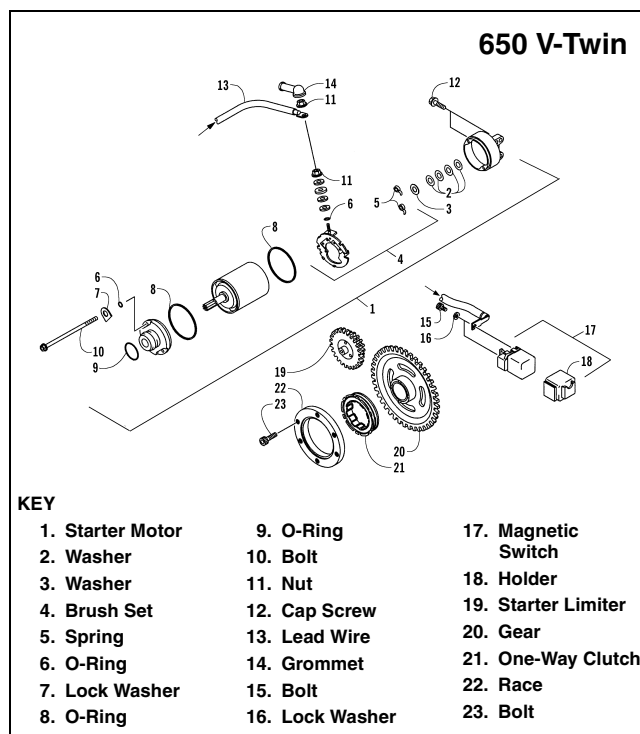
## ASSEMBLING/INSTALLING



0737-056



0737-779



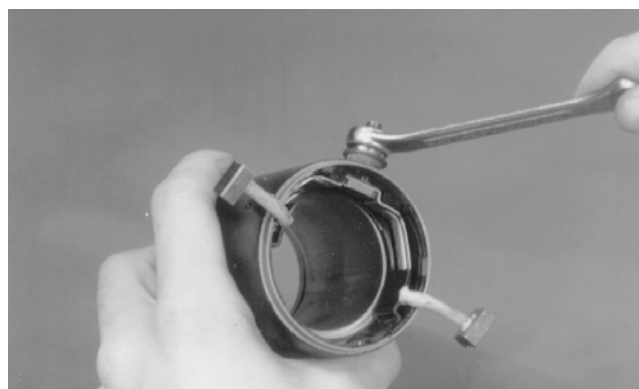
0739-019

1. Install the positive post on the positive brush assembly; then install on the starter housing.



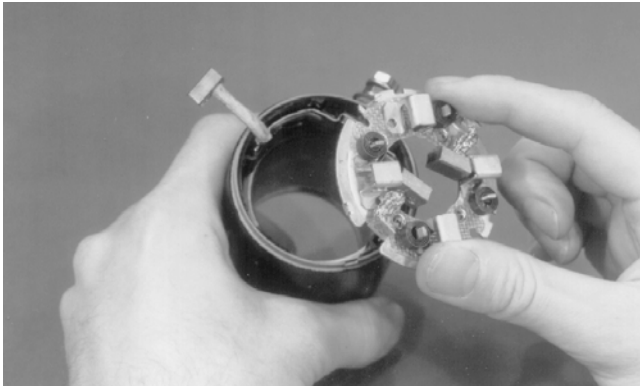
BC009

2. On the positive post, install an O-ring washer, a fiber washer, a flat washer, and a lock washer. Secure with the nut.



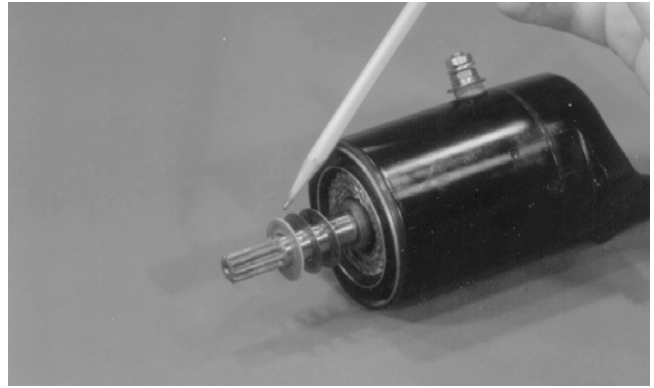
BC008

3. Align the tab on the brush holder with the notch in the starter housing; then install.



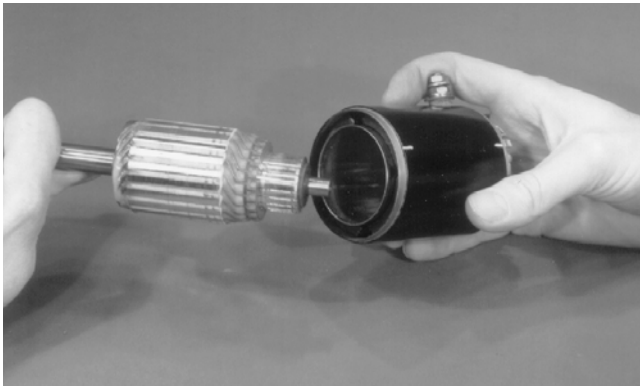
BC010

4. Install the armature into the starter housing; then while holding the brushes out, slide the commutator into the brush holder.



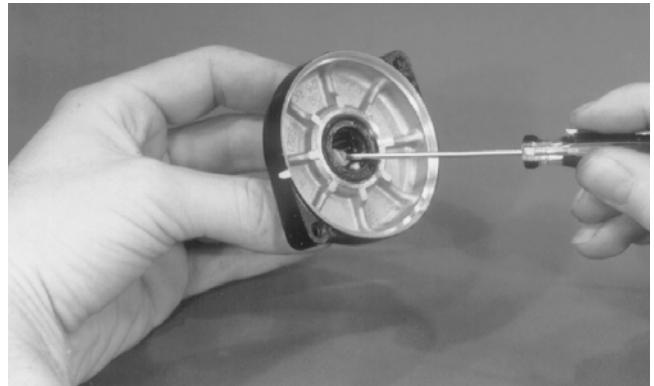
BC014

7. Apply a small amount of grease to the front cover bearing and seal; then install the seal protector.

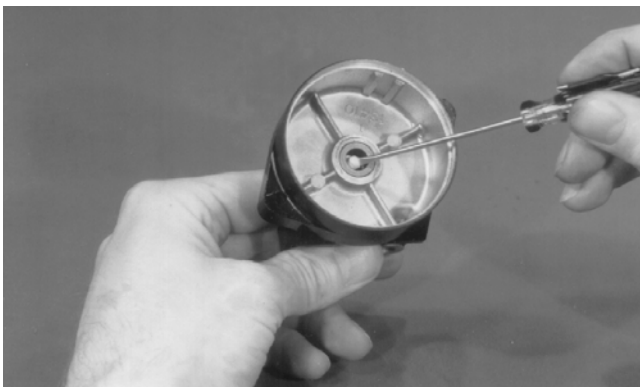


BC006

5. Apply a small amount of grease to the rear cover bushing; then install the cover on the starter housing making sure the reference marks align.

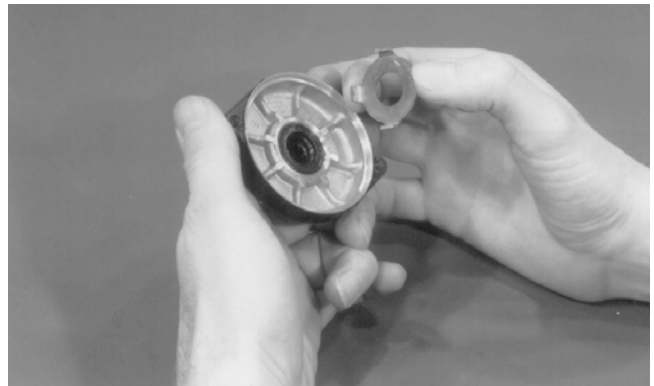


BC015



BC013

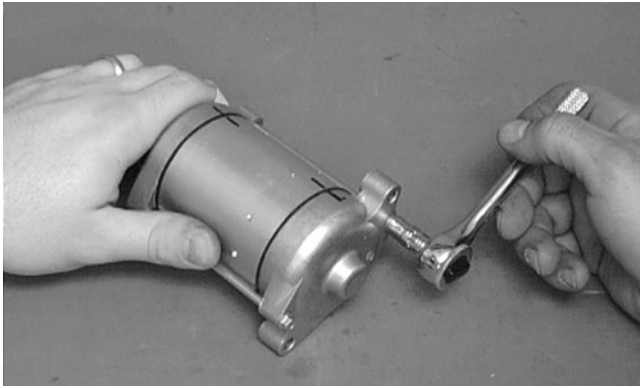
6. In order, install the thick metal washer, thin metal washer, and the fiber washer on the armature shaft; then install the housing O-ring on the starter housing.



BC004

8. Place the front cover onto the starter housing making sure it seats properly.
9. Apply red Loctite #271 to the threads of the two long cap screws and install. Tighten to 0.8-1.2 kg-m (6-9 ft-lb).





AR653D

10. Apply a small amount of grease to the O-ring seal on the starter; then install the starter into the crankcase. Secure with two cap screws and wiring forms.
11. Secure the positive cable to the starter with the nut.
12. Connect the battery.

## TESTING VOLTAGE

Perform this test on the starter motor positive terminal. To access the terminal, slide the boot away.

■ **NOTE:** The ignition switch must be in the **ON** position, the emergency stop switch in the **RUN** position, the reverse lever (on manual transmission models) in the **FORWARD** position, and the shift lever (on automatic transmission models) in the **NEUTRAL** position.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the starter terminal; then connect the black tester lead to ground.
3. With the starter button depressed, the meter must show battery voltage and the starter motor should operate.



AR607D

■ **NOTE:** If the meter showed battery voltage but the starter did not operate or operated slowly, inspect battery voltage (at the battery), starter motor condition, and/or ground connections.

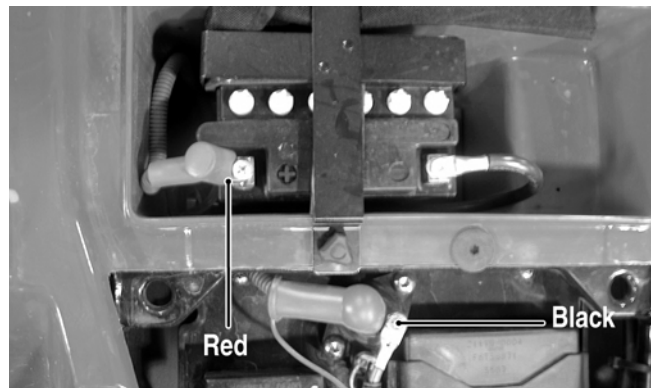
■ **NOTE:** If the meter showed no battery voltage, inspect the main fuse, ground connections, starter motor lead, battery voltage (at the battery), starter relay, or the neutral start relay.

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## Starter Relay

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1. Remove the seat; then using the multimeter set to the DC Voltage position, check the relay as follows.
2. Connect the red tester lead to the positive battery terminal; then connect the black tester lead to the starter cable connection on the starter relay. The meter must show battery voltage.



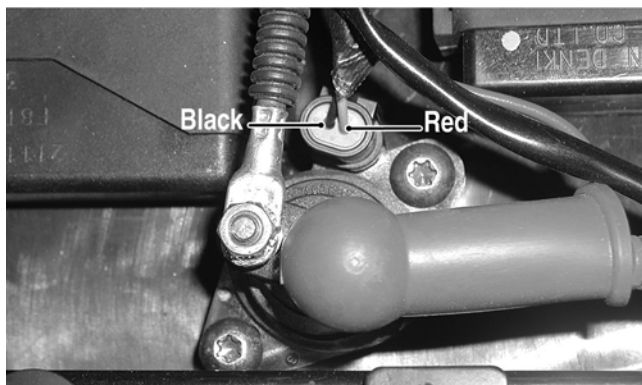
KX206A

■ **NOTE:** Make sure that the ignition switch is in the **ON** position, transmission in neutral, brake lock released, and the emergency stop switch in the **RUN** position.

3. Depress the starter button while observing the multimeter. The multimeter should drop to 0 volts and a “click” should be heard from the relay.

■ **NOTE:** If a “click” is heard and any voltage is indicated by the multimeter, replace the starter relay. If no “click” is heard and the multimeter continues to indicate battery voltage, proceed to step 4.

4. Disconnect the two-wire plug from the starter relay; then connect the red tester lead to the green wire and the black tester lead to the black wire.



KX059A

5. Depress the starter button and observe the multi-meter.

■ **NOTE:** If battery voltage is indicated, replace the starter relay. If no voltage is indicated, proceed to Neutral Start Relay check.

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## CDI Unit (400 FIS/TBX/500/650 H1/650 V-Twin)

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The CDI is located beneath the seat near the battery.

■ **NOTE:** The CDI unit is not a serviceable component. If the unit is defective, it must be replaced.

The CDI is rarely the cause for electrical problems; however, if the CDI is suspected, substitute another CDI unit to verify the suspected one is defective.

■ **NOTE:** Prior to replacing the CDI unit to assure the CDI unit is defective, it is advisable to perform a CDI peak voltage test (see Ignition Coils in this section) and/or perform a continuity test of the wiring harness from the CDI connector to the CDI unit.

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## Regulator/Rectifier

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The regulator/rectifier is located under the rear rack and rear fenders.

### TESTING

1. Start engine and warm up to normal operating temperatures; then connect a multimeter to the battery as follows.
2. Select the DC Voltage position; then connect the red tester lead to the positive battery post and the black tester lead to the negative battery post.

3. Start the engine and slowly increase RPM. The voltage should increase with the engine RPM to a maximum of 15.5 DC volts.

■ **NOTE:** If voltage rises above 15.5 DC volts, the regulator is faulty or a battery connection is loose or corroded. Clean and tighten battery connections or replace the regulator/rectifier. If voltage does not rise, check Voltage (Charging Coil - No Load) in this section. If charging coil voltage is normal, replace the regulator/rectifier.

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## Neutral Start/Front Drive Actuator/Start-in-Gear/Differential Lock/2WD Relays (FIS Models)

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The relays are identical plug-in type located on the power distribution module. Relay function can be checked by switching relay positions. The relays are interchangeable.

■ **NOTE:** The module and wiring harness are not a serviceable component and must be replaced as an assembly.

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## Headlights

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The connectors are the four 2-prong ones secured to the front bumper supports (two on each side) with cable ties.

### BULB VERIFICATION (Low and High Beam)

■ **NOTE:** Perform this test on each headlight bulb. Also, a 12-volt external power supply w/jumpers will be needed.

1. Disconnect the wiring harness from the bulb to be tested.
2. Connect the power supply (positive) to one bulb contact; then connect the power supply (negative) to the remaining bulb contact.
3. The bulb should illuminate.
4. If the bulb fails to illuminate, it must be replaced.

## VOLTAGE

■ **NOTE:** Perform this test in turn on the main harness side of all four connectors. Also, the ignition switch must be in the LIGHTS position.

■ **NOTE:** The LO beam is the outside bulb, and the HI beam is the inside bulb.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to one wire; then connect the black tester lead to the other wire.
3. With the dimmer switch in the LO position, test the two outside connectors (LO beam). The meter must show battery voltage.
4. With the dimmer switch in the HI position, test the two inside connectors (HI beam). The meter must show battery voltage.

■ **NOTE:** If battery voltage is not shown in any test, inspect the fuses, battery, main wiring harness, connectors, or the left handlebar switch.

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## Taillight - Brakelight

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The connector is the 3-prong one located under the rear fender assembly.

### BULB VERIFICATION

■ **NOTE:** Perform this test on the taillight-brakelight side of the connector. Also, a 12-volt external power supply (jumper) will be needed.

1. Connect the power supply (positive) to the middle terminal; then connect the power supply (negative) to the bottom terminal.
2. The taillight should illuminate.
3. With the negative power supply still connected, connect the positive supply wire to the top terminal.
4. The brakelight should illuminate.

■ **NOTE:** If either the taillight or brakelight fails to illuminate, inspect the bulb, the connectors, or the component wiring harness.

## VOLTAGE (Taillight)

■ **NOTE:** Perform this test on the main harness side of the connector. Also, the ignition switch should be in the LIGHTS position.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the white wire; then connect the black tester lead to the black wire.
3. With the ignition key in the LIGHTS position, the meter must show battery voltage.

■ **NOTE:** If the meter shows no voltage, inspect fuses, wiring harness, connectors, and switches.

## VOLTAGE (Brakelight)

■ **NOTE:** Perform this test on the main harness side of the connector. Also, the ignition switch should be in the ON position and the brake (either foot pedal or hand lever) must be applied.

■ **NOTE:** Make sure the brake lever (hand) and brake pedal (auxiliary) are properly adjusted for this procedure.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the red/blue wire; then connect the black tester lead to the black wire.
3. With either brake applied, the meter must show battery voltage.

■ **NOTE:** If the meter shows no voltage, inspect bulb, fuses, wiring harness, connectors, and switches.

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## Ignition Timing (400/500/650 H1)

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The ignition timing cannot be adjusted; however, verifying ignition timing can aid in troubleshooting other components. To verify engine timing, use the following procedure.

1. Attach the engine Timing Light (p/n 0644-197) to the spark plug high tension lead; then remove the timing inspection plug from the left-side crankcase cover.



2. With the Arctic Cat Engine Tachometer (p/n 0644-275) connected, start the engine and run at the specified RPM.
3. Ignition timing should be according to specifications.

| Model  | Timing              |
|--------|---------------------|
| 400    | 10° BTDC @ 1500 RPM |
| 500    | 10° BTDC @ 1500 RPM |
| 650 H1 | 10° BTDC @ 1500 RPM |

4. Install the timing inspection plug.

If ignition timing cannot be verified, the rotor may be damaged, the key may be sheared, the trigger coil bracket may be bent or damaged, or the CDI unit may be faulty.

## Ignition Timing (650 V-Twin)

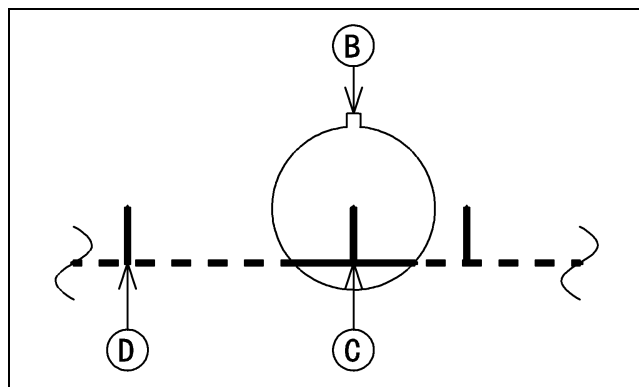
The ignition timing cannot be adjusted; however, verifying ignition timing can aid in troubleshooting other components. To verify ignition timing, use the following procedure.

### **WARNING**

**Oil will spray out of the timing inspection hole when the engine is running. Cover or shield the ATV around the inspection plug. Always wear protective glasses when doing timing checks.**

1. Attach the engine Timing Light (p/n 0644-197) to the front spark plug high tension lead; then remove the timing inspection plug from the left-side crankcase cover.
2. With the Arctic Cat Engine Tachometer (p/n 0644-275) connected, start the engine and run at the specified RPM.
3. Ignition timing should be according to the following chart and illustration.

| Engine Speed<br>r/min (RPM) | Slot (B) Aligned With                               |
|-----------------------------|-----------------------------------------------------|
| 1100 and below              | Advanced mark (C)<br>on alternator rotor (5° BTDC)  |
| 5000 and above              | Advanced mark (D)<br>on alternator rotor (28° BTDC) |



ATV2119A

4. Install the timing inspection plug.

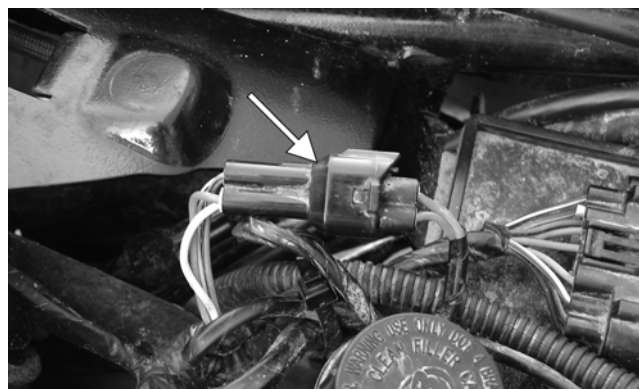
If ignition timing is incorrect, replace the CDI and pick-up coil.

## V-Belt Failure Mode Clearing (650 V-Twin)

### PROCEDURE

- **NOTE:** See Section 2 for V-belt inspection.

1. Turn the ignition switch to the OFF position; then disconnect the 4-pin connector and the belt indicator switch connector.



CF235A

2. Install the Reset Connector (p/n 0486-161) into the forward 4-pin connector; then turn the ignition switch to ON. Allow the speedometer/tachometer to power-up and reset to the running mode; then turn the ignition switch to OFF.
3. Remove the reset connector and connect the 4-pin connectors and the belt indicator switch connector.
4. Turn the ignition switch to the ON position and confirm that the word BELT is off.

---

## 100-Hour Belt Inspection Mode Clearing (650 V-Twin)

---

Every 100 hours, the word BELT will appear to alert for inspection. See Section 2 - Checking/Replacing V-Belt. To reset the belt indicator, use the following procedure.

### **WARNING**

V-belt inspection must be conducted in accordance with Section 2. Belt separation and lock-up could cause severe injury or death.

1. Turn the ignition switch to the OFF position; then disconnect the 4-pin connector.
2. Connect the Reset Connector (p/n 0486-161) into the forward 4-pin connector; then turn the ignition switch to the ON position. The word BELT will flash on the LCD, and the speedometer/tachometer needle will sweep.
3. Disconnect the belt indicator switch connector. The light should continue to flash. Allow the indicator to flash for 10 seconds before turning the ignition switch off.
4. Turn the ignition switch to the OFF position; then remove the reset connector.
5. Connect the 4-pin connector and the belt indicator switch connector; then turn the ignition switch to the ON position. The belt indicator should go off.

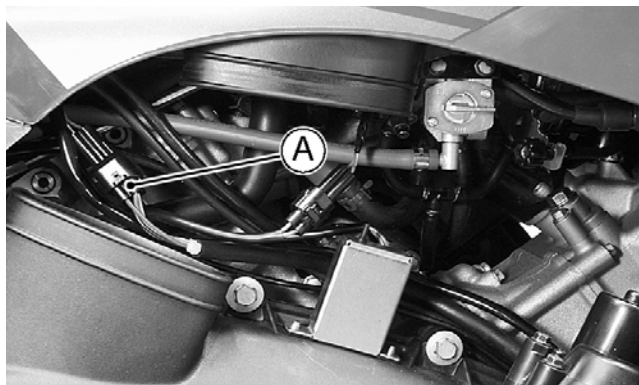
---

## Engine Brake Actuator Resistance (650 V-Twin)

---

■ **NOTE:** This component is located on the V-belt cover and controls drive clutch disengagement through a lever linkage.

1. Remove the air duct boot; then disconnect the actuator lead connector (A).

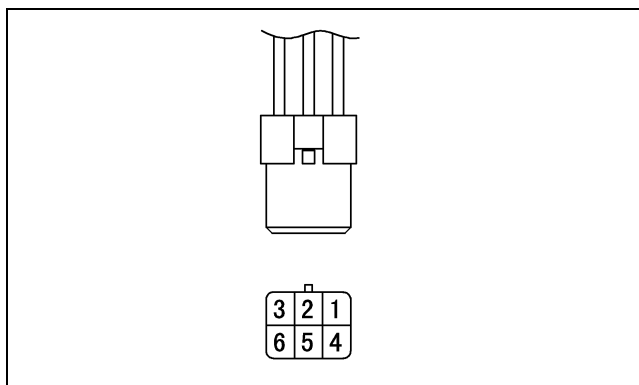


KX381

### **CAUTION**

Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.

2. Use the multimeter and select the ohms function; then measure resistance as follows: pins 4 (red) - 6 (black), 3-15 ohms; pins 1 (orange) - 3 (blue), 3500-6500 ohms; pins 2 (yellow) - 3 (blue), 630-5330 ohms. If readings are not as specified, replace the engine brake actuator.



ATV2143A

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## Engine Brake Controller Power Supply Voltage (650 V-Twin)

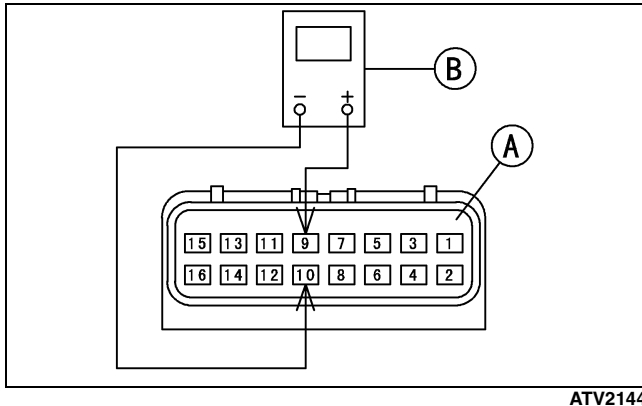
---

■ **NOTE:** This component is located under the seat and controls and drives the engine brake actuator through a microprocessor which processes data from the forward/reverse detecting sensor and from the speed sensor.

■ **NOTE:** For the following tests, make sure the battery is fully charged.

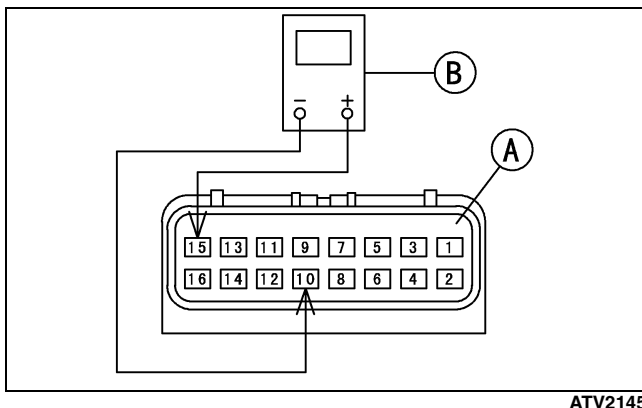
■ **NOTE:** Needle adapters will be required on the multimeter leads as these tests are made with the controller connected.

1. Select DC Voltage on the multimeter (B); then turn the ignition switch ON.
2. In the brake controller (A), connect the red tester lead to the orange wire terminal (9) and the black tester lead to the black wire terminal (10). The meter should read battery voltage.
3. If battery voltage is not present, check the 30-amp fuse, ignition switch, or wiring harness.



## Controller-to-Engine Brake Actuator Voltage (650 V-Twin)

1. Support the ATV on a stand or suitable jack so the wheels are off the ground; then select DC Voltage on the multimeter (B). Connect the red tester lead to the brown/white wire terminal (15) and the black tester lead to the black wire terminal (10) in the controller (A).



2. Turn the ignition switch ON and spin a rear wheel in the forward direction; then allow the wheel to stop. After at least one second, turn the ignition switch OFF.

3. After two seconds, observe the meter until the actuator stops. The controller output voltage should vary from 5-12 DC volts. If the voltage is not within specifications, check the forward/reverse detecting sensor. If the sensor is normal, replace the actuator controller.

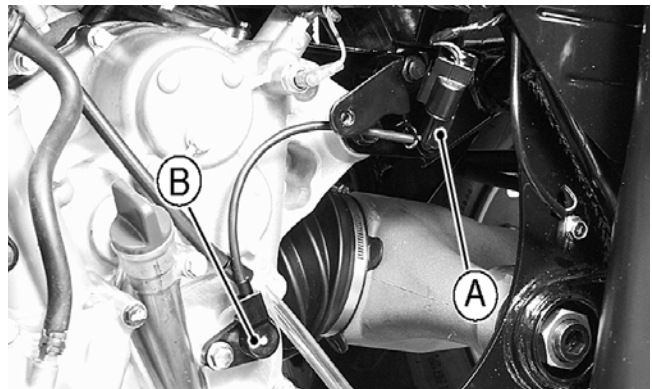
## Forward/Reverse Detecting Sensor Resistance (650 V-Twin)

■ **NOTE:** This component is located on the left side of the engine and provides vehicle direction data to the engine brake controller.

### ⚠ CAUTION

**Always disconnect the battery when performing resistance tests to avoid damaging the multimeter.**

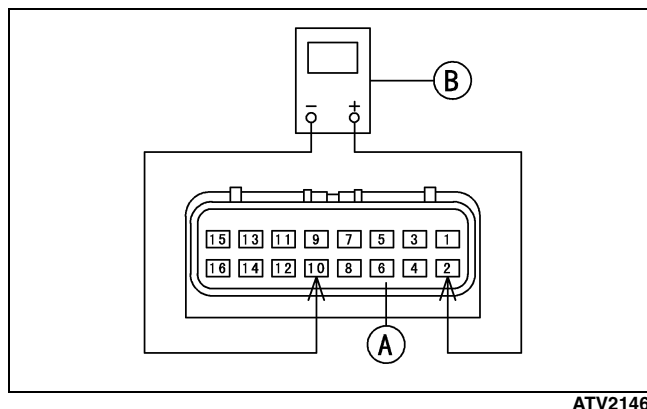
1. Disconnect the sensor lead wire connector (A); then select OHMS on the multimeter and check resistance between the sensor pins. The meter should read 1200-1600 ohms.
2. Check each lead of the sensor to ground. The meter should show an open circuit or infinity (4). If either test fails, replace the sensor (B).





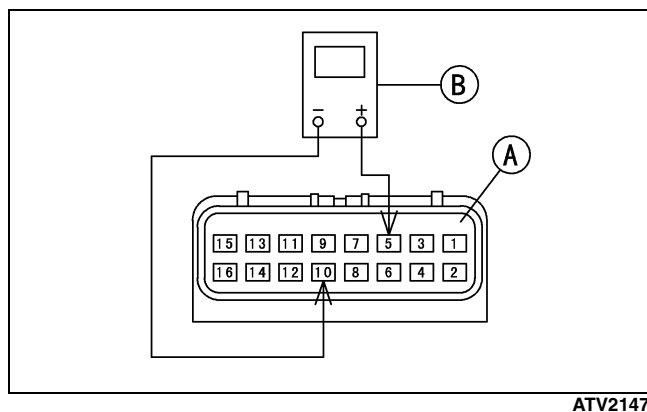
## Output-to-Actuator Voltage (650 V-Twin)

Select DC Voltage on the multimeter (B) and turn the ignition switch ON; then connect the red tester lead to the black/green wire terminal (2) and the black tester lead to the black wire terminal (10) in the controller (A). The controller output voltage should be  $4.8 \pm 0.2$  DC volts. If the reading is not as specified, replace the actuator controller.



## Output-to-Speed Sensor Voltage (650 V-Twin)

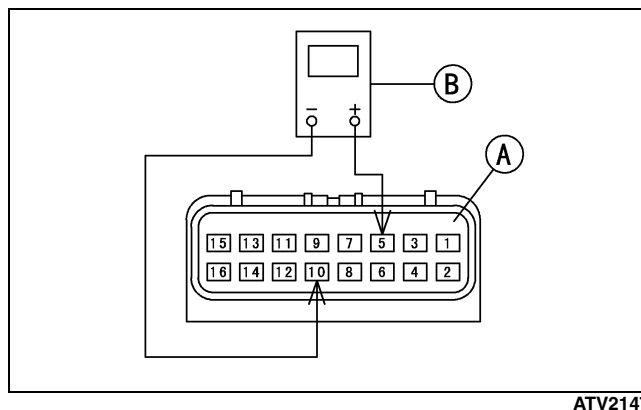
Select DC Voltage on the multimeter (B), disconnect the speed sensor connector, and turn the ignition switch ON; then connect the red meter lead to the pink/white wire terminal (5) and the black tester lead to the black wire terminal (10) in the controller (A). The meter should read  $5 \pm 0.25$  DC volts. If the reading is not as specified, replace the actuator controller.



## Speed Sensor Signal Voltage (650 V-Twin)

■ **NOTE:** This component is located on the right side of the engine and provides vehicle speed data to the engine brake controller.

1. Support the ATV on a stand or suitable jack so the wheels are off the ground; then turn the ignition switch ON.
2. Select DC Voltage on the multimeter (B); then connect the red tester lead to the pink/white wire terminal (5) and the black tester lead to the black wire terminal (10) in the controller (A).



3. Spin a rear wheel in the forward direction while observing the multimeter. The meter should alternately show 0 volts and 5 DC volts. If the reading is not as specified, replace the speed sensor.

## Tilt Sensor Voltage

(650 V-Twin)

### ⚠ WARNING

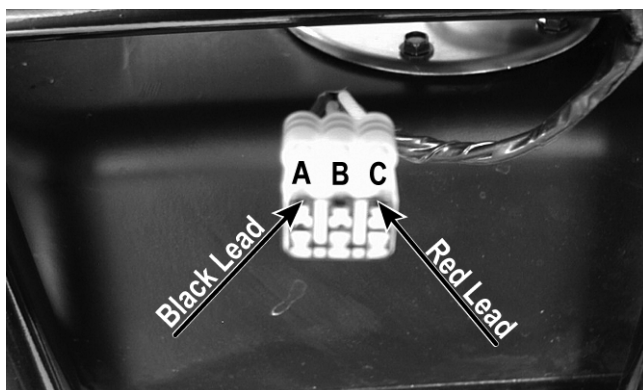
Incorrect installation of the tilt sensor could cause sudden loss of engine power which could result in loss of vehicle control resulting in injury or death.

### ⚠ CAUTION

Do not drop the tilt sensor as shock can damage the internal mechanism.

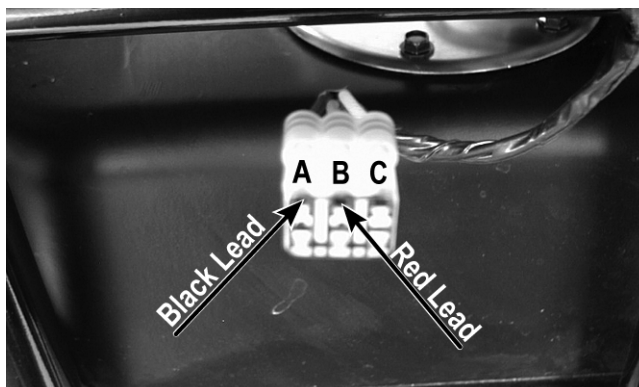
### SUPPLY VOLTAGE

1. Disconnect the three-wire connector from the sensor; then select DC Voltage on the multimeter and connect the red tester lead to the orange wire (C) and the black tester lead to the black wire (A).



CD706A

2. Turn the ignition switch to the ON position. The multimeter should read battery voltage. If battery voltage is not indicated, check the 30-amp fuse, wiring harness, or the ignition switch.
3. Remove the red tester lead and connect to the blue/brown wire (B). The multimeter should read 5.0 DC volts. If the specified voltage is not indicated, check wire connections at the CDI or substitute another CDI to verify the test.



CD706B

### OUTPUT VOLTAGE

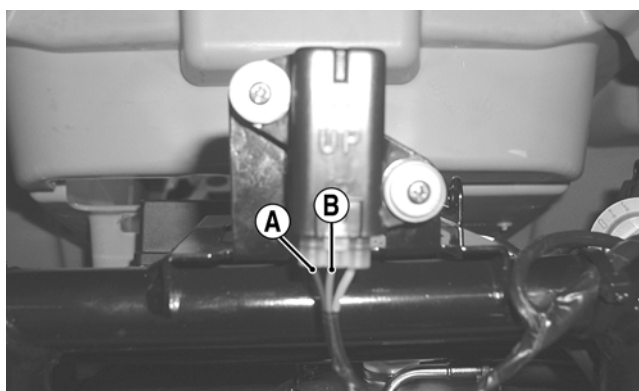
■ NOTE: Needle adapters will be required on the multimeter leads as the following tests are made with the sensor connected.

1. Connect the three-wire plug to the sensor; then remove the right-side mounting screw securing the sensor to the rear frame.



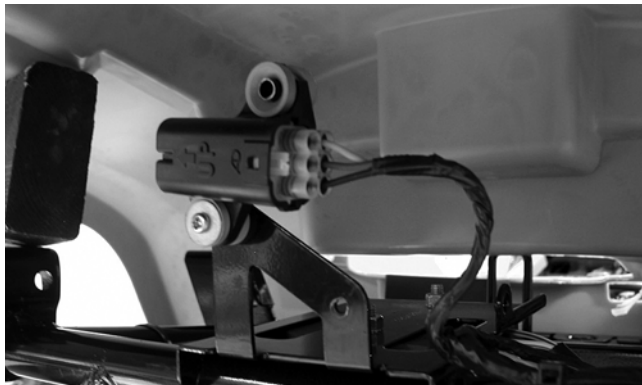
CD707

2. Install the needle adapters to the multimeter leads; then select DC Voltage on the multimeter.
3. Connect the red tester lead to the blue/brown wire (B) and the black tester lead to the black/yellow wire (A); then turn the ignition switch ON and observe the meter. The meter should read 0.8-3.0 DC volts.



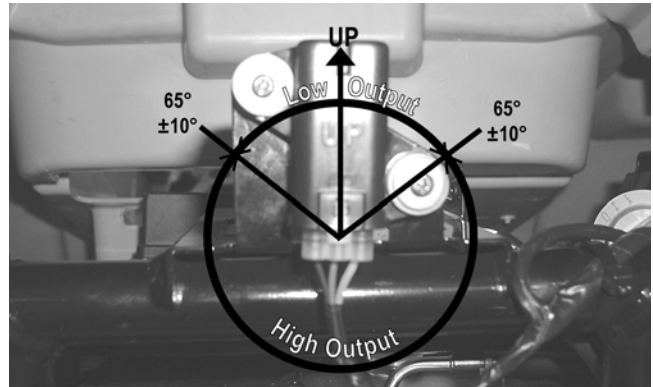
CD705B

4. Tilt the sensor 60° or more to the left and right observing the meter. The meter should read 4.0-8.0 DC volts after approximately one second in the tilted position. If the meter readings are not as specified, the tilt sensor is defective.



CD709

■ **NOTE:** When replacing the sensor after testing, make sure the arrow marking is directed up.



CD705A



# SECTION 6 - DRIVE SYSTEM

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## TABLE OF CONTENTS

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## Drive System

■ **NOTE:** Some photographs and illustrations used in this section are used for clarity purposes only and are not designed to depict actual conditions.

## General Information

All gear cases are tagged beneath a cover bolt. This tag is marked with a production date code, sequence code, and a ratio code.

A. A “6” on the lower-right corner indicates a 3.6:1 gear set ratio (10:36 teeth).

B. A “1” on the lower-right corner indicates a 3.1:1 gear set ratio (11:34 teeth).

The die-cast aluminum housings have been assembled with thread-rolling screws (trilobular). When assembling with these screws, start the screws carefully into the housing; then use the following torque values.

| Size                      | New Housing                     | Reassembled Housing           |
|---------------------------|---------------------------------|-------------------------------|
| M6<br>(Torx T-30 Recess)  | 1.1-1.3 kg-m<br>(8-9.5 ft-lb)   | 0.9-1.2 kg-m<br>(6.5-9 ft-lb) |
| M8<br>(Torx T-40 Recess)  | 3.5-4.3 kg-m<br>(25-31 ft-lb)   | 2.9-3.5 kg-m<br>(21-25 ft-lb) |
| M10<br>(Torx T-50 Recess) | 5.1-6.3 kg-m<br>(37-45.5 ft-lb) | 4.3-5.3 kg-m<br>(31-38 ft-lb) |

## SPECIFICATIONS

Specific specifications regarding the gear cases (capacities, lubricant type, etc.) can be found in Section 1 of this manual.

|                    |                                |
|--------------------|--------------------------------|
| Ring Gear Backlash | 0.28-0.38 mm (0.011-0.015 in.) |
| Ring Gear End Play | 0.1-0.2 mm (0.004-0.008 in.)   |

## SPECIAL TOOLS

A number of special tools must be available to the technician when servicing the gear case.

| Description                        | p/n      |
|------------------------------------|----------|
| Boot Clamp Pliers                  | 0444-120 |
| Pinion Gear/Shaft Removal Tool     | 0444-127 |
| Slide Hammer w/CV Joint Attachment | 0444-123 |
| CV Joint Attachment (Only)         | 0444-119 |
| Internal Hex Socket (48 mm)        | 0444-104 |

■ **NOTE:** Special tools are available from the Arctic Cat Service Parts Department.

## TROUBLESHOOTING

If a noise is heard from the gear case area, it can be difficult to locate and/or diagnose. If the noise is related to wheel speed, but not to engine RPM, the problem is probably in the final drive or engine/transmission bevel gear set. When a problem is localized, a number of inspections must be made to pinpoint that problem. The most obvious of the inspections include CV boots, wheel and hub nut tightness, wheel bearing damage, gear case lubricant contamination, low lubricant level, seal leakage, CV joints, or selector arm.

■ **NOTE:** Small metallic particles will collect on the magnetic drain plug as a normal part of break-in and will also give a metallic cast to drained lubricant. Contamination would include large particles or water which gives a “milky” look to the lubricant.

■ **NOTE:** Lubricant on a new pinion housing assembly could be grease. If the front of the gear case is leaking at the rear drive boot, wipe excess lubricant from the bottom of the pinion housing; then operate the ATV for a period of time. Inspect the pinion housing area for any signs of leakage. If lubricant is again on the bottom of the pinion housing, the seal must be replaced.

Additional troubleshooting could include the following.

- Binding/abrupt motion: CV boot torn (grease loss, foreign object damage, broken cage); gear lubricant loss or not filled (bearing seizure, broken gear teeth, seal leakage, bladder or hose leakage, missing filler/drain plug).
- Noise from drive system: wheel or gear case bearing damage, improper gear backlash, improper assembly, low or no gear case lubricant.
- Lockup: gear case lubricant loss or not filled, water contamination causing bearing seizure.

## Front Drive Actuator (400 FIS/500/650 H1/650 V-Twin)

■ **NOTE:** The actuator is not a serviceable component. If it is defective, it must be replaced.

■ **NOTE:** The actuator will operate only when the ignition switch is in the ON position.

The front drive actuator is located on the left side of the front drive input housing. With the engine stopped and the ignition switch in the ON position, a momentary “whirring” sound can be heard each time the front drive selector switch is shifted. If no sound is heard, see Section 5. If the actuator runs constantly or makes squealing or grinding sounds, the actuator must be replaced.

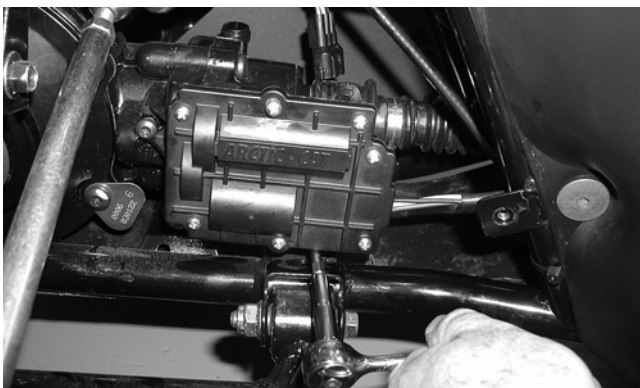
### REMOVING

1. Remove the left-front inner fender panel; then disconnect the connector on the actuator harness.
2. Using a T-30 torx wrench, remove the mounting cap screw from the driveshaft side of the actuator.



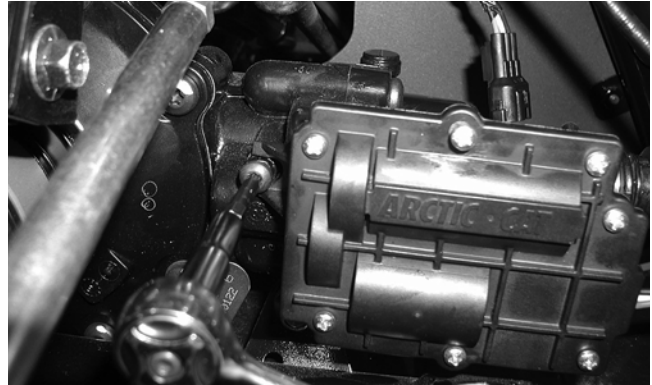
AG926

3. Remove the mounting cap screw from below the actuator on the suspension side.



AG927

4. Loosen but do not remove the mounting cap screw at the front of the actuator; then slide the actuator to the rear enough to clear the slotted mounting tab and the selector shaft.



AG928

### INSTALLING

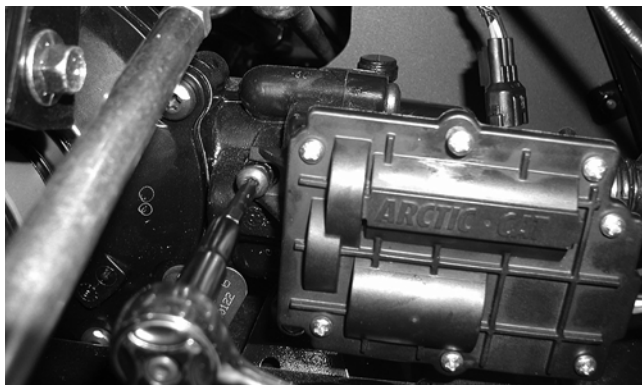
1. Lubricate the O-ring on the actuator; then ensure that all mounting surfaces are clean and free of debris.
2. Align the actuator with the selector shaft and slide it forward onto the shaft taking care to engage the cap screw in the slot of the front mounting tab.



AG925

3. While holding the actuator firmly forward, tighten the front cap screw to hold the actuator in place; then install but do not tighten the two remaining cap screws.





AG928

4. Loosen the front cap screw; then tighten the cap screw on the driveshaft side.



AG926

■ **NOTE:** It is important to tighten this cap screw while the others are loose to ensure proper seating of the actuator.

5. Tighten the remaining cap screws; then connect the electrical plug to the main harness.
6. Turn the ignition switch to the ON position and check the operation by shifting the selector switch several times.
7. Secure the wiring harness to the frame with a nylon cable tie; then install the inner fender panel.

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## Front Differential (FIS Models)

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■ **NOTE:** To remove the rear gear case on FIS models, see Rear Gear Case (FIS Models) in this section.

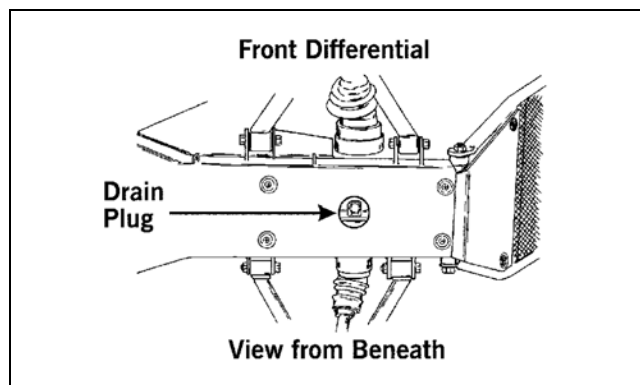
## REMOVING DIFFERENTIAL

1. Secure the ATV on a support stand to elevate the wheels.

### **WARNING**

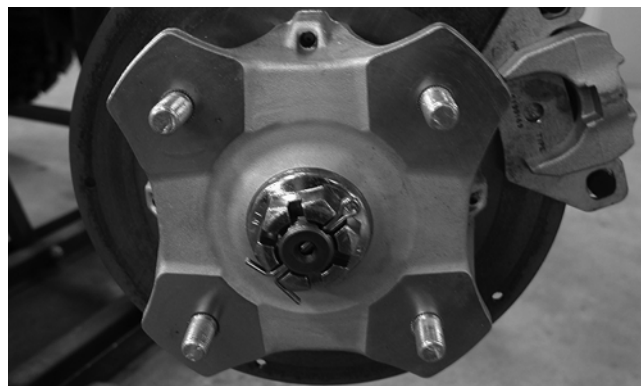
**Make sure the ATV is solidly supported on the support stand to avoid injury.**

2. Remove the drain plug and drain the gear lubricant into a drain pan; then reinstall the plug.



ATV0082A

3. Remove the front wheels.
4. Pump up the hand brake; then engage the brake lever lock.
5. Remove the cotter pin securing the hex nut; then remove the hex nut and washer.



KX041

6. Release the brake lever lock.

■ **NOTE:** It is not necessary to remove the brake hoses from the calipers for this procedure.

7. Remove the two brake calipers. Account for the four cap screws and four 0.76 mm (0.030 in.) spacer washers.



AF894D

8. Remove the tie rod cotter pins and discard the pins.



AF895D

9. Remove the tie rod lock nuts.



AF896D

10. Remove the upper ball joint cap screws taking care not to strip the threads on the ball joint shaft; then using a rubber mallet, tap the end of the axle and free it from the knuckle assembly.



AF628D

11. Pull the steering knuckle away from the axle taking care not to damage the seals with the axle end.



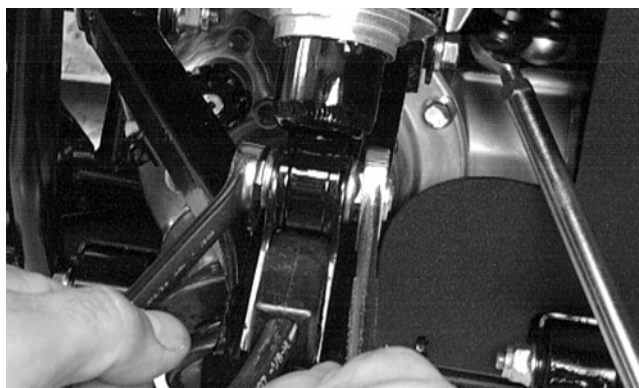
KX151

12. Support the axle to not allow it to drop or hang.

**CAUTION**

The axle must be supported. If the axle is allowed to drop or hang, damage to the inner CV joint may occur.

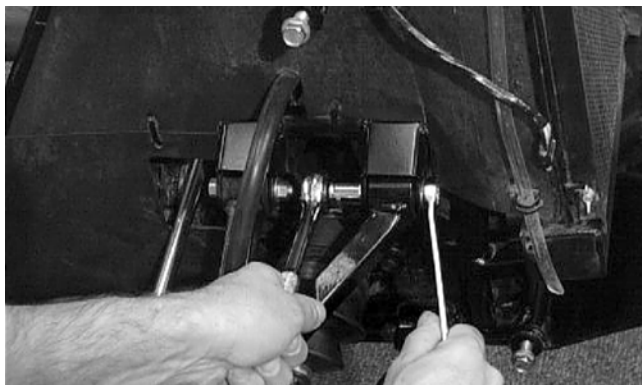
13. Remove the lower shock bolts. Account for the lock nuts; then move the shocks aside and secure them with a strap.



AF897D

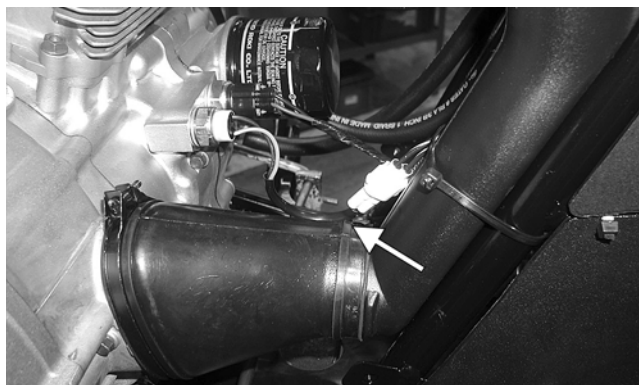
14. Remove the upper A-arm lock nuts and cap screws; then remove the A-arms.





AF610D

15. Using a slide hammer, remove the front axles.



CD517A

17. Using a T-30 torx wrench, remove the three screws securing the front drive actuator to the gear case; then remove the actuator.



AF899D

16. Remove the inner fender panels.

■ **NOTE:** On the 650 V-Twin, it will be necessary to remove the forward V-belt cooling duct boot and move it to the side.

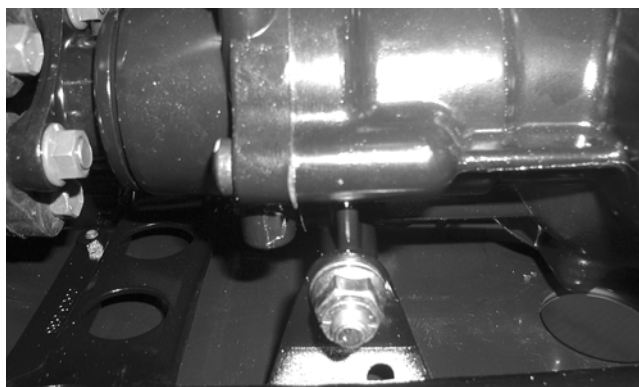


AG925

18. Remove the lower differential mounting cap screw. Account for a lock nut and washers.



AF902D



CD026

19. Remove the upper differential mounting cap screws.





CD016

20. Free the differential assembly from the frame mountings; then shift the differential assembly forward enough to disengage the front drive-shaft from the output yoke.



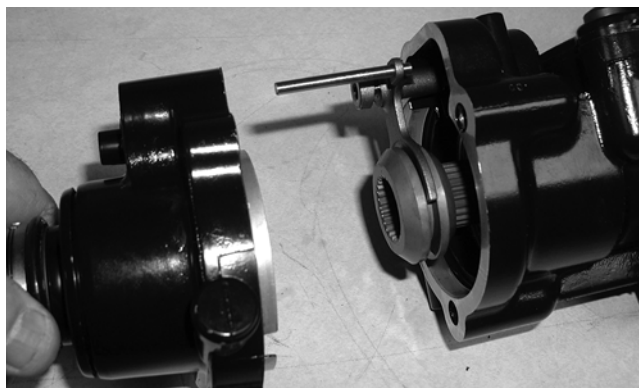
CD102

2. Using a rubber mallet, remove the housing. Account for a gasket. Remove the fork, collar, and spring. Note the location of all the components for assembling purposes.



KX161

21. Place the differential on its right side; then remove it from the frame.



CD103



CD106

3. Using a side-cutter (or suitable substitute), remove the boot clamps; then remove the boots and splined drive from the input shaft.



KX159

## Disassembling Input Shaft

■ **NOTE:** This procedure can be performed on a rear FIS gear case; however, some components may vary from model to model. The technician should use discretion and sound judgment.

1. Using a T-40 torx wrench, remove the cap screws securing the pinion housing.

6



CD114

4. Remove the input shaft from the pinion housing.



AF983



CD107

5. Using a seal removal tool, remove the input shaft seal. Account for a spacer.



AF984



AF982

6. Remove the snap ring securing the input shaft bearing; then place the pinion housing in a press and remove the bearing.



KX219

### Assembling Input Shaft

1. Place the pinion housing in a press and install the input shaft bearing. Secure the bearing with the existing snap ring making sure the sharp edge of the snap ring faces to the outside.





AF993



AF994

2. Install the input shaft seal making sure it is flush with the edge of the housing.
3. Lubricate the input shaft splines with High-Performance Grease (p/n 0436-501).

■ **NOTE:** Any time drive splines are separated, clean all splines with parts-cleaning solvent and dry with compressed air; then lubricate with recommended grease.



KX221



KX222

4. On the 400 FIS/500/650 H1, install the input shaft into the housing; then install the front boot and secure with Boot Clamp (p/n 0423-393) and the rear boot with Boot Clamp (p/n 0423-411).



CD112

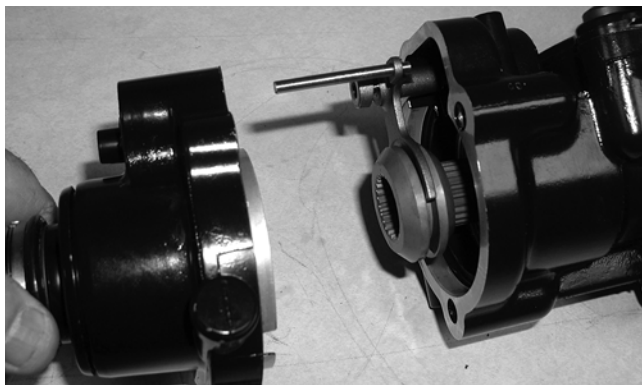


CD099

5. On the 400 FIS/500/650 H1, place the pinion housing with new gasket onto the gear case housing; then secure with the existing cap screws. Tighten to specifications.

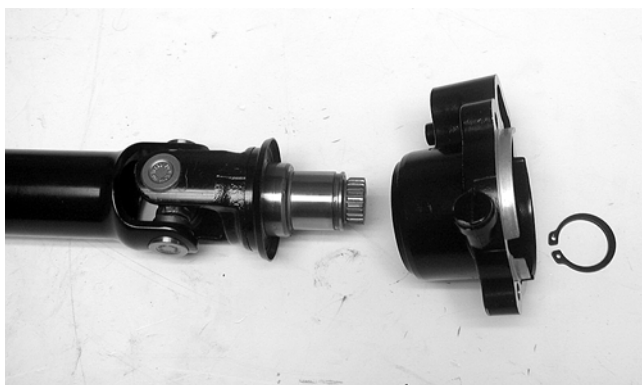
■ **NOTE:** If a new gear case housing is being installed, tighten the cap screws to 3.5-4.3 kg-m (25-31 ft-lb).





CD103

6. On the 650 V-Twin, install the input shaft into the pinion housing; then secure in the bearing with a circlip.



KX210

7. On the 650 V-Twin, place the pinion housing with new gasket onto the gear case housing; then secure with existing cap screws. Tighten to specifications.

■ **NOTE:** If a new gear case housing is being installed, tighten the cap screws to 3.5-4.3 kg-m (25-31 ft-lb).



KX209



CD110



KX158

## Disassembling Pinion Gear

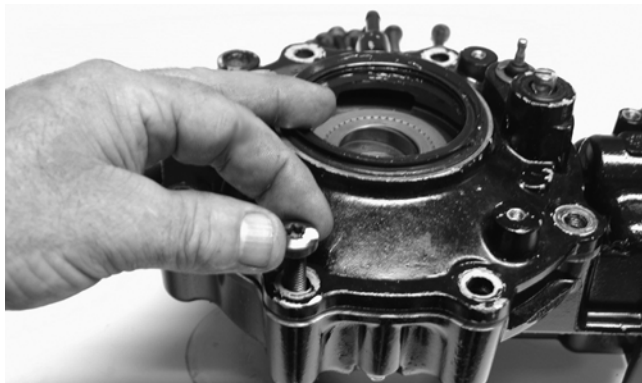
■ **NOTE:** This procedure can be performed on a rear gear case.

1. Using a T-40 torx wrench, remove the cap screws securing the pinion housing. Account for the coupler, fork, and spring.



KX209

2. Using a T-40 torx wrench, remove the cap screws securing the gear case cover. Account for and make note of the ID tag location for assembling purposes.



KX173

3. Using a plastic mallet, tap lightly to remove the differential cover. Account for an O-ring.



KX174

■ **NOTE:** If the cover is difficult to remove, pry on the cover in more than one recessed location.

4. Remove the splined coupler, shifter fork, pin, and spring of the differential lock assembly and set aside. Note position of parts for assembling purposes.



KX175

5. Make match marks on the left bearing housing and differential housing; then remove the plate and account for a shim. Mark the shim as left-side.



KX176



KX177



KX178

6. Place the differential with the open side down; then lift the housing off the spider assembly. Account for shim(s) and mark as right-side.



KX179

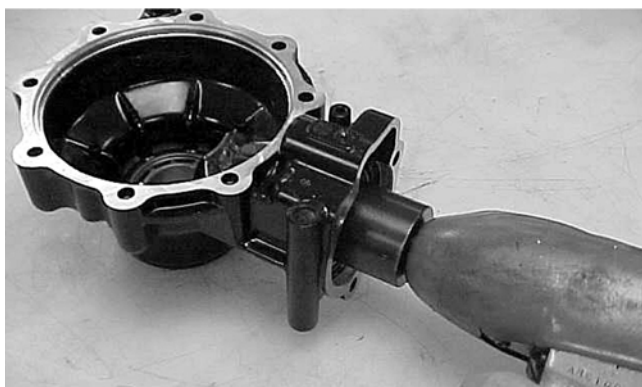




KX181

7. Using the 48 mm Internal Hex Socket (p/n 0444-104), remove the lock collar securing the pinion gear assembly.

■ **NOTE:** On a front differential, the lock collar has right-hand threads. On a rear gear case, the lock collar has left-hand threads.

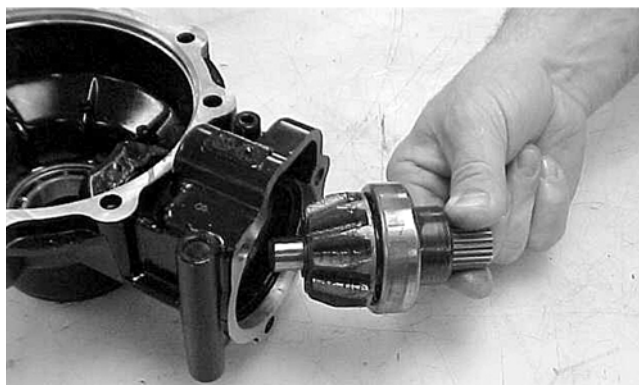


CC875



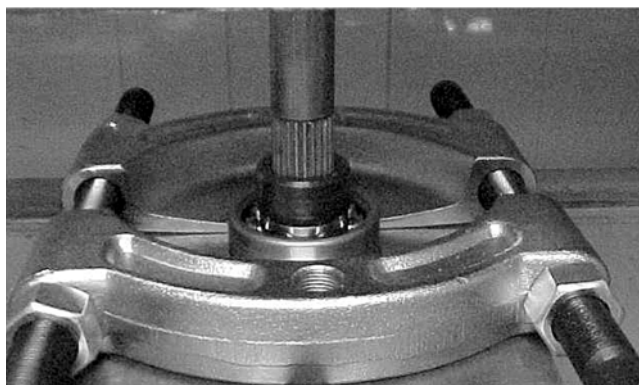
CC876

8. Using the Pinion Gear/Shaft Removal Tool (p/n 0444-127) and a hammer, remove the pinion gear from the gear case housing.



CC878

9. Secure the pinion gear in a bearing puller; then remove the pinion bearing using a press. Account for a collar, a bearing, and a shim.



CC879



CC880

■ **NOTE:** If gears are being replaced, use the existing shims. The numbers are scribed onto the gears: the ring gear has the number on the opposite side of the gears, and the pinion gear has the number on the end of the pinion gear shaft by the splines. If no number is present, it should be considered as being in the O category.

■ **NOTE:** If the gear case housing is being replaced, proceed to the following Shimming Procedure/Shim Selection sub-section.

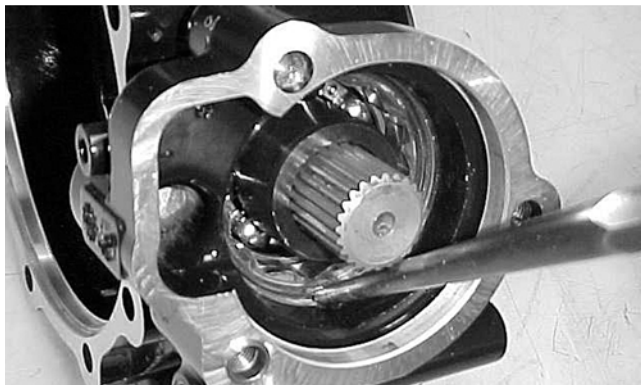


## Shimming Procedure/Shim Selection

1. Press bearings into bores by outer ring to hard contact with seat.
2. Note the following shim selections (shims are nominally 1.5 mm/0.060 in. thick):

A. Pinion Gear Sub-Assembly - add the value (A) on the gear case housing with 1.5 mm (0.060 in.); then subtract the value on the 10-tooth pinion gear. This will give you the proper shim thickness.

B. Install the lock collar and tighten to specifications; then on final assembling, stake the lock collar edge approximately 1.5 mm (0.060 in.) into the lower oil channel.

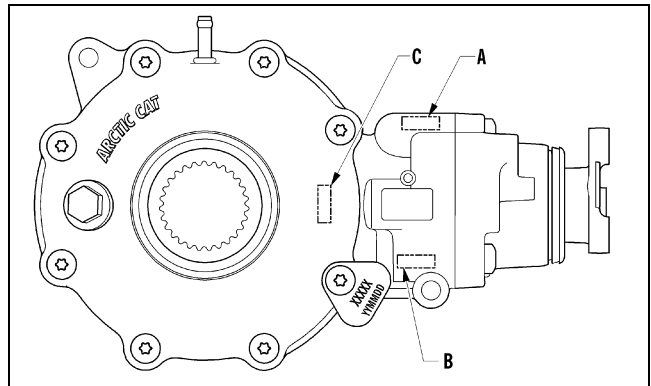


CC891

■ **NOTE:** Do not stake the lock collar until proper backlash has been verified.

C. Cover Side - add the value (B) on the gear case housing to the value (C) on the gear case cover; then add 1.5 mm (0.060 in.). This will give you the proper shim thickness.

D. Gear Case Side - install a 1.3-1.4 mm (0.050-0.055 in.) shim and tighten the bolts to 3.5-4.3 kg-m (25-31 ft-lb). Verify backlash to be within a range of 0.28-0.38 mm (0.011-0.015 in.) and end-play to be within a range of 0.10-0.20 mm (0.004-0.008 in.). If not within specification range, reselect shim until backlash specification range can be verified.

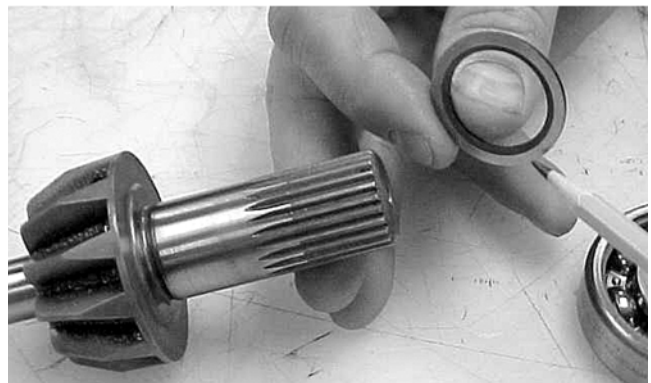


738-268A

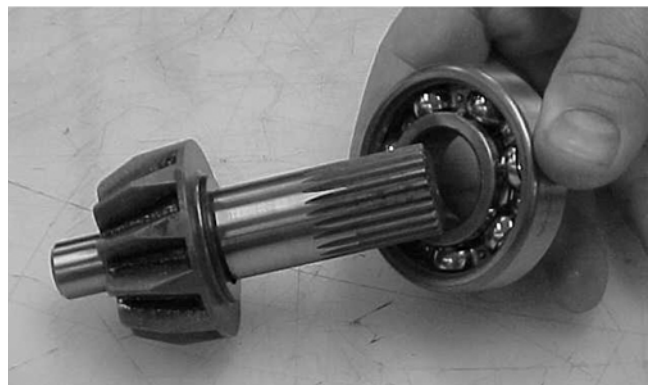
3. Prior to final assembling, apply molybdenum disulfide grease to all oil seal lips.
4. Prior to final assembling, prelubricate journal on pinion assembly with SAE 80W-90 hypoid gear lubricant prior to pressing assembly into gear case housing.

## Assembling Pinion Gear

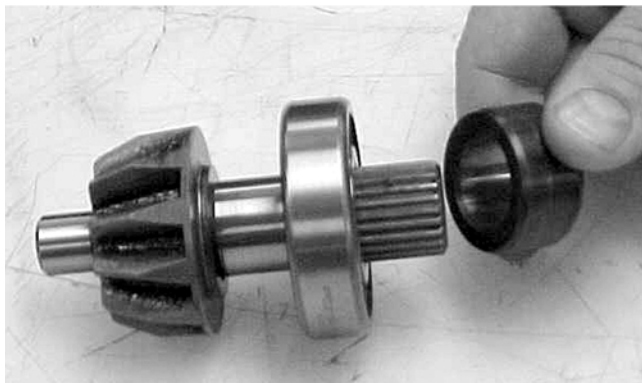
1. Place the shim ( with the chamfer side toward the inside) onto the pinion shaft; then install the bearing onto the pinion shaft. Install the pinion shaft collar.



CC881

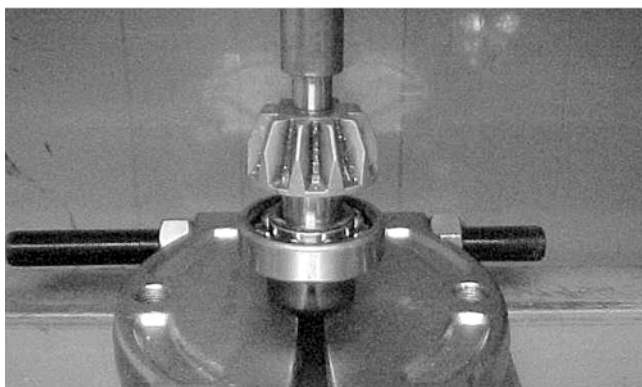


CC882



CC883

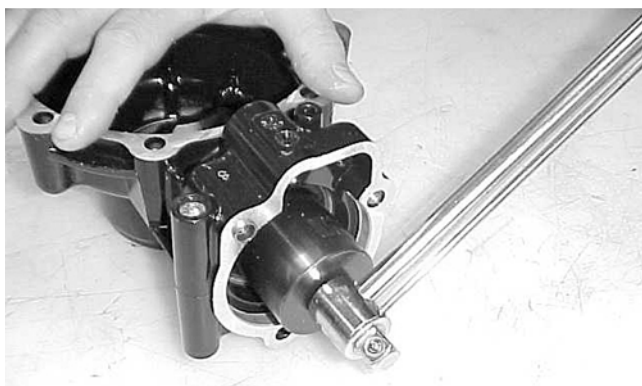
2. Place the pinion assembly in a bearing puller; then install the bearing using a press.



CC884

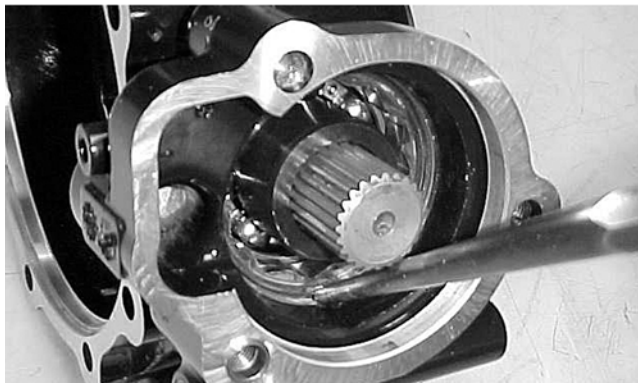
3. Install the pinion gear assembly into the housing. Using the 48 mm Internal Hex Socket (p/n 0444-104), secure the pinion gear assembly with the existing lock collar. Tighten to specifications.

■ **NOTE:** On a front differential, the lock collar has right-hand threads. On a rear gear case, the lock collar has left-hand threads.



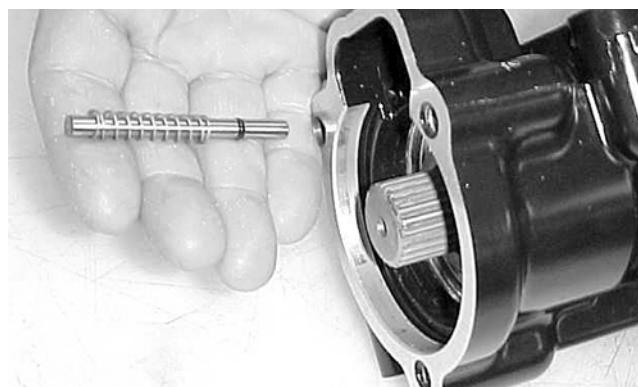
CC890

4. Place a punch on the edge of the lock collar in the oil gallery area; then using a hammer, stake the lock collar to ensure that the collar will remain securely tightened.



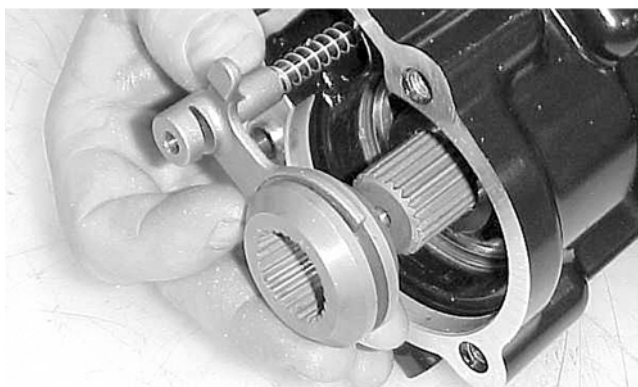
CC891

5. Install the shift fork shaft w/spring into the gear housing making sure the shaft O-ring is positioned to the inside.



CC892

6. Install the shift fork assembly making sure the fork leg is facing upward. Apply a small amount of oil to the gasket; then install the gasket.

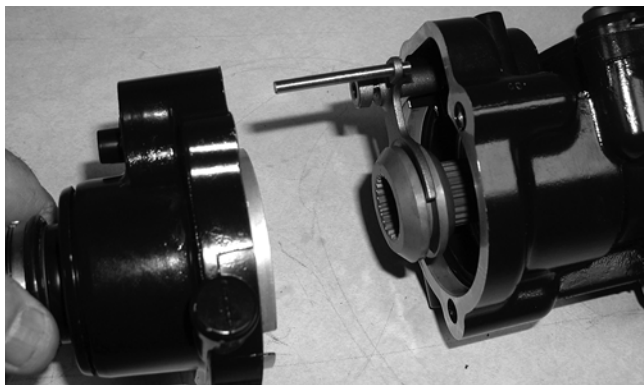


CC893

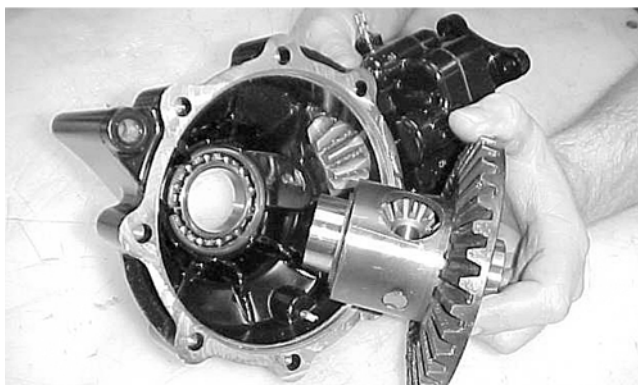
7. Place the input shaft assembly onto the gear housing; then secure with the existing cap screws. Tighten to specifications.

■ **NOTE:** If a new gear housing is being installed, tighten the cap screws to 3.5-4.3 kg-m (25-31 ft-lb).





CD103



CC897



CD110

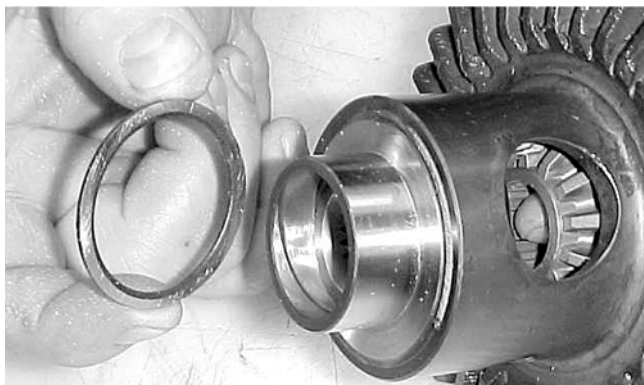


KX178

8. Install the proper shim onto the ring gear spider assembly making sure the chamfer side of the shim is facing toward the ring gear. Install the ring gear in the housing; then install the outside shim with the chamfer side of the shim toward the ring gear.

■ **NOTE:** The spider and ring gear assembly must be replaced as a complete unit.

9. Install the left bearing housing aligning the match mark to the mark on the differential housing.



CC896



KX177

10. Install the differential lock assembly into the bearing housing; then place the O-ring on the gear case housing.

6





KX175



KX174

11. Making sure the O-ring is properly positioned on the gear case housing, install the housing with existing hardware. Account for the ID tag. Tighten the cap screws to specifications.

■ **NOTE:** Grease can be applied to the O-ring for ease of assembling.

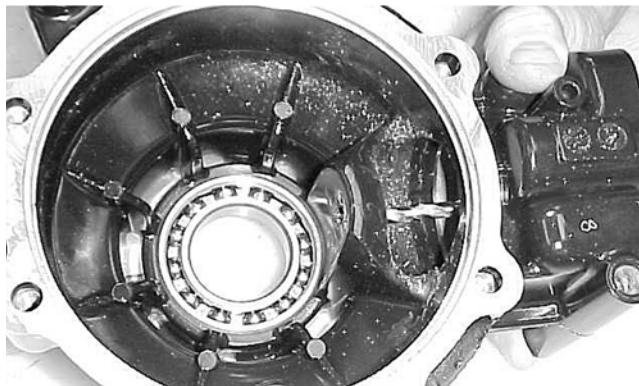
■ **NOTE:** If a new gear case housing is being installed, tighten the cap screws to 3.5-4.3 kg-m (25-31 ft-lb).

### Removing Needle Bearing

■ **NOTE:** Removing the needle bearing is rarely necessary. Avoid removing the needle bearing unless the bearing is clearly damaged.

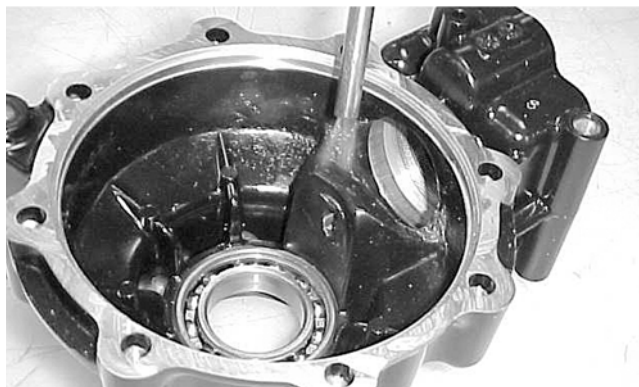
■ **NOTE:** This procedure can be performed on a rear gear case.

1. Place a 6.35 mm (1/4 in.) drill bit on the inside surface of the needle bearing (against the bottom side); then drill through the pinion shaft needle bearing housing.



CC885

2. Using a propane torch, heat the area surrounding the needle bearing to soften the Loctite.



CC886

3. Using a flat-nosed punch, drive the bearing out of the housing.



CC887

### Installing Needle Bearing

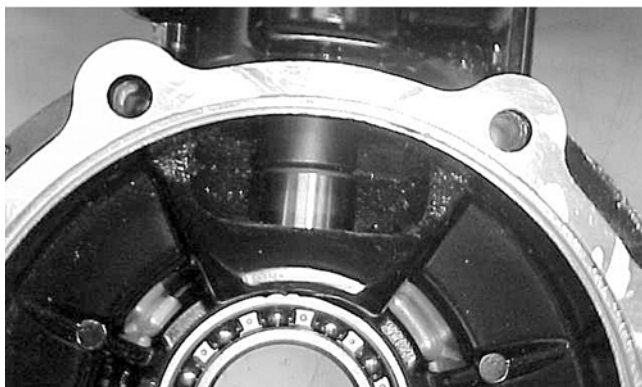
1. Apply red Loctite #271 to the outside of a new bearing; then place the new bearing into the housing.



CC888

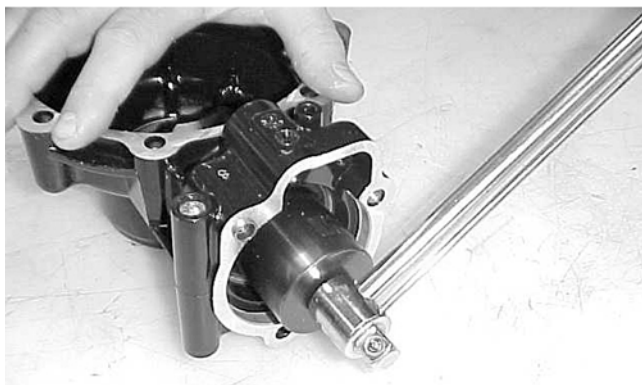
2. Using a suitable driver, install the needle bearing into the gear case housing making sure the bearing is seated.

■ **NOTE:** Do not push the bearing too far into the housing.



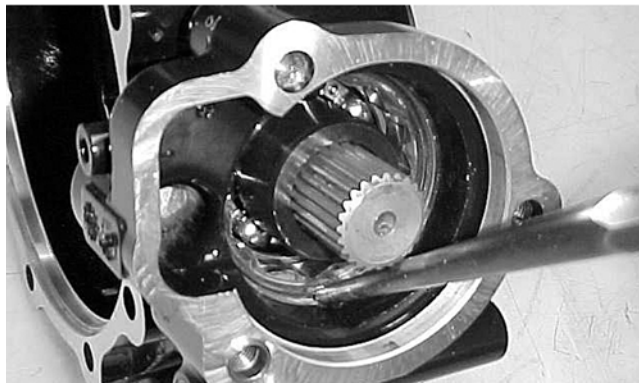
CC889

3. Install the pinion shaft and secure with the existing 48 mm lock collar. Tighten to specifications.



CC890

4. Place a punch on the edge of the lock collar in the oil gallery area; then using a hammer, stake the lock collar to ensure that the collar will remain securely tightened.



CC891

5. Install the pinion housing.

### Removing/Installing Axle Seal

■ **NOTE:** This procedure can be performed on a rear gear case.

1. Remove the seal using a seal removal tool.



CC899

2. Using a press, remove the bearing.

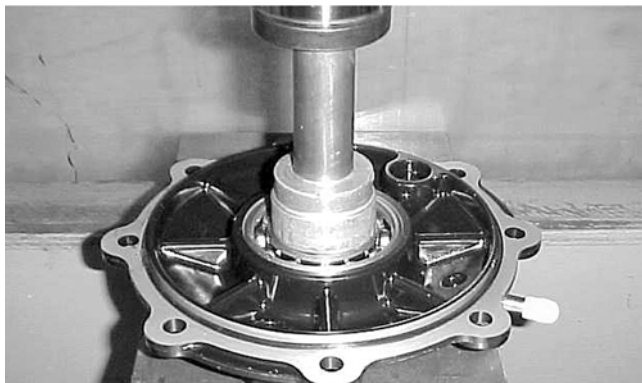


CC900

3. Using a press, install the new bearing into the housing.

6

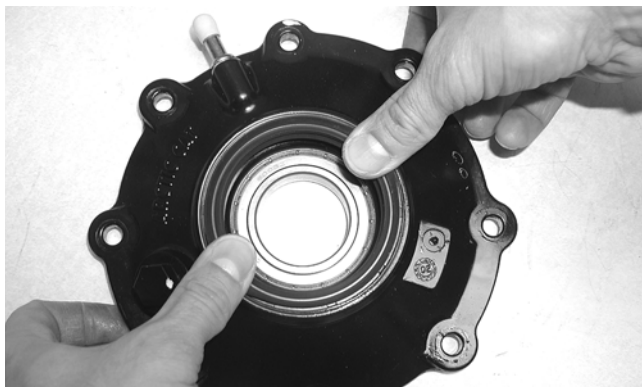




CC901

■ **NOTE:** Prior to installing the seal, apply grease to the seal outside diameter.

4. Install the seal into the housing pressing evenly on the outside edge until the seal is seated.



CD018

5. Repeat steps 1-4 for the opposite side.

## INSTALLING DIFFERENTIAL

1. Align the splined input yoke with the front output splines; then place the differential into position on the frame and install the cap screws, washers, and flex-lock nuts. Tighten to specifications. Make sure the rubber boot is properly seated on the input yoke.



CD857



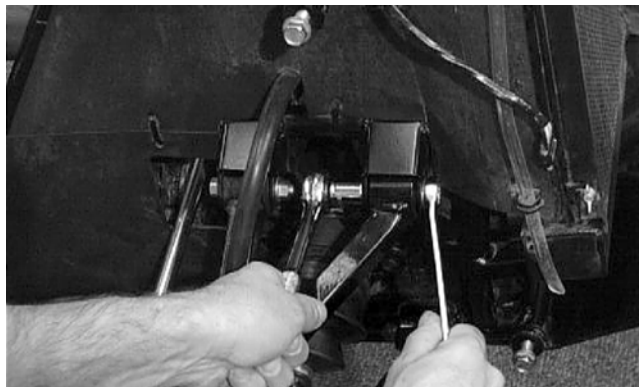
CD859

2. Pour 275 ml (9.3 fl oz) of SAE 80W-90 hypoid lubricant into the differential and install the filler plug. Tighten to specifications.
3. Install the front drive actuator with the three torx-head cap screws; then connect the wire connector to the main wiring harness.



AG925

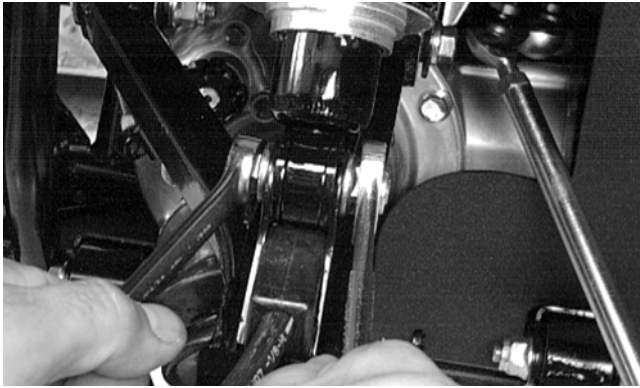
4. Install the inner fender panels.
5. Install the front axles (see Drive Axles in this section).
6. Secure the upper A-arms with cap screws and lock nuts. Tighten to specifications.



AF610D

7. Secure the lower shock eyelets with cap screws and lock nuts. Tighten to specifications.





AF897D

8. Secure the tie rods with the lock nuts. Tighten to specifications; then install and spread the cotter pins.

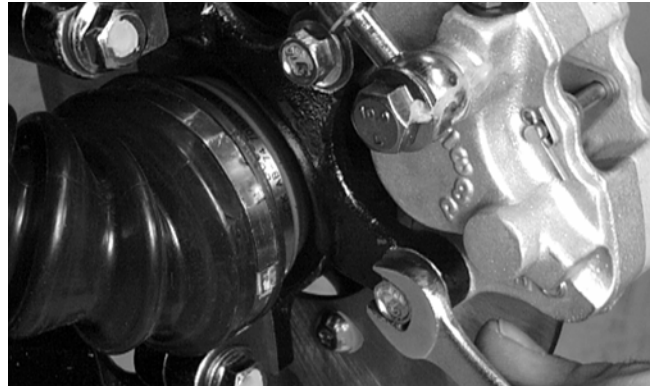


AF896D



AF895D

9. Making sure that each caliper has the 0.76 mm (0.030 in.) spacer washers between the caliper and the knuckle, install the brake calipers. Secure with the cap screws tightened to specifications.



AF894D

10. Install the wheels and tighten to specifications.

11. Remove the ATV from the support stand.

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## Drive Axles

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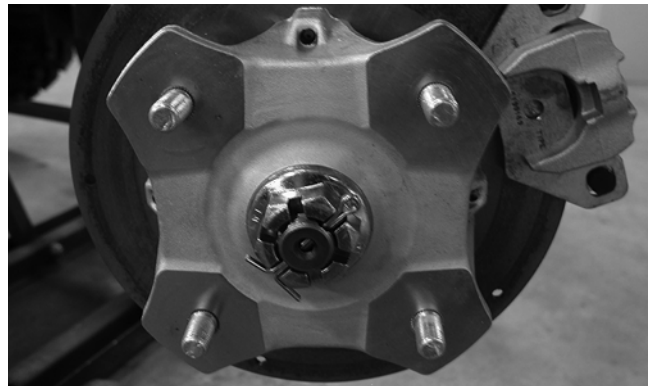
### REMOVING REAR DRIVE AXLE (Fully Independent Suspension)

1. Secure the ATV on a support stand to elevate the wheels.

#### **WARNING**

**Make sure the ATV is solidly supported on the support stand to avoid injury.**

2. Pump up the hand brake; then engage the brake lever lock.
3. Remove the wheel.
4. Remove the cotter pin securing the hex nut; then remove the hex nut. Release the brake lever lock.



KX041

5. Remove the two brake calipers (right side only).

■ **NOTE:** Do not allow the brake calipers to hang from their cable/hose.



### CAUTION

The calipers should be supported. If the calipers are allowed to hang from the cable/hose, damage may occur.

6. Slide the hub out of the knuckle and set aside.
7. Remove the cap screw and lock nut securing the knuckle to the upper A-arm. Discard the lock nut.

■ **NOTE:** Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.

8. While holding the drive axle stationary, pull the top of the knuckle out and down until it is free of the drive axle.
9. Place a drain pan under the ATV to contain any oil leakage; then using a slide hammer, remove the drive axle.



AF935

## REMOVING FRONT DRIVE AXLE (4x4 Models)

■ **NOTE:** For removing a front drive axle on a 4x4 model, see Front Differential (FIS Models) in this section.

## CLEANING AND INSPECTING

■ **NOTE:** Always clean and inspect the drive axle components to determine if any service or replacement is necessary.

1. Using a clean towel, wipe away any oil or grease from the axle components.



CD019

2. Inspect boots for any tears, cracks, or deterioration.

■ **NOTE:** If a boot is damaged in any way, it must be replaced with a boot kit.

3. Inspect the gear case seals for nicks or damage.

## DISASSEMBLING AXLES

1. Using a side-cutters (or suitable substitute), remove the large clamp from the boot.



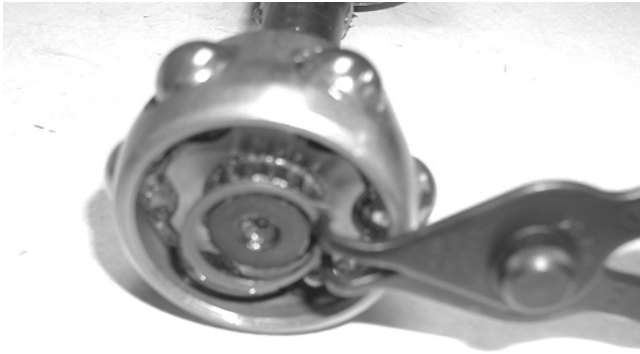
CD020

2. Wipe away excess grease to access the retaining ring. Using an awl or circlip pliers, remove the circlip.



CD021

3. Using a snap ring pliers, remove the circlip securing the bearing ring to the shaft. Note the direction of the bearing for assembling purposes.



CD023

- Note the difference inside each bearing ring end for assembling purposes; then remove the bearing ring.

■ **NOTE:** The recess of the bearing must face toward the housing.



CD022

- Inspect the splines of the shaft, the bearing ring, and the housing for damage.

■ **NOTE:** If any damage is apparent to the splines, the bearing ring, and/or the housing, the drive axle must be replaced as an assembly.

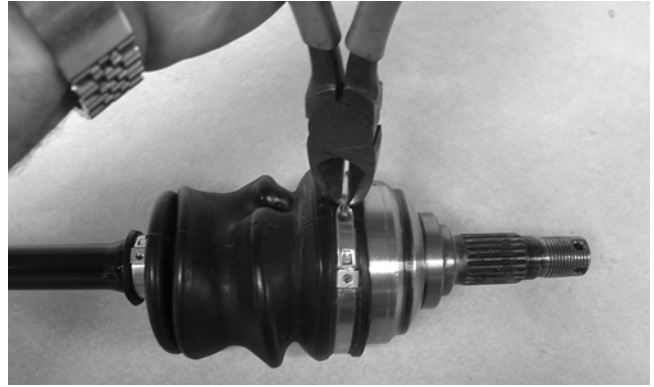
- Using a side-cutters (or suitable substitute), remove the small clamp from the shaft.



CD752

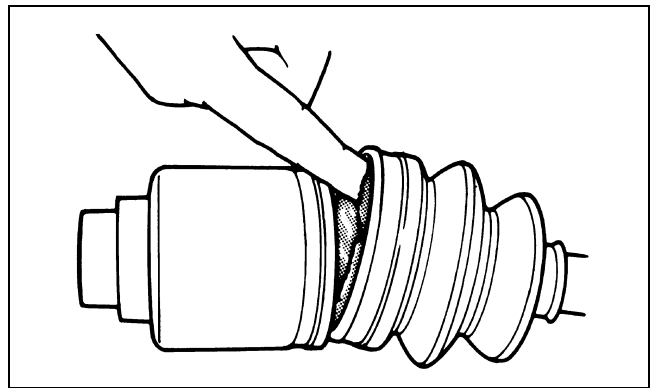
■ **NOTE:** At this point if the outside boot is damaged, continue with step 7.

- Using a side-cutters (or suitable substitute), remove both outside boot clamps from the shaft. Note the position of the different-sized clamps for assembling purposes.



CD751

- Apply 40 grams (1/3 of contents) of grease from the Grease Pack (p/n 0441-173) into the knuckles and the new outside boot.



ATV-1052

■ **NOTE:** Grease Pack (p/n 0441-173) contains 120 grams of grease. The inside joint (double-offset) requires approximately 70-90 grams of grease and the outside (bell-type) requires approximately 35-55 grams. When replacing boots, use 2/3 of the pack for inside boots and 1/3 of the pack for outside boots.



### CAUTION

Do not over-fill the joint as boot damage may occur resulting in joint failure.

- Slide the new outside boot onto the shaft with the new clamps positioned as shown. Note the different-sized clamps from removal.

■ **NOTE:** The boot is positioned correctly when the small end of the boot seats down into the recessed groove.





CD754

10. Using Boot Clamp Pliers (p/n 0444-120), secure both outside boot clamps.



### CAUTION

It is important that the clamps are positioned correctly or they may loosen when in motion.



CD024

## ASSEMBLING AXLES

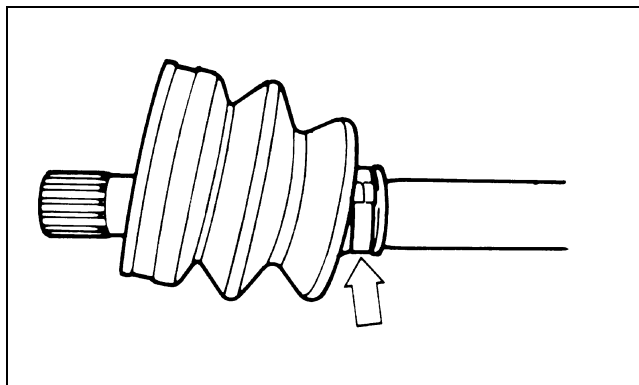
1. Install the inner boot with the small clamp making sure the ends of the clamp are positioned correctly.

■ **NOTE:** The boot is positioned correctly when the small end of the boot seats down into the recessed groove.



CD754

2. Using the boot clamp pliers, secure the small clamp of the inner boot.



ATV-1048

3. Apply 80 grams (2/3 of contents) of grease from the pack into the bearing housing.
4. Install the bearing onto the shaft making sure the recess of the bearing is facing the housing.



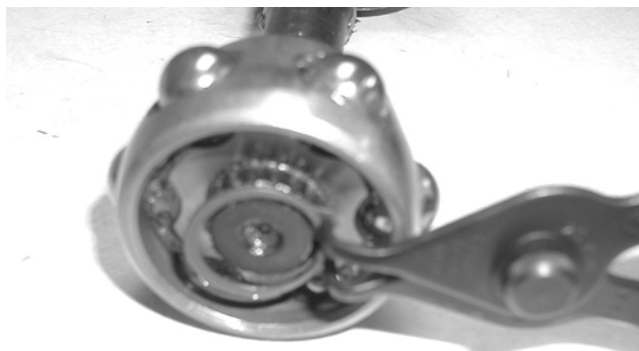
CD022



### CAUTION

The bearing ring must go onto the shaft with the side without splines facing toward the small clamp of the inner boot or severe damage will result.

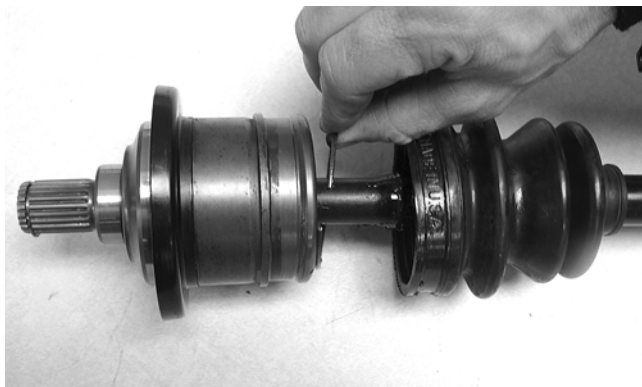
5. Secure the bearing ring with the circlip making sure the sharp side of the circlip faces away from the boot.



CD023

6. Making sure the marks made during disassembling align, slide the housing over the bearing ring; then completely seat the bearing ring into the housing and install the circlip.

■ **NOTE:** Pull the bearing ring out of the housing until it contacts the circlip; then slide the ring in half way. This will purge air from the housing and ensure the bearing is packed properly.



CD021

7. Slide the boot over the housing; then using the boot clamp pliers, secure the boot with the clamp.



CD024

8. Inspect the axle components for correct positioning of the four clamps. Also, inspect the boots for being correctly positioned on the shaft.

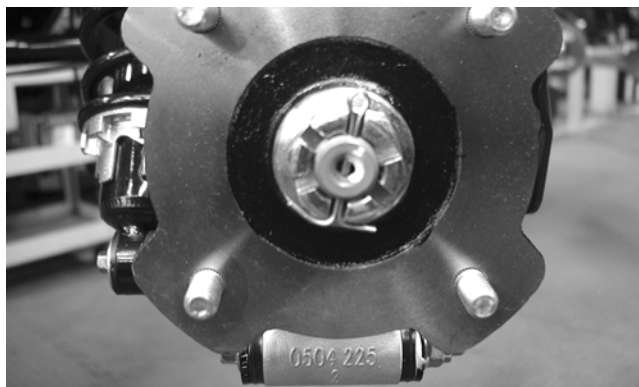
### **INSTALLING REAR DRIVE AXLE (Fully Independent Suspension)**

1. Slide the drive axle into place in the gear case.

■ **NOTE:** To assure proper seating of the axle, give it a light pull; the axle should remain “clipped” in place.

2. Swing the knuckle up and onto the drive axle; then place the knuckle into place in the upper A-arm. Secure the knuckle to the A-arm with a cap screw and a new lock nut. Tighten to specifications.
3. Place the hub into position on the axle followed by a hex nut. Tighten the hex nut finger-tight at this time.

4. If the brake calipers were removed, position them on the knuckle and secure with existing cap screws. Tighten the auxiliary brake caliper cap screws to specifications. Tighten the hydraulic brake caliper cap screws to specifications.
5. Pump up the hand brake lever; then engage the brake lever lock.
6. Tighten the hub hex nut (from step 3) to specifications; then install and spread a new cotter pin making sure each side of the pin is flush to the hub nut.



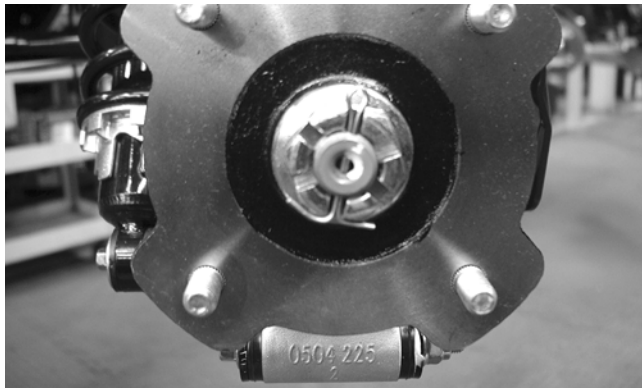
CD027

7. Install the wheel. Tighten to specifications.
8. Remove the ATV from the support stand and release the brake lever lock.

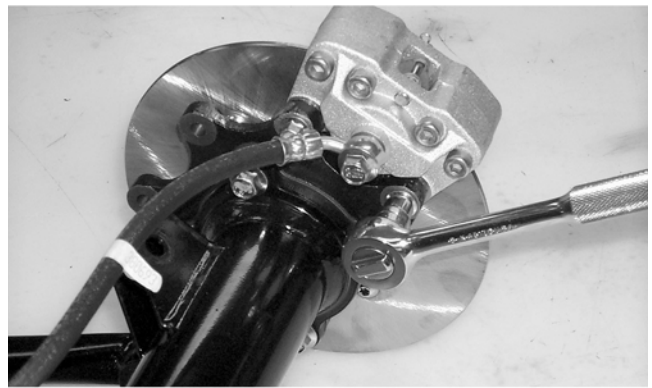
### **INSTALLING FRONT DRIVE AXLE (4x4 Models)**

**6**

1. Position the drive axle in the gear case and steering knuckle; then insert the upper A-arm ball joint into the steering knuckle. Secure with a cap screw tightened to specifications.
2. Place the brake hose into position on the upper A-arm; then secure the lower shock eyelet to the A-arm with a cap screw and a new lock nut. Tighten to specifications.
3. Secure the tie rod to the steering knuckle with a new lock nut. Tighten securely; then install and spread a new cotter pin.
4. Slide the hub w/brake disc into position in the steering knuckle followed by a washer and hex nut. Tighten finger-tight at this time.
5. Install the brake caliper on the steering knuckle. Tighten to specifications; then pump up the hand brake lever and engage the brake lever lock.
6. Tighten the hub hex nut (from step 4) to specifications; then install and spread a new cotter pin making sure each side of the pin is flush to the hub nut.

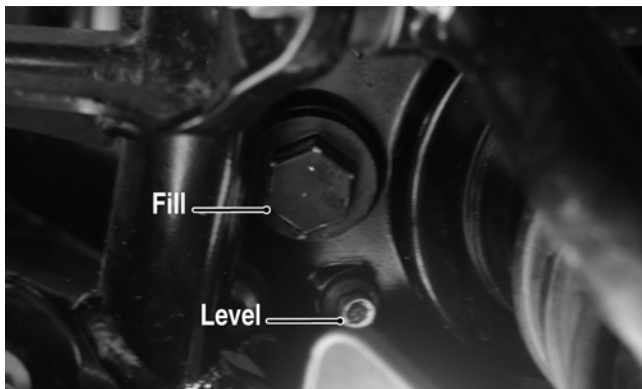


CD027



CC783

7. Install the wheel and tighten to specifications.
8. Remove the ATV from the support stand and release the brake lever lock.
9. Check the front differential oil level and add oil as necessary.



CF113A

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## VP - Rear Suspension

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### REMOVING

1. Place the ATV on a support stand (positioned just in front of and behind the footrest on each side) so the wheels are off the floor.

### WARNING

Make sure the ATV is solidly supported on the support stand to avoid injury.

2. Remove the rear wheels.
3. Remove the cap screws securing the brake calipers to the bearing housing; then remove the calipers and lay aside.

### CAUTION

Care should be taken not to damage the brake cable/hose when laying the calipers aside. Do not allow the calipers to hang from the brake cable/hose.

4. Remove the lower shock absorber cap screws and hex nuts; then disengage the shock absorbers from the axle housings.

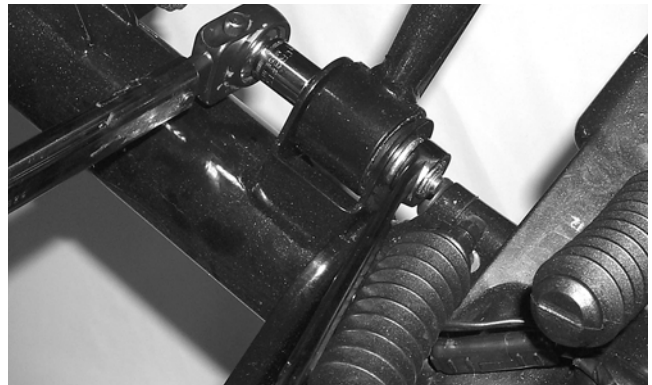
### CAUTION

Ensure that the rear gear case is properly supported BEFORE removing the shock absorber assemblies.



AF772D

5. Remove the four cap screws and nuts securing the rear of the swing arm(s) to the axle housing.



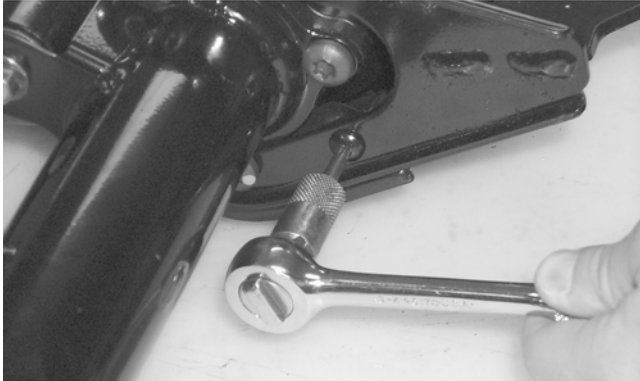
AF697D



6. Maneuver the axle assembly rearward allowing the propeller shaft to disengage and the final drive boot to separate from the drive housing.

## DISASSEMBLING

1. Remove the cap screws securing the gear case panel; then remove the panel from the gear case.

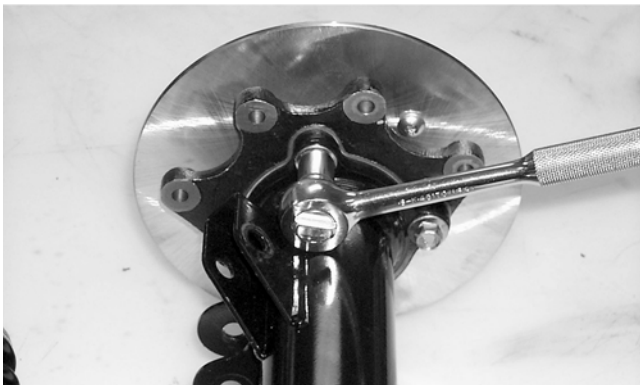


CC762

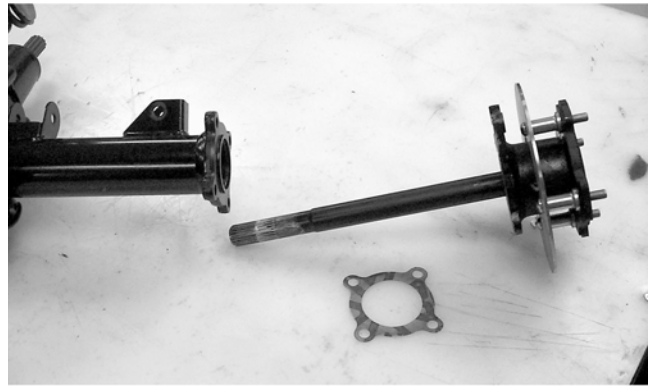


CC763

2. Remove the cap screws securing the axle assembly to the axle housing; then remove the axle assembly from the housing. Account for a gasket.

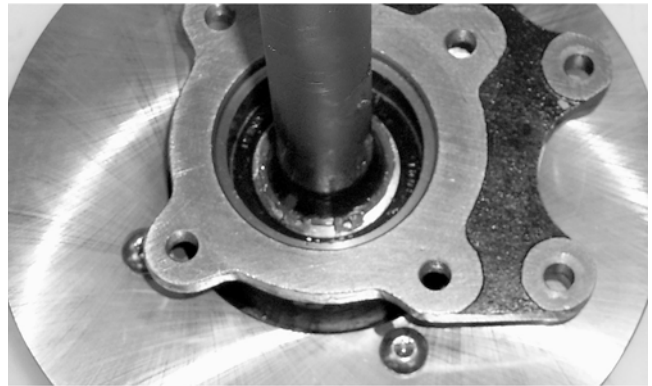


CC764



CC765

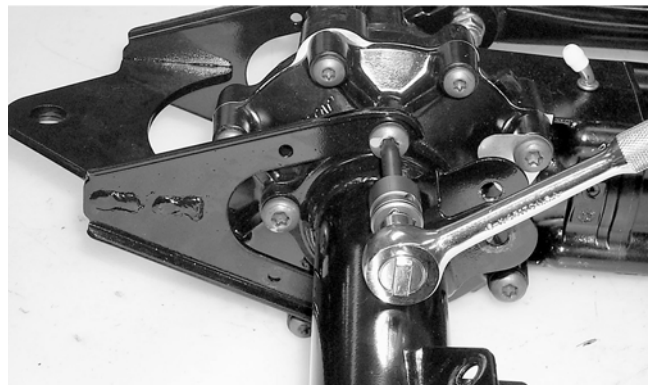
3. Remove the snap ring securing the bearing housing to the axle shaft; then slide the bearing housing off the shaft.



CC768A

4. Remove the four cap screws securing the hitch to the gear case; then remove the hitch.

■ **NOTE:** Note that these cap screws are 37 mm (1.5 in.) in length for installing purposes.



CC769

5. Remove the two cap screws securing each axle housing to the gear case.

■ **NOTE:** Note that these cap screws are 33 mm (1.3 in.) in length for installing purposes.



CC770

6. Remove the axle housing from the gear case. Account for a gasket.



CC771

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all external components.
2. Inspect the case for leaks or damage.
3. Inspect splines for wear.
4. Inspect the seal for damage.
5. Inspect housing mounting bosses for wear or elongated holes.
6. Inspect the frame welds for cracking or bending.
7. Inspect the rear drive and plug threads for stripping or damage.
8. Inspect the axle bearings. Rotate the bearings by hand, and if any roughness or binding is noted, replace the bearings.

## ASSEMBLING

1. Grease the splines of the ring gear.
2. Make sure the rear gear case/axle housing O-ring is properly positioned; then secure the axle housing to the rear gear case with two 33 mm (1.3 in.) cap screws. Tighten to specifications.

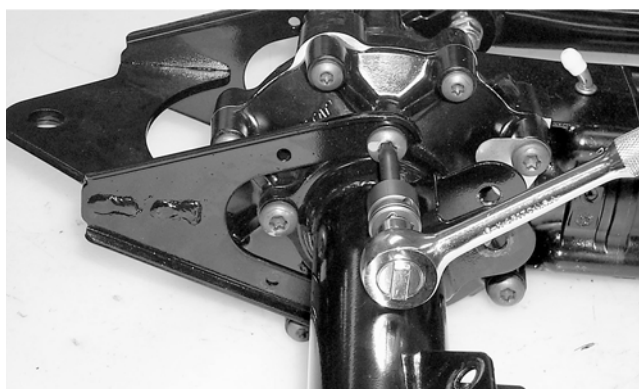
■ **NOTE:** If a new gear case is being installed, tighten the cap screws to 5.1-6.3 kg-m (37-45.5 ft-lb).



CC770

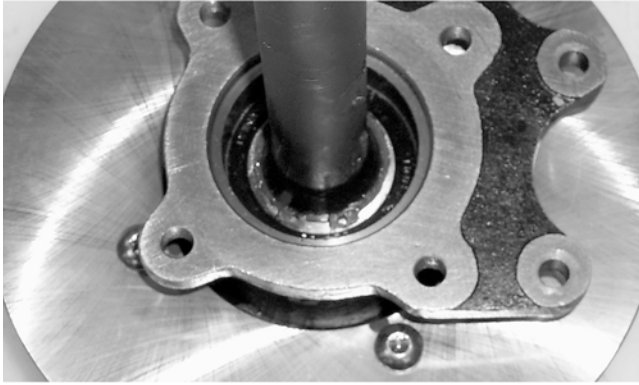
3. Secure the axle housing to the rear gear case with four 37 mm (1.5 in.) cap screws. Tighten to specifications.

■ **NOTE:** If a new gear case is being installed, tighten the cap screws to 5.1-6.3 kg-m (37-45.5 ft-lb).



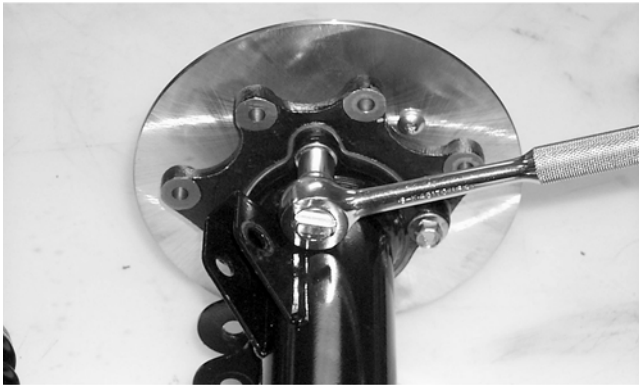
CC769

4. Lightly grease the bearing housing seal; then slide the bearing housing onto the axle shaft. Secure with the snap ring.



CC768

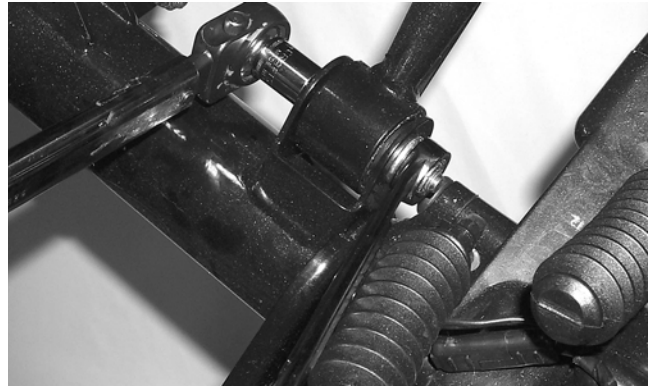
5. Place the axle gasket on the axle housing. Rotate the axle shaft slightly to ensure proper engagement with the gear case splines.
6. Rotate the bearing housing until the brake caliper mounting holes are on the top side; then secure the axle retainer assembly/axle assembly to the axle housing with four cap screws. Tighten to specifications.



CC764

## INSTALLING

1. Maneuver the axle assembly forward making sure propeller shaft splines engage properly and the final drive boot is positioned over the drive housing.
2. Place the rear of the swing arm(s) into position on the axle housings and case; then secure with four cap screws and hex nuts. Tighten to specifications.



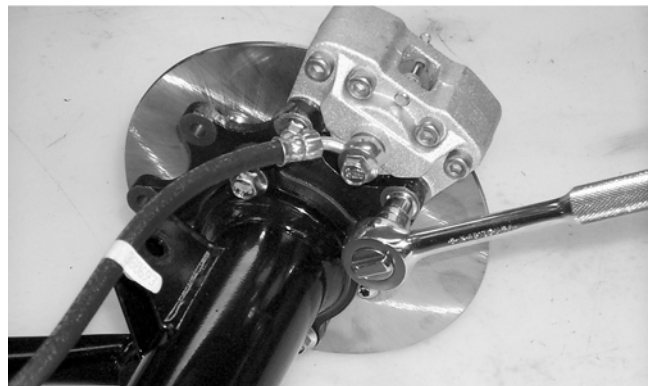
AF697D

3. Place the shock absorber into the frame mounts and secure using the cap screws and hex nuts tightened to specifications.

### CAUTION

**Do not tighten nuts beyond the 4.8 kg-m (35 ft-lb) specification or the shock eyelet or mount WILL be damaged.**

4. Place the brake calipers into position on the axle retainer assembly; then secure with the cap screws. Tighten the auxiliary caliper to specifications and the hydraulic caliper to specifications.



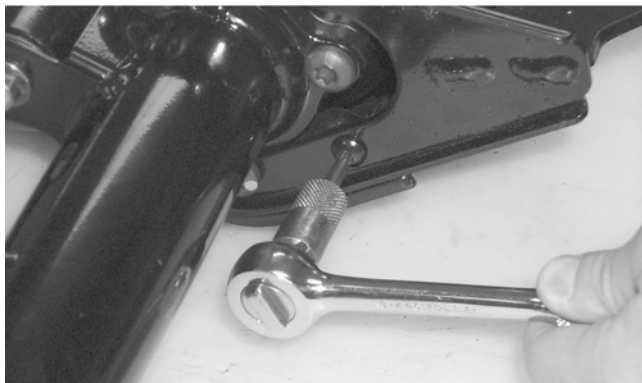
CC783

### CAUTION

**Care should be taken not to damage or kink the brake cable/hose when installing the calipers.**

5. Place the gear case panel into position and secure with the three cap screws. Tighten securely.





CC762

6. Install the wheels and tighten to specifications.
7. Remove the ATV from the support stand.

■ **NOTE:** Check all fasteners for tightness and check the brakes for proper operation before test riding.

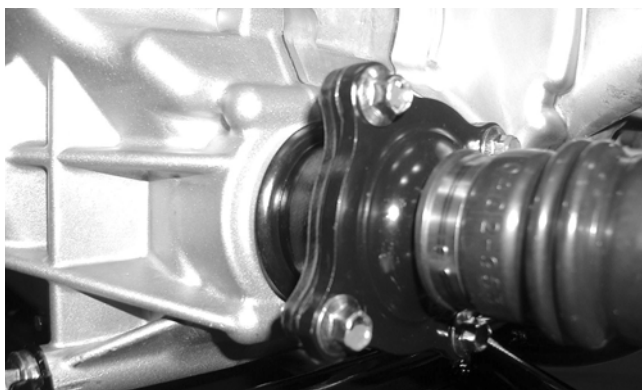
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## Rear Gear Case (FIS Models)

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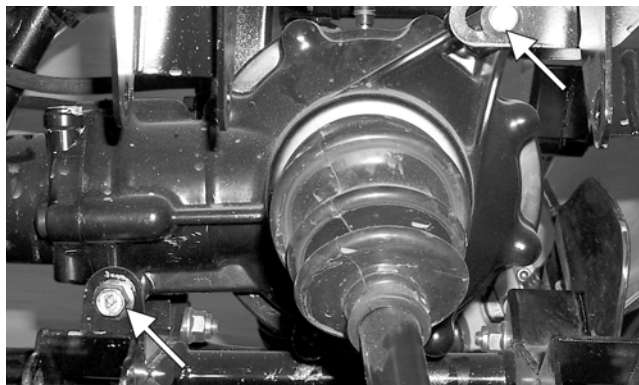
### REMOVING

1. Remove the left-side rear A-arms (see Rear A-Arms in Section 7).
2. Remove both of the rear drive axles (see Drive Axles in this section).
3. Remove the four cap screws securing the engine output shaft to the rear gear case input flange.



CD028

4. Remove the two cap screws and lock nuts securing the rear gear case to the frame; then remove the gear case through the left side.



AF960A

### ✋ AT THIS POINT

For servicing the input shaft, pinion gear, needle bearing, and axle seal on FIS models, see Front Differential (FIS Models) in this section.

### INSTALLING

1. Slide the gear case into position through the left side of the frame; then secure it to the frame with cap screws and lock nuts. Tighten to specifications.
- **NOTE:** If a new gear case is being installed, tighten the cap screws to 5.1-6.3 kg-m (37-45.5 ft-lb).
2. Secure the engine output shaft to the rear gear case input flange with three cap screws (coated with red Loctite #271) and lock nuts. Tighten to specifications.
  3. Install the rear drive axles (see Drive Axles in this section).
  4. Install the left-side rear A-arms (see Rear A-Arms in Section 7).

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## Hub

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### REMOVING

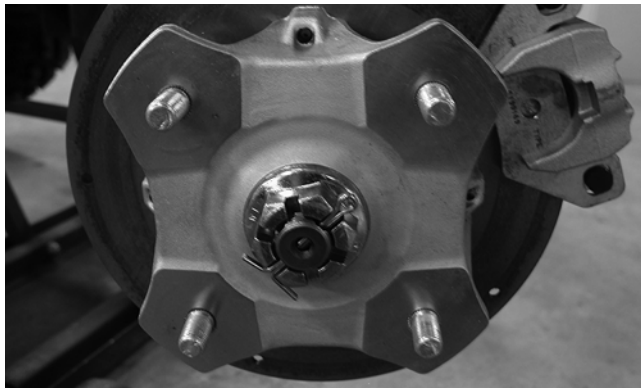
1. Secure the ATV on a support stand to elevate the wheel; then remove the wheel.

### ⚠ WARNING

Make sure the ATV is solidly supported on the support stand to avoid injury.

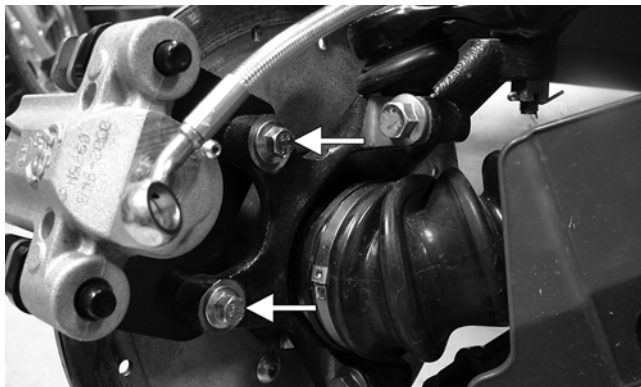
2. Remove the cotter pin from the nut.

■ **NOTE:** During assembly, new cotter pins should be installed.



KX041

3. Remove the flange nut securing the hub.
4. Remove the brake caliper.



PR243A

5. Remove the hub assembly.
6. Remove the four cap screws securing the brake disc.

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all hub components.
2. Inspect all threads for stripping or damage.
3. Inspect the brake disc for cracks or warping.
4. Inspect the hub for pits, cracks, loose studs, or spline wear.

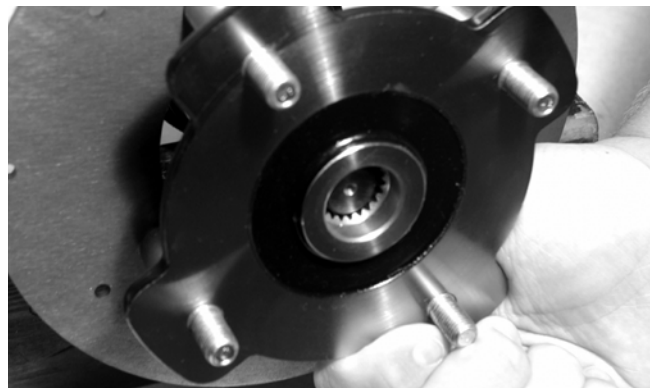
## INSTALLING

1. Secure the brake disc to the hub with the four cap screws coated with blue Loctite #243. Tighten to specifications.
2. Apply grease to the splines in the hub.



PR291

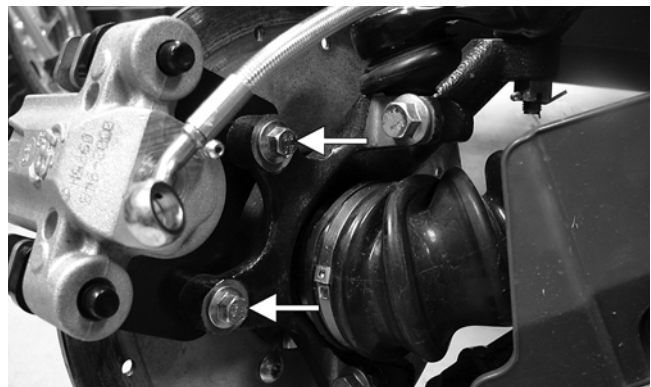
3. Install the hub assembly onto the shaft.



CD009

4. Secure the hub assembly with the nut. Tighten only until snug.
5. Secure the brake caliper to the knuckle with the two cap screws. Tighten the auxiliary caliper to specifications. Tighten the hydraulic caliper to specifications.

6



PR243A

6. Tighten the hub nut (from step 4) to specifications; then install and spread a new cotter pin making sure each side of the pin is flush to the hub nut.



CD008

7. Install the wheel and tighten to specifications.



CD006

8. Remove the ATV from the support stand.

---

## Hydraulic Brake Caliper

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■ **NOTE:** The brake caliper is a non-serviceable component; it must be replaced as an assembly (see Section 2).



# SECTION 7 - SUSPENSION



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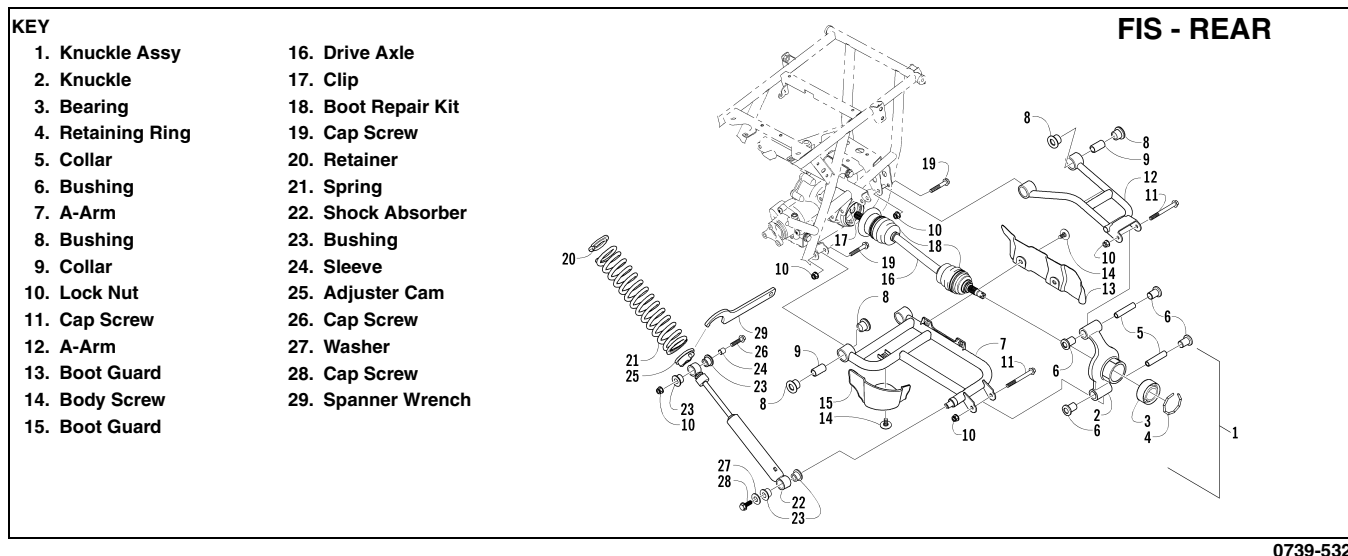
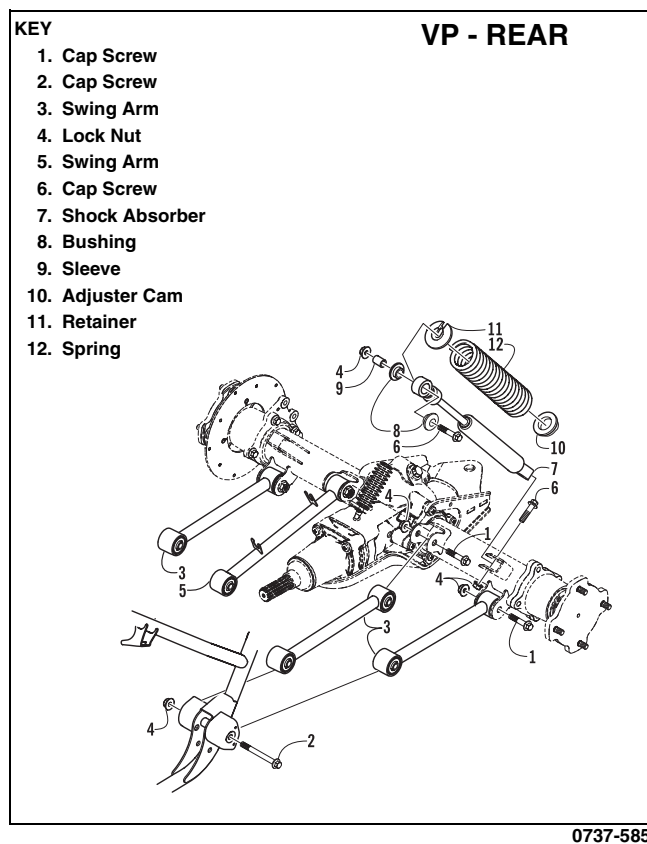
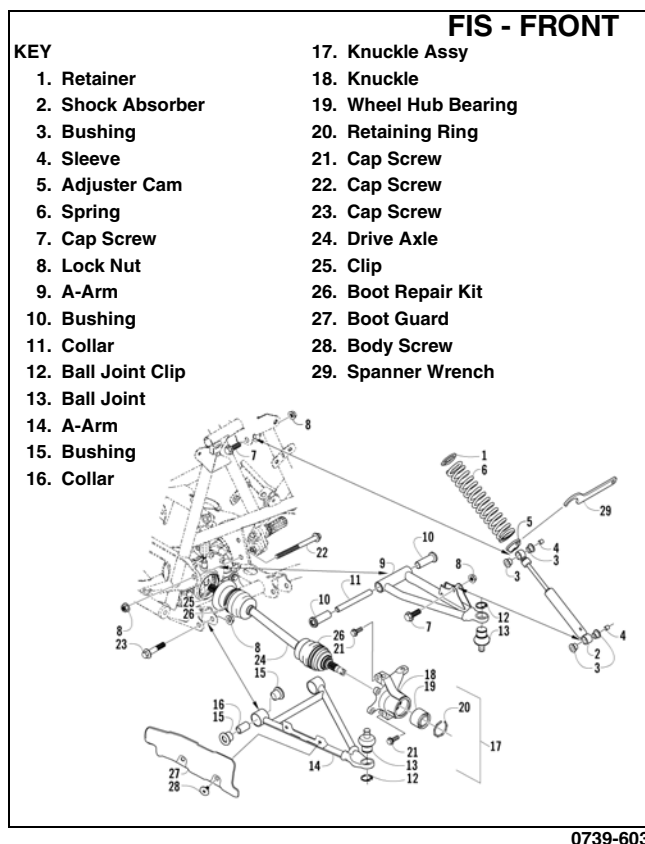
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# Front and Rear Suspension Assembly Schematics

■ **NOTE:** Some components may vary from model to model. The technician should use discretion and sound judgment.



## Shock Absorbers

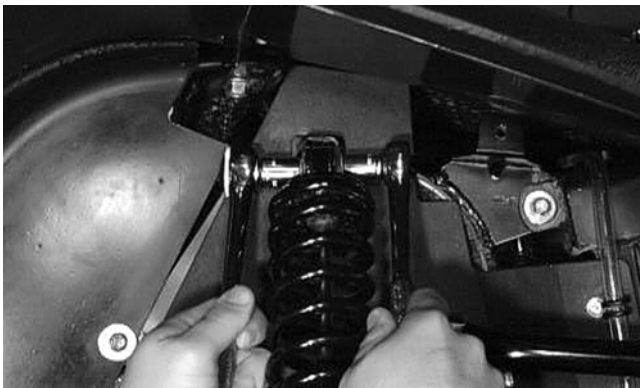
### REMOVING

1. Secure the ATV on a support stand to elevate the wheels and to release load on the suspension.

#### **WARNING**

**Make sure the ATV is solidly supported on the support stand to avoid injury.**

2. Remove the two cap screws and nuts securing each front shock absorber to the frame. Account for bushings and sleeves from each.



AF605D

#### **CAUTION**

**On the FIS style rear suspension, additional support stands are necessary to support the rear axle when the shock absorbers are removed or damage may occur.**

3. Remove the two cap screws and nut securing each rear shock absorber to the frame and rear suspension. Account for bushings and sleeves from each.



AF626D

4. Compress the shock absorber spring, remove the retainer, and remove the spring.



AF730D

### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all shock absorber components in parts-cleaning solvent.
2. Inspect each shock rod for nicks, pits, rust, bends, and oily residue.
3. Inspect all springs, spring retainers, shock rods, dampers, bushings, shock bodies, and eyelets for cracks, leaks, and bends.

### INSTALLING

1. Place the shock absorber spring over the shock absorber, compress the spring, and install the retainer.
2. Place bushings and sleeves (where appropriate) into shock eyelet; then install shock with two cap screws and nuts. Tighten all nuts to specifications.

#### **CAUTION**

**Do not tighten the nuts beyond the 4.8 kg-m (35 ft-lb) specification or the shock eyelet or mount WILL be damaged.**

■ **NOTE:** On the fully independent rear suspension models, the rear shock absorber-to-lower A-arm torque factor is 2.8 kg-m (20 ft-lb).

3. Remove the ATV from the support stand.



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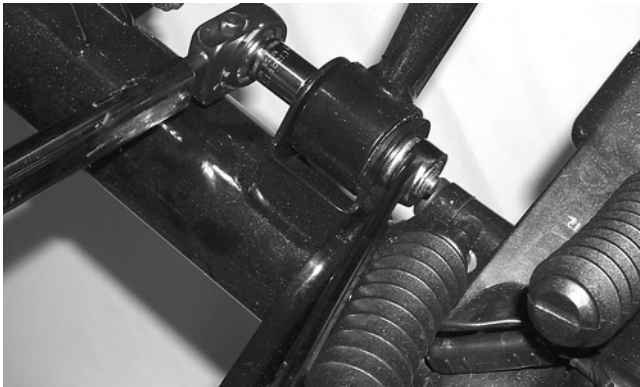
## Swing Arms

### (VP - Rear Suspension)

---

#### REMOVING

1. Remove the cap screws and lock nuts securing the front of the swing arms to the frame brackets.
2. On the left side, remove the cap screws and lock nuts securing the rear of the swing arms to the axle housing; then remove the swing arms.



AF697D

3. On the right side, remove the cap screw and lock nut securing the outer swing arm to the axle housing; then remove the cap screw and lock nut securing the inner swing arm to the axle housing. Remove the hose grommets from the hose guides.
4. Remove the swing arms and note the location of the hose guides on the inner swing arm (for installing purposes).

#### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all swing arm components in parts-cleaning solvent.
2. Inspect all swing arm weldments for cracks or unusual bends.
3. Inspect all tubing for cracks or unusual bends.

#### INSTALLING

1. On the right side, place the inner swing arm into position and secure it to the axle housing with a cap screw and lock nut. Do not tighten at this time.

2. On the right side, place the outer swing arm into position and secure to the axle housing with a cap screw and lock nut. Do not tighten at this time.
3. Secure the two right side swing arms to the frame brackets with cap screws and hex nuts. Do not tighten at this time.
4. On the left side, secure the swing arms to the axle housing and frame brackets with cap screws and hex nuts; then tighten all fasteners to specifications.

---

## Front A-Arms

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#### REMOVING

1. Secure the ATV on a support stand to elevate the front wheels; then remove the wheels.

#### **WARNING**

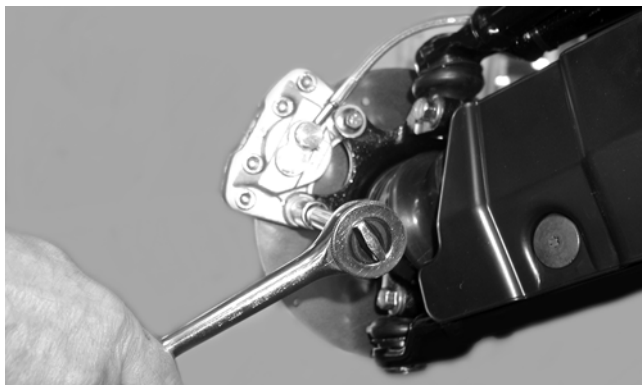
**Make sure the ATV is solidly supported on the support stand to avoid injury.**

2. Remove the cotter pin from the nut. Discard the cotter pin.



CD008

3. Remove the nut securing the hub.
4. Remove the brake caliper. Account for two cap screws and two 0.76 mm (0.030 in.) spacer washers.



CD007

5. Remove the hub assembly.
6. Remove the cotter pin and slotted nut securing the tie rod end to the knuckle; then remove the tie rod end from the knuckle.

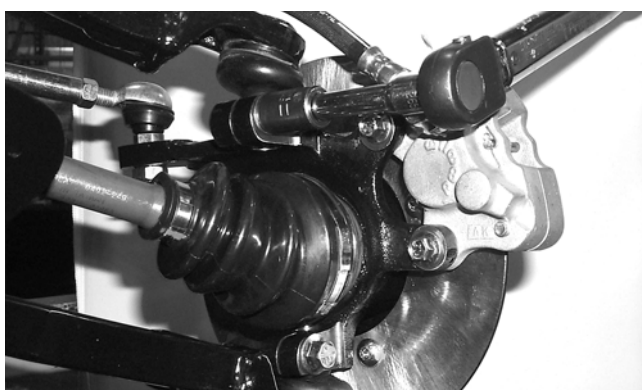


AF618D

7. Remove the cap screws securing the ball joints to the knuckle.

**CAUTION**

Support the knuckle when removing the cap screws or damage to the threads will occur.



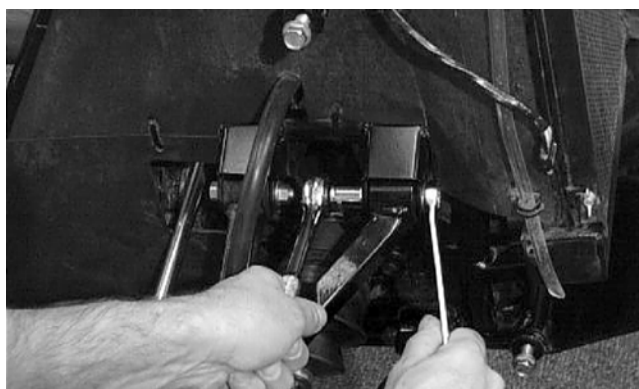
AF628D

8. Tap the ball joints out of the knuckle; then remove the knuckle.
9. Remove the lower shock absorber eyelet from the upper A-arm.



AF626D

10. Remove the cap screws securing the A-arms to the frame.



AF610D

11. Remove the circlip from the ball joint; then remove the ball joint from the A-arm.



AF616D

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all A-arm components in parts-cleaning solvent.
2. Clean the ball joint mounting hole of all residual Loctite, grease, oil, or dirt for installing purposes.

3. Inspect the A-arm for bends, cracks, and worn bushings.
4. Inspect the ball joint mounting holes for cracks or damage.
5. Inspect the frame mounts for signs of damage, wear, or weldment damage.

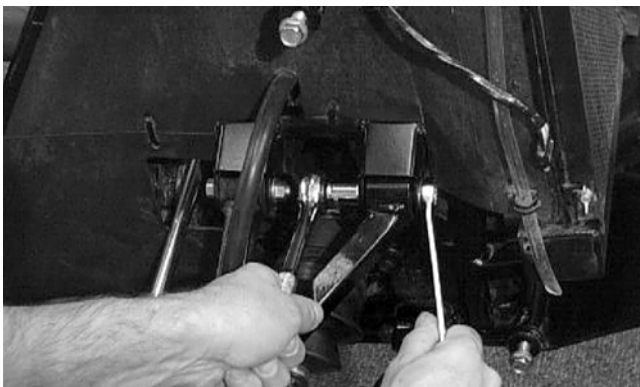
## INSTALLING

1. Apply green Loctite #609 to the entire outside diameter of the ball joint; then install the ball joint into the A-arm and secure with the circlip.



AF616D

2. Install the A-arm assemblies into the frame mounts and secure with the cap screws. Only finger-tighten at this time.



AF610D

3. Route the brake hose through the upper A-arm shock absorber mount.



AF627D

4. Secure the lower eyelet of the shock absorber to the upper A-arm. Tighten nut to specifications.
5. Secure the A-arm assemblies to the frame mounts (from step 2). Tighten the cap screws to specifications.

### CAUTION

**Do not tighten the nut beyond the 4.8 kg-m (35 ft-lb) specification or the shock eyelet or mount WILL be damaged.**

6. Install the knuckle assembly onto the ball joints and secure with cap screws. Tighten to specifications.

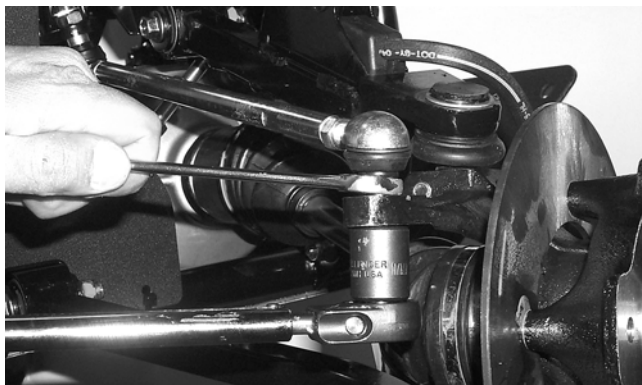


AF628D

7. Install the tie rod end and secure with the nut. Tighten to specifications; then install a new cotter pin and spread the pin to secure the nut.

■ **NOTE:** During assembly, new cotter pins should be installed.





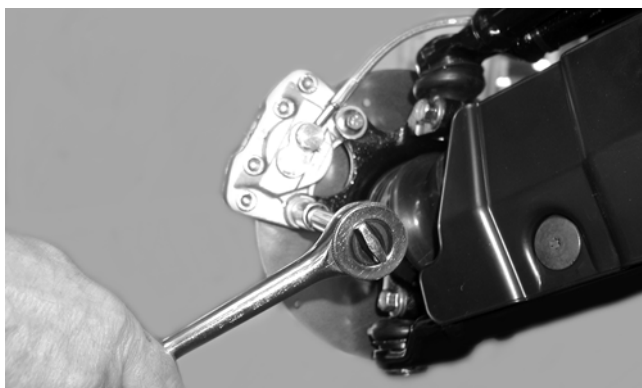
AF618D

8. Apply grease to the hub and drive axle splines; then install the hub assembly onto the drive axle.



CD009

9. Secure the hub assembly with the nut. Tighten only until snug.
10. Secure the brake caliper to the knuckle with the two cap screws making sure the two 0.76 mm (0.030 in.) spacer washers are positioned between the caliper and the knuckle. Tighten to specifications.



CD007

11. Secure the hub nut (from step 9) to the shaft/axle. Tighten to specifications.
12. Install a new cotter pin and spread the pin to secure the nut.



CD008

13. Install the wheel and tighten to specifications.
14. Remove the ATV from the support stand.

---

## Rear A-Arms (FIS - Rear Suspension)

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### REMOVING

1. Secure the ATV on a support stand to elevate the wheels.

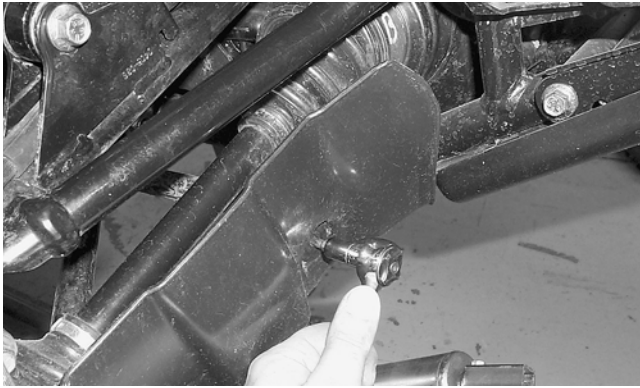
### **WARNING**

**Make sure the ATV is solidly supported on the support stand to avoid injury.**

2. Pump up the hand brake; then engage the brake lever lock.
3. Remove the wheel.
4. Remove the cotter pin securing the hex nut; then remove the hex nut. Release the brake lever lock.
5. Remove the two brake calipers (right side only).

■ **NOTE: Do not allow the brake calipers to hang from their cable/hose.**

6. Remove the cap screws and lock nut securing the shock absorber to the frame and lower A-arm; then remove the shock absorber.
7. Remove the cap screws securing the boot guard to the lower A-arm.



8. Slide the hub out of the knuckle and set aside.

9. Remove the cap screws and lock nuts securing the knuckle to the A-arms. Discard the lock nuts.

■ **NOTE:** Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.

10. Remove the cap screws and lock nuts securing the A-arms to the frame; then remove the A-arms.

■ **NOTE:** If removing the upper right A-arm, it will be necessary to disconnect the brake hose and brake cable from the A-arm.

## CLEANING AND INSPECTING

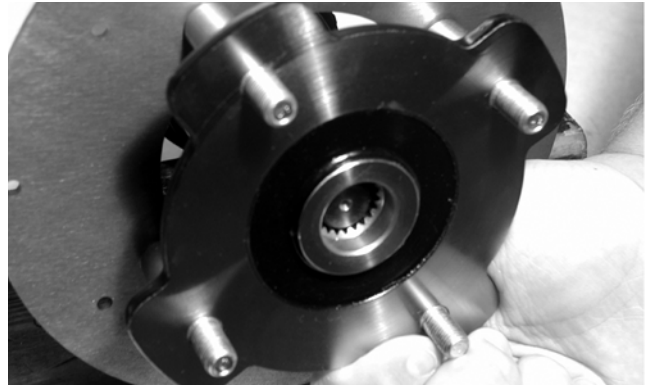
■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all A-arm components in parts-cleaning solvent.
2. Inspect the A-arm for bends, cracks, and worn bushings.
3. Inspect the frame mounts for signs of damage, wear, or weldment damage.

## INSTALLING

1. Install the A-arm assemblies into the frame mounts and secure with the cap screws and new lock nuts. Only finger-tighten at this time.
2. Slide the knuckle onto the drive axle and into position on the A-arms; then secure the knuckle to the A-arms with cap screws and new lock nuts. Tighten to specifications.
3. Tighten the hardware securing the A-arms to the frame mounts (from step 1) to specifications.

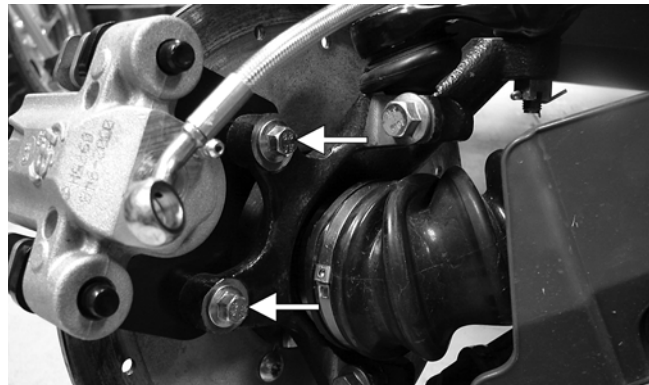
4. Apply grease on the drive axle splines; then install the hub assembly onto the drive axle.



5. Secure the hub assembly with the nut. Tighten only until snug.

6. Secure the brake caliper to the knuckle with the two cap screws (right side only). Tighten the auxiliary caliper to specifications. Tighten the hydraulic caliper to specifications.

■ **NOTE:** Ensure that the brake hose and brake cable are properly routed and secured to the upper A-arm.



7. Compress the hand brake lever and engage the brake lever lock; then secure the hub nut (from step 5) to the drive axle. Tighten to specifications.
8. Install a new cotter pin and spread the pin to secure the nut.



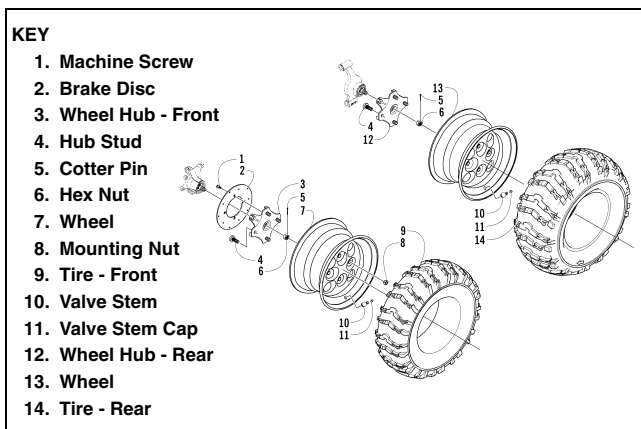
CD008

9. Secure the shock absorber to the frame with a cap screw and new lock nut. Tighten to specifications.
10. Secure the shock absorber to the lower A-arm with a cap screw and new lock nut. Tighten to specifications.
11. Secure the boot guard to the lower A-arm with the two cap screws. Tighten securely.
12. Install the wheel and tighten to specifications.
13. Remove the ATV from the support stand.

---

## Wheels and Tires

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0739-534

### TIRE SIZE

#### **WARNING**

Use only Arctic Cat approved tires when replacing tires. Failure to do so could result in unstable ATV operation.

The ATV is equipped with low-pressure tubeless tires of the size and type listed in the General Specifications (see Section 1). Do not under any circumstances substitute tires of a different type or size.

#### **WARNING**

Do not mix tire tread patterns. Use the same pattern type on front and rear. Failure to heed warning could cause poor handling qualities of the ATV and could cause excessive drive train damage not covered by warranty.

### TIRE INFLATION PRESSURE

Front and rear tire inflation pressure should be 0.35 kg/cm<sup>2</sup> (5.0 psi).

### REMOVING

1. Secure the ATV on a support stand to elevate the wheels.

#### **WARNING**

Make sure the ATV is solidly supported on the support stand to avoid injury.

2. Remove the wheels.

■ **NOTE:** Keep left-side and right-side wheels separated for installing them on their proper sides.

### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean the wheels and hubs with parts-cleaning solvent.
2. Clean the tires with soap and water.
3. Inspect each wheel for cracks, dents, or bends.
4. Inspect each tire for cuts, wear, missing lugs, and leaks.

### INSTALLING

1. Install each wheel on its hub.





CD006

■ **NOTE:** Make sure each wheel is installed on its proper hub as noted in removing (the “rotation arrow” (if applicable) must indicate forward direction of rotation).



AF612D

2. Tighten to specifications.

## **CHECKING/INFLATING**

1. Using an air pressure gauge, measure the air pressure in each tire. Adjust the air pressure as necessary to meet the recommended inflation pressure.



CD005

2. Inspect the tires for damage, wear, or punctures.



### **WARNING**

**Do not operate the ATV if tire damage exists.**

■ **NOTE:** If repair is needed, follow the instructions found on the tire repair kit or remove the wheel and have it repaired professionally.

■ **NOTE:** Be sure all tires are the specified size and have identical tread pattern.

3. Check the front wheel toe-in and toe-out and adjust as necessary (see Section 8).

4. Test drive the ATV on a dry, level surface and note any pulling to the left or right during acceleration, deceleration, and braking.

■ **NOTE:** If pulling is noted, measure the circumference of the front and rear tires on the pulling side. Compare the measurements with the tires on the opposite side. If pulling is noted during braking only, check and adjust the brakes as necessary and recheck operation (see Section 2).

5. Increase the air pressure in the tires with the smallest circumference measurement until all tires are equal in circumference.

6. Repeat steps 4-5 as necessary to ensure proper handling.

# SECTION 8 - STEERING/FRAME

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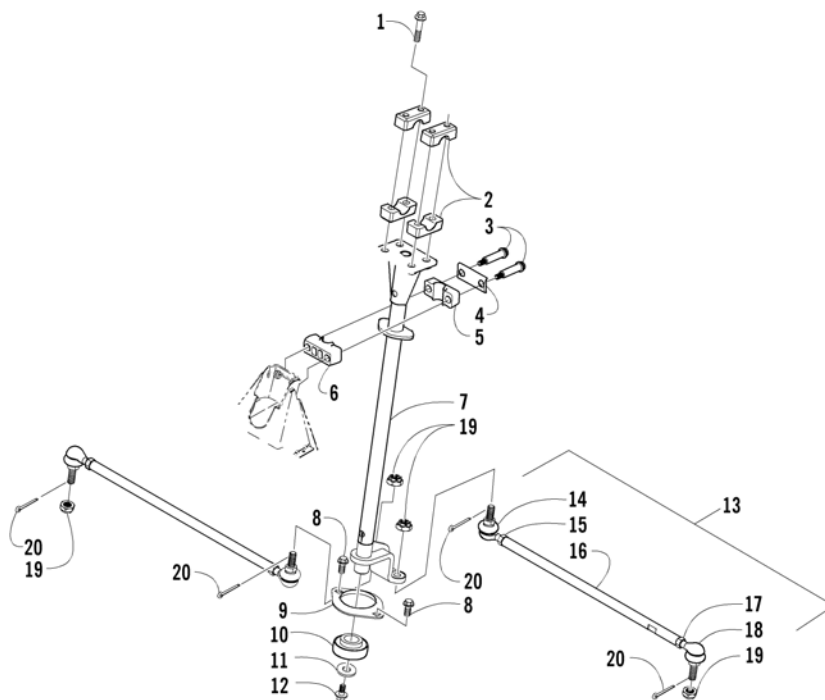
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## Steering Post/ Tie Rods

■ **NOTE:** Some components may vary from model to model. The technician should use discretion and sound judgment.

### KEY

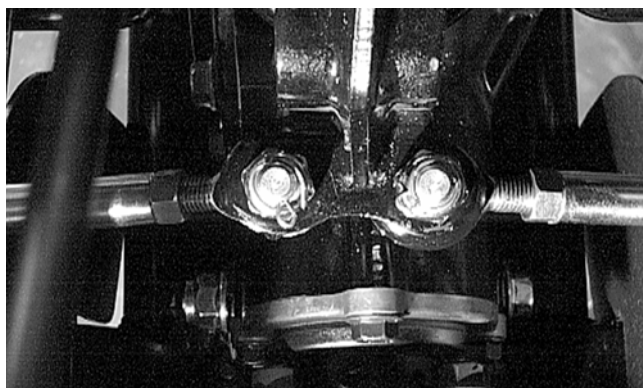
1. Cap Screw
2. Cap
3. Shoulder Screw
4. Housing Cap
5. Housing (Lower)
6. Housing (Upper)
7. Steering Post
8. Cap Screw
9. Bearing Flange
10. Bearing w/Oil Seal
11. Washer
12. Cap Screw
13. Tie Rod Assy
14. Ball Joint (Left)
15. Nut (Left)
16. Tie Rod
17. Nut (Right)
18. Ball Joint (Right)
19. Lock Nut
20. Cotter Pin



0739-774

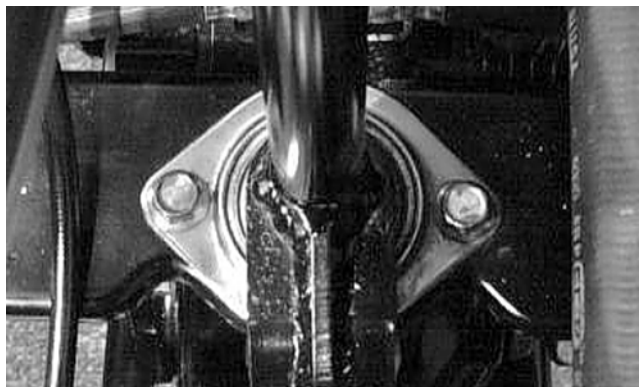
### REMOVING (400 VP)

1. Remove the gas tank (see Section 4).
2. Remove the inner splash shields (see Front/Rear Body Panel in this section).
3. Remove the cotter pin and slotted nut securing each tie rod end to the steering post arm. Remove the tie rod ends from the arm.



AF778D

4. Remove the cotter pin and slotted nut securing the side tie rod ends to the knuckles. Remove the tie rod ends from the knuckles; then remove the tie rods.
5. Remove the cap screws securing the steering post bearing flange.

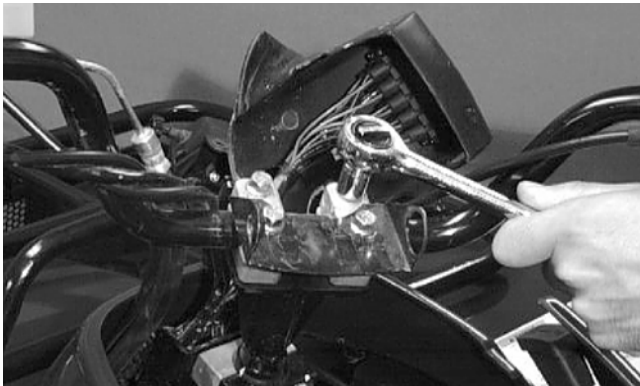


AL600D

6. Remove the reinstallable rivets securing the instrument pod.

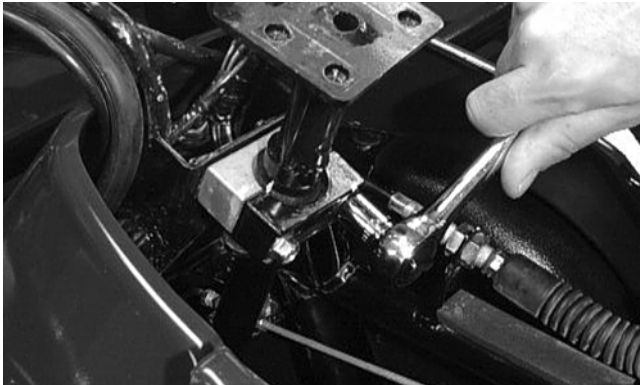


7. Remove the retaining ring securing the ignition switch.
8. Remove the four cap screws securing the handlebar caps (blocks) to the steering post; then move the handlebar out of the way.



AL614D

9. Remove the two cap screws securing the upper steering post bearing housings to the frame.



AL619D

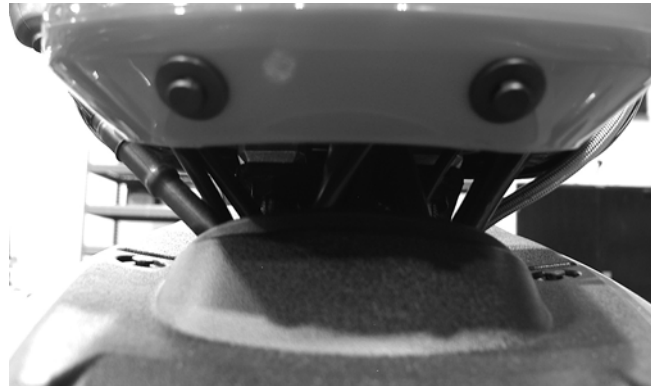
10. Remove the steering post.



AL618D

## REMOVING (500/650 H1/650 V-Twin)

1. Remove the ignition switch retaining ring; then remove the reinstallable rivets securing the instrument pod to the mounting bracket and remove the pod.



CD759

2. Remove the reinstallable rivets securing the radiator access cover and remove the cover.



CD666

3. Remove four reinstallable rivets securing the steering post cover and remove the cover.



CD667

4. Unlatch the storage compartment lid; then slide the storage compartment cover assembly forward and lift off.



CD669

5. Remove the storage compartment box.



CD671

6. Remove the four cap screws securing the handlebar caps and speedometer bracket to the steering post; then move the handlebar and speedometer out of the way. Account for four handlebar caps.



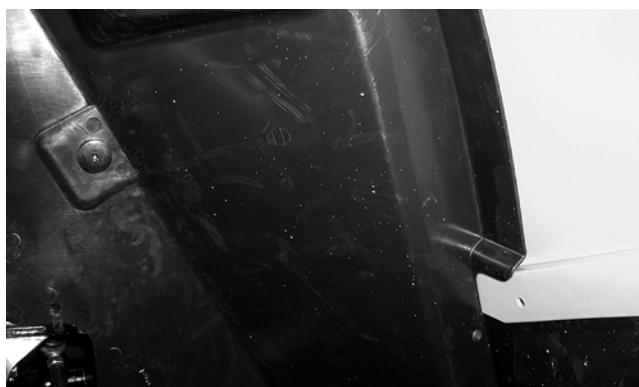
CD762

7. Remove two cap screws securing the upper steering post bearing to the frame. Account for two bearings and two housings.



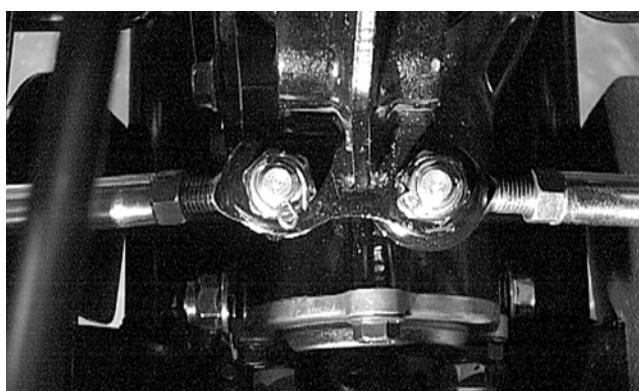
CD760

8. Using a suitable lift stand, raise the ATV enough to remove the front wheels; then remove the left-side and right-side splash panels.



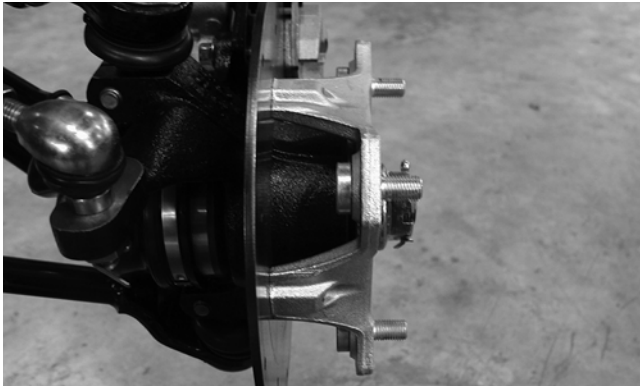
CD685

9. Remove the cotter pins and slotted nuts from the inner and outer tie rod ends; then remove the tie rods from the steering post arm and the left-side and right-side steering knuckles.



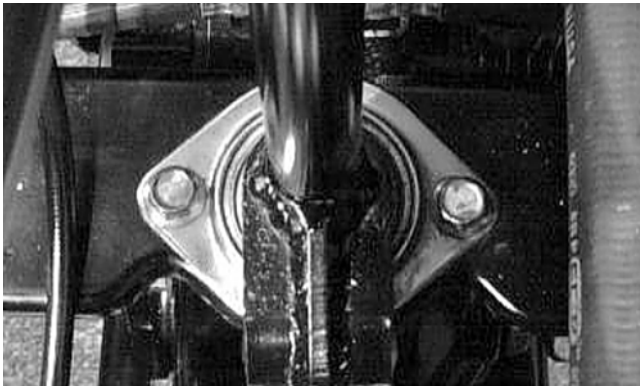
AF778D





KX039

10. Remove two cap screws securing the lower steering post bearing flange to the frame; then remove the steering post.



AL600D

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Wash the tie rod ends in parts-cleaning solvent. Dry with compressed air. Inspect the pivot area for wear. Apply a low-temperature grease to the ends.

### **WARNING**

**Always wear safety glasses when using compressed air.**

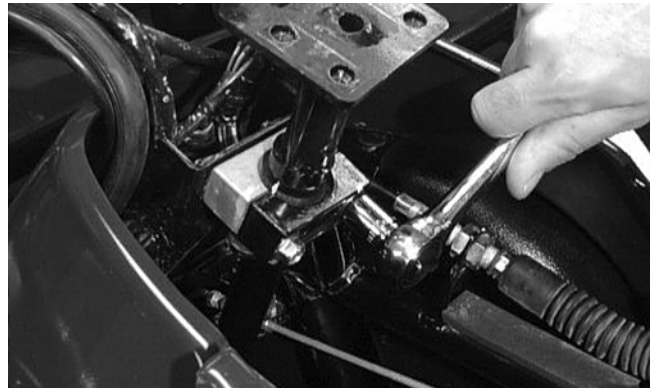
2. Inspect the tie rods for damaged threads or wear.
3. Inspect the tie rods for cracks or unusual bends.
4. Inspect all welded areas for cracks or deterioration.
5. Inspect the steering post and steering-post brackets for cracks, bends, or wear.
6. Inspect the bearing halves, bearing caps, and bearing housings for cracks or wear.

7. Inspect the handlebar tube for cracks, wear, or unusual bends.

8. Inspect the handlebar grips for damage or wear.

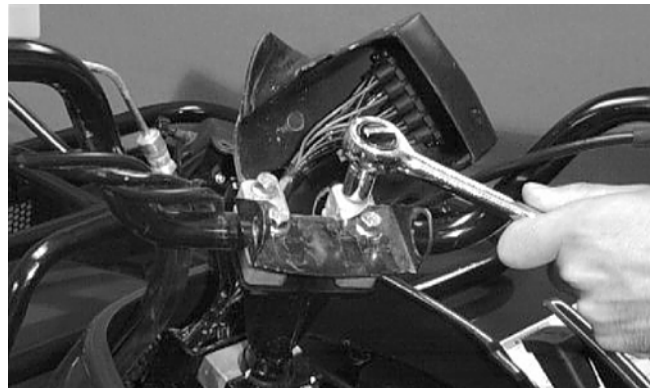
## INSTALLING (400 VP)

1. Place the steering post into position; then place the upper steering post bearings and housings on the steering post and install the two cap screws through the housings and into the frame. Tighten the cap screws to specifications.



AL619D

2. Place the handlebar into position and secure with the handlebar caps (blocks). Tighten the four cap screws to specifications.

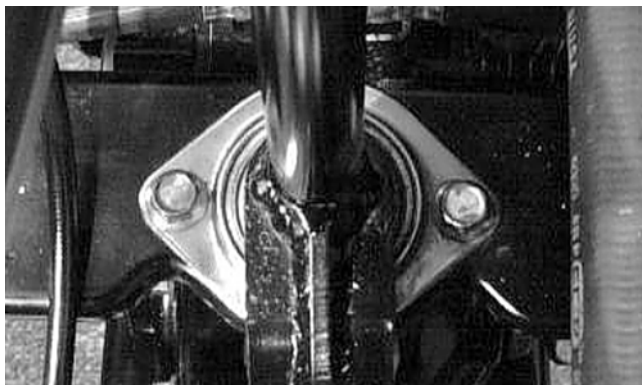


AL614D

3. Place the ignition switch into position; then place the instrument pod into position and secure with the reinstallable rivets and the retaining ring.

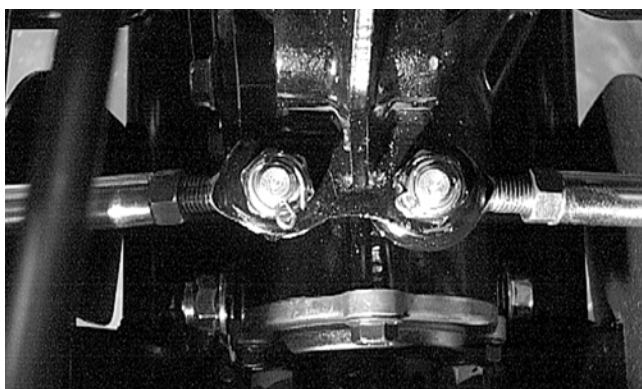
4. Place the steering post bearing flange into position. Secure with the cap screws tightened to specifications.





AL600D

5. Insert the tie rod ends into the knuckles; then install the slotted nuts and tighten to specifications. Lock the nuts with new cotter pins.
6. Insert the tie rod ends into the steering post arm; then install the slotted nuts and tighten to specifications. Lock the nuts with new cotter pins.



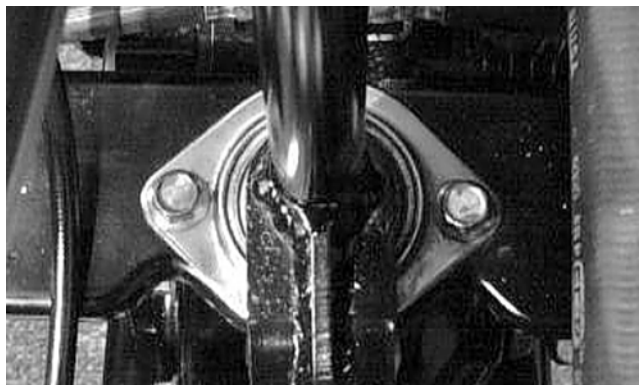
AF778D

7. Install the gas tank (see Section 4).
8. Install the inner splash shields (see Front/Rear Body Panel in this section).

■ **NOTE:** Turn the gas tank valve to the ON position only if starting the engine.

### **INSTALLING (500/650 H1/650 V-Twin)**

1. Place the steering post into position; then secure the lower bearing flange to the frame with two cap screws. Tighten to specifications.



AL600D

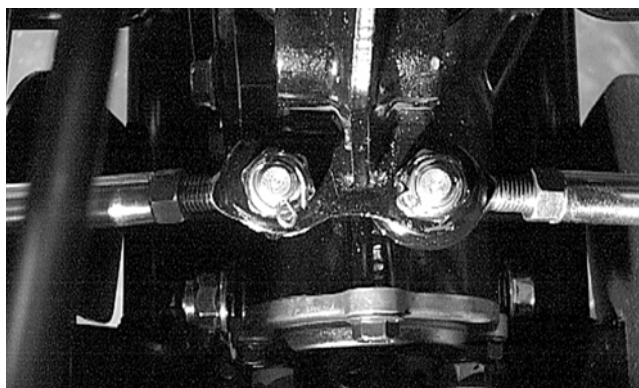
2. Place the upper steering post bearings into the housings; then position on the steering post and secure the housings to the frame with two cap screws. Tighten to specifications.



CD760

3. Install the tie rods and secure with the slotted nuts. Tighten to specifications; then install new cotter pins.

■ **NOTE:** If the slots do not align with the holes in the tie rod ends, tighten the nuts just enough to allow installation of the cotter pins.



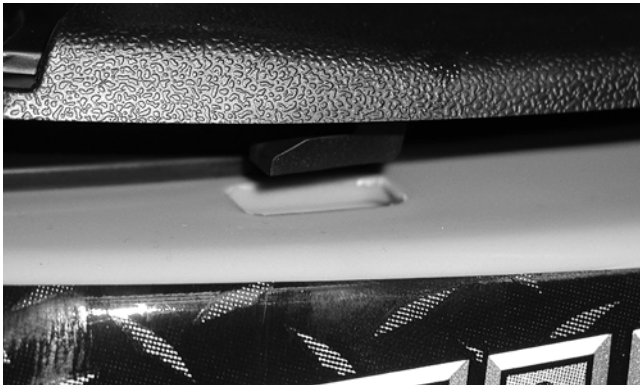
AF778D

4. Install the splash panels; then install the front wheels and tighten to specifications using a crisscross pattern.

5. Lower the ATV and place the handlebar and caps into position on the steering post; then position the speedometer on top of the caps and secure with the four cap screws. Tighten to specifications.
6. Install the storage compartment box; then attach the storage compartment cover assembly by engaging the lugs into the slots and sliding rearward. Lock the storage compartment lid to hold the assembly in place.



CD671



CD670

7. Place the instrument pod into position over the speedometer; then secure with two reinstallable rivets and the ignition switch locking ring.



CD677



CD676

8. Install the steering post access cover and secure with four reinstallable rivets; then install and secure the radiator access cover.

## Handlebar Grip

### REMOVING

1. Remove the plug from the head of the rivet.
2. Using a 1/8-in. drill bit, drill out the rivet.
3. Using compressed air between the grip and the handlebar, twist the grip back and forth until it slides free of the handlebar.

### INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Inspect the grip for wear, cuts, or cracks.
2. Inspect the grip for deterioration.

### INSTALLING

■ **NOTE:** Before installing a grip, use contact spray or alcohol to clean the inside of the grip and the handlebar of glue residue, oil, or any other contaminant.

1. Apply a liberal amount of Handlebar Grip Adhesive (p/n 0636-071) to the inside of the grip.
2. Align the rivet hole in the grip with the rivet hole in the handlebar; then align the notch (inside the grip) with the slot in the handlebar and slide the grip onto the handlebar until it is fully seated.
3. Wipe off any excess glue; then secure the grip with a new rivet.

4. Install the plug on the head of the rivet.

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## Steering Knuckles

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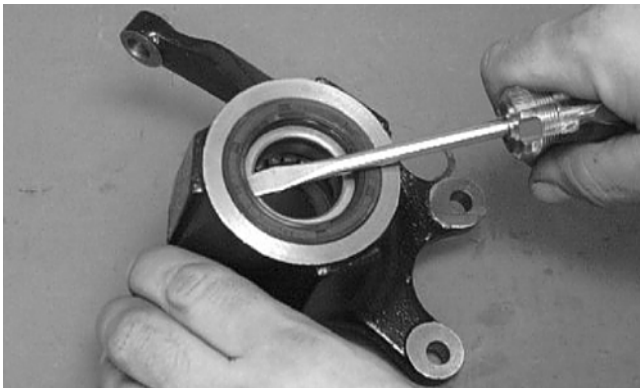
### REMOVING AND DISASSEMBLING

1. Secure the ATV on a support stand to elevate the wheel; then remove the wheel.

#### **WARNING**

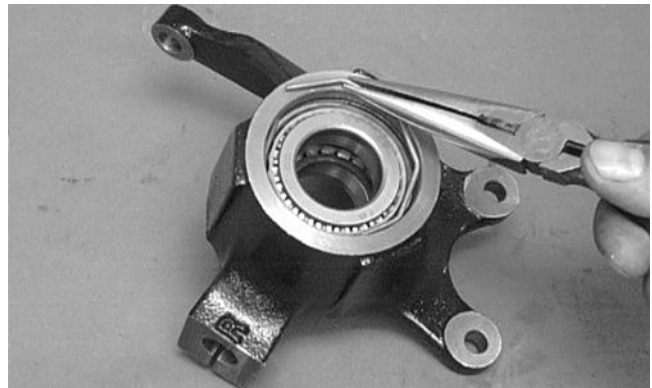
**Make sure the ATV is solidly supported on the support stand to avoid injury.**

2. Remove the wheel cap from the hub; then remove the cotter pin from the nut.
3. Remove the nut securing the hub.
4. Remove the brake caliper.
5. Remove the hub assembly.
6. Remove the cotter pin from the tie rod end and remove the tie rod end from the knuckle.
7. Remove the two cap screws securing the ball joints in the knuckle.
8. Tap the ball joint end out of the knuckle; then remove the knuckle.
9. Remove the seal from the knuckle.



AF725D

10. Remove the bearing retainer.



AF726D

11. Remove the bearings.

#### **CAUTION**

**Use extreme care when removing the bearing. If the bearing is allowed to fall, it will be damaged and will have to be replaced.**

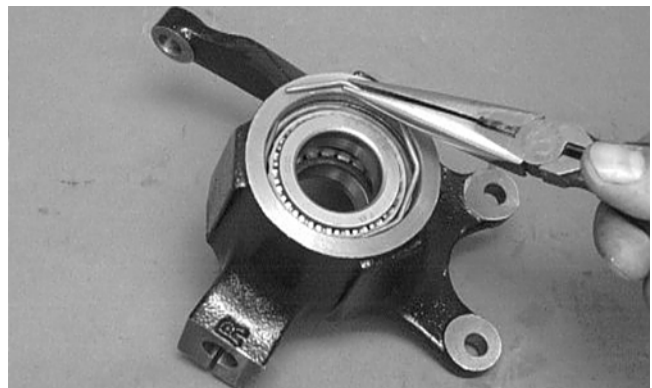
### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all knuckle components.
2. Inspect the bearing for pits, gouges, rusting, or premature wear.
3. Inspect the knuckle for cracks, breaks, or porosity.
4. Inspect threads for stripping or damage.

### ASSEMBLING AND INSTALLING

1. Install the bearing.
2. Install the bearing retainer.

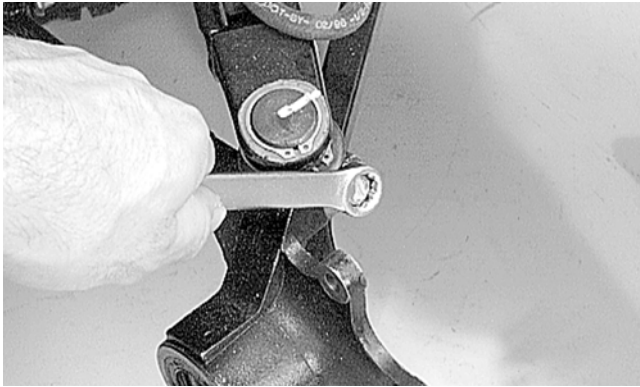


AF726D

3. Install a new seal into the knuckle making sure the seal is flush with the knuckle.
4. Apply grease to the seal.



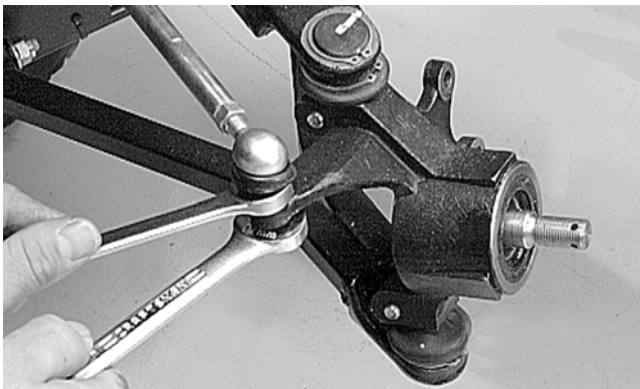
5. Install the knuckle to the upper and lower ball joints and secure with the two cap screws. Tighten to specifications.



AF760D

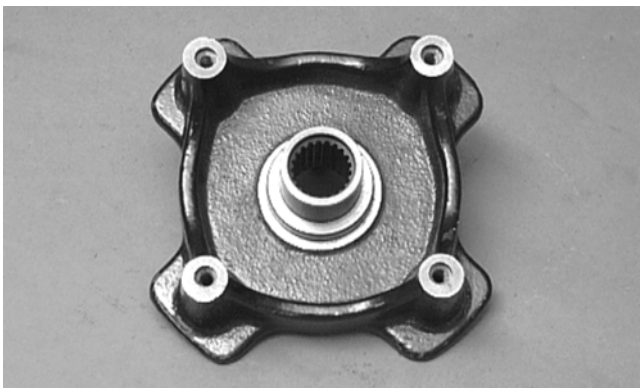
6. Install the tie rod end and secure with the nut. Tighten to specifications; then install a new cotter pin and spread the pin.

■ **NOTE:** During assembling, new cotter pins should be installed.



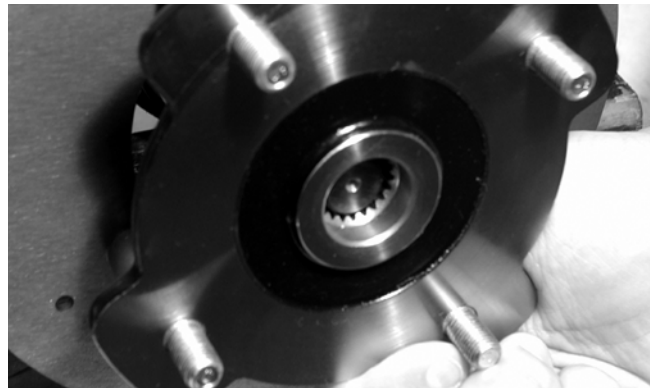
AF759D

7. Apply a small amount of grease to the hub splines.



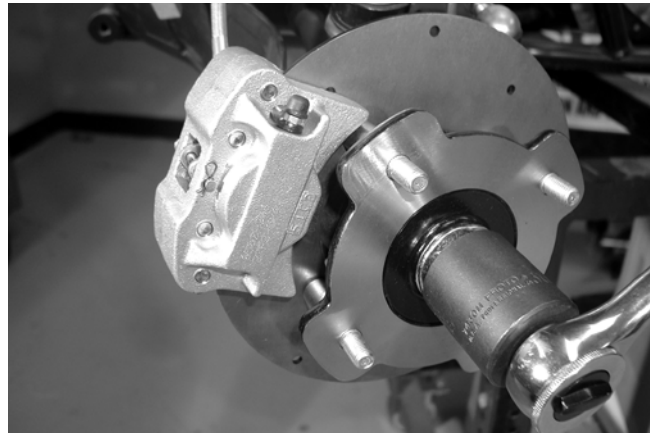
AF736D

8. Install the hub assembly onto the splines of the shaft.



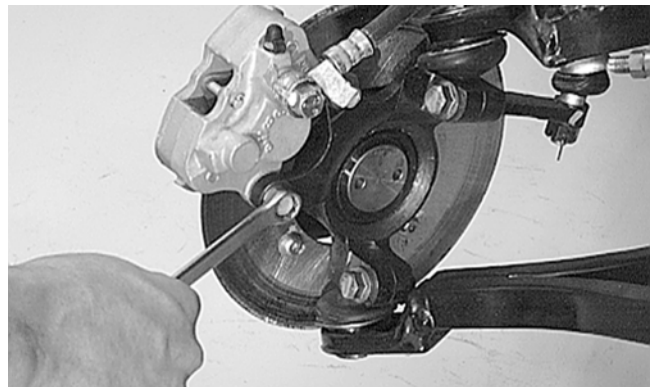
CD009

9. Secure the hub assembly with the nut. Tighten only until snug.



CD015

10. Secure the brake caliper to the knuckle with the two cap screws. Tighten to specifications.



AF746D

11. Pump the hand brake lever; then engage the brake lever lock.
12. Secure the hub nut (from step 9) to the shaft. Tighten to specifications.
13. Install a new cotter pin and spread the pin to secure the nut.
14. Install the wheel; then using a crisscross pattern, tighten to specifications.



CD006

15. Remove the ATV from the support stand.

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## Measuring/Adjusting Toe-In

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1. Thoroughly wash the ATV to remove excess weight (mud, etc.).
2. Refer to the specifications and ensure the tires are properly inflated to the recommended pressure.

■ **NOTE:** Ensure the inflation pressure is correct in the tires or inaccurate measurements can occur.



CD005

3. Place the ATV in a level position taking care not to push down or lift up on the front end; then turn the handlebar to the straight ahead position.

■ **NOTE:** When measuring and adjusting, there should be a normal operating load on the ATV (without an operator but with Arctic Cat approved accessories).

4. Measure the distance from the outside edge of each handlebar grip to the seat catch brackets.



CD012A

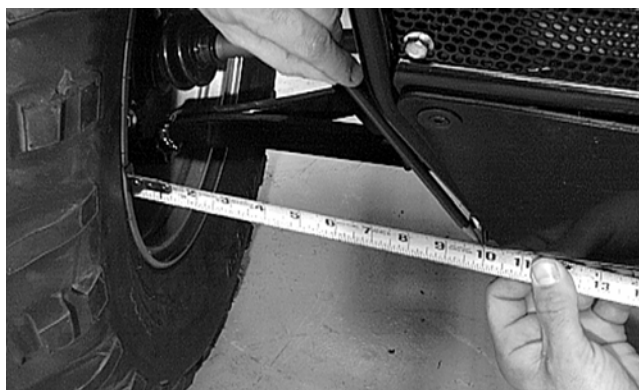
5. Adjust the handlebar direction until the two measurements are equal; then secure the handlebar to the rear rack using tie-down straps.

■ **NOTE:** Care must be taken not to allow the handlebar to turn while securing it.



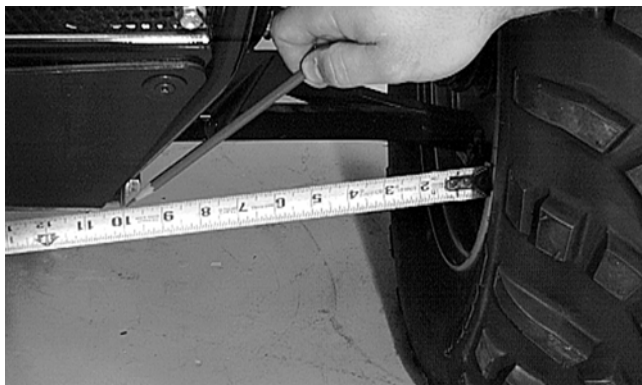
CD014

6. Measure the distance from the inside of each front rim to the lower frame tube.



AF785D

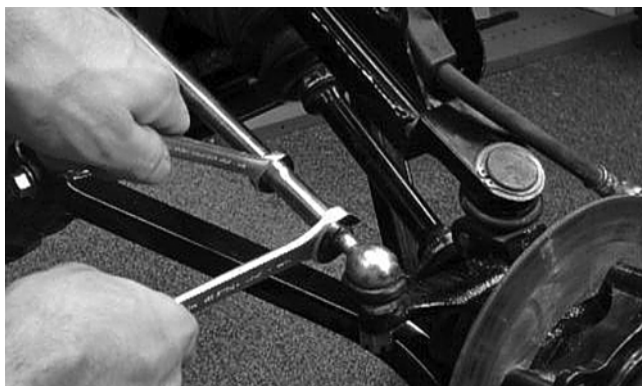




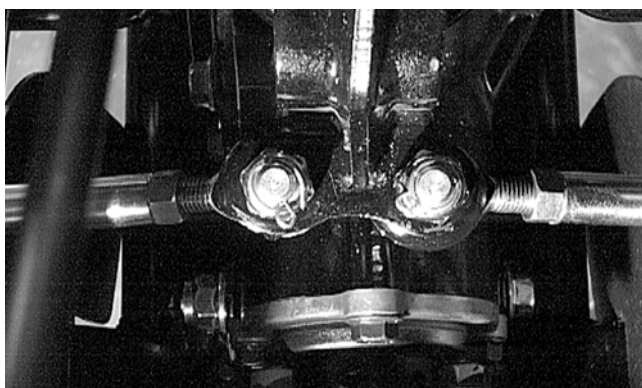
AF786D

■ **NOTE:** The distances from the inside rims to the frame tubes should be equal. If the measurements are equal, proceed to step 8; if the measurements are not equal, proceed to step 7.

7. To make the measurements equal, loosen the appropriate tie rod jam nuts and adjust accordingly; then proceed to step 8.



AF617D



AF778D

■ **NOTE:** The front wheels do not have to be removed to adjust the tie rod. Also, care should be taken not to disturb the handlebar position.

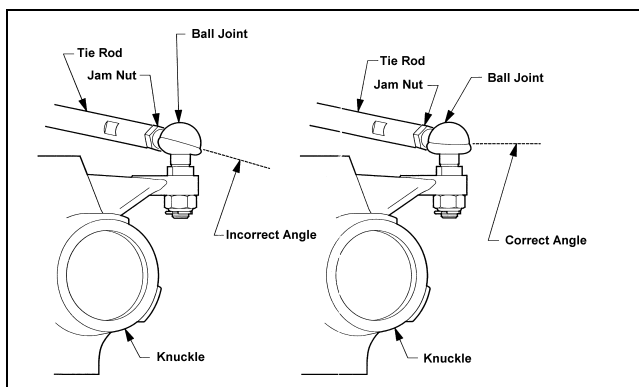
8. Using a permanent marker of some type, mark the center of each front tire (at a height parallel to the belly panel).



AF789D

9. Measure the distance between the marks (at a height parallel to the belly panel) at the front side; then record the measurement.
10. Push the ATV forward until the marks are parallel to the belly panel on the back side; then measure the distance between the marks.
11. The difference in the measurements must show 3.2-6.4 mm (1/8-1/4 in.) toe-in (the front measurement 3.2-6.4 mm (1/8-1/4 in.) less than the rear measurement).
12. If the difference in the measurements is not within specifications, adjust both tie rods equally until within specifications.

■ **NOTE:** Prior to locking the jam nuts, make sure the ball joints are at the center of their normal range of motion and at the correct angle.



733-559A

## Front Rack

### REMOVING

1. Remove the two cap screws and lock nuts securing the front fender panel.
2. Remove the cap screws and lock nuts securing the rack to the frame.



3. Remove the front rack from the ATV.

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all rack components with parts-cleaning solvent.
2. Inspect all welds for cracking or bending.
3. Inspect threaded areas of all mounting bosses for stripping.
4. Inspect for missing decals and/or reflectors.

## INSTALLING

1. Place the rack into position on the frame and front fender panel. Install the cap screws and lock nuts and finger-tighten only.
2. Install the two cap screws and lock nuts securing the rack to the fenders. Tighten all hardware securely.

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## Front Bumper Assembly

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### REMOVING

1. Remove the two flange bolts and lock nuts securing the upper bumper supports to the bumper.
2. Remove the through-bolt and lock nut securing the bumper to the frame; then remove the bumper.

### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all bumper components with parts-cleaning solvent.
2. Inspect all welds for cracking or bending.

### INSTALLING

1. Place the front bumper assembly into position and install the through-bolt. Start the lock nut and finger-tighten only.

2. Install the two flange bolts and lock nuts on the upper supports. Tighten all hardware securely.

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## Front/Rear Body Panel

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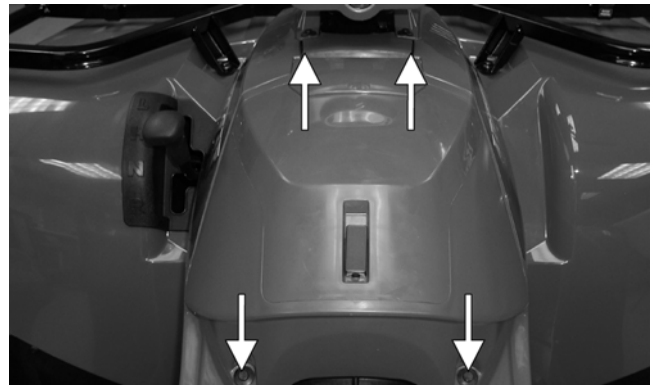
### REMOVING

1. Remove the seat; then remove the battery cover/tool tray.
2. Remove the negative battery cable from the battery; then remove the positive cable. Remove the vent hose; then remove the battery.

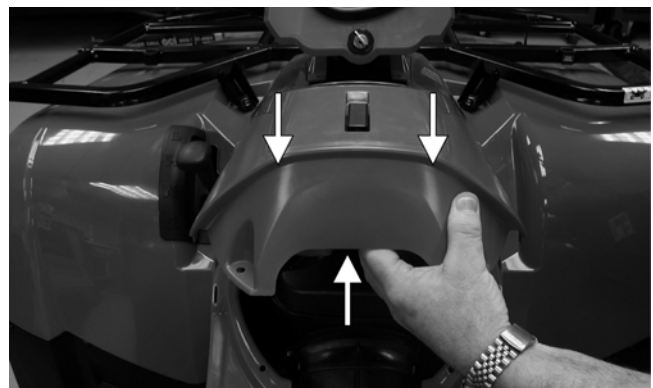
### ⚠ CAUTION

Battery acid is harmful if it contacts eyes, skin, or clothing. Care must be taken whenever handling a battery.

3. Remove four reinstallable rivets securing the storage compartment to the body; then remove the storage compartment and the steering post cover.

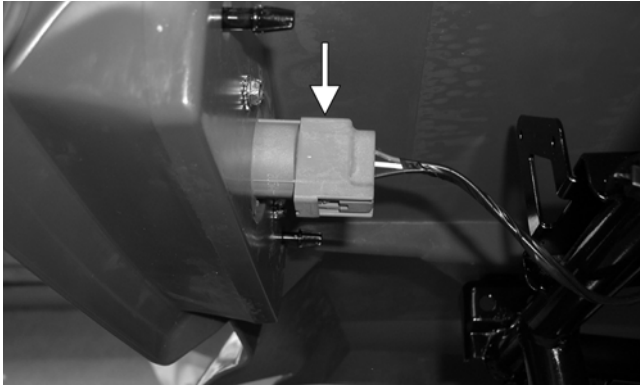


CF145A



CF143A

4. Remove the left-side and right-side fender splash panels; then remove one press-in fastener and one reinstallable rivet from the left side and right side of the air-intake splash shroud. Do not remove the shroud.
5. Disconnect the four headlight connectors and the taillight/brakelight connector from the sockets.

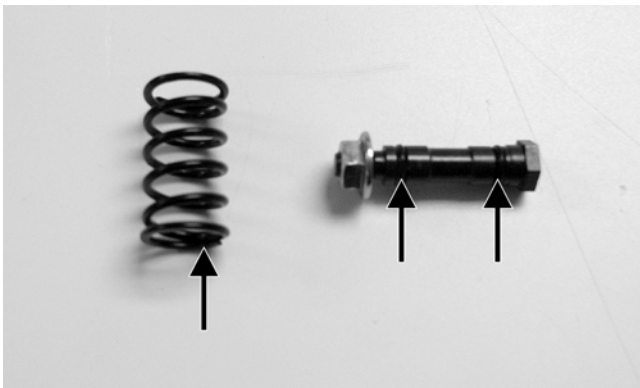


CF135A

6. Remove the shift knob; then remove the nut and axle pivot bolt securing the lever to the shift lever axle. Remove the shift lever. Account for the two O-rings on the axle bolt and one spring.

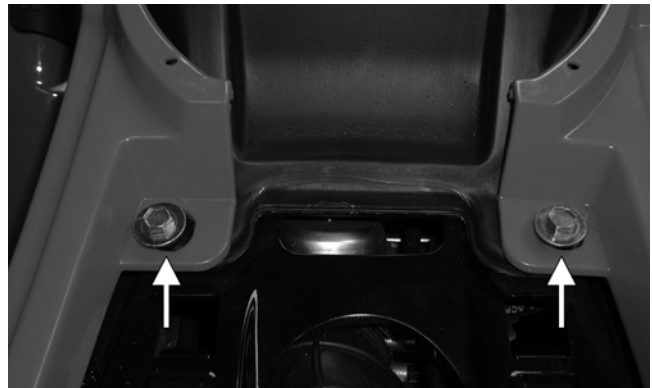


CD779



CD780A

7. Remove the front and rear racks; then remove the two body bolts adjacent to the air filter housing and two push nuts located behind the grille.



CF201A



CF160A

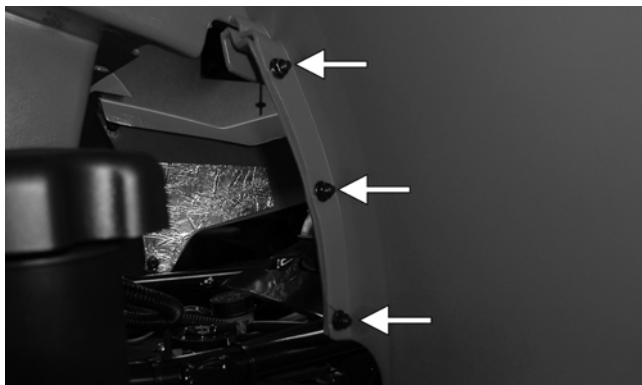
8. Remove the two cap screws and lock nuts securing the left foot peg and remove the foot peg.



CD782

9. Remove eight cap screws and lock nuts and one reinstallable rivet securing the right-side footwell to the fenders.

10. Lift and support the rear of the body to allow access to the torx-head cap screws securing the front and rear body sections together; then remove six self-locking nuts (three from each side). Remove the rear body panel; then remove the front one.



CF213A

■ **NOTE:** To aid in removing the body without separating the front and rear panels, it is advisable to have an assistant help with lifting and guiding the body clear of the handlebar.

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

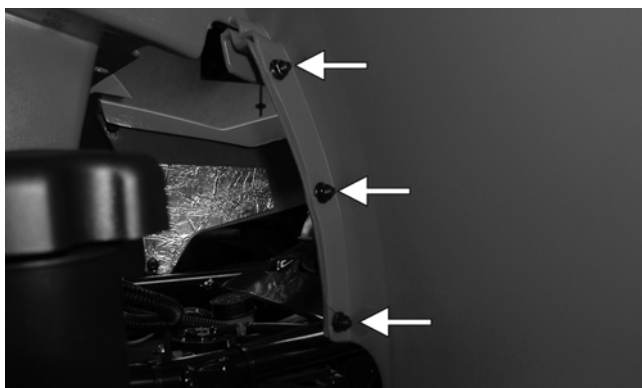
1. Clean all fender components with part-cleaning solvent and soap and water.
2. Inspect fenders for cracks and/or loose rivets.
3. Inspect for any missing decals.

## INSTALLING

1. Place the body assembly into position on the ATV.

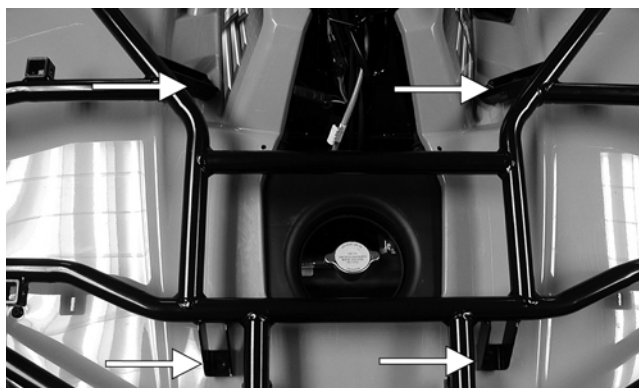
■ **NOTE:** If the front and rear body panels have been separated, proceed to step 2; if the panels have not been separated, proceed to step 3.

2. Install the torx-head cap screws and lock nuts securing the front and rear body panels together. Tighten securely.



CF213A

3. Making sure the body mounting grommets are in place, position the front and rear racks; then install the eight flanged cap screws and lock nuts. Do not tighten at this time.



CD679A



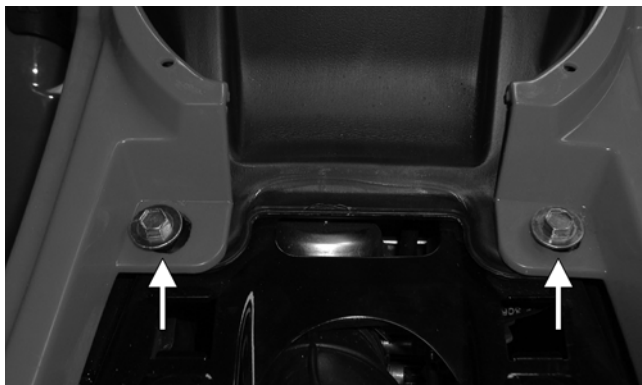
CD690A

4. Install four rack-to-body machine screws and lock nuts on the front and rear racks, two push nuts behind the grille, and two body bolts adjacent the air filter housing; then tighten all fasteners (from step 3 and 4) securely.



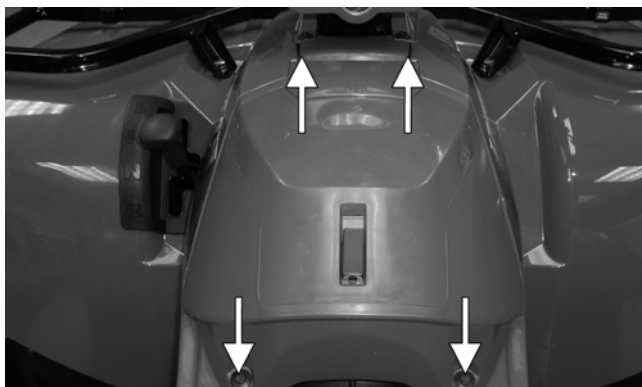
CF160A



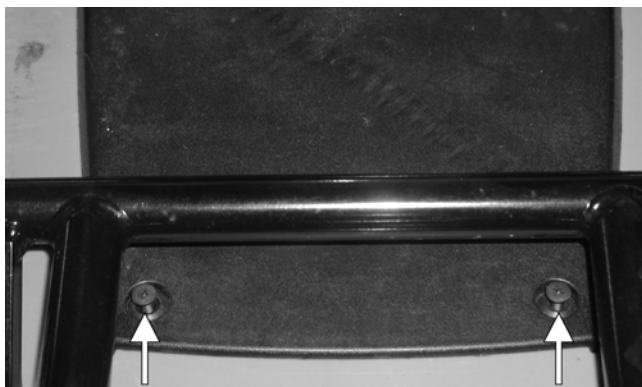


CF201A

5. Install eight cap screws and lock nuts securing the right-side footwell to the front and rear fenders; then place the left-side foot peg into position and secure with two cap screws and lock nuts. Tighten securely.
6. Place the storage compartment into position; then install the steering post cover. Secure with the reinstallable rivets.



CF145A



CF134A

7. Place the shift lever into position making sure the spring is installed; then secure with the axle pivot bolt and lock nut.
8. Install the shift knob and the left-side and right-side splash panels; then reconnect the headlights. Tighten all fasteners securely.
9. Place the battery into position in the battery box; then connect the vent hose.

10. Connect the positive battery cable; then connect the negative battery cable. Tighten the battery terminal cap screws securely.
11. Install the battery cover/tool tray; then install the seat. Make sure the seat locks securely.

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## Front Body Panel/ Side Panels

(TBX/TRV/500/650 H1/650 V-Twin)

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### REMOVING

1. Remove the reinstallable rivets securing the radiator access cover and remove the cover; then remove four reinstallable rivets securing the steering post cover and remove the cover.



CD666



CD667

2. Unlock the storage compartment lid; then slide the storage compartment cover assembly forward and lift off the storage compartment.



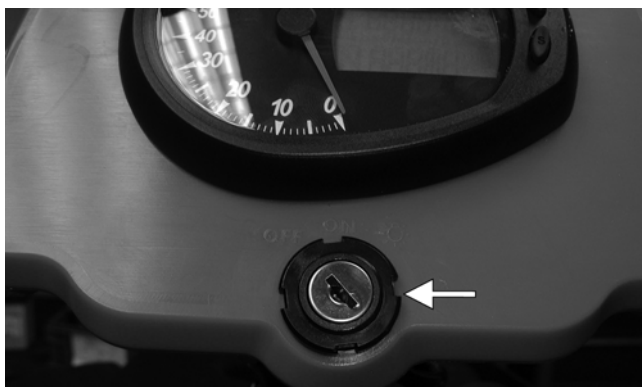
CD669

3. Remove the storage compartment box; then remove the seat.



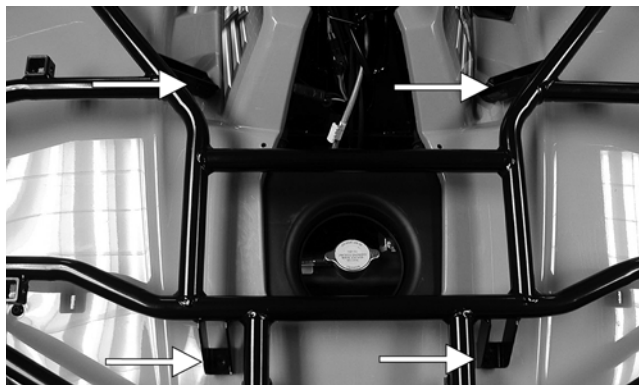
CD671

4. Remove the ignition switch lock collar and two reinstallable rivets securing the instrument pod; then remove the instrument pod.



CF207A

5. Remove four machine screws and lock nuts securing the front rack to the frame; then remove the front rack. Account for four grommets and four bushings.



CD679A

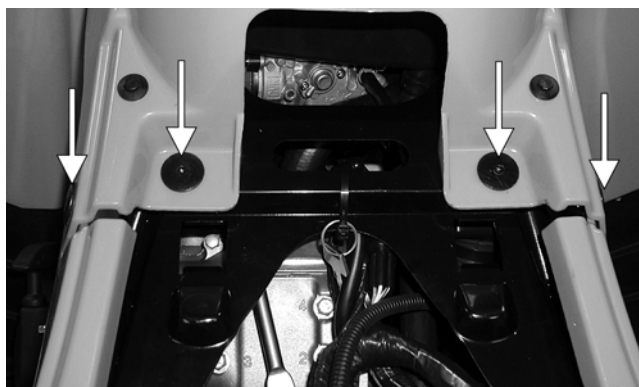


CD680

6. Remove three reinstallable rivets securing the right side panel; then remove two torx-head cap screws securing the rear of the front panel to the frame.



CD683A



CD684A



7. Remove the torx-head cap screws and nylon ties securing the left-side and right-side splash panels; then remove the panels.



CD685

8. Remove one shoulder screw and four plastic rivets on each side to separate the front panel lower fenders from the left-side and right-side footwells.



CD691

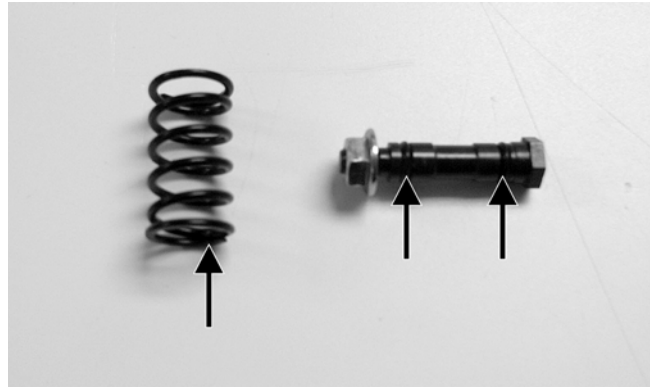


CD682

9. Remove the shift knob retaining pin and remove the shift knob; then remove the shift lever pivot axle nut and remove the axle and shift lever. Account for a spring and two O-rings.



CD779



CD780A

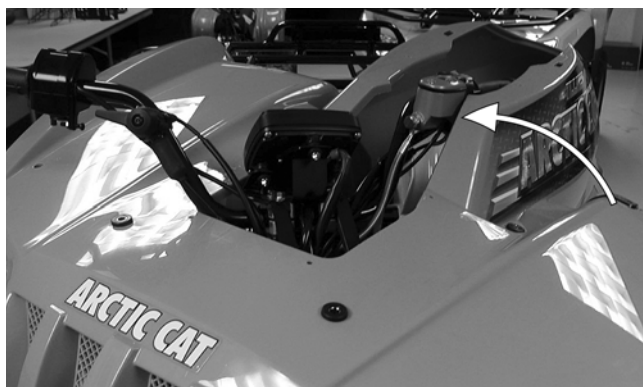
10. Disconnect four headlight connectors and secure the wires out of the way; then disconnect the wires to the front accessory plug.



CD681

11. Rotate the handlebar to the full-left position; then lift and slide the panel to the rear and lift the rear up to clear the handlebar.





CD765A

■ **NOTE:** It may be necessary to rotate the body panel to the right to align the opening with the handlebar.

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all fender components with part-cleaning solvent and soap and water.
2. Inspect fenders for cracks and/or loose rivets.
3. Inspect for any missing decals.

## INSTALLING

1. Rotate the handlebar to the full-left position; then place the front body panel over the handlebar and rotate and lower into position.



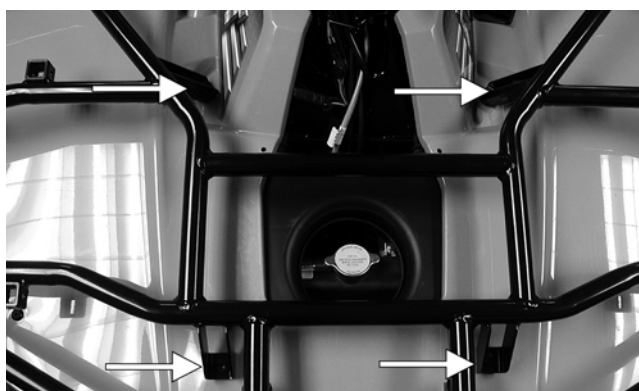
CD765

2. Connect the headlight connectors to the appropriate headlights and the front accessory plug wires to the accessory plug.



CD681

3. Make sure the four rubber grommets and bushings are in place; then place the front rack into position and secure with four machine screws and flange nuts. Tighten securely.

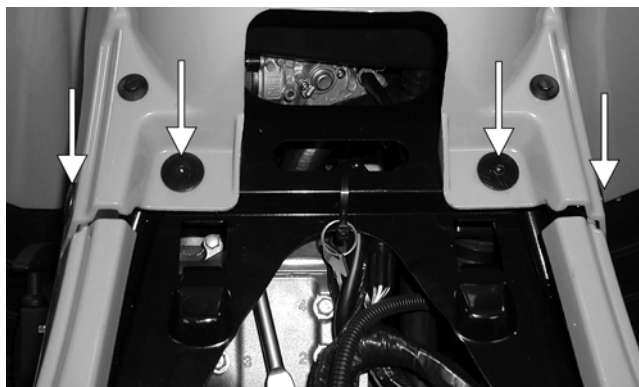


CD679A

4. Install one machine screw and flange nut and four plastic rivets on each side to secure the front fenders to the footwells. Tighten the flange nuts securely.

■ **NOTE:** If the footwells have been removed, see Footrests in this section.

5. Install four cap screws securing the front body panel to the frame and rear panel.



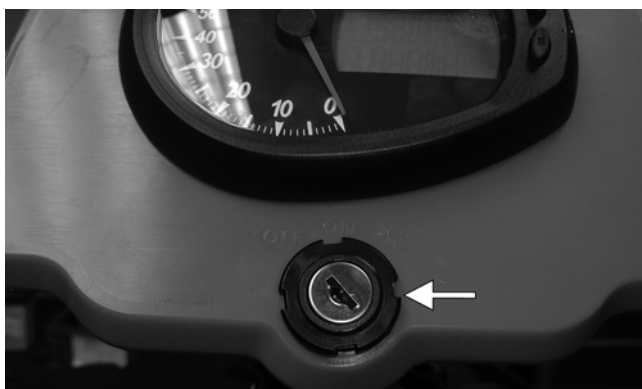
CD684A

6. Install the shift lever spring, shift lever, and pivot axle; then tighten the axle nut securely.



CD779

7. Install the left-side and right-side splash panels and tighten the cap screws securely. Install new nylon ties in the appropriate locations.
8. Install the instrument pod and ignition switch; then secure with two reinstallable rivets and the ignition switch lock collar.

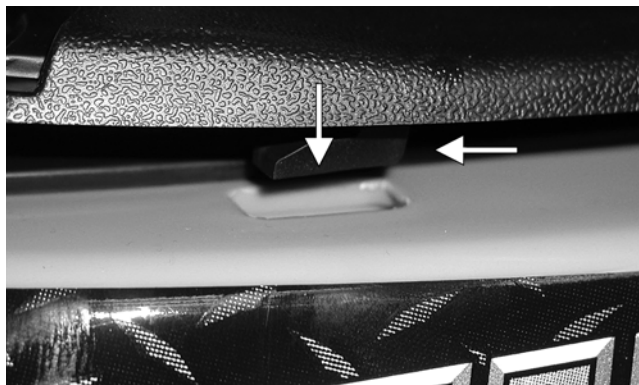


CF207A

9. Set the storage compartment box into position; then install the storage compartment cover making sure the mounting lugs engage the slots. Slide rearward to secure and lock by engaging the lid lock.



CD671



CD670A

10. Install the steering post cover and secure with the reinstallable rivets; then install and secure the radiator access panel.
11. Install the left and right side panels and secure with reinstallable rivets.



CD683A

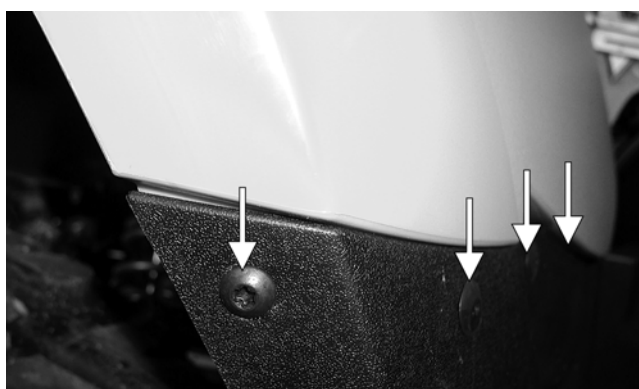
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## Footrests

---

### REMOVING

1. Remove the machine screws and flange nuts securing the front and rear fenders to the footwells.



CD691A

2. Remove the cap screws securing the foot pegs to the footrests; then remove the foot pegs and footwells.



CD782

3. Remove the cap screws and flange nuts securing the footrests to the frame; then remove the footrests.

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean the footrest in parts-cleaning solvent.
2. Inspect the footrest weldments for cracks or unusual bends.
3. Inspect all tubing for cracks or unusual bends.

## INSTALLING

1. Secure the footrests to the frame with four cap screws and two flange nuts; then tighten securely.
2. Place the footwells onto the footrests; then put the foot pegs in position and secure with two cap screws.



CD782

3. Install the machine screws and flange nuts securing the front and rear fenders to the footwells.

## Belly Panel

### REMOVING

1. Remove the machine screws and shoulder washers securing the belly panel to the underside of the frame.
2. Remove the belly panel.

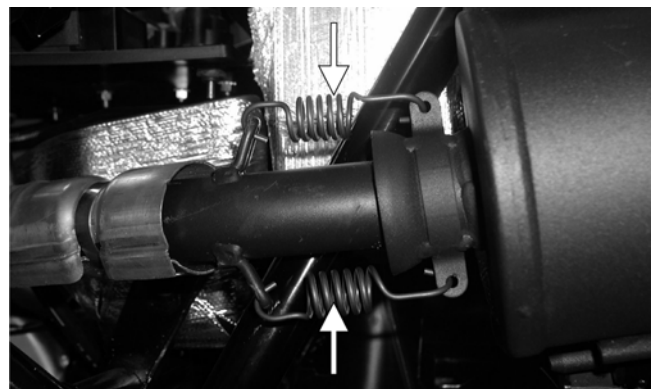
### INSTALLING

1. Place the belly panel into position on the underside of the frame.
2. Install the machine screws and shoulder washers. Tighten securely.

## Exhaust System

### REMOVING MUFFLER (400/500/650 H1)

1. Remove the two exhaust springs at the muffler/exhaust pipe juncture.



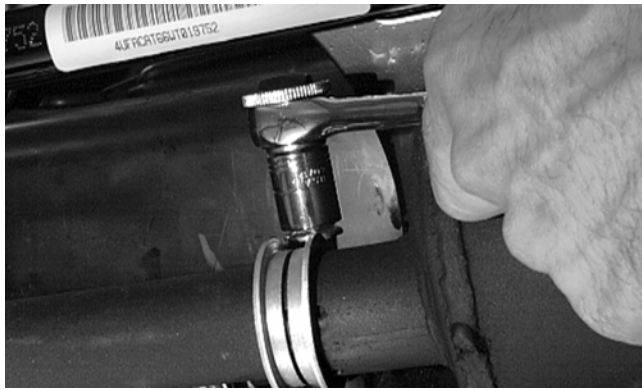
CF138A

2. Slide the muffler rearward to clear the mounting lugs and remove the muffler.

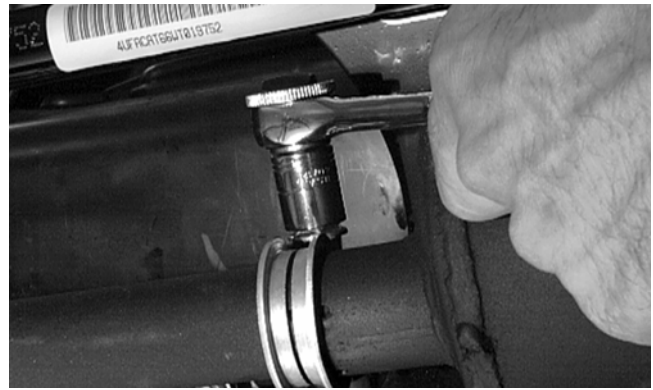
### REMOVING MUFFLER (650 V-Twin)

1. Remove the cap screws securing the muffler to the frame and account for all mounting hardware.
2. Loosen the clamp at the muffler/exhaust pipe juncture; then remove the muffler.





CH056D



CH056D

## INSPECTING MUFFLER

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Inspect muffler externally for cracks, holes, and dents.
2. Inspect the muffler internally by shaking the muffler back and forth and listening for rattles or loose debris inside the muffler.

■ **NOTE:** For additional details on cleaning the muffler/spark arrester, see Section 2.

## INSTALLING MUFFLER (400/500/650 H1)

1. Place the muffler into position engaging the mounting lugs into the grommets; then slide the muffler forward.
2. Install the two exhaust springs.

## INSTALLING MUFFLER (650 V-Twin)

1. Install the muffler on the frame and into the muffler/exhaust pipe juncture accounting for all mounting hardware.
2. Tighten cap screws securely; then tighten the juncture clamp.

## Rear Body Panel/Rack (500/650 H1/650 V-Twin)

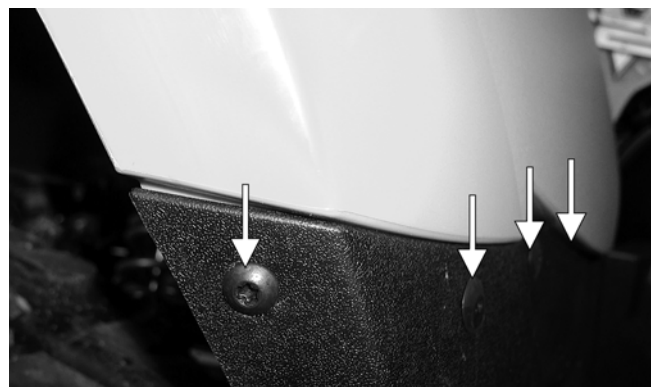
### REMOVING

1. Remove four machine screws and flanged nuts securing the rear rack; then remove the rear rack. Account for four bushings.



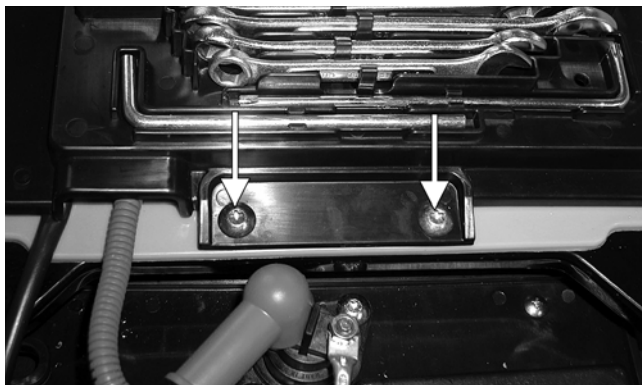
CD690A

2. Remove one shoulder screw and lock nut and three plastic rivets (on each side) securing the rear body panel to the footwells.



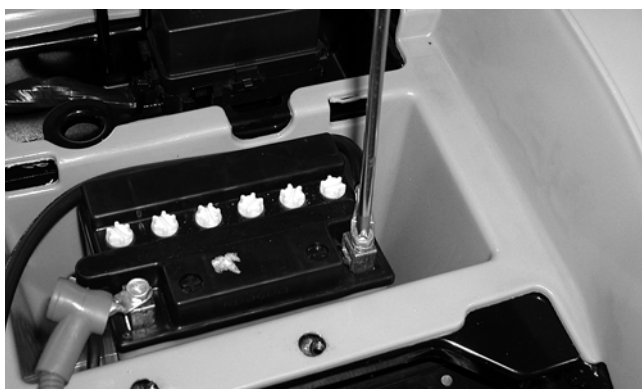
CD691A

3. Remove two machine screws securing the battery cover and remove the cover.



CD687A

4. Disconnect the battery (negative cable first); then remove the battery.



CD688

5. Disconnect the tail/brakelight; then remove the gas tank cap and lift off the rear body panel. Install the gas tank cap.

■ **NOTE:** If the front body panel has not been removed, the left-side and right-side panels and the two machine screws must be removed (see Front Body Panel/Side Panels in this section).

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all rear body panel components with parts-cleaning solvent and soap and water.
2. Inspect side panels and rear body panel for cracks and loose rivets.
3. Inspect threaded areas of all mounting bosses for stripping.
4. Inspect for missing decals.

## INSTALLING

1. Remove the gas tank cap and set the rear body panel in position; then install the cap and connect the brake/taillight connector.

2. Place the rear rack in position with four bushings and secure with four machine screws and flanged nuts. Tighten securely.



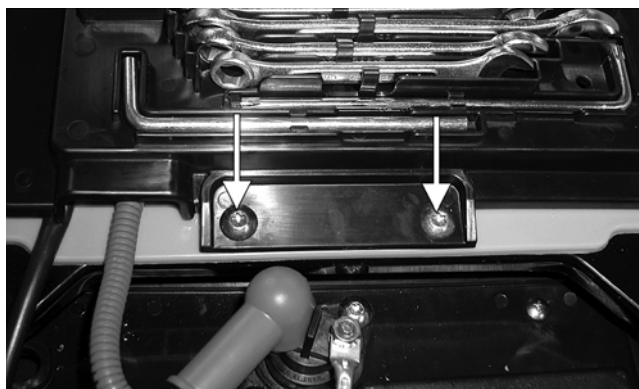
CD690A

3. Install one shoulder screw and three plastic rivets (on each side) to secure the front of the rear body panel to the footwells.



CD691

4. Place the battery into the battery box; then connect the battery (positive cable first) and secure with the battery cover.



CD687A

5. Secure the front and rear panels with two machine screws; then install the left and right side panels.

■ **NOTE:** If the front body panel has not been installed, see Front Body Panel/Side Panels in this section.

6. Place the seat into position making sure it locks securely.

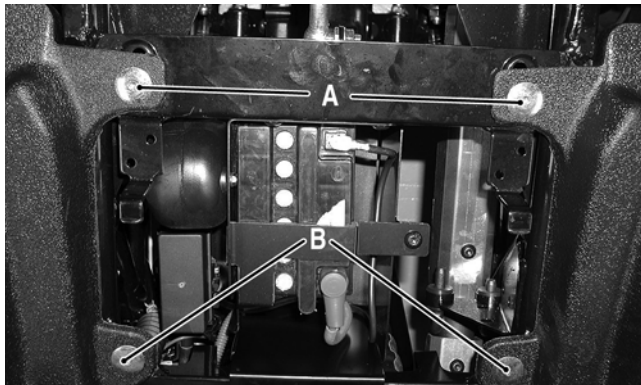
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## Side Storage Box (TBX Models)

---

### REMOVING

1. Rotate the cargo box latch handle (located on the left and right sides between the cargo box and the rear tire) and fully raise the cargo box.
2. Pull the seat lock lever forward (located below the right side of the seat), raise the front end of the seat, and slide it forward and off the ATV.
3. Remove the two cap screws (located inside the side storage box) securing the box to the footrest.
4. Remove the screw securing the box to the side panel.
5. Remove cap screws (A and B) securing the box to the frame.



CD045A

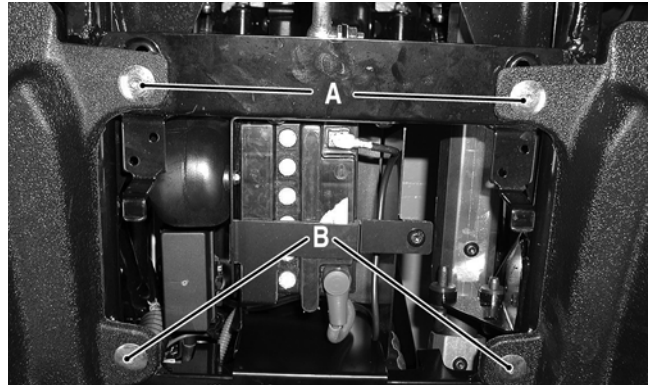
### CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all side storage box components with soap and water.
2. Inspect the box for cracks, tears, and loose mounting hardware.
3. Inspect the box hatch O-ring seals for cuts or tears.

### INSTALLING

1. Place the side storage box into position on the frame; then secure with the two cap screws (A and B). Tighten cap screws to specifications.



CD045A

2. Secure the box to the side panel with the existing screw.
3. Secure the box to the footrest with existing hardware. Tighten securely.
4. Install the seat.
5. Lower the cargo box and press down firmly on the front of the box. The cargo box will automatically lock into position.

---

## Cargo Box (TBX Models)

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### REMOVING

1. Rotate the cargo box latch handle (located on the left and right sides between the cargo box and the rear tire) and fully raise the cargo box.



CD771

2. Remove the retaining ring from the lower end of the box lift support; then separate the lift support from the lift support stud. Lower the cargo box.



3. Remove the two cap screws and lock nuts securing the cargo box to the frame; then remove the cargo box and discard the lock nuts.



CD122

■ **NOTE:** Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.

## CLEANING AND INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Clean all cargo box components with soap and water.
2. Inspect the cargo box for cracks, tears, and loose mounting hardware.
3. Inspect the welds of the cargo box frame for cracking or bending.
4. Inspect the cargo box gate latches for smooth operation.

## INSTALLING

1. Place the cargo box into position on the frame. Secure with cap screws and new lock nuts. Tighten to specifications.



CD122

2. While an assistant holds the cargo box in the raised position, place the lower end of the cargo box onto the lift support stud; then secure with the retaining ring.
3. Lower the cargo box and press down firmly on the front of the box. It will automatically lock into position.

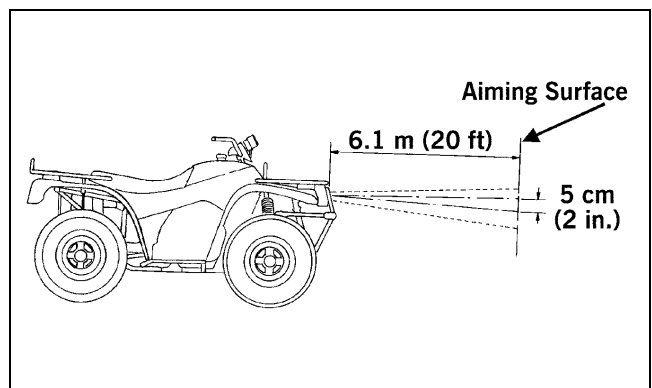
## Adjusting Headlight

The headlights can be adjusted vertically and horizontally. The geometric center of the HIGH beam light zone is to be used for vertical and horizontal aiming.

1. Position the ATV on a level floor so the headlights are approximately 6.1 m (20 ft) from an aiming surface (wall or similar aiming surface).

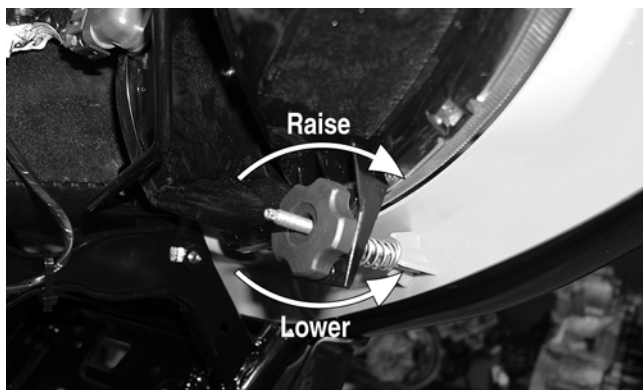
■ **NOTE:** There should be an average operating load on the ATV when adjusting the headlight aim.

2. Measure the distance from the floor to the mid-point of each headlight.
3. Using the measurements obtained in step 2, make horizontal marks on the aiming surface.
4. Make vertical marks which intersect the horizontal marks on the aiming surface directly in front of the headlights.
5. Switch on the lights. Make sure the HIGH beam is on. DO NOT USE LOW BEAM.
6. Observe each headlight beam aim. Proper aim is when the most intense beam is centered on the vertical mark 5 cm (2 in.) below the horizontal mark on the aiming surface.



ATV-0070

7. Adjust each headlight by turning the adjustment knob counterclockwise to lower the beam or clockwise to raise the beam.

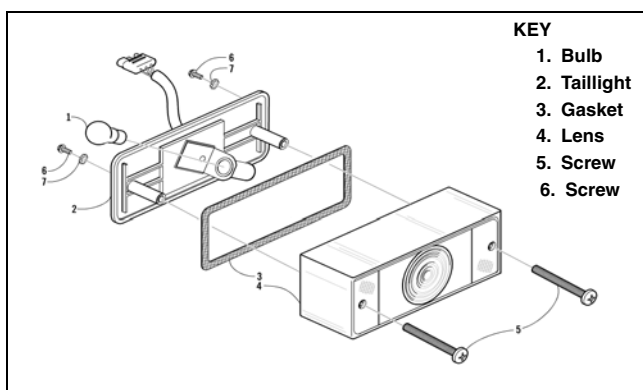


CD714A

### **⚠ WARNING**

Do not operate the ATV unless the headlight beam is adjusted properly. An incorrectly adjusted beam will not provide the operator the optimum amount of light.

## **Taillight Assembly**



0732-336

### **REMOVING**

1. Unplug the three-prong connector and free the taillight wiring harness from the frame.
2. Remove the torx-head cap screws securing the taillight assembly to the frame. Account for any washers.
3. Remove the taillight assembly.

### **INSPECTING**

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Inspect wiring harness, three-prong connector, lens, base, cap screws, and socket for damage.

2. Inspect all wires for corroding, pinching, and cracking.
3. Inspect the bulb for wattage, voltage, and proper operation.

### **INSTALLING**

1. Place the assembly into position on the frame and secure with torx-head cap screws and any washers.
2. Tighten the cap screws securely.
3. Route the wiring harness over the rear frame; then connect the three-prong connector.

## **Seat**

■ **NOTE:** Some components may vary from model to model. The technician should use discretion and sound judgment.

### **REMOVING/INSTALLING (400 TBX/500/650 H1/650 V-Twin)**

1. To remove the seat, lift up on the latch release (located at the rear of the seat). Raise the rear of the seat and slide it rearward.
2. To lock the seat into position, slide the front of the seat into the seat retainers and push down firmly on the rear of seat. The seat should automatically lock into position.

### **REMOVING/INSTALLING (400 FIS/VP)**

1. To remove the seat, pull the seat lock lever backward (located under the rear rack between the storage compartment and the frame). Raise the rear of the seat and slide it rearward.
2. To lock the seat into position, slide the front of the seat into the seat retainers and push down firmly on the rear of seat. The seat should automatically lock into position.

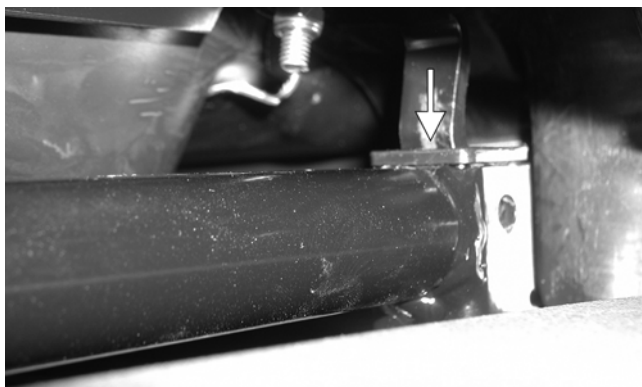
### **REMOVING/INSTALLING (TRV)**

1. To remove the rear seat, pull the two latch handles to the rear and rotate them to the vertical position.



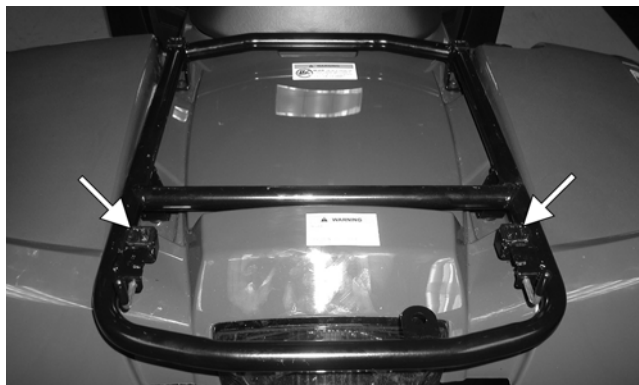
CF226

2. Lift the rear of the seat up; then pull slightly to the rear and lift the seat off the mountings.



CF227A

3. To lock the seat into position, engage the two front mounting lugs into the mounting rack; then holding down firmly on the front of the seat, push the seat forward until the rear tabs engage the rear mounting latches.



CF229A

4. Lock the seat into position by pulling the two latch handles to the rear and rotating them to the horizontal position.



CF226A

■ **NOTE:** The rear seat must be removed prior to removing the front seat.

5. To remove the front seat, pull the seat lock lever up (located at the rear of the seat). Raise the rear end of the seat and slide it rearward.
6. To lock the seat into position, slide the front of the seat into the seat retainers and push down firmly on rear of seat. The seat should automatically lock into position.



# SECTION 9 - CONTROLS/INDICATORS

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## Hand Brake Lever/ Master Cylinder Assembly

■ **NOTE:** The master cylinder is a non-serviceable component; it must be replaced as an assembly.

### REMOVING

1. Slide a piece of flexible tubing over one of the wheel bleeder valves and direct the other end into a container. Remove the reservoir cover; then open the bleeder valve. Allow the brake fluid to drain completely.

■ **NOTE:** Compressing the brake lever several times will quicken the draining process.



AF637D

2. Place an absorbent towel around the connection to absorb brake fluid. Remove the brake hose from the master cylinder.



AG929



### CAUTION

**Brake fluid is highly corrosive. Do not spill brake fluid on any surface of the ATV.**

3. Remove the circlip and pivot pin securing the brake lever to the master cylinder housing; then remove the brake lever and set aside.

4. Dislodge the brakelight switch from the master cylinder housing by gently pressing it toward the pivot pin hole in the housing; then lay it aside leaving the switch and wiring harness connected.



BC205

5. Remove the clamp screws securing the brake housing to the handlebar; then remove the assembly from the handlebar.



AG924

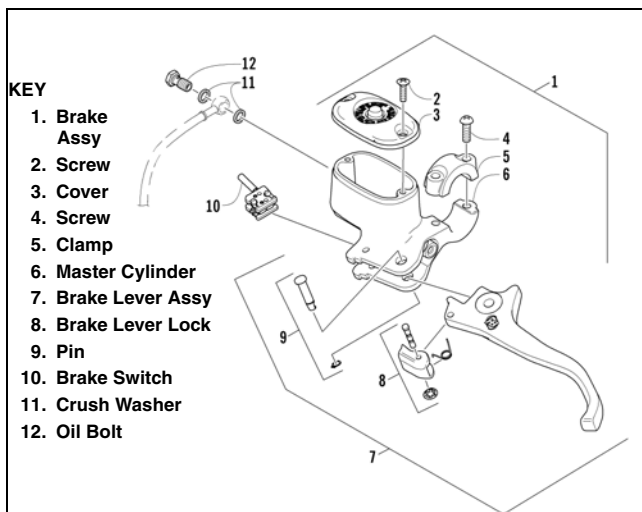
### INSPECTING

■ **NOTE:** Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.

1. Inspect the pin securing the brake lever for wear.
2. Inspect the brake lever for elongation of the pivot hole.
3. Inspect the reservoir for cracks and leakage.
4. Inspect the brake hose for cracks and deterioration and the condition of the fittings (threaded and compression).
5. Inspect the brakelight switch for corrosion, cracks, missing or broken mounting tabs, or broken and frayed wiring.

■ **NOTE:** If the brakelight switch is determined to be not serviceable, see Section 5.

## INSTALLING



0739-479

1. Position the brake housing on the handlebar. Secure with clamp screws; then tighten securely.



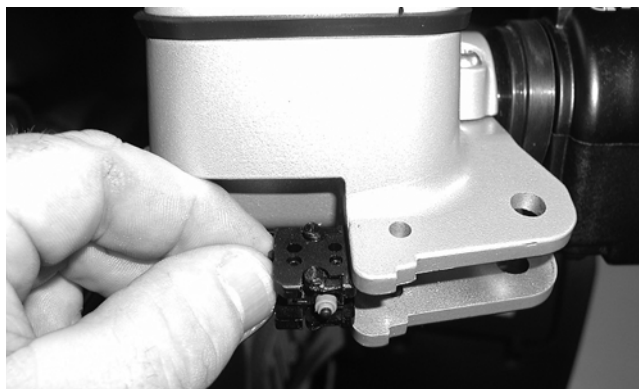
AG924

2. Install the brake hose on the master cylinder. Tighten to specifications.



AG929

3. Gently press the brakelight switch into the housing (left to right) until the mounting tabs snap into the four locating holes; then install the brake lever, pivot pin, and circlip.



BC206

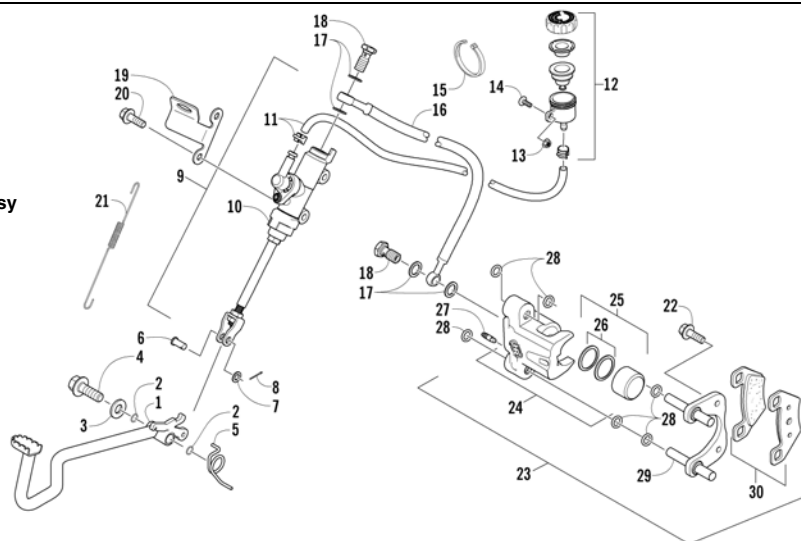
4. Bleed the brake system (see Section 2).



## Auxiliary Brake Assembly Schematic

### KEY

- |                     |                          |
|---------------------|--------------------------|
| 1. Brake Lever      | 19. Switch Bracket       |
| 2. O-Ring           | 20. Cap Screw            |
| 3. Washer           | 21. Spring               |
| 4. Cap Screw        | 22. Cap Screw            |
| 5. Spring           | 23. Caliper              |
| 6. Clevis Pin       | 24. Housing              |
| 7. Washer           | 25. Piston/Seal Set Assy |
| 8. Cotter Pin       | 26. Seal Set             |
| 9. Brake Assy       | 27. Valve                |
| 10. Master Cylinder | 28. O-Ring               |
| 11. Hose            | 29. Bracket Assy         |
| 12. Reservoir       | 30. Brake Pad            |
| 13. Flange Nut      |                          |
| 14. Machine Screw   |                          |
| 15. Cable Tie       |                          |
| 16. Hose            |                          |
| 17. Crush Washer    |                          |
| 18. Fitting Bolt    |                          |

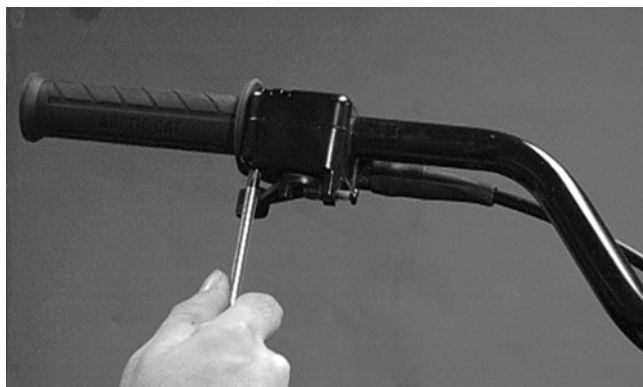


0740-359

## Throttle Control

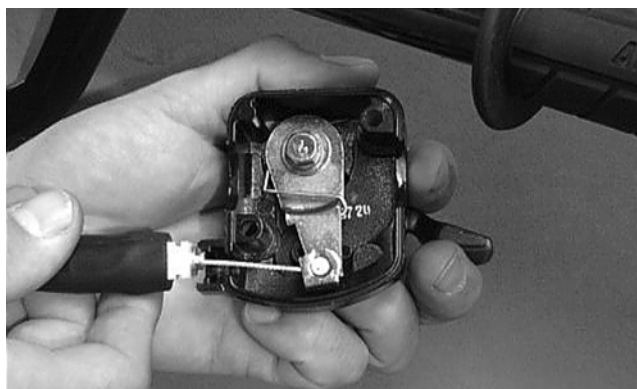
### REMOVING

1. Remove the two machine screws securing the throttle control to the handlebar.



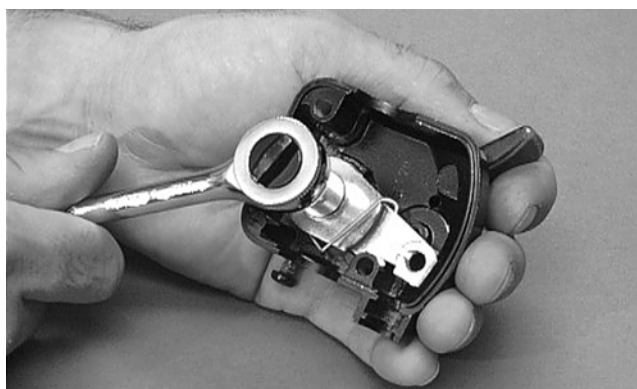
AL610D

2. Slide the grommet out of the lower half of the throttle control; then remove the cable from the actuator arm.



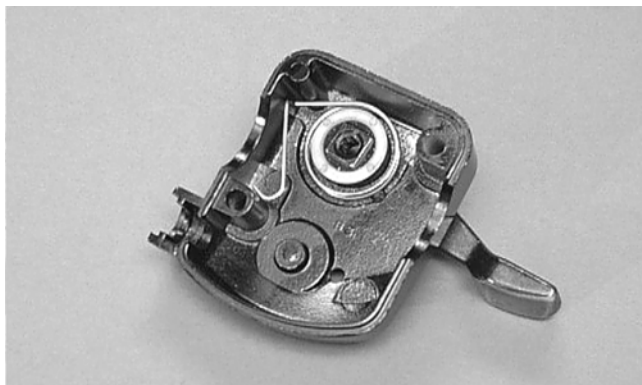
AF676D

3. Remove the cap screw, lock washer, and washer securing the actuator arm to the throttle control lever.

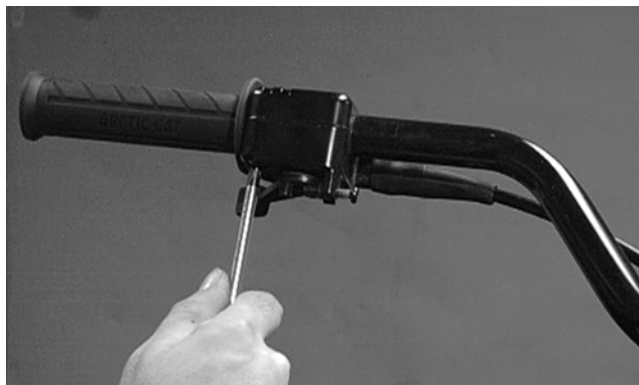


AF677D

4. Remove the actuator arm and account for a bushing. Note the position of the return spring for installing purposes.



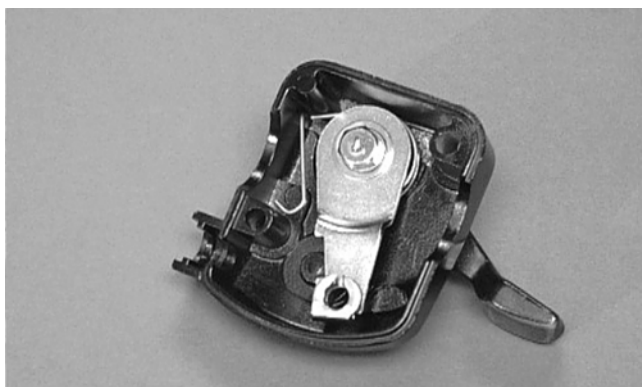
AF678D



AL610D

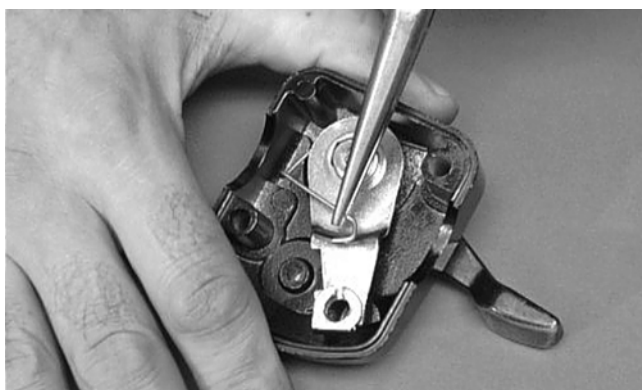
## INSTALLING

1. Place the return spring into the throttle control; then place the bushing and actuator arm into position. Secure with the cap screw, lock washer, and washer.



AF679D

2. Using a pair of needle-nose pliers, place the spring into position on the actuator arm.

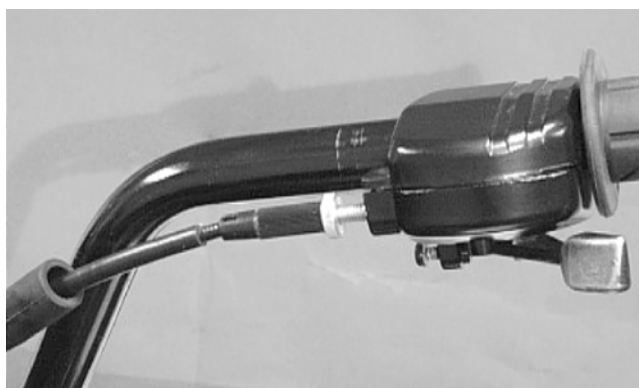


AF680D

3. Place the two halves of the throttle control onto the handlebars and secure with the two machine screws.

## ADJUSTING

1. Slide the boot back to reveal the jam nut; then loosen the jam nut.



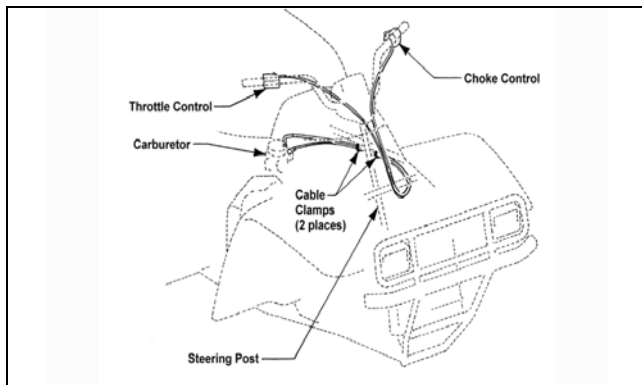
AF682D

2. Rotate the adjuster sleeve until 0.5-1.0 mm (0.02-0.04 in.) is attained.

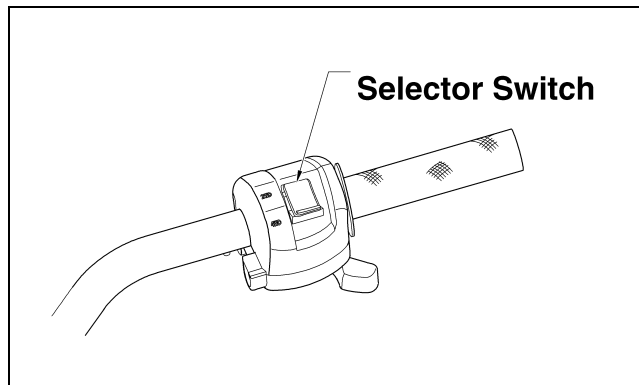


AL611D

3. Secure the adjustment by tightening the jam nut; then slide the boot over the jam nut.



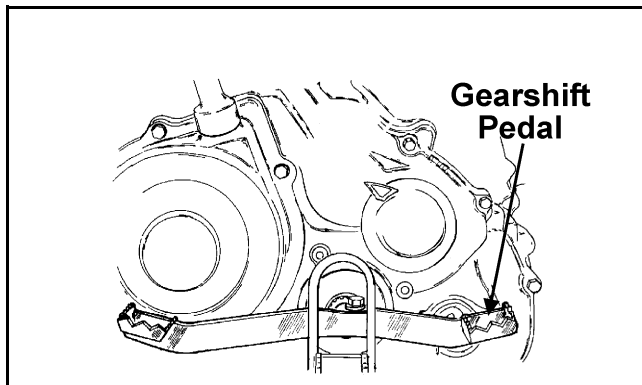
0732-412



738-422A

## Gearshift Pedal (Manual Transmission)

The gearshift pedal is attached to a ratchet mechanism in the transmission. Each time a gear is selected, the gearshift pedal will return to its normal position ready to select the next gear. To return to neutral, press down repeatedly (once for each gear) on the front of the pedal. Shift into gears by pressing down on the back of the pedal once for each gear. The ratchet mechanism makes it impossible to upshift or downshift more than one gear at a time.



ATV0078C

## Drive Selector (FIS Models)

The automatic drive selector allows the operator to operate in either 2-wheel drive (rear wheels) or 4-wheel drive (all wheels). For normal riding on flat, dry, hard surfaces, 2-wheel drive should be sufficient. In situations of aggressive trail conditions, 4-wheel drive would be the desired choice.

To either engage or disengage the front wheels, move the switch to the 4WD position or to the 2WD position.

### CAUTION

Do not attempt to either engage or disengage the front differential while the ATV is moving.

## Front Differential Lock (TBX/400 FIS/500/650 H1/ 650 V-Twin)

The front differential lock allows the operator to mechanically lock the differential to apply equal power to both front wheels. To engage the front differential lock, rotate the handle fully counterclockwise to LOCK; to disengage the front differential lock, rotate the handle fully clockwise to UNLOCK.

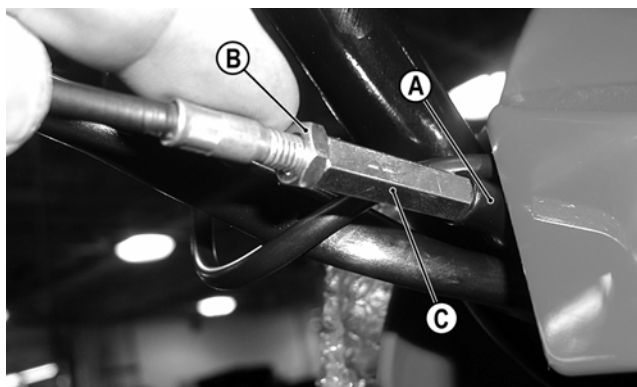


KX016A

### ADJUSTING CABLE

1. With the differential lock selector in the UNLOCK position, slide the rubber protector sleeve (A) off the cable near the differential lock selector; then loosen the jam nut (B) and turn the cable adjuster (C) to achieve 6.35 mm (0.250 in.) free-travel measured at the end of the differential lock selector handle.





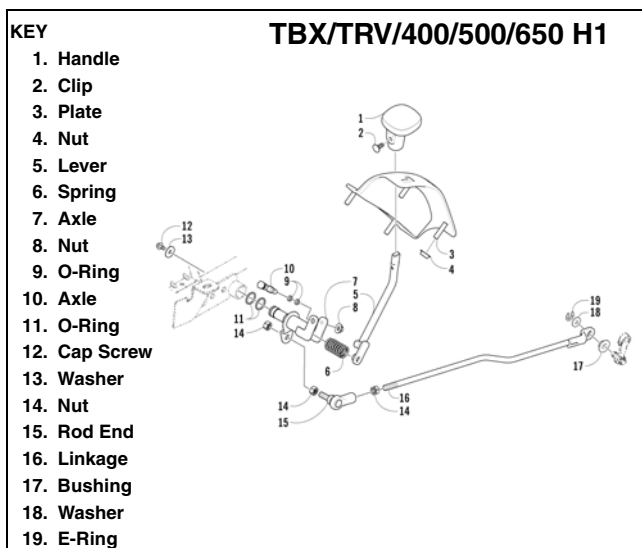
CD560A

2. Select the 2WD position on the front drive selector switch; then turn the ignition switch to the ON position and select the LOCK position on the differential lock selector. The front drive actuator should operate engaging four-wheel drive.

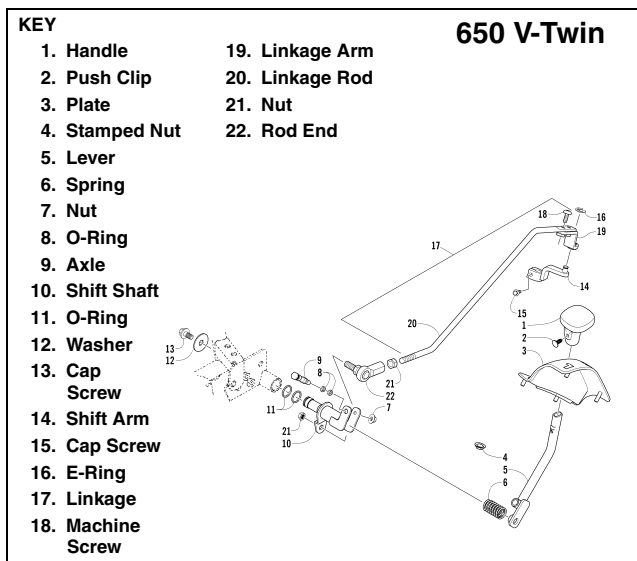
■ **NOTE:** It may be necessary to turn the handlebar or to rock the ATV forward and backward to align the differential lock splines and allow engagement.

3. Return the differential lock selector to the UNLOCK position and listen for the front drive actuator to operate.
4. Turn the ignition switch to the OFF position. Tighten the jam nut securely; then install the protector sleeve on the adjuster assembly.

## Reverse Shift Lever



0739-701



0739-824

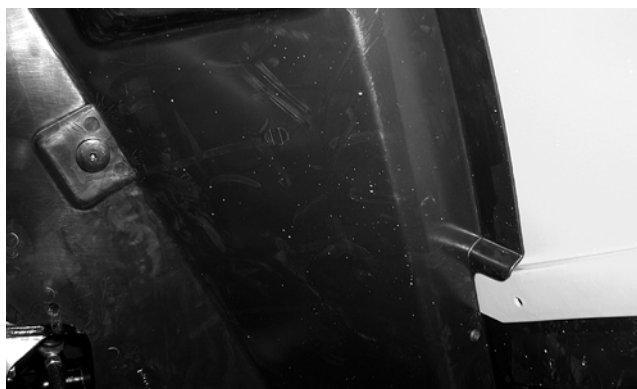
## REMOVING

1. Remove the E-clip securing the shift rod to the engine shift arm (TBX/TRV/400/500/650 H1). On the 650 V-Twin, remove two cap screws securing the front and rear shift rods together.



CD717

2. Remove two cap screws, two self-tapping screws, and three nylon ties securing the left-side splash panel and remove the panel.



CD685

3. Remove the axle and nut securing the shift lever to the upper shift arm; then remove the shift lever. Account for a spring and two O-rings.

9

4. Using two open-end wrenches, remove the lock nut securing the shift rod to the upper shift arm. Remove the shift rod and discard the lock nut.

■ **NOTE:** Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.

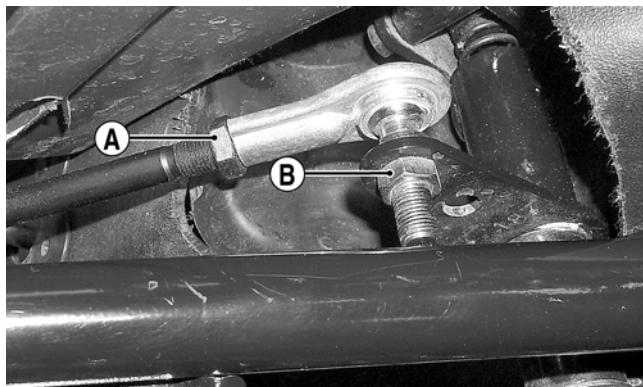
## INSTALLING

1. Place the shift rod into position on the engine shift arm and secure with the existing E-clip (TBX/TRV/400/500/650 H1). On the 650 V-Twin, connect the front and rear shift arms with two cap screws. Only finger-tighten at this time.



CD717

2. Using a new lock nut (B), secure the shift rod to the upper shift arm; then using two open-end wrenches, tighten securely.



AF941A

3. Place the spring into position between the upper shift arm and shift lever; then making sure the O-rings are in place on the axle, secure the shift lever to the arm with the existing axle and nut.
4. Check shift lever adjustment (see Section 2); then tighten jam nut (A) securely.
5. Install the left-side splash panel.

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## Speedometer/ Tachometer/LCD

(400 FIS/500/500 TBX/TRV/  
650 H1/650 V-Twin)

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## REPLACING SPEEDOMETER

To replace the speedometer, use the following procedure.

1. Remove the two reinstallable rivets securing the instrument pod; then remove the ignition switch retaining ring.
2. Remove the two nuts securing the mounting studs; then remove the speedometer and disconnect the multi-pin connector.
3. Mount the speedometer and secure with the two nuts; then connect the multi-pin connector.
4. Install the instrument pod and secure with the reinstallable rivets.
5. Secure the ignition switch with the retaining ring.

# SECTION 10 - AIDS FOR MAINTENANCE

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# Torque Specifications

## (400/500 - Manual Transmission)

| DRIVE TRAIN COMPONENTS                       |                             |         |         |
|----------------------------------------------|-----------------------------|---------|---------|
| Part                                         | Part Bolted To              | Torque  |         |
|                                              |                             | kg-m    | ft-lb   |
| Engine (Lower Rear/Front)                    | Frame                       | 5.5     | 40      |
| Engine (Upper Front Inside Bracket/Top-side) | Frame Bracket               | 2.8     | 20      |
| Front Differential*                          | Frame/Diff Bracket          | 6.2     | 45      |
| Pinion Housing                               | Diff Housing                | 2.9-3.5 | 21-25   |
| Diff Housing Cover***                        | Diff Housing                | 2.9-3.5 | 21-25   |
| Drive Bevel Gear Nut***                      | Shaft                       | 10      | 72      |
| Differential Gear Case***                    | Hub                         | 2.3-3   | 16.5-22 |
| Lock Collar                                  | Diff Housing                | 17.3    | 125     |
| Hub Nut                                      | Front/Rear Shaft/Axle (min) | 27.6    | 200     |
| Oil Drain Plug                               | Front Diff/Rear Dr          | 0.5     | 3.5     |
| Oil Fill Plug                                | Front Diff/Rear Dr          | 2.2     | 16      |
| Oil Drain Plug                               | Engine                      | 2.2     | 16      |
| Inspection Plug                              | Front Diff/Rear Dr          | 0.5     | 3.5     |
| Wheel                                        | Hub                         | 5.5     | 40      |
| Oil Fitting (400)                            | Engine                      | 0.8     | 6       |
| EXHAUST COMPONENTS                           |                             |         |         |
| Exhaust Pipe                                 | Engine                      | 2.8     | 20      |
| ELECTRICAL COMPONENTS                        |                             |         |         |
| Coil*                                        | Frame                       | 1.7     | 12      |
| Ground Wire                                  | Engine                      | 1.1     | 8       |
| STEERING COMPONENTS                          |                             |         |         |
| Handlebar Block                              | Steering Post               | 2.8     | 20      |
| Steering Post Bearing Housings               | Frame                       | 2.8     | 20      |
| Steering Post Bearing Flange                 | Frame                       | 2.8     | 20      |
| Lower Steering Bearing Washer Cap Screw***   | Steering Post               | 5.5     | 40      |
| Tie Rod End                                  | Knuckle/Steering Post       | 4.2     | 30      |
| BRAKE COMPONENTS                             |                             |         |         |
| Brake Disc*                                  | Hub                         | 2.1     | 15      |
| Brake Hose                                   | Caliper                     | 2.8     | 20      |
| Brake Hose                                   | Master Cylinder             | 2.8     | 20      |
| Brake Hose                                   | Auxiliary Brake Cylinder    | 2.8     | 20      |
| Master Cylinder (Rear)                       | Frame                       | 3.5     | 25      |
| Master Cylinder Cover                        | Master Cylinder             | 0.1     | 1       |
| Auxiliary Brake Pedal                        | Lever Axle                  | 3.5     | 25      |
| Hydraulic Caliper                            | Knuckle/Axle Retainer Assy  | 2.8     | 20      |
| Auxiliary Caliper                            | Knuckle/Axle Retainer Assy  | 2.8     | 20      |

| CHASSIS COMPONENTS             |                      |         |         |
|--------------------------------|----------------------|---------|---------|
| Part                           | Part Bolted To       | Torque  |         |
|                                |                      | kg-m    | ft-lb   |
| Footrest                       | Frame (8 mm)         | 2.8     | 20      |
| Footrest                       | Frame (10 mm)        | 5.5     | 40      |
| Shift Lever                    | Shift Axle           | 1.1     | 8       |
| Shift Lever*                   | Shift Axle           | 1.1     | 8       |
| SUSPENSION COMPONENTS (Front)  |                      |         |         |
| A-Arm (All)                    | Frame                | 4.8     | 35      |
| Ball Joint Cap Screw           | Knuckle              | 4.8     | 35      |
| Shock Absorber                 | Frame                | 4.8     | 35      |
| Shock Absorber                 | Upper A-Arm          | 4.8     | 35      |
| Knuckle                        | A-Arm                | 4.8     | 35      |
| SUSPENSION COMPONENTS (Rear)   |                      |         |         |
| Axle Retainer Assy             | Axle Housing         | 5.5     | 40      |
| Shock Absorber (Upper)         | Frame                | 4.8     | 35      |
| Shock Absorber (Lower)         | A-Arm                | 2.8     | 20      |
| A-Arms                         | Frame                | 4.8     | 35      |
| Swing Arm                      | Axle Housing/Case    | 4.8     | 35      |
| Knuckle                        | A-Arm                | 4.8     | 35      |
| Axle Housing (VP)              | Gear Case            | 4.8     | 35      |
| ENGINE/TRANSMISSION            |                      |         |         |
| Clutch Shoe                    | Crankshaft           | 13      | 94      |
| Clutch Sleeve Hub              | Countershaft         | 10      | 72      |
| Crankcase Half (6 mm)          | Crankcase Half       | 0.9-1.3 | 6.5-9.5 |
| Crankcase Half (8 mm)          | Crankcase Half       | 2-2.4   | 14.5-17 |
| Cylinder Head (Cap Screws)     | Cylinder             | 3.8     | 27.5    |
| Cylinder Head (6 mm Nuts)      | Cylinder             | 1.1     | 8       |
| Cylinder Head (8 mm Nut)       | Cylinder             | 2.5     | 18      |
| Cylinder Head Cover            | Cylinder Head        | 1.0     | 7       |
| Left-Side Cover                | Crankcase Half       | 0.9-1.3 | 6.5-9.5 |
| Mechanical Water Pump Impeller | Pump Shaft           | 1.05    | 7.5     |
| Oil Pump Drive Gear            | Crank Balancer Shaft | 8       | 58      |
| Oil Pump*                      | Crankcase            | 1       | 7       |
| Output Shaft Gear              | Output Shaft         | 10      | 72      |
| Rear Output Shaft              | Output Joint         | 2.8     | 20      |
| Recoil Starter                 | Left-Side Cover      | 0.8     | 6       |
| Reverse Cam Stopper Housing    | Crankcase            | 2.3     | 16.5    |
| Right-Side Cover               | Crankcase            | 0.9-1.3 | 6.5-9.5 |
| Rotor/Flywheel Nut             | Crankshaft           | 16      | 116     |
| Shift Stop Housing             | Crankcase            | 2.3     | 16.5    |
| Cam Sprocket**                 | Camshaft             | 1.5     | 11      |
| Starter Cup                    | Crankshaft           | 3.5     | 25      |
| Spark Plug                     | Engine               | 1.7     | 12      |

\* w/Blue Loctite #243

\*\* w/Red Loctite #271

\*\*\* w/Green Loctite #609

# Torque Specifications

## (400/500 - Automatic Transmission/650 H1)

| DRIVE TRAIN COMPONENTS                     |                             |                |                 |
|--------------------------------------------|-----------------------------|----------------|-----------------|
| Part                                       | Part Bolted To              | Torque<br>kg-m | Torque<br>ft-lb |
| Engine Mount - 400/500 (Front Upper)       | Frame                       | 2.8            | 20              |
| Engine Bracket - 400/500 (Upper)           | Engine                      | 2.8            | 20              |
| Engine Mounting Through-Bolt (400/500)     | Frame                       | 5.5            | 40              |
| Engine (650 H1)                            | Engine Cradle               | 5.5            | 40              |
| Engine Cradle (650 H1/TRV)**               | Rubber Mount                | 3.5            | 25              |
| Rubber Mount (650 H1/TRV)                  | Frame Bracket               | 4.8            | 35              |
| Front Differential*                        | Frame/Diff Bracket          | 6.2            | 45              |
| Rear Output Joint Assy                     | Engine                      | 2.8            | 20              |
| Input Housing                              | Diff Housing                | 2.9-3.5        | 21-25           |
| Diff Housing Cover***                      | Diff Housing                | 2.9-3.5        | 21-25           |
| Drive Bevel Gear Nut***                    | Shaft                       | 10             | 72              |
| Differential Gear Case***                  | Hub                         | 2.3-3          | 16.5-22         |
| Lock Collar                                | Diff Housing                | 17.3           | 125             |
| Hub Nut                                    | Front/Rear Shaft/Axle (min) | 27.6           | 200             |
| Oil Drain Plug                             | Front Diff/Rear Dr          | 0.5            | 3.5             |
| Oil Fill Plug                              | Front Diff/Rear Dr          | 2.2            | 16              |
| Oil Drain Plug                             | Engine                      | 2.2            | 16              |
| Inspection Plug                            | Rear Drive                  | 0.5            | 3.5             |
| Wheel                                      | Hub                         | 5.5            | 40              |
| EXHAUST COMPONENTS                         |                             |                |                 |
| Exhaust Pipe (400/500)                     | Engine                      | 2.8            | 20              |
| Exhaust Pipe (650 H1)                      | Engine                      | 2.8            | 20              |
| ELECTRICAL COMPONENTS                      |                             |                |                 |
| Coil*                                      | Frame                       | 1.7            | 12              |
| Ground Wire                                | Engine                      | 1.1            | 8               |
| STEERING COMPONENTS                        |                             |                |                 |
| Handlebar Block                            | Steering Post               | 2.8            | 20              |
| Steering Post Bearing Housings             | Frame                       | 2.8            | 20              |
| Steering Post Bearing Flange               | Frame                       | 2.8            | 20              |
| Lower Steering Bearing Washer Cap Screw*** | Steering Post               | 5.5            | 40              |
| Tie Rod End                                | Knuckle/Steering Post       | 4.2            | 30              |

| BRAKE COMPONENTS                       |                           |                |                 |
|----------------------------------------|---------------------------|----------------|-----------------|
| Part                                   | Part Bolted To            | Torque<br>kg-m | Torque<br>ft-lb |
| Brake Disc*                            | Hub                       | 2.1            | 15              |
| Brake Hose                             | Caliper                   | 2.8            | 20              |
| Brake Hose                             | Master Cylinder           | 2.8            | 20              |
| Brake Hose                             | Auxiliary Brake Caliper   | 2.8            | 20              |
| Master Cylinder Cover                  | Master Cylinder           | 0.1            | 1               |
| Auxiliary Brake Pedal                  | Lever Axle                | 3.5            | 25              |
| Hydraulic Caliper                      | Knuckle                   | 2.8            | 20              |
| Auxiliary Caliper                      | Knuckle                   | 2.8            | 20              |
| CHASSIS COMPONENTS                     |                           |                |                 |
| Footrest                               | Frame (8 mm)              | 2.8            | 20              |
| Footrest                               | Frame (10 mm)             | 5.5            | 40              |
| Gas Tank Valve (VP)                    | Gas Tank                  | 0.1            | 1               |
| Shift Lever*                           | Shift Axle                | 1.1            | 8               |
| SUSPENSION COMPONENTS (Front)          |                           |                |                 |
| A-Arm (All)                            | Frame                     | 4.8            | 35              |
| Ball Joint Cap Screw                   | Knuckle                   | 4.8            | 35              |
| Shock Absorber                         | Frame                     | 4.8            | 35              |
| Shock Absorber                         | Upper A-Arm               | 4.8            | 35              |
| Knuckle                                | A-Arm                     | 4.8            | 35              |
| SUSPENSION COMPONENTS (Rear)           |                           |                |                 |
| Axle Retainer Assy                     | Axle Housing (VP)         | 5.5            | 40              |
| Axle Housing/Hitch                     | Rear Gear Case (VP)       | 5.5            | 40              |
| Axle Housing/Hitch                     | Rear Gear Case (New) - VP | 5.5            | 40              |
| A-Arms                                 | Frame                     | 4.8            | 35              |
| Shock Absorber (Upper)                 | Axle Housing/Frame        | 4.8            | 35              |
| Shock Absorber (Lower)                 | A-Arm                     | 2.8            | 20              |
| Knuckle                                | A-Arm                     | 4.8            | 35              |
| SUSPENSION COMPONENTS (Rear) TBX Model |                           |                |                 |
| Shock Absorber                         | Frame                     | 4.8            | 35              |
| Shock Absorber                         | A-Arm                     | 2.8            | 20              |
| Tilt Box Frame                         | ATV Frame                 | 3.3            | 24              |
| Cargo Box (Plastic)                    | Tilt Box Frame            | 1.7            | 12              |
| Side Box                               | Frame                     | 2.8            | 20              |
| Side Box                               | Footwell                  | 1.1            | 8               |
| Rear CV-Joint**                        | Engine                    | 2.8            | 20              |

| ENGINE/TRANSMISSION<br>(400/500 - Automatic Transmission) |                      |           |         |
|-----------------------------------------------------------|----------------------|-----------|---------|
| Part                                                      | Part Bolted To       | Torque    |         |
|                                                           |                      | kg-m      | ft-lb   |
| Clutch Shoe                                               | Crankshaft           | 13        | 94      |
| Clutch Cover/ Housing Assy                                | Crankcase            | 1.1       | 8       |
| Crankcase Half (6 mm)                                     | Crankcase Half       | 0.9-1.3   | 6.5-9.5 |
| Crankcase Half (8 mm)                                     | Crankcase Half       | 2-2.4     | 14.5-17 |
| Cylinder Head (Cap Screws)                                | Crankcase            | 3.8       | 27.5    |
| Cylinder Head (6 mm)                                      | Cylinder             | 1.1       | 8       |
| Cylinder Head (8 mm)                                      | Cylinder             | 2.5       | 18      |
| Cylinder Head Cover                                       | Cylinder Head        | 1.0       | 7       |
| Driven Pulley Nut**                                       | Fixed Face           | 10.4-11.8 | 75-85   |
| Fixed Driven                                              | Clutch Shaft         | 10.4-11.8 | 75-85   |
| Ground Wire                                               | Engine               | 1.1       | 8       |
| Magneto Cover                                             | Crankcase            | 1.1       | 8       |
| Mechanical Water Pump Impeller                            | Pump Shaft           | 1.05      | 7.5     |
| Movable Drive Face**                                      | Driveshaft           | 10.4-11.8 | 75-85   |
| Oil Pump Drive Gear                                       | Crank Balancer Shaft | 5         | 36      |
| Output Shaft Gear                                         | Output Shaft         | 10        | 72      |
| Recoil Starter                                            | Left-Side Cover      | 0.8       | 6       |
| Rotor/Flywheel Nut                                        | Crankshaft           | 16        | 116     |
| Cam Sprocket**                                            | Camshaft             | 1.5       | 11      |
| Starter Cup                                               | Crankshaft           | 3.5       | 25      |
| V-Belt Cover                                              | Crankcase            | 1.1       | 8       |
| Spark Plug                                                | Engine               | 1.7       | 12      |

\* w/Blue Loctite #243

\*\* w/Red Loctite #271

\*\*\* w/Green Loctite #609

| ENGINE/TRANSMISSION<br>(650 H1) |                      |           |         |
|---------------------------------|----------------------|-----------|---------|
| Part                            | Part Bolted To       | Torque    |         |
|                                 |                      | kg-m      | ft-lb   |
| Clutch Shoe                     | Crankshaft           | 31.8      | 230     |
| Clutch Cover/ Housing Assy      | Crankcase            | 1.1       | 8       |
| Crankcase Half (6 mm)           | Crankcase Half       | 0.9-1.3   | 6.5-9.5 |
| Crankcase Half (8 mm)           | Crankcase Half       | 2.8       | 20      |
| Cylinder Head (Cap Screws)      | Crankcase            | 5.5       | 40      |
| Cylinder Head (6 mm)            | Cylinder             | 1.1       | 8       |
| Cylinder Head (8 mm)            | Cylinder             | 2.5       | 18      |
| Cylinder Head Cover             | Cylinder Head        | 1.1-1.2   | 8-9     |
| Driven Pulley Nut               | Fixed Face           | 13.5      | 97.5    |
| Fixed Driven**                  | Clutch Shaft         | 13.5      | 97.5    |
| Ground Wire                     | Engine               | 1.1       | 8       |
| Magneto Cover                   | Crankcase            | 1.1       | 8       |
| Mechanical Water Pump Impeller  | Pump Shaft           | 1.05      | 7.5     |
| Movable Drive Face**            | Driveshaft           | 10.4-11.8 | 75-85   |
| Oil Pump Drive Gear             | Crank Balancer Shaft | 8.5       | 61.5    |
| Output Shaft Gear               | Output Shaft         | 8.5       | 61.5    |
| Recoil Starter                  | Left-Side Cover      | 0.8       | 6       |
| Rotor/Flywheel Nut              | Crankshaft           | 14.5      | 105     |
| Cam Sprocket**                  | Camshaft             | 1.35      | 9.8     |
| Starter Cup                     | Crankshaft           | 3.8       | 27.5    |
| V-Belt Cover                    | Crankcase            | 1.1       | 8       |
| Spark Plug                      | Engine               | 1.7       | 12      |

\* w/Blue Loctite #243

\*\* w/Red Loctite #271

\*\*\* w/Green Loctite #609



# Torque Specifications

## (650 V-Twin)

| DRIVE TRAIN COMPONENTS                     |                          |         |         |
|--------------------------------------------|--------------------------|---------|---------|
| Part                                       | Part Bolted To           | Torque  |         |
|                                            |                          | kg-m    | ft-lb   |
| Engine Mounting Through-Bolts              | Frame                    | 5.5     | 40      |
| Engine Mount (Rear)                        | Frame                    | 5.5     | 40      |
| Front Differential****                     | Frame/Diff Bracket       | 6.2     | 45      |
| Rear Drive Gear Case                       | Frame                    | 6.2     | 45      |
| Pinion Housing                             | Diff Housing             | 2.9-3.5 | 21-25   |
| Diff Housing Cover***                      | Diff Housing             | 2.9-3.5 | 21-25   |
| Drive Bevel Gear Nut***                    | Shaft                    | 11-13   | 79.5-94 |
| Lock Collar                                | Diff Housing             | 17.3    | 125     |
| Hub Nut (Front)                            | Shaft/Axle (max)         | 27.6    | 200     |
| Hub Nut (Rear)                             | Shaft/Axle (max)         | 27.6    | 200     |
| Oil Drain Plug                             | Front Diff/Rear Dr       | 0.5     | 3.5     |
| Oil Fill Plug                              | Front Diff/Rear Dr       | 2.2     | 16      |
| Oil Drain Plug                             | Engine                   | 2.2     | 16      |
| Inspection Plug                            | Front Diff               | 0.5     | 3.5     |
| Wheel                                      | Hub                      | 5.5     | 40      |
| EXHAUST COMPONENTS                         |                          |         |         |
| Muffler                                    | Frame                    | 2.8     | 20      |
| Exhaust Pipes                              | Cyl Heads                | 1.9     | 14      |
| ELECTRICAL COMPONENTS                      |                          |         |         |
| Coil****                                   | Frame                    | 1.7     | 12      |
| Ground Wire                                | Engine                   | 1.1     | 8       |
| STEERING COMPONENTS                        |                          |         |         |
| Handlebar Block                            | Steering Post            | 2.8     | 20      |
| Steering Post Bearing Housings             | Frame                    | 2.8     | 20      |
| Steering Post Bearing Flange               | Frame                    | 2.8     | 20      |
| Lower Steering Bearing Washer Cap Screw*** | Steering Post            | 5.5     | 40      |
| Tie Rod End                                | Knuckle/Steering Post    | 4.2     | 30      |
| BRAKE COMPONENTS                           |                          |         |         |
| Brake Disc****                             | Hub                      | 2.1     | 15      |
| Brake Hose                                 | Caliper                  | 2.8     | 20      |
| Brake Hose                                 | Master Cylinder          | 2.8     | 20      |
| Brake Hose                                 | Auxiliary Brake Cylinder | 2.8     | 20      |
| Master Cylinder Cover                      | Master Cylinder          | 0.1     | 1       |
| Auxiliary Brake Pedal                      | Lever Axle               | 3.5     | 25      |
| Hydraulic Caliper                          | Suspension Knuckle       | 2.8     | 20      |
| CHASSIS COMPONENTS                         |                          |         |         |
| Footrest                                   | Frame (8 mm)             | 2.8     | 20      |
| Footrest                                   | Frame (10 mm)            | 5.5     | 40      |
| Shift Lever****                            | Shift Axle               | 1.1     | 8       |

| SUSPENSION COMPONENTS (Front)  |                   |        |       |
|--------------------------------|-------------------|--------|-------|
| Part                           | Part Bolted To    | Torque |       |
|                                |                   | kg-m   | ft-lb |
| A-Arm (All)                    | Frame             | 4.8    | 35    |
| Ball Joint Cap Screw           | Knuckle           | 4.8    | 35    |
| Shock Absorber                 | Frame             | 4.8    | 35    |
| Shock Absorber                 | Upper A-Arm       | 4.8    | 35    |
| Knuckle                        | A-Arm             | 4.8    | 35    |
| SUSPENSION COMPONENTS (Rear)   |                   |        |       |
| A-Arms                         | Frame             | 5.5    | 40    |
| Shock Absorber (Upper)         | Frame             | 4.8    | 35    |
| Shock Absorber (Lower)         | A-Arm             | 2.8    | 20    |
| Knuckle                        | A-Arm             | 4.8    | 35    |
| ENGINE/TRANSMISSION            |                   |        |       |
| Crankcase Half (6 mm)          | Crankcase Half    | 1.0    | 7     |
| Crankcase Half (8 mm)          | Crankcase Half    | 2.0    | 14.5  |
| Cylinder Head (Cap Screws)     | Crankcase         | 5.0    | 36    |
| Cylinder Head (6 mm)           | Cylinder          | 1.0    | 7     |
| Driven Pulley Nut              | Fixed Face        | 9.5    | 69    |
| Fixed Driven                   | Clutch Shaft      | 9.5    | 69    |
| Ground Wire                    | Engine            | 1.1    | 8     |
| Magneto Cover                  | Crankcase         | 0.9    | 6.5   |
| Mechanical Water Pump Impeller | Pump Shaft        | 0.8    | 6     |
| Recoil Starter                 | Left-Side Cover   | 1.2    | 9     |
| Rotor/Flywheel Nut             | Crankshaft        | 13     | 94    |
| Starter Flange                 | Crankshaft        | 0.85   | 6.5   |
| V-Belt Cover                   | Crankcase         | 0.9    | 6.5   |
| Spark Plug                     | Engine            | 1.3    | 9.5   |
| Cam Chain Guide                | Cylinder          | 2.0    | 14.5  |
| Connecting Rod Nuts            | Connecting Rod    | 3.5    | 25    |
| Thermostat Housing             | Lower Body        | 0.9    | 6.5   |
| Shift Shaft Spring Bolt**      | Shift Shaft Lever | 2.5    | 18    |
| Shift Shaft Positioning Bolt   | Crankcase         | 2.5    | 18    |
| Bearing Retainer*              | Bearing Housing   | 12     | 87    |
| Drive Bevel Gear Retainer Nut* | Bearing Housing   | 16     | 116   |
| Output Bearing Retainer*       | Bearing Housing   | 14     | 101   |
| Output Shaft Retainer Nut*     | Bearing Housing   | 16     | 116   |
| Driven Gear Assy               | Crankcase         | 2.7    | 19.5  |
| Drive Bevel Gear Housing       | Crankcase         | 2.7    | 19.5  |
| Intermediate Shaft             | Crankcase         | 4.5    | 32.5  |
| Position Plate                 | Crankcase         | 0.9    | 6.5   |
| Chain Tensioner Assy           | Crankcase         | 0.9    | 6.5   |
| Drive Clutch**                 | Crankshaft        | 9.5    | 69    |
| Oil Pump                       | Crankcase         | 0.9    | 6.5   |
| Chain Guide Attaching Bolts    | Crankcase         | 0.9    | 6.5   |
| Oil Pump Tensioner Bolt        | Crankcase         | 2.5    | 18    |
| Oil Pipe                       | Crankcase         | 0.9    | 6.5   |

| ENGINE/TRANSMISSION (cont) |                    |        |       |
|----------------------------|--------------------|--------|-------|
| Part                       | Part Bolted To     | Torque |       |
|                            |                    | kg-m   | ft-lb |
| Water Pump Cover           | Alternator Cover   | 0.9    | 6.5   |
| Pick-Up Coil               | Alternator Cover   | 1.3    | 9.5   |
| Stator                     | Alternator Cover   | 1.3    | 9.5   |
| Alternator Cover           | Alternator Housing | 0.9    | 6.5   |
| Drive Clutch Cover         | Drive Clutch       | 1.3    | 9.5   |
| Cylinder                   | Crankcase          | 0.9    | 6.5   |
| Cam Chain Tensioner        | Cylinder           | 0.9    | 6.5   |
| Chain Tensioner Cap Bolt   | Chain Tensioner    | 2.2    | 16    |
| One-Way Clutch*            | Rotor/Flywheel     | 3.5    | 25    |
| Tappet Cover               | Rocker Case        | 0.9    | 6.5   |

\* w/Blue Loctite #242

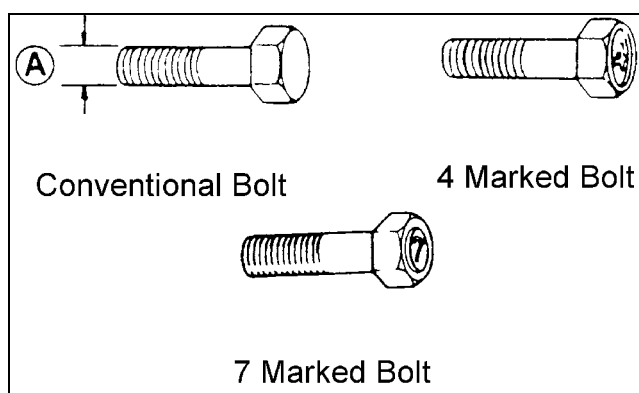
\*\* w/Red Loctite #271

\*\*\* w/Green Loctite #609

\*\*\*\*w/Blue Loctite #243

## Tightening Torque (General Bolts)

| Type of Bolt                    | Thread Diameter A (mm) | Tightening Torque |           |
|---------------------------------|------------------------|-------------------|-----------|
|                                 |                        | kg-m              | ft-lb     |
| (Conventional or 4 Marked Bolt) | 5                      | 0.2-0.4           | 1.5-3.0   |
|                                 | 6                      | 0.4-0.7           | 3.0-5.0   |
|                                 | 8                      | 1.0-1.6           | 7.0-11.5  |
|                                 | 10                     | 2.2-3.5           | 16.0-25.5 |
| (7 Marked Bolt)                 | 5                      | 0.3-0.6           | 2.0-4.5   |
|                                 | 6                      | 0.8-1.2           | 6.0-8.5   |
|                                 | 8                      | 1.8-2.8           | 13.0-20.0 |
|                                 | 10                     | 4.0-6.0           | 29.0-43.5 |



# Torque Conversions

| ft-lb | kg-m | ft-lb | kg-m | ft-lb | kg-m | ft-lb | kg-m | ft-lb | kg-m |
|-------|------|-------|------|-------|------|-------|------|-------|------|
| 1     | 0.1  | 21    | 2.9  | 41    | 5.7  | 61    | 8.4  | 81    | 11.2 |
| 2     | 0.3  | 22    | 3.0  | 42    | 5.8  | 62    | 8.6  | 82    | 11.3 |
| 3     | 0.4  | 23    | 3.2  | 43    | 5.8  | 63    | 8.7  | 83    | 11.5 |
| 4     | 0.6  | 24    | 3.3  | 44    | 6.1  | 64    | 8.9  | 84    | 11.6 |
| 5     | 0.7  | 25    | 3.5  | 45    | 6.2  | 65    | 9.0  | 85    | 11.8 |
| 6     | 0.8  | 26    | 3.6  | 46    | 6.4  | 66    | 9.1  | 86    | 11.9 |
| 7     | 1.0  | 27    | 3.7  | 47    | 6.5  | 67    | 9.3  | 87    | 12.0 |
| 8     | 1.1  | 28    | 3.9  | 48    | 6.6  | 68    | 9.4  | 88    | 12.2 |
| 9     | 1.2  | 29    | 4.0  | 49    | 6.8  | 69    | 9.5  | 89    | 12.3 |
| 10    | 1.4  | 30    | 4.2  | 50    | 6.9  | 70    | 9.7  | 90    | 12.5 |
| 11    | 1.5  | 31    | 4.3  | 51    | 7.1  | 71    | 9.8  | 91    | 12.6 |
| 12    | 1.7  | 32    | 4.4  | 52    | 7.2  | 72    | 10.0 | 92    | 12.8 |
| 13    | 1.8  | 33    | 4.6  | 53    | 7.3  | 73    | 10.1 | 93    | 12.9 |
| 14    | 1.9  | 34    | 4.7  | 54    | 7.5  | 74    | 10.2 | 94    | 13.0 |
| 15    | 2.1  | 35    | 4.8  | 55    | 7.6  | 75    | 10.4 | 95    | 13.1 |
| 16    | 2.2  | 36    | 5.0  | 56    | 7.7  | 76    | 10.5 | 96    | 13.3 |
| 17    | 2.4  | 37    | 5.1  | 57    | 7.9  | 77    | 10.7 | 97    | 13.4 |
| 18    | 2.5  | 38    | 5.3  | 58    | 8.0  | 78    | 10.8 | 98    | 13.6 |
| 19    | 2.6  | 39    | 5.4  | 59    | 8.2  | 79    | 10.9 | 99    | 13.7 |
| 20    | 2.8  | 40    | 5.5  | 60    | 8.3  | 80    | 11.1 | 100   | 13.8 |



# SECTION 11 - TROUBLESHOOTING

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# Engine

■ **NOTE:** A Condition/Remedy marked with an asterisk (\*) is for manual transmission models only.

| <b>Problem: Engine will not start or is hard to start (Compression too low)</b>                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. <b>Valve clearance</b> out of adjustment</li> <li>2. <b>Valve guides</b> worn - seated poorly</li> <li>3. <b>Valves</b> mistimed</li> <li>4. <b>Piston rings</b> worn excessively</li> <li>5. <b>Cylinder bore</b> worn</li> <li>6. <b>Spark plug</b> seating poorly</li> <li>7. <b>Starter motor</b> cranks too slowly - does not turn</li> </ol> | <ol style="list-style-type: none"> <li>1. Adjust clearance</li> <li>2. Repair - replace guides</li> <li>3. Adjust valve timing</li> <li>4. Replace rings</li> <li>5. Replace - rebore cylinder</li> <li>6. Tighten plug</li> <li>7. See Electrical in this section</li> </ol> |
| <b>Problem: Engine will not start or is hard to start (No spark)</b>                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                               |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. <b>Spark plug</b> fouled</li> <li>2. <b>Spark plug</b> wet</li> <li>3. <b>Magneto</b> defective</li> <li>4. <b>CDI unit</b> defective</li> <li>5. <b>Ignition coil</b> defective</li> <li>6. <b>High-tension lead</b> open - shorted</li> </ol>                                                                                                    | <ol style="list-style-type: none"> <li>1. Clean - replace plug</li> <li>2. Clean - dry plug</li> <li>3. Replace magneto</li> <li>4. Replace CDI unit</li> <li>5. Replace ignition coil</li> <li>6. Replace high tension lead</li> </ol>                                       |
| <b>Problem: Engine will not start or is hard to start (No fuel reaching the carburetor)</b>                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                               |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. <b>Gas tank vent hose</b> obstructed</li> <li>2. <b>Carburetor inlet needle</b> defective</li> <li>3. <b>Fuel hose</b> obstructed</li> <li>4. <b>Fuel screens</b> obstructed</li> </ol>                                                                                                                                                            | <ol style="list-style-type: none"> <li>1. Clean vent hose</li> <li>2. Replace needle</li> <li>3. Clean - replace hose</li> <li>4. Clean - replace inlet screen - valve screen</li> </ol>                                                                                      |
| <b>Problem: Engine stalls easily</b>                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                               |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. <b>Spark plug</b> fouled</li> <li>2. <b>Magneto</b> defective</li> <li>3. <b>CDI unit</b> defective</li> <li>4. <b>Carburetor jets</b> obstructed</li> <li>5. <b>Valve clearance</b> out of adjustment</li> </ol>                                                                                                                                  | <ol style="list-style-type: none"> <li>1. Clean plug</li> <li>2. Replace magneto</li> <li>3. Replace CDI unit</li> <li>4. Clean jets</li> <li>5. Adjust clearance</li> </ol>                                                                                                  |
| <b>Problem: Engine noisy (Excessive valve chatter)</b>                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                               |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. <b>Valve clearance</b> too large</li> <li>2. <b>Valve spring(s)</b> weak - broken</li> <li>3. <b>Rocker arm - rocker arm shaft</b> worn</li> <li>4. <b>Camshaft</b> worn</li> </ol>                                                                                                                                                                | <ol style="list-style-type: none"> <li>1. Adjust clearance</li> <li>2. Replace spring(s)</li> <li>3. Replace arm - shaft</li> <li>4. Replace camshaft</li> </ol>                                                                                                              |
| <b>Problem: Engine noisy (Noise seems to come from piston)</b>                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                               |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. <b>Piston - cylinder</b> worn</li> <li>2. <b>Combustion chamber carbon</b> buildup</li> <li>3. <b>Piston pin - piston pin bore</b> worn</li> <li>4. <b>Piston rings - ring groove(s)</b> worn</li> </ol>                                                                                                                                           | <ol style="list-style-type: none"> <li>1. Replace - service piston - cylinder</li> <li>2. Clean chamber</li> <li>3. Replace - service pin - bore</li> <li>4. Replace rings - piston</li> </ol>                                                                                |
| <b>Problem: Engine noisy (Noise seems to come from timing chain)</b>                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                               |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy</b>                                                                                                                                                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. <b>Chain</b> stretched</li> <li>2. <b>Sprockets</b> worn</li> <li>3. <b>Tension adjuster</b> malfunctioning</li> </ol>                                                                                                                                                                                                                             | <ol style="list-style-type: none"> <li>1. Replace chain</li> <li>2. Replace sprockets</li> <li>3. Repair - replace adjuster</li> </ol>                                                                                                                                        |

| <b>Problem: Engine noisy (Noise seems to come from clutch)</b>                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                | <b>Remedy *</b>                                                                                                                                                                                                                                   |
| <ol style="list-style-type: none"> <li>1. <b>Crankshaft splines - bearings</b> worn</li> <li>2. <b>Countershaft - hub splines</b> worn</li> <li>3. <b>Clutch plate teeth</b> worn</li> <li>4. <b>Driven - drive clutch plates</b> distorted - broken</li> <li>5. <b>Clutch dampers</b> weak</li> </ol>                                                            | <ol style="list-style-type: none"> <li>1. Replace crankshaft - bearings</li> <li>2. Replace countershaft - hub</li> <li>3. Replace clutch plate(s)</li> <li>4. Replace clutch plate(s)</li> <li>5. Replace dampers</li> </ol>                     |
| <b>Problem: Engine noisy (Noise seems to come from crankshaft)</b>                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                   |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                  | <b>Remedy</b>                                                                                                                                                                                                                                     |
| <ol style="list-style-type: none"> <li>1. <b>Bearing</b> worn - burned</li> <li>2. <b>Lower rod-end bearing</b> worn - burned</li> <li>3. <b>Connecting rod side clearance</b> too large</li> </ol>                                                                                                                                                               | <ol style="list-style-type: none"> <li>1. Replace bearing</li> <li>2. Replace bearing</li> <li>3. Replace thrust washer(s)</li> </ol>                                                                                                             |
| <b>Problem: Engine noisy (Noise seems to come from transmission)</b>                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                   |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                  | <b>Remedy</b>                                                                                                                                                                                                                                     |
| <ol style="list-style-type: none"> <li>1. <b>Gears</b> worn - rubbing</li> <li>2. <b>Splines</b> worn</li> <li>3. <b>Primary gears</b> worn - rubbing</li> <li>4. <b>Bearings</b> worn</li> <li>5. <b>Bushing</b> worn</li> </ol>                                                                                                                                 | <ol style="list-style-type: none"> <li>1. Replace gears</li> <li>2. Replace shaft(s)</li> <li>3. Replace gears</li> <li>4. Replace bearings</li> <li>5. Replace bushing</li> </ol>                                                                |
| <b>Problem: Engine noisy (Noise seems to come from secondary-transmission/left-side cover)</b>                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                   |
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                | <b>Remedy *</b>                                                                                                                                                                                                                                   |
| <ol style="list-style-type: none"> <li>1. <b>Gears - shaft(s)</b> worn</li> <li>2. <b>Bearing(s)/bushing(s)</b> damaged</li> </ol>                                                                                                                                                                                                                                | <ol style="list-style-type: none"> <li>1. Replace gears - shafts</li> <li>2. Replace bearing(s)/bushing(s)</li> </ol>                                                                                                                             |
| <b>Problem: Engine noisy (Noise seems to come from secondary bevel gear and final driven shaft)</b>                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                   |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                  | <b>Remedy</b>                                                                                                                                                                                                                                     |
| <ol style="list-style-type: none"> <li>1. <b>Drive - driven bevel gears</b> damaged - worn</li> <li>2. <b>Backlash</b> excessive</li> <li>3. <b>Tooth contact</b> improper</li> <li>4. <b>Bearing</b> damaged</li> <li>5. <b>Gears</b> worn - rubbing</li> <li>6. <b>Splines</b> worn</li> <li>7. <b>Final driven shaft thrust clearance</b> too large</li> </ol> | <ol style="list-style-type: none"> <li>1. Replace gears</li> <li>2. Adjust backlash</li> <li>3. Adjust contact</li> <li>4. Replace bearing</li> <li>5. Replace gears</li> <li>6. Replace shaft(s)</li> <li>7. Replace thrust washer(s)</li> </ol> |
| <b>Problem: Clutch slipping</b>                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                   |
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                | <b>Remedy *</b>                                                                                                                                                                                                                                   |
| <ol style="list-style-type: none"> <li>1. <b>Release roller</b> out of adjustment - loss of freeplay</li> <li>2. <b>Clutch springs</b> weak</li> <li>3. <b>Clutch shoes</b> worn</li> <li>4. <b>Pressure disc</b> worn - distorted</li> <li>5. <b>Clutch plates (driven - drive)</b> distorted</li> </ol>                                                         | <ol style="list-style-type: none"> <li>1. Adjust clutch bolts 1 &amp; 2</li> <li>2. Replace springs</li> <li>3. Replace shoes</li> <li>4. Replace disc</li> <li>5. Replace plates</li> </ol>                                                      |
| <b>Problem: Clutch dragging</b>                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                   |
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                | <b>Remedy *</b>                                                                                                                                                                                                                                   |
| <ol style="list-style-type: none"> <li>1. <b>Clutch release roller</b> out of adjustment - too much freeplay</li> <li>2. <b>Clutch springs</b> weak</li> <li>3. <b>Pressure disc - clutch plates</b> distorted</li> <li>4. <b>Clutch release mechanism</b> worn - damaged</li> </ol>                                                                              | <ol style="list-style-type: none"> <li>1. Adjust clutch bolts 1 &amp; 2</li> <li>2. Replace springs</li> <li>3. Replace disc - plates</li> <li>4. Adjust - replace mechanism</li> </ol>                                                           |
| <b>Problem: Transmission will not shift</b>                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                   |
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                | <b>Remedy *</b>                                                                                                                                                                                                                                   |
| <ol style="list-style-type: none"> <li>1. <b>Gearshift cam</b> broken</li> <li>2. <b>Gearshift forks</b> distorted</li> <li>3. <b>Gearshift shaft</b> worn</li> <li>4. <b>Clutch release mechanism</b> worn - damaged</li> <li>5. <b>Reverse cable</b> adjusted improperly</li> <li>6. <b>Gearshift cable</b> adjusted improperly</li> </ol>                      | <ol style="list-style-type: none"> <li>1. Replace cam</li> <li>2. Replace forks</li> <li>3. Replace shaft</li> <li>4. Adjust - replace mechanism</li> <li>5. Adjust cable</li> <li>6. Adjust cable</li> </ol>                                     |



| <b>Problem: Transmission will not shift back</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy *</b>                                                                                                                                                                                                                                                                                                                                                                                          |
| <ol style="list-style-type: none"> <li>1. <b>Reverse shift cam</b> broken</li> <li>2. <b>Shift shafts</b> rubbing - sticking</li> <li>3. <b>Gearshift forks</b> distorted - worn</li> <li>4. <b>Gearshift lever return spring</b> broken - damaged</li> </ol>                                                                                                                                                                                                                                                                                  | <ol style="list-style-type: none"> <li>1. Replace cam</li> <li>2. Replace shafts</li> <li>3. Replace forks</li> <li>4. Replace spring</li> </ol>                                                                                                                                                                                                                                                         |
| <b>Problem: Transmission jumps out of gear</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy *</b>                                                                                                                                                                                                                                                                                                                                                                                          |
| <ol style="list-style-type: none"> <li>1. <b>Shifting gears (driveshaft - countershaft)</b> worn</li> <li>2. <b>Gearshift forks</b> distorted - worn</li> <li>3. <b>Cam stopper spring (gearshift cam)</b> weak</li> <li>4. <b>Gearshift lever stopper pin</b> worn</li> </ol>                                                                                                                                                                                                                                                                 | <ol style="list-style-type: none"> <li>1. Replace gears</li> <li>2. Replace forks</li> <li>3. Replace spring</li> <li>4. Replace pin</li> </ol>                                                                                                                                                                                                                                                          |
| <b>Problem: Secondary-transmission will not shift or shift back</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Condition *</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Remedy *</b>                                                                                                                                                                                                                                                                                                                                                                                          |
| <ol style="list-style-type: none"> <li>1. <b>Sliding dog</b> broken - worn</li> <li>2. <b>Gearshift fork</b> broken - worn</li> <li>3. <b>Hi/Low shift lever</b> out of adjustment</li> <li>4. <b>Gearshift cam</b> worn</li> <li>5. <b>Cam stopper spring</b> weak</li> <li>6. <b>Gearshift fork shaft</b> worn</li> </ol>                                                                                                                                                                                                                    | <ol style="list-style-type: none"> <li>1. Replace dog</li> <li>2. Replace fork</li> <li>3. Adjust lever</li> <li>4. Replace cam</li> <li>5. Replace spring</li> <li>6. Replace shaft</li> </ol>                                                                                                                                                                                                          |
| <b>Problem: Engine idles poorly</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                                                                            |
| <ol style="list-style-type: none"> <li>1. <b>Valve clearance</b> out of adjustment</li> <li>2. <b>Valve seating</b> poor</li> <li>3. <b>Valve guides</b> defective</li> <li>4. <b>Rocker arms - arm shaft</b> worn</li> <li>5. <b>Magneto</b> defective</li> <li>6. <b>CDI unit</b> defective</li> <li>7. <b>Spark plug</b> fouled - <b>gap</b> too wide</li> <li>8. <b>Ignition coil</b> defective</li> <li>9. <b>Float</b> out of adjustment</li> <li>10. <b>Jets</b> obstructed</li> <li>11. <b>Pilot screw setting</b> improper</li> </ol> | <ol style="list-style-type: none"> <li>1. Adjust clearance</li> <li>2. Replace - service seats - valves</li> <li>3. Replace guides</li> <li>4. Replace arms - shafts</li> <li>5. Replace magneto</li> <li>6. Replace CDI unit</li> <li>7. Adjust gap - replace plug</li> <li>8. Replace ignition coil</li> <li>9. Adjust float height</li> <li>10. Clean jets</li> <li>11. Adjust pilot screw</li> </ol> |
| <b>Problem: Engine runs poorly at high speed</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                                                                            |
| <ol style="list-style-type: none"> <li>1. <b>High RPM "cut out"</b> against RPM limiter</li> <li>2. <b>Valve springs</b> weak</li> <li>3. <b>Valve timing</b> out of adjustment</li> <li>4. <b>Cams - rocker arms</b> worn</li> <li>5. <b>Spark plug gap</b> too narrow</li> <li>6. <b>Ignition coil</b> defective</li> <li>7. <b>Float level</b> too low</li> <li>8. <b>Air cleaner element</b> obstructed</li> <li>9. <b>Fuel hose</b> obstructed</li> </ol>                                                                                 | <ol style="list-style-type: none"> <li>1. Shift into higher gear - decrease speed</li> <li>2. Replace springs</li> <li>3. Adjust timing</li> <li>4. Replace cams - arms</li> <li>5. Adjust gap</li> <li>6. Replace ignition oil</li> <li>7. Adjust float height</li> <li>8. Clean element</li> <li>9. Clean - prime hose</li> </ol>                                                                      |
| <b>Problem: Exhaust smoke dirty or heavy</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                                                                            |
| <ol style="list-style-type: none"> <li>1. <b>Oil (in the engine)</b> overfilled - contaminated</li> <li>2. <b>Piston rings - cylinder</b> worn</li> <li>3. <b>Valve guides</b> worn</li> <li>4. <b>Cylinder wall</b> scored - scuffed</li> <li>5. <b>Valve stems</b> worn</li> <li>6. <b>Stem seals</b> defective</li> </ol>                                                                                                                                                                                                                   | <ol style="list-style-type: none"> <li>1. Drain excess oil - replace oil</li> <li>2. Replace - service rings - cylinder</li> <li>3. Replace guides</li> <li>4. Replace - service cylinder</li> <li>5. Replace valves</li> <li>6. Replace seals</li> </ol>                                                                                                                                                |

| Problem: Engine lacks power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Remedy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <ol style="list-style-type: none"> <li>1. <b>Valve clearance</b> incorrect</li> <li>2. <b>Valve springs</b> weak</li> <li>3. <b>Valve timing</b> out of adjustment</li> <li>4. <b>Piston ring(s) - cylinder</b> worn</li> <li>5. <b>Valve seating</b> poor</li> <li>6. <b>Spark plug</b> fouled</li> <li>7. <b>Rocker arms - shafts</b> worn</li> <li>8. <b>Spark plug gap</b> incorrect</li> <li>9. <b>Carburetor jets</b> obstructed</li> <li>10. <b>Float level</b> out of adjustment</li> <li>11. <b>Air cleaner element</b> obstructed</li> <li>12. <b>Oil (in the engine)</b> overfilled - contaminated</li> <li>13. <b>Intake manifold</b> leaking air</li> <li>14. <b>Cam chain</b> worn</li> </ol> | <ol style="list-style-type: none"> <li>1. Adjust clearance</li> <li>2. Replace springs</li> <li>3. Adjust timing</li> <li>4. Replace - service rings - cylinder</li> <li>5. Repair seats</li> <li>6. Clean - replace plug</li> <li>7. Replace arms - shafts</li> <li>8. Adjust gap - replace plug</li> <li>9. Clean jets</li> <li>10. Adjust float height</li> <li>11. Clean element</li> <li>12. Drain excess oil - change oil</li> <li>13. Tighten - replace manifold</li> <li>14. Replace cam chain</li> </ol> |
| Problem: Engine overheats                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Remedy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <ol style="list-style-type: none"> <li>1. <b>Carbon deposit (piston crown)</b> excessive</li> <li>2. <b>Oil</b> low</li> <li>3. <b>Octane</b> low - <b>gasoline</b> poor</li> <li>4. <b>Oil pump</b> defective</li> <li>5. <b>Oil circuit</b> obstructed</li> <li>6. <b>Gasoline level (in float chamber)</b> too low</li> <li>7. <b>Intake manifold</b> leaking air</li> <li>8. <b>Coolant level</b> low</li> <li>9. <b>Fan</b> malfunctioning</li> <li>10. <b>Fan switch</b> malfunctioning</li> <li>11. <b>Thermostat</b> stuck - closed</li> <li>12. <b>Radiator hoses - cap</b> damaged - obstructed</li> </ol>                                                                                        | <ol style="list-style-type: none"> <li>1. Clean piston</li> <li>2. Add oil</li> <li>3. Drain - replace gasoline</li> <li>4. Replace pump</li> <li>5. Clean circuit</li> <li>6. Adjust float height</li> <li>7. Tighten - replace manifold</li> <li>8. Fill - examine system for leaks</li> <li>9. Check fan fuse - replace fan</li> <li>10. Replace fan switch</li> <li>11. Replace thermostat</li> <li>12. Clear obstruction - replace hoses</li> </ol>                                                          |

## Drive

| Problem: Power not transmitted from engine to wheels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Remedy                                                                                                                                                                                                                                                                                              |
| <ol style="list-style-type: none"> <li>1. <b>Rear axle shaft serration</b> worn - broken</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ol style="list-style-type: none"> <li>1. Replace shaft</li> </ol>                                                                                                                                                                                                                                  |
| Problem: Power not transmitted from engine to either front wheel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                     |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Remedy                                                                                                                                                                                                                                                                                              |
| <ol style="list-style-type: none"> <li>1. <b>Secondary drive - driven gear teeth</b> broken</li> <li>2. <b>Propeller shaft serration</b> worn - broken</li> <li>3. <b>Coupling</b> damaged</li> <li>4. <b>Coupling joint serration</b> worn - damaged</li> <li>5. <b>Front drive - driven bevel gears</b> broken - damaged</li> <li>6. <b>Front differential gears/pinions</b> broken - damaged</li> <li>7. <b>Sliding dog/shaft/fork</b> worn - damaged</li> <li>8. <b>Front drive axle</b> worn - damaged</li> <li>9. <b>Front drive axle serration</b> worn - damaged</li> </ol> | <ol style="list-style-type: none"> <li>1. Replace gear(s)</li> <li>2. Replace shaft</li> <li>3. Replace coupling</li> <li>4. Replace joint</li> <li>5. Replace gear(s)</li> <li>6. Replace gears - pinions</li> <li>7. Replace gear(s)</li> <li>8. Replace axle</li> <li>9. Replace axle</li> </ol> |

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## Fuel System

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| Problem: Starting impaired                                                                                                                                                                                                                                                                     |                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Condition                                                                                                                                                                                                                                                                                      | Remedy                                                                                                                                                                                  |
| 1. <b>Starter jet</b> obstructed<br>2. <b>Starter jet passage</b> obstructed<br>3. <b>Starter body - carburetor</b> leaking air<br>4. <b>Starter valve</b> not operating properly                                                                                                              | 1. Clean jet<br>2. Clean passage<br>3. Tighten - adjust - replace gasket<br>4. Check - adjust valve                                                                                     |
| Problem: Idling or low speed impaired                                                                                                                                                                                                                                                          |                                                                                                                                                                                         |
| Condition                                                                                                                                                                                                                                                                                      | Remedy                                                                                                                                                                                  |
| 1. <b>Slow jet</b> obstructed - loose<br>2. <b>Slow jet outlet</b> obstructed<br>3. <b>Low speed fuel screw setting</b> incorrect<br>4. <b>Starter valve</b> not fully closed<br>5. <b>Float height</b> incorrect                                                                              | 1. Clean - tighten jet<br>2. Clean outlet<br>3. Adjust screw<br>4. Adjust valve<br>5. Adjust float height                                                                               |
| Problem: Medium or high speed impaired                                                                                                                                                                                                                                                         |                                                                                                                                                                                         |
| Condition                                                                                                                                                                                                                                                                                      | Remedy                                                                                                                                                                                  |
| 1. <b>High RPM "cut out"</b> against RPM limiter<br>2. <b>Main jet</b> obstructed<br>3. <b>Needle jet</b> obstructed<br>4. <b>Throttle vacuum piston</b> not operating properly<br>5. <b>Filter</b> obstructed<br>6. <b>Float height</b> incorrect<br>7. <b>Starter valve</b> not fully closed | 1. Shift into higher gear - decrease RPM speed<br>2. Clean main jet<br>3. Clean needle jet<br>4. Check piston operation<br>5. Clean filter<br>6. Adjust float height<br>7. Adjust valve |
| Problem: Overflow and fuel level fluctuations                                                                                                                                                                                                                                                  |                                                                                                                                                                                         |
| Condition                                                                                                                                                                                                                                                                                      | Remedy                                                                                                                                                                                  |
| 1. <b>Float valve</b> worn - damaged<br>2. <b>Float valve spring</b> broken<br>3. <b>Float</b> not working properly<br>4. <b>Float valve</b> dirty<br>5. <b>Float height</b> too high - too low                                                                                                | 1. Replace valve<br>2. Replace spring<br>3. Adjust float height - replace float<br>4. Clean valve<br>5. Adjust float height                                                             |



# Electrical

| Problem: Spark absent or weak                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Condition                                                                                                                                                                                                                                                                                                                                             | Remedy                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. <b>Ignition coil</b> defective</li> <li>2. <b>Spark plug</b> defective</li> <li>3. <b>Magneto</b> defective</li> <li>4. <b>CDI unit</b> defective</li> <li>5. <b>Pick-up coil</b> defective</li> </ol>                                                                                                      | <ol style="list-style-type: none"> <li>1. Replace ignition coil</li> <li>2. Replace plug</li> <li>3. Replace magneto</li> <li>4. Replace CDI unit</li> <li>5. Replace pick-up coil</li> </ol>                                                      |
| Problem: Spark plug fouled with carbon                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                    |
| Condition                                                                                                                                                                                                                                                                                                                                             | Remedy                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. <b>Mixture</b> too rich</li> <li>2. <b>Idling RPM</b> too high</li> <li>3. <b>Gasoline</b> incorrect</li> <li>4. <b>Air cleaner element</b> dirty</li> <li>5. <b>Spark plug</b> incorrect (too cold)</li> <li>6. <b>Valve seals</b> cracked - missing</li> <li>7. <b>Oil rings</b> worn - broken</li> </ol> | <ol style="list-style-type: none"> <li>1. Adjust carburetor</li> <li>2. Adjust carburetor</li> <li>3. Change to correct gasoline</li> <li>4. Clean element</li> <li>5. Replace plug</li> <li>6. Replace seals</li> <li>7. Replace rings</li> </ol> |
| Problem: Spark plug electrodes overheat or burn                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                    |
| Condition                                                                                                                                                                                                                                                                                                                                             | Remedy                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. <b>Spark plug</b> incorrect (too hot)</li> <li>2. <b>Engine</b> overheats</li> <li>3. <b>Spark plug</b> loose</li> <li>4. <b>Mixture</b> too lean</li> </ol>                                                                                                                                                | <ol style="list-style-type: none"> <li>1. Replace plug</li> <li>2. Service cooling system</li> <li>3. Tighten plug</li> <li>4. Adjust carburetor</li> </ol>                                                                                        |
| Problem: Magneto does not charge                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                    |
| Condition                                                                                                                                                                                                                                                                                                                                             | Remedy                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. <b>Lead wires/connections</b> shorted - loose - open</li> <li>2. <b>Magneto coils</b> shorted - grounded - open</li> <li>3. <b>Regulator/rectifier</b> shorted - punctured</li> </ol>                                                                                                                       | <ol style="list-style-type: none"> <li>1. Repair - replace - tighten lead wires</li> <li>2. Replace magneto coils</li> <li>3. Replace regulator/rectifier</li> </ol>                                                                               |
| Problem: Magneto charges, but charging rate is below the specification                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                    |
| Condition                                                                                                                                                                                                                                                                                                                                             | Remedy                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. <b>Lead wires</b> shorted - open - loose (at terminals)</li> <li>2. <b>Stator coils (magneto)</b> grounded - open</li> <li>3. <b>Regulator/rectifier</b> defective</li> <li>4. <b>Electrolyte</b> low</li> <li>5. <b>Cell plates (battery)</b> defective</li> </ol>                                         | <ol style="list-style-type: none"> <li>1. Repair - tighten lead wires</li> <li>2. Replace stator coils</li> <li>3. Replace regulator/rectifier</li> <li>4. Add distilled water</li> <li>5. Replace battery</li> </ol>                              |
| Problem: Magneto overcharges                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                    |
| Condition                                                                                                                                                                                                                                                                                                                                             | Remedy                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. <b>Internal battery</b> short circuited</li> <li>2. <b>Regulator/rectifier resistor</b> damaged - defective</li> <li>3. <b>Regulator/rectifier</b> poorly grounded</li> </ol>                                                                                                                               | <ol style="list-style-type: none"> <li>1. Replace battery</li> <li>2. Replace resistor</li> <li>3. Clean - tighten ground connection</li> </ol>                                                                                                    |
| Problem: Charging unstable                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                    |
| Condition                                                                                                                                                                                                                                                                                                                                             | Remedy                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"> <li>1. <b>Lead wire</b> intermittently shorting</li> <li>2. <b>Magneto</b> internally shorted</li> <li>3. <b>Regulator/rectifier</b> defective</li> </ol>                                                                                                                                                          | <ol style="list-style-type: none"> <li>1. Replace lead wire</li> <li>2. Replace magneto</li> <li>3. Replace regulator/rectifier</li> </ol>                                                                                                         |

| <b>Problem: Starter button not effective</b>                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                       | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                        |
| <ol style="list-style-type: none"> <li>1. <b>Battery charge</b> low</li> <li>2. <b>Switch contacts</b> defective</li> <li>3. <b>Starter motor brushes</b> not seating</li> <li>4. <b>Starter relay</b> defective</li> <li>5. <b>Emergency stop - ignition switch</b> off</li> <li>6. <b>Wiring connections</b> loose - disconnected</li> </ol>         | <ol style="list-style-type: none"> <li>1. Recharge - replace battery</li> <li>2. Replace switch</li> <li>3. Repair - replace brushes</li> <li>4. Replace relay</li> <li>5. Turn on switches</li> <li>6. Connect - tighten - repair connections</li> </ol>                                                                                            |
| <b>Problem: Battery "sulfation" (Acidic white powdery substance or spots on surfaces of cell plates)</b>                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                      |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                       | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                        |
| <ol style="list-style-type: none"> <li>1. <b>Charging rate</b> too low - too high</li> <li>2. <b>Battery electrolyte</b> excessive - insufficient</li> <li>3. <b>Specific gravity</b> too high - too low</li> <li>4. <b>Battery</b> run-down - damaged</li> <li>5. <b>Electrolyte</b> contaminated</li> </ol>                                          | <ol style="list-style-type: none"> <li>1. Replace battery</li> <li>2. Keep electrolyte to prescribed level</li> <li>3. Charge battery - add distilled water</li> <li>4. Replace battery</li> <li>5. Recharge - replace battery</li> </ol>                                                                                                            |
| <b>Problem: Battery discharges too rapidly</b>                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                      |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                       | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                        |
| <ol style="list-style-type: none"> <li>1. <b>Electrolyte</b> contaminated</li> <li>2. <b>Specific gravity</b> too high</li> <li>3. <b>Charging system (charging operation)</b> not set properly</li> <li>4. <b>Cell plates</b> overcharged - damaged</li> <li>5. <b>Battery</b> short-circuited</li> <li>6. <b>Specific gravity</b> too low</li> </ol> | <ol style="list-style-type: none"> <li>1. Replace battery</li> <li>2. Charge battery - add distilled water</li> <li>3. Check magneto - regulator/rectifier - circuit connections - adjust for specified charging operation</li> <li>4. Replace battery - correct charging system</li> <li>5. Replace battery</li> <li>6. Recharge battery</li> </ol> |
| <b>Problem: Battery polarity reversed</b>                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                      |
| <b>Condition</b>                                                                                                                                                                                                                                                                                                                                       | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                        |
| <ol style="list-style-type: none"> <li>1. <b>Battery</b> incorrectly connected</li> </ol>                                                                                                                                                                                                                                                              | <ol style="list-style-type: none"> <li>1. Reverse connections - replace battery</li> </ol>                                                                                                                                                                                                                                                           |

## Steering/Suspension

| Problem: Handling too heavy or stiff                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Front wheel alignment</b> incorrect</li> <li>2. <b>Lubrication</b> inadequate</li> <li>3. <b>Tire inflation pressure</b> incorrect</li> <li>4. <b>Tie rod ends</b> seizing</li> <li>5. <b>Linkage connections</b> seizing</li> </ol>                                                                                                                                         | <ol style="list-style-type: none"> <li>1. Adjust alignment</li> <li>2. Lubricate appropriate components</li> <li>3. Adjust pressure</li> <li>4. Replace tie rod ends</li> <li>5. Repair - replace connections</li> </ol>                                                                                  |
| Problem: Steering oscillation                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Tires</b> inflated unequally</li> <li>2. <b>Wheel(s)</b> wobbly</li> <li>3. <b>Wheel hub cap screw(s)</b> loose - missing</li> <li>4. <b>Wheel hub bearing</b> worn - damaged</li> <li>5. <b>Tie rod ends</b> worn - loose</li> <li>6. <b>Tires</b> defective - incorrect</li> <li>7. <b>A-arm bushings</b> damaged</li> <li>8. <b>Bolts - nuts (frame)</b> loose</li> </ol> | <ol style="list-style-type: none"> <li>1. Adjust pressure</li> <li>2. Replace wheel(s)</li> <li>3. Tighten - replace cap screws</li> <li>4. Replace bearing</li> <li>5. Replace - tighten tie rod ends</li> <li>6. Replace tires</li> <li>7. Replace bushings</li> <li>8. Tighten bolts - nuts</li> </ol> |
| Problem: Steering pulling to one side                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Tires</b> inflated unequally</li> <li>2. <b>Front wheel alignment</b> incorrect</li> <li>3. <b>Wheel hub bearings</b> worn - broken</li> <li>4. <b>Frame</b> distorted</li> <li>5. <b>Shock absorber</b> defective</li> </ol>                                                                                                                                                | <ol style="list-style-type: none"> <li>1. Adjust pressure</li> <li>2. Adjust alignment</li> <li>3. Replace bearings</li> <li>4. Repair - replace frame</li> <li>5. Replace shock absorber</li> </ol>                                                                                                      |
| Problem: Steering impaired                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Tire pressure</b> too high</li> <li>2. <b>Steering linkage connections</b> worn</li> <li>3. <b>Cap screws (suspension system)</b> loose</li> </ol>                                                                                                                                                                                                                           | <ol style="list-style-type: none"> <li>1. Adjust pressure</li> <li>2. Replace connections</li> <li>3. Tighten cap screws</li> </ol>                                                                                                                                                                       |
| Problem: Tire wear rapid or uneven                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Wheel hub bearings</b> worn - loose</li> <li>2. <b>Front wheel alignment</b> incorrect</li> </ol>                                                                                                                                                                                                                                                                            | <ol style="list-style-type: none"> <li>1. Replace bearings</li> <li>2. Adjust alignment</li> </ol>                                                                                                                                                                                                        |
| Problem: Steering noise                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Caps screws - nuts</b> loose</li> <li>2. <b>Wheel hub bearings</b> broken - damaged</li> <li>3. <b>Lubrication</b> inadequate</li> </ol>                                                                                                                                                                                                                                     | <ol style="list-style-type: none"> <li>1. Tighten cap screws - nuts</li> <li>2. Replace bearings</li> <li>3. Lubricate appropriate components</li> </ol>                                                                                                                                                  |
| Problem: Suspension too soft                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Spring(s)</b> weak</li> <li>2. <b>Shock absorber</b> damaged</li> </ol>                                                                                                                                                                                                                                                                                                      | <ol style="list-style-type: none"> <li>1. Replace spring(s)</li> <li>2. Replace shock absorber</li> </ol>                                                                                                                                                                                                 |
| Problem: Suspension too stiff                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>A-arm-related bushings</b> worn</li> </ol>                                                                                                                                                                                                                                                                                                                                   | <ol style="list-style-type: none"> <li>1. Replace bushing</li> </ol>                                                                                                                                                                                                                                      |
| Problem: Suspension noisy                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                           |
| Condition                                                                                                                                                                                                                                                                                                                                                                                                                 | Remedy                                                                                                                                                                                                                                                                                                    |
| <ol style="list-style-type: none"> <li>1. <b>Cap screws (suspension system)</b> loose</li> <li>2. <b>A-arm-related bushings</b> worn</li> </ol>                                                                                                                                                                                                                                                                           | <ol style="list-style-type: none"> <li>1. Tighten cap screws</li> <li>2. Replace bushings</li> </ol>                                                                                                                                                                                                      |



| Problem: Rear wheel oscillation                      |                                      |
|------------------------------------------------------|--------------------------------------|
| Condition                                            | Remedy                               |
| 1. <b>Rear wheel hub bearings</b> worn - loose       | 1. Replace bearings                  |
| 2. <b>Tires</b> defective - incorrect                | 2. Replace tires                     |
| 3. <b>Wheel rim</b> distorted                        | 3. Replace rim                       |
| 4. <b>Wheel hub cap screws</b> loose                 | 4. Tighten cap screws                |
| 5. <b>Axle shaft nut</b> loose (Manual Transmission) | 5. Tighten nut (Manual Transmission) |
| 6. <b>Auxiliary brake</b> adjusted incorrectly       | 6. Adjust brake                      |
| 7. <b>Rear suspension arm-related bushing</b> worn   | 7. Replace bushing                   |
| 8. <b>Rear shock absorber</b> damaged                | 8. Replace shock absorber            |
| 9. <b>Rear suspension arm nut</b> loose              | 9. Tighten nut                       |

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## Brakes

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| Problem: Braking poor                              |                                      |
|----------------------------------------------------|--------------------------------------|
| Condition                                          | Remedy                               |
| 1. <b>Pad</b> worn                                 | 1. Replace pads                      |
| 2. <b>Pedal free-play</b> excessive                | 2. Adjust free-play                  |
| 3. <b>Brake fluid</b> leaking                      | 3. Repair - replace hydraulic system |
| 4. <b>Hydraulic system</b> leaking air             | 4. Bleed hydraulic system            |
| 5. <b>Master cylinder/brake cylinder seal</b> worn | 5. Replace seal(s)                   |
| Problem: Brake lever travel excessive              |                                      |
| Condition                                          | Remedy                               |
| 1. <b>Hydraulic system</b> entrapped air           | 1. Bleed hydraulic system            |
| 2. <b>Brake fluid</b> low                          | 2. Add fluid to proper level         |
| 3. <b>Brake fluid</b> incorrect                    | 3. Replace with correct fluid        |
| 4. <b>Piston seal - cup</b> worn                   | 4. Replace seal - cup                |
| Problem: Brake fluid leaking                       |                                      |
| Condition                                          | Remedy                               |
| 1. <b>Connection joints</b> loose                  | 1. Tighten joint                     |
| 2. <b>Hose</b> cracked                             | 2. Replace hose                      |
| 3. <b>Piston seal</b> worn                         | 3. Replace seal                      |