

**I. OPERATING INSTRUCTIONS**

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# I. OPERATING INSTRUCTIONS

## 1. Intended use

Thank you for purchasing your Polini motorcycle. With proper care and maintenance, your Polini will last for many years and provide unparalleled performance. ALWAYS wear a helmet and other safety gear, respect the environment & local laws, and ride within your abilities. Do not carry passengers or operate motorcycle on any roadway. This motorcycle is intended for off-road competition use only. Learn proper use and operation of your motorcycle before riding. Make note of required service and adjustments as poor maintenance & service can lead to unsafe bike conditions, damage to the motorcycle and injury to the rider. Always check motorcycle for damage before riding and call your local dealer or Action Racing at (239) 566-9666 if you have any questions or problems.

1. Before use, check for proper adjustments and any broken or worn parts, repair or adjust before riding.
2. Do not ride beyond your abilities, use caution when encountering new obstacles or unfamiliar terrain.
3. Keep both hands on handlebars and and both feet on footpegs.
4. Never leave motorcycle running unattended to prevent theft or injury to others, or allow it to idle for more than a few minutes to prevent overheating of motorcycle.
5. Wear proper riding gear, including: Snell or DOT approved helmet, goggles, gloves, boots, riding pants, knee/shin guards, elbow guards, kidney belt, and chest/back protector. Note: kidney belts and chest protectors are strongly recommended for all children in addition to other protective gear, and are required by most racing organizations.
6. Be very careful to keep hands, feet, hair and loose clothing away from chain, sprockets and wheels to prevent injury.
7. Always apply brakes when starting motorcycle to prevent unexpected movement. **The motorcycle is always in gear and will move any time the throttle is applied.**
8. **See warnings and precautions in section III-1 before working on motorcycle.**

The Polini X1 motorcycles are recommended for children ages 4-6, assuming they have the size, strength, reflexes and maturity to operate a competition motorcycle. Make sure your child can confidently ride a bicycle and understand and respond to your instruction before allowing them to operate a motorcycle. The X3 model is intended for children ages 7-9, and the X5 model is for children 9 years old and older.

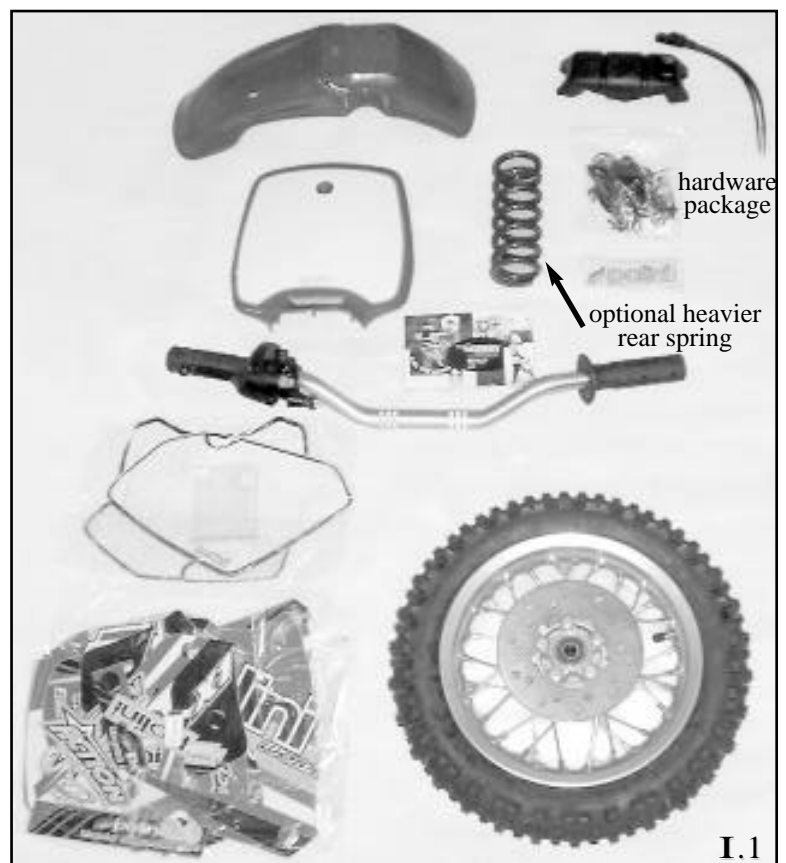
The use of genuine Polini replacement parts is strongly recommended to insure proper fit and function of your motorcycle. Due to their intended use, neither Polini nor Action North America offer or imply any warrantee whatsoever on any motorcycle or part.

## 2. Initial assembly

If your Polini motorcycle was shipped to you in a box, you will have to partially assemble your Polini, make several adjustments, and add oil and coolant. Take the time to read through this manual and familiarize yourself with the bike, its operation and proper maintenance procedures.

In general, it is a good idea to lightly grease any fittings that screw into aluminum using wheel bearing grease or anti-seize compound. Take care not to get any grease on the brake rotors or brake pads. References to the right and left side of the motorcycle are the rider's right and left as seated on the motorcycle.

**Assembly of motorcycle** - Carefully open the top of box and remove packing material. When bike is free to move, lift out of box holding fork bridge and top of rear rim. **Do not lift by rear fender!** Locate and remove hardware bag, decal envelope, handlebar, front wheel, extra heavy rate spring, front number plate, front fender and bar pad with plastic ties. Check all parts for damage, if any damage is found take photos of parts and of box damage and contact the shipper right away so they can file a claim for damage with the carrier. Open parts bag, and compare contents to photo. There should be 2 footpegs with springs, bolts, & nuts, two bar clamps with 4 allen bolts, 4 fender screws and washers, 1 brake cable guide, 1 kill switch clamp assembly, 1 front number plate screw with spacer, and 1 front axle pinch bolt. See photo I-2. (Only works models come with optional graphics package)



Contents of shipping box

Begin by cutting the plastic zip tie straps securing the front and rear calipers to their mounting brackets.

Install front fender using 4 phillips head screws M6x16 and 4 washers M6x18x1.

Install the front wheel next. Spread brake pads enough to accept rotor, then align front wheel with axle holes in forks. Insert front axle from right side of bike, through front wheel and into the left fork. Using a  $\frac{5}{16}$ " or 8mm allen wrench, turn the axle until it is fully threaded into the left fork, then torque to 50 Nm. Next compress the forks several times to properly align the forks on axle. Install and tighten axle pinch bolt using a 6mm allen wrench to 25 Nm.

Install handlebar using 2 U-shaped bar clamps with 4 M8x30 socket head bolts using 6mm allen wrench. Make sure gaps are even from front to rear of bar clamps. Tighten bolts to 25 Nm. Install bar clamp pad using 2 zip ties provided. Install kill switch on left side of handlebar near grip pointing up using 2 piece clamp assembly in hardware package.

Route cables as outlined in section II-4. (See page 8)

Adjust front brake lever (bar mounted rear brake lever also, if so equipped) using adjuster on lever so that free play is from 4 to 5mm, measured at gap between lever and cable holder - See photo III-2.

Check wheels for free rotation and proper braking when levers are applied.

Remove 2 screws from top of throttle housing and remove cover. Install end of cable into top hole in throttle tube. Install throttle cover making sure cable is in groove. Twist throttle repeatedly to check for any binding or failure to return to rest position when released. Fix sticking or sluggish throttles. Do not lube throttle grip assembly but remove and clean as needed. Use a small piece of duct tape to secure cable to adjuster to prevent setting from changing or cable from pulling out. Push cable boot fully onto throttle housing, using a small zip tie on the end of the boot will help prevent dirt from entering. These tips also apply to the carburetor end of the cable.

Install front number plate by inserting 3 fingers into holes in front fender, then insert phillips M5x30 screw using metric spacer 5.5 x 12 x 20. Spread the grey plastic front brake cable guide over cable, push into hole in front number plate.

Install footpegs using SCS M8x40, a M8 lock nut, and footpeg spring. See photo I-3. If necessary, bend straight end of spring down with a pair of pliers to tension footpegs more. To make spring easier to install, use a pair of pliers or a vise to compress spring, then hold in position using a small zip-tie. Install spring and then cut zip-tie to release.

Inflate tires to 18 psi.

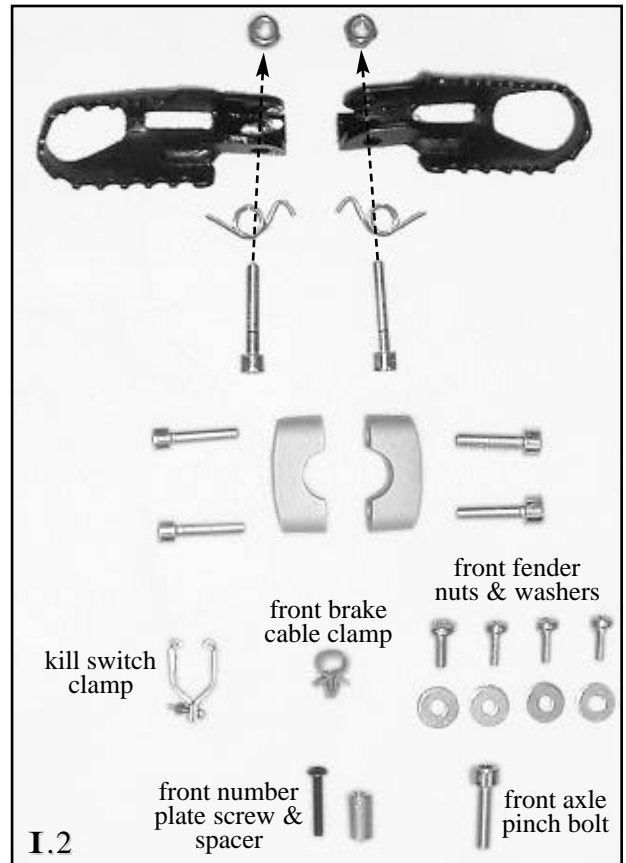
Fill radiator with approximately 27oz. (with dual radiators) of Engine Ice® antifreeze (ready to use). See section III-4. Fill transmission through vent hole or level checking screw hole with 300 cc (10 oz.) Maxima brand MTL 75 gear lube for best results. Remove checking screw and fill slowly in case some oil is already in transmission. Do not overfill. See procedure in section III-6.

Remove rubber cap from crankcase vent fitting and push vent tube onto fitting. (See photo I-4)

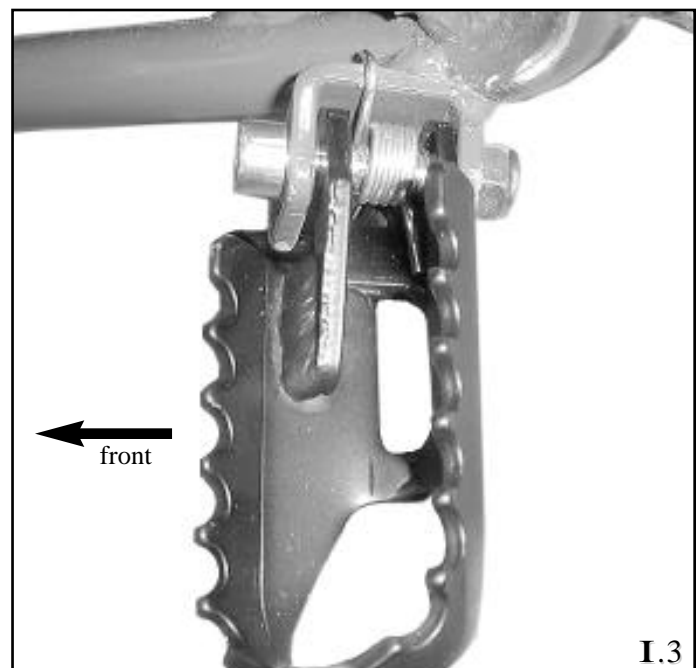
If kickstarter hits expansion pipe when folding in, remove pinch bolt using a 5mm allen wrench and remove kickstarter. Insert screwdriver blade into slot to loosen kickstarter on shaft if necessary. Reposition kickstarter rearward 2-3 splines and re-install. Torque pinch bolt to 10 Nm.

Apply the decals last (if necessary). Remove the fuel tank with shrouds attached before applying the decals to them. Try to apply the decals in a warm, clean, well lit area and at least 24 hours before the bike is to be ridden.

It is very important to properly prepare your bike's plastic for application of pressure sensitive decals. The plastic should be cleaned with conventional soap and water, and any scratched areas should be lightly sanded to make them smooth. The smoother the surface the better the adhesion. Before you peel back the backing on the decal, fit it in place and line it up properly. Tape it in position



All nuts, bolts and small parts are in a bag inside box.



Footpeg installation - left side shown.

with masking tape, and notice where any curves and creases might occur. The curves and areas where the plastic tapers in 2 directions will be the most difficult areas to apply. When you've determined the best fit, tape one edge of the decal securely in place, and remove the tape from the opposite edge. Lift the decal up and spray a light mist of water from a squirt bottle onto the entire plastic panel. This will allow you to dampen the adhesive so it won't stick as well during the application of the decal and allow repositioning if necessary without losing the the final bond.

Carefully align the decal and lay it on the plastic. If the graphic is not fitting the panel correctly, you can peel it back up and start over. Start pressing down near the center of the graphic to 'work' the water and any air away from the center and toward the edges of the decal. Pay extra attention to creases and irregular areas where the graphic needs to conform to the plastic in unusual ways. Take your time and work from the middle of the decal to the edges pushing out any water and air as you go. The water will weep out the side of the decal as you reach the edges.

If you're having trouble with an irregular area, use a blow dryer or heat gun to lightly warm up the decal in order to make it conform. The heat will soften the material, so that you can stretch or compress it as needed to make it fit. Use just enough heat to make the material pliable without melting it.

### 3. Pre-ride checks

**Initial startup** - When motorcycle is at operating temperature, adjust idle speed to the lowest speed at which the motorcycle will run smoothly by using idle adjustment screw. See photo II-6. Then adjust fuel metering screw. Roll on the throttle rapidly. If the engine bogs or hesitates, try rotating screw clockwise (leaner) in  $\frac{1}{4}$  turn increments until hesitation ceases. If the engine surges or misfires, rotate screw counterclockwise (richer) in  $\frac{1}{4}$  turn increments until bike accelerate smoothly. If the fuel metering screw has to be less than  $1\frac{1}{2}$  for proper running, consider using a leaner pilot jet. If fuel metering screw is more than  $2\frac{1}{2}$  -3 turns out, install a leaner pilot jet. The fuel metering screw is normally set from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  turns out from fully seated. Never tighten fuel metering screw, just gently turn in until it stops, then back out counting the turns to the desired setting. The fuel metering screw can cause overall jetting to be too rich if it is turned out too far. Note that the fuel metering screw only affects the initial throttle response in conjunction with the pilot jet until the needle jet takes over at  $\frac{1}{4}$  throttle and above.

**Regular pre-ride checklist** - Check chain tension and make sure chain is well lubricated and not worn. Check tire pressure, spokes, all nuts & bolts, steering stem for binding or play, swingarm bolt, engine mounting bolts, oil & coolant levels and condition, lever and throttle adjustment, & air cleaner. Look for broken or worn parts, leaking fluids, etc. Check brake calipers for proper freeplay and accumulations of dirt. Clean and adjust as needed to provide proper function.

### 4. Basic operation & control functions

**Engine startup** - Make sure motorcycle has premix fuel, transmission oil and coolant. Make sure air cleaner is installed and properly oiled. Note that arrow on air cleaner and filter cover must point to front of motorcycle.

Turn fuel valve to ON position (vertical position). See photo II-3.

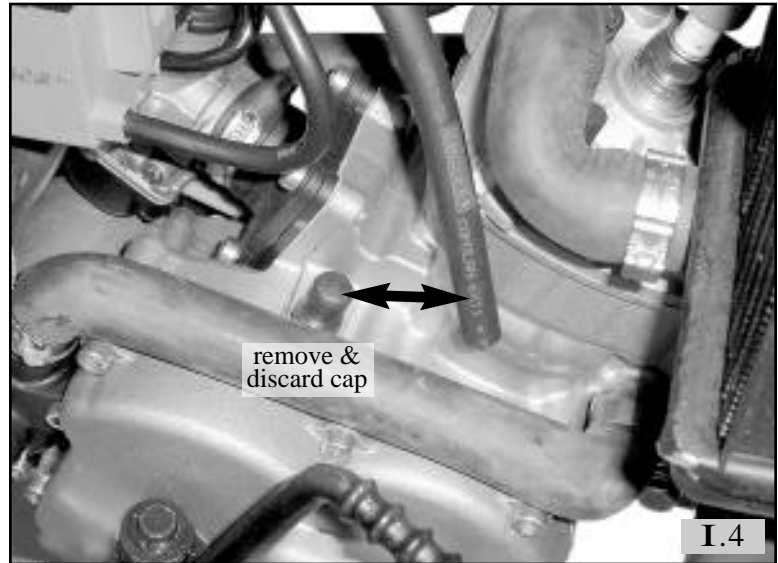
If engine is cold, lift the choke knob on carburetor and rotate about  $\frac{1}{8}$  turn so it stays in the up position. See photo II-4.

Squeeze brake lever to prevent sudden movement upon starting.

**Motorcycle is always in gear and may move suddenly when started or whenever throttle is applied.**

Push kickstarter down until slack is taken up, then kick briskly with throttle closed. If necessary, open throttle slightly and hold while kicking. Motor should start readily. **If adult is starting bike, use restraint not to damage kickstarter gears with excessive force! If bike will not start, find and fix problems rather than just kicking harder!** As engine warms, turn choke knob to return it to the closed position and apply throttle slightly until bike idles without stalling.

To stop motor, depress kill switch until motor stops. If motorcycle will not start and there is a strong smell of fuel, the engine is flooded. Turn off choke, open throttle fully and hold open, and kick motor approximately 10 times to clear engine of excess fuel. Release throttle and try starting again. If engine still won't start, remove sparkplug and inspect. If plug is wet with fuel, replace plug. If plug seems to be dry, check fuel valve position and carburetor float and needle valve assembly for proper function.



Remove rubber cap, install vent tube onto vent fitting.

**Break in** - The initial startup and running of the engine is crucial for long life and full power potential. Always warm engine for a few minutes before riding motorcycle. Do not idle for extended periods - note that water pump does not circulate when rear wheel is not turning. When starting for the first time, allow to warm for 1-2 minutes, and then ride motorcycle carefully for about 10-15 minutes. Avoid steep hills, mud, sand or other heavy loads on motor. Use partial throttle only, and vary speed when riding, do not maintain constant speed while breaking in motor. Allow motor to cool thoroughly. Repeat as above, gradually increasing throttle for another 15 minutes. Allow to cool. Break in is now mostly complete. Change transmission oil at end of day. Check all fasteners for loosening, check chain tension and brake lever(s) adjustments.

**Control Operation** - Twist right throttle grip to engage clutch and accelerate. Apply enough gas to fully engage clutch, do not rapidly engage/disengage clutch or premature wear will result. To slow or stop, release throttle and apply front and rear brakes evenly. Apply brakes while traveling in a straight line until proficient in advanced braking techniques. Note that the front brake is applied with the right hand lever and the rear brake is applied with the right foot lever (or left hand lever, if so equipped).

## 5. Control adjustment

**Brake Adjustment** - To adjust brake lever, (front brake and handlebar mounted rear brake), loosen knurled lock nut, and adjust threaded adjuster to obtain proper freeplay of 4-5mm as shown in photo III-2. If unable to obtain correct adjustment at brake lever, adjust play at caliper (see section III-9). Recheck freeplay at lever and make any final adjustments.

**Brake pedal** - The rear brake pedal is adjusted at the rear caliper. Check the movement of the caliper arm, it should be 5-10mm measured at the tip of the arm. Adjust caliper as needed using the same procedure as for the front brake caliper (see section III-9). If pedal has too much or not enough free play after adjusting caliper, loosen cable clamp on caliper arm and adjust cable position to obtain desired pedal free play. The tip of the brake lever should move between  $\frac{1}{4}$ " to  $\frac{3}{8}$ " before tire locks.

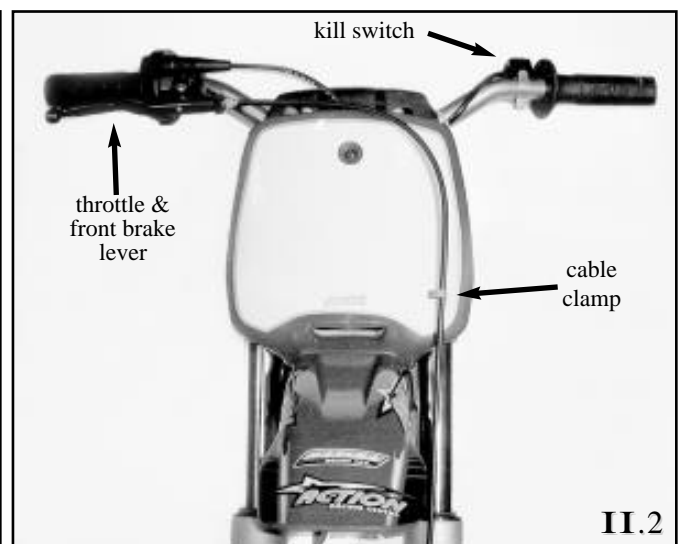
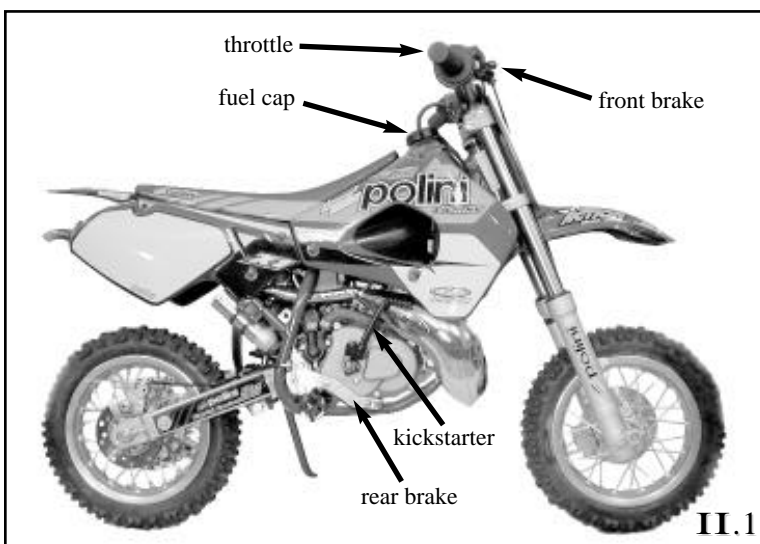
**Throttle adjustment** - With engine off, check throttle grip to make sure there is a small amount of freeplay ( $\frac{1}{8}$ " max). Check again while turned all the way to the right and all the way to the left. Make sure there is some slack in the throttle cable between where it is tied to the chassis and where it connects to the carburetor. Start engine and turn bars full left and right and make sure idle does not change. Adjust freeplay by pulling boot off throttle housing, then loosen locknut and turn adjuster screw into housing for more freeplay, turn screw out of housing for less freeplay. Tighten locknut and push boot back onto throttle housing.

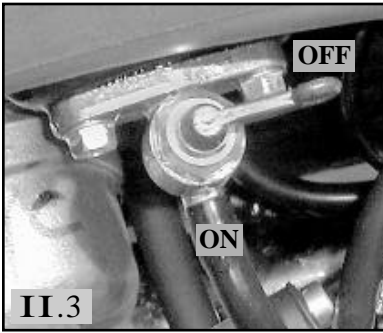
**Bar angle** - The angle of the bars can be adjusted to fit different riders. Taller riders might want to rotate bars slightly forward, while shorter riders can rotate bars backwards to make them easier to reach. Make only small adjustments to bar angle so that the grip angles do not become excessive.

**Lever angle** - The front brake lever (and rear if so equipped) can be adjusted so they are horizontal or angled downward. Aggressive riders who spend most of their time standing will want the levers angled somewhat downward for a more natural grip while standing. Beginning riders will generally prefer a nearly horizontal lever position, especially if they have small hands.

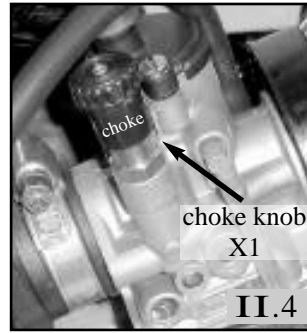
## II. GENERAL INFORMATION & SPECIFICATIONS

### 1. Description - diagram of motorcycle components & controls

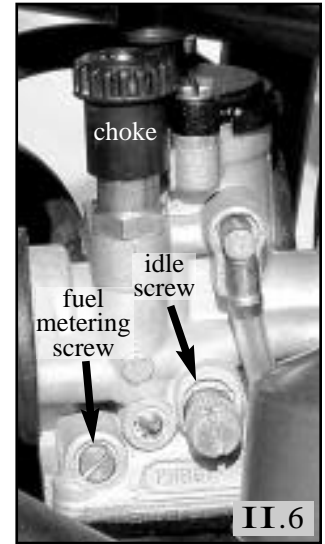




Fuel valve - Off position

Choke knob - X1  
lift & 1/8 turn to engage choke

Idle, fuel metering screw - X1

Idle, fuel metering screw  
X3 & X5

## 2. Specifications

Length - X1: 50" X3: XX X5: XX

Width - X1: 24 1/4" X3: XX X5: XX

Height - X1: 32 3/4" X3: XX X5: XX

Wheelbase - X1: 34 3/8" - 35 5/8" X3: XX X5: XX

Seat height - X1: 24" X3: 28" X5: 32"

Footpeg height - X1: 9 3/4" X3: XX X5: XX

Ground clearance - X1: 8" X3: XX X5: XX

Wet weight (no fuel) - X1: 97lb. X3: XX X5: XX

Fuel capacity, type - 1 gallon - 93 octane pump gas (must be mixed with premix oil)

Oil premix ratio - 40:1 mixture of fuel and Maxima K2 premix oil

Chain - Regina 415, 91 links (X1) X3: XX X5: XX

Steering head angle - 20°

Forks - conventional hydraulic, 5 1/2" travel, X1: 160cc 10wt fork oil, X3 & X5: 180cc 10wt fork oil

Shock, gas charged mono-shock, adjustable preload, compression & rebound dampening -

*shock springs specs, free length, XX kg/cm, Optional shock spring specs, free length, XX kg/cm, 5 1/2" suspension travel ??*

Engine type - single cylinder, 50cc case reed 2-stroke motor, liquid cooled

Bore & stroke - 40.2mm x 39.3mm

Compression ratio 14.5:1

Redline - 13,700 rpm

Transmission oil capacity - 10 oz. (300cc)

Coolant capacity - approx. 27oz. Engine Ice® antifreeze (dual radiator models)

Carburetor model - X1: Dell'Orto PHBG19, 19mm (X1 models sleeved to 14mm for AMA compliance) X3: 21mm, sleeved to 19mm X5: XX

jet sizes - X1: main: 88, needle: W3 @ 2nd clip from top, needle jet: 262, pilot jet: 55, choke jet: 60, fuel metering screw: 2 1/2 turns from bottomed. X3: XX X5: XX

**Float level - ?????!!**

Clutch - Works: automatic centrifugal 3 shoe type, engagement rpm adjustable from 5000 to 7000 rpm Std: automatic 2 shoe clutch, adjustable

Gear ratio - 12T front, 42T rear - Optional 13-14T front and 36-48T rear

Electrical system - Works: Selettra CDI P3356

Spark plug - NGK R5671A-11 or B9EV, gap .024"

Timing specification - 1.6mm BTDC

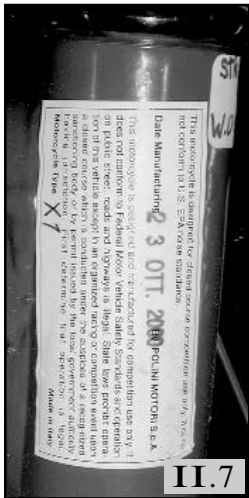
Wheels - 10" front & rear, straight pull spokes

Tires - Pirelli MT32A 2.50 x 10 @ 18psi

Brakes - Disc brakes front and rear with mechanical calipers, front brake hand lever, rear brake foot lever (works) or rear hand lever (std)

Color - Blue & white

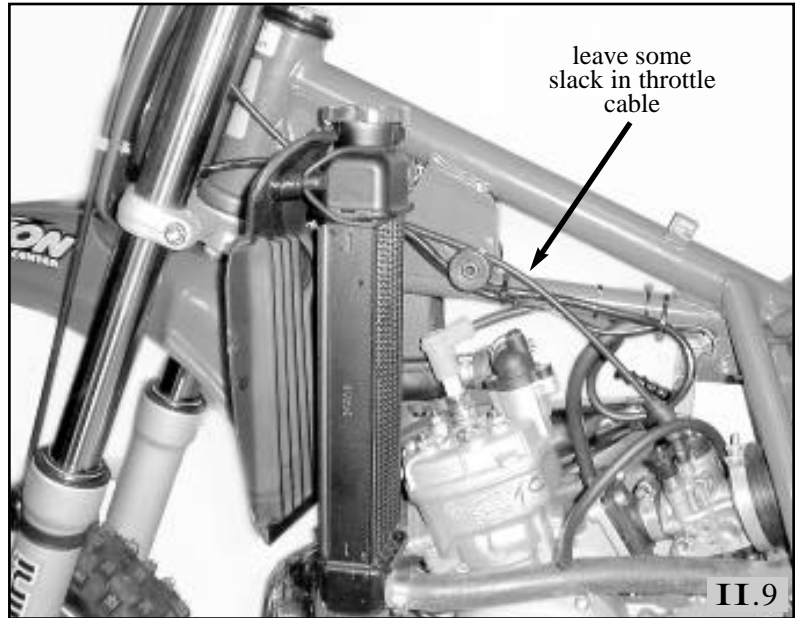
### 3. Chassis number, production year



Model &amp; year



Chassis number



Cable, hose &amp; wiring routing

### 4. Cable & hose routing

Route cables, hoses and wires as per photos II.9 and II.10. Be sure seal cable ends with tape and leave some slack in throttle cable near carburetor. Use a small zip-tie to secure cable boots and seal out dirt and water. Make sure to always replace vent hose onto vent fitting to prevent contamination of transmission. Check and clean carburetor vent hoses as needed to keep carburetor working properly. Clogged vent hoses can cause the carburetor to malfunction and can result in engine damage.



### 5. Fuel & oil requirements

**Fuel requirements** - Hi-test pump gasoline is recommended for your motorcycle with a minimum octane of 92-94. This octane rating is necessary to prevent possible detonation (pinging) and damage to piston from low octane fuel. If “pinging” or “knocking” occurs, check ignition timing, jetting, plug color, and piston dome for carbon deposits. An air leak can also cause these symptoms. **The fuel must be mixed with the proper type and amount of oil or severe engine damage will result.**

**Note:** Race fuel is not required unless the compression of the motor has been increased. Race fuel burns slower and will decrease the acceleration of the motorcycle. Even with increased compression, a 50/50 mixture of race gas and pump gas should be sufficient to prevent detonation.

**Oil requirements** - The fuel must be mixed with the proper type and amount of oil prior to fueling the motorcycle. The oil is required to lubricate the crankshaft bearings, rod bearings, piston, rings and cylinder walls. The transmission oil only lubricates the clutch and transmission, it does not lubricate the engine components in a 2 cycle engine. The oil must be specifically recommended for premix use in motorcycles or the oil may not provide enough lubrication, cause piston rings to stick, cause heavy deposits in engine and foul spark plugs, or separate from the gasoline. The use of Maxima brand K2 premix oil is strongly recommended. If this product can not be obtained, use a synthetic or semi-synthetic 2-stroke premix oil specifically for motorcycle use.

The oil must be mixed with the fuel at a ratio of 40:1 (40 parts fuel to 1 part oil) Graduated containers can be purchased which show the proper amount of oil for various quantities of fuel for any common ratio. One common type is called the “Ratio Rite™,” which can be purchased at most motorcycle stores. Otherwise, to obtain a 40:1 ratio, use 3.2 fluid ounces of oil per 1 gallon of fuel. (6.4 ounces for 2 gallons, 8 ounces for 2½ gallons, 16 ounces for 5 gallons, etc.) If measuring in liters, use 25cc oil per litre of fuel.

To mix oil with fuel, fill mixing container with ½ the desired amount of fuel. Add the proper amount of oil (for the total amount of fuel) to the fuel in the container. Tightly cap and secure vent on container, then vigorously swirl and slosh fuel to mix oil. Add other half of fuel and continue to mix thoroughly. Mix at least 1-2 minutes. Release fuel pressure using vent before opening container, be cautious of flammable fumes. **Never add oil to gas tank of motorcycle!** Always mix fuel and oil thoroughly in a separate container before fueling motorcycle, otherwise the oil will clog the fuel filter and jets in the carburetor and cause severe starting and running problems. Do not store gasoline any longer than necessary, as it loses its potency over time. An approved metal container is best for storage. Do not store fuel mixed with oil. Mix only enough fuel and oil to be used in a short time. Take great care that water or dirt does not contaminate fuel or gas tank.

## 6. Definition of units/conversions

- 1" = 25.4mm
- 1mm = .0394"
- 1cm = 10mm
- 1cc = 1 mL = .0338 oz. (fluid)
- 1 oz. (fluid) = 29.565 mL
- 1 oz. (weight) = 28.35 grams
- 1 gram = .035 oz. (weight)
- 1 liter = 1.057 quarts = 2.114 pints = 4.228 cups
- 1Nm = .102 m/kg
- 1m/kg = 9.804 Nm
- 1 lb. = 2.2 kg
- 1 ft/lb = 1.357 Nm = .1383 m/kg
- 1 barrel (beer) = 31 gallons
- 1 kilometer = .621 miles
- To covert degrees Fahrenheit to Celsius: subtract 32 and divide by 1.8
- To convert degrees Celsius to Fahrenheit: multiply by 1.8 and add 32.

For any other conceivable conversions you might need, consult [www.onlineconversion.com](http://www.onlineconversion.com)

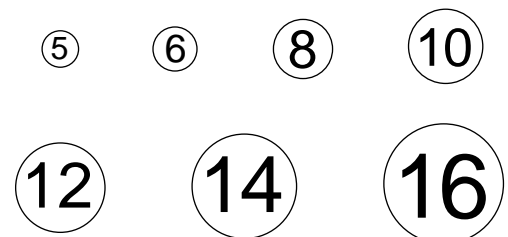
## 7. Torque values

- Alternator nut .....42 ft/lbs (57Nm)
- Brake rotor bolts .....
- Case bolts .....7 ft/lbs (10 Nm)
- Clutch nut .....42 ft/lbs (57Nm)
- Cylinder nuts.....10 ft/lbs (13.6 Nm)
- Engine mount bolt (front).....42 ft/lbs (57Nm)
- fork pinch bolts.....11 ft/lbs (15 Nm)
- Front axle .....37 ft/lbs (50 Nm)
- Front axle pinch bolt.....18 ft.lbs (25 Nm)
- Fork cap .....4 ft/lbs (5 Nm)
- Fork slider retaining bolt .....20 ft/lbs (27.1Nm)
- Fuel tank screw .....snug by hand only
- Handlebar clamps .....18 ft.lbs (25 Nm)
- Lower shock nut .....33 ft/lbs (45 Nm)
- Rear axle nut.....37 ft/lbs (50 Nm)
- seat bolt.....snug by hand only
- Spark plug.....20 ft/lbs (27.1Nm)
- Sprocket bolts .....
- Steering stem adjusting nut.....adjust by hand until play is gone
- Steering stem top nut .....18 ft.lbs (25 Nm)
- Swingarm nut .....37 ft/lbs (50 Nm)
- Upper shock nut .....33 ft/lbs (45 Nm)

### General torque values for fasteners not listed above

bolt size	hex head size	Socket head size	ft/lb	m/kg	Nm
5mm bolt	XXmm head		3.6ft/lb	.5m/kg	.5Nm
5mm screw			2.9ft/lb	.4m/kg	4Nm
6mm bolt	10mm head	.5mm	.7ft/lb	.1m/kg	10Nm
6mm screw			.65ft/lb	.9m/kg	.9Nm
8mm bolt	12mm head	.6mm	1.6ft/lb	.22m/kg	22Nm
10mm bolt	14mm head		2.5ft/lb	.35m/kg	35Nm
12mm bolt	17mm head		4.0ft/lb	.55m/kg	55Nm
14mm bolt	19mm head		6.1ft/lb	.85m/kg	85Nm
16mm bolt	22mm head		9.4ft/lb	1.3m/kg	130Nm

### Actual bolt sizes



note: bolt size refers to thread size, not the wrench size used on head of bolt!  
 bolt head sizes are for standard hardware, use torque values in service sections if provided.



## III. MAINTENANCE, ADJUSTMENTS & SERVICE PROCEDURES

### 1. Notes & warnings

Use caution when working on or around motorcycle. **Note that exhaust, engine, cooling system and brake parts may be extremely hot after operation. Be very cautious of moving parts, especially the chain and sprockets which can draw clothing, hair and fingers into sprockets, chain guard or chassis causing severe injury. Do not operate motorcycle in a confined area as exhaust fumes can be fatal.** This motorcycle is not equipped with a spark arrester and could discharge sparks from the muffler which could ignite any nearby combustible materials causing fire or explosion. **Do not use gasoline or other highly flammable liquids to clean parts or air filter. Fire or explosion may result. Mix gas and fuel motorcycle only in well vented areas free of sparks or flame. Note that gasoline fumes can travel long distances along the ground and readily ignite.** Safety glasses are necessary whenever working with oils or chemicals, whenever impact tools are used, or when tool breakage would result in flying metal fragments. Any mechanism with a spring has the potential for flying parts and eye injury. The rear shock is charged with nitrogen gas under very high pressure. It is not serviceable by the owner. **DO NOT** disassemble or discharge shock absorber. Use hearing protection to guard against exhaust noise, realize a helmet provides only limited protection from exhaust noise. When using wrenches, adjust wrench so it can be pulled rather than pushed to prevent injury if wrench or sockets slips. Use caution with open end wrenches as they can easily round off fastener heads.

### 2. Maintenance & lubrication schedule chart

**Air cleaner** - Clean and reoil daily or after each moto to prevent motor failure and reduced performance.

**Transmission oil** - change after every race, or at end of riding day.

**Chain** - check tension and lubricate before every ride, adjust or replace as needed. Reoil after riding in damp conditions.

**Clutch** - disassemble and clean clutch assembly frequently, every 2-3 races at least. Inspect kickstarter gears at this time.

**Ignition cover** - remove cover and wipe dry after each ride or after washing bike to remove condensation.

**Piston rings** - replace as often as every 3-5 races with expert rider, less often with less aggressive riders.

**Piston, pin, rod bearing & circlips** - replace as often as every 8-10 races with expert rider, less often with less aggressive riders.

**Coolant** - change yearly, make sure there is at least a 50/50 mixture of antifreeze if freezing temperatures are possible.

**Steering bearings** - Check daily for looseness or play. Adjust and regrease as needed.

**Swingarm** - Check often for looseness. Regrease several times a year. Replace bushings if any play is evident.

**Sprockets** - check for worn or curved teeth each time chain is adjusted.

**Chain roller & wear pads** - check roller for free rotation when checking chain. Make sure roller is not bent or damaged. Check chain wear strips on swingarm and chain guide frequently. Replace as needed to prevent chain from damaging motorcycle.

**Spokes** - Check after each race or after each day of riding for looseness or damage.

**Wheels & tires** - check wheels after each race for dents, cracks or other damage. Check tires for cuts, damage or wear. Check tire pressure daily and adjust for riding conditions.

**Shock** - Check shaft area daily for signs of oil leakage or damage. Check swingarm and shock bushings for looseness.

**Forks** - Check forks daily for leaking oil or damage to tubes. Make sure forks are not twisted check for smooth operation.

**Spark plug** - check sparkplug color and condition after each race or end of riding day. Adjust jetting to keep plug from fouling or overheating.

**Silencer** - If bike seems to be getting louder, replace packing and decarbonize inner tube.

**Expansion pipe** - check daily for large dents, damage or leakage. Remove carbon from headpipe when pipe is removed. Have large dents fixed, or any dents within 8" of the cylinder. Replace o-rings on pipe as needed to maintain a good seal.

**Footpegs** - check daily for proper operation, pegs should spring back into place. Make sure pegs are not bent or overly dull.

**Handlebars** - check bars after any crash for bending. Look for cracks near bar clamps. Replace bars that have been straightened more than 2 or three times, or if bar is badly bent. A weakened bar can snap suddenly causing injury to rider.

**Throttle** - check throttle for proper operation each time before bike is started. Remove and clean inside of grip and bar as needed.

**Grips** - check grips daily for wear or looseness. Replace as needed. Use grip glue & safety wire to help hold grips in position.

**Calipers & pads** - check pad wear and caliper function daily or after each race. Replace pads and clean calipers as needed.

**Brake lever** - check lever daily for damage or wear. Make sure lever is at proper angle for both seated and standing positions. Leave lever clamp loose enough to allow clamp to rotate during crash rather than breaking lever. Check and adjust freeplay as needed.

**Brake pedal** - Check pedal daily for damage and proper freeplay. Adjust rear caliper as needed.

**Reeds** - Remove and inspect reed block during every ring change. Check reeds for signs of wear, fraying and cracking. Make sure reeds sit flat and seal well. Replace at any sign of wear or damage or at least once a year, more often for expert riders.

**Nuts & bolts** - Check all nuts and bolts regularly. Make sure to check engine mounting bolts and swingarm bolt frequently.

### 3. Maintenance preparation

Before servicing, clean motorcycle to allow better inspection and repair, especially before any motor work to prevent dirt from falling into motor. Closely inspect entire motorcycle for broken or damaged parts on a regular basis.

## 4. Coolant

**Filling cooling system** - When engine is cool, unscrew radiator cap slowly to release any pressure safely. **Do not open when warm or hot!** Fill the radiator until liquid reaches opening. Wait a few minutes for the coolant to reach all the internal cavities, top off coolant as needed. Coolant must be visible over internal fins, but does not have to reach all the way to filler neck. Screw radiator cap back on. Start engine and run for a few minutes, making sure to engage clutch and spin rear wheel. After engine cools, remove cap and recheck coolant level. Add coolant if required. Screw cap back on. Coolant level must always be checked when engine is cool.

Check each day before riding, and after every race. If the radiators were just filled, some coolant will initially escape as the motor warms up. If coolant suddenly begins to discharge from the vent tube, look for a combustion chamber leak, improper timing, or lean jetting. Use motorcycle coolant only, automotive antifreeze contains abrasive silica and may damage water pump seals. Read container before use to determine if antifreeze needs to be diluted before use. Use antifreeze if freezing is possible to prevent engine damage. Engine Ice<sup>®</sup> motorcycle coolant is recommended as it will lower operating temperatures and is non-toxic. Keep ALL antifreeze away from children and pets!

**Note:** Water pump does not turn unless motorcycle is moving. Do not idle motorcycle for extended periods to prevent overheating.

## 5. Air filter cleaning

It is crucial to performance and engine life that the air filter be clean and properly oiled at all times. Proper cleaning is necessary to remove dirt which could severely damage the engine, dirt buildup will also cause the motorcycle to run very rich and lose power rapidly. The filter should be cleaned and re-oiled approximately every two hours of use under normal conditions, much more often during dusty or wet conditions. Cleaning filter or using a freshly oiled air filter before every race is advisable. If water is used to clean the filter, the filter **MUST** be completely dry before re-oiling, or the water will evaporate leaving un-oiled portions of the filter which will allow dirt and dust to pass directly into the motor. If the air filter gets soaked in water during use, it must be cleaned as soon as possible because the water can displace the filter oil. **Performance wise, having a clean air filter is the single most important item on the motorcycle and requires the most maintenance.** Purchasing one or more extra filters is a very good investment.

**UNDER NO CONDITIONS USE GASOLINE OR OTHER FLAMMABLE LIQUIDS TO CLEAN FILTER.**

In addition to creating an extreme fire hazard, these liquids will damage the filter foam over time, making it brittle and dissolving the glue used to make the filter.

1. Clean your filter with Maxima, Twin Air air filter cleaner, or kerosene to remove all the oil residue.
2. Next, wash your filter twice with dish soap and hot water. Rinse a third time. Do not stretch or twist the filter. Be careful not to damage or crush the seams at the corners of the filter.
3. Let filter dry **completely**, or else water will prevent oil from properly coating filter and will allow engine to suck dust through filter. Use a hair dryer or leave filter in the sun to dry it more quickly.
4. Now that filter is totally dry, hit the filter on your hand to get all the dirt out. If you do this over a piece of paper or cardboard you can see & hear the dirt falling onto it.
5. Now apply the filter oil, Maxima FFT Foam Filter Treatment is preferred as it is not prone to dripping into the carburetor and is resistant to washing out by water or gas vapors. Using a plastic bag, put your filter into it and pour in some filter oil. Totally saturate the filter with oil, making sure there are no dry spots. Squeeze out excess oil. Grease the groove on the air cleaner where it presses onto the airbox to prevent air leaks. Make sure to use extra grease in the corners. Install filter with arrow to front, making sure groove in air cleaner fits over sides of air box. Press filter cover over filter with arrow pointing to front to secure filter in place. Note that spray air filter lubes must also be liberally applied, then squeezed, then the excess removed to insure full coverage. For racing use, a long zip tie, or several attached together can be wrapped completely around air box and filter cover to insure positive retention.

## 6. Changing transmission oil

**Change transmission oil often to remove clutch wear particles and other contaminants from transmission. Changing oil frequently will greatly reduce the amount of clutch adjustment and cleaning required as well as reducing wear in the transmission.** Change oil after every race or at end of each riding day. Note that the Maxima MTL 75 transmission fluid is specifically formulated to extend clutch life **and is strongly recommended!**

To change the transmission oil, support motorcycle in a level position. Unscrew drain bolt on bottom of transmission cases using a 6mm allen wrench and remove drain screw from clutch side cover to fully drain oil. Drain oil while it is hot from riding to facilitate draining of oil and wear debris. Dispose of used oil properly. Replace the transmission drain bolt and torque to 15 ft/lbs, install and snug the transmission cover screw. Refill transmission using 10 oz. of recommended gear oil (Maxima MTL 75) through the upper level checking screw. The vent hose fitting can also be removed and oil added there. (vent hose fitting is behind the coolant hose at rear of cylinder) A ketchup squeeze bottle with a pointy tip is useful for injecting oil into screw hole. Mark the proper level on the container so the right amount can be dispensed in the future without measuring. Check oil level after filling.

To check oil level, support bike in a level position and remove oil level check screw from side of case (screw is below kickstarter). Oil should flow from hole. Add oil or allow excess oil to drain as required.

## 7. Seat removal

To remove seat, loosen large screw at rear of seat using a coin, or a wide, flat screwdriver. When screw is loose, lift up slightly on rear of seat and slide seat to rear to remove.

To install seat, note slot underneath seat at front. This slot must engage the bolt head on top of the fuel tank. Also note hook underneath seat. This hook will engage rear of fuel tank. Place seat on motorcycle with slot slightly to rear of bolt on tank. Slide seat forward, making sure slot engages bolt, and hook engages rear of tank. Push seat forward firmly, then snug screw at rear of seat. Do not overtighten. Make sure front of seat is properly installed by attempting to lift upwards.

## 8. Tank removal, checking, gas filter

To remove tank, first remove seat. Use phillips screwdriver to remove tank mounting screw. Disconnect vent hose from fuel cap. Check to make sure fuel valve is off, then remove fuel line from fuel valve. Lift tank upwards to remove. Make sure rubber pads located at front and rear of tank in recess that fits over frame do not get lost. A little weatherstrip cement can be used to secure the pads permanently to the bottom of the tank. **Use care in setting fuel tank down so that the fuel valve does not stick into dirt or debris and get clogged.** Make sure tank does not spill gas or vent fumes near flame or sparks.

To install tank, make sure fuel valve is not clogged with debris, run a little fuel into a container if there is any question and clean as required. Make sure two rubber pads are in place inside fuel tank frame recess. Line slots in tank up with two rubber cylinders on frame and lower tank onto frame. Install phillips bolt into grommet located to the rear and top of the fuel tank. Snug screw but do not overtighten. Reattach vent hose. Attach carburetor fuel line to fuel valve, making sure end of line is free of dirt or debris.

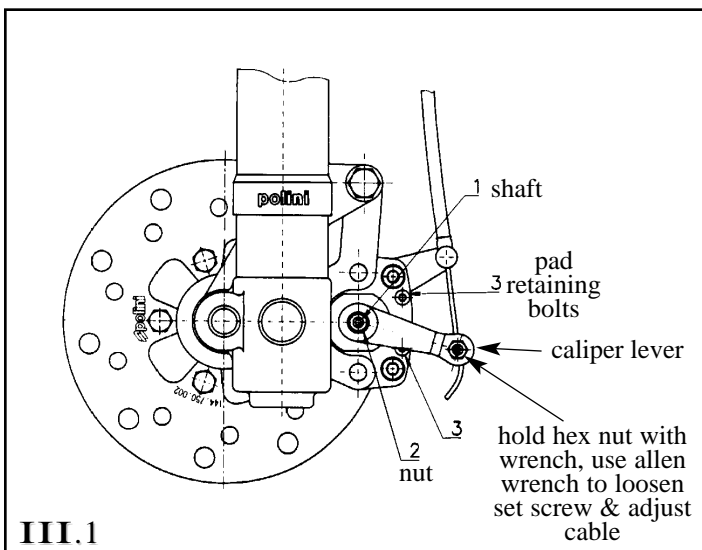
To check fuel filter, drain fuel and remove tank. Remove two screws attaching fuel valve to bottom of tank using an 8mm socket. Pull valve out of tank. Clean fuel filter carefully, do not attempt to remove filter from valve. Insert valve into fuel tank making sure o-ring is in place and not damaged. Install 2 screws and gently snug against valve. Do not overtighten screws or they will strip the threads in the tank. They only need to be snug for the o-ring to seal effectively. For racing use, you may wish to turn the fuel valve around so the lever faces inwards. It may be necessary to file the bump on the end of the lever for clearance.

## 9. Braking system

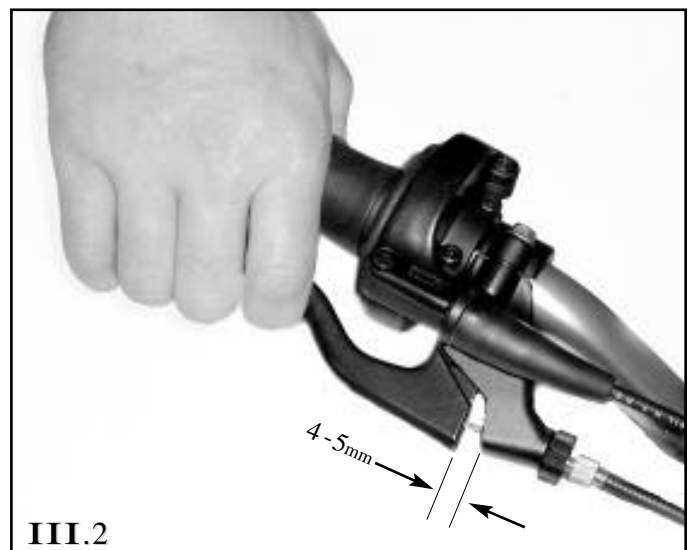
The motorcycle uses cable operated mechanical disc brakes. **Proper brake function is crucial for safe operation of motorcycle. For proper operation, they must be kept clean and lubricated and adjusted to specifications.** If brake pads are allowed to wear out, they may damage the discs, requiring costly replacement. Muddy conditions and improper servicing will lead to rapid brake pad wear and possible loss of braking. Calipers will need to be disassembled, cleaned and lubricated after riding in muddy or wet conditions.

Front and rear calipers are the same except for the mounting bracket. The foot activated rear brake can only be adjusted at the caliper, using the adjusting screw on the caliper and cable position adjustment. Replace brake pads when friction material is less than 1mm thick or if the pad surface is badly scored or damaged. Use grease cautiously when lubricating caliper assembly so that grease does not come out and contaminate the pads or disc.

Check brake rotors for damage, wear and wobble. If wear is noticeable check thickness of rotor several times across face, replace rotors if they measure less than 2.5mm (.098"). Use threadlocker on brake rotor bolts, and torque to **XX ft/lbs.**



Front caliper components, rear similar.



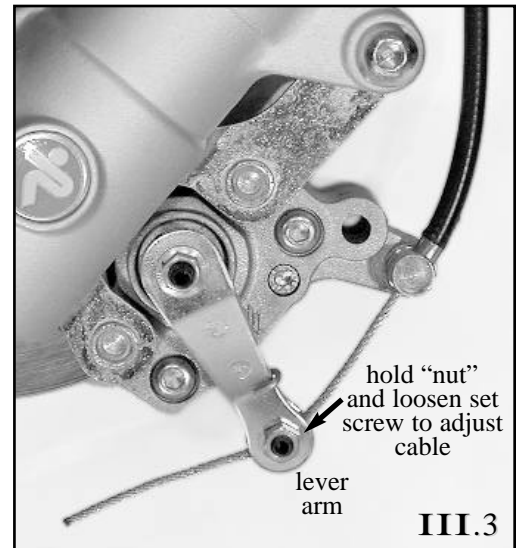
Adjust front brake lever play to 4-5mm as shown.

**Brake adjustment** - As the brake pads wear, adjustment to the caliper will become necessary to restore proper freeplay at the brake lever. A stroke of about 5-10mm should be obtained as measured at end of the caliper lever. To make this adjustment, unscrew caliper arm nut (2) and rotate threaded shaft (1) clockwise with a 2.5mm allen wrench until the correct stroke of the caliper lever is restored. Then, while holding the threaded shaft against rotation, tighten the caliper arm nut (2) again (to **60 in./lbs**), and check that the wheel is not dragging or locked. Make final adjustments at the brake lever adjuster as needed. See illustration III.1

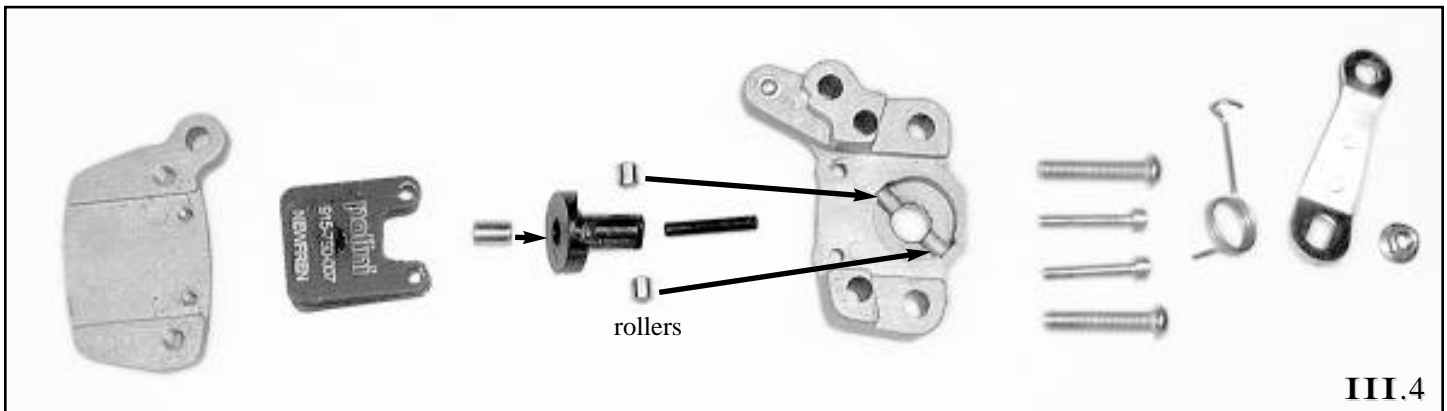
### Front brake caliper service

Support bike on stand with front wheel off ground. Remove front wheel. Loosen cable clamp screw using a 2.5mm allen wrench while holding cable clamp body with an 8mm wrench. Remove cable from arm. Be careful not to lose cable clamp assembly. Caliper will now slide off pins on mounting bracket. Remove two pad retaining bolts using a 3mm allen wrench and remove pads. Remove caliper lever using a 8mm wrench to remove retaining nut. Note position of lever spring. Remove two caliper housing bolts using a 4mm allen wrench. Push on lever shaft to remove caliper piston from housing, make sure not to lose two small rollers. Remove cylinder from center of piston. See photo III-4.

Clean caliper housings thoroughly, especially the piston bore. Clean piston assembly and make sure allen screw turns freely. Lubricate allen screw and piston cylinder carefully so excess lubricant does not end up on pads or disc. Lightly grease two rollers and insert them into piston bore, using a little grease to hold them in place. Lightly grease ramps on back of caliper piston and insert piston back into caliper housing. Assemble caliper housing using two bolts, torque to **XX ft/lbs**. Then insert pads with friction materials facing each other and install two pad retaining bolts and torque to **XX in/lbs**. Install lever spring and caliper lever and loosely install nut to retain lever. Push caliper onto mounting pins and reinstall front wheel. Spread pads to insert disc between pads. If disc will not fit between pads, turn allen screw on caliper lever shaft counterclockwise to loosen pad adjustment. Attach brake cable to caliper lever and adjust caliper free play. Tighten caliper lever retaining nut to 60 in/lbs. Adjust cable position and brake lever as needed.



Front caliper assembly



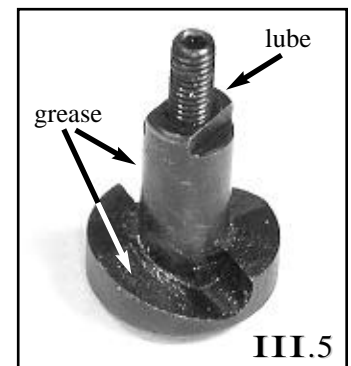
Exploded view of caliper assembly.

**Rear brake caliper service** - Support bike on stand with rear wheel off ground. Remove rear wheel. Proceed with service as for front brake caliper. Note that rear brake mounting bracket slot must engage pin on swingarm to prevent rotation, and that pedal freeplay is adjusted only at the caliper.

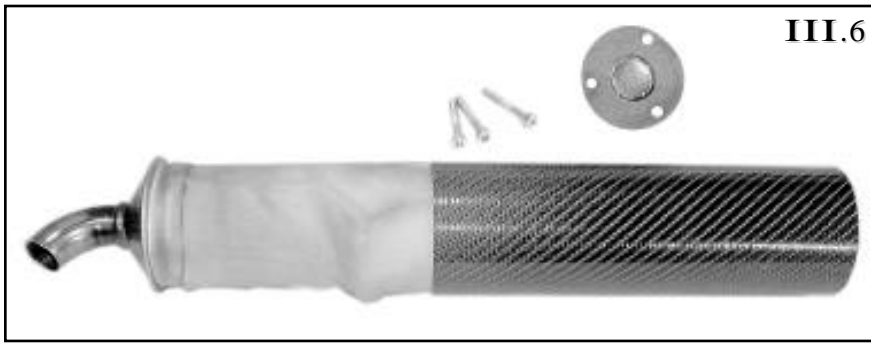
## 10. Expansion pipe & silencer, repacking

The exhaust system on your Polini needs regular service to properly quiet the bike and maintain peak power. The silencer uses fiberglass packing to reduce sound. If the packing becomes saturated with oil, or burnt and fragmented the exhaust gases will be much more turbulent in the silencer which will noticeably reduce power output as well as making the bike much louder.

The expansion pipe should be checked for cracks and large dents on a regular basis. Small dents on the pipe will not affect power much unless they are located within 6-8 inches of the cylinder. Make sure to replace the o-rings on the pipe when servicing motor. If the o-rings leak, power will be reduced in addition to the mess leaking oil will cause. When pipe is removed, check inside of pipe where it joins the cylinder for deposits of oil and carbon. Remove any deposits with solvent and a scraper. If cracks or holes are found, have welded or replace pipe. Most dents can be fixed by companies specializing in this service. Make sure pipe mounting spring(s) are in place and tight.



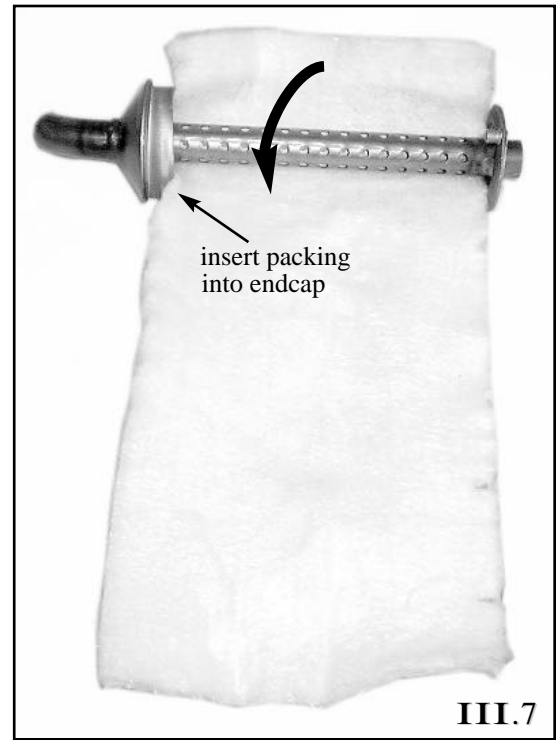
Grease ramps and rollers & lubricate adjusting screw



Inserting inner tube and packing into outer body.

**Repacking silencer** - To service silencer, remove right side panel/number plate. Remove bolt and clamp securing silencer to frame using a 6mm allen wrench. Twist and pull silencer off pipe. Remove three bolts at front of muffler using a 4mm allen wrench. Hold rear section of silencer with one hand and pull outer body of silencer off with other hand. Remove all remnants of silencer packing from both sections. If holes in inner tube are partially or fully clogged, use a drill bit of the proper size to remove the deposits from all the holes. Use a wire brush on the outside to help loosen deposits. Purchase fiberglass packing made for motorcycle silencers. If necessary, cut packing to the width of the silencer inner tube by about two feet long. Starting at one end, roll the packing material around the silencer inner tube, tucking the material into the endcap as needed. Wrap material snugly, but not so tight as to compress the material more than a little bit.

If the packing will not fit into the outer body, unroll the packing a few inches and trim off material until the outer body will fit snugly. Slide the outer body most of the way on, then seal the endcap with a light coat of silicone sealant to help prevent oil from dripping. Slide the outer body over the endcap, align the three holes and insert and tighten the three bolts. If oil drips out of silencer, a leaner main jet may be indicated. See section III-18 for testing procedure.



Roll new packing material around inner core.

## 11. Cables - adjustment & lubrication

Check throttle and brake cables frequently for binding or damage. Check for frayed ends or broken strands. Make sure cables have proper amount of freeplay. Cables can be lubricated with a special tool, available at most motorcycle stores. Replace cables often, lubrication will not fix a damaged or worn cable. Lubricating a cable will also attract dust, so inspect lubricated cables often.

## 12. Plastic care and cleaning

Cleaning bike frequently will keep motorcycle cooler and reduce weight. Mud can substantially increase weight of motorcycle. A clean bike is easier to inspect and service. However, be very cautious if using a pressure washer! The extremely high pressure water can cause considerable damage to wheel bearings, steering bearings, brake calipers, shock and fork seals, throttle grip, suspension bearings & bushings, carburetor, air cleaner and many other areas. Do not spray these areas directly, rather, work carefully around them to remove dirt but not force dirt or water into the bearing and seals of the motorcycle. At end of day, remove alternator cover and wipe any moisture out with a clean rag. The heating and cooling of the electrical system tends to cause moisture to condense inside the cover. If racing in mud, spray silicone or cooking spray heavily inside fenders and on number plates to help repel mud. Also spray a light coat on number plates to help keep numbers visible. Do not use any abrasive cleaners on plastic. Soft Scrub® cleanser seems to work well for cleaning dingy white plastic. Simple Green® is excellent for overall bike cleaning, and is non-toxic and biodegradable as well. It also works well for removing stains from riding gear. A light coat of WD40® will keep the bike looking shiny and new. A product called Plastic Renew® also does a good job of making plastic and decals shiny and repairing minor scuffs.

## 13. Footpegs

Check footpegs often for proper operation. Make sure they pivot freely and return smartly to level position when released. Bend spring for more tension or replace to maintain proper operation. Check pegs to make sure they are level, replace if they are bent. Points of teeth can be filed to restore them to their original condition, but for safety's sake do not make them overly sharp. Sharp teeth will also increase boot wear.

## 14. Vent hoses - carburetor, coolant & transmission

Make sure vent hoses are properly routed and not kinked or clogged at the ends. The carburetor vent hoses tend to get clogged at the ends, which can prevent the carburetor from working properly. The hoses should run between the end of the transmission cases

and the swingarm. The radiator overflow tube runs down the front left frame rail. Make sure the transmission vent line is properly secured and pointing to the rear of the bike so it does not tend to gather water. If the line is removed from the vent fitting, make sure to always replace it. Make sure the gas cap overflow hose is not kinked, twisted or clogged. Any obstruction can cause the tank to develop a vacuum, which will prevent gas flow to carburetor. See section II-4 for proper hose routing.

## 15. Reed valve, intake boots

Check rubber intake boots to make sure clamps are on in the proper location and are tight. Any leak will suck in dust and quickly destroy the motor. A leak between the carburetor and case will cause the motor to run lean, which will cause the idle to climb and could cause piston damage under heavy load. Check boots for cracks or punctures. The engine uses a reed block assembly to run properly. If the reeds are damaged, frayed or worn, the motor will have low compression and will be hard to start and down on power. If a reed breaks it will be sucked into the piston which can cause considerable damage. Check reeds whenever the engine is serviced, and replace reeds if they don't sit flat against sealing surface or if they show any visible wear at all. Use blue threadlocker on 4 screws securing reeds during reassembly. Install reed valve to case using a new gasket and torque 4 **Xmm** allen bolts to **XX ft/lbs**.



III.8

Reed valve assembly.

## 16.1 Engine Service - rings & piston

Under racing conditions, ring replacement is recommended every 10 hours of use, and piston replacement after every 20 hours of use. For practice and occasional race use, replace rings every 20 hours and piston every 30 hours or if power seems less than usual, the motor "pings" or becomes hard to start. Timely ring replacement will extend the useful life of the piston. Any excess ring wear will immediately and dramatically reduce top end power and will make starting more difficult. Always use new rings & circlips (2) when replacing piston, replacing rod bearing and pin with each new piston is also a good idea. Use of a high quality synthetic or semi-synthetic premix oil such as Maxima K2 will greatly extend piston life and reduce spark plug and muffler fouling.

### Piston & ring removal

Clean motorcycle thoroughly to prevent dirt from falling into motor.

**Remove seat** - Remove screw at rear of seat using a large flat screwdriver, then pull seat rearward and up.

**Remove fuel tank** - Remove fuel tank mounting screw using a large phillips screwdriver. Pull end of vent hose out of gas cap. Make sure fuel valve is off, then pull rubber hose off fuel valve. Pull tank off motorcycle and set aside away from fire or sparks, taking care that fuel does not spill. Make sure to cover end of fuel valve, or prop off ground to prevent dirt from entering it. Do not lose two rubber insulators under gas tank.

**Remove expansion pipe** - Remove spring(s) attaching pipe to cylinder. A tool can be purchased from your local dealer or Action Racing which will ease this task. (See photos III-9 and III-10)

Remove lock nut from rubber pipe mount (located on right frame rail near exhaust springs) Gently twist pipe side to side and pull forwards to detach it from cylinder exhaust extension. When pipe is free of cylinder, turn front wheel to right, then continue to pull rear of pipe out of muffler. When pipe is free, pull it forward, and then rotate top of pipe outward (see photo III-11) and carefully guide pipe out of frame rails. Do not force pipe.

Remove exhaust extension by removing two socket head screws using a 5mm allen wrench. See photo III-12.

**Drain coolant** - Make sure bike is cool. Loosen radiator cap. Put a container under bike to collect coolant. Remove socket head drain bolt (see illustration III-13, III-15) using 4mm allen wrench and allow coolant to drain. Remove cap and lean bike to help insure complete draining. Make sure copper sealing washer is on bolt, then re-install bolt **snugly** to prevent loss.



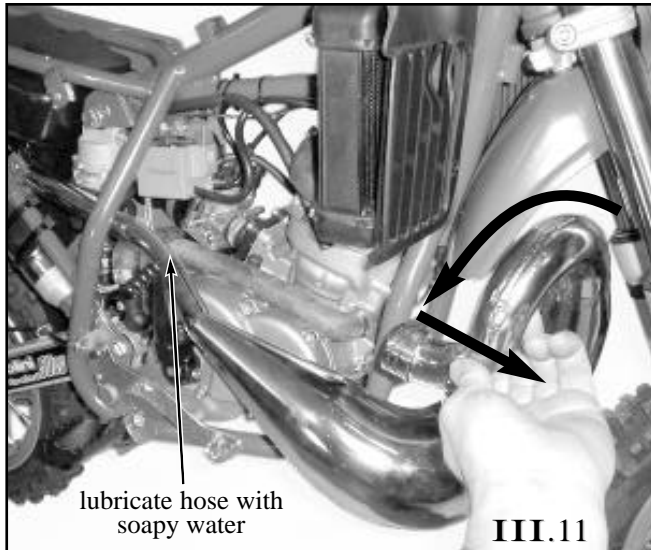
III.9

Remove 2 springs, and nut from exhaust mount.

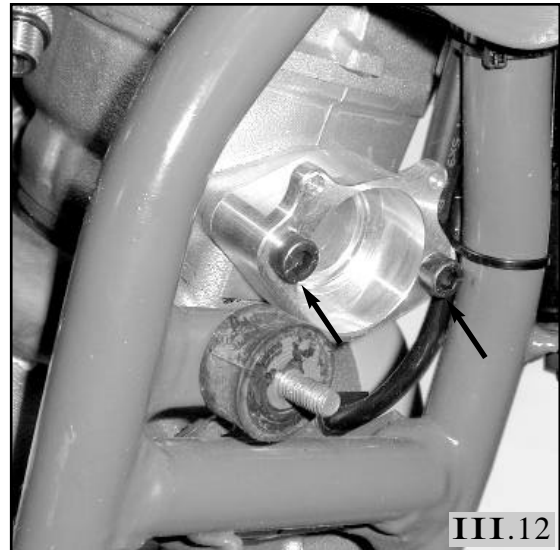


III.10

Homemade spring removal tool.



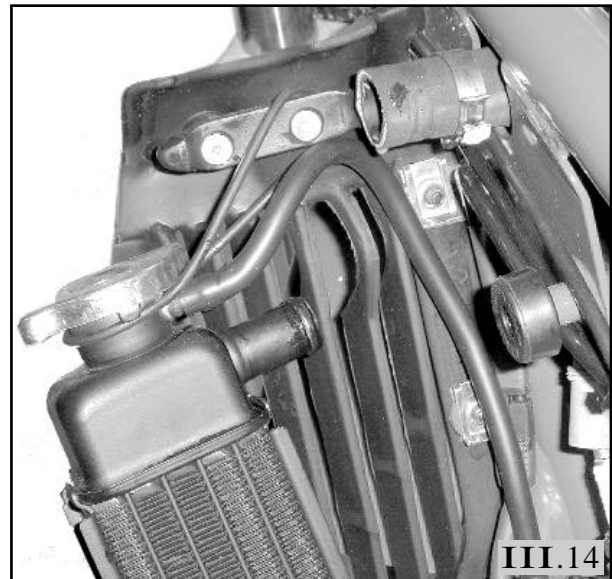
III.11  
 Rotate pipe outward and ease rear portion of pipe through frame. Note position of front wheel.



III.12  
 Remove exhaust extension using 5mm allen wrench.



III.13  
 Remove radiator cap & drain coolant using bleed screw



III.14  
 Hang radiator to side using rubber o-ring

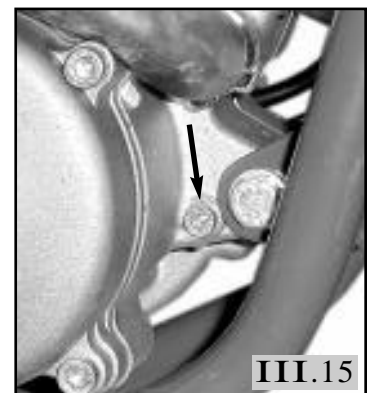
**Move radiators to side** - remove hose clamp (by prying end of clamp with flat-bladed screwdriver) and hose attached to cylinder head. Loosen clamp on hose on top of left side radiator (where hose goes through frame). Unhook rubber cord retaining radiator at top.

Pull top of radiator out of hose, then lift radiator up to disengage lower mounting pin from frame mount. Hang radiator to side using rubber cord (see photo III-14)

Loosen clamp on hose at top of right side radiator. Pull hose off of radiator from left side of frame, then remove clamp if it didn't come out of frame cavity with hose. Pull top of radiator away from frame, then lift up to remove. Clean front frame tube and frame tube over motor.

**Remove spark plug** - using  $\frac{13}{16}$ " (21mm) wrench for NGK plugs,  $\frac{5}{8}$ " wrench for original Champion plug.

**Remove cylinder nuts** - Remove 4 nuts on top of cylinder head using a 10mm wrench. To prevent warpage, loosen nuts  $\frac{1}{4}$  turn at a time using a criss-cross pattern until finger tight, then remove.



III.15  
 Coolant drain screw

**Remove cylinder head** - Lift up on cylinder head to remove. Rock side to side to loosen if necessary. **DO NOT** insert a screw driver or other implement between head and cylinder as damage will result! Small o-rings may stick to underside of head, take care not to lose them. Lift up on combustion chamber to remove from cylinder. Do not lose o-rings on underside, remove from head to prevent them from dropping into engine. Wipe up any coolant or dirt on cylinder or piston.

I  
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**Remove cylinder** - Lift cylinder straight up on studs. Rock cylinder to loosen as required - DO NOT pry between cylinder and cases. When cylinder nears top frame rail, angle cylinder rearward to match angle of top frame rail. Using care not to scratch inside of cylinder on studs, slide cylinder forward about 1 inch, then remove cylinder from right side. The front studs will pass through the center opening of the lower cylinder walls.

If unable to remove cylinder, remove front studs by threading two nuts onto end of stud, tightening the two nuts against each other, and then removing the stud by turning the lower nut with a wrench. Using a clean rag, immediately wrap rag around bottom of connecting rod and cover top of crankshaft area to prevent dirt, circlips, or other parts from falling into motor and necessitating engine removal and disassembly!

**Remove piston** - Hold piston in one hand, then use a pair of needlenose pliers to squeeze ends of piston circlip together and remove circlip. Do not squeeze ends more than required to remove circlip. Make sure not to drop circlips into motor! While supporting piston, push piston pin away from remaining circlip and out of piston and set aside. Remove piston by lifting straight up. Remove rod bearing from end of connecting rod.

## Inspection

Clean all parts thoroughly, then carefully examine all parts for wear, cracking or signs of leakage. Look for signs of blow by on piston skirt. A good, thorough inspection will prevent unsolved problems from causing the motorcycle to fail. Order any parts needed right away to prevent delays. Inspect the cylinder bore for scratches or other damage. The aluminum alloy cylinder is coated, it can not be over-bored and must be replaced if oversize or badly damaged.

Inspect piston closely inside and out for scratches, cracks or other damage. Excessive scorching below ring is cause for replacement. Examine piston pin for wear, then check fit of pin in piston. There should be no noticeable slop. Put rod bearing in end of rod, and fit piston pin through bearing. Lift straight up on pin to check for any play. Replace bearing and pin when installing new piston kit.

Pull straight up on connecting rod. If any play is detected, use a dial indicator to check amount of play. Check side clearance of crankshaft using a feeler gage between bottom of rod and side of crankshaft weight. A feeler gage larger than .030" should not fit. Have crankshaft rebuilt or replaced as needed.

Fit new ring into top of cylinder bore about  $\frac{1}{2}$ ". Insert piston from top upside down just enough to make ring square in bore, then remove piston. Check gap between ends of piston ring using feeler gages. A problem exists with the ring or the cylinder if the gap is less than .004" or more than .012". Resolve before proceeding.

Examine head, combustion chamber and cylinder for signs of coolant or combustion leakage. Replacing o-rings is recommended every time engine is disassembled, especially the highly stressed combustion chamber o-ring. If motor overheats and coolant overflows, suspect a failure of the combustion chamber o-ring.

Check flatness of cylinder head and combustion chamber sealing surfaces using a sheet of glass, surface plate, or other very flat surface. Replace or machine as required. If reusing piston, remove any carbon deposits on top of piston dome using solvent and a brass or plastic scraper. Use end of old piston ring to clean ring groove(s). Be careful not to scratch or damage piston. Remove any carbon deposits from exhaust port using solvents and a soft scraper.

If the rings are changed regularly, and the piston, piston pin and rod bearing are changed whenever any wear is evident, the air filter is scrupulously maintained to prevent dirt from entering the motor, and a high quality premix oil is used at a 40:1 ratio, then thorough visual inspection and part replacement will be all the service that is needed for quite some time.

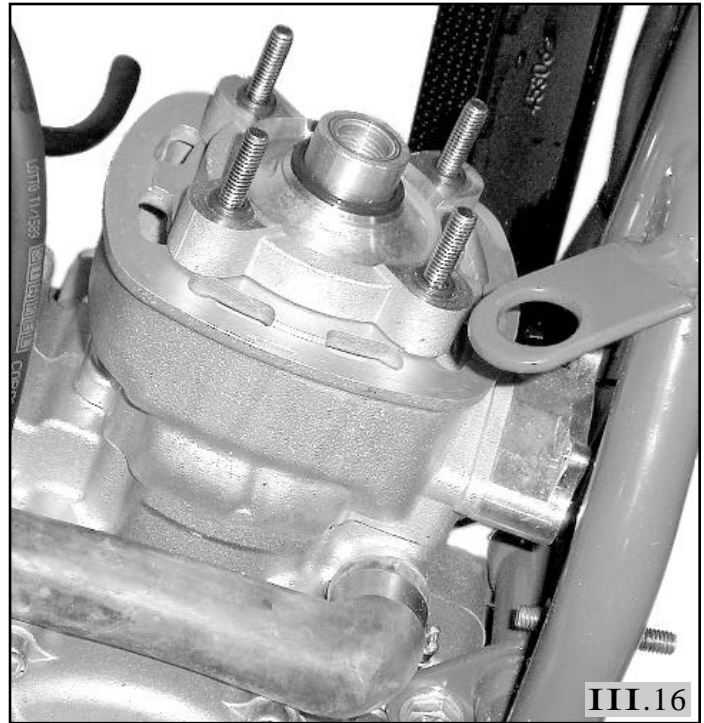


Photo of combustion chamber. Note o-rings on spark plug boss and cylinder studs.

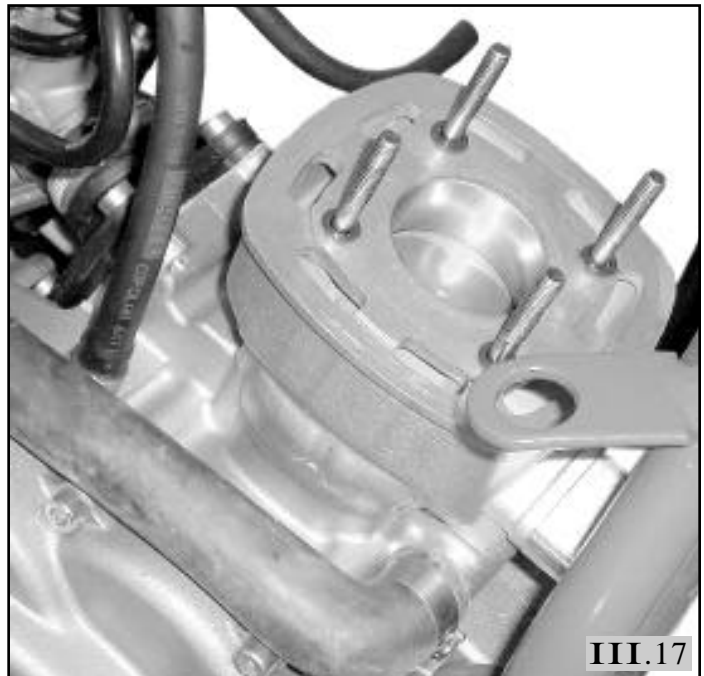


Photo of cylinder and piston dome. Note o-rings on studs.

If new rings and/or piston does not seem to restore the normal amount of power and the usual starting and running still suffers, then bring the motor to a machine shop for a thorough inspection using precision measuring tools.

This detailed inspection follows below.

**Engine tolerances** - Measure piston OD as shown in illustration III-18.

Measure cylinder bore from front to rear near the top, in the middle and near the bottom. Check again from side to side in the same manner. Calculate piston to cylinder clearance using the largest cylinder measurement and the piston measurement.

**Piston to cylinder clearance** = (cylinder bore - piston size)

Piston to cylinder clearance should be between .03mm and .07mm

Check the engine compression while the bike is new, and again after it is broken in and write it down. To check compression, remove spark plug and screw in hose snugly for compression gage. Hold throttle wide open, and cycle kickstarter several times. Record highest pressure reached. If testing at a later date reveals a much lower compression, suspect a badly worn or stuck ring, a leaking combustion chamber o-ring, cracked or damaged reeds, clogged air filter, or leaking crankshaft seals. Rings can be worn but still record a compression test near normal. A leakdown test is a much better indicator of ring seal and motor condition. This test measures leakage of rings as a percentage. A special tool is required for this test and a source of compressed air. If bike was overheating badly and discharging coolant, look for a leak from the combustion chamber or cylinder into coolant passages.

**Cylinder ID - Iron cylinder: 40.0 - 40.015mm new, 40.030mm max**

**Aluminum cylinder: 40.180 - 40.220mm new, 40.230mm max**

**Piston to cylinder clearance: .030mm min, .070mm max**

**Ring Gap: .45mm max**

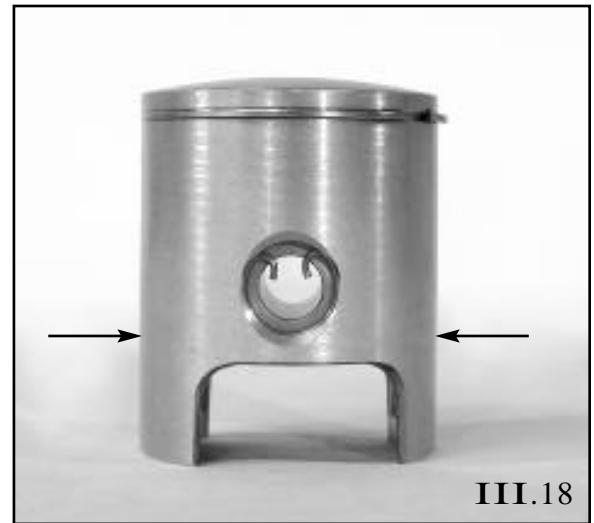
### Reassembly

Clean all parts thoroughly before assembly!

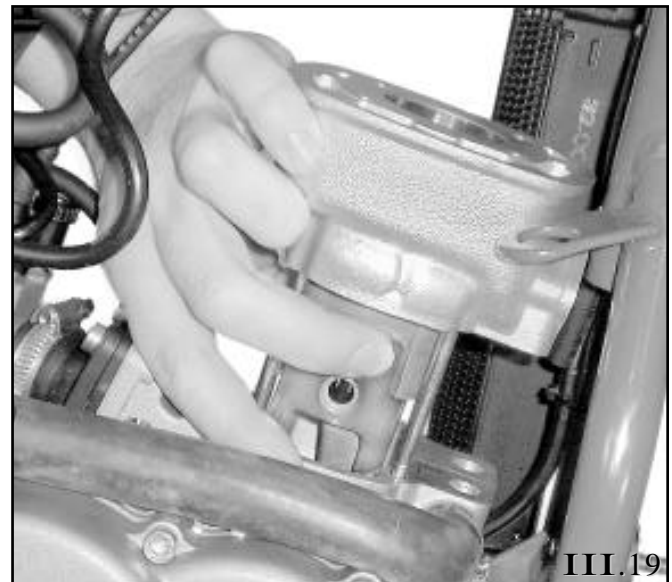
**Piston ring** - Remove old ring by spreading ends of ring with fingers and lifting off piston. Run end of old piston ring along piston ring groove to clean it being careful not to scratch piston skirt (if re-using old piston). Install new ring by spreading with fingers the least amount possible, and easing ring over top of piston and into ring groove. Align gap in ring with pin in piston groove. Works model single ring does not have a top or bottom side.

**Rod bearing** - Lube inside of rod bore with premix oil. Lightly coat rod bearing with premix oil and insert into rod bore.

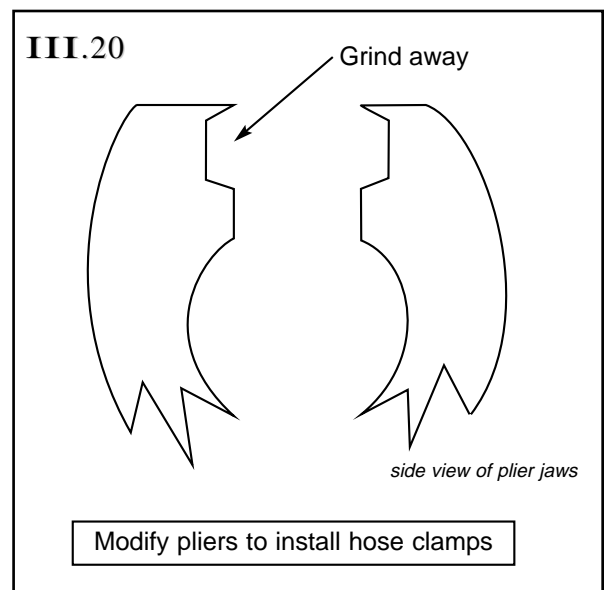
**Piston** - Install one circlip into piston with opening to top of piston. Lightly coat sides of piston, pin bores and ring with premix oil. Note arrow on top of piston, it must point to front of motorcycle. Lower piston over connecting rod and line up holes in piston with rod bearing. Insert piston pin through piston and bearing and snug up to circlip. Install 2nd circlip into piston with open end up. Make sure both circlips are fully seated into their grooves. **DO NOT re-use circlips.** They loose tension with each installation and could become loose and severely damage the motor.



Measure piston diameter at points indicated. Note position of circlip when installing.



Squeeze ring(s) on both sides of piston when inserting into cylinder. Make sure ring(s) are centered on alignment pin(s).



III

**Cylinder** - Coat both sides of the base gasket with a thin coat of RTV silicone sealer, especially around the water passages. Install the base gasket onto the base of the cylinder and line it up with the casting. Slide the cylinder into position over the cylinder studs, then lower it onto the studs. When cylinder nears the piston, prop the cylinder in position over the piston. Make sure the piston ring gap is centered over the alignment pin in the ring groove at the left rear of the piston. Using your thumb and forefinger, reach around the piston and compress the piston ring into its groove on both sides, making sure the ring gap is still centered over the alignment pin in the ring groove. Line the piston up with the cylinder bore and lower the cylinder and/or raise the piston until the top of the piston and the piston ring enter the cylinder. If the piston won't slide into the cylinder, do not force it. Remove the piston and try again. The ring must be compressed to enter the base of the cylinder, and the piston ring gap must line up with the alignment pin in the ring groove. Insert the piston into the cylinder as far as possible, then lower the cylinder onto the cases. See photo III-19.

**Head** - Using a little premix oil, stick the large o-ring into its groove in the underside of the combustion chamber. Place 4 small o-rings over cylinder studs and against top of cylinder. Making sure the o-rings stay in place, slide the combustion chamber over the cylinder studs and down onto the cylinder. Install the large o-ring around the spark plug hole and the 4 smaller o-rings on the cylinder studs. Install the large o-ring gasket into the groove of the cylinder head and install it on top of the combustion chamber. Thread the 4 cylinder nuts onto the cylinder studs finger tight. Check to make sure the cylinder fits the cases tightly and the cylinder head fits the cylinder tightly. Torque the cylinder nuts in 3 stages using a criss cross pattern each time. Tighten using a good quality torque wrench to 3 ft/lbs, then 6 ft/lbs, finally to 10 ft/lbs. Install spark plug and torque to 20 ft/lbs.

Reinstall radiators in reverse order. Use a pair of pliers modified as per illustration III-20 or a CV joint clamp plier (available at autopart stores) to snap the hose clamps closed again. Bolt exhaust extension in place and torque bolts to **10 Nm**. Guide expansion pipe through frame and insert rear of pipe into muffler. Lubricate o-ring on front of pipe, then insert front of pipe into exhaust extension and twist pipe back and forth while pushing to fully install pipe.

Hook spring(s) onto exhaust extension, then hook onto pipe. Install lock nut on rubber mount and snug — do not overtighten. Replace fuel tank and rear seat. Do not tighten tank or seat screw excessively. Add motorcycle type coolant to radiator until full. Put bike on stand with rear wheel off ground. Start bike and rev just enough to circulate coolant. Recheck coolant level and add coolant as needed. Follow instructions for break-in (Section I-4) to maximize piston and ring life.

## 16.2 Crankcase & Transmission

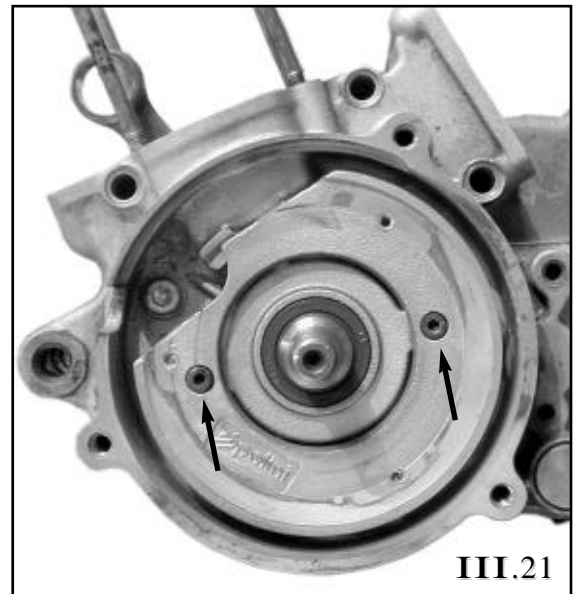
### Disassembly

**Remove engine from frame** - Remove seat and fuel tank. See section III-16.1 for removal of the following items. Remove exhaust pipe and exhaust extension. Remove carburetor from airbox & engine boot and set off to side. Drain coolant and remove left radiator. Disconnect radiator hoses from water pump cover. Remove hose and water outlet from top of cylinder head. Drain transmission oil. Loosen chain, remove sprocket guard, remove external snap ring and remove front sprocket from counter shaft. Remove vent hose from fitting on engine. Remove brake pedal. Remove ignition cover. Make an index mark on stator and case with magic marker or pen to help with retiming the motor on reassembly. Remove spark plug & install piston stop tool. Use puller to remove flywheel - see section III-20. Remove three phillips head screws and remove stator from engine, making sure to remove wiring grommet from case so it does not pull on stator wires. Set stator to side. Remove stator mounting plate using 3mm allen wrench. See photo III-21.

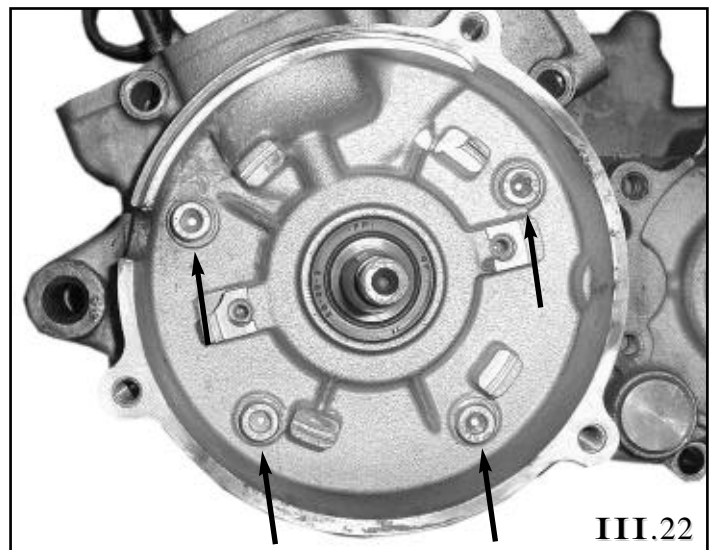
Remove kickstarter and clutch cover. Using piston stop tool, remove clutch nut and remove clutch assembly from crankshaft, see section III-17. Remove front motor bolt, then remove rear swingarm pivot bolt. Pull engine upward and forwards to disengage from swingarm, and remove from frame on left side.

Remove cylinder head, cylinder, piston and reed valve assembly - See sections III-15 and III-16.1

Remove 11 case bolts from left side of engine using 5mm allen wrench, including 4 under stator mounting plate. See photo III-22. Fit case splitting tool over crank shaft on right (clutch) side of engine as shown. Install bolts to secure tool to engine case.



Remove stator plate to expose 4 case bolts



Make sure to remove 4 case bolts beneath stator mounting plate.

Use 6mm allen wrench to turn forcing screw and begin to separate cases. See photo III-23. Turn forcing screw a little at a time. If it seems to require a lot of effort, check to make sure all the case bolts have been removed. Do not use screwdriver to pry cases apart! The transmission gears will not be able to separate during this process, so the countershaft will have to pull through the left case as the cases separate. Gently tap on the splined countershaft to ease it through the seal and bearing and allow the left side case to be removed.

**Crankshaft** - Use the crankcase splitting tool again to remove the crankshaft from the left side case. Inspect the bearings for wear or damage. Rotate bearings and check for rough or loose areas. Do not spin bearings dry or with compressed air as damage will result. If bearings need to be removed from crankshaft, use a bearing puller and a press. Rotate connecting rod and check for play or binding of the big end rod bearing. Check flywheel and clutch mounting surfaces for wear, damaged keyways or threads. If possible, use a dial indicator to make sure both sides of crankshaft are true and do not wobble. Have crank serviced or replaced as needed.

**Note:** install crankshaft seals after crankshaft has been installed and both cases put back together. If the seal is installed before crankshaft installation, the seal may be damaged or pushed out when cases are put back together.

**Transmission** - If the transmission gears or shafts need servicing, remove the nut and then the large driven gear (just to the rear of the clutch assembly). On newer models, the gear is splined and can easily be removed. On older models, the driven gear fits snugly on the transmission mainshaft using a keyway. A puller may be needed to remove the gear if the cases are not split. If the cases are split and a puller is not available, put a metal dowel on the end of the mainshaft and tap gently on the end of the dowel with a hammer. Do not attempt to remove the transmission shafts without removing this gear first, as the water pump drive gear will not allow the countershaft to move outward far enough for removal if the mainshaft is not free to move.

Inspect the gears, shafts, and bearings closely for damage, bending, or excessive wear. Also check the cases for damage or cracks around the bearing bores and the swingarm pivot boss. Welding the cases is not recommended due to potential warpage. Replace any damaged parts.

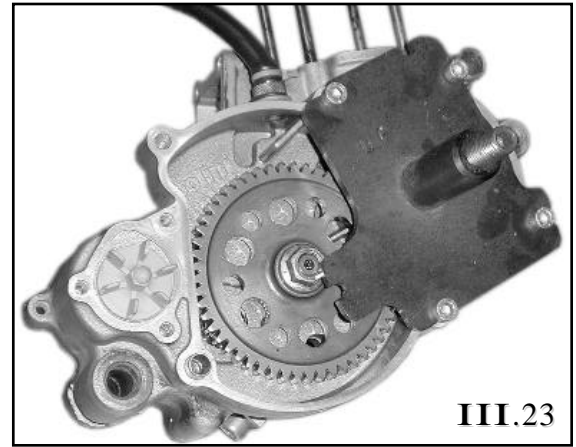
**Reassembly** - Make sure all gasket material has been removed from the engine cases and any dirt or debris flushed away. Always replace seals and gaskets with new parts. Lubricate crankshaft bearings with clean premix oil. Install crankshaft bearing as far as possible into right & left cases. Use a large socket to press bearings into place by pushing on the outer bearing shell only. Use a press if available, otherwise use a hammer to tap bearings evenly into place.

Position crankshaft into right side case, making sure connecting rod points up between cylinder studs. Squeeze crankshaft into case by hand while tapping crankshaft counterweight gently with a brass or plastic hammer in a criss cross pattern to seat crankshaft into right side case.

Install transmission shafts and gears into right case (if removed previously). Check gear alignment to make sure the gears engage fully and turn smoothly. Check that the countershaft gear drives the water pump assembly properly. Lubricate the transmission shaft bearings bearing with transmission oil, and the connecting rod bearing with premix oil.

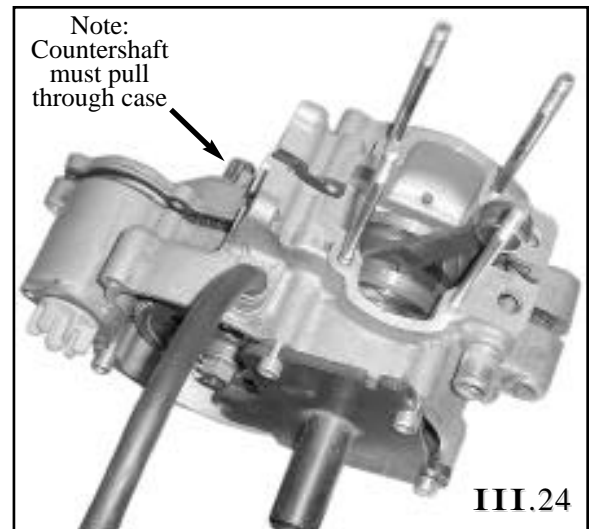
Check that the 2 case alignment dowel pins are in place. Coat case gasket with high tack adhesive, then align gasket and install over dowel pins.

Place left side case over crankshaft and align transmission shafts with bearings in case. Squeeze cases together by hand, then use a brass or plastic hammer to gently tap left case around flywheel and transmission area to ease cases together. If necessary, use two C clamps on front and rear mounting bosses to help pull cases together while tapping with hammer. Do not use excessive force, stop and start over if cases will not come together without damage. When cases are close enough together, check to make sure gasket is



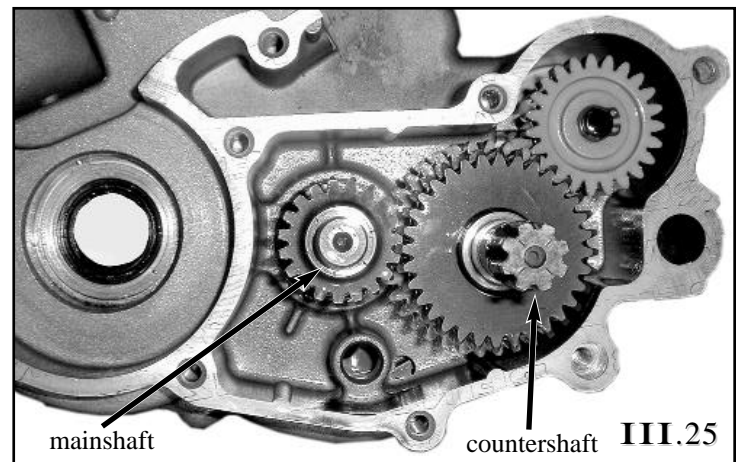
III.23

Install case splitting tool as shown.



III.24

Use case splitting tool to separate cases.  
Do not pry between cases!



III.25

Driven gear (opposite side) must be removed before transmission shafts can be removed from case.

properly in place and install 11 case bolts. Bolts can be gradually tightened in a criss cross pattern to bring cases fully together. Tighten case bolts to 10 ft/lbs. Using a brass hammer, tap gently on both ends of crankshaft to help center crankshaft in cases. Crankshaft should spin freely at this point. Tap gently on transmission mainshaft and countershaft, make sure they turn smoothly without binding. If the driven gear was removed, replace it using an impact wrench if available. Use red threadlocker on nut. If impact wrench is not available, a metal dowel can be inserted through hole in gear into recess in case to prevent gear from turning while nut is torqued to 43 ft/lbs.

Rotate driven gear and make sure countershaft and water pump impeller turn smoothly. Install new countershaft seal. See following section to install crankshaft seals. Install stator mounting plate using medium strength threadlocker on the bolts, and torque to 50 inch/lbs. Be careful not to over-tighten and strip bolts! Install stator assembly loosely, lining up alignment marks made previously, then install flywheel and torque nut to 42-45 ft/lbs. The ignition timing will need to be checked, and the stator centered and tightened when the cylinder, piston and head have been installed. See section III-20 for procedure. Install clutch assembly and clutch cover, and install engine into frame. Replace other parts in reverse order.

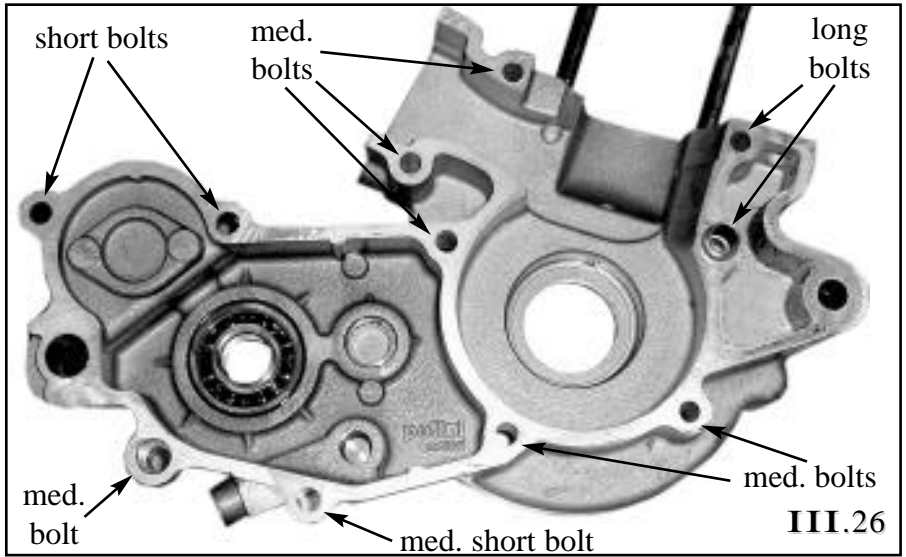
**Crankshaft seals** - Seals should be replaced every time cases are split. Also, if motor develops an air leak or seems to be burning oil, replace crankshaft seals. If seals need to be removed without splitting cases, a removal tool can be made by bending a screwdriver tip into a hook. Make sure there are no sharp edges to scratch the crankshaft. Gently work the tip of the hook under the seal lips, then pull the shaft of the tool outward to rotate the hook under seal. Jerk handle firmly to remove seal. See photo III-28.

To install seals, begin by lubricating both sides of the crankshaft lightly with grease where the seals will go. Lubricate the lips of the seals with grease, then guide the first crank seal over the crankshaft and start into the seal bore by hand. Make sure the lip of the seal is not rolled over before pushing the seal into the case. A blunt punch may be used to gently force seal into position, work side to side a little at a time until the seal is flush with the case. Do not push seal further in than flush. Repeat procedure on other side.

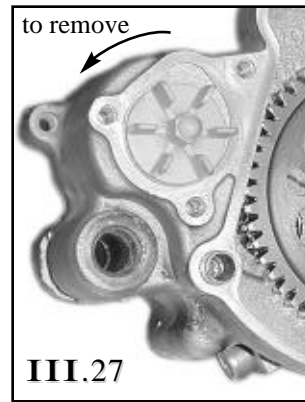
**Waterpump** - The waterpump will need service if the impeller shaft is seized, does not turn freely, slips, or the shaft seal allows coolant into the transmission oil. A quick check for function can be performed by putting the bike on a stand with the rear wheel off the ground, removing the waterpump housing and turning the plastic impeller in a clockwise direction. Turning the impeller by hand should be enough to rotate the rear wheel.

If the impeller turns but the rear wheel doesn't, either the impeller threads are stripped or else one or both of the plastic water pump drive gears are stripped inside the transmission cases. Replacement of the impeller, water pump cover or cover seal can be done by removing the water pump cover. Servicing the water pump shaft seal, bearings or drive gears requires splitting the engine cases.

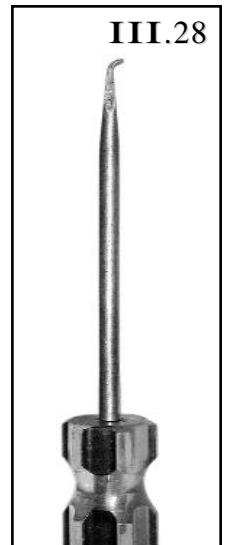
To service water pump, remove engine and split engine cases. Remove water pump cover by removing 3 bolts using a 5mm allen wrench. Remove impeller by twisting counter clockwise. Remove water pump gear by removing outside snap ring and



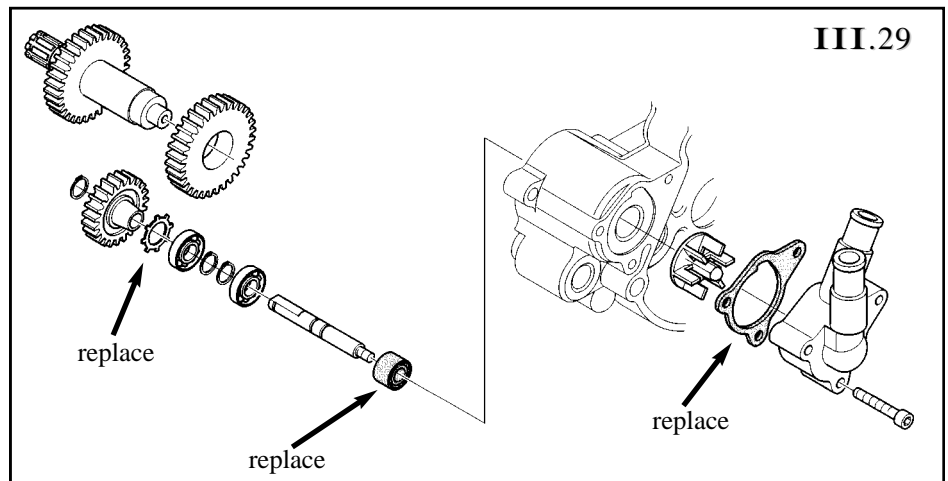
View of left side case.



water pump impeller



Seal removal tool



Water pump diagram

III

pulling the gear off the shaft. A disposable spring retainer is used to hold the waterpump shaft assembly into transmission case. Being careful not to damage waterpump shaft, use a screwdriver to pry the retaining ring out of the engine case. It will be necessary to bend or break the retaining ring to remove it. Once the retaining ring has been removed, the water pump shaft and bearings can be pushed out of the case from the impeller side. Push the waterpump seal out from the inside of the case. Inspect the water pump shaft for bending, wear or damage. Make sure the bearings turn freely and do not have excessive play or any roughness. If water pump is serviced, always replace waterpump seal and retaining ring with new ones.

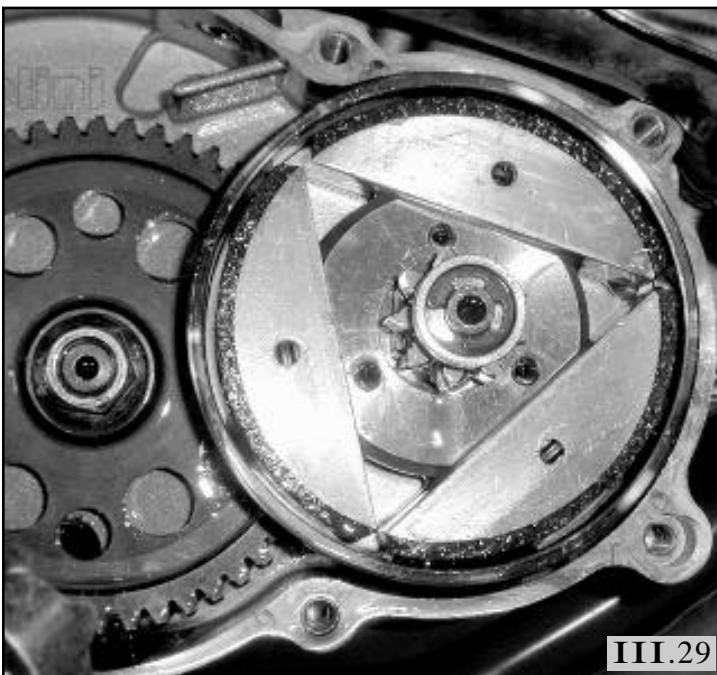
To install waterpump assembly, lubricate seal and press into place from outside of case. Install bearings onto shaft and lubricate shaft and bearings with oil. Push shaft into case from inside, being careful not to damage the seal. Push in new retaining ring using a deep socket that fits over waterpump shaft. Do not use excessive force to install retaining ring, or you may damage it. Install gear onto shaft and replace snap ring. Install impeller by threading on by hand in a clockwise direction. Do not over-tighten and strip impeller threads. Install a new o-ring into water pump cover and install bolts. Snug bolts, but do not over-tighten or housing will leak.

## 17. Clutch & kickstarter assemblies

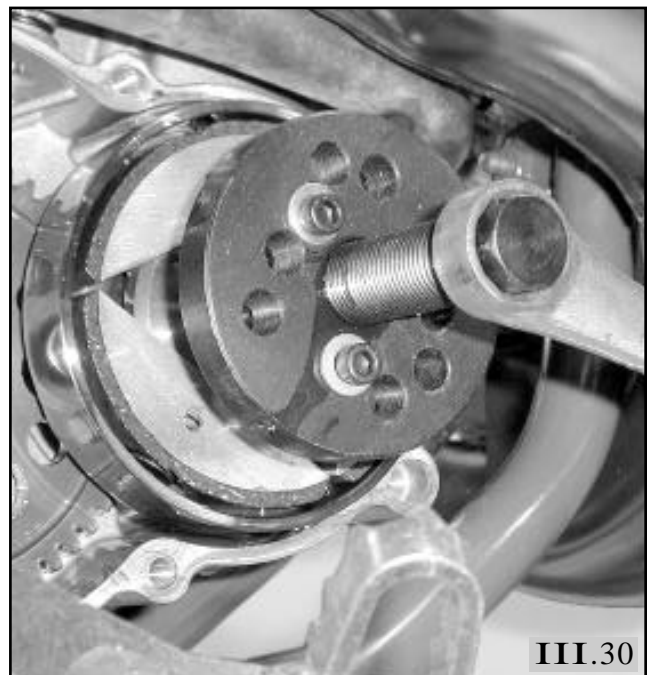
The works models use a custom 3 shoe racing clutch assembly, while recreational and standard models use a 2 shoe clutch. **To maximize clutch life and ensure optimum operation, change the oil frequently, after every race or at the end of each riding day. The clutch will need to be removed, disassembled and cleaned on a regular basis to maintain proper operation.** Wear particles from the clutch shoes can clog the spring washers and prevent full engagement as well as damaging the spring washers over time. A slipping clutch will rapidly wear out the shoes and may damage the drum. Regular oil changes and cleaning of the clutch will help prevent problems. **The Maxima MTL 75 transmission oil has special additives to prolong clutch life and is strongly recommended.**

**Three shoe clutch** - To service clutch, begin by removing brake lever pivot bolt using a 15mm wrench on the pedal bolt and a 13mm wrench on pedal bolt nut. Detach pedal spring, and lay pedal to side. Do not kink brake cable. Remove seat, fuel tank and spark plug. Insert piston stop tool. Drain oil, or be prepared to catch oil when sidecover is removed. Remove 6 case bolts using 5mm allen wrench. Hold kickstarter and use it to gently rock cover and pull it off. Be cautious not to tear clutch cover gasket, it can usually be reused many times. Check the teeth on the half moon shaped kickstarter gear attached to kickstarter shaft for wear or damage. Use your fingers to push the spring retainer on end of crankshaft inward, exposing the retaining "E" clip. Use a small screwdriver to pry the clip off the shaft. Be careful not to lose clip, replace if worn, loose, or bent. Remove retainer, spring, and starter gear. Make note of gear, clip, retainer and spring condition, replace if any noticeable wear or damage. Closely inspected the ratcheting teeth on the clutch nut and kickstarter gear for wear or damage. These parts wear with usage and will require eventual replacement. Use care when kickstarting to prolong their life. Push kickstarter down gently until engaged before kicking for best results.

Rotate clutch nut slowly counter-clockwise until piston contacts stop, then use a 19mm wrench or socket to remove clutch nut and washer, if installed. Most machines will have a washer under clutch nut, but not all. If a washer is not used, make sure that nut does not bottom on end of threads before tightening against clutch hub – take measurements to make sure. Under no circumstances use air impact wrench in conjunction with the piston stop or piston damage will result! Do not use heat to remove clutch nut or other clutch



Clutch and kickstarter driven gear assembly.  
Note that holes in sides of clutch shoes face outward.



Use proper puller to remove clutch assembly without damage! Lubricate puller threads before use.

components as it will damage shoe linings and springs. Install clutch puller. Make sure 3 puller bolts go into clutch hub evenly and as far as possible so they don't pull the threads out of the hub. To reduce damage to end of crankshaft, put a penny between puller screw and end of crankshaft to help protect it. Turn the center bolt of the puller to remove clutch from crankshaft, hold puller in one hand so clutch and puller do not fall onto the ground when they loosen. See photo III-30.

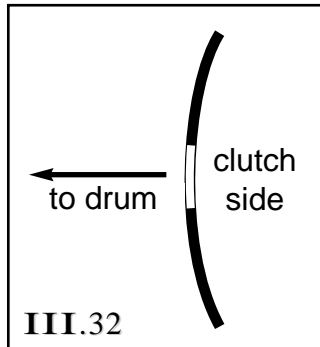
To remove clutch drum, use a small screwdriver or punch and carefully tap end of woodruff key which should begin to turn in slot which will allow removal. Then remove washer, be sure to note the way the washer is installed, with the cupped side facing out. See illustration III-32. Remove drum and bearing (early models will have a bushing pressed into clutch drum). Disassemble clutch by using a 1/32" or 4mm allen wrench to loosen 3 clutch shoe bolts. Remove clutch shoes and bolts, then carefully remove bolts and washers from shoes, making note of the washer positions. There are 4 pairs of cup washers with a flat washer at the bottom of the shoe bolt hole. See photos III-33 and III-34.

Clean all parts thoroughly in a non-flammable solvent and inspect all parts closely for wear or cracking. Check shoe friction material for thickness and even wear, also make sure friction material is not separating from shoe. Check spring washers for signs of abnormal wear or for flattening, also examine shoulder bolts for any grooves or wear. Check inside of clutch drum for scoring or uneven wear. If clutch shoes or drum appear glazed, they can be lightly sanded with 200 grit sandpaper to remove glaze. Make sure to flush away all sanding debris. Check the drum bushing for wear visually, and by attempting to rock drum while installed on crankshaft. Replace bushing if excessive play or wear is evident. Check keyway in bore of clutch hub for signs of wear or damage, as well as crankshaft keyway and woodruff key. Replace any damaged or worn parts.

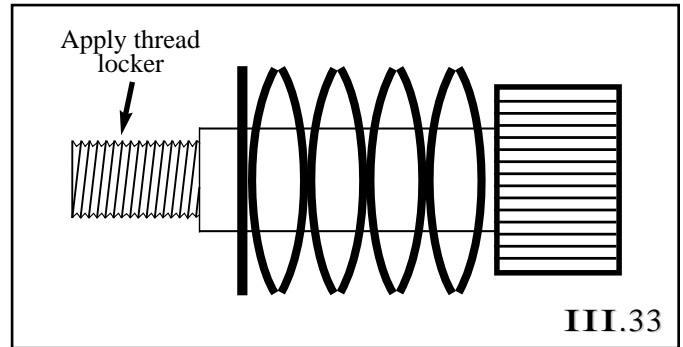
Action Racing strongly suggests using the spring washers in the stock configuration, with 4 pairs of spring washers facing each other and the flat washer at the bottom. See diagram III-33. For racing use, the clutch should engage from 6,000 to 6,500RPM. For recreational use or for beginners, the clutch can be adjusted from about 5,000RPM and above. To modify the rpm at which the clutch engages, replace the flat washer with a thicker or thinner one. Use the same thickness washer on all three shoes!



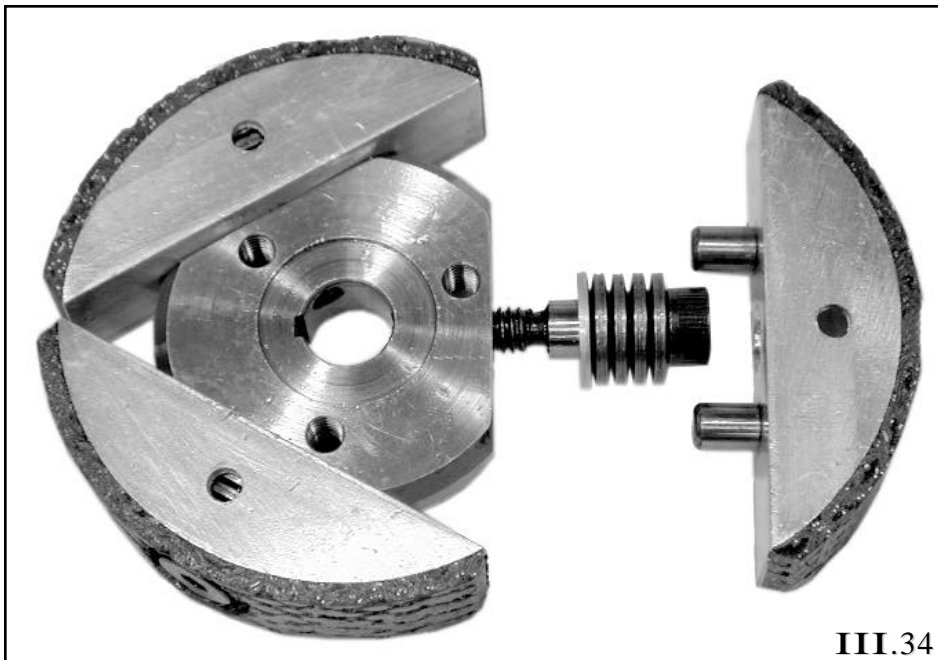
III.31  
Inspect both sides of clutch nut assembly for wear or breakage, replace as needed.



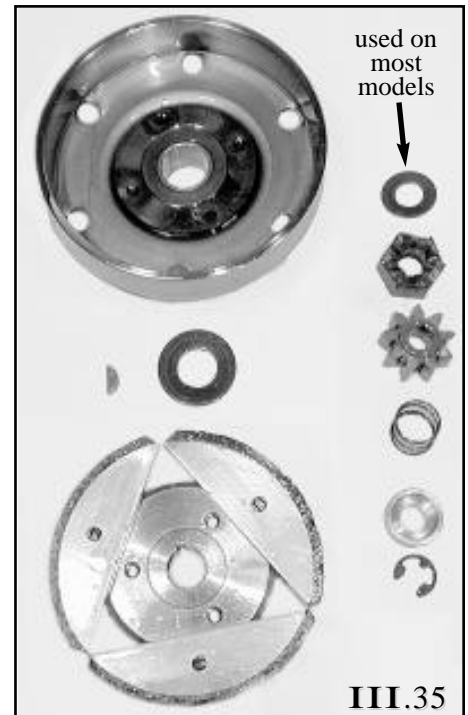
III.32  
Proper orientation of washer between clutch and drum



III.33  
Diagram of clutch bolt, spring washers and flat washer.

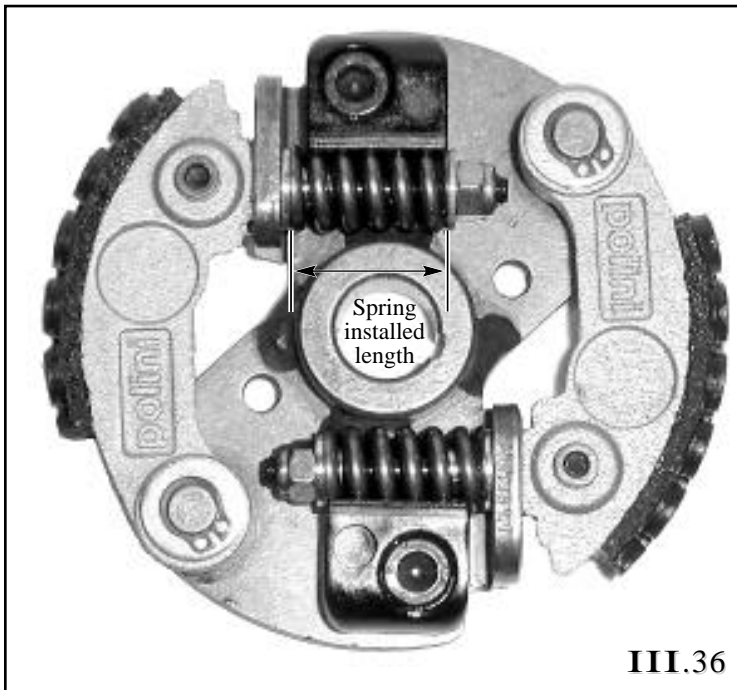


III.34  
Partially disassembled 3-shoe clutch, note position of washers on shoulder bolt.



III.35  
Complete 3-shoe clutch, drum and starter gear assembly.

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III.36

2-shoe clutch assembly.  
Adjust springs from 19 - 21mm.



III.37

Photo of kickstarter mechanism and spring.  
Note 2 dowels in case.

Different thickness flat washers ranging from .030" to .070" are available from Action Racing. Thicker washers will raise the engagement RPM, thinner washers will lower it.

To check the clutch engagement speed, you will need an inductive tachometer, which gets its signal from the spark plug wire. Ignition testers are available from SnapOn Tools and other tool merchants. A company call Northern Hydraulics has an inexpensive unit for under \$50 which works reasonably well.

Reassemble clutch by putting spring and flat washers on shoulder bolt. Insert bolt and washer assembly into clutch shoe. Degrease bolt threads and clutch hub threads with contact cleaner or brake cleaner. Apply red threadlocker sparingly to bolt threads and screw bolt into clutch hub. Tighten shoulder bolt to **10 Nm**. Repeat procedure for other 2 shoes. Remove any threadlocker from bore of clutch hub. If drum was removed, replace drum making sure bearing or bushing is in place. Install washer against drum, making sure the cupped side is out per diagram III-32. Install woodruff key into slot in crankshaft and press firmly into place. Make sure key is level. Place the clutch assembly on crankshaft and make sure slot in clutch hub aligns with woodruff key. Note recessed side of clutch hub faces out, and side with boss faces clutch drum. Press hub firmly onto shaft with hand pressure, then install clutch nut and washer (if used) and turn until piston contacts piston stop. Torque to 42 ft/lbs. Use a small amount of red threadlocker on clutch nut. Check end of crankshaft for wear. Make sure starter gear will slide over end of shaft. Remove any burrs as required with a file, covering clutch and cases with a rag to make sure filings do not enter cases or contaminate clutch. Install starter gear, spring and spring retainer. Push retainer inward and install a new clip into groove in end of crankshaft. Make sure clip is seated and that spring retainer encircles clip when it is released. See diagram III-29.

Fit gasket to side cover, making sure two dowel pins are in place. Fit cover to side of engine. Install 6 case bolts loosely, then rotate kickstarter until it engages the starter gear. Hold kickstarter in position and torque case bolts to **10 Nm**. A piece of wire attached to the footpeg can be used to hold kickstarter in position while tightening case screws. Check operation of kickstarter. If kickstarter binds or fails to return to upright position, loosen 6 case bolts and push side cover firmly upwards & rearward using a large screwdriver in addition to holding kickstarter in the engaged position, then tighten case bolts.

Remove piston stop and replace spark plug. Install brake pedal, fuel tank and seat. Fill transmission with oil. Check for oil leaks and reposition or replace gasket as required.

**Note:** consider using threadlocker to attach case dowels to side cover to prevent loss and ensure the gasket comes off with side cover and doesn't tear.

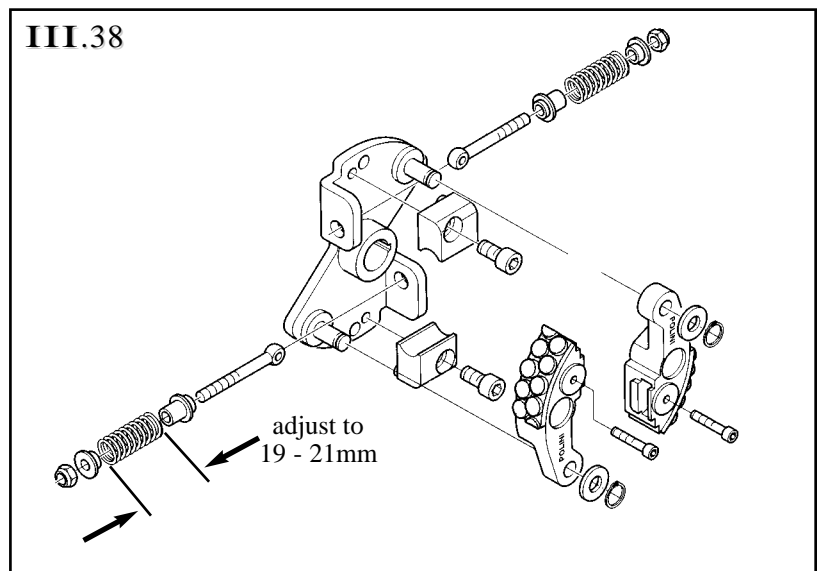


Diagram of two shoe clutch assembly.

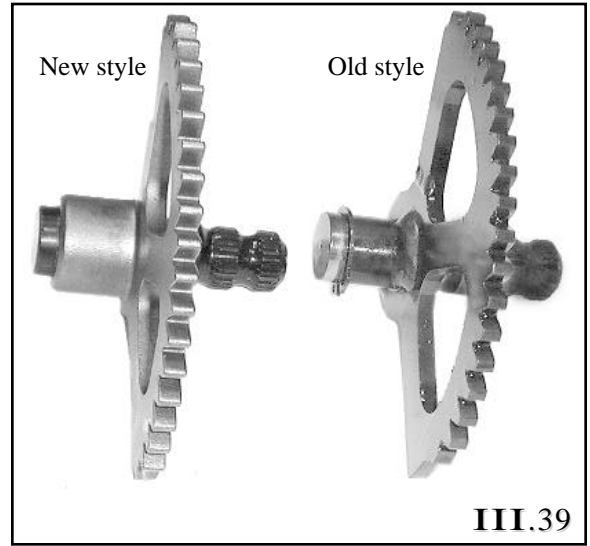
**Two shoe clutch** - Refer to three shoe clutch section for removal and replacement of 2 shoe clutch. The engagement RPM of the two shoe clutch can be adjusted by loosening or tightening the two nuts on the clutch assembly. The use of the optional HD clutch springs is recommended. **The standard duty springs are made of .XXX" wire, while the HD springs are made of .XXX" wire.** The springs can be adjusted from an installed length of 19 to 21mm to vary the clutch engagement speed. Make sure both springs are set to the same length. Measure length of spring between retaining washers to check installed length. See photo III-38. Tightening the springs will raise the engagement RPM of the clutch assembly, resulting in harder more powerful starts. Loosening the springs will decrease the engagement RPM resulting in slower and less powerfull starts. If the motor seems to bog and has trouble getting the bike moving, decrease the spring length and install the HD springs if not so equipped. As the rider becomes more aggressive, a switch to a 3-shoe clutch may be desirable.

**Kickstarter** - To remove kickstarter lever, use a **6mm** allen wrench to remove attaching bolt. Wiggle kickstarter lever and pull off shaft. If lever is difficult to remove, spray some penetrating oil on splines and gently spread slot with screwdriver to ease kickstarter lever off. To service kickstarter drive gear, remove clutch cover from engine. Remove two **6mm** allen bolts and retaining plate. Make note of proper spring position, then remove spring. The drive gear and shaft can now be removed. See photo III-37. If seal is to be replaced, drive old seal out from inside of case, and press new seal into place.

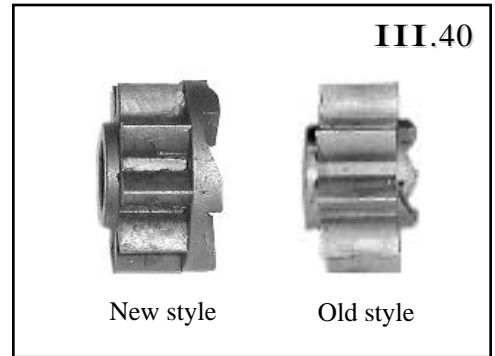
Bikes prior to 2002 had a weaker early style kickstarter drive gear and driven gear. See photos III-39 & III-40. These parts can be upgraded, but due to the thicker drive gear, the clutch cover case will need to be machined to match. A new driven gear and clutch nut must be used with the new drive gear. A new clutch cover case with the proper dimensions can be purchased rather than machining the old case. See illustration III-41 to determine if your case needs to be machined. The new kickerstarter gear & shaft assembly is part number 144.131.001. You will also need a new driven gear (144.110.001) and clutch nut (144.111.001). Do not use the old style driven gear and clutch nut or the drive gear will bind on the driven gear and the kickstart lever will not return to rest position, causing damage. If case is to be machined, have work done by a competent machinist. It is important that the proper clearances be obtained and that the machined surface is parallel to the case mounting surface.

**Reassembly** - Begin by lubricating kickstarter shaft, seal and bore with grease. Install kickstarter shaft from inside of case, being careful not to damage the seal. Install the kickstarter spring and retainer plate, using blue threadlocker on bolts. Using a 6mm allen wrench, torque bolts to **XX ft/lbs**. See photo III-37. Check spring for proper placement and operate lever to check for binding or interference.

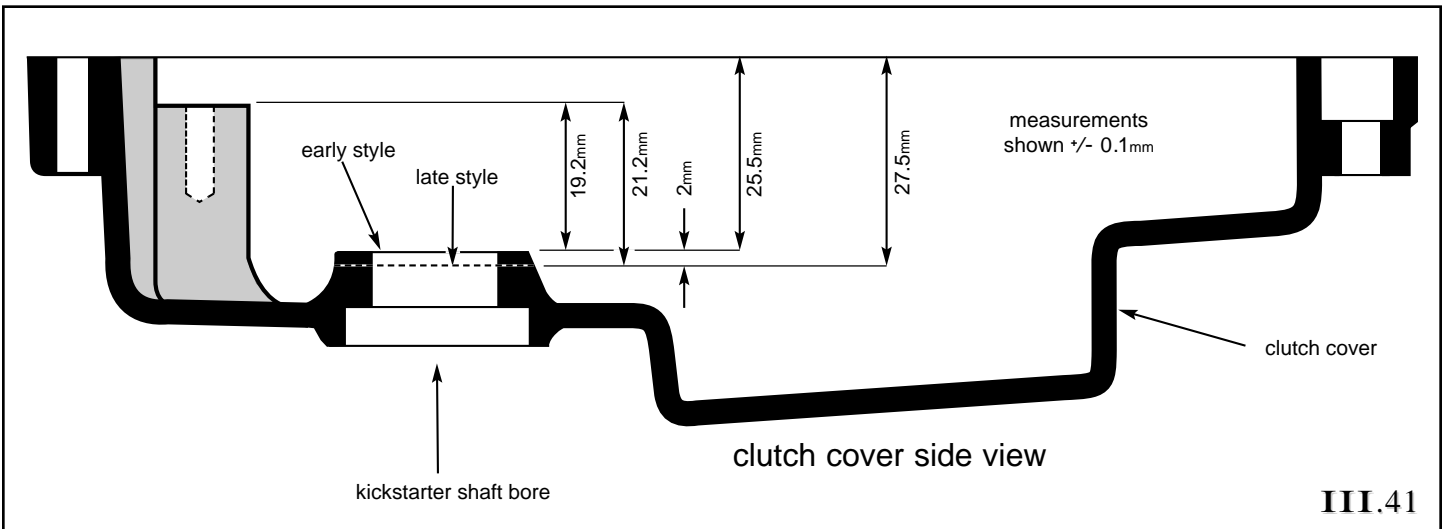
Install new style driven gear and clutch nut, see beginning of this section for removal and installation procedure.



New and old style kickstarter drive gears.



New and old style kickstarter driven gears.



Dimensions of clutch cover case for early and late style kickstarter gears.

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## 18. Carburetor

**Note:** X1 carburetor illustrated, X3 & X5 models similar

**Overview** - Your Polini is a high performance racing motorcycle. Because of the high level of performance, the carburetor will need adjusting for various riding conditions. Changes in temperature, elevation and load can all require major changes in jetting. If the jetting is not adjusted properly, problems can occur, ranging from a stumble or hesitation to severe engine damage. There are many factors which affect the proper jetting. Adding more oil to the fuel results in less fuel to burn and a lean condition. Cold air is denser, and will tend to make the bike run leaner. Hot weather will make the bike run richer. Changes in barometric pressure can affect jetting. Unfortunately, there are so many possible variables that change constantly the jetting must sometimes be adjusted daily for best results. To change jetting, you will need a selection of main jets, pilot jets, and needles. A jet selection is available from Action Racing, as well as optional slides, a fuel bowl with a plug for main jet changes, and various other parts. The idle speed and fuel metering screw will also have to be adjusted.

This is probably the most difficult aspect of working on your Polini, but in time will be one of the most rewarding. Mastery of jetting will enable your rider to always have the best tuned bike, which might be just enough for an advantage at that next start or high speed straightaway. Certainly, an ill-running bike can slow a rider considerably. Fortunately, there are a number of tests and procedures you can perform to help dial in the proper jetting. Like any skill, it will improve with practice and dedication. The following sections will attempt to cover the fundamentals of jetting and theory. However, ultimately you are responsible for the bike running properly, so use this information as a guide but at your own risk.

Before making adjustments to carburetor, be sure that the air cleaner is clean and properly oiled. If the air cleaner is dirty or too thick of an oil is used, a very rich condition will occur. Several mechanical problems can occur, which will affect the way the bike runs. If the carburetion appears to change dramatically for no apparent reason, look to mechanical causes before adjusting jetting. If the motor revs upon startup and idles at a very high speed you have an air leak. Find and fix the air leak before adjusting jetting!

**Note:** When working on carburetor, never use a wire or other sharp instrument to clean jets and passages as damage will result. Wear eye protection when using compressed air or solvents.

**Rich conditions** - Rich conditions can occur if: dirt enters the carburetor, the float can get stuck open, causing the bike to run rich and fuel to pour out of the vent tubes. Check float level and operation. Shake float gently to make sure no fuel has entered float. If the bike smokes alot and the plug seems fouled with oil, the transmission seal behind the clutch assembly may be leaking oil into the crankcase. Also check air passages in carburetor throat. Jetting will be adversely affected if they are clogged.

**Lean conditions** - Lean conditions can occur if the engine develops an air leak. Air leaks can occur in the carburetor, in the intake assembly, and in the engine itself. An air leak will make the idle speed erratic and very high. Common causes include: loose clamp on carburetor, punctured or damaged intake boot, leaking and/or warped reed block assembly, leaking cylinder base gasket, porosity or cracks in crankcase or cylinder castings, and a leaking seal on the alternator side of the engine. Spray carburetor cleaner around suspect areas with engine running. If idle increases you have located an air leak. If any of the jets get clogged with debris the motor will run lean due to the lack of fuel. Check timing to make sure it is within specifications.

Other things to check include making sure air filter oil is not dripping into the carburetor and partially clogging air passages or jets. Make sure to allow filter oil to "set" before installing filter as any dripping oil will flow directly into the carburetor. Maxima FFT air filter oil is recommended to help prevent this problem. Make sure fuel/oil mixture is fresh and well mixed. Check fuel flow from fuel hose to make sure fuel is flowing freely to carburetor. If fuel flow is sluggish, check hose and valve for blockages. Check and clean fuel filter as needed. A blocked fuel cap vent hose will also prevent fuel from flowing. Check carburetor vent hoses for kinking or blockage. Make sure o-ring is not lost or damaged on fuel metering screw assembly.

**Jetting variables** - The following list includes most of the factors affecting jetting. Other factors can also affect jetting, from fuel additives to slide wear. Proper jetting really boils down to the proper amount of fuel (and oil) well mixed with the proper amount of air. Most changes not relating to the fuel can be simplified to air density, which is simply the amount of air in a given space. Air density varies with elevation, barometric pressure, and temperature so the jetting requirements will also vary accordingly. A higher air density will result in a lean condition, a low air density will result in a rich condition. Gages are available to measure air density, and can be a very useful tool.

**Elevation** - can have a considerable affect on jetting. As the elevation increases from sea level, the air thins out, so the mixture will become increasingly richer. At the bottom of a mineshaft, you might get a little lean.

**Barometric pressure** - is similar to changing elevation. More pressure = more air = leaner condition. Lower pressures will tend to cause a richer condition.

**Temperature** - Higher temperatures (low air density) will cause the motor to run richer. Lower temperatures will make the motor run lean.

**Fuel mixture** - Reducing the amount of oil in the fuel will cause a richer condition, but engine damage may result if not enough oil is used. (less oil, more fuel = richer jetting) The opposite is also true, more oil will tend to cause a lean condition.

**Humidity** - The more moisture in the air, the less air available. High humidity may cause a rich condition.

**Load** - Heavy loads will require richer jetting, such as racing in deep sand or deep mud, heavier riders and long high-speed sections of track.

This list of variables is why jetting can vary at the same track from day to day, or even from hour to hour.

**Jetting** - If the jetting variables tend to make the motor run richer, you may need to install leaner jets and adjust the fuel metering screw, needle, and needle position for a leaner condition. If the jetting variables tend to make the motor run leaner, you may have to install richer jets and adjust the fuel metering screw, needle, and needle position.

The carburetor has several circuits which control the fuel/air mixture at different throttle openings. It is not the rpm of the engine but the throttle opening that is significant when diagnosing problems. At idle speeds to  $\frac{1}{8}$  throttle the fuel metering screw and pilot jet determine the jetting. From  $\frac{1}{8}$  to  $\frac{1}{4}$  throttle the straight section of the needle has an effect in addition to the fuel metering screw, pilot jet and slide shape. From  $\frac{1}{4}$  to  $\frac{1}{2}$  throttle the slide shape and the taper of the needle determine the jetting. From  $\frac{1}{2}$  to full throttle, the needle and main jet control jetting. The needle has less effect as the throttle position nears WOT (wide open throttle) and the main jet has more. See illustration III-42.

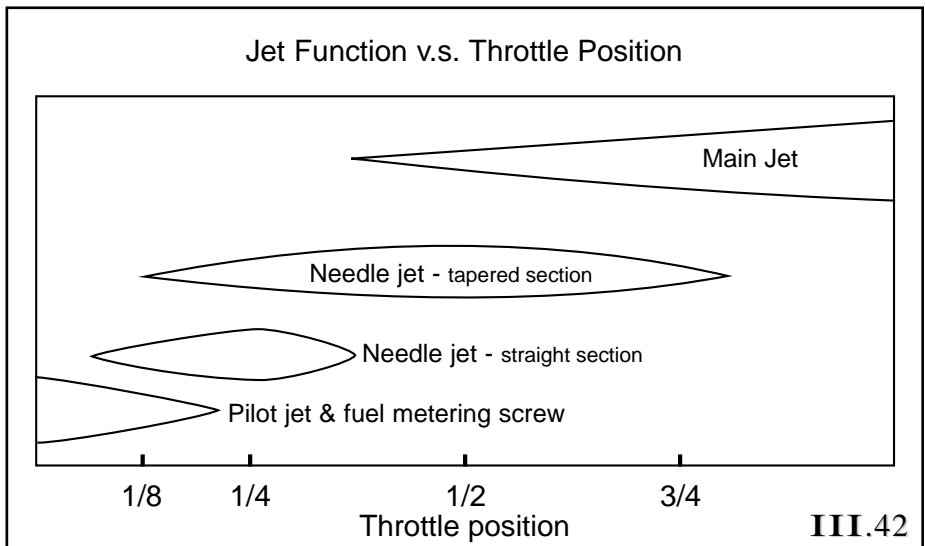
These circuits overlap to a large degree, but by testing each range of throttle positions you can begin to determine the proper jets to adjust. For instance, if the bike “bogs” from idle to  $\frac{1}{8}$  throttle, you will start by adjusting the fuel metering screw and possibly change to another pilot jet. If the bike seems to be running really rich and smokes alot from  $\frac{1}{2}$  to full throttle, you will probably try lowering the needle to lean the midrange, then changing to a leaner mainjet and/or a leaner needle if required.

**Note:** “Bogging” or “bogs” is a condition where you twist the throttle and the engine just sort of dies, until you release the throttle. This usually indicates an overly rich condition. When the bike is running too lean, it may “ping” or idle high with a “ying—ying—ying” sound. Cracking the choke will improve a lean condition, but make a rich one worse.

**Testing** - To test the different throttle positions, you will have to put a piece of tape on the throttle housing by the grip. Make a mark on the grip and mark the tape at the closed position. Twist the grip fully open and mark the position on the tape. Find and mark the center of the tape between your two marks to find the  $\frac{1}{2}$  throttle opening. Measure between the first two marks to find  $\frac{1}{4}$  throttle, and then again to find  $\frac{1}{8}$  throttle. Find a flat open area where you can ride in a circle. With the bike warmed up, ride in a circle very slowly and then accelerate to the  $\frac{1}{8}$  throttle opening making note of the bike’s response. If it hesitates and bogs, try again this time cracking the choke open slightly and see if the response improves with a richer mixture. Now go around the circle at  $\frac{1}{4}$  throttle and then accelerate to  $\frac{1}{2}$  throttle. Make note of the bikes response. Try the choke if necessary to see if a richer mixture seems to help. Repeat the process from  $\frac{1}{4}$  to  $\frac{1}{2}$  throttle, and again from  $\frac{1}{2}$  to full throttle. It is quite likely that jetting problems occurs in one or two of the throttle ranges but not all. Based on your findings, try to determine which circuits seem to be too rich or too lean. Make a small change to the circuits involved (1 size on the jets, 1 needle position or  $\frac{1}{4}$  turn on the fuel metering screw, etc.) and retest. If the problem goes away or is improved, you are on the right track. If the problem seems worse, make a change in the opposite direction of your starting point. Because the clutch does not engage until 5-6000 rpm, testing low throttle openings may be difficult with this method. The bike should rev freely when the throttle is twisted, and not bog or hesitate when the clutch starts to engage. Adjust fuel metering screw and pilot jet until the throttle can be twisted rapidly to launch the bike without hesitation.

Keep notes of your changes so you don’t become confused and can return to your starting point if you run into problems. Save your notes for future reference. Include the temperature and any other variables, so that in the future you will have a head start on jetting for similar conditions. When you get bike to run well, note how the bike responded when it was lean or rich so you can more easily recognize the signs in the future.

Note that it is much safer to run a little rich than too lean. A rich condition can foul plugs, but an overly lean condition can cause extremely high combustion temperatures and detonation which will destroy a piston in short order. If the bike is running very hot and seems to lose power, it is probably running too lean of a main jet. On the other hand, the bike will produce maximum power



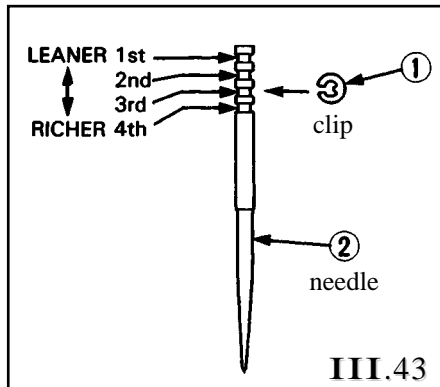
when it is as lean as safely possible. When you have the bike running well, try leaning out the needle position and main jet a little at a time, keeping close tabs on the condition of the spark plug at WOT. (See section III-20) As long as the spark plug test shows a tan colored insulator, you should not be too lean if everything is working properly. A dark colored, oily plug indicates a too rich mixture, while a white, glazed, or light tan appearance indicates a too lean condition (assuming the spark plug is the proper heat range).

**Adjusting carburetor** - Carburetor adjustments can be made without removing the carburetor from the motorcycle.

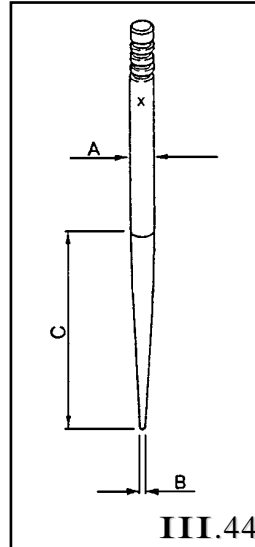
**Idle speed** - The idle speed and fuel metering screw can be reached with a long screwdriver from the right side of the bike (left side on X3 & X5). Adjust idle until bike runs smoothly without stalling when warm. See photo III-47.

**Fuel metering screw** -

Adjust fuel metering screw to fine tune initial throttle opening response. **Screw fuel metering screw in to lean mixture, screw out to richen.** The fuel metering screw is normally set from 1½ to 2½ turns out from fully seated. If less than 1½ turns is required to run properly, install a leaner



Clip positions & effect



Needle dimensions

code	Amm	Bmm	Cmm
W1	2.46	0.60	24
W2	2.46	0.60	22
W3	2.48	1.40	20
W4	2.48	1.40	18
W5	2.46	1.40	18
W6	2.50	1.00	24
W7	2.50	1.40	18
W8	2.50	1.40	16
W9	2.50	1.40	20
W10	2.50	1.80	16
W11	2.50	1.80	18
W12	2.50	1.80	20
W13	2.50	0.60	22
W14	2.50	0.60	24
W15	2.50	0.60	26
W16	2.50	1.00	22
W17	2.50	1.00	26
W18	2.50	0.60	24
W19	2.50	1.80	20
W20	2.50	1.60	24
W21	2.50	1.60	24
W22	2.50	0.60	26
W23	2.50	0.60	26
W24	2.50	1.80	24
W25	2.50	1.80	22
W26	2.50	0.98	24

Needle dimension chart III.45

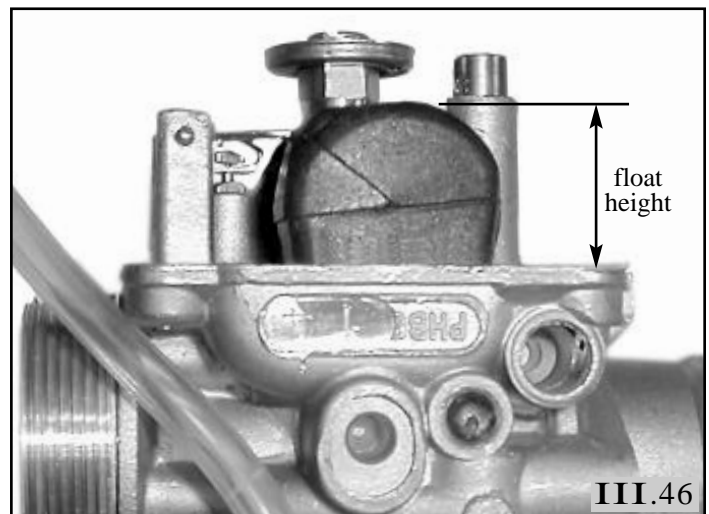
pilot jet, conversely, if more than 2½ turns out is required, install a richer pilot jet. Never tighten fuel metering screw, just gently turn in until it stops, then back out counting the turns to the desired setting. See photo III-47.

The fuel metering screw can cause overall jetting to be too rich if it is turned out too far. Note that the fuel metering screw only affects the initial throttle response in conjunction with the pilot jet until the needle jet takes over at ¼ throttle and above.

To access the carburetor needle and jets, remove the seat and fuel tank. Loosen the two clamps to the front and rear of the carburetor. Twist the top of the carburetor outward and make note of the proper orientation of the top cover. Remove the two screws and remove the top cover with the spring, slide and needle attached.

**Slide & needle** - To change slide or adjust needle, retract the spring against the top cover. Shake the white plastic retainer out of the top of the slide or push it out when removing the needle. Adjust the clip position as needed by removing the small clip and snapping it into another groove. The top groove will cause the needle to run leanest, the bottom groove will cause the needle to run richest. Changing the needle position causes the needle to reach the tapered portion sooner or later, which causes the needle to richen the fuel mixture sooner or later. If further adjustment in needle jetting is needed, the needle will have to be changed to a richer or leaner needle. See specification chart to choose the proper needle. A thicker needle will provide leaner initial jetting, a thinner needle will provide richer initial jetting. The longer the taper from the pointed end of the needle, the sooner the needle will begin to richen the carburetor as the throttle is opened. The diameter of the straight portion of the needle will affect the jetting from idle to just under ½ throttle, along with the pilot jet and fuel metering screw. A thicker needle will run leaner than a thinner one. A needle with a longer taper and a thinner tip will be richer than a needle with a shorter taper and a thicker tip. The needle fills the needle jet, so a thicker needle allows less fuel to flow resulting in a leaner mixture. Optional slides are also available. The stock 40 slide is available in a metal version, and optional slides numbered 30 - 60 are available. See photos III-43 - III-45.

To remove the cable from the slide, push the end of the cable into the slide to free the end of cable from the slide, then withdraw the end of cable through the larger hole. Reassemble in reverse order, making sure the needle retainer is fully seated and held by the spring. When inserting slide into carburetor body, make sure slot in



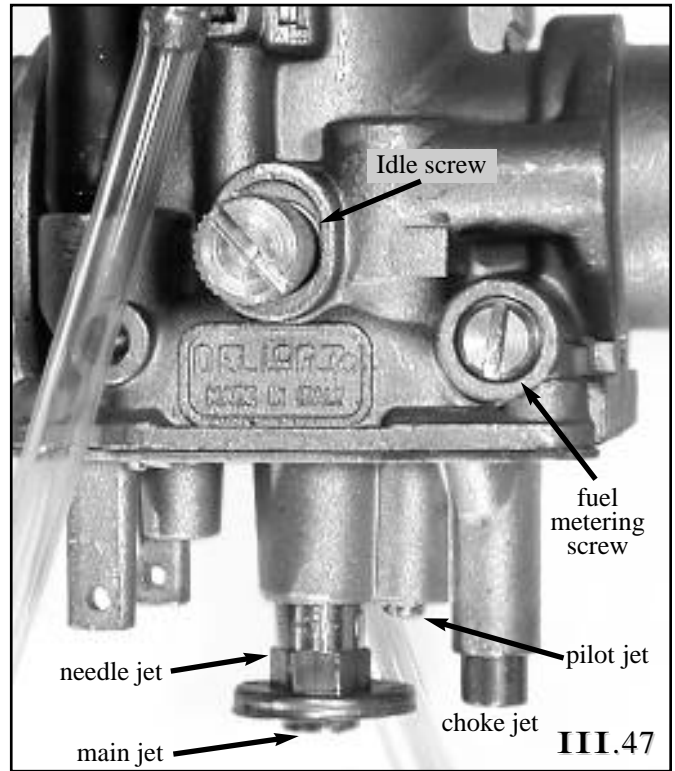
Measure float height as shown (remove gasket)

slide lines up with stud inside carburetor body. Make sure top cover gasket is in place and the top cover is in the proper direction. Do not force slide into carburetor. Install two top cover screws. An optional metal slide is available. See photo III-48.

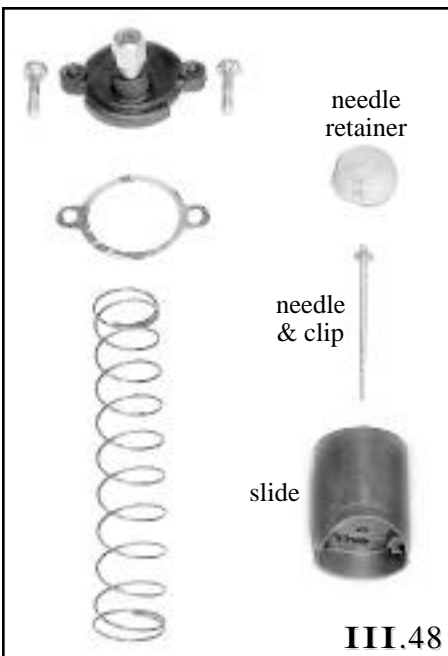
**Float** - To service jets and float assembly, remove slide as above. Loosen front and rear carburetor clamps, then push carburetor rearward until front of carburetor can be removed from intake boot. Remove carburetor from motorcycle. Remove 4 screws securing float bowl to carburetor and remove float bowl. Be careful float pivot pin does not slip out of place, unless float is to be removed.

To remove float, push float pivot pin to side and remove while supporting float. Withdraw float from carburetor, being careful not to drop needle valve which is loosely attached to float. Inspect tip of needle valve for wear or deformation, replace as required. Shake float gently to ensure there is no fuel inside float. To reinstall, hook needle valve onto float, and guide needle into bore. Line float pivot holes up with holes in carburetor body and insert pivot shaft. Make sure shaft stays centered as float bowl is being installed. To check float level, hold carburetor upside down and measure from top of float to float bowl mounting flange (with gasket removed). The correct dimension is .XXX". See illustration III.46. Adjust float level by bending the small tab which contact the needle valve up or down. If proper float level is not maintained, the bike can run very rich or lean, and may discharge fuel out the vent tubes. Too little float height will result in an overly rich condition, and too much float height will cause a lean condition. In severe cases, fuel can fill up the motor which can cause the piston to lock and create a fire hazard. If you suspect the carburetor has overflowed, do not force the kickstarter to move! Remove spark-plug, zip tie kill button in the off position, turn the bike upside down and allow fuel to drain, rotating the motor slowly with kickstarter. Do this in a well ventilated area free from fire or sparks!

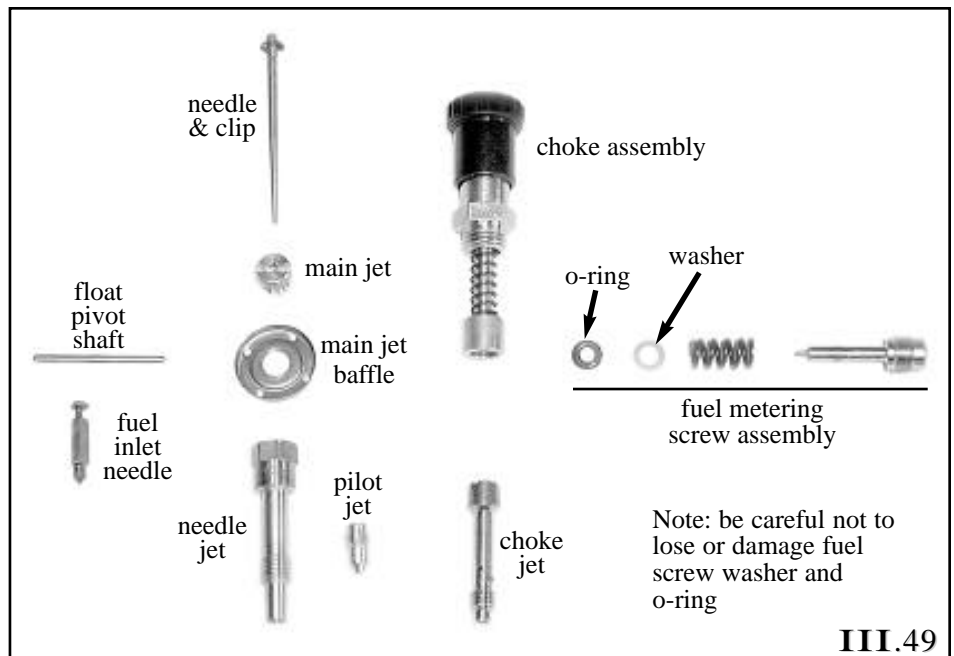
**Jets** - To change jets, use a flat bladed screwdriver to remove main jet and baffle. If needle jet is to be changed or cleaned, remove with 8mm wrench. Pilot jets and choke jets can also be removed with flat bladed screwdriver. Use a screwdriver of the proper size and in good condition to remove jets and use great care not to strip the slots in the jets, which are soft brass. Larger main jet and pilot jet numbers indicated larger, richer jets, while smaller numbers will be leaner. Change jet sizes one at a time. Crack choke and read spark plug as needed to determine if bike is running lean or rich. Snug jets gently when replacing. Do not overtighten! Needle jet and choke jet almost never need adjusting. Main jets are available from number 88 - 100. Pilot jets are available from 48 - 65. **Needle jets** are available from XX - XX. Note: A bigger number for the main or pilot jet indicates a richer jet, a smaller number a leaner jet.



Jet and adjustment screw positions



Slide & needle assembly.



Choke assembly, jets, & fuel metering screw assembly.

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**Cleaning** - If carburetor needs cleaning, remove choke assembly and fuel metering screw. Make sure all the parts come out with the fuel metering screw, including the spring and the tiny metal washer and o-ring. Use carburetor cleaner and/or compressed air to flush out all air and fuel jets and passages. Wear safety glasses as air, cleaner or debris can unexpectedly shoot out of air or fuel passages in various directions causing eye injury! Check to see all passages are open by noting flow of cleaner through them. Do not spray carburetor cleaner into motor, remove carburetor for cleaning if required. Make sure float bowl is free of debris. Never use wire or pointed objects to clean jets or carburetor passages as they will be damaged.

**Reducer** - The X1 model uses a Dell'Orto 19mm carburetor with an aluminum reducer in the outlet to comply with the AMA 14mm restriction requirement. X3 and X5 models use a 21mm carburetor which also may have a sleeve installed. If AMA compliance is not needed, the spacer can be removed for some additional power. Jetting will probably need to be richened to compensate. To remove spacer, remove carburetor from motorcycle and remove slide assembly. Holding carburetor firmly, use a long punch and a hammer to drive the spacer out of the carburetor outlet. Take care not to strike carburetor with hammer or gouge carburetor body. Clean any debris thoroughly and reassemble carburetor.

**Assembly** - Make sure bowl gasket is not torn or damaged and that float pin is centered when installing bowl. Snug 4 bowl screws evenly, do not overtighten! Install slide, making sure groove in slide aligns with pin in carburetor body and the needle slides into its hole for the needle jet. Make sure gasket is in place when securing top cover and make sure top cover is in the proper position. Do not over-tighten cover screws. Rotate carburetor to vertical position and tighten inlet and outlet clamps. Make sure vent hoses are routed properly and not kinked or plugged with dirt. Clean or replace vent hoses as required for proper operation. Check to make sure the fuel valve is not plugged with dirt.

## 19. Suspension & chassis

**Tires** - Check tire pressures daily, adjust to riding style and terrain as needed. Run 1-2 lbs less pressure for soft conditions such as sand, add 1-2 lbs for hard terrain and aggressive riders. Minimum recommended tire pressure is 18 psi on hard terrain to avoid tire or wheel damage. Replace tires when knobs begin to appear rounded. The rear tire can be reversed to yield some additional life by bringing the sharp backsides of the knobs into service if the knobs are not too badly worn.

**Changing tire** - To change tire, remove wheel from motorcycle. Support the wheel on a round barrel or similar stand if possible. Remove valve core from valve stem to deflate tube. Squeeze tire all around rim to unmount tire bead from wheel. The tire must be squeezed together to fit into the center portion of rim so the tire will be loose enough to pry over the edge of the rim. Squeezing tire into rim on one side, insert a tire iron into tire on the opposite side. Do not insert tire iron any further than needed. Push tire iron just slightly more than 90° towards the center of the rim to hold tire in place. Make sure tube is not near head of tire iron, push it further into tire with a blunt object if needed. Do not push the tire irons much more than 90° towards the center of rim or pinching the tube is very likely. See photo III-50. Have a helper hold first iron in place, then insert a 2<sup>nd</sup> tire iron next to the first and push the tire iron just over 90° to pry a section of bead over rim. Insert a 3<sup>rd</sup> tire iron next to the 2<sup>nd</sup> one, then remove the 2<sup>nd</sup> one when the 3<sup>rd</sup> one has pried the bead over the rim. Squeeze the tire frequently into the center portion of the rim to help keep it loose. Continue in this fashion until all the tire bead is over the rim. Once the first side of the tire is loose, remove the inner tube carefully, being careful not to snag it on the rear sprocket if changing the rear tire. Check the tube for chafing, puncture or damage. Patch or replace as needed.

To change the tire, use the tire irons to remove the 2<sup>nd</sup> side of the tire similar to the 1<sup>st</sup> side. Run a rag around the inside of the rim to remove any dirt and check for sharp edges. Make sure none of the spoke nipples are loose and protruding into the tube. Most racers will wrap several layers of duct tape or electrical tape around the inside of the rim to help prevent flats. If you use tape, make sure it is just in the curved center portion of the wheel or it will interfere with the tire seating on the rim. Duct tape is too wide and will have to be torn into narrower strips. Make sure to make a hole in the tape for the valve stem to pass through.

Before installing the new tire, make sure no staples or other debris are inside tire. Let tire sit in sun to warm up which will make it more pliable and easier to install. Lubricate tire bead with soapy water to ease installation and bead seating. Do not use oils or silicone as they won't dry and will cause the tire to slip on the rim. If tire slippage has been a problem, the inside of the rim can be roughened with a rough grit sanding disc to improve tire grip on rim.

Push one side of the tire's bead into the center portion of the rim. Use your fingers to work your way around the tire, pushing the bead into the wheel. Use a screwing motion to install as much of the bead onto the rim as possible, then use tire irons to complete installing the 1<sup>st</sup> bead. Install the tube. Make sure the tube is not bunched up or twisted and try any keep it away from the uninstalled side of the tire. Loosely install the valve stem nut to prevent the stem from being pulled into the tire as you work. Use your fingers to work the tire over the rim as far around the wheel as you can. Before you finish the remaining section of tire,



Do not pull tire iron too far to reduce chance of pinching tube

make sure the tire is squeezed together and in the center portion of the wheel so the tire has enough slack to mount. Slide a tire iron under the tire far enough to catch the rim, then push the tire iron up and outward just over 90° to mount that section of tire. Continue using 2 tire irons alternately until the tire is mounted. A helper can prevent the tire bead from coming off the other side of the remaining bead by squeezing the tire firmly. You are unlikely to pinch the tube IF you do not push the tire iron too far, which could cause the tip of the tire iron to pinch the tube against the inside of the rim. Push the tire irons just enough to get the bead over the rim—but no more!

Once the tire is mounted, check to make sure the valve stem is not cocked, rotate the tire to straighten the valve stem as needed. Replace the valve core and inflate the tire until both beads fully seat on the rim. If a portion of the tire seems tucked into the wheel, you will need to add more air pressure until the tire moves into place, sometimes with a popping sound. Do not exceed 30 to 40 psi to seat the bead. If tire will not seat, release air pressure and lubricate the bead well with soapy water and try again. Once bead is fully seated, adjust air pressure to 18 psi. Then snug the valve stem nut, but do not overtighten. Check to make sure that tube is holding pressure. If not, remove one side of tire as above, and remove tube for inspection and repair.

**Wheels & spokes** - Check the wheels frequently for cracks and dents. Small dents are probably OK, but any cracking or large dents require wheel replacement. Check spokes frequently for proper tension. They will loosen somewhat when the bike is new, but will hold their tension much longer once they break in. To check spokes, use a wrench or other metal object to lightly tap each spoke. The spoke should give off a musical tone. Check several spokes when the bike is new so you know what the proper sound is when checking the spokes. If the sound is dull, it is either too loose or is rubbing against another spoke. Tighten the spoke using a 5mm spoke wrench if loose, or else hold the other spoke slightly away from the spoke in question, and retest. Check the rest of the spokes, working back and forth from one side to the other. **DO NOT** adjust all the spokes on one side and then do the other side as this will warp the wheel. It may take 2 or 3 rotations to get all the spokes close to the same tone.

If wheel is to be replaced, zip tie all the spokes together where they cross each other. Remove all the spoke nipples, taking note of how many threads are exposed when the spokes are in the tightened position. Push the rim to one side and remove the rim from the spokes on the other side, then work your way around to completely remove the rim. Install the rim starting one one side, making

sure the angles of the spoke holes match the angle of the spokes. Insert the spoke nipples just enough to stay on the spokes and work your way around the rim, inserting the spokes and attaching the spoke nipples loosely. When all the nipples are installed, adjust them all to the same place, somewhat less than the fully installed position noted before disassembly. Working your way around the rim, tighten all the spokes evenly ¼ turn at a time. When spokes begin to get tight, adjust spokes by tapping on them and adjusting the tone until all the spokes are approximately the same sound. Mount the wheel to the bike, and check for any wobble or oval shape as the wheel turns and adjust as required. If all the spokes were adjusted evenly, the wheel should be fairly true and not wobble.

**Wheel removal, front** - To remove the front wheel, support the bike with the front wheel off the ground. Loosen the front axle pinch bolt using a 6mm allen wrench. Remove the front axle from the right side of bike using a 8mm allen wrench. Carefully pull brake disc out of caliper and remove wheel. Check wheel bearings for roughness or wear, service as needed.

To install front wheel, carefully spread brake pads apart and insert front disc between pads. Line up center of wheel with fork mounts and insert axle from right side. Tighten axle to 37 ft/lbs using an 8mm allen wrench. Hold front brake and push suspension down several times to allow forks to align. Tighten axle pinch bolt with a 6mm allen wrench to 18 ft/lbs. Check to make sure that wheel turns freely and that brake works correctly.

**Wheel removal, rear** - To remove rear wheel, support the bike with the rear wheel off ground. Remove the axle nut by using a 22mm wrench on both sides of axle. Remove spacer under nut, then pull axle assembly out of rear wheel. If axle is stuck, spray axle with penetrating oil by bearings on both sides, then screw nut back onto axle until flush and use a plastic or brass hammer to break axle loose. Use a rod or blunt drift to continue pushing axle out of wheel. Clean axle with steel wool or Scotchbrite® and lubricate. Do not strike end of axle with steel hammer or damage to threads will result. Take care not to lose spacers on either end of axle or against wheel bearings. Note that the left (sprocket) side spacer is thicker (.910") than the brake side spacer (.460"). Push wheel forward, then pull chain off to outside at top of sprocket. Work chain off from top to bottom and rest on end of swingarm. Remove wheel by pulling straight to the rear. Check wheel bearings for roughness or wear, service as needed.



Use rod at angle to drive out opposite wheel bearing.



Spacer tube in hub.

To install rear wheel, carefully spread brake pads and insert disc. Place wheel spacers on either side of wheel (wider spacer on sprocket side) and line up wheel with swingarm slots and brake mount hole. Make sure caliper bracket slot is over pin on inside of swing arm. Making sure the right axle spacer is on axle, insert axle from right side of bike through the swingarm, brake bracket, right spacer, wheel, left spacer and swingarm. Either loosen axle adjusting bolts to install chain on sprocket, or, push axle slightly to right so axle adjusting bolts miss axle spacers. Push wheel to front and install chain on sprocket starting at the bottom and working to the top. Install axle spacer and axle nut. Check chain tension and adjust as required. Make sure axle is firmly against adjusting bolts on both side, then tighten axle nut to 50 Nm. Check to see that rear wheel spins freely and brake operates correctly.

**Wheel bearing replacement** - If bearings do not rotate smoothly or appear damaged they should be replaced. Begin by removing wheel from motorcycle. Locate the hole inside the spacer tube. Insert a thin punch or rod into the hole in the spacer tube and hit the tool with a hammer to push the tube downwards. It only needs to move a little bit. Once the tube has loosened slightly, it can be pushed off to the side enough to catch the bearing on the other side with a rod or screwdriver. Use a hammer to drive out the bearing, see photo III-51. Once the first bearing comes out, remove the spacer tube. The other bearing will be easy to remove at this time.

To install bearings, lightly lubricate the bearing recesses in the hub with grease. Start the first bearing by hand, then use a large socket to drive wheel bearing evenly into place. Turn the wheel over and insert the spacer tube with its rubber spacer ring into the hub. See photo III-52. Start the other bearing by hand, then use the socket again to seat the second bearing. See photo III-53. Make sure spacer tube is centered before tapping the second bearing completely in. Check bearings to make sure they are flush, operate smoothly, and that the spacer tube is not loose or cocked inside hub.



Use large socket to drive bearing in squarely.

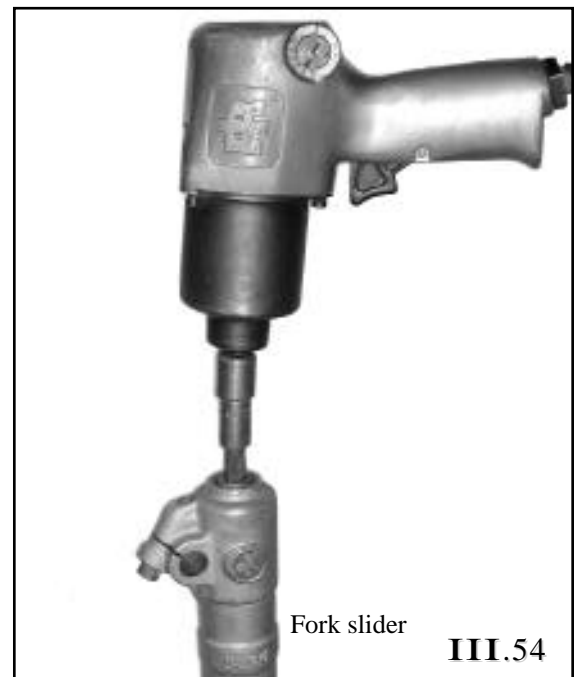
## Front suspension

The Polini uses a conventional hydraulic fork for the front suspension. It can be adjusted by changing the oil volume, oil weight, fork height and spring preload. The standard setting is 160cc of 10wt fork oil for the X1 model, and 180cc for the X3 & X5 models. Lighter riders can try a 7wt oil or mix a 5 and 10wt oil to reduce dampening force. Different brands of oil also have slightly different weights for the same specification. Oil weight affects both compression and rebound circuits. Adding more oil will increase bottoming resistance of the final portion of the forks stroke. Do not exceed a total **XXXcc** fork oil. Shim washers can be inserted beneath the upper fork caps to preload the fork springs more for heavier or more aggressive riders. Optional fork springs are also available from Action Racing. The fork tubes can be raised slightly in the clamps to improve cornering. However, the bike will be less stable at speed. Do not raise the fork tubes above the top fork clamp more than .100" (2.5mm) or lower them more than flush with the top of the fork cap (not including the hex portion, which should be above the top of the upper clamp)

Fork oil should be changed after first 20 hours of operation to remove the break in debris from the fork oil to help insure long life. Fork oil life will vary depending on the skill level of the rider, but it should be changed at least once a year even with a beginning rider. An expert rider will want to change the fork oil after every 6 races or so.

To change fork oil, loosen upper caps, then remove forks from motorcycle. Remove upper caps and remove fork springs. Invert forks and allow to drain. If you have extra fluid available, pour in some fresh fluid, work the forks a few times, and drain again. When forks are completely drained, turn them right side up and pour in 160cc of fork oil. Clean and insert the fork springs. Push the fork cap into the fork tubes and snug cap. Install fork tubes into upper and lower fork clamps, tighten fork clamps to **15 Nm**. Tighten the fork caps to **5 Nm**. Install front wheel and axle, but do not tighten axle pinch bolt yet. Holding the motorcycle upright, apply the front brake and push down on the front suspension several times to allow the forks to adjust themselves parallel to each other. Still holding the motorcycle upright, tighten the axle pinch bolt to **25 Nm**. Inspect the fork seals frequently for oil leakage and have forks serviced as needed.

**Front suspension adjusting & tuning** - Fork sag should be between 1-1½". To measure fork sag, measure between the top of the fork seal and the bottom of the lower fork clamp with the front wheel off the ground. Have the fully geared rider sit on the bike and bounce the suspension a few times. Take the



Fork slider

III.54

Use impact driver to remove lower fork bolt.

measurement again with the rider on the bike. The difference between the measurements is the fork sag. Add shim washers under the fork caps if the fork sag is too great, switch to a softer spring if there is too little sag. If the front tire seems to skitter and wash out in bumpy corners, consider using a lighter weight oil to reduce dampening forces. If the bike bottoms harshly on jumps, but the suspension works well otherwise, increase the oil level to reduce bottoming. If the suspension rides too low, increase spring preload, or change to a stiffer spring.

After making a change, evaluate the new settings. If they are worse than before, change back to the previous settings and perhaps make a change in the opposite direction. Front tire pressure will affect cornering and braking performance also, try various tire pressures in addition to adjusting the suspension.

**Fork disassembly and service**

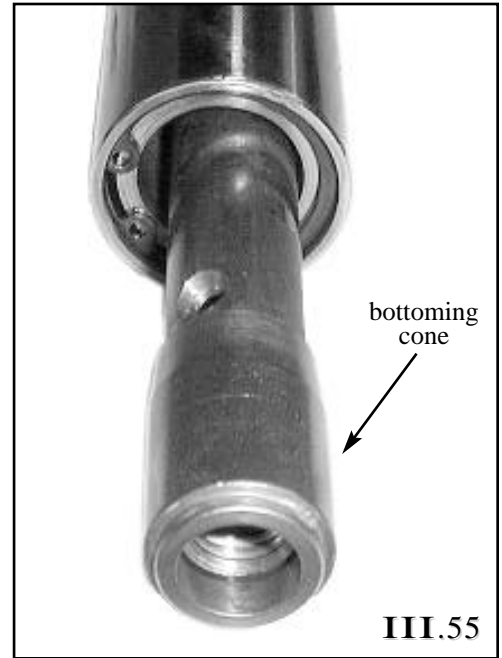
**Note:** It is not necessary to disassemble fork to change fluid or adjust spring preload. Do not clamp body of fork slider or fork tube in a vise! Clean fork thoroughly, especially around seals and bottom bolt to prevent dirt from entering the fork.

Loosen cap at top of fork tube (21mm) before loosening fork tube pinch bolts. Remove front wheel (section III-19), brake caliper and cable clamp from the lower right fork slider. Loosen pinch bolts and remove forks from motorcycle. Remove fork tube cap carefully, it may be under spring tension. Do not allow cap to spring off with force as it may cause severe injury. There may be a spacer (not shown) at the top of the spring if the fork was adjusted for a heavier rider. Remove the fork spring and invert the fork to drain oil. Pump the fork a few times to remove most of the oil.

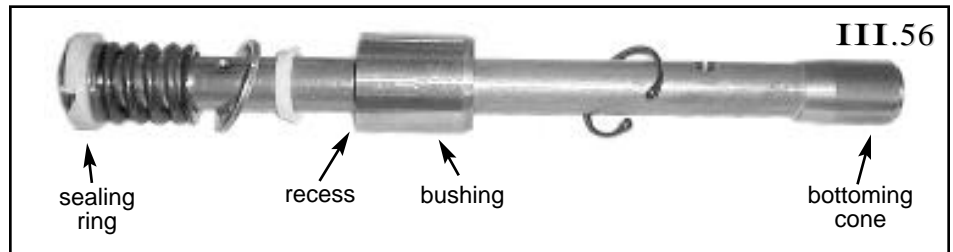
To disassemble the fork slider from the fork tube, an impact wrench or impact driver will be needed because there is no way to prevent the inner dampening tube from turning. Clean any dirt from around bolt, then remove the socket head bolt at the bottom using a 10mm hex bit. See photo III-54. Holding the fork horizontally, slowly remove the fork tube from the slider. Use care that the damper rod and bottoming cone do not fall out of the fork tube. Remove the bottoming cone from the bottom of the tube. Using internal snap ring pliers, remove the snap ring from the bottom of the fork tube and pull the dampening rod to remove the bottoming bushing, rebound spring and related parts. Inspect all parts for wear and damage. Replace as needed. See photos III-55 & III-56.

Fork seals do wear out and will require periodic replacement. If the fork seals are to be replaced, pry the dust seal from the tube using a blunt pry bar or tire iron. Remove the wavy retaining ring by prying out one end with a small screwdriver. Then remove the fork seal by prying it out with the blunt pry bar. See photos III-57 - III-58.

Clean all parts thoroughly with solvent and blow dry. Make sure no dirt, lint or other debris remains.



Use snap ring pliers to remove retaining ring.



Damper rod assembly & bottoming cone.



Use screwdriver to remove seal retaining ring.



Use blunt tool to remove inner seal.



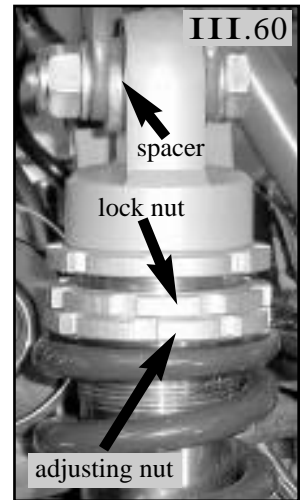
Installing oil seal into fork slider.

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**Assembly** - Lubricate fork seal lips and inside of fork slider with fork oil. Insert the seal by hand, then use the proper size seal driver or a large socket (shown) to drive seal gently into housing. See photo III-59. Note that the seal goes in just past the snap ring groove, do not attempt to drive seal too far. Install wavy snap ring making sure it is fully seated in groove. Wipe any excess oil from top of slider housing and press dust seal into place by hand. Do not lubricate dust seal or it will attract dirt.

Assembly damper rod to fork tube next. Lubricate damper rod sealing ring and inside of fork tube with fork oil, then insert damper rod carefully into fork tube. Insert spring and retaining ring with sharp edge facing inward. Install white plastic bushing as shown followed by the bottoming bushing and snap ring. Install snap ring with sharp edge facing outward. Install the bottoming cone onto the damper rod and push cone into tube until flush.

Lubricate inner fork seal lips and inside of fork slider lightly with fork oil. Hold fork tube horizontally, and gently ease fork tube through dust seal and fork seal. Do not use excessive force or you will damage the seals. Slide the fork slider fully onto fork tube. Holding the fork vertically, insert the bottom bolt with sealing washer by hand and turn it until it engages the threads in the damper rod. Thread it in fully by hand, then torque to 20 ft/lbs. Do not over-tighten bolt. Pour in the desired amount of fork oil into each fork. The amount of oil and oil weight can be varied to adjust the action of the fork in addition to using spring preload spacers under the fork cap. Insert the fork spring. Install and snug fork caps. The fork cap can easily be torqued to 48 in./lbs. once the fork has been installed on the motorcycle and the pinch bolts tightened. Check the forks for proper action and any binding before installing them on motorcycle. Clean fork tubes carefully, making sure to remove any oil that could attract dirt.



Turn adjusting nut to increase or decrease ride height.

## Rear suspension - X1

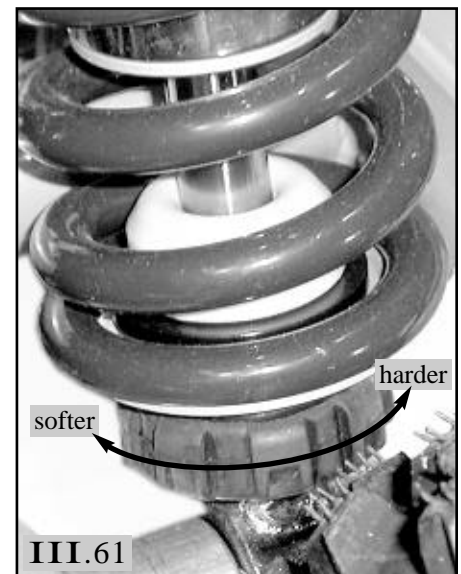
The X1 uses a gas charged shock absorber with separately adjustable compression & rebound dampening and spring preload. The preload of the rear shock can be adjusted for riders of different weights and abilities.

**Adjusting spring preload** - Use a spanner wrench to adjust the slotted adjusting nut. Use of a screwdriver and hammer to turn nut may damage nut and shock threads. Loosen the upper lock nut before adjusting the spring preload. Turning the spring adjusting nut clockwise will preload the spring which will tend to raise the rear of the bike. Make sure to tighten lock nut after adjusting spring preload. See photo III-60.

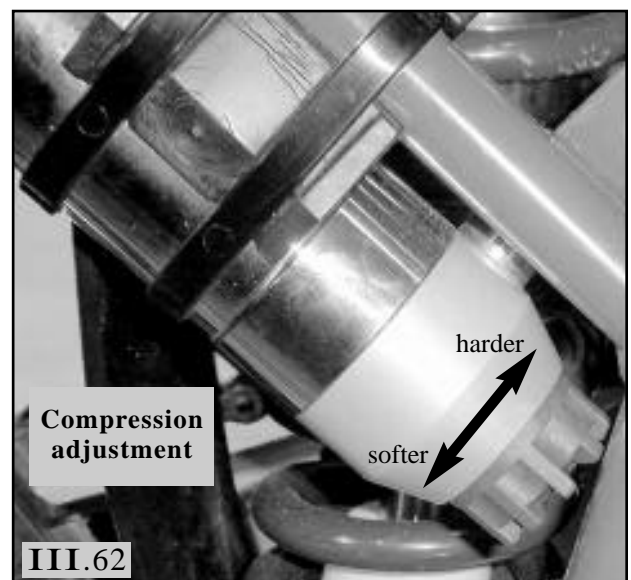
**Suspension sag** - Too much spring preload will make the rear of the bike stiff and unbalanced compared to the front. Too little preload will allow the bike to sag a lot under the rider's weight and leave little suspension travel for bumps. If increasing preload does not seem to be enough to raise the rear of the bike for heavier riders, install the optional stiffer spring that came with the bike. Spring preload should be adjusted to obtain the proper "sag," which is the amount the rear suspension moves when the rider's weight is placed on the bike. Adjust the suspension sag from 1-1½" initially, then fine tune for best results. If the bike seems to be riding low, increase the preload or change to a heavier spring to reduce the sag. If the bike seems stiff and the rear of the bike high, reduce the preload to increase the sag. Most importantly, the bike should be balanced from front to rear. Pushing hard on the footpegs should compress both the front and rear suspension as equally as possible.

To measure the sag, put the bike on a stand with the rear wheel off the ground. Measure from the center of the rear axle to the side panel bolt near the rear of the seat. Take the bike off the stand, and have the fully geared up rider sit on the bike with their feet on the pegs. Bounce the bike once or twice and then take the measurement again. The difference between the measurements is the sag.

**Dampening adjustments** - Compression dampening is adjusted by turning the knob at the bottom of the oil reservoir on the right rear frame rail. Turning the knob counter-clockwise as viewed from the top will increase the compression valving of the shock. The compression knob has 22 "click" positions total and the standard setting is 8-10 clicks out from



Turn knob as shown to make rebound stroke firmer or softer.



Turn knob as shown to make compression stroke stiffer or softer

III

being turned fully clockwise. (A click is approximately  $\frac{1}{8}$  turn) See photo III.62. The compression circuit determines the rear wheels resistance to moving quickly upwards, such as when hitting a high speed bump or landing from a jump. Stiffer compression settings will help resist bottoming. However, too stiff settings will make the bike harsh and the rear wheel tend to wash out. Large jumps will require stiffer settings. In the absence of unusual obstacles, the suspension would ideally be set so it just bottomed lightly on the hardest bump or landing on the track so the full range of suspension travel would be utilized. Tuning the suspension to work well for 80% of the track will probably yield better lap times than tuning for the extreme 20% portion. Tire pressures will also affect the rear while cornering and accelerating, tire pressure can be adjusted as needed as long as minimum pressure is maintained.

Rebound dampening is adjusted by turning the large rubber adjuster at the bottom of the shock spring retainer. Turning it counterclockwise as viewed from the top will increase the rebound dampening. The rebound dampening knob has 16 “click” positions total and the standard setting is 8 clicks out from being turned fully clockwise. See photo III.61. The rebound dampening controls the speed at which the wheel pushes downward after being pushed up by a bump. If the rebound dampening is set too light, the bike will tend to bounce after a landing. The rear wheel will kick up when hitting bumps and leaving jump faces. If the rebound dampening is too heavy, the wheel will not be able to return to its normal position quickly enough, and the bike will tend to run low with little suspension travel left after hitting the first bump in a series. Try decreasing the dampening setting 1 click at a time until the bike begins to bounce or kick up a little, then increase the rebound setting slightly. Increasing shock spring preload will probably require increased rebound dampening to compensate.

In general, the compression adjuster will probably need more fine tuning than the rebound adjuster once it is properly set. If available, use a video camera to film the bike on various sections of track. Play the recording back at slow speed and determine if the tires seem to be bouncing too much to maintain contact with the ground, or if the bike seems to ride too high or too low. If the tires can't react quickly enough to maintain contact with the ground, reduce rebound and/or compression dampening. Adjust spring preload to obtain proper level ride height.

## Curnutt Shock (X3 model)

The shock “sag” must be adjusted for rider weight and ability. To measure sag, put motorcycle on stand with rear wheel off the ground. Measure from center of rear axle to side panel screw near rear of seat. Have rider with all riding gear sit on bike and take measurement again. Sag is the difference between the two measurements. Set sag to 2” minimum, 3” maximum by adjusting the spring preload as described below.

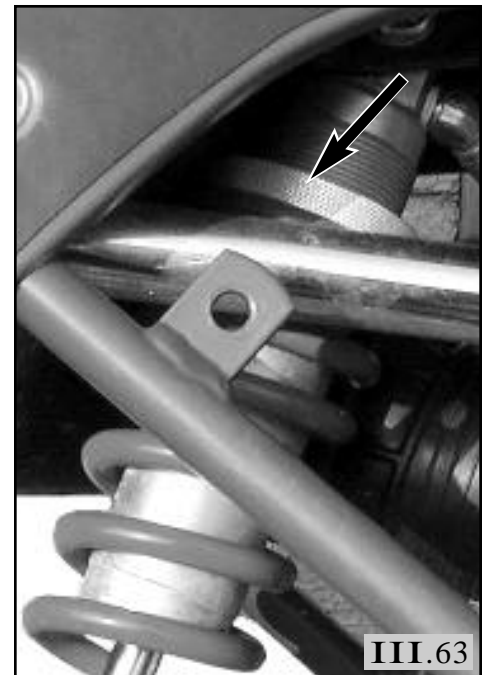
Optional stiffer and softer springs are available for different rider weights and abilities. Faster, heavier riders will likely need the stiffer spring, while lighter beginning riders may need the softer spring. If the sag must be set to 2” or less to prevent bottoming, purchase the stiffer spring. If using 3” of sag or more to make suspension soft enough and bottoming is not a problem, the softer spring is indicated.

**Adjusting Sag** - To adjust the sag, first clean and lubricate the shock body and threads. Then, loosen the set screw on the spring seat  $\frac{1}{4}$  turn using a  $\frac{1}{8}$ ” allen wrench. Adjust the spring seat using a **XXXX** tool. Turning the spring seat clockwise will preload the spring more and decrease sag, counterclockwise will increase the amount of sag. Once sag is set properly, tighten the set screw and apply a dab of silicone sealer to the set screw to seal out dirt and water. Do not overtighten the set screw or damage will result.

The Curnutt shock is further tuned by utilizing air pressure in the shock reservoir. To prevent damage never use less than 75 psi or more than 150 psi! Within this range, lower pressures will yield softer dampening and higher pressure will yield firmer dampening. If 150 psi is required to prevent bottoming out, a stiffer spring may be necessary. If the suspension still seems too stiff with 75 psi of pressure, a softer spring is required.

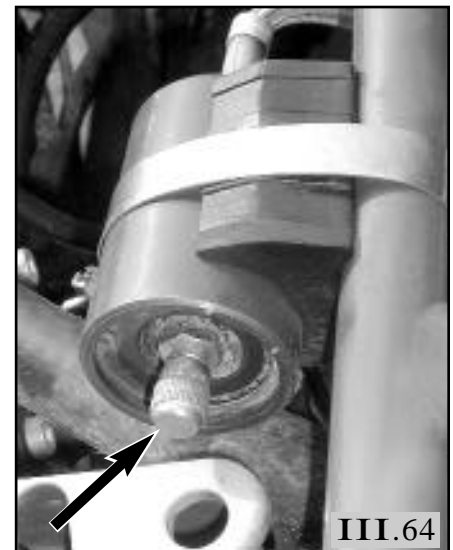
The supplied air pump can be used to adjust the air pressure in the shock. Begin with changes of approximately 25 psi, then fine tune by 10 psi increments.

**Adjusting Air Pressure** - Adjust air pressure when shock is cold and rear wheel is off ground (shock is fully extended). Remove the cap from the valve on the shock reservoir bottom. See photo III-64. Thread the pump onto the valve approximately 5 turns, or until you feel it touch the top of the fitting. Once it touches, tighten 1 further turn (do not overtighten to prevent damage). When pump is properly fitted, the shock pressure will register on the pump gage. Stroke the pump a few times, the shock pressure should increase slowly. If the pressure increases rapidly, the valve may not be open. In this event, tighten the pump cautiously until valve opens. Pump air into shock to reached desired setting (pressure must be between 75 and 150 psi). Remove pump and replace valve cap.



III.63

Preload adjuster on Curnutt shock



III.64

Air reservoir fitting - Curnutt shock

Proper maintenance will greatly prolong the life of the shock. The entire shock should be frequently lubricated with WD40, especially the shock shaft. Always spray shock after washing bike. Frequent cleaning and regreasing of the top and bottom bearings will greatly prolong their life. Be sure not to damage the bearings or shaft seal using a pressure washer. Replacement bearings for the top and bottom are available from Action Racing.

Under racing conditions, the shock should be serviced after every 30-40 hours of use. Regular service will help prevent costly damage to shock internals. Shocks can be shipped directly to Curnutt for servicing and repair. Allow 2 weeks for service and shipping. For tuning and servicing information, contact Action Racing or Curnutt Shocks at 310-538-3789. See contact information on page 44.

When calling about your shock or returning it for service, make note of the shock's serial number which will identify the specific valving and construction of your shock. Also be prepared to supply the rider's weight, ability level and performance of shock.

**Shock removal** - To remove rear shock for service, support bike with rear wheel off ground. Remove seat and shock splash guard. Drain coolant, and detach hose from water pump to allow shock reservoir hose to pass. (DO NOT loosen or remove shock reservoir hose from shock or reservoir, it contains very high pressure!) Remove rear wheel. Remove lower shock mounting bolt, spacer and washers. Cut ties holding shock reservoir. Remove upper shock mounting bolt and spacer washer, then angle bottom of shock rearward and withdraw from bottom of bike.

Reassemble in reverse order. Note that upper spacer washer is installed on left side of shock. Torque top and bottom shock mounting bolts to 33 ft/lbs. Note that the top shock mounting bolt should be inserted in the rearmost mounting hole. Use new heavy duty tie straps to secure reservoir to frame. Fill coolant and recheck after running engine.

**Swingarm removal** - Remove lower shock bolt and spacer. Remove rear brake pedal bolt and lay off to side. Remove caliper assembly from swingarm, and detach brake cable clamp from swingarm. Remove chain or unbolt chain guide from swing arm. Try to move swingarm up and down and side to side to check for excessive play or binding. Loosen and remove the swingarm shaft nut on the left side of bike using a 19mm socket. Prevent the bolt from turning by using a wrench or socket on the other side of the bike. Remove bolt from frame and remove swingarm from motorcycle. Do not lose washers, take note of their positions. Note that thick washers insert into inside of swingarm adjacent to engine case. Clean and inspect swingarm bushings and sleeves closely. Replace bushings or sleeves as needed. Grease well with waterproof grease before assembling. Assemble in reverse order. Torque swingarm pivot shaft to 37 ft/lbs. See illustration III.65.

**Steering bearings** - The steering bearings need to be checked frequently for play or binding and adjusted and regreased as needed. To check for play, put the motorcycle on a stand with the front wheel off the ground. Grasp the bottom of the fork tubes and push forwards and backwards to check for play. Turn the wheel side to side from lock to lock to check for binding or excessive effort. The bars should turn smoothly from side to side with almost no resistance to turning. The steering bearings should be greased at least once a year, much more often in wet conditions or with heavy usage. To adjust the steering bearing tension, loosen the top triple clamp fork tube bolts. A special wrench is available from your local dealer or Action Racing to loosen the steering stem nut. Snug adjusting nut just enough to eliminate any freeplay and provide a smooth turning action with only slight resistance to turning. Note that the play will decrease further when steering stem nut is tightened. See photo III-66. Tap top clamp with a plastic mallet to seat it against adjusting nut. Tighten steering stem nut to 18 ft/lbs. Tighten upper triple clamp fork bolts to 11 ft/lbs.

To access the steering stem bearings, remove the front wheel, forks, front number plate and fender. Remove the handlebar pad and clamps. Lay the bar carefully on top of the seat, tape in place if needed. Remove the vent tube and cap from the top of the steering stem. Using a 36mm socket, remove the steering stem nut and upper fork clamp.

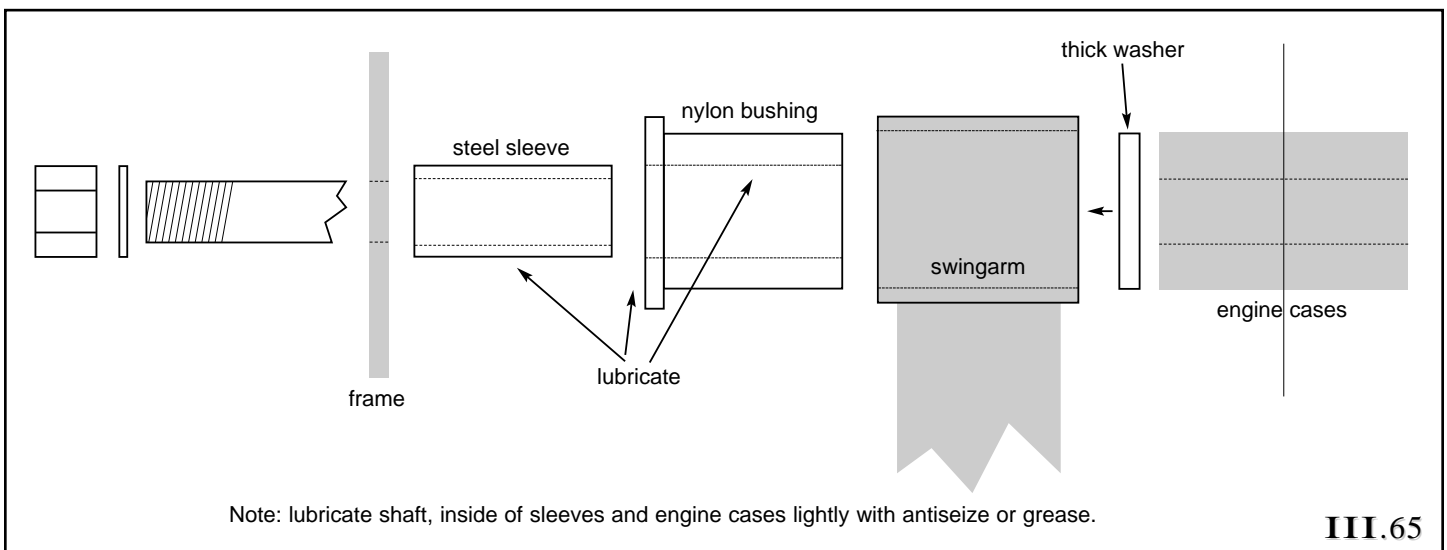


Diagram of swingarm assembly. Note positions of washers. Clean and regrease as needed for proper function.

To grease bearings, remove adjusting nut and remove the steering stem from the chassis from the bottom. Clean the bearings thoroughly and inspect for missing bearings, damage to the bearing cage or ball bearings. See photo III-67. Clean and inspect the ball races on the chassis, the steering stem, and on the steering stem adjusting nut assembly. Replace any worn or damaged parts. Using a high quality waterproof grease, thoroughly pack the upper and lower bearings with grease. Also coat both upper and lower races with grease. Place the lower bearing on the race on the bottom of the steering stem, then insert the steering stem into the steering tube from the bottom. Insert the upper bearing into the upper race and thread the steering stem adjusting nut and race assembly onto the top of the steering stem. Snug adjusting nut onto the upper bearing. Tighten the steering adjusting nut just enough to eliminate any play or slop in the steering. The stem should not be loose, but should take only minimal effort to turn. Fit the upper fork clamp over the top of the steering stem and lightly tighten the steering stem nut. Insert the forks into the fork clamps and tighten the lower fork clamp only. Tighten the steering stem nut to 18 ft/lbs. Tighten the upper fork clamps now to 11 ft/lbs. Replace the bars and torque mounting bolts to 18 ft/lbs. Install bar pad, front fender, wheel and number plate. Recheck the steering for play and binding from side to side.

**Grip replacement** - The rubber grips will become damaged and worn over time. When the bike falls, the ground will tend to cut the grips and push them into the handlebar. The throttle tube can also crack over time with crashes and will need to be replaced.

To remove the grips, slit them from end to end with a razor blade and peel them off. Remove as much of the old glue as possible. Now is a good time to seal the handlebar tube, so dirt doesn't get into the left side of the bar and work its way to the right side and the throttle tube. Squirt a little expanding foam or a glob of silicone into the left side of the bar and allow to harden.

To install the grips, it is best to use grip cement. Follow the directions on the glue for best results. Make sure the glue does not get onto the end of the throttle tube that goes into the housing. Remove any excess right away. Allow the glue to dry overnight before riding. However, if you need to ride the bike right away, install them dry or wrap a layer of friction tape around bars first. Safety wire grips on both ends and in the middle. Twist the safety wire until it bites into the grip. Cut the end of the wire short, about  $\frac{1}{8}$ ", then bend the end of the wire into the grip so there is no sharp end exposed. Safety wire pliers work well, but a pair of locking pliers will do the job in a pinch.

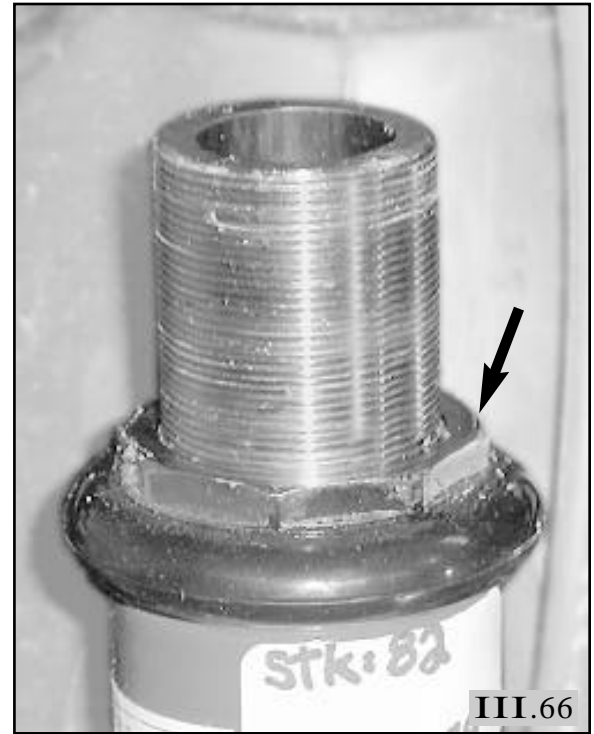
## 20. Electrical system

**Spark plug** - Check spark plug for proper coloration and fouling. Replace as needed. Adjust jetting and make repairs as needed to produce proper plug coloration. Use NGK plug R4118S-8 or B9EV as standard plug. Gap at .024" using a wire type gapping tool. A resistor plug is also acceptable but not required.

Check spark plug for color and condition. As long as the spark plug is the proper heat range, the coloration of the plug after a full throttle test will provide clues as to main jet calibration. If the plug is dark and oily, the main jet is too rich. If the plug is white or light colored, the main jet is too lean (a new spark plug must be run for 10-15 minutes for this test to be valid). When installing spark plug, torque to 20 ft/lbs. If torque wrench is not available, tighten by hand, then another  $\frac{1}{2}$  to  $\frac{3}{8}$  of a turn.

**Plug reading** - Reading the spark plug will yield valuable information about the accuracy of the jetting. This test will only work if the plug is the proper heat range. A plug that is too hot will overheat and always seem to indicate a lean condition. A spark plug that is too cold will always foul and seem to indicate an overly rich condition.

To take a plug reading, make sure the plug has had at least 15 minutes of running time if new. Warm the bike to operating temperature. In a safe open area, accelerate with the gas wide open as long as possible, then hit the kill switch to shut off the motor and coast to a stop. Hit the kill switch while the throttle is still wide open.



Steering stem adjusting nut.



Upper steering bearing and race.

Remove the sparkplug (careful, it will still be hot!) and closely examine the insulator of the plug. The insulator is the ceramic portion of the plug just behind the metal tip in the center of the plug. If the insulator is white and appears glazed, the bike is probably too lean. Try a richer main jet and retest.

If the insulator is a light brown or medium grey color, the jetting is probably just right. If the insulator is dark colored and oily, the main jet is probably too rich. Decrease the main jet by one size and retest. Always make sure to retest when installing a leaner main jet to avoid jetting too lean and damaging the motor.

**Ignition timing** - To check the ignition timing, a dial indicator will be required to measure piston travel. A special unit is made specifically for this purpose and can be purchased from Action Racing. Any indicator will work if it will fit and can be secured for testing. To check timing, remove the alternator cover, seat and fuel tank. Note the two marks on the flywheel and the mark on the stator assembly. The short mark on the flywheel is where the ignition is supposed to fire when it lines up with the mark on the stator. The long mark is roughly top dead center (TDC) when it lines up with the mark on the stator. See photo III.69.

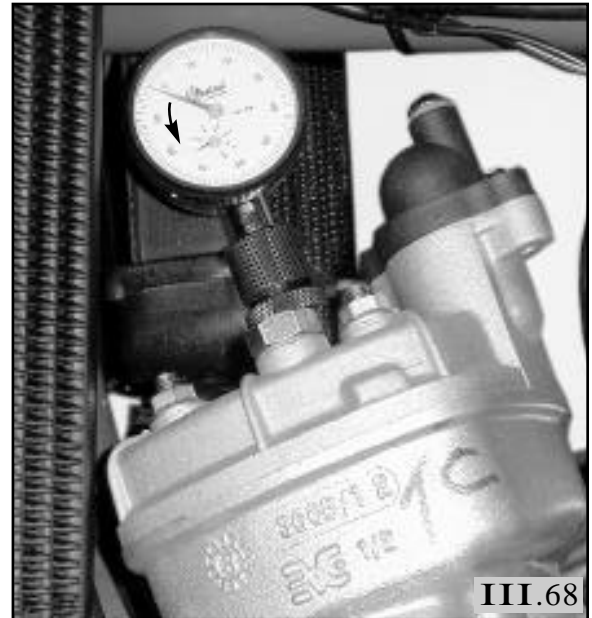
Next, remove the sparkplug and insert the dial indicator. It is a tight fit on the X1, you have to push the gage all the way into the adapter, insert the assembly into the head, then hold the gage and turn the adapter into the head until tight, then tighten the locking nut to secure the gage.

Find top dead center (where the piston stops moving up, and starts going down again). Make sure you don't jam the gage with the piston, proceed slowly and adjust gage as needed. Turn face of gage so it reads 0 at TDC. See photo III.68. Turn flywheel slowly using 15mm wrench on the nut until the short mark lines up with the mark on the stator. When the marks line up, you should indicate 1.6mm of piston travel (.063") Be careful when checking the travel, as the dial indicator reads backwards, i.e. if your indicator reads in mm, you should go 1 complete revolution (1mm), then to 40, which is .60mm traveled counterclockwise. If the marks don't line up, recheck, making sure your 0 measurement is still correct. If so, loosen the 3 screws holding the stator, and holding the flywheel in position rotate the stator until the two marks line up (with the piston at 1.6mm) Then tighten the screws. Recheck the 0 measurement and the firing measurement and make any final adjustments. Check to make sure the flywheel doesn't rub the stator, if so, insert 3 or 4 shims or feeler gages to center it, and then retighten the screws and remove the shims. Replace the sparkplug, install the alternator cover, fuel tank and seat.

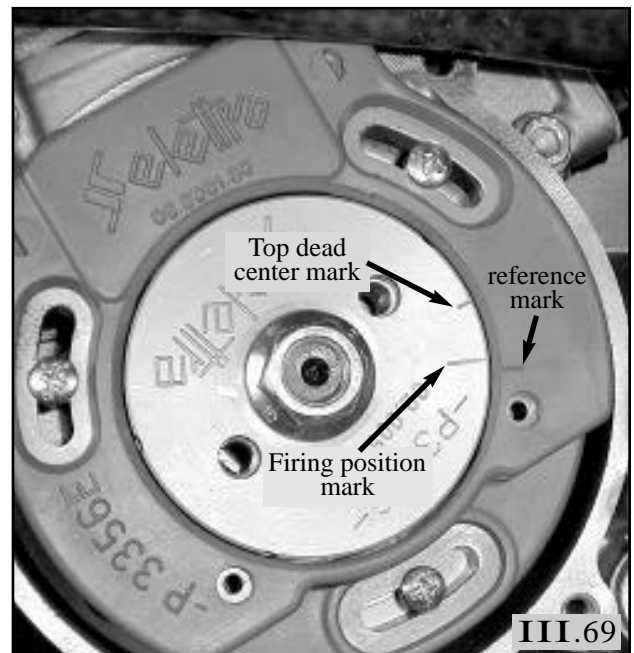
**Note:** The timing can not be checked with a timing light as there is no reference mark on the engine cases. Increasing the 1.6mm measurement would increase the timing advance, and vice versa. Increasing the timing advance too much will result in detonation and engine damage. Decreasing the timing too much will result in less power and acceleration.

**Flywheel and stator** - The stator assembly is a sealed one piece unit. It provides both the power for the ignition coil and the timing signal. There are no serviceable parts. To test the stator assembly, disconnect the plug located on the front frame rail next to the left radiator. Test the resistance across the male and female connections that lead to the stator using an ohmmeter. The meter should read 60 ohms, plus 40 or minus 5 ohms. Next check the resistance from one of the stator leads to the metal portion of the stator where the adjusting/retaining screws are located. This measurement should be infinity, meaning no connection at all. If a resistance is measured, the stator coil has shorted to ground and needs to be replaced.

The flywheel also has no serviceable parts. If the flywheel needs to be replaced, remove the flywheel nut and use the same puller used for the clutch to remove the flywheel, using only two bolts instead of three. To remove the stator, remove the three adjusting screws, loosen the grommet on the wires where they pass through the case, and pull the stator assembly straight out. When installing flywheel, make sure slot in flywheel, slot in crankshaft, and woodruff key are undamaged. Line up slot in flywheel with woodruff key in crankshaft and press flywheel into position. Install flywheel nut and torque to 42-45 ft/lbs. When installing the stator, fit over flywheel and loosely install 3 screws. Reset timing as above. If flywheel rubs on stator, insert 3 or 4 shims between flywheel and stator to center stator and tighten screws, then remove shims.



Rotate flywheel CW from TDC until indicator reverses 1.6mm (1 full rotation then to 40 mark)



Find TDC using dial indicator (set indicator to 0)  
Rotate flywheel CW to move indicator 1.6mm and check timing using short firing indicator mark.  
Adjust stator as needed to align marks.

**Coil & ignition assembly** - The coil and ignition assembly are a one piece unit and have no serviceable parts. One two conductor lead is connected to the stator assembly for power and timing signal. One lead goes to ground through the kill switch to stop the motor. The ignition lead goes to the sparkplug. If there is no spark, disconnect kill switch lead and recheck for spark using a new or known good plug with proper gap. Replace kill switch as required. If there is still no spark, or spark is weak, remove coil assembly and make sure there is no paint on at least one of the frame mounting tabs and that there is no corrosion preventing the coil from grounding to the frame. This is the most common cause of weak or no spark. If still no spark, check ignition assembly with an ohm-meter.

To test, disconnect the plug located on the front frame rail next to the left radiator. Measure the resistance from the male terminal on the wire leading to the coil assembly and the metal portion of the ignition coil. The resistance should measure approximately 47 kilo-ohms. Next, measure the resistance from the spark plug terminal in the coil wire to the metal portion of the ignition coil. The resistance should measure approximately 5 kilo-ohms. If these measurements check out, check the stator assembly as described above.

## 21. Final Drive

**Chain adjustment & lubrication** - The chain is a highly stressed component and requires frequent inspection, adjustment and lubrication. It is important not to tighten the chain too much, or it will bind—possibly resulting in the chain snapping and/or damage to the transmission, chain roller, and sprockets. If the chain is too loose, it will cause rapid chain and sprocket wear, it may slip on the sprockets or come off the sprockets resulting in damage to the motorcycle anywhere it hits in addition to transmission and/or case damage. Lubricate chain frequently using a motorcycle chain lubricant to reduce chain and sprocket wear. Most lubricants should be applied after riding while the chain is warm so they penetrate better and have a chance to “set” before riding next, which will reduce oil flinging off.

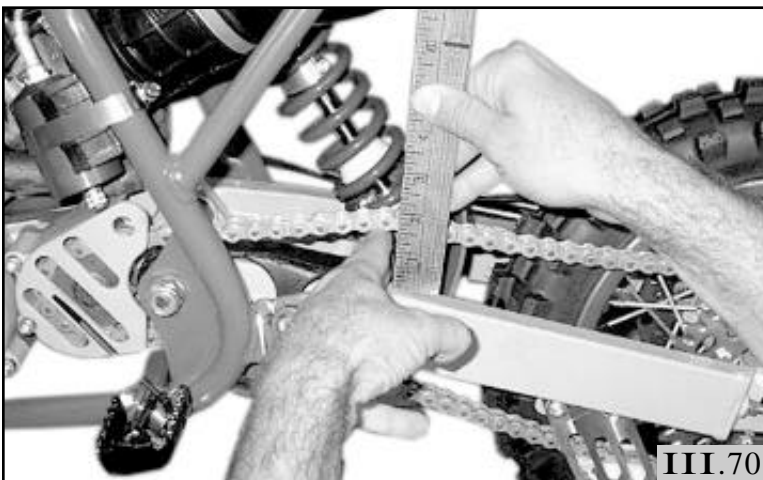
To lubricate chain, first use a brush or rag to remove heavy deposits of dirt. Put the motorcycle on a stand with the rear wheel off the ground or lean the bike against the kickstand to pull the rear wheel off the ground. Spray the oil on the lower section of chain between the footpeg and chain guide. Try and keep any overspray off the wheel and spokes. Turn the rear wheel by hand while spraying oil, make sure to coat the top and sides of the chain well. Lubricate until the chain is coated with oil. Allow to sit a few minutes for the oil to soak in and thicken. Note that o-ring chains are rarely used on mini's because of the horsepower they consume, so regular chain maintenance is required.

Check chain adjustment frequently when chain is new, it will stretch initially, then much more slowly for most of its useful life. Replace chain when it appears loose, the links bind, or the chain can be lifted away from the teeth at the middle of the rear sprocket. Replace chain as needed to prevent breakage and costly damage. Do not use a new chain on worn sprockets, or a worn chain on new sprocket(s) or rapid wear and breakage will result.

To check chain adjustment, the motorcycle must be sitting on a centerstand with the rear wheel off the ground. You should have about 30mm (1 $\frac{1}{8}$ ”) of free play. See illustration III-70. Adjust chain to this free play if needed. Muddy conditions may require a slightly looser adjustment to prevent binding when mud coats the sprockets.

To adjust chain, loosen rear axle nut until wheel is free to move. Loosen lock nut on the chain adjustment bolts, then screw bolts in or out to obtain proper chain adjustment. Make sure both bolts are adjusted to the same position by using a ruler to measure from weld on swingarm to end of adjusting bolt. See Photo III.71. When adjustment is correct, hold head of adjusting bolt with wrench and snug locking nut securely. Push rear wheel forwards to push axle against adjusting bolts and tighten rear axle nut to 37 ft/lbs. Double check adjustment by pushing down rear of bike until swingarm is level and checking to see that chain still has a small amount of play.

**Note:** remove and grease axle adjusting bolts when the bike is new and periodically thereafter to prevent them from snapping off in the swingarm if they become corroded.



Use ruler as shown to check slack, 1 $\frac{1}{8}$ ” is optimal.



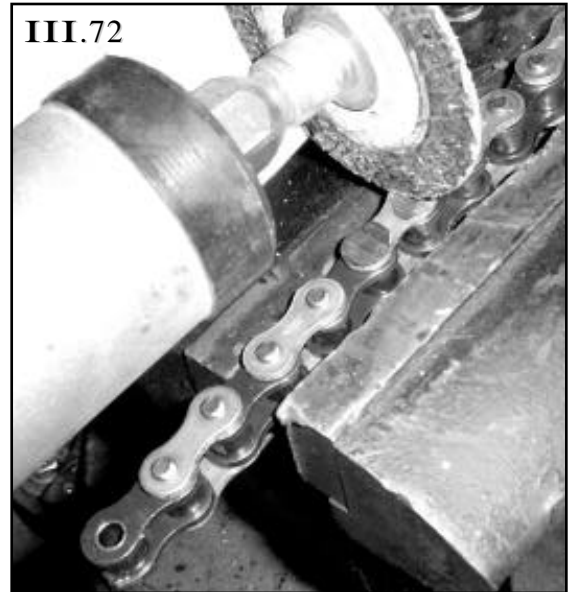
Make sure axle is same distance on each side.

**Chain replacement** - Most replacement chains will be longer than needed and will have to be trimmed to size. Remove the old chain by removing the master link. The master link will have a U shaped spring clip holding the chain's side plate on. Pry the clip off with a screwdriver, remove sideplate, and remove master link from chain. Spread the old chain out straight on the floor and lay the new chain next to it to determine where to cut the new chain. Mark the chain at the proper spot. Before cutting the chain, thread it onto the sprockets and make sure the mark is at the correct spot. It is possible the existing chain was shortened as it stretched, you don't want to cut your new chain too short. With the rear wheel adjusted almost all the way forward, your new chain should be just long enough. Adjust your cut mark if needed. A special chain breaker tool is available to cut the chain. If you do not have this tool, you will have to drill or grind the ends of the rivets flush with the sideplate on the link you wish to remove. See photo III-71. Then use a punch to drive the rivets through the sideplate and separate the link. See photo III-73.

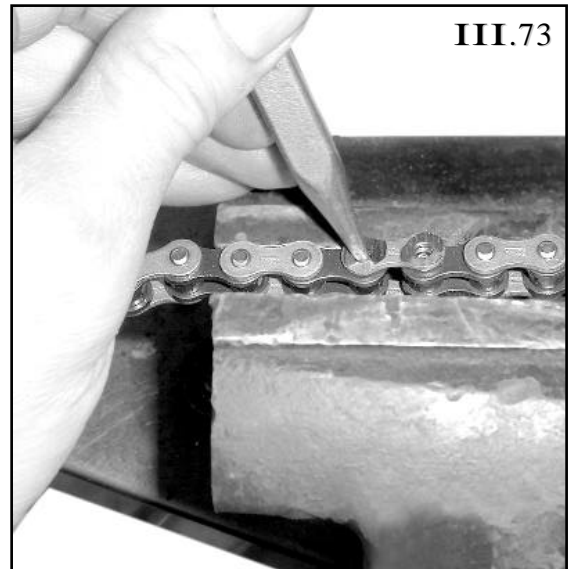
**Sprockets & gearing** - Check sprockets frequently for wear and damage. The sprocket teeth will begin to "hook" when the sprocket is worn out. Do not let sprocket wear become too bad or chain breakage may result. When changing rear sprocket, use medium strength (blue) threadlocker on sprocket bolts and torque to **XX ft/lbs** using a 10mm socket. To remove front sprocket, remove chain and use a pair of snap ring pliers to remove snap ring securing sprocket. Note that the boss on the front sprocket should face inward, towards the motor. Make sure the snap ring is fully seated in its groove when installing front sprocket. See photo III-74.

**Gearing** - The front and rear sprockets can be changed to alter the final gear ratio of the motorcycle. Using more teeth on the front sprocket raises gearing, while adding teeth to the rear sprocket lowers gearing. The calculate the actual gear ratio, divide the number of teeth on the rear sprocket by the teeth on the front sprocket. For example, with a 12 tooth front and 42 tooth rear:  $42/12 = 3.5$  If you add a tooth to the front sprocket:  $42/13 = 3.23$  If you add a tooth to the rear sprocket:  $43/13 = 3.31$  Adding teeth to the front sprocket makes a roughly 3 times larger change in gearing than adding a tooth to the rear sprocket. Note that a higher number is a "low" gear ratio, and a smaller number is a "higher" gear ratio. A higher ratio will increase the motorcycles top speed, but reduces the responsiveness and acceleration. A lower gear ratio will increase the responsiveness and acceleration but will lower the top speed. In general you want to use the lowest gear ratio possible that will still allow the speed needed for the fastest straightaway on the track. If too low a ratio is used, the bike will start well (but may wheelie) and will run out of acceleration on the fastest section of the track, allowing other bikes to pass. Too high of a ratio will result in slower starts and more difficulty in deep sand or mud. A beginning rider will generally benefit from a higher ratio until they can handle all the acceleration of the lower ratios (try the 13 or 14 tooth front with the standard 42 rear).

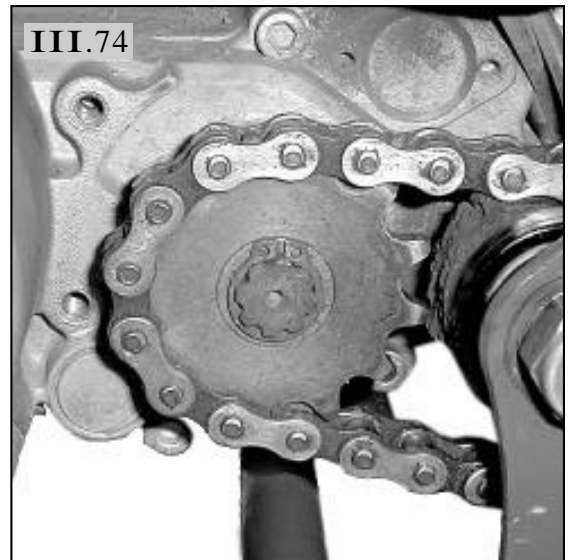
**Chain rollers, chain guide and wear pads** - The chain roller and wear pads on the swing arm and chain guide are important for the proper life and operation of the chain and sprockets. Check the chain roller periodically to make sure that it rotates freely. Replace if badly worn or frozen. Inspect the wear pads on swingarm to make sure they are not worn through. Replace as needed to prevent damage to chain or swingarm. Check wear pad in chain guide and replace as needed.



Grind or drill rivet heads flush.



Use a punch to remove sideplate.



Front sprocket &amp; snap ring. (boss faces inward)

## 22. Cleaning & storage

Before extended periods of storage, observe the following precautions:

- Clean and dry motorcycle thoroughly.
- Completely drain fuel tank and carburetor.
- Spray a little oil into spark plug hole and kick engine over a few times.
- Change transmission oil.
- Make sure coolant is fresh and at least a 50/50 antifreeze mixture.
- Lubricate the chain well.
- Inflate tires to proper pressure, store with tires off ground if possible.
- Seal exhaust outlet with a silencer plug tool or plastic bag.
- Make sure air filter is clean and well oiled.

## 23. Pre, post & between race maintenance

**Pre-race maintenance** - Proper maintenance is crucial for proper operation of motorcycle. Before each race, make sure to review the maintenance & lubrication schedule chart, section III-2. Take nothing for granted. Parts crack, break and corrode. Piston rings get tired. Gaskets leak. Give your rider the best possible chance of finishing the race by cleaning and inspecting the bike in plenty of time to service it and fix any damage prior to race day. Look for any leaking fluids and broken or damaged parts. Regular inspection can help prevent failures and injury.

Clean and oil spare air filters, and store them in ziploc® bags for ready use. Maintain stocks of transmission and premix oil so you don't run out on race day. Make sure you have spare spark plugs on hand. A selection of jets and common wear parts will come in very handy. Save old parts that might still work in an emergency, such as a worn set of clutch shoes. Buy extra gaskets, clips and other inexpensive but critical parts.

Try to develop a regular routine so you don't forget anything, and can do the various tasks as quickly and efficiently as possible. Check and adjust suspension sag periodically. Make sure you have gas and premix oil on hand, it can be hard to find on weekends or in an unfamiliar town. Mix enough fuel and oil the night before the race to get through the day. Take a few moments to check all bolts and nuts for proper tightness. Remove kickstand if required by rules. Make a checklist to make sure you have everything you need when you get to the races! In addition to normal maintenance, try and inspect and maintain the larger tasks each week in rotation. In other words, clean the brake calipers one week, adjust the steering play the next, and so on.

**Between moto maintenance** - Clean the bike as best you can between motos. Inspect the bike for damage and repair it the best you can in the time you have. In the event of more than minor damage, determine if the bike can be made safe in time for the next race. If not, try to arrange a backup bike or seek help to repair the damage in time. Do not risk your child's safety in the heat of the moment!

Clean off accumulations of mud and dirt. They can weight the bike down considerably which will affect handling, cooling and acceleration. Replace air filter with a clean one. Lubricate the chain and adjust as needed. Check tires, wheel and spokes for damage, also check and adjust tire pressure.

Remove the alternator cover and wipe out any moisture.

If race is muddy, inspect calipers for proper operation and clean frequently inside and out.

Quiz your rider about the bikes handling and change the suspension adjustments and tire pressures to suit riding conditions.

If there are problems with the jetting, use the choke and spark plug reading test to help determine if it is running rich or lean and rejet one jet size at a time.

Regear as needed for better starts or top end speed in long straights.

Make notes of any changes or problems to work on. Keep a log for future reference.

**Post race maintenance** - Make a list of any problems or parts needed while the race day is still fresh in you mind. If there were any jetting or handling problems, allow time to sort them out before the next race. Also make notes on how the rider performed, and what could be done to improve performance. Keep track of the best starting positions, lines and other information that will help you ride the track quicker the next time.

Clean and lubricate the bike thoroughly, inspecting for damage as you do. Remove alternator cover and wipe out moisture after washing bike or at end of day. Use care not to damage seals, bearings and linkages with pressure washer!

Order any new parts right away before you forget or there is not enough time to get them, especially if they are not in stock at your local dealer. Make any needed repairs well before the next race in case you run into problems. Close inspection will save you a lot of trouble, its better to know about any problems as soon as possible, rather than find out when it's too late!

Depending on the level of competition, you may wish to keep an inventory of parts. Keep track of parts to re-order as they are used. Make note of cost in case other racers need spares.

## 24. Special tools and supplies

### SUPPLIES

disposable gloves  
zip ties, assorted  
duct tape  
friction tape

### TOOLS

air tank or air pump  
bike stand  
container to catch oil & coolant  
funnel  
metric socket set with ratchet  
metric wrench set  
metric allen key set  
safety wire & pliers  
screw drivers - flat and phillips  
spoke wrench  
tire irons  
tire pressure gage  
torque wrench

### SPECIALTY TOOLS

bike stand  
CV boot clamp pliers (for hose clamps)  
inductive tachometer, Northern Hydraulics #160596 (to check clutch engagement rpm)  
Polini parts book 097.0064 (contains exploded parts diagrams & part numbers)  
main case splitter tool 144.695.001 (needed to split main cases)  
clutch puller set (2 & 3 shoe & flywheel) 99029 (this tool is the most useful puller for the price)  
flywheel puller 144.695.002  
clutch puller, 2 shoe 144.695.003  
timing gage set 144725 (necessary to set timing)  
piston stop tool  
chain breaker tool 148615 (useful to shorten chain)  
Exhaust spring tool 999.260.001 (used to remove and install exhaust pipe springs)  
air pump 999.625.008 (for Curnutt shock)

### CHEMICALS

Antifreeze - Engine Ice coolant  
antiseize compound  
brake cleaner  
chain lube  
Fork oil: 5 - 10wt.  
grip glue  
Maxima FFT foam air filter oil  
Maxima MTL75 transmission oil  
Maxima K2 premix oil  
threadlocker - blue and red types  
waterproof grease

## IV. TROUBLE SHOOTING GUIDE

Motorcycle won't start - check for:

**Spark at plug** - if weak or no spark, check coil ground, disconnect kill switch, and check ohm readings for coil & stator.

**Fouled spark plug** - replace, adjust jetting as needed.

**Fuel flow to carburetor** - if no flow from hose, make sure there is gas in tank and fuel valve is on. Make sure choke is on if engine is cold. Clean fuel filter and/or remove debris from fuel valve and hose. Clean carburetor.

**Plugged air filter** - clean and reoil.

**Low compression** - check reeds, combustion chamber o-ring, piston and rings.

Motorcycle runs poorly - check:

**Jetting** - use choke and plug reading to adjust as needed.

**Spark plug gap and condition** - make sure coil has good ground. Replace plug and adjust jetting as needed.

**Spark** - if spark seems weak with a new plug, check coil ground and ohm readings for coil and stator assemblies.

**Fuel** - make sure fuel flows readily from gas line. Remove float bowl and check for dirt and float operation & adjustment.

**Air leaks** - spray carburetor cleaner around carburetor, intake boots and reed block and see if idle changes.

**Air cleaner** - make sure air cleaner is clean and properly oiled. Make sure oil isn't dripping into carburetor.

**Compression** - if compression is low, check condition of reeds and then replace piston ring and/or piston.

**Exhaust** - if power is down, check for large dents, blown out silencer packing or heavy carbon fouling.

**Engine** - make sure motor mount bolts are tight.

Brakes are dragging or not working - check for:

**Mud or dirt jamming piston** - disassemble caliper, clean thoroughly and lubricate.

**Worn pads** - adjust caliper freeplay and/or replace brake pads

**Worn cables** - clean and lubricate cables or replace as needed.

Suspension not working well - check for:

**Oil leaks from forks or shock shaft** - have forks or shock serviced.

**Check for proper sag adjustment** - adjust spring preload or install heavier or lighter springs as needed.

**Adjust shock settings** - adjust compression and rebound settings for track conditions.

**Check shock bushings** - replace worn or binding shock bushings

**Binding forks** - loosen front axle pinch bolt, bounce forks several times and tighten pinch bolt.

**Loose steering stem** - check and tighten steering adjusting nut

**Loose swingarm bolt** - Tighten swingarm bolt, check swingarm for proper movement. Clean/grease bushings as needed.

## V. PARTS & ACCESSORIES

### 1. Recommended spares

tires, pirelli/hard pack, bridgestone/soft pack

tubes

grips

throttle assembly with tube

brake and throttle cables

kickstarter gears & with spring and clip

gaskets & o-rings

chain with master link & sprockets

jet selection

piston, piston pin, ring(s), rod bearing, circlips

brake pads

brake lever assembly

handlebars

clutch shoes & spring washers

spark plugs

air cleaners, spare

clutch woodruff key

clutch shoe bolts

clutch drum

## 2. tips & tricks

**Clean the air filter. Change the oil. Clean the clutch. Clean the air filter. Change the oil. Clean the clutch. Repeat...**

Zip tie carburetor & plug boots!

Disposable rubber or nitrile gloves will make messy and dirty tasks a lot less objectionable (like cleaning air filters...)

Use tape to seal both ends of throttle cable to boots.

Do not tighten brake lever too much, lever should shift in a crash rather than breaking the perch.

Use a wire nut to cover sharp ends of brake cables.

Make or buy a pickup strap for the back of the motorcycle.

Change sprockets! Adjust gearing for each track to maximize performance! Much cheaper than motor hop-ups! (and legal)

Expert riders can try a 32:1 premix oil ratio, for better ring seal and piston life. Adjust jetting to match!

Use a ketchup squirt bottle or large syringe to put oil in checking screw hole or end of vent hose.

Adjust clutch engagement to match rider's skill level!

Tape both ends of throttle cable to keep out dirt.

In muddy conditions, put a piece of duct tape over openings in caliper to help keep the mud out.

Extra springs can be used on caliper to insure more positive brake feel and to reduce brake sticking. Thread spring onto end of cable between caliper arm and cable mount.

If you manage to drop a piston circlip into the crankcase, try using a magnet probe to retrieve it. I once successfully removed one using a small magnet on a string stuck to the crankshaft weight. Gently rotating the magnet into the crankcase retrieved the circlip.

Consider powder coating parts for protection and appearance. Exhaust pipe can be coated with high temperature ceramic coating for durability. The piston can be dry film coated for longevity. The combustion chamber can be coated with thermal barrier material to help keep the heat in the combustion chamber. Contact [www.airbornecoatings.com](http://www.airbornecoatings.com) for more information.

Buy a piston stop. In a pinch, a length of CLEAN rope can be inserted into the spark plug hole to prevent the piston from rising to the top to allow removal and installation of the clutch nut.

Invest in education. Buy training manuals and videos. Both Gary Semics and Gary Bailey offer videos, books and instructional classes & schools. Knowledge is power! Many top riders receive coaching by these trainers, including Jeremy McGrath & Ricky Carmichael! [www.gsmxs.com](http://www.gsmxs.com) [www.garybailey.com](http://www.garybailey.com)

Buy the best safety gear available. Prevent injuries if possible! Make sure to use a kidney belt and consider the use of a neck collar to reduce neck and spine injuries. For very small riders, youth ELBOW guards may work well as KNEE guards.

## VI. CONTACT INFORMATION & RESOURCES

### 1. Action Racing Center, 6063 Jane's Lane, Naples, FL 34109

**Phone (239) 566-9666**

**Fax (239) 566-2220**

*For fastest service, call in parts order or technical questions - or - email to:*

**duanet@polinimicrocross.com** - part sales

**timd@polinimicrocross.com** - technical assistance

**darrelle@polinimicrocross.com** - shipping information

### **Curnutt Shocks, 654 West Alondra Blvd., Gardena, CA 90247**

Charlie Curnutt: PH (310) 538-3789 Fax (310) 538-5538

Mon-Fri 6pm-9pm, Sat & Sun 8:30am-9pm (Pacific Standard Time)

### **R&D Racing Products, 11419 Bombardier, Norwalk, CA 90650**

[www.randdracing.com](http://www.randdracing.com)

PH 562-864-8218

Fax 562-868-9554

## 2. WWW links

### Action Racing & Polini

[www.50ccminicross.com](http://www.50ccminicross.com)

[www.poliniminicross.com](http://www.poliniminicross.com)

[http://poliniminicross.com/forums/support\\_forum/](http://poliniminicross.com/forums/support_forum/) (Action Racing support forum)

[www.polini.com](http://www.polini.com)

### Sanctioning organizations

[www.nemamx.com](http://www.nemamx.com) - New England Motocross Association

[www.nemx.org](http://www.nemx.org)

[www.amadirectlink.com](http://www.amadirectlink.com), [www.ama-cycle.com](http://www.ama-cycle.com) AMA

[www.mxnetwork.com](http://www.mxnetwork.com) (MD, TN, VA, NC, SC)

[www.ahrma.org](http://www.ahrma.org)

### Useful links

[www.50ccperformance.com](http://www.50ccperformance.com) - aftermarket parts and service

[www.airborncoatings.com](http://www.airborncoatings.com) - powder coating, exhaust coating, piston coatings

[www.gsmxs.com](http://www.gsmxs.com) - Gary Semics books, videos and riding schools

[www.garybailey.com](http://www.garybailey.com) - Gary Bailey videos & riding schools

<http://eric-gorr.com> - technical information & services

[www.motocross.com](http://www.motocross.com)

[www.dirtrider.net](http://www.dirtrider.net)

[www.minimotoxr.com](http://www.minimotoxr.com) - chatroom for minis

### Manufacturer's links

[www.bobscycle.com](http://www.bobscycle.com) - discount gear

[www.elineaccessories.com](http://www.elineaccessories.com)

[www.factoryconnection.com](http://www.factoryconnection.com)

[www.maximausa.com](http://www.maximausa.com) Maxima lubricants

[www.motocrossaction.com](http://www.motocrossaction.com)

[www.moto-directory.com](http://www.moto-directory.com)

[www.oneal.com](http://www.oneal.com)

[www.promotorcyclesafety.com](http://www.promotorcyclesafety.com) - neck supports

[www.racerxill.com](http://www.racerxill.com)

[www.scottusa.com](http://www.scottusa.com)

*This manual is dedicated to the kids who ride the wheels off these things and give it their all.*

*This manual is for their dads (and moms), who make it all possible.*

This manual was created exclusively for Action Racing by Bryan Patton of Patton Productions, Avon, CT - (860) 673-1957.

It was designed on a Power Macintosh G4 computer, using Quark XPress and Adobe Photoshop.

All photographs were taken digitally, using a Nikon Coolpix 800, 2 megapixel digital camera.

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