

# WHITE BROTHERS E-SERIES

## MANUAL FOR OFFROAD MOTORCYCLES

YAMAHA YZ & WR400F 1998 -'99



Thank you for purchasing White Brothers revolutionary E-Series exhaust system. A system so uniquely advanced, that we have patented the shape and technology. Through years of being the leader in four stroke performance products, we have come to know what you want: increased performance, innovative design, easy installation, technical support, and most importantly, value for the dollar. The new E-Series is the cumulation of all these criteria, and much more.

Not only is the new E-Series exhaust systems available for most popular Offroad bikes and 4 wheelers, but also for Sportbikes, Harley-Davidsons, Cruiser, Snowmobiles, and even Automotive applications! Give us a call for specific applications

Unlike many other exhaust system manufactures, all E-Series exhaust systems are developed exclusively on the WB in-house Dynojet dyno. After development for maximum horsepower and torque, they are painstakingly fitted to perfection for easy, no hassle installation. Then, and only then, are they test ridden under the most extreme conditions, by some of the most fearsome test riders on the planet. These are the same riders that thrash the OEM test bikes for the major magazines. We do this to determine if dyno performance and track performance are perfectly matched. Bottom line, you get products that have been thoroughly put to the test.

The overall design of the system from a styling standpoint was extremely important to us. The E-Series silencer body, discs, and end cap, being an ELLIPTICAL SHAPE, give a much improved fit to the motorcycle. Even the end cap, that actually has no exhaust outlet hole in it, was thoroughly thought-out to give you an esthetic appeal. The entire unit provides better clearance, more aerodynamic shape, better flow, and most importantly, more horsepower than conventional exhaust systems.

Another innovative feature is that we use stainless steel, aluminum, carbon fiber, and/or titanium components throughout.

Our stainless steel is 304 series; virtually impervious to rust or corrosion, and you never have to worry about plating or paint flaking off. Our aluminum silencer bodies are made from 6063 extrusion. Our aluminum specific fit mounting brackets are manufactured by the extrusion process, then CNC'd to perfection. Our carbon fiber silencer bodies are built to standards unheard of previously (but that's our secret) and in a four twill pattern. Our titanium head pipes are from commercially pure stock normally reserved for the aircraft industry. Only the finest, most exotic materials for such a revolutionary new product are being utilized.



## FREQUENTLY ASKED QUESTIONS



**QUESTION:** Why doesn't the end cap have a hole

**ANSWER:** The end cap has no hole because the exhaust exits through a precise gap in the E-Series diffuser discs. The E-Series Discs create a suction that extracts spent exhaust gases from the pipe thus creating a cleaner, hotter burn on the next compression stroke. In addition, exiting the exhaust through the discs, and not an open hole, enables the E-Series to be a U.S.F.S. approved spark arrestor.

**QUESTION:** Can I run a open end cap?

**ANSWER:** Yes, but you will actually lose horsepower and torque. For example, on the Yamaha YZ400F, the E-Series loses over 2 horsepower on the dyno with the end cap & discs removed! You will also lose the ability to adjust powerband, sound levels and jetting; as well, the system will no longer be a U.S.F.S. approved spark arrestor. If you choose to run an open end cap, simply remove the blank disc and bolt the end cap back on.

**QUESTION:** Do I have to run the E-Series Discs?

**ANSWER:** Yes, but only if you want maximum horsepower, maximum adjustability, and a U.S.F.S. approved spark arrestor.

**QUESTION:** What is the minimum/maximum number of E-Series Discs I can run?

**ANSWER:** The minimum number of Discs you should use is 4. This will still be flowing the equivalent of a straight through one inch hole, normally still much more than an OEM system. The maximum number depends on the diameter of the core. In most cases, this will be somewhere between 18 & 28. Most systems utilizing a 2" core will make maximum horsepower with 7 to 12 E-Series Discs. It is very important to remember that more Discs do not necessarily mean more horsepower. Every engine/exhaust system has its "sweet spot". See your individual dyno chart for the best combination to begin with.

**QUESTION:** Do I need to re-jet?

**ANSWER:** No. The E-Series is designed to work with stock jetting, while increasing horsepower. If maximum horsepower via additional modifications such as aftermarket air filters, pistons, cams etc is your desire, rejetting may be required. Refer to the tuning guide for additional information or contact our Carburetion or R&D departments for assistance.

## HOW THE E-SERIES DIFFUSER DISCS WORK WITH YOUR ENGINE



As a 4 stroke engine enters the exhaust phase, the piston moves upward, and the exhaust valve opens as spent gases flow into the exhaust pipe making room for fresh fuel. There is however a quantity of unburned gases that remain in the combustion chamber. It is at this instant, when both intake valves and exhaust valves open, that a properly designed exhaust system can help scavenge as much of the residual gas as possible. The more efficient the scavenging, the less diluted the incoming fuel-air mixture will be.

As the exhaust valves open, a shock wave is generated which travels down the pipe. When it reaches the end of the pipe, negative pulse is reflected in the reverse direction. If the length of pipe is adjusted so that the suction wave arrives back at the exhaust valve just before it closes, a vacuum is created, allowing the cylinder to be charged with a purer mixture. The inertia in one moving exhaust packet assists the flow of the next charge. A purer mixture can now enter each cylinder, resulting in stronger explosions and more power.

Essentially, this type of tuning produces an increase in power over a relatively small RPM range. The suction wave produced is a combination of high energy and short duration. A wider powerband can be created with the use of a diffuser. There are two types of diffusers on motorcycles; Conical and Radial. A Conical diffuser is commonly called a megaphone (or S-Bend/Tail pipe in some cases). A radial diffuser is the E-Series Disc. Basically, a diffuser creates suction waves with a lower energy peak and longer duration. A simple way of understanding the process is thinking of a diffuser as creating a continual series of suction waves, providing effective cylinder scavenging over a much wider RPM range.

So how does a megaphone differ from the E-Series Discs? They both cause a suction. They both create diffusion as well as static & dynamic pressure. They both work on the "Bernoulli Equation" affect, relating total flow of energy being made up of two components (static & dynamic pressure) and is a constant. In other words, the total power or energy stored in the flow is the same at every point. As one component changes, the other changes the opposite amount to keep the total the same. So as the flow area decreases, the velocity must increase (and vice/versa). A carburetor "venturi" is a good example. At the throat of the venturi, the area is smaller and the velocity is greater than at the inlet or outlet. Consequently, the static pressure at the throat is lower and creates a suction. When a megaphone is added to a straight pipe, the final exit velocity where the exhaust enters the atmosphere is reduced because the exit flow area is now larger. In the megaphone inlet, where velocity is greater, static pressure must be lower than at the exit. Since the exit pressure is atmospheric, the static pressure at the inlet is below atmospheric. Below atmospheric pressure means that there is now a suction at the end of the straight pipe when the megaphone is added. The E-Series Diffuser Discs create the same effect as a megaphone, with the added benefit of being easily and readily tunable, as well as dispersing the sound level over a broader area. Like changing megaphone lengths and diameters, the E-Series Discs allow you to adjust for Power, Sound, and Jetting levels, only now you can do it in minutes.



Unless otherwise noted, it is highly recommended that you do not change the jetting after bolting on your new E-Series until you first try it with the standard and/or existing jetting, or the jetting that is noted in the instructions for your specific model. The E-Series Discs are designed to maximize flow without necessarily adding fuel (changing jetting). So many elements affect jetting such as altitude, weather conditions, engine and/or carburetor condition and cam timing etc. Even different riders will affect this. For instance, a novice who rides at lower throttle settings may notice more changes with the pilot and/or needle circuit. A professional using maximum throttle may not notice changes as much on the pilot and/or needle circuit, but will only be concerned with how it carburetes on the main jet. Again, first bolt on the system and try it before making any changes.

Bolt the system on with the number of E-Series Discs supplied in the kit, then go out and ride it. Note the power and how it carburetes compared to stock exhaust system. We have many cases where actually using less discs, increased the horsepower significantly. Your individual dyno chart for your model will show you the best overall combination to use.

All things being equal and in good working condition, a lean condition will be noted as a hesitation, increased temperature, loss of power and(or) back firing/popping on deceleration. A rich condition will be sluggish performance, black smoke, fouled spark plugs and(or) increased fuel consumption. Altering the number of E-Series Discs can improve and solve most of these conditions. When you understand how they work in conjunction with each other, tuning becomes a very simple procedure.

In the simplest form, increasing or decreasing the number of E-Series Discs basically increases and decreases the size of the outlet hole. **Adding** Discs **increases** the outlet hole size. **Subtracting** Discs **decreases** the outlet hole size. In most cases, 4 Discs will equal the flow of a stock exhaust system. Equally, 28 Discs is the maximum number of Discs (provided the silencer core is large enough to handle this amount of flow). The core size will also affect the number of Discs you are able to fully utilize. The chart below will provide you an example of how the Discs relate to flow/core size. You can note the core size in your particular E-Series by removing the End Cap/Disc assembly and measuring across the O.D. of the perforated core. Most E-Series come with a 2.0" round or 2.25" elliptical core.

NUMBER OF DISCS	CUBIC INCHES OF FLOW (SIZE OF HOLE/OR CORE STRAIGHT THROUGH)
4	.96
8	1.36
12	1.66
16	1.92
18	2.03
24	2.35
28	2.54



By adding E-Series Discs, you are increasing the outlet area and thereby increasing: the powerband for more top-end power, the sound level and leaning out the carburetion. By subtracting E-Series Discs, you are decreasing: the outlet area and thereby decreasing the powerband for more bottom end or torque, the sound level and enriching the carburetion.

Remember, using more or less E-Series Discs does not necessarily equate to an increase or decrease in horsepower. Every engine has its "sweet spot". And of course every person has their preferred powerband preference. Your new E-Series system has been supplied with enough Discs for an optimum overall powerband response, sound level, and stock jetting. Additional Discs are available to provide you an even broader choice of tunability.

While it is difficult to determine without a dyno and EGA machine, the exact power increase and/or jetting for each machine, the dyno graph and jetting specifications provided within this manual will give you a good base. Please contact our Carburetion and/or R&D departments with any questions you may have. All you need do is tell us what it is doing or not doing. We can then tell you what to do to correct it. Above all, do not be afraid to experiment with the Discs. Your new E-Series is fully tuneable. Adding and/or removing Discs can and does make a huge difference!

While tuning and/or diagnosing any glitches in your powerband that may arise, the following will provide you with a basic understanding of which circuits are affected during a particular throttle position. In most cases, adjusting the number of E-Series Discs will improve and/or fix most circuit problems. In case additional adjustments are required, this section will help you locate and solve the problem. It is important to remember that adjusting carburetion should only be attempted on an engine in good running condition that is thoroughly up to operating temperature. Do not make adjustments all at once, and most importantly, do not make adjustments until first trying the exhaust system with the existing jetting. Then trying to adjust by varying the number of E-Series Discs. Find the affected throttle position (circuit) and work on that area only. Doing one step at a time will ensure optimum performance and smooth efficient operation.

**Pilot Jet** - Up to 1/4 throttle - Controls fuel flow through the idle circuit - Mixture is adjusted by means of the mixture screw - There are two types of mixture screws - Fuel Screws and Air Screws ]

- A Fuel Screw, as the name implies, meters fuel - A Fuel Screw will be located on the engine side of the throttle valve, usually on the bottom of the carb - Turn in to lean mixture - Turn out to richen mixture - The engine should have a smooth, steady idle with the screw between 1/4 and 3-1/2 turns out from fully bottomed (gently!) - If the engine requires more than three turns out, the pilot jet may be too lean - If it requires less than 1/4 turn, it may be too rich.

- An Air Screw meters air - An Air Screw will be located on the air cleaner side of the throttle valve, usually on the right or left side - Turn in to richen mixture - Turn out to lean mixture - The engine should have a smooth, steady idle with the screw between 1/2 and 2-1/2 turns out from fully bottomed - If the engine requires more than 2-1/2 turns out, the pilot jet may be too rich - If it requires less than 1/2 turn, it may be too lean.

Symptoms and/or adjustment - With the idle at approximately 1000 rpm, turn the air screw mixture in slowly until the idle slows or becomes erratic, then begin turning the screw back out until it again becomes erratic. Count the number of turns in between the two positions. Set the position of the air screw between these two conditions, which should also be your smoothest idle . Finally, adjust the idle screw if necessary to approximately 1000 rpm again.

**Jet Needle** - from 1/8th to 3/4" throttle - Controls fuel flow through needle jet - Raising or lowering the clip location on the grooves, richens or leans fuel flow, as well as determines at what throttle position the tapered part of the needle is to be raised out of the needle jet - Raising the needle (lowering the clip) richens the mixture - Lowering the needle (raising the clip) leans the mixture.

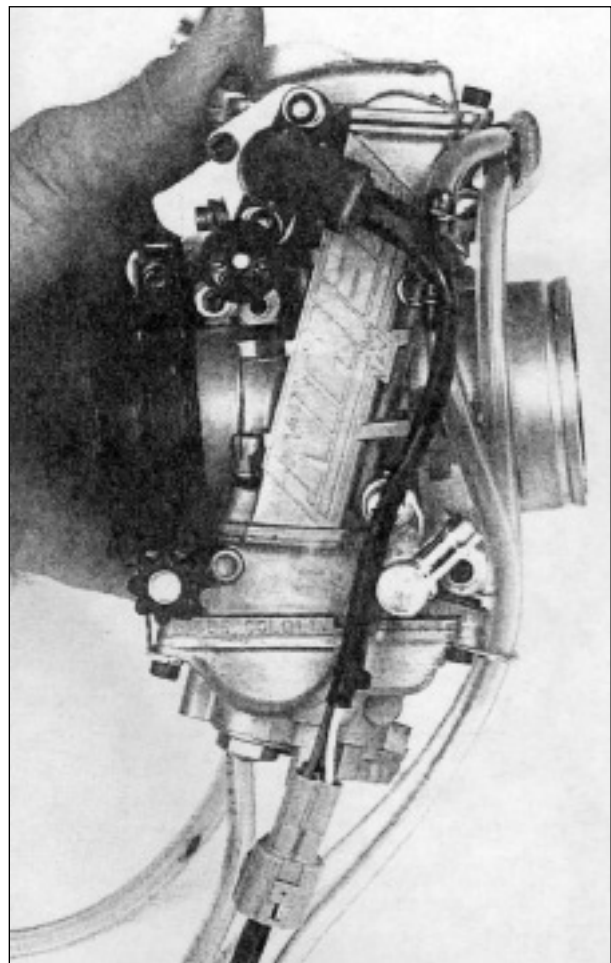
Symptoms and/or adjustment - Accelerate to 1/2 to 3/4 throttle, preferably in top gear. If acceleration seems weak, soft or flat, or the engine responds slow when the throttle is quickly opened, the mixture is too lean. Lower the needle clip one position to raise the needle. Conversely, if acceleration is crisp and strong, but hesitates or shutters as the throttle is closed from 3/4 to 1/2, the mixture is too rich. Raise the clip one position to lower the needle. The optimum setting will be crisp acceleration, with no load up (rich) as the throttle is backed off.

**Main Jet** - from 3/4 to full throttle - Controls fuel flow as the jet needle is lifted far enough out of the needle jet. Until this point (throttle position), the main jet has no effect on mixture strength. A larger # jet richens the mixture - A smaller # jet leans the mixture.

Symptoms and/or adjustment - The main jet is the last jet you deal with and by far the easiest to diagnose. You will only change the main jet if a problem exists at 3/4 to full throttle. Any other problems in the carburetion are not affected by the main jet. The two easiest ways to find the optimum setting are:

1) Set-up an area approximately 50 to 100 yards long. Have someone time you through this area. As you pass the entry, open the throttle fully (on the main jet circuit) and motor through this area. Essentially, the jet size that provides the least amount of time to run through this, is the correct main jet.

2) Starting with a fresh set of spark plugs that have been run for at least a few miles to gain some color to them, run the engine (under a load) for approximately a minute or so at 3/4 to full throttle. Then, in a safe area, pull in the clutch, hit the kill switch, and leave the throttle in its wide open position; all at the same time and coast to a stop. Then remove the spark plug and inspect its condition/color. The porcelain should be a reasonably clean color/condition, light gray to brown is good. If the plug is black and/or sooty, the main jet is too rich (big) and you should go down in size to a smaller number. If the plug is white, with no apparent change in color from brand new, and the engine appears to be running hotter than normal, it may be lean (small). You need to go up in size to a larger number.





**Description**

**Part number**

Complete End Cap Assembly, Elliptical	06-910
Complete End Cap Assembly, Turn Down	06-915
End Cap, Elliptical	06-920
End Cap, Turn Down	06-921
End Cap Screws (6, holds up to 18 Discs)	06-926
End Cap Screws (6, holds up to 28 Discs)	06-927
Exhaust Disc Shield (covers inner 120° of Discs)	06-925 *8:00 - 12:00 position
Exhaust Disc Shield (covers inner 180° of Discs)	06-935 *6:00 - 12:00 position
Exhaust Disc Shield (covers top 180° of Discs)	06-936 *9:00 - 3:00 position
Exhaust Disc Shield (covers 360° of Discs)	06-937 *12:00 - 12:00 position
E-Series Disc 6 pack	06-922
E-Series Disc 12 pack	06-923
Blank Disc (no opening for Spark Arrestor)	06-924
Silencer Core, S-Bend Series	06-940
Silencer Core, Meg Series	06-945
Silencer Repack Kit	84-9106
T-Bolt Clamps, Stainless Steel	1.5" 01-150
	1.75" 01-175C
	2.0" 01-200
	2.25" 01-225C
	2.5" 01-250C
Anti-Seize/High Temp Lube, 1cc tube	06-960
E-Series Name Plate	06-965
Replacement Shell - Carbon Fiber Silencer	06-970
Replacement Shell - Aluminum Silencer	06-980
Mounting Bracket, Extruded/CNC	05-0200

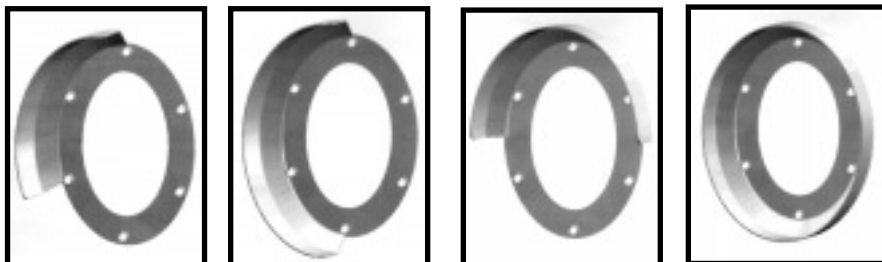


8-12 position

6-12 position

9-3 position

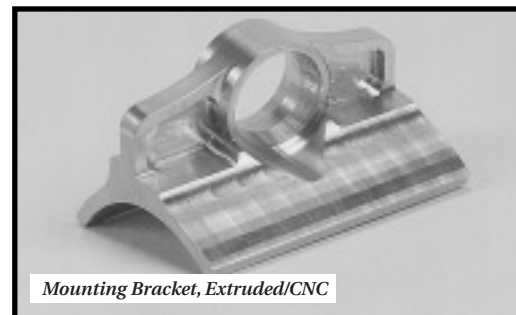
12-12 position



**Four Stroke Silencer Cartridge (YZ/WR400)**

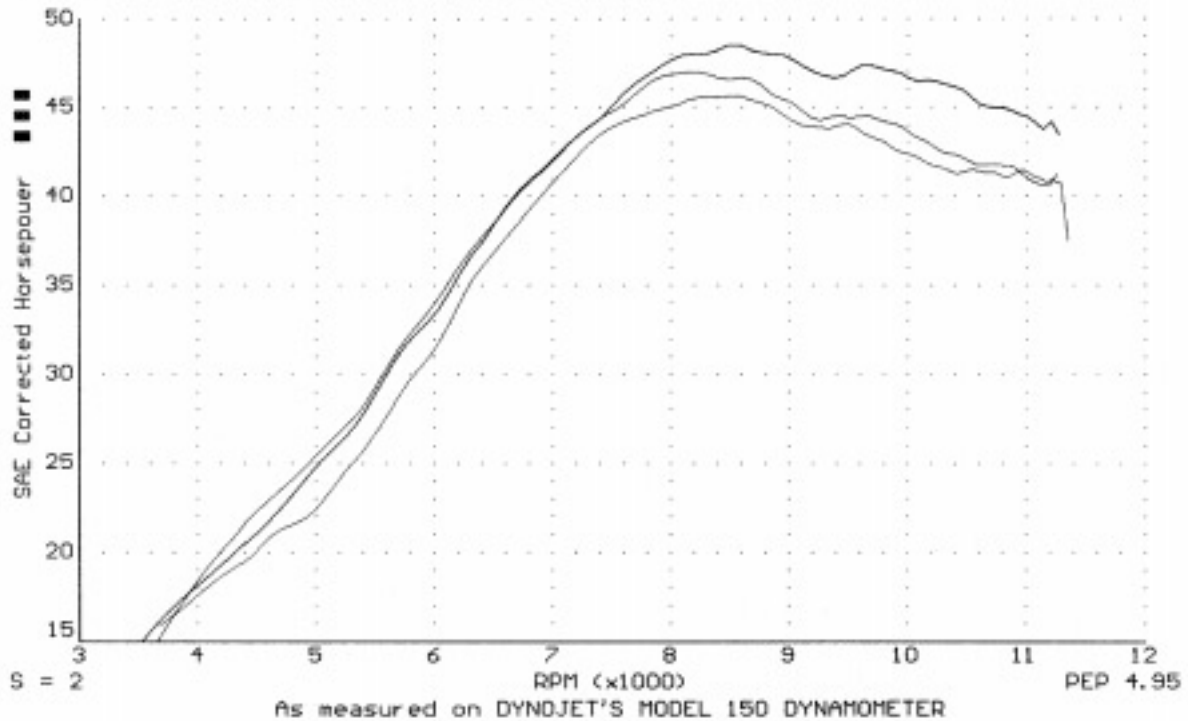
- Replaceable cartridge for your bikes muffler
- Maintain your bikes power and improve the sound quality
- Precut and pre-formed using WB confidential blend of materials for sound dampening

	E-series	OEM
Fits YZ/WR400(98)	Part No. 68-002	Part No. 68-001
YAMAHA P/N	YZR-5BEPA CK-20	YZR-5BEPA-CK-NG





DYNORUN.018 - 1.750 TI 2 S-BEND & 2 CORE 15 DSK RO  
 DYNORUN.003 - SPUD'S, all stock exhaust HP & BAFFLE RO  
 DYNORUN.026 - STD HEAD PIP, MEG, 2 CORE 15 DSK RO



DYNORUN.018      73.9 °F    29.48-0.58 in.Hg.    0 ft.    CF=1.01    RPM/MPH=156  
 Max POWER = 47.0  
 15 DISKS BLANK END CAP  
 1.750 Ti HEAD PIPE

DYNORUN.003      74.5 °F    29.43-0.54 in.Hg.    0 ft.    CF=1.01    RPM/MPH=156  
 Max POWER = 45.7

DYNORUN.026      74.8 °F    29.48-0.60 in.Hg.    0 ft.    CF=1.01    RPM/MPH=156  
 Max POWER = 46.5  
 15 DSK BLANK END CAP  
 STD 1.625 HEAD PIPE

WHITE BROS RESEARCH AND DEVELOPMENT LAB    YORBA LINDA, CA    (714) 692-3404

As you will note from the dyno graph, the best overall top end power out-put was obtained using 12 Discs on the megaphone system and/or 12 Discs on the S-Bend system. Adding Discs did not change the top-end power, but did increase the mid-range.

The Jetting on this particular bike was stock.

- AIR SCREW                    - 2-1/8 turns out
- PILOT JET                    - 45
- NEEDLE POSITION           - OBDVR, 4th clip position
- MAIN JET                    - 175

# **E-SERIES INSTALLATION**

## **PRO MEG CARBON & ALUMINUM, S-BEND ALUMINUM**

### **YAMAHA ,YZ400F/WR400F, 1998**

Part numbers covered in this installation sheet are: 05-040, 05-060, 05-000, 05-080, 05-180

#### **STOCK SYSTEM REMOVAL**

Be sure engine/exhaust is cool before removing and/or attempting to remove.

- 1.) Remove right side number plate panel.
- 2.) Loosen clamp securing silencer/tailpipe section to headpipe.
- 3.) Remove stand-off bolt securing silencer to frame located near "V" section of frame.
- 4.) Remove silencer mounting bolt securing it to upper frame/fender section. Set bolt/rubber grommet aside as you will re-use.
- 5.) Slide assembly off of headpipe. *\*NOTE:* If you have purchased the performance headpipe (#05-080 or 08-180), remove stock headpipe.

#### **E-SERIES INSTALLATION**

- 1.) Loosen headpipe flange bolts so it can be adjusted slightly if necessary during installation of the new E-Series. If you are installing the WB performance headpipe, replace exhaust port gasket (if necessary) and insert headpipe into port. Install nut/bolt - **Do not tighten!** Slide aluminum sleeve/gasket (provided with headpipe) onto outlet end.
- 2.) Install stock asbestos gasket back onto headpipe (it may have come off with stock system). Replace the gasket with a new one if necessary. *\*NOTE:* If are using the WB performance headpipe, you **will not** use this gasket.
- 3.) Slide new T-bolt clamp (provided) onto inlet section of S-bend/Meg, and install onto headpipe, rotating as necessary. Do not tighten.
- 4.) Line up stand-off mount through frame and install stock bolt. Do not tighten.
- 5.) Install stock rubber grommet into mounting bracket on silencer. Note: On S-Bend models, install the other T-bolt clamp (provided) onto the silencer, slide onto S-Bend, and line up bracket to frame mount location. Insert bolt, but do not tighten.
- 6.) Starting at the front, and adjusting as necessary for proper clearance and fit, tighten headpipe flange nut/bolt (17 foot pounds max), T-bolt clamp(s), frame stand-off bolt, silencer mounting bolt, side number plate. Tighten securely and re-check after running 50 miles.

**CAUTION: Carefully inspect rear sub-frame section for straightness. If the upper sub-frame is bent, causing silencer mount to be pulled towards the tire, silencer body may/can contact brake caliper on full compression/bottom out, causing damage to the silencer shell.**

#### **INSTALLING E-SERIES DIFFUSER DISCS**

Referring to the dyno chart provided for guidance, choose the number of discs best suited to begin with. It is very important to always install the blank disc (the one without the hole) on as the last disc before the end cap. Place a small amount of the 1cc tube of high temp lube (provided) onto the threads of the 6 socket head cap screws (provided). Install the entire assembly onto the core/silencer base and snug the screws down. Tighten securely in cross pattern with the 4mm hex key wrench (provided). When tightened securely, the discs provide a spring back affect, similar to a lock washer. Do not over tighten. Check periodically.

When adding or removing discs, always be sure to use a small amount of high temp lube on the screws to ensure that the threads will not gall or seize.



## MAINTAINANCE



To clean the aluminum and/or stainless steel components, simply use soap & water. For blemishes and/or discoloration, simply use a fine scotch-brite pad to touch up these areas.

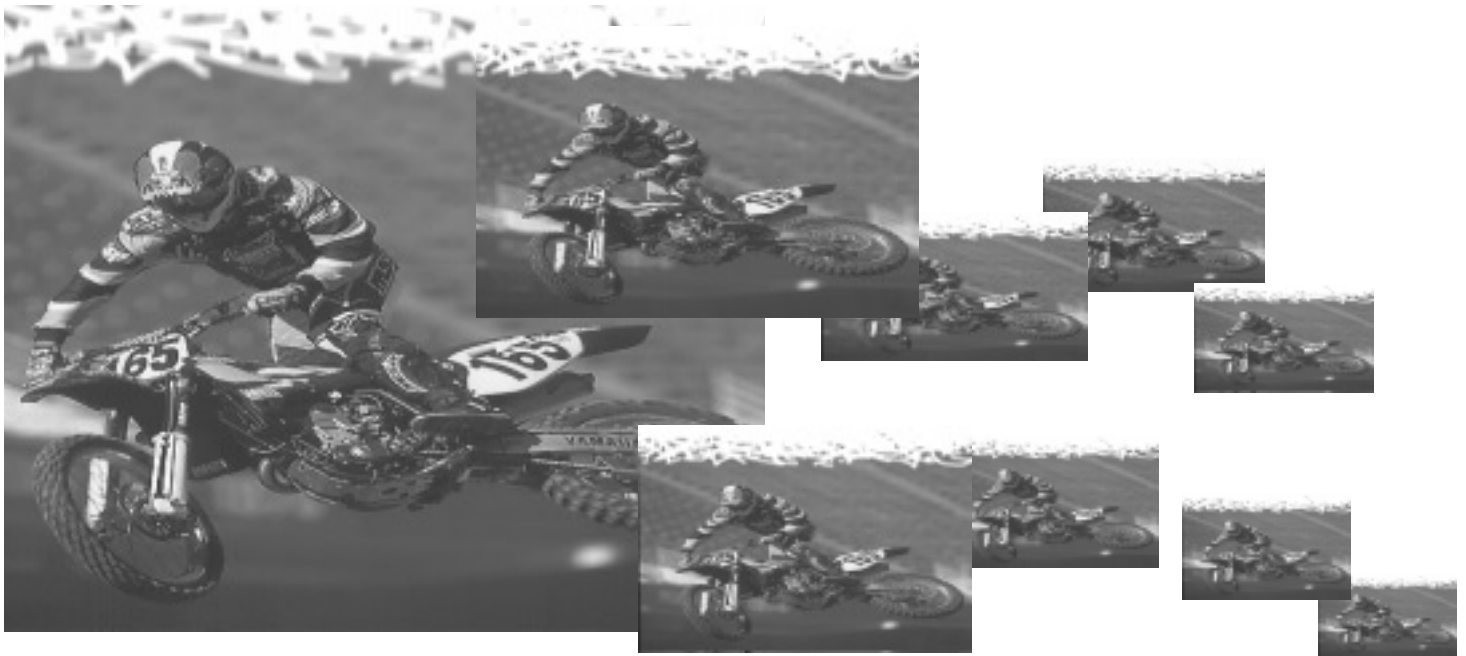
For Carbon Fiber components, again use soap and water to clean. A light coating of a good automotive wax will help dirt/mud slide off easier the next time around.

After washing, towel off the system and start your engine and warm thoroughly to operating temperature to remove all condensation and/or water.

The silencer packing cartridge is an exclusive blend of synthetics and steel from White Brothers. It will provide you with long life and easy maintenance. To repack the silencer, simply remove the button head screws securing the diffuser disc base (where the discs sit) and the entire assembly will slide out. Then simply inspect the condition of the packing material and determine if a new cartridge is needed. If the material is worn out, simply order a new cartridge (WB # 06-930) and install per the instructions supplied. Insert the entire assembly back into the silencer shell and you are done. It's never been simpler to repack a silencer!

For maximum sound intenuation and long life of your silencer shell, we highly recommend that you check the packing material in aluminum silencers at a minimum of 2 month intervals. For carbon fiber silencers, check at 1 month intervals. Though the carbon shell is extremely strong and durable, extreme heat caused by a dissipated packing cartridge can cause it to be damaged.

Keep in mind that the life of your silencer packing can vary greatly by your riding conditions and engine state-of-tune. Check often at first. This will then provide you a gauge for future maintenance intervals.



## LIMITED WARRANTY

White Brothers warrants its E-Series aluminum silencers and stainless steel megaphones/s-bends/headpipes for a period of one year against workmanship and material failure from date of purchase and to the original owner. Carbon fiber silencers and titanium headpipes are limited to a period of ninety days.

Under the terms of said warranty, White Brothers will repair or replace the defective component at their discretion. White Brothers does not pay for the cost of removal or reinstallation of the affected unit from any vehicle or delivery and pick up of the unit. Removal/reinstallation costs are the sole responsibility of the original owner. To obtain service under this warranty, the original purchaser must contact White Brothers customer service/warranty department for return number authorization prior to returning said unit. You must include a copy of original the sales receipt and/or warranty registration tag.

White Brothers has made every effort to improve cornering clearance; however, due to the design and space limitations on some motorcycles (center stand, oil filter, oil pan, ect.), ground clearance and corner clearance may not be improved and in some cases may be reduced. Be sure to follow proper installation instructions.

White Brothers shall not be responsible for any consequential, special or incidental damages of any nature, including, but not limited to the loss of the vehicle on which the unit was installed and the cost of obtaining another substitute exhaust system.

This warranty is valid only if the proper part number was installed in accordance with the proper model vehicle and operated and maintained within reasonable guidelines. This warranty is not valid if the system is modified or altered, installed improperly, dropped/crashed, or serviced by anyone other White Brothers.

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