

The Proper Care & Feeding of the Rotax Motor

Part 8

Understanding and Mounting Your Exhaust System

By Mike Stratman

The exhaust system is possibly one of the most misunderstood parts of a 2-cycle powerplant. This bulky and sometimes corroded piece of sheet metal is a vital part of your engine's mechanical workings, and is designed around some important criteria. The idea of a "high-performance tuned exhaust system" makes me think of my younger days when the local speed shop had "chromed masterpieces of bolt-on horsepower" hanging from the walls. It also makes me remember how I spent money I really couldn't afford to spend on one of these systems just to "snap the neck" of an unsuspecting passenger! All 4-cycle days aside, an exhaust system on a 2-cycle engine does a lot more than just quiet things down. Exhaust systems are designed to do a specific job in the performance of a 2-cycle engine.

Rotax engines use piston-port timing instead of a valve train to capture intake and combustion gases. The exhaust system is therefore called upon to help act as an exhaust valve and to help scavenge the exhaust gases from the combustion chamber. As illustrated in Figure 1, the spark fires the piston which is driven downward passing the exhaust port. This allows the gases to exit. As the piston travels further down, it passes the intake ports near the bottom of

its stroke. At this point, both the intake and exhaust ports are open to the combustion chamber. Here is where the "tuned exhaust" does its thing. The exhaust canister, located a determined distance from the combustion chamber, creates an "echo" back towards the chamber. This back-pressure acts like an exhaust valve slamming shut at the precise moment to keep the fresh intake gases from exiting the chamber while both ports are open. What simplicity. No moving parts! Figure 2 illustrates this action.

Obviously, the distance as measured from the exhaust port to the canister is critical, but the shape of the cone pipe is also a factor. You can change the routing of the cone or scavenger pipe, but you can't change this distance. Figure 3 shows dimensional drawings of all Rotax exhaust systems. These are your off the shelf choices. You will find they are all the same in this distance relationship.

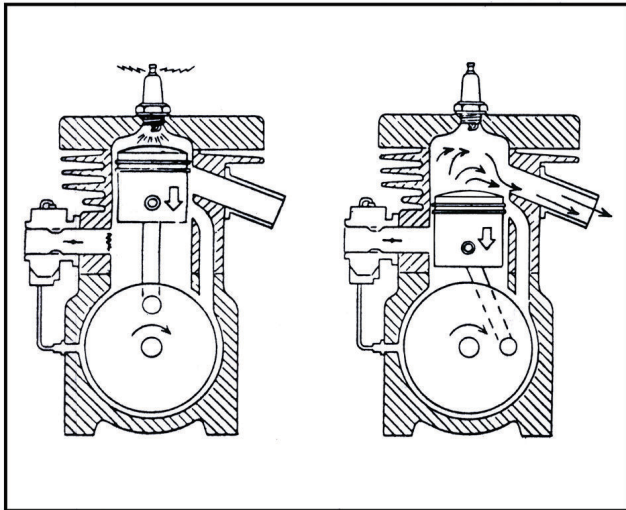


Figure #1. Shows the down stroke of a two-cycle engine as the combustion gases exit the exhaust port.

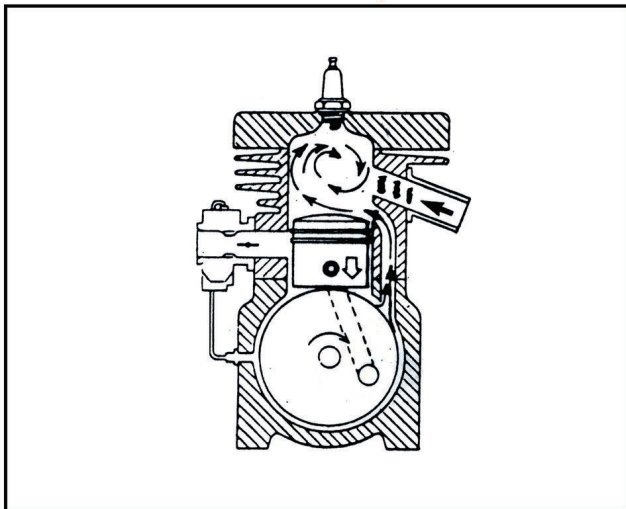
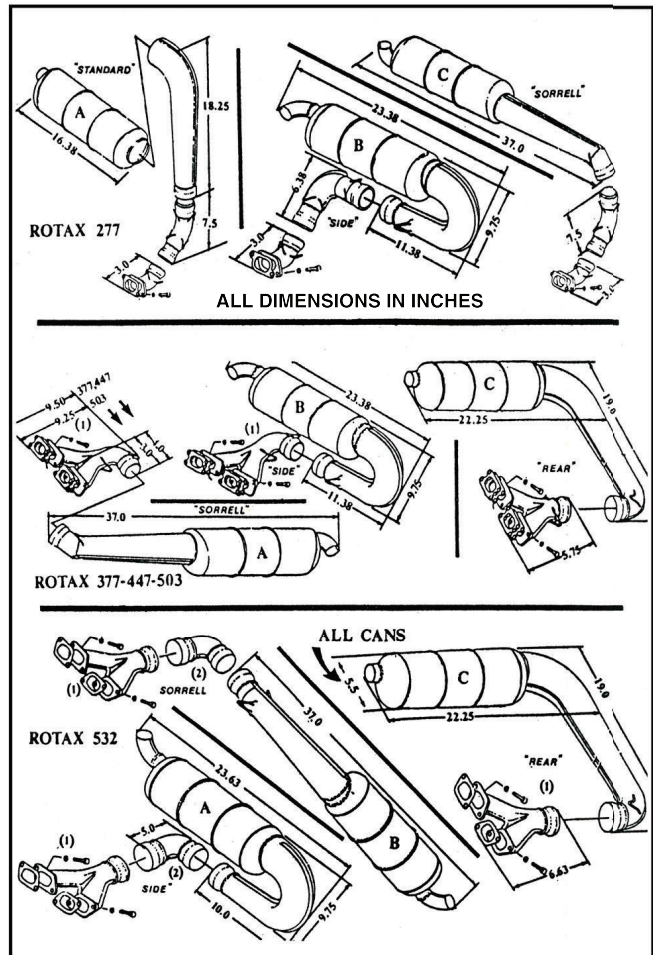


Figure #2. Illustrates the "echo" or back pressure needed to trap the fresh intake gases in the combustion chamber. The exhaust system provides the precise effect to act like an exhaust valve closing.



MOUNTING: Exhaust pipes are made as lightweight as reasonably possible. Mounting your exhaust system correctly will have everything to do with how long it will last. Vibration can crack exhaust parts in short order. The canister should be mounted on the same platform as the engine to help isolate the airframe from vibration. Some exhaust installations mount directly to the frame, so the balljoint will naturally have to flex more because both ends are separated by a motor mount system. Mounting the exhaust system with the engine will help minimize the flexing at this balljoint. Because there is an infinite number of motor-exhaust mounting situations, the Rotax factory can offer little help in getting the mounting job done.

California Power Systems has come up with a finished system to handle a large number of mounting situations. One common request was from individuals who were looking for a quick, no welding, bolt-on exhaust mounting kit. Mounting the canister to the head studs was an obvious solution.

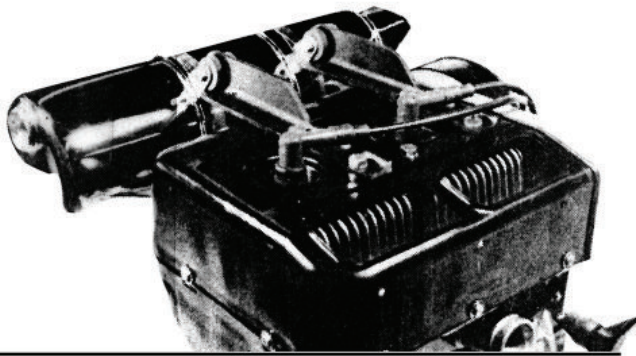


Figure #4. Shows an exhaust mounting system using the head studs cushioned by rubber bushings to absorb vibration and extend service life of muffler.

Figure #4 illustrates a typical side mount muffler installation utilizing the available head studs. The key to this setup is the rubber grommets that allow the natural vibrations of the engine to be absorbed by these parts rather than the thin-walled exhaust components. This goes a long way in extending the life of the canister and manifold parts.

Figure 5 illustrates the key components. A word of caution: Experience has shown that standard worm drive clamps are

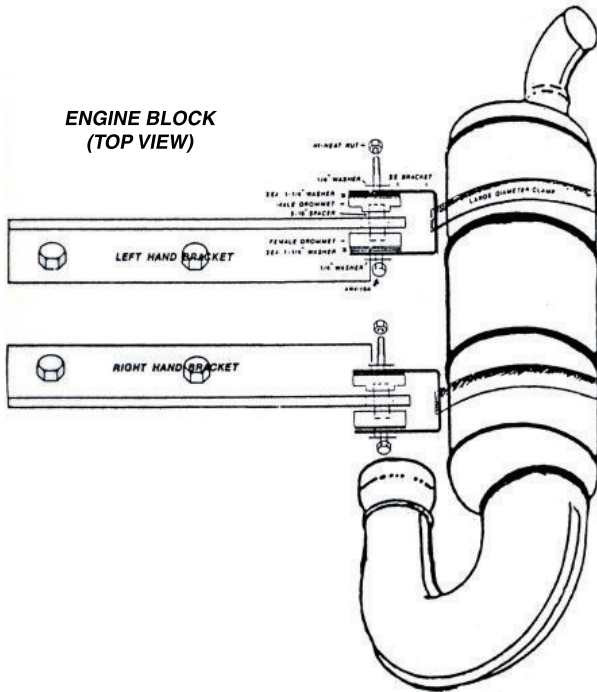


Figure #5. Illustrates the parts breakdown of the system shown in figure #4. Note male and female bushings provide for no metal to metal contact, minimizing vibration fatigue. Special AN bolt provides a predetermined "crush" on components for the proper flexibility.

prone to failure when used to secure the canister, exiting through a rear mounted propeller with an expensive crunch! A pair of heavy duty, bolt drive clamps are a necessity. This system has proved to be cost effective in extending exhaust system life as well as avoiding the expense and hassle of fabricating weld on brackets.

FINISHING THE SYSTEM: After mounting the exhaust system, it is highly advisable to safety wire the springs. These springs hold the ball flex junction together, and are notorious for breakage. They are also one of the leading sources for propeller destruction. Safety wire, run through the spring and anchoring hooks, will keep a broken spring in its place. A trick I've seen used is a bead of silicone sealant running the length of the spring, holding together even the smaller fragments safety wire can't.

PRE-FLIGHT: Pre-fighting your exhaust system should be a top priority even though you do a first rate installation job. Broken exhaust components rate on the list of emergency landings, folded cross-country trips and long walks home. Look carefully for broken springs, mounting brackets and cracked welds. Check carefully around the balljoint. Proper mounting and pre-flight inspection will go a long way towards extending the life of your exhaust system, and will give you many hours of trouble-free air time.

