

- **REVERSION**

Reversion is simply the exhaust gases momentarily flowing backwards during the overlap phase of the camshaft at low cycling rates. During the overlap phase the engine is on the exhaust stroke and the piston is pushing out the last of the exhaust gases. Prior to reaching top dead center the intake valve begins to open. At low cycling rates the intake charge and the exiting exhaust pulse have yet created any momentum. Thus the piston pushes some spent exhaust gas into the intake manifold. This is why engines with big camshafts idle and sound radical. The exhaust pulses shoot up into intake manifold causing a major disturbance. The cylinders receive an uneven mixture of air, fuel and spent exhaust gas. The piston then reaches top dead center and begins the intake stroke. At this point both valves are open, in fact the exhaust valve in some cases may not shut for another 50 degrees of crank rotation. During this 50 degrees of crank rotation the piston literally draws from both the intake and exhaust valves causing the exhaust gases will momentarily reverse. At high cycling rates the inertia of the incoming intake charge and the out going exhaust pulse keep the gases flowing in the proper direction. Not a problem until you add water into the exhaust stream. Concerning headers, reversion can be severe enough to add water to oil (milky oil), rust valve seats, even stall the engine. This effect only happens at idle, but engines encounter their greatest reversion pulse at shut down.

For this reason Lightning Performance Marine has developed guide lines to help you decide what options to add when considering an exhaust system.

Our guide lines are based on a 454 C.I. engine with a standard Mercury header and 8" long collector. The camshaft should be no larger than 240 deg. duration @ .050 lift. Lobe separation angle 112 degrees. Valve lift is not that much of a factor. These figures are just guide lines. Cubic inch displacement, valve size, connecting rod length, valve timing, etc. all have an effect on reversion.

THE ONLY TRUE TEST FOR REVERSION IS TO IDLE THE ENGINE WITH THE HEADERS ATTACHED AND WATER GOING THROUGH THEM, SHUT IT DOWN, REMOVE THE HEADERS AND IF YOU HAVE WATER RESIDUE LAYING IN THE EXHAUST PORTS, YOU HAVE REVERSION.

Lightning Performance Marine makes many options to reduce or totally eliminate reversion.

- **ANTI REVERSION TIPS**

1. **Header selection** The tip to header selection is to choose a design that will introduce water into the exhaust stream as late as possible. For example our **40340** header is actually made to replace a Mercury manifold with a 3" riser block. This header is 4" taller than a standard Mercury header plus it rocks forward 2" thus were able to add a 2" longer collector. If the height is not a concern you just added 6" of dry length to the header.
2. **Collector selection** If you have room to add dry collector length do it. Collectors are available in a variety of lengths.
3. **Cubic inch displacement** The tip here is simple, the bigger they are the harder they suck back. Either reduce the duration of the cam or start add some anti reversion options.
4. **Camshaft selection** With regards to headers the only thing your concerned about is how much piston movement in volume takes place while the exhaust valve is open on the intake stroke. A wide lobe separation angle actually advances the exhaust valve timing event which will close the

exhaust valve sooner, but the down side is it also moves the horsepower and torque curve up the RPM range. Rhoades style bleed down lifters will deduce the cam duration by as much as 20 degrees. Available only in standard hydraulic these lifters are a great choice.

5. **Connecting rods** Marine engine builders rarely think of connecting rod ratios effecting reversion, but it does. A longer than stock connecting rod will make the piston dwell at the top during the overlap cycle thus less piston movement with regards to crank rotation.