SUPERIOR AIR PARTS, INC

Tech Notes

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Subject: Engine Balancing Part II

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This is the second in a five-part series of short, somewhat-technical articles on methods of minimizing Engine Vibrations. Vibrations in a reciprocating engine are primarily caused by imbalance of 5 types:

Rotating, **Reciprocating**, Inertial, Combustion, and Torque

Reciprocating parts, such as pistons, connecting rods, piston pins, etc. are what convert the combustion pressures in the cylinder into mechanical force. These forces are applied on a moment arm of the crankshaft, the crankpin, which converts the force into torque. The movement of these parts back and forth in the cylinder barrel, and specifically the reversal of their motion, are what cause reciprocating vibrations. In order to reverse the motion of the reciprocating mass, the mass must first be slowed down and stopped, then reversed.

The force required to slow and stop the reciprocating parts is determined by the components' inertia. For all intents and purposes this inertia is the same as the parts weight. This is why pistons and connecting rods are installed in matched weight sets. Piston pins also fall into this category, along with rings, but weight variations in these parts are usually so low as to not have a significant effect.

Differences in reciprocating mass in an opposed engine cancel each other out, except for a resulting imbalance moment. This is caused by a bending force, due to the offset of the cylinders opposite one another. These forces are a function of the engine design and cannot be reduced. We can, however, reduce the forces due to imbalance of the reciprocating masses.

A small amount of imbalance between component masses can have a large effect on vibrations. For example, at 2700 RPM a piston imbalance of 1 ounce will result in over 18 pounds of force applied. This is why Superior takes great care in the manufacture of our parts, sets, and engines to insure the highest level of reciprocating component balance.

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