Adjusting Valves in OS and Saito Four Cycle Engines
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Introduction:
Unlike 2 cycle engines which have no moving parts to get air into the engine and exhaust gases out, 4 cycle engines have valves located in the cylinder head that open and close at the appropriate time to get air/fuel into the engine prior to combustion and exhaust gases out after combustion. The valves are opened and closed by rocker arms also located in the cylinder head. The rocker arms are driven by pushrods that ride on a camshaft connected via gears to the crankshaft of the engine. The camshaft is geared to rotate at ½ the speed of the crankshaft so that the intake and exhaust valves open and close only once in a complete cycle of the engine (i.e. 2 revolutions of the crankshaft).

Valve and valve train design can have a significant effect on engine performance, since torque and power output of an engine are directly related to an engine's ability to get air/fuel into the engine and exhaust gases out of the engine. Valves are as large as the size of the combustion chamber will allow. Once the valve size is fixed, performance of the engine is affected by the following:

1. When during the engine cycle the intake valve opens
2. How far the valve opens
3. How long the valve remains open
4. When during the engine cycle the exhaust valve opens
5. How far the valve opens
6. How long the valve remains open
7. How long the intake and exhaust valves stay closed

Items 1 through 6 affect the quantities of gas flow into and out of the engine and are determined by camshaft lobe design and the gap between the valve stem and the rocker arm (valve lash). Item 7 determines the amount of time the valves are in full contact with the cylinder head. This time is critical to cooling of the hot valves via the cooling fins in the cylinder head. In general, the larger the gap between the valve stem and the rocker arm, the greater the contact time and the cooler the valves operate but at the expense of performance.

New engines come with the gaps ideally set by the manufacturer and are ready to run right out of the box. Engine break-in and long term running will cause wear in the valve train components resulting in a

change in the designed gap between the valve stems and the rocker arms. The change in the gap can result in difficulty in starting and reduced power over time. As a result it is good practice to periodically measure and adjust the gap back to factory specifications under the following conditions:

1. After the first hour of operation
2. After every 50-60 flights
3. Whenever an engine seems hard to start or a loss of power is noticed during flying

Engine manufacturers provide valve gap specifications in their operating manuals to adjust the valve trains for wear. The gaps are easily measured and adjusted with feeler gauges, a small wrench and metric Allen wrenches. Details for measuring and adjusting valves are provided below.

Tools Required:
The following tools are needed to properly adjust both the intake and exhaust valves in a Saito or OS 4-cycle engine:

1. A set of metric Allen wrenches to remove valve covers and turn the valve lash adjusting screws.
2. A small metric wrench to fit the valve lash stop nut.
3. Feeler gauges to measure valve lash and make the appropriate adjustments. Two gauges are normally required: a minimum gauge (.04mm or .0015 in) and a maximum gauge (.1mm or .004 in).

OS does not generally supply these tools with their engines, but they are available separately as an adjustment kit (See your owner's manual for details). Saito furnishes Allen wrenches, a stop nut wrench, and a max .1mm feeler gauge with its engines. (Evidentally, they believe adequate performance can be obtained using the max gauge and not the min gauge.)

Valve lash specifications are approximately the same for both OS and Saito engines across all engine sizes. Check you owner's manual to confirm specifications for your engine before adjustments are made.

Engine Preparation:
1. Valves must be adjusted with the engine "cold"; i.e. at ambient conditions.
2. Remove the valve cover bolts and remove the valve cover. Saito engines have a valve cover for each valve, so two covers need to be

removed. If valve cover gaskets are used, be careful with them. They can be reused if in good condition.

3. Valve lash is adjusted when both valves are fully closed and no force is exerted on the rocker arms by the pushrods. These conditions exist when the piston is at its highest point in the compression stroke. To get the valve train in the proper position for adjustment, rotate the crankshaft counter-clockwise until you feel maximum resistance from compression and turn the crankshaft an additional ¼ turn.

Valve Lash Measurement and Adjustment:

Before you measure valve lash and decide whether or not adjustment is required, you need to decide whether you want to achieve nominal or maximum performance with your engine. Nominal performance requires a maximum gap of .1 mm or .004 in. Maximum performance requires a maximum gap of .004 mm or .0015 in. Of course, anything in between will be just fine.

Intake valves have the same valve lash specifications as exhaust valves and are measured/adjusted the same way.

1. Insert the feeler gauge between the top of the valve stem and the rocker arm. If you can't insert the gauge easily, the gap is too small and needs to be made larger. If the gauge slides in easily and you have lots of "wiggle room", the gap is too large and needs to be made smaller.
2. If adjustment is required, insert an Allen wrench of the appropriate size into the top of the adjusting screw. Loosen the lock nut about ¼ turn, and turn the adjusting screw counter-clockwise about ½ turn to open the gap. Insert the feeler gauge into the gap and turn the adjusting screw clockwise until it just contacts the feeler gauge. While holding the adjusting screw position with the Allen wrench, firmly tighten the lock nut. You can tell if the adjustment is right if you can detect a slight resistance in moving the feeler gauge in the gap. If the adjusted gap is too loose or too tight, loosen the nut and readjust the screw.
3. After adjusting both valves, rotate the crankshaft counterclockwise through 2 revolutions and re-check the gaps with the feeler gauge. Readjust the gaps as needed to get a little resistance to feeler gauge movement.

Replace the valve covers and valve cover gaskets (if furnished for your engine). Snugly tighten the valve cover bolts and your engine is ready to run with what should be noticeable improvement in performance.