

## Camshaft Degreering instructions

The purpose of degreering a camshaft is to ensure that it is phased correctly with the crankshaft. Some of the factors that may cause improper positioning are:

1. Cam or crank gear marked incorrectly

2. Improperly machined crank or cam keyways and splines

3. Accumulation of machine tolerances (head and or barrel machining)

Equipment needed to properly "degree" in a camshaft, they are available from most performance auto outlets and machine shop suppliers. We can supply a kit from Hotcams.

1 Degree wheel

2 Rigid pointer that can be attached to the engine cases

**Note; refer to your specific cam card to ensure your dial indicator has enough range to measure maximum lift**

4a base that the dial indicator can attach to the rocker cover region

5A top dead centre stop or a dial indicator that will reach the piston crown with the head on.

6A means to attach the degree wheel to the crankshaft

The intake centreline method

There are several accepted ways to degree a camshaft. We feel that the exhaust centreline is the easiest and most accurate. This method of cam degreering is very practical and indifferent to lobe design characteristics. It simply involves positioning the centre, or point of maximum lift, of the exhaust lobe with Top Dead Centre (TDC). The exhaust centreline method still requires accuracy to be correct, but is somewhat more forgiving. Once you have degree'd a camshaft using this method, you will be surprised at it's ease. We do recommend using the exhaust cam over the intake as the exhaust timing is more critical. (this only applies to 4 lobe cams like XR RFVC engines, twin cam engines need both the inlets and exhausts checked) Position the dial indicator onto the valve spring retainer, or bucket. This makes the process as accurate as possible in relation to what actually goes on inside the engine.

### Time to go to work

**Step 1** The camshaft and timing tensioner have been installed. Make sure the timing marks on both the flywheel and cam gear are aligned as per the workshop manual

**Step 2** For example, we have our cam and it suggests we install the cam on 105 degree exhaust centrelines. Adjust the tappets to the clearances recommended by the cam manufacturer.

**Step 3** Attach the pointer to the cases. Many people will make a pointer out of some sort of rigid yet manageable wire. A coat hanger works well

**Step 4** Attach the degree wheel to the crank snout. You may need to space the wheel out to clear the cases, use the flywheel bolt. Rotate the engine from the other end of the crank or you could move the degree wheel if you turn the engine by the flywheel bolt.

Never rotate the engine with the kick-starter while checking clearances. Use a long lever to rotate the engine. Remember the longer the lever, the smoother you will be able to rotate the engine thus more accuracy.

**Step 5** Before installing the piston stop, rotate the crankshaft to TDC with both exhaust and intake valves closed. This can be a rough guess but will save you from a mistake later. Adjust your pointer to zero or TDC on the degree wheel.

**Step 6** Turn the crankshaft opposite the engine rotation approximately 20 degrees, this will lower the piston enough to allow the TDC stop to be installed in the sparkplug hole. Screw in the piston stop until it touches the piston continue to turn the engine the same direction until the piston comes back up and touches the piston stop, mark the degree wheel with a pencil on the number the pointer is on. Turn the engine in the other direction, same as engine rotation until the piston comes back up and touches the piston stop; make a mark on the number the pointer is on. To calculate TDC add both of the numbers together and divide by two.  $18 + 14 = 32 / 2 = 16$ . TDC is therefore at 16 degrees, adjust the pointer to 16 degrees and you have TDC.

**Step 7** Check step 6 again! This step by step is critical to proper cam alignment.

**Step 8** Attach the dial indicator to the dial indicator mount. Position the indicator mount so the tip will contact the retainer of the exhaust valve. It is important that the indicator plunger be parallel to the valve stem.

**Step 9** Rotate the engine in the normal direction of engine rotation until you reach maximum lift. The dial indicator will change direction at the point of maximum lift. At this point set the dial indicator at zero.

**Step 10** Turn the engine backwards until the indicator reads 0.100 then turn the engine back in the normal direction of rotation until the dial indicator reads 0.010 before maximum lift record the degree wheel reading.

**Step 11** Continue to rotate the engine over its normal direction of rotation until the indicator goes past zero to 0.010 on the closing side of maximum lift. Again record the degree wheel reading.

**Step 12** add the two numbers together and divide by two that number will be the location of maximum lift on the exhaust lobe in relation to the crank and piston. This is the exhaust centre line.

For example the first degree wheel reading was 96 degrees the second reading was 116 degrees, these two numbers (96 + 116) and added together will be 212.  $212 / 2 = 106$  your actual exhaust centre line is 106. Refer back to your cam spec card and we see that the recommended intake centreline for your camshaft is 106 degrees, everything is where it should be.

In the event your camshaft did not degree as per the cam-card it will be necessary to either advance i.e. (move the cam ahead) or retard (move the cam back) the cam to meet exhaust centreline.

To allow cam adjustment you will need to file the cam bolt holes this can be done with a chainsaw blade sharpening file. After setting the exhaust centreline locktite and torque the cam securing bolts to manufacturing specifications.

Keep in mind that to advance the cam you must lower the intake centreline. For example if our cam has a lobe separation of 110 degrees the cam is "straight up" when the intake centreline is 110 degrees. Moving the centreline to 106 degrees advances the cam 4 degrees. If we change the centreline to 112 degrees, this would be 2 degrees retarded.