Confirming Piston Deck Height for Proper Squish Band Gap

Determining the current piston to deck height of each engine is one of the most critical steps in proper engine assembly. This process is a measurement of the tolerance stack of all of the components combined that make up a complete engine. The most effective method for confirming the squish is to measure the piston to deck height before you remove the original pistons and cylinders from the engine. This will provide you with accurate data of the tolerance stack of your crank, connecting rods, case deck height and cylinder length so you have accurate information to how your engine kit can be constructed for the proper deck height.

Why do I need to Calculate and Set a Proper Squish Band?

Zipper's Performance would never recommend assembly of an engine without measuring the deck height. Assembling engines with wide squish has a host of problems that lead to serious consequences. The wide gap between the piston and the squish in the head allows gases to remain trapped in this area during the combustion process which allows pre-ignition and or detonation. When this abnormal condition occurs timing has to be removed which tunes out the power, increased fuel consumption and dramatically increases engine heat with shortened engine life with unwanted detonation.

Depending on the type of connecting rod structural integrity and the RPM band of the engine, squish band ranges can be set as tight as .**035-.045 range**. Zipper's stocks a large variety of Cometic head and base gaskets in various thicknesses so a remedy may be as easy as selecting a different gasket. In extreme cases may require the deck of the cylinder to be shorted, which is why we suggest getting a measurement before removing the cylinders from the engine base before you send your cores in for processing.

How to Calculate Squish

To Calculate Squish, measure the piston deck height & the head gasket thickness. It's a very simple equation to calculate, but you must get the piston position in relation to the deck correct. A piston below cylinder deck should be written as a negative number. So 0.005" below deck must be written out as **-0.005"**. A piston that's above deck will be position, so 0.003" above deck, will be recorded as +0.003".

Squish = Head Gasket Thickness – Piston Deck height.

An engine with a 0.054" head gasket and a piston below deck by 0.005" will be calculated as:

Squish = 0.054" – (-0.005")

Squish = 0.059"

Note that a piston below deck adds to the squish number, and a piston above the deck height, reduces the squish number. You're simply measuring the distance between the piston and the cylinder head, so the further below deck the piston is, the larger the squish number. If you were unable to obtain this specific information

before the engine was fully disassembled, then the process needs to be completed before the engine kit is assembled. Zipper's manufactures a tool for accurately measuring the piston to deck height, yet even a parallel and a feeler gauge is far more accurate than assuming it will be fine. In most cases, TC and M8 engine piston deck heights can be off the chart in the wrong direction. This can easily be corrected once you measure where you're at.

Measurement Notes:

Cylinder Rigidly Held in Place - The cylinder must be locked to the engine case to obtain the proper deck height of the piston. This means the cylinder must be bolted to the engine in a fixed position. If you just set the cylinder on the engine case, the process of moving the piston up and down will rock the cylinder, and affect the measured number. Since the measurement is going to be a very small number, the measurement accuracy is critical.

Prevent Piston from Rocking - Piston rings should be used if possible, but it is also acceptable to wrap the piston with masking tape, until it's snug in the cylinder bore, if you are in mockup mode & aren't ready to install the rings. Always measure at the center of the piston, or on the flat above the wrist pin. If you measure on the front or rear part of the piston, the piston can rock, and alter your measurement.

Domed Pistons: If you're measuring the deck height of a piston with a dome on it, do not measure the dome itself. Always measure outside of the dome, on the flat part of the piston.

Angle Cut Squish Band Pistons: Some piston / head combinations use an angled squishband, which eliminates the flat to measure from. Setting the squish is just as critical, but slightly more complicated to measure. In this instance, you must install the cylinder head and all gaskets, and lay pieces of solder on the top of the piston. Turn the engine over, which will compress the solder between the cylinder head and piston. Remove the cylinder head, and measure the thickness of the solder.

Counterbored Cylinder Heads: You may encounter an engine that has already been modified, and had a counterbore put into the head to correct the squish on a previous build. If you see this, you must measure the depth of the counterbore, and add it to the head gasket thickness, to obtain a proper squish. This is not a common scenario, but counterboring the head is an acceptable way to gain clearance if required. It is hands down the most complicated way of correcting squish, so it's no common to see. This is usually only seen when the piston is measured to be above deck height, and limited head gasket options are available.

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How to Correct the Squish Band Gap:

There are several solutions to correcting the squish band in an engine. The solutions are based upon availability of parts, or machine shop services, for the application you're working with. This may include changing head gasket thickness, base gasket thickness, machining the top of the cylinder, or machining a counterbore into the cylinder head. In most cases, the correction will just take a gasket alteration, but if you have a significant difference, machine work may be the only solution.

Many standard Twin Cam engines do not have base gaskets, which just eliminates one option for correcting the squish band. However, most engines from this era are built with a tighter squish from the factory, and do not require such significant alterations to re-set the squish.

Example:

A 2017 FLHX, equipped with a 107" Milwaukee-Eight engine was measured during teardown to have 0.068" of squish from the factory. The engine was built with a 0.020" base gasket, a 0.054" head gasket, and the piston was measured to be 0.014" below deck.

Since this engine was being converted to a 4.125" 117" big bore, the cylinders by default were decked, to re-true the gasket surfaces. A total of 0.006" was removed from the head gasket surface. Then a 0.010" base gasket was used, meaning the cylinder had shifted downward by a total of 0.016", putting the piston 0.002" above the deck surface of the cylinder from the previous build. A 0.040" head gasket was selected, and the final squish measurement ended at 0.038", which is tremendously better than the original setup of 0.068".

Example	Tear Down	Engine Rebuild
Head Gasket Thickness	0.054	0.040
Piston Deck Height	-0.014	0.002
Total Squish (Head Gasket Thickness - piston height)	(0.054)-(-.014) = 0.068"	(0.040)-(0.002)= 0.038"

Cylinder Decking - Amount of Material Removed	0	0.006"
Base Gasket Thickness (used to alter the Piston Deck Height - if equipped)	0.020	0.010

Note that the same engine may be corrected without additional machine work. If the cylinders were never decked, the proper dimension can be achieved with just gasket changes. Going to a 0.014" base gasket from a 0.020", the piston will go from 0.014" to 0.008" below deck. Then the 0.054" head gasket is removed, and replaced with a 0.030" head gasket. The total squish will end at 0.038" in this scenario. Although Zipper's always recommends to re-true the gasket surface, the additional machine work may prove to be cumbersome if it's not found until the final assembly.

Your Engine Build	Tear Down	Engine Rebuild
Head Gasket Thickness		
Piston Deck Height		
Total Squish (Head Gasket Thickness - piston height)		

Cylinder Decking - Amount of Material Removed		
Base Gasket Thickness (used to alter the Piston Deck Height - if equipped)		