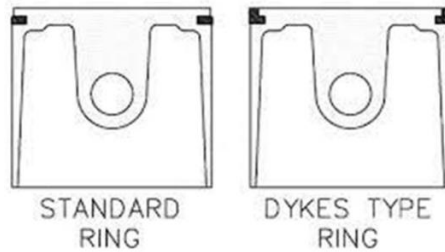


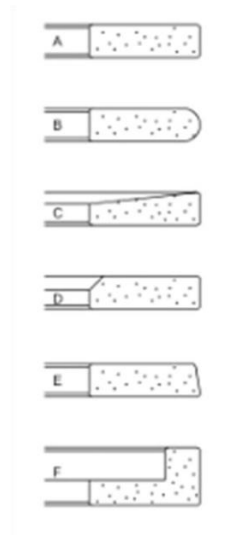
Chapter 11 – Cylinder: Rings

11.1 Types

Rings come in a variety of shapes, models, materials, and fit types. Let's first discuss the types available. Basically, they don't vary much in shape, except for the Dykes type, which has an L-shape. This model has a higher side and receives compression from the combustion chamber to increase cylinder sealing, as the pressure applied to the internal part forces it against the cylinder wall.



The others are flat and do not change their geometry much.

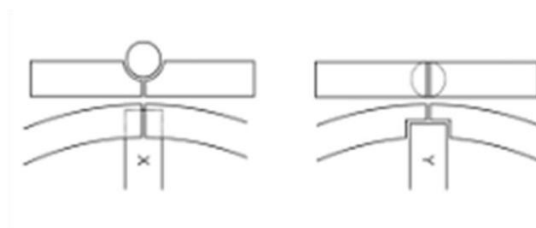


11.2 Fitting types

Another characteristic we find is the construction of the pin fitting that prevents it from rotating in the piston. We call these rings with a central or lateral pin. The ring with a central pin has a cutout on the inside of the circumference to accommodate the pin, which is cast into the piston. The ring with a lateral pin, on the other hand, has a chamfer at the ends, and the pin is located at the top of the ends, preventing them from rotating. There is no one better than the other; each manufacturer chooses one of the two when designing. However, I prefer the ring with a central pin,

as the area in contact with the cylinder is the same throughout the ring's circumference.

Recognizing these two models is important when replacing the ring, as one fitting won't fit the other. Therefore, it's important to check this feature before purchasing.



11.3 Materials

In engines two we basically find two material models:

Cast iron: The most common type found in two-stroke engines. It offers good wear resistance and often

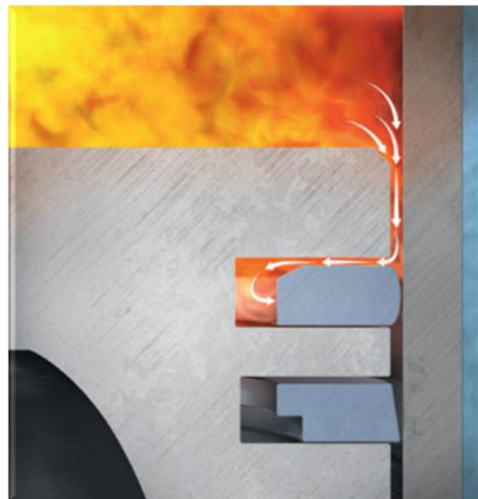
contains graphite in its structure, which improves lubrication in the event of a lubrication shortage.

Steel: May or may not contain coatings. When coated, chromium, molybdenum, chromium-ceramic, or PVD may be used. The coating's function is to increase the ring's durability and reduce friction.



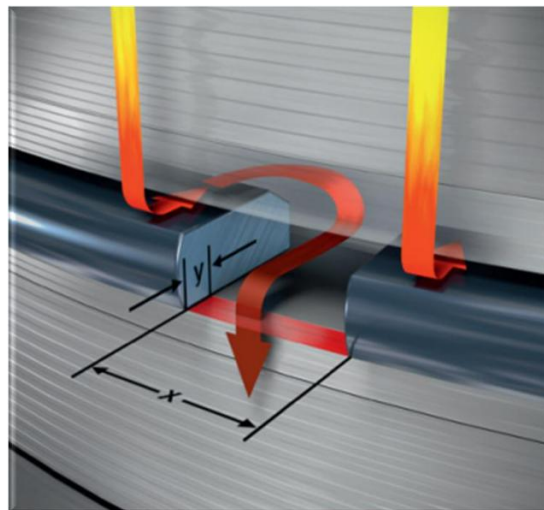
11.4 Sealing

The biggest misconception when considering cylinder sealing is that this function belongs to the piston, when it belongs exclusively to the rings. It is the piston that receives the pressure load from combustion and, after being pressed against the piston, seals and prevents pressure loss to the crankcase. After combustion, pressure passes through the side of the piston, which in turn pushes the ring against the cylinder and piston, creating the seal. This is why we should never scratch the piston groove at the bottom, as this will result in a loss of compression.



Another area where we need to be careful to avoid pressure loss is at the ring joint. We'll never achieve a perfect seal, as the gap ensures there's no contact between the ends in the event of heat and expansion. If the ends touch, the piston will seize and damage the cylinder.

To avoid blow-by, which is the loss of compression to the crankcase, as much as possible, we need to know how to size the ring opening to a safe dimension, but one that avoids excessive losses.



Wiseco recommends using 0.1 mm of opening for every inch (25.4 mm) of piston.

For example: if my piston is 56mm in diameter, I need to do a rule of three to find out.

For example:

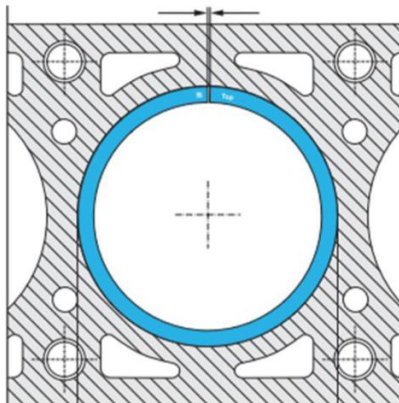
$$\begin{array}{l} 25,4 \times 0,1 \\ 56 \times A \end{array}$$

$$A \times 25,4 = 56 \times 0,1$$

$$A = \frac{56 \times 0,1}{25,4}$$

$$A = \frac{5,6}{25,4}$$

$$A = 0,22\text{mm}$$

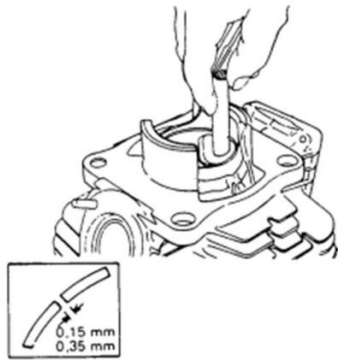


Note: If the piston already has the clearance indicated on the piston itself or in its manual, follow the manufacturer's recommendation. If you have your engine's service manual, follow its recommendation. Use the rule I mentioned above when you don't have either information.

In the service manual for the RD125, which uses a 56mm piston, we see that Yamaha recommends a clearance of 0.15 to 0.35mm. The value we found is in the middle of the recommended range, but we need to understand that 0.15mm is the minimum clearance for a stock engine, and 0.35mm would be the limit, considering that there are losses.

Wiseco 's suggested value would be for a Racing engine, since the pistons they manufacture follow this line of use. We understand, then, that if we use their suggestion in tuned engines, we certainly won't have problems with ring seizing due to expansion.

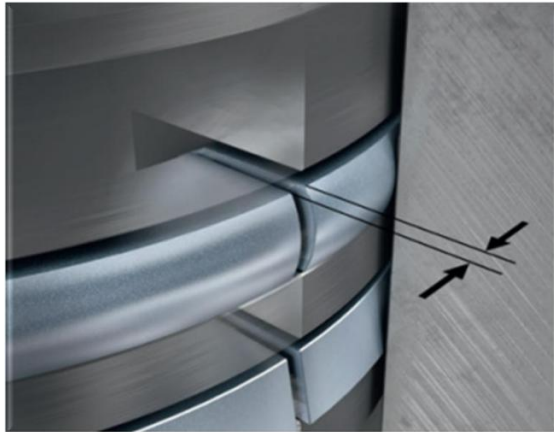
• Abertura dos Anéis



The ring gap width can be checked with a feeler gauge, the same one I suggested for use in measuring cylinder graduation.

However, we need to know how to use this tool and interpret what we are measuring.





First, we need to insert the ring into the cylinder and align it with the piston. If the ring is uneven, the measurement will be incorrect.



It's possible that the ring is larger than we calculated. In this case, there's nothing we can do, but we need to measure and find the exact gap. If this gap is

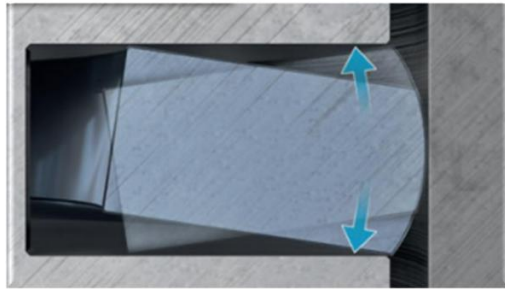
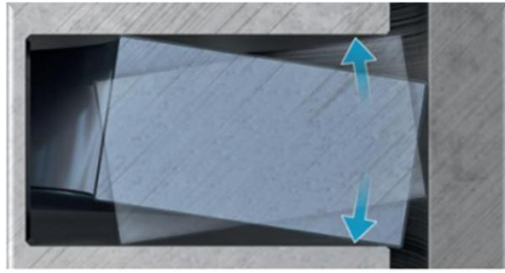
greater than 50% of what we calculated, that is: $0.22 + 50\% = 0.33$. In this case, if the gap is greater than 0.33, we'll have excessive compression leakage. If the gap is smaller, we'll need to file the ends to increase the space and prevent the ring from seizing.



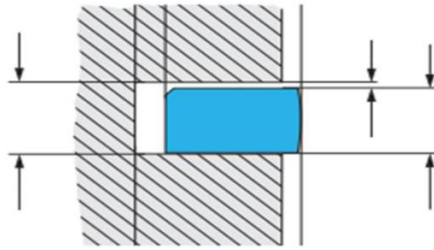
11.5 Piston groove opening

This is another parameter we can measure, but we can't change the groove opening. There needs to be clearance so the ring doesn't lock onto the piston and allows compression to expand the ring.

However, too much clearance can cause excessive ring vibration. This is why rings should preferably have a rounded edge, to compensate for this movement and avoid damaging the cylinder.

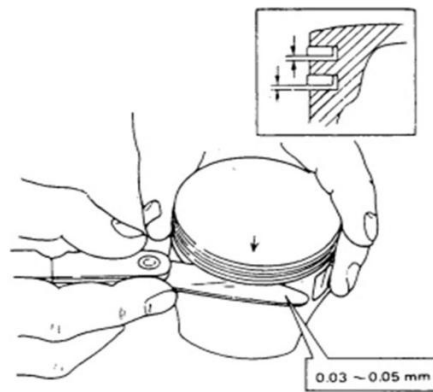


The method of measuring the groove and ring clearance also uses the blade, and Yamaha recommends for the RD125, from 0.03 to 0.05 mm opening. Therefore, the 0.05 mm blade should not enter or enter with a lot of interference.



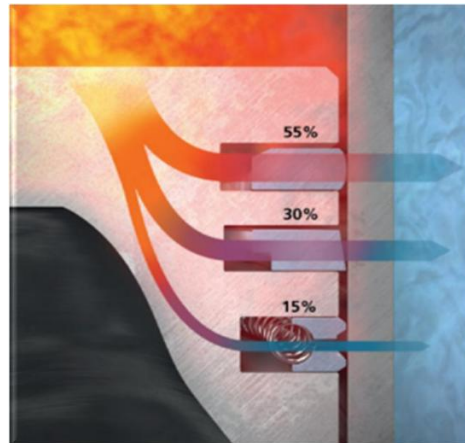
Clearance example taken from the Yamaha RD125 service manual.

- Folga entre Anel e Canaleta



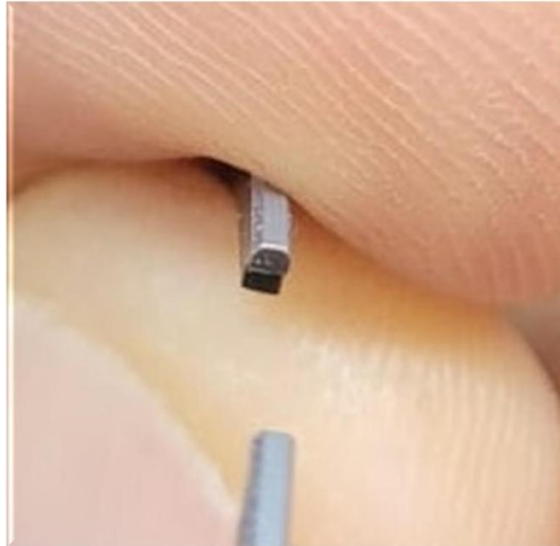
11.6 Heat transfer

Like the piston skirt, the ring's function is to transfer heat from the top of the piston to the cylinder. In the example below, we see a four-stroke piston, but the function is the same for two-stroke engines.

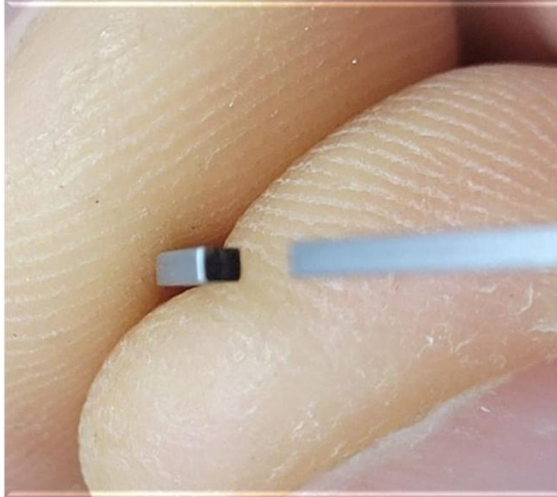


11.7 Chamfers

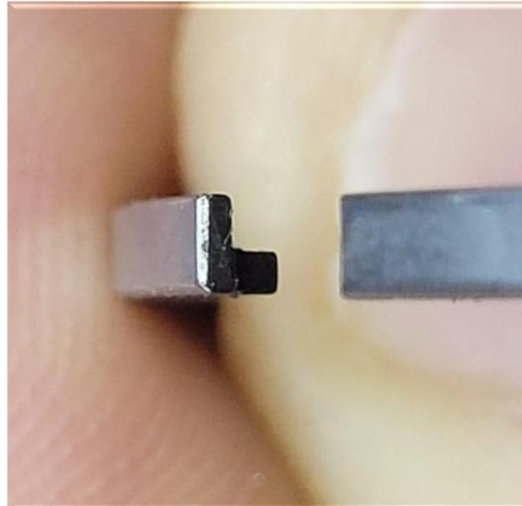
On the side, we see a photo I took of a Meteor ring, a renowned manufacturer of pistons for performance motorcycles and karts. We can see that it has a chamfer where sharp edges would contact the cylinder. This helps with entry and exit ports, especially large exhaust ports.



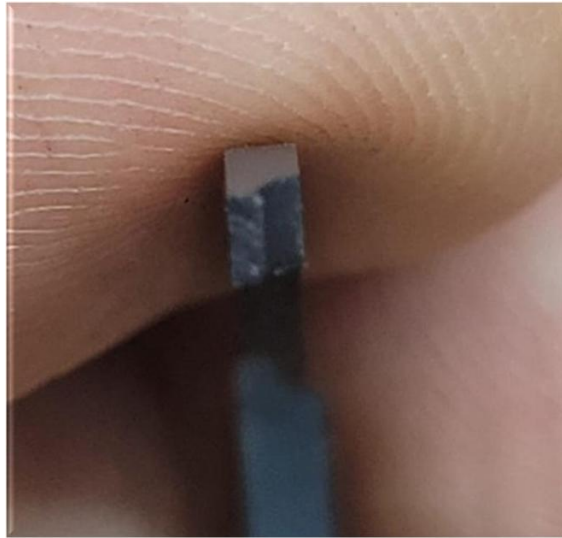
In this photo, we can see a Doppler ring from a current cylinder manufactured in France. We can see that it has much smaller chamfers than the previous one, but it does exist. In this case, the ring is used on a 50cc cylinder, and for this reason, the chamfer is not as evident, since the windows are small.



Dykes ring from a KTT kart piston. It also has chamfers on both sides. Another detail we can notice is a chamfer at the tip, which allows compression leakage. We can see that by looking at the rings in photos and zooming in, we can find several details we wouldn't normally notice.



In the photo below, we see a cheap cylinder ring. It's cast iron and has sharp edges in contact with the cylinder. Imagine this ring passing through any imperfections left in the cylinder preparation or passing through large windows. The risk of this ring breaking is very high. Therefore, if you find such a ring and the cylinder is assembled original, without preparation, it's acceptable. However, if you use this ring on prepared cylinders, you'll certainly need to perform the following work.



I created a technique that I always use on rings with sharp corners, with good results. I made a 45-degree angle on a grinding stone, and with the help of a bench drill, I use the table with the stone very close to grind the corner of the ring. Simply turn on the drill and carefully pass the ring around its entire diameter to create the chamfer. You can also use a hand grinder with a stone or sandpaper. The only care to be taken is when we reach the ends, as we can't let the stone or sandpaper enter the middle of the ends, as this will create that chamfer, I mentioned in the dykes ring and lose compression.

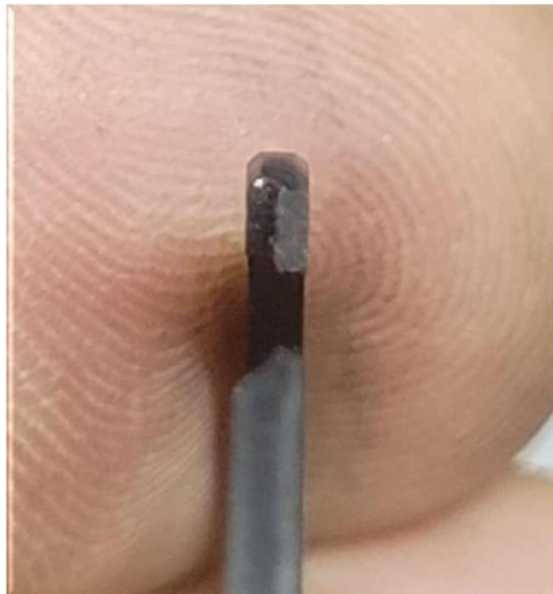


The expected result is shown in the photo below.
We can see that we now have a chamfer that allows the

ring to move in and out of the window without getting stuck. Understand that I'm not reinventing the wheel; I'm simply following the example of racing engine manufacturers.

Observation is always the best teacher, as long as we base ourselves on safe and reliable sources and not videos or posts of techniques that have never been tested.

This is the result after grinding with the stone at 45 degrees.



Chapter 12 – Cylinder: Liners

12.1 Types of coatings

Two-stroke cylinders are made of cast iron (older models) or aluminum. Cast iron cylinders allow for machining and honing directly on the cylinders themselves, resulting in lower manufacturing costs and thus being used in basic applications.

For aluminum cylinders, we need a hard coating layer, as aluminum is soft and does not have the mechanical strength for this application.

Coatings can be of several types:

Cast iron: In this case, a cast iron liner is added to the cylinder by thermal expansion and then ground and honed. The advantage of this application is that it can be reopened and a new, larger piston can be used in the event of a break.

And after finishing the grinding, a new liner can be fitted. However, cast iron doesn't have good hardness and sliding properties.