CPI Piston & Rider Rings FAQ

Why are some piston rings one piece and some multipiece?

The main reason for selecting either a single or multipiece piston ring design is the flexibility of the material that the piston ring is being manufactured from. Some materials, both metallic and non-metallic are not flexible at all. When rings are produced from these, two- or three-piece designs are necessary. Consideration also must be given to the size (cylinder diameter) and axial and radial dimensions of the rings because even with flexible materials, small piston rings can be difficult to expand over the piston diameter.

Do piston ring gaps and need to be checked and corrected on site prior to installation into the compressor?

All piston rings produced by CPI are manufactured with the correct end gap to suit cylinder diameter and operating conditions the ring is going to be used in.

Can I check piston ring gaps by placing the piston ring in the cylinder?

Not without a great deal of difficulty. When piston rings are installed into a cylinder without gas loading it is very difficult to ensure that the O.D. of the ring contacts the cylinder all the way around, and that the ring is exactly perpendicular to the axis of the cylinder. In addition to this, the temperature on site can often vary widely which can affect the field measurements versus when the rings were made under controlled temperatures in CPI's manufacturing facility.

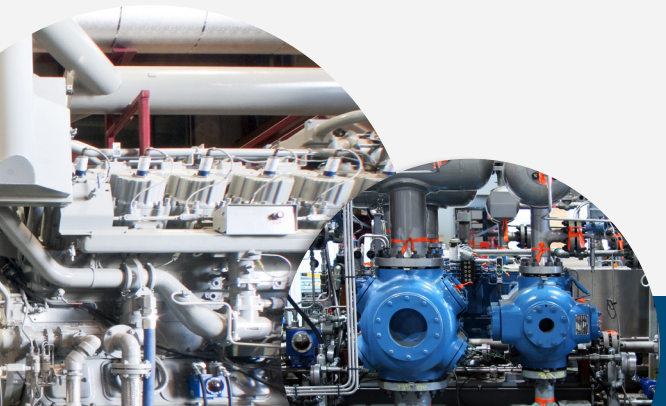
The only accurate way of checking piston ring gaps is to lay the ring flat on a surface plate and hold the ring OD at the cylinder diameter measurement in a bore gauge or using feeler gauges and a pi-tape. Again, the measurement must be done at the same temperature at which the ring was manufactured.

Do piston rings need to be pressure balanced?

Pressure balancing was thought to help reduce the wear rate of piston rings in both lubricated and non-lubricated applications. However, there is no evidence that this solved what was basically a piston ring material wear problem. With today's modern materials pressure balancing of piston rings is not necessary and in fact experience has shown that it can weaken the ring.

Can rider rings run at higher loadings than that recommended by API 618?

The rider ring loadings advised in API 618 are only a guide for filled PTFE materials and do not cover material such as CPI polymer alloys that are able to operate at significantly higher loadings.



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Do nonmetallic piston rings need an expander spring to work well?

All piston rings are gas loaded onto the cylinder wall and do not need the addition of a metal expander spring to push them onto the cylinder wall. Expanders can damage the piston ring grooves and the cylinder if the piston ring wears and the expander ring breaks, sending metallic debris between the piston and cylinder. In some very special applications expander springs can be beneficial, but the expander spring and its effect on other components in the cylinder should be the subject of a thorough design review.

How are the number of piston rings used on a piston selected?

The number of piston rings selected for an application is calculated considering the following:

- Gas molecular weight
- Pressure differential
- Whether the cylinder is lubricated or non-lubricated
- Rotative speed of the compressor
- Space available on the piston

A considerable amount of the emphasis placed on these factors is based on empirical experience and consequently it is possible to get significant variation in the number of piston rings recommended by different manufacturers and compressor builders.

When should I change the piston rings?

There is no firm answer to this question, each application must be looked upon separately. The main function of the piston rings is to provide a seal between the moving piston in the static cylinder. Provided this seal is still being achieved, piston rings can be allowed to wear until they virtually disappear. However, in most applications a reduction in cylinder performance is noticed before the situation occurs. A good rule is that piston rings should be changed when they have worn between 30% to 50% of their original radial thickness.

Should piston rings and rider rings spin on the piston when in operation?

No, piston and rider rings should not spin while in operation and all aspects of design should be utilized to prevent this. Ring spinning causes unstable high wear rates.

Why do some piston rings have straight cut and some angle cut gaps?

The function of the gap in a piston ring is to allow the ring to flex and move as it wears and to allow for circumferential expansion of the ring. The gap should consider both functions while allowing the minimum amount of leakage and the angle joint is the best design from this standpoint. However, as gas passes through the angled gap, the piston ring tends to turn in the groove and if the piston material is soft, the groove can wear. In these applications a straight cut gap is preferred. Also, the straight cut gap is stronger and is preferred for some very small diameter rings.

Do the piston rings support the piston?

The primary function of piston rings is to provide a dynamic seal between the moving piston and the static cylinder wall with piston support being provided by separate rider rings. Recent material developments have enabled piston rings to be designed to perform both the guiding and sealing function in the cylinders where space on the piston is restricted. This is a design compromise and it is preferred that piston rings only perform the sealing function.

In non-lube service how does the liner material condition affect the performance of piston and rider rings?

The ability of piston and rider rings to work well in non-lubricated service is to a large extent affected by the cylinder liner material and the condition of the liner. CPI polymer alloys are less sensitive to the conditions than filled PTFE's but the chemical composition, hardness and surface finish of cylinder liners need careful study in some applications if good non-lubricated performance of the piston and rider rings is going to be achieved.

Why do some cut rider rings only have grooves on the shoulders?

Some pistons have been designed to use split rider rings which have a reduced radial thickness closer to that used for stretch-on rings. On these designs the face relief groove cannot be used as they will weaken the rings causing them to break in service. For those rider rings, shoulder relief grooves are the only type of pressure relief that can be used.

Why do some rider rings have to be stretched onto the rider ring groove?

Originally the first non-lubricated compressors were adaptations of existing lubricated machines. In these applications the rider rings were installed on the ends of the pistons overrunning the valve ports and cylinder counterbores. If split rider rings were used they could drop into the valve ports and break, consequently stretch-on (solid uncut) rider rings were the only design that could be used.

Do split rider rings need to be pegged to stop them turning on the piston?

It is important that split rider rings are stable on the piston and do not spin. This is normally achieved by the correct design of pressure relief grooving but can also be achieved by pegging the rider ring with an anti-rotation pin. This anti-rotation pin also allows the rider ring to be turned on the piston enabling its life to be effectively doubled.

What is the minimum safe stand out of a worn ring?

This will vary with cylinder size and the clearance between the piston rod and packing case but as a guide, when the rider ring stand out from the piston OD is reduced to 20% of its original then the rider ring should be changed.

Do the piston and rider rings always need to be the same material?

In lubricated service the material of the piston rings can be different to that of the rider rings if there is a good technical reason. In non-lubricated cylinders, except in very special applications, it is preferred to have the piston and rider rings manufactured from the same material as both will have to operate on the same transfer film.

Why do rider rings have grooves on the face and shoulder?

The grooves on the side and face of rider rings are designed to prevent the ring from acting as a piston ring. The grooves on the face also help to distribute oil around the cylinder wall in lubricated service and are angled in alternate directions to help prevent the ring spinning therefore ensuring that the entire cylinder surface is swept, preventing ridges from forming on the cylinder surface.

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