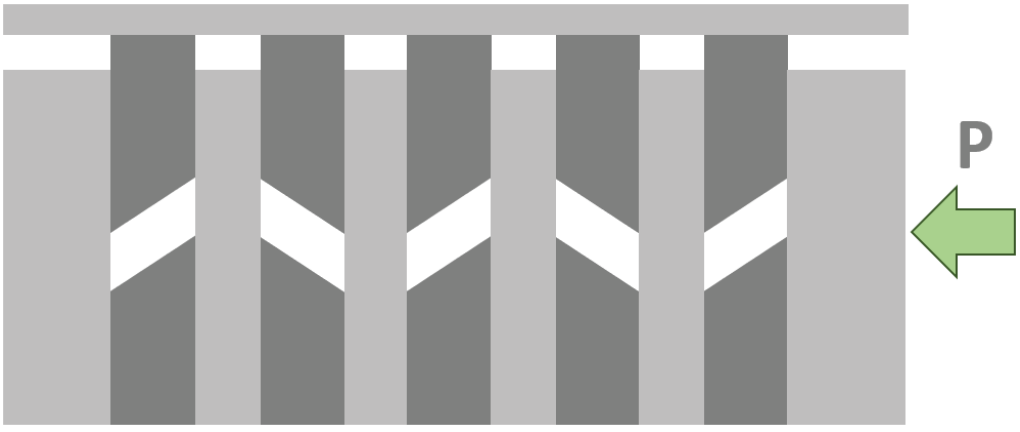
Piston Ring Design Product Brief

Piston rings are cut for multiple reasons :

- To allow the ring to make constant sealing contact on the cylinder bore as the ring wears over time
- To maintain sealing along the stroke even on unevenly worn cylinder bores
- To provide end clearance as the ring material increases in circumference as the ring heats to the higher average cylinder temperatures
- For ease of installation over the piston and into the grooves

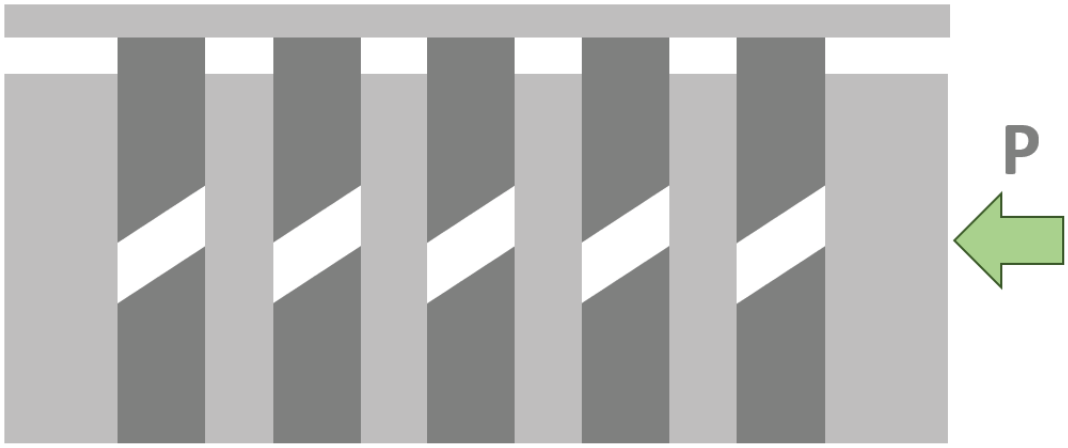
Piston rings are typically made with an angle cut which allows for thermal growth while also minimizing the gas passage width. Minimizing the gas passage width results in lower leakage to maximize the cylinder capacity. In the past it was common to alternate the direction of the angle cuts ("left hand" and "right hand") which was thought to reduce leakage by creating a more indirect gas path.

Alternate Cut Piston Rings



However, through long term use in the field and monitoring performance studies it has been proven that alternating the direction of the cuts does not influence the cylinder leakage. Therefore, all the piston rings can be standardized and manufactured more efficiently. The piston ring angle cuts will be manufactured in one angle direction unless specifically directed by our customers. Non-standard designs will require different part numbers and may increase the price.

Non-Alternate Cut Piston Rings



Alternate Cut Piston Rings - Performance Analysis

Recent testing by CPI at their R&D laboratory in Feignies, France has challenged long-standing beliefs and practices in the industry.
It has been demonstrated that producing and alternating the direction of piston ring gaps for a set of piston rings does not have any impact on compressor capacity and performance.
The tests were conducted on CPI's test compressor illustrated below:

The summarized results from these controlled tests are presented below:

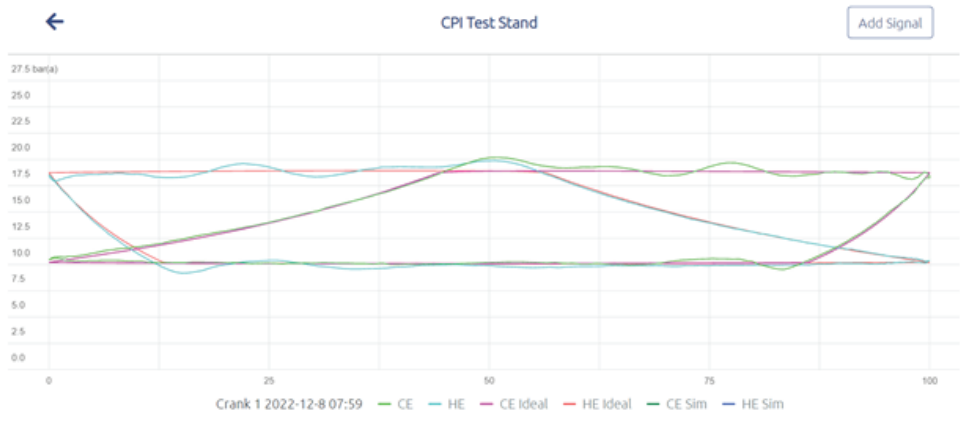
Test Conditions

Alternate cut piston rings	Non-alternate cut piston rings
Stage 1 5 x 302 Stage 2 5 x 302 Test medium: Air	Stage 1 5 x 302 Stage 2 5 x 302 Test medium: Air

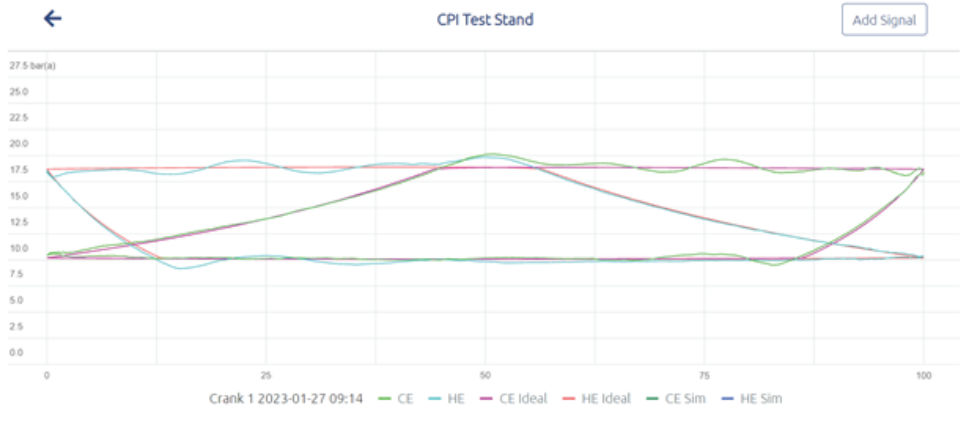
Howden Uptime Compressor Performance Data

Alternate cut piston rings	Non-alternate cut piston rings
December 8 07:59 RPM: 368.00 rpm **December 8 07:59** Crank 1: 10.23 bar(a) Crank 2: 18.12 bar(a) **December 8 07:59** Crank 1: 18.70 bar(a) Crank 2: 42.29 bar(a) **December 8 07:59** Crank 1: 2961.43 kg/h Crank 2: 2859.96 kg/h	**January 27 09:15** RPM: 368.00 rpm **January 27 09:15** Crank 1: 10.22 bar(a) Crank 2: 18.07 bar(a) **January 27 09:15** Crank 1: 18.66 bar(a) Crank 2: 42.28 bar(a) **January 27 09:15** Crank 1: 2963.28 kg/h Crank 2: 2851.84 kg/h

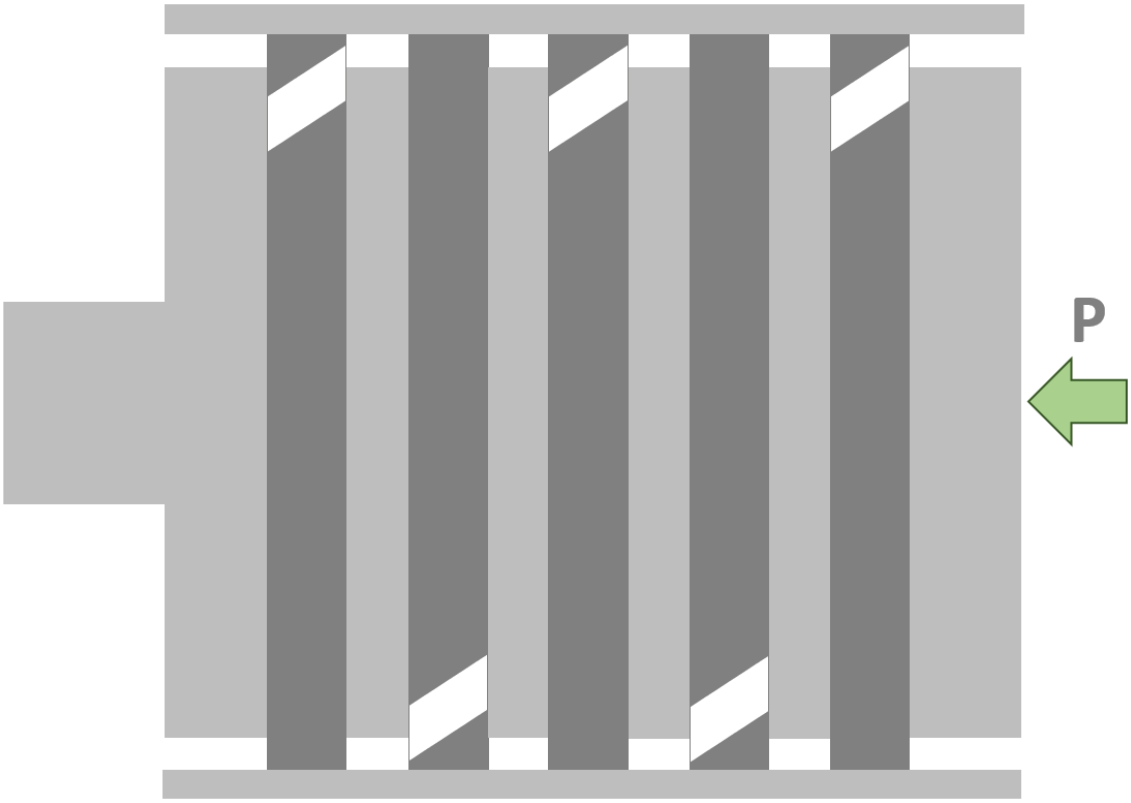
Alternate cut piston rings



Non-alternate cut piston rings



Finally, when installing the piston rings into the piston ring grooves, it is generally recommended to alternate the circumferential location of the individual ring gaps to prevent any direct alignment of all the gaps at startup. However, during normal operation the gap locations will change over time because the piston rings are free to rotate.



CPI, part of the Howden group, is an industry-leading manufacturer of precision engineered components for reciprocating compressors used in petrochemical, refining, natural gas, and offshore industries. The CPI product range includes packing, piston and rider rings and a complete line of compressor valves designed to provide each customer with maximum performance and reliability for their application. In addition, CPI offers the highest quality lubrication system technology for further compressor efficiency and protection.