MaK Parts
Comparison Bulletin

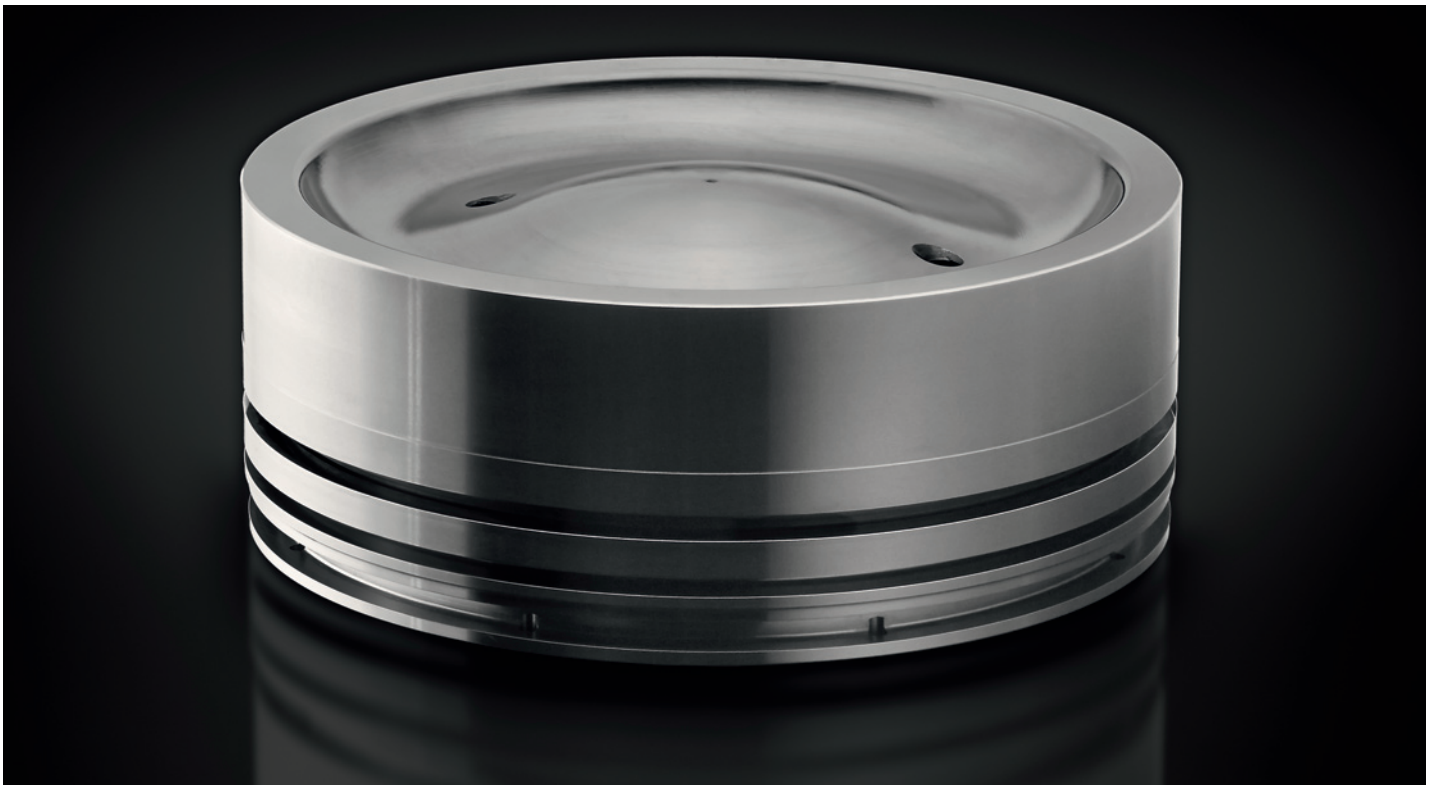
Genuine Parts

Piston Crowns –
The Hidden Value of Genuine Components

Introduction

As an engine builder, Caterpillar designs, develops and supplies its own Repair and Exchange Parts (REParts™) piston crowns, incorporating an approved and patented process exclusive to Caterpillar. This globally consistent REParts™ process, leads to high quality Original Equipment Manufacturer (OEM) approved piston crowns, using original and genuine parts and procedures.

Various types of coatings and surface treatments can be applied to engine parts to improve durability, enhance scuff resistance and lubrication, control heat, boost thermal efficiency and reduce friction. REParts™ piston crowns are machined to the original OEM dimensions; this ensures correct fit to the piston ring as well as good distribution of gas forces to prevent instability of the piston rings and to reduce wear. The innovative REParts™ coating system provides maximum wear protection and is suitable for used piston crowns, which have or have not been coated, that require overhaul.



Overview

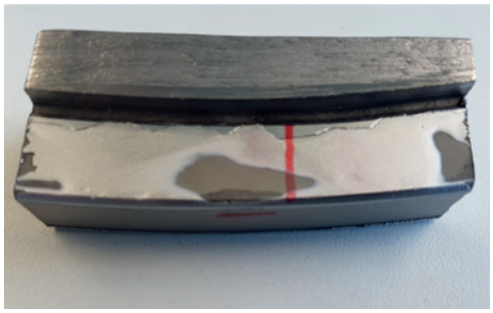
The following points describe further engineering analysis, comparing a genuine REParts™ M43 chrome plated piston crown to a non-original welded and chrome plated piston crown, in their conformance to OEM dimensions, tolerances and metallurgical specifications. Further conclusions are drawn concerning the quality and benefits of REParts™ vs non-OEM welded piston crowns.

Findings and Consequences

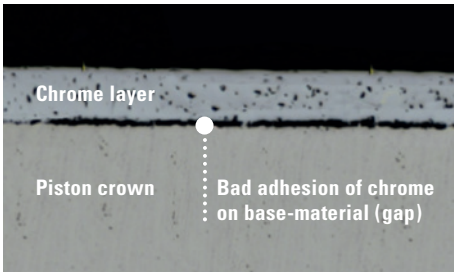
1. MaK piston crowns, overhauled through a non-genuine process, show chrome residues at the ring groove under cuts, causing abnormal piston ring dynamic, uneven contact surface and sharp edges. These can result in excessive wear on the first ring groove close to the OEM wear limits after few running hours.

Excessive wear on the first ring groove.

2. Poor adhesion of the chrome layer can result in a higher risk of wear (pilling and/or chipping) and damage to piston ring groove, piston rings and liner due to unstable chrome particles.

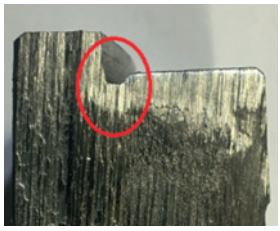


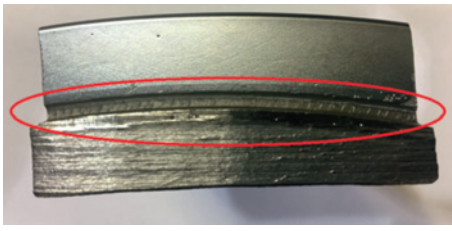
Excessive wear of the piston ring groove.

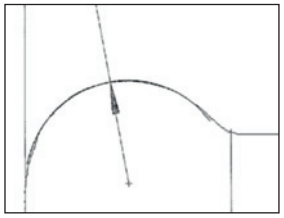


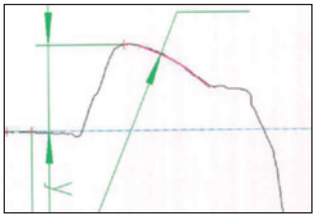
Cross section of ring groove flank with bad adhesion of chrome layer.

3. Insufficient coating/welding of the ring groove flanks can result in a higher risk of cracks in the radius at the bottom of the groove. It is well known that the abrasive wear resistance of a chromium plating layer depends on the hardness and micro-crack density, which are the most essential factors in improving wear resistance as well as perfect adhesion of the chrome layer.



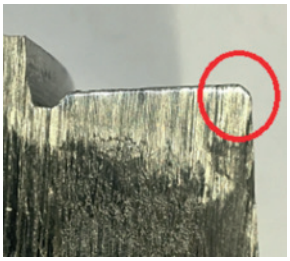






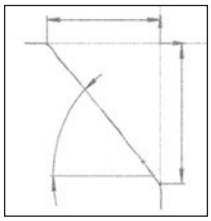
REParts™ radius shape at the groove bottom vs. non-genuine shape.

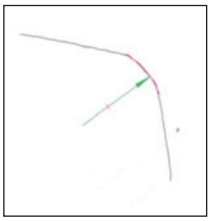
4. Inaccurate radius shape instead of defined edge angles can increase the risk of piston ring issues.



Example of non-genuine flank edges.

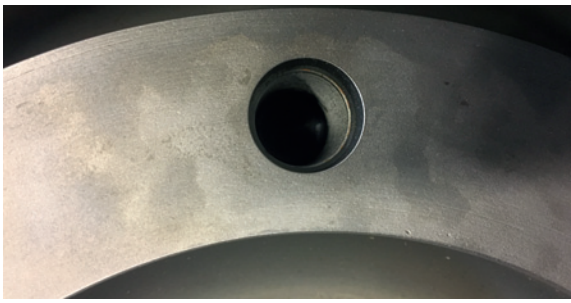
REParts™ flank edges vs. non-genuine flank edges.





5. Main supporting surface with insufficient contact pattern can be caused by an incorrect reconditioning process, which may result in major engine damage by loosening of the piston crown.

Main contact surface with insufficient reconditioning.



Conclusion

Investigation of the non-original welded and chrome plated piston crowns has highlighted multiple deviations from the OEM dimension, tolerances and metallurgical specifications. These deviations may negatively impact the proper function of the complete cylinder unit, such as: poor adhesion between chrome layer, weld and base material, together with inaccurate flank edges and radiuses in the ring groove area, and deviations in the contact pattern of the main support surfaces, caused by an improper overhaul process.

Poor adhesion of chrome and welded layers dramatically increases the risk of wear (pilling and/or chipping) through detached chrome particles and subsequent damage of piston ring grooves, piston rings and liners. An improperly reconditioned main support surface causes insufficient connection between piston crown and skirt which ultimately can cause major engine damage.

Finally not meeting OEM tolerances and material specifications can lead to subsequent damage. As piston crowns are included on the list of IMO emission relevant parts, not meeting OEM specifications risks being non-compliant with IMO emission regulations.

MaK REParts™ Benefits

The advantages of a genuine MaK REParts™ Marine-CM compared to non-OEM overhauled piston crowns:

- Machined to original OEM dimensions
- Optimized surface grinding
- Correct fit and function of piston ring
- Proper distribution of gas forces
- No additional edge loading
- Reduced ring groove wear and tear
- Correct piston ring tension
- Skirt surface reworked to OEM specifications
- No chrome delamination or layering
- Sufficient lubrication, low liner wear and no blow by
- Full 24 months factory warranty
- Technical approval from Caterpillar

The REParts™ piston crown rework process can be repeated up to four times in the life of a piston crown, even if the groove surfaces are damaged. After 90,000 running hours Caterpillar recommends replacement with new.

Original REParts™ piston crowns are clearly distinguishable by their REParts™ logo and nomenclature.

Frequently Asked Questions

What are the business risk of piston crown welding?

There is a significant risk of not meeting OEM tolerances and material specifications. Not meeting OEM specifications can lead to subsequent damage as well as not being compliant with IMO emission regulations.

What are the main difficulties with the process of welding piston crowns?

Selection of the correct parameters, dimension, tolerances and metallurgical specifications is essential. An incorrect choice leads to poor adhesion of chrome and welded layers which dramatically increases the risk of wear (pilling and/or chipping) through detached chrome particles and subsequent damage of piston ring grooves, piston rings and liners. Depending on what type of welding process is used the amount of experience required by the operator may vary significantly.

What is the REParts™ solution for welded piston crowns?

As an alternative, the REParts™ program offers “as good as new” high quality OEM approved piston crowns that are compliant with IMO emission regulations. Contact your local MaK Dealer Representative who will be able to assist you.

Does Caterpillar Motoren offer any warranty on welded piston crowns?

Due to the risks and complexities associated with such processes, Caterpillar Motoren does not recommend piston crown welding in general and therefore will not guarantee reliability for any subsequent damage which arises as a result of the execution of this process.

Faster. Less Expensive. Damage-Free parts.

All of our genuine MaK parts are easily available via the dealer network

Services for the lifetime of your engine – when you choose Caterpillar, you get that and much more. Our global network of local and certified dealers is available to support you with solutions and genuine expertise. The network offers you consistent availability of genuine parts and services worldwide while contributing to meeting your environmental and operational goals.

To find your local dealer, please visit our Dealer Locator:
https://www.cat.com/en_US/by-industry/marine/mak-dealer-locator.html

Global dealer network

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For more information please visit our website:
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