**Original design**

Expected lifetime 12-16,000 hours.

Based on ring pack equipped with :

Upper ring designed with controlled pressure relief *(CPR)* alu-coated chrome.

The rest of the rings are alu-coated.
**MBD-C supply**

Always supplied according to latest design.

Upper ring: Height reduced by 0.1mm (reduced risk of sticking).

Position of relief grooves has been modified (grooves moved away from the stress area).

Ensures the correct ring configuration.

Ensures the correct ring material for the original cylinder liner.

*CPR ring ensures:

- Improved pressure drop across ring pack.
- Reduced heat load on second piston ring
- Longer lifetime of ring pack.*
Piston ring, 90 MC/C

Original design

Expected lifetime 12-16,000 hours.

Cylinder liner equipped with PC ring

Based on ring pack equipped with:

Upper ring produced with controlled pressure relief *(CPR) alu-coated chrome/alu coated.

The rest of the rings are alu-coated.

Alternative:

The whole ring pack is taper faced with/without CPR and without alu-coating.

Price-wise cheaper but without the same expected lifetime.
**MBD-C supply**

Always supplied according to latest design.

Upper ring: Height reduced by 0.1mm (Reduced risk of sticking).

Position of relief grooves has been modified. (grooves moved away from stress area).

Ensures the correct ring configuration.

Ensures the correct ring material for the original cylinder liner.

*CPR ring ensures:

- Improved pressure drop across the ring pack.
- Reduced heat load on second piston ring.
- Longer lifetime of ring pack.
**Original design**

Expected lifetime 12-16,000 hours.

Cylinder liner equipped with PC ring

Based on ring pack is equipped with:

Upper ring produced with controlled pressure relief *(CPR) alu-coated.

The rest of the rings are alu-coated.

Alternative:

The whole ring pack is taper faced with/without CPR and without alu-coat.

Price-wise cheaper but without the same expected life-time.

Genuine spare part

Alu-coated piston ring

Developed at our Research Centre

• Reduced running in time more than 50%
• Saving cylinder oil
• Thickness about 0.3 mm
**MBD-C supply**

Always supplied according to latest design.

Upper ring: Height reduced by 0.1mm. (Reduced risk of sticking).

Position of relief grooves has been modified (grooves moved away from the stress area).

Ensures the correct ring configuration.

Ensures the correct ring material for the original cylinder liner.

*CPR ring ensures:

- Improved pressure drop across the ring pack.
- Reduced heat load on second piston ring.
- Longer lifetime of ring pack.
Ring pack – When the liner is equipped with PC ring

For L/K90MC, K80MC
See special plate

- High topland piston crown
- 1st piston ring with increased height
- Copper band on piston skirt
The stated type of engines are sensitive for coke formations and thereby for scuffing.

The guide line for the ring pack is following:

<table>
<thead>
<tr>
<th>Ring pack with CPR ring and liner <strong>with</strong> PC ring.</th>
<th>Ring pack with CPR ring and liner <strong>without</strong> PC ring.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st ring: CPR with alu-coat.</td>
<td>1st ring: CPR with PM14</td>
</tr>
<tr>
<td>2nd ring: RM5 with alu-coat</td>
<td>2nd ring: RM5 with alu-coat</td>
</tr>
<tr>
<td>3rd ring: RM5 with alu-coat</td>
<td>3rd ring: RM5 with alu-coat</td>
</tr>
<tr>
<td>4th ring: RM5 with alu-coat</td>
<td>4th ring: RM5 with alu-coat</td>
</tr>
</tbody>
</table>

UBP 03/05-05
- Upper piston ring with double-lap S-seal and 6 Controlled Pressure Relief (CPR) gaps
- Even heat distribution on 2nd piston ring
- 2nd, 3rd and 4th piston rings with oblique cut ring gaps
- New piston ring material:
  RVK-C for 70-26 cm bores and RVK-C with Alu-coating on 98-80 cm bores

When the liner is equipped with PC ring
MAN B&W standard piston rings and their compatibility with different kinds of cylinder liner materials

<table>
<thead>
<tr>
<th>Ring No. 1</th>
<th>CPR, high</th>
<th>RVK-C with Alu-coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring No. 2</td>
<td>Low, left cut</td>
<td>RM5 with Alu-coating</td>
</tr>
<tr>
<td>Ring No. 3</td>
<td>Low, right cut</td>
<td>RM5 with Alu-coating</td>
</tr>
<tr>
<td>Ring No. 4</td>
<td>Low, left cut</td>
<td>RM5 with Alu-coating</td>
</tr>
</tbody>
</table>

其他组合的活塞环/气缸 liner 材料可能导致两者活塞环或气缸 liner 的磨损增加

*RM4 活塞环在特殊情况下已被成功地用于 tarkalloy C-Va cylinder liner

For the existing engines without a PC ring, the top ring of RVK-C with PM 14 (relatively hard material) coating is still necessary

© MAN B&W Diesel
Man B&W standard piston rings and their compatibility with different kinds of cylinder liner materials.

<table>
<thead>
<tr>
<th>Ring No.</th>
<th>Standard</th>
<th>Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td>CPR, high</td>
<td>RVK-C</td>
</tr>
<tr>
<td>No. 2</td>
<td>Low, left cut</td>
<td>RM5</td>
</tr>
<tr>
<td>No. 3</td>
<td>Low, right cut</td>
<td>RM5</td>
</tr>
<tr>
<td>No. 4</td>
<td>Low, left cut</td>
<td>RM5</td>
</tr>
</tbody>
</table>

*RM4 piston ring has in special cases been used successfully in C-Va cylinder liner.

Other combinations of piston ring/cylinder liner materials can lead to increased wear of either the piston rings or the cylinder liners.
Cylinder liner and piston ring wear highly depends on the compatibility between the cylinder liner and the piston ring material.

<table>
<thead>
<tr>
<th>Daros</th>
<th>Nippon</th>
<th>Riken</th>
<th>Properties</th>
<th>Cylinder liner material</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM 5</td>
<td>Uballoy</td>
<td>Rik 45</td>
<td>Grey cast iron</td>
<td>Tarkalloy</td>
</tr>
<tr>
<td>RM 5</td>
<td>NPR Uballoy S</td>
<td>Rik 47</td>
<td>Copper-molybdenum alloyed, flake graphite</td>
<td>Tarkalloy-Tarkalloy-C</td>
</tr>
<tr>
<td>RM 4</td>
<td></td>
<td></td>
<td>Vanadium and copper molybdenum alloyed, flake graphite</td>
<td>PVA *(Tarkalloy C)</td>
</tr>
<tr>
<td>RVK-C</td>
<td>Tarkalloy G</td>
<td>Rik 29</td>
<td>Aligned high strength CV graphite iron</td>
<td>Tarkalloy C/A</td>
</tr>
<tr>
<td>RVK/pm 14</td>
<td></td>
<td></td>
<td>Base material RKV with ceramic coating on the running surface</td>
<td>All</td>
</tr>
<tr>
<td>RVK-C</td>
<td>Tarkalloy G</td>
<td>Rik 29V</td>
<td>Aligned high strength CV graphite iron with wear reducing carbides</td>
<td>Tarkalloy C/A</td>
</tr>
<tr>
<td>RVK-C/Alu-bronze</td>
<td>Tarkalloy G/ Alu-bronze</td>
<td>Rik29V/ Alu-bronze</td>
<td>Aligned high strength CV graphite iron with wear reducing coating</td>
<td>All</td>
</tr>
</tbody>
</table>

CV: Compact vermicular iron

Please view page 2 for further remarks
CPR Piston Ring Development

Original location of grooves
(6 CL-grooves)

6 relocated CL-grooves
(E-Type from Jan. 2002)

Width of CL-groove: 2mm

4 relocated CL-grooves
(E4-Type)

Width of CL-groove: 3mm

http://MarEngine.com
New material specification for piston rings supplied from MBD-C

1) CV1 "C for Cast iron – V for Vermicularjern – 1 for identification” ex. RVK-C
2) CF4 ”C for Cast iron – F for Flagegrafitjern – 4 for Identification” ex. RM4
3) CF5 ”C for Cast iron – F for Flagegrafitjern – 5 for Identification” ex. RM5

Juni 2004