

Action code: **WHEN CONVENIENT**

## Cooling Water System

### Maintenance and recommendations

SL2014-584/LRA

January 2014

#### Concerns

Owners and operators of MAN B&W two-stroke marine diesel engines.  
Type: MC/MC-C and ME/ME-C/ME-B

#### Summary

This Service Letter provides a number of possible actions to prevent the following problems; corroded or cracked engine parts (cylinder cover, cylinder liner and cooling jackets) and cooling water leakage.

Dear Sirs

This Service Letter replaces SL2001-393 dated 21 June 2001.

It is our experience that most cases of heavy corrosion in the cooling water system or cracked cooling jackets on the cylinder cover are related to insufficient cooling water maintenance. In such cases, heavy deposits of dirt and metallic particles (i.e. rust and chips, etc.) are found everywhere in the system where it is allowed to rest by the circulating cooling water. Deposits tend to find the way into the clearances between the cylinder cover and the cooling jacket, making heat expansion of the cylinder cover impossible without also exposing the cooling jacket to significant stress as the heat expansion is reducing the clearances.

In combination with heavy corrosion of the engine components caused by insufficient cooling water treatment, the cooling jacket may consequently crack.

The above is also sometimes seen in combination with leakages from the O-rings of the cooling jackets. Most of these cases are related to the problem described above, namely heavy deposits now acting as insulation of the surfaces, causing increased temperatures, local boiling and steam formation. Under these conditions, the O-rings will have a reduced lifetime as they permanently deform while losing their elasticity.

We would like to stress that the situations described above are maintenance and/or installation related and thus not a warranty issue. However, we have made some design improvements, which will reduce the sensitivity to such situations. Some of them are already standard on new engines and some are offered as spare parts.

Yours faithfully

Vice President  
Engineering

Senior Manager  
Design Small Bore

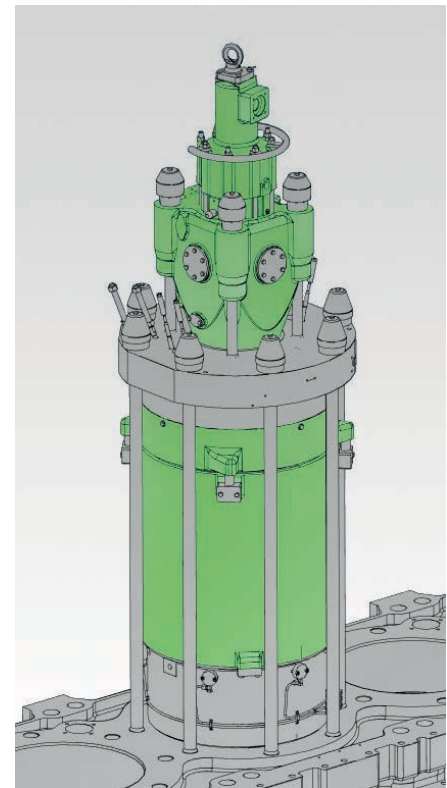
**Head office (& postal address)**  
**MAN Diesel & Turbo**  
Tegholmegade 41  
2450 Copenhagen SV  
Denmark  
Phone: +45 33 85 11 00  
Fax: +45 33 85 10 30  
info-cph@mandieselturbo.com  
www.mandieselturbo.com

**PrimeServ**  
Tegholmegade 41  
2450 Copenhagen SV  
Denmark  
Phone: +45 33 85 11 00  
Fax: +45 33 85 10 49  
PrimeServ-cph@mandieselturbo.com

**Production**  
Tegholmegade 35  
2450 Copenhagen SV  
Denmark  
Phone: +45 33 85 11 00  
Fax: +45 33 85 10 17  
manufacturing-dk@mandieselturbo.com

**Forwarding & Receiving**  
Tegholmegade 35  
2450 Copenhagen SV  
Denmark  
Phone: +45 33 85 11 00  
Fax: +45 33 85 10 16  
shipping-cph@mandieselturbo.com

**MAN Diesel & Turbo**  
Branch of MAN Diesel & Turbo SE,  
Germany  
CVR No.: 31611792  
Head office: Tegholmegade 41  
2450 Copenhagen SV, Denmark  
German Reg.No.: HRB 22056  
Amtsgericht Augsburg





**Contents**

Cooling water system	2
Fresh cooling water treatment	2
Risks	2
Precautions	2
Regular check of the cooling water	2
Improved O-ring compound (peroxide cured)	3
Mounting of O-rings	3
Securing the cooling jacket on the cylinder cover	3
Improved design	4
Cylinder cover cooling jacket	4
Slim design cylinder cover	4
Improved cooling of the O-rings grooves	5

Otherwise, there is a risk of damage to the surfaces of the cooling system, which are in contact with the water.

The recommended water treatment is explained in-depth in the Operation Manual, chapter 709, and in the new layout manuals, chapter 50, but a summary is made below.

**Risks**

In case the cooling water treatment is inappropriate, the following might occur:

**Corrosion** is a chemical process, which removes material from the attacked surface. Over time, corrosion of O-ring sealing surfaces will lead to leakage problems.

**Cooling water system**

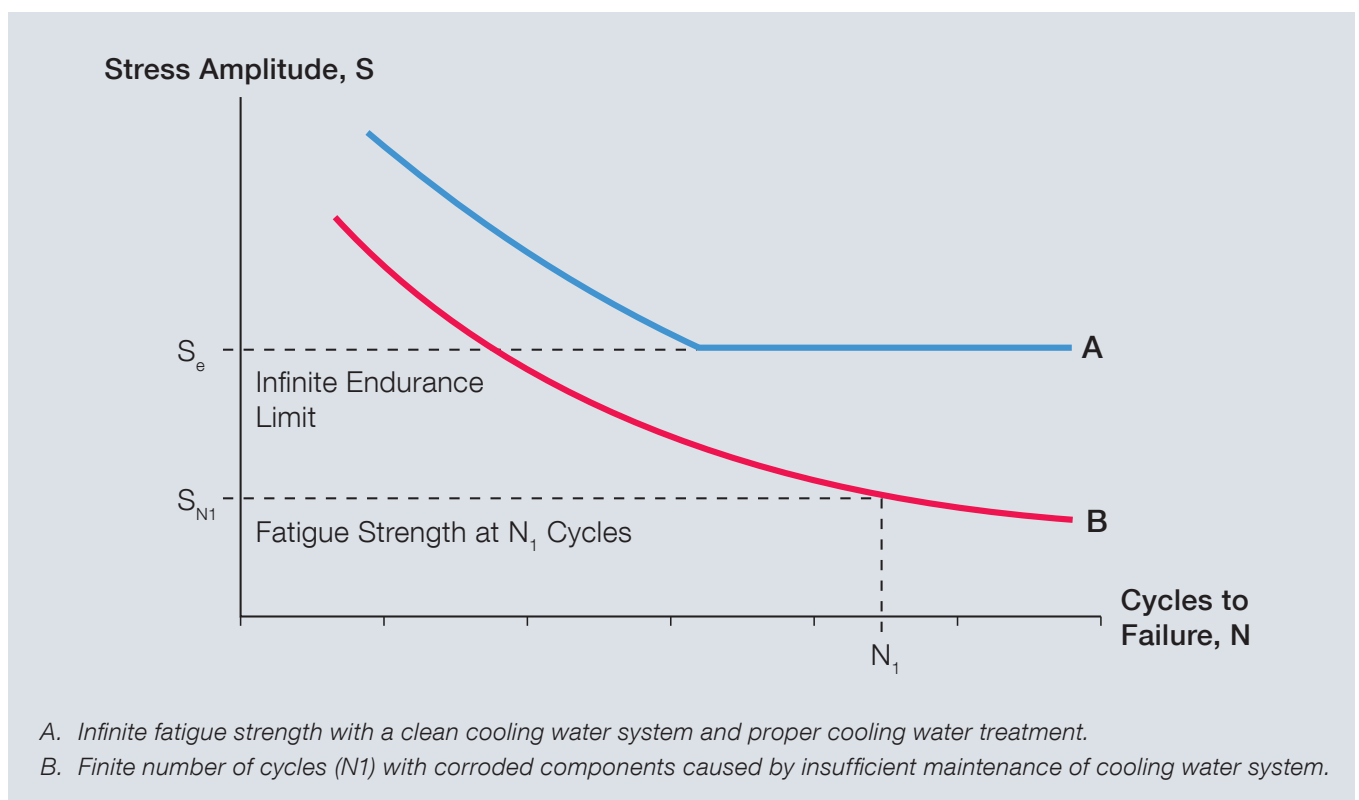
We recommend certain intervals for the cooling water inlet pressure and the outlet pressure. Please see chapter 7045-0100-0004 (Guidance Value Automation) in the Instruction Manual. Keeping the inlet pressure within the mentioned range is the most important, but in general pressure fluctuation should be avoided in order to prevent local boiling damaging the O-rings.

**Corrosion fatigue** can develop into cracks because of simultaneous corrosion and dynamic stresses. The figure below shows the effect of corrosion on components dimensioned for an infinite life time. Cycles to failure is infinite at one stress level [ $S_e$ ] (for the component with uncorroded surface) and becomes finite with significantly reduced amplitude stresses (for the component with corroded surface). The mechanism can also be related to hydrogen embrittlement.

**Fresh cooling water treatment**

Like fuel oil and lubricating oil, the engine cooling water is a medium, which must be carefully selected, treated, maintained and monitored.

**Scale formation**, which reduces the heat transfer, mostly due to lime deposits.





## Precautions

The above risks can be minimized by the following fresh water treatment.

**Cleanliness.** The cooling water system should be kept clean and free from rust and deposits. If cleaning is necessary, measures like descaling and acid circulation are explained in-depth in the manual.

**Filling up with freshwater.** It is important to use deionized or distilled freshwater for example produced in the freshwater generator.

**Adding a corrosion inhibitor.** Various types of inhibitors are available, but generally only nitrite-borate based inhibitors are recommended.

In some cases, we have seen cathodic protection used. The benefits are that no chemicals are added to the cooling water. Our experience is, however, that this type of protection is inadequate, resulting in corrosion of the cooling water system. Also, we have found a large amount of sludge in the system when cathodic protection is applied. [For this reason, we do not recommend using cathodic protection as cooling water treatment.](#)

## Regular check of the cooling water

### Once a week

The condition of the cooling water should be checked regularly, preferably once a week. The key values to be checked are the inhibitor concentration, the pH value, and the chloride ion concentration. For this purpose, the inhibitor manufacturers normally supply simple test kits, and the correct values are in the manuals.

### Every third month

Preferably every third month, a cooling water sample should be sent ashore for laboratory analysis, in particular to ascertain the contents of the inhibitor, sulphate and iron, as well as the total salinity of the water.

### Once a year

Once a year, the cooling water system should be emptied, flushed, refilled and recharged with the inhibitor.

### Every four-five years and after long out-of-operation periods

Based on the regular checks, clean the cooling water system for oil sludge, rust and lime. During cleaning, cooling jackets should be removed from the cylinder liner and cylinder cover, and the exhaust valve should be removed from the cylinder cover. This is necessary in order to perform thorough cleaning of the entire cooling water system. Finally, refill the system and add the inhibitor.

Partly cleaning of the system during piston overhaul is also recommended (removal of the cooling jacket on the cylinder cover, clean and re-fit with new O-rings) as the cylinder cover is the most sensitive area of the cooling water system.

A clear record of all measuring results should be kept, so that the actual condition and trend of the system may be ascertained and evaluated on an ongoing basis.

Any time a substantial amount of cooling water is changed or added, the inhibitor concentration should be checked to ensure a proper level.

## Improved O-ring compound (peroxide cured)

In cases of repeated cooling water leakages from the cooling jackets on the cylinder liner or the cylinder cover, we recommend installation of our new O-rings of an improved compound. The new O-rings will provide improved resistance against high temperatures and steam in areas where deposits and foreign particles are restricting water flow.

The peroxide cured O-rings are not standard on all engine types, but will be delivered on request from our PrimeServ organisation.

In our previous SL2001-393, we recommended the use of oversize O-rings (i.e. O-rings with a slightly larger cross section). As the O-ring groove dimensions have been updated and successively introduced via new spare parts on engines in service, the need for oversize O-rings has been eliminated over the last decade. Furthermore, the new O-rings of an improved compound will be able to seal O-ring grooves of both previous and updated dimensions. However, this is provided that the sealing surfaces are in normal working condition.

## Mounting of O-rings

Before fitting the cooling jackets on the cylinder cover or the cylinder liner, the O-rings should always be well lubricated with Vaseline. The lubrication is necessary in order to prevent twisting or damaging the O-ring during mounting. It is, however, important that no other lubricants such as Molycote or Cupper grease are used as this may initiate corrosion or even damage the O-rings.

## Securing the cooling jacket on the cylinder cover

After fitting the cooling jacket on the cylinder cover, the cooling jacket is secured by screws. Several different designs of fastening methods are used on the different engine sizes. One widely used design is a special screw holding the cooling jacket, but without contact between the screw

head and the cooling jacket, see Fig. 1. It is important that only bolts of the original design are used as normal screws will increase the risk of cracked cooling jackets.

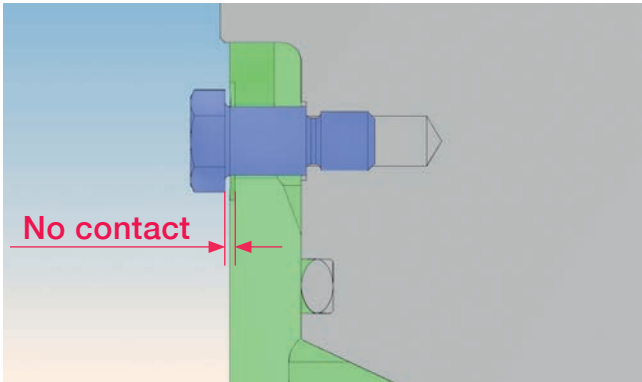


Fig. 1: Special screw for securing the cooling jacket

Another widely used design is a normal screw (inside hexagon socket screw) holding the cooling jacket in place, but without tightening the cooling jacket and the cylinder cover together, see Fig. 2.

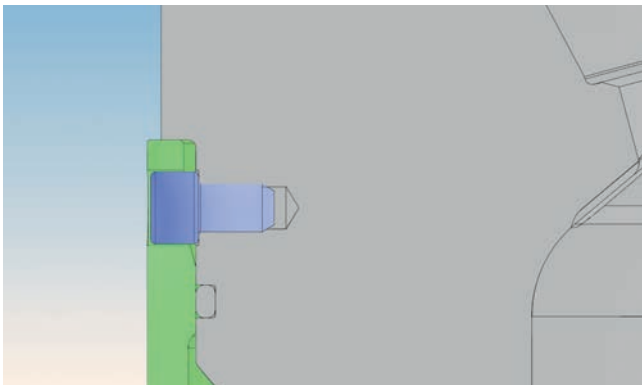


Fig. 2: Inside hexagon socket screw for securing the cooling jacket

Please note that both designs shown above are widely used and are equally good. However, they should not be mixed or replaced with standard screws with outside hexagon.

### Improved design

#### Cylinder cover cooling jacket

For most of our engine types in the small bore segment S35/40MC-C/ME-B and S46/50MC-C/ME-B/ME-C, we have introduced a modified design of the cooling jacket on the cylinder cover in order to improve cooling water circulation. In order to do so, the previous radial cooling water inlet has been changed to a more “tangential” inlet in order to create a forced water rotation and hereby pull out more of the foreign particles from the cooling water space and preventing deposits and creating a more uniform cooling of the entire circumference of the cylinder cover. The mentioned inlets are marked in blue in Figs. 3 and 4.

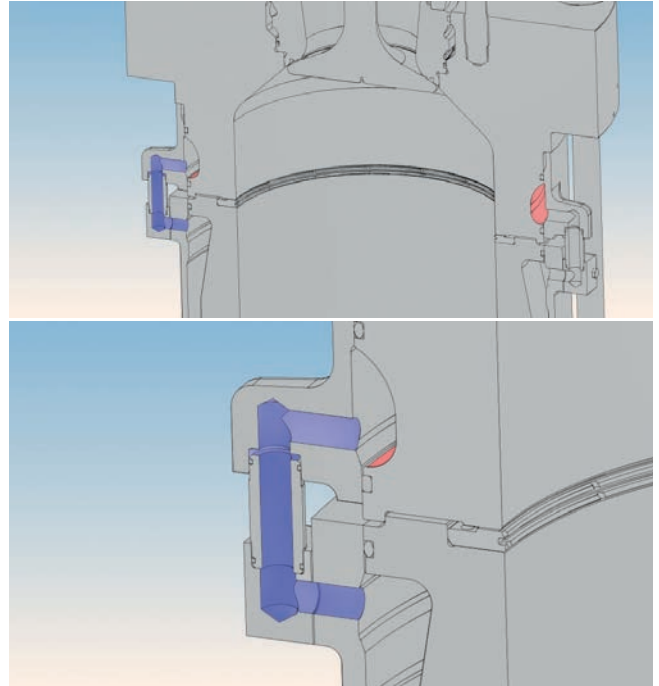


Fig. 3: Previous design

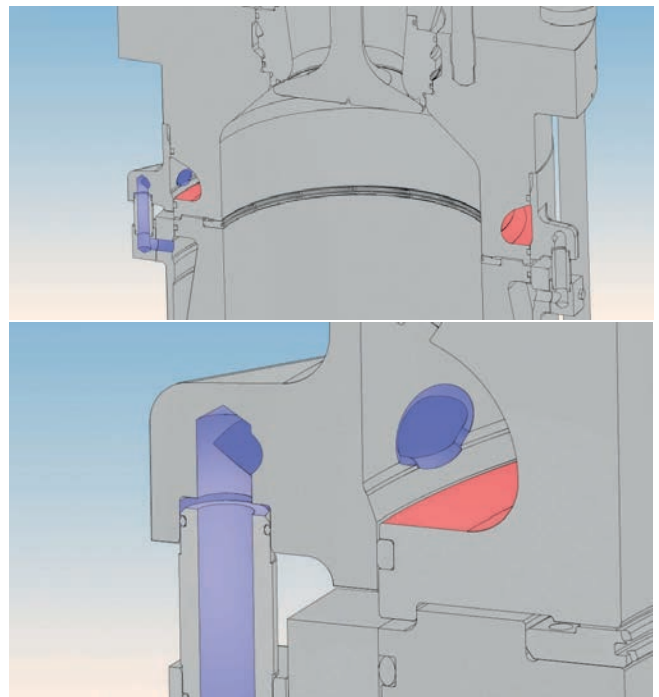


Fig. 4: New design

#### Slim design cylinder cover

For the S46/50MC-C/ME-B/ME-C engine types and S/L60MC-C with slim cylinder liners, we have also introduced a slimmer design of the cylinder cover in order to further reduce the temperature in the O-ring groove. (Marked red in the pictures above). This will increase the margin against damage of the O-rings in cases where deposits are restricting cooling of the components causing increased surface temperatures.

**Improved cooling of the O-rings grooves**

In order to provide improved working conditions for the O-ring, the cooling water access to the O-ring groove has been improved by opening the clearance on the water side of the O-ring, see Fig. 5 below.

PrimeServ (PrimeServ-CPH@mandieselturbo.com) will be at your service for assistance for modification of existing components or supply of updated spare parts.

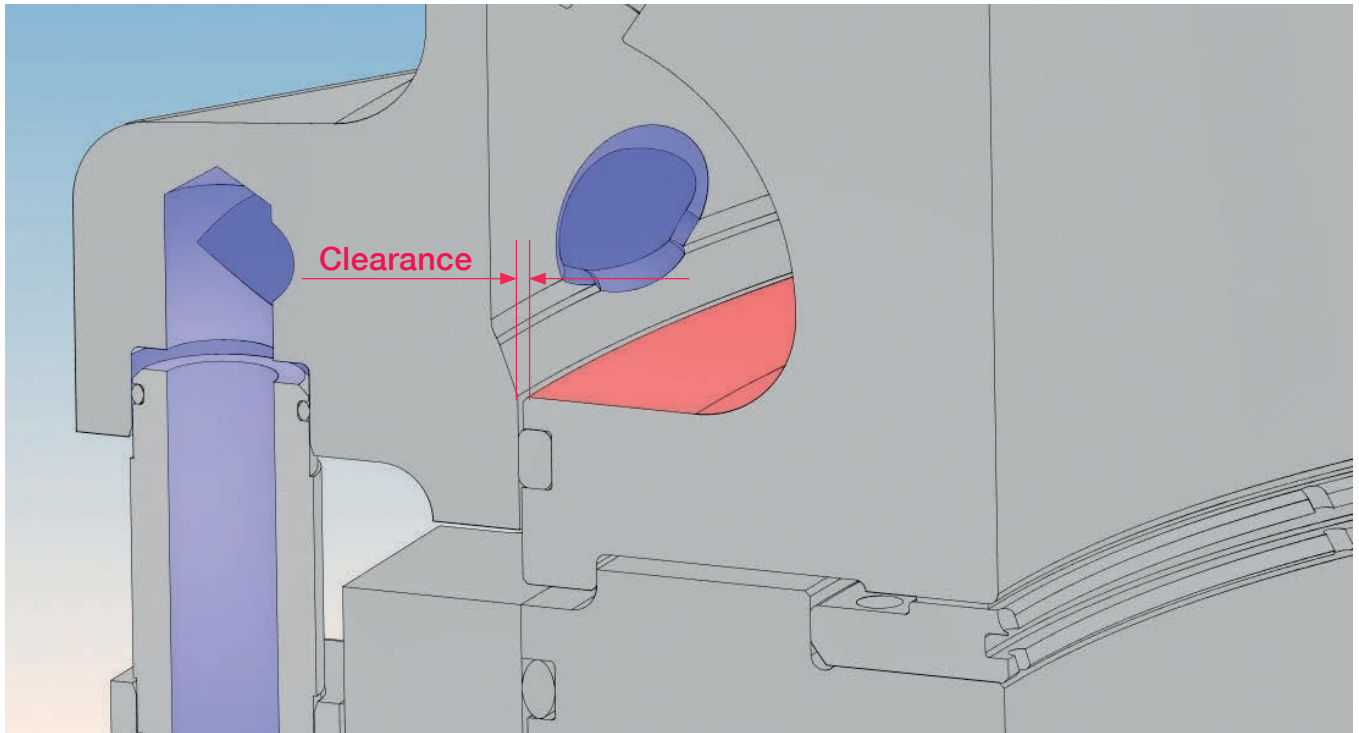


Fig. 5: Improved cooling water access