		GE Power Christian BAUER Service Engineering Distributed Power GE Jenbacher GmbH & Co OG Achenseestr. 1-3 A-6200 Jenbach, Austria T +43 5244 600 2399 christian1.bauer@ge.com
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Service Technician Instruction	ST-190	13 July 2016

Engine type **J412-A, J416-A & J420-A**

Subject **Thrust ring seat on the crankcase**
Repair method for engines in the field

ST-190 describes a repair method for modifying Type J4xx-A engines in the field when the seat of a thrust ring on the crankcase exhibits wear outside of the allowable tolerances.

AFFECTED ENGINES / SCOPE OF THIS BULLETIN

The repair method described in this Service Technician Instruction can be used on Type J412-A, J416-A and J420-A engines, in other words on Type 4 version A engines, when the wear on the part of the crankcase where the thrust ring sits exceeds the limit figure defined below.

This bulletin does NOT apply to all more recent versions of Type 4 engines (Type J4xx-B,...)!

DESCRIPTION OF THE CONTENT

A thrust ring is used between the crankcase and cylinder head in Type 4 engines. Its purpose is to extend the piston stroke and form the upper liner landing (seat) for the cylinder liner in the crankcase. When the cylinder head nuts are tightened, the thrust ring is pressed against the crankcase via the cylinder head, cylinder head gasket and cylinder liner. This results in a natural settling process at the crankcase surface, which can potentially increase over time and result in more or less severe wear indications (hammering marks, corrosion,...). If this wear exceeds the limit defined below, the repair method described here can be used on engines in the field to optimise the position/alignment of the thrust ring on the crankcase, and the components mounted on it, in order to allow for continued operation of the plant.

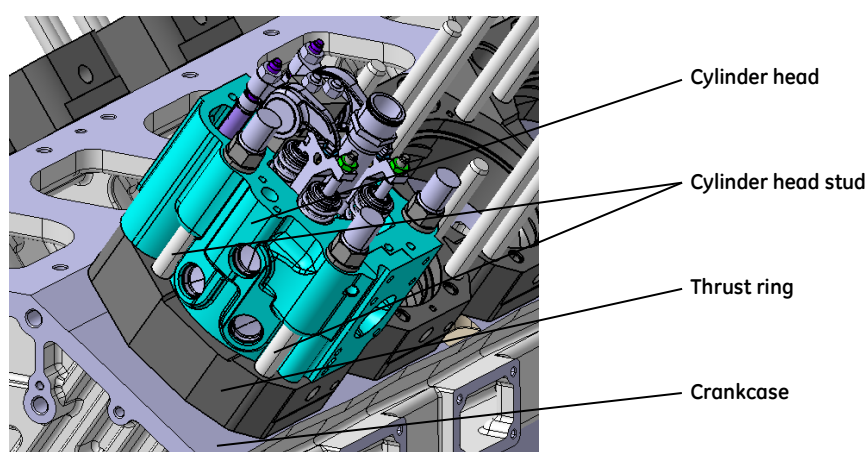


Figure 01: Thrust ring for Type 4 engines

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Series solution

Figure 02 shows the underside of a series thrust ring as used in new plants with Type 4 engines. When installed, a series thrust ring like this is pressed against the crankcase with the surface marked in red here. An O-ring held in the correct position by the shoulder marked in blue in the illustration provides the necessary seal between the components. Figure 03 shows where the series thrust ring is seated on the crankcase. Figure 04 illustrates the situation when it is installed.

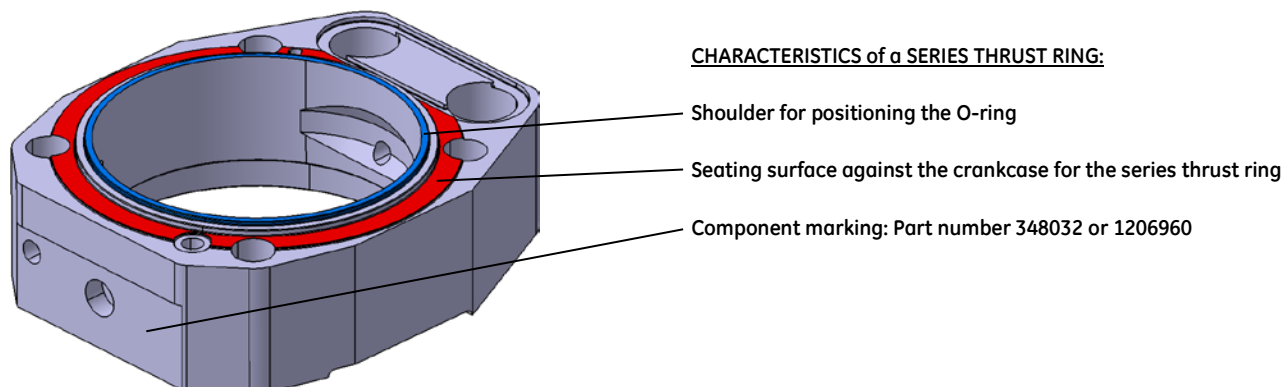


Figure 02: Series thrust ring – underside view

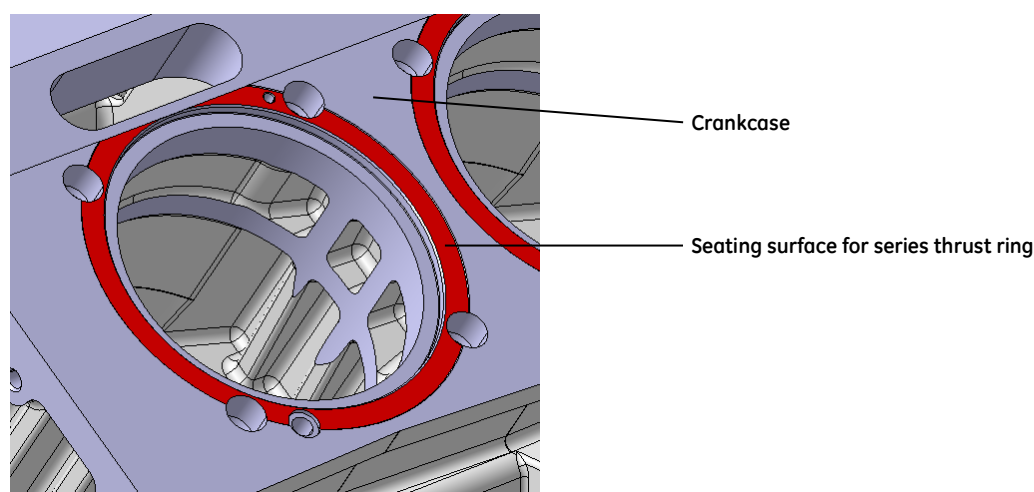


Figure 03: Crankcase – seating surface for series thrust ring

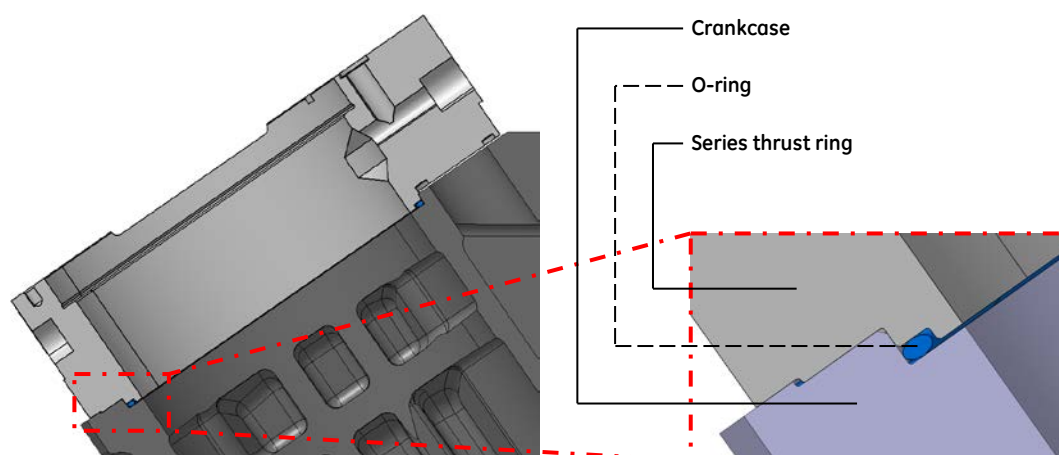


Figure 04: Series thrust ring when installed – sectional view (section surfaces not shown hatched)



Repair solution

Figure 05 shows the underside of a repair thrust ring that may be used on Type 4 engines in the field if the wear at the part of the crankcase that acts as a seating surface for the series thrust ring (see the area marked in red in Figure 03) exceeds the limit defined below. A comparison of the two thrust ring designs quickly reveals that the O-ring shoulder of the series thrust ring (marked in blue in Figure 02) is missing from the repair thrust ring. In the repair solution, a metal ring provides the required seal between the components. It is clamped between the new thrust ring-crankcase seating surfaces marked in red in the two Figures below.

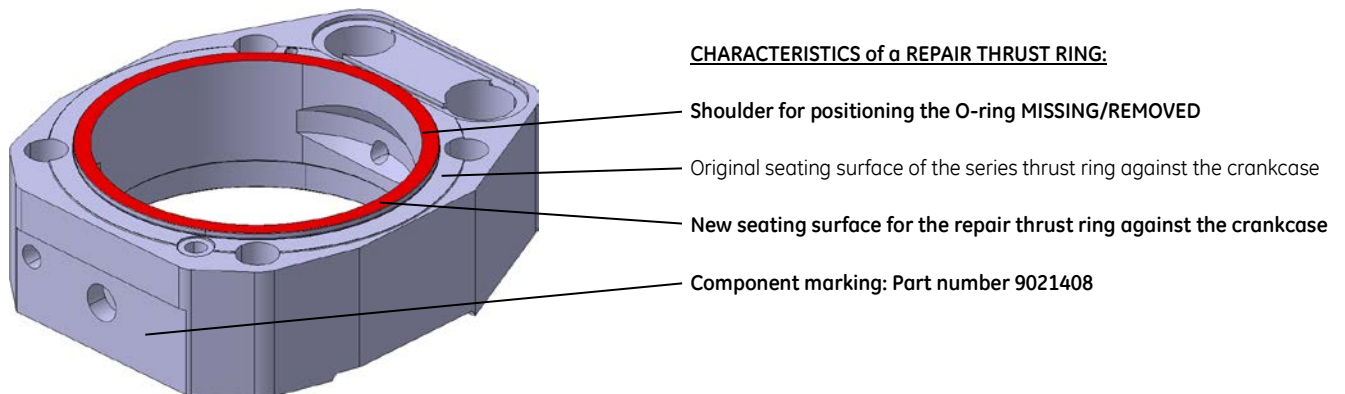


Figure 05: Repair thrust ring – underside view

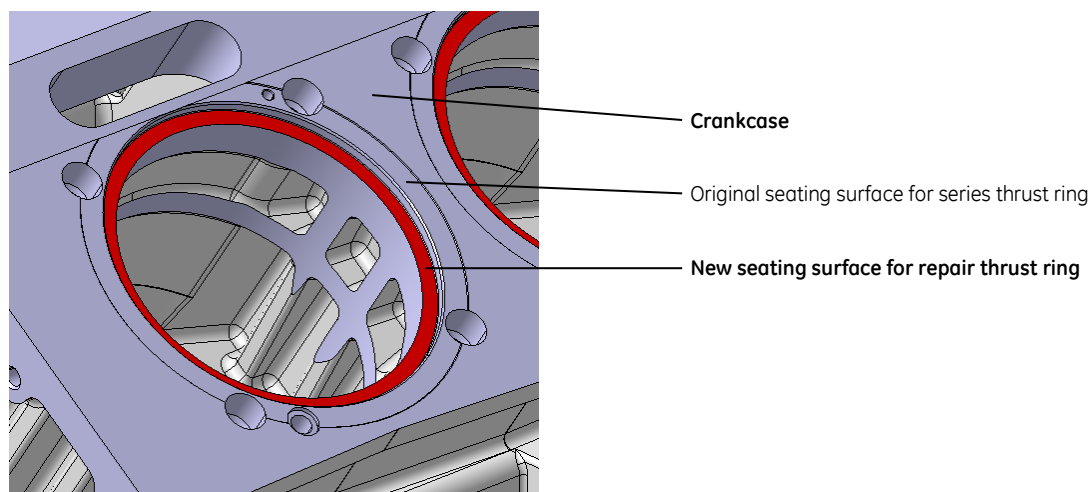


Figure 06: Crankcase – seating surface for repair thrust ring

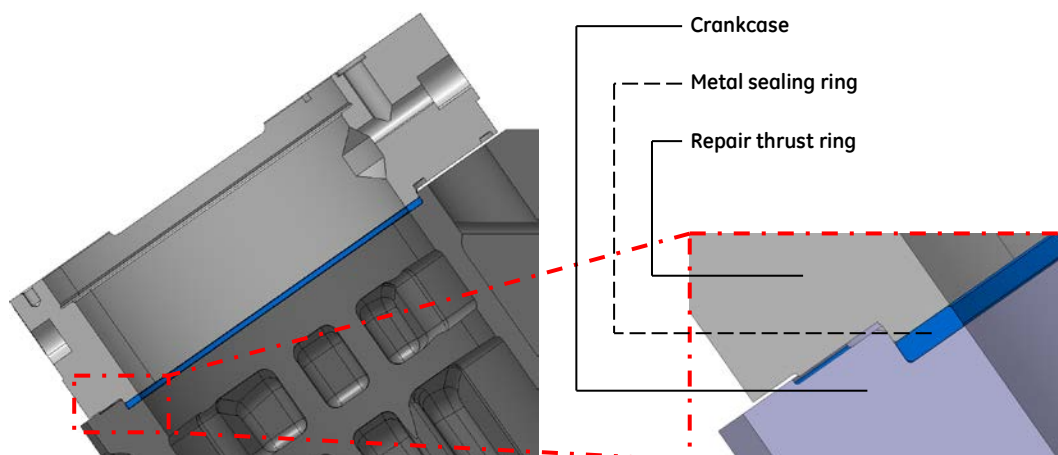


Figure 07: Repair thrust ring when installed – sectional view (section surfaces not shown hatched)



Wear indications in the series solution

As already mentioned, in the series solution the area of the crankcase where the series thrust ring is seated (see the red marked area in Figure 03) can exhibit more or less severe wear with increasing engine operating hours. The depth of the wear can vary around the circumference of the seat. It is usually at a maximum over the top arc, between the 9 and 3 o'clock positions.

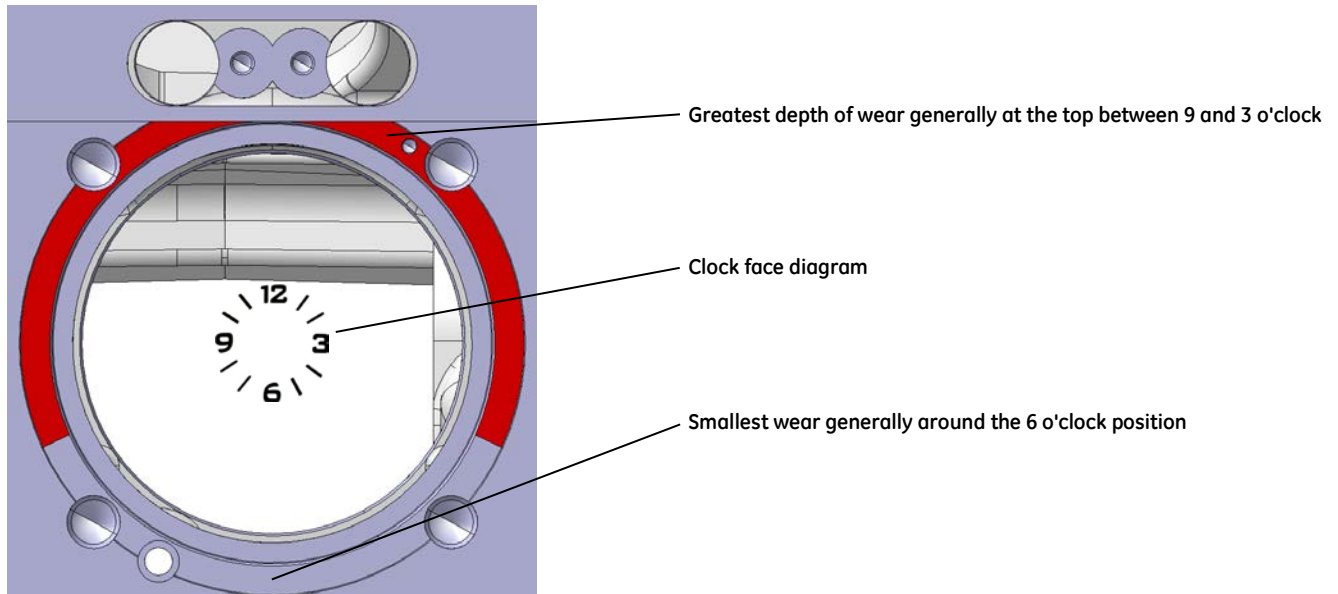


Figure 08: Crankcase – greatest wear between the 9 and 3 o'clock positions

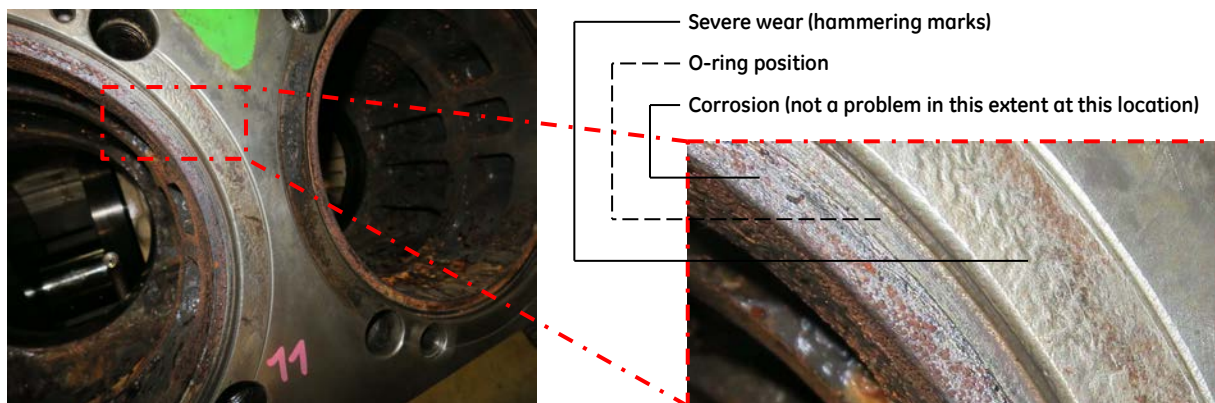


Figure 09: Crankcase – severe wear indications (hammering marks, corrosion)

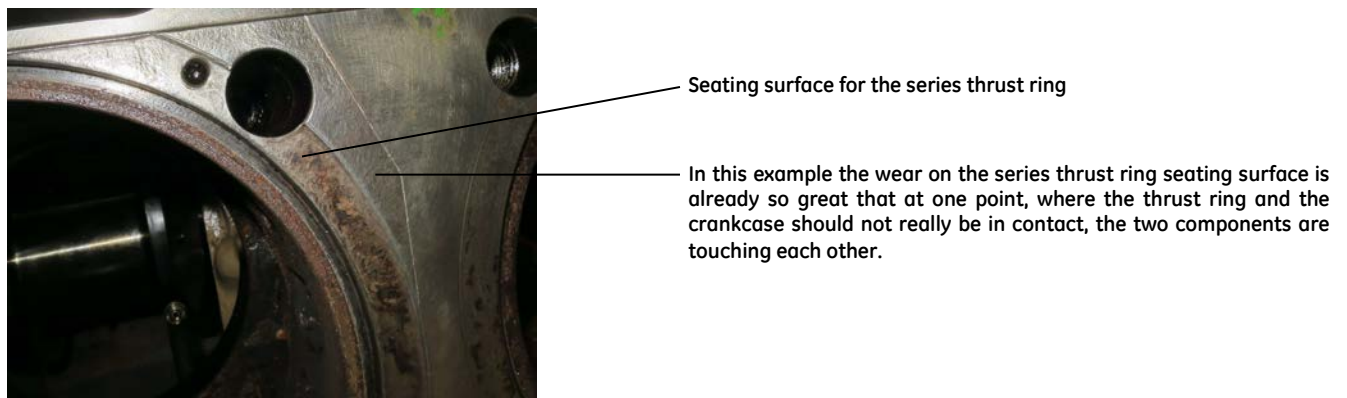
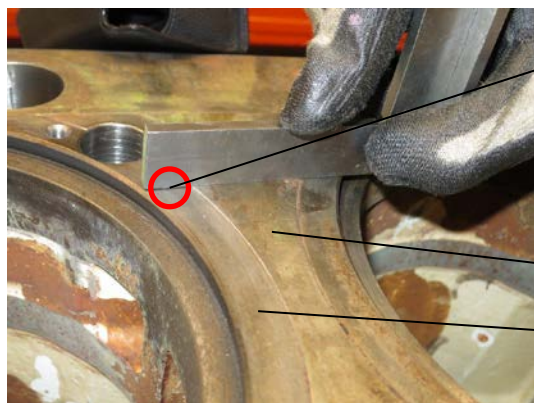


Figure 10: Crankcase – severe wear indications



Wear limit on the seating surface for the series thrust ring

When removing components, if the maintenance plan does not prescribe replacement, components should be inspected carefully to check whether they still meet all the requirements for continued use. When a series thrust ring has been removed, it is essential to pay particular attention at the same time to any wear on the crankcase (as described above). Measurements can clarify here whether the use of a series thrust ring is still permissible or installation of the repair solution described here must be considered.



The gap between the surface of the crankcase (at a properly cleaned location without any wear or paint) and the seating surface for the series thrust ring must not exceed the limit value defined below AT ANY POINT around the ENTIRE CIRCUMFERENCE. The following applies:

- Note the position of the greatest wear as shown in Figure 08
- Take several measurements at different places
- If there are uneven areas in the seating area for the series thrust ring (hammering marks), always measure at the lowest point

Crankcase surface

Seating surface for series thrust ring

Figure 11: Measuring the wear on the crankcase at the seating surface for the series thrust ring

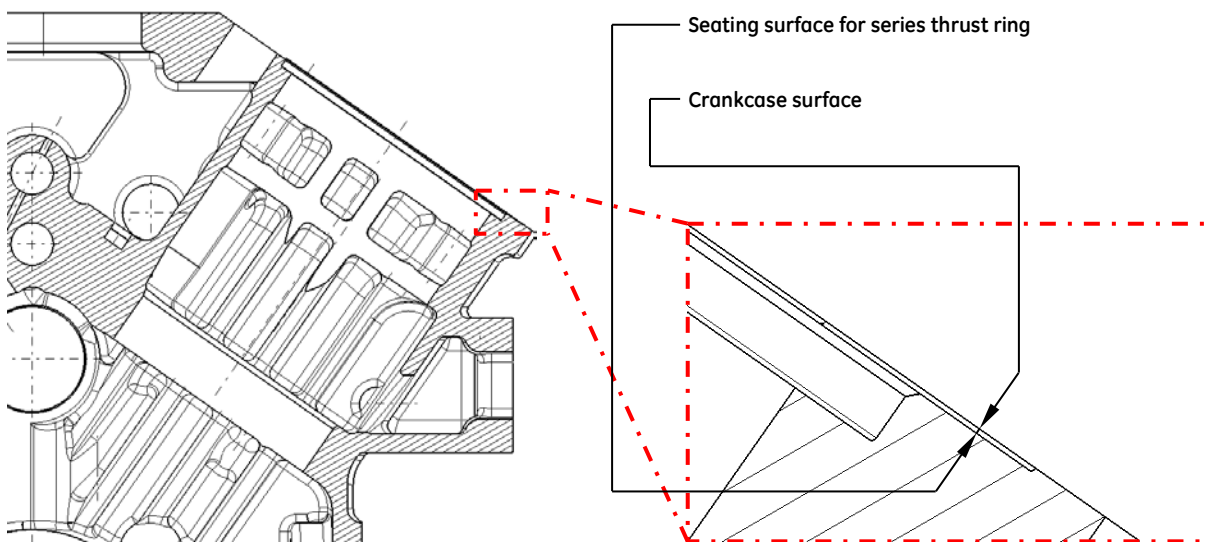


Figure 12: Measuring the wear on the seating surface for the series thrust ring

Gap between the crankcase surface and the seating surface for the series thrust ring	
Nominal dimension	0.5mm
Limit	0.7mm

Table 01: Wear limit on the seating surface for the series thrust ring

Actions depending on the results of the gap measurements described above	
ALL measurement results <0.7mm	Series solution still permissible
AT LEAST one measurement result >0.7mm	Series solution no longer permissible; check whether the repair solution is possible (see below)

Table 02: Action depending on the wear on the seating surface for the series thrust ring



Wear limit on the seating surface for the repair thrust ring

Before the repair solution can be installed, the crankcase must be checked to see whether the seating surface for the repair thrust ring meets the quality and dimensional accuracy criteria demanded. This is done by a visual inspection (surface quality) and additional measurements (maximum permissible wear depth).

Checking the surface quality by means of a visual inspection

The two comparison tables below are intended to give an idea of the required surface quality. For reasons of simplicity, we have decided not to use measuring instruments to determine the exact roughness.

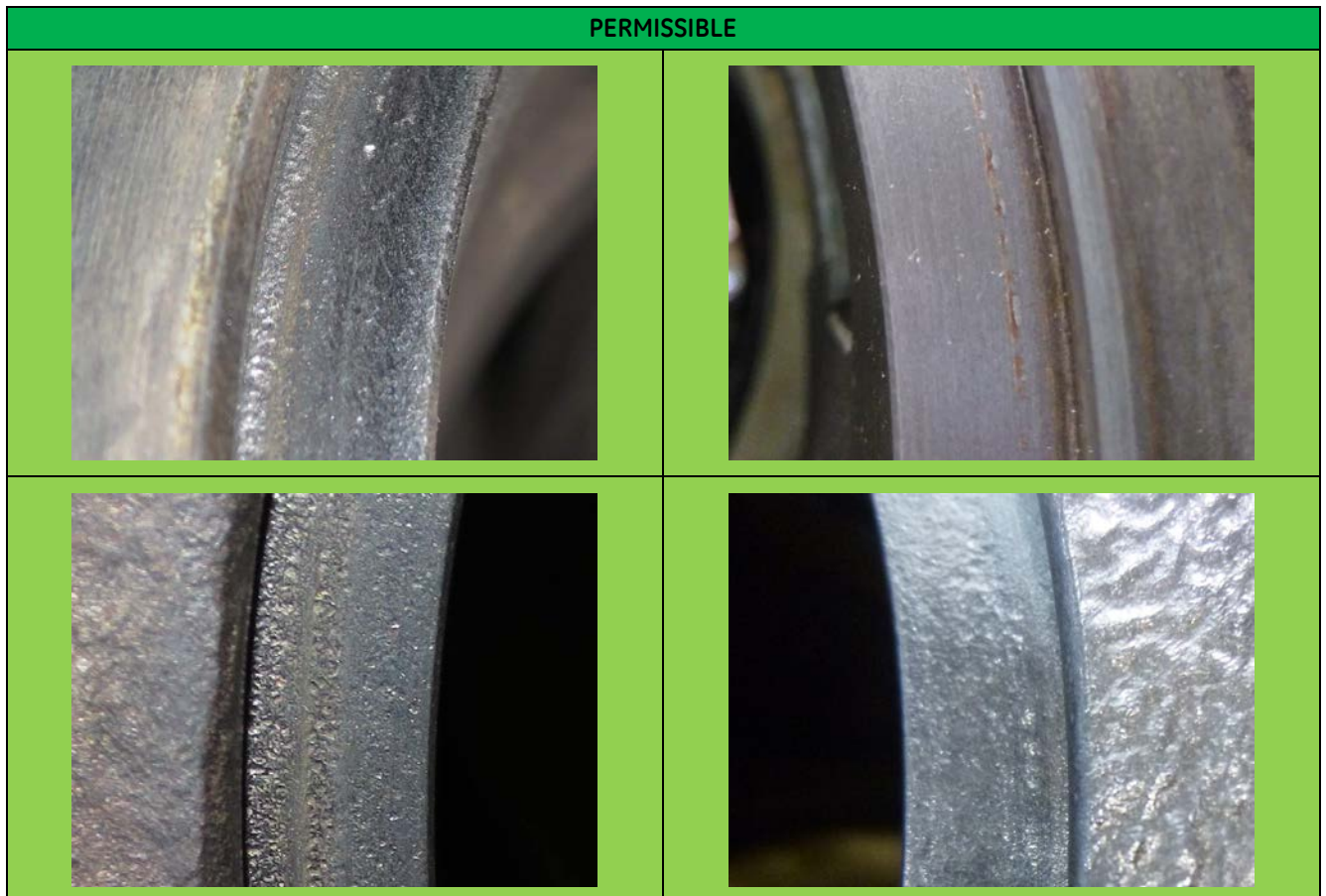


Table 03: Seating surface for the repair thrust ring on the crankcase – PERMISSIBLE surface quality

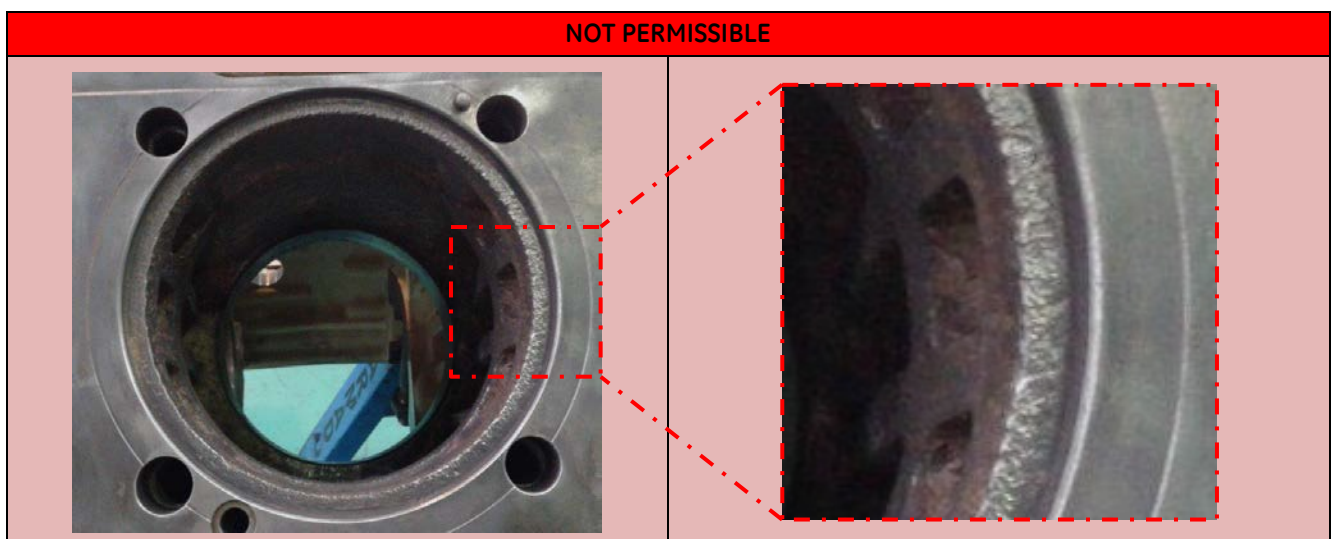
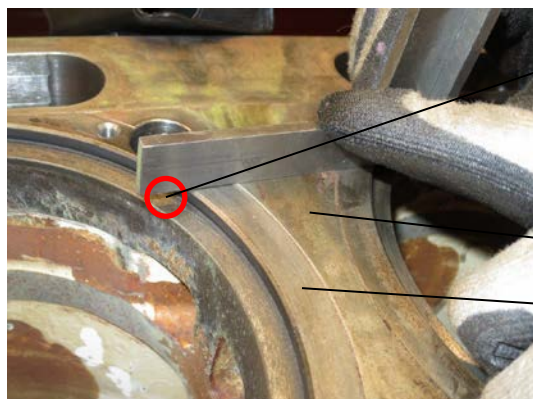


Table 04: Seating surface for the repair thrust ring on the crankcase – NOT PERMISSIBLE surface quality



Checking the maximum permissible wear depth by measurements

If the surface quality is declared PERMISSIBLE by the visual inspection mentioned above, the seating surface for the repair thrust ring must still be checked for dimensional accuracy, i.e. depth measurements are taken here as well to check compliance with the tolerance as given below (limit figure).



The gap between the surface of the crankcase (at a properly cleaned location without any wear or paint) and the seating surface for the repair thrust ring must not exceed the limit value defined below AT ANY POINT around the ENTIRE CIRCUMFERENCE. The following applies:

- Take several measurements at different places
- If there are uneven areas in the seating surface for the repair thrust ring (corrosion) always measure at the lowest point

Crankcase surface

Seating surface for repair thrust ring

Figure 13: Measuring the wear on the crankcase at the seating for the repair thrust ring

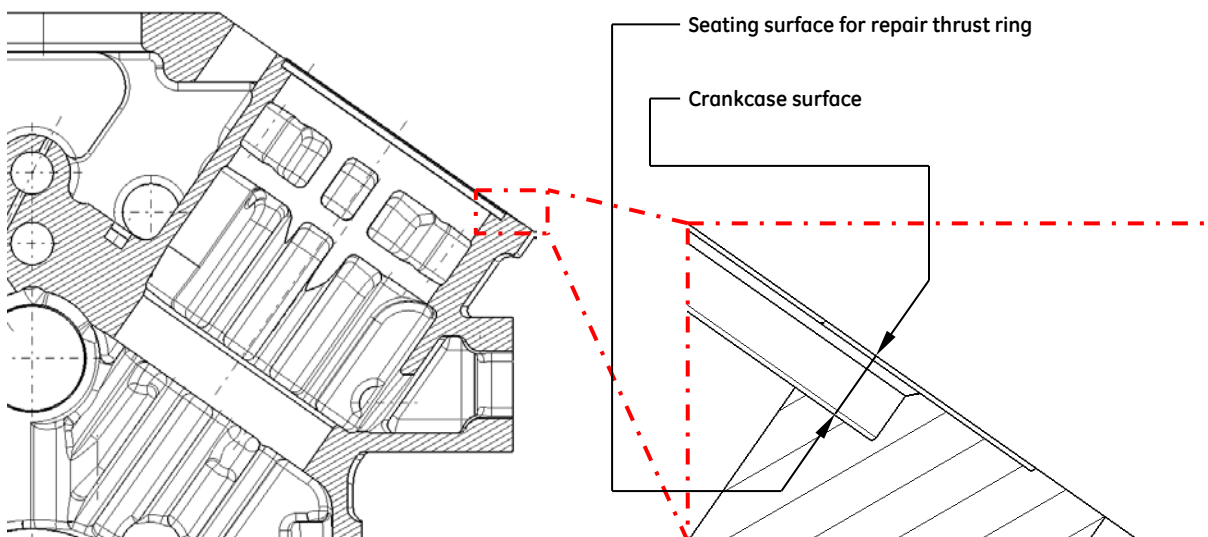


Figure 14: Measuring the wear on the seating surface for the repair thrust ring

Gap between the crankcase surface and the seating surface for the repair thrust ring	
Nominal dimension	6.8mm
Limit	7.2mm

Table 05: Wear limit on the seating surface for the repair thrust ring

Actions depending on the results of the gap measurements described above	
ALL measurement results <7.2mm	Installation of the repair solution permissible
AT LEAST one measurement result >7.2mm	We advise against any further use of the crankcase

Table 06: Actions depending on the wear on the seating surface for the repair thrust ring



Procedure for installing the repair solution

The procedure for installing the repair solution is similar in principle to replacing a cylinder liner, as laid down in the maintenance plan for every Type 4 engine. Therefore the removal and cleaning of individual parts or the draining of the engine cooling water is not detailed here. This instruction stops at the assembly description after installation of the cylinder liner. Attention must always be paid to the UPMOST CLEANLINESS during the work, and it is always advisable in any case to perform the work together with other maintenance or repair work (oil change, piston replacement,...).

- Shut down the engine in accordance with Technical Instruction TA 1100-0105 and protect it against unauthorized restarts, observing TA 2300-0010
- Read safety instructions TA 2300-0005 and wear the appropriate personal protective equipment
- As mentioned above, we assume that...
 - the preliminary work before removing the components involved has been carried out (draining the engine cooling water,...),
 - all the relevant components have been removed, including the series thrust ring and the O-ring seal,
 - the crankcase and parts to be re-used have been cleaned and checked,
 - re-use of a series thrust ring has been ruled out on the basis of the criteria defined above, and
 - implementation of the repair solution has been declared PERMISSIBLE.
- Check the condition of the dowel pin, or replace the pin if necessary (part number as for the series solution)



Figure 15: Checking the dowel pin, replacing as necessary



- Apply red or white silicone sealant to the seating surface for the repair thrust ring and metal sealing (white is usual in the field)



Figure 16: Applying red or white silicone sealant (white is usual in the field)



- Fit the metal sealing ring



Figure 17: Fitting the metal sealing ring



- Apply red or white silicone sealant to the metal sealing ring (white is usual in the field)



Figure 18: Applying red or white silicone sealant (white is usual in the field)



- Fit the seal (part number as for the series solution) in the oil return gallery in the crankcase



Figure 19: Fitting the seal





- Fit the seal (part number as for the series solution) for the pushrod bores in the repair thrust ring



Figure 20: Fitting the seal



- Fit the repair thrust ring



Figure 21: Fitting the repair thrust ring



- Apply red or white silicone sealant to the repair thrust ring (white is usual in the field)

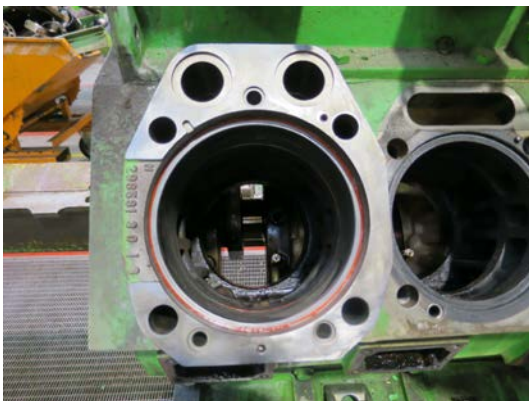
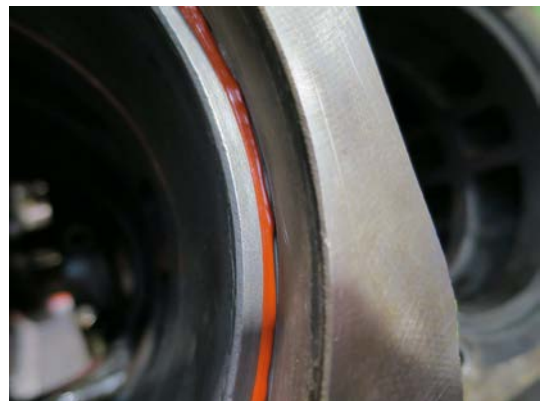


Figure 22: Applying red or white silicone sealant (white is usual in the field)





- Fit the cylinder liner (part number as for the series solution)



Figure 23: Fitting the cylinder liner



- Clamp down the parts



Figure 24: Clamping down the parts



- Continue and complete the engine assembly (fitting the piston, cylinder heads,...) using the normal procedures
- Correct the spare parts catalogue on site so that the lists reflect the number and part numbers of the thrust rings and sealings between thrust rings and crankcase currently installed on the engine (see the chapter "Relevant Part Numbers" in this Service Technician Instruction)

- Update the BoM (Bill of Materials) in Oracle (Markus Brindlinger's team)

The following data will be needed for this:

- Name of the plant
- J-number of the plant
- Engine number
- Number of operating hours
- Number of engine starts
- Number and part numbers of the thrust rings installed
- Number and part numbers of the sealings installed (between the thrust rings and the crankcase)
- Date of the modification
- Name, company and contact data (telephone, e-mail address) of the technician(s) who carried out the work

All the relevant part numbers are listed in the "Relevant Part Numbers" chapter of this Instruction.



RELEVANT PART NUMBERS

Table 07 summarises all the parts that are changed in the modification from the series to the repair solution. The parts on the left are replaced by the parts on the right.

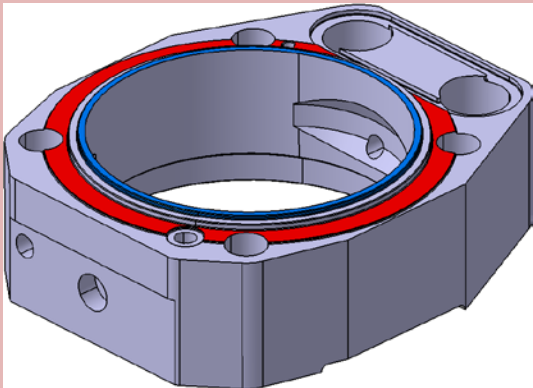
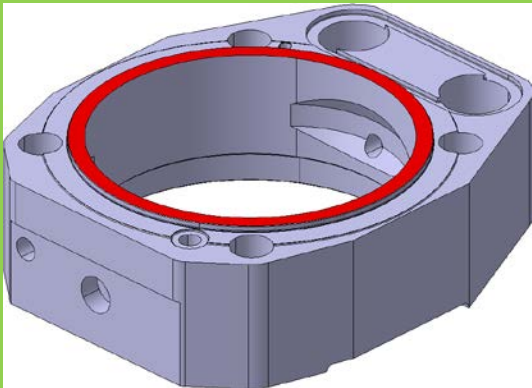


SERIES SOLUTION	REPAIR SOLUTION
 Series thrust ring 348032 or 1206960	 Repair thrust ring 9021408
 O-ring 376488	 Metal sealing ring 9021409

Table 07: Relevant part numbers – comparison of series and repair solution

Table 08 shows the required quantity PER CYLINDER of necessary parts to be able to install the repair solution.

PART NUMBER	REQUIRED QUANTITY PER CYLINDER	DESCRIPTION
9021408	1	Repair thrust ring
9021409	1	Metal sealing ring

Table 08: Relevant part numbers – required quantity per cylinder



APPLICABLE RULES

- Every time a series thrust ring is removed, its seat on the crankcase must be checked as described in this instruction and the repair solution applied if necessary.
- It is not the purpose of this instruction to call for removal and inspection of series thrust rings that goes beyond the scope of the maintenance measures we prescribe and any ensuing repair or modification work.
- Series and repair thrust rings may be mixed on the same engine, i.e. the repair solution can be applied to INDIVIDUAL cylinders of an engine instead of all of them.
- In the course of a major overhaul of an engine the crankcase may need to be machined (metal-cutting), in which case the installation of a so-called special thrust ring 357437 is necessary. These differ from series thrust rings in their height (+0.5mm) and the positioning of the positioning dowel. If such special thrust rings are fitted to an engine, the repair solution CANNOT be used.
- Metal sealing rings 9021409 can be re-used after undoing the cylinder head studs and nuts (e.g. as part of a cylinder head replacement) provided that no damage can be seen.
- The installation of a repair thrust ring has NO effect on the prescribed torques, i.e. all the cylinder head nuts in both the series and repair solutions must both be tightened to the same torque as laid down in Technical Instruction TA 1902-0213.
- Attention must be paid to the UPMOST CLEANLINESS during the work described here, and if possible the work should always be performed together with other maintenance or repair work (oil change, piston replacement,...).

CONTACTS

Should you have any questions regarding this Service Technician Instruction, please do not hesitate to contact us.

- Project manager:
Mr. Arnfried KIERMEIER
T +43 5244 600 2185
E Arnfried.Kiermeier@ge.com

RELEVANT DOCUMENTS

When working on GE Jenbacher modules, all applicable local regulations must of course be observed in addition to our documentation. In relation to this Service Technician Instruction we stress the fact that the following documents must also be observed:

- Technical Instruction TA 1100-0105: Engine shut-down
- Technical Instruction TA 1100-0111: General conditions – Operation and maintenance
- Technical Instruction TA 1100-0113: Cleanliness during service work involving clean oil parts
- Technical Instruction TA 1902-0213: Screwing and tightening torques for Type 4 engines
- Technical Instruction TA 2102-0020: Check list for engine repairs and overhauls
- Technical Instruction TA 2300-0005: Safety instructions
- Technical Instruction TA 2300-0010: Guidelines for using the LOTO kit
- Maintenance Instruction W 8053 M4: Cylinder head replacement

REVISION CODE

INDEX	DATE	DESCRIPTION / REVISION SUMMARY
01	Jul. 13, 2016	First version of this document

Table 09: Revision history