

SHOP MANUAL



GUIDANCE FOR REUSABLE PARTS

TORQUE CONVERTER



GUIDANCE FOR REUSABLE PARTS

KOMATSU

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INTRODUCTION

This Guidance for Reusable Parts provides explanation of the causes of damage about torque converter.

It includes photographs of various types of damage so that judgment can be made visually as to whether a part can be used again or not.

This Guidance for Reusable Parts is designed so that it can be used by a wide range of people in the repair and maintenance of torque converter. We hope that it will be used to make suitable judgment about reuse or replacement of parts to reduce repair costs and to improve machine availability.

Note: This publication is intended for guidance only and KOMATSU LTD. hereby expressly denies and excludes any representation, warranty or implied warranty for the reuse of torque converters.

DAMAGE AND CAUSES

Damage and drop in performance arise when various problems occur together. In particular with the torque converter, oil is used as the medium for transmitting motive power, so improper operation (rise in oil temperature) and improper maintenance of lubricating oil (oil level, oil pressure, dirt in oil) are important factors.

Operation

The torque converter uses fluid to transmit the motive power, so the oil temperature is likely to rise. If the torque converter is stalled, or is operated for long periods near stall condition, the motive power from the engine is converted into heat and this causes the oil temperature to rise. For this reason, it is necessary to be careful to select the proper speed range when operating the machine to avoid overheating.

***MEMO**

Stall:

This occurs when the transmission is in a FORWARD or REVERSE speed range (not NEUTRAL), and an excessive load is applied or the brake is depressed to stop the machine while the engine is still running. In other words, the condition where the pump is rotating but the turbine is stopped is called "stall".

Oil Level

If there is too much oil and the oil level is too high, there will be increased horsepower loss caused by churning resistance, and there is danger that the oil temperature may rise abnormally. Therefore, it is necessary to check the oil amount (oil level) correctly.

Oil Pressure

If bubbles are formed in the torque converter oil, the performance will drop, and cavitation may occur. To prevent this, the pressure of the oil inside the torque converter is made higher than atmospheric pressure.

There is a relief valve installed to the inlet port circuit of the torque converter to protect the torque converter from abnormal high pressure. It is actuated when the pressure of the oil entering the torque converter exceeds the set pressure.

There is a regulator valve installed to the outlet port circuit on the torque converter to prevent the internal oil pressure from dropping below the specified pressure. This maintains the oil pressure by the resistance inside the piping so that the torque converter can display its ability.

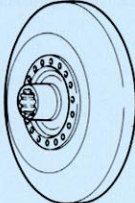
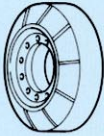
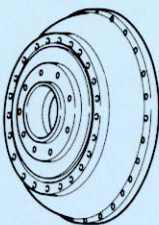
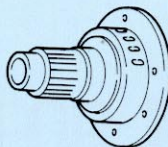
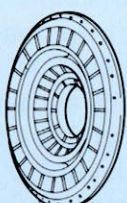
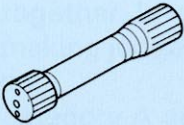
JUDGEMENT ABOUT DAMAGE

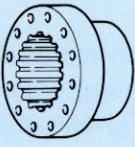
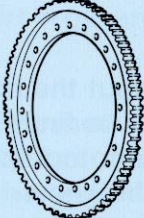
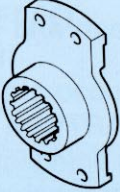
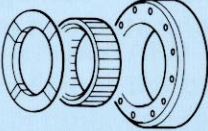

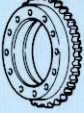

The torque converter is the heart of the machine. If there is wear, scuffing, dents, or seizure of the torque converter, the performance of the machine will drop and other problems will occur. Therefore, it is important to exercise extreme care when making judgements about the reuse of parts.

When making judgements about the reuse of parts, it is important to consider daily maintenance and operating conditions to find out exactly why that kind of damage was caused. In this Guidance Manual, there are photographs of damage ranked A, B or C. These photographs should be used together with the know-how derived from experience to make judgements about reuse of the part.

Check points when judging parts

To make accurate judgement on damaged parts, it is necessary to wash and clean the parts first and then to pay careful attention to the following check points.

Part name	Check point	Part name	Check point
Turbine 	<ul style="list-style-type: none"> ● Crack of blade bottom ● Looseness of rivet ● Wear of spline ● Wear of bearing mount ● Wear of tooth surface of clutch disc engagement 	Stator 	<ul style="list-style-type: none"> ● Crack of blade bottom ● Crack of flange ● Settling of spline
Drive case 	<ul style="list-style-type: none"> ● Crack ● Wear of bearing mount 	Stator shaft 	<ul style="list-style-type: none"> ● Damage of seal ring groove ● Wear of working face of free wheel ● Wear of sliding surface of seal ring ● Wear of bearing mount (Inside diameter, outside diameter) ● Wear of spline
Pump 	<ul style="list-style-type: none"> ● Crack of blade bottom ● Crack of outside periphery of flange ● Crack of inside periphery of flange 	Turbine shaft 	<ul style="list-style-type: none"> ● Wear of spline ● Damage of seal ring ● Wear of sliding surface of oil seal seat ● Wear of bearing mount ● Settling or wear of mating surface shoulder of turbine boss

Part name	Check point	Part name	Check point
<p data-bbox="300 562 360 584">Race</p> 	<ul data-bbox="491 566 759 640" style="list-style-type: none"> ● Wear of spline ● Wear of sliding surface of free wheel 	<p data-bbox="858 562 970 584">Drive gear</p> 	<ul data-bbox="1074 566 1342 611" style="list-style-type: none"> ● Wear of tooth surface ● Lack of tooth surface
<p data-bbox="292 860 392 882">Coupling</p> 	<ul data-bbox="491 864 751 938" style="list-style-type: none"> ● Wear of spline ● Wear of seal surface ● Crack of flange 	<p data-bbox="834 864 1010 887">One way clutch</p> 	<ul data-bbox="1074 864 1265 938" style="list-style-type: none"> ● Wear of sprag fastening ● Wear of bush
<p data-bbox="312 1158 368 1180">Disc</p> 	<p data-bbox="488 1162 759 1236">For details, see "Guidance for Reusable Parts", Disc Plate Section.</p>	<p data-bbox="839 1162 994 1258">Gear Driving gear of scavenging pump</p> 	<ul data-bbox="1074 1167 1345 1240" style="list-style-type: none"> ● Wear of sliding surface of seal ring ● Wear of tooth surface
<p data-bbox="312 1456 368 1478">Plate</p> 	<p data-bbox="488 1460 759 1534">For details, see "Guidance for Reusable Parts", Disc Plate Section.</p>		

STANDARD FOR DAMAGE DETERMINATION

The level of damage is categorized into three stages: A, B, C. Judgement about reuse of parts is made according to these categories.

Category	Level of damage	Action
A	This category indicates slight or minor damage which creates no problem for the performance of the machine. There is no risk of this damage causing secondary damage.	Can be used as it is
B	This category indicates medium damage which at present is no problem to the performance of the machine, but there is a risk of secondary damage, so replacement is preferable if the part is used for heavy duty work.	Repair and reuse
C	This category indicates serious or critical damage, or that the part has reached the end of its life. If this part is used it may break and cause serious damage, so it must be replaced.	Can not be reused

STANDARD FOR REUSE

Damage to parts does not simply consist of one type of damage; it often consists of several types of damage occurring together. In such cases, take the most dangerous form of damage as a guide when making judgement, and always take the overall safety of the machine into consideration.

If the level of damage is ranked between category A and category B as shown in the photographs, the damage should be ranked at the more dangerous category, that is, category B.

Part name	Damage mode	Category		
		A	B	C
Turbine	Crack	No crack	—	Do not use again except left A.
	Looseness & damage of rivet	No looseness & damage	—	Same as above
	Wear	No wear	See Shop Manual.	Do not use again except left.
Drive case	Crack	No crack	—	Do not use again except left A.
	Wear	No wear	Correcting with hard chrome plating	Do not use again except left.
Pump	Crack	No crack	—	Do not use again except left A.
Stator shaft	Wear	No wear	See Shop Manual.	Do not use again except left.
	Damage of seal ring groove	No damage	—	Same as above
Turbine shaft	Wear	No wear	See Shop Manual.	Do not use again except left.
	Damage of seal ring groove	Same as above	—	Same as above
Race	Wear	No wear	See Shop Manual.	Do not use again except left.
Coupling	Wear	No wear	See Shop Manual.	Do not use again except left.
	Wear of spline Crack of flange	No wear	—	Same as above
Disc plate	Wear (Damage)	No wear	See Shop Manual and Guidance for Reusable parts, Disc Plate Section	Do not use again except left.
Stator	Crack	No crack	—	Do not use again except left A.
	Settling of spline	No settling	See Shop Manual.	Same as above
Gear (Scavenging pump driving gear)	Wear	No wear	See Shop Manual.	Do not use again.

Common part

Gear	For details see "Guidance for Reusable Parts", Gear Section.	For details see "Guidance for Reusable Parts", Gear Section.	For details see "Guidance for Reusable Parts", Gear Section.	For details see "Guidance for Reusable Parts", Gear Section.
Bearing	For details, see "Guidance for Reusable Parts", Bearing Section.	For details, see "Guidance for Reusable Parts", Bearing Section.	For details, see "Guidance for Reusable Parts", Bearing Section.	For details, see "Guidance for Reusable Parts", Bearing Section.

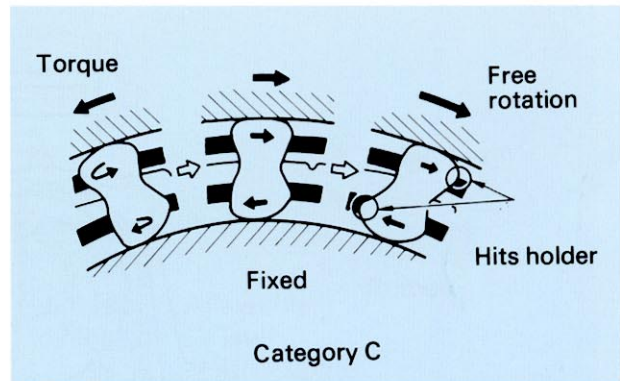
Judgement Standards for Reuse of One Way Clutch

Sprags that have come away from the holder (regardless of the number) may not be reused. In addition, parts with the following damage may not be reused.

Popping

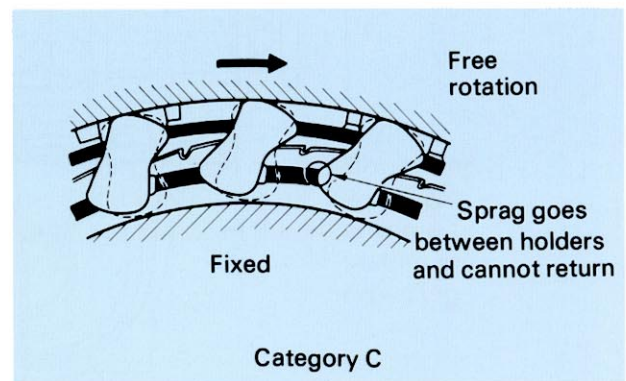
If the sprag slips when it is engaged and the load is suddenly removed, the sprag falls to the free side as a result of the reaction.

(Because of this, the column of the holder is hit and wears or breaks.)



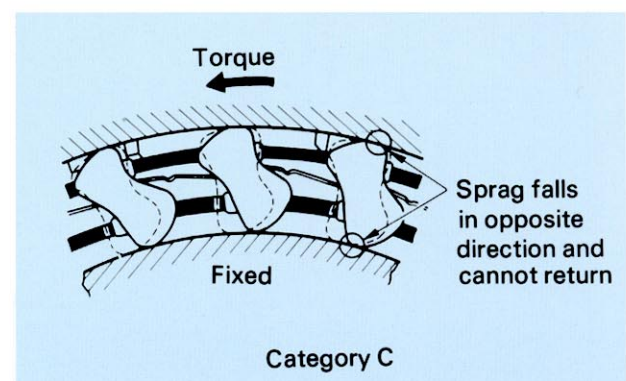
Pop out

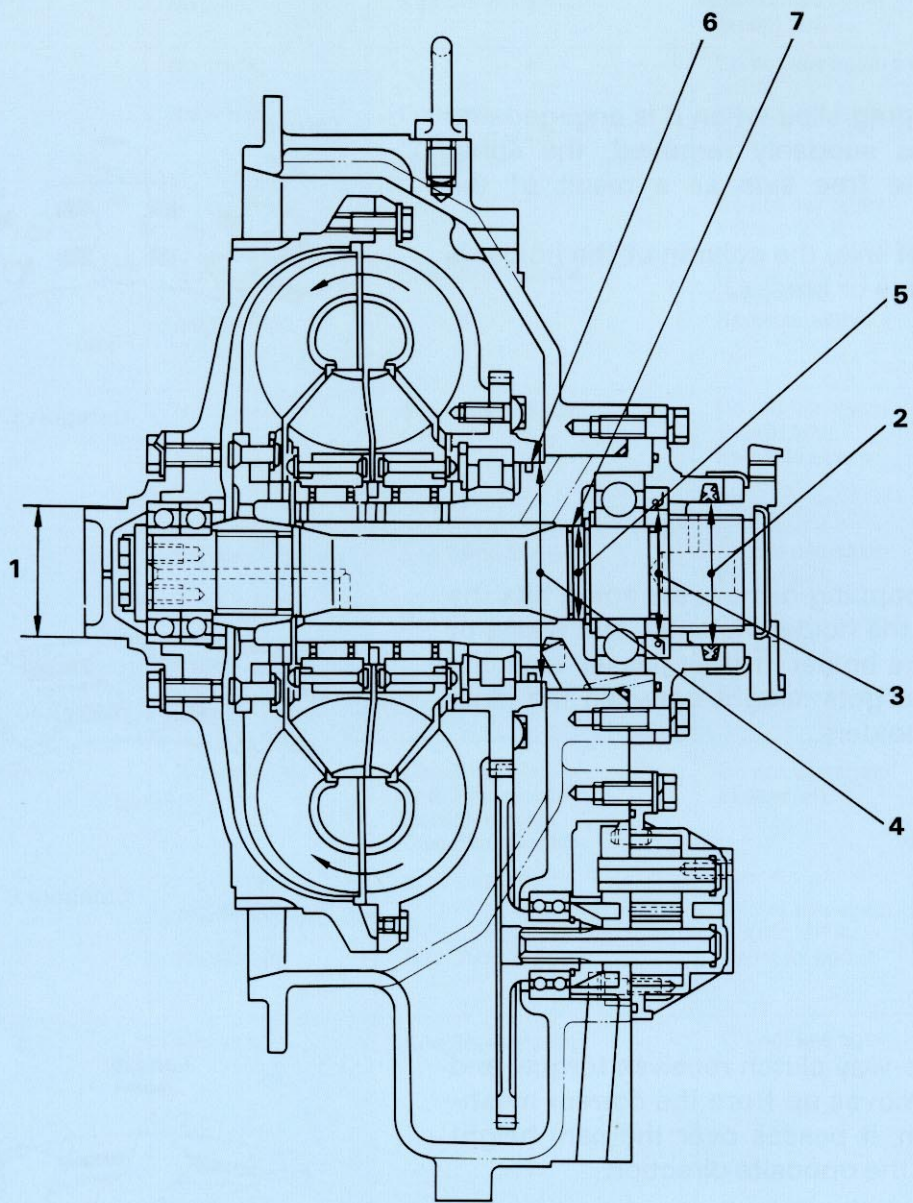
When popping occurs, the sprag hits the column of the holder violently, and wears or deforms the holder. It then passes over the column and gets caught between the inner and outer holders.



Roll over

The one-way clutch receives torque, and the sprag moves up from the correct meshing position. It passes over the cam height and falls in the opposite direction.

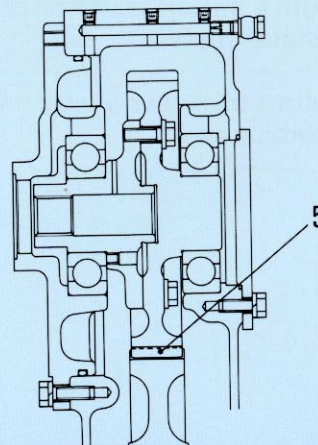
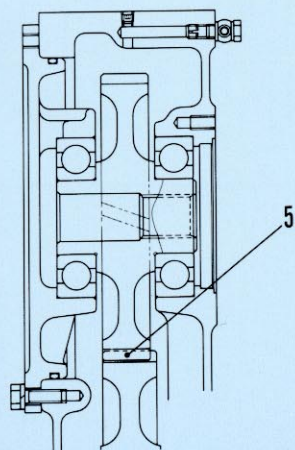
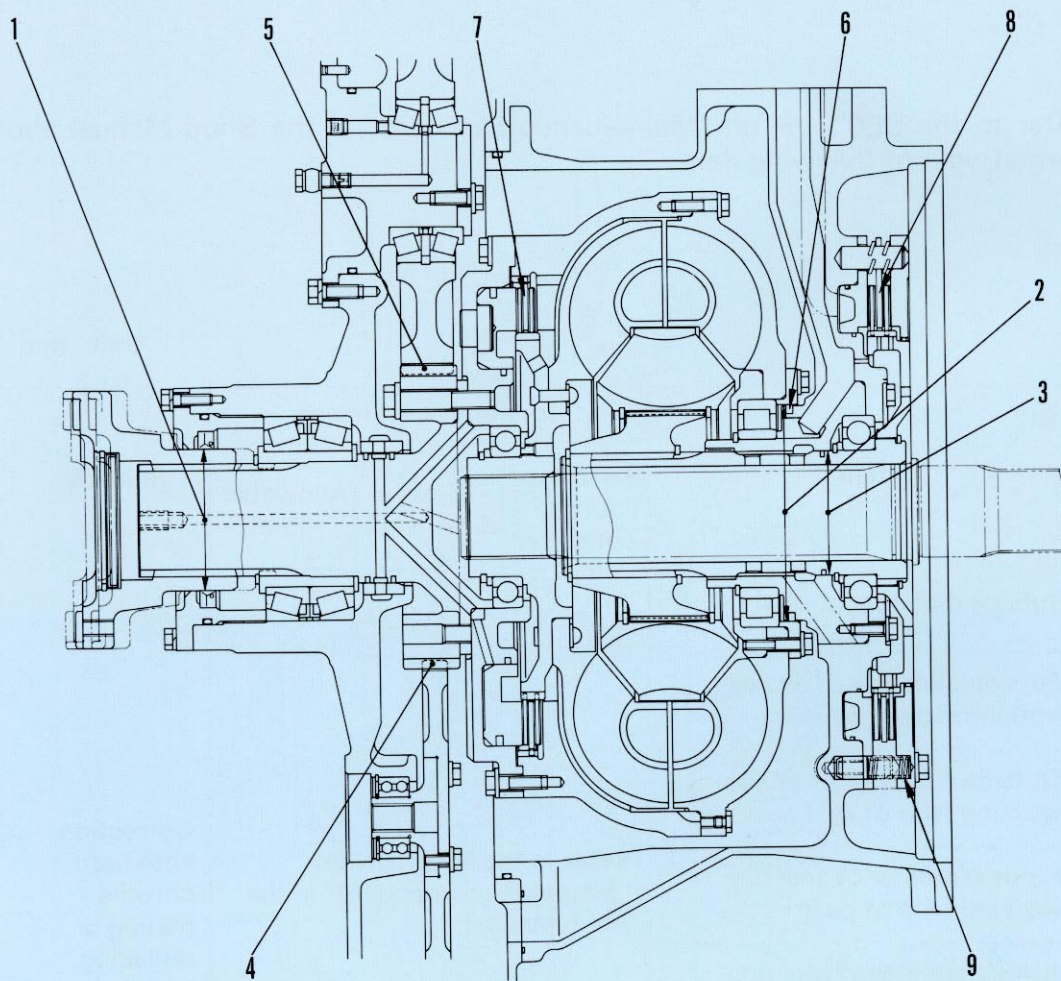




★ Refer to the SECTION on “Maintenance Standard” in the Shop Manual about normal wear of following item.

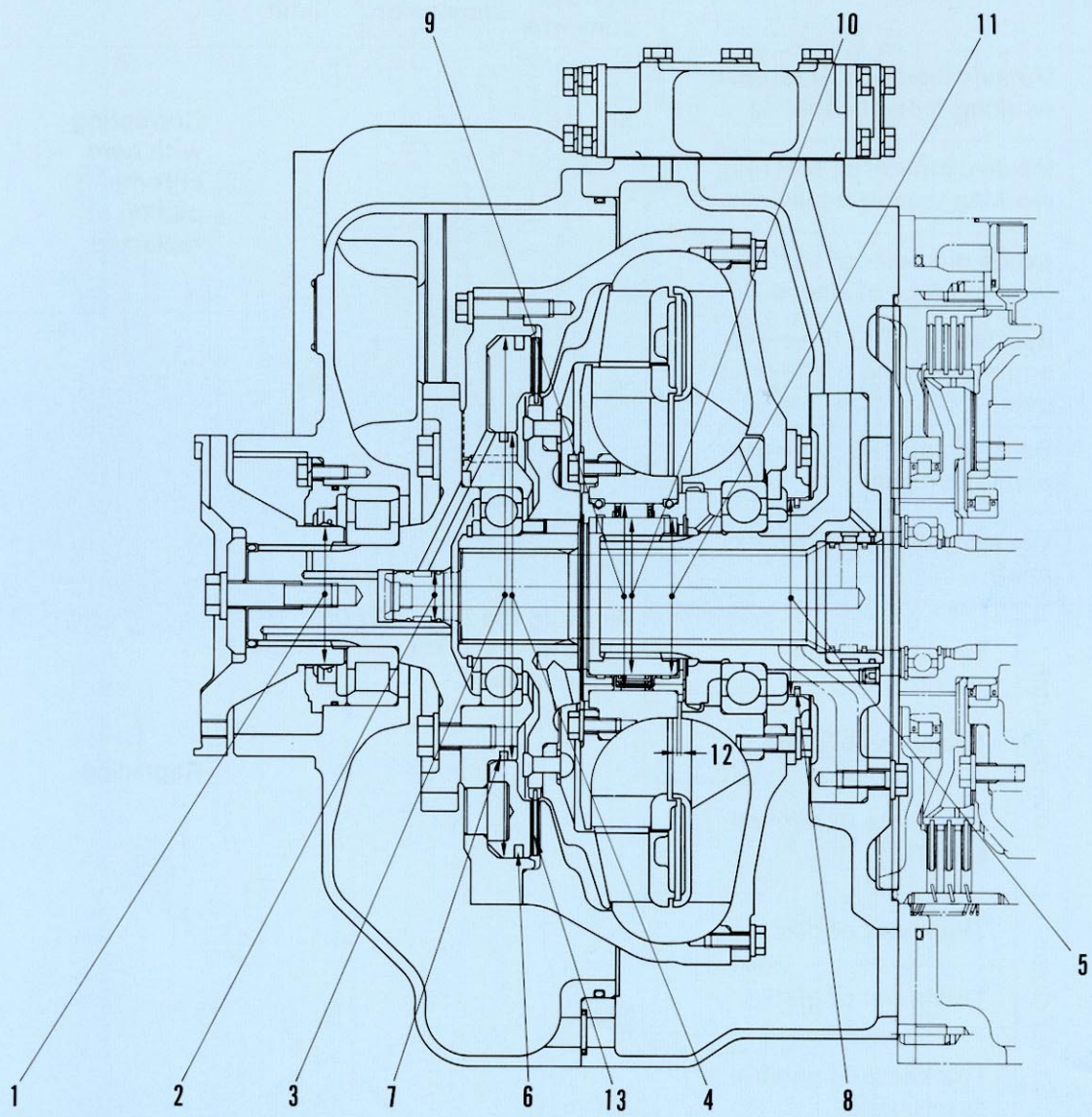
Unit: mm

No.	Item	Judgement standard			Remedy
		Ser. No. of torque converter	Basic dimension	Allowable limit	
1	Outside diameter of pilot	Refer to the SECTION on “Maintenance standard” in the Shop Manual.			Correcting with hard chrome plating or replacing.
2	Outside diameter of oil seal working face of coupling				
3	Outside diameter of oil seal working face of seal seat				
4	Inside diameter of seal ring working face of gear				
5	Inside diameter of seal ring working face of stator shaft				
6	Width x thickness of seal ring of stator shaft				
7	Width x thickness of seal ring of turbine shaft				



Unit: mm

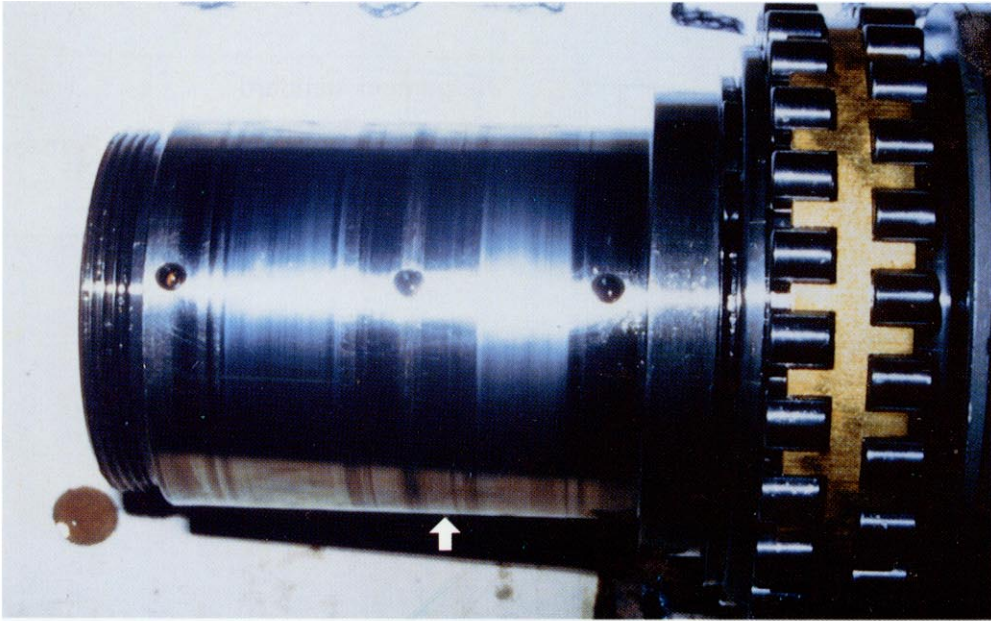
No.	Item		Judgement standard			Remedy								
			Ser. No. of torque converter	Basic dimension	Allowable limit									
1	Outside diameter of oil seal working face of coupling		Refer to the SECTION on "Maintenance standard" in the Shop Manual.			Correcting with hard chrome plating or replacing								
2	Inside diameter of seal ring working face of retainer													
3	Inside diameter of seal ring working face of sleeve													
4	Backlash of PTO drive gear and scavenging pump drive gear													
5	Backlash of PTO drive gear and driven gear													
6	Wear of seal ring of stator shaft													
7	Lock-up clutch	Thickness of disc							Replacing					
		Thickness of plate												
		Thickness of general assembly												
8	Stator clutch	Thickness of disc											Replacing	
		Thickness of plate												
		Thickness of general assembly												
9	Stator clutch spring													



Unit: mm

No.	Item		Judgement standard			Remedy
			Ser. No. of torque converter	Basic dimension	Allowable limit	
1	Sliding portion of oil seal of coupling		Refer to the SECTION on "Maintenance standard" in the Shop Manual.			Replacing
2	Inside diameter of sliding portion of seal ring of input shaft					
3	Inside diameter of sliding portion of seal ring of clutch housing					
4	Inside diameter of sliding portion of seal ring of clutch piston					
5	Inside diameter of sliding portion of seal ring of pump housing					
6	Seal ring	Width				
		Thickness				
7	Seal ring	Width				
		Thickness				
8	Seal ring	Width				
		Thickness				
9	Inside diameter of transfer face of outer race one way clutch					
10	Diameter of transfer face of one way clutch					
11	Inside diameter of bush sliding portion					
12	Thickness of bush sliding portion					
13	Thickness of clutch disc					

EXAMPLES OF DAMAGE



Wear of stator shaft

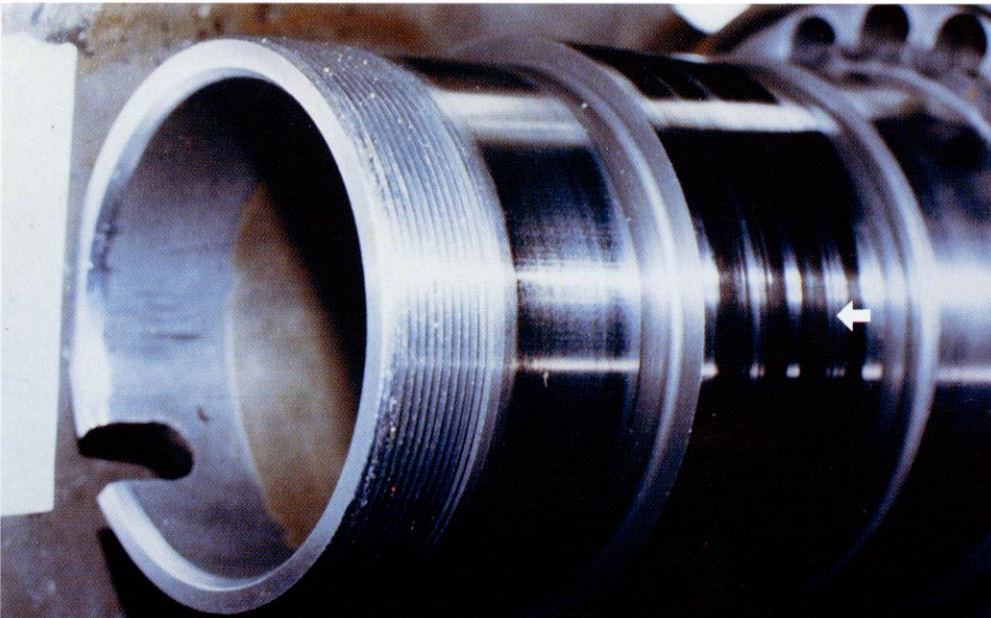
Category: A

Condition

- Wear

Remedy

- Use again. No correction



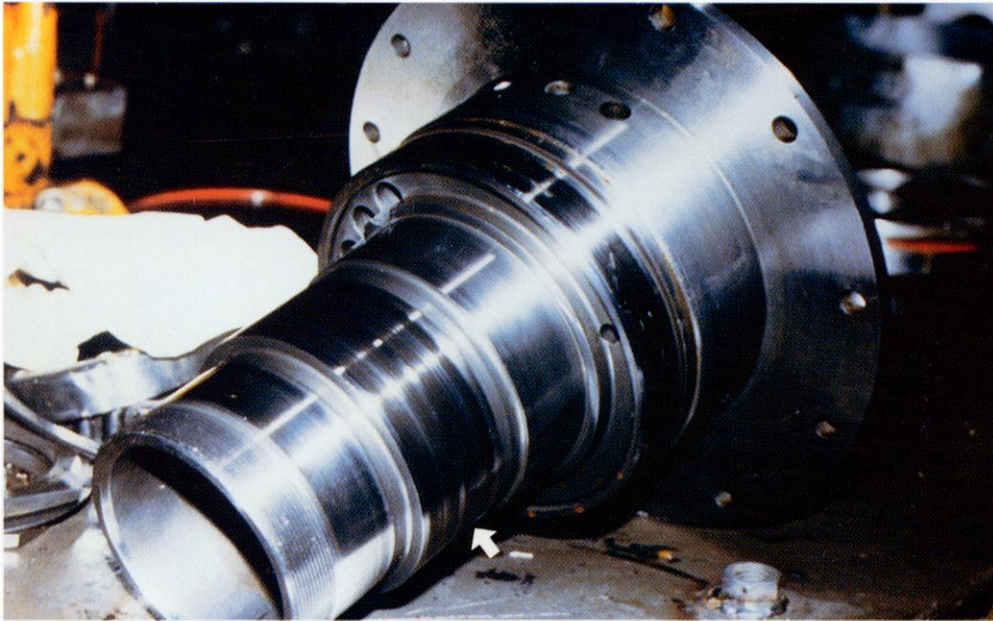
Category: A

Condition

- Wear

Remedy

- Use again



Wear of sliding surface of stator shaft

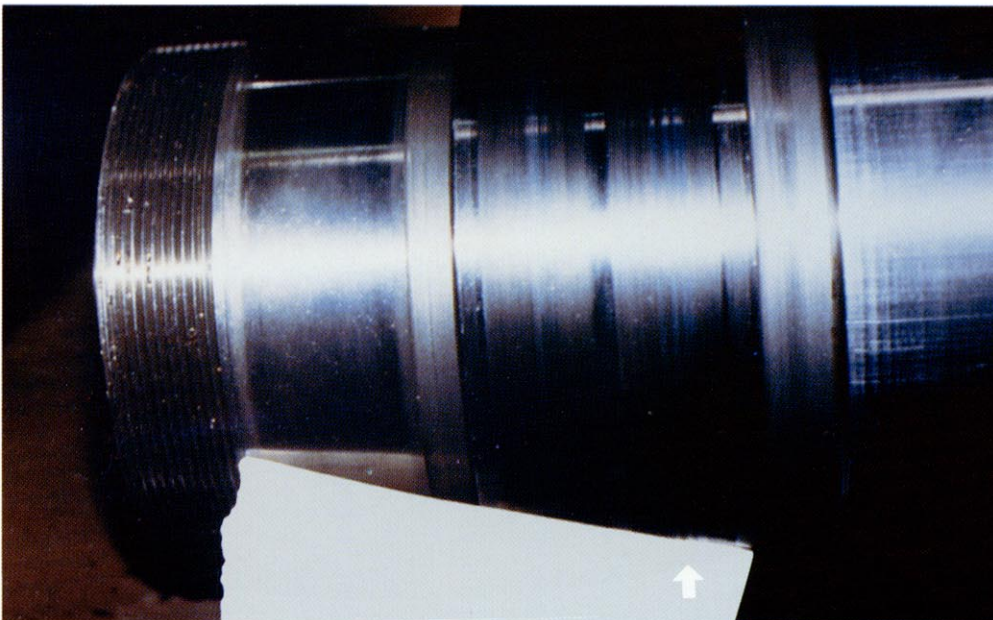
Category: A

Condition

- Wear, scratch

Remedy

- Use again. No correction



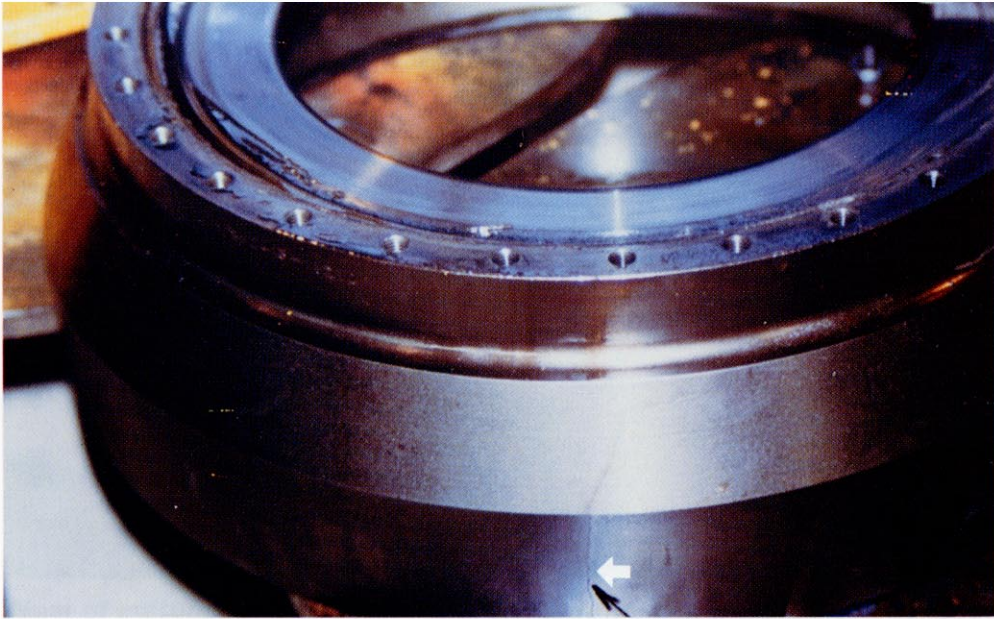
Category: A

Condition

- Wear, scratch

Remedy

- Use again



Crack of drive case

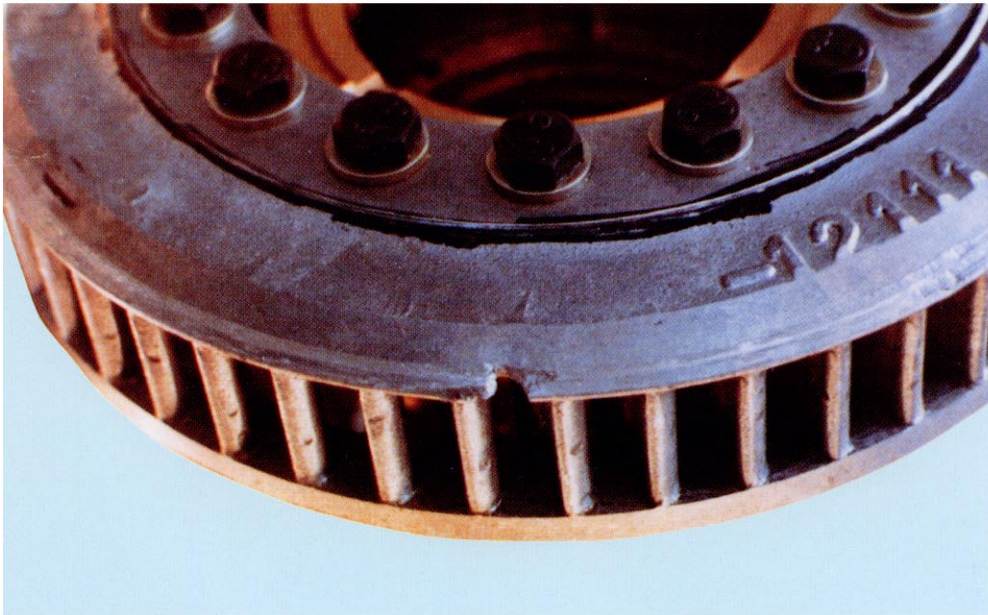
Category: C

Condition

- Crack caused by abnormal high speed rotation of engine (overrun) or generation of peak pressure.

Remedy

- Replace



Failure of stator

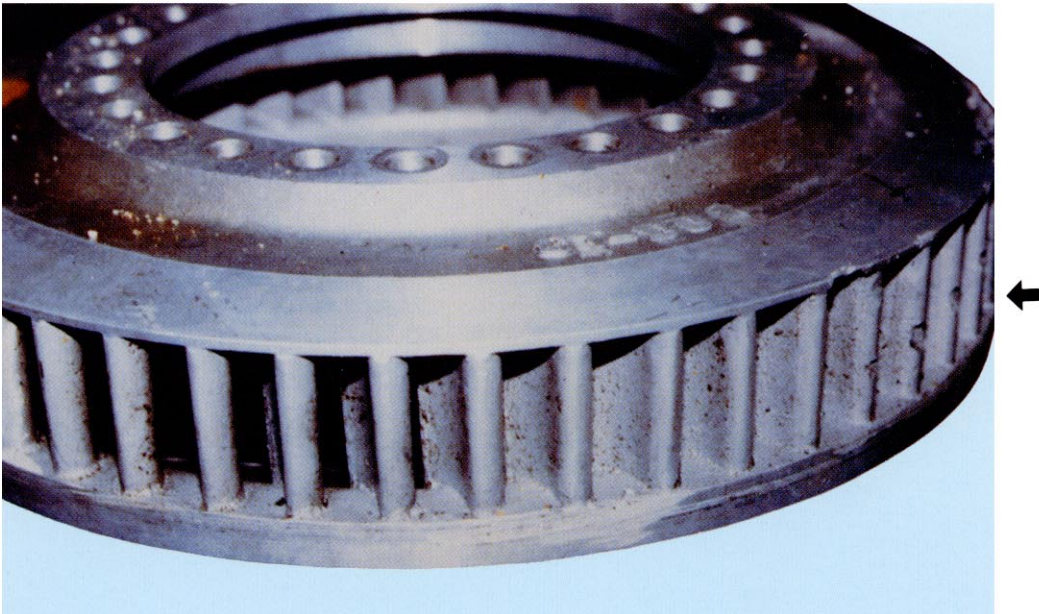
Category: C

Condition

- Failure of stator caused by foreign substances entered into T/C.

Remedy

- Replace



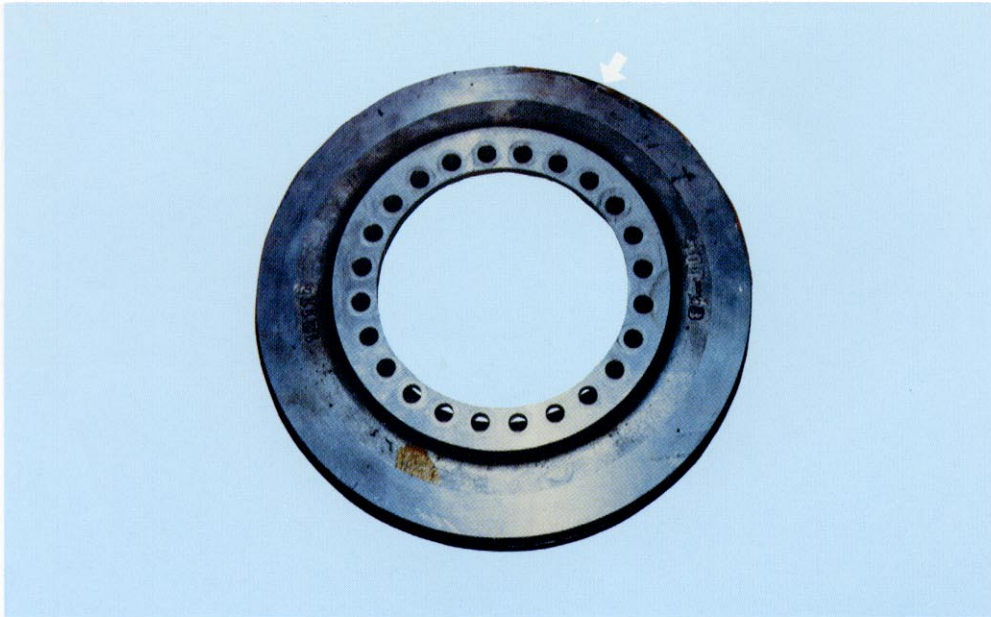
Category: C

Condition

- Failure of stator caused by foreign substances entered into T/C.

Remedy

- Replace



Failure of stator

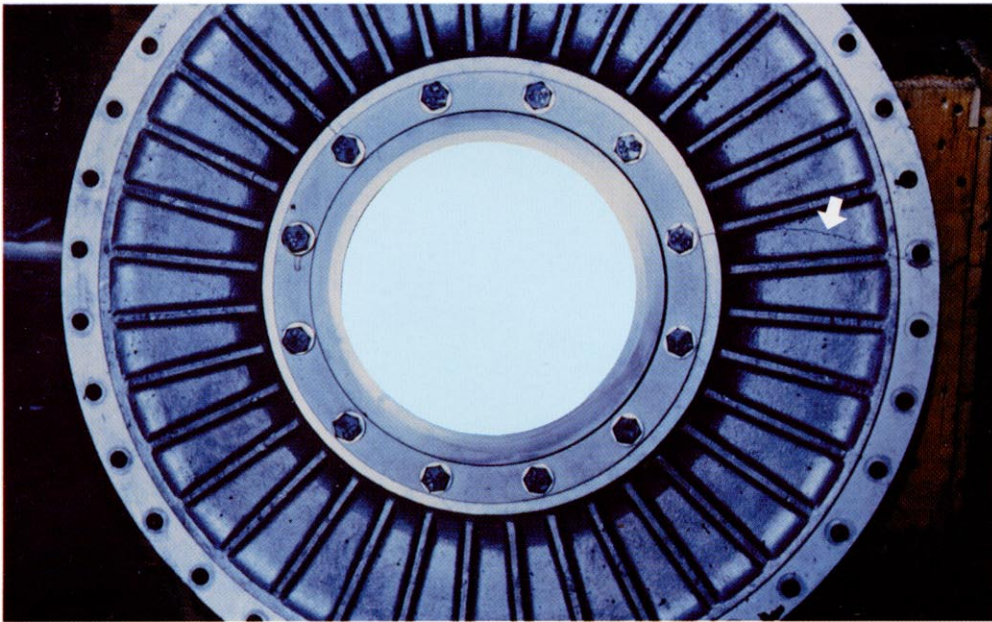
Category: C

Condition

- Failure of stator caused by foreign substances entered into T/C.

Remedy

- Replace



Crack of pump

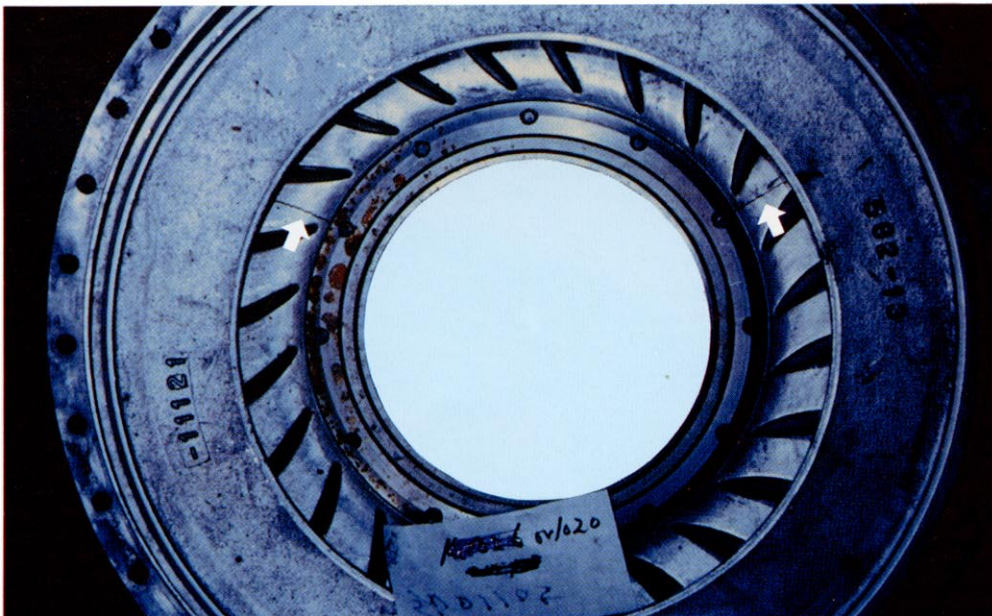
Category: C

Condition

- Crack caused by abnormal high speed rotation of engine (overrun) or generation of peak pressure.

Remedy

- Replace



Category: C

Condition

- Crack caused by abnormal high speed rotation of engine (overrun) or generation of peak pressure.

Remedy

- Replace



Interference of turbine

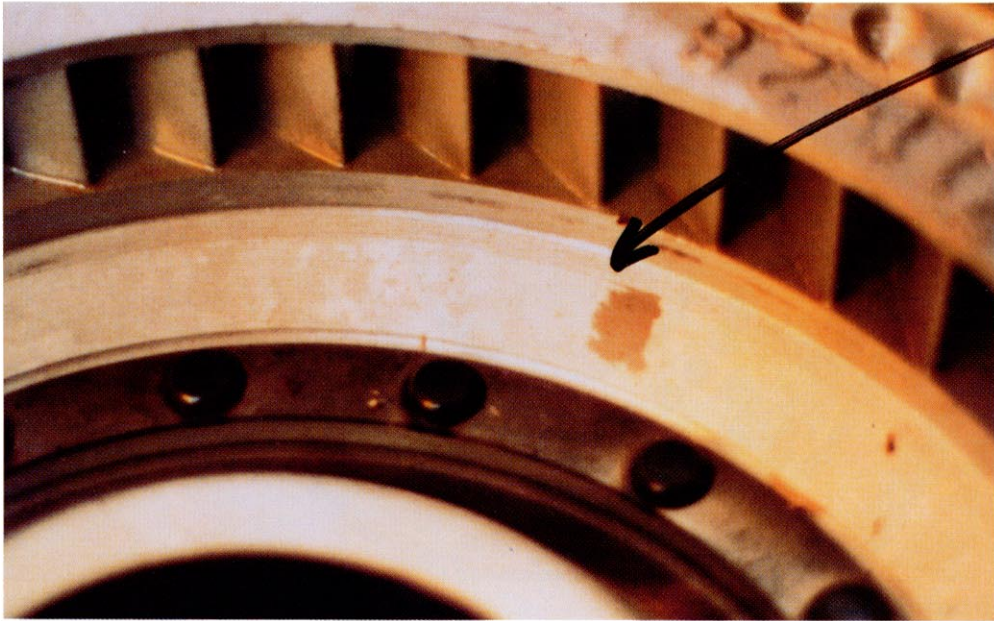
Category: B

Condition

- Abnormal wear caused by interference between turbine and opposite part (stator).

Remedy

- Correct



Interference of turbine

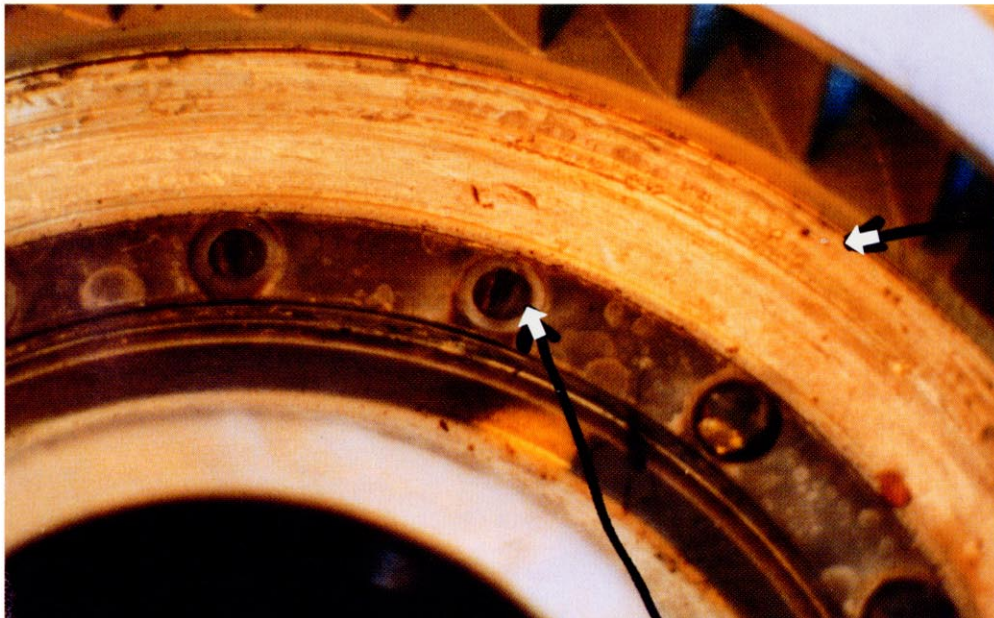
Category: B

Condition

- Interference of opposite part (stator) (Initial condition of wear by interference)

Remedy

- Correct



Interference

Failure of rivet

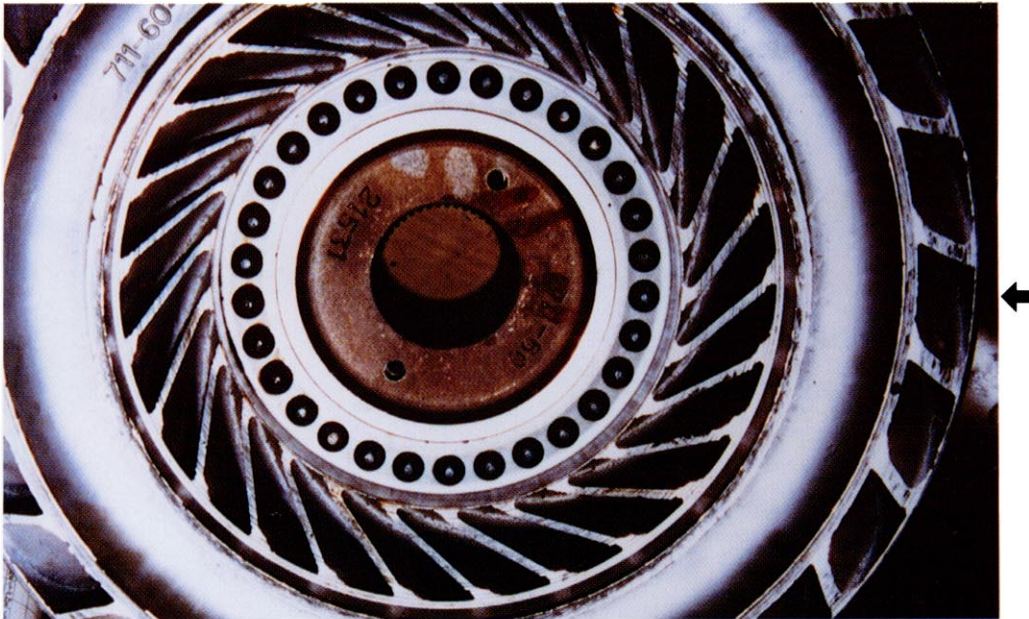
Category: C

Condition

- Failure caused by progressive looseness of rivet

Remedy

- Replace



Interference of turbine

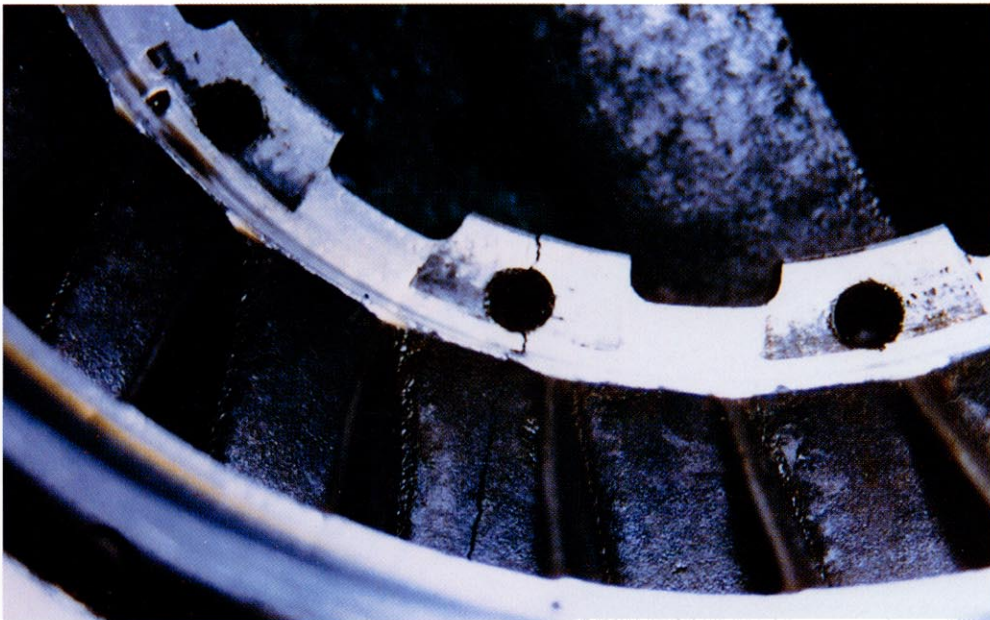
Category: C

Condition

- Interference between turbine and pump stator during rotation caused by damage of components (bearing etc.)

Remedy

- Replace



Crack of pump

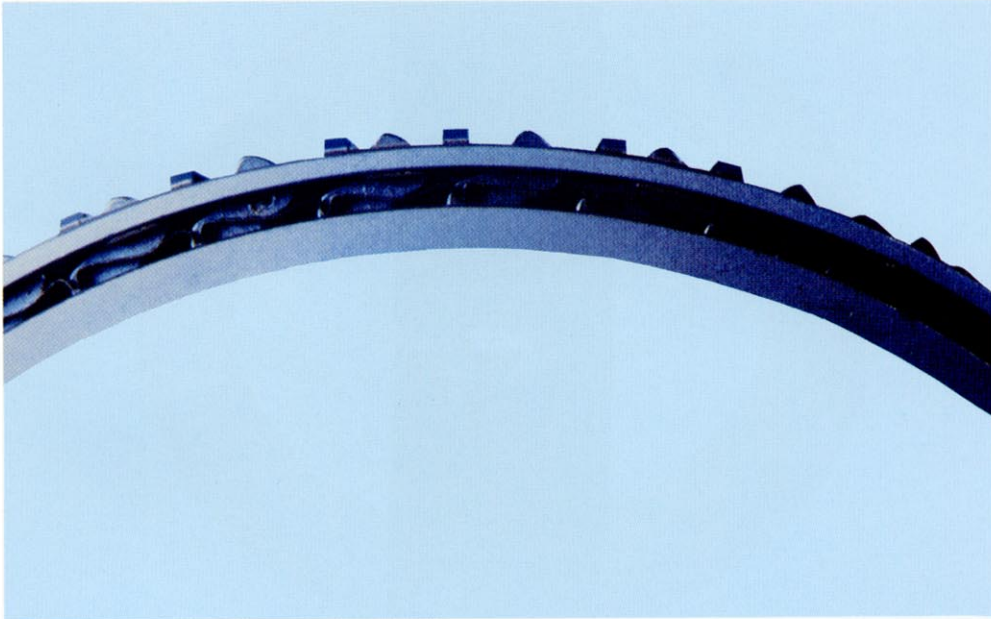
Category: C

Condition

- Crack caused by abnormal high rotation of engine (overrun) or generation of peak pressure

Remedy

- Replace



Category: C

Condition

- Roll over of one way clutch. (See P. 7)

Remedy

- Replace



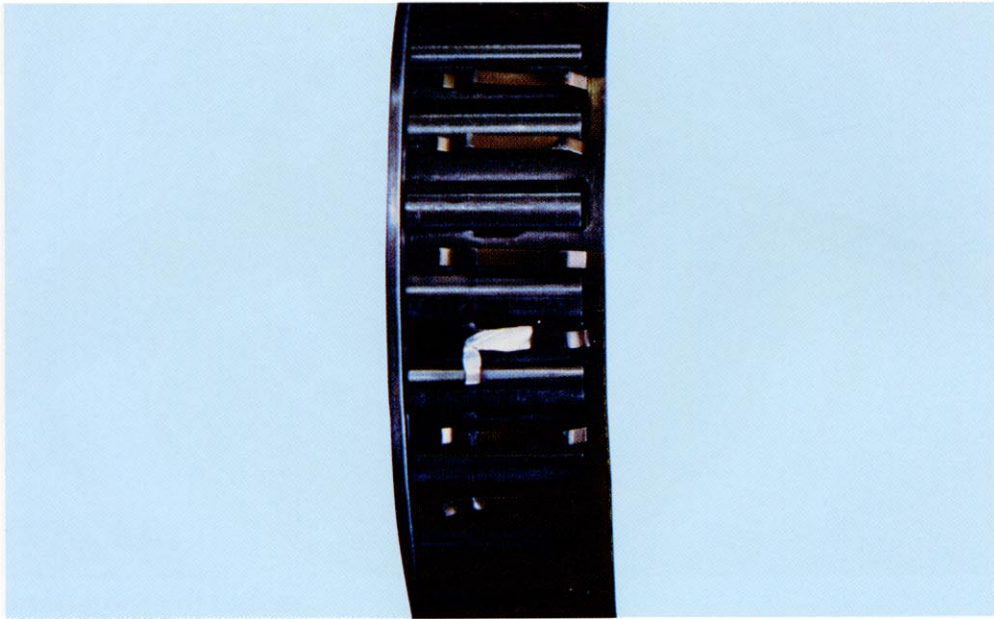
Category: C

Condition

- Roll over of one way clutch

Remedy

- Replace



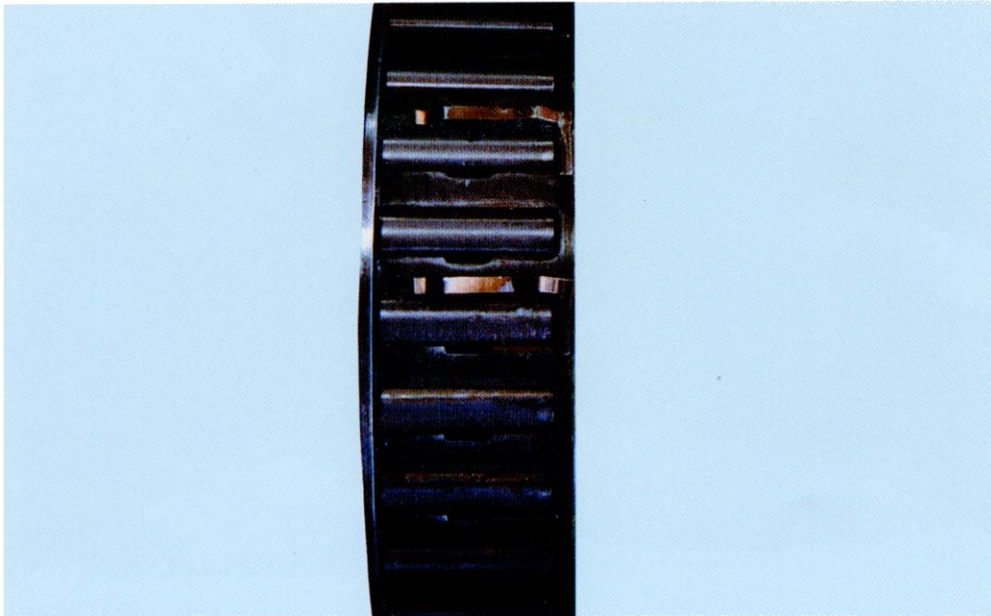
Category: C

Condition

- Damage of drag clip of one way clutch

Remedy

- Replace



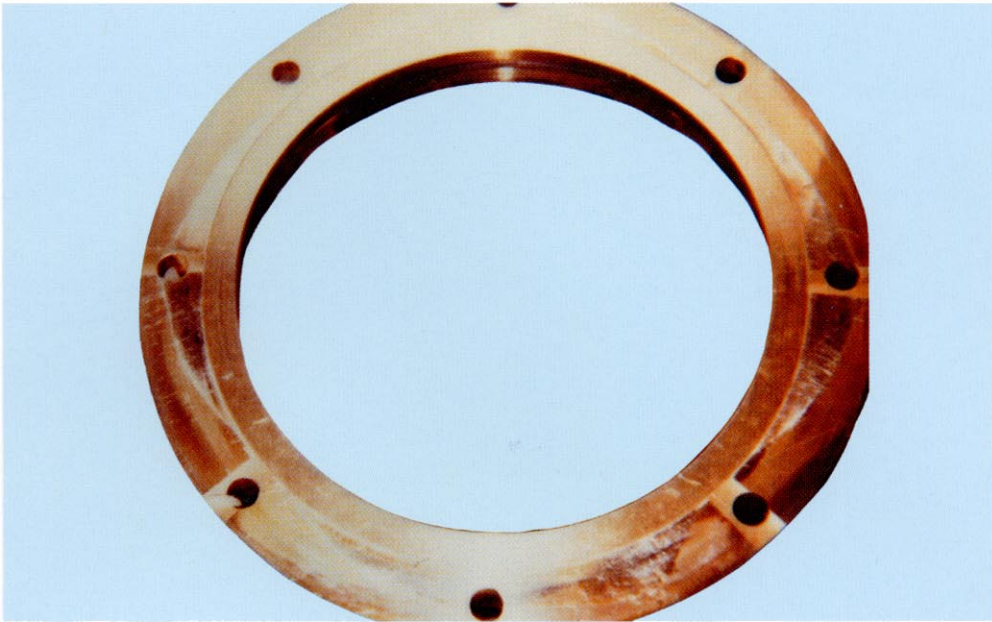
Category: C

Condition

- Damage of drag clip of one way clutch

Remedy

- Replace



Wear of bush

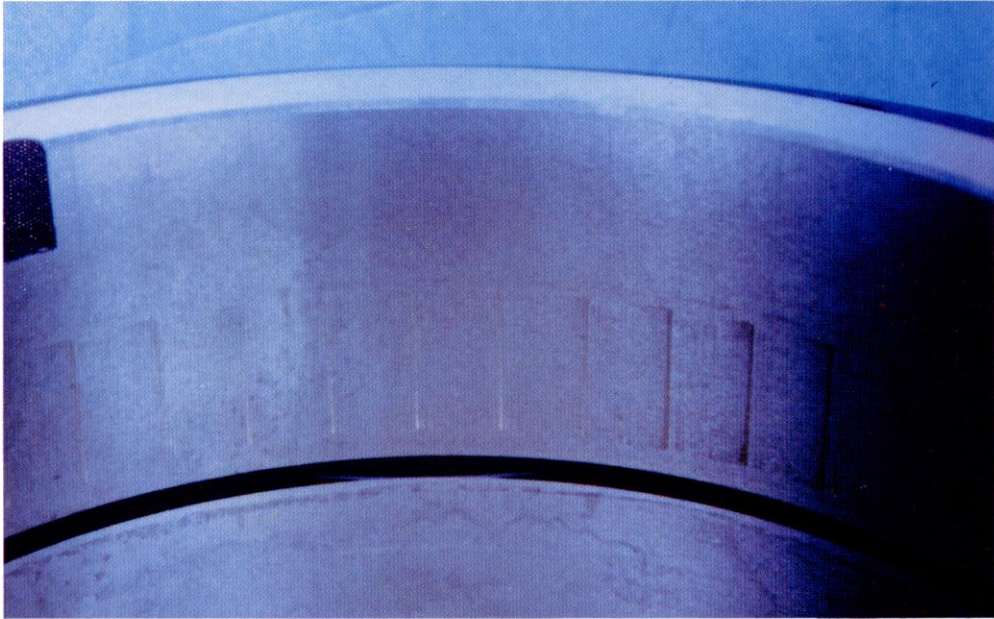
Category: C

Condition

- Abnormal wear of thrust surface of bush

Remedy

- Replace



Impression of outer race

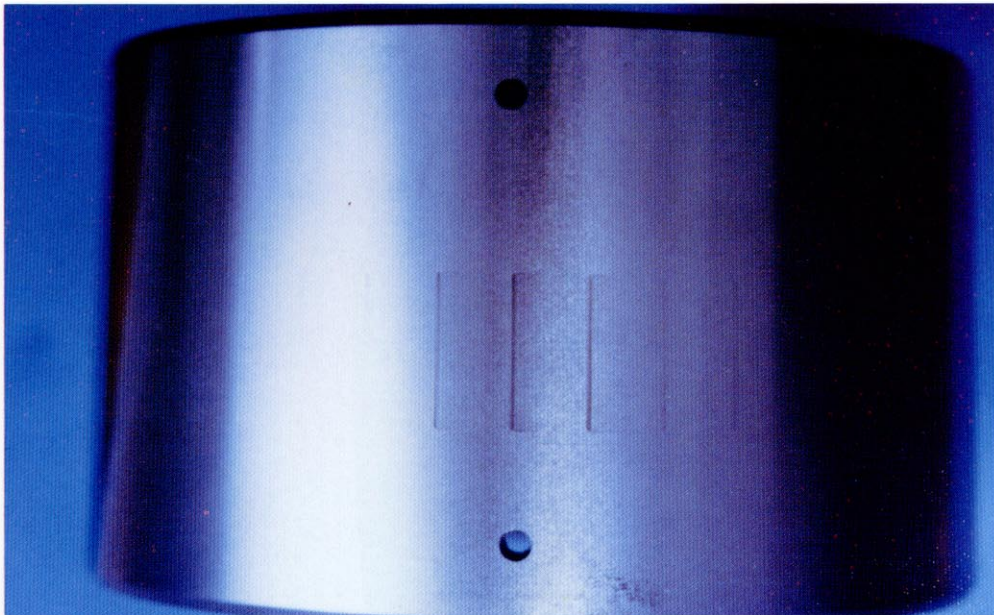
Category: C

Condition

- Impression caused by action of all sprags of one way clutch toward lock side or caused by roll over accident of one way clutch.

Remedy

- Replace



Impression of inner race

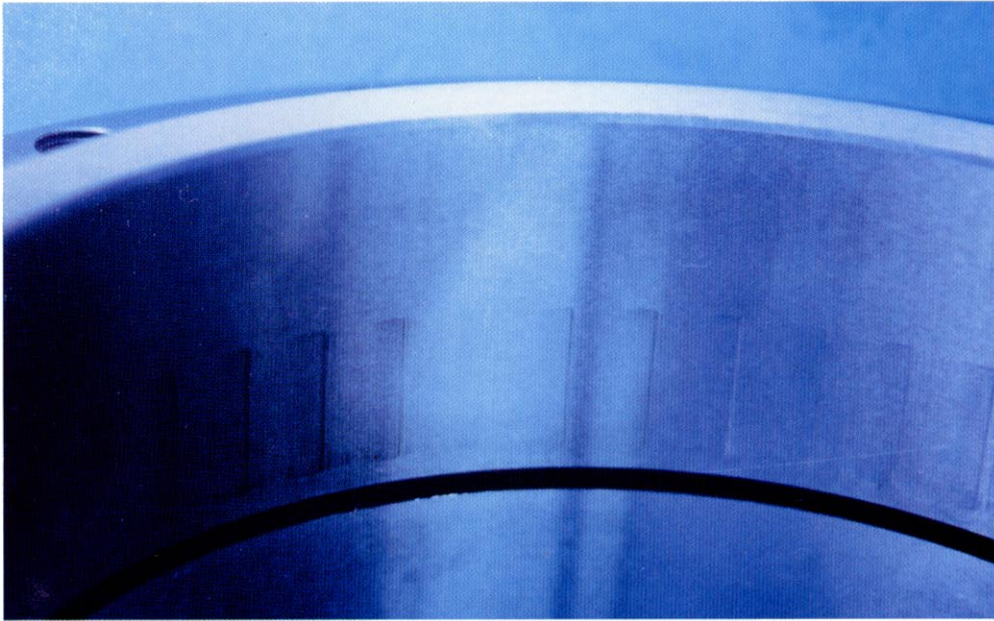
Category: C

Condition

- Inner race side of above.

Remedy

- Replace



Impression of outer race

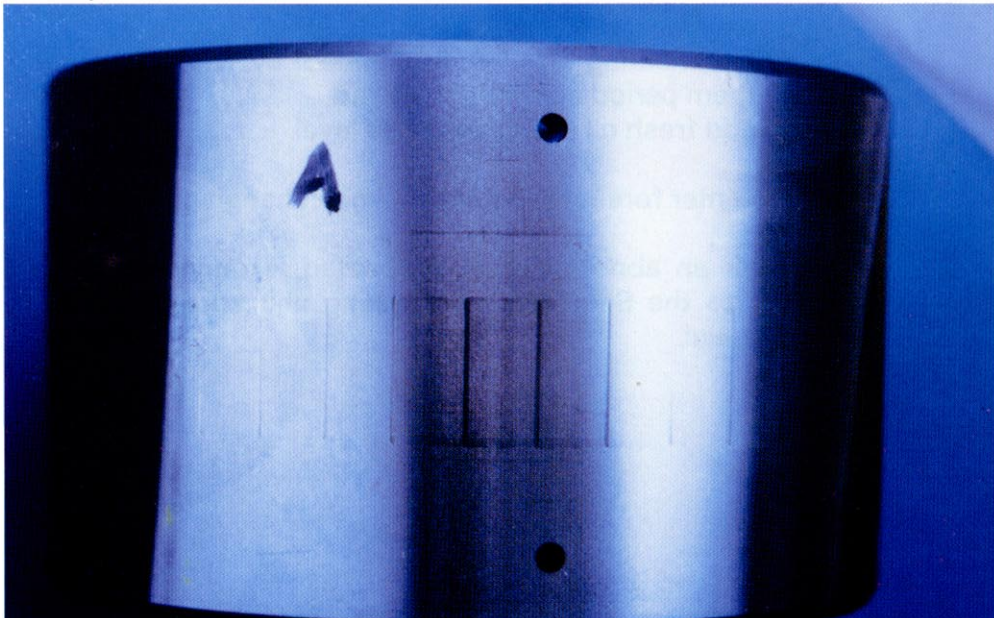
Category: C

Condition

- Impression caused by action of all sprags of one way clutch toward lock side or caused by roll over accident of one way clutch.

Remedy

- Replace



Impression of inner race

Category: C

Condition

- Inner race side of above.

Remedy

- Replace

PREVENTIVE MAINTENANCE

To prevent failures in the machine before they occur, and to allow the machine to demonstrate its function 100%, it is necessary always to know the condition of the machine, in particular to be aware of selecting each gear speed for matching with operating condition of torque converter under running. Wrong conditions, such as lack of output, slow speed and lack of tractive force, etc., are sometimes caused by torque converter. In addition, by carrying out maintenance correctly as listed in the operation manual, most damage can be prevented, but be particularly sure to have the user carry out the following points properly.

1. Operate at each gear speed for matching with operating condition, and particularly avoid continuous stall operation and overrun operation.
 2. Use the lubricating oils recommended by KOMATSU and change them periodically as scheduled.
Always add fresh oil to the specified level.
 3. Avoid to enter foreign substances when changing oil.
- ★ Whenever an abnormality is suspected, examine the cause referring to the SECTION on "Testing and adjusting" in the Shop Manual.

