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**IMPROVEMENT  
OF  
COOLING TOWER GEAR REDUCER**

*Apr. 10, 2004*

*Yeoun Ho Ji*

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## **1. Purpose**

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- ✓ **To maintain good condition without break down of cooling tower system.**
  - ✓ **To reduce maintenance cost through modification of sealing part.**
  - ✓ **To prevent outflow of new gear reducer's expense. (Another country)**
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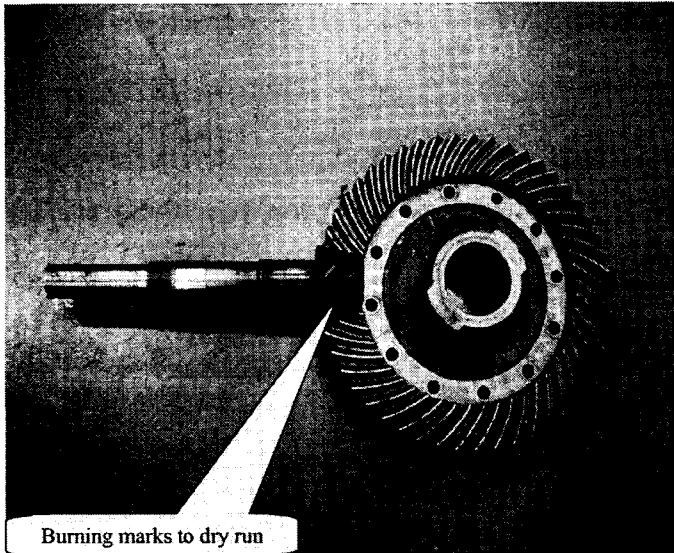
## **2-1. Current status**

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- ✓ **Continuous operation of cooling tower system was not possible because of worn-out bearing, oil seal and consumable parts, and so on.**
  - ✓ **If worn-out bearing, oil seal, consumable parts are changed to new ones, existing reducing gear sets can be continuous use.**
  - ✓ **But, oil seal system should be changed from o-ring type to mechanical seal type because existing Gear shaft was worn-out and was showed Oil leakage at that point.**
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## 2-2. Current status

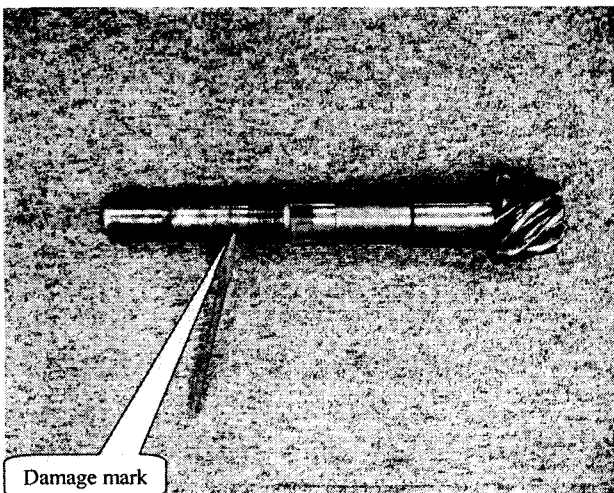
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- ✓ Continue operation is impossible because wear and tear of gear was caused by oil leak.
  - ✓ So it has to be replaced to new shaft.
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## 2-3. Current status

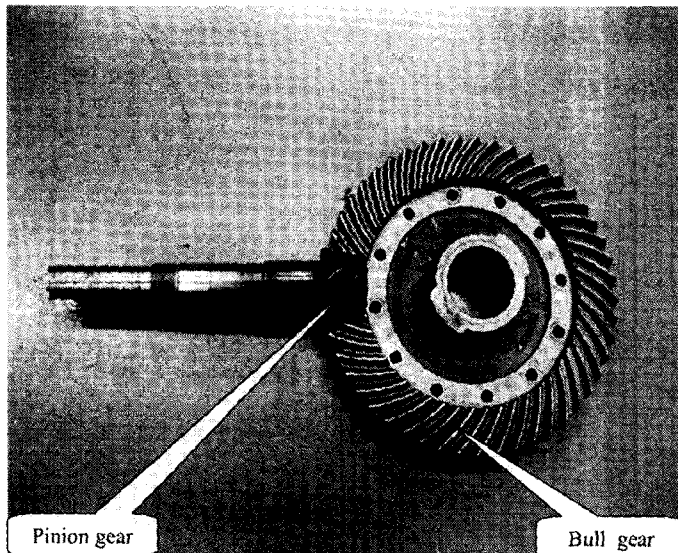
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- ✓ Shaft is composed of one body with a pinion gear. Hence replacing shaft means replacing pinion gear.
  - ✓ So, new pinion gear and shaft will to be replaced with new one at the same time.
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## 2-4. Current status

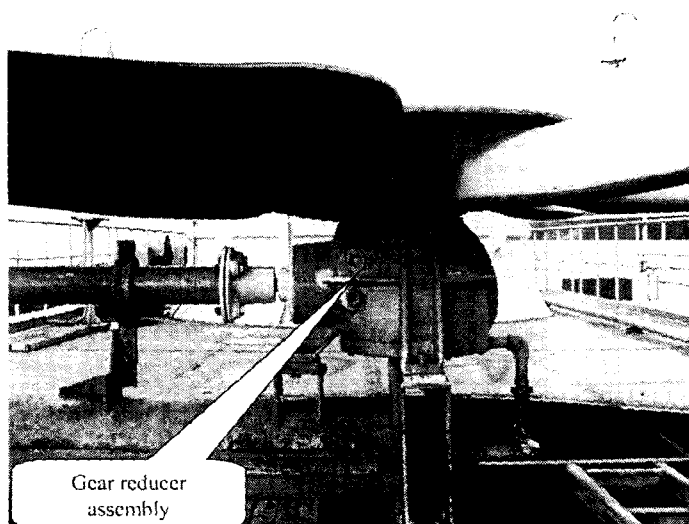
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- ✓ When the pinion gears, replaced new one, Bull gear has to be replaced new one at same time.
- ✓ This is common request from gear makers.
- ✓ So, one gear set has to be replaced at once.
- ✓ But this was installed 10 years ago. So, we can not buy the assembly parts due to suspension of manufacture.

## 2-5. Current status

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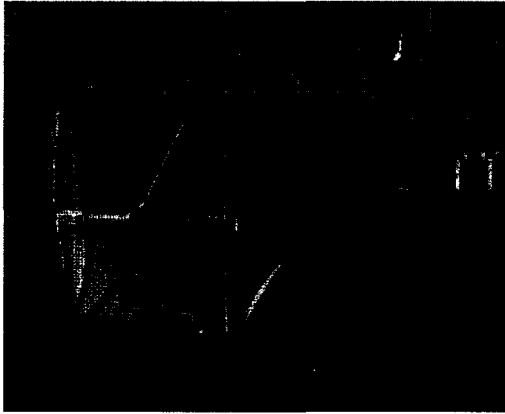


- ✓ Hence, we have to replace all of the gear reducer system.
- ✓ It is asked for a lot of cost for installation, removal and disassembly.

### 3-1. System layout

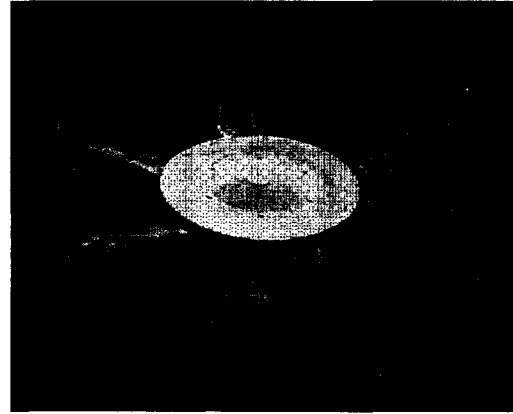
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#### ■ Cooling tower fan stack



- ✓ Diameter : 4300 mm
- ✓ Hight : 2300 mm

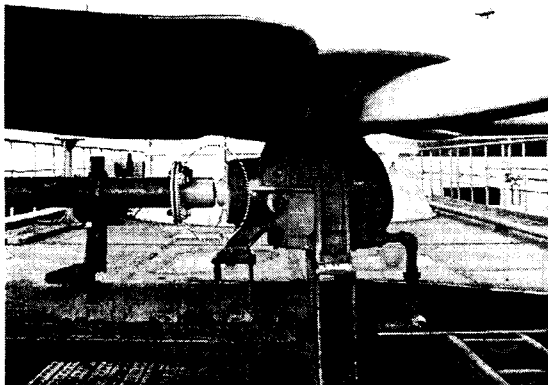
#### ■ Cooling tower fan (Propeller)



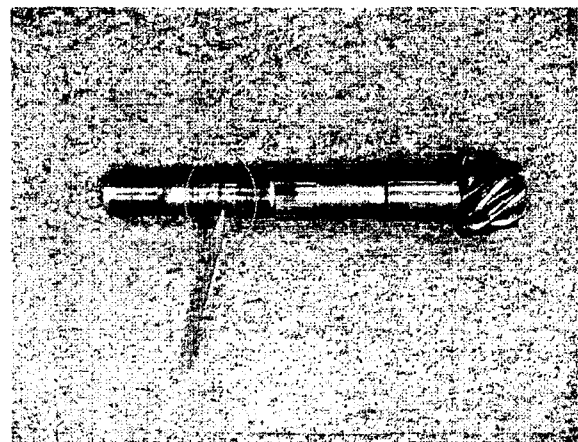
- ✓ Material : Fiberglass Reinforced Plastic
  - ✓ Qty' : Six Blades
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### 3-2. Summary of revision point

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- ✓ An example of normal facility

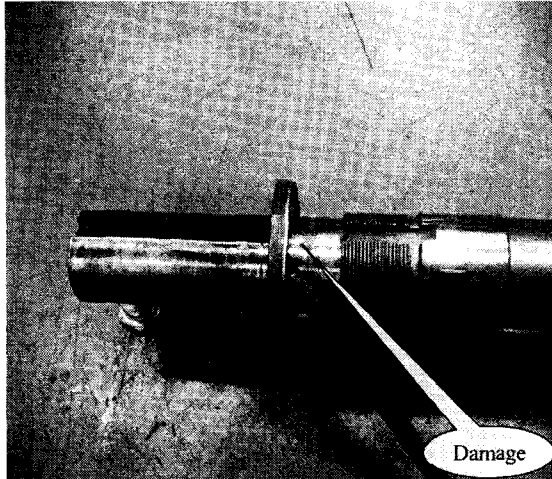


- ✓ Oil seal point
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## 4-1. Problems of existing oil seal

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✓ Before : Oil seal

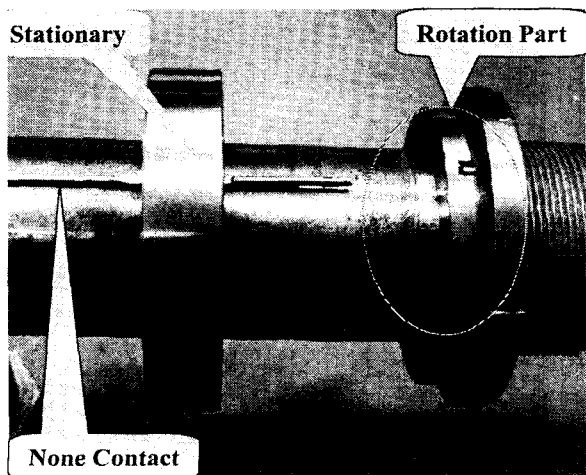


- ✓ It was a touching type of seal and shaft, it shows oil leakage because of the wear and tear caused by using long time.
  - ✓ Oil seal was attached on the surface of shaft with moving on the right and left. But because shaft was eroded.
  - ✓ Material of a seal is the soft rubber.
  - ✓ Because attached distance is short (8 mm) and initial fabrication cost is low, in general, makers prefer using this assembly parts.
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## 4-2. Improving scheme of Seal

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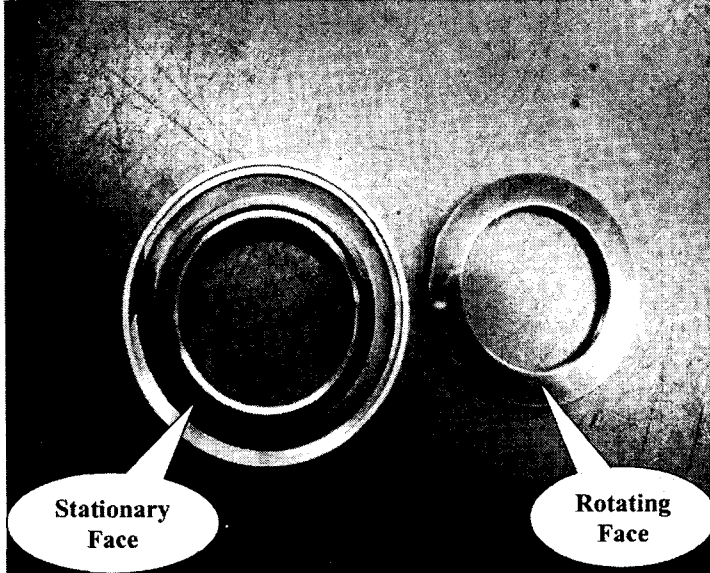
✓ After : Mechanical seal



- ✓ It (M/S) is not touched with a shaft. Even though that was using long time, the shaft will be not worn out.
  - ✓ Its attachment distance is longer than an oil seal. Oil seal and it has a complex structure. Hence, it is difficult to modify by users at site.
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## 5-1. Mechanical seal detail

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- ✓ Stationary face is composed of carbon graphite and rotating part is coated with ceramic on the stainless.

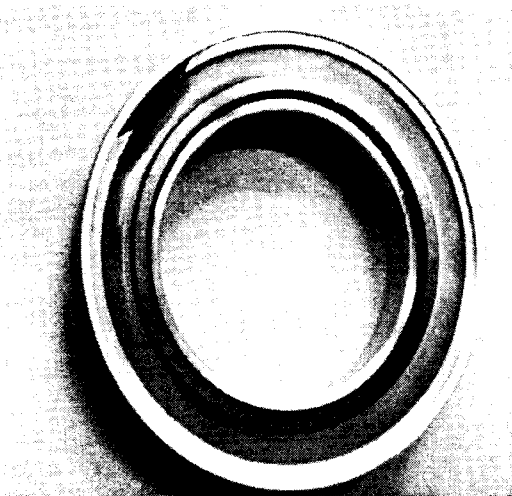
**Stationary part & rotating part**

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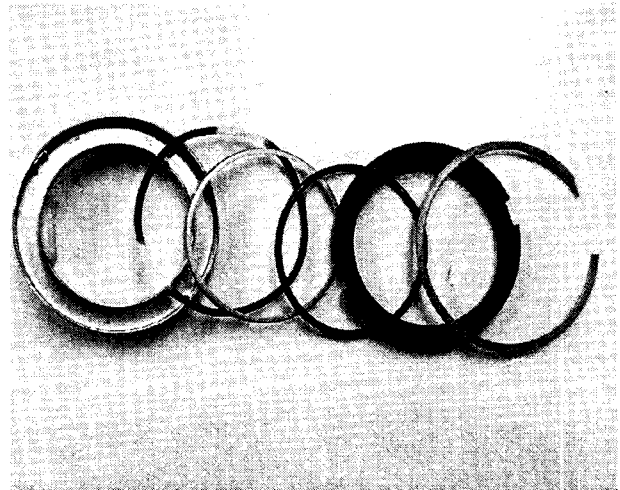
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## 5-2. Mechanical seal detail (Stationary Part)

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✓ Stationary Part Assembly



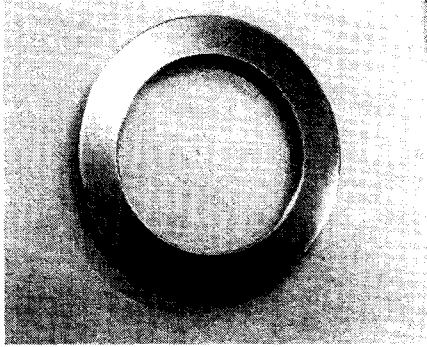
✓ Stationary Parts Detail

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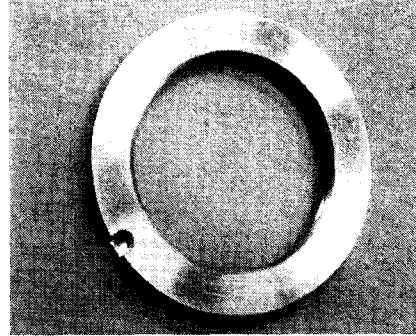
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### 5-3. Mechanical seal detail (Rotation Part)

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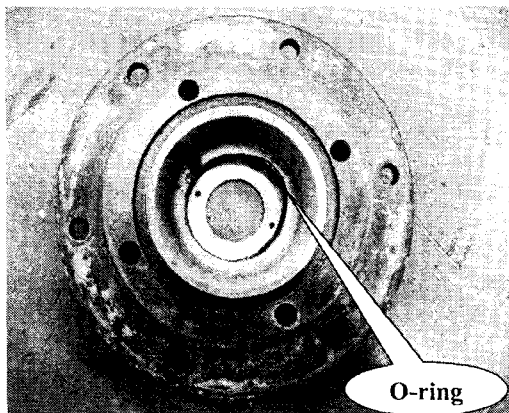
- ✓ Rotation Part (Front Side)
- Stainless + Ceramic coating



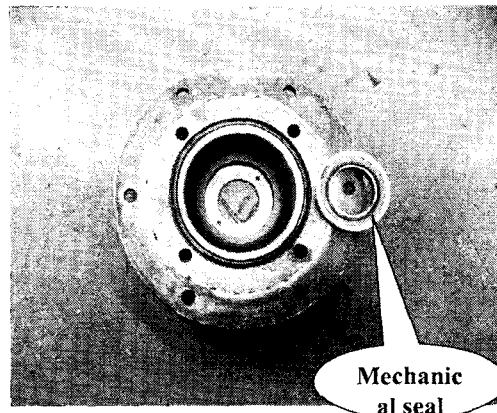
- ✓ Rotation Part (Rear Side)
- O-Ring of inside
- In order to minimize distance, slim

### 6-1. Installation of Mechanical seal (Stationary)

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- ✓ Housing processing
- ✓ O-Ring attachment

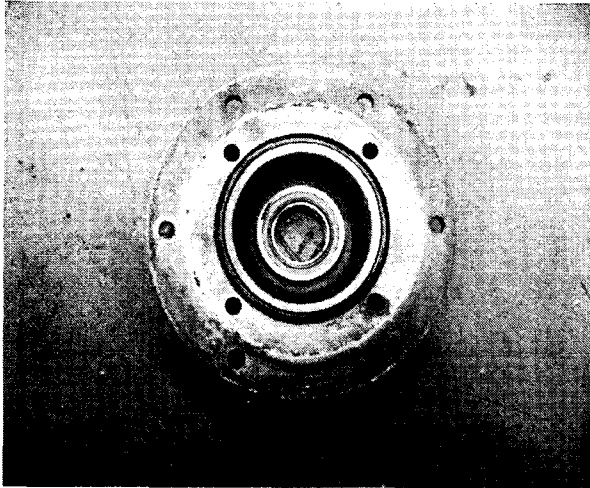


- ✓ Installation of Stationary Part



## 6-2. Installation of Mechanical seal (Stationary)

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✓ New housing is modified within ranges of structures and intensity being not influenced by using existing oil seal hole. And in new above one, new mechanical seal stationary was attached.

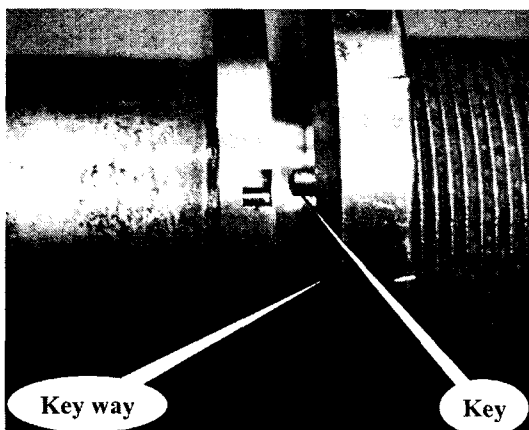
✓ Assembled stationary part in housing.

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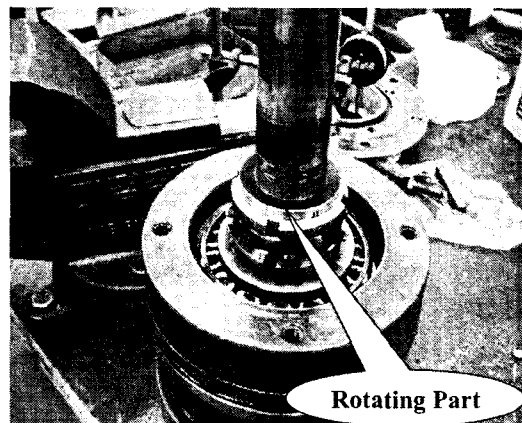
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## 7-1. Installation of Mechanical seal (Rotating Part)

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✓ Rotator was fixed by lock nut use



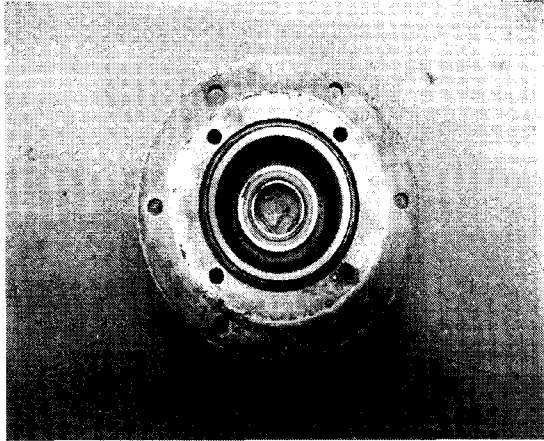
✓ Rotating Part is completed by Shaft Installation

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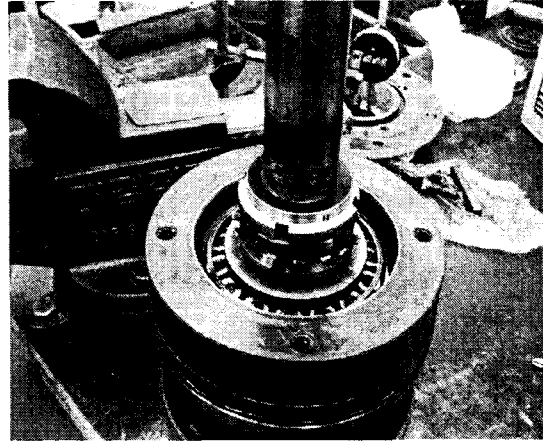
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## 8-1. Mechanical seal assembly detail

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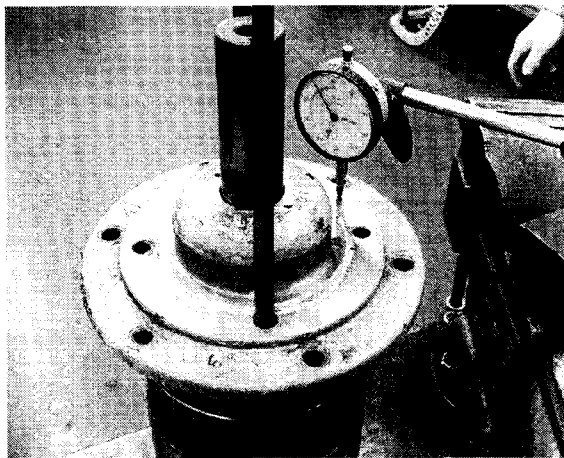
✓ Assembled stationary part in housing.



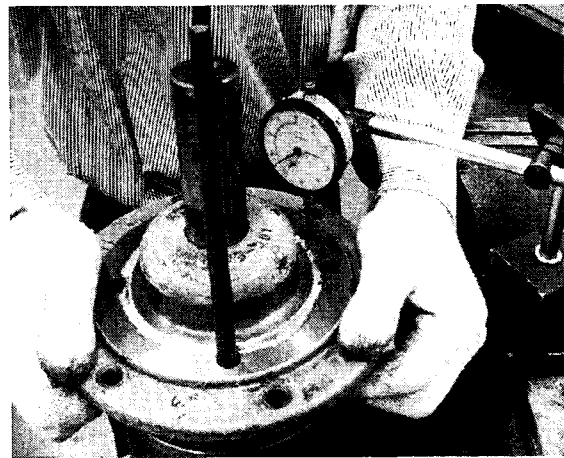
✓ Completed by Shaft Installation of Rotating Part

## 8-2. Mechanical seal assembly detail

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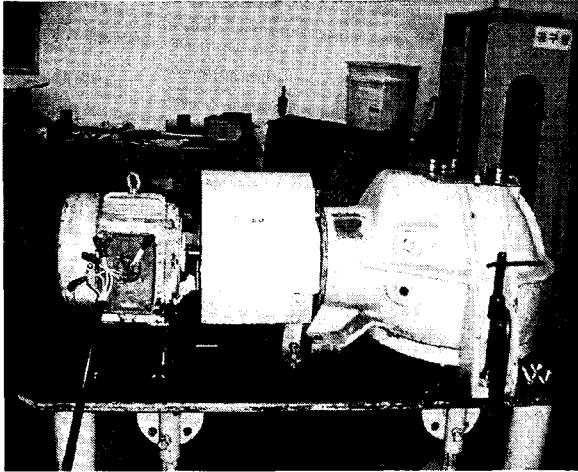


✓ Seal Tension adjustment processing  
( Free tension )



✓ Seal Tension adjustment completion  
( 1.2mm )

### 8-3. Assembled mechanical seal test



✓ Running test

- ✓ After seal assemble as same condition of site, simulation test of assembled gear set was done in the maintenance shop in order to minimize risk.
- ✓ After shop test, they were installed in the original site.

### 9. Effect (cost saving)

(Unit : mil. Won)

1	Gear Reducer Change	6	Set	45.6	2.0	45.6	No, 1,2,3,4,5,6 Completed
2	Removal Cost	6	Set	12.0	0.0	12.0	
3	Installation Cost	6	Set	12.0	0.0	12.0	
Total cost saving				69.6	2.0	67.6	97% cost saving

## 10. Conclusion

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- ✓ We reviewed a lot of maker's M/C data to look for modifying part after existing oil seal of 8 mm was eliminate. But We couldn't get a proper assembly part. And/or, because of little things (6 ea order), it was difficult to look for specialists and to modify it.
  - ✓ Hence, we had to modify it by ourselves. And it has been applied for 95 days since installation. But it doesn't show any problems until now.
  - ✓ Reducing gear will be possible to be continuously used for long time without oil leakage.
  - ✓ Finally, we will continuously do our best for cost savings in order to maximize MKC's benefits.
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## 11. Action Plans

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Description		Sep. 2002						Oct. 2002						Remarks
		5	10	15	20	25	30	5	10	15	20	25	30	
Gear Reducer No, 1,3,4,5,6	Plan													All Completed
	Actual													

■ Cooling Tower Gear Reducer No, 1,2,3,4,5,6 : Oct. 24. 2002 Completed

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