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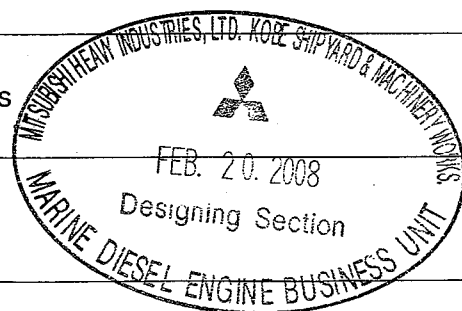
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 MITSUBISHI HEAVY INDUSTRIES, LTD. NAGASAKI SHIPYARD & MACHINERY WORKS	

ISSUED **MAR. 14, 2008**

MITSUBISHI SERVICE INFORMATION INDEX FOR MITSUBISHI-SULZER RT-flex96C DIESEL ENGINE

S.No.2228

BULLETIN No.	SUBJECT
MSI-0005E △	Prevention of Dust Entering the Crosshead Bearing at Overhaul Work
MSI-0006E	Notice for Mixing Use of Different Brand Cylinder Oils
MSI-0007E	Prohibition against Mixing Fuel Oil with Waste Lubricating Oil on Board
MSI-0101E △	Water Going into Tie Bolt Hole during Engine Maintenance
MSI-0103E	Reconditioning Work for the Cylinder Liner Inner Surface at Piston Removal
MSI-0201E △	Reconditioning of Piston Rod Re-machining for Undersized Piston Rod
MSI-0202E	Scavenging Air Temperature Control
MSI-0203E △	Material-loss on Combustion Surface of Exhaust Valve Spindle Disk
MSI-0204E	Main Engine Troubles due to Fuel Oil Mixed with Solvents
MSI-0208E	Notice at Turbocharger Overhaul
MSI-0211E	Prevention of Spark Erosion on Bearing Metals
MSI-0214E	MET type Turbocharger : Thrust Clearance Measurement Procedure
MSI-0306E △	Periodical Inspection of Main Engine Turning Gear
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**mitsubishi service information index
for mitsubishi-sulzer RT-flex96C diesel engine**

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MSI-0404E	Recommendation on Stamp Control of Parts for NOx Regulation
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MSI-0501E	Notice for Using Low Sulfur Fuel Oil (less than 1.5%)
MSI-0504E	Handling of Back-seat Type Indicator Valve (AB-1 Type)
MSI-0601E	Rupture Disk of Starting Air Pipe
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MSI-8707E △	MITSUBISHI SULZER RTA TYPE ENGINES Low Temperature Corrosion along Exhaust Gas Passage Part in Exhaust Valve Cage
MSI-8802E △	Wear of Piston Head Ring Groove
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**MITSUBISHI SERVICE INFORMATION INDEX
FOR MITSUBISHI-SULZER RT-flex96C DIESEL ENGINE**

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MSI-9107E	Criteria for Selecting Fuel Oil
MSI-9108E	Periodical Analysis of the System Oil for an Engine with Oil-cooled Pistons
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mitsubishi service information index
for mitsubishi-sulzer RT-flex96C diesel engine

BULLETIN No.	SUBJECT
MSI-9701E	Installation of Cylinder Cover Joint Ring
MSI-9702E	Checking of Fitting Condition for Tachometer Pick-up Sensor



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KOBE SHIPYARD & MACHINERY WORKS
DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Prevention of Dust Entering the Crosshead Bearing at Overhaul Work	Classification	Mitsubishi Sulzer Diesel Engine
	Type	RTA(*)
	No.	MSI-0005E Rev. 2

It has been reported that crosshead bearing and pin were damaged because sludge, dust, etc. entered at the crosshead bearing upper part when overhauling the piston or the stuffing box without piston extraction.

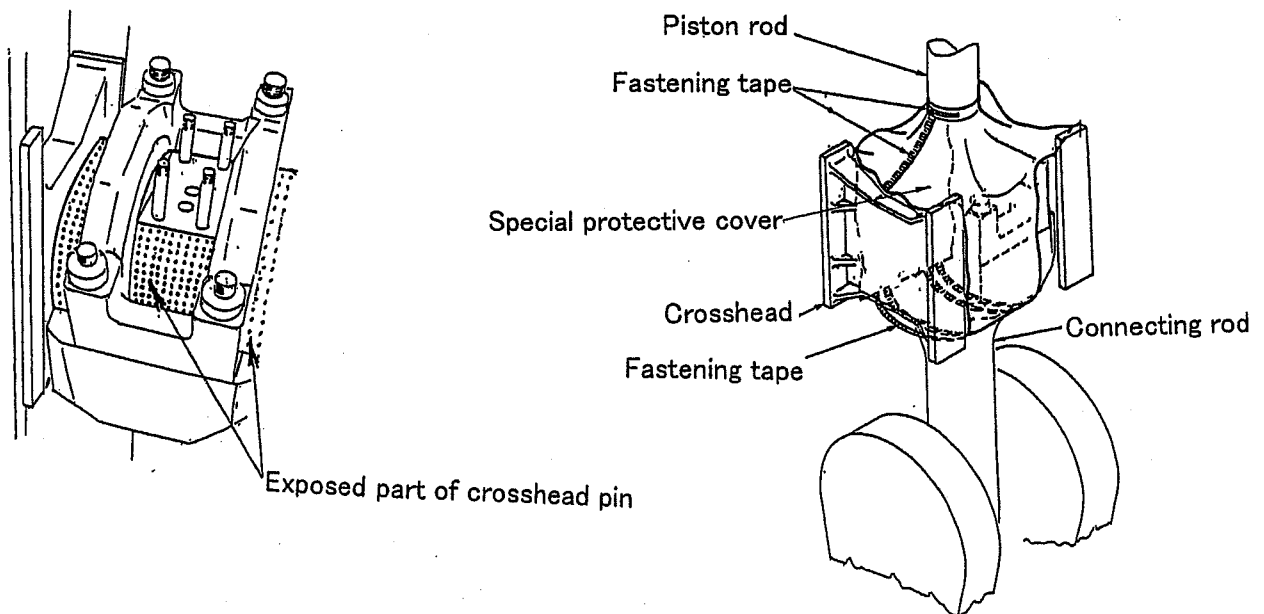
The crosshead pin is widely exposed at its upper part, and if sludge and dust enter those parts, they might damage the bearing metal or the crosshead pin and might bring about the peeling-off of the bearing metal in the worst case.

Therefore, it is recommended to take measures for preventing dust from entering when the above work is carried out over the crosshead bearing.

We have prepared a special protective cover so as to prevent dust from entering during the overhaul when the piston is not extracted. (Refer to the figure below.)

You are kindly requested to place us an order for the cover when it is necessary.

In addition, when overhauling the stuffing box, you are kindly requested to carry out the cleaning of piston under side space surely before the overhaul.



(*)Engine type: RTA52, 52-UG, 52U, 62, 72, 84M, 84C, 84C-UG, 96C, RT-flex 96C

HISTORY	⚠ Engine type is reconsidered. Jan. 2005 Rev.2 : RT-flex 96C was added. May '07	Approved	<i>T. Ohtani</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: '00-11-15
		Checked	<i>G. Izuhara</i>	
		Designed	<i>E. Iizawa</i>	



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078)651-4166

Subject: Notice for Mixing Use of Different Brand Cylinder Oils	Classification	Mitsubishi Sulzer Diesel Engine
	Type	All types
	No.	MSI-0006E

An inconvenience occurred on piston ring and cylinder liner of the main engine was reported when different brand cylinder oils (general oil properties such as viscosity and TBN were similar with each other) were mixed together.

The verification test investigating the effect of the mix of different brand cylinder oils was carried out by the seizure test(high temperature ball test), and it has been ascertained that load carrying capacity may decrease in some cases when different brand cylinder oils were mixed. (refer to the following graph)

Therefore, when different brand cylinder oils are to be mixed unavoidably when cylinder oil is changed to other brand, it is recommended to limit the mixing ratio which should be less than 10 %.

(If two tanks or more for cylinder oils are available, it is recommended to supply a new brand cylinder oil after using up old one in other tanks almost completely.)

Oil Type	Load Carrying Capacity (Relative)
Brand A oil	High
A + B oil Mixed	Low
Brand B oil	High

History	Approved	<i>T. Ohkawa</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE : '00-11-29
	Checked	<i>G. Izuhara</i>	
	Designed	<i>M. Nishida</i>	



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN

TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Prohibition against Mixing Fuel Oil with Waste Lubricating Oil on Board		Classification	Mitsubishi Sulzer Diesel Engine	
		Type	All types	
		No.	MSI-0007E	
Recently, it has been reported that waste lubricating oil on board and drain oil of piston rod stuffing boxes were put into the F.O. settling tank and used as fuel oil for the main engine, and problems were found on the parts for combustion chamber parts and fuel oil system as the following process. ● Waste lubricating oil and the drain oil of piston rod stuffing boxes include hard foreign particles such as sludge or worn metal powder/flake. ● Various kinds of additives (detergent dispersant additives, etc.) are included in Lubricating oil, and foreign particles in fuel oil are wrapped with some of these additive and then the apparent specific gravity of the mixed fuel becomes lighter. For this reason, it becomes difficult to remove the foreign particles by the centrifugal purifier. Therefore, if these foreign particles enter fuel oil injection pumps, fuel oil injection valves and cylinders of the main engine, it may bring about abnormal wear on them in some cases. For safety operation of the main engine, you are kindly requested to unload the waste oil of the ship or dispose of it with incinerating equipment on board. <u>Examples of Waste L.O. :</u> - Stuffing box drain - Piston underside drain - Waste oil at cleaning of strainers and purifiers - Leak oil from L.O. apparatus				
HISTORY		Approved	<i>T. Ohtani</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: '00-12-28
		Checked	<i>G. Izuhara</i>	
		Designed	<i>B. Iijima</i>	



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078) -672-3797 FAX : (078) 651-4166

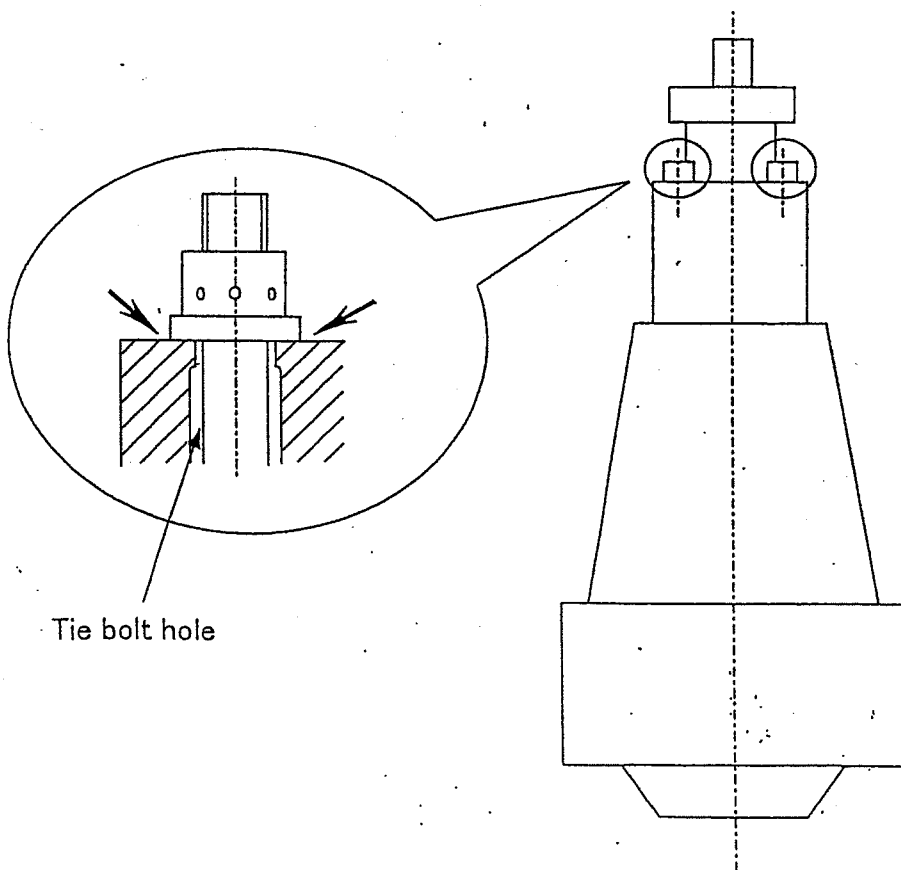
Subject : Water Going into Tie Bolt Hole during Engine Maintenance	Classification	Mitsubishi Sulzer Diesel Engine
	Type	ALL
	No.	MSI-0101E

It is thought that water or corrosive liquid might introduce tie bolt holes while maintenance work is carried out in dock or on board and it makes tie bolt threads or the tie bolt hole inside for the tie bolt corrode in some cases.

It is presumed that admitting water or corrosive liquid into tie bolt holes might lead to a serious problem due to the corrosion.

Therefore, when the repair work in dock or maintenance work on board is carried out, you are kindly requested to take care to prevent water or corrosive liquid from entering the tie bolt holes.

If, accidentally, water or corrosive liquid enters into the bolt holes, drain it off immediately.



Tie bolt hole

HISTORY	Engine type is reconsidered. July 2003	Approved		DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Sep. 10, 2001
		Checked		
		Designed		



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SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078)651-4166

Subject : Reconditioning Work for the Cylinder Liner Inner Surface at Piston Removal		Classification	Mitsubishi Sulzer Diesel Engine		
		Type	All RTA types		
		No.	MSI - 0103E		
As you may have well realized, piston ring breakage results from the mechanical problem such as the piston ring collides against cylinder liner top ridge and also is caught in scavenging ports of the cylinder. We have already introduced additional machining for the upper cylinder oil grooves and chamfering for scavenging ports by issuing MSI-9002E, -8809E of our service information concerning the countermeasures of the above piston ring breakage. This service information introduces the top ridge removal procedure when the piston is extracted or inserted (specially in case of new piston rings installed) and further piston ring breakage is brought about due to collision to the top ridge. You are kindly requested to recondition the cylinder liner at piston removal according to this service information. <u>How to remove top ridge</u> Please be advised the followings with the attached procedure. <u>1. Preparation before grinding</u> (1) Clean the running surface of the cylinder fully with waste cloths by removing oils. (2) Cover cylinder oil lubricating holes and grooves on the cylinder liner and protect them with gummed cloth tapes. (3) Seal the gap between the piston crown and the cylinder liner with waste cloths to prevent dust from entering when removing the top ridge with the piston in the cylinder liner. (4) Remove and clean carbon which adhered on the non-running surface around the top ridge sufficiently. (5) Attach the protective plates (shown in the attached figure) on the running surface right under the top ridge collar according to the attached procedure.					
HISTORY			Approved	<i>T. Ohtani</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Feb. 28 th 2001
			Checked	<i>B. Izuhara</i>	
			Designed	<i>M. Fujiwara</i>	

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2. Grinding procedure

(1) Rough grinding

At first, grind off the top ridge up to 0.2 mm to 0.3 mm on this side of the running surface by using a sander grinder.

Since the thickness of layer of two protective plates becomes 0.2 mm, the grinding is to be carried out nearly the height of the protective plates.

(Minimize the grind-off of the protective plates.)

(2) Finish grinding

Finish-grind by using a fine particle sander of small disk or stone grinder with bar.

Be sure to grind the ridge carefully so as not to leave the collar.

3. Measures after grinding

(1) Remove the gummed cloth tape.

(2) Remove and clean debris on the running surface completely.

(3) After cleaning, apply cylinder oil thoroughly on the running surface.

(Note) The above procedure is introduced as temporary.

It is recommended to carry out the additional machining for the upper relief groove as the permanent countermeasure by taking an opportunity.

Besides, you are kindly requested to place an order of the work to us because the special tools are necessary.



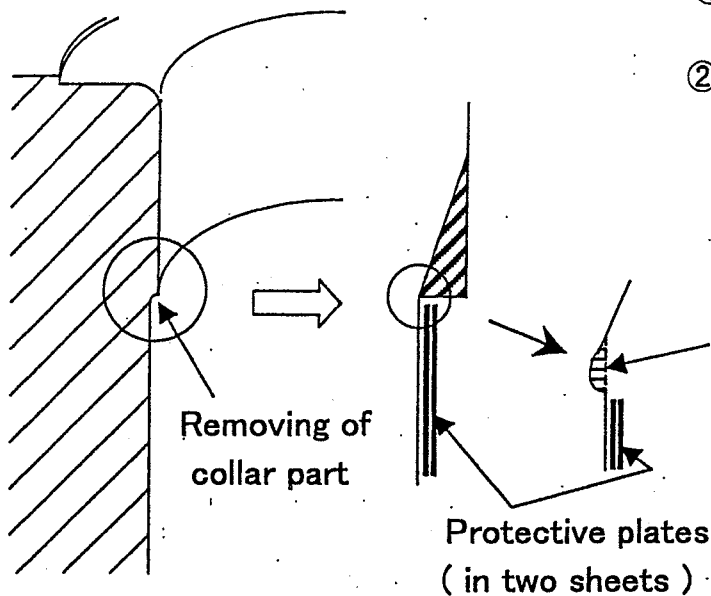
CAUTION

1) When grinding, put on the safety and protective aids, eye mask, dust protective mask, etc.

2) There is a possibility of getting burned while the cylinder liner temperature is high.

Carry out the work after the temperature becomes lower or sufficient heat insulated measures are taken.

(Shape of top ridge)

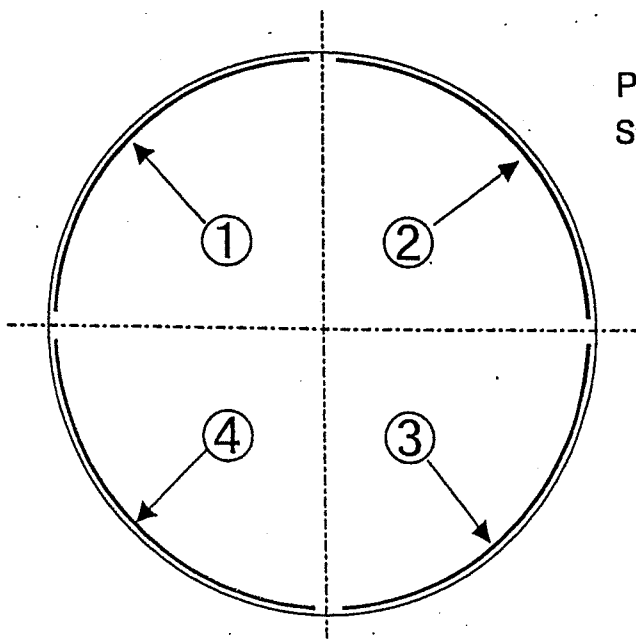
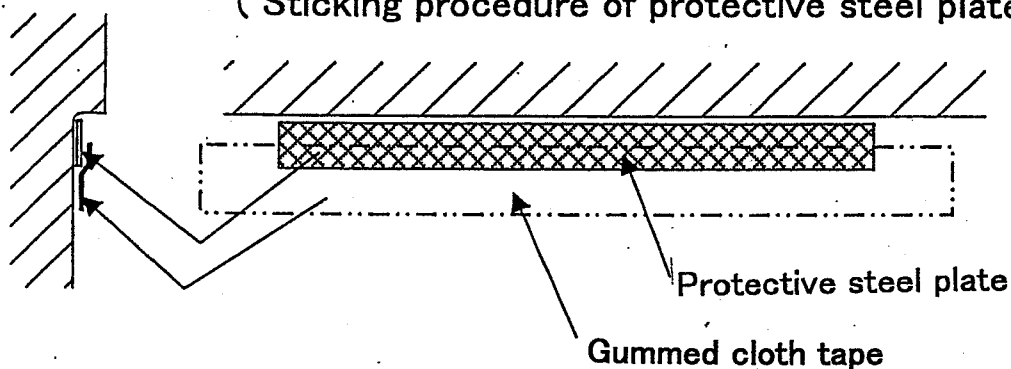


(Removing procedure)

- ① To be roughly ground by using a sander grinder.
 - ② To be finished by using a fine sander or stone grinder with bar.
- Finishing to be carried out so as not to leave collar and make the shape as shown in the following figure.

Recess to be made a little

(Sticking procedure of protective steel plate)



Protective plate set
Stainless plate 0.1 mm

300 in length		6 sheets
500 in length		6 sheets
840 in length		4 sheets



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SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN

TEL : (078)-672-3797 FAX : (078) 651-4166

Subject :	Classification	Mitsubishi Sulzer Diesel Engine
	Type	RTA
	No.	MSI-0201E Rev.2

Once a piston rod is roughened, scored, or close to the wear limit, the performance of the stuffing box decreases. The wear of the elements and also their tightness and scraping efficiency deteriorate.

In this connection, we introduce undersize re-machining correction for the piston rod as mentioned below;

1. Wear limits of piston rods:

The maximum wear where reconditioning has to be done, is given in the table below.

If a piston rod surface is roughened or wear progresses excessively, please measure the diameter of the piston rod and recondition it if necessary.

Table 1 : Wear limit for original sizes [mm]

Engine type	Diameter of New piston rod	Wear Limit (Diameter)
RTA52	195	194.40
RTA62	230	229.30
RTA72	280	279.10
RTA84M/C(UG)	310	309.00
RTA58	210	209.30
RTA68	250	249.30
RTA76	280	279.10
RTA84	310	309.00
RTA58T	220	219.30
RTA96C/RT-Hex96C	370	368.80

2. Grinding of piston rods to 2 mm undersize and wear limit of 2 mm undersize piston rod:

If piston rods exceed the wear limits given in Table 1, they can be ground to a newly introduced 2 mm undersize diameter according to Table 2 (next page).

HISTORY	⚠ Added RTA58T, 96C. Apr. 2005 Rev. 2: Added RT-Hex 96C May. 2007	Approved	<i>T. Okamoto</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Jan. 10 th 2002
		Checked	<i>S. Iizawa</i>	
		Designed	<i>G. Iizawa</i>	

Table 2 : 2mm Undersize dimensions [mm]

Engine type	Undersize rod diameter	Wear Limit (Diameter)
RTA52	193	192.40
RTA62	228	227.30
RTA72	278	277.10
RTA84M/C(UG)	308	307.00
RTA58	208	207.30
RTA68	248	247.30
RTA76	278	277.10
RTA84	308	307.00
RTA58T	218	217.30
RTA96C/RT-flex 96C	368	366.80

3. Grinding of piston rods to 4 mm undersize

An undersize solution with 4 mm in diameter has been prepared for cases where the wear exceeds 2 mm undersize limit.

However, sufficient time for delivery has to be given as our stock keeping for the stuffing box components will be limited, so you are kindly requested to ask us about the time of delivery.

4. Arrangement for piston rod reconditioning and undersize gland packing

When the piston rod is ground to undersize one, gland packings have to be also used for undersize gland packings and consequently, please order the gland packings from our company.

When ordering gland packings, please inform us of the Code No. and undersize packing.

(Example : U231XX – 2U 2U : 2 mm undersize)

5. Spares Keeping

Great care must be taken not to mix the parts of the original with the new or undersized design.

It could be easy to maintain the undersize piston rods through the engine to avoid mixed use. Additionally it is recommended that a spare piston is always ready, together with the respective stuffing box with under size scraper and joint rings, to avoid time-consuming dismantling of stuffing boxes at piston overhauls or fitting of parts with wrong sizes.



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DIESEL ENGINE DEPARTMENT

SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN

TEL : (078)-672-3797 FAX : (078) 651-4166

Subject :

Scavenging Air Temperature Control

Classification

Mitsubishi Sulzer

Diesel Engine

Type

All RTA

No.

MSI-0202E

As a general rule, cooling water flow quantity to the air cooler, relating to scavenging air temperature is wholly passed through the air cooler and the quantity is not to be throttled at the air cooler inlet.

However, for this reason, it is occasionally found that much drain water generates due to a decrease in scavenging air temperature in some weather conditions and the drain water which could not be fully caught by the drain separator enters into cylinder liners as water drops and this brings about excessive wear on piston rings or cylinder liners.

In order to prevent these cases, it is recommended to control scavenging air temperature.

As the way of the control, if the ship is operated in the zone of high humidity climate in particular, generation of scavenging air drain is watched and scavenging air temperature is made to increase up to the temperature (in the range of 40 to 50°C as a standard) which can keep down drain generation as much as possible.

It is recommended to adjust scavenging air temperature to around 45°C as a standard under normal condition,

However, if cooling water flow quantity is too much throttled in the case of using sea water for the air cooler, please carry out the regulation according to the following procedure to prevent clogging in cooling tubes in the air cooler due to salt extraction from sea water.

- ① Cooling water outlet temperature at the air cooler is to be adjusted to 50 °C or below.
- ② Cooling water inlet and outlet valves at the air cooler is not to be throttled by more than 50% opening.
- ③ Air venting is to be surely carried out by using air vent cock at the air cooler.

HISTORY

Approved

T. Ohtani

Checked

C. M. S. S. S.

Designed

Y. Izuhara

DIESEL ENGINE DEPARTMENT

SERVICE ENGINEERING SECTION

DATE OF ISSUE: April 10th 2002



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SERVICE ENGINEERING SECTION
1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078)651-4166

Subject :

Material-loss on Combustion Surface of Exhaust Valve
Spindle Disk

Classification

Mitsubishi Sulzer
Diesel Engine

Type

RTA

No.

MSI-0203E Rev. 2

When the exhaust valve is used for a longer period, material-loss occurs on combustion side surface of exhaust valve spindle disk. This material-loss progress speed differs depending on running condition and even fuel oil properties in use.

If the material-loss comes to the repair limit shown in the following table or is expected to reach the repair limit by the next maintenance occasion, the exhaust valve has to be repaired.

On the other hand, the use limit is also shown in the following table, which shows material-loss amount in the case of scrapping the valve spindle without repairing.

Consequently, you are kindly requested to judge repairing the exhaust valve spindle disk or using it until the material-loss amount is reached to the use limit (scrap base), by taking service conditions and maintenance schedule of the ship into consideration.

Engine type		Amount of material-loss on combustion face (mm)	
RTA-"2" series	RTA-"8" series	Repair limit	Use limit (to be scrapped)
-	RTA48	6	13
RTA52(U)	RTA58	9	16
RTA62/RTA58T	RTA68	9	19
RTA72	RTA76	10	21
RTA84M RTA84C(UG)	RTA84	12	25
RTA96C/RT-flex96C	-	12	28

Incidentally, you are kindly requested to place an order for the repair with our company when the repair is required.

HISTORY

⚠ Added RTA96C. Apr. 2005
Rev. 2: Added RT-flex 96C. May 2009

Approved

Checked

Designed

T. Okada
S. Iizawa
H. Izuhara

DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION
DATE OF ISSUE: May 10th 2002



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Main Engine Troubles due to Fuel Oil Mixed with Solvents		Classification	Mitsubishi Sulzer Diesel Engine	
		Type	ALL	
		No.	MSI-0204E	
It has been reported that sticking of fuel oil injection pump plungers and abnormal wear of cylinder liners and piston rings occurred in the engines whose fuel oil bunkered in Singapore recently, though you might have already heard. (refer to DNV press statement attached) According to the analysis result of a fuel oil examination organization, various solvents were found out in the fuel oil in question and it was assumed that solvents for washing and removing paint mixed with fuel oil. This kind of fuel oil mixing with solvents of aromatic group leads to the troubles that oil film breakage occurs on cylinder running surface due to flame attack on the liner wall from ignition delay or a fuel oil injection pump plunger sticks due to vaporization of low boiling point solvents in fuel oil pipe lines. The existence of these solvents in fuel oil cannot be detected by means of a general fuel oil analysis method, so we have to wait for a fuel oil examination organization to develop a simple analysis way. It is not clearly said that there is no entire possibility that solvents mixed with fuel oil like this time happens not only Singapore but also other bunkering ports. Basically, the fuel oil mixed with solvent like this is kept from using, but you are kindly requested to carefully pay attention to each running data of the engine after starting to use new fuel oil, assuming that the fuel oil is bunkered to the ship by any chance.				
HISTORY	Approved		<i>J. Ohtani</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: May 20, 2002
	Checked		<i>S. Saezumi</i>	
	Designed		<i>T. Ohtani</i>	

Press Statement

From DNV Petroleum Services
14 January 2002



Issued in response to media enquiries on the bunker contamination incident in Singapore

We refer to the bunker contamination incident reported in the Jan 4 and Jan 7 issues of Singapore Business Times ("Toxic waste alleged to be 'laundered' via ships" fuel; "Bunker fuel problem more widespread than thought" and "List of accredited bunker suppliers to be drawn up").

Although the contaminated fuels analysed by DNV Petroleum Services met Table 2 of the ISO 8217: 1996 (E) requirements with respect to routine test parameters for Marine Residual Fuels, DNVPS has identified the presence of di-methyl esters of hexanedioic acid in them. These are chemicals used in cleaning solvents, paint thinners, paint strippers as well as chemical intermediates, and they are the common components detected in all the samples taken from vessels which reported engine damages. As clause 4.1 of the ISO 8217: 1996 (E) states that "...the fuels should not include any added substance or chemical waste which jeopardises the safety of ships or adversely affects the performance of the machinery...", the tested bunkers would have failed to meet the general requirements of the ISO fuel quality specifications.

Our records show that 22 fuel samples taken from vessels that bunkered in Singapore during the late October to early November period contained di-methyl esters of hexanedioic acid.

With more than 80 percent market share in the marine fuel testing business, DNVPS is likely to have analysed the majority of samples associated with this unfortunate incident. We can confirm in this regard that tri and tetrachloro ethylene were in fact not present in any of the samples we have tested; contrary to the alleged findings of a US-based laboratory recently quoted in the media. Although DNVPS is not in a position to comment in detail about the test methods or results from other fuel testing services, our findings are backed by many years of experience and specialised expertise in the marine fuel testing business.

The routine test parameters in existing fuel testing programmes and ISO 8217: 1996 (E) will not be able to detect the additional contaminants, while specialised testing is going to be very costly for the shipping industry. With this in mind, DNVPS is now extensively engaged in gathering shipboard operational feedback and laboratory research to formulate new tests methods that will help ship owners pre-empt the risk of similar incidents.

DNVPS will also continue to work closely with port authorities around the world to encourage appropriate actions for preventing irresponsible parties from using marine fuels as a medium to dispose off industrial waste.

For more information, contact David Wong, DNV Petroleum Services Singapore.
Address: 27 Changi South Street 1, Singapore 486071.
Tel: +65 887-6059 Fax: +65 779-5636 Email: david.wong@dnvps.com
DNVPS Internet Homepage: <http://www.dnvps.com/>
DNV Internet Homepage: <http://www.dnv.com/>



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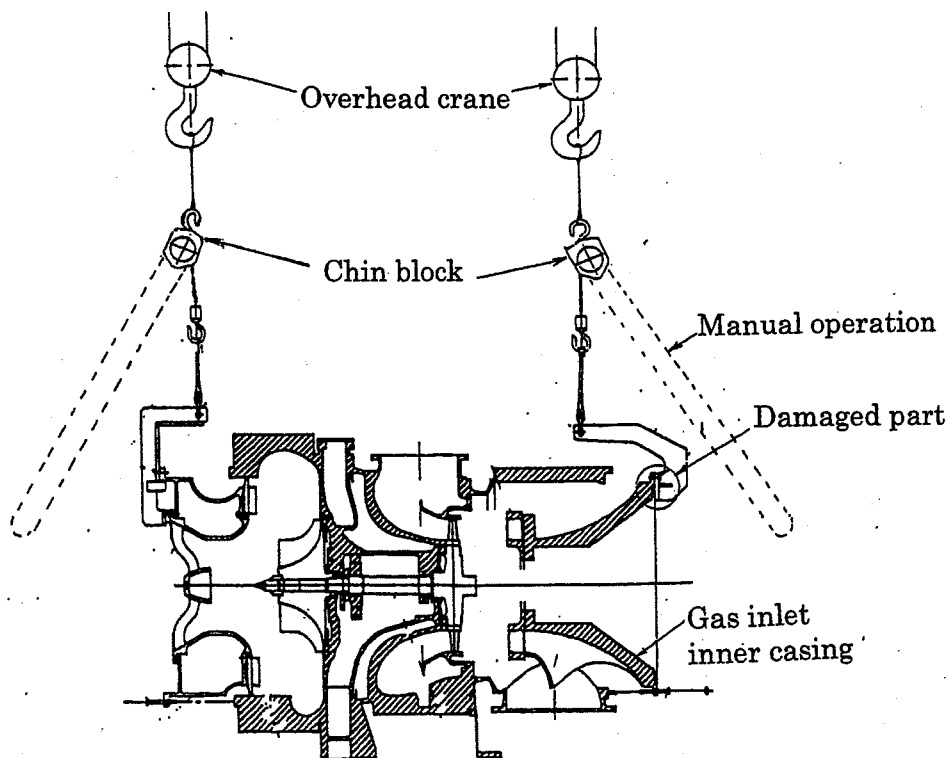
MITSUBISHI HEAVY INDUSTRIES, LTD.
KOBE SHIPYARD & MACHINERY WORKS
DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION
1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078)651-4166

Subject : Notice at Turbocharger Overhaul	Classification	Mitsubishi Sulzer Diesel Engine
	Type	All RTA
	No.	MSI-0208E

It has been reported that when the turbocharger was overhauled, the gas inlet inner casing was damaged at the flange part by an inappropriate dismantling work.

When the proper dismantling tool was fitted and directly connected to the overhead crane and then the gas inlet inner casing was pulled out while it was lifting up, the flange of the inner casing was damaged due to the fact that excessive force worked suddenly at the flange since fine adjustment could not be carried out for lifting up the inner casing.

In the same way, lifting-up and lifting-down work of dismantling and assembling parts needing small force and fine adjustment is not to be carried out by the overhead crane directly and the work is to be carried out by the condition that a chain block is connected between the overhead crane and the dismantling part and the chain block is manually operated.



HISTORY	Approved	<i>T. Ohtani</i>	DIESEL ENGINE DEPARTMENT
	Checked	<i>C. S. S. S.</i>	SERVICE ENGINEERING SECTION
	Designed	<i>K. Fujimoto</i>	DATE OF ISSUE: Nov. 20 th 2002



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TEL : (078)-672-3797 FAX : (078)651-4166

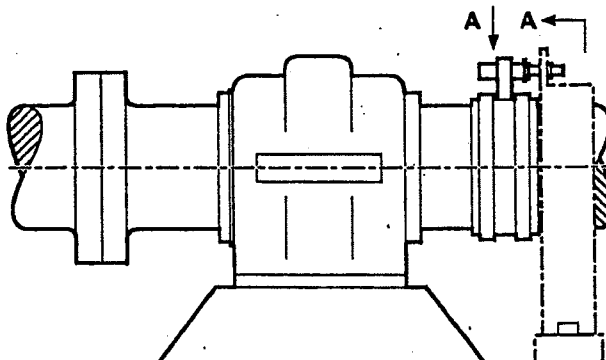
Subject : Prevention of Spark Erosion on Bearing Metals	Classification	Mitsubishi Sulzer Diesel Engine
	Type	All RTA
	No.	MSI-0211E

In order to prevent spark erosion on bearing metals on board, a measure such as earthing device for the shafts has been usually taken for ships. Nowadays even Impressed Current Cathodic Protection (ICCP) has been installed in some ships.

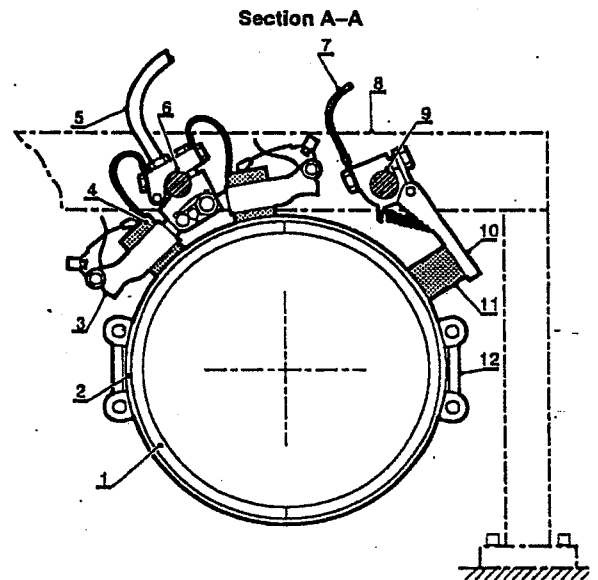
The maintenance for these devices has to be required during a long time service and we would like to ask you to carry out periodical maintenance at the opportunity of dry-docking.

If these devices do not work effectively, it is assumed that damage due to spark erosion occurs on bearing metals and may lead to serious troubles. Therefore, we would like to ask you to carry out the periodical maintenance for these devices.

Normally, it is necessary to inspect wear and damage on brushes (4) and monitoring brush (11) shown in the following figure.



Typical earthing arrangement for the main shaft



View on 'A' -
Brush gear omitted

1. Slip ring
2. Tension bands
3. Twin holder
4. Brushes
5. Connection to the ship's hull
6. Steel spindle
7. Connection to the voltmeter
8. Mounting bracket
9. Insulated spindle
10. Single holder
11. Monitoring brush
12. Clamps

HISTORY	Approved	<i>T. Ohtani</i>	DIESEL ENGINE DEPARTMENT
	Checked	<i>O. Sazawa</i>	SERVICE ENGINEERING SECTION
	Designed	<i>G. Iyehara</i>	DATE OF ISSUE: Dec. 20 th 2002



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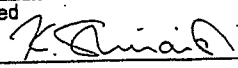
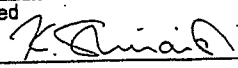
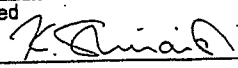
DIESEL ENGINE DEPARTMENT

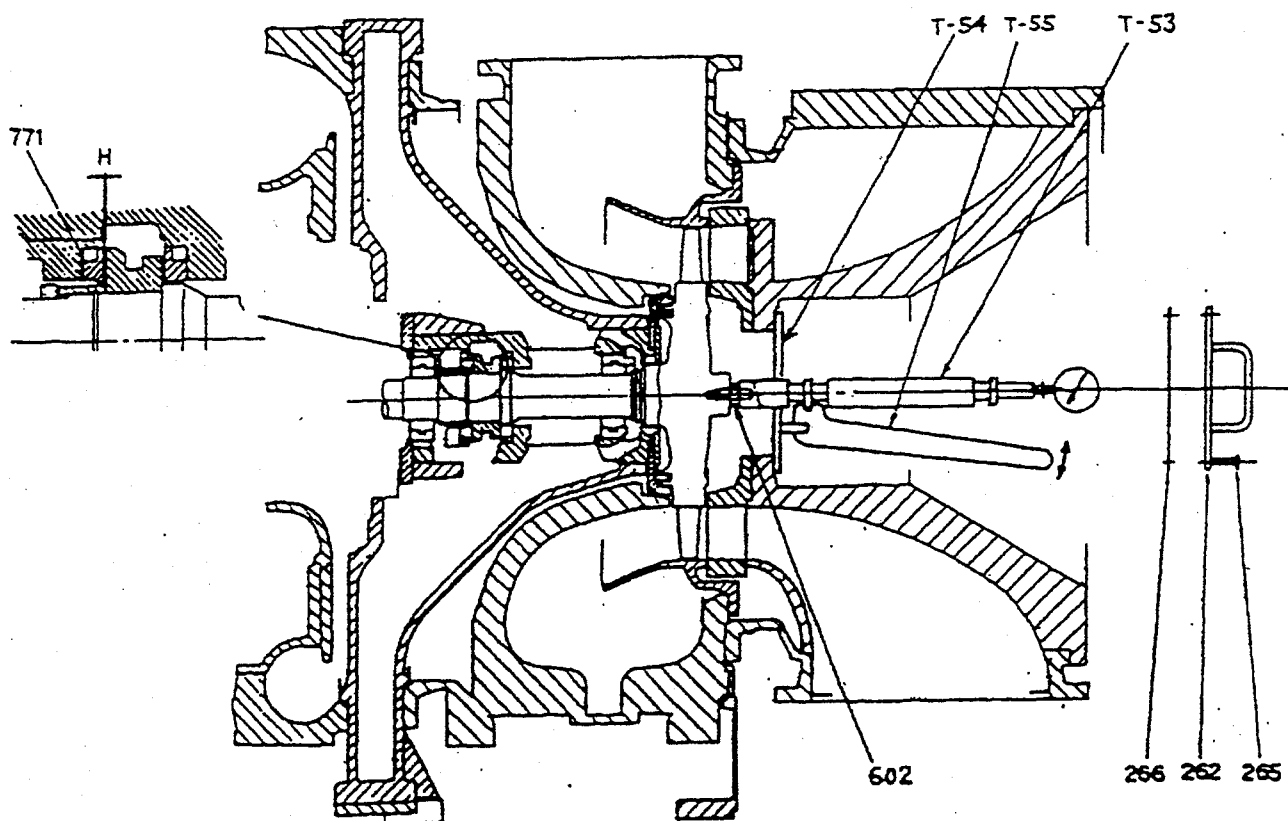
SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN

TEL : (078)-672-3797 FAX : (078) 651-4166

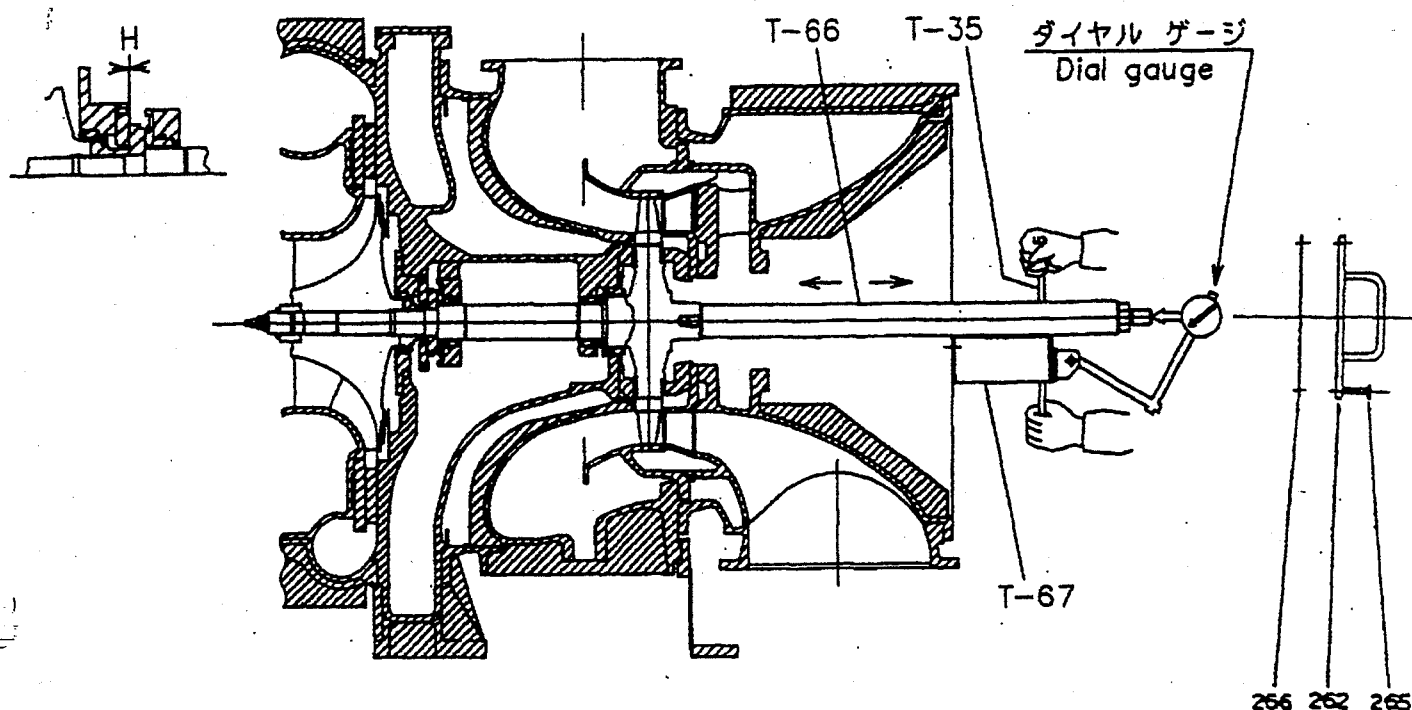
Subject : MET type Turbocharger : Thrust Clearance Measurement Procedure	Classification	Mitsubishi Sulzer Diesel Engine	
	Type	All RTA	
	No.	MSI-0214E	
Our service information bulletin being carried on the home page has been started since this year and the service information bulletin issued by our engine component manufacturers have been also carried on the home page at this opportunity. We are pleased to inform you of the service information bulletin regarding the captioned subject as attached. (Attached : Tz - M3319)			
HISTORY	Approved	<i>[Signature]</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Dec. 25 th 2002
	Checked	<i>[Signature]</i>	
	Designed	<i>[Signature]</i>	

type MET-SB,SC ,SD,SE,SEII	Title MET Turbocharger Thrust Clearance Measurement Procedure	Ref Tz - M3319 Date 5 July, 2001																								
MHI recommends overhaul inspection of thrust bearing every 4,000 to 5,000 operating hours. In consideration of the case that the turbocharger cannot be overhauled such as equipped onboard a tanker until the time of docking, we hereby advise a way of checking the thrust bearing condition by judging the measured thrust clearance. 1. Application Turbochargers larger than MET 66SB, SC, SD, SE, and SEII. 2. Thrust clearance measurement interval Approximately 7,000 hours 3. Measurement Procedure Please refer to the attached Figs. 1 and 2. 4. Standard of Thrust Bearing Overhaul Inspection Compare the values of clearance at the time of installation to the measured clearance. If the increased value exceeds the critical wear or it is assumed to exceed by next inspection, carry out the overhaul inspection. The critical wear is described below. <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <tr> <th style="width: 15%;">T/C TYPE</th> <th style="width: 15%;">66SB</th> <th style="width: 15%;">66SC,SD</th> <th style="width: 15%;">66SE</th> <th style="width: 15%;">66SEII</th> <th style="width: 15%;">71SE</th> </tr> <tr> <td>Critical wear (mm)</td> <td>0.031</td> <td>0.043</td> <td>0.043</td> <td>0.047</td> <td>0.051</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <tr> <th style="width: 15%;">T/C TYPE</th> <th style="width: 15%;">83SB</th> <th style="width: 15%;">83SC,SD</th> <th style="width: 15%;">83SE</th> <th style="width: 15%;">83SEII</th> <th style="width: 15%;">90SE</th> </tr> <tr> <td>Critical wear (mm)</td> <td>0.039</td> <td>0.054</td> <td>0.054</td> <td>0.080</td> <td>0.088</td> </tr> </table> The critical wear indicates the condition that the ratio of thrust bearing metal taper/land is approximately 1:1.			T/C TYPE	66SB	66SC,SD	66SE	66SEII	71SE	Critical wear (mm)	0.031	0.043	0.043	0.047	0.051	T/C TYPE	83SB	83SC,SD	83SE	83SEII	90SE	Critical wear (mm)	0.039	0.054	0.054	0.080	0.088
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Plan record		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Approved</td> <td style="text-align: center; padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">Checked</td> <td style="text-align: center; padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">Drawn</td> <td style="text-align: center; padding: 5px;">Y. Ono</td> </tr> </table>	Approved		Checked		Drawn	Y. Ono																		
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Drawn	Y. Ono																									



- ① Stop the main engine lube oil pump.
- ② Wait one (1) hour.
- ③ Loosen the bolt (265) and remove the blind flange (262).
- ④ Turn the rotor shaft more than ten (10) times.
- ⑤ Fit a support plate (T-54) against the blind flange attaching part and screw in the rotor extension rod (T-53) into the double end stud (602) at the end of the rotor shaft.
- ⑥ Touch the measuring point of the dial gauge to the end face of the rotor extension rod (T-53) and set the thrust lever (T-55).
- ⑦ Move the thrust lever (T-55) up and down and move the rotor shaft in axial direction and read the dial gauge graduation and then, measure the thrust clearance "H".
- ⑧ Carry out the measurement of "H" more than five (5) times and confirm that the measurement is almost constant.

Fig. 1 Thrust Clearance Measurement Procedure (MET-SB)



- ① Stop the main engine lube oil pump.
- ② Wait one (1) hour.
- ③ Loosen the bolt (265) and remove the blind flange (262).
- ④ Turn the rotor shaft more than ten (10) times.
- ⑤ Screw in the pulling out tube (T-66) at the end of rotor shaft.
- ⑥ Set a dial gauge to the stay (T-67) and touch the measuring point of the dial gauge to the end of pulling out tube (T-66).
- ⑦ Insert a hand handle (T-35) into the guide bar pulling out tube (T-66), move the handle (T-35) in axial direction and read the dial gauge graduation and then, measure the thrust clearance "H".
- ⑧ Carry out the measurement of "H" more than five (5) times and confirm that the measurement is almost constant.

Fig. 2 Thrust Clearance Measurement Procedure (MET-SC, SD, SE, SEII)



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SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN

TEL : (078)-672-3797 FAX : (078) 651-4166

Subject :

Periodical Inspection of Main Engine Turning Gear

Classification

Mitsubishi Sulzer
Diesel Engine

Type

ALL

No.

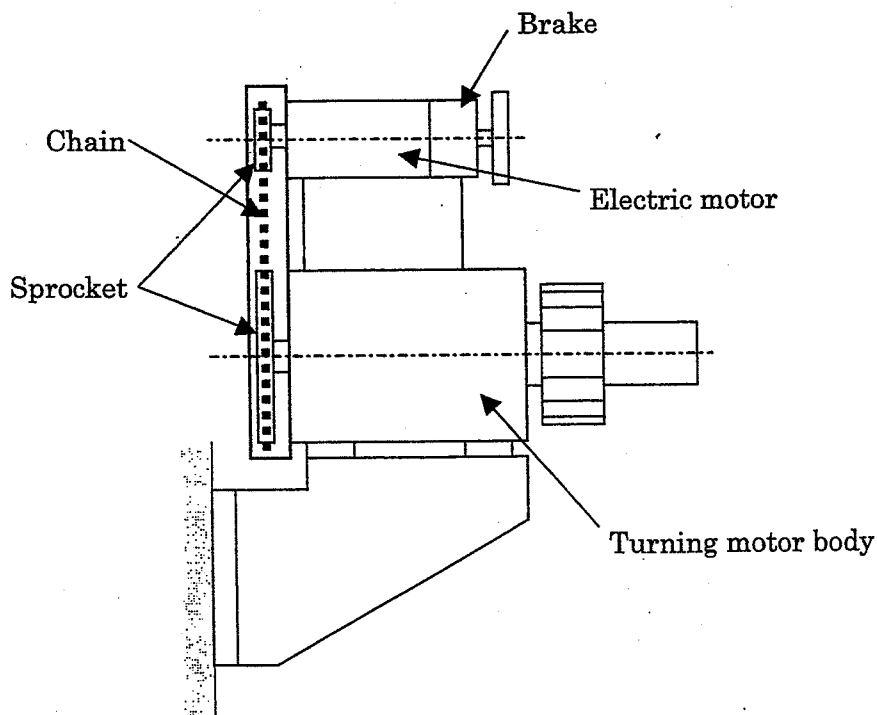
MSI-0306E

Recently, it has been reported that sprockets and/or chains of the main engine turning gear were worn after more than 15 years operation from her commission, though the periodic inspection for the lube oil level is recommended in the "Engine Maintenance Manual."

Such wear for turning gear transmitting mechanism and/or the wear for brake of electric motor may be in danger of human accident, and therefore, such parts have to be replaced with sound ones immediately if the said wear is revealed.

In this regard, it is strongly recommended to carry out the periodic inspection to the transmitting mechanism/safety mechanism of the engine turning gear device including the electric motor as well as an inspection for the oil level, especially to engines that have longer running hours, to avoid any possible human accident due to such wear mentioned above.

For the detail in inspection, please refer to the Instruction Manual of the turning gear.



HISTORY

Engine type is reconsidered. July 2003

Approved

Checked

Designed

DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION
DATE OF ISSUE: Mar. 31, 2003



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078)651-4166

Subject : Periodic Inspection of Crosshead Pin Lower Bearing Metal and Crosshead Pin	Classification	Mitsubishi-Sulzer Diesel Engine
	Type	All RTA
	No.	MSI-0401E

It has been mentioned in the engine instruction book that the overhaul inspection for the crosshead bearing should be carried out at "appropriate time," but it is recommended hereafter that the overhaul inspection should be carried out with the aim to be every 30,000 to 40,000 hours after the delivery of the ship according to the classification in order to make the standard periodic inspection time clear.

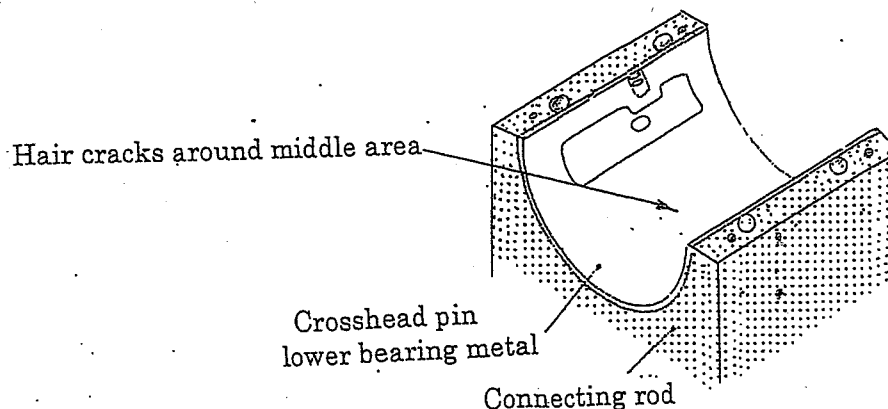
This recommendation as above has been made from the service condition that hair cracks occurred around the middle area on the white metal in some service ships which experienced for a long time service hours since delivery.

When the hair crack is found out on the area in question at the periodic overhaul inspection by any chance, since the crack will progress though the propagation is slow, we would like to ask you to renew the bearing metal by catching an opportunity. Furthermore, if white metal separation is found on the bearing metal, it has to be early replaced and we recommend replacing the bearing metal at the opportunity as soon as the ship's schedule allows.

On the other hand, if the time of the first overhaul inspection of lower metal has passed more than 50,000 hours since the delivery of the ship from various situations, it is recommended that preliminary arrangement of the metal exchange should be carried out before inspection.

Furthermore, though surface roughness of the crosshead pin is specified to $0.2 \mu\text{m Ra}$ in order to keep reliability of the bearing, cracks may occur earlier in some cases due to drop in the roughness of this pin. Please pay attention to the cleanliness around the crosshead pin and also if the roughness drops or metal replacement becomes necessary, recover the roughness within the specified values by reconditioning.

Besides, please kindly place an order for the new bearing metal with MHI.



HISTORY	Approved	M. Okabe	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Jan 28 th 2004
	Checked	S. Saegusa	
	Designed		



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Recommendation on Stamp Control of Parts for NOx Regulation	Classification	Mitsubishi Sulzer Diesel Engine	
	Type	All type	
	No.	MSI-0404E	
ANNEX VI of "International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978"(the so-called NOx regulation) adopted by International Maritime Organization (IMO) in 1997 is expected to meet necessary conditions for becoming effective within 2004. The IMO NOx regulation is applied to all diesel engines of more than 130 kW installed on the ships built on and after January 1st 2000 or the diesel engines of more than 130 kW whose main components are remodeled on and after January 1st 2000. (for ocean going vessels) When the IMO NOx regulation is applied to the engine, the ship must have the Technical File approved by the main administrative office, and NOx relevant components or service conditions have to be selected and applied within the conditions specified in the Technical File. Distinguishable method for NOx relevant components (mainly ID-number stamping on the parts) is mentioned in the Technical File and it is obliged to always use the components adaptable to the matters in the Technical File. Moreover, components in use are checked with the components specified in the Technical File by the main administrative office at the time of the special survey at intervals of less than five years and/or at the time of the intermediate survey between the special surveys. If the ship is operated in the condition without being adaptable to the IMO NOx regulation, there is a possibility that the port state control takes the measure that the ship concerned is made not to sail. For the engines installed on the ships applied to the IMO NOx regulation, it is strongly recommended to use the genuine parts, whose distinguishable method is employed by ID-number stamping, etc., specified in the Technical File of the ship concerned after confirming NOx relevant components from the stamp, etc.			
HISTORY	Approved	<i>M. Okabe</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Jun. 8 th 2004
	Checked	<i>S. Hasegawa</i>	
	Designed	<i>K. Tazumi</i>	



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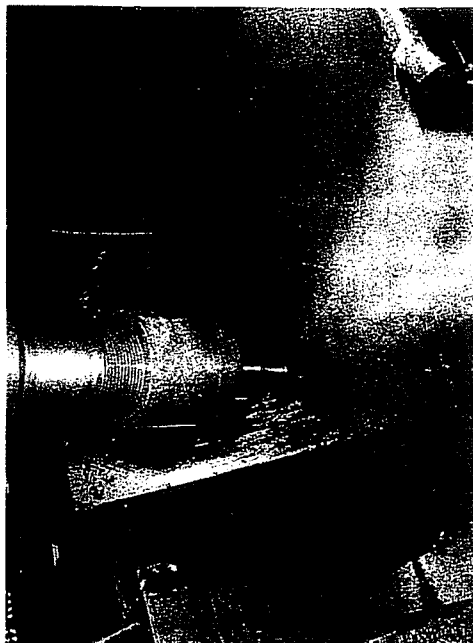
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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Management and Maintenance of Fuel Injection Valve Nozzles		Classification	Mitsubishi Sulzer Diesel Engine	
		Type	All RTA	
		No.	MSI-0405E	
Although the fuel injection valve seriously affects combustion performance and the most important part seriously affecting reliability of combustion chamber components, it is occasionally seen that the records of the maintenance, used hours, etc. of the fuel injection valve are not sufficiently managed. It is believed that the reason for the insufficient management originates from a time-consuming job due to short maintenance intervals and many fuel injection valves, but it is proposed that the following sufficient management should be carried out for the injection valve as a measuring stick in order to prevent it from being inadaptable to combustion chamber components. 1) The contents of nozzle management: 1. Used cylinder No. and used hours of fuel injection valve body and nozzle 2. Maintenance record of the nozzle 2) Using limit of fuel injection valve: 1. The nozzle body is to be renewed in 10,000 to 12,000 hours. 2. Shrink-fit part of one piece type nozzle tip end can be replaced only once. 3. Condition of the fuel injection valve is to be confirmed by injection test every 3000 hours, and the maintenance is to be carried out if necessary. 3) Maintenance of fuel injection valve: For seat surfaces of valve seat and needle, it is planned to grind their surfaces with the angle set up separately. A high technique is required for this maintenance. Therefore, it is recommended to place an order for the maintenance with us or to maintain the valve at the specialized workshop so that the maintenance cannot be lead to unexpected troubles such as poor combustion due to insufficient maintenance on board. Note: Since criteria of FOV nozzle spray test is attached as a measuring stick of maintenance on shore, please refer it. (judge it spray condition with the specified pressure)				
HISTORY	Attached photo is added in Oct. 2004	Approved		DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Sep. 17 th 2004
		Checked		
		Designed		

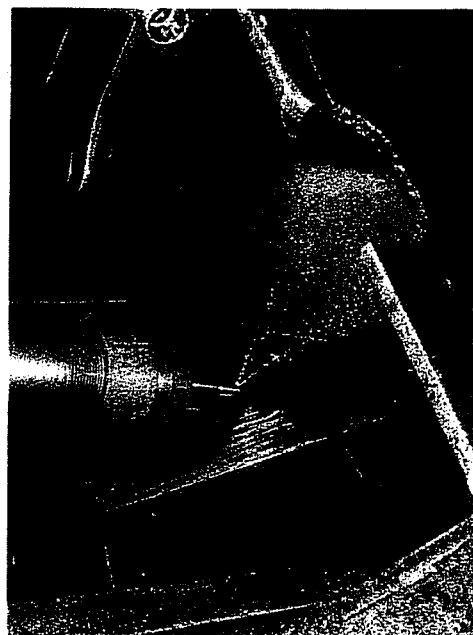
Judgment Criteria of the Spray Pattern of Fuel Injection Valve on Test Stand

噴霧テスト良否判断基準



Sound condition

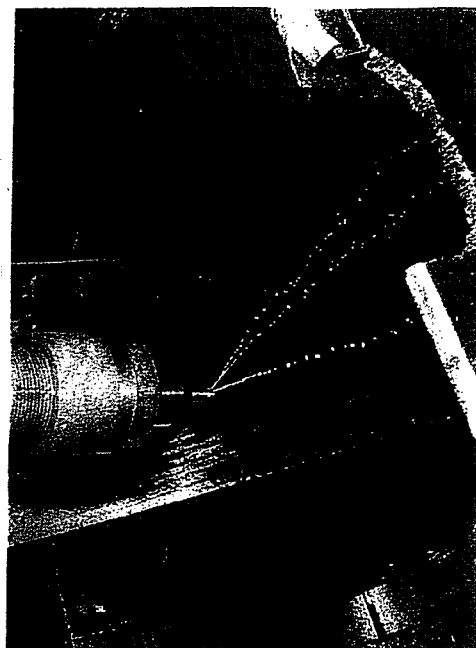
良好



Abnormal or poor injection

The fuel valve nozzle to be landed for reconditioning

噴霧異常又は不良
陸揚げ修理が必要





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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078)651-4166

Subject: Prohibition against Application of Molykote with Brush on Back Surface of Each Bearing (main, crankpin, & crosshead pin)		Classification	Mitsubishi Sulzer Diesel Engine	
		Type	All RTA	
		No.	MSI-0410E	
The bearing back surface is very important part where bearing reaction force is received, actually there are some cases that the bearing metal results in damage due to uneven contact on its back surface. For example, recently we have been reported that a bearing metal was damaged because a paste type Molykote applied was not uniformly applied and hardened on a part of the bearing back surface before assembly. In order to prevent the same kind of trouble, it is recommended to use a spray type Molykote, which has better fluidity, for applying on the bearing back surface.				
HISTORY		Approved	<i>M. Otake</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Nov. 26, 2004
		Checked		
		Designed	<i>C. Iijima</i>	



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Notice for Using Low Sulfur Fuel Oil (less than 1.5%)	Classification	Mitsubishi Sulzer Diesel Engine
	Type	All RTA
	No.	MSI-0501E

Generally, the sulfur content in fuel oil is well recommended to be from 1.5% to 3.5% as marine engine fuel oil, however nowadays it is increased to have the opportunities when still lower sulfur content fuel oil is supplied due to an environmental compliance, and the inconvenience on engines supposedly caused by the supply of this kind of fuel oil has been reported.

Some kinds of low sulfur fuel oils have a possibility to be the flame resistant fuel oil having characteristics such as two steps burning and after-burning or the FCC fuel oil containing hard particles.

When these fuel oils are once used, they have severely affected on running performance of piston ring and cylinder liner, so a reduction in cylinder oil feed rate by taking consideration of only neutralization of sulfur does not always lead to the solution.

It has been worried so far that the combination of low sulfur fuel oil and higher BN cylinder oil educes some components (calcium, etc.) in additives of cylinder oil, which become sludge and have the adverse effect on running performance of piston ring and cylinder liner such as piston ring sticking.

However, in the case of changing the cylinder oil to lower BN one, special attention has to be paid because a drop in extreme pressure oil performance and/or a drop in detergent dispersant performance of the cylinder oil may occur in some cases and as a result of it, the inconvenience of engines is worried. (it has been actually reported that the inconvenience of engines may occur due to use of lower BN cylinder oil)

Taking the above into consideration, when low sulfur fuel oil have to be used, we would like to ask you to consult with the lubricating oil maker about the existence of drops in performance of extreme pressure and detergent dispersant for applicable cylinder oils in advance.

In the case of using low sulfur fuel oil, it is generally recommended to take the following measures.

1. Inspect the current condition (before using low sulfur fuel oil) on piston rings and cylinder liners.
 - Sketching & photographing the running surface condition
 - Measuring the piston ring gap (or wear measurement of piston rings and cylinder liners)

HISTORY	Approved	<i>Mr. Okabe</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Mar. 15 th 2005
	Checked	<i>O. Matsunaga</i>	
	Designed	<i>Y. Saito</i>	

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- Sketching & photographing the contaminated condition on piston ring land and piston head
- 2. Increase cylinder oil feed rate more than 10 % and set cylinder cooling water outlet temperature to lower 10°C than the standard set value.
- 3. If cylinder liner temperature monitor is equipped, always watch liner temperatures during engine operation.
- 4. After 200 to 300 running hours, inspect piston rings and cylinder liners and compare their condition with the record mentioned in the item 1 of the above.
- 5. Carry out the following actions if necessary due to the above inspections.
 - In the case of improper running condition on piston rings and cylinder liners;
 - Increase cylinder oil feed rate (by approx. 0.14 g/kWH) [approx. 0.1 g/PSH]
 - In the case of increase of contamination on piston head top surfaces, etc.
 - Reduce cylinder oil feed rate (reduction of one time: approx. 0.07 g/kWH)
[approx. 0.05 g/PSH]

Or review BN of cylinder oil.

Return cylinder cooling water temperature to the standard set value.

If, as the result of analyzing the bunkered fuel oil, it is expected that the above FCC particles are mixed into the engine fuel oil system, the following actions should be generally carried out.

- ① Discharge the drain of the settling tank and the service tank frequently (several times a day) and discharge sludge including FCC particles on their tank bottoms.

This is carried out in order to prevent FCC particles, which have been accumulated on the tank bottom and highly concentrated, entering the engine inside by stirring during rough sea condition. In addition, since there is a possibility that discharged sludge includes a great deal of FCC particles, waste it or burn it in the boiler without returning it to the tank.
- ② If the service tank has two suction inlets for "High" and "Low", use the higher inlet in order to prevent sludge on the tank bottom from sucking in.
- ③ Operate all purifiers in parallel and each purifier with the lowest flow ratio, and increase the efficiency of removing sludge.
- ④ For the engine equipped with the fine filter, do not bypass the filter while supplying fuel oil.
- ⑤ For the engine equipped with cylinder liner temperature monitoring unit, operate the engine carefully by watching it always and pay attention to the abnormal rise or fluctuation of temperature.
- ⑥ It is recommended to pay attention to fuel oil properties by taking samples of fuel oil at bunkering and analyzing fuel oil always by the facility for analysis.

As for the details, refer to our Service Information bulletin [MSI-9652E] (Prevention of Inadaptability due to Use of FCC Fuel Oil).

After that, inspect piston rings and cylinder liners periodically and follow the condition sufficiently.

MITSUBISHI SERVICE INFORMATION

In order to prevent this mistake operation, the split pin has been inserted to U-nut.

However, it was reported that the clearance occurred between the U-nut and the opening/closing nut caused by worn-out threads of the opening/closing nut and the U-nut due to use for many hours; therefore, it has been determined that the split pin is disused hereafter. As for the handling of the indicator valve hereafter, please pay attention to the following matters.

1. The opening and closing of the indicator valve has to be surely carried out by the opening/closing nut without using U-nut.

The caution plate is fitted to the chain part for the indicator valve cap.

(If the caution plates are needed, please contact us.)

2. The U-nuts have to be periodically tightened. (The tightening is to be carried out during engine stop.)

The U-nut has to be tightened in the full-open position of the indicator valve. (tightening torque: about 50Nm)

(If the split pin is inserted to the U-nut, please remove the split pin.)

Note: When the U-nut is tightened, fix the spindle end by using a spanner so that the spindle cannot be turned together with the U-nut.



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KOBE SHIPYARD & MACHINERY WORKS

DIESEL ENGINE DEPARTMENT

SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN

TEL : (078)-672-3797 FAX : (078) 651-4166

Subject :

Handling of Back-seat Type Indicator Valve (AB-1 Type)

Classification

Mitsubishi Sulzer
Diesel Engine

Type

All RTA

No.

MSI-0504E

The back-seat type indicator valve (AB-1type) is structured as shown in Fig. 1 and the spindle is tightened & fixed to the opening/closing nut with U-nut and unifies with them, and the pressure in the cylinder is led into the indicator.

The opening and closing of the indicator valve is done by operating the opening/closing nut (clockwise⇒opening). However, when the indicator valve is opened/closed, the U-nut is turned counterclockwise by mistake (properly the opening/closing nut has to be turned), by which the U-nut is loosened and the clearance occurs between the opening/closing nut and the U-nut and then gas blow-by occurs through the seat part of the spindle.

(For the mechanism of gas leak, refer to Fig. 2.)

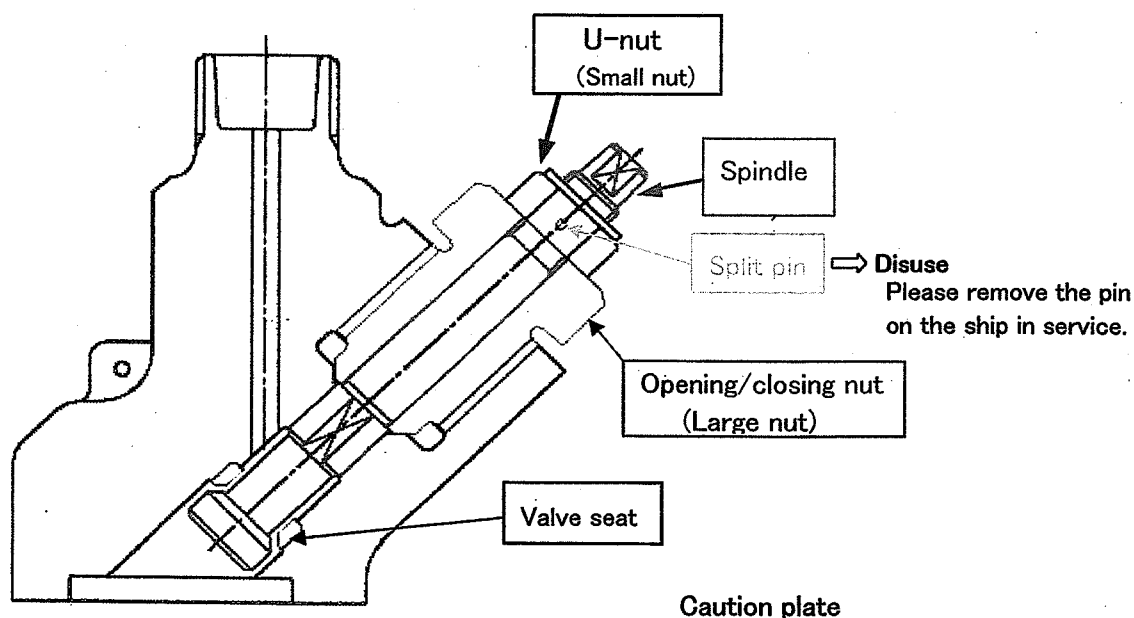


Fig. 1 AB-1 Type Indicator Valve

HISTORY

Approved

M. Okahe

Checked

Designed

S. Iwajima

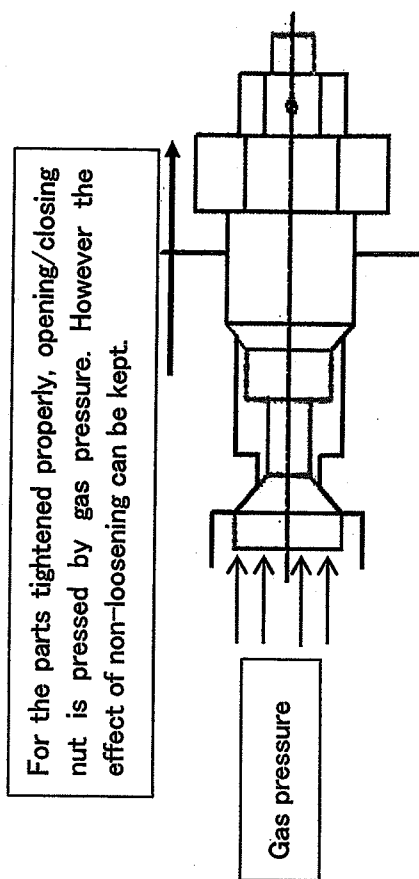
DIESEL ENGINE DEPARTMENT

SERVICE ENGINEERING SECTION

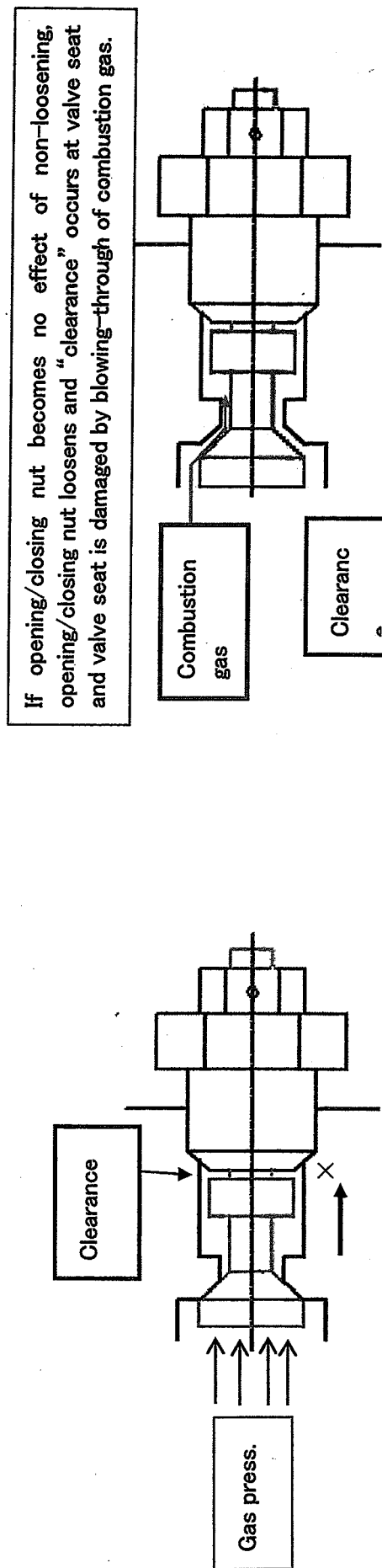
DATE OF ISSUE: July 5, 2005

Fig. 2 Mechanism of Gas Blow-by due to Loosening of U-nut

In the case that U-nut is sufficiently tightened:



In the case that U-nut has been loosened and a clearance has occurred between opening/closing nut:



Since "clearance" occurs on trouble parts of poor tightening, gas pressure does not work to opening/closing nut and effect of non-loosening of U-nut is reduced.



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TEL : (078)-672-3797 FAX : (078)651-4166

Subject : Rupture Disk of Starting Air Pipe		Classification	Mitsubishi Sulzer Diesel Engine	
		Type	RTA84C, 96C	
		No.	MSI-0601E	
There are engines whose starting air piping is equipped with the rupture disks in addition to the safety valve as the safety device for preventing piping system from breaking if an accidental sudden rise in pressure occurs in the starting air pipe. The burst pressure of rupture disk becomes lower due to aged deterioration even though it is used in the normal condition. For this reason, the rupture disk may burst in even the case where an abnormal rise in the pressure does not occur in the starting air pipe. Even though the rupture disk does not burst, we would request you to replace the disk with the new disk every about two to three years in accordance with the type of disk as the periodical maintenance inspection. In addition, for the procedure of inspection and replacement, please follow the instruction manuals filed in "FINAL DRAWING" for each ship.				
HISTORY		Approved	<i>E. S. Li</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Feb. 3 rd '06
		Checked	<i>Y. Izuhashi</i>	
		Designed	<i>K. Tazumi</i>	



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1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Engine Parts	Classification	Mitsubishi Sulzer Diesel Engine
	Type	All Types
	No.	MSI-0602E Rev.1

In our manufactured engines, the engine troubles have occurred due to the fact that the engine parts, whose supply sources were not our company, were mounted to our engines.

In particular, as for the following functional parts and the parts affected with engine performance, the best tuning for the parts may be employed on the material and manufacturing from the standpoints of improvement in reliability and performance and adaptability to IMO Nox regulation. Furthermore, in the case of the ship in compliance with IMO Nox regulation, the engine has to be operated by using the applicable parts mentioned in the Technical File.

Taking the above into consideration, please place orders for the engine parts with our company from the view points of maintaining good engine running condition, preventing engine troubles, and the safe operation of the ship.

[When ordering the parts from us, please advise us of the engine type, the engine number, and the name of the ship (or the hull number together with shipyard).]

Functional parts and the parts affected with engine performance:

Cylinder liner*, Cylinder cover*, Piston crown*, Piston ring, Piston rod* and gland packing,
Compression shim*, Exhaust valve spindle & valve seat, Fuel oil injection valve*,
Fuel oil injection pump*, Fuel cam*, Exhaust cam*, Turbocharger*, Air cooler*, Various bearings
Besides, accessories of the above parts

Note: The parts marked with (*) are the parts in compliance with IMO Nox regulation.

For RT-flex type engine,

Cylinder liner*, Cylinder cover*, Piston crown*, Piston ring, Piston rod* and gland packing,
Compression shim*, Exhaust valve spindle & valve seat, Fuel oil injection valve*, Turbocharger*,
Air cooler*, Various bearings

Besides, accessories of the above parts

Exhaust valve upper housing*, Exhaust valve housing*, Housing of partition device (exhaust valve unit)*, Software package*, Control module*, Injection control block (unit)*

HISTORY	Rev. 1 Added RT-flex type: May 2007	Approved	S. Shindo	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Sep. 28 th 2006
		Checked	Y. Izuhara	
		Designed	K. Tatsumi	



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 TEL (078) 672-4082/4087 TELEX J78846

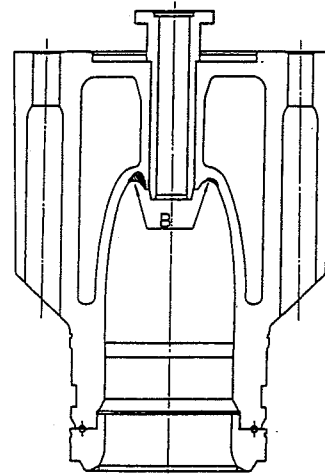
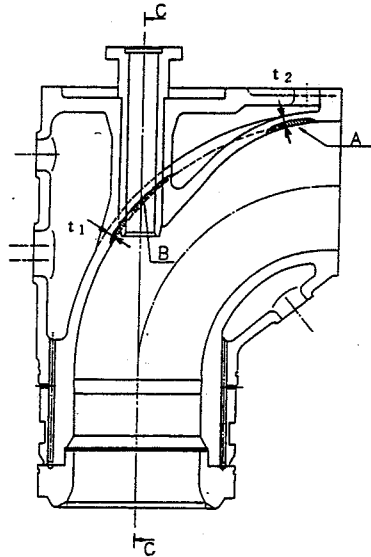
Subject : MITSUBISHI SULZER RTA TYPE ENGINES Low Temperature Corrosion along Exhaust Gas Passage Part in Exhaust Valve Cage	Classification	MITSUBISHI SULZER Diesel Engine
	Type	RTA
	No.	MSI-8707E Rev.5

The corrosion has been found, although exceptional, along the "A" and "B" parts as shown in the following sketch on the ships in service.

Accordingly it is requested to have inspection on the above parts at each time the exhaust valve cage are overhauled.

The allowable depth of the corrosion is to be not more than half of thickness and the repair by welding shall be made in case the depth exceeds the above limit. (The under-mentioned table is to be referred to for the designed thickness of each engine model.)

We would like to recommend you to place a repair order with our company because the repair work needs a special technique due to the material of cast iron.



SECTION C-C

Remark: The corrosion on "B" part is remarkable due to swirling at the stern side.

Engine Type	RTA48	RTA58	RTA68	RTA76	RTA84
t ₁	18	22	30	24	30
t ₂	18	22	40	24	30

(mm)

Engine Type	RTA52	RTA52U	RTA62	RTA72	RTA84M	RTA84C(UG)	RTA96C	RT-flex96C
t ₁	22	25	30	35	30	35	45	45
t ₂	22	35	30	40	30	40	45	45

HISTORY

- ④ RTA52U, RTA96C were added. (Oct., 2005)
- ① Marks t₁ and t₂ have been added in the sketch.
- ② Added t₁ and t₂ of RTA48,52,62,72,84M engine.
- ③ Added t₁ and t₂ of RTA84C engine.

KOBE SHIPYARD & MACHINERY WORKS
 DIESEL DEPARTMENT

MHI DIESEL SERVICE CO., LTD.
 KOBE BRANCH
 TECHNICAL SERVICE DEPARTMENT

Jan. 1994

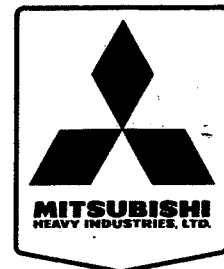
Rev. 5: Added RT-flex96C: May '07

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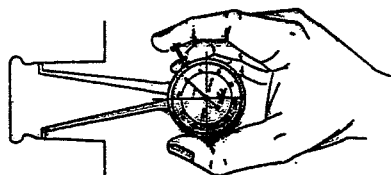


Subject : Wear of Piston Head Ring Groove		Classification	MITSUBISHI-SULZER Diesel Engine
		Type	RND (M) , RL, RTA
		No.	MSI-8802E
When the operating time of the piston heads exceeds approximately 20,000 hours (inclusive of reused ones with repair by welded), the chrome plated layer at the bottom surface of the top ring grooves particularly is worn and the shape of the grooves is changed into wedge shape as the case may be. Consequently the breakage of the top rings frequently occurs as the secondary damage. Therefore when the pistons are overhauled, it should be confirmed whether the plated layer at the bottom surface of the top ring grooves remains or not, and furthermore the heights of the ring grooves at cut end and inner part, i.e. "a" and "b" shown in the figure should be measured. By our experiences when the size "a" exceeds 0.3~0.5mm and above beyond the original size, the rings tend to be broken, consequently it would be recommended that such ring grooves should be repaired by welded deposit. In the above repair work the base metal of the piston head or the equivalent metal generally has been used as the welding rod material for primary deposit by welding prior to chrome plating. The repair method for the preventive measure against wear has been especially established by our company, and proved that such method was effective on elongation of the repaired parts life time. Therefore it would be recommended that the order for the above repair work would be placed to our company. Note: 1. The example of plaster mold of the ring groove wear shape Original size of the ring groove $a, b = 18 + \begin{matrix} 0.47 \\ 0.42 \end{matrix}$ 2. The remaining chrome plated layer is confirmed by the following method. A file is slid diagonally with pushing on the layer surface, and • When a file slips, the layer remains • When a file scratches, no layer remains. - 1 -			
HISTORY	Added measuring procedure of the ring groove on March, 1989.		KOBE SHIPYARD & ENGINE WORKS DIESEL DEPARTMENT
			MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT

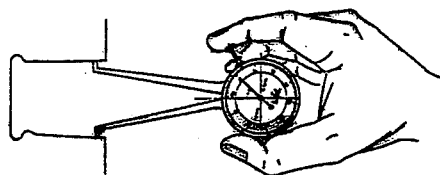
Measuring Method of Ring Groove

1. If a Caliper gauge is available, please measure surely at (a) and (b) points.

(b)

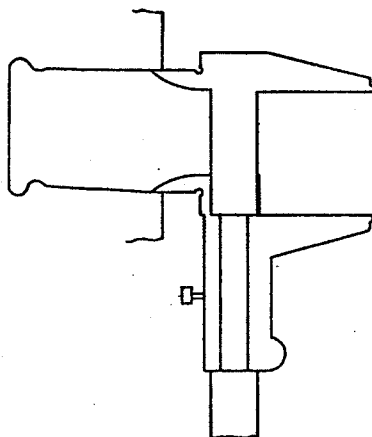


(a)



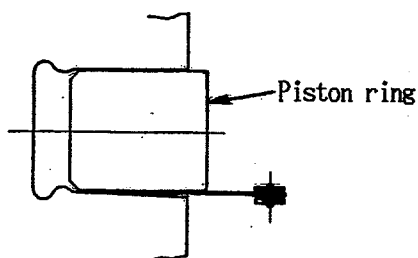
2. If a Caliper gauge is not available, please measure according to the methods below.

2.1. Measure only (a) point by Vernier Caliper for reference.

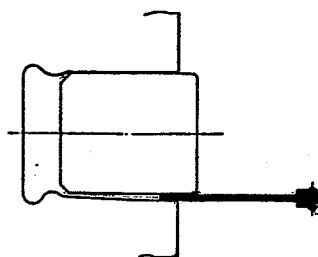


2.2. After inserting and pushing up the ring to groove, measure the lower side clearances between ring and groove bottom face at (a) and (b) points by Feeler gauge.

(b)



(a)



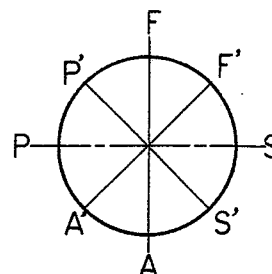
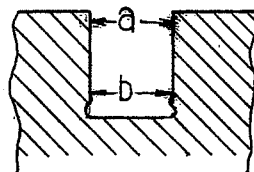
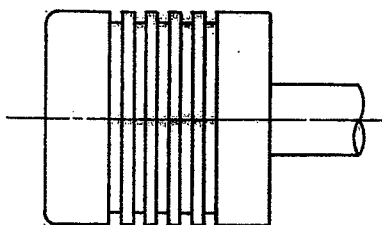
※ The upper surface of groove has almost small wear compared with bottom face.
if you measure the upper side clearance, you could not get the true wear of groove including the circumferential wear pattern.

M/V

Date : _____

Running Hrs : _____

Measurement Record of Piston Ring Grooves



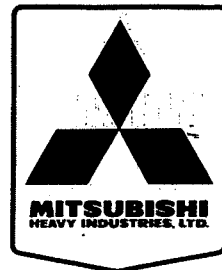
CYL. No.	STAGE No.	POSITION	F	F'	S	S'	A	A'	P	P'
	1	a								
		b								
	2	a								
	3	"								
	4	"								
	5	"								
	1	a								
		b								
	2	a								
	3	"								
	4	"								
	5	"								
	1	a								
		b								
	2	a								
	3	"								
	4	"								
	5	"								

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TEL (078) 672-3111 TELEX J78846



Subject : Cracks on Cylinder Liners	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	RND-M, RL, RTA
	No.	MSI-8804E

Generally speaking, the low grade heavy fuel oil has the various properties.

The properties of the said oil is particularly more complicated according as the petroleum refinery method varies, and therefore, assessment of quality of the fuel oil is considered to be difficult only by the fuel oil specifications from oil supplier when bunkerd.

Recently, many cases of supply of undesirable fuel oil, e.g. unflammable oil which may cause after burning, fuel oil which has unbalanced distribution in some of the contents such as vanadium/sodium, have been experienced in addition to the supply of fuel oil produced by Fluid Catalytic Cracking method that had sometimes given the problems.

It is presumed that the above cases may be come out from poor quality of basic oil or complicated refinery procedure of the oil, and among the rest, unflammable fuel oil is difficult to burn in the short time which is required for diesel engines, resulting in severer conditions to the combustion spaces.

According to the above-mentioned conditions, the cracks on the cylinder liners which had have been rarely reported in the past, have occurred recently in several cases on some of the vessels with RND-M, RL and RTA type engines, and in the heavier case the cracks partly penetrated through to the cooling chambers.

The followings are the conditions of crack occurrence, the assumed causes of the cracks, and the cares to be taken for the future treatment for your reference.

- 1 -

HISTORY	KOBE SHIPYARD & ENGINE WORKS DIESEL DEPARTMENT
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT
	December, 1988

1. Crack Conditions

There are roughly two patterns reached into the cracks as shown in p.4.

2. Causes of the Cracks

The direct cause of Case-1 is assumed that the combustion gas in the more volume exceeding the normal amount made blow-by by the broken piston rings, therefore the cylinder liner wall temperature rose, and the cracks and partly heat-check like tortoise shell occurred.

Cracks

It is assumed that the cracks on Case-2 occurred due to scuffing. When the friction on the sliding surface between piston rings and cylinder liners increases due to oil film break and/or fouling by sludge, etc., the temperature in way of these parts rises and reaches the melting point, and this results in scuffing.

When scuffing develops into remarkably worse stage, the wear in cylinder liners and piston rings increases, and results in break of piston rings. Accordingly the blow-by of combustion gas increases more, and the break of oil film proceeds, and the cylinder liners and piston skirts are deformed in proceeding of the above conditions.

Particularly the piston skirts themselves are not cooled though cylinder liners are cooled, therefore they expand by high temperature, generating the higher temperature by scuffing cylinder liners with the expanded skirts and the above phenomenon is assumed to result in the crack and damage of both cylinder liners and piston skirts.

Although the phenomena are as mentioned above, the cracks and damages occur possibly due to the complicated factors.

Therefore, when the indications at least are observed in the ordinary inspection and/or overhauling inspection, various factors and/or causes shall be totally checked.

Being advised that the causes would be clarified referring to the attached table of the causes, and the necessary countermeasures would be taken as soon as possible.

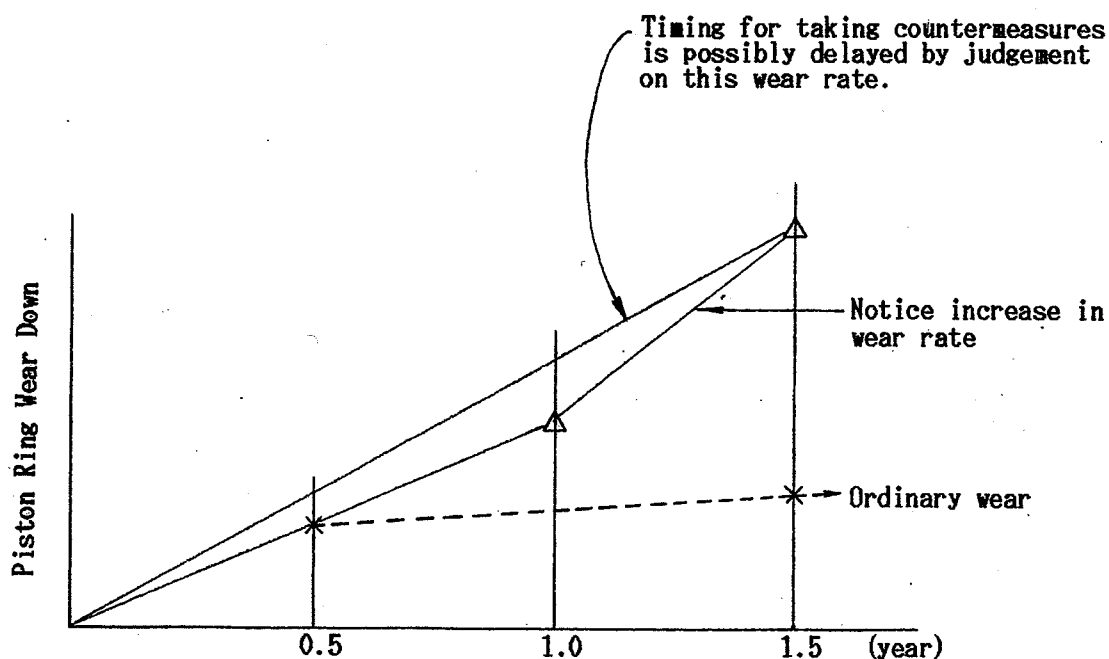
In conclusion, the most important thing is that the wear condition of piston rings and their breakers shall be observed carefully.

Even in the case the engines are operated aiming at long time no-overhauling, it is necessary that some of cylinders among all cylinders are alternately selected for overhauling, and any of cylinders is checked for observing the wear condition of piston rings every half or one year.

The conditions of the other cylinders also can be estimated by the above method, and furthermore the variation of the conditions of piston rings is able to be realized early, and it is possible to take the necessary countermeasures.

→ Early finding out extraordinary wear of piston rings

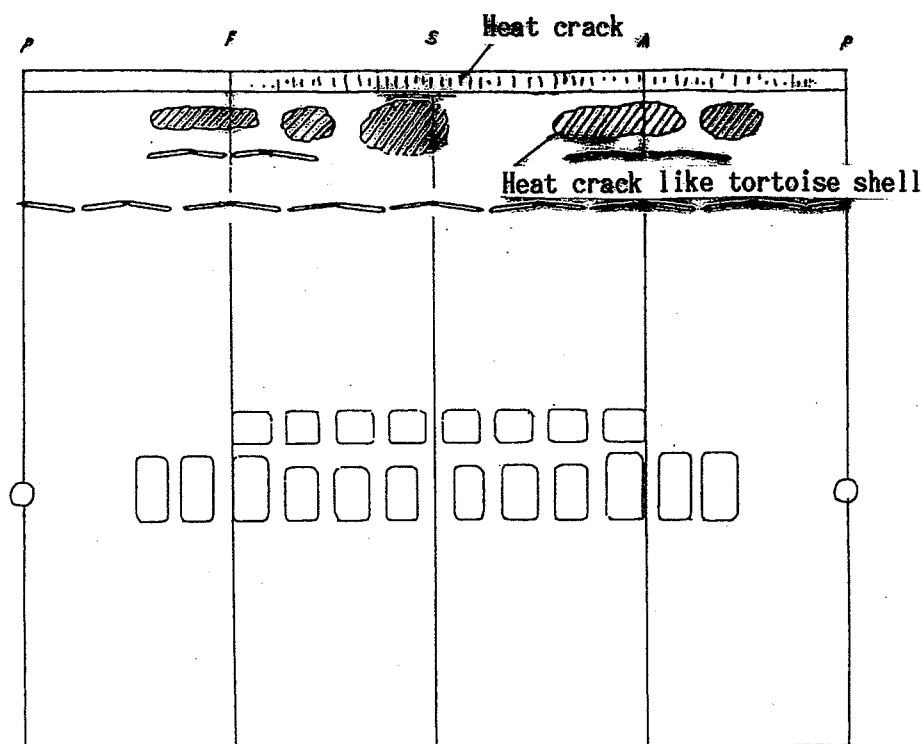
→ Prevention the cracks on cylinder liners



It is able to be judged for this period that the other cylinders shall be noticed.

Fig.-1 Appearance of Crack on Cylinder Liner Running Surface

Example-1



Example-2

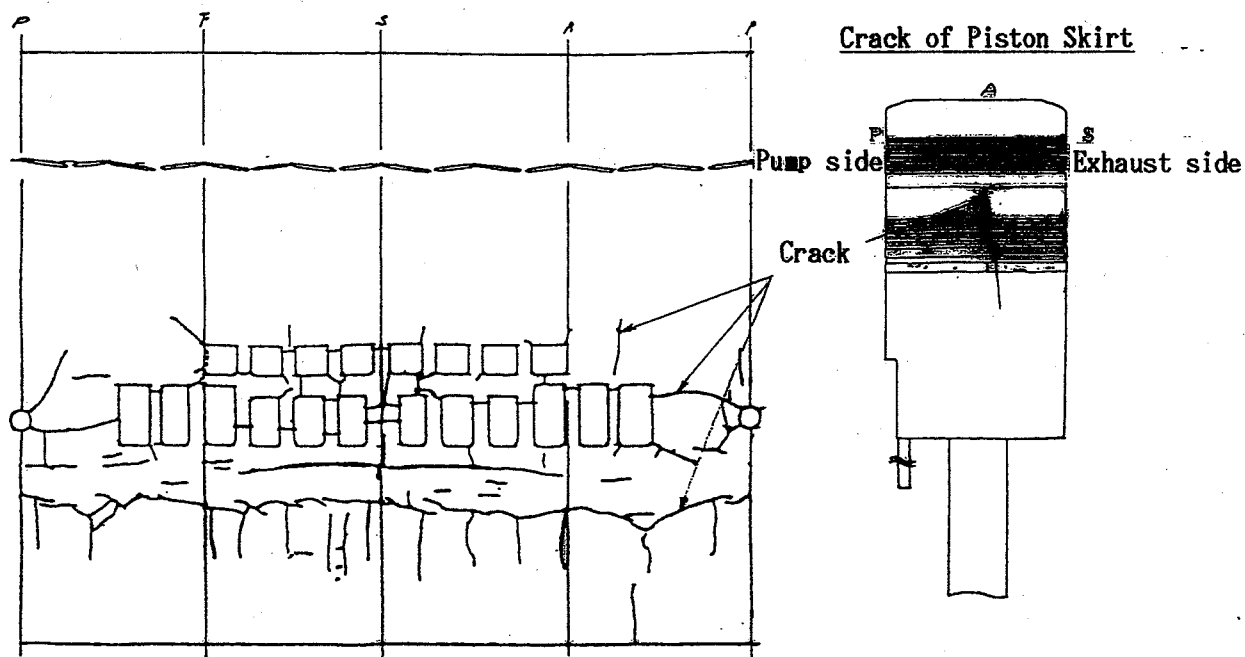


Fig.2 CYLINDER LINER HEAT CRACK
(Heat Cracks of Upper Part on Cyl. Liner)

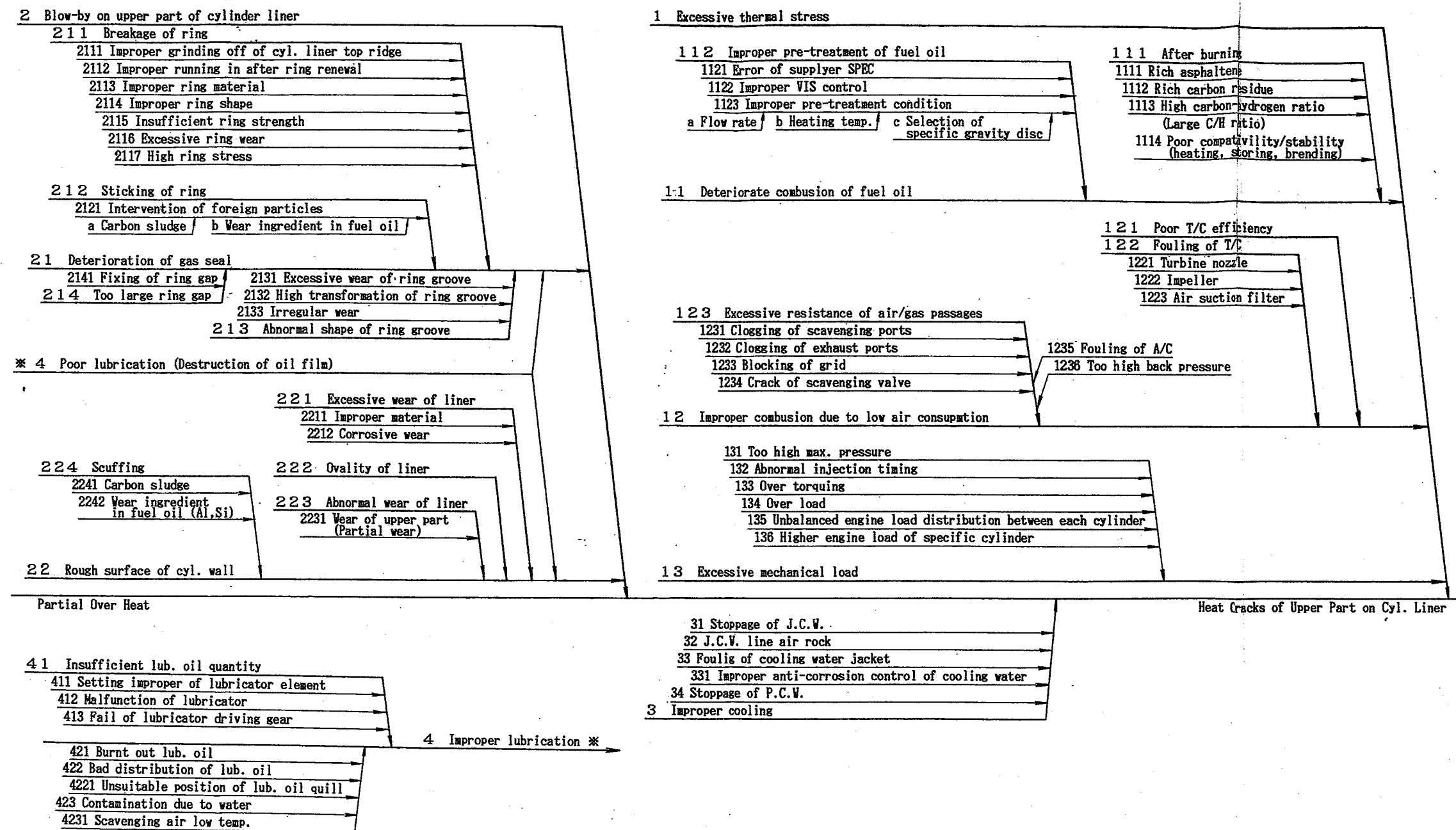
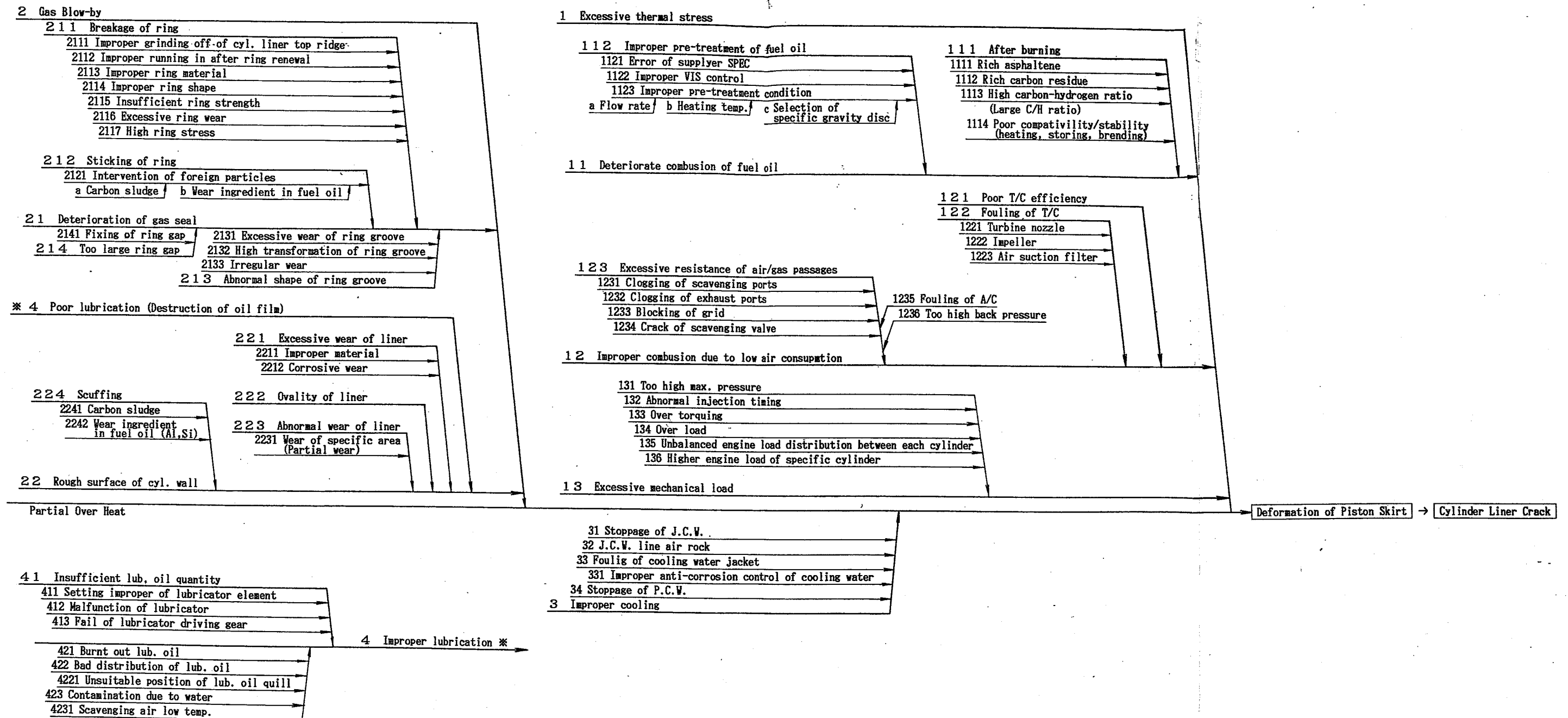


Fig.3 CYLINDER LINER HEAT CRACK

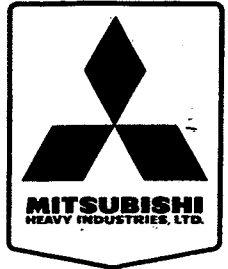


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Subject : Control of System Oil Quality	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	RTA
	No.	MSI-8805E

Change of system oil properties tends to become greater somewhat with the adoption of the long stroke type and higher turbo-charging system on RTA type engine compared with the conventional type of engines.

Particularly the problems raised by the users are the increase in TBN and viscosity. The view points as engine maker would be advised as follows, and it would be appreciated if you could understand the matters hereunder and treat properly them.

1. The Highest Limit Value of TBN

The lowest limit value of TBN in the system oil is strictly stipulated because of additive's property, however as for the highest limit value of TBN, there is no established theory, and the cases almost can not be found in which the limit value had been stipulated.

The lowest limit value of 2.0 is given as shown in Page 3 (075-1) (attached hereafter) of RTA type engine Instruction Book, but the highest limit value is not specifically given.

TBN of the system oil essentially increases as its viscosity increases as the time elapses and it is actually impossible to prevent such tendency, due to the use of high alkaline oil for cylinder oil.

Additives and dispersed sludge in system oil is corpuscle, and there is no apprehension that its lubricity become worse.

On board in service, over 30 TBN is shown as the experienced example in the data on Page 4, however no actual harm has been reported.

Consequently even if the alkaline value (TBN) increases somewhat, it is considered that this fact need not be regarded as questionable.

- 1 -

HISTORY		KOBE SHIPYARD & ENGINE WORKS DIESEL DEPARTMENT
		MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT

2. View Concerning Make-up Using SAE20 Lub. etc. for Decreasing the Viscosity

When the increase in viscosity within the specified value is difficult by adding the same kind of system oil, supplement of the same base SAE20 of low viscosity grade is generally adopted for decreasing the viscosity.

The follow-up data in the above measure on board ships are shown in Page 4 for your reference.

In each cases the remarkable change of viscosity was observed, however no disadvantage had not been reported.

The somewhat rapid increase in viscosity was observed in the actual results, and it is considered that the increase in viscosity is related to the property of the used oil, etc., and also to the life-time of oil scraper rings in any way. Consequently the renewal of the oil scraper rings at the appropriate interval would be recommended.

When comparatively large quantity of new oil is supplied into the old oil at one time, the contaminants in the oil system disolube into which the fouling of system oil, or the sludge in oil purifier increases in some case, and in the other case the persion of the sludge in the oil become difficult due to decreased alkaline value.

The temporary measure such as the operation of the centrifugal separator by the decreasing in oil nominal passage is necessary as the case may be.

3. Wear of Oil Scraper Rings

As the result of following up the actual results on board ships, the case was reported that particularly two upper oil scraper rings reached the wear limit in comparatively shorter period.

Accordingly the material quality and shape of oil scraper rings are planned to be modified, and the applicaiton to the ships in service are being prepared to be introduced to the customers.

MITSUBISHI-SULZER

075-01

The analysis values of the lubricating oil should remain within following characteristic which be taken as guidance values;

Type of oil		R&O type	HD type
Viscosity	cst 40°C	+30%	+30%
(Change % of the new oil)		-10%	-10%
Flash point	coc °C	min. 180	min. 180
Water	vol.%	max. 0.2	max. 0.2
Salt		if water over 0.5 vol.%, report needs salt content	
Heptane insolubles	wt.%	max. 0.5	max. 1.0
Toluene insolubles	wt.%	max. 0.3	max. 0.6
Total acid number	KOH mg/g	New oil + 1.5	—
Strong acid number	KOH mg/g	0	0
Total base number	KOH mg/g	—	min. 2.0

Should one of these values be reached, remedial action must be taken to bring the oil charge back to the normal condition. This can be achieved by intensified separation, treatment in a renovating tank (settling tank) or by a partial exchange of the oil charge. It is recommended that the oil supplier be consulted.

3. Cylinder Lubricating Oil

Under normal running conditions an additive type, alkaline cylinder lubricating oil of SAE 50 viscosity grade should be used. Modern cylinder lubricating oils are nearly all of the single phase type where the alkalinity providing additive is in solution with the base oil. The alkalinity of the oil is indicated by its Total Base Number (TBN, unit: mgKOH/g).

The alkalinity of the lubricating oil must be chosen with regard to the sulphur content of the fuel, the higher the sulphur content, the higher the lubricating oil's alkalinity (TBN) must be.

The following relation is indicated for guidance:

Sulphur in the fuel (%):	0.5	— 1	over 1
TBN of the lub. oil (mgKOH/g):	20	— 25	60 — 70

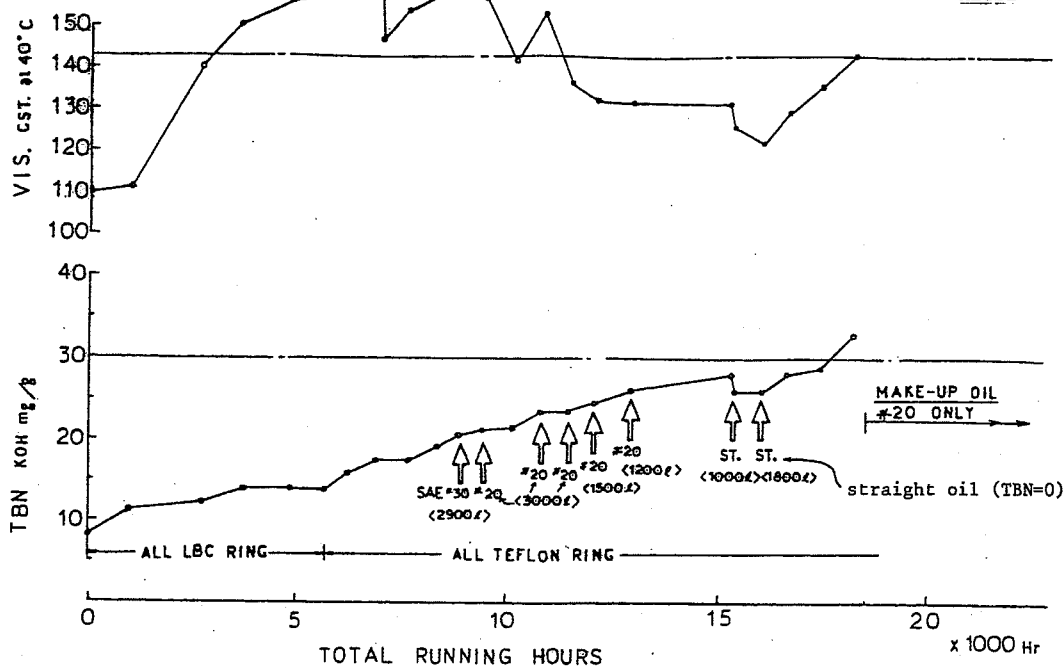
If the engine is run continuously with a fuel of high sulphur content, the application of a cylinder lubricating oil with a TBN higher than 70 can also be considered.

When running the engine continuously on a fuel having a very low sulphur content, i.e. sulphur content below 0.5% by weight, an excessively alkaline cylinder lubricating oil must be avoided. Such a combination can easily lead to scuffing of the piston ring and cylinder liners, particularly after a piston overhaul (new rings).

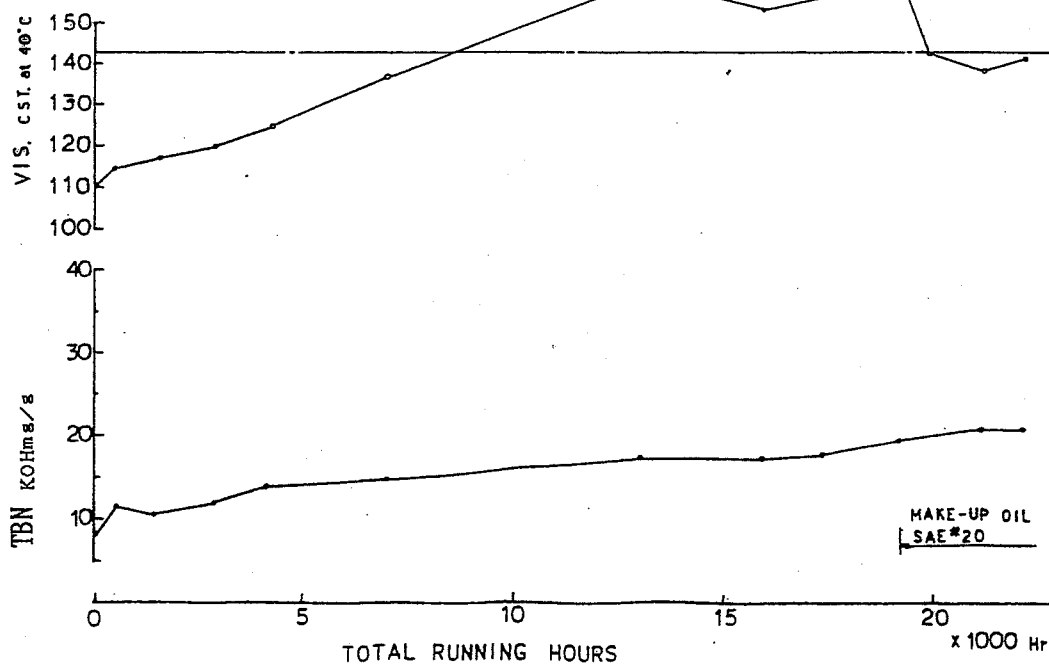
In practice, lubricating oils having a TBN of about 15 have proven successful in service.

RT
1987
M

M/V "AA" 6RTA58
ROD LEAK OIL 90L/D
REUSE



M/V "S MARU" 5RTA76
ROD LEAK OIL 50L/D
REUSE

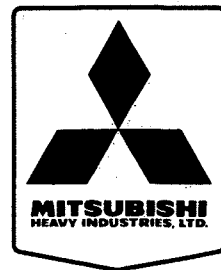


MITSUBISHI SERVICE INFORMATION



MHI Diesel Service Co., Ltd.

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KOBE BRANCH 1-1, 1-CHOME, WADASAKICHO, HYOGOKU, KOBE, JAPAN
TEL (078) 672-3111 TELEX J78846



Subject : Chamfering of Scavenging Ports on Cylinder Liners

Classification	MITSUBISHI-SULZER Diesel Engine
Type	RTA
No.	MSI-8809E Rev.3

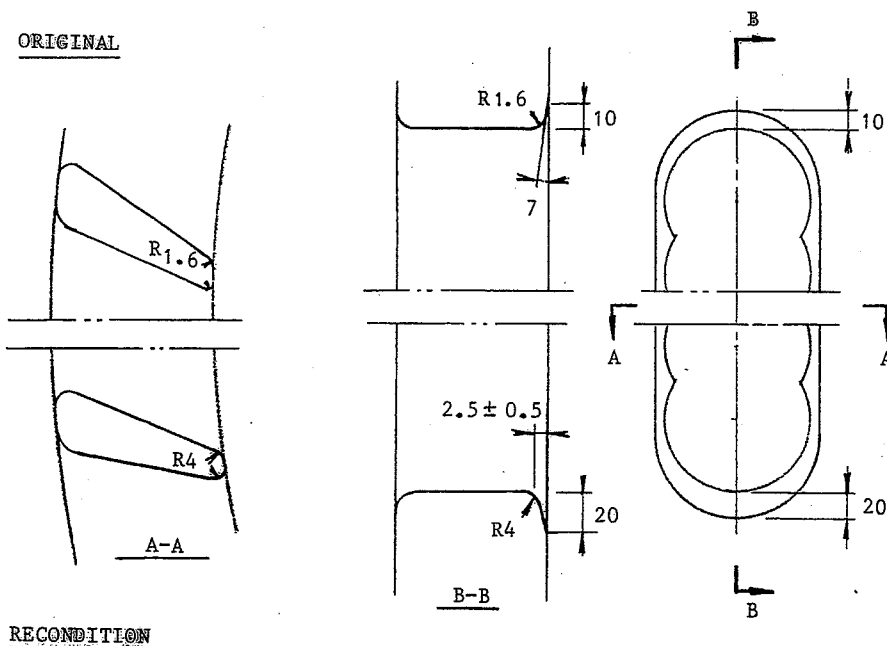
In relation to the breakage of piston ring during operation, you are advised to check for whether or not chamfer at the upper and lower edges of scavenging ports on the cylinder liners remain sufficiently when the pistons or exhaust valves are overhauled.

Liner wear around the ports is much less in the normal condition, however it is the exceptional case that the round part around the port edges become sharp due to wear down.

In this case the position of rings gap will be easily caught by this sharp edges of port, possibly resulting in breakage of ring.

Consequently, you are advised that rechamferring should be made as shown in the following figure depending on the chamfer condition of the port edges.

A small-sized grinder is most suitable to chamferring and a file and emery cloth should be used for finish work.



- 1 -

HISTORY

⚠ Mar.1989. Changed on port edges dimensions at rechamferring.

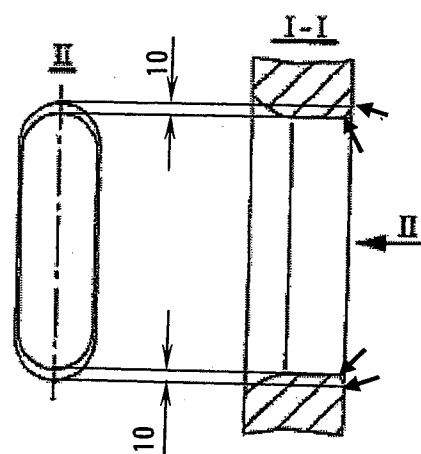
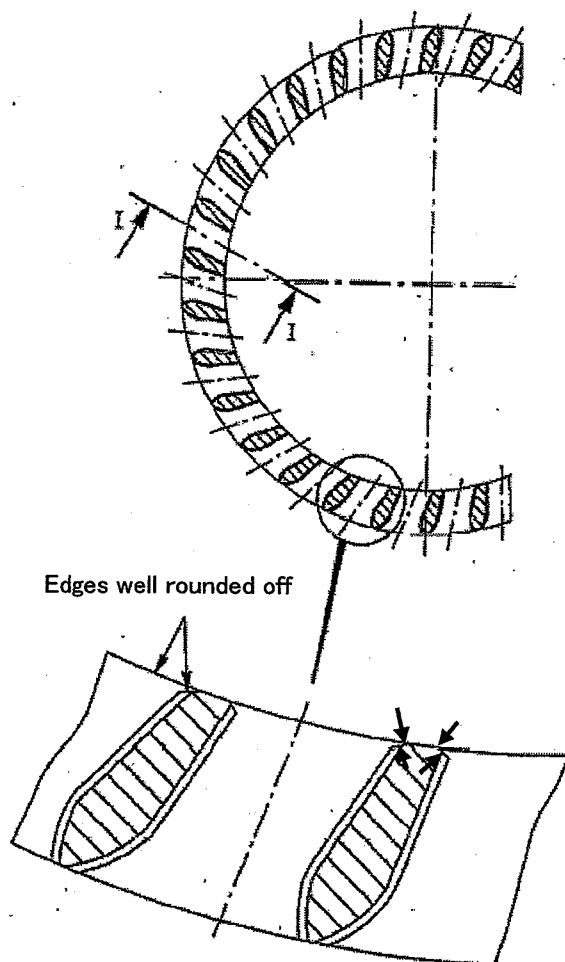
⚠ Page 2 was added. Apr. 2005

Rev. 3 Added RT-flex 96C May, 2007

KOBE SHIPYARD & ENGINE WORKS
DIESEL DEPARTMENT

MHI DIESEL SERVICE CO., LTD.
KOBE BRANCH
TECHNICAL SERVICE DEPARTMENT

December, 1988



↑ :Edges well rounded off

RTA96C/RT-flex96C



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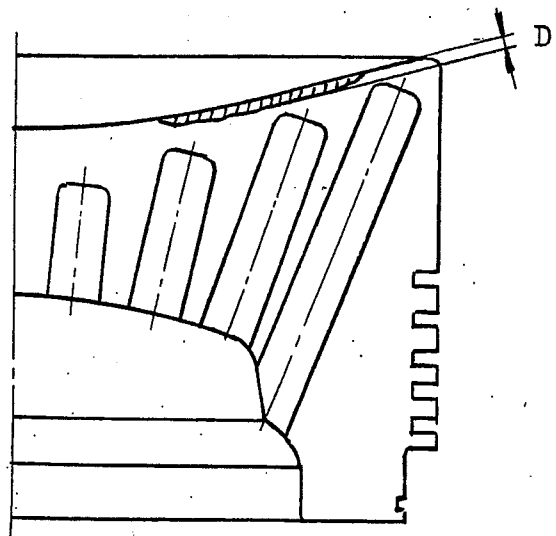
SERVICE INFORMATION

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KOBE SHIPYARD & MACHINERY WORKS
DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION
1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject : Allowable Limit of Wear (Burnt-off) on Combustion Surface of Piston Crown	Classification	Mitsubishi Sulzer Diesel Engine
	Type	All RTA types
	No.	MSI-8810E Rev. 4

We established the criteria as under-mentioned for the limit of wear allowable for combustion surface of piston crown, and so we are pleased to inform you thereof.

Type of Engine	Limit of Wear D (mm)
RTA48	8
RTA58	8
RTA68	8
RTA76	9
RTA84	10
RTA52(U)	10
RTA62	10
RTA72	10
RTA84M	10
RTA84C(UG)	10
RTA58T	10
RTA96C	10
RT-flex96C	10



Further, for the wear which has reached the limit value, we can recondition it by welding, and therefore we beg to be favored with your order.

Note) The general situation is such that the wear on combustion surface of piston crown is generated on the area onto which injection by fuel valve directly hits.

A progress of wear is generally slow and usually inevitable, and the causes include the following items, and therefore deliberate precautions should be given to engine maintenance:

- 1 -

Rev. 4: Added RT-flex 96C, May 2007

HISTORY	① Mar.1995 Added RTA84C.	Approved	<i>[Signature]</i>	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Mar. 1995
	② Jan.2002 Added RTA52U.	Checked	<i>[Signature]</i>	
	③ Added RTA58T, 96C. Apr. 2005	Designed	<i>[Signature]</i>	

- Fuel system : Debasement of fuel oil including the corrosive component, unsuitable heating temperature of fuel oil, inadequate cleaning of fuel oil, inadequate maintenance of fuel pump or fuel valve, enlarged and wear down nozzle hole of fuel valve.
- Overload : Torque rich of engine
- Fall of cooling effect : Abnormality of cooling water (oil) passage, contamination of cooling water (inadequate maintenance of telescopic pipe packing, poor removal of oil content in cooling water), accumulation of scale in cooling side of piston crown.
- Shortage of air quantity: Contamination of scavenging air and exhaust gas system, damage in scavenging valve plate.



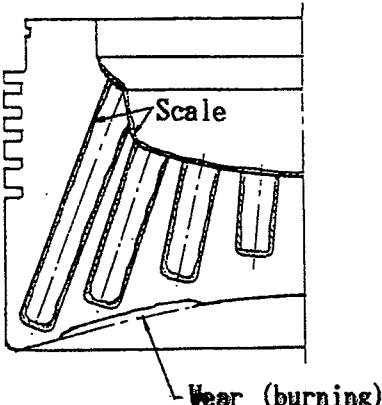
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SERVICE INFORMATION



MHI Diesel Service Co., Ltd.

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TEL (078) 672-3111 TELEX J78846

Subject : Periodical Inspection of Piston Head Cooling Space		Classification	MITSUBISHI-SULZER Diesel Engine
		Type	RL, RTA
		No.	MSI-8902E
Special attention should be paid for wear (burning) on combustion surface of piston head as we informed you through the Service Information MSI-8810 previously published. In the Service Information, a reduction in cooling effect is mentioned as one cause of wear. As the result of recent investigation of piston head which is subject to severe burning, it proved that a large amount of scale (oily sludge) had adhered to the cooling side including cooling bores, and we confirmed that this had become a cause of burning. Hereafter, from the viewpoint of preventing this problem, we would recommend you to overhaul piston heads and inspect inside of at least one to two heads in the first two to three years after ship commissioning even if there is no abnormality on combustion surface irrespective of water cooled, or oil cooled, and then, to carry out piston overhauling for cleaning of scale on inner cooling surface at intervals of three to four years depending on its conditions. Further, in case that occurrences of abnormal burning are found, it is necessary for you to carry out piston overhauling immediately and check the state of cooling side.			
 The diagram shows a cross-section of a piston head. The top surface is the combustion surface, and the bottom surface is the cooling side. A layer of 'Scale' is shown adhering to the cooling side. The combustion surface shows 'Wear (burning)'.			
HISTORY	KOBE SHIPYARD & ENGINE WORKS DIESEL DEPARTMENT		
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT		
	April, 1989		



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Subject : Speed-Up Trouble When Passing Through Barred Range for Torsional Vibration	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	RND-M, RL, RTA
	No.	MSI-8903E
Recently, we have received reports about the trouble that engine speed remained tied up or could not be increased in the barred range, in case its range being in the harbor speed range. It is considered first of all that these are attributed to the fact that scavenge pressure limit of governor functioned in relation to the slow follow-up of turbo-charger in response to the rapid rise of engine load. Therefore, in case that such problems should take place, we would like to request you to take emergency measures immediately as mentioned below. <u>In case that device for EMERGENCY RUN is provided.</u> In order to release the scavenge pressure limit of governor, keep pressing EMERGENCY RUN push button on manoeuvring panel until the revolution goes up outside of barred range. <u>In case that scavenge pressure limiter release device is provided.</u> Operate the release switch on manoeuvring panel until the revolution goes up outside of barred range. <u>In case that neither device as above-mentioned is provided.</u> We would recommend you to add the device at control room for electrically energizing solenoid valves in pneumatic logic box in order to cancel the scavenge pressure limit. However, since it is conditioned that two spare wires should be provided among DC 24 source, C/R and pneumatic logic box, its confirmation is required. Note: Since it is also considered that the above-mentioned problems will be raised in connection with fouling of ship hull or performance deviation of engine, we hope that you should take measures for remedy early. And there are cases in which problems take place in connection with navigation in rivers or shallow seas.		
HISTORY	KOBE SHIPYARD & ENGINE WORKS DIESEL DEPARTMENT	
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT	
	May, 1989	

MITSUBISHI SERVICE INFORMATION

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 TEL: (078) 672-3770 FAX (078) 651-4166



Subject : Fuel Nozzle Maintenance Record Sheet	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	RND (M) , RL , RTA
	No.	MSI-8906E

For the major component parts (cylinder cover, cylinder liner, piston head etc.) around combustion chamber, we hope that the history of use in respective part may have been usually clearly recorded.

In regard to fuel nozzle, even in view of importance of parts, its history of use should be recorded and followed similarly.

However, owing to actual circumstances of frequent replacement of fuel nozzle, we see that there are many cases in which maintenance records on board are not so clear.

It is well known that fuel nozzle has limit of use by itself, and therefore we would request you to grasp and make clear respective accumulative running hours and the number of maintenance (or recondition) also for the purpose of maintaining good combustion condition and preventing various defaults around combustion chamber due to poor combustion.

We consider that maintenance interval for reconditioning at shop or time when any fuel nozzles should be abandoned can be almost properly discriminated on-board ship by retaining continuously these data.

In this sense, we have prepared recording sheet as attached herein this time, and we have the pleasure to introduce the sheet as well as example of description.

Then, we would request you to distribute it to each ship owned by you and make the best use of it hereafter by all means.

- 1 -

HISTORY		KOBE SHIPYARD & ENGINE WORKS DIESEL DEPARTMENT
		MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT
		April, 1989

MITSUBISHI-SULZER

M/V " " , Main Engine "

FUEL NOZZLES MAINTENANCE RECORD

Nozzle Type "

[illegible]

Modified Nozzle Type " " ; No. of Nozzle () () ()
(if any)

M/V "

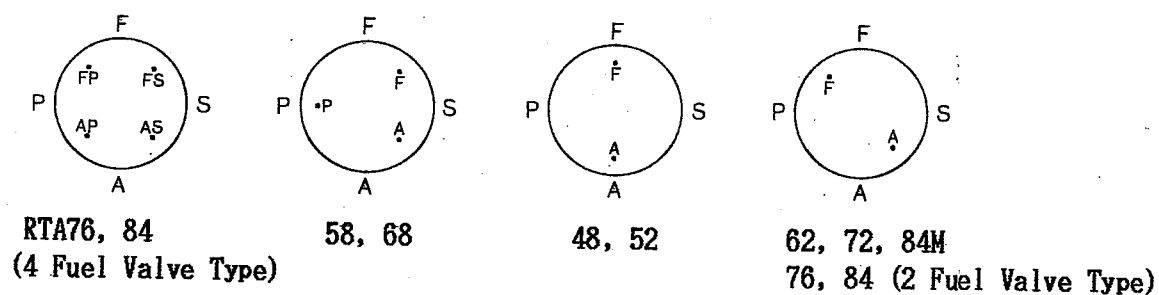
, Main Engine "6RTA58"

FUEL NOZZLES MAINTENANCE RECORD

Nozzle Type "N333"

No. of F.O.V.	No. of Nozzle	Date		Jan. 16, 1989 ①		Apr. 20, 1989		Aug. 30, 1989		Dec. 15, 1989			
		Place (TRH)		Kobe ② (0 ③)		Nagoya (1600)		Kobe (3600)		Tokyo (5600)			
				Existing	Service Hr.	Existing	Service Hr.	Existing	Service Hr.	Existing	Service Hr.	Existing	Service Hr.
				New	Cyl. No.	New	Cyl. No.	New	Cyl. No.	New	Cyl. No.	New	Cyl. No.
④				⑤	⑥ / ⑦		/		/		/		/
				⑧	⑨								
[Example]	8806-01			123-001	0 / 0	123-001	1600 / 1600		/	123-007	0 / 0		/
					1 - P	123-007	Spare (0)				2 - P		
	8806-02			123-002	0 / 0	123-002	1600 / 1600	123-002	3600 / 3600	123-001	0 / 1600		/
					2 - P		2 - P	123-001 R1	Spare (1600)		1 - P		
					/		/		/		/		/
	8806-05			123-005	0 / 0	123-005	0 / 0		/	123-005	4000 / 4000		/
					Spare (0)		1 - P		←		Spare (4000)		
	8806-06			123-006	0 / 0		/	123-006	0 / 0	123-006	2000 / 2000		/
					Spare (0)				2 - P	123-008	Spare (0)		
*	8806-20				/		/		/	122-010 R3	0 / 6000		/
											Spare (6000)		
					/				/		/		/

Viewed from above



- Note: ① Date of replacement
 ② Place of replacement
 ③ Accumulative running hours of main engine
 ④ No. of fuel valve body
 ⑤ No. of fuel nozzle
 (In case recondition is carried out, R1, R2 ... are affixed to the end corresponding to the number of recondition.)
 ⑥ Running hours of fuel nozzle from fitting to detaching on fuel valve body in service
 ⑦ Accumulative running hours of fuel nozzle
 ⑧ No. of fuel nozzle fitted newly to fuel valve body.
 ⑨ Cyl. No. and position where fuel valve is inserted according to above figure only RTA type engines.
 In case of retaining fuel valve body fitted with reconditioned fuel nozzle as spare, accumulated running hours of its nozzle until then shall be written in (). New nozzle has (0).

Example of Entry

Fuel valve body 8806-01

On Jan. 16, 1989, installed fuel nozzle 123-001, and inserted it into P position of No.1 cyl., and started to use.

On Apr. 20, 1989, after withdrawing at running hours of 1600hr, detached fuel nozzle for the purpose of reconditioning, and after installing new spare fuel nozzle 123-007, retained this valve body as spare.

On Dec. 15, 1989, fitted to P position of No.2 cyl. and restarted to use.

Fuel valve body 8806-02

On Jan. 16, 1989, installed fuel nozzle 123-002, and inserted it into P position of No.2 cyl., and started to use.

On Apr. 20, 1989, after withdrawing at running hours of 1600hr, checked, and reused at the same position as it was.

On Aug. 30, 1989, after withdrawing at running hours of 3600hr, detached fuel nozzle from the body for the purpose of reconditioning, and installed fuel nozzle 123-001 which had been reconditioned, and retained it as spare.

On Dec. 15, 1989, installed it into P position of No.1 cyl. and started to use.

Fuel valve body 8806-05

On Jan. 16, 1989, installed new fuel nozzle 123-005 and retained as spare.

On Apr. 20, 1989, inserted into P position of No.1 cyl. and started to use.

On Aug. 30, 1989, not checked at this time and retained as it was.
(← mark written)

On Dec. 15, 1989, after withdrawing and making checks, retained as spare as it was.

Fuel valve body 8806-06

On Jan. 16, 1989, installed new fuel nozzle 123-006 and retained as spare.

On Aug. 30, 1989, inserted into P position of No.2 cyl. and started to use.

On Dec. 15, 1989, after withdrawing, detached fuel nozzle for the purpose of reconditioning, and installed new spare fuel nozzle 123-008 and retained as spare.

Fuel valve body 8806-20

On Dec. 15, 1989, installed recondition fuel nozzle 122-010 and retained as spare.

* Even for fuel nozzles in sister ships of which history of use are unknown, we would request you to start this maintenance recording based on approximate running hours, till now.

29

60



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SERVICE INFORMATION

MITSUBISHI HEAVY INDUSTRIES, LTD.
KOBE SHIPYARD & MACHINERY WORKS
DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION
1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078)651-4166

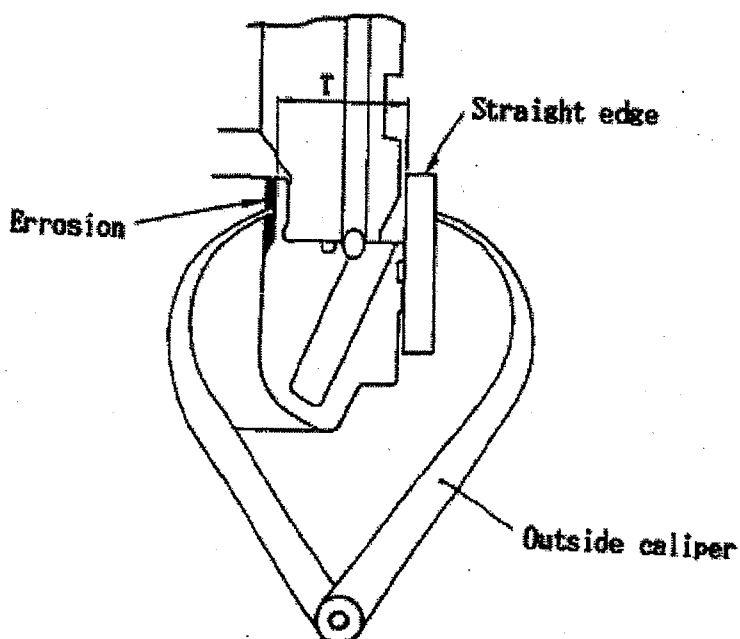
Subject : Corrosion on Exh. gas passage part of Exhaust valve seat	Classification	Mitsubishi-Sulzer Diesel Engine
	Type	All RTA type
	No.	MSI-8914E Rev. 4

Recently there are some cases in which corrosion occurred on gas passage part of exhaust valve seat in some vessels in service.

It is possible to recondition the corroded part by welding for each type of engine, but, since corrosion occurs in the vicinity of thin wall part between valve box and inserted part, you are requested take care of this problem earlier.

Moreover, as for limit of use when corroded, you are requested to judge whether reconditioning is necessary or not, based on the limit dimension on the table below.

Besides, as the quality of high grade and precise dimension control are required for reconditioning, you are requested to order the work from our company.



Engine type	Limit : T [mm]
RTA48	70.0
RTA52/52U	46.0
RTA58/58T	63.5
RTA62	54.5
RTA68	67.5
RTA72	65.5
RTA76	76.0
RTA84(M)(C)(C-UG)	85.5
RTA96C/RT-flex96C	92.5

Rev. 4 : Added RT-flex96C : May 2007

HISTORY	Rev.1 Mar. 1995 Added RTA84C.	Approved	Y. Hasegawa	DIESEL ENGINE DEPARTMENT SERVICE ENGINEERING SECTION DATE OF ISSUE: Mar. 1995
	Rev.2 Jan. 2002 Added RTA52U.	Checked	T. Nasu	
	Rev.3 Sep. 2006 Revised table, added RTA96C. <i>K. Takami</i>	Designed	Y. Izuhara	



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TEL (078) 672-4082/4087 TELEX J78846

Subject : Addition of Groove at Upper Part of Cylinder Liner	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	RTA, RL, RND (M)
	No.	MSI - 9002E
As a means to improve the running condition of piston rings on the cylinder liner of the RTA and RL engines, an additional groove at the upper part of cylinder liner has been taken into consideration and has already been applied to some engines. Its details and effects expected are as follows and it is recommended to apply it to every ship at her docking or other chances if it has never been applied to her. When applying this groove to the engine, please contact us because special tools are needed for this work. <u>1. Addition of groove at upper part of cylinder liner</u> This groove is made on the running surface of cylinder liner at the position corresponding to the T.D.C. of the top piston ring. (See Fig.1.) <u>2. Effect and influence of groove</u> (1) Prevention of step(wear ridge)on liner When the liner has worn down to a certain extent a step(wear ridge)appears due to the difference in level between the running surface of liner and the surface on which piston rings do not run. For the engines which are not overhauled for a long term, it is not easy to remove this step completely. The trouble caused by this step can be avoided by marking a groove on the liner surface at the position corresponding to the T.D.C.of the top piston ring. a) It can be thought that when the operating condition changed, the upper corner of piston ring bits this step, and abnormal wear and deformation occur on the ring. Furthermore, the lower surface of top ring groove of the piston crown is worn out by the ring being pressed to it.		
HISTORY Oct'90 Added to part on 3 clause.	KOBE SHIPYARD & MACHINERY WORKS DIESEL DEPARTMENT	
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT	
	Oct. 1990	

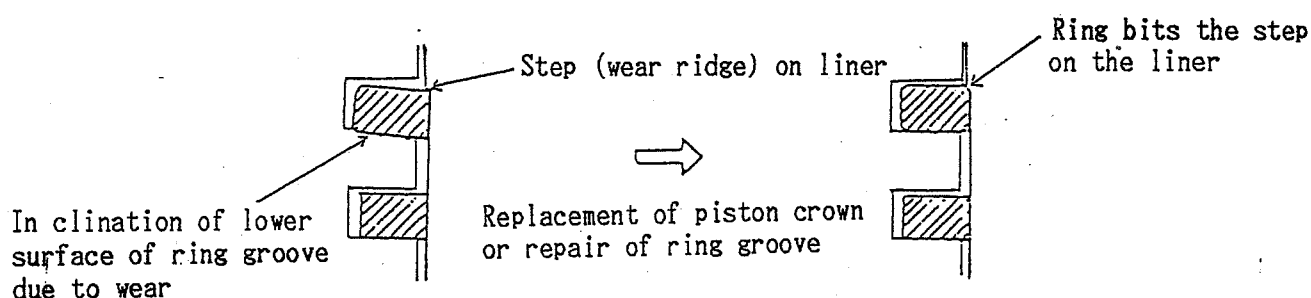
These troubles can be decreased by making this upper groove.

This is the main purpose.

These troubles become serious when the piston crown is renewed or the ring groove is repaired in particular.

When the step is left on the liner, the ring groove is loaded with excessive force and wears down rapidly.

Since the same kind of trouble can be supposed when the top ring is renewed, be careful about it.



- b). It is possible that, when the aforementioned step becomes large, combustion residue scraped up by the rings accumulates on the area in the vicinity of this step and accelerates the wear of liner and rings.

This upper groove prevents this trouble. (See Fig.2.)

(2) Effect as an oil groove

Since this groove acts as oil groove, the improvement in lubrication can be expected more or less, though it is considered to be a secondary effect.

- (3) Since the wear of the piston ring or the liner is largely influenced by the operating condition of engine, fuel oil and lubricating oil, it can not be concluded that the wear can be reduced by this upper groove alone.

However, it is thought that this groove has no bad influence and, on the other hand, it has a substantial effect of decreasing maintenance work.

3. Interchangeability

Since the thickness of compression shim is constant in almost all cases, the liner with additional upper groove is interchangeable with those of every other cylinders. Due attention should be given when using the above cylinder liner to another engine, because, in many case, thickness of the compression shim is defferent in each engines.

4. Special tools for making groove

These tools are in stock to make this groove at the right position corresponding to the step of liner. Please give us an order for these tools including a special grinding stone which is made in accordance with the shape of groove.

Addition of Groove at Upper Part of Cylinder Liner

Drawing for the piston at T.D.C.

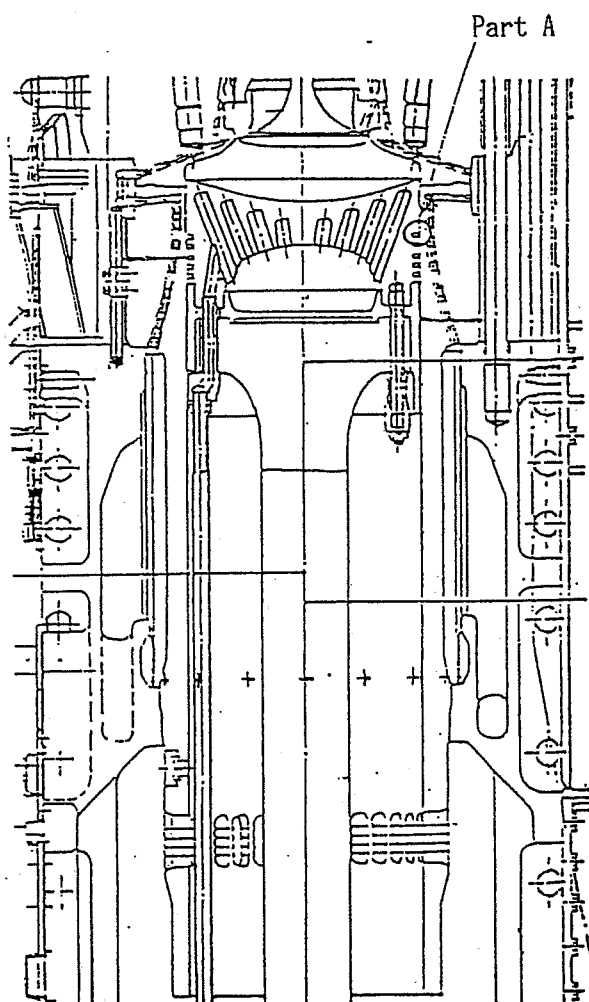


Fig. 1

Detail A

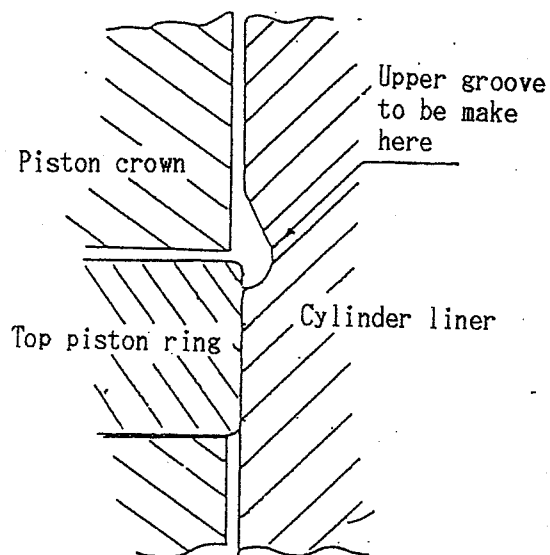
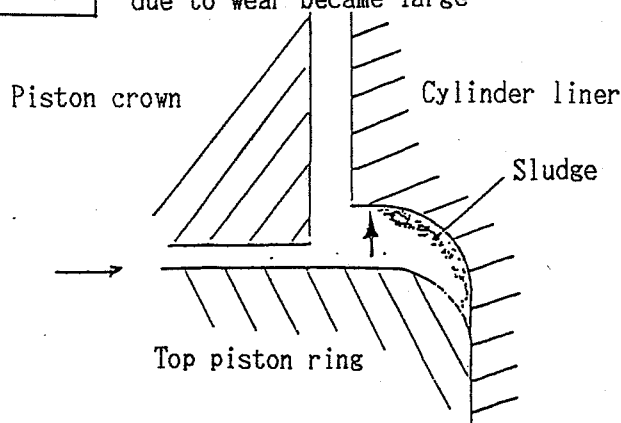


Fig. 2

Estimated state when the step (wear ridge) due to wear became large





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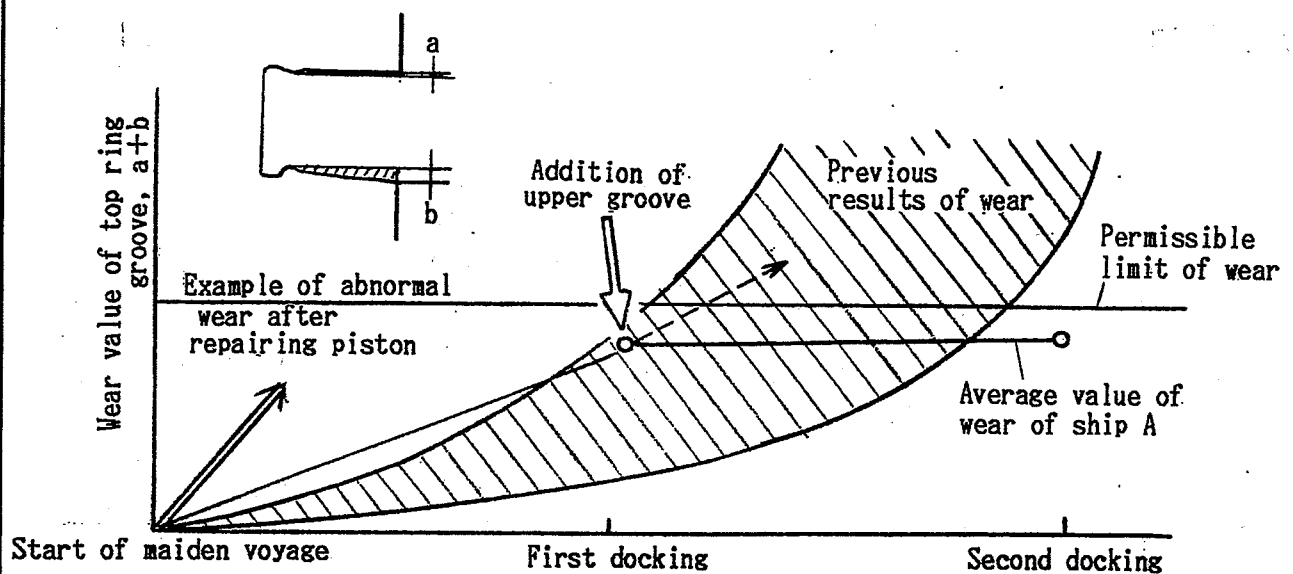
SERVICE INFORMATION



M H I Diesel Service Co., Ltd.

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Subject :	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	RTA, RL, RND (M)
	No.	MSI-9010E
Effect of Upper Groove of Cylinder Liner For the additional machining of the upper groove of cylinder liner, we have already issued MHI Service Information MSI-9002E. On the other hand, we would like to introduce an actual result which shows drastic decrease in the wear of the top ring grooves of the piston in service to which upper grooves have been added the wear of this engine had been in question before. You are requested to study this addition of upper groove by taking account of its effect on maintenance work in the future. - 1 -		
HISTORY	KOBE SHIPYARD & MACHINERY WORKS DIESEL DEPARTMENT	
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT	
	December, 1990	



Drawing for the piston at T.D.C.

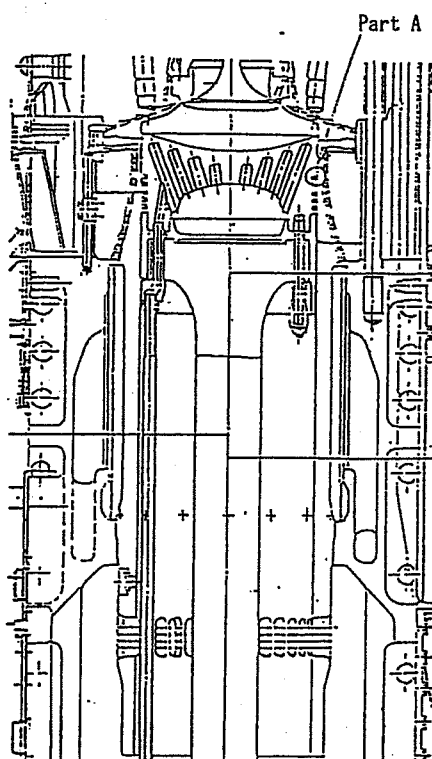
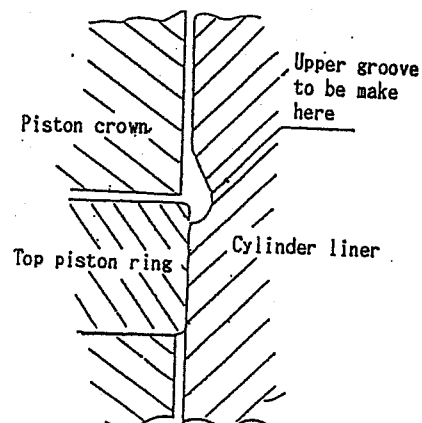


Fig. 1

Detail A



Such cases can often be seen recently that the wear of ring grooves progresses in a short time after pistons have been repaired (mark $\Rightarrow$ in the above figure) this wear is considered to be attributable to the insufficient removal of a wear ridge or to the fact that it has been left as it is due to timewise limitation or oblivion.



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Subject : Regular Maintenance of Exhaust valve	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	R T A
	No.	MSI-9104E
The condition of exhaust valves and valve seats of ships in service is extremely good in general and they can be reused after slightly grinding or without repairing in most cases. For this reason, overhaul intervals tend to be extended. On the other hand, it has been reported that some exhaust valves could not be pulled out because of the sticking of valve seats in their holes after long operation without overhauling and had to be jacked up after disassembling cylinder covers. This sticking of valve seat has been caused by <u>water leakage due to the aging of the O-ring of valve seat</u> after long operation without overhauling. You are therefore requested to overhaul and recondition exhaust valves after 6000 - 8000 operating hours at longest by taking account of the durability of O-rings. - 1 -		
HISTORY	KOBE SHIPYARD & MACHINERY WORKS DIESEL DEPARTMENT	
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT	
	July, 1991	



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Subject : Criteria for Selecting Fuel Oil	Classification	MITSUBISHI-SULZER Diesel Engine
	Type	RTA
	No.	MSI-9107E
The heavy fuel oil properties for RTA engines, described in 071-21 of our Instruction Book, show the limiting values for fuel oil properties (marked with * in the attached table), which are judged to be reasonable based on the past service results and with reference to the tendency of international standards, such as ISO, CIMAC, BS, etc. However, we have rare cases in which heavy fuel oil having the limits of properties is continuously used. Bunkering ports and obtainable quantity for such kind of fuel oil also are extremely limited. Furthermore, such heavy oil is not economical because of its high viscosity and lack of stability. Practically, the quality of fuel oil is selected considering the results of use of various kinds of fuel oil on many vessels (engines), above all both reliability and economic efficiency. Fuel suppliers also control the quality and cost of heavy fuel oil laying stress on the demands. However, there is a good amount of heavy fuel oil which has problems from viewpoints of quality, particularly of combustion properties. Therefore, when the recent requirement for operation of engines for a long period without overhauling is taken into consideration, heavy fuel should be selected on a quality basis putting ourselves in users place. In this Service Information, the criteria for selecting fuel oil (the guiding properties for use or the recommendable specifications), which are based on a great number of actual use results, have been shown for MHI-SULZER RTA engines (all types) from the above-mentioned viewpoints. In that table, CCAI should especially be noticed as a new index, and we would recommend you to make reference in the future selection of fuel oil. - 1 -		
HISTORY	KOBE SHIPYARD & MACHINERY WORKS DIESEL DEPARTMENT	
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT	
	August, 1991	

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68
HISTORY

Table The criteria for selecting fuel oil

		Guiding properties for use	Limit properties for use *
density at 15°C kg/m ³	max.	980	991
dynamic viscosity at 50°C, cst		380	700
" at 100°C, cst		35	55
flash point °C	min.	60 1)	60 1)
pour point °C	max.	24	30
water content % (v/v)	max.	0.2 2)	1.0 2)
carbon residue, conradson % (m/m)	max.	12	22
asphaltene % (m/m)	max.	2/3×residual carbon	2/3×residual carbon
sulfur content % (m/m)	max.	3.5	5.0
ash content % (m/m)	max.	0.05	0.2
vanadium mg/kg	max.	300	600
sodium mg/kg	max.	100 and 1/3×vanadium	1/3×vanadium
aluminium mg/kg	max.	--	30
(reference values)			
ignition index CCAI	max.	840	--
low calorific value kcal/kg		9500	--
Aluminium + Silicon mg/kg	max.	30	80

1) As specified by law.

2) Water content not exceeding 0.2% vol. after fuel treatment.

1. The daily maintenance for every part of engines is necessary for maintaining engines in good condition, but how to ensure good combustion of engines is more important problem. Keeping fuel oil quality at the appropriate level for the purpose will lead to favorable results in every point, such as preventing troubles on components around combustion chambers, decreasing the wear of both cylinder liners and piston rings, avoiding lub. oil deterioration, and reducing lub. oil consumption.

Furthermore, it has a direct effect on soot firing or emission control of exhaust gas system.

From the above-mentioned viewpoints, it is essential that fuel oil with appropriate properties should be selected, ensured (by restricting bunkering ports and kinds of fuel oil) and ascertained quickly about its properties, and thus combustion control is carried out correctly.

2. Trend of fuel oil quality and measure to the trend

The most of bunker heavy oil is mixing oil of cracked residual fuel, which is produced in the manufacturing process of the secondary refinery (vacuum distillation method and thermal cracking method, visbreaking process, F.C.C. method: fluid catalytic cracking process), and cracked gas oil, which is cutting material for adjusting density and viscosity.

These mixed oil has the following properties.

(1) High density, high viscosity, and the relation between density and viscosity
Fuel oil with high density contains a large volume of cracked residue, where as fuel oil with low viscosity and very high density (e.g., 180cst, 0.993) has a problem in combustibility.

(2) Increase in asphaltene and sludge content

In the table shown above, the maximum allowable asphaltene content is equal to carbon residue (max. 12%) $\times 2/3$. However, when asphaltene content exceeds carbon residue content, care should be taken to the combustibility or stability of the fuel oil.

Also, regarding fuel oil which CCAI value exceeds 840 (shown in the below item (3)), combustibility problems have been experienced in some case when asphaltene content exceeds around 8%, and therefore due attention should be paid for these values.

In relation to that, asphaltene is dissolved in a solution of toluene, but petroleum cokes, etc., which are not dissolved in toluene, are hard to combust, and may cause soot-firing.

(3) Deterioration of combustibility and ignitability.

CCAI (Calculated Carbon Aromaticity Index) is widely used to evaluate combustibility, but fuel oil with much aromatic compound and high density causes ignition lag and abnormal wear of piston rings.

Note: Rough values of CCAI can be obtained using the graph in page 5 .

Example	Viscosity (at 50°C cst)	Density	CCAI
	180	991	861
	380	980	842

(4) Deterioration of stability and affinity with water

As concerns stability, three situations, such as heating, mixing and storing, are considered, and asphalt content is the element having an effect on every case in common.

In cracked residual fuel, asphaltene, etc., in asphalt is dispersed and dissolved by aromatic characteristics of cutting material, which is called chemical stability. However, when the capability of solvent is not sufficient, or asphalt content is too high volume, the stability will be reduced.

On the other hand, the affinity with water can cause to produce sludge at a portion where water invades or contacts with fuel oil.

The stability of fuel oil can be evaluated partially by spot test using chemical analysis filter paper. However, the sample of the fuel oil should be examined in a laboratory to deal with the phenomena correctly whenever an actual problem has occurred.

(5) Others

Abnormal wear of piston rings and cylinder liners, caused by Al-Si group catalyst used in FCC process, and damage of exhaust valves, caused by coexistence of vanadium and sodium salts, are remarkable ones as damage due to impurities contains in fuel oil. Especially, sodium content should be noticed to be within the specified value, because sodium content may indicate the risk of sea water invasion.

3. The specification on fuel oil

"The guiding properties for use" is shown in the preceding section.

These values in the table are based both on actual experience for a good many years and on worldwide standards on fuel oil.

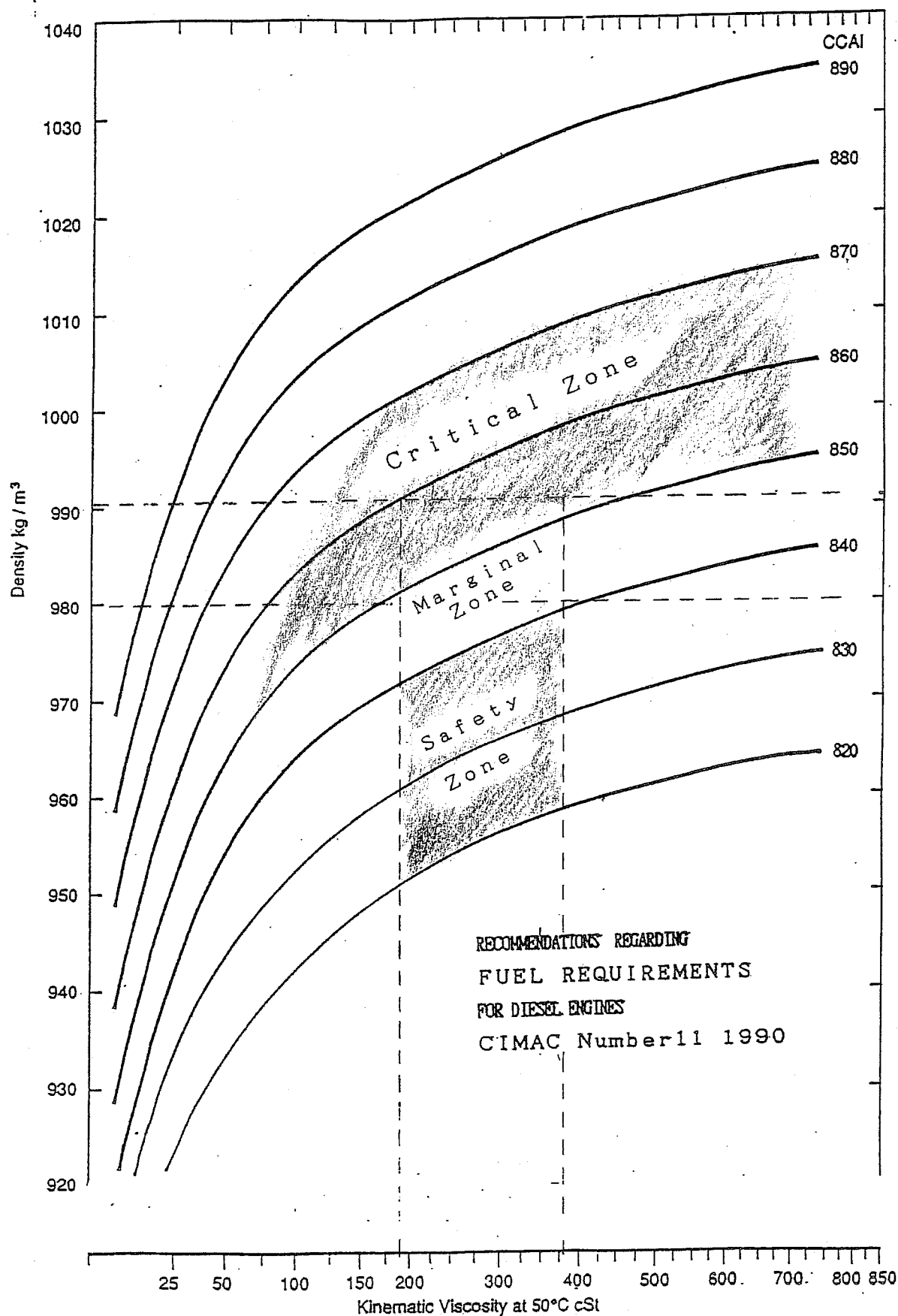
We will pay attention to the tendency of the following standards, and particularly deal with the results obtained by specified test method as a common evaluating measure.

ISO ISO 8217 First Edition 1987.4.15

CIMAC CIMAC Recommendation Vol.11 1990

BSI BS-MA100 1982.1 & 1989

Other standars of oil suppliners, engine markers and worldwide markers





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Subject :	Periodical Analysis of the System Oil for an Engine with Oil-cooled Pistons	Classification	MITSUBISHI-SULZER Diesel Engine
		Type	R T A
		No.	MSI-9108E
o Troubles are increasing recently caused by deterioration of the engine oil. For example, troubles are occurring such as burnt piston surface exposed under combustion flame, excess wear of running surface and broken piston ring caused by sludge of the system oil accumulated on the cooling side of the oil cooled pistons. o One of the effective measures to prevent such troubles is the periodical analysis and diagnosis of the system oil. Recently, satisfactory results are being substantiated by some oil suppliers with a method of quick analysis for multiple ingredients by use of a small amount of sample oil, and also, an in-vessel simplified analyzing device is being applied. o We strongly recommend to carry out periodical analysis of the system oil for further enhanced reliability of the engine. As for the analysis results, you are kindly requested to send them to us for our reference. Please do not hesitate to contact us with regard to the information in carrying out the above referred analysis and any other necessary information. - 1 -			
HISTORY	KOBE SHIPYARD & MACHINERY WORKS DIESEL DEPARTMENT		
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT		
	December, 1991		

Remarks: Quick analytical method in each oil supplier
(Example)

- o RAPID LUBRICANTS' ANALYSIS (RLA.) Shell Marine Service Worldwide
Showa Shell Sekiyu Kabushikikaisha,
Sales Engineering Department
- o PROGRESSIVE FAST ANALYSIS. (PFA.) Mobil Sales and Supply Co.
Moble Sekiyu Kabushikikaisha
International Sales Department
- o EXXCARE Esso Research Centre
Esso Sekiyu Kabushikikaisha,
Marine Products Devision



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Subject : Mitsubishi-Sulzer Diesel Engines Corrosion Control of Cooling Fresh Water System	Clasification	mitsubishi-sulzer Diesel Engine
	Type	R T A
	No.	MSI-9202E 
It seems generally recognized that, for diesel engine, one of the most important problems associated with the engine maintenance during the vessel put in service is "Corrosion Control of Cooling Fresh Water System". It is also the undeniable fact that, side by side with the achieved improvement of the diesel engines performance, the importance attached to the Corrosion Control has been increased accordingly. For example, the vital components of the Engine subject to the severe loads (both thermal and mechanical) while in running, such as the water-cooled piston, Cylinder Cover and the Cylinder Liner etc. are appreciably affected, with respects to their reliability and durability, by the quality of the corrosion control, as widely known by the diesel engineers. This means a great need for precaution to be taken by the engine user for the cooling water treatment for improved corrosion control. Recommended practices for the effective corrosion control are as described hereunder at length. 1. Inside cleaning of the Cooling Water System In Mitsubishi-Sulzer Diesel Engine, there are three different cooling systems separated from each other, namely, (1) Cylinder Jacket → Cylinder Cover Cooling (include Exh.valve and VTR Turbocharger) (2) Piston Cooling (except Oil Cooling System) Presence of deposit, iron particles, metallic oxide or scale in any of above mentioned three Cooling Water Systems is always a cause of the reduced heat conduction and excessive consumption of the anticorrosives having been charged into the System as well, therefore inside of the Cooling Systems should be made clean or dirt-free before changing the cooling water by properly flushing or cleaning to be done in advance. (For the right method of prior inside cleaning of the Cooling Systems, consult the anticorrosives manufacturer who will furnish the useful technical informations as to the chemical cleaning most suited for the condition of fouling for a particular case.) - 1 -		
HISTORY	 Aug.1992 Revised recommended density for YUNIPROT PC-200	
	KOBE SHIPYARD & MACHINERY WORKS DIESEL DEPARTMENT	
	MHI DIESEL SERVICE CO., LTD. KOBE BRANCH TECHNICAL SERVICE DEPARTMENT May, 1992	

2. Requirements for Cooling Fresh Water

Cooling fresh water to use must be pure water (distilled water) or city water.

In case the water has been obtained outside Japan, special caution should be given to the quality of the same which needs be analyzed chemically at the earliest possible date to check to see the compliance with the following specifications.

Hardness Matter	30 mg CaO/l or under
Cl ⁻ ion	100 ppm or under
SO ₄ ²⁻ ion	50 ppm or under

Where resulting data obtained have exceeded the above standard limits, there is a large likelihood of a noticeable drop of anti-corrosion efficacy or of scale formation from the precipitate or sediment, depending on the brand of the anticorrosive having been used (for the right procedures of water examination for analysis, consult the anticorrosive manufacturer).

3. Recommended Commercial Brands of Anticorrosive

The commercial brands generally in use as specified below are recommended for cooling water treatment.

Brand	Manufacturer	Density (ppm)	Standard quality of cooling water
RUSMIN MK-45	KYOEISHA YUSHI KAGAKU KOGYO Co., Ltd.	2000 ~ 2500	Hardness matter: < 30 mg/l (as CaO) Cl ⁻ ion : < 100 ppm SO ₄ ²⁻ ion: < 50 ppm Especially, attention must be paid to the above
PORICRIN 1-172D	KURITA WATER KOGYO Co., Ltd.	2500 ~ 3000	
KOHRUYU MS-2	KOHRUYU KOGYO Co., Ltd.	2500 ~ 3000	
HI-MOL AM-5	TAIHO KOGYO Co., Ltd.	2000 ~ 2500	
KYOKUKO W-No.1	TAIYO KAGAKU Co., Ltd.	2500 ~ 3000	
YUNIPROT PC-200	NIPPON YUKA KOGYO Co., Ltd.	2000 ~ 2500	
NEOS PN-106	NEOS Co., Ltd.	2000 ~ 3000	Hardness matter < 30 mg/l (as CaO) Cl ⁻ ion : < 50 ppm SO ₄ ²⁻ ion: < 50 ppm (Never exceed the above levels)
DEWT-NC	DREW AMEROID MARINE D/V. ASHLAND CHEMICAL INC.	3000 ~ 4500	

4. Controls of Cooling Water

4.1 Concentration (ppm) of Anticorrosive

For charging the Cooling System with the anticorrosive, weigh a specified dose which then should be dissolved perfectly in water in a suitable Preparation Tank or some other Container to obtain an aqueous solution for charging into the Cooling Water System.

Then, allow the water containing the anticorrosive to circulate adequately until the uniform concentration is achieved. See that the ppm concentration is at a specified level.

Generally, in the early stage of charging make up fresh water, the anticorrosive tends to be appreciably consumed with a resultant drop of ppm concentration, which means a need for frequent check (daily, if possible) and additional anticorrosive charge as may be found necessary.

Subsequently, a change of ppm concentration will be stabilized gradually, so that care should be taken to keep close watch on the tendency of the changing concentration for satisfactory control of quantity and intervals of additional charges of the anticorrosive.

Concentration check in a stabilized condition should be carried out at least once a one or two weeks to see that the optimum concentration is maintained. Take the record of the results of checking to provide a guide for early detection of the onset of abnormality, if any in the future.

It should be noted that for any of three different Cooling Water Systems, a certain degree of water loss is unavoidable, for which a makeup of water must be carried out properly, with a great caution taken for a change of concentration through every makeup and charge of the anticorrosive and for confirmation of a trend of makeup requirement.

4.2 PH

PH value of Cooling Water must be maintained at between 8 and 10. Deviation of PH from the said range is always a cause of reduced efficiency of corrosion inhibition by the charged anticorrosive. Therefore, at every occasion of checking the ppm concentration of the anticorrosive in the Cooling Water, PH value must also be checked very carefully.

Adjustment of PH value needs be carried out by addition of caustic soda when the said value has been found to be 8 or under, or by makeup with unused fresh water after 10 to 20% discharge of cooling water when the said value has been confirmed to be 10 or above.

4.3 Water Quality

Check the Cooling Water at least once a month by qualitative analysis to see that the requirement set forth in PH value is complied with.

Should a deviation from the specified level stated in PH value be found, the Cooling Water must be renewed, losing no time.

Note, however, that a very high concentration of the anticorrosive for only a short period during the readjustment of water quality is tolerable, but it is always accompanied by the difficulties such as a heavy deposit of sediment and useless loss of the anticorrosive, which deserve the special attention of the operating personnels of the engine user.

Special Notes:

Adequacy of corrosion-inhibiting additive charge affects substantially the fatigue strength of various Engine Components such as the Cylinder Cover and others.

For example, assuming that the fatigue strength of the components exposed to air is 100%, it is reduced down to as low as 62% when in water.

5. Renewal of Cooling Water:

Cooling water must be renewed in one or more of the following cases.

5.1 PH value of 6 or under

5.2 Entry of Sea Water into Fresh Water because of breakage of the Fresh Water Cooler.

5.3 Change of a Commercial Brand of Anticorrosive to another.

5.4 Abnormal formation of Floating Matter and/or Sediment in the Cooling Water Systems.

5.5 Besides the above case, renew the fresh water normally once a two years (for Cooling Water Jacket) or an one Year (for Piston), frequency being subject to some change, depending on the condition of fouled Cooling Fresh Water.

5.6 When one of combustion space components such as a cylinder cover, liner and piston has been cracked and combustion gas has intruded into cooling water, ever if it has occurred on only one cylinder, we kindly ask you to quickly change the whole quantity of cooling water, as this trouble surely influence other cylinders.

6. Others

6.1 Instrument for Concentration Check

For checking the Cooling Water, use must be made of only the Instruments recommended by the anticorrosive manufacturer.

The Instruments are to be procured by the Customer and will not be supplied by Mitsubishi.

It is highly recommended to carry out the periodic shipboard sampling of the Engine's Cooling Water for sending to the anticorrosive manufacturer to ask for determination of the concentrations, in order to confirm the accuracy of the values of measurement performed by the Ship's personnel.

6.2 Formation of Floating Matter in the Cooling Water Systems

Whenever the Cooling Water has been left maintained at a normal temperature (40°C or below) for a prolonged period (exceeding about 10 days), the floating matter (a kind of mildew) is often formed, the said mildew being gelatinous, furred and even agar-like. Once it appears, it can not be wiped out even by heating or circulation, and, at the same time, the concentration of the anticorrosive is often reduced appreciably. Therefore, for re-use of the Cooling Water after along period of engine shut-down, check carefully the bottom of the Head Tank and the Sump Tank in the Cooling Water System and if the formation of the described type of foreign matter has been witnessed, clean the System and renew the Cooling Water.

6.3 Draining of Cooling Water

When in port, overboard draining of the cooling water treated with anticorrosive may on some occasions be contrary to anti-pollution regulations (COD). In such a case, consult the anticorrosive manufacturer for proper disposal procedures of the cooling water.

6.4 Clogging of Cooling Water Passages

Cooling water passages through the fuel valves and the exhaust valve seats are generally narrow and partial stagnation of water may occur somewhere in the cooling passages. If such should be the case, impurities in the cooling water would educe and accumulate into deposits, entailing clogging of water passages in course of time. Particular care is requested to the corrosion control of this cooling water system.

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Subject : Method of Measuring Piston Ring Gap	Classification	MITSUBISHI SULZER Diesel Engine
	Type	All
	No.	MSI-9401E 

Regarding the captioned matter, the Service Information MSI-8706E , which was already issued, recommends a rubbing method with cellophane tape for measuring piston ring gaps. However, there are cases where this method troubles customers due to inferior working surroundings. Furthermore, it can not be avoided that the rubbing method with cellophane tape is accompanied by errors, since piston ring ends are rounded.

There are also cases where piston ring gaps are measured with a thickness gauge. This method has demerits such that it is accompanied by work for descaling ring end surfaces and that it is also accompanied by errors and takes many hours because measurement by this method is liable to be done by feeling in many cases.

In order to eliminate these demerits, we have contrived an easy method such that a ring gap can be measured by slightly hammering a led rod shown below into the ring gap and measuring the thickness of its deformed part. It has been ascertained that this method has remarkably improved the workability and accuracy of the measurement of ring gaps and shortened working time necessary for it.

We recommend every ship to apply this method to the measurement of ring gaps in future.



This tool can be used repeatedly by machining this part.

You are kindly requested to order this measuring led rod from our company.

- 1 -

HISTORY	 Engine type is reconsidered. July 2003	SERVICE & ENGINEERING GROUP DIESEL ENGINE DEPARTMENT
		DATE OF ISSUE: April.1994

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Subject :

Low Temperature Corrosion on Gas Passages
 of Exhaust Valve Cages (No.2)

Classification

**MITSUBISHI SULZER
 Diesel Engine**

Type

RTA All Type

No.

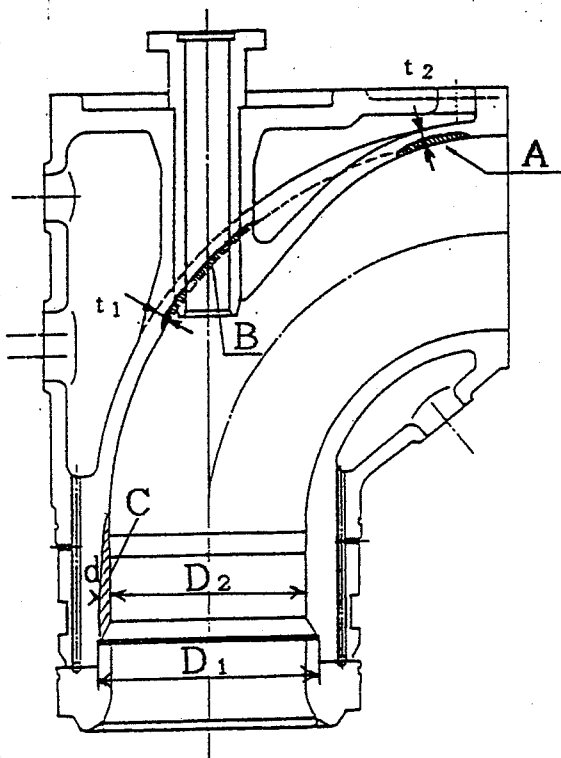
MSI-9402E Rev.2

Though we already informed you of corrosion on A and B parts of the valve cages shown below through MSI-8707E, we got information that corrosion was also found on C part in the figure recently.

We therefore kindly ask you to also check the condition of corrosion on this part at every overhaul of the exhaust valve.

Allowable depth of corrosion is shown in the table below. But we ask you to repair cages of which values of corrosion depth are close to limits using the diameter D_1 (the outer diameter of the valve seat spigot) as a yardstick after landing them in an early stage.

Since special techniques are necessary for repairing the valve cage because its material is cast iron, you are kindly requested to order repairing work from our company.



Engine type	D_1 (mm)	D_2 (mm)	Allowable depth of corrosion (mm)
RTA48	250	210	9
RTA58	265	245	10
RTA68	320	290	15
RTA76	360	322	19
RTA84	400	355	22.5
RTA52(U)	280	251	14.5
RTA62	330	302	14
RTA72	380	346	17
RTA84M RTA84C(UG)	400	355	22.5
RTA58T	295	265	15
RTA96C	470	430	20
RT-flex96C	470	430	20

- 1 -

HISTORY

△ Added RTA58T, 96C. Apr. 2005
 Rev. 2; Added RT-flex96C May 2007

SERVICE & ENGINEERING GROUP
 DIESEL ENGINE DEPARTMENT

DATE OF ISSUE: June.1994



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Subject : Lowering of Engine Performance Due to Wear of Gas Outlet Guide of Turbocharger	Classification	MITSUBISHI SULZER Diesel Engine
	Type	R T A
	No.	MSI-9505E

Ships that have been operated for five to six years after having been put in service reported trouble to us such that a rise in exhaust gas temperature at the cylinder outlet and the lowering of scavenging pressure due to the lowering of turbocharger performance.

Some of ships also reported to us that turbochargers surged and the normal operation of engines was impossible in the worst case.

As the result of inspection carried out on the ship that has the above-mentioned trouble, it has been found that the main cause has been an increase in clearance due to the wear of the inside surface of the gas outlet guide and the tips of turbine blades of the turbocharger.

The above-mentioned increase in clearance (L-dimension for the MET-type turbochargers and R-dimension for the VTR-type turbochargers) is generally caused by the flowing two factors. One is the wear of the turbine-blade tips and the inside surface of the gas outlet guide due to the contact of blade tips with the guide caused by bearing seizure and the impact of hard fine particles in exhaust gas. The other is corrosion on the inside surface of the gas outlet guide due to aging.

For the above-mentioned reasons, we recommend you to confirm that each clearance in relation to the compressor and turbine does not exceed its limit shown in the clearance table of the turbocharger instruction manual without fail when the turbocharger is overhauled for regular inspection. We kindly ask you to pay attention to L-dimension(MET) or R-dimension(VTR) in particular.

- 1 -

HISTORY	P.2&4 are revised. Jan. 2005	POWER SYSTEMS ENGINEERING DEPARTMENT DIESEL SERVICE GROUP
		DATE OF ISSUE: Feb.1995

1. Remedy

When this clearance exceeds the limit of L-dimension(MET) or that of R-dimension(VTR) shown in the instruction manual of each type of turbocharger, the gas outlet guide shall be renewed.

(Example of explanation on the limit for MET 66SB T/C)

When the L-dimension of the turbocharger with a designed dimension in the range of 0.80 to 1.30mm shown in the clearance table of its instruction manual exceeds a limit of 1.50mm even at one point, the gas outlet guide shall be replaced.

L-dimensions smaller than the designed lower limit of 0.80mm are unallowable because the turbine blades may contact with the gas outlet guide.

2. For the SB-series of the MET turbocharger, this clearance is reduced by thermal spraying on the gas outlet guide to improve its performance.

(Thermal spraying has been adopted to prevent damage even if the turbine blades contact with the gas outlet guide.)

However, it has been decided not to apply thermal spraying for repair because it has been found that the layer of sprayed metal is spalled away by hard fine particules in fuel oil in recent years. For the above reason, recommend you to replace this gas outlet guide with new one without having a sprayed metal layer same as other types.

3. Clearance tables for various types of turbochargers

(1) MET type turbocharger : See Fig-1

MET 56, 71, 90	MET 560, 710, 900
MET 56S, 60S, 71S	MET 53SB, 66SB, 83SB
MET 53SC, 66SC, 83SC	MET53SD, 66SD, 83SD MET66SE II, 83SE, 83SE II

(2) VTR type turbocharger : See Fig-2

VTR 401, 501, 631, 750	
VTR 454-11, 564-11, 714-11	VTR 454-31, 584-31, 714-31
VTR 454-32, 564-32, 714-32	

Note) For the MET type, measure the L-dimension under the condition that the rotor is fitted.

For the VTR type, measure the inside diameter of the gas outlet guide and the outside diameter of the blade part of the rotor after removing the latter, and then record a value of half of the difference between the outside diameter and the inside diameter, since this clearance can not be measured unless the rotor is removed.

Clearance table for MET Turbochargere

	Standard clearance (mm)	Allowable range (mm)	Standard clearance (mm)	Allowable range (mm)	Standard clearance (mm)	Allowable range (mm)
MET**		MET56		MET71		MET90
L	0.95 ~ 1.45	0.95 ~ 1.80	1.20 ~ 1.80	1.20 ~ 2.25	1.30 ~ 1.90	1.30 ~ 2.40
MET***		MET560		MET710		MET900
L	0.75 ~ 1.25	0.75 ~ 1.90	1.00 ~ 1.50	1.00 ~ 2.20	1.25 ~ 1.75	1.25 ~ 2.30
MET**S		MET56S		MET60S		MET71S
L	1.20 ~ 1.70	1.20 ~ 2.00	1.20 ~ 1.70	1.20 ~ 2.00	1.40 ~ 2.00	1.40 ~ 2.20
MET**SB		MET56SB		MET60SB		MET71SB
L	1.05 ~ 1.55	1.05 ~ 1.70	1.05 ~ 1.55	1.05 ~ 1.70	1.20 ~ 1.80	1.20 ~ 2.00
MET**SB		MET53SB		MET66SB		MET83SB
L	0.60 ~ 1.16	0.60 ~ 1.30	0.80 ~ 1.30	0.80 ~ 1.50	1.05 ~ 1.60	1.05 ~ 1.90
MET**SC		MET53SC		MET66SC		MET83SC
L	0.80 ~ 1.30	1.50	1.00 ~ 1.50	1.70	1.30 ~ 1.85	2.15
MET**SD		MET53SD		MET66SD		MET83SD
MET**SE, SE II				MET66SE II		MET83SE, SE II
L						
Top	0.80~1.20	1.40	1.00~1.40	1.60	1.15~1.70	2.00
Starboard, Port	0.95~1.25	1.45	1.20~1.40	1.60	1.30~1.85	2.15
Bottom	1.05~1.30	1.50	1.20~1.50	1.70	1.45~2.00	2.30

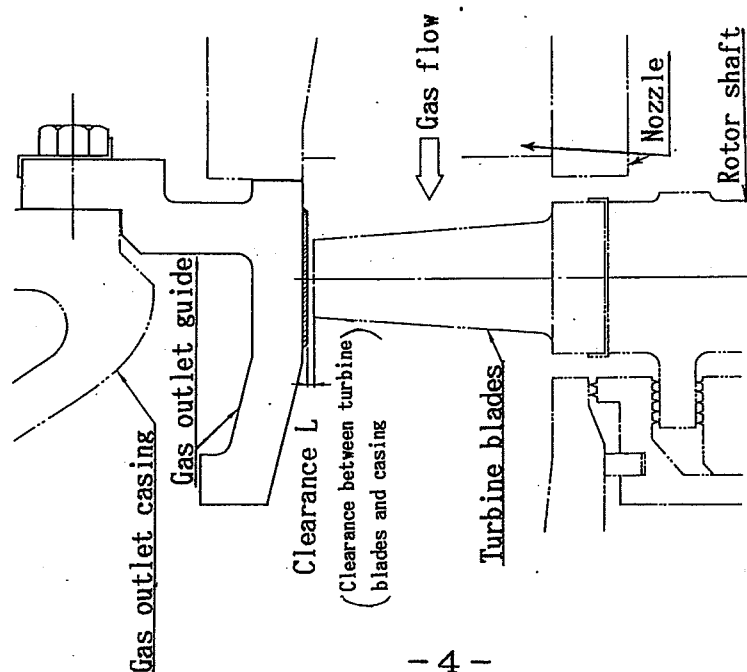


Fig-1

Clearance table for VTR T/C

R_1 : Min Clearance of Bottom • R_2 : Max Clearance of Upper
 R = Nominal Average Clearance • $R = (R_a - R_b) / 2$
 R_a = Inside Dia. of Gas Outlet Guide • R_b = Outside Dia. of Turbine Blade
 R_L = Usable Limit

Type	VTR401-2	VTR501-2	VTR631-1	VTR750
R_1	0.33~1.18	0.57~1.03	0.76~1.29	0.92~1.43
R_2	0.73~1.57	0.97~1.43	1.21~1.74	1.37~1.88
R	1.00~1.10	1.00~1.28	1.28~1.60	1.43~1.68
R_L	2.04	2.43	2.96	3.20
Type	VTR454-11	VTR564-11	VTR714-11	VTR750
R_1	0.38~0.82	0.55~1.06	0.77~1.31	
R_2	0.78~1.22	0.95~1.46	1.23~1.77	
R	0.92~1.00	0.98~1.25	1.45~1.58	
R_L	1.83	2.19	2.66	
R_1	0.68~1.12	0.93~1.44	1.24~1.78	
R_2	1.08~1.52	1.33~1.84	1.70~2.24	
R	1.24~1.32	1.57~1.64	1.95~2.08	
R_L	2.28	2.76	3.36	

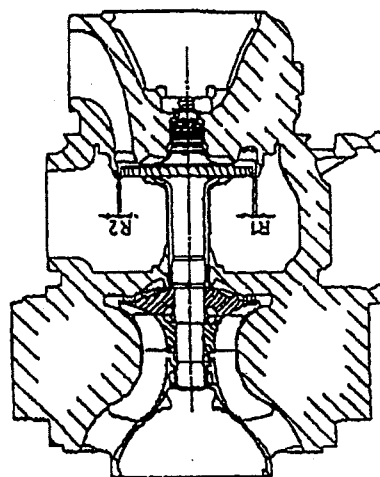
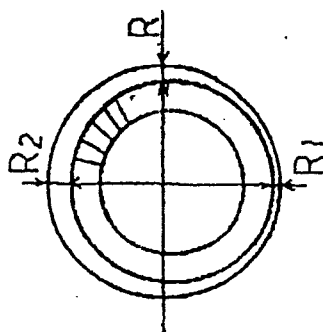


Fig-2



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SERVICE INFORMATION

MITSUBISHI HEAVY INDUSTRIES, LTD.
KOBE SHIPYARD & MACHINERY WORKS
DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION

1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652-8585 JAPAN
TEL : (078)-672-3797 FAX : (078) 651-4166

Subject :

Prevention of Inadaptability due to Use of FCC Fuel Oil

Classification

Mitsubishi Sulzer
Diesel Engine

Type

All type

No.

MSI-9601E

Recently, for the past few months, the cases resulting excessive wear on the piston ring and cylinder liner have tended to occur frequently due to fuel oil containing catalytic particles (FCC) of the fuel refine process (herein after called FCC fuel oil). On the background, it is presumed that the tendency is affected by bunker oil of inferior quality due to a steep rise in prices; therefore, you are kindly requested to pay attention to the following items for ship's service.

It has been reported from some ships in service that inadaptable phenomena such as heavy wear on the plunger of the fuel oil injection pump and the seat being abnormal of the fuel oil injection valve occurred besides serious inadaptable phenomena such as gas blow-by and excessive wear on the piston ring and cylinder liner.

You are kindly requested to avoid using FCC fuel oil because it is presumed that the main engine running is seriously affected by the fuel and ship's service is possible to be hindered, and also service economy is considerably affected if FCC fuel oil is continuously used.

If the fuel oil judged to be FCC fuel oil is unavoidably bunkered , you are kindly requested to prevent FCC fuel oil particles from entering engine by carrying out proper pretreatment with the fuel oil cleaning system in the ship.

1. Properties of FCC fuel oil

In general, the catalyst particles containing in FCC fuel oil is almost spherical, sized in diameter of $5\mu\text{m}$ to $150\mu\text{m}$, the main content is a compound of Aluminium and Silicon, and the hardness is near grinding material and very hard in comparison to steel.

If the hard FCC particles enter the running surface between the piston and the cylinder liner, scratches occur on the running surface even though the running-in has been finished on the piston and the liner, and so excess wear is brought about on them because normal oil film formation is hindered and scuffing and combustion gas blow-by occur.

In the case of the fuel oil injection pump plunger and the fuel oil injection valve, the particles are affected on the sliding faces and the valve seat as they are nearly ground and the life time of each part is influenced due to wear acceleration; therefore, you have to pay attention to the particles.

- 1 -

HISTORY

- The content is revised on Sep. 25, 2000.
- Item 4 on page 3 is added in Feb. 2006.

DIESEL ENGINE DEPARTMENT
SERVICE ENGINEERING SECTION
DATE OF ISSUE: Jan. 1996

MITSUBISHI SERVICE INFORMATION

In addition, if FCC particles enter the piston stuffing box, the running surfaces are damaged, the packing ring wear is accelerated, and oil leaking from the stuffing box is increased; therefore, care should be taken for the stuffing box.

2. Avoidance of the inadaptability

① As mentioned in the engine instruction book, if the fuel oil is determined to be FCC oil, we recommend to refrain from using it as fuel oil as much as possible.

② As the method judging the mixture of FCC particles in the bunker oil beforehand, the following three examples are considered.

1) Be sure to get oil supplier list. It is recommended that the specification (including Aluminium and Silicon) of bunker oil is within the attached recommendable values of heavy fuel oil properties.

2) Direct observation method by the test kit in the ship

Since FCC particles have a tendency to increase in proportion to containing rates of Aluminium and Silicon, it is presumed that the method observed with a microscope is effective so as to detect the existence of FCC particles.

Outline for direct observation;

a) Take sample oil from various positions.

b) Dissolve fuel oil with Toluene.

c) Filtrate it with a filter.

d) Observe residue solids on the filter with a microscope and confirm the existence of FCC particles.

Besides, for the detail of analysis method, please make inquiries to our office.

3) As the examples that some ship owners obtain good results, we can recommend Quick Service (DNV/PS, ABS/OTS, LRS/FOBAS) of fuel oil analysis of Classification Society.

Furthermore, some ship owners make the routine process that bunker sample is directly sent from an oil supplier to the service of Classification in advance and the bunkering is determined by the result of the service.

③ If FCC fuel oil is bunkered by any chance and the FCC fuel oil has to be used for the ship's service at any rate, please be sure to service the ship by keeping the following matters.

In addition, frequently check the piston rings and cylinder liners and watch their conditions.

1) Increase cylinder oil feed rate.

2) Lower cylinder cooling water temperature from 85°C to 75°C so as to preserve oil film.

3) Lower scavenging air temperature as much as possible.

4) Drain out the sludge of the settling tank and service tank strictly (several times a day).

5) Operate all purifiers in parallel and raise the efficiency of sludge removal by minimizing the oil passing quantity against the capacity of one purifier.

6) If the fine filter is installed in the fuel oil line, do not bypass the fine filter when the fuel oil is supplied to the engine.

7) If the cylinder liner temperature observation system is installed for the engine, operate the engine, while watching the system.

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④ Wear restraint measures when wear has occurred on liners and rings:

As the wear restraint measures when wear has occurred due to use of FCC fuel oil, add the following matters to the matters mentioned in the ③ items above.

- 1) Lower the engine load within the service schedule as much as possible.
(Load reduction is an effective measure so as not to advance wear.)
- 2) The spacer is fitted to the fuel oil injection pump of the cylinder whose wear is larger than others and the load of the cylinder in question is reduced.
- 3) By replacing piston rings with high hardness piston rings and operating the engine, FCC particles remaining on cylinder liner running surface are removed and running-in of cylinder liners proceeds again.

⑤ Handling of fuel oil tank:

In order to minimize the amount of FCC particles into the engine, the following procedure is to be carried out together.

- 1) Drain out the sludge including FCC particles of the bottom of the settling tank and service tank frequently (several times a day).
This is the purpose for preventing high concentrated FCC particles from entering the engine so that the FCC particles accumulating on the tank bottom are stirred at rough sea. Besides, do not return drained sludge to the tanks and scrap or burn out it in the boiler, etc. because there is a possibility that the sludge contains a great many of FCC particles.
- 2) When there are "high" and "low" suction parts in the service tank, use "high" suction part so as to prevent sludge of the tank bottom from sucking.

3. Fine filter and purifier:

In current circumstances of inferior quality of bunker oil, there is a case that waste oil from automobile lubricating oil, etc. is mixed in bunker oil. In that case, FCC particles cannot be separated from the oil by the purifier. Therefore, the most effective measure against FCC fuel oil is to use the fine filter (less than 5 to 10 μ m in practical effect) and we strongly recommended to use automatic back washing type fine filter. In addition, if the fine filter is not installed on the ship, we would like to install it additionally so as to prepare it for the ship's service hereafter.

Besides, be sure to scrap or burn out the back-washed drain oil in the boiler, etc. because there is a possibility that the sludge contains a great many of FCC particles.

4. Notice for using the automatic back washing type fine filter:

Since the following cases of troubles have been recently reported, you are kindly advised to pay attention to these matters.

Case 1:

When the fine mesh filter bypass line was used, FCC particles entered into cylinder liners and unusual wear occurred on piston rings and cylinder liners.

Preventive/Corrective action:

Except unavoidable cases such as emergency, do not use the bypass line.

(The filter meshes of bypass line are around 60 μ in many cases and FCC particles are not caught with the filter.)

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Case 2:

The fine mesh filter was bypassed when automatic back flush worked, and FCC particles entered into cylinder liners and unusual wear occurred on piston rings and cylinder liners.

Preventive/Corrective action:

There is the filter which is automatically bypassed when automatic back flush works, depending on the filter type, so it is recommended to install another fine mesh filter in the bypass line.

(In case FCC particle content is high, frequency and time of automatic back flush of the filter increase; therefore, the total bypassing period increases.)

If FCC fuel oil is supplied, strongly notify the warning to the bunker supplier and also advise us of the matter.

**Mitsubishi Sulzer Diesel Engine
Recommendable Values of Heavy Fuel Oil Properties
at Bunkering and Engine Inlet**

Item		Heavy fuel oil		
		Bunkering oil quality limit value	Recommended fuel quality	
			Bunker	Engine inlet
Specific gravity (15°C)	kg/m ³	≤ 991	≤ 991	≤ 991
Viscosity	Centistokes at 50 °C	≤ 700	≤ 700	13~17
	R. W. No.1 sec at 100° F	≤ 7,000	≤ 7,000	62~75
Flash point	°C	≥ 60	≥ 60	≥ 60
Water content	Vol. %	≤ 1.0	≤ 0.5	≤ 0.2
Carbon residue	Wt. %	≤ 22	≤ 15	≤ 15
Ash		≤ 0.20	≤ 0.05	≤ 0.05
Sulfur		≤ 5.0	1.5~3.5	1.5~3.5
Vanadium	mg/kg	≤ 600	≤ 150	≤ 150
Sodium		≤ 100	≤ 100	≤ 30
Aluminium + Silicon		≤ 80	≤ 30	≤ 10 *

* : Size of FCC particles is less than 10 μm.



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POWER SYSTEMS SALES DEPARTMENT
DIESEL ENGINE AFTER-SALES SERVICE CENTER
1-1, WADASAKI-CHO 1-CHOME, HYOGO-KU KOBE 652 JAPAN
TEL: (078)672-3797 FAX: (078)651-4166

Subject :

RTA type Engine-Damage protection for
the Cooling Water Bore of the Cylinder Cover

Classification

MITSUBISHI SULZER
Diesel Engine

Type

RTA All Type

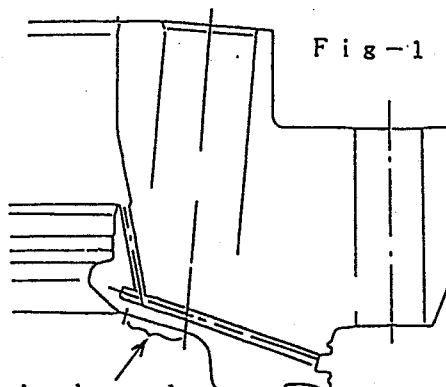
No.

MSI-9603E

With regard to the RTA-type engine in Service , it is reported that cracks have appeared in the cooling water Bore (please refer to the diagram below), and have even penetrated into the combustion chamber. Inspection of the affected part has shown that the cracks originate from corrosion pits on the cooling water bore. This reaffirms the absolute necessity of taking anti-corrosion measures for preventing recurrence of such cracks.

Details regarding measures for prevention of corrosion owing to the coolant are enumerated in Service Information MSI-9202 , and it is requested that the quality of water must be controlled and further improved in order to prevent the occurrence of corrosion pits. For your reference, a water quality inspection record sheet is also appended. It is suggested that the inspection data be chronologically recorded in this form, and it should be ensured that the recorded values are within the prescribed control value.

In addition, it is also recommended that frequent inspections of the cylinder covers shall be carried out in order to verify their soundness. Such inspections can be carried out on board, by opening the cover and checking the respective coolant bores using a Borescope or ECT (Eddy Current Testing) flaw detection technique. It is suggested that during the inspection, the scales inside the coolant bores shall be also cleaned using a paper grinder. In case any damage is discovered during the inspections, this office may be approached for conducting the necessary repairs.



Area where crack is observed

- 1 -

HISTORY

POWER SYSTEMS SALES DEPARTMENT
DIESEL ENGINE AFTER-SALES
SERVICE CENTER

DATE OF ISSUE: Jan, 1997

Main Engine Coolant Treatment & Water Quality Inspection Record

MV :
Eng. Type :
Anti-corrosion
solution(type) :

[illegible]

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 TEL: (078)672-3797 FAX: (078)651-4166

Subject :	Classification	MITSUBISHI SULZER Diesel Engine
	Type	RTA
	No.	MSI-9701E

Installation of Cylinder Cover Joint Ring

Recently we have been reported that exhaust gas had leaked between cylinder cover and cylinder liner due to the faulty installation of the joint ring. The joint ring is made by punching and there is possibility to be warped slightly.

If the warped joint ring is installed in the wrong direction as shown in Fig.1, there is some possibility that the joint ring may be shifted and bitten by cylinder cover and cylinder liner at the time of installing cylinder cover, as shown in Fig.2.

In this connection, we would like to recommend to confirm the warp condition and to install the joint ring properly as shown in Fig.3 in order to prevent similar gas leakage.

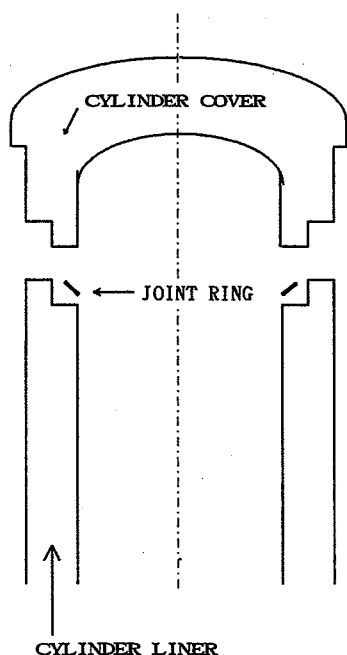


Fig 1

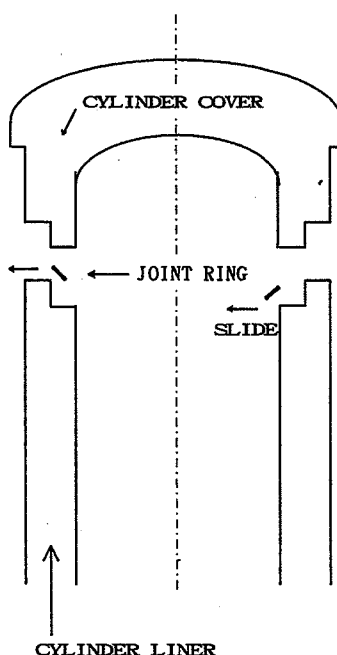


Fig 2

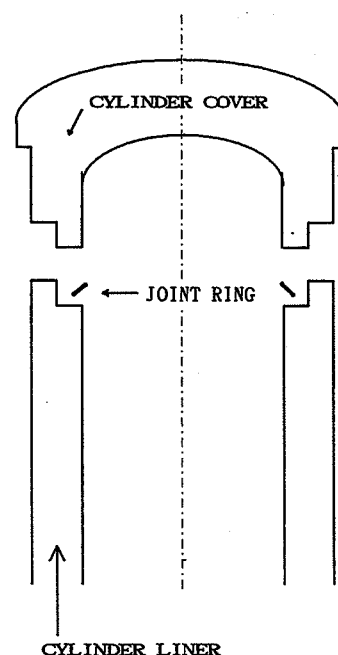


Fig 3

- 1 -

HISTORY

POWER SYSTEMS SALES DEPARTMENT
 DIESEL ENGINE AFTER-SALES
 SERVICE CENTER

DATE OF ISSUE: Jan. 1997



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TEL: (078)672-3797 FAX: (078)651-4166

Subject : Checking of Fitting Condition for Tachometer Pick-up Sensor	Classification	MITSUBISHI SULZER Diesel Engine
	Type	RTA
	No.	MSI-9702E
The electric speed signal of the main engine is detected with the pick-up sensor that counts the running teeth of the flywheel. The pick-up sensor is fitted on the fitting base near to the rear end of the bed plate. After being used for a long period, it may not detect the speed correctly because of loosening of the sensor or electric wire terminals, and so on, and the remote control system does not function properly. Therefore, please check the following items every half year to confirm that the fitting is secure : [Check Item] 1. Looseness of bolts on the fitting base of the pick-up sensor 2. Looseness of nuts for fitting the pick-up sensor 3. Looseness of the electric wire terminals 4. Looseness of the electric wire gland nut 5. Clearance between the pick-up sensor and flywheel tooth ends (For the design clearance, refer to the instruction manual kept on the ship.) 6. Remove the grease which is adhered on the pick-up sensor in order to keep proper function - 1 -		
HISTORY	POWER SYSTEMS SALES DEPARTMENT DIESEL ENGINE AFTER-SALES SERVICE CENTER DATE OF ISSUE: Feb. 1997	