

Confidential

JAPAN ENGINE CORPORATION

SERVICE ENGINEERING DEPARTMENT, SERVICE ENGINEERING SECTION
1, MINAMIFUTAMI, FUTAMI-CHO, AKASHI-CITY 674-0093, JAPAN

TEL. +81-78-949-0804 (direct), e-mail: sales2@j-eng.co.jp (parts & engineer order), service@j-eng.co.jp (technical inquiry)

(1/5)

Subject : Prevention of Inadaptability due to Use of FCC Fuel Oil	Application	UEC Diesel Engine
	Type	All UEC
	No.	USI-10013E
If necessary		

Recently, the cases resulting excessive wear on the piston rings and cylinder liners have tended to occur frequently due to fuel oil containing catalytic particles (FCC particles, cat fine) of the fuel oil refining process (hereafter called FCC fuel oil). On the background, it is presumed that the tendency is affected by bunker fuel oil of inferior quality due to a steep rise in prices of crude oil; therefore, you are kindly requested to pay attention to the following items for ship's services.

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

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

If the fuel oil judged to be FCC fuel oil is bunkered unavoidably, it is requested to prevent FCC particles from entering in the engine by carrying out proper pretreatment with the fuel oil cleaning system on 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 μ m to 150 μ m, the main content is an oxide compound of aluminium and silicon, and its hardness is near grinding material and very hard in comparison to steel.

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

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

The action priority indicated at the upper right corner is settled by Japan Engine Corporation originally and it does not decide the action of users.
Further, it is not guaranteed the every action carried out according to this service information.
The service information issued by Japan Engine Corporation included not only copyright but also all rights is reverted on Japan Engine Corporation.

Plan record	Newly issued 13th Dec. 2017 MSI-9652 Rev.3(1st Jan.1996)	Approved	<i>T. Yamamoto</i>	SERVICE ENGINEERING DEPARTMENT
		Checked	<i>N. Nakashima</i>	ENGINEERING DEPARTMENT
		Designed	<i>T. Fujimoto</i>	DATE OF ISSUE :13th Dec. 2017

In addition, if FCC particles enter the piston rod stuffing box, the running surfaces are damaged. The wear accelerated increasing oil leaking from the piston rod stuffing box. Therefore, it also should be taken carefulness for the piston rod stuffing box.

2. Avoidance of the inadaptability

- ① As mentioned in the engine instruction book, if the fuel oil is determined to be FCC fuel oil, it is recommended to refrain from using the fuel oil as much as possible.
- ② As the method of judging the contamination of FCC particles in the bunker fuel oil beforehand, the following three examples are considered mainly.
 - 1) It should be sure to get the bunker receipt from the fuel oil supplier. It is recommended that the specification (including aluminium + silicon) of bunker fuel oil purchased is within the attached recommendable values of heavy fuel oil properties.
 - 2) Direct observation method by the test kit on board
In order to FCC particles have a tendency to increase in proportion to containing rates of aluminium and silicon, it is presumed that the method observed directly with a microscope is effective in order to detect the existence of FCC particles.
Outline for direct observation;
 - a) Taking samples of fuel oil from various positions.
 - b) Dissolving the fuel oil with toluene.
 - c) Filtrating it with the filter.
 - d) Observing the solids residue on the filter with a microscope and confirm the existence of FCC particles.
 - 3) It can be recommended Fuel Oil Analysis Service (DNVPS, LR/FOBAS, etc.) of Classification Societies.
- ③ If FCC fuel oil is bunkered by any chance and the FCC fuel oil has to be used for the ship's service, it would be sure to service the ship by keeping on the following matters. In addition, it has to check frequently the piston rings and cylinder liners and watch their conditions.
 - 1) Increase cylinder lubricating oil feed rate.
 - 2) Lower cylinder cooling water temperature from 85°C to 75°C in order to preserve lubricating oil film.
 - 3) Lower scavenging air temperature as much as possible in the tolerance value.
 - 4) Drain out the sludge of the settling tank and service tank strictly (several times a day).
 - 5) Operate all purifiers in parallel and increase 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 pretreatment system, do not bypass the fine filter when the fuel oil is supplied to the main engine.
 - 7) If the cylinder liner temperature monitoring system is installed for the main engine, it should be operated the main engine while watching the system.

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

As the wear restraint measures, when wear has occurred due to use of FCC fuel oil, adding to the mentioned matters in the ③ items above, reduction of the engine load within the service schedule as much as possible is an effective measure in order not to progress the wear.

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 fuel oil 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 the drained sludge to the tanks. The drained sludge would be disposed or burned out in the boiler, etc. because there is a possibility that the sludge contains a lot of FCC particles.

- 2) In the case of the “high” and “low” suction ports exist in the service tank, it should be used the “high” suction port in order to prevent the sludge collected at the tank bottom.

3. Fine filter and purifier:

In current circumstances of inferior quality of bunker fuel oil, there is a case that waste oil from automobile lubricating oil, etc. are contaminated in bunker fuel oil. In this case, it becomes difficult to separate FCC particles from the fuel oil by the purifier. Therefore, the most effective measure against FCC fuel oil is to use the fine filter (less than 5 to 10 μm in practical effect) and it is recommended strongly to use the automatic back washing type fine filter. In addition, if the fine filter is not installed on the ship, it is also recommended strongly to install it additionally in order to prepare for the ship's service hereafter.

Besides, dispose or burn out the back-washed drain oil in the boiler, etc. because there is a possibility that the sludge contains a lot of FCC particles.

4. Notices for using the auto-backwashing type fine filter:

The following cases of troubles have been reported recently. Please pay attention to these matters.

Case 1:

The bypass line of fine filter unit was used, therefore FCC particles entered into the combustion chamber and unusual wear occurred on the piston rings and cylinder liners.

Preventive/corrective action:

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

(The filter mesh size of bypass line is around 60 μ m in many cases and FCC particles are not caught with this filter.)

Case 2:

The fine filter was bypassed when auto-backwash worked, then FCC particles entered into the combustion chamber and unusual wear occurred on the piston rings and cylinder liners.

Preventive/corrective action:

There is the fine filter which is bypassed automatically when auto-backwash works, depending on the fine filter type. Therefore, it is recommended to install another fine filter in the bypass line.

(In case of content of FCC particles is high, the frequency and time of auto-backwashing of the filter increase; therefore, the total period of bypassing is increases.)

If FCC fuel oil is supplied to the ship, it has to notify the warning strongly to the bunker fuel oil supplier for the prevention of recurrence.

FCC: Fluid Catalytic Cracking

UEC Diesel Engine
 Recommendable Values of Heavy Fuel Oil Properties
 at Bunkering and Engine Inlet

Item		Heavy fuel oil		
		Bunkering fuel oil quality limit value	Recommended fuel oil quality	
			Bunker	Engine inlet
Specific gravity (15°C)	kg/m ³	≤ 991	≤ 991	≤ 991
Kinematic viscosity (50°C)	mm ² /s	≤ 700	≤ 700	(13 ~ 17)*
Flash point	°C	≥ 60	≥ 60	≥ 60
Water	Vol. %	≤ 0.5	≤ 0.5	≤ 0.2
Carbon residue	mass %	≤ 18	≤ 12	≤ 12
Ash		≤ 0.10	≤ 0.05	≤ 0.05
Sulfur		≤ 3.5	0.1 ~ 3.5	0.1 ~ 3.5
Vanadium	mg/kg	≤ 350	≤ 150	≤ 150
Sodium		≤ 50	≤ 30	≤ 30
Aluminium + Silicon		≤ 60	≤ 30	≤ 7

*: Kinematic viscosity at engine inlet is described at the heating condition.

About the detail of recommendation of fuel oil properties are referred to USI-10014.