

SHIP IMPLEMENTATION PLAN

(for the consistent implementation
of the 0.50% Sulphur limit)

[0000 Shipping]

Name of vessel	
IMO NO.	

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SHIP IMPLEMENTATION PLAN(SIP)

Rev. 1.1

“SHIP NAME” / IMO No.1000000

2019.07.25
(Revision date)

Ver. No	Date	History	Remark
1.1	2019.7.25	SIP sample is established (through KR GEARS, http://gears.krs.co.kr)	



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Explanatory notes

1. MEPC 70 agreed to "1 January 2020" as the effective date of implementation for ships to comply with global 0.50% m/m sulphur content of fuel oil requirement and adopted resolution MEPC.280(70) on the Effective date of implementation of the fuel oil standard in regulation 14.1.3 of MARPOL Annex VI.
2. In this context, MEPC 73 agreed that Administrations should encourage ships flying their flag to develop implementation plans, outlining how the ship may prepare in order to comply with the required sulphur content limit of 0.50% by 1 January 2020. The plan could be complemented with a record of actions taken by the ship in order to be compliant by the applicable date.
3. A ship implementation plan is not a mandatory requirement, but administrations and PSC authorities may take into account the implementation plan when verifying compliance with the 0.50% sulphur limit requirement.
4. The ship implementation plan is about the fuel-related methods of compliance but for the ships fitted with EGCS can also develop this plan even if they already have a SOx emission compliance plan (SECP).



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Contents

1. Risk assessment and mitigation plan (impact of new fuels)
2. Fuel oil system modification (if needed)
3. Tank cleaning plan
4. Procurement of compliant fuel oil
5. Fuel oil changeover plan (conventional residual fuel oils to 0.50% Sulphur compliant fuel oil)
6. Documentation and reporting

● Ship particulars

Name of ship	
Distinctive number or letters	
IMO Number	
Company _(optional)	
Class _(optional)	KOREAN REGISTER
Flag _(optional)	
Ship's type _(optional)	00,000 DWT Product/Chemical Tanker



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1. Risk assessment and mitigation plan (impact of new fuels)

1.1 Risk assessment about the impact of new fuels :

Yes ☒ No ☐

• Detailed description

Prior to use of the LSFO (below 0.5% S) as main fuel of a ship, the risk assessment was carried out based on the result of the technical meeting with each manufacturer. Details were described on the attached document (Appendix 1 ship's risk assessment of new fuels).

· See the attached document (Appendix 1.1.1 ship's risk assessment of new fuels)

메모 포함[KR GEARS1]: Ships are advised to assess potential risk about the impact of new fuels. It is recommended to consider the fuel oil properties detailed in relevant IMO documents (Appendix 2 of MEPC.1 Circ.878 / Appendix 2 of Resolution MEPC.320(74)).

1.2 Linked to onboard Safety Management System (SMS) :

Yes ☐ No ☒

• Detailed description

...
...

· See the attached document (Appendix 1.2.1 ship's safety management system)

메모 포함[KR GEARS2]: KR's risk assessment sample can be the good guideline for developing ship's specific risk assessment tool.

*Please attach the appropriate pages for Risk assessment only (no heavy SMS with full contents)



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2. Fuel oil system modifications (if needed)

2.1.1 Schedule for meeting with manufacturer :

Date	2019. 9. 1
Manufacturer	MAN ES (2st Engine Maker)
Details	<p>After the technical meeting with MAN ES, we found major issues and mitigation measures as follows.</p> <p>1. Potential risk</p> <p>(1) Main Engine</p> <p>(a) Sticking phenomenon of the fuel injection pump</p> <p>(b) Difficulty to increase rational speed or load</p> <p>(c) Low temperature corrosion on fuel valves</p> <p>(d) Excessive wear of the cylinder line and piston ring, ring Groove, fuel injection valve</p> <p>(e) Poor ignition performance</p> <p>(f) Excessive deposits on the piston crown</p> <p>(2) Fuel oil system</p> <p>(a) Sticking phenomenon of the fuel supply/transfer pump</p> <p>(b) Excessive wear of gear parts</p> <p>(c) Leakage from pump seal</p> <p>(d) Decrease of the pump capacity</p> <p>(e) Shortening bearing life of pumps</p> <p>(f) Clogging of the filter</p> <p>(g) Sludge precipitation in the purifier</p> <p>(h) Sludge deposition in fuel oil storage tanks</p> <p>(i) Gasification of the low Sulphur fuel oil in piping line</p> <p>2. Mitigation measures</p> <p>(a) Installation of the cooler or chiller to keep viscosity of low sulphur fuel oil above 2cSt</p> <p>(b) Change of the cylinder oil with low BN (25-40) instead of high BN suitable for use of low sulphur fuel oil (0.5%)</p> <p>(c) Use of cermet-coated piston rings</p> <p>(d) Installation of the piston cleaning ring</p> <p>(e) Installation of 10um filter at inlet side of M/E</p> <p>(f) Parallel running operation of H.F.O purifiers</p> <p>(g) Replacement of the gravity disc suitable for use of low sulphur fuel oil (0.5%)</p> <p>(h) Adjustment of the fuel index</p> <p>(i) Replacement of the pump seal</p> <p>(j) Keep the temperature of the low sulphur fuel oil in fuel oil storage tanks at least 10 degree above the pour point</p> <p>(k) Removal of the steam tracing line surrounding the fuel oil line</p> <p>*If possible, attach the record files of meeting with manufacturer</p> <p>· See the attached document (<u>Appendix 2.1.1 Meeting memorandum with each manufacturer for the fuel system modification-Main Engine</u>)</p>

메모 포함[KR GEARS3]: The ship tank configuration and fuel system may require adjustments. A fully segregated fuel system for distillate fuels and blended fuels is recommended because they may require special attention the compatibility matter of fuel mixing onboard. Ship tank configuration and segregated fuel system will also allow for better management of potentially incompatible fuels.

When ship owners and operators consider the possible Fuel oil system modifications, they should consult with equipment manufacturers and classification societies about the modification plans to ensure their requirements.



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2.1.2 Schedule for meeting with manufacturer :

Date	2019. 9. 10
Manufacturer	HHI Engine & Machinery Division (4st Engine Maker)
Details	<p>After the technical meeting with MAN ES, we found major issues and mitigation measures as follows.</p> <p>1. Potential risk</p> <p>(1) Aux. engines</p> <p>(a) Sticking phenomenon of the fuel injection pump</p> <p>(b) Difficulty to increase rational speed or load</p> <p>(c) Low temperature corrosion on fuel valves</p> <p>(d) Excessive wear of the cylinder line and piston ring, ring Groove, fuel injection valve</p> <p>(e) Poor ignition performance</p> <p>(f) Excessive deposits on the piston crown</p> <p>(2) Fuel oil system</p> <p>(a) Sticking phenomenon of the fuel supply/transfer pump</p> <p>(b) Excessive wear of gear parts</p> <p>(c) Leakage from pump seal</p> <p>(d) Decrease of the pump capacity</p> <p>(e) Shortening bearing life of pumps</p> <p>(f) Clogging of the filter</p> <p>(g) Sludge precipitation in the purifier</p> <p>(h) Sludge deposition in fuel oil storage tanks</p> <p>(i) Gasification of the low Sulphur fuel oil in piping line</p> <p>2. Mitigation measures</p> <p>(a) Installation of the cooler or chiller to keep viscosity of low sulphur fuel oil above 2cSt</p> <p>(b) Change of the cylinder oil with low BN (25-40) instead of high BN suitable for use of low sulphur fuel oil (0.5%)</p> <p>(c) Use of cermet-coated piston rings</p> <p>(d) Installation of the piston cleaning ring</p> <p>(e) Installation of 10um filter at inlet side of A/E</p> <p>(f) Parallel running operation of H.F.O purifiers</p> <p>(g) Replacement of the gravity disc suitable for use of low sulphur fuel oil (0.5%)</p> <p>(h) Adjustment of the fuel index</p> <p>(i) Replacement of the pump seal</p> <p>(j) Keep the temperature of the low sulphur fuel oil in fuel oil storage tanks at least 10 degree above the pour point</p> <p>(k) Removal of the steam tracing line surrounding the fuel oil Line</p> <p>*If possible, attach the record files of meeting with manufacturer</p> <p>· See the attached document (<u>Appendix 2.1.2 Meeting memorandum with each manufacturer for the fuel system modification-Aux' Engine</u>)</p>



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2.1.3 Schedule for meeting with manufacturer :

Date	2019. 9. 13
Manufacturer	KANGRIM (Aux. Boiler Maker)
Details	<p>After the technical meeting with Kang-rim Boiler, we found major issues and mitigation measures as follows.</p> <p>1. Potential risk</p> <p>(1) Burner part</p> <p>(a) Falling off in the turn down ratio</p> <p>(b) Gasification of the low Sulphur fuel oil in the sprayer</p> <p>(e) Unstable or poor combustion performance</p> <p>(f) Different wave length of light areas</p> <p>(2) Fuel oil pump & Fuel oil system</p> <p>(a) Decrease of the pump capacity</p> <p>(b) Shortening bearing life of pumps</p> <p>(c) Excessive wear of gear parts</p> <p>(d) Sticking phenomenon of the fuel pump</p> <p>(e) Leakage from pump seal</p> <p>(f) Gasification of low Sulphur fuel oil in the piping line</p> <p>2. Mitigation measures</p> <p>(a) Installation of the cooler or chiller to keep viscosity of low sulphur fuel oil above 2cSt</p> <p>(b) Adjustment of combustion control such as the air/fuel ratio</p> <p>(c) Replacement of newly designed sprayer suitable for use of low sulphur fuel oil (0.5%)</p> <p>(d) Replacement of newly designed flame detector sensing the different wave length of the light area</p> <p>(e) Replacement of the pump seal</p> <p>(f) Removal of the steam tracing line surrounding the fuel oil Line</p> <p>*If possible, attach the record files of meeting with manufacturer</p> <p>· See the attached document (<u>Appendix 2.1.3 Meeting memorandum with each manufacturer for the fuel system modification-Aux' Boiler</u>)</p>



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2.1.4 Schedule for meeting with manufacturer :

Date	2019. 9. 14
Manufacturer	SAMGONG (HFO Purifier)
Details	<p>After the technical meeting with SAMGONG, we found major issues and mitigation measures as follows.</p> <ol style="list-style-type: none">1. Potential risk<ol style="list-style-type: none">(a) Sludge precipitation in a purifier(b) Abnormal vibration of the purifier body(c) Reduction of cleaning efficiency2. Mitigation measures<ol style="list-style-type: none">(a) Adjustment of the feed rate and the sludge discharge interval(b) Replacement of gravity discs <p>*If possible, attach the record files of meeting with manufacturer · See the attached document (<u>Appendix 2.1.4 Meeting memorandum with each manufacturer for the fuel system modification-Purifier</u>)</p>

2.1.5 Schedule for meeting with class :

Date	2019. 9. 15
Classification Society	Korean Register (Head Office/BUSAN)
Details	<p>After the technical meeting with KR head office, we found major issues and mitigation measures as follows.</p> <ol style="list-style-type: none">1. Potential risk<ol style="list-style-type: none">(a) Sufficient availability of low sulphur fuel oils in the world(b) Compatibility of blended low sulphur fuels when mixed together(c) No international standard(ISO 8217) for low Sulphur fuel oils such as the blending fuel oil and low Sulphur residual fuel oil except of MGO(d) Malfunction of combustion equipment such as engines, aux. boilers and purifiers as well as each pump and piping system in the engine room2. Mitigation measures<ol style="list-style-type: none">(a) Development of a ship implementation plan for your ship according to IMO guidance (MEPC.1/Circ.878) and our KR guidance (Ship owner's guidance for a ship implementation plan) <p>*If possible, attach the record files of meeting with class · See the attached document (<u>Appendix 2.1.5 Meeting memorandum with Class</u>)</p>



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2.2 Structural modification required :

Yes ☒ No ☐

• If Yes, continue with the below

2.2.1 Details of modification

Modification		Start date:	End date:
1. Fuel oil storage system	<input checked="" type="checkbox"/>	2019.10.1	2019.10.2
2. Fuel transfer, filtration and delivery sys	<input type="checkbox"/>	Country	Yard name
3. Combustion equipment ○ M/E ○ A/E ○ BLR ○ Others ()	<input type="checkbox"/>	KOREA	KOREA Shipyad
4. Other ()	<input type="checkbox"/>		

Details

In order to use the low sulphur fuel oil as the main fuel of a ship instead of the high sulphur fuel oil, the name of existing fuel oil tanks were changed without any structure modification and relevant drawings were also re-approved by classification society (KR) as follows.

(1) List of renamed fuel oil tanks

	Before	After
1	No.1 H.F.O. TK (S)	No.1 L.S.F.O. TK (S)
2	No.1 H.F.O. TK (P)	NO.1 L.S.F.O. TK (P)
3	NO.2 H.F.O. TK (P)	NO.2 L.S.F.O. TK (P)
4	NO.2 H.F.O. TK (S)	NO.2 L.S.F.O. TK (S)
5	H.F.O. Serv. TK (P)	L.S.F.O. Serv. TK (P)
6	H.F.O. Sett. TK (P)	L.S.F.O. Sett. TK (P)
7	H.F.O. Overflow TK (P)	L.S.F.O. Overflow TK (P)
8	M.D.O. Storage TK (S)	M.G.O. Storage TK (S)
9	M.D.O. Storage TK (P)	M.G.O. Storage TK (P)
10	M.D.O. Service TK (P)	M.G.O. Service TK (P)

(2) List of relevant drawings to be re-approved by class (KR) surveyor

- (a) General arrangement (DWG. No. 00000-000-00-R0)
- (b) Engine room construction (FR.21 ~ FR.32 Sec., DWG. No. 000000000)
- (c) Engine room construction (FR.33 ~ FR.40 Sec., DWG. No. 000000000)
- (d) D/BTM Const. In E/Room Incl. 3rd Deck (FR.11 ~ FR.30 Sec., DWG. No. 000000000)
- (e) D/BTM Const. In E/Room Incl. 3rd Deck (FR.31 ~ FR.40 Sec., DWG. No. 000000000)

• See the attached document (Appendix 2.2.1 Revised drawings for the LSFO)

메모 포함[KR GEARS4]: Examples :

Fuel oil storage sys' -

Distillate fuel tank modification

Disconnection or removal of heating coil

Fuel transfer, filtration and delivery sys' -

Line modification of Fuel oil return system

Newly installing the cooler or chiller for fuel line

Marking on the valves associated with modification and fuel changeover operation

Combustion equipment -

Changes of the fuel injection system, Burner arrangement, and Fuel heating system including the trace heating system if fitted.



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2.2.2 Details of modification

Modification	Start date:	End date:
1. Fuel oil storage system	<input type="checkbox"/>	2019.10.1
2. Fuel transfer, filtration and delivery sys	<input checked="" type="checkbox"/>	2019.10.5
3. Combustion equipment	<input type="checkbox"/>	Country
<input type="radio"/> M/E <input type="radio"/> A/E <input type="radio"/> BLR <input checked="" type="radio"/> Others ()	<input type="checkbox"/>	Yard name
4. Other ()	<input type="checkbox"/>	China
China Shipyard		

Details
<p>In order to prevent any problems during ship operations when the low sulphur fuel oil is used as main fuel of ship, relevant fuel oil systems were modified and also re-approved by classification society (KR) as follows.</p> <p>(1) List of modified piping lines</p> <ul style="list-style-type: none">(a) F.O transfer & purifying system(b) M/E & G/E F.O service system(c) Aux. Boiler F.O service system(d) Steam service & drain system(e) F.W. service system <p>(2) List of relevant drawings to be re-approved by class (KR) surveyor</p> <ul style="list-style-type: none">(a) Machinery arrangement (DWG. No. 000000000)(b) Piping system diagram in E/R (DWG. No. 000000000) <p>(3) Details of modification</p> <ul style="list-style-type: none">(a) One(1) cooler was installed before F.O supply pumps on the fuel oil service line for M/E and G/Es.(b) One(1) cooler was installed before supply pumps on the fuel oil service line for the Aux. boiler.(c) All inlet & outlet valves on the steam tracing line for existing H.F.O service line (M/E, G/E and Aux. Boiler) were completely closed and also inserted the blind plate into flanges on the steam inlet line.(d) Inlet & outlet valves on the steam line for M/E & G/E F.O preheaters and a boiler F.O heater were completely closed and also inserted the blind plate into flanges on the steam inlet line.(e) Inlet & outlet valves on the steam line for a boiler F.O heater was completely closed and also inserted the blind plate into flanges on the steam inlet line.(f) Additional F.W line for two (2) coolers were installed.(g) 10 um filters were installed at the inlet side of each engines (one(1) for M/E and three(3) for G/Es)(h) sampling cocks were installed at the inlet side of each engine (one(1) for M/E and three(3) for G/Es) <p>· See the attached document (<u>Appendix 2.2.1 Revised drawings for the LSFO</u>)</p>



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2.2.3 Details of modification

Modification		Start date:	End date:
1. Fuel oil storage system	<input type="checkbox"/>	2019.10.1	2019.10.5
2. Fuel transfer, filtration and delivery sys	<input type="checkbox"/>		
3. Combustion equipment	<input checked="" type="checkbox"/>	Country	Yard name
<input checked="" type="radio"/> M/E <input type="radio"/> A/E <input type="radio"/> BLR <input type="radio"/> Others ()	<input checked="" type="checkbox"/>		
4. Other ()	<input type="checkbox"/>	KOREA	KOREA Shipyard
Details			
<p>In order to prevent any problems during ship operations when the low Sulphur fuel oil is used as main fuel of ship, relevant equipment and spare parts were modified as follows.</p> <p>(1) List of modified parts</p> <ul style="list-style-type: none">(a) Piston rings(b) Piston cleaning rings(c) O-rings in fuel injection pumps and fuel injection valves <p>(2) List of relevant drawings</p> <ul style="list-style-type: none">(a) Main engine(b) Detail drawings of spare parts <p>(3) Details of modification</p> <ul style="list-style-type: none">(a) Existing four(4) piston rings were replaced with cermet-coated piston rings(b) Piston cleaning rings were installed between the cylinder liner and cylinder head.(c) All existing O-rings in fuel injection pumps and fuel injection valves were replaced with new one suitable for the operation on the low Sulphur fuel oil. <p>· See the attached document (<u>Appendix 2.2.1 Revised drawings for the LSFO</u>)</p>			



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2.2.4 Details of modification

Modification		Start date:	End date:
1. Fuel oil storage system	<input type="checkbox"/>	2019.10.1	2019.10.5
2. Fuel transfer, filtration and delivery sys	<input type="checkbox"/>		
3. Combustion equipment ○ M/E ○ A/E ○ BLR ○ Others ()	<input checked="" type="checkbox"/>	Country	Yard name
4. Other ()	<input type="checkbox"/>	KOREA	KOREA Shipyard
Details			
<p>In order to prevent any problems during ship operations when the low Sulphur fuel oil is used as main fuel of ship, relevant equipment and spare parts were modified as follows.</p> <p>(1) List of modified parts (a) Piston rings (b) Piston cleaning rings (c) O-rings in fuel injection pumps and fuel injection valves</p> <p>(2) List of relevant drawings (a) Aux. engine (b) Detail drawings of spare parts</p> <p>(3) Details of modification (a) Existing four(4) piston rings were replaced with newly designed piston rings suitable for the operation of the low Sulphur fuel oil. (b) Piston cleaning rings were installed between the cylinder liner and cylinder head. (c) All existing O-rings in fuel injection pumps and fuel injection valves were replaced with new one suitable for the operation on the low Sulphur fuel oil.</p> <p>· See the attached document (<u>Appendix 2.2.1 Revised drawings for the LSFO</u>)</p>			



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2.2.5 Details of modification

Modification		Start date:	End date:
1. Fuel oil storage system	<input type="checkbox"/>	2019.10.1	2019.10.5
2. Fuel transfer, filtration and delivery sys	<input type="checkbox"/>		
3. Combustion equipment ○ M/E ○ A/E <input checked="" type="radio"/> BLR ○ Others ()	<input checked="" type="checkbox"/>	Country	Yard name
4. Other ()	<input type="checkbox"/>	KOREA	KOREA Shipyard

Details

In order to prevent any problems during ship operations when the low Sulphur fuel oil is used as main fuel of ship, relevant equipment and spare parts were modified as follows.

(1) List of modified parts

- (a) Burners
- (b) Flame detectors
- (c) Supply oil pumps

(2) List of relevant drawings

- (a) Aux. boiler
- (b) Burners
- (c) Detail drawings of spare parts
- (d) Supply oil pumps

(3) Details of modification

- (a) Existing burners were replaced with newly designed burner suitable for the operation of the low Sulphur fuel oil.
- (b) Existing pumps were replaced with new one
- (c) Existing flame detectors were replaced with newly designed burner suitable for the operation of the low Sulphur fuel oil
- (d) The air/fuel ratio were adjusted for the operation of the low sulphur fuel oil.

· See the attached document (Appendix 2.2.1 Revised drawings for the LSFO)



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2.2.6 Details of modification

Modification		Start date:	End date:
1. Fuel oil storage system	<input type="checkbox"/>	2019.10.1	2019.10.5
2. Fuel transfer, filtration and delivery sys	<input type="checkbox"/>		
3. Combustion equipment ○ M/E ○ A/E ○ BLR <input checked="" type="radio"/> Others (Purifier)	<input checked="" type="checkbox"/>	Country	Yard name
4. Other ()	<input type="checkbox"/>	KOREA	KOREA Shipyard
Details			
<p>In order to prevent any problems during ship operations when the low Sulphur fuel oil is used as main fuel of ship, relevant equipment and spare parts were modified as follows.</p> <p>(1) List of modified parts (a) Gravity discs</p> <p>(2) List of relevant drawings (a) H.F.O purifiers (b) Detail drawings of spare parts</p> <p>(3) Details of modification (a) Existing gravity discs were replaced with new one suitable for the operation of the low Sulphur fuel oil. (b) Interval of the sludge discharge were adjusted.</p> <p>· See the attached document (<u>Appendix 2.2.1 Revised drawings for the LSFO</u>)</p>			



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(Revision date)**3. Tank cleaning plan**

3.1.1 Fuel storage tanks :

General	Current tank name & Capacity(m³)		Fuel type in current tank (S MAX, Grade)	New fuel type (S MAX, Grade) 0.42% S, LSFO	Tank cleaning required
	No.1 H.F.O. TK (S) / 176.8 m³		2.8% S, IFO380	0.42% S, LSFO	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>
	No.1 H.F.O. TK (P) / 176.8 m³		2.8% S, IFO380	0.42% S, LSFO	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>
	No.2 H.F.O. TK (S) / 531.5 m³		2.8% S, IFO380	0.42% S, LSFO	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>
	No.2 H.F.O. TK (P) / 451.4 m³		2.8% S, IFO380	0.42% S, LSFO	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>
	M.D.O. TK (S) / 105.1 m³		0.1% S, MDO	0.1% S, MGO	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
Cleaning Schedule	Start date			End date	
	2018. 08.15			2018. 12.15	
Cleaning Work	Method	Manual Cleaning at Dry dock	<input type="checkbox"/>	Using Additives	Quantity, Spec' and Supplier
		Manual Cleaning During service	<input type="checkbox"/>		a. Quantity of the fuel additive - 1 liter per 10 tons b. Specification of the fuel additive - AMERGY 222 c. Supplier - Drew Marine
		Dilution During service	<input checked="" type="checkbox"/>		
	Worker	Own crew	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
		Hired crew	<input type="checkbox"/>		
		Riding crew	<input type="checkbox"/>		
Other description	The tank cleaning procedure was basically divided into two steps and details are as follows. First step : Removal of the sludge in each tank - In this step, the fuel additive capable of dissolving the accumulated sludge in the bottom of each tank was poured to each fuel storage tank. This method was carried out twice during the bunkering according to the maker's recommendation. Second step : Flushing existing tanks with low sulphur fuel oil (0.1% S) - The sludge in each tank was dissolved and removed as much as possible by using the fuel additive in the first step, and then the amount of the existing high sulphur fuel oil (2.8% S) in each tank was minimized by sequentially using the fuel oil in each tank. · See the attached document (<u>Appendix 3.1.1 Recommended procedure for tank cleaning by a chemical manufacturer 'Drew Marine'</u>)				

메모 포함[KR GEARS5]: Up to late 2019, most ships will have been using high sulphur fuel oil (HSFO) based primarily on residual fuel oils. Such fuels tend to adhere to the inside of fuel tanks forming layers of semi-solid substances containing sediments and asphaltic sludge; such residues will also typically have solidified and settled in various parts of the fuel oil service system including pipelines, settling and service tanks.

The ship operator may choose to clean the fuel oil tanks of these residues before loading compliant fuel prior to 1 January 2020.

Time required will vary depending on tank size and the number of tanks, how long it has been since the last tank cleaning and the number of crew available to perform safe and complete tank cleaning operations. Tank cleaning can be performed by the ship's crew and/or by employing a riding crew for this purpose.

메모 포함[KR GEARS6]: It is recommended to clean out the residues at the bottom of tank manually. If operator choose to dilute such sediments with pure distillate oil, they need to definitely consider the side effects of them on the combustion machinery and system.



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3.2.1 Settling and service tanks :

General	Current tank name & Capacity(m ³)		Fuel type in current tank (S MAX, Grade)	New fuel type (S MAX, Grade) 0.42% S, LSFO	Tank cleaning required
	H.F.O. Sett. TK (P) / 36.3 m ³		2.8% S, IFO380	0.42% S, LSFO	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>
	H.F.O. Serv. TK (P) / 45.3 m ³		2.8% S, IFO380	0.42% S, LSFO	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>
	M.D.O. Serv. TK (S) / 47.2 m ³		0.1% S, MDO	No change	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
	H.P.P Engine Gas Oil TK (S) / 34.3 m ³		0.1% S, MDO	No change	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>

Cleaning Schedule	Start date		End date	
	2018. 08.15		2018. 12.15	

Cleaning Work	Method	Manual Cleaning at Dry dock	<input type="checkbox"/>	Using Additives <input checked="" type="checkbox"/>	Quantity, Spec' and Supplier a. Quantity of the fuel additive - 1 liter per 10 tons b. Specification of the fuel additive - AMERGY 222 c. Supplier - Drew Marine
		Manual Cleaning During service	<input type="checkbox"/>		
		Dilution During service	<input checked="" type="checkbox"/>		
	Worker	Own crew	<input checked="" type="checkbox"/>		
		Hired crew	<input type="checkbox"/>		
Riding crew		<input type="checkbox"/>			

Other description
<p>The tank cleaning procedure was basically divided into two steps and details are as follows.</p> <p>First step : Removal of the sludge in each tank - In this step, the fuel additive capable of dissolving the accumulated sludge in the bottom of each tank was poured to each fuel storage tank. This method was carried out twice during the bunkering according to the maker's recommendation.</p> <p>Second step : Flushing existing tanks with low sulphur fuel oil (0.1% S) - The sludge in each tank was dissolved and removed as much as possible by using the fuel additive in the first step, and then the amount of the existing high sulphur fuel oil (2.8% S) in each tank was minimized by sequentially using the fuel oil in each tank. Here, the existing high sulphur fuel oil (2.8% S) in the HFO settling tank was first emptied as much as possible and then filled with low sulphur fuel oil (0.1% S). When 30% of the existing high sulphur fuel oil (2.8% S) remained in the HFO service tank, the low sulphur fuel oil in the HFO settling tank was transferred to the HFO service tank. And then the existing high sulphur fuel oil in the HFO service tank was sufficiently diluted as of this procedure.</p> <p>· See the attached document (<u>Appendix 3.1.1 Recommended procedure for tank cleaning by a chemical manufacturer 'Drew Marine'</u>)</p>



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3.3.1 Lubrication oil tanks :

	Current tank name & Capacity(m ³)	LUB' oil type in current tank (BN Number)`	NEW LUB' oil type (BN Number)	Tank cleaning required
General	No.1 Cyl. Oil St. TK (S) / 22.2 m ³	100	15-40	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
	No.2 Cyl. Oil Stor. TK (S) / 20.9 m ³	100	15-40	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
	M.L.O Stor. TK (S) / 16.3 m ³	-	No change	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
	M.L.O Sett. TK (S) / 16.3 m ³	-	No change	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
	G/E L.O Stor. TK (S) / 4.1 m ³	100	15-40	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
	G/E L.O Stor. TK (S) / 4.1 m ³	100	15-40	Y <input type="checkbox"/> N <input checked="" type="checkbox"/>
Cleaning Schedule	Start date		End date	
Cleaning Work	Method	Manual Cleaning at Dry dock	<input type="checkbox"/>	Quantity, Spec' and Supplier
		Manual Cleaning During service	<input type="checkbox"/>	
		Dilution During service	<input type="checkbox"/>	
	Worker	Own crew	<input type="checkbox"/>	
		Hired crew	<input type="checkbox"/>	
		Riding crew	<input type="checkbox"/>	
Other description	*If No plan to clean the tank, describe the details of alternate steps taken to ensure the tank condition for receiving compliant fuel oil without tank cleaning.			

3.4 Approximate total fuel oil content (m³) in the fuel oil transfer, purification and delivery system :

Fuel oil transfer system	Purification system	Delivery system
2	1	1



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4. Procurement of compliant fuel oil

4.1 Details of fuel purchasing procedure of company to source compliant fuels, including procedures in cases where compliant fuel oil is not readily available :

• Detailed description

Our company, 0000 shipping, had signed a supply contract with 00 Innovation & 00 Trading International, a global refining company, to supply the low sulphur fuel oil for 10 years. Those oil refinery companies have a plan to supply the blending fuel oil (0.5% S) at Singapore port and Ulsan port respectively. In addition, our company has an emergency response plan in case the compliant fuel is not available. Refer to the attachments

• See the attached document (**Appendix 4.4.1 Detail of purchasing procedure**)

4.2 Estimated date for the first bunkering of compliant fuel oil, not later than 24:00 hrs, 31 DEC 2019 :

Date	Bunkering port	Estimated fuel type and quantity	
2019.11.15	BUSAN	Blending fuel oil	1200 M ³

4.3 The fuel arranged by charterer (If possible, attach the copy page of contract for that contents):

Yes ☐ No ☒

• If Yes, continue with Q. 4.4 and If No, Go To Q. 4.6

4.4 In contract, charter party have obligation to provide compliant fuel after 01 JUN 2019 or other identified date :

Yes ☐ No ☐

• If Yes, Go To Q. 4.6 and If No, continue with Q. 4.5

4.5 Detailed description of alternate steps taken :

...

• See the attached document (**Appendix 4.4.5 Alternate steps - procurement bunker**)

4.6 Is there confirmation from bunker supplier(s) to provide compliant fuel oil on the specified date? :

Yes ☒ No ☐

• If Yes, Go To Q.4.8 and If No, continue with Q. 4.7

4.7 Detailed description of alternate steps taken to ensure timely availability of compliant fuel oil :

...

• See the attached document (**Appendix 4.4.7 Alternate steps - bunker supplier**)

메모 포함[KR GEARS7]: The required 0.5% S_{max} compliant fuels should be ordered well enough in advance of 1st JAN' 2020.

It is recommended that ships consider completing the changeover well before 1st JAN' 2020 in order to handle any operational and supply issues that could arise before the Global Sulphur Cap enters into force.

But, fuel oil suppliers are unlikely to produce and make available large quantities of 0.5% S_{max} compliant fuels until there is demand for them.

So, it is recommended that owner/operators discuss their needs with suppliers and start ordering compliant fuels from as early as the middle of 2019.

These requirements should be communicated to the charterer in those cases where the charterer purchases the fuel oil.

Should a ship, despite its best effort to procure compliant fuel oil, be unable to do so, the master/company must prepare a record of actions taken to attempt to bunker correct fuel oil and report evidence of an attempt to purchase compliant fuel oil in accordance with its voyage plan to the ship's flag state and/or competent PSC.

If, despite best efforts, it was not possible to procure compliant fuel oil, the master/Company must immediately notify the port State Administration in the port of arrival and the flag Administration (regulation 18.2.4 of MARPOL Annex VI)



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4.8 Is there plan to dispose of any remaining non-compliant fuel oil? :

Yes ☐ No ☒

• If No, describe the detail only

Date	Country	Port
Detailed description		
...		
· See the attached document (<u>Appendix 4.4.8 Schedule for dispose of N/C fuel oil</u>)		



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(Revision date)**5. Fuel oil changeover plan**

(conventional residual fuel oils to 0.50% Sulphur compliant fuel oil)

This page is the summary description of Fuel Oil Changeover Plan, and the full document of the plan should be attached in this document.

메모 포함[KR GEARS8]: Consider whether a ship-specific fuel changeover plan is to be made available. The plan should include measures to offload or consume any remaining non-compliant fuel oil. The plan should also demonstrate how the ship intends to ensure that all its combustion units will be using compliant fuel oil no later than 1 January 2020.

5.1 Is a ship-specific fuel changeover plan available? :

(This plan refers to the fuel switch for 'compliance with the 2020 Sulphur cap' and not the fuel switch when sailing in and out of ECAs)

Yes ☒ No ☐

• If Yes, the full plan should be attached and If No, needless to fill the below

• See the attached document (Appendix 5.1 Ship's fuel oil changeover plan to compliant with 2020 sulfur cap)

5.2 Estimated date & time(UTC) for commencement of the changeover procedure :

Date	Time
2019.12.16	09:00

5.3 The maximum time period required to changeover the ship's fuel system to use compliant fuel at all combustion units :

Main Engine	5 hour(s) 30 minute(s)
Main Boiler	hour(s) minute(s)
Generator Engine	3 hour(s) minute(s)
Auxiliary Boiler	hour(s) 30 minute(s)
Inert Gas Generator	hour(s) minute(s)
Other()	hour(s) minute(s)

5.4 Expected date & time (UTC) of completion of changeover procedure :

(This completion date means the day when all the combustion units are fully changeovered with compliant fuel oil)

*The date should be the same date as stated in the official documents (Oil Record Book, ENG Log Book)

Date	Time
2019.12.16	14:00



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5.5 The complete changeover procedure should include these following items, please check whether it was included or not :

A formula for calculating the time required for complete changeover	<input checked="" type="checkbox"/>
Sequence of changeover operation	<input checked="" type="checkbox"/>
Location of valves, pumps and heaters	<input checked="" type="checkbox"/>
Changing cylinder oil with different base number	<input checked="" type="checkbox"/>
Note :	
a. The time for fuel oil change-over was calculated by using the FOCO program developed by KR, and described separately on the attached document (Appendix 5.1 ship's fuel oil changeover plan to compliant with 2020 sulphur cap)	
b. Details of fuel oil change-over procedure including schematic diagram showing the location of valves, pumps and heaters were developed for our ship and described separately on the attached document (Appendix 5.1 ship's fuel oil changeover plan to compliant with 2020 sulphur cap)	
c. Procedures for changing the lubricating oil for marine diesel engines were described separately on the attached document (Appendix 5.1 ship's fuel oil changeover plan to compliant with 2020 sulphur cap)	

5.6 Attach the relevant records showing ships specific familiarization and training of crew with the Fuel Oil Changeover Plan :

- Detailed description

The training course of our crews was basically divided into two steps and details are as follows.

First step : Set up the scenario for training of crews

- In this step, the simulation scenario was developed in order to educate for the fuel oil change-over based on the fuel oil change-over procedure. This training was carried out twice a month.

Second step : Actual training for fuel change-over between HSFO and LSFO

- In this step, All valves and each equipment related to the fuel oil change-over for M/E, G/Es and Aux. boilers were checked before entering SECA (SO_x emission control area) and then the HSFO in the fuel oil system were slowly changed to the LSFO. At that time, all values such as the temperature and the pressure, especially the viscosity of the fuel in fuel oil system, were monitored and recorded in the engine room log book and the education document.

· See the attached document (Appendix 5.6 Specific familiarization and training of crews with the Fuel Oil Changeover Plan)



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6. Documentation and reporting

6.1 If there are any modifications planned to the fuel oil system, related documents should be consequently updated :

6.1.1 Shipboard fuel oil tank management plans

...
Modifications of the fuel oil system were described on attached documents
(Appendix 3 Revised drawings for the LSFO)

6.1.2 Stability booklets :

There were no modification on the stability document because fuel tanks were not modified.

6.1.3 Trim booklets :

There were no modification on the stability document because fuel tanks were not modified.

6.1.4 Other :

None

6.2 When following the implementation plan the ship has to bunker and use non-compliant fuel oil due to unavailability of compliant fuel oil safe for use on board the ship, steps to limit the impact of using non-compliant oil could be :

- Detailed description

When our ship can't receive the LSFO during ship's operation it is inevitable to use the HSFO. In this case the following measures should be taken to minimize the impact of using of the HSFO.

First step:

- In this step, the HSFO should be loaded in No.1 bunker tanks (P & S) in order to minimize the mixing of different oil in bunker tanks in consideration of the ship's operation schedule.

Second step:

- The amount of the LSFO in the L.S.F.O service tank should be minimized as much



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as possible in order to minimize the mixing of different oils in this tank when the HSFO is transferred to both L.S.F.O settling & service tanks.

Third step:

- The fuel oil system should be lined up to make it suitable for using the HSFO and then the bunker change should be carried out according to our standard procedure for the fuel oil change-over.

Final step:

- After the LSFO is loaded on our ship during the ship's operation proper measures should be taken to minimize the mixing of different oils in No.1 bunker tank (P&S), L.S.F.O settling & service tanks during the bunker change.

- 6.3 The ship should have a procedure for Fuel Oil Non-Availability Reporting (FONAR). The master and chief engineer should be conversant about when and how FONAR should be used and who it should be reported to.

- Detailed description

This report is purpose to provide evidence if a ship is unable to obtain fuel oil compliant with the provisions stipulated in regulations 14.1 or 14.4 of MARPOL Annex VI. A procedure and standard form for FONAR were described on attached documents. Refer to the attachments (*Appendix 6.3 FONAR*)

Appendix list

1. Risk assessment and mitigation plan

- *Appendix 1.1.1 ship's risk assessment of new fuels*
- *Appendix 1.2.1 Ship's safety management system*

2. Fuel oil system modification

- *Appendix 2.1.1 Meeting memorandum with each manufacturer for the fuel system modification-Main Engine*
- *Appendix 2.1.2 Meeting memorandum with each manufacturer for the fuel system modification-Aux' Engine*
- *Appendix 2.1.3 Meeting memorandum with each manufacturer for the fuel system modification-Aux' Boiler*
- *Appendix 2.1.4 Meeting memorandum with each manufacturer for the fuel system modification -Purifier*
- *Appendix 2.1.5 Meeting memorandum with Class*
- *Appendix 2.2.1 Revised drawings for the LSFO*

3. Tank cleaning plan

- *Appendix 3.1.1 Recommended procedure for tank cleaning by a chemical manufacturer (Drew Marine)*

4. Procurement of compliant fuel oil

- *Appendix 4.4.1 Detail of purchasing procedure*
- *Appendix 4.4.5 Alternate steps - procurement bunker*
- *Appendix 4.4.7 Alternate steps - bunker supplier*
- *Appendix 4.4.8 Schedule for dispose of N/C fuel oil*

5. Fuel oil changeover plan

- *Appendix 5.1 Ship's fuel oil changeover plan to compliant with 2020 sulfur cap*
- *Appendix 5.6 Specific familiarization and training of crew with the Fuel Oil Changeover Plan*

6. Documentation and reporting

- *Appendix 6.3 FONAR*

M/V “Vessel Name”

JULY 2019

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Appendix 1.1.1 ship’s risk assessment of new fuels

Notices

This document provided by Korean Register is a guidance and sample for the preparation of a Risk Assessment that consists of a part of the Ship Implementation Plan (SIP). Although the document presents a wide range of cases and examples expected for Risk Assessment and mitigation plan of new fuels applied, it is not necessary for shipping companies and ships to adopt all of them. Thus, it is recommended that the actual Risk Assessment and mitigation plan are developed based on the inherent requirements of the vessel and the company's own quality system that manages whole fleets. The guidance is only intended for general informational purpose. Therefore, please note that Korean Register is not responsible for any loss or damage caused by the use or acceptance of the information contained in this document.

Purpose

FOR THE DEVELOPMENT OF A SHIP IMPLEMENTATION PLAN (SIP)
FOR ACHIEVING COMPLIANCE WITH THE 0.50% SULPHUR LIMIT
ENTERING INTO FORCE ON 1 JANUARY 2020 USING COMPLIANT FUEL.

1. Risk Assessment & Mitigation

Risk assessment is a series of logical steps to enable, in a systematic way, an analysis and evaluation of risks. There are many ways and methods used for hazard identification and risk quantification, each of them having some benefits and deficiencies. That is why selection of the suitable method is very important. In choosing an adequate method some information should be taken into account. It includes the purpose of the assessment, current state of the shipping companies, data available or financial implications. Each method requires sufficient transparency of particular steps both for companies of the risk assessment results and all ships which can be affected by risk.

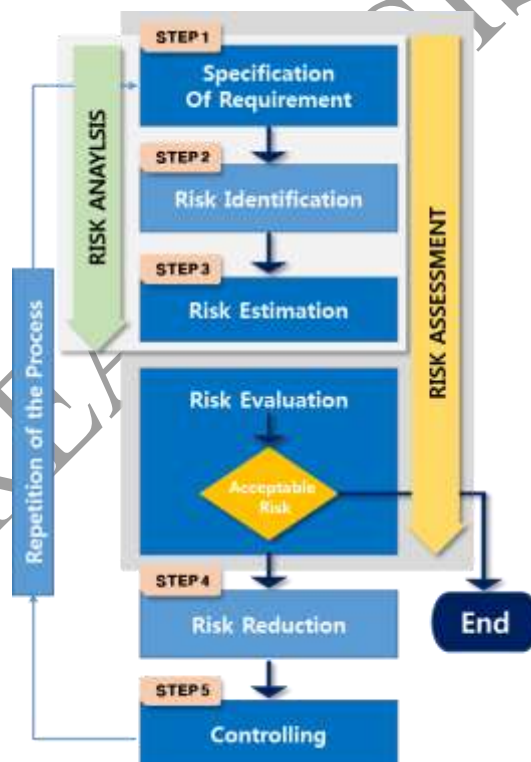


Figure 1: Methodology of risk assessment and reduction/mitigation

2. Methodology

Step 1. Specification of Requirement

The first step of 'risk assessment and reduction/mitigation' consists in collecting complete and up-to-date information concerning the type of action performed by the manner of their execution, machinery condition, as well as operated machines and tools and the protective measures which are already in use. In the course of collecting the above information it is essential to take account of all types of action.

Step 2. Risk Identification

The most important phase in the risk assessment process consists in identifying all hazards which, when applying the new fuels to the ships and preparing the procurement of them, may cause undesirable result expected.

Step 3. Risk Estimation & Risk Evaluation

Risk estimation consists in determining the effect of triggered hazards and their probability. Consequently, in the risk evaluation it has to be decided whether or not and how fast actions need to be taken in order to eliminate or minimize the risk.

Step 4. Risk Mitigation/Reduction

Depending on the level of the assessed risk it is necessary to plan and implement effective preventative measures, creating 'proposed action' (see Annex II of this guidance). Their aim is to eliminate or minimize the existing risk while not generating new hazards at the same time.

Step 5. Controlling

Preventative measures should be integrated and coordinated at the whole company & ship level. This approach will provide the basis for the development of an efficient risk management system based on the flow of information and harmonized actions.

Annex I. Risk Matrix and Evaluation Criteria

[Risk Matrix]

FI	Frequency	Severity Index		
		1	2	3
		Low	Medium	High
5	Frequent	5.0	10.0	15.0
4	Probable	4.0	8.0	12.0
3	Occasional	3.0	6.0	9.0
2	Rare	2.0	4.0	6.0
1	Improbable	1.0	2.0	3.0

[Risk Index/Rating, RI]

RI	Risk Level		Description
10~20 :	H	Not Acceptable Risk	Additional Safety measure is "required" in order to reduce the risk
4~9 :	M	ALARP Risk	Additional Safety measure is "recommended" to reduce the risk "As Low As Reasonably Practical(ALARP)"
1~3 :	L	Acceptable Risk	No additional safety measure is required

[Frequency Index, FI]

FI	Frequency	Description
5	Frequent	Likely to occur once per 3 months on one ship
4	Probable	Likely to occur once per 6 months on one ship
3	Occasional	Likely to occur once per one year on one ship
2	Remote	Likely to occur once per 5 years on one ship
1	Improbable	Likely to occur once per 25 years on one ship

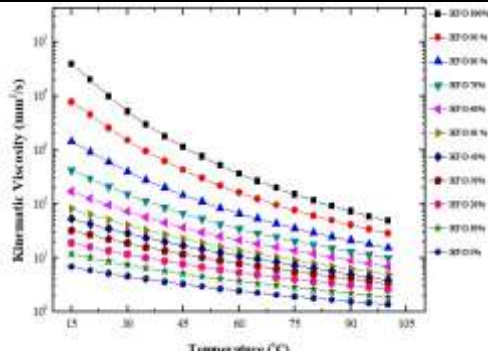
[Severity Index, SI]

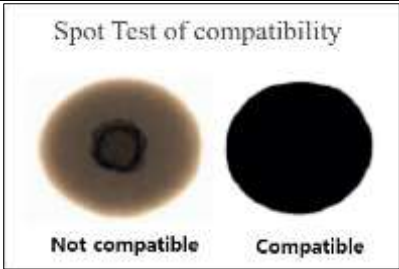
SI	Severity	Definition (Effect on)	
		Ship	Environment
1	Minor	Local Damage	Partial/local environmental influence (Takes months of environmental restoration)
2	Major	Serious Damage	Serious/local environmental influence (Takes years of environmental restoration)
3	Critical	Critical Damage	Critical/wide environmental influence (Takes hundreds of years of environmental restoration/Not possible)

Annex II. Sample of Risk Assessment Report

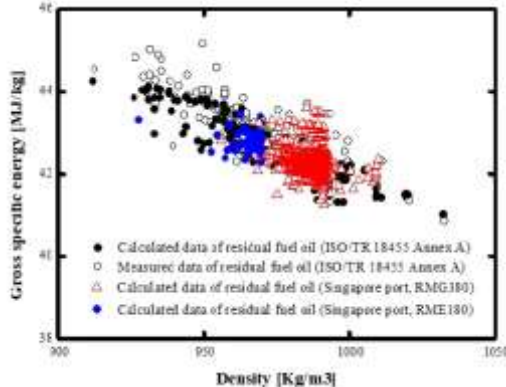

Risk Assessment						Risk Reduction & Controlling					
No	Risk Identification		Risk Evaluation			Proposed Action	Risk Evaluation				
	Event & Cause	Potential Consequence	FI	SI	RI		FI	SI	RI		
101. Procurement of compliant fuel / 규제만족 연료유의 수급											
01	Off-spec. compliant fuel to quality requirement(such as the latest version of ISO 8217) 품질기준 부적합 연료유 사용 (ISO 8217 등)	• Damage, failure of the machinery 기기의 손상 • Machinery performance deterioration 기기 효율의 저하	4	3	H	1. Set the requirements for fuel specifications(ex. ISO 8217 : 2017), when contracting compliant fuel supply 연료유 수급 계약 시, 품질기준 (ISO 8217 등) 제시 2. When receiving fuel, request fuel analysis to professional analytical agency 벙커링 시 전문 분석기관에 연료유 샘플 분석 의뢰 3. Keep the list for on-spec' fuels suppliers by region 수급 지역별 양호한 연료유 공급자들 관련 현황 및 기록 관리	3	1		L	
02	Lack of stock for compliant fuel oil at bunkering port 급유 항에서의 규제 만족연료유의 재고 부족	• Failures to procure adequate amount of compliant fuel oil 적정량의 규제 만족 연료 수급 불가	3	3	M	1. Establish the procedure of the supply fuel oil for a specific voyage. 특정 항해 구간에 대한 선박 연료유 수급 절차 계획 수립 2. Use the alternative fuels (MGO, ULSFO(0.1 %)) 대체 가능한 연료유의 사용 (MGO, ULSFO(0.1 %)) 3. If additional bunkering is not possible, Fuel Oil Non Availability Report (FONAR) is to be submitted to the ship's flag state and/or competent port authority of destination(See Appendix 6.3 FONAR) 추가적인 연료유의 공급이 불가할 시 기국 또는/그리고 항만국에 연료유 이용 불가보고서(FONAR) 작성 및 제출(SIP Appendix 6.3 참조) 4. After FONAR, Prepare how to deal with remaining fuels exceeding the 0.1/0.5% Sulphur limit, based on policy of flag state at the next port of call(e.g. De-bunkering) FONAR 제출 후, 차항지 항만당국의 지시에 따라 미준수 연료유를 처리(예 : 육상 양륙) 5. Proceed with compliant fuel purchase according to pre-planned alternatives 규제 만족 연료유의 수급 불가에 대한 수립된 대처 방안 수행 6. Getting familiar with the fuel changeover procedures stated in chapter 5 of SIP established(See Appendix 5.1 Fuel Oil Changeover plan) SIP 5항, 연료유 전환절차에 대한 재 숙지(SIP Appendix 5.1 참조)	2	1		L	

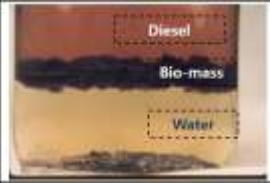

03	Unavailability of proper lubricant oil 적합한 윤활유의 사용 불가	<ul style="list-style-type: none"> Excessive deposit generation at upper part of piston crown caused by the use of inappropriate lubricant oil(unmatched TBN) 부적합한 윤활유 사용(부적합한 TBN)으로 인한 과도한 퇴적물 발생(피스톤 크라운 상부 등) 	3	2	M	<p>1. Consulting with engine manufacturer about the proper lubricants for compliant fuel oil(See Appendix 5.1 Fuel Oil Changeover plan - 2.6 MAN ES) 규제 만족 연료유에 적합한 윤활유에 대해 엔진 제조사와 협의 (SIP Appendix 5.1 – 2.6 참조)</p> <p>2. Preventing the damage of piston ring & cylinder liner seizure caused by using unsuitable lubricant (e.g. Installing piston cleaning ring) 과도한 퇴적물로 인한 피스톤 링, 실린더 라이너 손상 방지 (예: 피스톤 클리닝 링 설치 등)</p> <p>3. Take proper measures to reduce damages on the component inside ship engine/exhaust line 기관 및 배기 계통 손상을 최소화 할 수 있는 적절한 조치 이행</p>	1	1	L
201. Fuel Storage and management / 연료유의 저장 및 관리									
01	Inappropriate fuel tank cleaning 부적절한 연료유 탱크 소제	<ul style="list-style-type: none"> Alleged violation of the sulfur limits caused by contamination of new fuel, resulting fine and detention. 새 연료유의 오염에 따른 규제의 위반으로 벌금, 출항금지 조치 Asphaltene and sludge deposition, finally causing machinery damages (e.g. Excessive vibration of purifier) 슬러지 생성으로 인한 기기 손상 (예: 청정기 과진동) 	3	3	M	<p>1. Analyze Sulphur content of fuel sample in use before entering engines when finishing the fuel change over according to SIP(Test Method: ISO 8754) 수립된 SIP에 따라 연료유 전환을 완료한 후 엔진 전단의 연료유에 대한 황 함유량 분석 시행(시험방법: ISO 8754)</p> <p>2. Conducting tank inspection before bunkering and fuel changeover. 연료유 수급 및 전환 전 탱크 점검 수행</p> <p>3. Develop the procedure for cleaning the tank according to SIP with technical measures to remove all the deposition and contaminated sludge (See Appendix 3.1.1 Procedure for tank cleaning) 퇴적 오염물에 대한 기술적인 탱크 소제 절차 수립(SIP Appendix 3.1.1 참조)</p>	1	2	L
02	Failure of viscosity control of compliant fuel & Low lubricity 규제 적합 연료유의 점도 관리 실패, 낮은 윤활성	<ul style="list-style-type: none"> Fuel leakage, pressure drop in supply line, degradation of lubricity 연료 공급라인 내 누유 및 압력 저하, 윤활성 감소 Potential damage of machinery caused by fuel viscosity & low lubricity 연료유의 낮은 점도와 윤활성으로 인한 기기 손상 Machinery performance deterioration 기기 효율의 저하 Insufficient fuel supply to combustion 	5	2	H	<p>1. Check the characteristics of fuel viscosity depending on temperature 온도변화에 따른 연료의 점도특성 파악</p>	1	1	L

		unit, inducing power degradation 연소장치 내 연료유 공급 장애				 <p>[Kinematic Viscosity of blended fuels with various mixing ratio of RME 380sct@50°C & MGO 11cst@40°C] • Source : KR Research Division</p> <ol style="list-style-type: none"> Set up and operate the automated temperature control system to keep the proper viscosity(e.g. using fuel cooler/chillers) 연료유의 자동 온도 조절 장치 설치 및 운용(cooler, chiller) Improve fuel oil lubricity using additives 첨가제 사용을 통한 연료 윤활성 개선 (According to manufacturer's instruction) Replace pumps considering viscosity & lubricity (제작사의 권고사항에 따라) 낮은 점도와 윤활성을 고려하여 펌프 교체 Replace engine piston rings as per engine manufacture's recommendations (e.g. Installation of cermet coated piston rings) 엔진 제작사의 권고사항에 따른 엔진 피스톤링 교체 (예: 서멧 코팅 피스톤 링 설치) 			
03	Stability & compatibility issues of compliant fuel oil (generation of sludge) 규제만족 연료유의 안정성, 혼합 안정성 관련 이슈사항 (슬러지 생성)	<ul style="list-style-type: none"> Potential damage of machinery caused by sludge 슬러지 유입으로 인한 기기 손상 Filter clogging problem in fuel system 연료유 계통 내 필터 폐색 Machinery performance deterioration 기기 효율의 저하 	5	2	H	<ol style="list-style-type: none"> Establish a management plan for the fuel oil tank considering various types of fuel oils and bunkering locations 서로 다른 유종과 연료유 수급지에 따른 연료유 탱크의 관리 및 계획(필요 시 연료 공급 및 보관 시스템 변경) Establish a plan to handle the problems due to the mixing of various compliant fuels (e. g. fuel tank segregation) 서로 다른 연료의 혼합에 대응 하기 위한 계획 수립(탱크 분리 등) <p>- Check the compatibility(e. g. ASTM D4740), prevent sludge formation and fuel stratification</p>	1	2	L

	<p>- such as supply of unstable fuels produced by the upgrading unit of refinery 정유 과정에서 생성되는 불안정한 연료유의 공급</p> <p>- such as mixing of two different fuel on board. 다른 성분의 연료유 혼합</p>	<ul style="list-style-type: none"> • Problem of fuel supply to fuel combustion unit 연소장치 내 연료유 공급 장애 • Abnormal operation of purifiers caused by sludge deposition (e.g. Excessive vibration of purifier) 슬러지 폐색에 따른 청정기의 비정상적 작동(예: 청정기 과진동) 				 <p>Source : Chevron</p> <p>연료유의 호환성 확인, 연료유 탱크 내 슬러지 발생 및 연료유 계층화를 방지 하기 위한 방안 수립</p> <ol style="list-style-type: none"> 3. Use the dispersant to prevent sludge precipitation 슬러지 침전을 방지하기 위한 분산제 투입 4. When receiving fuel, request fuel analysis to professional analytical agency 병커링 시 전문 분석기관에 연료유 샘플 분석 의뢰 5. Conduct measures to avoid sludge deposition in purifiers (e.g. Parallel operation of purifier, adjusting flow rate and discharge interval) 청정기 내 슬러지 폐색을 막기 위한 조치 실행 (청정기 병렬운전 및 통유량, 배출 간격조절) 			
04	<p>Excessive contents of Cat-fines in compliant fuel oil 규제만족 연료유의 Cat-fine 함량 과다</p>	<ul style="list-style-type: none"> • Abrasive wear of combustion unit (piston ring & liner, gear, plunger and barrel) caused by catalytic fines (Al+Si) Cat-fine으로 인한 연소장치 과다마모 	5	2	H	<ol style="list-style-type: none"> 1. Conduct measures to prevent abrasion of supply system's gear (e.g. Parallel operation of purifier, adjusting flow rate and discharge interval) 공급 시스템의 마모를 완화하기 위한 조치 실행 (청정기 병렬운전, 연료유 토출 유량 및 배출 간격조절) 2. Additional installation or replacement of fine filter at inlet of combustion unit 연소장치 전단에 미세필터를 추가 설치하거나 필터를 교체 3. Drain out the water and sludge at the bottom of tanks (cat-fine may exist) Settling 탱크 내 물과 슬러지 배출, 탱크 하부에 Cat-Fines이 존재하는 경우가 있음 3-1. When receiving fuel, request fuel analysis to professional analytical agency 병커링 시 전문 분석기관에 연료유 샘플 분석 의뢰 3-2. If fuel is out of specification, need to confirm the contract about Cat-fines contents and prepare some proving data for possible arguments 연료유 off-spec의 경우, Cat-Fine(계약 위반)을 확인하여, 법적 조치를 위한 연료유 공급과 기계 장치의 손상에 대한 증거를 수집 	1	2	L

05	Low quality of ignition and combustion of compliant fuel 규제 적합 연료유의 점화, 연소특성 관련 문제	<ul style="list-style-type: none"> Increased levels of unburned hydrocarbon, resulting deposition in the combustion chamber (e. g. piston crown) and other exhaust system. 연소장치 및 배기 계통에 불완전 연소물질들의 퇴적 Failure of engine start, or take longer time 엔진 시동 불량 Increase in exhaust gas in temperature 배기가스 온도 상승 Loss of engine power 엔진출력 감소 Increased wear of cylinder liner caused by disrupted lubrication oil film with high temperature. 연소실 내 온도 과다 상승으로 인한 실린더 라이너 손상 Shut down of engine 기기 정지 	3	3	M	<p>1. Close monitoring of engine's condition parameters - Fuel & exhaust gas temperature, fuel consumption, cylinder liner temperature, cylinder pressure, turbocharger rpm etc. 엔진 운전 상태 모니터링 철저</p> <p>- 연료유 및 배기가스 온도, 연료 소모량, 실린더 라이너 온도, 실린더 압력, 터보차저 RPM 등</p> <p>2. Check the ignition/combustion properties of compliant fuel (FIA test result, CCAI, carbon residue, density, engine test etc.), before contract. 공급 계약 전, 규정 준수 연료유에 대한 엔진 점화/연소 특성 확인 (FIA Test 결과, CCAI, 잔류 탄소분, 밀도, 엔진 테스트 등)</p> <p>3. Take proper measures based on the monitoring data and fuels' combustion properties(with engine maker's recommendation)</p> <p>- Adjustment of VIT within the limit not exceeding NOx emission(as per approved NOx technical file) Increase/decrease of the engine load/speed based on monitored data & combustion properties</p> <p>- Unusual high density of fuels* may cause undesirable phenomena in combustion process, thus avoid using those fuels (ignition delay, post-combustion, low specific energy etc.) <i>*Possibly, those fuels have high content of HCO & Aromatics (Heavy Cycle Oil produced in upgrading unit of refinery). These have strong chemical bonding which make the combustion difficult.</i></p> <p>모니터링 데이터와 연료 연소 특성을 확인하여 적절한 조치 실행 (엔진 메이커 권장사항 참고)</p> <p>- NOx 규정을 준수하는 정도에서의 VIT 조절(NOx Technical file 참조)</p> <p>- 엔진 부하와 속도를 모니터링 및 연소 데이터를 기준으로 조정</p> <p>- ·비정상적으로 높은 밀도의 연료* 는 연소를 어렵게 할 가능성이 있어 사용을 지양할 것(점화지연, 후 연소, 낮은 비 에너지 등)</p>	1	2	L
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						 <p>[Gross Specific energy of marine fuel with density variation] • Source : KR Research Division</p>																										
						4. Use additives for improving combustion/ignition quality 연소 성능 향상을 위한 연료 첨가제 사용																										
06	Cold flow properties of low viscosity fuels 저점도 연료의 저온 유동 특성	<ul style="list-style-type: none">Filter clogging problem in fuel system caused by Wax formation 왁싱 현상으로 인한 연료유 계통 내 필터 폐색Wax deposition in purifier disc, occurring the excessive vibration of purifier 청정기 디스크의 왁스 퇴적으로 인한 청정기 과진동 발생  <p>• Source : INNOSPEC</p>	4	2	M	<p>1. Confirm the cold flow properties and FAME that described in the ISO 8217 ISO 8217 최신 버전의 표 1에 명시된 저온 유동 특성과 FAME의 내용 확인</p> <table border="1"><thead><tr><th colspan="2">Characteristics</th><th>Unit</th><th>Test Method</th></tr></thead><tbody><tr><td colspan="2">FAME*</td><td>Volume %</td><td>ASTM D7963 or IP 579</td></tr><tr><td rowspan="2">Cloud point</td><td>winter</td><td rowspan="2">°C</td><td rowspan="2">ISO 3015</td></tr><tr><td>summer</td></tr><tr><td rowspan="2">Cold filter plugging point</td><td>winter</td><td rowspan="2">°C</td><td rowspan="2">IP 309 or IP 612</td></tr><tr><td>summer</td></tr><tr><td rowspan="2">Pour point</td><td>winter</td><td rowspan="2">°C</td><td rowspan="2">ISO 3016</td></tr><tr><td>summer</td></tr></tbody></table> <p>(1) FAME (Fatty Acid Methyl Ester, Bio-diesel): Bio-derived fuels and blends of bio-derived fuels with petroleum products are considered by some sections of marine industry since they are renewable and can result in reduced GHGs and SOx emissions. These fuels have disadvantages on cold flow properties.</p>	Characteristics		Unit	Test Method	FAME*		Volume %	ASTM D7963 or IP 579	Cloud point	winter	°C	ISO 3015	summer	Cold filter plugging point	winter	°C	IP 309 or IP 612	summer	Pour point	winter	°C	ISO 3016	summer	1	2	L
Characteristics		Unit	Test Method																													
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	<p>Blending of Bio-fuel(FAME) with compliant fuels(MGO/MDO) 규제 적합 연료유(MGO/MDO)의 바이오 연료(FAME) 혼입</p>	<p>• Problem of fuel supply to fuel combustion unit 연소장치 내 연료유 공급 장애</p> <p>• Fuels become highly hygroscopic (Affinity to absorb and hold water) 연료유 친 수성 상승</p> <p>- Degraded low-temperature flow properties 저온 유동특성 악화</p> <p>- Microbial Contamination; Microbes, in general, live at the fuel water interface 미생물 오염, 일반적으로 유수 경계 면에 서식</p> 				<p>(2) According to ISO 8217:2017(table 1), Distillates which are produced through the mixing of FAME blends with conventional marine diesel should contain FAME no more than 7.0%v/v.</p> <p>(1) FAME(지방산 메틸에스테르, 바이오디젤): 바이오 연료 혹은 바이오 연료 혼합 석유제품을 일컬음. 온실가스와 황산화물배출 저감에 효과적인 재생에너지이나, 저온유동성에 대한 취약점이 있음.</p> <p>(2) ISO 8217:2017(table 1) 기준에 따르면, 선박용 경유의 FAME 함량은 7.0%를 초과하면 안됨.</p> <p>※ Cold Flow Properties of Marine fuels</p>  <p>2. Precise control of fuel temperature (heating), if not able to heat, take proper measures such as fuel circulation and using additives for controlling Cold flow 정밀한 연료 온도 조절, 만약 연료유 히팅을 할 수 없는 경우 적절한 방법으로 저온 유동성을 방지(연료유 순환, 적절한 첨가제 투입)</p> <p>3. Avoid to expose the fuel to low temperature environment 저온 환경 노출 방지</p> <p>4. Shorten the maintenance period of filter/strainer and purifier. 필터/스트레이너 및 청정기의 관리 주기 단축</p> <p>5. Establish a plan for storage and handling of marine distillates containing FAME(Bio-diesel) *, which includes the following considerations</p> <ul style="list-style-type: none"> - Recommendations with the engine and other equipment manufacturers - Maximum storage periods - Fuel condition monitoring(acid number, oxidation stability, water contents) <p>* For more detailed information about FAME, you can refer to the CIMAC guideline (the guideline for ship owners and operators on managing distillate fuels up to 7.0% v/v FAME_biodiesel_2013)</p> <p>다음사항 고려해, FAME가 포함된 증류유의 저장 및 취급 계획 수립*</p> <ul style="list-style-type: none"> - 엔진 및 기자재 제조사 권장사항 			
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						<ul style="list-style-type: none"> - 최대 저장 기간 - 연료유 상태 모니터링(산가, 산화안정성, 수분함량 등) *FAME에 대한 자세한 사항은 CIMAC 가이드라인 참조 (선주 및 사용자를 위한 최대 7.0% FAME 함유 바이오디젤 관리법_2013) 6. Use additives for improving cold flow properties 저온 유동특성 향상을 위한 연료 첨가제 사용 			
301. Fuel supply system / 연료유 공급 시스템									
01	Inappropriate temperature and viscosity control of fuel oil 부적절한 연료유 온도 및 점도 관리	<ul style="list-style-type: none"> • Vapor lock in fuel system(e.g., fuel supply pipeline, boiler atomizer) 연료유 공급라인에 증기폐색 • Blockage of strainer and Shortening bearing life of pump 스트레이너의 폐색 및 펌프 베어링의 수명 단축 • Decrease in fuel oil flow rate and fuel oil pressure due to problem in viscosity and lubricity 연료의 점도 및 윤활성에서 기인한 연료 유량 및 압력 감소 • Stuck components in fuel injection pump and injection v/v for engine 연료 인젝션 펌프 및 인젝션 밸브 내부 고착 발생 • Insufficient fuel supply to combustion unit, inducing power degradation 연소장치 내 연료유 공급 장애 • Machinery performance deterioration 가기 성능 저하 	5	2	H	<ol style="list-style-type: none"> 1. Check the specification(Cloud point, Cold Filter Plugging Point , Pour point, Viscosity) of compliant fuel and take measures for fuel storage according to fuel oil tank management plans 규제 만족 연료유의 특성 확인(운점, CFPP, 유동점) 및 선내 연료유 탱크 관리 절차에 따른 대응 방안 실행 2. Set up and operate the automated temperature control system for maintenance(e.g. using fuel cooler/chillers) 연료유의 자동 온도 조절 장치 설치 및 운용(cooler, chiller) 3. Removal or closing the steam tracing line surrounding the fuel oil line 연료유 공급라인 옆 스팀 트레이싱 라인 제거 혹은 스팀 밸브 잠금 4. Modify pumps including plunger barrel as per manufacture`s advice to run on low viscosity/lubricity 제작사의 권고사항에 따라 낮은 점성과 윤활성을 고려해 펌프 교체 5. Improve fuel oil lubricity by using additives 첨가제 사용을 통한 연료 윤활성 개선 	2	1	L

		<ul style="list-style-type: none"> • Machinery damage or Ship failure 기기 손상 및 운항 손실 							
02	Inappropriate countermeasures for impurities in compliant fuel 연료 내 불순물에 대한 대처 방안 미흡	<ul style="list-style-type: none"> • Abnormal wear of fuel pump for engine 비정상적 엔진 연료유 펌프의 마모 • Insufficient fuel supply to combustion unit, inducing power degradation 연소장치 내 연료유 공급 장애 • Machinery performance deterioration 기기 성능 저하 • Machinery damage or Ship failure 기기 손상 및 운항 손실 	5	2	H	1. Installation or displace proper filter at fuel supply system 연료 공급시스템에 적절한 크기의 필터를 설치하거나 필터를 교체 2. Shorten the maintenance period of filter/strainer and purifier. 필터/스트레이너 및 청정기의 관리 주기 단축 3. Take measures to mitigate the wear of supply system's gear parts (e. g. adjust purifier's capacity and/or gravity disc.) 공급 시스템의 마모를 완화하기 위한 조치 실행(예, 청정기의 용량 또는 비중판 조정)	1	2	L
401. Fuel oil Combustion Unit(Main engine, Generator engine, Boiler) / 연료유 연소 장치(메인 엔진, 발전기, 보일러)									
01	Excessive wear of piston ring& cylinder liner of M/E and A/E 엔진 피스톤링, 실린더 라이너의 과다 마모 Decrease in the thickness of Lub. oil film on cylinder wall due to low sulfur fuel oil 저유황유 사용으로 인한 실린더 벽의 유막 두께 감소	<ul style="list-style-type: none"> • Machinery performance deterioration 기기 성능 저하 • Machinery damage or Ship failure 기기 손상 및 운항 손실 	3	2	M	1. Modify piston ring as per manufacture's advice (e. g. Service letter of MAN ES, SL2019-659/JAP) 제작사의 권고사항에 따라 피스톤링 교체 (예: Service letter of MAN ES, SL2019-659/JAP) 2. Installation or displace with proper filter at inlet of M/E and A/E 엔진 전단에 적절한 필터를 설치 또는 교체 3. Parallel operation of purifier, adjusting flow rate and discharge interval 청정기 병렬운전 및 통유량, 배출 간격조절 4. Adjust/increase the flow rate of Lub. oil fed on engine cylinders as per manufacturer's recommendations (See Appendix 5.1 Fuel Oil Changeover plan - 2.6 MAN ES) 제작사의 권고에 따라 엔진 실린더에 공급된 윤활유량을 조절 (SIP Appendix 5.1 – 2.6 참조)	2	1	L
02	Inappropriate TBN of cylinder oil for engine 부적절한 실린더유의 TBN	<ul style="list-style-type: none"> • Corrosion and abnormal wear of piston ring & cylinder liner 피스톤 링, 실린더 라이너의 부식과 비정상적인 마모 • Machinery performance deterioration 기기 성능 저하 • Machinery damage or Ship failure 기기 손상 및 운항 손실 	3	2	M	1. Consult engine manufacturer to identify issues with lubricant regarding compliant fuel (See Appendix 2.2.1 - I. Confirmation letter for Main Engine) 규제 만족 연료유에 적합한 윤활유에 대해 엔진 제조사와 협의 (SIP Appendix 2.2.1 – I. M/E 제조사 확인서' 참조)	2	1	L

03	Inappropriate TBN of system oil for engine(4-stroke engine) 부적절한 시스템유의 TBN (4 행정)	<ul style="list-style-type: none"> Corrosion and abnormal wear of piston ring & cylinder liner 피스톤 링, 실린더 라이너의 부식과 비정상적인 마모 Machinery performance deterioration 기기 성능 저하 Machinery damage or Ship failure 기기 손상 및 운항 손실 	3	2	M	1. Consult engine manufacturer to identify issues with lubricant regarding compliant fuel (See Appendix 2.2.1 - m. Confirmation letter for G/E Engine) 규제 만족 연료유에 적합한 윤활유에 대해 엔진 제조사와 협의 ('SIP Appendix 2.2.1 - m. G/E 제조사 확인서' 참조)	2	1	L
04	Using the inappropriate burner's unit & equipment for boiler 부적절한 보일러 버너 유닛, 및 장비 의 사용	<ul style="list-style-type: none"> Decrease in fuel flow rate and fuel atomization 연료유 유량 및 무화량 감소 Machinery damage or Ship failure 기기 손상 및 운항 손실 Machinery performance deterioration 기기 성능 저하 Machinery damage or Ship failure 기기 손상 및 운항 손실 	4	2	M	1. Modify atomizer as per manufacture's advice 제작사의 권고사항에 따라 분사기 교체 2. Modify flame detector as per manufacture's recommendation 제작사의 권고사항에 따라 화염 감지기 교체 3. Ask manufacture to adjust of combustion control(such as the air/fuel ratio) 제조사에 보일러 연소제어관련 개선 의뢰 (예: 공연비 조절) 4. Take measures to prevent the gasification of compliant fuel in the boiler components (e.g., pipeline, atomizer etc.) 보일러 구성품 내에서 규제만족 연료유의 가스화를 방지하기 위한 적절한 조치를 시행 ※ (See Appendix 2.2.1 - n. Confirmation letter for Aux. Boiler) (SIP Appendix 2.2.1 - n. Aux. Boiler 제조사 확인서' 참조)	3	1	L
501. Human resource and Safety management system / 인적 자원 및 안전관리 시스템									
01	Lack of experience for compliant fuel oil procurement (Company person in charge) 규제만족 연료유 수급에 대한 경험 부족 (회사 내 연료유 구매 담당자)	<ul style="list-style-type: none"> Failure to obtain compliant fuel oil 규제만족 연료유 수급 실패 Detention, fine and other enforcement of the ship 선박의 출항정지 및 벌금 조치 등 	5	3	H	1. Ship Implement Plan(SIP) to be prepared and implemented 선박 이행 계획서의 준비 및 이행 2. Establish the appropriate purchasing procedure for compliant fuel and implementation of it 규제만족 연료유의 적절한 구매절차 수립 및 이행	1	1	L
02	Lack of experience for compliant fuel(Crew) 규제만족 연료유에 대한 경험 부족 (선원)	<ul style="list-style-type: none"> Machinery performance deterioration 기기 성능 저하 Machinery damage or Ship failure 기기 손상 및 운항 손실 	5	3	H	1. Ship crew to be trained ashore regarding the plan, procedure and manufacturer's instructions for using the compliant fuel 규제만족 연료유 사용 관련 계획, 절차 및 제조사 안내 등에 대한 육상 교육 시행	1	1	L

03	Inappropriate plan and operation manual for fuel supply system, fuel combustion unit 연료유 관련 시스템에 대한 부적절한 계획 및 사용 절차	<ul style="list-style-type: none"> • Machinery performance deterioration 기기 성능 저하 • Machinery damage or Ship failure 기기 손상 및 운항 손실 • Detention, fine and other enforcement of the ship 선박의 출항정지 및 벌금 조치 등 	5	3	H	1. Improve and Change the plan, procedure and existing instructions for using of compliant fuel 규제만족 연료유 사용 관련한 계획서, 절차 및 지침서의 개선 2. Review of SMS(Safety Management System) document to be taken in the view of fuel type change 연료 유형 변경에 대한 선박 안전관리 시스템 문서(SMS) 검토	1	1	L
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Appendix 1.2.1 Ship's safety management system

***Appendix 2.1.1 Meeting memorandum with each
manufacturer for the fuel system modification-Main Engine***

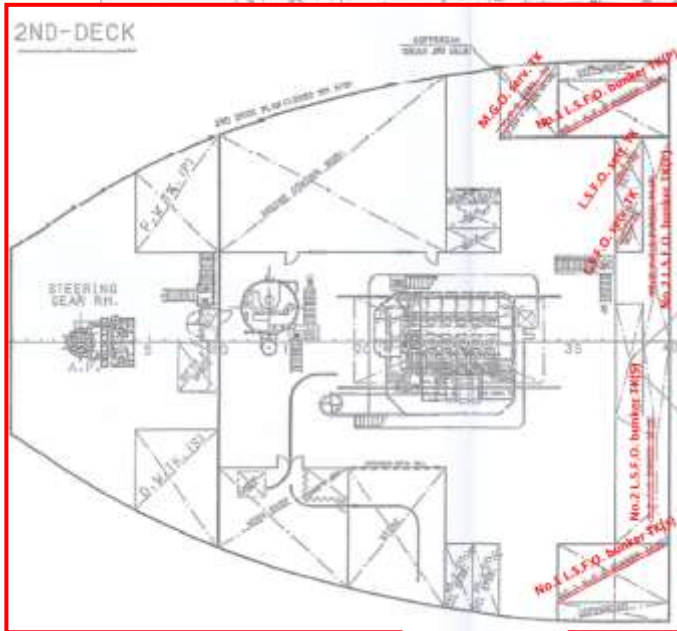
***Appendix 2.1.2 Meeting memorandum with each
manufacturer for the fuel system modification-Aux' Engine***

***Appendix 2.1.3 Meeting memorandum with each
manufacturer for the fuel system modification-Aux' Boiler***

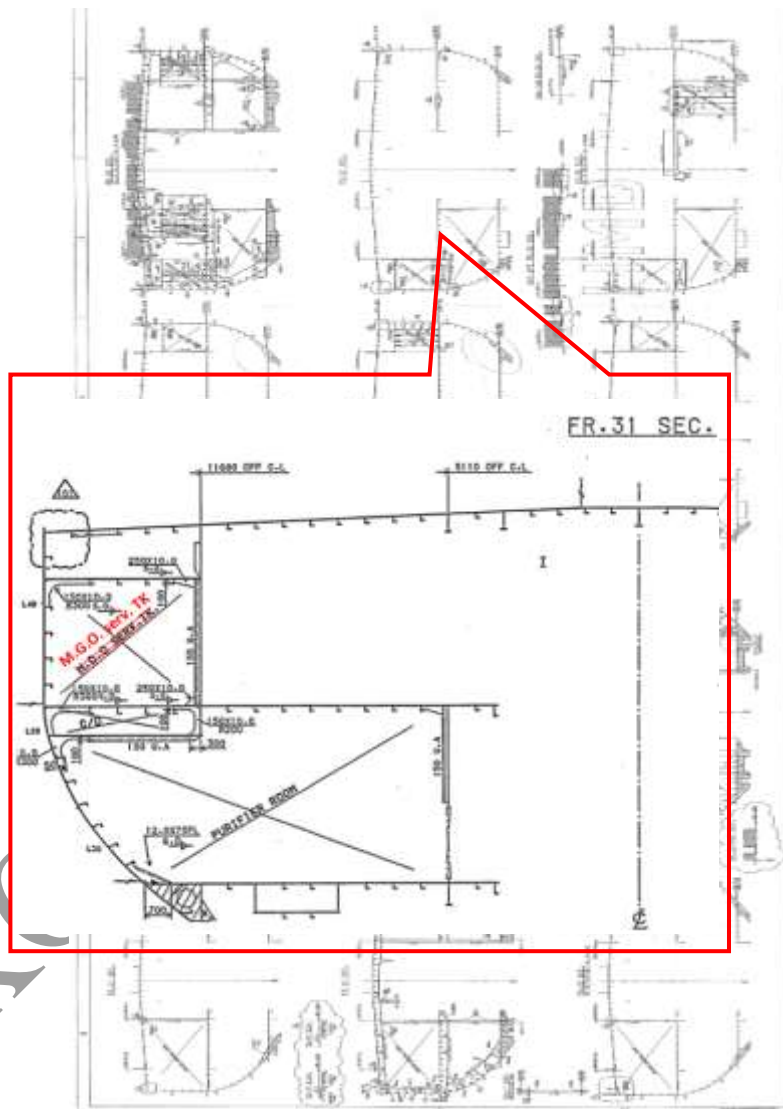
***Appendix 2.1.4 Meeting memorandum with each
manufacturer for the fuel system modification -Purifier***

Appendix 2.1.5 Meeting memorandum with Class

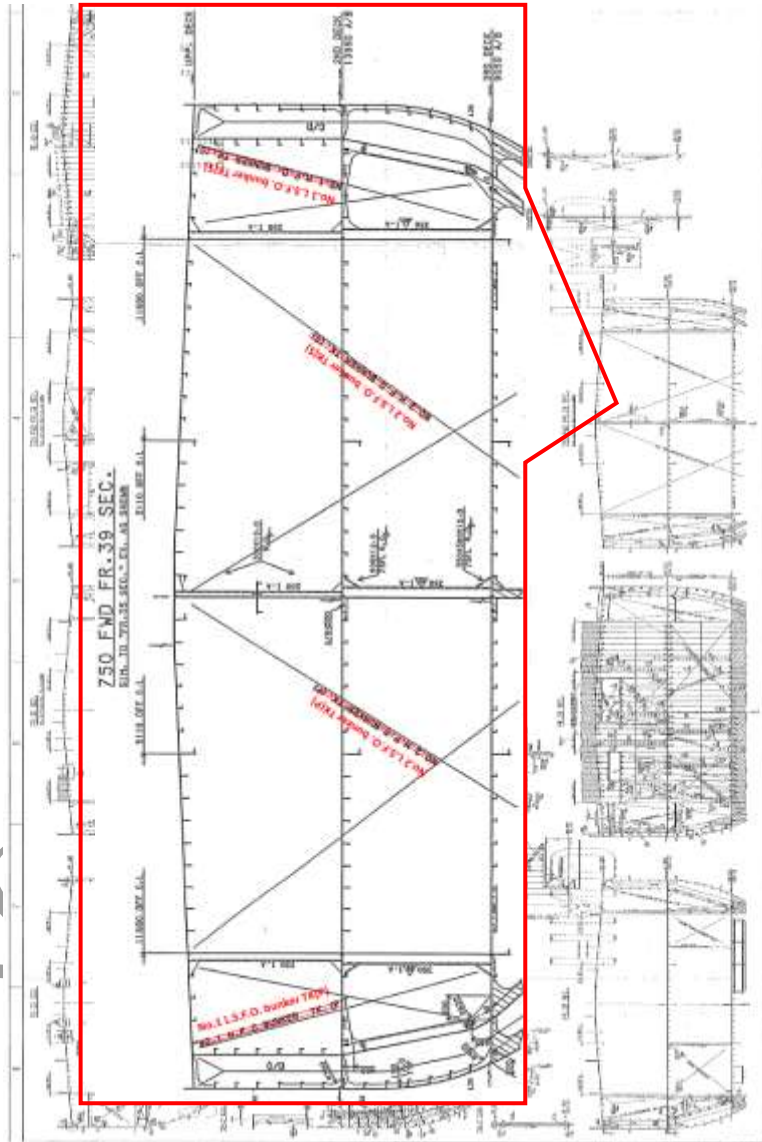
Appendix 2.2.1 Revised drawings for the LSFO



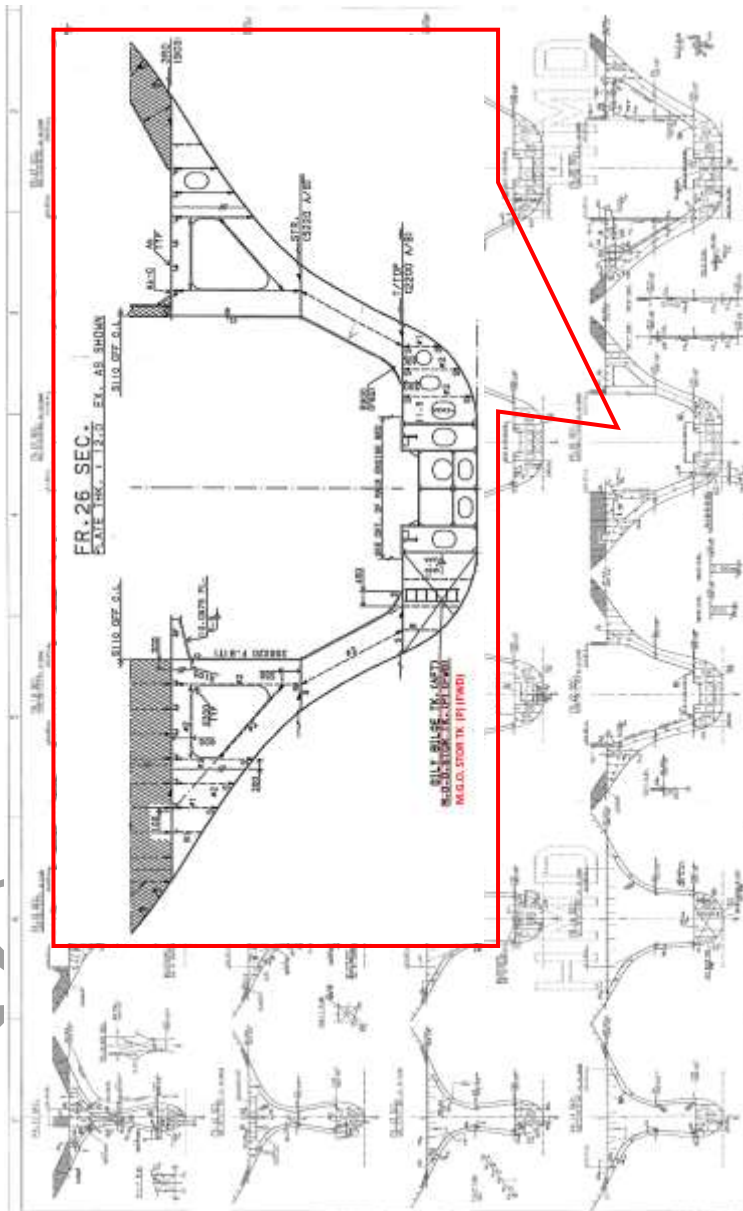
b. Engine room construction (FR.21~FR.32 sec.)



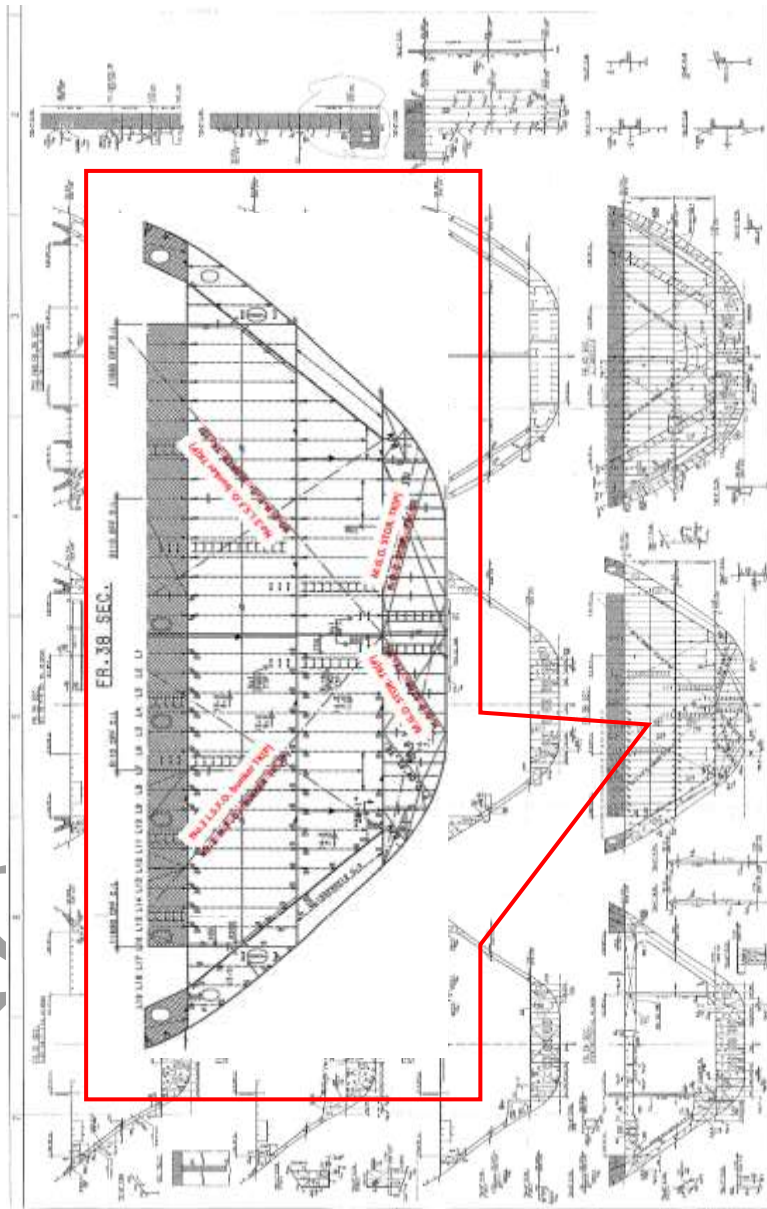
c. Engine room construction (FR.22~FR.40 sec.)



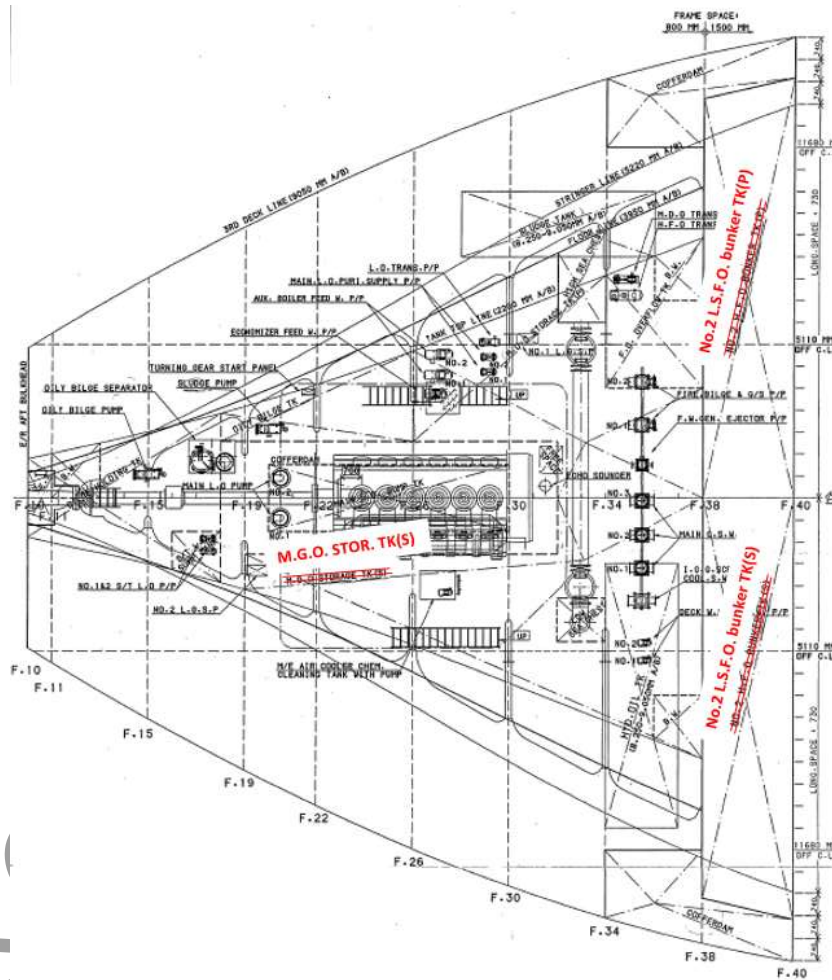
d. D/BTM const. in E/Room Incl. 3rd Deck (FR.11~FR.30 sec.)

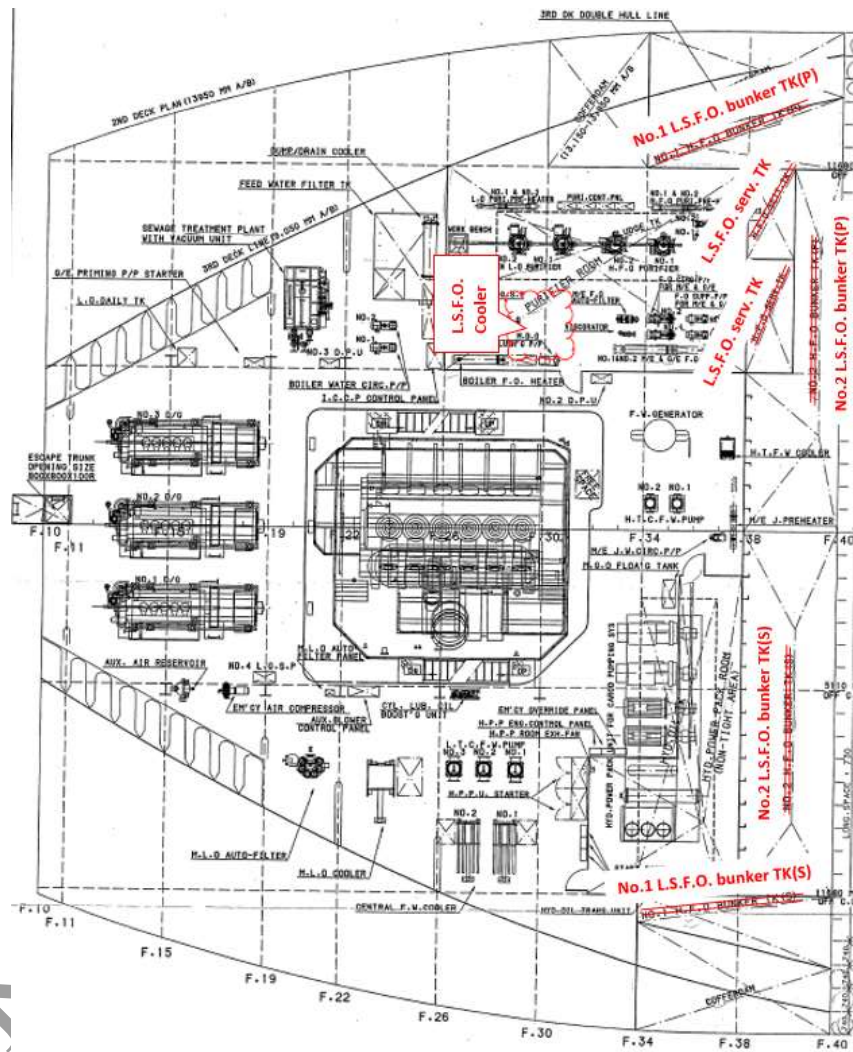


e. D/BTM const. in E/Room Incl. 3rd Deck (FR.31~FR.40 sec.)



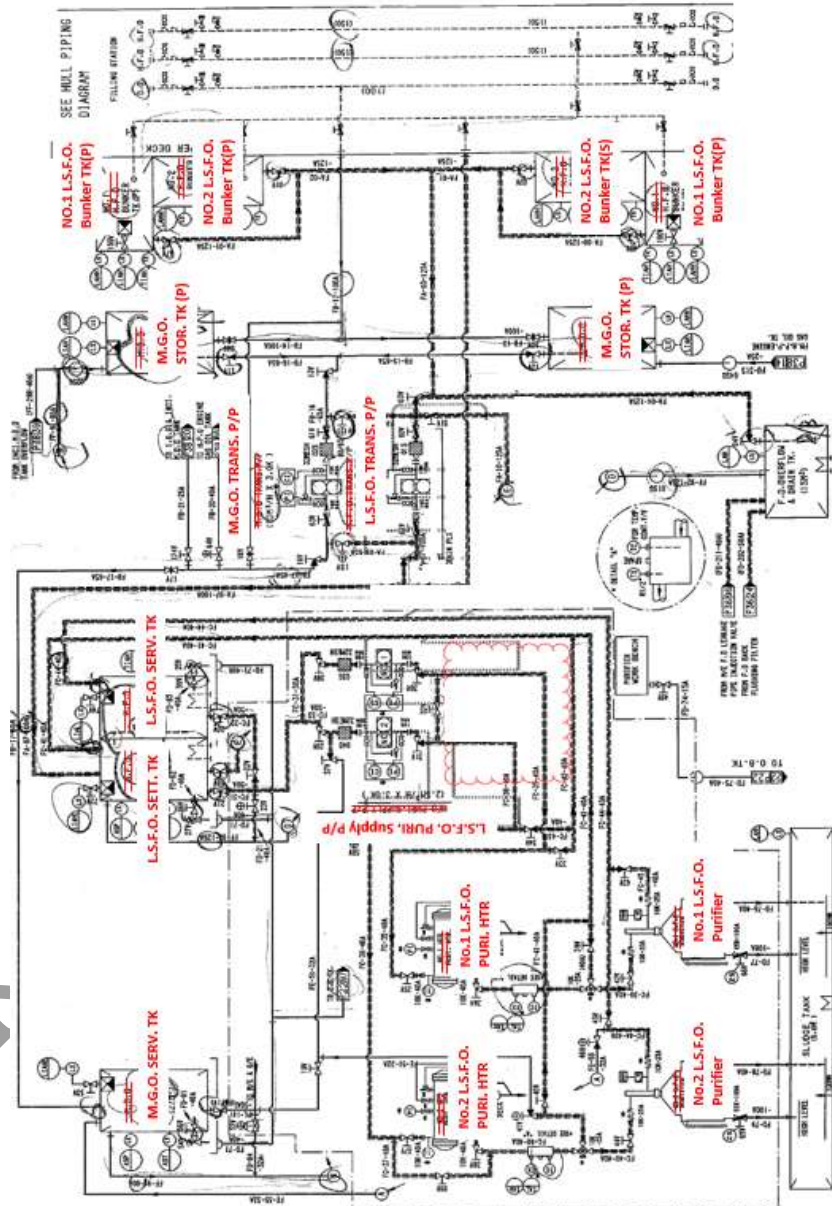
K



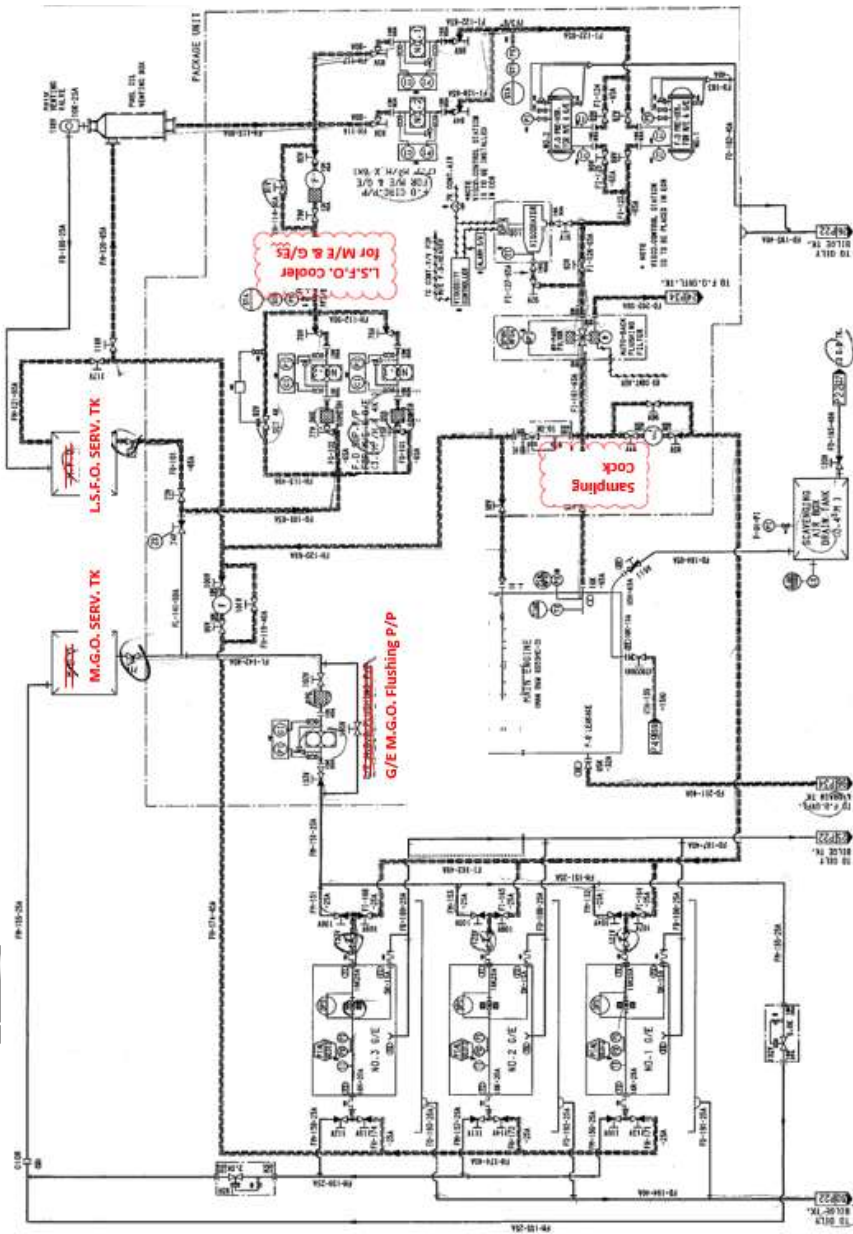




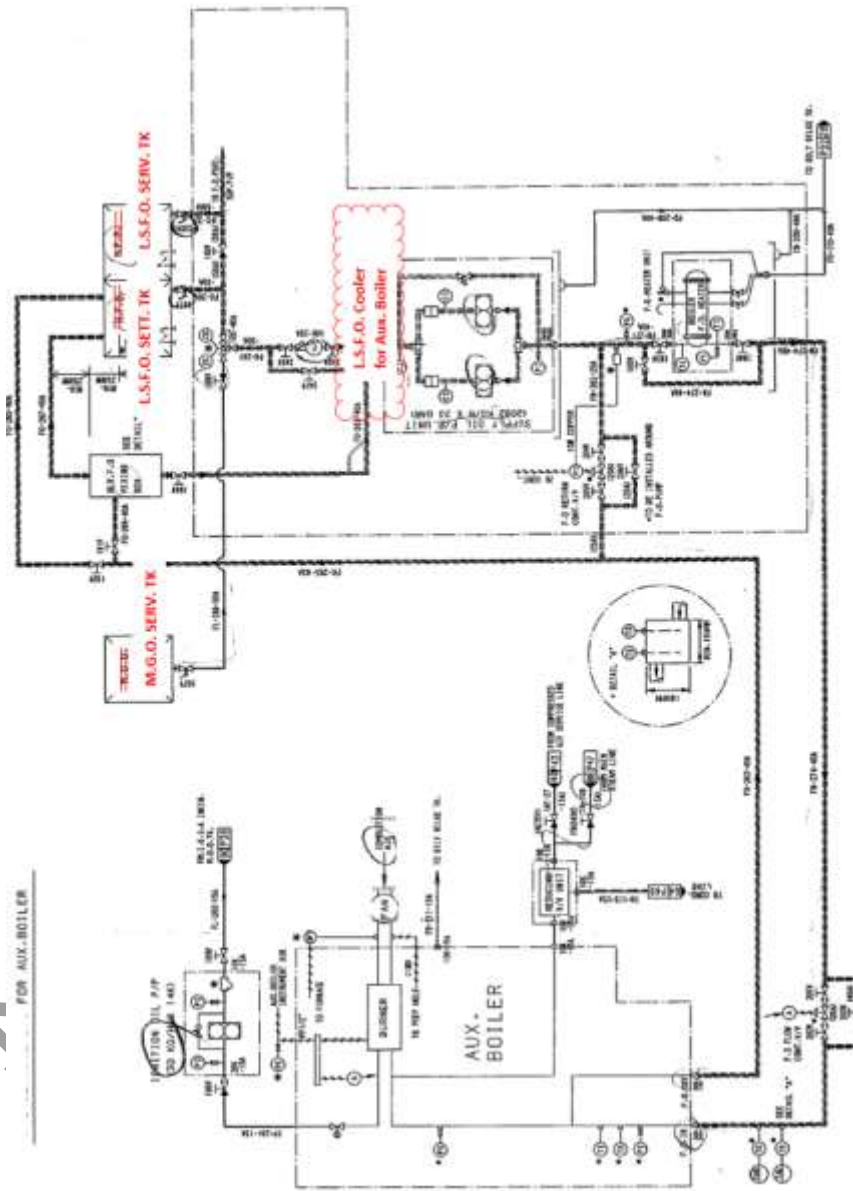
h. Piping system diagram in E/R (F.O transfer & purifying system)



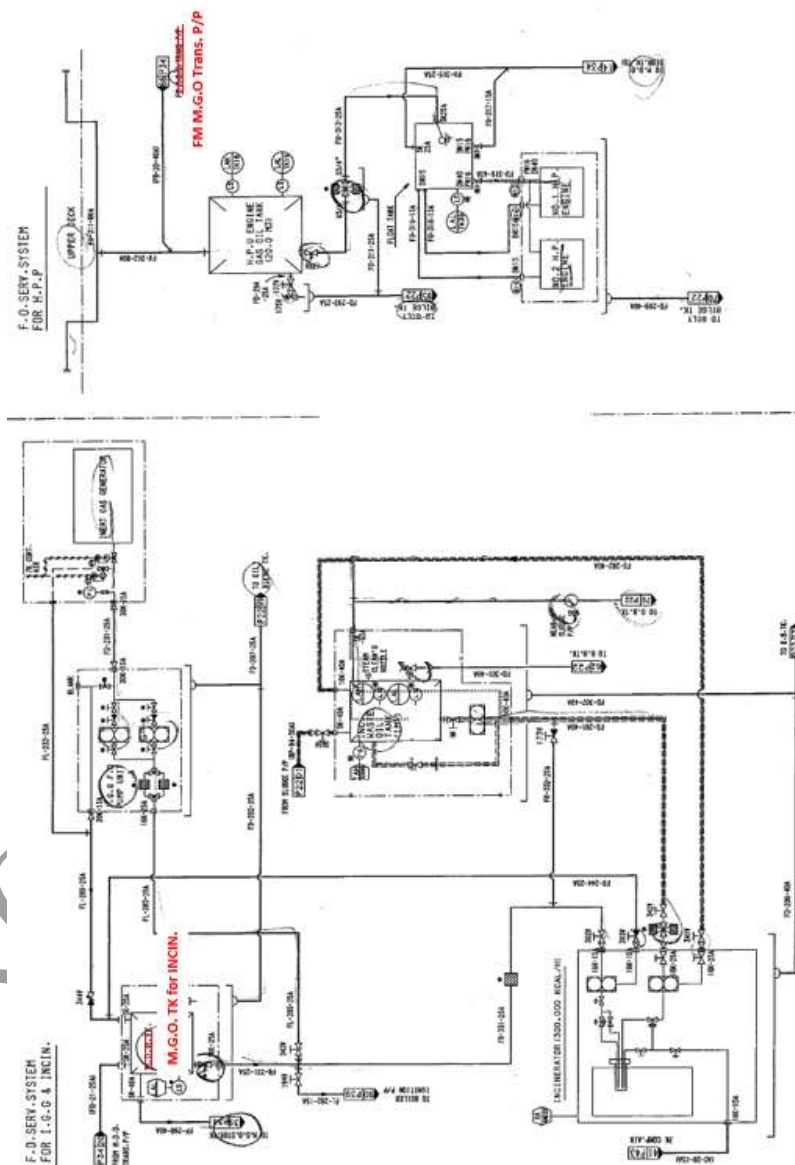
i. Piping system diagram in E/R (M/E & G/E F.O service system)



j. Piping system diagram in E/R (Aux. boiler F.O service system)



k. Piping system diagram in E/R (Incin. / I.G.G. & H.P.P F.O system)



1. Confirmation letter for Main Engine

Page : 1

TEL :

FAX :

E-Mail :

TO		FROM	
ATTN.		REF. NO.	
FAX		DATE	
C. C.		PAGE	

※ If you fail to receive all of this transmission, please inform us at above Tel.

Subject : Main Engine Operation on Fuel with less than 0.1% Sulphur

Dear Mr. Kim

Thanks for your cooperation so far.

Regarding the subject, all our MAN B&W two-stroke engines are optimized to operate on heavy fuel.

However, we are pleased to inform you that fuels with less than 0.1% Sulphur can be used when appropriate consideration as follows are made to ensure as safe and reliable performance.

- 1) The minimum viscosity at the engine inlet to be of above 2cSt, but, prefer above 3cSt
- 2) The proper external system for low sulfur fuel operation to be prepared.

We hope this will be of service to you.

Thanks,

Best regards,

m. Confirmation letter for Generator Engine

TO		FROM	
ATTN.		REF. NO	
E-mail		DATE	
C. C.		PAGE	

* If you fail to receive all of this transmission, please inform us at above Tel. no.

SUBJECT: Generator engines – Recommendation for MGO Operation

Dear Sir,

First of all, we appreciate your kind cooperation so far.

Regarding above subject, we are pleased to inform you of our recommendation and confirmation for MGO operation as follows:

[HiMSEN guideline for using MGO]

All HiMSEN engines are suitable and developed for continuous operation on HFO as well as MDO/MGO under following recommendations.

- MGO viscosity at engine inlet should be kept within the value of 2 ~ 14 cSt.
- When the MGO is to be used only for temporary engine operation (e.g. in port), the acceptable period of temporary is less than 200 hours with higher BN lube oil used for residual fuel (HFO).

We hope this will be of service to you.

Best regards,

n. Confirmation letter for Aux. Boiler

Pohang factory
1111, Haean-ro, Haenghae-eup Buk-gu, Pohang city, Korea
Tel : +82-54-230-6500, Home : www.kangrim.com

Date	:		Our Ref.	:	
To	:		From	:	
	:		Tel.	:	
Your Ref.	:	_____	Page	:	1sheet

Aux. Boiler Modification for low sulphur oil operation

Dear sir,

Thank you very much for your good cooperation so far.

We confirm that the present boiler system for _____ can be operated
with MGO which is having sulphur content - max. 0.1% by mass and min. viscosity - 1.5 cSt
(according to ISO 8217) and there will be no problem in MGO operation with
the present arrangement of boiler system.

But, to be considered MGO viscosity keep above 1.5 cSt.

Thank you!

Best regards, _____

Date :

Our Ref :

To : Kangrim Heavy Industries Co., Ltd.
Technical Business Dep't
Mr.K.J.Ahn / Section Manager

Dear Sirs,

The MGO modification about the burner of AUX. Boiler for

Regarding the MGO modification about the burner of AUX. boiler for , we reply as follows;

We confirm that this project burner can operated with MGO which is having sulphur content Max. 0.1% bay mass and Min. Viscosity 1.5cst (ISO 8217) and there will be no problem with the present arrangement of boiler system for this burner system.

Best regards

KOI

o. Confirmation letter for pump manufacturer

Lustenau, June 26, 2009

To whom it may concern

Currently we observe a lively discussion in the global shipping industry referring to the increased requirement of burning distillate fuels, both for propulsion and steam generation on board of ocean going vessels. This discussion is mainly triggered by the marine notice 2009-3 of the California Air Resources Board. This rule forces vessels about to visit Californian ports to switch to either Marine gas oil (DMA acc. to ISO 8217) or Marine diesel oil (DMB acc. to ISO 8217), starting already from July 1, 2009.

The standard ISO 8217 specifies for DMA a lower viscosity limit of 1,5mm²/s at 40°C. This is distinctly lower than the minimum values that might be found with residual fuels and therefore the question arises whether the current machinery equipment will be able to safely handle these fuels.

Referring to the flowmeters produced by KRAL we can confirm that there is no objection to operating them both with DMA or DMB. Referring to our pumps we can confirm that for pressure differences up to 30bar and a minimum viscosity of 1,4mm²/s there are also solutions available to safely handle these fuels. To check whether this is the case for any individual application we kindly ask you to contact KRAL or our representatives.

KORLE

***Appendix 3.1.1 Recommended procedure for tank cleaning
by a chemical manufacturer (Drew Marine)***

* Source: HFO Tank Cleaning Procedure Convert HFO storage tank to LSFO storage tank (Drew Marine)



Subject: HFO Tank Cleaning Procedure
Convert HFO storage tank to LSFO storage tank

2020 $\leq 0.5\%$ Sulphur fuel oil:

Distillates fuels

- 0.50% Sulphur fuel oil when offered could be distillate fuel or provide an alternative to conventional distillate fuel such as Marine Distillate Fuel or road diesel.

Blended residual fuels

- 0.50% Sulphur fuel oil when offered could be RMA 10, RMB 30, RMC 80, RME 180 or other

The ship implementation plan for 2020

The ship implementation plan for 2020 could cover various items relevant for the specific ship, including, as appropriate, but not limited to:

1. Risk assessment and mitigation plan of new fuels.
2. Fuel oil system and storage tank cleaning.
3. Fuel oil capacity and segregation capability.
4. Procurement of compliant fuel.
5. Fuel oil changeover plan (conventional residual fuel oils to 0.50% Sulphur compliant fuel oil).
6. Documentation and reporting.

A fully segregated fuel system for distillate fuels and blended fuels is recommended because they may require special attention and better management of potentially incompatible fuels.

Recommend Fuel Storage Tank Cleaning:

- Clean sludge deposit in bottom of storage tanks before change to $\leq 0.5\%$ fuel oil.
- New $\leq 0.5\%$ fuel oil may have compatibility problem with remaining unpumpable HFO.
- New $\leq 0.5\%$ fuel oil with lower viscosity may act like cleaner to remove deposit from tank bottom into fuel system.
- New $\leq 0.5\%$ fuel oil may have stability and compatibility problem when fuel supplier vary.

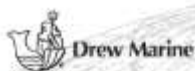
AMERGY 222 treat and clean:

- 1) No or minimum manual cleaning by crew to prepare fuel storage tanks.
- 2) Slip disposal will be avoided or reduced.
- 3) Preventing or mitigation on compatibility when tanks clean by AMERGY 222

Open HFO tank to inspect from outside of fuel tank to know internal condition nearby the man hole before clean. Take photos as record, if possible. (**Note:** Use portable gases detector to confirm gases free for safe entry.). BA unit required for tank internal inspection, if enter the bunker storage tank..

Recommendation – 2019 working schedule

- 1st and 2nd quarter of 2019, all user proceed pretreat HFO by AMERGY 222
 - 1st quarter; AMERGY 222 1/15,000 (1 liter for 15 tons HFO)
 - 1/15,000 for vessel not use AMERGY 222 regularly,
 - 1/12,000 for vessel using AMERGY 222 regularly.



- 2nd quarter: AMERGY 222 1/10,000 (1 liter for 10 tons HFO)
- 3rd quarter use AMERGY 222 1/6000
- To prepare about half (50%) number of FO Storage tanks to LSFO tank by tank clean circulation (preferred) or Rolling clean
- 4th quarter start to bunker 0.5% LSFO by tanks been cleaned. Clean rest of 50% HFO Storage tanks.
- All storage tanks recommend to flush by < 0.5% LSFO in 4th quarter to avoid >0.5% Sulphur problem in early 2020.
- All HFO over 0.5% sulfur should be consumed before 2020.

Recommendation – FO Storage Tank clean

Check General Arrangement Drawing to know number of FO Storage, Capacity and Type.

- Lower Wing Tank: most of double haul vessels, FO Storage tanks are lower wing tanks
- Double Bottom Tank – most difficulty to clean.
- Deep Tank – act like settling tanks

First quarter (January – March)

First quarter to clean deposit in HFO tank:

1. Add AMERGY 222 to empty tank before bunkering. The dosage is 1 liter for 12-15 ton HFO.
2. Shift to use FO in other fuel tank when *10-25% HFO remaining (see below). Rolling clean sludge in bottom for 5 – 7 days (longer better), temperature 40°C. (Vessels without heating capability in Storage tank. AMERGY 222 need to increase 20% and rolling clean for 10 days).
 - FO storage tank in side wing tanks and double bottom tanks keep 20-25% remaining
 - FO storage tank deep type keep 10-15% remaining for better rolling clean.
 - 2 storage tanks clean together and circulate by FO Transfer pump will get better clean performance, if circulation can be arranged. (Give attention on fuel level of Settling Tank.)
3. Giving extra attention on FO Purifying system when use the fuel after rolling clean.
 - 80-85 °C Settling tank temperature.
 - Drain water and sludge from Settling and Service tanks in every 4 hours, 10-15 second.
 - Reduce Purifier throughput to improve clean efficiency.
 - Drain 10-15% HFO from Settling Tank to Over-flow tank after each storage tank's remaining fuel consumed. Preventing high sediment and ash (including Al & Si) deposit in Settling Tank and flow into HFO Service system that may cause engine excessive wear.
 - Transfer the drained high sludge FO back to Settling Tank when vessel in ECA (using LSMGO) or vessel in port (M/E stopped and 2 G/E running that lower FO consumption). Operate 2 purifiers (98°C) in parallel to clean FO by circulate between settling tank and service tank. More and over 24 hours clean preferred.
4. Trim vessel to pump out as much as possible to ensure less fuel remaining in storage tanks.

Second quarter (April – June):

- Same procedure with 1st quarter.
- AMERGY 222 dosage increase to 1/10,000 (10 tons fuel dose 1 liter AMERGY 222).

Third quarter (July – September):

- Same procedure with 1st quarter.



Drew Marine

- AMERGY 222 dosage increase to 1/6,000 (6 tons fuel dose 1 liter AMERGY 222).

Fourth quarter (October – December):

- Start using <0.5% sulfur fuel oil.

All fuel storage tanks should be treated and clean by AMERGY 222 in 3 stages in above at least one each.

Question & Answer:

When determining how much fuel additive to use, should I calculate based the fuel tank's full rated capacity or the specific amount of fuel being loaded into that particular tank?

- Fully load fuel could be 85 – 87% tank volume.
- While we recommend to treat as close as possible to the recommended dosage rate per volume of fuel loaded into the fuel tank, it is ok to round up to the nearest liter of fuel treatment.

How do I ensure proper mixing of AMERGY 222 with new HSFO bunkers?

- Always add the fuel treatment to empty nominated fuel tanks as early as possible before bunkering by sounding pipes.
- After bunkering, dose to suction filter of FO Transfer Pump and pump to Storage Tanks. Recirculate the treated fuel with same bunker in other tank until all fuel has been recirculated at least twice.

High sludge problem in FO Purifying system when tank clean by AMERGY 222. How to mitigate problem?

- Add additional AMERGY 222 into Settling Tank by filter of Transfer Pump. Operate stand-by Purifier feed pump to circulate Settling Tank by open 3 way valve for proper mixing. If additional circulation needed.
- Additional dosage should be repeated in every 12 hours.

Recommendation 2020

- Quality of 0.5% LSFO may vary by ports and bunker suppliers.
- Kept 2 batch LSFO onboard for safety consideration
- Vessel should keep 5-10 pail of AMERGY 222 onboard to overcome fuel compatibility problem after 2020.
- Noted:
 - Do not dose AMERGY 222 into loaded bunker tank when problem sludge in system. FUEL and AMERGY 222 are not able to mix homogeneously in full tank conditions.
 - AMERGY 222 should dose to SETTLING TANK by filter of Transfer pump after bunkering.

Appendix 4.4.1 Detail of purchasing procedure

Appendix 4.4.5 Alternate steps - procurement bunker

Appendix 4.4.7 Alternate steps - bunker supplier

Appendix 4.4.8 Schedule for dispose of N/C fuel oil

*Appendix 5.1 Ship's fuel oil changeover plan to compliant
with 2020 sulfur cap*

Fuel Oil Change Over Procedure

1. General

In order to comply with global SO_x regulation from 1 January 2020, it is important to prepare appropriate procedure for switching safely from high sulphur fuel (3.5% S, hereafter HSFO) oil to low Sulphur fuel oil (0.5% S, hereafter LSFO). This document is purpose to operate each equipment, which were already modified to use LSFO as main fuel of ships.

2. Change over procedure between HSFO and LSFO

2.1 Main engine and generator engines

1) Major considerations

In general, the steam valve for the fuel oil heater is controlled by the viscosity controller. During the fuel change-over, however, observations of the temperature/viscosity must be carefully implemented to protect the fuel components of each engine and pumps. Two factors are to be kept under observation.

- a. The viscosity at the engine inlet must not drop below 2 cSt and not exceed 20 cSt
- b. The rate of temperature change of the fuel inlet to the fuel pump must not exceed 2 °C/min, to protect the fuel equipment from thermal shock, which result in the sticking phenomenon

2) Fuel oil change over from HSFO to LSFO

- a. Check that the temperature of the LSFO in the service tank is approximately 10 °C above the pour point.
- b. Set the viscosity controller to 17 or 18 cSt to decrease the temperature of the fuel in the pipeline. Here, manual control of the pre-heater might be necessary if it is observed that the viscosity control exceeds the maximum of 2 °C/min
- c. Decrease the engine load to max. 50% SMCR when the fuel oil reaches a temperature corresponding to 17 or 18 cSt in order to ensure a slow reduction of the temperature at the engine inlet.
- d. Close all valves for steam tracing line in the fuel oil system
- e. Carry out change over by turning the three-way valve. The recommended rate of the temperature change is below 2 °C/min

- f. If the temperature changes too much, wait until the fuel temperature is stable. Then you can continue the procedure. Try to decrease the temperature as linearly as possible.
- g. Close all steam valves for pre-heaters for M/E & G/E when the regulating valve has closed completely. Depending on system layout and condition, it might be necessary to open the heater bypass.
- h. Start the cooler slowly to give a linear and smooth temperature change at minimum viscosity (10 cSt). Note that the viscosity of the fuel must not be less than 2 cSt.
- i. After finishing the fuel oil change over completely, before the viscosity of the LSFO would be reached at 2 cSt, the cooler system should be operated in order to keep the minimum viscosity to the engine.

2.2 Aux. boiler

1) Major considerations

During the fuel change-over, the viscosity of the fuel oil in the pipe line must not drop below 2 cSt, and the air/fuel ratio must be adjusted for the operation of the LSFO.

2) Fuel oil change over from HSFO to LSFO

- a. Check that the temperature of the LSFO in the service tank is approximately 10°C above the pour point.

b. Preliminary flushing of Aux. Boiler F.O service and return line

Before the fuel change over, the below-mentioned steps are to be followed in HSHO burning mode of Aux. boiler

- Close all valves for steam tracing line in the fuel oil system
- Close steam inlet/outlet valves for the Boiler F.O heater
- When the temperature of the HSFO is reached at 80 ~ 100 °C carry out change over by turning the three-way valve
- Turn off the aux. boiler burner and boiler F.O pump when the temperature of the FO service line is reached at 60 °C

c. Draining the HSFO in the recirculation line

- Isolate the FO service line
- Open the drain valve near the boiler FO mixing box.
- After checking the HSFO drain, close the drain valve near the boiler FO mixing box
- Line up the FO service line

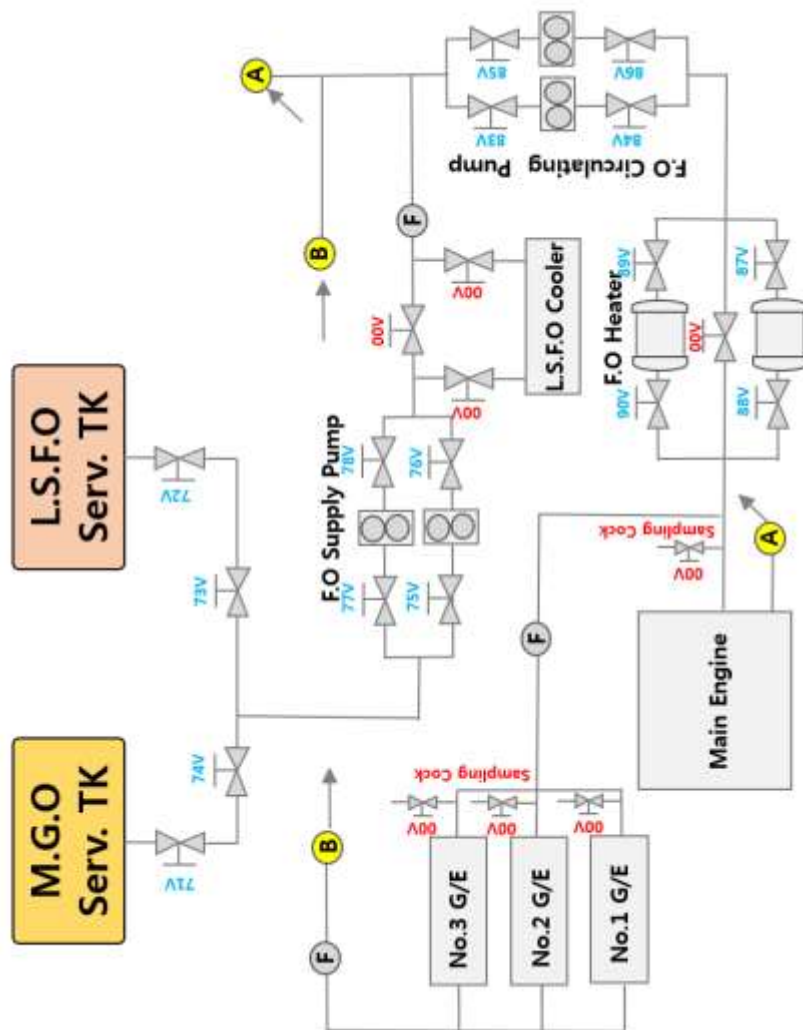
d. Flushing the FO service line

- Carry out change over by turning the three-way valve and start boiler FO pump
- For a complete change over, flushing must be carried out with sufficient time
- After sufficient flushing procedure, stop the boiler F.O pump
- Check the condition of the fuel oil in the FO service line by using the drain valve
- To ensure the perfect change over from the HSFO to LSFO, repeat this flushing procedure

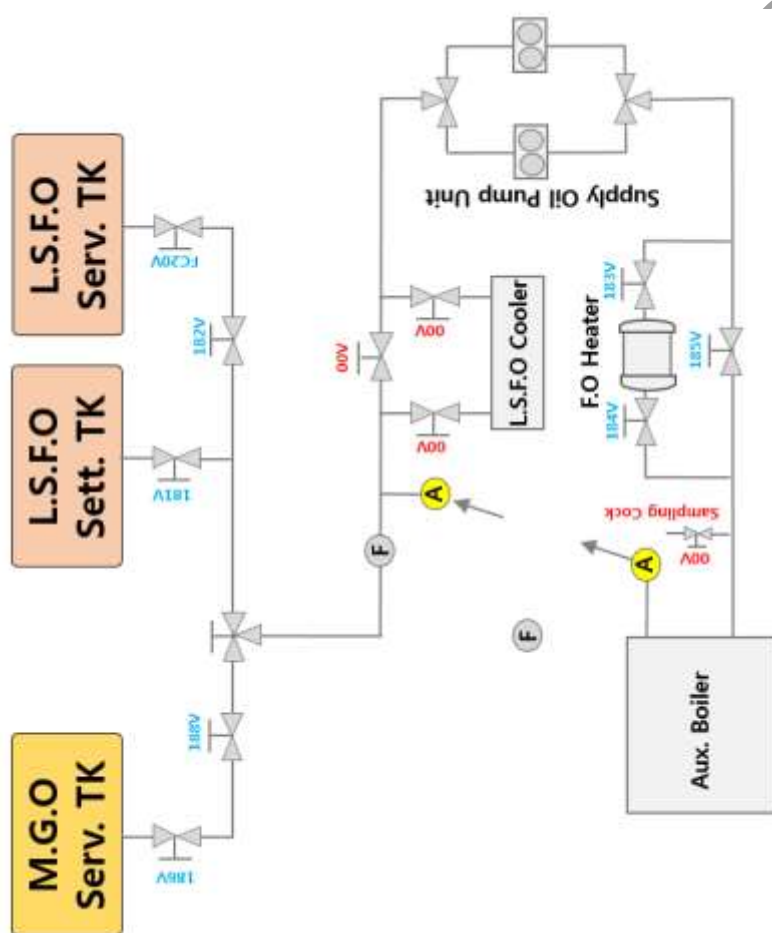
e. After completing this flushing in the FO service line, start the aux. boiler in the LSFO mode

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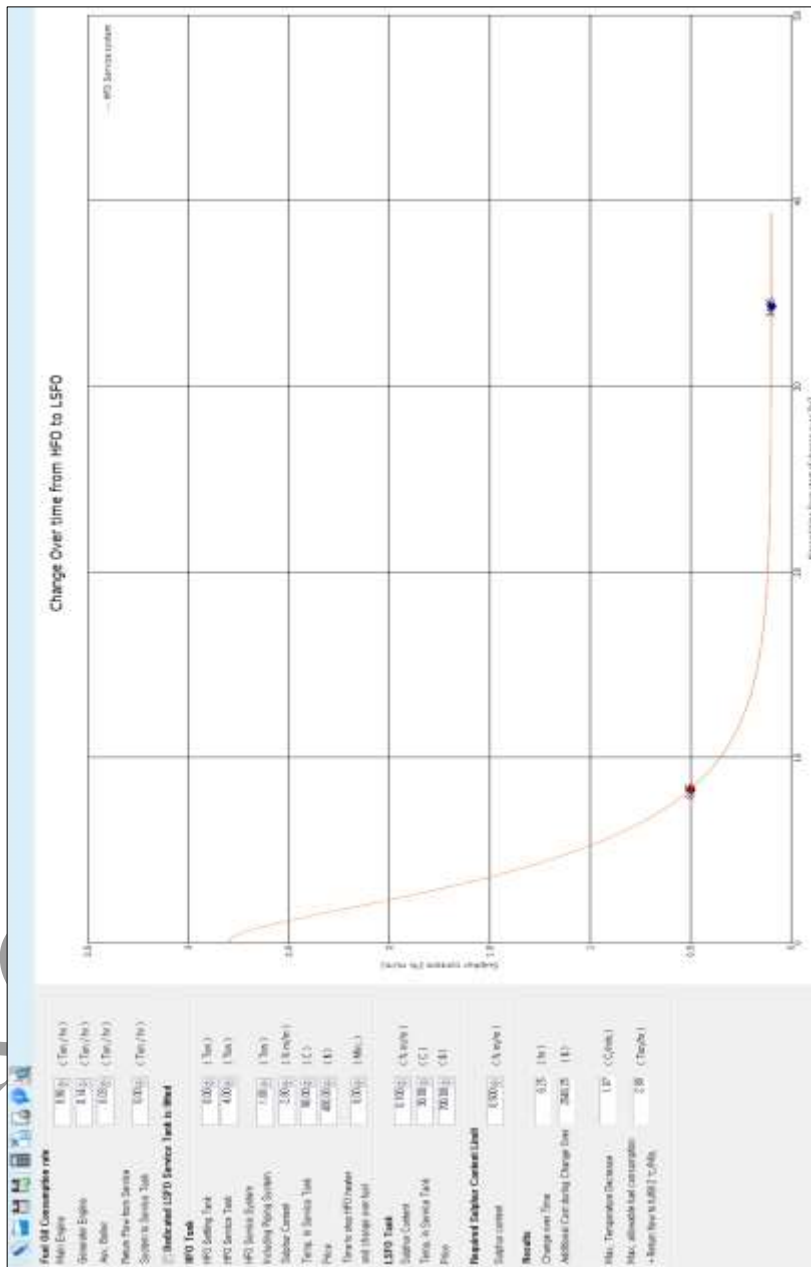
2.3 Schematic diagram for fuel oil change over (M/E & G/E)



2.4 Schematic diagram for fuel oil change over (Aux. boiler)



2.5 Calculation result of FOCO program for fuel oil change over



2.6 Examples of low-BN cylinder oil for operation on LSFO (below 0.5% S)

* Source: MAN ES, Service Letter LS2014-593/D0JA

1. Low-BN cylinder oils

Until now, marine low speed engines and their lubricants have been optimised for operation on heavy fuel oil (HFO) with high sulphur (S) content. During combustion, the S is converted to sulphur trioxide SO_3 , SO_2 and water from the combustion and the scavenge air form sulphuric acid (H_2SO_4). When the liner temperature drops below the dew point of sulphuric acid and water, a corrosive mixture condenses on the liner wall. The high alkaline lubricants (high-BN oils) neutralise the acid and prevent corrosion of piston rings and cylinder liner surfaces.

When operating on fuels with less than 0,1 %S such as distillates, new types of fuel with less than 0,1% S ultra-low-sul-

phur fuel oil (ULSFO), LNG, methanol, ethane and LPG, only small amounts of sulphuric acid are formed in the combustion chamber. The cylinder lube oil additives are then not used for the designed purpose and they tend to build up as deposits. These deposits may disturb the lube oil film and obstruct the piston ring movement, which could lead to micro-seizures on the piston rings and liner and increase the risk of scuffing. Deposit formation and the total lack of corrosion increase the risk of bore-polishing, which could also lead to increased wear and scuffing. For engines operating continuously in SECA on fuels with less than 0,1% S, we recommend to install piston rings with cermet coating on all four rings, to reduce the risk of seizures and scuffing.

Lubrication strategy

It is recommended to use cylinder lube oils with low amount of deposit-forming additives and a good detergency (low BN oils) and operate at the lowest recommended cylinder lube oil feed in order to avoid complications with deposit build-up. The feed rate should be decreased to the minimum feed rate specified in our latest service letters.

The general lubrication strategy is to use high-BN cylinder oil (70-100 BN) when operating on high-sulphur fuels and low-BN oil (15-40 BN) when operating on low-sulphur fuel. An overview of how to choose suitable cylinder lube oils is shown in Fig. 1.

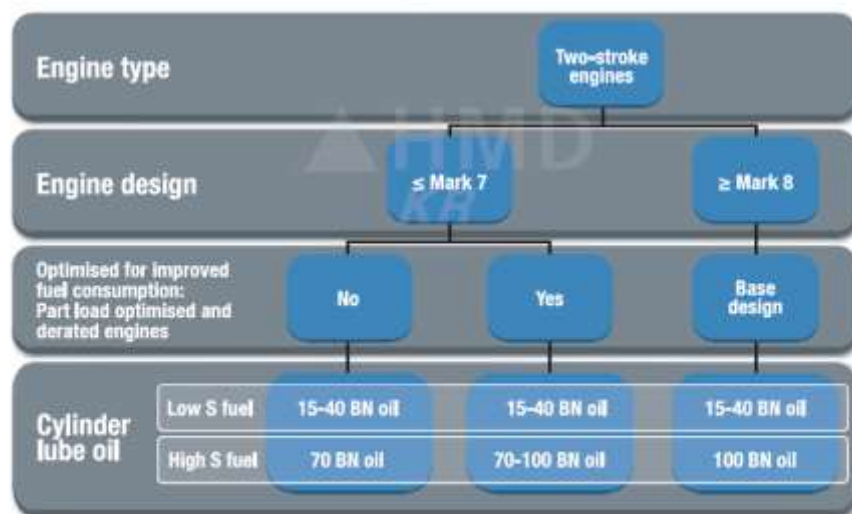


Fig. 1: General overview of cylinder lube oils and how to choose suitable cylinder lube oil. Low S fuel = low-sulphur fuel, incl. distillates, new type fuels with less than 0,1% S, LNG, methanol, ethane and LPG. High S fuel = high-sulphur fuel.

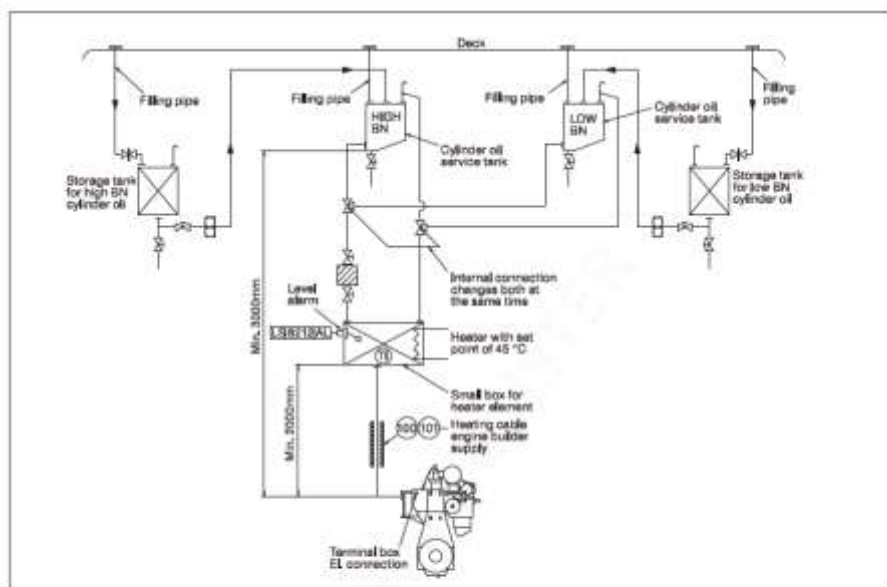


Fig. 2: Recommendation for cylinder lubrication system for ME engines. Similar system should be installed on MC engines using the Alpha Lubricator or mechanical lubricators

When switching to fuels with less than 0,1% S, we recommend switching to low-BN cylinder oil at the same time as switching the fuel. We do not recommend the use of high-BN cylinder oil when running on fuels with less than 0,1% S. This recommendation is valid for all engine types and Mark numbers, and for all lubricator types: electronic (ME and Alpha Lubricator) and mechanical (e.g. Hans Jensen). Please also refer to service letters on cylinder lubrication, SL2014-587 (electronic lubricators) and SL2013-553 (mechanical lubricators).

To support this, we have for many years recommended to install two service

tanks, one for low-BN oil and one for high-BN oil (Fig. 2).

There are low-BN cylinder lube oils with different BN levels on the market today. Currently, there are three different low-BN levels: 17, 25 and 40 BN. However, development continues and in the future there could be oils with other BN levels. Good performance of the low-BN oil is the most important factor,

As the neutralising capacity of these oils varies with the BN, the max. fuel S content also varies. We recommend using them for fuels within the below-specified fuel S content interval (Table 1).

When using the low-BN oils for higher sulphur fuels (e.g. 0.5% S fuel) we recommend dosing the oils at higher feed rates as according to the normal ACC or Feed Rate Factor (FRF) strategy for

Cylinder lube oil BN	Min. % S fuel	Max. % S fuel
15-24	0	0,5
25-34	0	1,0
35-40	0	1,5

Table 1 Fuel S applications for low-BN cylinder oils

electronic lubricators (see Appendix or CLO Advisor).

We expect that the lowest BN oils (17 and 25 BN) will perform best, both in short and long term operation, on fuels with less than 0.1% S. The 40 BN oils may perform satisfactorily for a shorter time on such fuels, and we recommend a maximum operation time of 1-2 weeks on 40 BN oils, see Table 2.

Used oil samples (also called drain oil or scrape down oil) taken from the engine through the scavenge bottom drain can be used for cylinder condition evaluation. Drain oil analysis can show whether the cylinder condition is within the normal range or whether action must be taken, e.g. lowering the feed rate towards minimum dosage or removing cat-fines from the fuel, see latest service letter or the CLO Advisor.

Operation on fuels with less than 0.1% S induces less corrosion on the liners, so we expect normal wear values for iron (Fe) to be in the range of 50-100 ppm and the remaining BN to be 5-10 BN less than the original BN value. Guiding values for alarm levels may be found in the Table 3.

Table 4 shows examples of low-BN cylinder oils presently available in the international market. High- and low-BN oils are listed in "Oils for Marine Two-Stroke Engines" (case no. 50921-2014).

Summary 1: Low-BN Cylinder oils

- Recommendations are valid for all engine types and Mark numbers
- Use low-BN oil (15-40 BN) when operating on fuels < 0.1% S
- When switching to < 0.1% S fuels: Switch immediately to low-BN oil
- Operation on < 0.1% S fuels: Optimise the feed rate towards minimum (0.6-0.7 g/kWh) for electronic lubricators. Use the fixed feed rate for mechanical lubricators
- Two service tanks: one for high-BN oil and one for low-BN oil
- Monitor the cylinder condition and act accordingly

Cylinder lube oil BN	Recommended time of operation on fuels < 0.1% S
15-30	Short and long term service
30-40	Less than 1-2 weeks

Table 2 Recommended time of operation on fuels with less than 0.1% S

Cylinder lube oil BN	Scavenge drain oil – Guiding values	
	Remaining BN	Fe, ppm
15-24	> 5-10	< 100-200 depending on engine type
25-34	> 5-15	< 100-200 depending on engine type
35-40	> 10-20	< 100-200 depending on engine type

Table 3 Guiding alarm levels for scavenge drain oils for fuels with less than 0.1% S

Oil company	Oil name	BN level
Aegion	Altacylo S40 LS	40
Castrol	Cyltech 40SX	40
Chevron	Taro Special HT LF	25
	Taro Special HT LS 40	40
ExxonMobil	Mobilgard 525	25
Gulf Oil Marine	GulfSea Cylocare ECA 50	17
	GulfSea Cylocare DCA 5040H	40
Indian Oil Corp.	Servo Marine LB 1750	17
JX Nippon Oil & Energy	Marine C405	40
Lukoil	Navigo 40 MCL	40
Shell	Alexia S3	25
Sinopec	Marine Cylinder Oil 5040	40
Total	Talussa LS 25	25
	Talussa LS40	40

Table 4 Examples of low-BN cylinder oils on the international market

***Appendix 5.6 Specific familiarization and training of crew
with the Fuel Oil Changeover Plan***

Training Evaluation Report

Training Date

From :

To :

Education Course : Fuel oil change-over drill (LSFO spill)

Instructor name / Title / Sign :

Verified by training supervisor :

No	Rank	Name	Grade	Instructor's opinion
1	1/E		A	
2	2/E		A	
3	3/E(A)		A	
4	3/E(B)		A	

Remarks

『Scenarios for fuel oil change-over drill』

1. DRILL : Fuel oil change-over drill (LSFO spill at leakage part of No.1 fuel oil supply pump in the fuel oil system)

2. DATE : 2019.10.10

3. PLACE : Purifier room

Simulation Scenarios	Items	
After completing the fuel oil change-over from HSFO to LSFO, Duty engineer, 3/E, finds out oil spill at No.1 fuel oil supply pump in the fuel oil system.	<ol style="list-style-type: none"> 1. Immediately, Duty engineer reports this phenomenon that fuel oil is now leaked at No.1 fuel oil supply pump to the chief engineer with transceiver or telephone in the ECR 2. Start No.2 fuel oil supply pump immediately, and then stop No. 1 fuel oil supply pump 3. Close inlet/outlet valves for No.1 fuel oil supply pump 4. Check the spilled quantity of the fuel oil in the oil coaming and the FO overflow tank. 5. Transfer the fuel oil in FO overflow tank to the FO setting tank 6. Report this measure to the chief engineer. 7. Drill finish 	
PREPARE / 3/E /	REVIEW / C/E /	APPROVAL / MASTER /
RECORD OF TRAINING		
MASTER		

Appendix 6.3 FONAR

Procedure for Fuel Oil Non-Availability Report

1. General

This report is to be sent to the flag Administration and to the competent authorities in the relevant port(s) of destination in accordance with regulation 18.2.4 of MARPOL Annex VI. The report shall be sent as soon as it is determined that the ship/operator will be unable to procure compliant fuel oil and preferably before the ship leaves the port/terminal where compliant fuel cannot be obtained. A copy of the FONAR should be kept on board for inspection for at least 36 months.

2. Purpose

This report should be used to provide evidence if a ship is unable to obtain fuel oil compliant with the provisions stipulated in regulations 14.1 or 14.4 of MARPOL Annex VI.

3. Major considerations

Before filing a FONAR, the following should be observed by the ship/operator:

- 1) A fuel oil non-availability report is not an exemption. According to regulation 18.2 of MARPOL Annex VI, it is the responsibility of the Party of the destination port, through its competent authority, to scrutinize the information provided and take action, as appropriate.
- 2) In the case of insufficiently supported and/or repeated claims of non-availability, the Party may require additional documentation and substantiation of fuel oil non-availability claims. The ship/operator may also be subject to more extensive inspections or examinations while in port.
- 3) Ships/operators are expected to take into account logistical conditions and/or terminal/port policies when planning bunkering, including but not limited to having to change berth or anchor within a port or terminal in order to obtain compliant fuel.
- 4) Ships/operators are expected to prepare as far as reasonably practicable to be able to operate on compliant fuel oils. This could include, but is not limited to, fuel oils with different viscosity and different sulphur content not exceeding regulatory requirements (requiring different lube oils) as well as requiring heating and/or other treatment on board.

Fuel Oil Non-Availability Report

1. Particulars of ship

- 1.1 Name of ship: _____
- 1.2 IMO number: _____
- 1.3 Flag: _____
- 1.4 (if other relevant registration number is available, enter here): _____

2. Description of ship's voyage plan

2.1 Provide a description of the ship's voyage plan in place at the time of entry into "country X" waters (and ECA, if applicable) (Attach copy of plan if available):

2.2 Details of voyage:

1 – Last port of departure: _____

2 – First port of arrival in "country X": _____

3 – Date of departure from last port (dd-mm-yyyy): _____

4 – Date of arrival at first "country X" (dd-mm-yyyy): _____

5 – Date ship first received notice that it would be transiting in "country X" waters (and ECA, if applicable) (dd-mm-yyyy): _____

6 – Ship's location at the time of notice: _____

7 – Date ship operator expects to enter "country X" waters (and ECA, if applicable) (dd-mm-yyyy): _____

8 – Time ship operator expects to enter "country X" waters (and ECA, if applicable) (hh:mm UTC): _____

9 – Date ship operator expects to exit "country X" waters (and ECA, if applicable) (dd-mm-yyyy): _____

10 – Time ship operator expects to exit "country X" waters (and ECA, if applicable) (hh:mm UTC): _____

11 – Projected days ship's main propulsion engines will be in operation within "country X" waters (and ECA, if applicable): _____

12 – Sulphur content of fuel oil in use when entering and operating in "country X" waters (and ECA, if applicable): _____

3. Evidence of attempts to purchase compliant fuel oil

3.1 Provide a description of actions taken to attempt to achieve compliance prior to entering "country X" waters (and ECA, if applicable), including a description of all attempts that were made to locate alternative sources of compliant fuel oil, and a description of the reason why compliant fuel oil was not available: _____

3.2 Name and email address of suppliers contacted, address and phone number and date of contact (dd-mm-yyyy): _____

Please attach copies of communication with suppliers (e.g. emails to and from suppliers)

4. In case of fuel oil supply disruption only

4.1 Name of port at which ship was scheduled to receive compliant fuel oil: _____

4.2 Name, email address, and phone number of the fuel oil supplier that was scheduled to deliver (and now reporting the non-availability): _____

5. Operation constraints, if applicable

5.1 If non-compliant fuel has been bunkered due to concerns that the quality of the compliant fuel available would cause operational or safety problems on board the ships, the concerns should be thoroughly documented.

5.2 Describe any operational constraints that prevented use of compliant fuel oil available at port: _____

5.3 Specify steps taken, or to be taken, to resolve these operational constraints that will enable compliant fuel use: _____

6. Plans to obtain compliant fuel oil

6.1 Describe availability of compliant fuel oil at the first port-of-call in "country X", and plans to obtain it: _____

6.2 If compliant fuel oil is not available at the first port-of-call in "country X", list the lowest sulphur content of available fuel oil(s) or the lowest sulphur content of available fuel oil at the next port-of-call: _____

7. Previous Fuel Oil Non-Availability Reports

7.1 If shipowner/operator has submitted a Fuel Oil Non-Availability Report to "country X" in the previous 12 months, list the number of Fuel Oil Non-Availability Reports previously submitted and provide details on the dates and ports visited while using non-compliant fuel oil, as set out below:

Report: _____

Date (dd-mm-yyyy): _____

Port: _____

Type of fuel: _____

Comments: _____

8. Master/Company information

Master name: _____

Local agent in "country X": _____

Ship operator name: _____

Shipowner name: _____

Name and position of official: _____

Email address: _____

Address (street, city, country, postal/zip code): _____

Telephone number: _____

Signature of Master: _____

Print name: _____

Date (DD/MM/YYYY): _____

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