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UPORABA LAKIH I TEŠKIH DIZELSKIH GORIVA NA PRIMJERU DVAJU BRODOVA ZA RASHLAĐENI TERET

THE NECESSITY OF USING MDO AND OF CHANGING OVER FROM HFO TO MDO (AND VICE VERSA) ON THE EXAMPLE OF TWO REEFER VESSELS

SAŽETAK

Uporaba TDG-a[1] na trgovačkim brodovima ima prednost u smislu troškova putovanja u kojima troškovi goriva imaju značajnu ulogu. Ipak, postoje posebne okolnosti pri kojima uporaba LDG-a postaje nužna i dovodi do povećanja ukupnih troškova. Takve okolnosti prepoznate su na primjeru dvaju brodova istog vlasnika[2] koji posluju u sustavu jednog Pool[3]-a, a koji su prema Pool-ovim normativnim tablicama prikazani kroz uporabu samo TDG-a. Na taj je način nastala razlika u troškovima koja bi prema propisanim pravilima između sudionika trebala teretiti samo vlasnika.
Uvažavajući podatke pronađene u dostupnim izvorima, naglašene su glavne karakteristike strojeva u kojima se izgara gorivo na oba broda, a u svezi korištenja LDG-a i prebacivanja između TDG-a i LDG-a (i obrnuto), te su istaknute i posebne okolnosti za svakog od njih postavljajući temelj za donošenje zaključnih stavova.
Nakon analize svih dostupnih podataka, kao i uvidom u stručnu literaturu sintetizirano je jednoznačno određenje za navedeni slučaj.
Zaključno je objašnjena nastala razlika u skladu s naputcima proizvođača i operativnim uvjetima brodova čime je ostvaren preduvjet prihvaćanja nužnosti priznavanja navedenih povećanih troškova od strane Pool-a.

Ključne riječi: *TDG, LDG, prebacivanje s TDG-a na LDG-e i obrnuto*

SUMMARY

Using the HFO[1] on board merchant ships has an advantage in terms of voyage expenses where fuel costs have an important role. However, there are special circumstances in which the use of MDO becomes necessity and leads to the increased total costs. Such circumstances are recognized on the example of two ships of the same owner[2] who operate in the system of one Pool[3], and that the Pool's normative tables are shown only through the use of HFO. In this way the result of the differences in costs that would be prescribed by the rules of the participants, should be charged only to the owner.
Taking into account the information found in available sources, the main characteristics of the machines in which the fuel burns on board both the ships were pointed out in relation to the usage of MDO and to the changing over from HFO to MDO (and vice versa), and thus highlighted the special circumstances for each of them, laying the foundation for the adoption of the concluding positions.
After analyzing all available data, and examining the professional literature a uniquely synthesized definition for the specified case is given.
Conclusive result is explained the difference in accordance with the manufacturer's instructions and operating conditions of ships, which is made a precondition of accepting the necessity of recognition of these increased costs by Pool.

Key words: *HFO, MDO, changing over from HFO to MDO and vice versa.*

[1] Oznaka goriva:
– TDG – teško dizelsko gorivo međ. oznaka: IFO 380 RMG380;
– LDG – lako dizelsko gorivo međ. oznaka: MDO DMB
[2] Ime vlasnika (Društva) poznato autoru.
[3] Ime Pool-a poznato autoru.

[1] Bunker grades refer to:
– HFO – refers to IFO 380 RMG380;
– MDO – refers to MDO DMB
[2] The Owner's (Company) name is known to the author.
[3] The Pool name is known to the author.

1. UVOD

1. INTRODUCTION

Glavne karakteristike: / *Main Particulars*	
1. Ime: *Brod 1*[*] / *1. Name: Vessel 1*[**]	
Zastava: / *Flag:*	Liberijska / *Liberia*
Luka upisa: / *Port of Registry:*	Monrovia
God. gradnje: / *Year built:*	1987.
LOA/LPP:	136.02/128.00 m
Širina: / *Beam:*	18.00 m / 18.00 m
Dubina: / *Depth:*	10.50 m / 10.50 m
Int. GT/NT:	5 839/2 877
Panama NT:	4 801
Suez GT/NT:	6 145/4 689
Istisnina: / *Displacement:*	10 093 t
GM: / *M/E:*	Mitsui B&W
Tip/model: / *Type/model:*	5 L 50 MC-E
MCR: / *MCR:*	4 600 kW at 133 RPM
PM: / *A/E:*	Yanmar
Tip/model: / *Type/model:*	6 M 200 L-ET
MCR:	480 kW at 720 RPM
Gen. izlaz: / *Gen. out.:*	600 kVA (60 Hz)
El. raz. pl.: / *Switchboard:*	440 V/ 60 Hz
Kotao: / *Boiler:*	Hada Boiler, Tortoise Engineering Co., Ltd.
Tip/model: / *Type/model:*	kompozitni vertikalni tip/ MKSC-20-1000/90 / *composite type vertical*/ MKSC-20-1000/90
2. Ime: *Brod 2* / *2. Name: Vessel 2*	
Zastava: / *Flag:*	Liberijska / *Liberia*
Luka upisa: / *Port of Registry:*	Monrovia
God. gradnje: / *Year built:*	1989.
LOA/LPP:	124.7/117.31 m / 124.7/117.31 m
Širina: / *Beam:*	17.8 m
Dubina: / *Depth:*	9.85 m
Int. GT/NT:	5 476/3 559
Panama NT:	4 922
Suez GT/NT:	5 476/3 559
Istisnina: / *Displacement:*	10 103 t
GM: / *M/E:*	Kobe Diesel
Tip/model: / *Type/model:*	6 UEC 45 LA
MCR:	5 150 kW at 158 RPM
PM: / *A/E:*	Daihatsu Diesel Engine
Tip/model: / *Type/model:*	6 DL 20
MCR:	485 kW at 720 RPM
Gen. izlaz: / *Gen. out.:*	562 kVA (60 Hz)
Sl. raz. pl.: / *Switchboard:*	440 V/ 60 Hz
Kotao: / *Boiler:*	Hada Boiler, Tortoise Engineering Co., Ltd.
Tip/model: / *Type/model:*	loživi gorivom, MVS-11, M-1438 / *oil fired*, MVS-11, M-1438

[*] Imena brodova i IMO brojevi poznati autoru.

[**] Vessels' names and IMO numbers are known to the author.

2. GLAVNE KARAKTERISTIKE STROJEVA U KOJIMA SE IZGARA GORIVO NA SVAKOM OD BRODOVA U ODNOSU NA KORIŠTENJE LDG-a I PREBACIVANJE IZMEĐU TDG-a I LDG-a (I OBRNUTO)

Glavni motor na Brodu 1

U skladu s podacima pronađenim u Instrukcijskoj knjizi (Mitsui B&W Volumen 1 'Operation and data' manual, Chapter 4.: Other operational aspects, It. 4.2: 'Fuel change-over' – str. 705.08 – 705.10), potrebno je uočiti da je spomenuti glavni motor konstruiran za neprekidno korištenje predgrijanog teškog dizelskog goriva čak i za vrijeme mirovanja (zaustavljanja).

Isto tako, naglašeno je da proizvođač ne preporučuje korištenje lakog dizelskog goriva u motoru (primjenjivo na sva opterećenja) zbog mogućeg latentnog rizika nastajanja nekompatibilne smjese pri prebacivanju između lakog dizelskog goriva i teškog dizelskog goriva marginalne kvalitete. Potrebno je primijetiti da takve smjese, kao i nagle temperaturne promjene mogu uzrokovati i probleme kao što su:

– 'zaribavanje' ili zapinjanje pumpe goriva ili rasprskača,
– loše izgaranje,
– zaprljanje plinskih provoda.

U samom poglavlju nije spomenuto, ali je općepoznato na koji način se to može odraziti na ostale dijelove motora (npr. ispušne ventile, klipne/stapne prstenove ili krunu, košuljice, glave/poklopce cilindra).

Ipak, proizvođač dopušta 'posebne okolnosti' pri kojima prebacivanje na lako dizelsko gorivo postaje nužnost. To su one okolnosti u kojima se očekuje duže zaustavljanje broda s 'hladnim' motorom, npr. zbog:

– dokovanja,
– zaustavljanja dužeg od 5 dana,
– značajnijeg popravka na sustavu goriva ili
– kad brod dolazi u područja u kojima zakonodavstvo zahtijeva korištenje goriva s niskim udjelom sumpora.

2. MAIN CHARACTERISTICS OF THE MACHINERIES BURNING THE FUEL O/B EACH VESSEL REGARDING THE USAGE OF MDO AND OF THE CHANGING-OVER BETWEEN HFO AND MDO (AND VICE VERSA)

Main engine of Vessel 1

Referring to the data found in the Mitsui B&W Volume 1 'Operation and data' manual, Chapter 4.: Other operational aspects, It. 4.2: 'Fuel change-over' – Pg 705.08 – 705.10, it is to be noted that the mentioned main engine is designed for the constant operation on preheated heavy fuel oil, even during standstill.

It is also highlighted that the manufacturer's recommendation is 'not to use diesel oil for the operation of the engine' (applying it to all loads) due to latent risk of diesel oils and heavy fuels of marginal quality forming incompatible blends during fuel change-over. There is to be noted that such blends, as well as too rapid temperature changes, can evoke problems such as:

– fuel pump and injector sticking/scuffing,
– poor combustion,
– fouling of the gas ways.

It is not mentioned in that chapter, but it is well known, how this can affect the other components of the engine (for ex. exhaust valves, piston rings, piston crowns, cylinder liners, cylinder covers).

However, the manufacturer permits 'special circumstances' when the change-over to diesel oil becomes necessary. This is the case when 'the vessel is expected to have a prolonged inactive period with cold engine', for ex. due to:

– a docking,
– more than 5 days stop,
– a major repair of the fuel oil system etc.; or
– when the vessel is approaching the areas where environmental legislation requires the use of low-sulphur fuels.

The owner has presented the records of the vessel's ESP (end of sea passage) and SSP

Vlasnik je dostavio podatke za brod o njegovom početku (SSP – engl. start of sea passage) i završetku (ESP – engl. end of sea passage) putovanja za sva putovanja izvršena u 2009. godini (Put. br. 012009 do 082009) iz kojih je vidljivo prosječno zaustavljanje od 6,9 dana, s primjetno dužim zaustavljanjima pri dolasku u zapadnoafričke luke (vidjeti tablicu 1 u prilogu). Procjena operatora broda o zaustavljanju u lukama, obično nije bila u skladu s onom stvarno ostvarenom (obično podcijenjena). Također, treba primijetiti da je dio putovanja izvršen i u luke Sjevernog mora koje su uključene u SECA područje (područje s nadzorom nad količinom sumpora u ispušnim plinovima, o. a.) u kojem je obveza koristiti LSHF (engl. low sulfur haevy fuel – gorivo s niskim udjelom sumpora, o. a. ili LDG-e ako prethodnog nije bilo na brodu).

U tim okolnostima razumljivo je da pogonski strojevi moraju biti spremni pri dolasku, pa se posada obvezuje slijediti upute proizvođača i zahtjeve okolišnog zakonodavstva.

Stoga je, u tim 'posebnim okolnostima' (kad je zaustavljanje bilo duže od 5 dana ili ulaskom/izlaskom u SECA područje bez LSHF goriva na brodu) bilo apsolutno nužno prebaciti gorivo s TDG-a na LDG-e na kraju i s LDG-a na TDG-e na početku putovanja (ili ulaskom/izlaskom u SECA područje) da bi se manevriranje izvršilo na siguran način.

Glavni motor na Brodu 2

U skladu s podacima iz Instrukcijske knjige (Kobe Diesel – Mitsubishi UE Diesel Engine (UEC 45 LA) instruction book, chapter 2 – Engine operation, pg. 023-01-02), navedeno je da se motor smije uputiti uz korištenje jedino LDG-a.

S obzirom na tu činjenicu, razumljivo je da se na kraju putovanja gorivo mora prebaciti s TDG-a na LDG-e prije početka manevriranja pri dolasku u luku, jednako kao i s LDG-a na TDG-e na početku putovanja odlaskom iz luke.

U odnosu na ulazak/izlazak iz SECA područje prebacivanje treba razmotriti na isti način kao za prethodni brod.

Pomoćni motori na oba broda

Korištenje LDG-a i prebacivanje s LDG-a na TDG-e (i obrnuto) za pomoćne motore treba promatrati različito, ali jednako za oba broda.

(start of sea passage) respecting the voyages completed during 2009. (Voyage Nr. 012009 – 082009), showing the average standstill of approx. 6.9 days, with notably the highest stoppage when approaching West African ports. (See Table 1) The durations of stoppage at ports estimated by the operator were not usually in accordance with the durations of the actually stoppage (usually under estimated). It is also to be noted, that part of the voyages made in that period were to the North Sea ports that are included in the SECA areas, so the engines had to be changed-over to LSHF oil (or MDO if the first one wasn't available o/b).

In those circumstances it is understandable that the vessel's main engine should be ready for the manoeuvering when approaching the ports and the crews were obliged to follow the manufacturer's instructions and environmental legislation required.

So, for those 'special circumstances' (when stoppage was more than five days long or when entering/leaving the SECA areas was without LSHF oil o/b) it was absolutely necessary to change-over the fuel from HFO to MDO at the end of the sea passage and from MDO to HFO at the beginning of the sea passage (or when entering/leaving the SECA areas) to end manoeuvering in a safety manner.

Main engine of Vessel 2

Referring to the data found in the Kobe Diesel – Mitsubishi UE Diesel Engine (UEC 45 LA) instruction book, chapter 2 – Engine operation, page 023-01-02, it is stated that the engine is to be started using diesel oil only.

Due to that fact, it is understandable that at the end of the voyage the fuel should be shifted from HFO to MDO before manoeuvering when approaching the port, as well as from MDO to HFO at the beginning of the sea passage when leaving the port.

Regarding entering/leaving the SECA areas the changing-over should be considered in the same way as above mentioned.

Auxiliary engines on both vessels

The usage of MDO and the changing-over from MDO to HFO (and vice versa) for auxiliary engines should be considered in a different way, but equally for both the vessels.

Pomoćni motori na oba broda mogu jednako koristiti i LDG-e i TDG-e. Pri upućivanju motora, proizvođači preporučuju uporabu LDG-a i nakon što se motori ugriju može se izvršiti prebacivanje na predgrijani TDG-e. Također, prije zaustavljanja, motori koji su koristili TDG-e moraju se prebaciti na LDG-e. To se mora učiniti zbog činjenice da ne postoji mogućnost cirkulacije goriva kroz sustav kad je motor zaustavljen, pa bi se TDG-e zaostao u sustavu ohladio i blokirao sustav onemogućavajući ponovno upućivanje.

Rizik promjene s jednog na drugo gorivo je u mogućnosti nastanka istih oštećenja kao što su ona prethodno navedena za glavni motor.

Treba uočiti da se optimalni uvjeti rada motora i najbolje izgaranje postižu kad motor radi na optimalnom opterećenju koje je obično iznad 75-80% MTS-a (maksimalne trajne snage, o. a.). Kad motor radi pod niskim opterećenjem, njegovi su dijelovi (npr. rasprskači, unutarnji prostori izgaranja, ispušni ventili, ispušni vodovi, turbine, itd.) izloženi taloženju ostataka uslijed smanjene efikasnosti procesa izgaranja. To se događa pri korištenju LDG-a, a posebno je visoko kod uporabe TDG-a. Zbog toga, proizvođači ne dopuštaju korištenje TDG-a pri niskim opterećenjima (npr. 30% MTS-a)

Dakle, ako se motori žele ispravno koristiti, operatori (posada stroja, o.a.) moraju uzeti u obzir navedene postavke da bi ostvarili siguran rad i izbjegli povećane troškove održavanja/popravaka.

Odlučivanje o tome koje gorivo treba koristiti za pomoćne motore u luci ili za vrijeme putovanja uglavnom zavisi od postavljenog opterećenja koje posredno ovisi o: brodskim operacijama, tipu tereta koji se ukrcava ili prevozi i instaliranim strojevima, npr. rashladni kompresori, ventilatori skladišta, dizalice, itd.

Postoji značajna razlika u opterećenju kad brod ukrcava/prevozi smrznuti ili rashlađeni teret ili teret koji ne zahtijeva nikakvo hlađenje. Obično se dogodi da jedan generator nije dostatan za pokrivanje cjelokupnog opterećenja, pa se drugi mora staviti 'u paralelni rad'. Paralelni rad generatora na oba broda moguć je jedino u načinu 'jednakog opterećenja' (nema mogućnosti izbora načina, npr. 'optimalni' ili ' ciklični'). To znači da kad su 'u paraleli' generatori nose jednako opterećenje (svaki cca ½). To

The auxiliary engines on board both the vessels can use MDO and HFO equally. For starting of the engines, the manufacturers recommend the usage of MDO and when the engines are warmed up the changing-over from MDO to the preheated HFO can be performed. Furthermore, before stopping the engines that were run on HFO, the fuel should be switched to MDO. This is to be done due to the fact that, when stopped, there is no circulation of the fuel provided through fuel system components of the engines themselves, so any HFO left in the system will cool down clogging the system and preventing future starting.

The risk when changing over from one to another fuel can cause damages which are the same as the ones mentioned for the main engine.

It is to be noted that 'engine performance optimum' and 'best combustions' are achieved when the engine runs at an optimal load which is usually above 75-80% of MCR. When the engine runs at low load, its components (e.g.: fuel valves, internal combustion spaces, exhaust valves, exhaust gases lines, T/C etc.) are exposed to deposits of residuals left from the decreased efficiency of the combustion process. This occurs when using MDO and it is especially high when using HFO. Due to this fact, the manufacturers do not permit the usage of the HFO when the load applied is too low (e.g.: 30% MCR).

So, if the engines are to be run with care and in good manner the operator should consider those facts respectively to obtain safely running and avoid excessive maintenance/repair costs.

The deciding factor which fuel is to be used for A/Es at the port or during the voyage mainly depends on the load applied to them, that respectively depend on: the operation of the vessel, type of cargo loaded/carried and on the usage of the machineries installed (e.g.: reefer compressors, hold fans and derricks, etc.).

There is a significant difference between loads on auxiliary engines when the vessel is loading/carrying frozen or chilled cargoes or cargo that doesn't require any cooling. It is a common thing that one generator will not be enough to maintain the entire load applied, and that another one is to be run 'in parallel'. The parallel run of the generators on both the vessels is available in 'equal' mode only (there is no possibility of changing the mode (e.g. 'optimal' or 'cyclic' load). That means that when the

može dovesti do čestog slučaja kad niti jedan od njih ne radi u optimalnom području.

Za održavanje slučajeva naizmjeničnih vršnih i doljnjih opterećenja (koji su tako uobičajeni na brodovima za rashlađeni teret koji imaju tri rashladna kompresora, mnogo ventilatora skladišta, dizalice, itd.) potrebna su dva generatora, a oni najčešće 'u paraleli' nose neznatno iznad 50% MTS-a. To opterećenje je daleko od optimalne razine (iznad 75%) što bi pri takvoj dužoj uporabi dovelo do nakupljanja prethodno spomenutih taloga smanjujući kapacitet motora i povećavajući troškove održavanja.

Ti su učinci daleko veći pri uporabi TDG-a. Vršni udari mogu pomaknuti opterećenje na optimalnu razinu koja je poželjna, ali će padovi smanjiti opterećenje čak i manje od 30% MTS-a kad uporaba TDG-a nije dopuštena.

Poznavajući navedeno, upravitelj stroja na brodu mora odlučiti koje je najbolje rješenje za trenutnu situaciju. (Npr., ako se može očekivati učestala promjena opterećenja tijekom ukrcaja ili iskrcaja i nužnost za uzastopnim upućivanjem i zaustavljanjem drugog pomoćnog motora, bilo bi razumno koristiti LDG-e. Inače, kad se može očekivati prilično jednakomjerno opterećenje blizu optimalnog od 75-80% MTS-a prebacivanje na TDG-e bit će poželjno smanjujući troškove za utrošeno gorivo.)

U svezi s izvješćem o pregledu broda prije kupnje, važno je istaknuti da se vrijednosti za tu svrhu uzimaju iz Dnevnika stroja i savjetujući se s upraviteljem na brodu koji je na dužnosti za vrijeme pregleda. Dakle, pretpostavljajući da je pregled izvršen na isti način i uzimajući u obzir prethodna razmatranja, vrijednosti mogu biti realne uvažavajući teret koji je bio na brodu u vrijeme kad je pregled izvršen (utrošak LDG-a od 3-5 t/dan).

Loživi kotlovi na oba broda

Općenito je pri zagrijavanju, poželjno uputiti kotao na LDG-e čak i kada postoji mogućnost korištenja TDG-a (npr. kad je ugrađen električni zagrijač goriva u usporedbi sa sustavom s parnim zagrijačem kada nema mogućnosti upućivanja s TDG-a iz 'hladnog' stanja). No, jednom kad je kotao ugrijan, preporučena je uporaba TDG-a. Potrošak izgorenog goriva jako ovisi o klimatskoj zoni i godišnjem dobu, kao i o količinama TDG-a u tankovima koje treba

generators are 'in parallel' they should carry equal load (approx. ½ each). This might lead to the most common situations that neither one of them runs at the optimal load.

The cases of intermittent load peaks and downs to be maintained (which are so common on the reefer vessels having three reefer compressors, plenty of hold fans, derricks, etc.), require two generators and mostly when running in parallel they carry slightly above 50% of MCR. This load is far away from the optimum level (above 75% MCR) and for a prolonged use it will cause accumulation of the deposits mentioned above, reducing the power capacity of the engine and raising the costs of maintenance.

Those effects are much higher when HFO is in use. The 'peaks' can shift the load to optimum levels for both, which is favorable, but the 'downs' can reduce the load to less then 30% MCR when HFO is not allowed for use.

Knowing this, it is up to the Chief Engineer o/b to decide which the best solution at the current situation is (e.g. if frequently changes of load during loading or discharging and the necessity for several starting and stopping of another auxiliary engine are to be expected then it will be reasonable to run them on MDO. Otherwise, when the load is expected to be pretty constant and near to the optimum 75-80% of MCR, the change-over to HFO will be appreciated, reducing the costs of the fuel consumed.).

Regarding the pre-purchased survey reports, it is to be noted that the figures for that purpose are usually obtained from the Engine Log Book and consulting the C/E in charge o/b during the survey. Therefore, supposing that the surveys were done in the same way, and taking into account the above mentioned considerations, the values might be realistic respecting the cargo o/b in the time being conducted (usage of 3-5 t/day of MDO).

Oil fired boiler on both vessels

Generally, in the starting of the boiler when 'heating up', it is favorable to use MDO even if there is a possibility of using HFO (e.g. if there is an electrical heater installed comparing to systems with a steam heater - when there is no possibility of starting on HFO from the cold state). But, once heated up, the use of HFO is recommended. The consumption of the oil

predgrijati. U tropskoj zoni treba utrošiti manju količinu goriva, a u Sjevernom/Južnom zimskom godišnjem dobu utrošak za grijanje goriva u tankovima, prostorija posade, ili ponekad i skladišta tereta bit će veći.

Oba broda imaju mogućnost nekorištenja loživih kotlova tijekom putovanja (jer imaju ugrađene kotlove na ispušne plinove: na *Brodu 1* kompozitni kotao, a na *Brodu 2* odvojeni kotao na ispušne plinove). No, pri dolasku u luku, kad nedostaje ispušnih plinova zbog manevriranja ili boravka u luci kad je motor zaustavljen – upućivanje loživog kotla je nužnost, jer čak i u tropskim područjima postoji stalna potreba za grijanjem tankova TDG-a ako se isto misli koristiti.

U svakom slučaju, ne postoji mogućnost da se, na primjer, za pomoćne motore koristi predgrijani TDG-e u luci, a da se pritom nije trošilo gorivo za kotao. Jer su, za zagrijavanje TDG-a za pomoćne motore ugrađeni parni zagrijači, a za održavanje temperature u tankovima postoje parne serpentine – stoga, para je nužnost, a za njenu proizvodnju, kad je brod u luci, dio goriva mora se utrošiti za kotao. Potrošak, prema prethodno navedenom, ovisi o klimatskoj zoni, godišnjem dobu i količini TDG-a na brodu koji treba zagrijati.

3. ZAKLJUČAK

Usprkos činjenici da su na oba broda motori i kotlovi dizajnirani za gotovo konstantno korištenje TDG-a, postoje posebne okolnosti kad prebacivanje na LDG-e postaje apsolutno preporučeno od strane proizvođača ili zahtijevano zbog udovoljavanja okolišnog zakonodavstva.

U takvim okolnostima (npr. duži zastoj broda – više od 5 dana, ulazak/izlazak iz SECA područja bez LSHF goriva na brodu, rad nisko opterećenih pomoćnih motora kod naizmjeničnog vršnog i niskog opterećenja, itd.) prebacivanje na LDG-e je preporučeno ako se pogon želi koristiti na ispravan, siguran i odgovoran način. U suprotnom će to rezultirati visokim troškovima održavanja/popravaka i smanjenom pouzdanošću pogona.

Normativi Pool-a u prezentacijskim tablicama brodova u kojima su prikazane vrijednosti utroška TDG-a za pomoćne motore, i istovremeno bez utroška goriva za kotlove, jednostavno ne mogu biti valjani prema objašnjenju iz

burned largely depends on the climate zones and seasons, and on the quantity of HFO in tanks that needs to be pre-heated. The tropical zone requires less fuel to consume and the North/South winter season requires higher quantities of fuel to be burned to heat up HFO tanks, accommodation spaces or even, occasionally, cargo spaces.

Both vessels have the possibility not to use an oil fired boiler during the voyage (due to the exhaust gas economizer installed: on *Vessel 1* composite boiler and on *Vessel 2* separated exhaust gas economizer). But, approaching the port when there will not be enough exhaust gases for heating purposes due to the maneuvering procedure or during standstill at the port when M/E is stopped - the start of the oil fired boiler is a necessity because, even in the tropical areas, there is a constant need for heating the HFO tanks if HFO is to be used.

Anyway, there is no possibility that, for example A/Es were run on preheated HFO at the port without the consumption of oil at the boiler. Because, to heat up the HFO for the A/Es there are steam heaters installed and to maintain the temperature of the HFO tanks there are steam heating coils to be used – so, steam is necessary, and for its production the part of the oil should be used for oil fired boiler when the vessels are in the port. The consumption, as mentioned above, depends on the climate zones and on the seasons, as well as on the quantity of HFO having o/b that need to be heated.

3. CONCLUSION

In spite of the fact that o/b each vessel there are engines and boilers that are designed for the use of HFO almost permanently, there are several occasions when changing-over to MDO becomes absolutely recommended by the manufacturer or required to comply with environmental legislations.

In such occasions (e.g.: prolonged standstill of the vessel - more than 5 days, entering/leaving the SECA areas without having LSFO o/b, running the auxiliary engines on low load during intermittent peaks and downs, etc.) the changing-over to MDO is recommended if the machineries are to be operated in good, safely and responsible manner. Otherwise, it will result in high maintenance/repair costs and in a reduced reliability of the machineries.

prethodnog poglavlja pod točkom 'Loživi kotlovi na oba broda'.

Takve 'posebne okolnosti' mogu dovesti do razlike u vrijednostima potrošnje goriva, ali se one trebaju uzeti u obzir kod izračuna utroška goriva kako bi se dobile točne i prihvatljive vrijednosti i za vlasnika i za Pool.

The Pool normative in Ships presentation tables show A/E's 'in port' consumption figures of HFO, and in the same time no consumption of the fuel for the boiler, simply cannot be valid as explained in the previous chapter under 'Oil fired boiler on both vessels' items.

Such 'special circumstances' may raise the differences in fuel oil consumption figures, but they are to be taken in consideration when calculating the fuel being used in order to obtain the correct and acceptable figures for the owner and the Pool.

LITERATURA / REFERENCES

[1] Mitsui B&W, 5 L 50 MC-E - operation and data manual;
[2] Kobe Diesel – Mitsubishi UE Diesel Engines instruction book (operation manual);
[3] Yanmar, 6 M 200 L-ET – operation and data manual;
[4] Daihatsu Diesel Engine, DL-20 instruction book;
[5] Hada Boiler, composite type vertical/ MKSC-20-1000/90 – završni plan;
[6] Hada Boiler, oil fired MVS-11, M-1438 – završni plan;
[7] Sunflame, oil burning apparatus SSR-1 – završni plan;
[8] Sunflame, oil burning apparatus SSC-4 – završni plan;
[9] Zapisi rezultata provedenih testova (službeni: probni stol / radionička proba, probna vožnja) za predmetne brodove i njihove pogone;
[10] Izvedbeni nacrt cjevovoda goriva za oba broda;
[11] Izvedbeni nacrt cjevovoda pare za oba broda;
[12] Izvješće o predkupovnom pregledu za oba broda;
[13] Izvješća o analizi ukrcanog goriva (2009.) za oba broda;
[14] Podaci Društva o putovanjima izvršenim u 2009. g. za oba broda;
[15] Prezentacijske tablice Pool-a za oba broda;
[16] Kees Kuiken, Diesel engines parts I and II, Target Global Energy Training, Onnen, NL, 2008.

PRILOZI

ATTACHMENTS

Tablica 1. *Popis putovanja izvršenih u 2009. g. za Brod 1 (prema podacima ureda Društva)*

Putovanje Br.	Luka	ESP	SSP	Proc. Pool-a	Trajanje
Put. 012009	Nouadhibou	24/12/08 11:30	01/01/09 16:24	24/12 – 03/01	8 d 4 h 54’
	Abidjan	09/01, 16:30	20/01, 19:12	09/01 – 18/01	11 d 2 h 42’
	Tema	21/01, 22:18	25/01, 21:12	20/01 – 24/01	3 d 22 h 54’
	Douala	27/01, 13:18	10/02, 13:30	27/01 -31/01	14 d 0 h 12’
	Cape Town	17/02, 10:24	20/02, 22:45	16/02 – 19/02	3 d 12 h 21’
Put. 022009	Las Palmas	08/03, 22:10	13/03, 08:00	08/03 – 09/03	4 d 9 h 50’
	Flushing	18/03, 06:45	19/03, 21:45	18/03 – 19/03	1 d 15 h
Put. 032009	Runevig	21/03, 23:00	30/03, 02:00	21/03 – 27/03	8d 3 h
	Velsen	01/04, 05:00	04/04, 01:15	28/03 – 01/04	2 d 20 h 15’
	Abidjan	16/04, 15:50	21/04, 16:30	-	5 d 0 h 40’
	Lagos	23/04, 05:15	04/05, 18:00	19/04 – 23/04	11 d 12 h 45’
Put. 042009	Nouakchott	11/05, 05:30	23/05, 10:45	11/05 – 16/05	12 d 5 h 15’
	Abidjan	28/05, 03:00	13/06, 00:30	28/05 – 01/06	15d 21 h 30’
	Tema	14/06, 06:30	20/06, 18:00	13/06 – 19/06	6 d 11 h 30’
	Cotonou	21/06, 05:30	30/06, 19:10	20/06 – 26/06	9 d 13 h 40’
Put. 052009	Las Palmas	13/07, 13:15	20/07, 23:15	09/07 – 13/07	7 d 10 h
	Ijmuiden	26/07, 10:45	31/07, 20:00	26/07 – 02/08	5 d 9 h 15’
Put. 062009	Las Palmas	06/08, 04:00	11/08, 23:00	06/08 – 08/08	5 d 19 h
	Point Noire	21/08, 08:00	24/08, 16:45	21/08 – 26/08	3 d 8 h 45’
	Port Harcourt	26/08, 17:30	24/09, 17:00	26/08 – 03/09	28 d 23 h 30’
Put. 072009	Dakar	02/10, 08:30	08/10, 19:40	-	6 d 11 h 10’
	Nouadhibou	10/10, 01:35	13/10, -	-	-
	Flushing	19/10, 18:00	20/10, 08:10	19/10 – 22/10	0 d 14h 10’
	Karmoy	21/10, 15:00	23/10, 03:20	21/10 – 24/10	1 d 12 h 20’
	Tromso	25/10, 06:30	29/10, 21:00	25/10 – 27/10	4 d 14 h 30’
	Lodingen	30/10, 04:20	31/10, 21:00	31/10 – 04/11	1 d 16 h 40’
	Las Palmas	11/11, 23:00	12/11, 21:22	11/11 – 11/11	0 d 22 h 22’
	Port Harcourt	23/11, 03:15	29/11, 16:00	23/11 – 27/11	6 d 12 h 45’
	Lagos	30/11, 19:15	07/12, 19:21	30/11 – 04/12	7 d 0 h 06’
Put. 082009	Nouadhibou	16/12, 17:55	18/12, 12:30	-	1 d 18 h 35’
Put. 092009	Rijeka	26/12, 08:30	-	-	

Table 1. *List of voyages done 2009 for Vessel 1 (Referring to Company’s office records)*

Voyage Nr.	Port	ESP	SSP	Pool estim.	Duration
Voy 012009	Nouadhibou	24/12/08 11:30	01/01/09 16:24	24/12 – 03/01	8 d 4 h 54’
	Abidjan	09/01, 16:30	20/01, 19:12	09/01 – 18/01	11 d 2 h 42’
	Tema	21/01, 22:18	25/01, 21:12	20/01 – 24/01	3 d 22 h 54’
	Douala	27/01, 13:18	10/02, 13:30	27/01 -31/01	14 d 0 h 12’
	Cape Town	17/02, 10:24	20/02, 22:45	16/02 – 19/02	3 d 12 h 21’
Voy 022009	Las Palmas	08/03, 22:10	13/03, 08:00	08/03 – 09/03	4 d 9 h 50’
	Flushing	18/03, 06:45	19/03, 21:45	18/03 – 19/03	1 d 15 h
Voy 032009	Runevig	21/03, 23:00	30/03, 02:00	21/03 – 27/03	8d 3 h
	Velsen	01/04, 05:00	04/04, 01:15	28/03 – 01/04	2 d 20 h 15’
	Abidjan	16/04, 15:50	21/04, 16:30	-	5 d 0 h 40’
	Lagos	23/04, 05:15	04/05, 18:00	19/04 – 23/04	11 d 12 h 45’
Voy 042009	Nouakchott	11/05, 05:30	23/05, 10:45	11/05 – 16/05	12 d 5 h 15’
	Abidjan	28/05, 03:00	13/06, 00:30	28/05 – 01/06	15d 21 h 30’
	Tema	14/06, 06:30	20/06, 18:00	13/06 – 19/06	6 d 11 h 30’
	Cotonou	21/06, 05:30	30/06, 19:10	20/06 – 26/06	9 d 13 h 40’
Voy 052009	Las Palmas	13/07, 13:15	20/07, 23:15	09/07 – 13/07	7 d 10 h
	Ijmuiden	26/07, 10:45	31/07, 20:00	26/07 – 02/08	5 d 9 h 15’
Voy 062009	Las Palmas	06/08, 04:00	11/08, 23:00	06/08 – 08/08	5 d 19 h
	Point Noire	21/08, 08:00	24/08, 16:45	21/08 – 26/08	3 d 8 h 45’
	Port Harcourt	26/08, 17:30	24/09, 17:00	26/08 – 03/09	28 d 23 h 30’
Voy 072009	Dakar	02/10, 08:30	08/10, 19:40	-	6 d 11 h 10’
	Nouadhibou	10/10, 01:35	13/10, -	-	-
	Flushing	19/10, 18:00	20/10, 08:10	19/10 – 22/10	0 d 14h 10’
	Karmoy	21/10, 15:00	23/10, 03:20	21/10 – 24/10	1 d 12 h 20’
	Tromso	25/10, 06:30	29/10, 21:00	25/10 – 27/10	4 d 14 h 30’
	Lodingen	30/10, 04:20	31/10, 21:00	31/10 – 04/11	1 d 16 h 40’
	Las Palmas	11/11, 23:00	12/11, 21:22	11/11 – 11/11	0 d 22 h 22’
	Port Harcourt	23/11, 03:15	29/11, 16:00	23/11 – 27/11	6 d 12 h 45’
	Lagos	30/11, 19:15	07/12, 19:21	30/11 – 04/12	7 d 0 h 06’
Voy 082009	Nouadhibou	16/12, 17:55	18/12, 12:30	-	1 d 18 h 35’
Voy 092009	Rijeka	26/12, 08:30	-	-	

Tablica 2. Popis putovanja izvršenih u 2009. g. za Brod 2 (prema podacima ureda Društva)

Putovanje Br.	Luka	ESP	SSP	Proc. Pool-a	Trajanje
Put. 012009	Esbjerg	24/01/09 20:30	30/01/09 23:05	24/01 – 29/01	6 d 2 h 35
	Mostaganem	05/02/09 00:30	18/02/09 13:30	05/01 – 08/02	13 d 13 h 0’
Put. 022009	Las Palmas	21/02, 13:10	23/02, 21:45	21/03 – 23/03	1 d 22 h 35’
	Guayaquil	18/03, 18:00	26/03, 21:35	10/03 – 17/03	8 d 3h 35’
	Curacao	22/04	26/04	-	-
	Gibraltar	05/05	05/05	-	-
	Tartus	15/05, 08:00	21/05, 23:20	15/03 -18/03	6 d 15 h 20’
Put. 032009	Rijeka (dd)	26/05, 12:00	07/07, -	26/05 – 23/06	-
	Gibraltar	13/07, 13:42	14/07, 14:00	13/07 – 14/07	1 d 18 h 0’
	Puerto Moin	26/07, 07:32	01/08, 12:06	26/07 – 01/08	6 d 4 h 34’
	Cristobal	02/08, 00:36	02/08, 23:30	-	0 d 22 h 54’
	Callao	06/08, 11:40	20/08, -	06/08 -11/08	13 d 12 h 40’
	Chimbote	21/08, 16:00	24/08, -	22/08 – 26/08	2 d 8 h 0’
	Balboa	28/08, 04:24	29/08, 10:42	27/08 – 29/08	1 d 6 h 18’
	Havana	01/09, 05:30	03/09, 23:48	01/09 – 04/09	1 d 18 h 18’
	Santiago de C.	05/09, 19:52	-	05/09 – 07/09	-
Put. 042009	Santiago de C.	-	14/09, 07:00	07/09 – 14/09	8 d 11 h 08’
	Havana	16/09, 00:42	17/09, 16:48	16/09 – 19/09	1 d 16 h 06’
Put. 052009	Matanzas	17/09, 20:00	22/09, 12:42	-	4 d 16 h 42’
	Rotterdam	05/10, 08:30	08/10, 16:45	05/10 – 07/10	3 d 8 h 24’
Put. 062009	Ijmuiden	08/10, 18:36	09/10, 18:36	-	1 d 0 h 0’
	Las Palmas	14/10, 08:30	20/10, 00:18	14/10 – 21/10	5 d 15 h 48’
	Point Noire	28/10,11:30	04/11, 19:18	26/10 – 31/10	6 d 7 h 48’
	Port Harcourt	06/11, 15:00	12/11, -	-	5 d 8 h 0’
	Tema	14/11, 05:24	02/12, 23:18	14/11 – 28/11	18 d 17 h 54’
	Lagos	03/12, 13:00	16/12, 01:30	05/12 – 10/12	15 d 12 h 30’
Put. 072009	Nouadhibou	22/12/09 08:00	09/01/10 18:00	22/12 – 24/12	18 d 10 h 0’
	Las Palmas	12/01/10 13:00	-	12/01 – 15/01	drifting

Table 2. *List of voyages done 2009 for Vessel 2 (Referring to Company’s office records)*

Voyage Nr.	Port	ESP	SSP	Pool estim.	Duration
Voy 012009	Esbjerg	24/01/09 20:30	30/01/09 23:05	24/01 – 29/01	6 d 2 h 35
	Mostaganem	05/02/09 00:30	18/02/09 13:30	05/01 – 08/02	13 d 13 h 0’
Voy 022009	Las Palmas	21/02, 13:10	23/02, 21:45	21/03 – 23/03	1 d 22 h 35’
	Guayaquil	18/03, 18:00	26/03, 21:35	10/03 – 17/03	8 d 3h 35’
	Curacao	22/04	26/04	-	-
	Gibraltar	05/05	05/05	-	-
	Tartus	15/05, 08:00	21/05, 23:20	15/03 -18/03	6 d 15 h 20’
Voy 032009	Rijeka (dd)	26/05, 12:00	07/07, -	26/05 – 23/06	-
	Gibraltar	13/07, 13:42	14/07, 14:00	13/07 – 14/07	1 d 18 h 0’
	Puerto Moin	26/07, 07:32	01/08, 12:06	26/07 – 01/08	6 d 4 h 34’
	Cristobal	02/08, 00:36	02/08, 23:30	-	0 d 22 h 54’
	Callao	06/08, 11:40	20/08, -	06/08 -11/08	13 d 12 h 40’
	Chimbote	21/08, 16:00	24/08, -	22/08 – 26/08	2 d 8 h 0’
	Balboa	28/08, 04:24	29/08, 10:42	27/08 – 29/08	1 d 6 h 18’
	Havana	01/09, 05:30	03/09, 23:48	01/09 – 04/09	1 d 18 h 18’
	Santiago de C.	05/09, 19:52	-	05/09 – 07/09	-
Voy 042009	Santiago de C.	-	14/09, 07:00	07/09 – 14/09	8 d 11 h 08’
	Havana	16/09, 00:42	17/09, 16:48	16/09 – 19/09	1 d 16 h 06’
Voy 052009	Matanzas	17/09, 20:00	22/09, 12:42	-	4 d 16 h 42’
	Rotterdam	05/10, 08:30	08/10, 16:45	05/10 – 07/10	3 d 8 h 24’
Voy 062009	Ijmuiden	08/10, 18:36	09/10, 18:36	-	1 d 0 h 0’
	Las Palmas	14/10, 08:30	20/10, 00:18	14/10 – 21/10	5 d 15 h 48’
	Point Noire	28/10,11:30	04/11, 19:18	26/10 – 31/10	6 d 7 h 48’
	Port Harcourt	06/11, 15:00	12/11, -	-	5 d 8 h 0’
	Tema	14/11, 05:24	02/12, 23:18	14/11 – 28/11	18 d 17 h 54’
	Lagos	03/12, 13:00	16/12, 01:30	05/12 – 10/12	15 d 12 h 30’
Voy 072009	Nouadhibou	22/12/09 08:00	09/01/10 18:00	22/12 – 24/12	18 d 10 h 0’
	Las Palmas	12/01/10 13:00	-	12/01 – 15/01	drifting