OIL COMPANIES INTERNATIONAL MARINE FORUM

Hydrostatically Balanced Loading

(December 1998)

The OCIMF mission is to be recognised internationally as the foremost authority on the safe and environmentally responsible operation of oil tankers and terminals.

The Oil Companies International Marine Forum (OCIMF) is a voluntary association of oil companies having an interest in the shipment and terminalling of crude oil and oil products. OCIMF is organised to represent its membership before, and consult with, the International Maritime Organization (IMO) and other government bodies on matters relating to the shipment and terminalling of crude oil and oil products, including marine pollution and safety.

Hydrostatically Balanced Loading (HBL)

Introduction

This information paper has been produced by a small task force representing the membership of OCIMF. In preparing the paper the task force recognised that the oil tanker industry has only limited experience in operating tankers under the HBL regime and consequently this paper represents a technical 'snapshot' based on our current experience. It is OCIMF's intention that the paper will be revised in the light of future operational experience. The paper is a commentary on the technical issues and challenges faced by the oil tanker industry and offers neither approval nor disapproval of operating oil tankers in the HBL mode.

The HBL Concept

Cargo tanks on oil tankers are currently loaded to 98% and in some cases 99% capacity with the oil level well above the level of the sea. If the ship's hull plating is breached then due to the pressure of the oil on the ship's bottom being greater than the pressure of the sea, oil will flow out causing pollution. When a vessel loads a tank under HBL the oil pressure on the ship's bottom is equal to or less than that of the sea on the ship's bottom. In this situation when the hull is breached then the sea will flow in thus preventing pollution.

Background

All newly built tankers must now, under Regulation 13F of MARPOL 73/78, be constructed with either a double hull or an approved alternative arrangement. To date only one other arrangement, the Coulombi Egg, has been approved and no ship has yet been built to this design.

For existing tankers Regulation 13G of MARPOL 73/78 now applies. These existing tankers can be split into two categories, those built before approximately 1980, which are known as Pre-MARPOL tankers and those built between approximately, 1980 and 1993, which are known as Post-MARPOL Tankers. Regulation 13G requires: -

- All tankers to be subjected to an enhanced survey programme.
- Post-MARPOL tankers can trade to 30 years old at which time they must be provided with a double hull or taken out of service.
- Pre-MARPOL tankers to be taken out of service or provided with a double hull or alternative arrangements when they reach 25 years old. Once they reach 30 years old they must be fitted with a double hull or taken out of service.

Pre-MARPOL Tankers

There are four approved alternative arrangements for Pre-MARPOL tankers that comply with the requirements of Regulation 13G: -

- Designating certain cargo tanks as non cargo carrying spaces.
- The provision of Segregated Ballast Tanks (SBT).
- Installation of Bulkheads or Double Bottoms to reduce hypothetical outflow.
- Operation of Hydrostatically Balanced Loading.

Once these tankers reach 30 years old they must either be fitted with a double hull or taken out of service. The option of fitting double hulls to either Pre-MARPOL or Post-MARPOL would be very expensive and in reality is not considered to be a viable option.

For many 25 year old+ Pre-MARPOL tanker the most attractive option for meeting the requirements of Regulation 13G, is to utilise Hyrostatically Balanced Loading. There are a total of 628 Pre-MARPOL tankers of over 50,000 tonnes deadweight. The peak years for the potential phasing in of these tankers to HBL is 2000 and 2001 with 142 and 134 ships per year respectively.

It is considered there is no Safety, Technical or Environmental reason why ships should not continue to trade utilising HBL until the ships reach their 30th Anniversary provided that they comply with class requirements, that all their statutory certificates remain valid and that the operational concerns discussed below are satisfied. OCIMF is of the opinion that there are several operational aspects of HBL that need to be brought to the attention of the shipping industry as a whole. These are as follows: -

- **Ballast Water Management** - Under the HBL Regulations it is a requirement that when performing multi port operations tanks covering at least 30% of the side of the length of the cargo section should be kept empty until the last loading location or they should be unloaded at the first discharge port. This means that when a vessel arrives at the load port its ballast must be so distributed to enable the centre tanks and some of the wing tanks to be loaded first. The ballast management procedures may have to be modified to allow for this change. This will be especially difficult on free flow ships, which traditionally arrive at the load port with clean ballast in the centre tanks. They will, under HBL, have to arrive with their clean ballast in the wing tanks if the centre tanks are to be loaded first. This is also true of non free flow ships but they will have greater flexibility than free flow ships. The wing tanks will have a higher percentage of shadow sectors, which will make them more difficult to clean to enable clean ballast to be put into them.

  A potential draw back of this change in ballast procedure is that different tanks may now be used for ballast operations which may have a greater structure-surface-area to tank-volume ratio which would make tank

cleaning more difficult and generate more oil slops at the end of the tank washing procedure. The potential for pollution when discharging 'clean' ballast is thus increased. As a result there is the possibility that more ballast slops may have to be retained on board, possibly reducing cargo-lifting capability.

At some terminals there is a requirement to maintain a certain percentage of the ship's deadweight on board at all times. At terminals where this is not required it may under certain circumstances be possible to deballast the whole ship prior to loading and this would eliminate the requirement to change the ballast configuration.

- **Bunker Management** - When a vessel is loaded in the HBL mode it must remain HBL compliant throughout the voyage. On a mid 1970's built turbine vessel the daily bunker consumption is in the region of 150 tonnes per day. As the bunkers are consumed the vessel's displacement will decrease and there is the possibility that on long voyages the vessel may become HBL non-compliant. There are two possible solutions to solve this potential problem, firstly daily ballasting to compensate for the bunkers consumed, or secondly the HBL tanks are loaded in such a manner that the vessel will be HBL compliant throughout the voyage taking into account the bunkers and other consumables that will have been used on passage.

  On occasions large quantities of bunkers may be shipped after the cargo has been loaded. During the cargo loading operation the level of cargo in the HBL tanks should be such that the tanks will remain HBL compliant after the bunkering operation has been carried out.

- **Density of Cargo** - The ullage to which a tank can be loaded for HBL is dependent on the density of the cargo. At many load ports the density of the cargo is not accurately known until after loading has been completed, although a rough approximation is given on arrival. If an accurate cargo density is not available from the terminal prior to or during the loading operation then it is recommended that the vessel obtain on-board measured densities at various times throughout the loading. Failure to do this could result in the vessel being non-HBL compliant and hence in contravention of MARPOL 73/78.

- **Operational Complexity** - When a vessel is operated in the HBL mode, the whole operation becomes more complex and there is a need to train the vessel's staff in the management of HBL operations. Revised operations manuals will need to be produced and it is important for the ship operator to ensure that all his staff involved with HBL operations are fully conversant with the requirements of HBL. This will be particularly so when multi-port and lightering operations are carried out as the vessel must remain HBL compliant throughout the whole operation.

- **Cargo Calculations** - The calculation determining the amount of cargo that a vessel can lift in the HBL mode is far more complex than before HBL was used. When a vessel loads either a light or medium density cargo it

will not achieve its maximum assigned loadline. The vessel can, however, still load down to its assigned loadline by ballasting tanks to increase the draught hence allowing more cargo to be loaded into the assigned HBL tanks. An iterative calculation must be done to minimise the ballast required and to maximise loaded. A computer software programme would best achieve this calculation.

- **Damaged Condition** - one of the advantages of operating ships in the HBL mode is that, under most conditions, there are slack tanks and in the event of a breach of a cargo tank there is greater availability to transfer cargo into these slack HBL tanks. Obviously this would make the tanks non compliant but this would be acceptable on the basis of ship safety and to reduce pollution.

- **Structure, Stress, and Stability** - When a vessel is 'converted' to operate in the HBL mode no modification to the vessel's structure are required. Generally there are no additional stability or stress problems and, to some extent, the bending moments in the loaded condition may be less. In this aspect HBL may be a better option than designating cargo tanks as ballast tanks as this will necessitate pipeline modifications and increase the shear forces in the vessel.

- **Corrosion** - When vessels are operating in the HBL mode cargo oil tanks remain as oil tanks whereas, if the SBT option is chosen, cargo oil tanks are converted to ballast tanks. It is very likely that these tanks will be non-coated and will be subject to increased corrosion during both the loaded and ballasted phase of the voyage.

- **Documentary Evidence of Compliance** - Under Regulation 13G of MARPOL 73/78 certified ullage measurement reports must be retained on board for a period of 3 years to demonstrate compliance with HBL. It is recommended that full cargo documentation for all stages of both loading and discharging operations are retained for this 3-year period. The ship must remain HBL compliant throughout the voyage and any ballasting or other operations carried out on passage to maintain HBL compliance must also be carefully recorded. It is possible that a Flag State or Port State inspector may inspect the vessel to ensure that HBL has been fully complied with throughout the entire voyage.

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