

Conversion of a bulk carrier into a selfunloading cement ship

Ad Ligthart, Fuller Kovako, describes in detail the work on *m.v. Thai Ho* highlighting the requirements and scope of work behind these ship conversions.

Introduction

The majority of the selfunloading ships utilized for international cement trade are converted bulkcarriers rather than newly built ships. The main reason for this is the fact that international cement trade is a volatile market, unlike the domestic distribution markets which are quite stable. Therefore, ships on the international market require a much

shorter payback period. This can be achieved by conversion of an 8 - 12 year old bulkcarrier into a selfunloading ship. The total costs after conversion are usually half the cost of a newly built selfunloader.

A further difference between selfunloading ships used for international trade and ships used for domestic distribution is their versatility.

Ships used for domestic distribution are usually dedicated for one or a few fixed routes only. Their equipment is therefore purpose designed. Selfunloading ships for the international cement trade have to be suitable to meet changing routes, loading facilities and unloading terminals. Their equipment has to be able to meet these changing circumstances.

Conversions of bulkcarriers into selfunloading cement ships is therefore speciality work. Two experienced companies in this field are H.W. Carlsen from Sweden and its sister company Fuller-Kovako Asia in Hong Kong. Both companies co-operate closely and recently were involved in 4 conversion projects on the Asian market resulting in the most powerful selfunloading ships in this region.

One of these ships is the *m.v. Thai Ho*. This article describes, the conversion of this ship in detail to show the requirements and scope of work behind these ship conversions.

Requirements

There were 3 main requirements for the conversion of the *m.v. Thai Ho*:

- The ship structure should be kept intact as much as possible to save conversion costs and time.
- The cargo capacity, taking into account weight and volume, should be affected as little as possible.
- The equipment should be able to load and unload the ship at a high capacity for a wide range of loading and unloading terminals.

As a basis to comply with the above requirements the Carlsen unloading system was selected, which combines a fluidised hold bottom with vacuum extraction to unload the cement from



The *m.v. Thai Ho* under conversion at Hyundai Mipo dockyard, Korea.



M.v. Shine Ho, m.v. Thai Ho's sister ship, unloading cement in Victoria Harbour, Hong Kong.

the holds. This system can be easily combined with a range of loading and unloading systems.

The system is extremely suitable for ship conversions.

- The inclined fluidised hold bottom can be prefabricated, including all piping, and put on top of the existing double bottom of the ship. All remaining equipment can be put on deck. The structure of the ship is hardly affected and because of the high amount of prefabrication work the actual conversion time that the ship has to spend at the shipyard is very short.
- Ships are flexible. In high seas the structure of the ship flexes considerably. The pneumatic system is insensitive to these ship movements. It does not require special alignments, heavy support structures or other special features. Installation is very simple.

The Carlsen vacuum system has additional advantages:

- Extremely high reliability (no moving parts in the cement flow other than a butterfly valve).
- Low energy costs, as the fluidised bottom strongly reduces the required energy for the pneumatic conveying.
- Low maintenance costs.
- Compliance with all shipping regulations including the new SOLAS requirements.

The hold volume and weight of the conversion were carefully considered. The extra weight of the conversion consisted of the new inclined fluidised hold bottoms, the machinery for the loading and unloading system and a deckhouse for this as well as some new deck sections. The reduced weight of the conversion consisted of removing hatchcovers, hatchcoamings and 2 of the 3 deck cranes (one was retained as a hose handling crane).

The final result was a ship weight almost equal to that before the conversion.

The hold volume of a ship is reduced by a conversion, as a result of the inclined fluidising bottom and the removed space between the hatchcoamings.

Bulk carriers however are usually designed with a hold volume for light cargos such as grain ($SG=0.8$). Cement is a heavy cargo ($SG=1.1$) requiring much less space.

By using a diamond shaped fluidised bottom developed by Fuller-Kovako Asia, a minimum of hold volume is lost whilst a high inclination angle of the bottom is achieved. The result is an excellent cement flow to the suction pipe, giving a high overall unloading capacity, and excellent cleaning capabilities.

By designing the loading system in such a way that the holds can be filled almost level to the top, an effective hold volume of ample size for the cement cargo was achieved.

Loading and unloading system

The *Thai Ho* is equipped with high capacity loading and unloading equipment.

The loading system is suitable for gravity loading by a mechanical shiploader as well as pneumatic loading with the cement being blown to the ship through a pipeline. The loading capacity is 1200 tph maximum.

The loading system consists of a cement receiver/cyclone and an airslide distribution system. The cement receiver/cyclone is situated midships on top of the cement handling machinery room. With pneumatic loading the cement is blown directly into the receiver/cyclone. The conveying air is vented into the holds and from there to the large dust collecting system in the cement handling machine room.

From the receiver/cyclone the cement then flows into the aft or forward distribution airslides. These airslides guide the cement to the port and starboard loading inlets of the 4 holds. Flow control and direction valves take care of a controlled and automatic distribution. Level detectors in the hold prevent overloading.

For mechanical loading the ship is equipped with loading airslides on the port and starboard side. These airslides are located low and have their loading points close to the shipsides. This makes it possible to load this



Installation of fluidised, diamond shaped bottom in m.v. Thai Ho.

large vessel with relatively small mechanical loading systems. The loading airslides convey the cement to the centre line of the ship. Here the cement flows into a high capacity vertical screw that conveys the cement into the receiver/cyclone. From there the cement is distributed similarly to the pneumatic loading.

The *Thai Ho* has a fully pneumatic unloading system. Two pressure tanks are alternately filled with cement by vacuum and then blown empty to the shore silos by means of pressured air. The fluidisation system in the holds ensures an even and controlled flow of cement to the centre of the hold. Here the fixed suction pipe is located which leads to one of the pressure tanks. At the suction inlet the fluidized cement is mixed with additional air and vacuumed to the pressure tank. When pressure tank 1 is full, the system switches over and starts to fill pressure tank 2 by vacuum. Meanwhile, the cement in pressure tank 1 is mixed again with pressured air and the mixture is blown through a pipeline system to the shore based silos. A flexible, heavy duty rubber hose connects the ships piping system to the shore piping system.

The *Thai Ho* is equipped with four compressors providing 7 bar pressure. This makes unloading at 600 tph possible using a single pipeline of only 14 inch. Because of the possibility of using different numbers of compressors and conveying pressures the *Thai Ho* is suitable for unloading a wide range of pipeline lengths and diameters.

The *Thai Ho* is designed for the possibility that a mechanical outloading system will be added in the future. Instead of emptying the pressure tanks by pressured air, the tanks are then emptied by gravity into a screw conveyor system. This screw conveyor system conveys the

cement into a outloading boom equipped with an airslide and outloading bellows. This boom can be swung above a conveying belt and the bellows can be connected to the loading point of this belt. It is also possible to load bultrucks directly. Maximum capacity would be 600 tph.

Continuing orders

The *Thai Ho* is the fourth vessel that has been converted by Fuller Kovako Asia and H.W. Carlsen for Ta-Ho Maritime, the shipowning company for Taiwan Cement. The three other vessels are the *m.v. Jui Ho* (12 000 dwt), *m.v. Yung Ho* (now *Cement Hope*, 8800 dwt) and the *m.v. Shine Ho* (17 000 dwt).

The companies recently received the order for the conversion of a 5th vessel, the *m.v. Sheng Ho* (19 000 dwt) which will be converted in April 1995.

In December the conversion of the *m.v. Lucky Pioneer* was completed. This ship (18 000 dwt) is owned by the shipping company of Lucky Cement in Taiwan. This ship is also equipped with 1200 tph loading systems and 600 tph unloading systems.

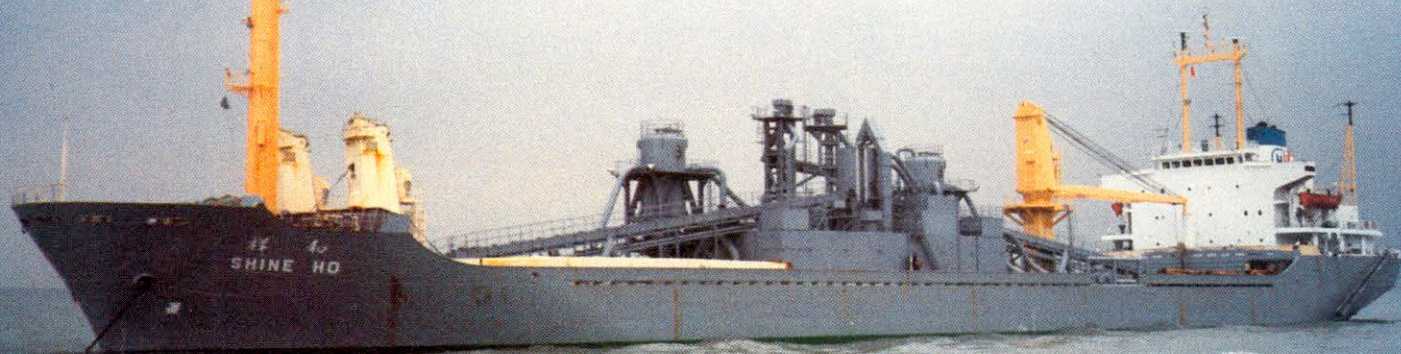
Both Fuller Kovako Asia and Carlsen have also received substantial orders for domestic distribution systems and import terminals including fluidised ships, shore based pneumatic conveying systems, large shipunloaders, silo equipment etc. Major markets are Indonesia, Philippines, Taiwan and China.

Cement transportation by sea is expected to grow considerably in Asia both in international cement trade and for domestic distribution. Fuller Kovako Asia and H.W. Carlsen have a major share in the equipment supply for these projects.

H.W. Carlsen

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Selfloading/unloading Cementcarriers



M/V SHINE HO, 17.000 dwt selfloading/selfunloading cement-carrier converted in Korea in 1992. Loading capacity 1.200 t/h and unloading capacity 600 t/h pneumatically or by gravity.

M/V HALLA NO 5, 9.000 dwt selfloading/selfunloading cementcarrier built in Korea in 1992. Newbuilding. Loading capacity 1.000 t/h and unloading capacity 500 t/h by gravity and pneumatically respectively.



H W Carlsen offers fully pneumatic-, mechanical-, or gravity-systems as well as combined systems of own world-famous design for both loading and unloading

Get in touch with one of the leading experts in the world on pneumatic cement handling with over 30 years experience in selfunloading cementcarriers.



Interior of a cargo-hold. Here an original Carlsen Bulkslide system covering the bottom of a shiphold for fluidizing the cement can be seen as well as the suction pipes in the centreline.

Loading Arrangement. This picture shows the Carlsen designed combined piping system and airslide system on deck of m/v Shine Ho for loading at 1.200 t/h pneumatically or by gravity.



of cementcarriers of all sizes, for newbuildings as well as for conversions and with capacities from 100 t/h to 2.000 t/h depending on the customers' requirements.

H.W.Carlsen 
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