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AUG 31, 1997

HARRIS PYE MARINE LTD.
SURVEY REPORT.

INSPECTION OF SS NORWAY.

Inspection of s.s. "NORWAY" was carried out on 30th and 31st August 1997 at Southampton and le Havre.

The writer was invited by Per Sopp of Norwegian Cruise Lines to attend the ship at this opportunity to investigate the feasibility of retubing all four boilers as an alternative to the installation of new boilers, and whether this work could be carried out at sea and/or during a refit period.

At the time of the inspection several observations were made by the engineering staff on tube failures currently being experienced in various parts of all boilers, but discussions with the Chief Engineer revealed no current conditions of class on any drum nor header. However, previous reports are believed to contain information of repairs carried out to surface cracks on some of these components, but, as these have been addressed to the satisfaction of attending surveyors we believe that these pressure parts are suitable for many more years of use. Assuming this to be the case, we believe that the simple retubing of existing boilers would achieve the same result as the replacement of the existing boilers, and the following text investigates the practicalities of such a solution.

1. DESCRIPTION OF THE LAY OUT.

The four boilers are arranged with two facing aft and two forward and with limited space between the opposing components, especially at economiser level. Two boilers are right handed and two are left, 22 and 23 being of the same hand while 21 and 24 are opposite. The accompanying layout sketch clearly describes the handing!

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2. POSSIBILITIES FOR REPAIR.

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The following discussions about access possibilities look at the routes required during a refit and that required with the vessel at sea.

2.1. RETUBING DURING REFIT.

To do this type of work efficiently it is best to devise a one way route whereby the new material enters the boiler room from one location while all the scrap is taken out on the opposite side.
The B Deck port and starboard side bunker stations at FR 120 have good sized access panels at the ship's side. Immediately below these bunker stations are crew cabins which could be vacated and cleared during the refit and the bunker station deck cut away to give very good access down to the C deck alleyways.
The boiler room doors are only 6 - 7 metres from these cabins with easy handling of tubes between these locations.
The boiler room access is restricted by crew showers / toilets which could be cut out for the refit period giving good access into the boiler room immediately above the firing platform level - where most of the tubes will need to be delivered!
Inside the boiler room it will be necessary to remove various platforms, handrails and vent ducting to be able to manoeuvre the tubes, but this is not a large amount of work.
If all new materials are stowed on one side and the scrap bins on the other side of the ship then the optimum one way system can be utilised which will allow the work area to be kept clear and safe.

The retubing of the economisers can also utilise this route, but if it is considered to increase the congestion too much then the route down through the funnel deck hatch can be used with some removals of handrails, platforms and ladders only at the fan room deck level and the one immediately beneath.
The cast iron gilled economisers could be retubed by replacing the gilled elements in "hairpin" format by removing sections of the economiser casings for access and rebuilding around the new tubes once they are in place.
The bare tube economiser elements have sufficient withdrawal space between opposing boilers IF THE OPPOSING BOILER SOOTBLOWER PIPING IS REMOVED. Thus, it would be better if both starboard boilers were shut down when either starboard economiser is being retubed and similarly with the port side.

2.2. RETUBING AT SEA

The critical point about whether it is possible to carry out extensive retubing at sea on this ship is finding a sensible location for storing the tubes at one end of a good access path, and the following possibilities were investigated:-

2.2.1. FORWARD STORAGE HATCH FRS 260/280

There is a forward storage hatch with its main structure extending down to C Deck, although the lower two levels are used as a carpenter's shop and the crew's shop. Some preparatory work could install a vertical access duct, maybe 2 metres square, through these two lower decks to give access to the longitudinal alleyways.
To allow clear access for the long tubes it will be necessary to take out two crew cabins in one side alleyway to give straighter access through fire doors, and, on the same side, to remove the toilet facility adjacent to the boiler room door.
Of course, the tubes could be manhandled over the decks from the forward hatch to the engine room hatch aft of the after funnel, the disadvantage of which is the disruption to passengers and the high labour intensity required. This could be done by crane in port, to just deliver the tubes needed over the next few days to the funnel deck for handling into the boiler room, and this becomes a feasible possibility if the trading pattern puts the ship alongside a quay with suitable craneage at lease two or three times each week.

2.2.2. STORAGE ON THE FUNNEL DECK FRS 80/140

approval A further possibility investigated is to store the tubes on the funnel deck immediately aft of the after funnel, although this possibility has two problems:

i. How much weight will the aluminium funnel deck withstand?
ii. How will the stability of the ship be affected by the weight at that height?

There are several options for storing the tubes around this area. The tidiest is to have them delivered in a container which can sit on the funnel deck, out of the way of the passengers. The container would probably have to be sited on spreader bars to distribute the load over the funnel deck area and advice on this would be required from the NCL Naval Architect. Alternatively, Harris Pye Marine could engage a Naval Architect to do a design study of the area and produce drawings of such a load spreading arrangement for approval.

Another option is to have the tubes delivered in bundles to be located spaced out over the funnel deck and it's surrounding well and in the ventilation room beneath which would be boarded over with wood to distribute the loading.

A , possibly, more practical option is to only deliver the tubes that will be required for that section of the voyage, and to deliver the remainder in stages. This would require careful co ordination to ensure that the work was not delayed while waiting for tubes and would be best suited to a trading pattern where the ship is in a certain port each week, and that port would be the storage point for all materials. The tubes so delivered would be colour coded and very clearly check marked on coloured drawings to ensure that only the correct tubes were delivered at the planned time.

Should the stability factor be critical, it is possible to build scaffolding platforms at various levels in the vertical space between the boiler uptakes. The optimum level could be selected by the NCL Naval Architect or the Chief Officer using the ship stability tables.

It is certain that, from the foregoing possibilities, a mixture of methods can be accepted which will allow the safe storage and reasonable handling of the boiler tubes before and during the retubing operation at sea.

2.3. ACCESS IN THE BOILER ROOM.

Considering the possibility of bringing the tubes into the boiler room from the funnel deck, tubes may be taken into the boiler room either via the engine room bolted hatch and the boiler room door, or through a new access hole to be cut in the after end of the funnel casing.

Once inside the boiler room there will need to be some removals of ladders and platforms at the top end only, and then there is a clear drop almost to the firing platform to allow the repairers bring the new tubes to the work site.

Above the steam drum level there is some redundant equipment, comprising some air receivers and associated piping as well as a hopper and piping which should be scrapped out to improve the lower end space. This could be done by ship's staff or as part of the retubing contractor's preparatory work.

At the firing level the area has access for retubing, but the operation will have to be strictly controlled to maintain a safe working environment and not to interfere with the operation of the working boilers.

Considering carrying out the retubing operation at sea, there is no clear way to remove large components of scrap tube to maintain the one way system, so all scrap will have to be cut into handleable pieces for removal from the boiler room.

The location of a main steam line adjacent to the furnace side walls of boilers 22 and 24 on the port side of the boiler room would make access difficult to retube the side wall tubes of these boilers, whereas the outboard side of boilers 22 and 24 has almost 3 metres clear. This means that the side wall tubes on the port (22/24) boilers would be more difficult to renew at sea. The reason for this comment is that, although full retubes on all boilers is possible, should Owners decide to retube two boilers only at sea then the (21/23) would be easiest.

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3. CONCLUSIONS.

Athough these boilers are around 40 years old and are currently suffering from on going tube failures there is no report of the main components - i.e. headers or drums - having any Conditions of Class put on them. It is known that various defects have been noted and attended to in the past, but we would not suggest that this precludes these components from many more useful years work, once the deteriorating tubes have been addressed.
To replace the boilers with new plant in its entirety will obviously solve the current leaking tube problems, but is the associated vast expense necessary, and can it be paid back during the expected life of the ship?

Retubing the boilers by a professional specialist with ISO 9002 accreditation will return the plant to a good status of reliability, and any unknown defects discovered during the retubing operation can be dealt with at the time by experienced boiler repair engineers using the appropriately skilled and qualified tradesmen - at a small fraction of the cost of replacement!

It is therefore our considered opinion that the retubing of these boilers at sea, or at sea and during refit is a sensible and economical option and our quotation and provisional programme proposals will be prepared and dispatched as soon as completed.

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Technical Director of Harris Pye Marine Ltd.
31st August 1997
le Havre, France.