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Increasing Service Life of Vessel

[An intention to increase service life of ships]

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Abstract
To prolong the life of ships and its machinery/equipment. [Normal life time of a vessel is 25 years].

Keywords
Bilges, Classification Societies, Deck, Fatigue, Hull, International Maritime Organization, Navigation and Radio equipment, Shell Expansion, Stability, Watertight Integrity, Windlass, GPS (Global Positioning System), VHF (Very High Frequency), UHF (Ultra High Frequency), INM C (Inmarsat C), P/A (Public Address), Stbd. (Starboard).

I. Introduction

Majority of trade is carried out by the shipping industry. Crude oil, other fine petroleum products, Bulk Chemicals, Iron ore, Coal, Grain, and Containers.

Due to various reasons of the owners like new building constraints, delay of deliveries, and economical reasons, the vessel service life requires to be increased provided it meets all the regulations after condition monitoring and necessary repairs.

Computerized maintenance management systems are used for planning and carrying out the maintenance and repairs including surveys. But still a very thorough judgement should be made by using latest technological and computer software programs to assess and increase service life of vessels such as fatigue analysis of ship structures and machinery components through ANSYS/MATLAB.

II. Methodology

Condition Monitoring Priority

Priority wise the *hull and tanks* condition should be good, as it involves water tight integrity and stability of the vessel.

Repairs/maintenance and renewal of machinery/equipment should be done as required to prolong the life.

Classification Societies

Classification Societies play a very important role in surveying the vessels and giving recommendations for the increase of service life of the vessels.

III. Method of Investigation

Following hull, machinery and equipment should be investigated into.

(i) Water Tight Integrity and Strength of Hull and its member structures

This is possible for evaluation by:

a) Thickness measurements
b) Corrosion condition
c) Pitting condition
d) Welds seam condition
e) Mechanical damage
f) Cracks/holes
g) Tanks condition
h) Fatigue Strength

(ii) The condition of Steering and Propulsion Systemsshould be ascertained

a) Steering gear
b) Main Engines
c) Propeller Driving Gear

(iii) The condition of the Power Plants

a) Generator Engines/Alternators
b) Auxiliary Boilers/Turbo Alternators

(iv) The condition of Navigation and Radio Equipment on Bridge

a) Radar
b) Magnetic Compass
c) Speed Log
d) GPS
e) Barometer
f) Aldis Lamp
g) VHF/UHF Communication Systems
h) Receiver
i) INM C
j) P/A System
k) Internal Communication System
l) EPIRB and SART

(v) The condition of other Auxiliary Machinery

a) Oily Water Separators
b) Air Compressors and its systems
c) Pumps, Coolers, Filters, and Piping systems (especially seawater piping systems)
d) Refrigeration and Air Conditioning Systems
e) Harbor Generator Engine/alternator

(vi) Condition of Deck Machinery

a) Windlass and its associated hydraulic systems
b) Tanks vent heads
c) Deck Piping

vii) The condition of Accommodation

a) Living Quarters
b) Galley
c) Mess Room
d) Wash Rooms

(viii)The Condition of Electrical Systems

a) Main Switchboard
b) Transformers

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c) Other Feeder Panels
d) Lighting Systems
e) Emergency Batteries

(ix) Life Saving and Fire Fighting Appliances
a) Life Boats
b) Life Rafts
c) Life Jackets
d) Emergency Fire Pump
e) Fire Extinguishers
f) External Fire Fighting Systems

IV. Thickness Measurements

The "Diminution Summary" indicates the plates and structural members to renew in the 'Thickness Measurements" report.
On 'Shell Expansion Plans' the strakes are identified with alphabets as follows:

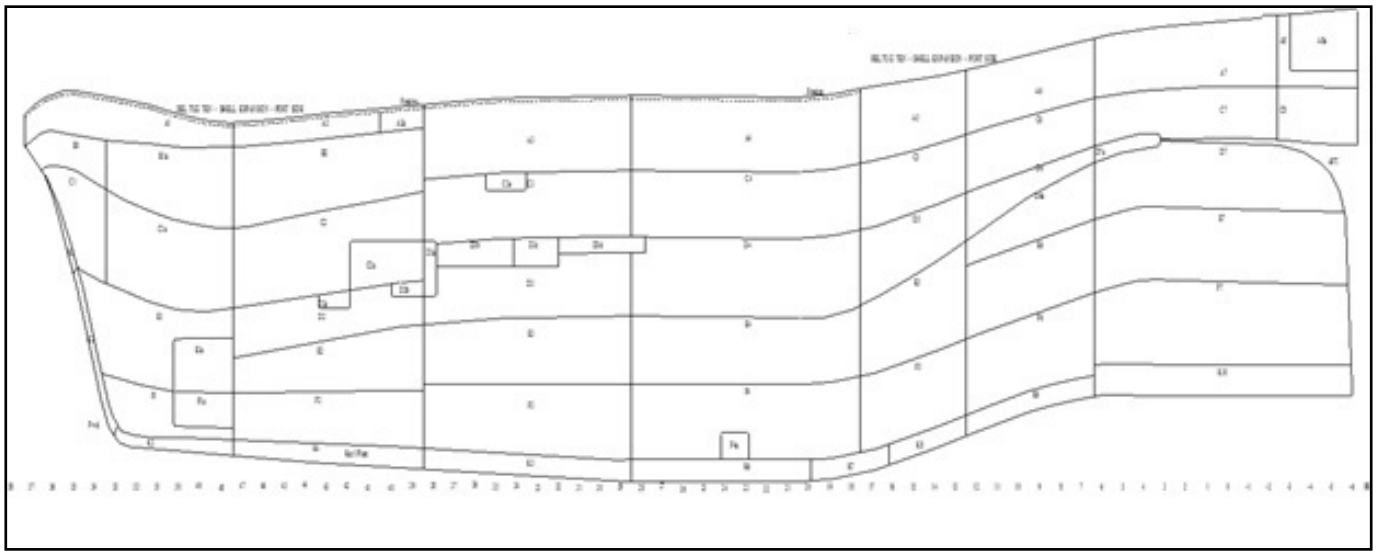

Fig.1: Shell Expansion Port Side - Names and Letters designating the shell strakes

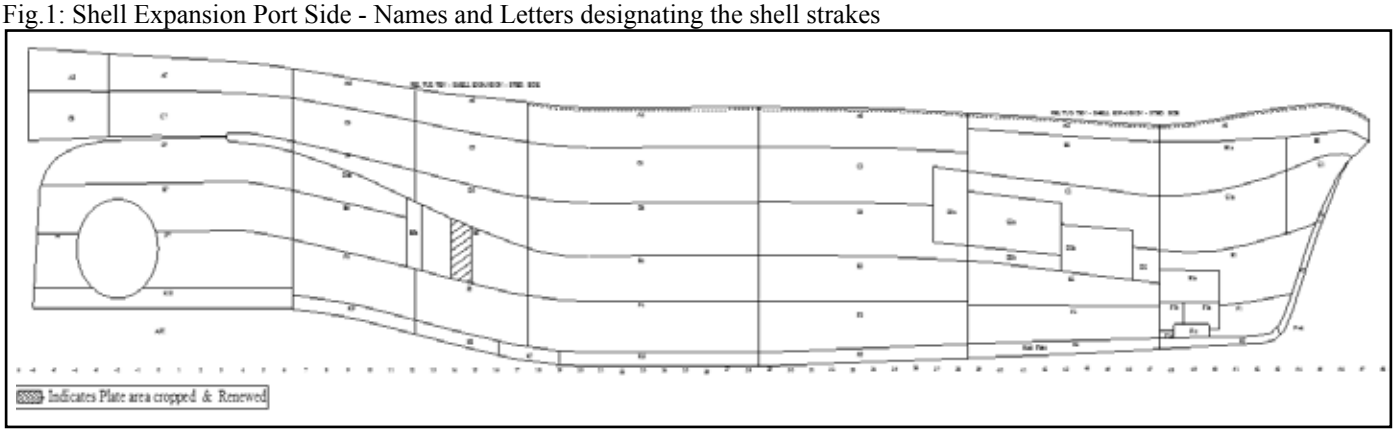

Fig 2: Shell Expansion Stbd. Side - Names and Letters designating the shell strakes

Ex: Strake position of a plate E5, original thickness is 12 mm. Strake/plate position (ex. 10), and number of letter (E5) to be noted.

Table 1: After thickness gauging

Forward Reading					
Gauged		Diminution Port		Diminution Stbd.	
P	S	mm	%	mm	%
11.7	11.2	0.3	2.5	0.8	6.7
Aft Reading					
Gauged		Diminution Port		Diminution Stbd.	
P	S	mm	%	mm	%
10.9	9.8	1.1	3.2	2.2	18.3

Maximum allowable diminution: 2.4 mm (20%)

V. Recomendations

Fatigue Analysis of Hull Structure

It would be necessary to do the fatigue analysis of the hull structure by using Finite Element Method (FEM) and simulation by softwares like ANSYS/SOLIDWORKS.
From the fatigue analysis, the service life prolonging should be considered.
International Association of Classification Societies (IACS) guidelines to follow in doing fatigue analysis and finding the life of the vessel.

Fatigue Analysis of Engine Parts

As per routine/breakdown maintenances, many parts of engines (main/auxiliary) are renewed from time to time.

But some major parts like bed plate, crankshaft, cylinder column, tie rods, camshaft, gear trains, foundation bolts etc. are aged.
Their fatigue strengths have to be ascertained for increasing service life of vessels.

Seawater Piping Renewal and Protection
In tugs, especially, seawater piping protection systems are generally not considered in older construction of vessels.
Schedule 80, MS Pipes, ungalvanized are chosen instead.
But still, the pipes are being corroded, and with time the pipes condition is in a very deteriorated state.
Also, considerable marine growth takes place in these seawater pipes leads to clogging of pipes, thus suction/discharge pressure problems.
Corrective action in terms of renewal of pipes of better materials (Schedule 80 galvanized pipes), cleaning the pipes and seawater pipes protection systems to consider.

Cleaning and Painting of Engine Room Bilges
Seawater leaks from glands, pipes lead to deterioration of bottom plating in Engine Rooms.
Holes are formed through and through of bottom plating of hull at Engine Room side, where a pump gland leaks and falls on the bottom plate.
Thorough cleaning and painting of bilges is recommended for further increase of ship's life.

Hydraulic piping Condition Monitoring and Renewal
Especially the hydraulic piping on deck deteriorates with time.
Piping, flanges, and bolts/nuts get wasted.
Valve blocks seals leak.
Same to be examined and renewed.

Electronic Equipment and its Software
Electronic equipment and replacement units become obsolete.
Even the loaded old software will be difficult to obtain for the respective equipment.

Light fittings
It will be very difficult to get the same light fittings.
To meet the fitness of the vessel, these fittings should be replaced with present standard available fittings.

Original Equipment Manufacturer (OEM)
OEM spares are not available for many machinery/equipment.
The manufacturers stopped manufacturing sometime years back.
Owners must be in touch with them for alternatives for prolonging the life of a vessel.

Hygienic Conditions
Galley, mess rooms, accommodation, and bath/toilets conditions to be maintained as these deteriorate with time.

Cosmetic Condition
Extra efforts are needed to maintain the cosmetic appearance of decks, accommodation, and engine room.

Rules and Regulations
International Maritime Organization (IMO), Flag State and local regulations (ex: safety, pollution) to comply.

VI. Conclusion

The service life of the vessel can be extended till the next dry dock for another 2.5 years provided the vessel's hull and tanks condition, machinery and equipment condition is satisfactory after investigation and respective repairs.

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[2] Reliance Ports and Terminals Limited, Sikka, Jamnagar, Gujarat for access to Tugs
[3] Ocean Sparkle Limited, Sikka, Jamnagar, Gujarat for guidance

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Author Profile

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