

Estimation of plate thickness deduction of oil tanker for domestic area - Indonesia waterways

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Abstract

The requirement of plate thickness of classification society is taking into account the net thickness, corrosion allowance and additional extra margin as owner request. Corrosion allowance is an additional constant value that is related to the environmental condition which shall be added in the formulae to calculate the requirement plate thickness and profile of the ship construction in accordance with the classification society rules. It is known that major Classification Societies rules are based on the North Atlantic Ocean environmental condition. However, if the ships are operated in local domestic area, i.e. Indonesia waterways, the rules requirements become very conservative. These condition make the ship design be coming over design. This study aims to develop time-dependent corrosion allowance formulation. The statistical analysis of thickness diminution carried out using measurement records that are documented from 23 Oil Tankers during her voyages in Indonesian waterways. The age of target ships was ranging from 5 to 23 years. The thickness measurements were located in the deck plate, bottom plate, inner bottom plate and side shell plate which are located on ballast tank, fresh water tank, void tank, fuel oil tank, slop tank and cargo tank. It is found that the Weibull distribution could be used for estimation the time dependent plate thickness deduction. In general, for design life of 25 years the greatest deduction of plate thickness is in deck area of 2.4 mm, followed by bottom plate of 1.8 mm, 1.6 mm side plate and the smallest is in inner bottom plate which is 1.1 mm. Generally, the results show that the thickness diminutions in Indonesian waterways are smaller than IACS CSR requirements, but greater than Sone's results.

Keyword: Thickness deduction, Indonesian waterways, thickness measurement, Weibull distribution

1. Introduction

The assessment of structural members of ship structures should be done based on the area where the structure operates. Corrosion is one of the degradation processes that are influenced fully by environmental conditions. Corrosion allowance is one of the most influential variables in calculating the thickness of the plates or profiles of ships' structures based on the classification society rules requirements.

Referring to the ships which are operated in the domestic voyage i.e. Indonesia waterways, there are several conditions causing the requirements in the Classification Society Rules, which use North Atlantic Ocean environmental condition and International voyages, to be very conservative and the ship be coming over design. These conditions refer to the environmental conditions, the type of cargo, ship operations, and others. Salinity, velocity, pH and temperature are the environmental factors that influence the rate of corrosion. Atashin et al [1] stated that individually, temperatures have a greatest effect on the rate of corrosion. These environmental factors may affect each other in the same direction which results in increasing of the value of corrosion rate or at opposite direction resulting in neutral reaction.

In determining the rate of corrosion, the important thing is the corrosion starts definition. Yamamoto et al [2] [3] introduced a probabilistic model in explaining the generation of corrosion, which is divided into 3 stages: the period when the coating was deteriorated. The next stage was followed by the formation of pitting point. If the pitting point was formed then the last stage is the development of corrosion. Wang et al [4] presented a database of wastage allowances for single Oil Tankers which are then processed to obtain an estimated corrosion rate [5] [6]. There have also been several studies that have been conducted on the corrosion model on the ship structure [7] [8] [9].