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SHAFT BRACKET STRENGTH ASSESSMENT BASED ON SEIZING AND LOSS BLADE METHOD

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Abstract

As part of structure which hold propeller shaft in extended open shaft system, shaft bracket become crucial piece in strength of propulsion system. It shall be capable to withstand against static load and some of dynamic loads as rotatory shaft. Classification Societies rules have been set up the minimum requirement relating to its dimension, e.g. thickness and cross sectional area. However, the requirement by each class society, in practical, provides a different level of safety. This case would be an important issue for designer to determine standard of the strength for new building, not limited for existing ship which intended to proceed transfer of class. Hence, further study to figure out the actual minimum requirement need to be established. This paper is discussed about 2 analysis methods that may be used to assess shaft bracket scantling as alternative tachnique in lieu of prescriptive formulae by class society. *Seizing method* is applied by considering the load due to shaft misalignment. While *loss blade* simulates damage condition of the system. Both methods are principally capable to represent primary load component experienced by shaft while on duty and also used by class society for developing their prescriptive requirement. In the interest of proving it, the formula derivation in accordance with loading condition has been generated, then verified by Finite Element Method (FEM). The result shows that there are number of assumptions which are used by class society relating to loading condition, boundary condition, shape and cross sectional area, length of bracket as well as the permissible stress.

Keyword: Shaft bracket, scantling, seizing, loss blade, finite element

1. INTRODUCTION

In ship propulsion system, shaft bracket shall be able to maintain shaft and propeller position while experiencing load. This structure is commonly found at small vessel e.g. tug boat and crew boat which has limited space to cover shaft inside hull, thus one recognize the system as open extended shafting. In lieu of bearing in closed shafting system, load due to shaft and propeller in operating condition is to be considered affecting its strength. Load by static mass and unbalance inertia moment as rothatory shaft condition, i.e. by shaft misalignment and loss blade which represent damage condition are working together with non-linear portion load due to combination of propeller inertia, thrust and vibration [1].

There are two main type of bracket which practically used, single-strut (I-strut) and double-strut (V-strut). Single type has only one arm as shaft holder and usually applied on small displacement craft. While, double type is used for larger vessel. It is also recognized as V-Strut since the arm configure some angle at a meeting point. As consequence, the load can be distributed to both arm, thus the section modulus become smaller. Furthermore, based on connection at meeting point, V-strut may be also devided into radial and tangential where each type has advantage and weakness [2]. Strut axis in radial type is aligned with core of boss barel, therefore connection become more solid. However, narrow gab between strut may disturbs fluid flow and generates wake so that it become more sensitive to vibration. Whereas for tangential type, strut edge are connected outside the barel. Main advantage of this configuration is minimizing flow disturbance since fluid enter propeller inlet as laminer flow and establishing steady thrust.