Research on Securing Method for Irregular Heavy&Big Segments

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ABSTRACT

The welding securing method is commonly used when H&B Segments are transported on the sea. The reasonable and reliable arrangement of welded structures can help avoid shipping accidents caused by sliding or dumping of cargos. This paper investigates the welding securing method for irregular ship segments. Firstly, external forces applied to the segments are calculated. Then the maximum horizontal and vertical seizing forces are derived. Finally, the transverse sliding balance, longitudinal sliding balance and lateral reversing balance of the segments are analyzed and the number and arrangement of the securing components are determined.

KEY WORDS: H&B Segments; inertia force; securing moment; weld strength.

INTRODUCTION

Nowadays, the maritime transport of H&B Segments are becoming more and more frequent given the construction of long-span bridges and large steel structures, as well as the off-site construction of ship segments and the trans-shipment of large equipment. Most of these large cargos are not standardized so they need a particular securing method during transportation and the validity of the securing structural components must be guaranteed. The sliding or dumping of large cargos will happen in the complex and changeable ocean environment if they are not secured properly, which may result in serious accidents (Xu, Du and Tian, 2002). Surveys on many marine accidents have found that many accidents on ships with H&B Segments are due to improper securing methods (Yang, 2010). Thus, reliable securing of H&B Segments is of vital importance.

At present, the large cargos are fastened by specially-made structural components welded on the deck in order to avoid sliding and dumping. As compared with flexible securing methods, this rigid securing method has the advantage of easy installation and operation, high strength and good adaptability, but it needs special equipment for installation and disassembly (Wang, 2009).

With regard to the design and checking of rigid securing for welding structural components, the Maritime Towage Guide (2001) (hereinafter referred to as Guide) and the Cargo Securing Manual Preparation Guide (1998) only provide the safety factor for the yield stress of the welding structural components, while the specific securing method and computing method are not given (The International Maritime Organization, 2003; China Classification Society, 1999). Because of this, many technicians do not know clearly how to arrange the welding structural components and assess the validity.

A ship segment is a typical example of a heavy cargo. The shape of ship segments varies a lot but they can be divided into two types based on the shape of resting surface: the first type are irregular segments, like the fore part and the stern part; the second type are regular segments, like the side part, double-bottom part and superstructure part. This paper focuses on the securing of the welding structural components for irregular ship segments. The securing method was devised and the assessment method for the validity of this welding securing method is proposed, which would provide some reference for the welding securing of irregular H&B Segments.

THE WELDING SECURING METHOD FOR IRREGULAR SEGMENTS

The weight, center of gravity, external dimensions and shape of the resting surface of each segment should be obtained before loading. The loading arrangement plan should be devised according to the dimensions and weight of each segment as well as the size of the barge cargo deck. The welding securing method can be determined based on the loading arrangement plan. The principal dimensions of the barge discussed in this paper are: 90m long, 32m wide and 2.2m deep. Fig. 1 is the loading arrangement plan of this barge during a voyage. ⪞ refers to the gravity center of each segment, while the number beside refers to the height of gravity. ⪠ refers to the gravity center of the whole ship, while the number beside it refers to the gravity height of the whole ship. Table 1 shows the dimensions and weight of each segment. The navigating zone is unrestricted.