



大连船舶重工集团有限公司
DALIAN SHIPBUILDING INDUSTRY CO., LTD.

The State of Oil Tanker Construction for CSR in Shipbuilding Industry

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1. Introduction

- In order to reduce the risks of structural failure and provide adequate durability of the hull structure for the design life, the Common Structural Rules for Double Hull Oil Tankers established and became effect for new generation of oil tanker.
- Other conventions and/or regulation became or will become mandatory to CSR tanker concerning the marine safety and environment protection, such as PSPC, FOT protection, BWTS and so on, they also have important influence to the construction of oil tanker and introduced more construction work

1. Introduction

- DSIC has finished the development and design of new generation of VLCC, Suezmax tanker, Aframax Tanker and Panamax tanker complied with CSR and relevant new conventions and/or regulations.
- The design and construction experience show that more steel weight introduced and upgraded structural details should be applied;
- Considering that more construction works are introduced, the production efficiency is becoming more and more important factor in shipbuilding for the present and future CSR tanker.

1. Introduction

- Improvement of production efficiency is comprehensive. It is relevant on all the shipbuilding process from the design to the construction technology and project management.
- A specific efficient construction technology for VLCC, we name it “Shipbuilding by Two Parts”, applied in DSIC will be introduced

2. Procedures of Shipbuilding by Two Parts

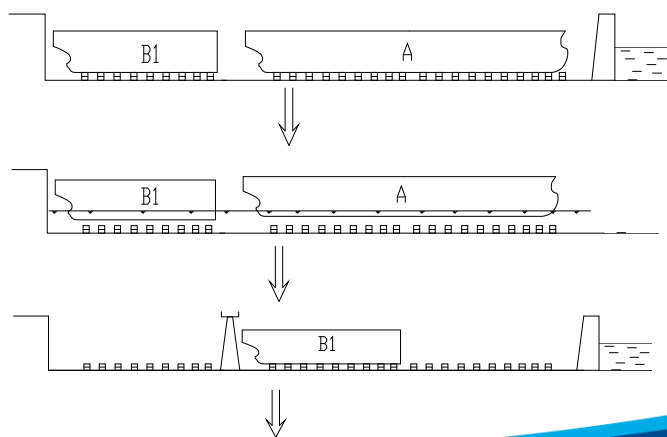
- The construction of large tanker normally applies the “Island” type or “Tier” type method. With traditional method, at the beginning, a base block is placed on a slipway or in a dry dock, and then to assemble hundreds of other blocks in order until to complete a whole vessel.
- If building in dock with this kind of method, it will occupy long period in the dock and make the production efficiency lower to DSIC because of its special construction resources.

2. Procedures of Shipbuilding by Two Parts

- Shipbuilding by Two Parts means a whole vessel to be built in a dry dock by joining two large sections, i.e. aft body part and fore body part, however, the two parts can be built in different docks and/or slipways.
- This technology will improve the production efficiency to the shipbuilding obviously, especially when it is applied for the construction of series vessel. It can fully utilize the relevant facilities and resources in the DSIC.
- The construction procedures of one cycle (total four round) for a series of vessels by this method will be illustrated

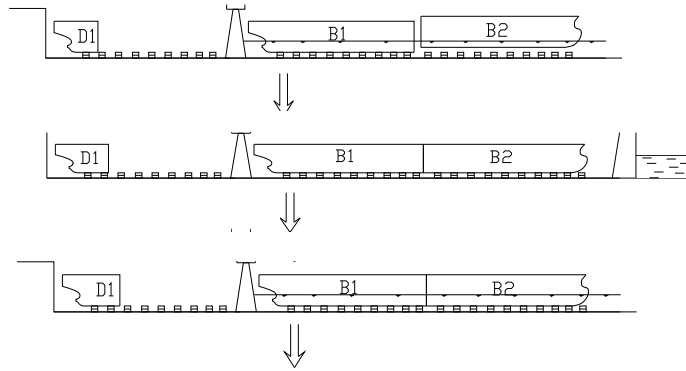
2. Procedures – First Round

- Aft body of ship B (B1) and a whole ship A (A) are built in same dock →
- A and B1 are floating at the same time →
- B1 will be re-docked →



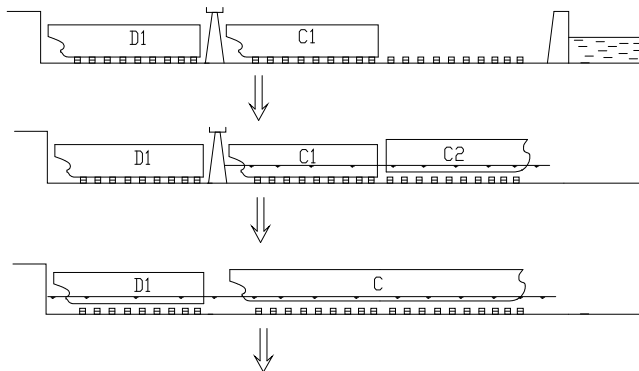
2. Procedures – Second Round

- Fore body of ship B (B2) completed, B1 and B2 float into dock →
- B1 and B2 docked and combined →
- Ship B floating out /D1 will be built →



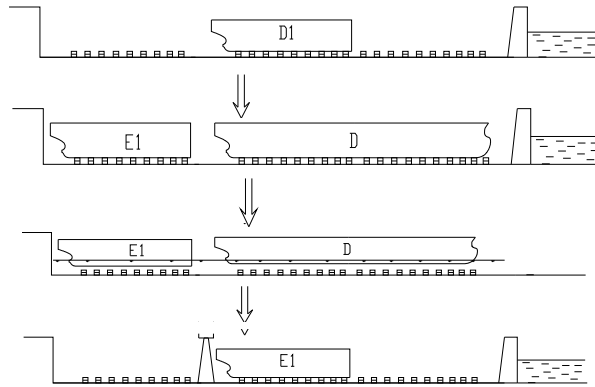
2. Procedures – Third Round

- D1 and aft body of ship C (C1) are built →
- C2 completed in other dock or slipway, and C1 C2 floating in dock→
- D1 and ship C are floating out



2. Procedures – Forth Round

- D1 re-docked →
- Finish the rest of ship D and Aft body of ship E (E1) →
- D and E1 will be floating →
- E1 re-docked → to go to another cycle



2. Procedures – Summary

- (1) The first and third forth occupied the dock for block erection, the other two rounds mainly for the joint of two parts;
- (2) The aft part of the dock is used to build the aft part of another ship, so the full dry dock has been utilized fully;
- (3) During the second and third round, the construction of vessel (aft part) in the aft dock has not been interrupted by other works in fore part of the dock, and the construction process in the whole dock is continuously without any pause;
- (4) The other resources such as other dock or slipway can be used for building of large vessel, and the resources mentioned above can be full utilized

3. Key issues of Shipbuilding by Two Parts

(1) Size of the parts

Since the movement and location adjustment should rely on the parts' gravity and the buoyancy, all the weight and centroid of the steel, equipment and outfitting of each part will be exactly estimated for choosing the proper size of the parts to adjust and control the draft and trim and make it possible of the proper alignment of the two parts for joint.

As for our solution of part subdivision, suitable ballast have to be introduced before docking: The draft of the aft body is a little bigger than that of fore body, so the aft body part can dock first; The aft body may have a little trim and the fore body is near even.

3. Key issues of Shipbuilding by Two Parts



Fore body built on slipway

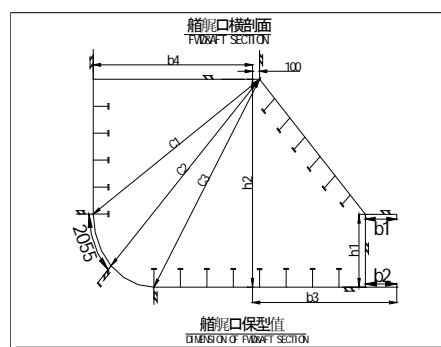
3. Key issues of Shipbuilding by Two Parts

(2) Section accuracy of the two parts

The shipbuilding is comprehensive. The welding, erection, heavy pressure and self weight of the structure, all those may bring deformation more or less, and the construction tolerance is another important issue to be seriously considered.

Fortunately, by the amassed experience and practice and the tolerance control system throughout building process in DSIC, the section tolerance, especially at the section plane of the joint, is within the allowable range.

3. Key issues of Shipbuilding by Two Parts



Example Table used for tolerance control

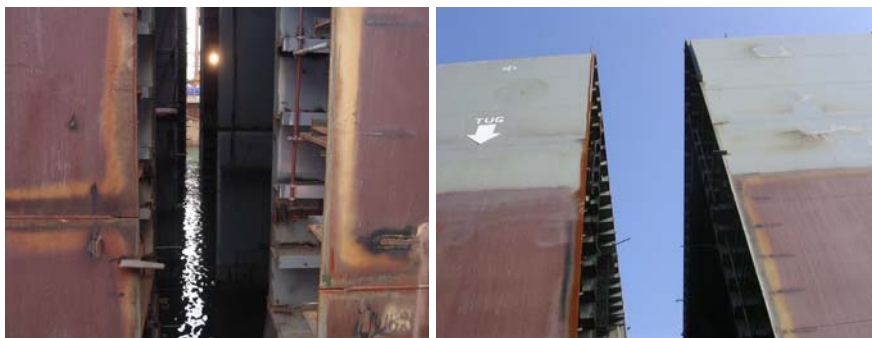
3. Key issues of Shipbuilding by Two Parts

(3) Docking in the exact position

Docking in the exact location can ensure the accuracy of alignment for the two parts, and that is another key issue for proper joint.

So, we have to prepare a particular operation procedure as detail as possible after cautiously investigating the whole process and all kind of possibility that might come forth, such as the circumstance, weather, human element and so on. During docking, each people and every course shall strictly follow the procedure.

3. Key issues of Shipbuilding by Two Parts



Afloat condition of two parts just before combination

3. Key issues of Shipbuilding by Two Parts



Fore body docking by means of limiter

Two parts after docking for join

3. Key issues of Shipbuilding by Two Parts



Completed for sea trial

4. Benefits of Shipbuilding by Two Parts

Up to now, some VLCC have been constructed in DSIC with the technology of Shipbuilding by Two Parts. Considering the special resource configuration of DSIC, there are more benefits with the shipbuilding technology.



4. Benefits of Shipbuilding by Two Parts

- The existing resource and facilities can be utilized comprehensive. DSIC has many dry dock and slipways, among those, there is a dry dock enough long to arrange one and a half of vessel, a big slip way and a smaller dry dock suitable for construction of half vessel. With the shipbuilding technology, all those resource can be utilized fully.
- The average period occupied by each vessel will reduced obviously, the construction efficiency is improved correspondingly.
- Since other resources can be used for building of large vessel, no great investment or great alteration to the existing facility is needed in order to increase amount of shipbuilding.
- Shipbuilding by Two Parts will require more high level of the project management and construction, and will make the progress in the shipbuilding technology to satisfy the demand of the shipping.



Thanks for your attention!