

## OJT Activity Report

### **OJT Card (4):**

### **Welding Design Exposure and Application in Construction**

#### **OJT Participation:**

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**OJT Card Reference** : Doc Ref\_OJT-Card 4

**Objective** : To know basic welding in design and application for construction.

**Target** : OJT Will have experience/Known about;

1. What is NDT Plan for construction.
2. How To perform the NDT Plan Dwg.
3. Drawing Tools Skill (AVEVA/AutoCAD).

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#### **Activities to be achieved:**

Activity 1: Welding Design Exposure and Application in Construction

Activity 2: Welding Application

Activity 3: NDT

#### **Activity 1: Welding Design Exposure and Application in Construction**

In this week, I been exposed to the hull structure part which is welding. Welding was compulsory element in ship building construction. Therefore, it's must follow all the classification requirements by the experts. All the welder that welding the plates for construction must follow the rules that been exposed by experts that was Bureau Veritas (BV). There have two types rules that apply in Boustead which is Rules for Classification of Naval Ships (**NR 483**) and Rules on Material & Welding (**NR 216**). BV Rules for naval ships that 2 main types of connecting welding that was butt welding and filled welding.

In general, butt welds are the full penetration of welding for plates or welded on both sides except special procedures or techniques considered equivalent by BV. For full penetration, its compulsory for lengths of longitudinal of shell & strength deck plating in 0.6L amidships or elements with high stresses. Butt weld also

possible on permanent backing. Backed flange of face plate of stiffener and preparation to be qualified by yard was the type of bevel, gap between plates. Butt welds has tapering which is in case of welding of plates with difference in thickness. For  $\geq 3\text{mm}$  if thinner plate has thickness  $\leq 10\text{mm}$  and  $\geq 4\text{mm}$  if thinner has thickness  $> 10\text{mm}$ . For slope of tapering governed by stress flow it's had to be adjusted stress concentration to change in thickness. About  $15^\circ$  if tapering perpendicular to main stress direction and for about  $20^\circ$  if tapering parallel to main stress direction.

Next, fillet welds have 2 types of welding which is continuous fillet welding and intermittent fillet welding. Continuous fillet was on each side of abutting plate. Intermittent fillet has 3 main types which is chain welding, staggered welding and scallop welding. For T connection, generally ordinary fillet welding without bevel. Partial of full T penetration welding required for connections subjected to high stresses that details where fatigue analysis is required, strength deck, side shell/ tank top and vertical bulkhead corrugations. Lap joint welding was acceptable for peripheral connection of doublers and internal structural elements subjected to very low stresses. Continuous welding generally adopted (corrosion). Slot welding acceptable for connection of doublers (except on strength and shell in 0.6L amidships) and only where stresses act in predominant direction: slot welds to be aligned in this direction. Plug welding acceptable only on case by case basis, subject to BV agreement. For example welding of rudder plating on internal structure.

## **Activity 2: Welding Application**

Welding application was divided to 3 main part which is qualification of welders, qualification of welding procedures and testing of welds. In the qualifications of welders, welders are to be individually qualified such as manual and semi - automatic welding to be performed by welders certified by BV. Certification is specified in BV document NR476 and alternative standards or procedure may be accepted by BV on cases (EN 287, ISO 9606, ASME Section IX). Job performed by the welder is to be within the limits of his/her qualification need to be stated on welder's certificate: process, material, thickness, welding position, etc). Yard need to keep record of welder's qualification and when required, need to provide valid approval test certificates.

Next, qualification of welding procedure stated that welding procedures (WPS) are to be qualified in accordance with BV document NR216 and alternative standards or procedure may be accepted by BV based on equivalence. The welding procedure should be supported by the welding procedure qualification record. The specification must include welding process, types of electrodes, weld shape, edge preparation, welding techniques and welding positions.

Then, testing the welds. After the completion of the welding operation and workshop inspection, the structure is presented to BV Surveyor for visual examination at a suitable stage of fabrication. Non – destructive testing (NDT) of the ship hull welds are to be performed by shipyard or its subcontractors. BV surveyor may require witnessing the test only. Shipyard also have a responsibility in testing of welds. Their responsibility was to ensure that testing specifications and procedures are complied with and to make report available to BV surveyor. As far as possible, results on non- destructive examination (NDE) are to be submitted.

When visual or non – destructive examinations reveal presence of unacceptable indicators, the relevant connection is to be repaired to sound metal for an extent and according to a procedure agreed with the surveyor. The repaired zone is then to be submitted to NDE to verify that the repair is satisfactory. Additional examinations may be required by the surveyor on a case by case basis. Ultrasonic and magnetic particle examinations may also be required by the surveyor in specific cases to verify the quality of the base material.

Weld joints covered the butt welds with full penetration, tee, corner and cruciform joints with or without full penetration and fillet welds. For testing method, its contain detection of surface defects and detection of internal defects which is visual testing, VT, Liquid penetrant testing, PT, and magnetic particle testing, MT for surface defects and ultrasonic testing, UT, and radiographic testing, RT for internal defects.

### **Activity 3: Non – Destructive Test (NDT)**

Non – destructive test was the test that been used to check the toughness and wellness of the welding. It's was compulsory to the structure that have been welding to run this test. In this work, radiographic testing (RT) was the test that been selected to test the welding of plates of the ship. To calculate the number of RT in the structure of the ship, I must know or identified the seam on the structure. In this project, I have been stated to calculate the number of RT and the place of the RT been run on the structure of transverse water bulk. This structure contains 11 MWB. To calculate the number of RT in each structure, all the seam in that structure must been calculated and multiply by the coefficient of the class of the structure. Mostly the structure was the Class C and the coefficient was 1.5%. After that, we will divide the amount that we get with the 300mm because the size of the film of test was 300mm. Therefore, we will get the number of the RT in that structure. This step will be applied to the all structure and being sum to get the total of the number of RT.

Next, we must identify the place or critical part on the structure that need to be test and this must been standardize with the calculation on the previous step. This critical part need to test because at that part maybe the welder may occur the error during the welding process. The critical part on the structure was at the joint of the plates/seam. At the joint, we must consider it necessary to been test because the weld on the plates may have not perfect weld. So that, the structure toughness and strengthens maybe will reduce and this mistake will lead the failure of structure.

### **References:**

- a) Doc Ref\_OJT-Card 4\_001
- b) Doc Ref\_OJT-Card 4\_002