

# EQUIPMENT IN THE RENOVATION PROCESS OF A BOW THRUSTER

Marta Janowitz (Mechanical Department, IV year)  
Magdalena Jażdżewska (Mechanical Department, V year)

Gdynia Maritime University, Gdynia 81-225, Poland

**Abstract.** *The need to increase maneuverability of floating units forced the rise of demand for production of bow thrusters. Installed in tunnels located at the bow or stern of the vessel below the water line, they significantly improve the possibilities of maneuvering. Difficult operating conditions cause damage to subassemblies, they are also the cause of changes of geometry, and strength parameters of screw blades, which undergo various types of damage. This necessitates in regeneration, which in turn forces the repair centers to be equipped with suitable devices for repair work. Authors describe the way and the working environment of bow thrusters, and also typical damage with regard to their importance for renovation process. Further part of the study is focused on selected technological issues which occur in the renovation process of bow thrusters and proposals for their solution with the help of specialized tools facilitating this complicated and complex process. The article presents instruments used for transport of adjustable screw's blades between the repair stations and tools used to it's mounting on the repair station- lathe.*

**Keywords:** *bow thrusters, blades, renovation process, maritime engineering*

## 1. Introduction

Continuing growth of possibilities of cargo and tourist marine transport result in ever increasing demand to construct larger and broader vessels. Harbours and narrows through which vessels must sail are characterized by limited space, which makes manoeuvres difficult and increases the danger of collision. Bow thrusters were introduced as an answer to these issues. Using

the force produced by the water flowing in canals, they immensely improved the manoeuvre abilities of marine vessels. Thanks to the force mentioned, vessels are now able to turn around even at stoppage.

Bow thruster, similarly to many other parts of the vessel is vulnerable for various kinds of damage in course of exploitation. Because of its location, the main threats for it are cavitation and mechanical damage. In order to repair these, it is subjected to processes such as turning, machining or welding.

The paper aim is to describe typical kinds of thrusters' damage, their regeneration methods and usage of instruments designed to improve the repair process.

## **2. Characteristic of Bow Thrusters**

The main purposes of bow thrusters are to vest the vessel in desired direction, to maintain the chosen course and to enable its rapid change through manoeuvring or quick turn. [5] The advancement of scientific knowledge thanks to which new, highly salt water corrosion-resistant materials were discovered, opened the possibility to introduce solutions which improve the vessel manoeuvre abilities. This followed in introduction of bow thrusters located fore and aft, which contributed to advancement in manoeuvre abilities of the marine vessels. Bow thrusters are viewed as an addition to the main thruster. They consist of propulsion unit, propeller and flow duct. [3]

Bow thrusters can be divided into following:

- TUNNEL THRUSTERS (standard, with fixed pitch propeller „magnetic”, with controllable pitch propeller);
- AZIMUTHAL THRUSTER (with fixed pitch propeller, with controllable pitch propeller)

## **3. Materials used for bow thrusters production**

According to PRS regulations, materials which can be used in construction of bow thrusters are casting copper alloys. They are characterized by high corrosion and abrasion immunity. Properties of a given material depend on their chemical composition, which is precisely regulated by rules of Polish Ship Registry.

## 4. Main types of damage and their detection

Damages of bow thruster can be divided into following main categories: mechanical damages, electrical damages, hydraulic damages and control damages. Mechanical damages can be further subdivided into external and internal. The former, because of difficult access to the tunnel, can be detected only with use of camera, through which entire system is inspected and verified. Typical damages in this area are damages of angle drives and seals, sleeves and bearings. Damages of the second group are characterized by easier detection, without the need to dock the vessel. Engagement of frogman or trimming the vessel to aft or fore are typical examples of measures of their detection. Despite easier diagnostic procedures, detection of faults of the group mentioned also results in the necessity to dismantle the damaged part and send it overhaul. This group of damages consists of curved or broken foils, dents, cavitation and corrosion. The usual cause of breaks and dents are pieces of garbage located in water, ex. stones, beams etc. Damages caused by corrosion and cavitation mostly appear because of lack of anodal coatings.



*Image 4.1 Mechanical damage of the blade. Author's photograph.*

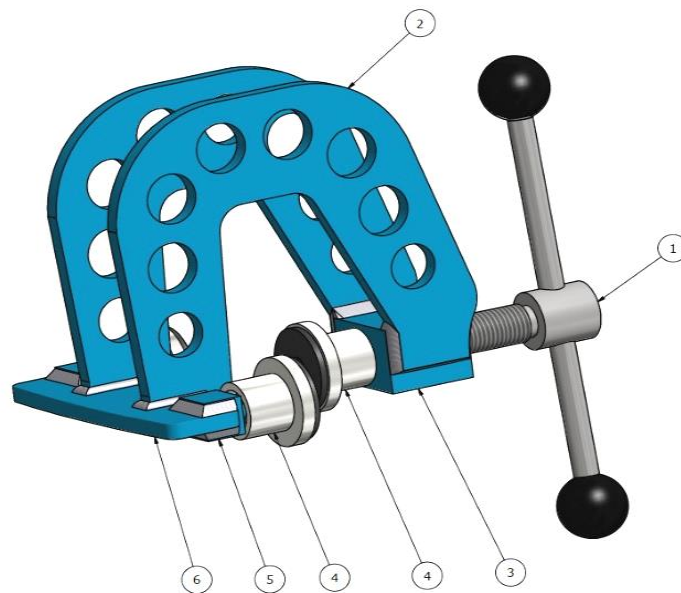
## 5. Regeneration of bow thrusters blade.

In the course of bow thruster overhaul, after its dismantling, firstly its parts have to be cleaned and verified (for instance, through accurate examination or penetrating diagnosis), which in turn makes the decision about regeneration or replacement of that part. If individual parts of the thruster, along with economical premises advocate for the repair, the next step is the transport of

specific elements of the thruster to adequate working stations. Afterwards, foils are installed at stations devised for boring, pad welding, straightening or grinding. [2]

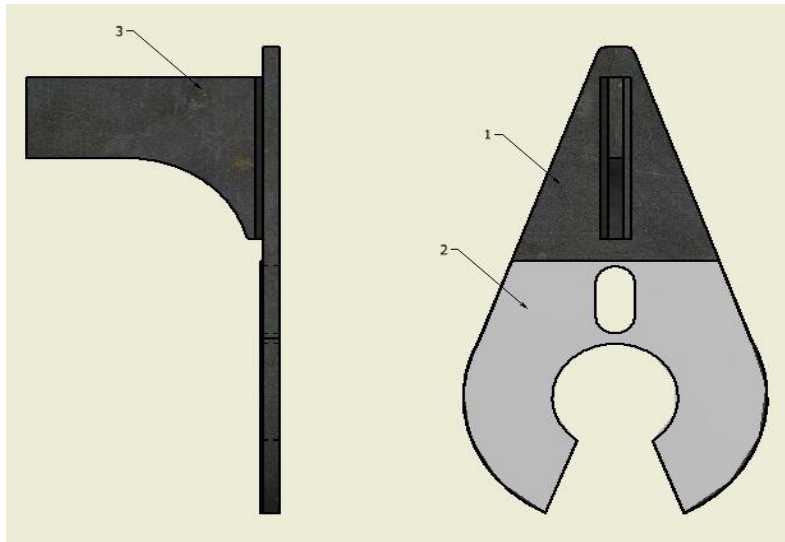
### 5.1. Devices simplifying transport of the bow thrusters' blade.

Important part of the bow thrusters' renewal process is the transport of its particular parts between the work stations. The elements are particularly heavy, and due to this factor, special equipment for their transportation is needed. Following sketches depict outlines of devices designed especially for the bow thrusters' blades transport.



**Image 5.1.1 Draft of blade transport welded handle. [6]**

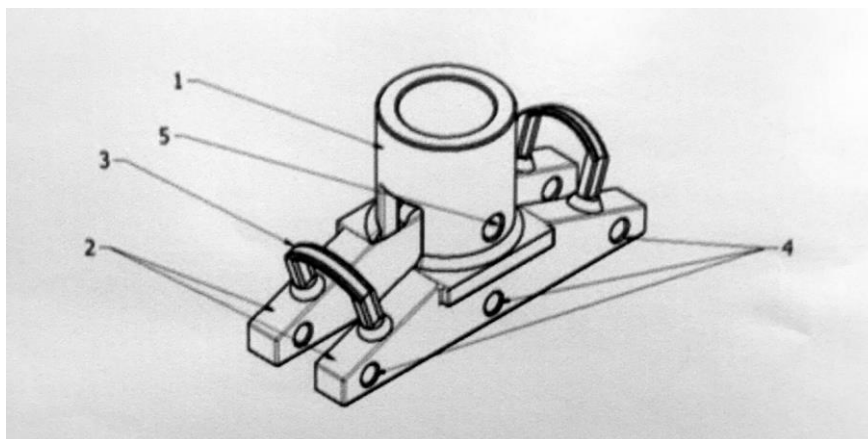
1-screw with lever, 2-construction metal component, 3-construction threaded element. 4-shoes, 5-shoe embedding element, 6-construction metal component.



**Image 5.1.2 Draft of blade transport welded handle. [4]**  
*1-grip footing, 2-teflon pad, 3-grip arm.*

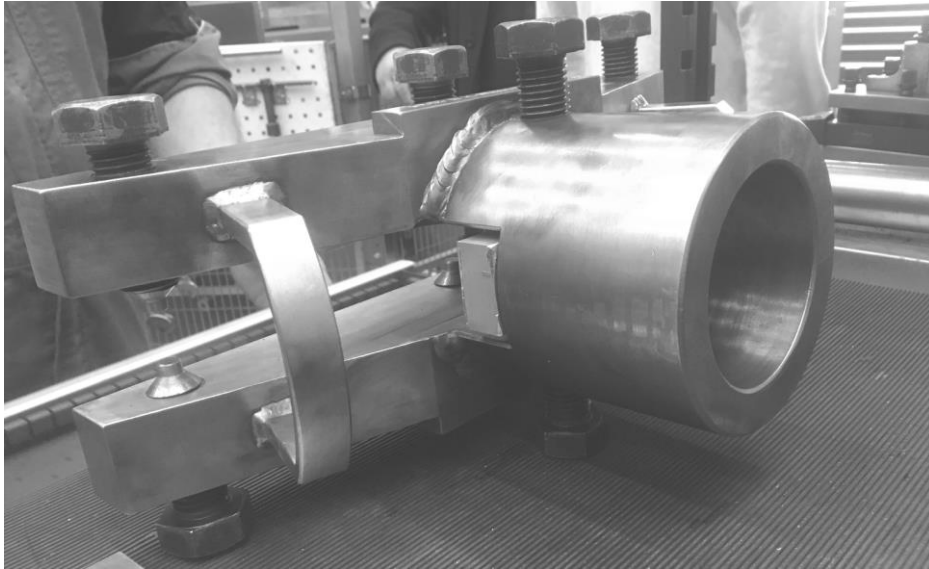
## 5.2. A device facilitating tooling of a blade.

Image no 5.2.1 shows visual sketch of a special handle made for bow thrusters blade mounting while machining horizontally in a lathe.



**Image 5.2.1 Visual sketch of a mounting handle.[1]**  
*1- collar, 2 – body, 3 - support elements, 4,5 - threaded gaps.*

On a next drawing (5.2.2) we can see a photography of the same handle after realization on the basis of above mentioned project.



**Image 5.2.2** *Photography of a realized project of a special handle for lathe machining. Author's photograph.*

## **6. Conclusions**

Wide spread of the bow thrusters usage, constant need for carrying out their overhauls and the search for means speeding up the repair process inspired us to carry out the analysis of the equipment used for their blades overhaul.

Bow thrusters became an indispensable element of each newbuilt vessel because of their assets. However, their localization results in necessity to carry out frequent inspections or repair operations. Solution presented above is devised to accelerate this type of work. Presented devices improve transport and treatment of the foils in need of a repair.

**Literature:**

1. L. Iwanicki, L. Kyzioł, D. Kozyra, R. Tarsa “*Spin test - the ability of spin test method usage in thrusters' fault detection and isolation*”. Journal of KONES, 2014.
2. D. Lachowicz: „*Analiza uszkodzeń sterów strumieniowych pod kątem możliwości ich napraw na wybranym typoszeregu*”. Gdynia: Akademia Morska w Gdyni, 2015.
3. P. Nowak, M. Kamieniecki „*Stery strumieniowe, konieczność czy zbędny wydatek?*” Pogoria 2013.
4. J. Nowicki „*Projekt wstępny uchwytu do przenoszenia płyta śruby steru strumieniowego*”. Materiały niepublikowane.
5. A. Perepeczko „*Okrętowe urządzenia sterowe.*” Wydawnictwo Morskie, Gdańsk 1983.
6. M. Stępkowski „*Projekt uchwytu spawanego.*” Rolls-Royce, Materiały niepublikowane.