

**Title:** DP Thrusters – Understanding Dynamic Loads and Preventing Mechanical Damage

**Author:** Jie Dang, MARIN

### **Abstract**

Despite the wide and successful use of mechanical azimuthing thrusters in various marine applications, such as dynamic positioning (DP), dynamic tracking (DT), bollard pull (BP), low speed manoeuvring, as well as high speed transit trips at continuous full power (then used as the ship's main propulsion system), damages on the gears and bearings of mechanical azimuthing thrusters have been reported in many cases. According to the statistics of survey records of major classification societies (e.g. ABS, DNV and LRS), the failures of gears and bearings are among the first three major kinds of damages, where one of them is the propellers which are however exposed directly to a quite harsh environment in the water.

In order to help the industry to get an insight in the failures with respect to the external loads on the drives of thrusters, MARIN has been dedicated in studying the hydrodynamic loads on mechanical azimuthing thrusters in the past decades. Series of six-component transducers, with high-accuracy and high response frequencies, have been designed, manufactured and applied. Systematic model test campaigns and full-scale measurements in order to obtain dynamic loads to the higher frequencies have been carried out. Through investigations into extreme manoeuvring operations, thruster-thruster interactions, thruster ventilation and thruster-ice interactions, a thorough understanding on the characteristics and the amplitudes of the external loads in various operational conditions has been gained.

This paper gives descriptions of test set-ups, used transducers, scaling laws and test procedures. Test campaign results have been reported, extreme loads have been identified and conclusions have been drawn. The test results and findings can serve as principle guidelines to prevent damages, which are important both for the thruster designers and manufacturers, as well as for the operators.

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