



# QDESP

## Prediction of propulsive performance

QDESP predicts the resistance and propulsion characteristics of displacement ships. The predictions are based on formulas obtained from a regression analysis on results of MARIN model experiments and sea trials.

QDESP can be used to estimate the speed and propulsion power in the early design stage. Correlation with test or trial data of similar ships is possible. The test data can be used to derive the correlation allowance as input for a new design.

### References

- Holtrop, J.; "A Statistical Resistance Prediction Method with a Speed Dependent Form Factor", SMSSH 88, Varna, October 1988.
- Holtrop, J.; "A Statistical Re-analysis of Resistance and Propulsion Data", International Shipbuilding Progress 31, November 1984.

### Application

QDESP delivers the resistance components and propulsion efficiency for the design speed or the design power, a review of the resistance, the thrust and propulsive power as a function of the speed and tables of the pulling performance at both constant torque and power.

The input parameters are the main dimensions of the ship, the displacement volume, the form coefficients CM, CWP LCB, the bulb particulars, the immersed transom area when at rest and various parameters related to the propeller arrangement. For the calculation of the drag of stream-lined and flow-oriented appendages either the equivalent appendage drag factor and wetted surface area or a detailed description of the various appendages can be provided.

### Computational approach

QDESP applies a simple hydrodynamic model for the resistance components according to the form factor method. As to the propeller-hull interaction statistical, formulas were derived for the wake fraction, the thrust deduction factor and the relative-rotative efficiency. The preliminary design of a propeller is based on the Wageningen B-series or Ka-series polynomials. The propeller can be designed either for fixed speed or for fixed power.

In addition, either the diameter or the rotation rate can be optimised within given constraints. Effects of cavitation on the propulsion, if any, are approximated. QDESP is suitable for some generic optimising hull forms related to main dimensions, but optimisation on detailed hull characteristics is discouraged. In this case, the performance effects of various parameters are modelled with insufficient accuracy.

## Accuracy

As to the accuracy, QDESP results show both systematic and random deviations. Random deviations are about 8 per cent of the delivered power for large, comparatively slow ships ( $F_n < 0.25$ ) and tend to be larger in the steep, pre-hump range around  $F_n = 0.3$ .

The accuracy in the post hump range is comparable to the accuracy at low speeds. An accuracy similar to model tests can be achieved when QDESP is correlated with relevant model test data.

Regarding the systematic deviations it is noted that QDESP represents 'the average ship'. Optimised hull forms can perform 5-10 percent better than predicted by QDESP. For special hull forms such as dredgers and barges QDESP can be used only when checked first against results of similar ships. QDESP cannot be used for planing craft.

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Example of statistical power prediction

