

Analysis of Dissimilar Engine-Gear-Propeller Systems with PropExpert

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HydroComp PropExpert is a program for the selection and analysis of propellers for motor yachts and workboats. The architecture of PropExpert assumes all engine-gear-propeller systems are identical (i.e., single screw, symmetrical twin-screw). However, it is possible to analyze dissimilar systems by treating each system separately.

OVERVIEW

Some vessels have propulsion systems designed to allow for independent operation in cruise and sprint modes. For example, such a vessel might have a principal centerline inboard propeller with twin retractable stern-drives for use in sprint mode.

The procedure to size and evaluate such a system is as follows:

1. Choose a speed and determine the total thrust requirement at this speed.
2. Calculate the thrust-making capability of the principal propeller at this speed.
3. Determine the required thrust for the stern-drives by deduct the principal propeller thrust from the total required thrust.
4. Size the stern-drive propellers and check the thrust.

DETERMINE TOTAL THRUST REQUIREMENTS

You will set up PropExpert with the principal propeller to determine the total required thrust for the vessel. Remember that in equilibrium there must be a match between resistance and delivered thrust. So, at the defined speed there is only one value for required thrust - regardless of the propeller or engine. This

allows us to use any propeller and find the total thrust required by the vessel.

1. Enter the vessel information into PropExpert and set up for the principal propeller.
2. Enter the Engine data associated with this propeller.
3. Enter the propeller Sizing data, and size the needed parameters (e.g., pitch) as necessary.
4. The analysis will find the total required thrust, and you should copy this figure down. You will note that the power and RPM are likely to be out of range. This is not a problem because, as stated before, we are only interested in the equilibrium required thrust.

CALCULATE THE REAL THRUST-MAKING CAPABILITY OF THE PRIMARY PROPELLER

The engine that is driving the primary propeller can only operate within its own rated power and RPM, of course. Therefore, we must use PropExpert to determine the actual thrust generated by this propeller at the design speed.

1. Back in the Vessel page, turn the Auto update checkbox OFF to retain the proper propulsive details.
2. Then change the Service to Bollard (rated RPM). This forces an analysis of the propeller using the rated RPM, rather than finding the equilibrium condition.
3. Rebuild the analysis in the Service page. This will display a Thrust which is the maximum available thrust from the primary propeller.

FIND THE REQUIRED THRUST FOR THE ADDITIONAL PROPELLERS

Simply deduct the available thrust determined above from the total required to find the thrust needed from the additional propellers. Write this figure down.

SIZE THE PARAMETERS FOR THE ADDITIONAL PROPELLERS AND EVALUATE THE RESULTS

From this point on, you will be running PropExpert as you would normally - with one small exception. You will be defining the drag of the vessel based on the needed thrust figure from above.

1. Modify the Vessel information as needed (i.e., change 1 propeller to 2, change Service back from Bollard). Let PropExpert update the Details section as appropriate.
2. Set Prediction to Based on similar vessel, and click Edit speed prediction data. Enter the vessel parameters, and enter the appropriate Vessel drag. Drag is found by multiplying the needed thrust by (1 - thrust deduction). A System efficiency is not needed.
3. Enter the appropriate Engine data.
4. Enter the propeller Sizing data, and size the needed parameters (e.g., pitch) as necessary.
5. Check to see if the system has the ability to meet or exceed the design speed, and you are finished.

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