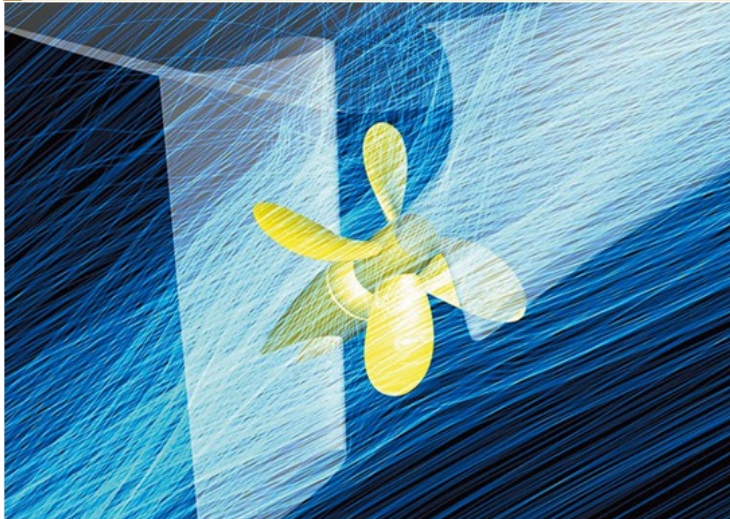


Ultimate rudder bulb

Energy saving device for Zone-3



3~6%
Improvement



Rudder bulb closest to the propeller

Three main factors contribute to the efficiency gains made by rudder bulbs.

- (i) Reduction of hub vortices occurrence
- (ii) Increasing wake gain and uniformity of propeller wake
- (iii) Improved interference effects between propeller and rudder

As a rudder bulb closer to the propeller is more effective, the Ultimate rudder bulb has a rounded cap to ensure that the bulb is positioned closest to the propeller.

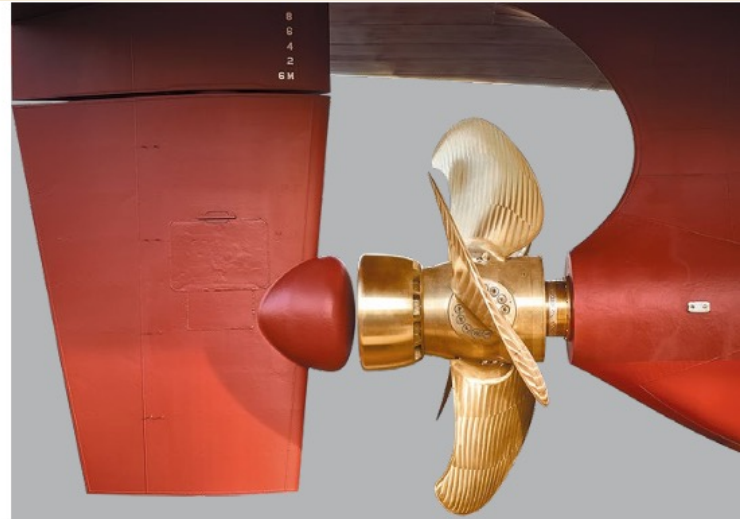
Increase of rudder thrust

A strong hub vortex, which normally causes energy losses at the rudder, is generated from the aft end of the cap toward the port side of the rudder. A strong hub vortex hitting the rudder leads to increasing rudder resistance. The Ultimate rudder bulb reduces rudder resistance by increasing the negative pressure at the leading edge of the rudder as the bulb head suppresses the hub vortex.

Self-propulsion test results on the Ultimate rudder bulb on a 208BC model ship showed an efficiency improvement of over 5%–6%, and the lift–drag ratio was comparable to that without the rudder bulb in a rudder angle change tests.

Delivery record

Several existing vessels in service are using the Ultimate rudder bulb. They are used in both low- and high-speed vessels and on both fixed- and controllable-pitch propellers.



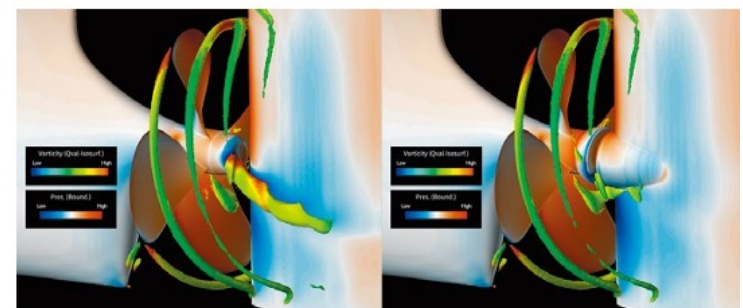
Ultimate rudder bulb profile



Normal rudder

Ultimate rudder bulb

Example of hub vortex analysis by CFD



Normal rudder

Ultimate rudder bulb

