The Fishing Vessel Propeller

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Introduction

Correct propeller design is critical to successful operation of a trawler. The propeller acts to translate the power produced by the engine into thrust to overcome the resistance of the vessel and to provide a tow rope pull.

The extremes of propeller performance are to design a propeller that makes the vessel go as fast as possible; or to design the propeller to give a great amount of pull. Normally a propeller design strikes a compromise between these two extremes. This compromise will depend on the conditions existing in the particular fishery that the vessel operates in. Vessels with long steaming times may require better free running capabilities than those working inshore and requiring larger pulls. The decision on the propeller design point should be made with thought as to the relative profits of the fishing profile and operation of the vessel. If two types of fishing are undertaken for different periods of the year it may be viable to change the propeller to suit each fishery.

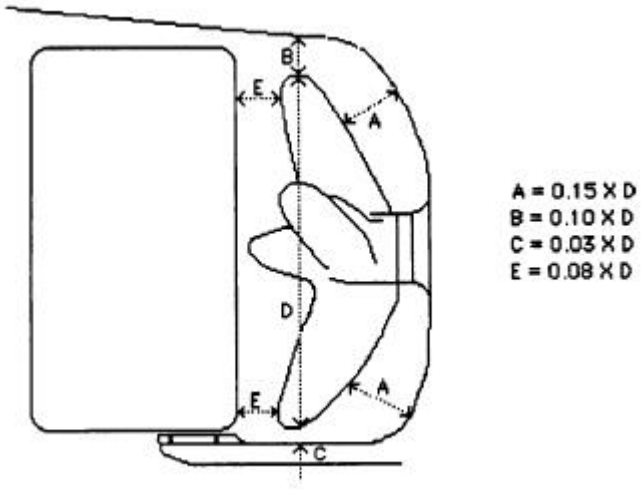
Many vessels are fishing with different operating conditions from those for which they were originally designed and the propellers are no longer optimal for these operating conditions.

Considerable fuel savings, improved towing pulls, or improved steaming speeds can be achieved by modifying or replacing the existing propeller with a new one to an optimised design for the new operating conditions.

Physical Characteristics

Propellers are described by several of their physical dimensions and characteristics. The main ones referred to are the diameter, the pitch and number of blades. Others are the blade area ratio, the rake, skew and section type.

Propeller Aperture Clearances



Diameter -
This is the diameter of the circle formed by the propeller tips. Generally the diameter of the propeller is as large as is necessary to allow its blades to absorb the full power of the engine and will also be as large as the aperture permits. If necessary the aperture and propeller diameter may be a compromise.
Adequate clearance between the propeller-hull and rudder must be allowed in order to prevent serious vibrations that can cause hull damage.

Pitch - Pitch is the characteristic of the propeller which creates the force to move the hull. It is the distance advanced by the propeller in one complete revolution if it was turning like a screw in wood and there was no slip like there is in water.
Very slight variation in pitch may greatly effect the performance of a propeller.

Number of Blades - Three, four and five bladed propellers are used on trawlers with four blades being the most common.
The number of blades for a propeller is chose in conjunction with the power, blade area and propeller revolutions.
For vibration considerations the number of blades must not be close to the product of the number of pistons x the gearbox ratio.

Blade Area - The term describing the size of a propellers blades is called the blade area ratio and refers to the proportion of the propeller circle taken up by the blades.
The blade area ratio is a carefully calculated value because too much area may result in overloading the engine whereas too little may result in cavitation.

Cavitation - Cavitation is caused when the pressure on the back (ship side) of the propeller blade becomes so low that the sea water boils.
Cavitation damage occurs most frequently at the blade tips.

Choice of Propeller - Propeller Design Point.

A fixed pitch propeller can only be designed to absorb full power at **one** design point. The decision on the propeller design point should be made with thought as to the relative profits of the fishing profile and operation of the vessel.
A propeller designed to give maximum thrust whilst stationary is known as a Bollard Propeller.

- A propeller designed to give maximum thrust whilst towing is known as a towing propeller.
- A propeller designed to give maximum thrust for full speed is known as a free running propeller.
- A propeller designed to give maximum thrust at a point between towing and free running is known as a compromise propeller.
- A propeller not operating at its design point will give a lesser performance than when it is.

There are some fishing operations which require the propeller to give a pull less than is available from a propeller designed for maximum free running speed and in this case the free running design point would be the best choice.

A propeller has the first call on the power available from the engine. When other power demands are placed on the engine via takeoffs i.e. pumps and generators, then the total power demand on the engine may be in excess of its rated power and cause overheating if the propeller has been designed to take maximum power in that area of engine operation. The propeller is only one item in the propulsion package and due account of the other items must be taken into consideration when designing a propeller.

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