

# APPLICATION

## TUG BOATS



# THE CHALLENGE

## PROPULSION SYSTEMS IN TUG BOATS

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Up to 20,000 kW engine power, 7,000 operating hours a year and greatest possible manoeuvrability – these are the demands made of tug boats. In order to meet these demands powerful diesel-mechanical and diesel-electrical drive systems, in conjunction with POD drives, are frequently being used. This application demands a high availability of the propulsion system and this in return poses the challenges for modern tug drive line components:





## REQUIREMENTS

- ⊕ Continuous respectively Medium Duty Operation
- ⊕ high availability
- ⊕ low maintenance costs
- ⊕ highly cost effective solutions
- ⊕ high deflection compensation capability

# THE MODERN SOLUTION

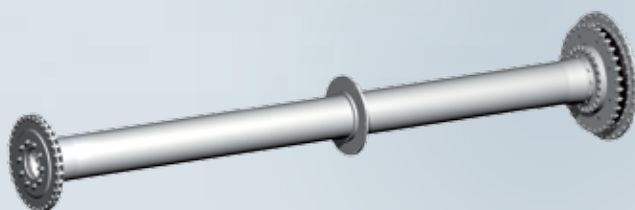
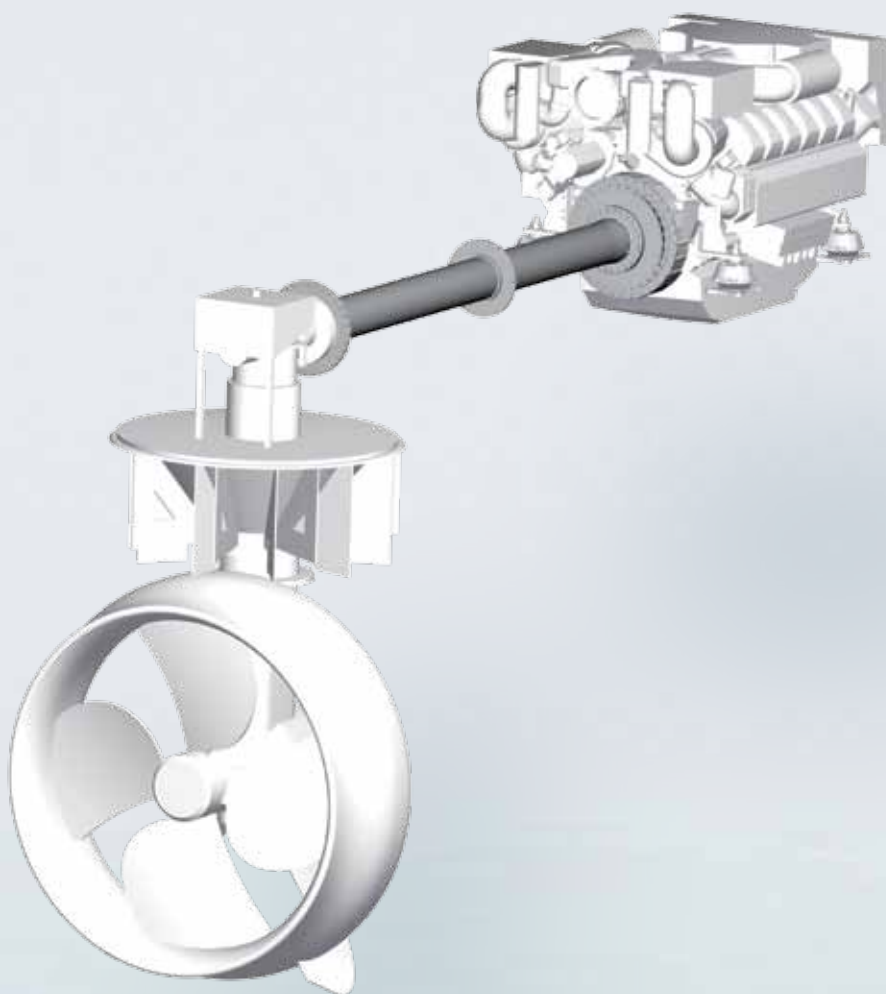
## RATO R COUPLINGS WITH COMPOSITE INTERMEDIATE SHAFTS

VULKAN Couplings provides ideal solutions for tug boat drive lines. Nowadays the rubber elements for VULKAN couplings are designed, tested and manufactured in VULKAN owned rubber production facilities following the recently introduced ACOTEC approach.

Conventional high speed shaft arrangements require several pedestal bearings in the shaft line to ensure a proper running behaviour of the high weight, bending sensitive steel shafting.

In case of drive shafts connecting the Diesel engine and the thruster over longer distances an advantageous arrangement consists of a VULKAN

Composite shaft between the radially supported RATO R and the thruster. The Composite shaft is of double cardanic design with a membrane coupling assembly at the RATO R and another membrane assembly at the rear end of the Composite shaft. VULKAN Composite shafts are made from all available fibre grades e.g. featuring a top axial stiffness similar to the one of steel with about only 25% of the density of steel. This leads to a significant weight saving and increased critical speed of the shaft with subsequent reduction of bearings. Composite shafts are in service since the early nineties and have well proven reliability.



### ADVANTAGES

- ⊕ high misalignment capacity
- ⊕ low overall reaction forces
- ⊕ bridging longer distances up to 7 m
- ⊕ reduced weight
- ⊕ reduced alignment work
- ⊕ less parts than conventional solutions
- ⊕ reduced overall installation costs
- ⊕ low maintenance costs

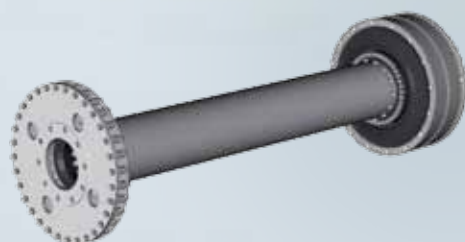
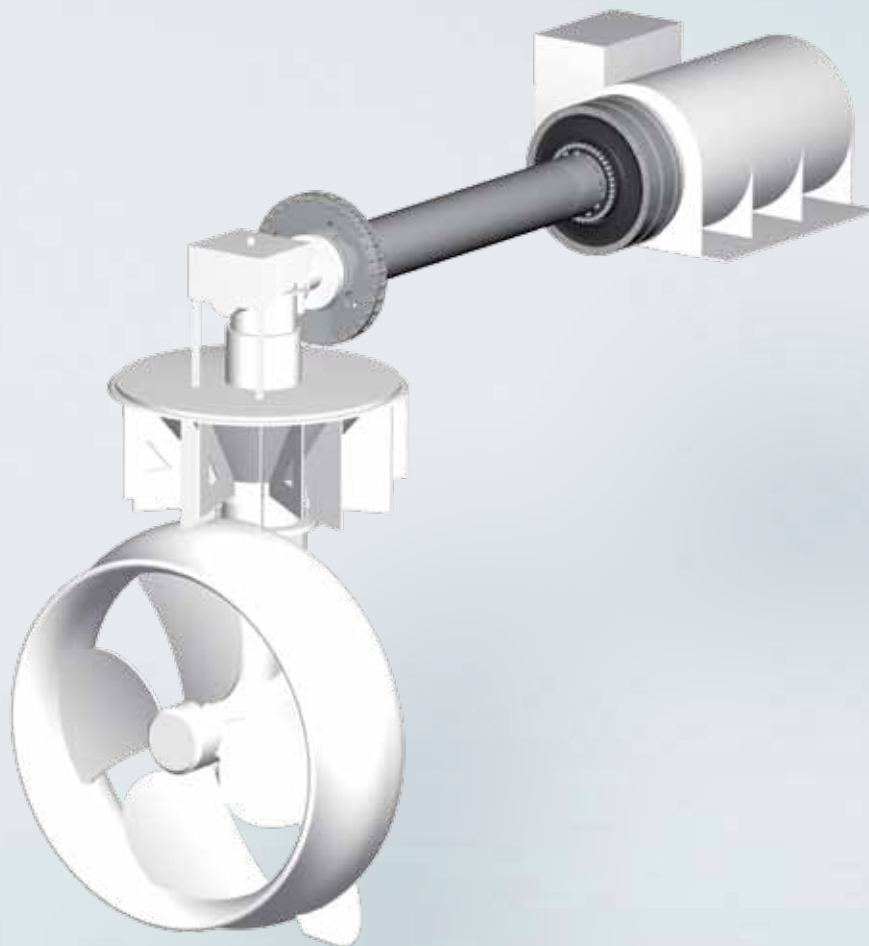
# THE INNOVATION

## THE VULKAN INTEGRATED SHAFT COUPLING DESIGN (ISC)

VULKAN Couplings introduced a new combination of the well proven RATO DS coupling with a directly connected Composite shaft to be used in Diesel engine and electric motor driven arrangements as well. The RATO DS is characterised by rubber shear stresses with a pre-dominant radial/circumferential component. This makes the rubber element of the RATO DS stiff in radial (transverse) direction. Thus the Integrated Shaft Coupling Design (ISC) works as an integrated torsional and misalignment coupling without radial support. The angular deflection of the RATO DS causes – even at high misalignment levels – a rather low strain level

compared to the torque load. Therefore no additional misalignment component is required between RATO DS and shaft. Shaft lengths up to 7 meters can be achieved without any additional pedestal bearing.

The VULKAN Couplings' expertise also allows to use the Composite shaft as an additional torsionally flexible part for optimised tuning and damping of torsional vibration.



### ADVANTAGES

- ⊕ significant parts reduction
- ⊕ bearing less design
- ⊕ weight saving
- ⊕ low overall reaction forces
- ⊕ reduced alignment work
- ⊕ bridging longer distances, shaft lengths up to 7 m
- ⊕ optimized tuning and damping of torsional vibration
- ⊕ low installation costs
- ⊕ low maintenance costs



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