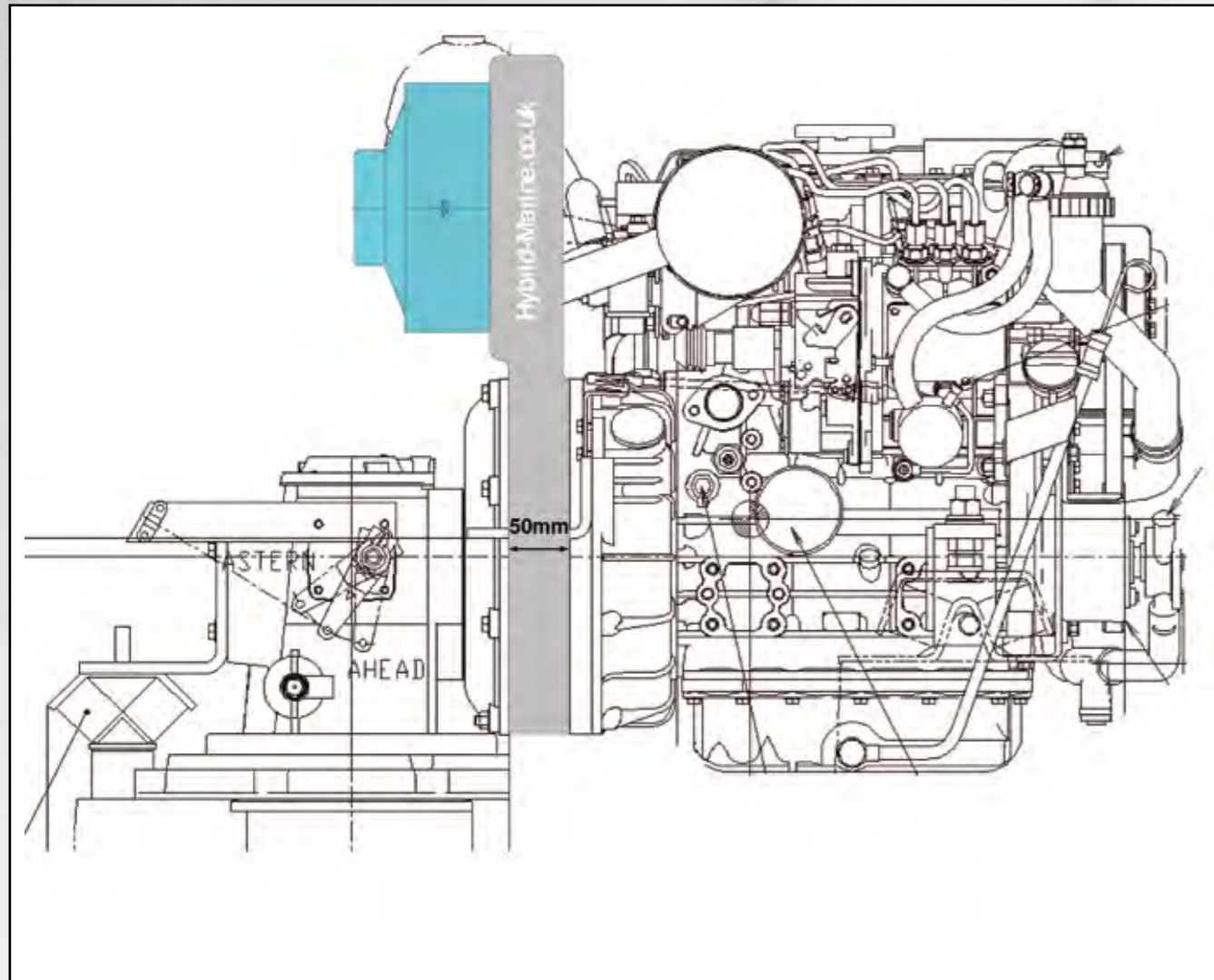
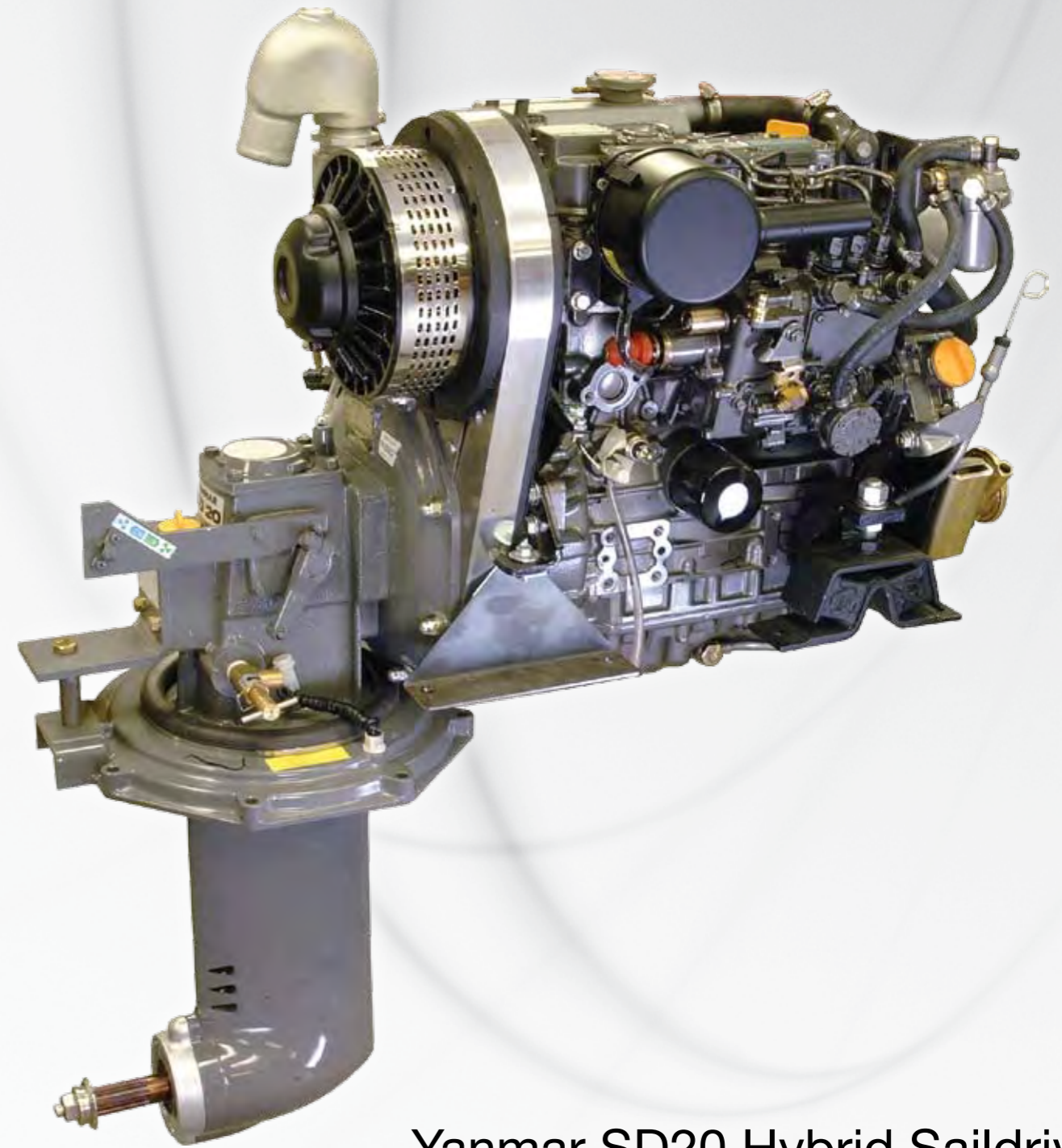


# Technical Drawing

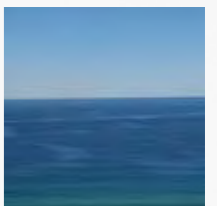
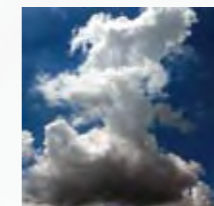


The Yanmar SD20 Hybrid Saildrive is a joint venture between Hybrid Marine and E. P. Barrus Ltd

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## Yanmar SD20 Hybrid Saildrive

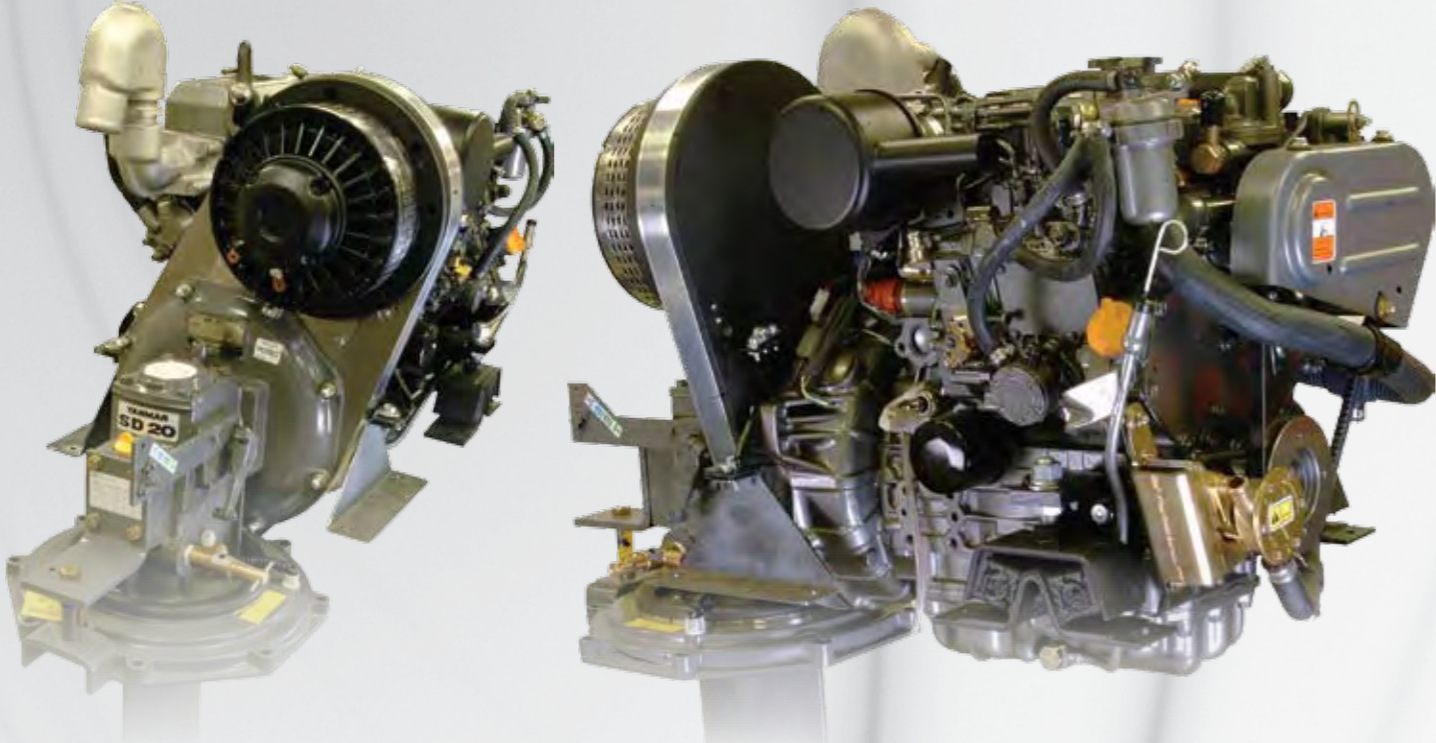


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An integrated hybrid system providing a generator and electric propulsion solution for saildrive equipped small craft.



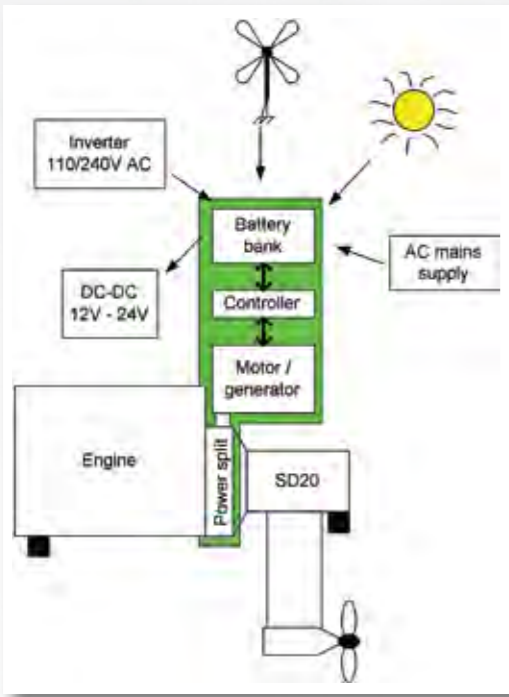
A parallel hybrid saildrive system can be fitted to a vessel during its initial construction or retrofitted to an existing saildrive installation. The parallel hybrid system as the name implies is connected to the drivetrain in parallel with the standard diesel engine. Hybrid systems have the most to offer in efficiency improvements during mid to low power cruising and our system makes best use of this basic principle. The standard diesel engine is sized to provide the maximum power requirement for the vessel, while the electric drive is designed to match the boats mid range power needs. This allows the electric drive components to be smaller and provides a very cost effective hybrid solution.

**System Functions**

- Whisper quiet electric operation yet the vessels standard diesel engine remains available to meet high end power requirements
- Whilst sailing the system regenerates a significant and useful amount of electricity from the rotating propeller
- System can be operated as a standalone 5Kva diesel generator when at anchor or if shore power is unavailable - this can support air conditioning and other domestic loads

**System Features**

- Highly efficient system with much improved fuel consumption figures. Extended cruising range on limited tankage
- Built in redundancy, if the diesel engine fails then you can use the electric drive and visa versa
- Off the shelf system suited to both new build and retrofit applications, only adds 50mm to drivechain
- Simple user friendly seamless controls
- Acts as an intelligent power management system, can be combined with other renewable energy sources
- A cost effective solution that can be customised around your vessels power requirements



Hybrid technology can offer reductions in fuel consumption and the electric drive enables quiet, green boating. Our integrated hybrid system has been designed from the ground up to provide an off the shelf solution.

The system is controlled by innovative electronic technology that is designed to serve you rather than baffle. The complexity is hidden away and a user-friendly control panel provides simple system operation. The system can be installed from new or retrofitted to an existing vessel. Since no plumbing or external cooling system is required then fitting the system is much simpler than installing a diesel generator. Purchase, installation and servicing costs are lower than those of a standalone diesel generator plus in addition you get all the extra hybrid features listed overleaf. Ultimately this makes ours a very cost effective system and a real "value" purchase.



**How does the system work ?**

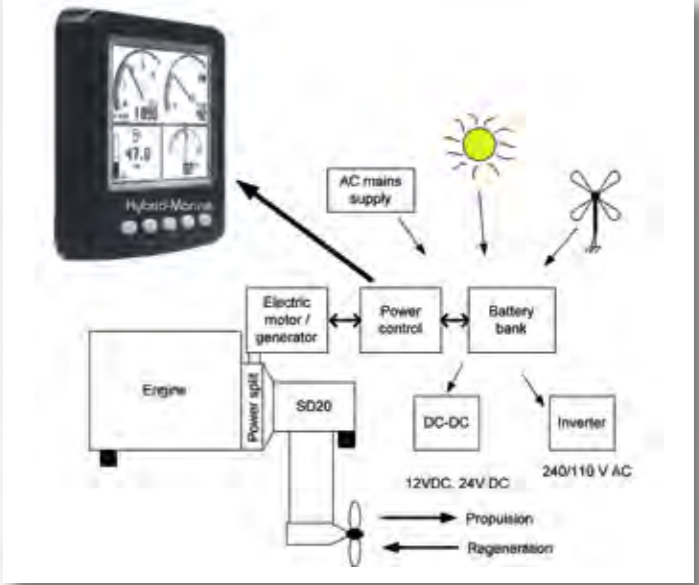
During low to mid power cruising (around 2/3 of maximum hull speed) the electric motor can drive the vessel using the energy stored in the battery bank. When the batteries are depleted or if higher speeds are required then the main engine automatically starts to drive the vessel. At this time the 10kW electric motor automatically becomes a 5kW generator and recharges the batteries as well as providing power for domestic equipment. The extra shaft load seen by the engine during this combined propulsion and charging period causes the engine to operate with higher efficiency. Once the batteries are recharged you can then switch back to electric drive. Alternatively you can keep the energy in your batteries to silently drive high power appliances when anchored at the end of the day.



When sailing the propeller can be locked or allowed to freewheel. The motor/generator can then be allowed to rotate and regenerate electricity to charge your batteries. This charging process does add some drag to the vessel and so in light airs regeneration can be reduced or disabled via the control panel.



If you need to punch into heavy seas or motor against the tide then the full power of the diesel engine can be used to drive the vessel. Equally in calmer conditions you can slip your lines and motor in complete silence under electric drive, later in the day perhaps after some regenerative sailing you can return in the same way. In the evening you can use power stored in the battery bank to silently run standard domestic appliances.



**How fast can I go using the electric motor ?**

The standard system uses a 10kW motor (13hp). A 35' yacht has a hull speed of approximately 8kts and requires 30hp to achieve this. However at 6.5kts it only needs 10kW so for this vessel the electric drive can achieve in excess of 75% of hull speed in average conditions.

**How far can I go on my batteries?**

This depends on the size of your boat, the capacity of the battery bank and how fast you want to go. For example to take a 35' vessel requiring approximately 2kW to achieve 4.5kts. With 4 x 100Ah batteries we would have about 3.8kW of usable energy storage. We could thus travel constantly for about 2 hours at 4.5kts. Increase the size of the battery bank and you can go faster or further!