alamarin-jet

GO WITH THE FLOW

THE EVOLUTION OF SMALL WATERJET PROPULSION SYSTEMS WITHIN RECENT YEARS

ABSTRACT

Over the last five years, a lot of work has been done to develop waterjets below 500kW into not only better performing, but also easier-to-install systems.

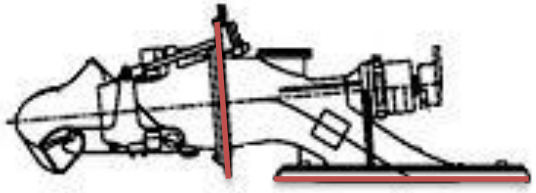
Regarding performance, significant improvement was achieved i.a. by enhancing cavitation resistance without the loss of top speed. This enables higher towing capabilities, better vessel acceleration and negotiation of the planing hump more easily also in laden condition.

Bearing boat designers in mind, an installation method allowing two different ways of placing the propulsion system into the hull was developed. The patented Combi-Frame structure makes it possible to install the same jet either long tail or short tail, meaning a longer or shorter protrusion respectively of the system over the transom. This creates more freedom for layout design, optimization of the center of gravity, and for maintenance aspects.

The end user has been considered by integrating more components into the waterjet than before, e.g. a steering cylinder, which normally is not a standard component on propulsion systems of this size. Maintenance procedures are substantially easier to perform due to the increased size of the inspection hatch. According to surveys, the location of this inspection hatch has always been subject to differing opinions among customers. The Combi-Frame structure provides a solution for this dispute, as the hatch can be located either inside or outside the hull, depending on the above mentioned installation method.

Installation

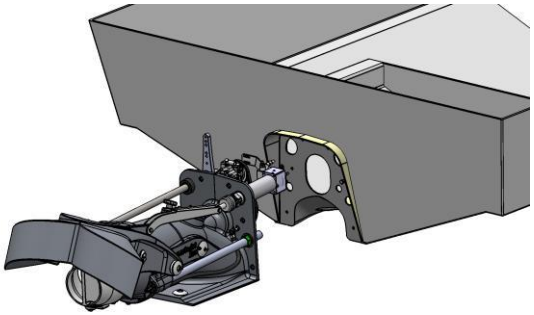
Adapter mount



Adaptor Mount. Installation starts by making a flat area on the bottom and the transom and two holes are cut; one to the bottom and the other to the transom. Then the jet unit can be mounted with adapters which can be bolted or welded into the hull.

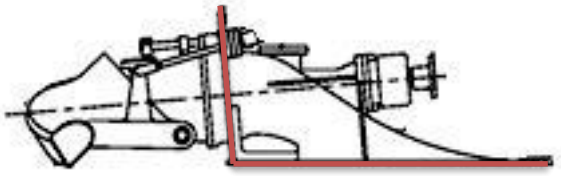
This method usually will mean that the waterjet inspection hatch is located INSIDE the hull and also that the majority of the jet body is also located INSIDE the hull. We call this **SHORT TAIL**

Transom mount



Transom Mount. This method involves fitting an installation insert into the hull, and the jet is mounted from outside the boat to this insert. The inspection hatch is located outside the vessel. We call this **LONG TAIL**

Mounting rim



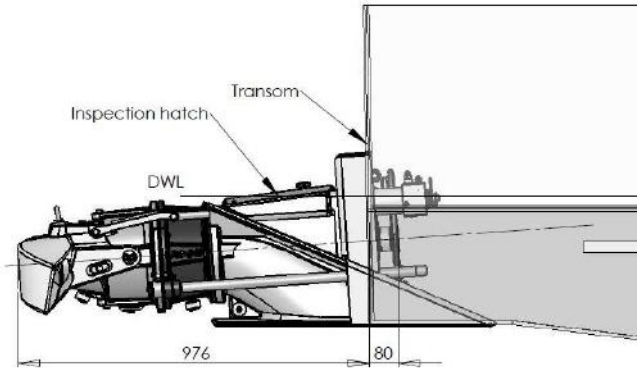
Mounting Rim. An evolution of the Adaptor Mount method which is supplied as a singular piece and can either be welded or glassed directly to the hull or alternatively bolted in position. If bolted it means the jet can be installed from the outside, otherwise the jet has to be installed from the inside. Again this is a **SHORT TAIL** installation

Installation

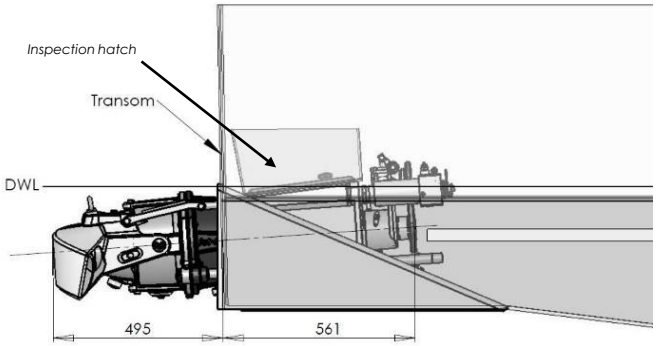
At Alamarin-Jet our traditional installation method is the **LONG TAIL TRANSOM MOUNT**, this allows for much less space to be occupied by the jet inside the vessel, allowing for smaller engine rooms, reduced LCG and also simpler sterndrive repowering. We had a need from our customers to be able to install our jets SHORT TAIL though, some required overall vessel length to be reduced, some needed the inspection hatch to be located inside the hull for various reasons, and many had a platform with other jet manufacturers and wanted to switch to our product but did not want to make significant hull changes.

Therefore we designed our patented COMBI FRAME design.

It allows both short tail and long tail installation with only a different hull insert.



Combi-frame, long tail

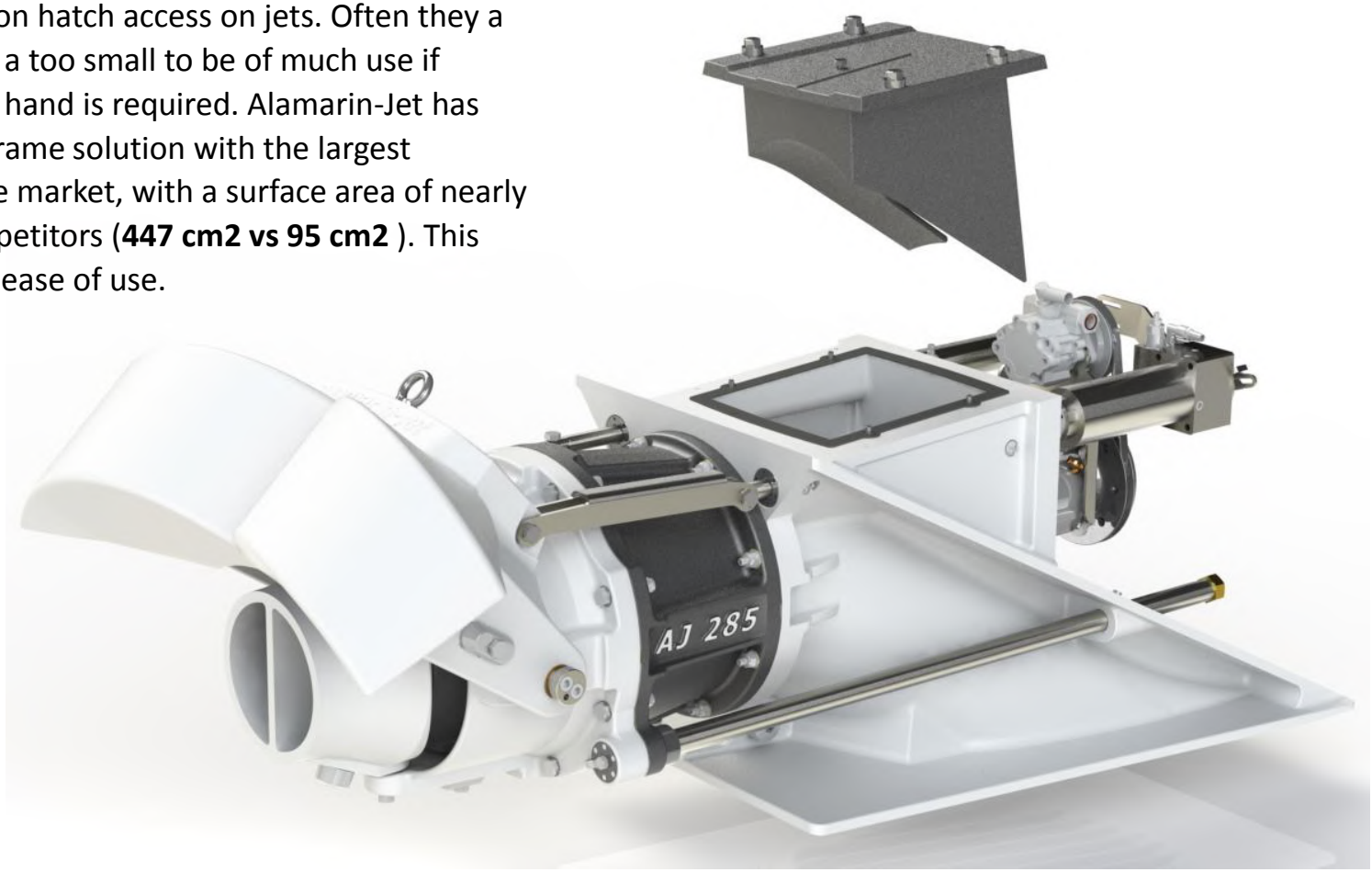


Combi-frame, short tail

Installation

Service

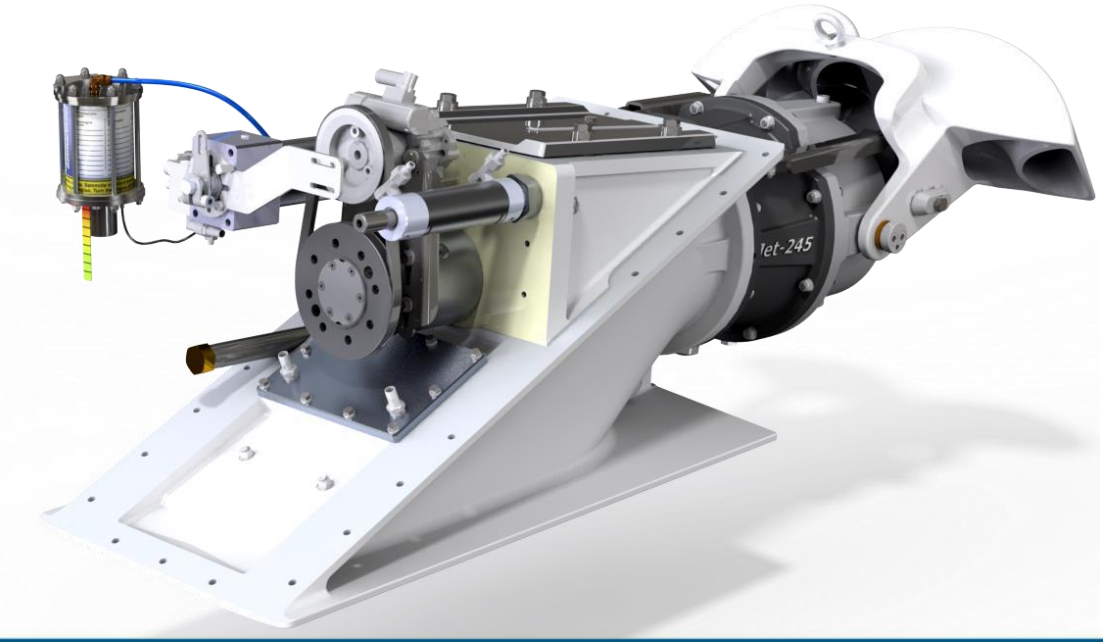
To increase service ability, we listened to customer feedback regarding the inspection hatch access on jets. Often they a poorly positioned and a too small to be of much use if clearing a blockage by hand is required. Alamarin-Jet has provided the Combi-Frame solution with the largest inspection hatch in the market, with a surface area of nearly five times that of competitors (**447 cm2 vs 95 cm2**). This significantly increases ease of use.



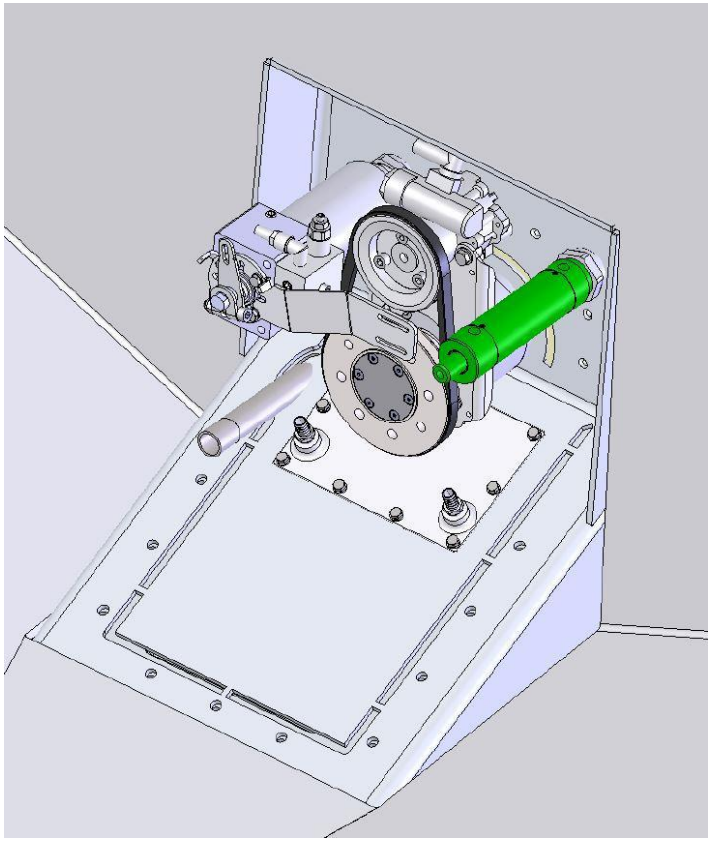
Service

Alamarin-Jets feature a **GREASE LUBRICATED REAR BEARING** compared to the competitors choice to use water lubricated bearings. Special rear bearing materials have been developed to better withstand the impact of abrasive particles. However, a rolling bearing with a sealed housing extends the operating life much further. In addition, standard spare parts are easily available and require no special equipment. Alamarin-Jet waterjet propulsion units have long used grease lubricated rear bearings.

The automatic lubrication unit was developed to cut down the need for manual lubrication. It utilises the working pressure of the reversing deflector hydraulics and continuously lubricates the rear bearing. This ensures even lubrication and long equipment life.



Integral steering



For the combi-frame models we have also included an integrated hydraulic steering cylinder which allows for a simple installation but most importantly saves space and reduced the overall package footprint of the propulsion unit – no additional cylinders are required to be mounted horizontally to the unit.

Performance

A recent comparative test shows us in practice the differences in the cavitation limit. The test included the Alamarin-Jet AJ 285, which in practice is a successor of the AJ 288 and very similar in its hydrodynamics. This unit is compared to a similarly sized unit from a known manufacturer. The size difference is to the advantage of the comparison unit, as it has larger intake duct dimensions and impeller diameter.

HTech A25, aluminum hull deep V, foam fender

Displacement in the speed test: 2,700 kg, LCG 2.7 m

Displacement in the acceleration test: 2,700 kg + 990 kg additional load, LCG not verified.

Engine: Mercruiser 496HO 425hp@4800-5200rpm
Transmission: ZF80A 1:1,567 (B-pos)

Performance

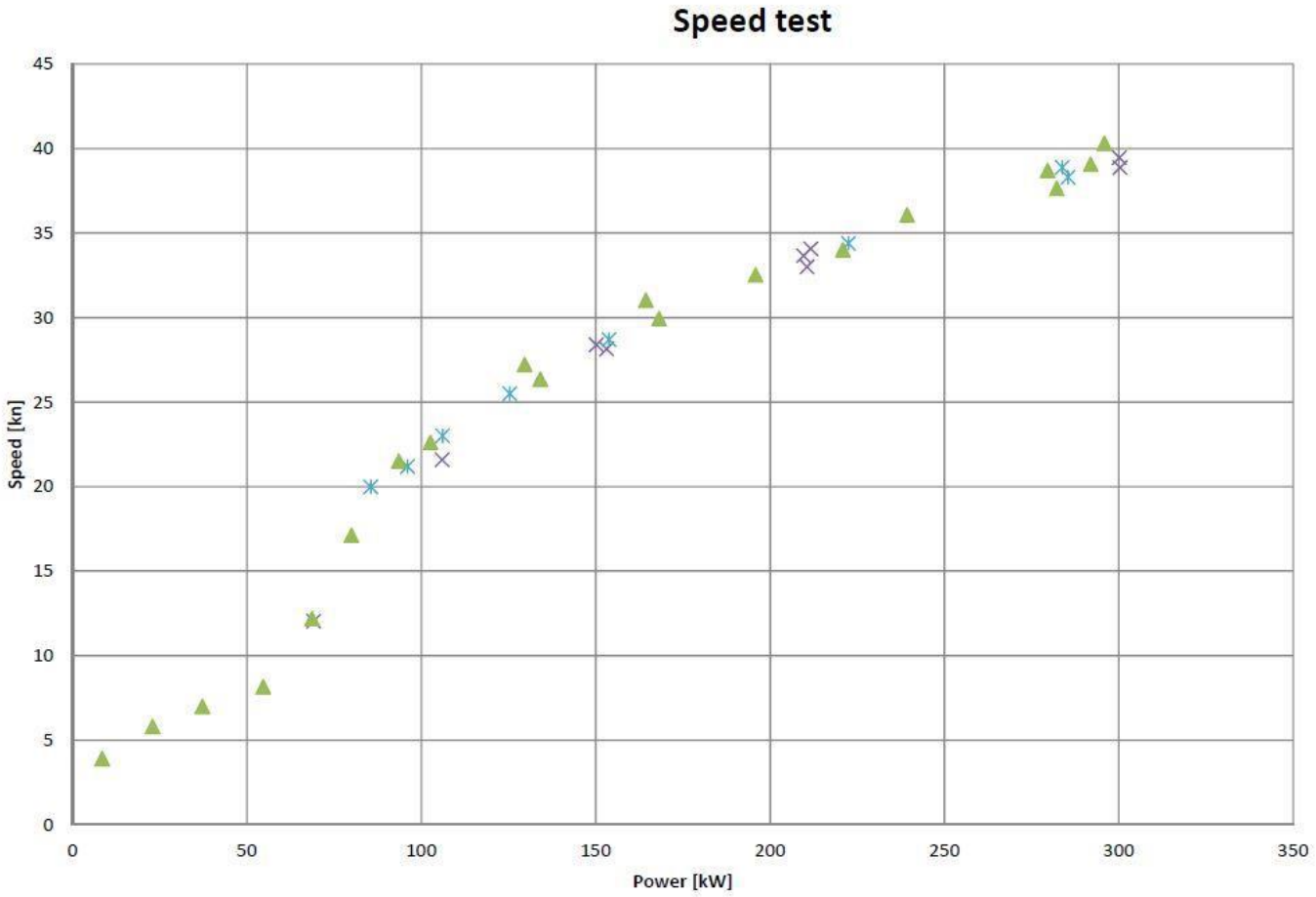
Key Points about the jet comparison:

- Inline torque meter installed, rpm reading with inductive sensor from the transmission output flange.

- Bollard pull force reading with load cell.
- Speed measurement from GPS sensor.
- All the measurement logged in voltage to data-logger and converted into actual values with equations generated in calibration.
- Same 9kW rating in the impellers. The results show power vs. performance, which is most direct comparison where impeller match with the engine doesn't make effect. As a comparison, secondary impeller of AJ 285 has been tested also (#17-4).

- Smaller water intake
- Smaller physical jet size
- Smaller diameter impeller

Performance



SPEED

Speed tests were made in basic load and acceleration tests with 990kg extra load, 22pcs. of sand filled containers at 45kg each. Location of the extra weights are kept carefully the same.

Weather in both tests 0-1m/s, flat seas. Measurements in speed test made in two directions.

No noticeable speed difference.

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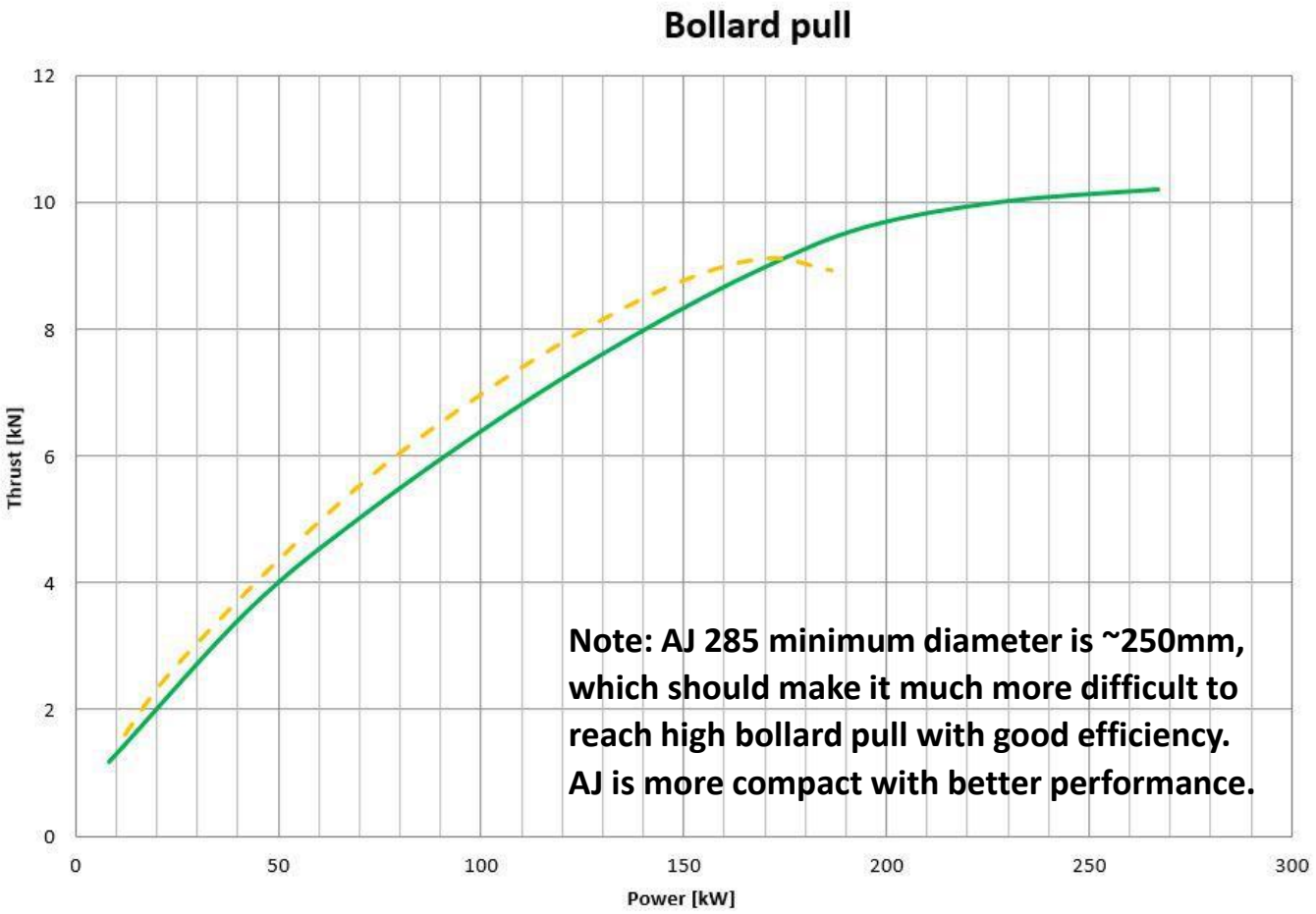
Performance

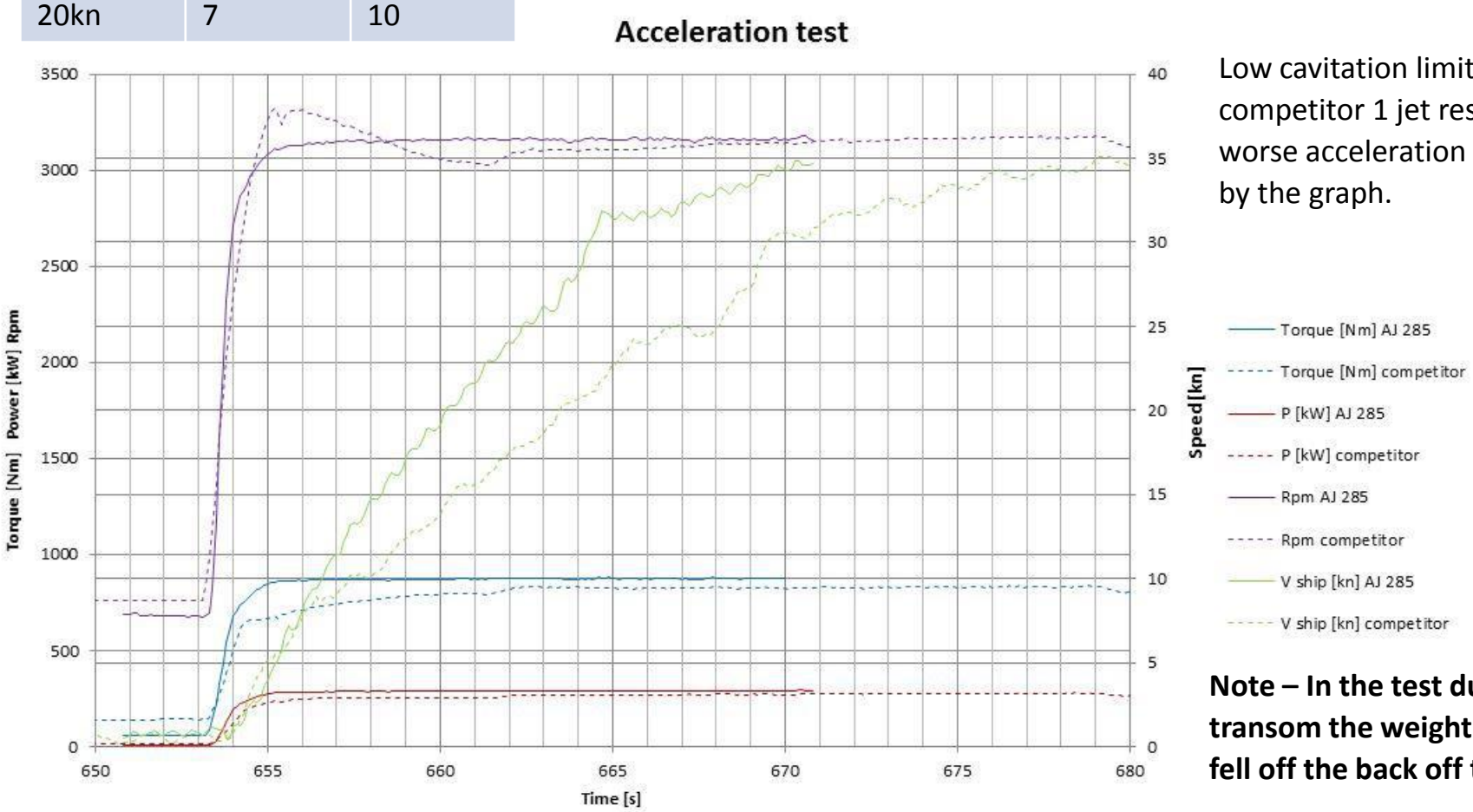


Bollard pull, cavitation limits

AJ 288 and 285 reach max 1040kg with several impellers. All the impellers are above 1000kg.
Competitor 1 maximum 920kg.
Competitor 1 bollard pull force slightly higher at low power range. This has no benefit in speed and or acceleration tests as a performance benefit due to cavitation margins being lower with the competitor 1.

Performance

	AJ 285	Comp 1
10kn	3	4
15kn	5	7
20kn	7	10



Low cavitation limits of competitor 1 jet results in worse acceleration shown by the graph.

Note – In the test due to open transom the weights for AJ test fell off the back off the boat

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Performance

Finally I would like to show you of a video of the sister vessel to this tested boat which we took for trials at the HSBO forum in Lisbon last year.

Here we see that the driver does not touch the throttle lever once in operation as the cavitation margin is so high that there is no thrust collapse even in highly aerated water.