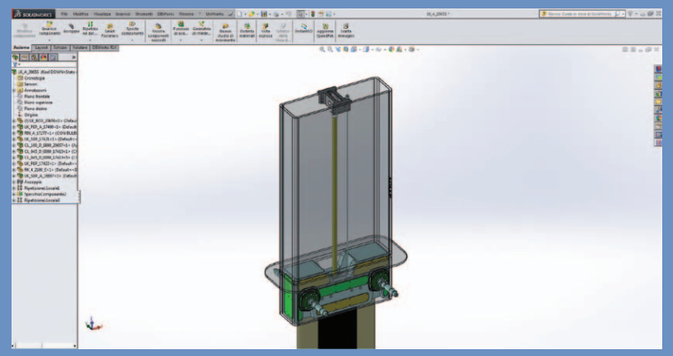
LIFTING KEEL



The possibility to lift the keel can allow an easy entry in shallow water harbours without reducing the performance of the boat. The peculiarity of our lifting keel system is that the fin is allocated, when in lower position, on 4 pins that contribute to transfer the loads to the keel box.

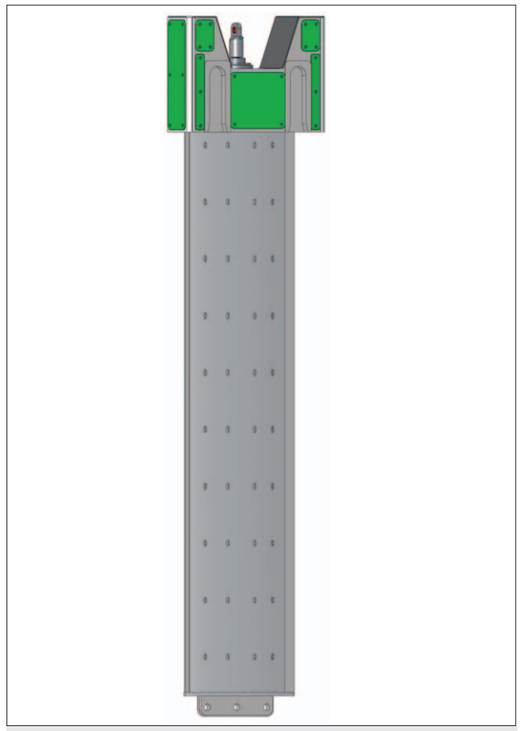
Botin 65' Caro
Lifting keel system

LIFTING KEEL

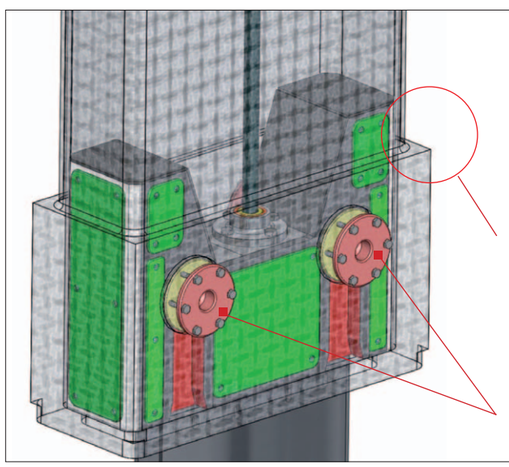
The main elements of our standard lifting keel system are:

- ***Keel head:*** made of stainless steel, with sliders with low friction and reduced swell water characteristics. Machined at CNC milling machine, it is completed with seats for the 4 pins.
- ***Lifting keel cylinder:*** it is a double acting cylinder made of 17-4-PH flanged on the head.
- ***Cylinder support:*** made of stainless steel, it is placed on the top of the trunk and it is designed to support the weight of the keel and the bulb.
- ***Keel pins:*** made of stainless steel, they're the core of our keel system; they contribute to hold the loads and they give stability to the system while sailing.
- ***Keel box:*** usually made of the same material of the boat (carbon fiber or fiber glass). To obtain the internal correct dimensions, we machine at the CNC milling machine a pre-size male mold.
- ***Fin:*** it can be made of several materials, like Weldox, SAF or forged stainless steel.
- ***Testing:*** keel box, fin, cylinder and pins are tested all together prior shipping to absure the perfect sliding inside the keel box.

Class 40' by Cantieri Navali d'Este



40' Cruiser-racer lifting keel fin



When the keel is full down it is stuck on the pins without any chance to have unwanted movements

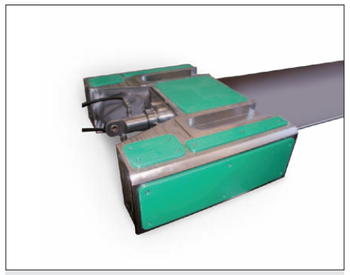
The trunk has reinforced sections in the lower part in order to keep grounding load as for other kind of systems

Pins are placed on the lower part of the trunk and they transfer the loads to the keel box even in case of grounding

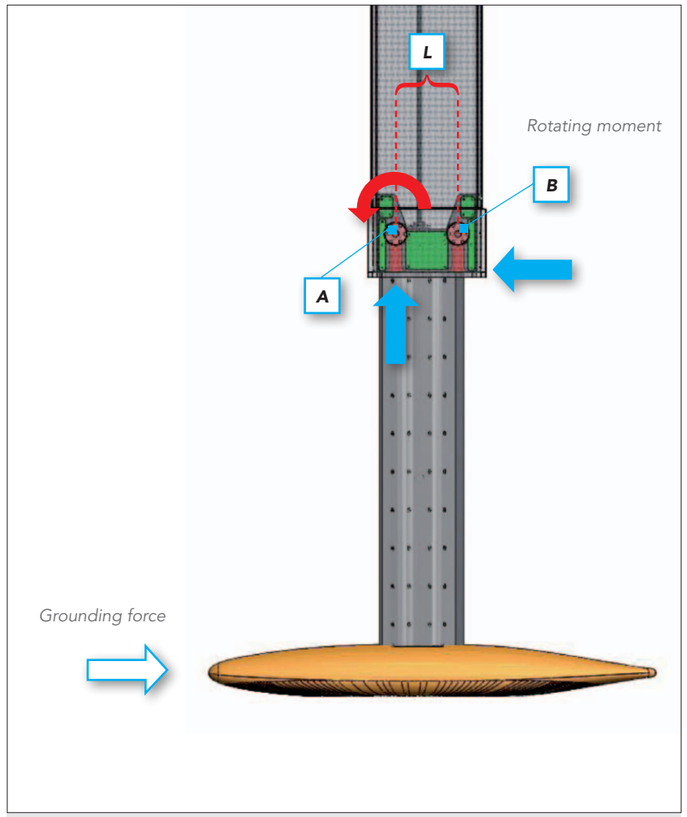
LIFTING KEEL

If a grounding occurs, the keel pins contribute to transfer the loads to the keel box. The grounding load pushes the system to rotate around pin A.

- ***Pin A*** keeps the horizontal load to balance the grounding load.
- ***Pin B***, thanks to the stiffness of the keel head, contributes to keep the fin in position and it transfers the load to the keel box through the pins and the sliding guides.
- The pins are placed as far as possible between each others in order to give good stability to the system (L).
- Lifting cylinder doesn't keep any load higher than the designed compression load. The cylinder can keep the fin and the bulb in position if the capsize occours.

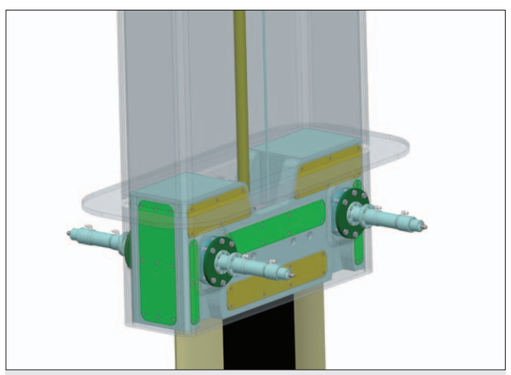


Fin head



Loads in grounding scenario

On the keel pins, it is possible to connect locking cylinders made of stainless steel.



Locking system example in a 65' sailing yacht

When the keel is up, the cylinders push against the keel shape to reduce any noisy movement of the keel at the mooring. They have an integrated linear sensor used for the logic of the lifting keel system.

The locking cylinders increase the security of the system in particular in case of capsize.

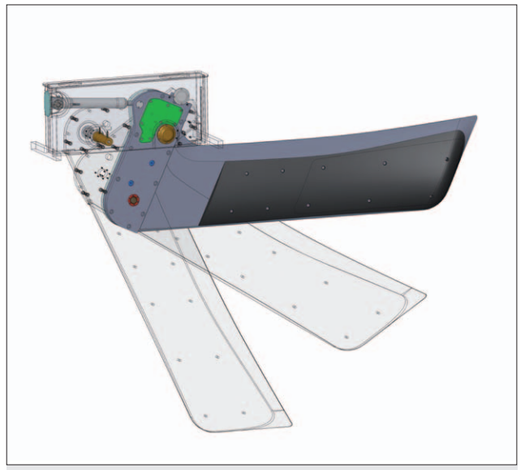
Freya 60' by Knierim Yachtbau

LIFTING KEEL

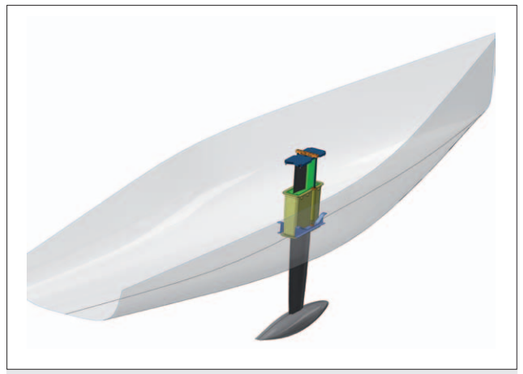
For small boats, it has been developed a lifting keel system which can easily be placed eventually inside the table basement. When the keel is down, the required space is reduced to the minimum.

The system is composed by two hydraulic cylinders and a compact hydraulic powerpack.

Systems in different heights are available on request.



The pivoting keel assembly for a 35' day sailer

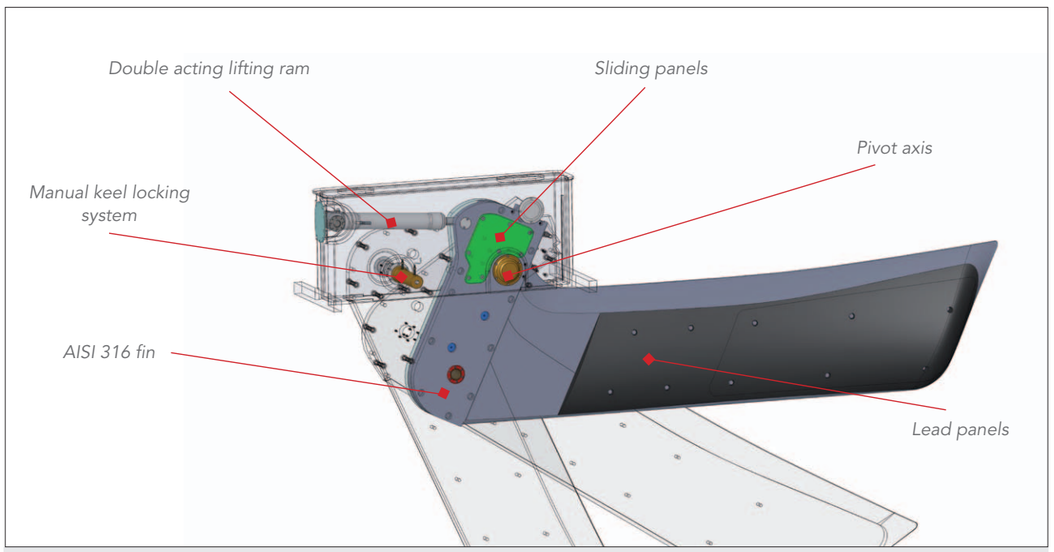


The lifting keel system for a 31' day sailer

Another way to improve the shallow water performance of a sailing boat is a swinging keel as the one we designed and machined for a 35' project.

The keel has a pivot axis transverse to the boat. A double acting ram moves the keel up and down in order to reduce the overall draft of the boat (from 2m to 0,58m); the hydraulic ram, the bearings and the main axis are fully contained inside the watertight keel box.

The keel is powered by a compact DC powerpack.
The system is completed by a recovery and a manual locking system.



Main items on a pivoting keel

LIFTING KEEL RAMS

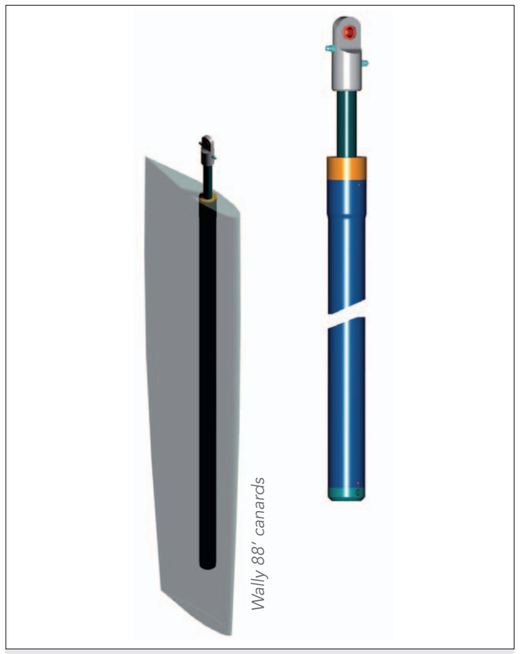
We supply also other types of lifting keel systems and hydraulic cylinders.

There are many ways to control a lifting keel and connect the lifting ram between the fin and the boat structure; the three typical systems are shown in the following images:

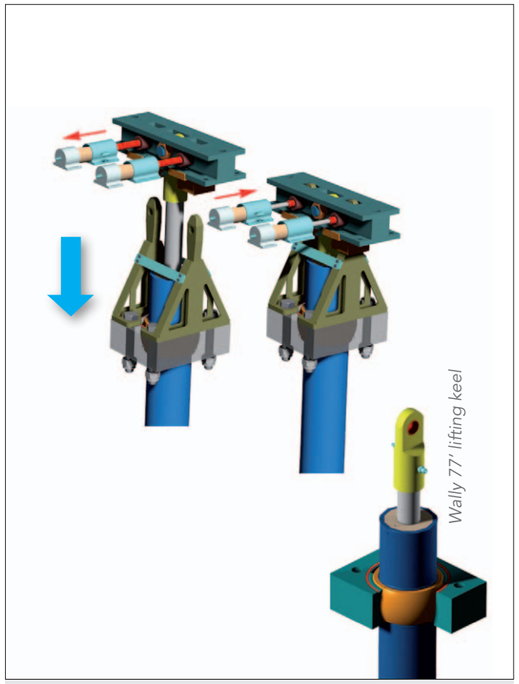
- ***flanged connection***
- ***bearing connection***
- ***pin connection***

Both flanged and bearing connection reduce the rod buckling problem and the size of the cylinder. The flanged connection arrangement needs a very precise guide system (0,5 ° max keel moving) while it is not required in the bearing connection.

The pin connection is used when there are no buckling problem, as for a canard.

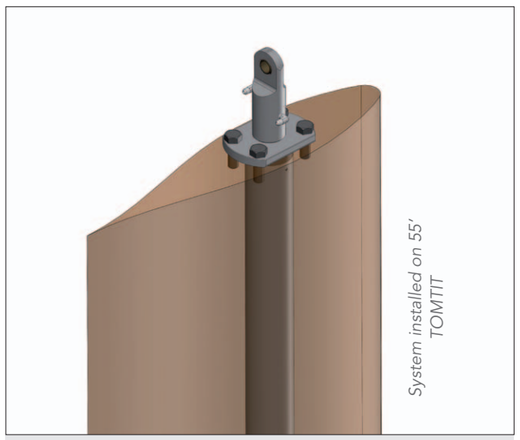


Pin connection
The rod terminal has a spherical joint to be fixed on the boat structure.
The cylinder tube is fully inside the fin.
The tube terminal has a hole to hold the fin by a pin.
This system is often used for canards.



Bearing connection
The spherical bearing is placed on the top of the fin.
The rod terminal has a spherical fixing part.

The tube of the cylinder is inside the fin.



Flange connection
The cylinder tube head has a flange bolted to the fin. The rod terminal has a spherical bearing to allow small misalignment of the system.

Both oil fittings are placed on the rod terminal in order to avoid any movement of hoses.

The cylinders are usually made of stainless steel with structural parts made of high strenght 17-4-PH.