The World’s first electrical Magnus effect Yacht stabilizer system

**RotorSwing 140**

*Stabilization without fins*

Completely electronic system without fins for stabilization at speeds from 4 to 14 knots

RotorSwing 140 achieves equivalent performance to a 1.1m² fin

Retractable under hull to reduce drag at higher speeds

System designed for vessel ranging from 15 to 25 meters

Greater safety compared with protruding fins

Simple installation without the need for hydraulics

Installation position on vessels length of the hull is not critical

Optional transom installation if required

Designed and manufactured using Dutch craftsmanship
Around 1850 the German physicist Dr Magnus discovered the phenomenon that a spinning projectile from a cannon had a deviation upward or downward depending on the wind direction. He expected that there would be a lateral deviation of the projectile but more importantly that it would hit above or below the target, this was something that everyone, including Dr Magnus, did not expect.

He made a simple test setup with a rotating cylinder in a hinged construction to prove his claim. The cylinder was rotated by pulling on a cord and placed it in the wind. It became clear from the tests that there was a lateral force dependant on the speed and prevailing wind direction. The discovery of this phenomenon was named after him: the Magnus effect. Practical applications are clearly seen in football, golf and especially tennis. Here the "backspin" and "topspin" are a clear example of how the ball is “pressed” up and down respectively because the ball is rotating in different directions. Magnus did not quantify his discovery; he realized the impact, but not the huge potential. RotorSwing have realized the effects potential and applied it to our stabilizer system.

The diagram above illustrates the principal. The cylinder is shown moving right to left and rotates clockwise. The rotating cylinder bends the flow of water over itself when rotated clockwise thus generating lift in and upward direction. You can see that the streamlines at the top have a longer distance to travel and so the speed is greater than those at the bottom. We have to thank the physicist Bernouilly for this understanding and the results it has i.e. pressure times velocity is a constant. The path over the top of the cylinder is a longer distance and so the flow has to move faster. At the higher speeds on the topside, the pressure has to reduce in order to keep the outcome constant and hence the resultant force is upwards. We call this force the "Lift".

What does all this have to do with stabilizers?

The best known roll damping systems for motor yachts are fin stabilizers. They are effective and relatively simple in their design. They generate a force when moving CW or CCW and the generated Lift can therefore be used in roll damping with great effect.

There are two main drawbacks to conventional fins:

1. Fin stabilizers need a proper water velocity and so at speeds below 5-6 knots they do not perform well.
2. Fins permanently protrude outside the hull reducing vessel safety and performance. To reduce the chance of damage often undersized fins are installed within the vessels beam/keel envelope that do not generate enough stabilizing Lift

The disadvantages of fin stabilizers are addressed by the RotorSwing 140 system

1. Using the RotorSwing there is no need to sail at high speed to get optimum roll damping as the RotorSwing performs very well from 3 to 14 knots which in turn increases the vessels range.
2. When the RotorSwing is not needed it can be “Parked”. Thus less resistance and less vulnerability.

At speeds above 14 knots, the RotorSwing must be retracted by activating the “PARK” button on the control panel. The resistance in the “DRIVE” position becomes too large. However vessels travelling at speeds above 14 knots usually enjoy good stability from being on the plain.
What does the RotorSwing look like?

The rotors of the RotorSwing, when not used, are neatly folded into the streamline of the water under the hull substantially reducing any speed loss. The rotors are almost entirely in the turbulent boundary layer of the vessel and the hydrodynamic design of the rotor allows water to easily flow over the unit.

The adjacent image shows the rotor prototype installed on board a Linssen 430 GS motor yacht.

RotorSwing 140 compared with fins

The 140 version of the RotorSwing is 140mm in diameter and 1000 mm in length. Thus a projected surface area of only 0.14 m². These rotors are relatively small however the performance can be compared to fins of 1.1m²! This says something about the enormous potential of such an installation.

A technological breakthrough

_RotorSwing are proud to introduce the first electric Magnus effect stabilizer system in the world._ As well as being electric the system is also retractable. No problems with assembly of hydraulic pumps, oil reservoirs and expensive high pressure hydraulic lines. No leakage and complex installations.

This picture is a "fish eyes view" of a 15m motor yacht with rotors in a deployed position.

Protected against damage when docking

The RotorSwing is designed in such way that the rotors turn to a neutral “parked” position automatically when the vessel’s reversing gear is switched to neutral or astern. When docking or manoeuvring switching to the "parked" position couldn’t be simpler. To re-activate the RotorSwing the DRIVE switch is pressed and the rotors become active.
The drive motor for the rotation is shown horizontally and the swivel motor stands vertically. The manual override hand wheel can be seen mounted on the side of the swivel motor. The rotor and drive motor rotate over 90 degrees or less depending on the setting of the electrical switches on the gearbox. The rotor is held by a safety coupling so that in case of a collision any damage to the ship will be avoided.

The Control

Operation of the system is extremely simple: just “PARK” and “DRIVE” buttons. Led’s indicate the status of the RotorSwing. The control uses the latest microprocessor technology allowing it to constantly “pro-actively” read the sea conditions in order to optimize performance. The system will dampen the roll caused by a wave before it even hits the vessel.

Manufacturing facility and designers

The RotorSwing has been designed and developed by Theo Koop, formerly of KoopNautic stabilizers and is manufactured at the Dutch based facility, Wetech BV, who also manufacture the Super Yacht industry leading Quantum range of stabilizer systems for vessel ranging from 30 to 160 meters.
How the system out performs fins

The following explanatory sketch is of a rotor and a fin installed together in a vessel of about 15m. The fin on the port side has a size of 0.6 m² and is limited in size so as not to protrude past the beam/keel envelope. For safety reasons protrusion past the beam/keel envelope is not preferable. The dotted line illustrates the envelope.

The RotorSwing stabilizer shown on the starboard side has a comparable area of approximately 1.1 m² and eliminates any permanent protrusion past the envelope when retracted. The active area, comparable to the surface of a fin, is thus over 80% more!

For roll damping both Lift force and moment arm are of interest. The moment arm is the line between the Lift and the roll centre of the ship. At the fin in this example the Lift has a relative large angle with the moment arm and thus can only use 65% of its force (L1) for roll damping. The horizontal placement gives the rotor stabilizer on the right a near full force (R1) available for roll damping which means it loses only 5%. In addition, the moment arm is nearly 20% higher for the rotor stabilizers. So even if the rotor had an identical Lift generated as a fin (and this may be the case at higher travel speeds) the larger moment arm causes a significantly improved roll damping moment.

The stabilizing moment (lift force times moment arm) is:

- For the fin stabilizer 65% x 2244 = 1458
- For the rotor stabilizer 95% x 2665 = 2531

Even when the lift force is the same as the fin, this is nearly a factor of 1.75 greater performance!

In addition to that, the lift of the rotor is a factor 1.83 higher than that of the fin, in particular at speeds around 6 knots and lower. The degree of efficiency is 1.75 x 1.83 = 3.2 times higher!
Technical details and dimensions

Specifications

Required load: 1500W per rotor
Average power consumption: 1000W per rotor
Voltage: 230V 1 phase AC
Supply box dimensions in mm: 400 * 400 * 150
Electronic control unit dimensions in mm: 400 * 300 * 100
Operating panel size: 110mm diameter
Control Functions: DRIVE and PARK switches only, FORCED ROLL via hidden switch
System Weight: approx 139 kg per rotor
Steel welding bushing dimensions: 214mm diameter, 250mm high
Rotor material: epoxy / glass laminate
Elbow: cast steel with special coating
Contingency retraction: by hand wheel
Lubrication: via nipple on housing (once a year or 250 hours)
The Future...ZeroSpeed at anchor Stabilization by RotorSwing

For customers who require a dual purpose system for stabilization whilst anchored and underway, RotorSwing is further developing a ZeroSpeed system based on the Neenam Patent. The electronic control system is created using a completely new digital approach.

For vessels within the Super Yacht market stabilization whilst anchored has become a standard requirement. When vessels drop anchor, comfort on board becomes most important and a stabilization system that can provide that comfort is a must. This type of stabilization has always been limited to larger vessels with a 5 second roll period or above….not anymore.

The RotorSwing ZeroSpeed system will provide stabilization for vessels with a 3 second roll period in the 15 to 25 meter range and above whilst maintaining a very low noise operation. The ZeroSpeed system is expected to achieve a far greater reduction in roll than any equivalent fin system.

If ZeroSpeed stabilization is of interest, please let us know and we can give further information on the stage of development.

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<th>Achieved Objectives:</th>
<th>Goals for the future:</th>
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<tr>
<td>1. Full electric driven system - no hydraulics</td>
<td>1. Complete development of the ZeroSpeed system .</td>
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<td>2. Swing and retract away reducing hull protrusions</td>
<td>2. Further refinements of the &quot;Rake&quot; positioning of the rotors reducing the resistance at higher speeds.</td>
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<td>3. More effective than known systems, especially at low speeds</td>
<td>3. Establish RotorSwing as a standard requirement for vessels where stability is of importance.</td>
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<td>4. Adaptive 3-term control electronics</td>
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<td>5. Simple automatic operation with few buttons</td>
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<td>6. Easy to install</td>
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<td>7. Big moment arm, allowing greater roll damping</td>
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<td>8. High &quot;static heel&quot; with big advantages in following seas</td>
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