Installation guide

SPS55 series v1.2.0

Designed for vector fins™

Patent pending:
PCT/NO2013/050067

Made in Norway

© Sleipner Motor AS 2016

www.side-power.com
sidepower@sleipner.no
# Installation Instructions SPS55 - 1.2.0 2016

**INDEX**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Stabilizer functions</td>
<td>3</td>
</tr>
<tr>
<td>Installation planning</td>
<td>3</td>
</tr>
<tr>
<td>Safety</td>
<td>4</td>
</tr>
<tr>
<td>Important notice</td>
<td>4</td>
</tr>
<tr>
<td>General description</td>
<td>4</td>
</tr>
<tr>
<td>Safety precautions</td>
<td>4</td>
</tr>
<tr>
<td>Yacht design considerations</td>
<td>5</td>
</tr>
<tr>
<td>Key Components</td>
<td>6</td>
</tr>
<tr>
<td>Measurements</td>
<td>7</td>
</tr>
<tr>
<td>Installation measurements</td>
<td>8</td>
</tr>
<tr>
<td>Hull forces</td>
<td>9</td>
</tr>
<tr>
<td>Fin Positioning</td>
<td>10</td>
</tr>
<tr>
<td>Mechanical Installation</td>
<td>14</td>
</tr>
<tr>
<td>Mounting of the stabilizer actuator assembly</td>
<td>18</td>
</tr>
<tr>
<td>Hydraulic installation</td>
<td>21</td>
</tr>
<tr>
<td>Electrical installation</td>
<td>26</td>
</tr>
<tr>
<td>Fin installation</td>
<td>37</td>
</tr>
<tr>
<td>Checklist</td>
<td>47</td>
</tr>
<tr>
<td>Start-up</td>
<td>49</td>
</tr>
<tr>
<td>Sea trial</td>
<td>52</td>
</tr>
<tr>
<td>Control panel information</td>
<td>54</td>
</tr>
<tr>
<td>Fin removal</td>
<td>58</td>
</tr>
<tr>
<td>Maintenance</td>
<td>59</td>
</tr>
<tr>
<td>Warranty statement</td>
<td>63</td>
</tr>
</tbody>
</table>
**Stabilizer functions**

The fin stabilizers function is to reduce the roll of the boat, and how efficiently they can do this will depend on several factors. The main factor is of course the size of the fins compared to the boats “stabilizing requirements”, but also the fin positioning on the hull which in turn decides the angle they work and leverage arm length around the boats centre of gravity are important factors to overall efficiency.

In principle, the bigger the stabilizer fins, the more you can reduce your roll, but there are certainly limits also, because there will always be a limit to the size of fin stabilizers you can or wish to fit on a boat. These limitations are typically decided by: space requirements compared to available space in the boat, a limitation in the added drag and potential speed loss you wish to have, budget limitations and so on. Your Side-Power representative will be able to help make an educated decision for what is the best solution (or compromise if you wish) for your boat and your preferences.

The typical or default size suggestion will be that the stabilizers are calculated to the best of our abilities and based on the provided data to reduce the roll at your chosen “minimum stabilizing speed” of approximately 5 degrees. But please note that this is not a guaranteed figure as there are still many factors out of our control. They will reduce the roll less at lower speed, and more at higher speeds. The “AnySpeed” or as also called, “zero speed” or “at anchor” stabilization, if chosen, is by default calculated to reduce the roll by approximately 4 degrees.

If these factors of roll reduction are less than what you are looking for, please double check the stabilizer sizing with your Side-Power representative before starting the installation so that we can be sure that you are not installing parts and products that will not meet your expectations.

**Installation planning**

Please follow this general guide for steps to prepare and plan your installation process:

Find the best possible position of the fins based on the information provided in the sections about:
Safety and General precautions
Measurements
- Please note the very flexible installation methods possible including off-set angle installation
- possible with Side-Power stabilizers as this might enable installation in positions more suited and efficient than possible with some other brands or types of fin stabilizers.

Fin positioning
Hull forces
- Ensure that it is space to do the reinforcement of the hull if necessary

Plan the installation of the hydraulic parts including hose / pipe runs based on the information provided in the sections:
- Basic hydraulic installation
- AC power pack
- Noise considerations
- Relevant hydraulic diagram with hose specifications for your particular system

Plan the installation of the electrical parts including the control panel and wiring runs based on the information in the sections:
- Power supply
- S-link wiring
- Control panel installation
Important Notice

Sleipner Motor AS is a manufacturing company of marine equipment (Side-Power) and not a Naval Architectural company & therefore will bare no responsibility in regards to the installation of our products onto sea going vessels. This includes any requirement for the vessels hull reinforcement, change in stability, its dynamic performance, its weight and moment, its noise proofing or its watertight integrity after installation during normal operations or in the event of a collision.

It is the responsibility of the installer/boat builder to determine hull reinforcement requirements, ensuring that sufficient strengthening measures are in place & the vessels hull will withstand & maintain watertight integrity in the event of a collision of our product, impacting an immovable object when the vessel is underway.

The recommendations made in this manual are to be used as starting guidelines only, and Sleipner Motor AS (Side-Power) strongly recommend that advise prior to installation should be obtained from a naval architect familiar with the particular vessel brand, prior to installation.

General description

The Side-Power Stabilizer System consists of two under water moveable fins located on shaft and actuator assemblies penetrating through each side of the yachts hull and hydraulically powered with a Side-Power compact Hydraulic System. The system is electronically gyro controlled utilizing the Side-Power S-link (CanBus) network system & stabilizes the yachts rolling motion in the water at various speeds and sea conditions or at anchor (optional).

General Information, Safety Precautions and Lethal Warnings.

Prior to installation it is important the installer reads this manual thoroughly to ensure necessary knowledge of the product.

The Installation & User Manual is intended to support educated/experienced marine engineering personnel.
and therefore not sufficient in all details for the correct installation of the product - general engineering standards & practices must be followed.

Personnel are required to use necessary personal safety equipment to prevent injury in accordance with health and safety directives.

The stabilizer product includes heavy parts therefore suitable lifting and support equipment is required during installation & removal to prevent material damage or personnel injury. Before any servicing work is carried out on the stabilizer system, ensure electrical & hydraulic power is switched off.

**WARNING!**

Stabilizer systems with ‘at anchor’ function installed & ‘Auto’ selected can suddenly operate & move without warning.

During yacht lifting operations, ensure the stabilizer fins are in the locked/neutral position and lifting personnel are informed that stabilizer fins are installed, preventing the danger of snagging the lifting slings & damage to the yacht, its equipment or injury to personnel.

**NOTE!**

Yacht transportation over land with road vehicles may require for the removal of the stabilizer fins & shafts. Instruction procedure is found in the manual.

Hydraulic operated equipment must be clean and debris free at all times, therefore do not remove the equipment orifice protection blanks or covers until ready for use, preventing ingress of undesired contamination.

**WARNING!**

Hydraulic equipment (including Nitrogen pressure filled accumulator) operates at high pressure; therefore ensure that all system pressure is released before carrying out any servicing work. Never carry out any welding, soldering or mechanical work on the accumulator vessel!

Avoid applying anti-corrosion protection lubricants to the hydraulic actuator cylinder rods as this can attract dirt and debris causing oil leaks due to damage seals.

On completion of the installation and yacht launch thoroughly check for leakages & the yachts hull watertight integrity is maintained.

**Yacht design considerations**

Provide servicing access hatches to stabilizer actuator assemblies for the removal & installation of Stabilizer fin shafts as & when required.

When the Stabilizer System ‘At Anchor’ function (optional) is installed, position and sound proof the hydraulic power pack (AC generator & pump)& sound proofing of the actuator assembly compartments and hydraulic hose runs, such that the noise the equipment emits doesn’t disturb sleeping passengers.

Provision is made to ensure yachts watertight integrity is maintained in the event of a fin collision.
KEY COMPONENTS

Bolts

Hull plate

Shaft sea hub

Shaft nuts

Locking washer

Cylinder

Encoder cpos. sensor cover

Cylinder
**MEASUREMENTS**

Actuator weight: 100kg

EXACT HULL THICKNESS!
when inside is finished it must be absolutely flat
and average parallel to outside hull: Thickness
49,00mm (+0 / -3mm tolerance) (Sealant included)

Fin actuator assembly may be installed in any
convenient radial 360° position in the hull.

**IMPORTANT!**
Ensure to consider and plan the positioning/orientation of the actuator to
achieve full fin range of movement in both directions. It is also important to
achieve correct fin alignment that is parallel to the yacht’s keel.

**Vector fin:**

<table>
<thead>
<tr>
<th>Vector fin:</th>
<th>VF650</th>
<th>VF800</th>
<th>VF1050</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size (m²):</strong></td>
<td>0,65</td>
<td>0,80</td>
<td>1,05</td>
</tr>
<tr>
<td>A (mm):</td>
<td>1271</td>
<td>1395</td>
<td>1618</td>
</tr>
<tr>
<td>B (mm):</td>
<td>661</td>
<td>733</td>
<td>847</td>
</tr>
<tr>
<td>C (mm):</td>
<td>337</td>
<td>337</td>
<td>429</td>
</tr>
<tr>
<td>D (mm):</td>
<td>912</td>
<td>1035</td>
<td>1186</td>
</tr>
</tbody>
</table>

Fins have zero weight in water. Patent pending PCT/NO2013/050067

**NOTE!** Please see next page for further space requirements and positioning recommendations.
**Important!**

Ensure that all equipment with physical functions (actuators, valves, electrical & hydraulic connection points) are installed so that you allow space in the boat after reasonable dismantling of other parts or interior / furniture (fit service hatch or similar) for service access as per the following illustrations to get ample room for maintenance and any necessary service or repairs.

*This is the installer / boatbuilders full responsibility.*
Note that all calculated values are nominal and found by equilibrium considerations and also that various coefficients are inaccurate as hull design etc will affect the actual fin effect. Dynamic effects such as jumps/impacts with waves, backflow closing of valve etc could further increase the hull/shaft loads. Therefore all dimensioning should account for this by using a safety factor.

The aft top face of the fin is deliberately made weaker than the rest of the fin so it will break easier in case of an impact with the hull. If the shaft bends by hitting something in the water or the ground, the fin is still a strong part.

We generally advice that the hull is strengthened, or at least made with materials suitable to sustaining impacts over the total length of the fin within an area of approximately 10 degrees fin rotation in each direction from center as an extra safety measure to be absolutely sure that the fin is prevented from breaking through the hull in a collision situation.

The Vector Fin design also has benefits in hull safety, with the fins being curved, any impact with the ground will not only bend the shaft backwards, but also outward, allowing the fin to break away with less stress on the hull.
FIN POSITIONING

No part of the fin should be above water level during normal roll motion/under normal sea conditions.

Fins should ideally not extend outside the beam or below the keel when in neutral position.

Fins should be placed as far outboard as possible, and NOT inline with the propellers, to ensure avoiding possible disturbance of the waterflow to the props which in the worst case can cause vibrations / cavitation.
To avoid unwanted influences on the steering characteristics, the fins should be placed close to the vessel longitudinal center of gravity (LCG) - If unknown, this is usually a little aft of 50% of the waterline length.

For high speed vessels, the fins should be placed with trailing/leading edge within middle 1/5 of waterline length at speed and not in front of the LCG.

For vessels with top speed under 15 knots, fin may be placed within the middle 1/4 of waterline length.
**Transversal fin positioning of Vector Fins™**

With Vector fins™ it is a priority to push the fins as far outboard as possible to achieve the most possible leverage for the fins forces (unlike standard fins, see illustration on front page).

With Side-Power stabilizers it is possible to install the fins so they have different stroke angles innboard and outboard as the locked center and cruising center is totally flexible because they are locked hydraulically. Another point that is well worth considering as such is to avoid having to cut off any of the back top of the fin (normal on most fins on hard-chine boats) as this cut-away will cause added resistance/drag by the fin due to the “bigger hole” this area will make in the water in higher speeds, as well as the big distance the aftward part of the fin (the most efficient area in at anchor stabilization) will loose force also as part of the water will pass easier between the hull and the fin.

Also, because of the outward ”bend” of the fins, keeping the lower part inside the boats ”envelope” will also result in the upper part of the fins being further inboard than they would on straight fins – so you will naturally have less of an outboard stroke in the upper part of the fin (along the hull).

There are many considerations for fin and actuator positioning, and often it is the inside configuration and space that ends up playing a major part of the decision.

In general – push the actuators as far as possible outboard – while keeping at least 22 degrees of outboard stroke as a minimum (if less, and lower part is within boat envelope, a small cut-away of the back upper part can be done as a compromise). If inside configuration / access to inside parts of actuators etc. dictates moving further inboard this is fine, but the performance will be reduced slightly due to less leverage arm for the stabilizing force applied by the fins.

Measurements along hull bottom outwards to chine(upper) and outside boat ”envelope” (lower) in mm, center shaft to chine start / outside envelope:

<table>
<thead>
<tr>
<th>Fin size</th>
<th>At maximum: 38°</th>
<th>At minimum : 22°</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF650</td>
<td>Upper / lower</td>
<td>Upper / Lower</td>
</tr>
<tr>
<td></td>
<td>575 / 810</td>
<td>350 / 625</td>
</tr>
<tr>
<td>VF800</td>
<td>642 / 900</td>
<td>390 / 695</td>
</tr>
<tr>
<td>VF1050</td>
<td>731 / 1016</td>
<td>444 / 791</td>
</tr>
</tbody>
</table>

---

**“Boat” view**

**“Top” view**
In case of the fin positioning being so that you need to cut down some of the top aft end of the fin to avoid it hitting the hull (very typical on planning boats with hard chines), please do so as per the instructions below.

The fins are made with a pre-molded foam core with a vacuum injected Vinylester skin.

1/ Cut away the desired area – “dig” / cut out the foam core 7mm all the way along the cut area – but approx. 18mm at the edges.

2/ Fill this with epoxy filler, level with the fin outer skin. Grind the GRP back on the fin top edges to allow mat to be applied flush later on.

3/ Then apply a couple of layers of GRP mat and epoxy over the top and onto the external skin. The GRP should then be sanded/ground flush with the original surface. The repaired surface should be primed with the customers choice of Anti-foul paint prior to the application of the final coats of Anti-foul.
Using the pilot hole as centre line cut a **Ø230 mm diameter hole** (refer to template fig 2) internally in the yachts hull using a suitable cutting Jig & tool (Fig 1b/1c).

**IMPORTANT!**
Reinforce the yachts hull for stabilizer installation in accordance to Naval ships architects recommendations.

When the optimal position of the stabilizer fins is allocated, drill a 21mm pilot hole at the fin shaft centre line position externally through the yachts hull (Fig 1a).
Adjust the hull thickness to the required measurement of 49mm (Sealant included) (SPS55) and ensure that the internal and external surfaces are parallel and absolute flat. (Fig 1e, 1f & 1g).

**IMPORTANT!**
Tolerances for the hull thickness is +0/-3mm - the thickness of the hull must NOT be larger than 49mm.

This tool can be delivered on request.
Refer to template (Fig 2) mark the positions of the holes for the securing bolts

**Fig. 2**

**NOTE!**
Use the external securing plate as template.
Cut & drill the holes using appropriate cutting and drilling equipment (Fig 1j).

**Fig. 1j**

Apply a generous coating of water tight sealant to the mating surface (Fig 1k).
It is of ultimate importance that the surface is perfect within tolerances and parallel with the outer hulls angle in the centre of the actuator. The surface must be flat.

**Fig. 1k**

**IMPORTANT!**
Sealant must be compatible with hull material. Naval architect/Boatbuilder must confirm this.
MOUNTING OF THE STABILIZER ACTUATOR ASSEMBLY

Using appropriate lifting equipment (sling) to lift the Stabilizer Actuator.

**IMPORTANT!**
Do not lift or attach lifting equipment to the actuating cylinders or their rams.

Carefully lower the Stabilizer Actuator Assembly into the hulls actuator hole & place in the correct orientation before laying onto the sealant mounting surface. Utilize two of the securing bolts to assist temporally lock the correct Actuator Assembly positioning (Fig 1m).

**IMPORTANT!**
Make sure to apply sealant in the gap between center hole in hull and the shaft sealant hub. Sealant must be compatible with hull and hull plate material. Naval architect/Boatbuilder must confirm this.

**IMPORTANT!**
Holes must be countersunk to allow room for bolt heads and sealant without damaging the hull.
Apply a coat of water tight sealant externally to the hull surface (Fig 1q). Make sure to fill up around the bolts.

**IMPORTANT!**
Sealant must be compatible with hull and hull plate material. Naval architect/Boat builder must confirm this.

Place the External Securing Plate over the Stabilizer shaft & onto the external hull mounting surface (Fig 1r). 

Take care that the preassembled actuator assembly hoses are not obstructed in the yacht's bilge, avoiding any risk of damage from sharp edges or chaffing (Fig 1p).
Coat the securing bolts with sealant and insert into the External Securing Plate, the Yachts hull and the Actuator Assembly and secure each with a plain washer and a nut (Fig 1s). Tighten & torque load the securing bolt nuts diagonally to avoid misalignment to 60 Nm.

**IMPORTANT!**
Ensure to connect a ground wire from the yachts main bonding/anode system to each actuator. (Fig 1t)
Hydraulic system installation
Refer to Side-Power ‘Hydraulic System Installation, Start-up, User & Service Manual’.
Actual system drawing will be sent on request.
Example of Standalone power pack (10 44xx) system
Actual system drawing will be sent on request.
**Actuator Valve Unit.**
The actuator Valve Unit requires to be located as close as possible to the Actuator and must be mounted on a rigid flat surface. It is a compact and silent unit, but we recommend to use a vibration dampening material behind them to avoid any high frequency noise/vibration to go into the boats structure. Weight: Approx. 1.6kg.

The valve have multiple functions:
1. Combiner for the cylinder hoses from the dual hydraulic rams
2. Electric operated decouple valve
3. Manual operated decouple valve

**Manual operation:**
- Push the red button for manual bypass/decoupling.

Fins are now free and can be moved manually to required position.

**Hose Connection:**
Note! Some banjo fitting brands used in combination with metric or BSP crimp fittings can cause interference between the swivel nut and the cylinder rod end.

If required, the electrical operated decouple valve coil can be removed during hose installation for better access to the hose fittings.

**IMPORTANT!**
Electric operated decouple valve (coil nut) to be re-torqued to 6,8-9,5Nm (5-7 Ft -1bs) Over torqueing of the coil nut will damage the valve function!

**Fin Valve Unit.**
The Fin valve unit should be located as close as possible (Recommended < 2,5m (max 3,5m)), to the Actuator Valve Unit (Fig 5a) with recommended hose dimensions (System drawings). Use minimum 2 layer steel braded hoses.

If installed more than 2,5m from the actuator, very stiff (non expanding) hoses or even better, some of the distance in rigid piping is necessary to not make the fin movement “soft” by the hoses expanding with varying pressure. Always fit hoses to hull on soft mounts.

The unit must be mounted on a rigid flat surface (Fig 5b) - and we recommend to use a vibration dampening material behind them to avoid any high frequency noise/vibration to go into the boats structure.

**IMPORTANT!**
The unit must be mounted on a rigid flat surface (Fig 5b)
**Accumulator tank**

All stabilizer systems have accumulator tanks. The main purpose of the accumulator is to create additional capacity and quicker response to the stabilizing system. It also have an pulse dampening effect to the system.

**IMPORTANT!**

Due to logistic reasons most accumulator tanks are shipped without nitrogen($N_2$) (if nothing else is agreed when order was placed) in the pressure bladder in top of the accumulator tank. Therefore, make sure to fill the tank or check the pressure before startup.

For Nitrogen($N_2$) filling and testing procedure - see HYDAC manual.

Bladder charge pressure - 40bar.

Base kit (Filling kit) - 321308 covers these countries: Austria, Belgium, Check Republic, Denmark, Finland, Germany, Netherlands, Norway, Poland, Sweden, Switzerland.

For other countries, additional adapters must be used, see HYDAC manual for correct adapter.

**Running the system without any nitrogen/pressure on the tank will damage the stabilizer system.**

---

**Fin Valve Unit manual decouple operation**

The manual operated valve (Fig 5c) can be used to allow manual movement of the Stabilizer Actuator Rams/Stabilizer fins.

- Unlock valve by turning the 9/16” lock nut anti-clockwise
- Open the valve by turning 3/16” Allen key anti-clockwise.

Fins are now free and can be moved manually to required position.

**IMPORTANT!**

Manual decouple valves have to be fully closed during normal operation of the stabilizer system.

---

**WARNING!**

If valve is unlocked and opened be aware of unexpected movement of fins and cylinders. Especially if boat is afloat!
**Main Valve Unit**
The following functions and ports are integrated into the Main Valve unit:
(Fig 5f)

- Accumulator Unloading Valve (1)
- LS-V: Load sense from Tank mounted valve unit (2)
- PC: Pressure to Cooling Pump (3)
- Cooling Pump ON/OFF valve (4)
- Feed from Main Pump(s) ON/OFF (5)
- P-AC: Pressure from AC Pump (6)
- P-MAIN: Pressure from Main Pumps (7)
- T: Return to Return Combiner (8)
- LS-P: Load sense to Main Pumps (9)
- Manual Unloading Valve (10)
- P-STAB: Pressure to Fin Valve Units (11)

**IMPORTANT!**
During normal operation, the manual unloading valve have to be fully closed (tightened clockwise).

**Hydraulic hoses**
Ensure to connect and route the recommended hoses (System drawings), so they have full range & freedom of movement to avoid snagging, chaffing or damage from sharp edges of the yachts structure, the stabilizer components or each other during stabilizing operations.

**Oil filling**
Prior to filling the tank, prime the pump(s) through their upper drain port.

Fill the oil tank with correct hydraulic oil through the oil filling filter. Use new and clean mineral based hydraulic oil with anti-wear additives, viscosity ISO VG 46 (by ISO 3448). Or, 32 for arctic climate.

The oil level in the tank should be approximately 3/4 full, or to the upper edge of the indicator sight glass. Because vessels heels and the fact that we have an air breathing filter in the oil filler cap, avoid higher oil level than what the sight glass can indicate.

**Pump damages caused by running pumps without oil is not covered by warranty.**
Mounting the ECU:
Mount the ECU (Electronic Control Unit) #321300 on a bulkhead perpendicular to the keel, as central as possible in the boat (so it moves as little as possible).
A typical location is the forward or aftward engine room bulkhead, but try to avoid that the ECU is affected by all engine vibrations.
It must be installed with the cable outlet facing DOWN - the direction, if it is mounted facing forward or aft is a setting done in the control panel during setup.

Mounting the Control Panel:
1. Cut a rectangular hole in the dashboard according to the drawing below.
2. Drop the panel into the cut opening, and fit the securing clamps into the panel openings.
3. Tighten the clamp screws.

Wiring the control system:
An overview of the control system components are shown in Figure 1.

ECU Power Supply
Connect the ECU power supply terminals to a 15A fused 24V DC supply.
The supply should be routed through a switch that enables the user to turn the system on or off.

FIN Actuator Encoders
Run one #321702 cable from each fin actuator encoder to the ECU. The encoder has a cable fitted, that the #321702 connects to.

FIN Actuator Valve Terminal Blocks
Attach the #321700A wire harness to the Fin Valve Terminal. See Figure 1b for reference.
Run the #321701 cables from the Fin Valve Terminal harness to the ECU.

Main Valve Unit
See Figure 1c for reference.
ELECTRICAL INSTALLATION

Figure 1

Available cable lengths:

<table>
<thead>
<tr>
<th>Length</th>
<th>1m</th>
<th>2m</th>
<th>3m</th>
<th>4m</th>
<th>5m</th>
<th>7m</th>
<th>10m</th>
</tr>
</thead>
<tbody>
<tr>
<td>321701</td>
<td>321702</td>
<td>321703</td>
<td>321704</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STBD Encoder #321098B

PORT Encoder #321099B

STBD Valve Terminal

PORT Valve Terminal

AUX terminal box #321710

DC Power Supply 24V/15A

Main Power Switch

GPS Antenna

Junction Box

S-link

Control Panel #321720

Actual system drawing will be sent on request.
Figure 1b

Decouple valve connector

Lock valve connector with LED A/B

Servo valve connectors A/B

NOTE!
Connectors A/B can be placed either way. The valves direction will automatically be identified at startup.

Figure 1c

IMPORTANT!
All electrical connections and wiring must be secured with cable ties appropriately and not in conflict with actuator cylinder hoses.

To AUX Terminal box (#321710)

Alt. 1.: Part of Tank Cable Harness
Alt. 2.: To PHC (Thruster control Cabinet)
Wiring the control system (cont.):

*Control Panel*
Run the Control Panel cable #321720 from the dashboard to the ECU. Attach the green power supply connector to the input terminal on the Control Panel. Attach the red data connector to the Control Panel connector marked “PLC”.

*S-link*
Basics: The system need a spur drop cable (green) for each s-link unit and a backbone loop through the yacht where you connect all the spur cables included a power feed spur on T-connectors. The stabilizer system will need s-link connection to the control cabinet and the SPSC controller. The stabilizer control panel is “hard wired” from the SPSC cabinet, so no s-link cable to this panel. If you have upgraded to SEP thrusters you will also have the thrusters and their power switches on the s-link. See S-link overview for cabling references.

*AUX terminal box*
The AUX terminal box is the termination point for connections to the hydraulic system sensors and controls. The AC powerpack control signals also wire into this box (if fitted). Wiring diagram shown in figure 2.

Reverse detection switches: These sensors will need to be installed on the main engine gearbox. By detecting the pressure level in the gearbox control, we will monitor the drive direction. When gearboxes are in reverse, our fins will automatically be locked in center position to avoid damage. Sensor port position can vary between different gearbox models. Please contact your engine supplier for instructions. In some cases (e.g. pod drives) you will not have any pressure port available for these switches and a signal relay solution must be discussed with engine supplier. 2 pcs of reverse detection pressure switches are included in our SPSC controller kit.

*GPS receiver*
The GPS input cable 321704 must be spliced with the GPS antenna cable in a proper location. The system can be delivered with SA-920 GPS receiver. Connect the receiver according to the correct diagram in figure 3.

Wiring the AC Power Pack:
In case of single phase supply systems, a Variable Frequency Drive (VFD) is delivered as part of the Power Pack. The VFD is used as an AC motor starter device, that supply 3 phase voltage for the AC motor. A separate breaker is required for the VFD supply. Recommended breaker size and the wire gauges can be found in the VFD quick start guide. Cable from VFD to motor should be of screened type, suited for VFD use. For further reference, see Quick Start Guide supplied with the VFD. See figure 4 for main circuit wiring. Control signal wiring shown in figure 2.
Example of S-Link wiring with Stabilizers and DC PRO Thrusters.

You need:
2 x 6 1327 End terminators
9 x 6 1326 T-connectors
1 x 6 1328 Power spur
8 x 6 1320-xxM Backbone cables
8 x 6 1321-xxM Spur cables

NOTE!
The yellow wire(shield) in the Power spur must be connected together with the black wire to Battery minus as in the drawing below.
Example of S-Link wiring with Stabilizers and HYD Thrusters.

You need:
- 2 x 6 1327 End terminators
- 5 x 6 1326 T-connectors
- 1 x 6 1328 Power spur
- 4 x 6 1320-xxM Backbone cables
- 4 x 6 1321-xxM Spur cables

**NOTE!**
The yellow wire (shield) in the Power spur must be connected together with the black wire to Battery minus as in the drawing below.
Figure 2
General AUX box wiring diagram

NOTE!
This diagram is relevant when a Variable speed controlled AC pump is installed.
Figure 2b
Example of Standalone power pack (10 44xx) system.
Actual system drawing will be sent on request.

NOTE: Cooling pump signal output must be set to "inverted" in control panel setup menu for correct operation of the cooling pump including "power save" function.

Installation Instructions SPS55 - 1.2.0 2016
NOTE!
Ensure to install all electrical connections in appropriate methods to avoid water ingress.

<table>
<thead>
<tr>
<th>Signals</th>
<th>RED</th>
<th>POWER SUPPLY +</th>
<th>BLUE</th>
<th>BLACK</th>
<th>POWER SUPPLY -</th>
<th>GREEN</th>
<th>GREEN</th>
<th>OUTPUT (DATA) +</th>
<th>RED</th>
<th>SHIELD</th>
<th>OUTPUT (DATA) -</th>
<th>YELLOW</th>
<th>321704-xx</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Receiver</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA-320</td>
<td>321704-xx</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 4

VFD cable dimensions:

<table>
<thead>
<tr>
<th>Motor power (kW)</th>
<th>Input Phases</th>
<th>Input Voltage (V)</th>
<th>Input Current (A)</th>
<th>Motor Current (A)</th>
<th>Input Wire Size (mm²)</th>
<th>Motor Wire Size (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,5</td>
<td>1</td>
<td>220</td>
<td>21,8</td>
<td>12,6</td>
<td>4</td>
<td>2,5</td>
</tr>
<tr>
<td>4,6</td>
<td>1</td>
<td>220</td>
<td>29,1</td>
<td>16,8</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>5,5</td>
<td>1</td>
<td>220</td>
<td>39,0</td>
<td>22,5</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>7,5</td>
<td>1</td>
<td>220</td>
<td>46,2</td>
<td>26,7</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>7,5</td>
<td>3</td>
<td>220</td>
<td>26,7</td>
<td>26,7</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>220</td>
<td>67,5</td>
<td>39,0</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>220</td>
<td>39,0</td>
<td>39,0</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>220</td>
<td>88,3</td>
<td>51,0</td>
<td>35</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>220</td>
<td>51,0</td>
<td>51,0</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>400</td>
<td>28,0</td>
<td>28,0</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Changes or misprints might occur in information given.

**IMPORTANT!**

Responsible electrical technician must consider fitting method and temperature conditions before doing this electrical work. This table is just a general recommendation.
**AC Motor driven Pump Unit Pre-Startup**

**IMPORTANT!**
The yachts main engines must be switched off during this procedure. The first start of the AC Motor/Pump Unit must be carried out manually from the VFD (variable frequency drive) control panel. The VFD panel is factory programmed, therefore no additional functional programming is required.

- Leave Stabilizer system off at control panel. (Bypass and dump valves will be open)
- Check oil level in tank and open cock valves (if present) on AC pump feed line.
- Open the Manual Unloading Valve (Fig 5f item 10) by turning the wheel fully anti-clockwise.
- Select local mode using the LOC REM button(7). The LED will illuminate when the drive is in local mode.
- Pulse start the AC Motor/Pump Unit by pressing the ‘START’ and “STOP” button(10/9) on the VFD control panel to verify the drive direction in accordance with the direction arrow label on the AC Motor/Pump Unit (Fig 5h). To better see/feel the drive direction you can insert a plastic cable tie in between the fan blades while pulsing the motor. Re-wire for correct pump rotation if required.
- Perform a new start & check for correct rotation. The pump will now run at minimum speed 250 RPM, leave the pump running for 2 minutes while monitoring oil level, temperature and system pressure. Running the system for more than 2 minutes without cooling can damage the system.
- Stop the AC pump and refill oil if required.
- Close the Manual Unloading Valve (Fig 5f item 10).
- Select ‘Remote’ by pressing the VFD control panel LOC REM button(7) to complete the manual start-up procedure.
- Check for oil leaks and tighten if required.

**PTO pump pre-startup**

Important! Prior to filling the tank, prime the the pump(s) through their upper drain port. Stabilizer sytem must not be activated. Check pump feed line from tank(Dimension/routing) for good gravity feed.

- Fill hydraulic tank. (ISO VG 46 (by ISO 3448). Or, 32 for arctic climate.)
- Remove pump drain blank or hose from pump. (To ensure oil has reached pump)
- Re-fit drain blank or hose in PTO pump port.
- PTO1: Start engine1 and watch pressure gauge for stanby pressure of 10-30 bar. (Monitor oil level)

**NOTE!** Gauge at PVG valves for thruster + stabilizer system. For stabilizer only pressure reading on system status page in stabilizer control panel.

- PTO2: Start engine2 and watch pressure gauge for stanby pressure of 10-30 bar. (Monitor oil level)

Note! If no pressure, confirm rotation.

- Check for leaks between tank and pump that is running
- Shut down engine(s) and check oil level in tank. Refill if required. (Refill oil only while accumulator tank is depressurized to avoid flooding the tank later on.)
PTO pump pressure adjustment
Most stabilizer system come with preset PTO-pump(s) from Side-Power. The pump has a tag on the drive shaft telling actual pressure setting, if this tag is not present, or other settings are required the pump must be re-adjusted.

Note! System pressure will always be directly related to actual system load at the time. Lack of system pressure is more often caused by open bleed/bypass/dump valve or other system related problems than incorrect pump setting.

When above issues are excluded and pump pressure is confirmed incorrect, contact Side-Power for pump adjustment instructions. Please have system serial number and pump model data available for correct instructions.

FIN INSTALLATION

FIN ASSEMBLY OVERVIEW
Correct actuator position for fin shaft installation

The following figures illustrate the position the stabilizer actuator assembly cylinders must be positioned in relation to the fully outboard position of the relevant fin.

When viewed from inside/above the relative Stabilizer Actuator assembly
- Rotate the Port Actuator fully to clockwise.
- Rotate the Starboard Actuator Fully counter clockwise.
INSTALLATION OF THE FIN ASSEMBLIES

**WARNING!**
A hand oil pump (Installation tool kit, Item nr VFT55) must be used to achieve the fin installation. The pump should only be operated by qualified personnel that follow the pump manual operating instruction and health and safety directives.

**Step 1**
Place each fin on separate pallet and position as close to actuator as possible.

**Step 2**
Within 2.5m (recommended) of each actuator you will find the fin valve unit.

**Step 3**
On the fin valve unit it will be a manual decouple valve.
- Unlock the valve by turning the 9/16” lock nut anti-clockwise.
- Open the valve by turning the 3/16” Allen key anti-clockwise.
**Step 4**

Use a 36 socket and ratchet on the large nut that is welded to the actuator port cover to move the actuator to the most outboard position. Checking on the actuator that the cylinders are in the outboard position (inboard will be fully aft, outboard will be fully forward)

- Unscrew all nuts and washers.
- Inspect and clean the internal hub to ensure it’s free from dirt, dust and debris.

![Image of actuator with nut and ratchet]  
**Inspect and clean the internal hub to ensure it’s free from dirt, dust and debris.**

**Step 5**

Remove shaft covers from fin using a 4mm Allen key.

![Image of fin with shaft cover]  
**Remove the actuator port cover**

**Step 6**

Remove protective covering *(Do NOT cut the protection cover)* from the fin shaft cone and ensure it is free of dirt, dust or packing materials. Clean and degrease the coned surface.

**NOTE!** The protective cover can easily be removed by blowing air using a air pressure gun into the bottom hole of the cover.
**Step 8**
Lubricate the shaft and the securing ring with the supplied hydraulic oil (ISO VG 100).

**IMPORTANT!**
Do NOT use grease, only specified oil.

**Step 9**
When handling the fin assembly, ensure enough manpower is available to assist with careful insertion and alignment positioning and at the same time avoiding any unnecessary damage.

- Lift the correct handed fin assembly in the appropriate direction and insert the fin shaft into the actuator.
- Fit two nuts with washers back onto the securing bolts opposite each other to prevent the fin from falling.
Step 10
Remove both hydraulic pump ports from where the shaft enters the fin.

![Diagram of hydraulic pump](image)

Remove both oil injection blinds.

Step 11
Assemble the high pressure pump according to manual included with the pump.

**WARNING!**
The pump should only be operated by qualified personnel that follow the pump manual operating instruction and health and safety directives.

A. Connect the high pressure hose.
   Part no: 227957A/4000

B. Fill up the container with oil.
   Oil part no: LHMF 300/1 (ISO VG 100)

C. Use the pump to bleed out the air in the hose.
   Part no: 226400 + 226402

D. When free oil flows connect the hose to the shaft ON fitting.

E. FITTING TO SHAFT
   Part no: 1014357 A

**IMPORTANT!**
OFF port must be open for drainage.
**Step 12**
Move the fin as far outboard as possible without hitting outer edge of the hull. See page 37.

**Step 13**
Fit the rest of the nuts and washers to the remaining bolts and tighten until the fin does not move on its own.

**Step 14**
Place rags or oil soaking pads underneath the fin or around the shaft and underneath the hydraulic pump.

**Step 15**
Use the pump until it is stiff, then use a 19mm spanner move around in a cross pattern tightening as many nuts as possible to pull the fin into the shaft. See illustration.

Cross pattern tightening

**Step 16**
Once the nuts are all tight, using a 19mm spanner tighten bolts in a circular pattern.

**Step 17**
Repeat pump and tighten until the securing plate protrudes 2 +/- 0,1mm. Control tighten all nuts to approx. torque 60Nm.

**Step 18**
Re-tighten the manual decouple valve from Step 3 on the fin valve unit.
**Step 19**  
Refit the ON and OFF plugs into their position.

**Step 20**  
Loosely place the shaft protectors and inspect the top face to see if it will rub against any section of the actuator face. If rubbing will occur grind and sand off material on the shaft protectors to remove enough material to ensure clearance.

**Step 21**  
Secure shaft protectors using a 4mm Allen key.

*NOTE!*  
For Fin removal see page 58.
**FIN INSTALLATION**

**Step 22**
On the stabiliser panel, select MENU.

**Step 23**
Select SETTINGS

**Step 24**
Select STARTUP (Password is 1234)

**Step 25**
Select FIN INSTALLATION

**Step 26**
Select UNLOCK ACTUATORS (These will automatically re-lock in 2 minutes)

**Step 27**
Position the fins manually so that the aft. edge and the fore edge are exactly the same distance from the keel.
Step 28
Press RETURN and then press SET ABSOLUTE CENTERS and then STORE CENTRE POSITION.

Step 29
Press RETURN and go back into the FIN INSTALLATION PAGE and lock the fins.
### CHECKLIST

#### Start-up checks Actuators

- **Actuator Manual Decouple Valve Tight.** (See page 24 Fig 5a)
- **Check Electric operated decouple valve (coil nut) is tightened** Under 6.8-9.5 Nm. (See page 24 Fig 5a)
- **Check hose spec from combiner to fin valve(Less than 2.5m)(Recommended).**
- **Actuator Hose Connections Tight/Clear Port/Stb, and hoses have full range of movement.**
- **Actuator Electrical Connections Clear.**
- **Actuator Encoder Belt, Wheels ok and Belt Tight.**
- **Actuator Bonded to the boats electrical system.** (See page 20)
- **Actuators clear of Boat Structure.**

#### Start-up checks Fin valve unit

- **Fin Valve Manual Decouple Valve Tight.** (See page 24 Fig 5b)
- **Fin Valve Check Hose Connections Port/Stb.** (See page 24 Fig 5b)
- **Fin Valve Electrical Connections Correct.** (See page 28 fig 1b)

#### Start-up checks Accumulator block

- **Accumulator Block Manual Decouple Valve Tight.** (See page 25 and 28)
- **Accumulator Block Hose Connections Ok.** (See page 25 and 28)
- **Accumulator Block Electrical Connections Correct.** (See page 25 and 28)
- **Accumulator Pressure Transmitter Reading Correct.** (See page 25 and 28)

#### Start-up checks Electrical components

- **Check Control Cabinet Connections are correct.** (See page 33)
- **Check Power Feed is Active.** (See page 33)
- **ECU Electrical Connections.** (See page 27)
Start-up checks Cooling pump

**Electric:**
Check Relay Box Electrical connections, negative from connection 3,4 should be connected to relay pin 86. (See page 33)


Check Cooling pump connections are correct and pump runs in correct direction. (See page 32)

**Hydraulic:**

Check connections and drive direction

**Both Electric and Hydraulic:**
Check cooling pump is installed below waterline.

No air traps in the water lines(continous rise).

Cooling water discharge should have minimum resistance/back pressure. (Discharge to engine exhaust will cause porblems for the water pump.

Auxiliary Terminal Box Connections Correct. (See page 32)

GPS Connections Correct and Valid Signal. (See page 34)

**Start-up checks AC pump**

Ac Pump Clockwise. (See page 36)

Ac Pump Standby Pressure (90 BAR VF800 Vector Fins/70 BAR VF 650 Vector Fins).

**Start-up checks PTO pump**

See page 36 for complete checks.
Before Running Start-up Procedure Ensure that Parameters are filled in. Standard start-up parameters below. These are only for start-up and will be changed depending on boat model.

### Parameters page

<table>
<thead>
<tr>
<th></th>
<th>P:</th>
<th>I:</th>
<th>D:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cruising</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At anchor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fin pos.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Advanced Page

<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ramp Angle</td>
</tr>
<tr>
<td>2</td>
<td>Stop Angle</td>
</tr>
<tr>
<td>3</td>
<td>Valve Ramp</td>
</tr>
<tr>
<td>4</td>
<td>Ramp Angle</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Fin size</td>
</tr>
<tr>
<td>7</td>
<td>Algorithm Select</td>
</tr>
</tbody>
</table>

### IMPORTANT!

Before running or making setting adjustments in STARTUP, SEA TRIAL and Parameters ensure that:
- Stabilizer system (also At Anchor) is in OFF status on the panel.
- AC pump is AUTO/ON or PTO is ON.

### Select Menu

- Turn Ac Power Pack On
- Check Pressure On Accumulator Gauge (70/90Bar)

**Note!** VF800 Fin 90Bar/VF650 Fin 70Bar
VFD Must be in Remote Mode {REM}
Check Direction of Motor, If backwards no pressure will be made.
Installation Instructions SPS55 - 1.2.0 2016

START-UP

(Menu Page)

- Ensure Fin Enable indicators are both Green.
- Select settings

(Seting Page)

- Select System Status

(System Status)

- Stabilizer Pressure Should Read 100BAR
- GPS Valid?
- Select Return
- Select Start-up

(Startup Menu)

- Select Bleed Actuators

(Bleed System)

- Select Bleed Sequence
- Inspect actuators movement
- Check for Leaks
- Once Complete Select Return
- Select Actuator Tuning

Note! When Bleed Sequence is running check lock valve illuminates. Check tank oil level and refill oil if necessary during air bleed sequence.

(Actuator Tuning)

- Select Start (actuators should move, this is indicated by the positions at the bottom of screen)
- Once Complete Select Return
- Select Set Zero Inclination

Note! If you receive alarm during process (encoder or fin valve connection fault) check encoder and fin valve connections are correct and for damage and repeat.

SIDE-POWER.com
(Set zero inclination)
- Select Start
- Once Complete Select Return
- Select System Configuration

(System Configuration)
- Select Main Engine Pump and Ac Pump so they go Green.
- Select Direction of ECU
- Select Return Until You Reach Main Screen

(Main Screen)
- If Alarms Active acknowledge alarms
- Select Return
- Select At Anchor and ON/OFF
- Stabilizers should activate
- Start-up complete
**DYNAMIC CENTER EXAMPLES**

Typical fin center angles as found in dynamic center tests on around 70’ planning V- hull boats. The fins are centered by water flow under the boat through test and then fine-tuned manually.

**PS! Even if the fins in test at less than 4 knots are found to have an outward angle, the lowest speed should be set to 0 knots (zero) and fins parallel to the keel**

---

**Example 1**
The actuators are physically installed absolutely straight by the keel in the boat:

*Found in test > Consider and evaluate results > Adjust to be «logic»*

<table>
<thead>
<tr>
<th>SPEED (knots)</th>
<th>PORT CENTER</th>
<th>STBD CENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>7.88</td>
<td>4.12</td>
</tr>
<tr>
<td>3</td>
<td>16.37</td>
<td>6.85</td>
</tr>
<tr>
<td>4</td>
<td>24.00</td>
<td>5.00</td>
</tr>
<tr>
<td>5</td>
<td>32.00</td>
<td>2.10</td>
</tr>
</tbody>
</table>

---

**Example 2**
The actuators are fitted offset inwards so that fins do not go outside of boat envelope, slightly imperfect fit in angles so not equal on both sides:

*Found in test > Consider and evaluate results > Adjust to be «logic»*

<table>
<thead>
<tr>
<th>SPEED (knots)</th>
<th>PORT CENTER</th>
<th>STBD CENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>-8.00</td>
</tr>
<tr>
<td>2</td>
<td>7.88</td>
<td>-11.81</td>
</tr>
<tr>
<td>3</td>
<td>16.37</td>
<td>-15.30</td>
</tr>
<tr>
<td>4</td>
<td>24.00</td>
<td>-14.20</td>
</tr>
<tr>
<td>5</td>
<td>32.00</td>
<td>-9.90</td>
</tr>
</tbody>
</table>
SEA TRIAL - SET CENTER POSITION

1. Locked position - recommended to be parallel to keel
2. By pressing, you use the previously “absolute center” as the locked position. Only use if positions stored during fin installation is correct!
3. Unlock the fins to let them float and find their natural (minimal drag) position. Lock when finished.
4. Instant information boxes show speed and the position of each fin continuously.
5. Shows offset from mechanical center of fins depending on various cruising centers are set to. Can be changed or input manually. It is recommended to fine-tune this as floating angle will not be accurate. Use average - and see section about DYNAMIC FIN CENTERS.
6. IMPORTANT! Make sure to input all lines by increasing speeds
7. GPS speed for corresponding fin angle setting
8. Pressing these buttons will STORE the values.
9. Goes back to STARTUP menu

SEA TRIAL - PARAMETER SETTINGS

1. Cruising «P» - relates to the inclinometer sensor and is the «comfort» setting that can heel the boat inwards in turns etc. As it is slower than the gyro, it should not be more than max 35% of «D» or less if the boat is fast and has short roll times
2. Cruising «I» – is the «auto trimtab» function that will work to keep the boat straight. Works very slowly compared to the other factors and should be low – below 15% of «D»
3. Cruising «D» – is the main roll reduction / roll countering factor. It works off the very fast gyro sensor and will work to stop any roll action. If too high the boat will feel un-natural and «jerky»
4. Factor for how aggressive the «At Anchor» control algorithm is, typically a setting of force ratio between fins and boat. The effect of this factor is also adjustable by operator by the sliders in the first menu page.
5. Factor for how aggressive the «fin regulator» is.
   A high factor here will require the Cruising and At Anchor factors to be reduced
6. Factor for how much the system prioritize to center fins when no rolling occurs in At Anchor
7. A filter that reduce the effect of some frequencies picked up by sensors
8. The upper speed for when the boat is in «full displacement» mode.
   The stabilizers will have the same reaction pattern in all speeds below.
9. The fins have a force as a result of speed^2 which is then inverted as the default fin reaction by boat speed. However, fast planing boats also tend to stiffen up when going fast, so setting this to less than 2 will make the fins more reactive
10. Goes back to «Setup» menu.

<table>
<thead>
<tr>
<th></th>
<th>SPEED</th>
<th>PORT CENTER</th>
<th>STBD CENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE!
Type in actual results from testing performed.
CONTROL PANEL INFORMATION

CONTROL PANEL (HMI)

A: MAIN screen description:
1. Shows fin position.
2. If lit - the system is sensing backing and goes into suspend mode.
3. If lit – Fins are locked (and centered)
4. If lit – The AC powerpack is ON
5. If showing «Reduced Performance», one fin is deactivated – ref. MENU screen (B.6)
6. Turns stabilizer ON / OFF name in button will change to function it will do when pressing
7. Must be activated (green line above) for the stabilizers to go into «At Anchor» mode (below 3 knots) – ON must also be active.
8. Darkens the screen for night time use
9. Takes you to more choices - MENU Screen (B)
10. STATUS INDICATOR
   Background colour: Green = running Red = not running
   INIT: needs startup
   OFF: is not on
   CRUISING: active in cruising mode
   AT ANCHOR: active in «at anchor mode»
   SUSPENDED: temporarily «off» because of backing or thruster running
   HALTED: The system is shut down because of a fault alarm
11. Shows boat angle

B: MENU screen
1. OFF – shuts off the AC pump
   ON – starts the AC pump
   AUTO – if enabled, and newer system lets the system decide to run or not (depending on sensed pressure from engine driven pumps
2. If lit – the AC power pack is running
3. If lit – the AC power pack is in its startup process
4. If lit – the AC power pack has AC power to it
   If NOT lit, there is no power so you can not start it.
5. Indicates a fault on the AC motor VFD (Variable Frequency Drive) or other starting equipment fitted.
6. Allows you to individually disable one of the fins, for example if there is a technical problem with one fin only and you want to still have 50% stabilization function, or if you are mored close to a dock or another boat on one side but still want some stabilization
   Green light = Enabled (ON)
   Red light = Disabled (OFF)
7. Increase or decrease the stabilizers function in CRUISING.  + = more agressive / - = less agressive
8. Increase or decrease the stabilizers function in At Anchor.  + = more agressive / - = less agressive
9. Brings up the SETTINGS screen (C).
10. Returns to the MAIN screen (A).
CONTROL PANEL INFORMATION

C: SETTINGS screen
1. Goes to «SYSTEM STATUS» page (D)
2. Goes to «SYSTEM INFO» page (E)
3. Goes to «STARTUP» page (F)
4. Goes to «SETUP» page (G)
5. Returns to MENU (B)

D: SYSTEM STATUS screen
1. If lit – the system is getting a valid GPS signal (if not the stabilizer will not work)
2. Shows info about:
   - GPS SPEED: the actual speed input from GPS
   - SYSTEM STATE: the state the system is in at present (Cruising, At Anchor, Off, Init, Suspended)
   - SYSTEM PRESSURE: Shows the hydraulic pressure at present
3. Returns to SETTINGS menu (C)

E: SYSTEM INFO screen
1. ECU = Main controller serial number
2. ECU = Main controller software version (programmable by S-link)
3. ECU = Main controller Hardware version
4. ECU = Main controller bootloader version (may need update through S-link to support further updates later)
5. Control panel software version.
6. Separate update directly in panel – not by S-link
7. Shows the total operating hours of the system
8. Shows the operating hours of the system since main authorized service.
9. Press to program date and time
10. Returns to SETTINGS menu (C)

SET DATE/TIME screen
Shows current date/time.
Touch date/time numbers to change.

F: STARTUP screen
1. Status lights for completed steps in the startup procedure.
   All must be lit green for the stabilizer system to be operational.
2. Starts the STARTUP procedure (Startup chapter)
3. Goes back to «SETTINGS» menu (C)
CONTROL PANEL INFORMATION

**G: SETUP screen**
1. Goes to «PARAMETER SETTINGS» menu (Sea trial)
2. Goes to «SYSTEM SETTINGS» menu (H)
3. Goes to «MAINTENANCE» menu
4. Goes to «TEST MODE» menu
5. Goes to «DIAGNOSTICS» menu (I)
6. Goes to «ALARM SETTINGS» menu (J)
7. Goes to «ADVANCED» menu (L)
8. Goes to «TEST MODE» menu
9. Goes back to «SETTINGS» menu (C)

**H: SYSTEM SETTINGS**
1. The system have an option of automatically shutting down the stabilizer system if the hydraulic pressure drops below this set point. Beneficial if sometimes forgotten to stop the stabilizers (center them) before all the oil pressure is gone if the engines are shut down – recommended setting: 38 bar.
2. The system have the option of showing an alarm in the panel (and S-link type thruster panels if present) if the boat is run at a higher than this speed limit without the stabilizers active. The reason for this is that some fast planing boats with large fins (AnySpeed function) have been known to heel over some on their own, so it is recommended to always run with the stabilizers active to avoid this. If left at «0» the alarm is not active.
3. Choose to have the hydraulic cooling pump On or in Auto (temperature dependant)
4. Leave on
5. Reset the operation timer between main services – only authorized personell
6. Goes back to «Setup» menu

**I: DIAGNOSTICS**
1. Shows actual fin position encoder value at present
2. If lit – fins are locked
3. Shows speed value from GPS
4. Shows systems current operational status
5. Shows systems hydraulic pressure
6. Shows a calculated dampening factor
7. By programming a number here you can force the system to work as if you have a certain GPS speed input (overrides GPS). For test/roubleshooting only
8. Goes back to «Setup» menu
J: ALARM SETTINGS
1. Turn monitoring of fins On or Off.
   Light indicator (green if on) shows what is activated.
2. Turn monitoring of hydraulic system On or Off,
   Light indicator (green if on) shows what is activated.
3. Turn monitoring of Dump valve On or Off,
   Must be off if no dump valve present. Light indicator (green if on) shows what is activated.
4. Turn monitoring of Dual lock valve On or Off. Light indicator (green if on) shows what is activated.
5. Goes to «ALARM LIST» page (K)
6. Resets the alarm history (deletes it)
   Only to be done in trouble free systems by authorized service personnel.
7. Goes back to «Setup» menu

K: ALARM LIST
1. Time stamp for when the alarm occurred
2. Alarm description. See alarm list (page XX) for explanation
3. Scroll up and down in the alarm list if necessary!
4. ACKNOWLEDGE ALARM IMPORTANT!
   This MUST be pressed to enable the system to try to resume operation. Should of course only be done after ensuring that the reason for the alarm is no longer present
5. Goes back to «Setup» menu

L: ADVANCED SETTINGS
1. Option 1: The retarding curve shape for endstop in «AtAnchor»
   Default: 2.0. Can be down to 1.1
2. Option 2: Offset factor for the valve control in «retarding» mode compared to acceleration mode to have most possible equal fin speed by valve opening in all modes
3. Option 3: Can adjust the breaking ramp in relation to the acceleration ramp.
   If 1 = equal acceleration and decelleration
   If 2 = retarding is double the ramp which means do the same in half the time / double as aggressive
4. Option 5: The percentage / amount of continous self adjustment of valve current
5. Type in Fin Size
6. At Anchor algorithm. USE : Std = 1 (FM = 2) (IM = 3)
7. How many degrees from endstop the «controlled retarding sequence» of the fins starts
8. How close (in degrees) from mechanical endstop we hydraulically stop the fins.
   Minimum 1, and if necessary more to surely avoid hitting mechanical endstop.
9. Sets lower «ramp» point of valve opening change - Factor is valve opening change in percent per second. Controls max acceleration of fins (to avoid «harsh» feeling in boat)
10. Sets upper «ramp» point for valve opening change limitation. Factor is «valve ramp» times this factor.
11. Goes back to «Setup» menu
REMOVING THE FIN

**WARNING!**
A hand oil pump (Installation tool kit, Item nr VFT55) must be used to achieve the fin installation. The pump should only be operated by qualified personnel that follow the pump manual operating instruction and health and safety directives.

**Step 1**  
Take and record measurements of the distances from the aft end of the fin to the keel and the fore end of the fin to the keel.

**Step 2**  
Remove the shaft cover using a 4mm Allen key.

**Step 3**  
Loosen the nuts but do not remove them.

**Step 4**  
Remove the OFF port cover for the hydraulic port.

**Step 5**  
Attach the line into the port marked OFF. The first adaptor is secured with a 22 spanner. The second part is secured with a 15 spanner.

**Step 6**  
Use the hydraulic pump until the fin drops down but is held up by the nuts.

**Step 7**  
Use two people to take the weight of the fin while you remove all the nuts and washers.

**Step 8**  
Lower the fin to the floor and replace the protective shaft cap.

**Step 9**  
Replace the actuator port cover with rubber seal.
FIN ACTUATOR UNITS

The stabilizer system is in general a low maintenance product, but as all moving parts some degree of preventive maintenance will increase the lifetime and reliability of the system.

A chart for recommended check and service points is thereby offered at the end of this section.

For all new installations, or after a major parts change, a basic check should be done after the first 100 hours of operation or after the first week of proper use:

- Check that all hydraulic fittings are tight.
- Check all hoses for chaffing, and ensure they are not in contact with any moving parts.
- Inspect hydraulic cylinder rods and gland seals for damage, leaking, or scratches.
- Inspect the dirt indicator on the return oil filter.
- “Shake” the fins from the outside to feel if there is any play in any connection.
- Open the fins manual decouple valve (at the acuator point ot allow movement) and manually move the fin fully to both sides to feel that there is not spesific tough spot in the bearings.

Every time the boat is out of the water for service or other reason, we recommend that you take this opportunity to more thorougly check some points that is not possible when the boat is in the water. A proper cleaning and check of the fins anodes (if fitted, can also be bonded to boats large anode system) is also appropriate during a haul out.

- Axial and radial play in the shaft can also be checked at this time; see the table below that details play allowances. A dial indicator is recommended for this procedure.
  - Radial play should be checked with the indicator/micrometer positioned just below the seal housing between the top of the fin and the underside of the hull.
  - Axial play should be checked by measuring the relative distance between the top of the axle shaft and hull plate. By using a crow bar on the twin yoke, moving and feeling the tighteness of the bearings inside the boat while measur ing from a fixed point with a micrometter.

<table>
<thead>
<tr>
<th></th>
<th>Shaft Radial Play (mm)</th>
<th>Shaft Axial Play (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Maximum</td>
</tr>
<tr>
<td>SPS 65/66</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>SPS 55/90/91/92/93</td>
<td>0.15</td>
<td>0.30</td>
</tr>
</tbody>
</table>

NOTE!

Because of the big variation in different vessels actual use and operation, system specifications and maintenance, it is not possible to accurately predict the anticipated service life of the main shaft bearings. Thereby, Sleipner recommends that the bearing clearances be checked periodically when possible so to avoid extra halout between normal service need.

The service timing indicated in the chart is based calculations and experience, but please note that because of the variations in use and load, both due to different operation and for example different fin sizes allowed on the same actuator size, the life of bearings and seals can be both longer and shorter than indicated by the maintenance chart.

FINS

It is recommended that a thorough inspection of the fins be performed when the vessel is lifted out of water for maintenance. Damages on the fin surface must be repaired with vinylester/epoxy done by professionals

HYDRAULICS

The pressure filters require periodic element changes as per the maintenance schedule. The valves and manifolds are to be inspected regularly for external damage. To avoid corrosion and deterioration, a water inhibitor such as WD-40 or similar should be applied to the valves and fittings immediately after wash-down of the equipment.

*Filter replacement:

We recommend to replace pressure and return line filter elements after the initial start up and test period, and latest at 50 operating hours. Thereafter every 2000 operating hours or every 2nd year.
Both pressure filter and return filter have pressure drop indicators. Check indicators every 6th month. The check have to be done with oil temperature above 40˚C, and the most flow demanding consumer active. Filter element replacement are required if indicators are in the red area.

**Hydraulic oil replacement:**
Every 4000 operating hours or every 3rd year. For heavy duty applications and commercial use, we recommend oil sample analyses every year.

***Check oil color every 6th month. White or grey oil indicates water ingress or heavy condensation. This will require filter replacement, oil replacement and flushing of the system. See schedule and Hydraulic system manual.***

**CONTROL SYSTEM**
With the exception of keeping the electrical parts and wiring clean, dry and damage-free, no maintenance is required for these parts. In general, all electrical equipment should be periodically checked to ensure that there are no mechanical damage or water build-up.

**POWER UNIT**
The power unit and its associated components require maintenance and have a lifetime so will in the future require replacement which can be done preventively as indicated within the charts here, to avoid potential follow damage to other parts.

The hydraulic oil integrity must be checked as per the schedule by extracting a sample from the system for analysis to ensure it is within the standards of its specifications.

The hydraulic power unit motor should not stay unused for longer periods, and either manually rotated every 3 months or started to ensure proper lubrication of the shafts and bearings on its shaft and bearings.

**PREVENTATIVE MAINTENANCE SCHEDULE**
The maintenance schedules in this section indicate the recommended preventative maintenance intervals for equipment supplied by Side-Power. Components utilized in Side-Power Stabilizer Systems but not supplied by Side-Power are not included in the maintenance schedule or under any Side-Power warranty.

The maintenance intervals are listed in hours of operation and time where relevant. Maintenance is to be performed according to this schedule utilizing time or hour intervals, whichever comes first. The maintenance schedule incorporates the minimum required maintenance to ensure correct operation of the system. Should these guidelines not be followed, the warranty for those items will be void.

To perform maintenance, replacement parts may need to be purchased. Refer to the recommended spares list and/or drawings for associated part numbers.

- **Contact a Authorized Side-Power technician.**

* If analysis of the scheduled oil sample indicates an elevated level of brass particles in the hydraulic system, the pumps should be replaced or overhauled as soon as possible. Delay in component removal and system flushing will lead to contamination problems throughout the hydraulic system. Erratic component operation may be a symptom of hydraulic fluid contamination.

*** 2000 operating hours or annually, whichever occurs first.

**** Fins should be inspected annually by diver if possible

The data in the table below is provided to assist the vessel in scheduling the appropriate service staff and coordination of vessel docking (haul out) for maintenance procedures.
**A. HULL UNIT**

<table>
<thead>
<tr>
<th>Service level</th>
<th>250h</th>
<th>500h</th>
<th>2000h</th>
<th>4000h</th>
<th>8000h</th>
<th>12000h</th>
<th>When out of water</th>
<th>When required</th>
<th>Months/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Change oil in bearing assembly</td>
<td>🦜</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
<td>1 D</td>
</tr>
<tr>
<td>2. Inspect spherical bearings, and Main Cylinders for external leakage</td>
<td>1 W</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Inspect Stabilizer Manifolds</td>
<td>1 W</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Inspect Stabilizer Manifolds Electrical Connections</td>
<td>1 W</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Inspect Fin Angle Sensor Belts</td>
<td>1 W</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Inspect Twin Yoke Area</td>
<td>1 W</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Inspect Hydraulic Hoses</td>
<td>1 W</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Check Shaft Clearances</td>
<td>💩</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
<td>3 D</td>
</tr>
<tr>
<td>9. Replace Lower Shaft Seals</td>
<td>💩</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
<td>3 D</td>
</tr>
<tr>
<td>10. Replace Main Shaft Bearings</td>
<td>💩</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
<td>3 D</td>
</tr>
<tr>
<td>11. Replace Spherical Bearings and Cylinder Pins. (NOT relevant for SPS55)</td>
<td>💩</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
<td>2 W</td>
</tr>
<tr>
<td>12. Rebuild/Replace Cylinders</td>
<td>💩</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
<td>3 W</td>
</tr>
<tr>
<td>13. Replace the Fin Angle Belt</td>
<td>1 W</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**B. FINS**

<table>
<thead>
<tr>
<th>Service level</th>
<th>250h</th>
<th>500h</th>
<th>2000h</th>
<th>4000h</th>
<th>8000h</th>
<th>12000h</th>
<th>When out of water</th>
<th>When required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inspect Fin Surfaces</td>
<td>💩</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Maintenance schedule**

- **Level 1**: Onboard maintenance possible at sea
  - No shore support required
- **Level 2**: Shore supported maintenance and corrective measures
- **Level 3**: Trained personnel required - Side-Power personnel or equivalent
- **D**: Dry - Vessel must be out of water to perform task
- **W**: Wet - Vessel can be in water to perform task
### C. HYDRAULIC POWER UNIT

<table>
<thead>
<tr>
<th>Maintenance schedule</th>
<th>Service level</th>
<th>250h</th>
<th>500h</th>
<th>2000h</th>
<th>4000h</th>
<th>8000h</th>
<th>12000h</th>
<th>When out of water</th>
<th>When required</th>
<th>Months/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inspect the Dirt Indicator of the return filter, replace when required</td>
<td>1 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6/0.5</td>
<td></td>
</tr>
<tr>
<td>2. Inspect Flexible Hoses</td>
<td>1 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Inspect Suction Hoses</td>
<td>1 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Inspect Electrical Connections</td>
<td>1 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Inspect Cooling Pump</td>
<td>1 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Inspect Oil Cooler Tubes</td>
<td>1 W</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Inspect Pump Drive Coupling</td>
<td>1 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Inspect Motor and Frame Mounts</td>
<td>1 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Test Hydraulic Oil Quality by means of taking sample***</td>
<td>2 W</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓ 12/1st</td>
<td></td>
</tr>
<tr>
<td>10. Replace Return Filter Element*</td>
<td>1 W</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24/2nd</td>
<td></td>
</tr>
<tr>
<td>11. Replace Pressure Filter Element*</td>
<td>1 W</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24/2nd</td>
<td></td>
</tr>
<tr>
<td>12. Change Oil. Refill with mineral based hydraulic oil ISO - VG46</td>
<td>1 W</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>36/3rd</td>
<td></td>
</tr>
<tr>
<td>13. Replace Drive Coupling Element</td>
<td>3 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Rebuild/Replace Cooling Pump</td>
<td>3 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Replace Hydraulic Hoses</td>
<td>3 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Replace Oil Cooler</td>
<td>3 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Replace Hydraulic Pumps*</td>
<td>3 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### D. CONTROL SYSTEM

<table>
<thead>
<tr>
<th>Maintenance schedule</th>
<th>Service level</th>
<th>250h</th>
<th>500h</th>
<th>2000h</th>
<th>4000h</th>
<th>8000h</th>
<th>12000h</th>
<th>When out of water</th>
<th>When required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clean the Cooling Fan of the VFD 1</td>
<td>1/3 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1/3 W</td>
</tr>
<tr>
<td>2. Test the Emergency Stop Button</td>
<td>1/3 W</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. The equipment manufactured by Sleipner Motor AS (The “Warrantor”) is warranted to be free from defects in workmanship and materials under normal use and service.

2. This Warranty is in effect for of two years (Leisure Use) or one year (Commercial use) from the date of purchase by the user. Proof of purchase must be included, to establish that it is inside the warranty period.

3. This Warranty is transferable and covers the product for the specified time period.

4. In case any part of the equipment proves to be defective, other than those parts excluded in paragraph 5 below, the owner should do the following:
   (a) Prepare a detailed written statement of the nature and circumstances of the defect, to the best of the Owner’s knowledge, including the date of purchase, the place of purchase, the name and address of the installer, and the Purchaser’s name, address and telephone number;
   (b) The Owner should return the defective part or unit along with the statement referenced in the preceding paragraph to the warrantor, Sleipner Motor AS or an authorized Service Centre, postage/shipping prepaid and at the expense of the Purchaser;
   (c) If upon the Warrantor’s or Authorized Service Centre’s examination, the defect is determined to result from defective material or workmanship, the equipment will be repaired or replaced at the Warrantor’s option without charge, and returned to the Purchaser at the Warrantor’s expense;
   (d) no refund of the purchase price will be granted to the Purchaser, unless the Warrantor is unable to remedy the defect after having a reasonable number of opportunities to do so. Prior to refund of the purchase price, Purchaser must submit a statement in writing from a professional boating equipment supplier that the installation instructions of the Installation and Operation Manual have been complied with and that the defect remains;
   (e) warranty service shall be performed only by the Warrantor, or an authorized Service Centre, and any attempt to remedy the defect by anyone else shall render this warranty void.

5. There shall be no warranty for defects or damages caused by faulty installation or hook-up, abuse or misuse of the equipment including exposure to excessive heat, salt or fresh water spray, or water immersion except for equipment specifically designed as waterproof.

6. No other express warranty is hereby given and there are no warranties which extend beyond those described in section 4 above. This Warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability, fitness for the ordinary purposes for which such goods are used, or fitness for a particular purpose, and any other obligations on the part of the Warrantor or its employees and representatives.

7. There shall be no responsibility or liability whatsoever on the part of the Warrantor or its employees and representatives for injury to any person or persons, or damage to property, loss of income or profit, or any other consequential or resulting damage or cost which may be claimed to have been incurred through the use or sale of the equipment, including any possible failure or malfunction of the equipment, or part thereof.

8. The Warrantor assumes no liability for incidental or consequential damages of any kind including damages arising from collision with other vessels or objects.

9. This warranty gives you specific legal rights, and you may also have other rights which vary from country to country.