

PACIFIC

WELCOME

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WELCOME ...

... to the world of silent self-steering!

Prepare to be pleasantly surprised by your new windvane steering system: life aboard will never be the same again!

Learn to trust your new live-aboard guest. Enjoy the moment you realise it can steer with the kind of stamina and prolonged precision we can only dream of. Hand over to your tireless new mate and make the most of all the time it leaves you for other things. Life aboard will become much more relaxed; time at sea will be generally more restful. And those long trips that were once all but inconceivable are now very much within your grasp.

We at WINDPILOT are almost as single-minded as our windvane gears. We have been continuously developing and refining our systems for more than 30 years now - and all that experience comes free with every system sold. You will notice the difference: we have left no stone unturned!

KISS (keep it simple, stupid) - that's the motto we live by at WINDPILOT. We realise that manuals are probably well down your list of reading priorities, but there are mistakes to be made and they can be avoided. Good advice is particularly valuable at sea, especially if you have it there on board with you, so take a deep breath and read on...

You expect good steering from your WINDPILOT and it, in turn, has certain expectations of you:

**- DON'T NEGLECT YOUR SAIL TRIM**

Poor trim amplifies weather helm, which means more pressure on the rudder and less boat speed. Don't sail with the handbrake on! A well trimmed boat heels less and requires less pressure on the rudder. That means it sails faster. Adjust the mast, trim the sails: try it, you have plenty of time!

**- BE AWARE OF THE CONDITIONS**

Some combinations of wind and sea conditions will be too much for your windvane gear: imagine trying to steer around breaking waves with your eyes closed, for example.

**- MAKE SURE YOUR WINDPILOT IS PROPERLY INSTALLED**

Install it with care, treat it well and be prepared to give it a little attention now and again.

**- TALK TO US, PREFERABLY RIGHT FROM THE START**

If you would like confirmation that your system is properly installed and that the steering lines and so on are just right, send us a few photos of your WINDPILOT set up and ready for action. Pictures tell it like it is and make it easier for us to help you.

You have our word on it - lazy days at sea await... at least as far as steering is concerned...

Peter Förthmann

## PACIFIC

### 1.0 INSTALLATION

#### 1.1 TOOLS

- rule
- pencil
- 2.5 mm, 5 mm, 6 mm, 8 mm and 10 mm Allen keys (included in delivery package)
- 9 mm and 10.5 mm drill bits
- 10 mm, 17 mm and 19 mm ring/fork wrench/spanner
- Sikaflex sealing compound
- rubber mallet
- drill

#### 1.2 INSTALLATION OPTIONS

- MB 0 standard multifunctional mounting bracket for moderately raked sterns
- MB 1 multifunctional mounting bracket with extension for special sterns
- MB 2 multifunctional mounting bracket with extension for extreme sterns
- MB 3 multifunctional mounting bracket with extension for small sugar scoop sterns
- MB 4 multifunctional mounting bracket with extension for extreme sugar scoop sterns
- MB 5 multifunctional mounting bracket for sterns with a transom-hung rudder
- CB crossbar for steering lines on extreme sterns
- WC wheel adaptor for boats with wheel steering
- AP autopilot support

### 1.3 POINTS TO CONSIDER BEFORE INSTALLATION

#### 1.3.1 ASSEMBLING THE SYSTEM AFTER DELIVERY

- The PACIFIC was partially assembled before leaving our premises.
- Place the base of the windvane assembly 130 on windvane shaft 140 and fasten with the Allen key (5 mm) such that the bolt engages in the hole in the windvane shaft.
- Guide push rod 150 through ring 152 from below.
- Set washer 153 and nut 154 on the top of push rod and tighten.
- Now unscrew nut 154 very slightly (1/8 of a turn).
- The windvane assembly 130 should now be able to rotate freely about the push rod 150.
- Mounting bracket 0 is delivered fully assembled.
- Mounting brackets 1-5 are delivered with one half of the unit assembled. Assemble the other half as the mirror image of the first.

#### 1.3.2 POSITIONING THE SYSTEM

- Your WINDPILOT should be installed at the centre of the transom approximately 10 cm/4 in below deck level.
- Off-centre installation is possible (max. 10 cm/4 in) but not ideal.
- If your boat has a centrally mounted bathing ladder, it should be relocated to the port side.

- CAUTION: think twice before moving the ladder to the starboard side. When the pendulum rudder is raised, the pendulum arm 300 swings down very close to the bottom of the transom on the starboard side - check for clearance.
- TIP: install the PACIFIC first, then sort out the bathing ladder.
- Tie safety lines to all components before you start.
- Secure clamps 860 on the mounting bracket with tape.
- Coat the mounting bolts with lanolin or Duralac.
- Should I use a spirit level? No, boats are never perfectly level; it is better to trust your eye.

### 1.3.3 BAD AIR AND THE WINDVANE

- The windvane should not be subject to disturbed airflows in its working position. Any unnecessary turbulence will impair the quality of the steering impulses it provides.

#### NO PROBLEM

- Bad air from a sprayhood: the sprayhood is normally far enough from the stern not to be a problem.
- Bad air around davits - provided the dinghy is not still hanging from them!
- Bad air from the superstructure
- Bad air off the mainsail (sloop/cutter)
- Bad air caused by people in the cockpit

#### PROBLEM

- Bad air off the mizzen sail
- Bad air caused by an outboard motor on the pushpit
- Bad air caused by fenders/liferaft on the pushpit
- Bad air caused by a dinghy on the davits

### 1.3.4 PENDULUM RUDDER AND MAIN RUDDER

- The pendulum rudder is used simply to generate hydrodynamic force; since it does not steer the boat directly, is ok for it to be close behind the trailing edge of the main rudder.
- The pendulum rudder moves laterally in operation.
- Turbulence caused by the main rudder does not interfere with the operation of the pendulum rudder.

### 1.3.5 ON LAND OR IN THE WATER?

- You can fit your WINDPILOT with the boat ashore or afloat: it doesn't really matter, as all the holes are above the waterline.
- But you may be able to find the height above the waterline for installation more easily and accurately with the boat in the water.

## 1.4 INSTALLATION: QUICK GUIDE

### 1.4.1 THE FIVE CRITERIA

- 1 - Installation height: mounting bolt 435 for the pendulum rudder blade 440 should be 10-20 cm/4-8 in above the water (static waterline).
- 2 - Overhanging/traditional sterns: does ring 345 on the pendulum arm 330 swing clear of the top of the transom/pushpit when the pendulum rudder is raised? And is the ring clear of the transom in the lift-up position?

- 3 - Forward-raked/sugar-scoop sterns: does pendulum rudder shaft 420 swing clear of the bottom/aftermost edge of the transom?
- 4 - Start by fastening the mounting bracket 800/810 in place with just one bolt. Then align the bracket, mark where the remaining holes should be and predrill them with the 9 mm bit. Now drill out the holes with the 10.5 mm bit and complete installation of the mounting bracket.
- 5 - Align the system. Windvane shaft 140 must be vertical!

## 1.5 INSTALLATION: COMPREHENSIVE GUIDE

- Remember the five criteria.

### 1.5.1 HEIGHT ABOVE THE WATERLINE

- The rudder shaft has been manufactured to the correct length for your boat.
- The dynamic waterline should cover the rudder blade.
- The rudder will project some distance above the static waterline.
- Ideal installation height: bolt 435 should be about 5-10 cm/2-4 in above the static waterline.

### 1.5.2 INSTALLATION BY MOUNTING BRACKET TYPE

#### 1.5.2.1 MOUNTING BRACKET 0

- MB 0 is the standard mounting bracket and is designed for moderate sterns (approx.  $< -20$  degrees to  $< +10$  degrees of rake) and canoe sterns.

#### INSTALLATION PROCEDURE

- Locate the mounting bracket on the transom at the appropriate installation height.
- Rotate the four clamps 860 into place against the transom (use the mallet if required).
- Drill one hole (predrill with the 9 mm bit then complete with the 10.5 mm bit).
- Pass a bolt through the hole just drilled to hold the bracket in place.
- Align the bracket (level).
- Predrill three holes through the clamps 860 (9 mm bit).
- Remove the bracket.
- Drill out all the holes with the 10.5 mm bit.
- Place sealing compound (Sikaflex) around each hole.
- Set the 60 mm diameter plastic discs on the Sikaflex compound.
- Position the bracket on the transom and insert all four bolts.
- Working inside the hull, set the washers on the bolt ends and tighten the nuts/locknuts.
- SEQUENCE: bolt head/stainless washer/plastic washer/clamp/60 mm plastic disc/Sikaflex/transom/stainless washer/nut/nut

#### 1.5.2.2 MB 1 AND MB 2 EXTENSIONS

- MB 1 is designed for more extreme sterns (approx.  $< -40$  degrees to  $< +25$  degrees of rake) and transoms incorporating a short bathing platform.
- MB 2 is designed for very extreme sterns (approx.  $> -40$  degrees to  $> +25$  degrees of rake) and transoms incorporating a slightly more substantial bathing platform.

### INSTALLATION PROCEDURE

- Brackets 1 and 2 are designed to be installed on the (approximately) vertical face of the transom.
- Remember the five criteria.
- Both extension components 820/825 and 830/835 have slots that allow the system to be moved fore and aft, i.e. positioned horizontally. The flat surfaces of these extension components should be vertical with the rounded ends pointing aft.
- The pendulum arm 300 should swing close to the transom (3-5 cm/1¼-2 in should be enough clearance). This ensures that it will not stick out beyond the aft edge of the transom in the lift-up position and will therefore be safely protected. Remember, the pendulum rudder shaft 420 is angled 10 degrees off vertical.
- Ideally everything should be as close to the transom as possible for optimal protection in the lift-up position.
- Fit crossbar CB if the steering line angle is greater than 30 degrees (see 1.6 The Steering Lines).

#### 1.5.2.3 MB 3 AND MB 4 EXTENSIONS

- MB 3 is designed for boats with a large bathing platform where the top of the platform is around 50 cm/20 in above the waterline.
- MB 4 is designed for boats with a large bathing platform where the top of the bathing platform is < 50 cm/20 in above the waterline.

### INSTALLATION PROCEDURE

- Brackets 3 and 4 are designed to be installed on the base (horizontal surface) of the sugar scoop.
- See items 1, 3 and 5 of the five criteria to determine the ideal position.
- Both extension components 840 and 845 have slots that allow the system to be moved up and down, i.e. positioned vertically. The flat surfaces of the extension components should be vertical with the rounded ends pointing up.
- The pendulum arm should swing close to the transom. This ensures that it will not stick out beyond the aft edge of the transom in the lift-up position and will therefore be safely protected. Remember, the pendulum rudder shaft 420 is angled 10 degrees off vertical.
- NOTE: you can adjust the position of the pendulum rudder with respect to the aft edge of the transom even if the system is already completely installed: loosen bolts 801/811 on the bracket extensions 840/845 and bolts 805 that retain the bracket crown 800 - you should now be able to adjust the system fore and aft as required. Don't forget to retighten everything once you've finished!
- Fit crossbar CB 880 (see 1.6 The Steering Lines).

#### 1.5.2.4 MB 5 EXTENSIONS

- MB 5 is conceived for boats with a transom-hung rudder, Colin Archer designs etc.

### INSTALLATION PROCEDURE

- First fasten the upper pair of arms 850 to the transom with bracket cheeks 820 and clamps 860 so that the main rudder can turn freely (move the clamps closer together or further apart as required).
- Remember the five criteria.

- The main rudder must be able to move freely along its length even with the pendulum rudder in the lift-up position.
- Now fit the lower pair of arms 850 with any extension plates required.
- Ideally all four arms should be level.
- If you need to align the system, slacken bolts 801/805.
- Fit crossbar CB 880 if the steering line angle is greater than 30 degrees (see 1.6 The Steering Lines).

#### CAUTION

- The bolts must be properly seated and tightened - check them regularly!
- If the bolts work loose, the whole system could be lost.
- Attach a safety line to your PACIFIC just in case.

#### 1.5.3 DO I NEED TO REINFORCE THE TRANSOM?

- No. The forces on the transom are relatively low and should never exceed the steering force exerted on the tiller plus the weight of the system itself.
- The washers supplied provide sufficient load distribution for steel, aluminium, wooden and composite (solid laminate) hulls.
- Composite hulls built in sandwich laminate: cut the sandwich out from the inside and replace with wood. The wooden sections should be glued into place with synthetic filler (load distribution).
- CAUTION: If you decide you want to fit steel/stainless/aluminium transom reinforcement plates anyway, just in case, be sure to pack them in with filler so that the loads are properly distributed!

#### 1.5.4 WHAT IF THE BRACKET IS ALIGNED INCORRECTLY?

- No problem: slacken of the mounting bolts and use the rubber mallet to move the clamps 860 along the bracket sides 810 until the alignment is satisfactory.

#### 1.5.5 INSUFFICIENT SPACE FOR THE MOUNTING BRACKET (MB 0 ONLY)

- The system may be installed offset horizontally by up to 10 cm/4 in.
- The bracket may be adjusted vertically on its mountings by sliding clamps 860 along bracket sides 810. There must be at least 8 cm/3 1/5 in of vertical separation between each pair of clamps.

#### 1.5.6 MOUNTING THE SYSTEM ON THE MOUNTING BRACKET

- Slide the system into the bracket with the pendulum axle 340 at the front and fasten in place with bolts 805.

#### 1.5.7 IS THE WINDVANE SHAFT VERTICAL?

- Windvane shaft 140 must be vertical. You can adjust it by slackening all four side bolts 801 and both bolts 805 and then aligning the bracket crown 800.
- Check the alignment of the pendulum rudder shaft 300: it should now be angled aft 10 degrees from vertical.

#### 1.5.8 REMOTE CONTROL

- Lead the thin red line supplied through the slot in windvane shaft 250 and around the knurled red knob 270.
- Knot the two ends of the line together and secure the line in the cockpit with bungee cord.

- To operate the remote control, take the line in both hands and pull on one side of the loop with one hand while paying the other side without tension with the other hand. Never pull on one side with both hands!

### 1.5.9 ALIGNMENT

#### WINDVANE SHAFT 140

- The windvane shaft 140 must be vertical.
- Side-to-side adjustment: release bolts 801/805
- Fore-and-aft adjustment: release bolt 251
- Don't forget to retighten the bolts once the windvane is properly aligned!
- If you still can't make the windvane vertical, see 1.5.4 What if the Bracket is Aligned Incorrectly.

### 1.5.10 PENDULUM RUDDER LIFT-UP

- Tie one end of the red lift-up line through ring 345 and secure the other end to the pushpit. Raise the pendulum rudder, take the red line once around windvane shaft 140 and rudder shaft 400 and tie it back to the pushpit.

## 1.6 THE STEERING LINES

### 1.6.1 GENERAL

- The steering performance of your PACIFIC will be strongly influenced by the quality of the force transmission from the pendulum rudder to the main rudder; in other words, you can't have good steering unless the steering lines are working smoothly.
- Depending on the setting of the variable transmission, the PACIFIC provides maximum steering line travel of between 20 and 25 cm/8 and 10 in (a feature it shares with other popular systems like the Aries and Monitor).
- Anything that impairs the force transmission will have an immediate impact on steering quality. Slack, stretch or play in the steering lines or stiffness in the main rudder bearings all detract from the performance of your system. Errors and compromises at this point add up to poor steering, plain and simple. All servo-pendulum gears that use the 2:1 bevel gear linkage (Aries, Fleming, Monitor) work in exactly the same way. The differences lie in the operating conditions on different boats!
- NOTE: what use is 20-25 cm/8-10 in of travel at the pendulum arm if only a fraction of that reaches the main rudder?

### 1.6.2 THE BASICS

- Keep the steering lines as short as possible.
- Use the smallest possible number of blocks.
- Use non-stretch lines.
- Make sure the angle formed by the lines between the system and the back of the boat (seen from above) is no greater than 30 degrees.
- Check the tension of the steering lines.
- Watch to make sure that line travel is not being wasted between the pendulum arm and the main rudder.
- Check that the main rudder bearings run smoothly.

- Check wheel steering systems for play and stiffness.

### 1.6.3 WINDPILOT SYSTEM REQUIREMENTS

- Ring 345 on the pendulum arm must be at deck level.
- This keeps the steering lines short.
- There are no unnecessary blocks on the steering lines.
- There are no blocks fitted to the system itself.
- The pendulum rudder shaft is long enough to provide plenty of leverage for the pendulum rudder.
- The bevel gear linkage is working properly to provide automatic yaw damping.
- The system is sensitive in light airs but powerful in stronger wind conditions.

### 1.6.4 BE AWARE

- Take care when setting up the steering lines between the WINDPILOT and the main rudder. Poor force transmission will seriously impair steering quality.

### 1.6.5 CROSSBAR

- A crossbar should be fitted if the angle formed by the lines between the system and the first set of turning blocks on the back of the boat (seen from above) is greater than 30 degrees. Above 30 degrees the amount of wasted steering line travel becomes a serious problem, especially on larger boats (around 38 ft and upwards) where the full travel is essential for optimal performance.
- The crossbar is available as an option with mounting brackets 0, 1, 2 and 5 and is standard with mounting brackets 3 and 4.
- The crossbar 880 is installed adjacent to the top of the mounting bracket. The two aft blocks can then be fitted at the ends of the crossbar to give a much more favourable angle and recover the lost travel.

### 1.6.6 DEDICATED BREAK POINT FOR STEERING LINES

- Two of the turning blocks for the steering lines should be fastened to the boat only with thin cord (e.g. 3 mm burgee halyard). If, for whatever reason, the transmission system should be overloaded, these thin lines will break and save the rest of the setup.

### 1.6.7 SHOULD I SPLICE THE STEERING LINES?

- No, it is better just to use knots as you can then end-for-end the lines easily to spread the wear.

### 1.6.8 STEERING LINES AND TILLER STEERING

#### 1.6.8.1 POSITIONING THE TILLER FITTING

- Tiller fitting 010 should be mounted about 65% of the way along the tiller, measuring from the rear (e.g. if your tiller is 100 cm/40 in long, the fitting should be about 65 cm/26 in from the aft end).
- Moving the tiller fitting further forward increases leverage but reduces the angle through which your PACIFIC can turn the rudder.
- Moving the tiller fitting aft increases this angle but reduces leverage.
- NOTE: it is impossible to have more leverage and more movement at the same time!

- A servo-pendulum system with automatic yaw damping like the PACIFIC is designed to operate with an average steering line travel between the system and main rudder of 20-25 cm/8-10 in (once again this is typical of such systems: the Aries and Monitor are just the same).

#### 1.6.8.2 POSITIONING THE RING ON THE PENDULUM ARM

- Moving the ring up the arm (away from the axle) increases travel but reduces transmission force.
- Moving the ring down the arm (towards the axle) increases transmission force but reduces travel.
- See 2.2.8.1 Determining the Ideal Settings.

#### 1.6.8.3 STEERING LINE BLOCKS

- The first pair of blocks should be mounted on or outside the pushpit as far aft as possible.
- The other pair should be mounted on the cockpit coaming slightly aft of the tiller fitting.
- Tie the steering lines to the ring 345 on the pendulum arm.
- Lead them forward to the tiller through the two sets of blocks.
- Attach the chain section where the steering lines approach the tiller fitting.

#### 1.6.8.4 LINE TENSION

- The lines must be neither too slack nor too tight; either will impair steering.
- The steering lines should be rigged such that engaging the chain in the tiller fitting sets them to their ideal working tension.
- IDEAL TENSION: no slack, no strain.

#### 1.6.8.5 CENTRING THE TILLER AND THE CHAIN

- The system and tiller can be centred with respect to each other (e.g. to compensate for weather helm as wind and sea conditions change) by adjusting the chain at the tiller fitting.
- Assembly sequence: line/shackle/chain/2 snap shackles/line.

### 1.6.9 STEERING LINES AND WHEEL STEERING

#### 1.6.9.1 FITTING THE WHEEL ADAPTOR

- Start by fastening the adaptor to one spoke of the wheel.
- Make sure the adaptor is centred and then fasten two more clamps to the wheel.
- Remove the plastic retaining bolt. The adaptor must be able to rotate freely without fouling the spokes.
- The lines should each be led around the adaptor one and a half times from the point where they attach to it (friction/load distribution). They can then be connected to the steering lines coming from the side/aft (using snap shackles).

#### 1.6.9.2 RIGGING THE STEERING LINES

- Both lines should initially be led from the ring 345 to their respective corners of the pushpit.
- If desired, one line may now be led across the pushpit so that both lines are on the same side of the boat.

- NOTE: keeping both lines on the same side of the cockpit leaves the other side free for access.
- Take the lines forward until they are level with the wheel.
- Pass them through a pair of turning blocks and across towards the binnacle.

#### BOTH LINES ON THE PORT SIDE

- The line that runs from the system to the port side of the boat should be led around the bottom of the wheel adaptor.

#### BOTH LINES ON THE STARBOARD SIDE

- The line that runs from the system to the starboard side of the boat should be led around the bottom of the wheel adaptor.

#### 1.6.9.3 CONNECTION POINT

- Each line from the wheel adaptor should be connected to the appropriate steering line from the system using two snap shackles (i.e. four snap shackles in total). This helps when you come to release or reconnect the lines (to engage or disengage the PACIFIC). Ideally the connection should be half way between the binnacle and the pair of turning blocks at the side of the cockpit, but if there is insufficient space, the snap shackles can also be connected between the turning blocks in the cockpit and those on the pushpit.
- CAUTION: be sure to mark the snap shackles so that you can tell which to connect to which!

#### 1.6.9.4 LINE TENSION

- Slack can be controlled by including an extra block on the steering lines. This block is mounted (e.g. on the pushpit) so that it can be tensioned perpendicular to the lines using thin cord. The more you tension the cord, the more the block pulls the slack out of the steering lines.
- Releasing this block provides sufficient slack to uncouple the four snap shackles at the connection point.
- The block can then be used to re-tension the steering lines once the snap shackles have been reconnected prior to switching over to WINDPILOT steering.

#### 1.6.9.5 TRANSMISSION RATIO

- The wheel adaptor is designed for mechanical wheel steering systems with a range of around two and a half revolutions from stop to stop and a wheel diameter of approximately 60 cm/24 in. This means in practical terms that the maximum line travel of 25 cm/10 in is sufficient to turn the wheel through half a revolution, given perfect transmission.

#### 1.6.9.6 VARIABLE FORCE TRANSMISSION

- The force transmission characteristics can be adjusted using the slot in the pendulum arm 330 (see 2.2.8.1 Determining the Ideal Settings).

#### 1.6.9.7 FORCE TRANSMISSION WITH WHEEL STEERING: EXAMPLES

Example 1:

- Wheel diameter = approx. 60 cm/24 in
- Revolutions from stop to stop = 2.5
- Position of ring 345 = approx. centred in the slot

Example 2:

- Wheel diameter = approx. 100 cm/40 in
- Revolutions from stop to stop = 1.5
- Position of ring 345 = towards the bottom of the slot

Example 3:

- Wheel diameter = approx. 55 cm/22 in
- Revolutions from stop to stop = 3-4
- Position of ring 345 = towards the top of the slot

#### 1.6.9.8 TEST

- It is actually quite straightforward to work out the key parameters for your boat - see 2.2.8.1 Determining the Ideal Settings.

#### 1.6.10 STEERING LINES AND THE EMERGENCY TILLER

##### 1.6.10.1 MECHANICAL WHEEL STEERING

- Connecting the steering lines to the emergency tiller of a mechanical wheel steering system will not yield good steering because the tiller has to move the whole of the steering mechanism from the wrong end every time it tries to turn the rudder. It's like trying to turn the steering wheel of your car by sitting in the road and tugging on the front wheels!
- Good steering can only be had by this route if the transmission components of the wheel steering system are completely disconnected from the quadrant (emergency).

##### 1.6.10.2 HYDRAULIC WHEEL STEERING

- Connecting the steering lines to the emergency tiller of a hydraulic steering system is pointless, as the tiller cannot possibly supply enough force effectively to move the hydraulic cylinder. A bypass valve will not help either.
- Good steering can only be had by this route if the transmission components of the wheel steering system are completely disconnected from the quadrant (emergency). A word of advice for anybody still tempted to try connecting a servo-pendulum system up to a hydraulically operated main rudder: don't do it - you'll end up steering by hand!

#### 1.7 THE PENDULUM RUDDER

##### 1.7.1 MOUNTING THE RUDDER BLADE 440

- The blade should be mounted with the rounded edge facing forward and the sharp edge facing aft.

##### 1.7.2 POSITIONING THE RUDDER BLADE

- The pendulum rudder blade must be angled down and aft exactly in line with the rudder shaft, otherwise the balance will be off.
- Adjusting the rudder blade aft reduces the force generated (by reducing the balance proportion).
- Adjusting the rudder blade forward increases the balance proportion excessively, with the result that the rudder controls the windvane instead of the other way around.

- Both the adjustments described impair the performance of the system and make steering problems inevitable.

### 1.7.3 OVERLOAD PROTECTION

- Mounting bolt 435 for the rudder blade 440 should be tightened gently so that the rudder blade can still swing up if it strikes something below the water.
- The rudder blade is retained in the shaft fork by friction only.

### 1.7.4 PENDULUM RUDDER LIFT-UP

- Tie one end of the red lift-up line through ring 431 and secure the other end to the pushpit.
- Raise the pendulum rudder, take the red line once around the windvane shaft 140 and rudder shaft 420 and tie it back to the pushpit.
- It is not possible to raise the pendulum rudder out of the water while the boat is moving as the resistance is generally too high. Lift-up under way may be possible at speeds below two knots.
- The pendulum rudder may be dropped back into the operating position at any time.

## 1.8 WINDPILOT AND AUTOPILOT

### 1.8.1 CONFIGURATION

#### MB 0

- A pin suitable for connecting an Autohelm or Navico push rod autopilot is included as standard on the windvane hanger 110 of every WINDPILOT system.
- Find a good spot to attach the cockpit autopilot to the pushpit. The autopilot should be at approximately the same height as the pin on the windvane hanger.
- Rotate the windvane shaft into a position where the autopilot push rod can move through its full travel from stop to stop unimpeded. Mark this position on the windvane shaft.
- Fit the mount for the autopilot to the pushpit (e.g. on a wooden block on the railing).
- The autopilot/windvane combination should only be used to steer compass courses.
- The autopilot/windvane combination will not perform well motoring in calm conditions as turbulence from the propeller interferes with the proper operation of the pendulum rudder. The autopilot should be connected directly to the tiller or wheel in these conditions; since the engine is running, there is no need to save power by using the windvane anyway.
- See 2.0 Sailing with Your WINDPILOT for operating instructions.
- CAUTION: always secure the autopilot with a safety line!

#### MB 1 - 5

- If your PACIFIC uses a crossbar for the steering lines and it is not possible to mount the autopilot on the pushpit, fit additional clamp 870/875 with the autopilot support onto the mounting bracket and adjust the length and position as required.

## 2.0 SAILING WITH YOUR WINDPILOT

## 2.1 SAILING WITH YOUR WINDPILOT: QUICK GUIDE

- Bring the boat onto course.
- Lower the pendulum rudder blade into the water.
- Fit the windvane.
- Set the windvane into the wind (it should now be standing upright).
- Connect the steering lines to the boat's main steering.
- Fine trim the steering at the system or the main rudder.

## 2.2 SAILING WITH YOUR WINDPILOT: COMPREHENSIVE GUIDE

### 2.2.1 SYSTEM NOT IN USE

- Keep the pendulum rudder blade in the lift-up position.
- Remove the windvane.

### 2.2.2 PREPARING FOR USE

- Bring the boat onto course.
- Lower the pendulum rudder blade into the water.
- Fit the windvane and turn it into the wind manually (the windvane should now be standing upright).
- NOTE: the counterweight should now be pointing into the wind.

### 2.2.3 CONNECTING THE STEERING LINES

#### 2.2.3.1 TILLER STEERING

- Connect the two snap shackles.
- Engage the chain in the tiller fitting.
- Remove any slack in the lines.
- CAUTION: only remove the slack. Do not pull the lines taught, as this increases friction and impairs steering.

#### 2.2.3.2 WHEEL STEERING

- Connect the two pairs of snap shackles (make sure the lines are not crossed!).
- Remove any slack in the lines.
- CAUTION: only remove the slack. Do not pull the lines taught, as this increases friction and impairs steering.

### 2.2.5 ALTERING COURSE/TURNING

- Turn the windvane shaft 140 either manually or with the remote control and refer to the degree scale on the windvane shaft 140.

### 2.2.6 FINE TRIM - TILLER STEERING

- If wind/weather helm change, adjust the rudder position by changing the chain link in the tiller fitting.
- The windvane should work evenly around the upright position most of the time. If it is permanently off to one side, adjust your sail trim or reef down.
- NOTE: your PACIFIC can exert up to 200 kg/440 lbs of tensile force on the main steering, but sailing with the rudder well over all the time is highly undesirable (i.e. slow). Trim your boat and your sails - it's simpler and you'll get there faster!
- You can tell if your trim could/should be improved just by looking at the tiller. If the tiller is constantly off-centre, something needs to be done!

### 2.2.7 FINE TRIM - WHEEL STEERING

- Release the levers on the wheel adaptor.
- Adjust the main wheel until the boat is properly balanced.
- Retighten the levers.
- CAUTION: do not overtighten the adaptor levers. The adaptor works like a disc brake: if the system is overloaded, the drum slides on the disc to absorb the excess force and prevent damage to itself or the other transmission components.
- TIP: it is not necessary to release the adaptor levers completely to fine trim at the wheel. The whole operation is easier if they are simply loosened enough to allow the adaptor to slide. It is normally sufficient on boats up to 36 ft or so to tighten only one of the levers. The second lever can then be tightened if required in more difficult conditions.

### 2.2.8 IS THE VARIABLE FORCE TRANSMISSION SET CORRECTLY?

- With the boat making good speed, manually turn the windvane all the way to one side and hold it there:
- If the pendulum rudder moves approx. 25 degrees to one side, the force transmission is set correctly.
- If the pendulum rudder moves significantly less than 25 degrees, slide ring 345 a little further down the pendulum arm (less travel but more force).
- If you have tiller steering, you could alternatively move the tiller fitting forward (never move the fitting aft).

#### 2.2.8.1 DETERMINING THE IDEAL SETTINGS

- The pendulum arm should always be able to make use of its full 25 degrees of travel to each side. This can be adjusted by moving the transmission point (ring 345).
- TIP: leave the ring in the centre of the slot until you have tested everything properly under sail.
- If the pendulum arm reaches 25 degrees off-centre too quickly and easily, move ring 345 up the slot (longer lever).
- Keep testing the settings and moving the ring up until the lateral travel of the pendulum arm begins to be limited to less than 25 degrees.
- Now gradually move the ring 345 back down the slot, testing the different settings as you go, until the pendulum arm is just able to reach the full 25 degrees of travel.
- CAUTION: larger, heavier boats may need to reach a relatively high boat speed to move the pendulum arm through the full 25 degrees.
- The force generated by the servo system is always dependent on leverage, rudder area and speed. These factors are the product of physical laws, the consequences of which are inescapable!

### 2.2.9 SETTING THE WINDVANE FOR DIFFERENT WIND STRENGTHS

#### 2.2.9.1 LIGHT WINDS

- Set the windvane absolutely vertical for maximum sensitivity.
- The upright setting also provides maximum steering force with the wind from astern.

- A strip of spinnaker cloth ('windvane telltale') on the upper trailing edge of the vane further improves sensitivity.
- CAUTION: you should not need to use a larger windvane in light airs. If you do use a larger vane, it must be exactly the same weight as the standard vane.
- This setting is particularly suitable for sailing with the wind aft of the beam, when the apparent wind strength is always relatively low.

#### 2.2.9.2 MODERATE WINDS

- Set the windvane angled back 20 degrees away from the wind.
- This position is the general setting for sailing with the wind forward of the beam (relatively high apparent winds).

#### 2.2.9.3 STRONG WINDS

- Angle the windvane further back from the wind (more damping).
- If the windvane begins to vibrate in very strong winds, try angling it back even further. The vane can go as far as about 70 degrees back, which should improve damping and give smoother steering impulses (and hence better steering).
- This position is the general heavy air setting.

#### 2.2.9.4 THE IDEAL WINDVANE POSITION

- The windvane should always be working evenly around the upright position.
- If all the movement is occurring on one side, i.e. between the upright position and one of the end stops, adjust the tiller connection or wheel adaptor position until the movement is more evenly distributed.
- If the windvane is permanently well over to one side, correct the course setting at the windvane shaft either manually or using the remote control.
- Check the degree scale.
- NOTE: the reading on the scale at the windvane shaft 140 may differ slightly from the reading on your wind instrument. This is because wind conditions at deck level tend to be different from those at the top of the mast.

### 2.2.10 WINDPILOT AND AUTOPILOT

#### PREPARING FOR USE

- Remove the windvane.
- Turn the windvane shaft to the marked position.
- Fit and secure the cockpit autopilot.
- Connect the power supply.
- Connect the steering lines to the boat's main steering.
- Switch the cockpit autopilot from standby to on.
- CAUTION: check the polarity at the autopilot. If it turns to starboard when you request port, you need to reverse the polarity.
- Reversing the polarity should be a simple two button function on most of today's cockpit autopilots (check the autopilot manual).
- TIP: the PACIFIC/autopilot combination only makes sense on a larger boat (6 metric tons or heavier) with wheel steering if the boat has no conventional cockpit wheel autopilot.

#### 2.2.11 SWITCHING BACK TO MANUAL STEERING

### 2.2.11.1 EMERGENCY

- Disconnect the steering lines from the main steering (tiller: disengage chain, wheel: release wheel adaptor adjustment levers).
- The windvane gear is now completely isolated and will not interfere with the steering in any way. You may alter course as desired.

### 2.2.11.2 NORMAL USE

- Remove the windvane.
- Disconnect the steering lines from the main steering.
- Lift up the pendulum rudder using the red line.
- CAUTION: slow down before attempting to lift up the pendulum rudder. If the boat is moving too fast, there will be too much resistance to raise the pendulum rudder.
- The pendulum rudder may actually be left in the water without doing any harm, but don't forget to lift it up out of the way before entering harbour/manoeuvring under engine.

### 2.2.12 REMOVING THE SYSTEM IN HARBOUR/FOR WINTER STORAGE

- Release bolt 805.
- Secure the system with a safety line.
- Remove the system.
- There is no need to remove the mounting bracket.
- CAUTION: When fitting/removing your PACIFIC be sure never to handle/lift it by the windvane shaft 140 alone. The shaft is retained on the worm gear 260 by just two M4 bolts 261 and is not designed to bear the weight of the whole unit.
- The system is best handled/lifted using the casting 250 at the base of the windvane shaft.

### 3.0 CAUTION

- The WINDPILOT PACIFIC is a servo-dynamic system.
- Keep hands well away from the pendulum arm when the system is in operation (trap hazard).
- Take care when adjusting the windvane shaft manually (e.g. changing course) while the vane is in operation: moving parts can be dangerous.
- The pendulum rudder can only be raised into the lift-up position at boat speeds of less than 2 knots.
- The pendulum rudder may be dropped back into the operating position at any time.
- Always secure the system with a safety line before attempting to fit or remove it.
- Check the mounting nuts and bolts on the transom regularly.
- CAUTION: the system may be lost if the mounting bolts work loose. Never use the system if the bolts are known to be loose.
- When fitting or removing the system handle/lift it only using the pendulum arm and the casting at the bottom of the windvane shaft!

### 4.0 MAINTENANCE

- The system is largely maintenance free. It is, however, as susceptible to the effects of sun, salt and dirt as anything else onboard and will reward you for a little

attention. Please take note of the care guidelines below. Follow them, and your WINDPILOT system should keep going indefinitely.

#### 4.1 BEARINGS

- The bearings are made from Teflon, POM and Delrin. These materials must not be oiled or greased.
- Grease or oil in contact with seawater quickly solidifies, causing bearings to stick or seize.

#### 4.2 CLEANING

- Clean the system with fresh water and rinse thoroughly.
- TIP: thoroughly soak your PACIFIC in salt water (15 minutes should be long enough) at twilight on a damp evening and then rinse with fresh water.
- This applies equally to the rest of the boat. Salt crystals and sunlight soon take the gloss off any shiny surface, but a thorough soak and rinse at the end of every long trip will keep your boat looking its best.

#### 4.3 BEVEL GEAR LINKAGE

- Clean the bevel gear linkage twice a year.
- Clean any salt or oil from bearing 328.
- Make sure the gears are in the right position when reassembling the linkage (see 5.0 Troubleshooting).
- Never grease bearing 328!
- Axle 334 may be treated with WD-40 or Teflon spray.
- TIP: try to avoid leaving your system exposed for long periods without use (remove or cover the system). When the pendulum rudder is in the lift-up position, dew and rain wash accumulated dirt and grime off the rudder and rudder shaft down into the bearings, causing them to seize. The bearings can only become blocked with salt/dirt like this in the lift-up position; the same can never happen in the operating position!

#### REMOVING THE SMALL BEVEL GEAR 305

- Remove red cap 320.
- Release screw 163 to remove push rod 150.
- Remove bolt 251 to release the windvane support 250.
- Slide the pendulum arm 330 and the windvane support 250 forward off the pendulum axle 340.
- CAUTION: watch out for bearing rings 341.
- Release nut 331.
- Release screw 334.
- Remove bevel gear and clean.

#### 4.4 PUSH ROD 150

- Always check that the top (156) and bottom (160) universal joints turn smoothly on the push rod. If they stick at all, try loosening the connections. Apply WD-40.

#### PUSH ROD POSITION

- Nuts 154 are adjustable.

- Ideal position: windvane vertical, pendulum arm 330 vertical, pendulum rudder 440 in line with keel, arm of small bevel gear 305 in the 'quarter past twelve' position

#### 4.5 WORM GEAR 260/270

- The worm gear will appreciate a drop of washing up liquid or a squirt of silicone/Teflon/WD-40 spray every so often.
- If the worm gear is sticking, release bolt 273 and nut 271, remove the worm 270 and clean it.

#### 4.6 CAST AND TUBULAR COMPONENTS

- All the cast and tubular components in the system have been treated with lanolin before assembly and will come apart again readily even after prolonged operation.
- Wax the tubular components occasionally.

#### 4.7 LANOLIN

- Lanolin has been applied to all screwed or bolted joints to prevent electrolytic reactions.
- Lanolin works equally well on all the other screws and bolts on the boat (and also makes a good hand creme!).

#### 4.8 ANTIFOULING

- Never antifoul the pendulum rudder blade. It should only be in the water when the system is in use, so there should never be any growth on it anyway.
- The pendulum rudder blade can be cleaned in the lift-up position.
- Antifouling may clog the bearing if liquid paint runs up the blade in the lift-up position.
- TIP: treat the blade with varnish only.

#### 4.9 WINDVANE

- A spare or replacement windvane must weigh exactly the same as the original windvane. If it does not, adjust the dimensions until it does.
- CAUTION: even a coat of paint can significantly add to the weight of your windvane. The painted windvane must weigh exactly the same as the original it is to replace.
- The counterweight is matched to the weight of the original windvane. Using a windvane of a different weight will reduce the sensitivity of the system and impair steering quality, especially in lighter airs.
- The windvane may be no more than 50 g/1¾ oz lighter than the counterweight. It must never be heavier than the counterweight!

#### 4.10 WINDVANE TELLTALE

- There comes a point where there is just too little wind to move the windvane. The fluttering of the windvane telltale, a strip of spinnaker cloth attached towards the upper trailing edge of the vane, provides that little extra steering impulse and extends the range of conditions over which the system can sensibly be used.

#### 5.0 TROUBLESHOOTING

### 5.1 SYSTEM IS TURNING THE WRONG WAY

- Are the steering lines connected wrongly to the wheel adaptor? See 1.6.9.2 Rigging the Steering lines.

### 5.2 SYSTEM PERFORMANCE IS NOT SATISFACTORY

- Is the pendulum rudder positioned correctly? See 1.7 The Pendulum Rudder.

#### 5.2.1 POSITION OF PENDULUM RUDDER BLADE

- If the pendulum rudder blade is too far aft, the balance proportion will be too small and the system will only be able to steer at relatively low speeds. No effective steering impulse will be generated at higher speeds.
- If the pendulum rudder blade is too far forward, the balance proportion will be too large. The pendulum rudder will be moving the windvane instead of the other way around, leaving the system completely unable to steer.
- Lower the pendulum arm into the water. If it immediately starts swinging around and seems unable to settle on centre, the pendulum rudder is too far forward.

#### 5.2.2 STEERING LINES RIGGED INCORRECTLY

- Are the transmission angles ok? See 1.6 The Steering Lines.
- Do you need a crossbar? See 1.6 The Steering Lines.
- Are the steering lines free of slack, stretch and play? See 1.6 The Steering Lines.

#### 5.2.3 THE PENDULUM RUDDER IS NOT MOVING 25 DEGREES TO EACH SIDE

- See 2.2.8 Is the Variable Force Transmission Set Correctly.

### 5.3 SYSTEM IS STICKING

#### 5.3.1 AT THE WINDVANE

- Does the windvane hanger 110 turn easily on axle 113?
- Check screw connection 113/116 and adjust if required.
- Are the screw connections on the push rod 150 and the top and bottom universal joints 156/160 properly adjusted? The universal joints must turn freely on the push rod.
- The upper screw 301 on the pendulum arm 330 must not be too tight otherwise bearing 328 will stick.

#### 5.3.2 AT THE RUDDER AXLE

- If there is friction at the rudder axle, the system will have to be disassembled and cleaned.

### DISASSEMBLY PROCEDURE

- Remove the system from the transom.
- Remove red cap 320.
- Remove screw 254.
- Push shaft 255 down out of bevel gear 253.
- Mark the relative positions of the two gears in the bevel gear linkage.
- Clean bearing 328.

## ASSEMBLY PROCEDURE

- Check the position of the two gears. The lever on the small gear 305 should be in the 'quarter past twelve' position.
- Check that the pendulum arm is vertical.
- Check that the pendulum rudder blade is in line with the keel.
- Check that the hole in bevel gear 253 is flush with the hole in shaft 255.

### 5.3.3 AT THE STEERING LINES

- Do the blocks move freely?
- Are the transmission paths too long?
- Is the wheel too far from the transom (centre cockpit)?
- Are the main rudder bearings stiff?
- Is the wheel steering system stiff?

### 5.4 THE PUSH ROD IS BENT

- Check the balance proportion of pendulum rudder blade 440 (see 1.7 The Pendulum Rudder).
- The push rod can be straightened easily.

### 5.5 THE WINDVANE SHAFT IS LOOSE

- Tighten bolts 251 and 805.

### 5.6 THE RUDDER BLADE IS VIBRATING

- Adjust the position of the pendulum rudder blade 440 in rudder fork 430.
- The vibrations should die down if you move the rudder blade aft very slightly.
- CAUTION: do not overtighten bolt 435 (overload protection).

## 6.0 REPAIRS

- The system may be disassembled and reassembled using the component drawings.
- If cast components suffer collision damage and replacements cannot easily be obtained, it may be possible to repair them. Cast aluminium components can be welded back together quite easily if the faces to be joined are first heated thoroughly for a few minutes with an open welding torch flame. The actual welding procedure should only be attempted with proper aluminium welding equipment.
- 6 mm marine plywood is ideal for making replacement windvanes (see 2.2.9 Setting the Windvane for Different Wind Strengths).
- Some bearing play may develop in pendulum axle bolt 340. This is not a problem and will not impair the steering performance of the system.
- The pendulum rudder blade may be replaced with a simple wooden plank (approx. 120 x 900 x 20 mm). Even a completely unprofiled piece of wood will work on a temporary basis.

- CAUTION: the pendulum rudder needs a balance proportion of around 20%, which means that 20% of the rudder area must be located in front of the rudder shaft. If necessary try turning the blade around. The windvane should always control the pendulum rudder blade and not the other way around. Check this by lowering the pendulum arm 180 into the water. If it immediately swings out to one side and forces the windvane to do the same, there is too much rudder blade in front of the shaft.

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and we'll do everything we can to help!