INSTALLATION GUIDE

HYDROVANE INTERNATIONAL MARINE INC
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HYDROVANE INSTALLATION GUIDE

APRIL 2017

We are so pleased that Hydrovane will be part of you sailing adventure.

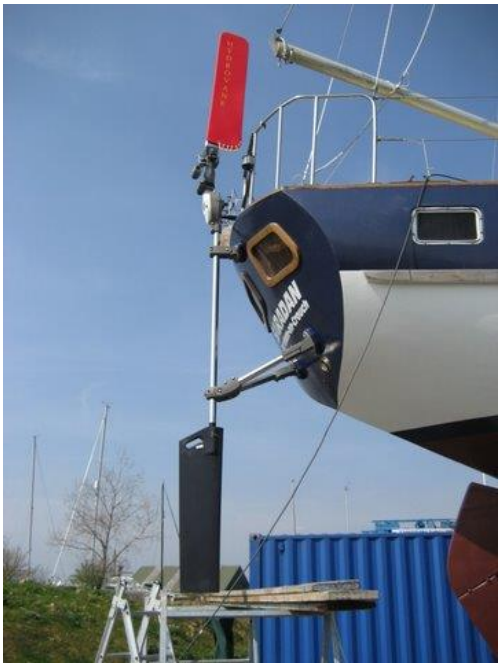
Should you have any questions during the installation, do not hesitate to ask John or Will.

Also of interest may be the installation videos, found on our website. Please note that the Final Inspection Drive Sleeve Test, as explained in the video, has changed for post-2015 units.

CONTENTS

The complete Hydrovane can be 10 to 15 feet (3 to 5 metres) tall and includes:

1. Vane – 56.5in/1435mm (Standard) or 42in/1118mm (Stubby or XT)
2. Drive Unit – 25.5in/650mm
3. Shaft assembly – various lengths
4. 2 brackets attaching the shaft to the transom
5. Rudder – 43 in/1092mm



A. CONSIDERATIONS AND PREPARATIONS

- INSTALLATION 'IN THE WATER' OR 'ON THE HARD'? – We have seen some problematic installations that were done in a boatyard. Our preference is for the 'in the water' installation, primarily because it provides certainty as to where the waterline is.

  Warning: If done in the water, keep lines on everything – the pieces are slippery, heavy, and valuable. Use strong tape and good knots.
  Tip: Rig a tarp under the aft end of the boat… just in case!

- 'OVER ENGINEER' to make a ROCK SOLID INSTALLATION – The loads on the Hydrovane brackets will be enormous at critical times. The weakest link need not be the timber pads (spacers), backing plates, or bolts – but that is what happens with poor installations. Use materials that are good quality and plenty strong.

Parts not Provided

The requirements of these items are unique from boat to boat, therefore, we do not supply with the unit:

- TIMBER PADS (SPACERS) – Pads are not provided, unless ordered from us. Many customers will custom fabricate. Pads / spacers are pieces of teak or suitable synthetic that are very hard and shaped in order to pick up the contour differences between the transom and the flat inside faces of the flanges. Even if the fiberglass transom appears to be flat at that point it is wise to make a spacer to be sure the load is equally distributed. That being said, true flat areas on the transom will not required a pad.

  Warning: The flanges must be flush with the contact surface, or the aluminum casting could fracture.

  PAD THICKNESS: Our old recommendation for a maximum thickness of timber pad was 4 in. or 100 mm. but that can be increased somewhat if the much harder phenolic plastics are used – then the challenge is to find bolts of sufficient length. For greater distances/thicknesses a stainless steel extension must be fabricated. This will have been discussed with Will or John.

  Suggestions on pad material:

  - The timber pads we sell are made of Oroko Teak – looks good and easy to work with, and can sandwich multiple pads together if required. They are 1" (25mm) thick each.
  - HDPE (has lots of brand names) – cheapest, easiest to work with and light (it floats)
  - UHMWPE (has lots of brand names… Starboard) – pricier

- Phenolic plastic or Tufnol – looks like wood, but very expensive
- Delrin/Acetol

Warning: Please bear in mind that it is critical the brackets cannot 'work' – THEY MUST BE ABSOLUTELY RIGID. Therefore, properly shaping the pads – if needed – is an important step, and many admit it is the most time-consuming part of the installation.



Tips: Pad Shaping – for some boats this is easy, others may need to get more creative!

TIMBER PADS – CONTOURING THE TIMBER PADS FOR CURVED SURFACES – Provided by Scott R. (Folkes 39): *"I taped a sheet of 3M 'Sandblaster' 60 grit (this paper cuts amazingly fast and doesn't load up) to my curved deck and transom where the pads would be mounted. I then drew indicating lines on each teak timber pad then began to "Holystone" in reverse! I would check the indicating lines to adjust the cutting evenly and to know when I was finished."*

MAKING A TEMPLATE – Provided by Scott R. (Bristol 40 yawl): *"I made a template of the transom curvature by laminating cereal box cardboard to the shape. I taped a piece of cardboard on the transom where the bracket was going. I then laminated additional sheets of cardboard on top on the taped-down one and used a hot glue gun as the adhesive for the laminate. The template came off the transom with the correct curvature, which is now my template for cutting the Starboard."*

- SEALANT – On the outside where the fit should be flush, any sealant from Sikaflex to 4200 or 5200 is fine. The purpose is to make it watertight.
- BACKING PLATES – The bolt head or nut on the inside of the transom must have its load distributed. Any substantial marine material can be used as a backing plate: 316 stainless, aluminum plate, any of the hard plastics that are listed above. Marine plywood can be another suitable material. Depending on the thickness of the hull, a 1/8" (3mm) stainless steel plate or 3/4" (2cm) plywood or synthetic is normally suitable. Washers alone are just not enough support – especially on modern lighter weight boats built to minimum tolerances.

  Sikaflex, 4200 or 5200 are often fine to use if the inside is fairly flat and the plate is flush.

  NUTS MUST BE FLUSH TO PLATE – EPOXY or FIBREGLASS RESIN FOR SPACER – The bolt nuts must be flush against whatever surface. If there are substantial gaps between the backing plates and the hull, they should be filled: mix a suitable quantity of epoxy or fiberglass resin and put it into a Saran Wrap or plastic pouch – fitted between the bracket flange and hull – tighten bolts – before the epoxy or resin hardens you must cut or mould the material to the desired shape – carving away any surplus – must be nimble – once hardened that stuff is brutal to work with.

  If there are obstructions for the bolts and the plates on the inside of the hull, two separate ones can be used. The bolts are 7" (17.8cm) apart.

Backing Plate Examples

- BEEF UP TRANSOM WITH FIBERGLASS – Generally not necessary for offshore capable boats. However, if there is any transom flex or potential for flex under load, the likelihood for failure is high, especially in the worst of conditions. Beef up the section of the transom with more fiberglass or use large, single piece, heavy gauge metal backing plate.
- M10 TRANSOM MOUNTING BOLTS – You will need to source 4 Mounting Bolts… 6 if you have the A bracket. The length required is dependant on the thickness of your pads, the transom, and the backing plate. Use metric M10 or non-metric 3/8" bolts (if you have a choice the metric M10 is the better of the two, a bit thicker, although we have no history of either breaking). The bolts must be marine grade – made of 316 or A4 stainless steel.

  Tip: If a particularly long bolt is required, but not available, one can be fashioned from threaded rod, using nyloc nuts on both ends and cutting off the excess. Such threaded rod is inferior to a proper bolt but considered adequate.
- WIRE BRUSH AND LITHIUM GREASE – Follow best practices to help prevent galling of all stainless steel bolts and and nyloc nuts provided with the unit:
  1. Always clean the thread of any residual bits – wire brush, wipe or blow
  2. If there are any burrs left from manufacturing, clip them off and file smooth the rough edge.
  3. Use a lubricant before tightening. The suggested lubricants should contain substantial amounts of molybdenum disulfide (moly), graphite, mica, or talc. We use a 'high pressure bearing grease' – Morris K43EP Lithium Multipurpose Grease (KEP).
  4. It may be wise to use non-stainless steel nuts (plain steel, plastic etc.) when positioning as 'dummies' and only use the stainless nuts for the final assembly.
  5. Never use an electric drill – the speed and pressure causes heat which makes matters worse.
  6. If you intend to remove the Hydrovane from the boat on a regular basis, consider replacing the stainless steel nyloc nuts with bronze (or NAB – Nickel, Aluminum, Bronze) and locking washers – to eliminate the potential for galling.

  Warning: Thread galling occurs when pressure and friction cause bolt threads to seize to the threads of a nut or tapped hole. Heat caused by tightening too quickly or too hard is usually the trigger. Once seized, the only solution is to cut the bolt or snap the bolt by adding extreme force to the wrench. That is why rigging screws are typically made with bronze barrels. This problem is exacerbated by bits of stray stainless steel or other grit and especially if the nut and bolt threads are cut to a tight tolerance. Follow best practices to avoid this frustrating problem.

- 2″ OD PVC TUBING – Not required, but recommend to be used as dummies for the shaft and bracket struts. Both are sized as 'imperial' (non-metric) 2″ (precisely 50.8mm) Outside Diameter (OD). In North America there is a common 2″ OD white plastic tube that is cheap and readily available (for central vacuum systems) and there is a European equivalent – 50mm pipe. Use the plastic tubes as lightweight dummies for positioning and determining strut lengths. The actual shaft is heavy to be playing around with.

PVC Tube Examples

Receiving Your Hydrovane

A new Hydrovane is shipped in 4 or 5 Boxes, each segment fully assembled:

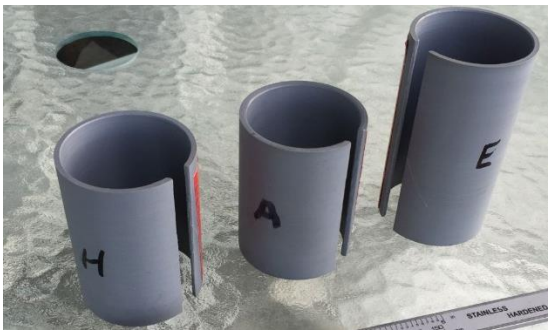
1. Drive Unit, H Bracket, Tiller/Fork Arm Assembly, Lead Counter Weights

   Warning: Tiller/Fork Arm Assembly and Counter Weights are under separate flaps. Be sure not to throw these out with the box! Look for them carefully… they will be there.

2. Rudder and Standard Vane Assembly
3. Shaft Assembly
4. Secondary bracket: A, E, or second H
5. Stubby or XT 'Extendable' Vane Assembly (if required)

- CHECK FOR DAMAGE – If there are any signs of damage from shipping, notify us immediately. UPS, our preferred shipper, will only process claims within 10 days of delivery.
- CHECK THAT THE SHAFT SPINS FREELY – Holding the shaft assembly in the air by the outer tube, spin the shaft inside. It should rotate freely. Once the shaft assembly is installed, you will do this test again to ensure the shaft is not binding. Check that the black Top Bearing and white Bottom Bearing are flush with the stainless tube. Check that stainless Bottom Collar is not touching the Bottom Bearing.

  Warning: Shaft Bearings can be knocked out of place during shipping. No damage done – usually only the two bearings need knocking back in place. Tap or bang each end of the shaft on a hard floor. The stainless Bottom Collar #26 might need re-setting. Loosen the set screw on the Bottom Collar then insert the shaft into the Rudder and then insert the Rudder Lock Pin. The Bottom Collar should sit on top of the Rudder, touching the rudder. Tighten the set screw to hold it in that position. Ensure a space between the top of the Bottom Collar and the Bottom Bearing – at least business card size.



- SHAFT SLEEVES – Take note of the shaft sleeves (grey plastic) that are included with both brackets, where the shaft slides in. These are common to lose overboard during the installation so we recommend taping them to the bracket. The sleeves are machined to specific widths and are NOT interchangeable. To avoid sleeve mix-ups, as of 2016, the A Shaft Sleeve is glued in place.

  Warning: Tightening brackets onto the shaft with incorrect sleeve will result in cracked castings. If you are installing an older unit, be wary not to mix them up.

Planning Your Installation

- John and Will Curry will have helped determine the correct shaft length and bracket configuration for your boat. You will probably have a good idea on where and how you want to mount the unit.
- FLEXIBILITY IN PLACEMENT – Since the brackets do not require critical positioning, you may move the placement higher or lower subject to the little surprises found on the inside of the transom and the following maximums and minimums.
- SHAFT VERTICAL – The object is to install the shaft in a vertical position, somewhere on the transom. To establish what is vertical, start with a measuring tape on the transom's mid point at the top to the point at the bottom (if there is one). For eyeballing, compare to the mast (or better yet, the keel, if on the hard).
- BOTTOM OF THE SHAFT SITS ABOVE THE WATER – Aside from 'off center' and 'distance from the main rudder' discussions with Will or John, the shaft is intended to sit with its bottom stub 1" (2.5 cm) above the water… for the practical reason: to avoid growth. That position is very suitable for normal operation. If, for other reasons, it is desirable to lower or raise the shaft, that is fine – subject to the obvious considerations.
- UPPER BRACKET – Preferably the upper bracket is close to the drive unit. The higher, the better, but leave at least 7" (18 cm) of shaft and stub for the Drive Unit to slide over. The upper bracket should be, preferably, no lower than 18in (46 cm) from the drive unit. This maximum has been stretched without consequence, but the concern is the amount of unsupported weight and structure.
- LOWER BRACKET – The bottom bracket should clamp on to the shaft at somewhere between 10 in (25 cm) and 20 in (50 cm) above the waterline. Ideally the bottom bracket is as low as possible but not too close to the bottom bearing as it will cause binding – prefer a minimum of 2" (5 cm) of stainless visible below the clamp. If need be, the bracket can clamp on a bit lower down of the shaft but ensure the shaft can spin freely and the bottom bearing is not crimped.

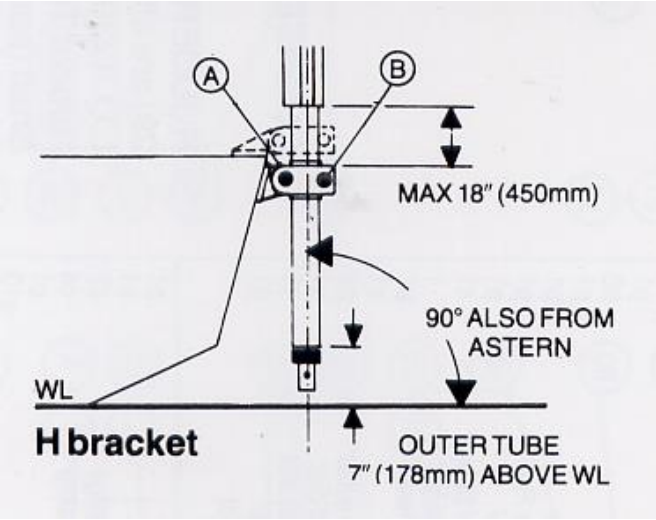
B. FITTING THE BRACKETS AND SHAFT

Always install the H (Hinged) bracket first! Your secondary bracket will be another H, an E, or an A.

First Bracket: Hinged 'H' Bracket

Every installation will have at least one H bracket.

For some installations, extra consideration may need to be made as to which way around it should be mounted – hinging up (more common) or hinging down (allows more space between the H shaft clamp and the bottom of the shaft).



Bolt Tightening Sequence: A – B

H Bracket lower position with plastic Pad

1. Mark out the centerline of the transom or a line parallel to the centerline for off center installation.
2. Put the H bracket on the transom and use a dummy PVC tube to find correct positioning where the shaft will be vertical side to side (fore and aft is not an issue at this point – the H bracket is hinged).
    - Traditional: if the transom is vertical or slopes forward from the deck, the bracket is fitted close to the deck line or on the deck.
    - Reverse and sugar scoop/platform: if the transom slopes aft from the deck, the H bracket is fitted as low as possible on the transom or on the counter underneath, but within the limits shown.

3. DRILL HOLES - Use the bracket flange as a template to mark the position of the two 3/8" (10 mm) clearance holes for the mounting bolts.
4. TIMBER PAD - If required, have ready a timber pad for between the bracket and the hull. See 'Timber Pad' above.
5. BACKING PLATE - Ensure use of a backing plate. See 'Backing Plate' above.
6. BOLT FLANGE TO TRANSOM - Bolt the H bracket securely on its timber pad to the hull using a sealing compound and 3/8" (10 mm) diameter stainless steel bolts.
7. CHECK POSITIONING - Before tightening the hull bolts fit the shaft assembly into the bracket with bolts (A) and (B) tightened only sufficiently to hold the shaft vertical to ensure the correct location of the bracket flange. Also be sure to check positioning of the grey shaft sleeve between the casting and the shaft tube.
8. SHAFT CLAMP BOLTS - You may choose to fit the real shaft at this point. Or, you may continue to use a PVC dummy shaft for positioning the secondary bracket.

   Whenever you are ready to install the real shaft and tighten the H Bracket Bolts, be sure to follow the BOLT TIGHTENING SEQUENCE:

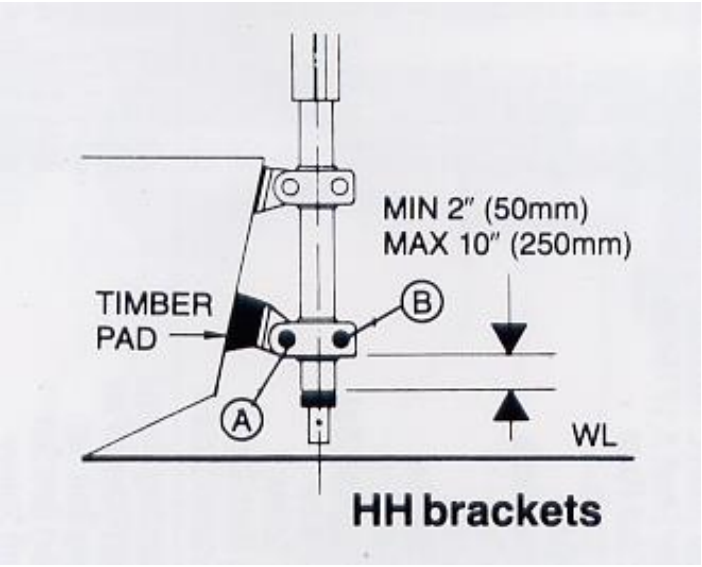
   - If you want, insert the SHAFT LOCKING PIN in the top hole and the fit the rudder (held in place with the RUDDER LOCKING PIN) to help confirm that the shaft is lined up vertically.
   - Support the unit so that bolt B may be slackened off and the forward bolt A tightened first, hard. Finally, tighten bolt B hard.

   Warning: Follow the Bolt Tightening Sequence!
9. When the H bracket installation is complete, recheck the tightness of all bolts.

Second Bracket: Hinged 'H' Bracket

On H/H installations the second H bracket is fitted as detailed above to give maximum bracket spacing within the limits shown.

If the transom is raked, the second H bracket will require a thicker pad to keep the shaft vertical. When the installation is complete, recheck the tightness of all bolts.



Bolt Tightening Sequence: A – B

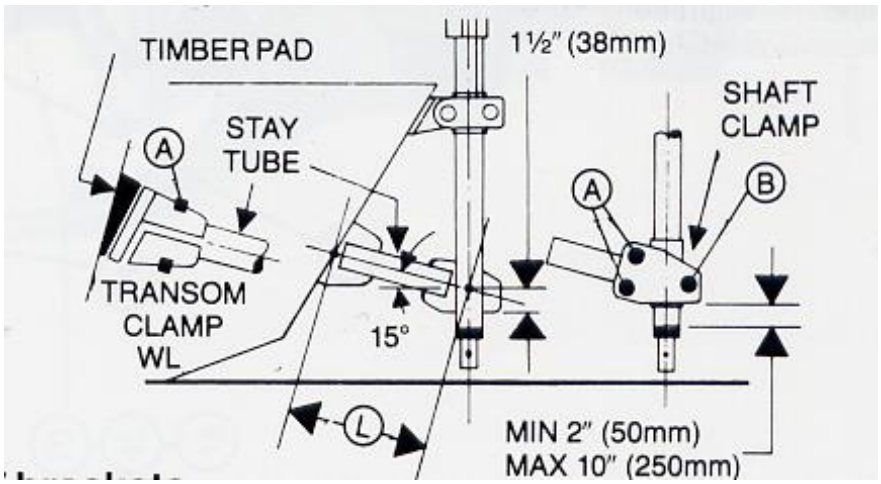
Second Bracket: Single Strut 'E' Bracket

The E bracket is the only bracket without a hinge, meaning the angles are fixed and MUST be accommodated by using a timber pad to accommodate the contour of the hull and the difference in angles.

- FIXED ANGLES – Each of the castings at either end of the Strut (Stay Tube) hold the tube at an angle of 15 degrees. The result, depending on the direction the castings are positioned, it to create aggregate angles of either 30 (15 + 15) or zero (15 – 15) degrees.

The E Flange should always be mounted horizontally on the transom for maximum lateral support.

Warning: The bracket must be well aligned. Misaligning the castings and struts cannot be solved by cranking into place when bolting together. The bracket must fit perfectly before bolt tightening. If bolted in place in other than its natural position (ie, forced into place) then there will be constant stress on the casting(s) which inevitably ends in a 'stress fracture' – a broken casting. The aluminum metal used can tolerate considerable flex for short periods and withstand enormous working loads BUT it cannot handle constant stress.



Bolt Tightening Sequence: all A's – then B

E bracket in lower position

E bracket in upper position

1. FLANGE FLAT ON TRANSOM - Start with the flange as close to flush with the transom as possible. As shown above, there is almost always a difference in angle to accommodate. Ideally the bolts will be perpendicular to the transom (means the bolt heads on the inside will sit naturally flush to the backing plate). This is rarely the case so the timber pad is very important. Similarly, as previously discussed, fiberglass or epoxy resin must fill the gap between the backing plate and the hull. The result must be that the backing plate sits flush, not cock-eyed, to the bolt head or nut. If the backing plate puts uneven pressure on the bolt head or nut, the risk is that the bolt could bend and break at that point.
2. DETERMINE POSITION - FAR FROM THE 'H' - Try to maximize the distance from the 'H' bracket ... but:

- CLEAR OF BOTTOM BEARING - If it is the bottom bracket - keep clear of the bottom bearing - recommend 2 in./5 cm. of stainless showing above the bottom
- LEAVE ROOM FOR DRIVE UNIT - If it is the top bracket - leave 7 inches (18 cm.) of shaft for the Drive Unit to sit on.

3. DRILL HOLES - Use the bracket flange as a template to mark the position of the two 3/8" (10 mm) clearance holes for the mounting bolts.
4. TIMBER PAD - Have a timber pad ready to fit between the bracket and the hull. See 'Timber Pad' above.
5. BACKING PLATE - Ensure use of a backing plate. See 'Backing Plate' above.
6. ESTIMATE AND CUT TUBE – Establish distance 'L' from the transom to the shaft.
   - The strut length: L less 2" (5cm), less an allowance for the thickness of a timber pad.
   - The stainless struts are provided at a length of 18" (46cm). Once appropriate length for your installation is determined, cut stainless tube with fine toothed hacksaw.

   Tip: First use PVC tube to play around with estimated E Stay Tube Strut length.
7. BOLT FLANGE TO TRANSOM – Bolt the E bracket flange on its timber pad securely to the hull with the backing plate inside.
8. ASSEMBLE THE END FITTINGS ONTO THE STRUT (STAY TUBE) AND BOLT
   - SHAFT CLAMP: Assemble the shaft clamp around the strut and the shaft tube. As this point, you will be using the real tube. Ensure that the plastic shaft sleeve is in place (best if taped to the clamp). Tighten the bolts only sufficiently to hold the shaft clamp in its planned position. The stay tube should be touching the plastic sleeve.
   - TRANSOM CLAMP: Assemble the transom clamp around the strut with the strut fully into the clamp.
   - TIGHTEN BOLTS ACCORDING TO BOLT TIGHTENING SEQUENCE: All 4 (2 on each) A bolts must be tightened first. Check that the tightening is even – the gaps in the castings are even. Only when all A bolts are tightened should the B bolt then be tightened.

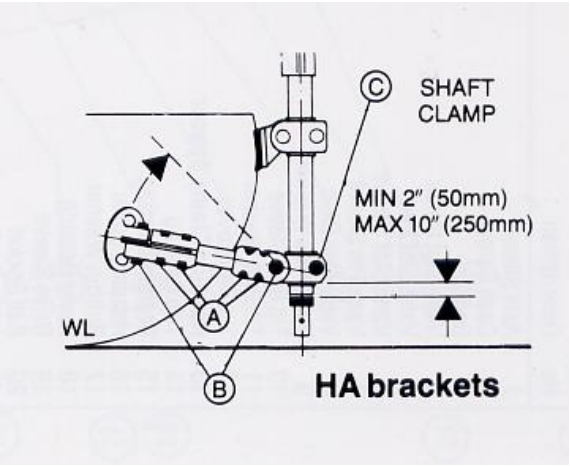
     WARNING: The most common mistake, typically made by skilled tradesmen that do not look at these instructions, is to NOT properly tighten the bolts that clamp the castings on the tube. Be sure to follow the Bolt Tightening Sequence!
9. When the E bracket installation is complete, recheck the tightness of all bolts.

Second Bracket: Double Strut 'A' Bracket

Our biggest, strongest and most versatile bracket. The 'A' Bracket solves most difficult installation issues:

- Its flexibility:
  - Arms swing up or down vertically
  - Arms open in or out from 40 degree to 80 degrees separation (new in summer 2013)
  - Transom attachment flanges fully rotate to become flush with any surface.
  - Struts/tubes can be cut to any length
- Strength - Engineers love triangles

Warning: The bracket must be well aligned. Misaligning the castings and struts cannot be solved by cranking into place when bolting together. The bracket must fit perfectly before bolt tightening. If bolted in place in other than its natural position (ie, forced into place) then there will be constant stress on the casting(s) which inevitably ends in a 'stress fracture' – a broken casting. The aluminum metal used can tolerate considerable flex for short periods and withstand enormous working loads BUT it cannot handle constant stress.



Bolt Tightening Sequence: A – B – C

1. Fix the real or dummy shaft tube into the H Bracket – so shaft is in place.
2. Slide the A Shaft Clamp casting onto the shaft tube

- If necessary, use the 'Opener' - If the shaft clamp does not slide easily onto the shaft tube, remove bolt (C) and screw it into the adjacent, threaded hole – see more discussion about the OPENER in the section on Assembly of the Drive Unit. Note there are total of 5 of such 'Opener' holes on the 'A' Bracket - each to open the casting to get it onto the Shaft tube or Strut tubes.

  Warning: Be careful with the Opener – excessive force can crack the casting. Open one quarter turn at a time only.

3. Determine position
   - FAR FROM THE 'H' - Try to maximize the distance from the 'H' bracket ... but:
     - CLEAR OF BOTTOM BEARING - If it is the bottom bracket - keep clear of the bottom bearing - recommend 2 in./5 cm. of stainless showing above the bottom
   - LEAVE ROOM FOR DRIVE UNIT - If it is the top bracket - leave 7 inches (18 cm.) of shaft for the Drive Unit to sit on.
   - FOR VERY LONG SHAFTS - If the drive unit is particularly high - means the shaft is an X+? - the bracket should be within 25 inches (65 cm) of the top - but preferably closer.
4. TIGHTEN ONTO SHAFT - Tighten bolt (C) lightly to hold it temporarily in place.
5. ESTMATE TUBE LENGTHS BASED ON WHERE YOU WISH TO POSITION FLANGES – Estimate the required length of the struts.

   Tip: First use PVC tube to play around with A Stay Tube Strut position and lengths. IDEA! If you have an upper 'A' bracket and can configure it with both struts horizontal, then it's possible to construct a little platform to rest on top. Great for cleaning fish.

   - Note that each of the 4 castings that fit onto the tubes has a threaded hole for use as an 'Opener' - see explanation above, if needed.
6. CUT TUBE LENGTH - Cut stainless steel tubes to the estimated length using a fine-toothed hacksaw and assemble the complete bracket by bolting it lightly together.
7. POSITION ARMS - Swing the two arms up and rotate the mounting flanges to lay flush with the hull.
8. DRILL HOLES - Using the flanges as templates, drill the 3/8 in. (10mm) clearance holes through the hull.
9. TIMBER PAD - If required, have ready timbers pad for between the flanges and hull. See 'Timber Pad' above.

10. BACKING PLATE - Ensure use of backing plates. See 'Backing Plate' above.
11. CHECK ALIGNMENT - Check the overall alignment and location of the bracket and the overall position of the unit.
12. ASSEMBLE THE END FITTINGS ONTO THE STRUT (STAY TUBE) AND BOLT
    - SHAFT CLAMP: Assemble the shaft clamp around the strut and the shaft tube. As this point, you will be using the real shaft. Ensure that the plastic shaft sleeve is in place (best if taped to the clamp). Tighten the bolts only sufficiently to hold the shaft clamp in its planned position. The stay tube should be touching the plastic sleeve.
    - TRANSOM CLAMP: Assemble the transom clamp around the strut with the strut fully into the clamp.
    - TIGHTEN BOLTS ACCORDING TO BOLT TIGHTENING SEQUENCE: All 4 (2 on each) A bolts on each arm must be tightened first. Check that the tightening is even – the gaps in the castings are even. Only when all A bolts are tightened should the B bolt then be tightened.

    Warning: The most common mistake, typically made by skilled tradesmen that do not look at these instructions, is to NOT properly tighten the bolts that clamp the castings on the tube. Be sure to follow the Bolt Tightening Sequence!
13. BOLT FLANGE TO TRANSOM – Bolt the A bracket flanges on their timber pads (if required) securely to the hull with the backing plate inside.
14. When the A bracket installation is complete, recheck the tightness of all bolts.

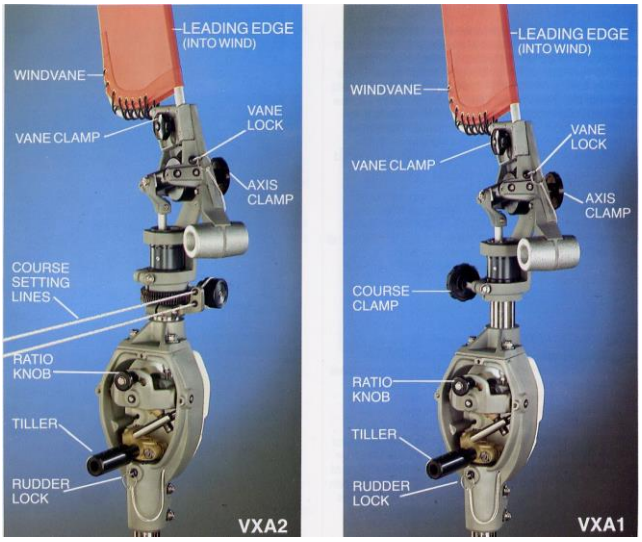
Shaft Assembly Check

The Shaft Assembly should be bolted firmly in place prior to attaching the Drive Unit.

The top of the shaft is machined to 1". Once installed, spin the shaft within the outer tube; it must spin around easily and freely. If it is binding, check that the white Bottom Bearing is not being crimped by the lower bracket clamp… If it is, you will need to lower the shaft assembly.

Check that the bottom collar (stainless) is not touching the bottom bearing (white). If the Bottom Collar needs re-setting, put on the Rudder and insert the Rudder Locking Pin. Loosen the Bottom Collar set crew. Re-position so that the collar sits on top of the Rudder, touching the rudder. Tighten the screw to hold it in that position. Most important is to ensure a space between the top of the Bottom Collar and the Bottom Bearing – at least business card size.

C. ATTACHING THE DRIVE UNIT



Ready the Drive Unit

1. Bolt on the counterweights.
2. Remove the white plastic housing (Frame Case) from the Drive Unit to avoid damage.
3. Insert the Vane Locking Pin - to keep the top section rigid.
4. Remove the Shaft Locking Pin from its sleeve in the Drive Unit frame.
5. Move the Ratio Knob to the far left so that the plastic-sleeved Drive Arm points to the far right - at the 4 o'clock direction (approximately).

Install the Rudder

1. If you haven't already done so, install the Rudder onto the shaft - held in place with its Locking Pin.

Fit the Drive Unit onto the Shaft

1. Test to see if the bore hole of the Main Frame fits onto the shaft - do not force it - it might or might not fit without using the 'Opener'.

2. OPENER – Find the 2 bolts at the base of the Drive Unit that clamp it onto the shaft. Check that those bolts are loose. Note the empty middle hole... that is the Opener.
    - If the Opener is needed, remove one of those 2 bolts. Screw it into the middle opener hole until it is hard against the far wall, then tighten this bolt only one quarter of a turn at a time until the Drive Unit frame will slide easily into the shaft assembly.

      WARNING: Be very careful not to tighten excessively – the casting could crack or break.
3. Hold the Drive Unit in a big bear hug and slide it onto the Shaft.
4. If the Drive Unit collar does not slide easily onto the Shaft Assembly, do not attempt to force it in but give the OPENER bolt another quarter turn - keep doing so - until it fits.

Fit tiller onto the shaft & fork holding the ratio rod

1. You will see that the stub of the shaft emerges from the frame collar (bore hole) into the open space.
2. Lift the Drive Unit slightly in order to slide the Tiller Casting into the frame with two stainless rods (Drive Rods) holding the plastic-sleeved Ratio Rod.
3. The bronze Fork Arm will fit onto the top of the shaft.

Positioning

At this stage an extra pair of hands are helpful, but can be done solo, to achieve:

1. RUDDER @ 180 DEGREES - It is helpful to have someone hold the rudder in the dead aft position – to insure the Shaft Pin hole is at the 180 degree fore and aft direction - helps in locating the Shaft Pin Hole.
2. SHAFT LOCKING PIN SHOULD FIT FREELY - The shaft is in the right position when the Shaft Locking Pin can move freely into its sleeve on the front of the Drive Unit and passing through the hole in the plastic collar at the top of the Shaft Assembly.

   Tip: Sometimes the Shaft Pin Hole fit is very tight. If it is very difficult to insert and remove, you can ream the pin sleeve slightly. You want it to be a snug, but not impossible, fit.
3. TIGHTEN DRIVE UNIT SHAFT BOLTS - Loosen the 'opener', if used, and tighten the Shaft Bolts to secure the drive unit on ... hard. Of course, if the 'opener' was used then that bolt with its washers will be re-installed in its bolt hole and tightened hard.

Set #58 Fork Bolt – Locks Fork Arm onto the top of the shaft

1. Shaft Locking Pin #61 inserted
2. Vane Locking Pin #60 inserted
3. Ratio Control Knob #21 to the far left - means the Ratio Rod #35 points between the 2 Drive Rods #36 at a 4 o'clock direction. This is best shown in our videos.
4. Line up the Tiller #23 so that the Ratio Rod #35 sits evenly between the 2 Drive Rods #36 without touching either one. Feel with a finger that the Drive Sleeve #19 on the Ratio Rod #35 can rotate. For post 2015 units with a thicker Drive Sleeve, the Ratio Rod is normally forced into the correct position – perfectly centered between the two Fork Rods.
5. For pre 2015 units with a thinner Drive Sleeve, it is helpful to put some paper (eg - business cards) on either side of the Drive Sleeve to hold equal amount of space on either side with you set the fork arm.
6. Tighten #58 Fork Bolt … hard … very hard!
7. Remove paper spacers, if any.

Positioning Tests

These tests are repeated as Final Inspection Tests

1. DRIVE SLEEVE CAN BE ROTATED - ROTATE the #19 Drive Sleeve with your finger. The #19 Drive Sleeve should be able to be rotated in all but the 3rd or far left Ratio Setting. At that point, it binds, but just slightly – still free enough to be moved with the touch of a finger.

   For pre-2015 units with a thinner Drive Sleeve, the Drive Sleeve MUST spin freely in all positions. If it does not, re-set the Fork Arm as above and be sure to use a business card spacer.
2. SMOOTH THROUGH ALL RATIO POSITIONS – Pull out the Ratio Knob and move it back and forth through all positions to see that #35 Ratio Rod moves freely between the #36 Drive Rods.
3. RUDDER CENTERED? – Insert Shaft Locking Pin to check that the Rudder lines up fore and aft to the boat.
4. TILLER FLIPPING - Remove the Shaft Locking Pin and swing the tiller back and forth to see that its angle from side to side is symmetrical and smooth. There should be no friction.

D. REMOTE COURSE SETTING

The remote course setting line allows you to adjust the angle of the vane to the wind without leaving the cockpit. It's meant to be set up somewhere handy to the cockpit. It can be as long as you like – any route – and friction is not a problem.

- The remote course setting line should be led through the fairleads and around the grooved track.
- The line should be led to a position that is convenient – along the lifelines or into the cockpit.
- Double blocks can be used to lead the lines forward around any obstruction.
- The final anchoring for the line is made using the block and bungee cord provided.
- It's like a clothesline – make an endless loop with the line provided.

Heat Weld the Remote Course Setting Line

Once the blocks and positioning have been set, you want to 'close the loop'. Two sets of hands are required for the 'heat weld' – one person to hold the lines, one person to hold the lighter.

1. The line must be new (no contact with salt water). Make sure both ends are clean and not frayed.
2. Perhaps cut off a small section to experiment with first?
3. Hold both ends to a flame (actually, rotate them above the flame so that the material can heat up slowly – do not want it bursting into flames – just slowly melting) and make both ends hot enough that they are gooey. This normally takes 5-10 seconds.
4. Once gooey, quickly mash the ends together and pat down any hump very quickly.

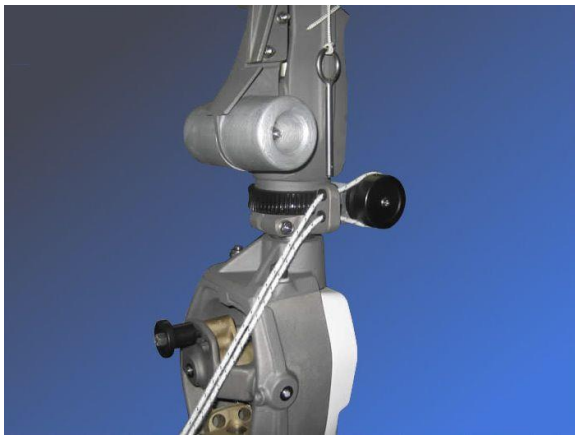
   Tip: helps to wet one's fingers for that 'patting down'! Person least sensitive to pain should have this job ;)
5. You're done. Within 30 seconds you can snap it or try to break the weld with all your strength – the weld is tougher than the line. The weld will look like a section of solid plastic.

Tips: Which line to pull??

ADDING A RED MARKER – Provided by Dee & Pippa (Elizabethan 31): *"I sometimes found altering course with my Hydrovane's control lines difficult. It was worse at night. Sometimes I just couldn't think which of the two lines*

to pull. I would resort to trial and error. It worked, but I wasn't happy with it. Then the solution dawned on me. Mark the line!

So I tied a Turks Head knot onto one control line. I used red line, so I pull the line attached to the Turks Head to turn the boat to port. Even I didn't need a marker to say the other one turns the boat to starboard. It has made life so much easier for both Pippa and I, that I thought to share it with you and other Hydrovane owners."



REFLECTIVE TAPE – IDEA FOR 'NIGHT VISION' – Provided by Gordon C. (Moody 38): *Gordon puts 2 bits of reflective tape on the flat parts of the chrome end of the Worm Gear. At night he can see how much he adjusts the Course Setting – each reflection (half turn) equals 3 degrees change in course. He also puts reflective tape on the Tiller so he can see if the boat is 'on course' or not.*

E. FITTING THE VANE COVER

The Cover may look short or small, but yes - it will fit!

Standard or Stubby Vane

1. Spray liberally with Silicone Spray – Do not worry about messing up the vane cover… it all dries up and disappears. Spray the inside of the vane cover, covering the entire perimeter (the part that will touch the aluminum frame). Also spray the outside of the frame. Be quick, it soon dries up.

   Tip: if you don't have silicone spray, water will do. Put the Vane Cover in a bucket of water and leave it for 15 minutes.

2. Pull it on like panty hose – Slide the cover on the frame, smoothing down the leading and trailing edges and insuring that the seams are exactly placed over the tubes. It takes a lot of yanking and pulling. You can squeeze the side of the tube frame inward. It helps a bit.

3. Lacing – Start near the casting. Push the laces through the eyelets from the inside outwards, diagonally hole to hole until the end of the lace is reached. Tie a knot across the bottom of the tube at this stage. There will 2 or 3 pairs of holes still not laced.
4. Sweat the laces – No it is not too short! At this stage the cover will seem to be 3 or even 6 inches (15 cm) too short. This is not so. Once a portion of the lacing is threaded, use the line to cinch down the cover. Sweat it like old style corsets. The material is stretchy – will not rip.

   TIP: Use cable ties (also known as a hose tie, zap-strap, zip tie) to help cinch and then cut away when done.

Extendable 'XT' Vane

1. Follow Steps #1 and #2 as above for Standard or Stubby Cover
2. For the XT Vane, you probably need to use cable ties. Before lacing, first cinch down the cover by using Cable Ties (Zap Straps or Zip Ties) – long ones. Only need 3 or 4. Loop them through the eyelets and around the lower big, square, black frame tube. The purpose is to put minimal pressure on the round tube.

   Warning: cinching on the round tube may result in breaking the weld. Be sure to attach the ties to the lower black frame tube.
3. Once the bottom of the Vane Cover has been pulled down sufficiently so that its surface is flattened, do the lacing onto the round tube.
4. Finally, cut and remove the cable ties.

F. FINAL INSPECTION TESTS

You may have done some of these tests after installing the Drive Unit, but please perform again once the entire unit is installed.

Periodically, it is wise to get familiar with the amount of friction in the system so that you can be aware if it starts to lose its responsiveness. If there is any friction, it will need correcting.

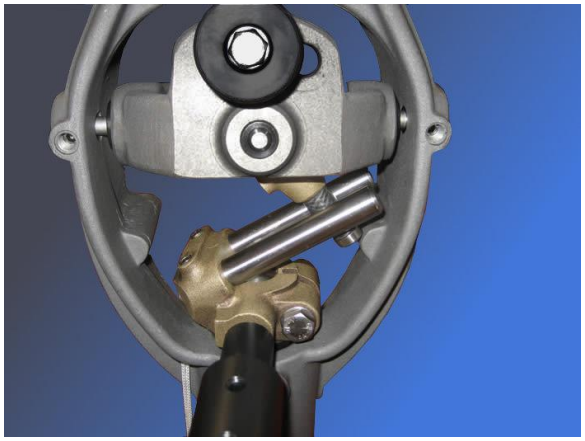
Please also note that the Hydrovane is designed to 'rattle' – so, do not re-set joints to remove the 'rattle' or 'looseness'. The purpose of the loose joints is twofold: there must be room for a delay in the transition from a course change in one direction to a course change in the opposite direction, and secondly the joints need space to accommodate salt and dirt build-up. A tight system soon becomes too tight causing unnecessary friction and poor performance.

The degree of looseness should be just enough to feel a 'tic' – less than a millimeter – when moving parts back and forth. Cumulatively all those little spaces result in a fairly loose feeling when the tiller is jiggled.

Smooth Ratio Rod Movement / Rotate Drive Sleeve Test

1. Shaft Locking Pin #61 inserted
2. Vane Locking Pin #60 inserted
3. Swing the Ratio Control Knob #21 back and forth so that the Ratio Rod #35 moves through all four positions. The Ratio Rod should move easily through all positions, between the two Drive Rods #36.
4. Use your finger to rotate #19 Drive Sleeve in each of the 4 Ratio positions. The #19 Drive Sleeve should be able to be rotated in all but the 3rd or far left Ratio Setting. At that point, it may bind, but just slightly – still free enough to be moved with the touch of a finger.
5. For pre-2015 units with a thinner Drive Sleeve, the Drive Sleeve MUST spin freely in ALL positions. If it does not, re-set the Fork Arm as above and be sure to use a business card spacer. See instructions under Set #58 Fork Bolt - Page 20

Finger is on the plastic Drive Sleeve



Tiller / Fork Arm assembly

Hydrovane Rudder Parallel To Centerline Of Boat?

The tiller and the rudder should be 180 degrees - parallel to the centerline of the boat. If the rudder is off, it is like trying to walk while you are leaning 5 degrees to starboard. Note – The tiller can be off a bit, but not the rudder. If the tiller seems to off by a few degrees, that is okay. Conversely, the Rudder should be truly on or parallel to the center line.

Tip: All you can do is eyeball it. If it looks okay, it should be okay. If it doesn't look okay, then re-set the Fork Arm as explained above.

Tiller Flipping Test

1. Remove Shaft Locking Pin #61
2. Set Ratio Control Knob in 'neutral', far right position
3. Flip the Tiller back and forth. The tiller should move freely from side to side with only the slightest push. If it stops before going fully over, the problem can be either:
    - Bottom collar #26 is binding on Bottom bearing #25. There must be a hair of space between the two. Use a credit card to space apart.
    - Lower bracket is too close to the Bottom bearing. We suggest at least 2" (5 cm) of stainless shaft tube showing above the white or black lip of the bearing.

Windvane & Balance Weight Have Free Airspace

Using the Remote Course Setting Line - Rotate the vane through the full 360 degrees. At any point where the vane or weights are near potential obstructions fully deflect and incline the vane to see if the vane or weights touch anything.

Tip: If the Vane makes contact, please email us. The Stubby or XT Vane are always a good solution. Some have even had success shortening the Stubby Vane by an inch or so, if that's all that is needed. Contact very late into the Vane's deflection on one point of sail is more of a nuisance than a problem that would affect performance.

Axles Firmly Hold The Vane Lever & Bottom Lever

The axels should never be in need of adjustment, especially not on a new unit, but we have heard of it once or twice – Loctite not put on all set screws in assembly. If resetting is required on your new unit, please email us to let us know. This information should be purely information.

There are a total of 8 Axles that allow all the movement in the mechanism. The #69 Bottom Lever casting has a total of 4 Axles: on each side and also fore and aft. The Bottom Lever should comfortably rock up and down on its Axles but should have no lateral movement sideways or fore and aft – should be firmly held by those Axles. It would be self-evident if any of those 4 Axles are loose as the end that sticks out should look the same for each.

For the upper Vane Lever casting, the Axles are more evident – 2 side by side on each side. Please note that the two axels holding the #3 Bobbin stick out more than the others and do not look even. The test is that the Bobbin cannot slide laterally – can only rock up and down.

Loosen the Axel Screw (pre-2016 units: 3/8", post-2016 unit: M10), reset the Axel in the Axel Sleeve, re-tighten Axel Screw with Loctite.

G. SAFETY & MAINTENANCE

Bolt Tightness

- RE-CHECK BOLTS – Check that all the bracket and hull bolts are tight after your first sail! Check at intervals afterward.

Tethers on Everything!

- TETHER THE RUDDER – Use a length of line, not less than 3/8" (10 mm) diameter, tied through the rudder handle and secured loosely to some point on the stern, to ensure that the rudder is not accidentally lost.

  Warning: The Rudder does not float! A few are living at the bottom of the ocean…

- TETHER THE LOCKING PINS – All 3 Locking pins have tethers on them
- TETHER THE VANE – the Vane Knob secures the Vane in place, but a tether is prudent.

  Warning: The Vane is lightweight and may try to fly away when being taken on or off

Reduce Vibration

- ROTATE LOCKING PINS – The Locking pins are interchangeable. The pins will suffer from metal fatigue over time. Best to periodically change it with spares or rotate it with the other locking pins.
- LIMIT VIBRATION WHILE MOTORING. Some engines cause considerable vibration which when transferred to the shaft and rudder produces quite a chatter of the Hydrovane rudder. Its length and weight combined with the loads created by the water and boat speed can result in hammering on the locking pin that holds the shaft in place – in this case, fracturing of the Shaft Locking Pin becomes inevitable. If you notice vibration, the solution is to break the harmonic chatter by cinching up the rudder with considerable force.

  Tip: A heavy duty rubber snubber is the answer – same as is used on dock lines. Bungee cords have no effect. Take the line with the snubber from the Hydrovane handle onto a cleat – heave hard before tying off.

- EXTREME VIBRATION WHEN MOTORING –The solution is as described above to break the harmonic wave by cinching up the rudder. Other solutions could be a change in engine RPMs or altering the pitch of the propeller if you have a variable pitch prop.
- VIBRATION WHEN SAILING – If an annoying vibration develops when sailing, the cause and solution is similar to the item above – just much subtler – not caused by engine vibration but by the slightly loose rudder and a harmonic that has developed. The solution is to add a bit of weight to the Tiller – not too much as that would affect the Hydrovane performance.

Try putting a bilge pump handle in the hole of the tiller, or use a bungee chord to add a little pressure on the Tiller.

- REDUCE RUDDER HOLE WEAR – Take the Rudder off when not in use, especially for weeks or months at a time.

Maintenance and Cleaning

- SOAP AND WATER – When washing the boat, also wash down the Hydrovane with fresh water.
- WD40 - At least once a year the whole of the unit, including castings, should be cleaned well with fresh water and soap. When dry, the unit, again including castings, should be thoroughly sprayed with a light aerosol oil such as WD40.
- SPRAY CASTINGS WITH CORROSION INHIBITOR – The gray metal aluminum casting could use periodic spraying with a corrosion inhibitor, especially the brackets as they are closer to the water
    - Lanocote – used on all bore hole during assembly
    - CorrosionX
    - T-9
    - LPS3
    - many more, use your favorite.
- DO NOT GREASE ANYTHING! EVERY JOINT SHOULD RATTLE – If any of the axels, shafts, or bearings are removed for cleaning or adjustment (although no reason to do such), the unit should be reassembled so that there is a slight but noticeable end play between the moving parts. The Hydrovane is designed to 'rattle' – so, do not re-set those joints to remove the 'rattle' or 'looseness'. The purpose of the loose joint is twofold:
    - There must be room for a delay in the transition from a course change in one direction to a course change in the opposite direction. Otherwise, the system would be 'on' all the time – another type of 'over steering'.
    - The joints need space to accommodate salt and dirt build-up. Otherwise a tight system soon becomes too tight causing unnecessary friction.

H. GO SAILING!

I. CONTACT US

We are always so pleased to receive photos and performance reports!

If you are struggling, please do not hesitate to contact us for further technical assistance.

Email:

- John Curry: john@hydrovane.com
- Will Curry: will@hydrovane.com
- Sarah Curry: sarah@hydrovane.com

Call our Vancouver office:

- Locally: 604 925 2660
- Within North America: 1 604 925 2660
- From Europe: 00 1 604 925 2660
- From Australia: 0011 1 604 925 2660