Saye's Rig

Saye's Rig

Installation
and
Operation
Manual

June 2018

Scanmar International
14138 Washington Avenue
San Leandro, California 94578

510-215-2010

email: scanmar@selfsteer.com

www.ScanmarInternational.com

SAYE'S RIG MANUAL

TABLE OF CONTENTS

1 Welcome Aboard

Welcome to the ranks of Saye's Rig sailors. We hope you will be as satisfied with the Saye's Rig as we are. The Saye's Rig is built to give a lifetime of excellent performance and to take the kind of punishment the sea sometimes delivers.

Many yachtsmen are still unfamiliar with windvane self-steering gears. They view windvane gears as oddities used by single-handed race heroes and circumnavigators. The truth is that a good windvane gear, such as the Saye's Rig, is a useful piece of equipment even on short passages of no more than an hour or so. Once the freedom of sailing with the Saye's Rig has been experienced, this will be fully appreciated.

In order to enjoy the experience of self-steering, the windvane gear must, of course, work. Unfortunately, windvane self-steering is not a push button phenomenon. Knowing how to sail and how to balance your boat on different points of sail is necessary to get the most from the gear. Even experienced ocean racing sailors have confessed that windvane sailing has taught them some things they did not know about balancing and trimming a boat.

However, this is no excuse for inferior performance. The Saye's Rig is built with no corners cut and with the greatest consideration for performance and durability.

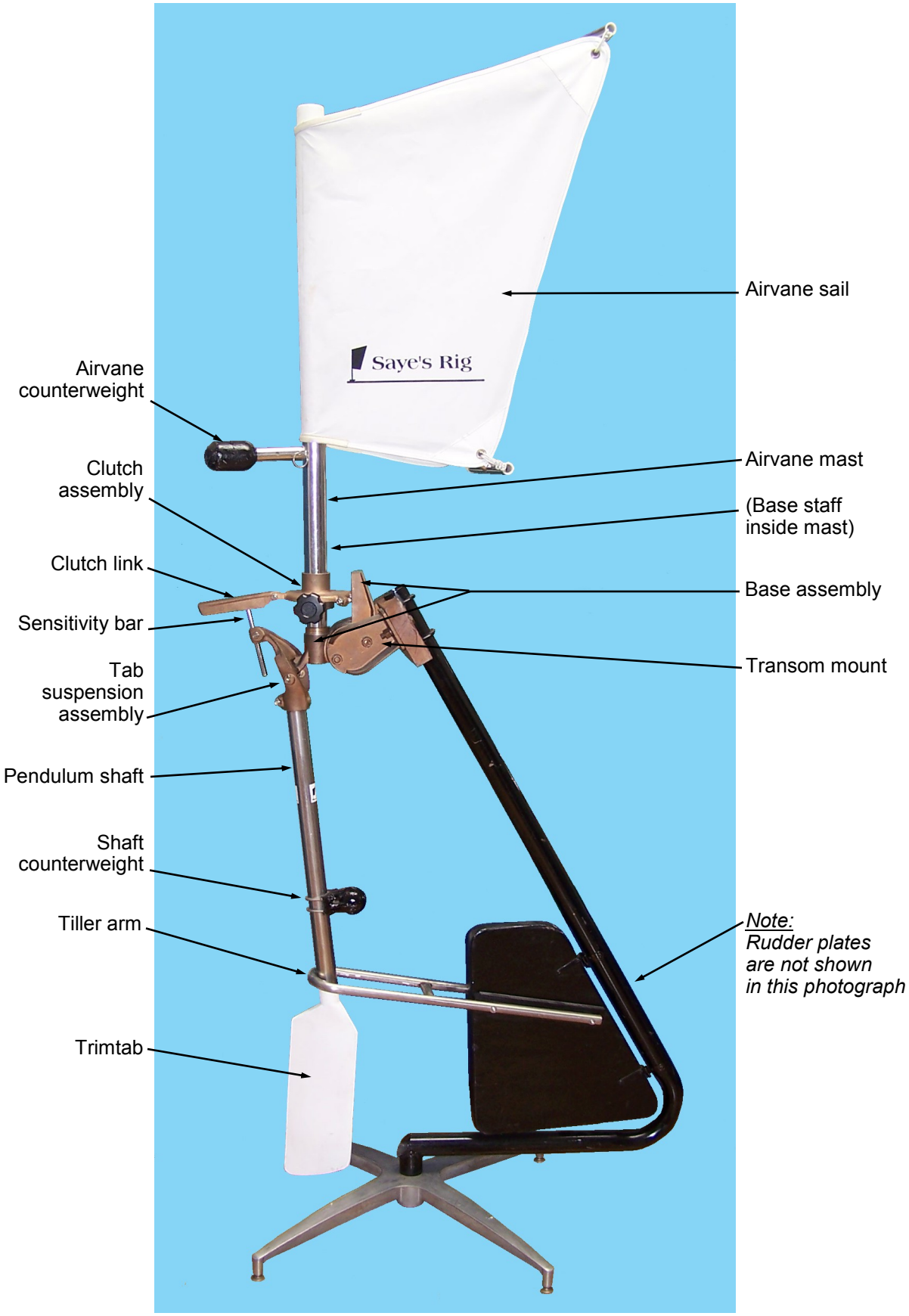
The Saye's Rig is recommended for boats with hydraulic steering, tiller, or cable and quadrant (when the wheel can be removed easily). With hydraulic steering, a bypass valve is needed to enable the windvane to move the rudder. Note that a hydraulic steering system cannot be easily moved "in reverse" and the Saye's Rig is not recommended for boats without a bypass valve.

This extensive manual is provided because windvane self-steering requires some learning and experimenting before one becomes a perfect operator. Proper installation and proper operation are essential. We hope you read this manual.

2 A Description Of The Saye's Rig

The Saye's Rig adds a simple pendulum and trimtab to your boat's rudder. The airvane controls the Saye's Rig pendulum shaft and trimtab which is connected to the boat's rudder by a tiller arm. This windvane design was first developed by Roland Saye, a Southern California engineer. Scanmar Marine Products purchased the productiuon rights and began manufacturing the Saye's Rig in 1985 after Roland retired.

The signal from an airvane is always comparatively weak and usually not, in itself, powerful enough to correct the course of the boat. However, by using this signal to control a power source, a wind powered system steers exceptionably well. The Saye's Rig design amplifies the force of the windvane's signal. It uses the boat's own speed through the water on the trimtab as a power source. The length of the tiller arm between the boat's rudder and the pendulum shaft provides further amplification of power, resulting in a much more powerful system than a trimtab hung on the back of an outboard rudder.



Saye's Rig on display stand
(Pendulum shaft and tiller bar are necessarily shortened)

2.1 The Base Assembly And Mounting Brackets (Parts Diagrams 1 and 2)

The heart of the Saye's Rig mechanism consists of just a few parts which are bolted to the stern of your boat. The base assembly is a bronze casting which has fixed to it a staff which serves as a mount for the airvane mast. The staff has a thrust bearing on the bottom to carry the weight of the airvane mast, and a bushing on top which steadies it. The base assembly also has a machined bronze ball which carries the weight of the tab suspension assembly and the pendulum shaft. The base assembly is held by a pair of mounting brackets. The brackets can be one of two different types - deck mounted, or transom mounted. The transom mount is used in most installations. It uses just two bolts. The deck mount uses four bolts. In either case, the installation is simple and the mounting strong. The mount is not heavily loaded. The Saye's Rig attachment is universally adaptable to all kinds of stern configurations but is particularly suited to "traditional style" transoms.

2.2 The Airvane (Parts Diagram 4)

The airvane of the Saye's Rig is a tubular stainless steel frame to which an ultra violet protected dacron sail is attached. The wedge shape of the sail provides a sensitive aerodynamic shape which responds to the slightest shift in the wind direction. This sail must be kept very tight. Dacron rope is provided to secure and tension the sails.

The airvane shaft pivots around a vertical axis. It lifts off the Saye's Rig base without removal of any fasteners. The dacron sail and tubular struts holding the sail are easily removed from the frame to permit compact storage when the Saye's Rig is not to be used for an extended period of time.

In use the airvane sail is positioned and locked with its counterweight facing into the wind when the boat is on the desired heading. When the leading edge is turned into the wind, the equal wind pressure on either side of the sail will cause it remain in that position. If the boat wanders off course, the wind hits only one side of the sail and the shaft will rotate.

The airvane generates ample power to rotate the paddle and is very sensitive to minor changes in wind direction. To get maximum performance, the airvane mast pivots on nylon balls running in a machined bronze thrust bearing.

The counterweight mounted on the airvane mast balances the weight of the sail and its struts. This is adjusted at the factory before shipment and should need no further adjustment.

2.3 The Clutch Assembly (Parts Diagram 5)

The pivoting motion of the airvane mast is transferred to the pendulum shaft and trimtab through a bronze clutch which is engaged by two locking knobs. These knobs tighten up on a collar on the airvane mast. Once tightened, the airvane mast causes the pendulum shaft and trimtab to rotate by way of a clutch link which engages a sensitivity bar on the tab suspension casting.

When the sail is feathered in the wind (e.g. the on-course position), the boat's rudder and the trimtab should be lined up exactly fore and aft.

2.4 The Tab Suspension Assembly (Parts Diagram 6)

The pendulum shaft and trimtab assembly is fixed to the bottom of the tab suspension casting. A socket in the tab suspension casting is fitted with a teflon insert, and it rides on a bronze ball machined on the base assembly. A sensitivity bar holds the link from the clutch housing. The sensitivity bar is set for optimum performance at the factory and should not be moved. A locking pin allows for quick unshipping of the suspension casting and pendulum shaft when not in use.

2.5 The Pendulum Shaft And Trimtab (Parts Diagram 3)

The pendulum shaft is a length of 316L stainless steel pipe. A semi-balanced trimtab is attached at its bottom. The trimtab, a reinforced fiberglass lay-up, is both epoxied and mechanically fastened to the pendulum shaft. This trimtab is the powerhouse of the Saye's Rig gear. The force to steer the boat is generated when the sail and airvane mast turns this trimtab. A lead counterweight is attached to the pendulum shaft to provide balance as the boat heels. This counterweight should not be re-positioned from its factory setting. The trimtab has a NACA high lift profile, and its leading edge is moved forward of the center of rotation to semi-balance the blade. This allows the airvane to rotate the pendulum shaft with a minimum of force thus improving the light air performance of the gear.

2.6 The Tiller Arm (Parts Diagram 3)

The Saye's Rig requires no lines to the boat's steering system. The power of the trim-tab is transmitted directly to the boat's rudder via a tiller arm which is attached directly to the rudder.

3 Installing The Saye's Rig

The installation procedure consists of two steps - installing the base assembly and brackets on the transom or hull, and installing the tiller bar on the boat's rudder. The tiller bar installation requires hauling out the boat to gain access to the rudder.

3.1 Installation Drawing

A scale installation drawing is provided with each new Saye's Rig. The installation should be done as shown on this drawing as closely as possible. If a major deviation is necessary, contact Scanmar Marine Products for guidance before making any radical changes to the windvane components.

3.2 Installing The Base Assembly And Brackets

Loosely bolt the mounting brackets to the base assembly. Set the brackets on the deck or transom as shown on the mounting drawing, on the boat centerline as high as possible so you can easily reach the top of the pendulum shaft and suspension casting from the deck. This location should enable you to easily install or remove the pendulum shaft at sea. It should also be easily reached to adjust the two clutch locking knobs for course adjustments. At this same location, the airvane mast must be free to turn 360o without the sail striking stern rails, davits, pulpits, or anything else.

Mark the correct location of the brackets on the transom (or deck if using deck brackets) and, if necessary, shape a wood mounting block to fit the contour of your boat's transom. The outside face of the transom wood block (if used) does not need to be vertical. This step often is not necessary on a boat with a traditional transom. Mark the hole locations on the transom and drill the bolt holes - two 1/2" holes for a transom mount, four 3/8" holes for a deck mount. Use same diameter stainless steel bolts to fasten the brackets in place. The bolts are not furnished because their length depends on the thickness of the hull and the wood block, if fitted. Loosen the two bolts holding the base to the brackets and adjust the base so the staff is vertical. Then tighten the two bolts.

On a boat with a reverse transom, a boomkin must be constructed so that when the base is mounted, it extends aft of the aftermost part of the transom as shown on the installation drawing.

Transom brackets on a Roberts 43

Deck brackets on the boomkin grating of a Union 36

3.3 Installing The Tiller Arm

The boat should be hauled. Before hauling the boat, install the pendulum shaft (with suspension casting attached) on the base assembly and allow it to hang vertically in the water. Mark the pendulum shaft with a piece of tape where it enters the water. Measure the horizontal distance between that point on the pendulum shaft to a convenient spot low on the transom and record it. This measurement will be used when installing the tiller arm.

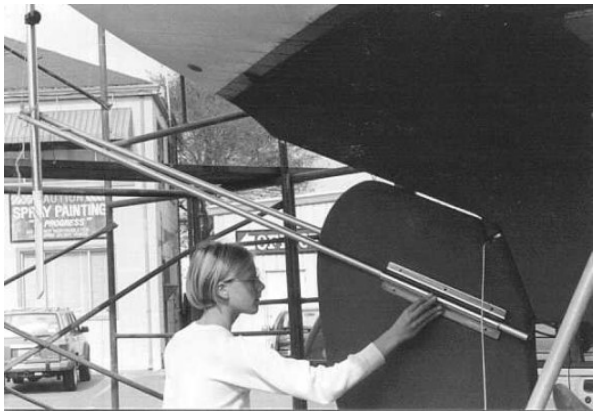
After hauling the boat, the location and angle for permanently bolting the tiller arm to the rudder can be determined. Hang the pendulum shaft from the base assembly and position it so the mark on the shaft matches the dimension taken as described above. The correct mounting location of the tiller arm on the rudder will meet the following conditions:

The tip of the tiller arm should be slightly out of the water when the boat is at rest. This allows you to see the end when installing the pendulum shaft through the tiller arm.

The tiller arm will slope downward somewhat as it runs forward to the rudder.

The aft end of the tiller arm should end about 1" FORWARD of the pendulum shaft when the pendulum shaft is positioned vertically as described above. This will make the bottom of the pendulum shaft angle forward when it is installed into the tiller arm.

When the pendulum shaft is fitted inside the tiller arm it must be possible to turn the rudder to the extreme port or starboard thus moving the pendulum shaft without interference between the pendulum shaft, trimtab paddle and the tiller arm. Be extra careful to check this clearance on spade rudders.



Rudder plates on a Huntingford design

Fairing shims added to the rudder of a Tashiba 40 Pilothouse

When these steps have been completed, it is time to mark the correct location of the rudder plates on the rudder. The tiller arm is attached to the rudder with two stainless steel rudder plates and the 5/16" threaded rod provided. The rudder plates have been pre-drilled at the factory for fastening to the rudder and tiller arm.

Unless the rudder is flat and about four inches thick, wooden fairing blocks may need to be made to go between the rudder plates and the rudder. The goal is having the rudder plates laying flat and parallel with each other. Fairing blocks and possibly internal bracing may be necessary when the rudder is a foam core with a thin fiberglass shell.

The rudder plates and fairing blocks should be positioned and clamped on the rudder. Six all thread bolts should be prepared by cutting the 5/16" threaded rod to the appropriate lengths.

Before drilling, insert the tiller arm into the clamped side plates to insure that they are parallel to each other and the tiller arm is positioned correctly. Remove the tiller arm, and drill and bolt the rudder plates to the rudder using a good bedding compound.

Now install the tiller arm. If the side plates are parallel, little force will be needed to position the tiller arm into the rudder plates. If not, adjustment may be needed to slightly reposition the rudder plate mountings.

Review the Installation Drawing and the Tiller Arm/Pendulum Shaft Alignment Drawing. It is possible that the tiller arm may need to be shortened so that the pendulum shaft will operate at the correct angle. If so, shorten the tiller arm in accordance with the installation drawing.

Insert the tiller arm fully into the rudder plates and mark it through the pilot holes pre-drilled in the rudder plates. Remove the tiller arm, drill 1/4" holes at the marked positions, reinstall into the rudder plates and bolt in place with the 1/4" bolts provided.

3.4 Fitting The Pendulum Shaft

The pendulum shaft is shipped ready for use. Do not cut the pendulum shaft without first contacting with Scanmar Marine Products and talking to a mounting designer. If it is necessary to shorten the pendulum shaft, remove the nut and bolt on the tab suspension assembly and remove the tab suspension assembly. After cutting the pendulum shaft to the correct length, replace the tab suspension assembly. A new ¼" hole must be drilled for the tab suspension assembly bolt. ***The tab suspension assembly must be located in the same plane, fore and aft, as the as the paddle and on the same side of the pendulum shaft as before the cut.*** When you are sure the tab suspension assembly is positioned correctly, re-drill the 1/4" hole and replace the safety bolt.

3.5 Nameboards And Swim Ladders

Some owners let the position of a nameboard or swim ladder dictate the mounting level of the windvane gear. This is a faulty order of priorities if the Saye's Rig is intended for serious use as a self-steering system. The Saye's Rig tirelessly performs the work of several crew members. Its importance can only be appreciated by sailing a passage with the gear and then without it.

The correct positioning of the windvane is of great importance for the system to work well. Usually the Saye's Rig mounts above a nameboard. Centrally mounted swim ladders will normally have to be moved to the side to accommodate the Saye's Rig mount. This is normally quite easily done, since the bracket assembly is quite narrow.

3.6 Davits

The Saye's Rig is often mounted on boats with davits. The airvane mast can usually be designed to carry the sail above a dinghy slung from davits. However, we feel it is bad practice to sail at sea with a dinghy on davits because of the possibility of loss or major damage in heavy weather.

4. Sailing With The Saye's Rig

Once your boat is back in the water, it's time to become acquainted with your self-steering gear.

4.1 Becoming A Windvane Sailor

The vast majority of new windvane sailors successfully use the vanes on their first sail. However, windvane sailing is not a push button phenomenon - it takes some learning about sail setting and unlearning of bad sailing habits. We have supplied this type of equipment for many years and have heard more than once from new windvane owners who think that their gear does not work. After a few friendly hints and some experimenting, the new windvane sailor will admit that the windvane gear does work on some points of sail, but not as well as expected. A year or so later the same sailor will shake your hand with great feeling, and state that the windvane gear is fantastic, and he has given his gear a name in token of the closeness between himself and his most appreciated crew.

This part of the Saye's Rig manual will make your own introduction a bit speedier. After giving a standard operating checklist and some hints for your first sail with the Saye's Rig, we discuss in depth the problem of balancing the boat for self-steering.

4.2 Standard Operating Procedure Checklist

These steps should become a standard drill whenever the Saye's Rig is to be used.

4.2.1 Ready The Gear

The pendulum shaft and airvane should be mounted when the boat is at rest (i.e. at anchor or at the dock). Install the pendulum shaft and suspension assembly. The paddle on the shaft is inserted into the end of the tiller bar, the suspension casting is placed on the ball of the base assembly, and the locking pin is engaged. The airvane mast is set onto the staff of the base assembly. Leave the clutch link up until you are ready to engage the windvane.

The airvane mast can be left on except when the Saye's Rig will not be used for a long period of time. The pendulum shaft should be removed (at anchor or dock) upon completion of the days sail. When mounting the pendulum shaft make sure that you have a good grip on it, and that you are well supported - a safety harness is recommended if you are leaning over the stern. The safety line which is secured to the pendulum shaft should always be tied to the boat before installation or removal. If you are underway and must install or remove the pendulum shaft, slow the boat to a safe minimum speed.

4.2.2 Assume The Desired Heading

Get out in open water where you can maneuver and experiment. Set your boat on a long board where it will not be necessary to tack.

4.2.3 Balance The Boat For The Desired Point Of Sail

Balancing the boat for self-steering is crucial to performance. In essence, this involves choosing a sail combination and trimming the chosen sails to make the boat want to stay on the desired heading. If a wave or a gust takes the boat off course, the sails should start to bring the boat back on course aiding the windvane gear instead of fighting it. ***GOOD BOAT BALANCE IS THE KEY TO SUCCESSFUL WINDVANE STEERING.***

4.2.4 Trim The Airvane And Engage The Windvane Gear

There are minimal adjustments that can be made to the Saye's Rig. The sensitivity adjustment bar #604 is normally centered in its clamp in the tab suspension casting #602, and the height of he clutch housing #403 is set so the clutch link #405 is level when it is engaged on the top of the sensitivity bar. This rarely, if ever, needs changing, and if so it's for swing clearance purposes. Angling the sensitivity bar up or down does not affect the operation of the Saye's Rig.

The one adjustment that can be made is limiting or increasing the swing of the airvane and paddle by loosening the nuts #404.1 and screwing in or out the two set screws #406. If the Saye's Rig tends to overcorrect, limit the paddle swing a bit.

With the boat sailing on course, loosen the two knob locking screws and allow the airvane to feather into the wind. Tighten both locking screws
When all is ready engage the Saye's Rig by dropping the link down to engage the sensitivity bar. The hydraulic bypass should be engaged on hydraulic steering systems. On boats with a heavy wheel, the wheel should be removed. The Saye's Rig is now steering the boat.

4.2.5 Fine Tune For Optimum Course-Holding

After engaging the windvane gear, remain at the steering station for while to check the self-steering performance.

If the windvane gear is constantly working to keep the boat from deviating to one side of the course only, sails must be trimmed to bring the boat into balance. The same is true if the boat spends very little time on the desired heading and more time zig-zagging widely to each side.

Trimming and adjusting should be done so the boat stays close to the course line. Deviations should be small on BOTH sides of the course line as well as being quickly corrected by the windvane gear. This can usually be achieved by fine-trimming, which involves adjusting sails and tinkering with the windvane gear itself.

Since fine-tuning is an important aspect of ultimate windvane performance, it will also be treated in more depth in the following section. Here we want to point out that if there is any remaining imbalance after the gear has been engaged, you should always try to work it out by SAIL TRIM FIRST. The objective of balancing should be to have as neutral a helm as possible. Try to steer the boat with sails alone. This will insure that the boat keeps on self-steering over a wider range of conditions.

4.3 Your First Sail With The Saye's Rig

If you have never sailed with a windvane gear before, you should find the following hints especially helpful during your first sail.

If possible, choose a day with a DECENT BREEZE, 10-15 knots or so. Trying the windvane gear out with too much or too little wind will complicate your observation of what the windvane is doing on this first sail.

DO NOT OVER CANVAS. If the boat can be sailed well on a jib alone, SET A JIB ONLY, at least for starters. Avoid dealing with a lot of sheets, potentially gibing booms, and a boat rushing along with her lee rail under. Concentrate on the gear and making it work on all points of sail. Avoid the problems of handling the boat and concentrate on self-steering. Add sail area after becoming familiar with the workings and operation of the Saye's Rig.

START BY SAILING UPWIND without really pinching. Turn the airvane sail by loosening the locking knobs then retightening them after it is allowed to feather into the wind.

LET THE BOAT SETTLE DOWN with the self-steering controlling it. Even if the boat is not going exactly where you intend, give it a couple of minutes to assume a steady heading. Observe the way the airvane sail moves and how this movement sends the pendulum shaft swinging and the boat's own rudder turning.

MOVE THE AIRVANE SAIL SETTING SLIGHTLY WITH THE LEADING EDGE POINTING FURTHER UPWIND, and observe how the boat is taken closer to the wind. Once again give the boat and the control system time to settle down. Retrim your sails if necessary.

After being satisfied that the boat is sailing well on course, change the airvane sail setting again with the leading edge pointing further downwind. As the windvane makes the boat bear off, retrim the sheets and let the boat settle down on the new course.

Go through all points of sail in a similar fashion.

Remember always to allow the boat and the windvane gear to settle down after making a change. The most common mistake is changing too many things too fast.

4.4 Balancing For Self-Steering - Various Conditions

Not all boats sail the same, and not all boats react to different weather conditions the same. Here are some pointers.

4.4.1 Problem Boats and Easy Ones

Obviously not all boats are the same in terms of the ease with which they can be made to self-steer.

Factors which make a boat easy for the windvane gear to handle are good course stability, moderate response to rudder, little or no weather or lee helm on all points of sail, a steering system which turns easily and with little friction, and a sail plan which allows many alternative sail combinations.

Problems are introduced by excessively heavy weather helmed boats, poor or non-existent bypass valves on hydraulic steering systems, very light displacement with accompanying fin keels and spade rudders, binding and friction in the steering system, and a rig which does not allow many options for sail combinations and trim.

Such boats can be steered by the SAYE'S RIG, but they do require more insight and seamanship from the operator.

4.4.2 Light Wind

"Does it work in light winds?" This is a standard question asked of anyone involved with windvanes. Obviously, since the windvane gear takes its signals from the wind and its power from the boat's movement though the water, the wind has to blow and the boat has to move for the windvane gear to work.

How little it can blow and how slow the boat can travel with the gear still functioning depends to a great extent on the boat itself, on the skill of the operator, and on the point of sail in question.

If the boat is very large, it will generally take more force from the windvane gear to operate its rudder. The same is true if there is much resistance to free turning in the boat's steering system. The windvane gear has much less power in light airs, and the key to making it work is to reduce undue binding and friction. Light air performance can be vastly improved by balancing and fine tuning. In general, the gear will do a better job in light airs on a small or moderate size boat remaining functional down to about 2 to 2-1/2 knots of boat speed with the corresponding wind strength. However, a good sailor, balancing his boat properly, can make the Saye's Rig steer a large boat in surprisingly light conditions.

4.4.3 Running

"Does it work downwind?" This question is as common as the one about light winds.

The problem with self-steering when sailing downwind is that you are moving in the same direction as the wind. Consequently, THE WIND VELOCITY AVAILABLE TO THE AIRVANE FOR CORRECT SIGNALS IS DECREASED BY THE SPEED OF THE BOAT.

While the trimtab has ample power from the movement of the boat, the signals from the airvane sail become weaker as the wind speed decreases. In light winds it takes longer for the gear to return to neutral, and the Saye's Rig sometimes becomes outright erratic or too weak to fight the frictional resistance in the boat's steering system. This results in the boat being steered in a serpentine course, constantly crossing and recrossing the desired heading.

In heavy winds if too much canvas is carried, especially aft of the mast, the windvane gear may not be able to prevent the boat from rounding up completely.

THE FIRST AND FOREMOST REMEDY TO DOWNWIND PROBLEMS IS TO USE THE RIGHT SAILS AND THE RIGHT AMOUNT OF SAIL.

Before the advent of mechanical windvane gears, boats were sailed around the world self-steering downwind in the trades by use of twin headsails on poles. The trick is to sheet the twins a little bit loose. If the boat wants to round up, the leeward sail starts spilling wind. The pressure from the windward sail gradually increases, acting like a giant finger gently nudging the boat back on course again until both sails are drawing equally.

If cruising plans are for a lot of downwind cruising, it might pay off to set the boat up for twin headsails. Combined with the Saye's Rig this set-up gives excellent self-steering even on problem boats. It is also efficient as well as being very safe and easy to manage. The only disadvantage is that the boat rolls more with twins than with the main and headsail.

IF THE MAIN IS CARRIED, THERE SHOULD ALWAYS BE A FORESAIL POLED OUT ON THE OPPOSITE SIDE TO COUNTERACT THE MAINSAIL'S STEERING FORCE. This is an adequate sail combination for self-steering on almost any boat using the SAYE'S RIG.

If sail must be drastically reduced, take the main down and leave the poled-out jib hoisted. Although the pressure from a single jib is on one side of the boat, it is concentrated at the bow providing better balance and letting the windvane gear handle the boat with relative ease.

Let us assume that only the main is carried. If the wind is fresh, steering will be like walking a tight rope. A very attentive helmsman may be able to keep the boat on course by instantly countering every move away from the course line. However, this choice of sail makes the boat increasingly unbalanced as it deviates from the desired heading. Once off course, the boat gets out of hand. Even full rudder will not keep the boat from rounding up or gibing once the process has begun. The pressure from the wind is concentrated behind the mast making the boat want to point into the wind as soon as it gets a little bit off its precarious equilibrium of sailing more or less dead downwind.

This situation can be likened to moving a cart by pushing it from behind with a stick (mainsail only) versus pulling it from ahead with a string (jib or twin jibs). It is practically impossible to keep the cart going where you want it to go with the stick

especially if any kind of speed is involved. A cart will follow nicely when pulled.

The spinnaker is set ahead of the mast and gives good balance. Trouble can happen because spinnakers are tremendously powerful. The spinnaker makes the boat move fast downwind. Since the sail is not hanked onto any controlling stay or track, it will continue to exert pressure long after a poled-out foresail would spill its wind. Because of the size of the sail, this pressure can be enormous and completely overpower the boat's rudder, as anyone knows who has experienced his first spinnaker broach. Therefore, the spinnaker should be used in ideal weather only after experiencing with how the Saye's Rig will steer the boat.

To sum up: ***BALANCED DOWNWIND SAILS FLOWN FROM THE BOW GIVE THE BEST AND SELF-STEERING. IF POSSIBLE, THESE SHOULD BE POLED OUT ON EACH SIDE OF THE HULL. WHEN THE MAIN IS USED, IT SHOULD ALWAYS BE COUNTERBALANCED BY A POLED-OUT FORESAIL ON THE OPPOSITE SIDE. OVER CANVASSING SHOULD BE AVOIDED. USING A SPINNAKER DURING BAD WEATHER CAN EASILY LEAD TO BROACHING.***

4.4.4 Reaching

Seldom are we asked whether the Saye's Rig works well on a reach. In fact, reaching can be harder for any windvane gear than other points of sail. While a boat can be made to steer downwind as well as upwind by itself, achieving this can be much more difficult on a reach in puffy or gusty weather. With a one-masted rig there are fewer options for using sails to balance the boat.

With a two-masted rig, especially when the boat has a bowsprit, the mizzen and jib can be worked to bring the boat back on course when it bears off or starts going to weather. Even so, this is tricky to do and normally takes some experimenting.

CONSEQUENTLY, THE WINDVANE GEAR IS MOST NEEDED WHEN REACHING. However, faulty sail trim can over-power the gear, and it is necessary to understand how to create the best possible balance. The greatest problem is keeping the boat from rounding up when the wind increases in strength.

Twin headsails or main and a poled-out jib can be carried to about 34-40 degrees away from straight downwind and will provide the best self-steering as long as they can be kept up. As the boat starts reaching, the poles must come down.

Again, using the main alone is not the way to go. Although you can try to compensate for the greater weather helm with the rudder before you engage the windvane gear, any increase or decrease in wind strength is likely to change the balance. Once more, you must strive to balance the boat with the sails first and not use the rudder to compensate for a significant lack of balance. The rudder should be used for fine tuning after the boat has been set up to sail on course as much as possible by itself.

If only one sail is used, a headsail should be the choice.

Most of the problems are because of puffs and squalls - increasing & decreasing winds and quick apparent wind direction changes. When the wind increases, many boats will experience increased weather helm even with only the headsail set. However, this weather helm is very mild compared to what the mainsail would induce under similar

circumstances, and the windvane gear can easily hold the boat on course.
When the main and headsail are used, both sails may work to bring the bow to weather. To limit weather helm, as well as great increases in weather helm during a gust, each sail, but especially the main, should be TRIMMED LOOSE OR REEFED. This will slow the boat slightly. The effect is to make the sails spill their wind when a puff hits, minimizing the boat's tendency to round up. When weather helm decreases, the windvane gear is capable of pulling the boat back on course.

If problems continue, reduce sail area, especially the main, and continue to ease the sheets even though the leeches may flutter a bit.

In light winds or when the wind significantly drops, the boat will want to bear off downwind, especially if the main rudder has been used to compensate for a lot of weather helm. This is one of the chief reasons why the rudder should not be a primary factor in balancing the boat. In this case, carrying the main is actually helpful. As the boat veers off, the main will cover the headsail(s) and catch all the wind. This will move the pressure behind the mast and bring the boat back on course.

THE CLUES TO SUCCESSFUL SELF-STEERING ON A REACH ARE TO AVOID EXCESSIVE CANVAS, TO RELY PRIMARILY ON THE HEADSAILS FOR POWER, TO SHEET THE SAILS LOOSELY, AND TO USE SAIL TRIM RATHER THAN THE MAIN RUDDER FOR BALANCING THE BOAT.

4.4.5 Hard To Weather

Most yachts can easily be made to self-steer when hard on the wind without using any windvane gear. Consequently, the windvane will have little problem keeping the boat on course. Because the movement is towards the wind, the velocity of the wind working the airvane sail increases by the speed of the boat. The vane's signals will be true and strong.

THE BEST PERFORMANCE WILL BE GUARANTEED BY NOT KEEPING TOO MUCH SAIL AREA AND BY NOT SHEETING THE SAILS TOO HARD. Over canvassing and oversheeting will only heel the boat unnecessarily inducing great weather helm which may become difficult for the windvane to control in a gust.

4.4.6 Give It A Chance

Armed with these hints on balancing the boat on different points of sail, you should experience no difficulty in making the windvane gear steer your boat. After using the Saye's Rig awhile, it will steer even better. Sailors probably will have learned a thing or two about sailing and balancing the boat. Give everything a chance to work and remember that some learning is necessary to get the most from the windvane. The experimenting will certainly be worth it.

4.5 Useful Hints To Get The Most Out Of Your Airvane

After setting up the windvane gear to steer your boat, remain in the cockpit for a couple of minutes observing the behavior of the boat.

The boat should remain on the desired heading, deviations should be small and quickly corrected, and the windvane gear should not be fighting to keep the boat from wandering off on one side of the course line.

If the boat has a persistent tendency to luff or bear off, it is not properly balanced. Sails have to be either sheeted in or out, reduced, or changed completely. A small adjustment of the boat's rudder may help, but large imbalances should not be compensated for by the rudder.

USUALLY, RELEASING THE MAINSHEET A BIT WORKS WONDERS IN TAMING TENDENCIES TO ROUND UP.

4.5.1 The Downwind Problem

When sailing downwind in light airs, there may be a tendency for the gear to permit the boat to wander too far off course before reacting. Once the airvane has given its signal sending the boat back towards course, the same tardy reaction causes the boat to cross to the other side of the course line. This results in a repeated serpentine movement around the desired course.

This is because the airvane has very little wind from which to take its cue. Normally, when the wind is blowing strongly on the airvane, the Saye's Rig will follow the small wind direction changes well.

As the wind becomes very weak downwind, the windvane becomes increasingly affected by other factors. When the boat rolls from side to side, the windvane (without strong apparent wind to control) it no longer follows the real wind direction. This produces faulty signals to the pendulum shaft. The rolling boat may cause the airvane to react to the apparent wind resulting from the roll rather than the actual apparent wind. This is when a small electric autopilot should be used.

Normally, the apparent wind would hold the airvane steady and inhibit the undesired movement of the boat's rudder. However, when the boat is moving fast downwind with little apparent wind on the sail, the trimtab can remain in its swung out position. Pressure from the wake on the trimtab as well as inertia keeps the airvane sail in the incorrect position until the boat has gone off course.

4.5.2 Friction And Binding

Friction, especially friction and binding that interferes with the airvane's ability to rotate the tab suspension assembly, is a deadly enemy of light air performance. Friction and binding may result from salt build-up in the vane's bearings. However, this problem usually disappears after some fresh water has been flushed through the ball bearings. Don't lubricate the bearings with oil, WD-40, etc., as this will result in a build-up of salt in the bearing and won't wash out.

In some boats the yacht's own steering is the culprit. The windvane gear is very powerful in a hard blow when the boat is moving fast, but performance drops dramatically in light airs if the boat's own steering has a lot of friction. Everything possible should be done to free the movement of the boat's own rudder.

If the windvane gear has problems in controlling the course even though the boat is

properly balanced, friction and binding are the first suspects. All moving parts should be checked.

5 Maintenance And Problem Solving

The Saye's Rig is remarkably trouble-free, and has almost no parts that need adjusting. However, there are a few things to keep in mind that will keep your windvane operating at full potential.

5.1 Appearance

The Saye's Rig is made of bronze and 316 stainless steel. The trimtab is reinforced fiberglass. After fabrication, the individual stainless parts are electropolished in a chemical bath to remove impurities from the surface and welds of the metal. The individual parts are assembled to make a finished windvane gear.

The bronze castings are not affected by sea water and salt air, and will soon develop a green patina. The bronze is electrically compatible with stainless steel so galvanic corrosion is not a problem with the Saye's Rig. Stainless steel is a very hard metal alloy with a much harder surface than regular steel. Any time that stainless is handled with regular tools, the stainless picks up surface contamination from the softer material in these tools. After use in salt water, there may be some surface staining on the pendulum shaft. This can be cleaned off with metal polish. Since the pendulum shaft is 316 stainless steel, any staining will be minimal. After a couple of cleanings, it should not re-occur.

5.2 Regular Maintenance

The Saye's Rig bearings and bushings are made from materials that work better with water on them. Maintenance consists of hosing the gear with fresh water whenever you have the opportunity. Take care to flush all places that have bearings to clean out salt deposits. Regular rain often takes care of this job. Remember **don't use oil or other lubricants.**

5.3 Problem And Damage Prevention

Here are a few simple steps to keep your Saye's Rig safe.

5.3.1 Removing The Pendulum Shaft

Because the windvane gear is mounted outboard of the hull, it is vulnerable to collision. Unfortunately, vanes are run into by other less than expert skippers and are damaged. This can happen in a marina as well as in an anchorage. Fortunately, the Saye's Rig is less exposed then most other vanes. As previously mentioned, the pendulum shaft should be removed when not in use. The tiller arm is usually protected by the boat's hull although it would be a good practice not to lock the rudder so that it could move if the tiller arm was struck. The tiller arm can be removed from the rudder plates when the boat is not being used for long periods of time.

The pendulum shaft is 316 stainless steel pipe and quite strong. Riding behind the hull, protected by the boat's own keel and rudder from forward impact and by its own ability to swing from sideways impact, chances are very small that the pendulum shaft will get damaged.

5.3.2 Removing The Airvane Mast

When planning not to use the Sayes Rig for any length of time, remove the airvane by simply lifting it off the base. This will reduce wear on the bearings, protect the unit from possible damage from collision and greatly prolong the life of the sail.

5.3.3 Using A Safety Line On The Pendulum Shaft

The only real threat to the pendulum shaft is dropping it overboard during installation or removal. Secure the pendulum shaft safety line to the boat to protect against this possibility.

5.3.4 Heavy Weather

Hard winds and fast speeds make the Saye's Rig very powerful. Sailors have reported using the gear in extreme storm conditions. The only time when the boat would need to be hand steered would be when the boat is threatened by dangerous waves. The SAYE'S RIG cannot see a freak wave and in very big seas there can actually be a lack of wind at the bottom of the trough between two waves, which interferes with the steering ability of the windvane gear.

In really bad weather the windvane gear will do a better job of steering then a helmsman. The gear does not get tired. The boat is safe while the Saye's Rig is steering. The strain of big waves hitting the pendulum shaft is taken by the tiller arm, and the resistance from the boat's own rudder will act as a shock absorber.

When forced to hand steer while running before the wind, it is important that the clutch Link is secured in the "up" position so that the windvane does not interfere with your ability to steer. For longer periods the gear should be removed.

6 Making Repairs

The sea punishes everything on a boat. The windvane is possibly the hardest working piece of equipment on a cruising sailboat.

The bronze and stainless construction of the Saye's Rig plus its extremely simple design with a minimum of moving parts has resulted in a unit that requires no "Spare Parts Kit" nor a maintenance schedule other then an occasional fresh water washing down. In the unlikely event of collision damage, bronze and stainless steel can be easily worked and/or welded. The corrosion resistant materials make it possible to

take the gear apart and reassemble it even after long use.

We recommend taking a spare sail if you plan a year long (or longer) cruise. However, this item can be made at any port of call and probably will not require replacement for a long time.

Should you need a part or want to discuss or describe some element of the Saye's Rig, we have included complete parts diagrams and a parts list at the end of this manual.

GOOD SAILING!!!

SAYE'S RIG PARTS LIST

BRACKETS AND BASE ASSEMBLY (Parts Diagrams 1 and 2)

101	2	Brackets - Transom Mount
101L	2	Brackets - Deck Mount
102	1	Bushing
103	1	Shim (.030" or .060")
104	1	Base
105	1	Staff
106	1	Thrust Bearing
107	1	Delrin Ball Bearings (set of 28)
108	3	1-1/4" I.D. Retaining Rings (snap rings)
109	2	1/2"-13 x 3-1/2" Bronze Hex Head Bolts
110	2	1/2"-13 Bronze Nuts
111	2	1/2" Bronze Lock Washers

TILLER ASSEMBLY (Diagram 3)

201	1	Tiller Arm (3/4" OD up to 5' long; 1" OD from 5' to 10' long)
202	1	5/16"-18 x 3" Threaded Rod, 316 Stainless Steel
203	12	5/16-18 Hex Nuts, 316 Stainless Steel
204	2	Tiller Plates, for either 3/4" OD or 1" OD Tiller Arm

AIRVANE ASSEMBLY (Diagram 4)

301	1	Counterweight
302	1	Lower Sail Strut
303	1	Upper Sail Strut
304	1	Airvane Mast
305	1	Sail
306	3	1/4" Clevis Pin, Stainless Steel
307	3	Cotter Ring, Stainless Steel
308	1	1/8" x 48" Dacron Line
390	4	Mast Cord Bushings

CLUTCH ASSEMBLY (Diagram 5)

401	1	1/4"-20 x 1/4" Set Screw, Stainless Steel
402	1	Bronze Collar
403	1	Clutch Housing
404	2	Clutch Locking Knob
404.1	2	3/8"-16 Jam Nut
405	1	Link
405.1	1	1/4"-20 x 3" Hex Bolt, Stainless Steel
405.2	1	1/4"-20 Nylock Nut, Stainless Steel
406	2	3/8"-16 x 1/-1/2" Set Screw (takes 3/32" allen wrench)
407	2	3/8"-16 Nylock Nut, Stainless Steel

TRIM TAB ASSEMBLY (Diagram 3)

501	1	Trim Tab Watervane Paddle
502	1	Pendulum Shaft (5' standard)

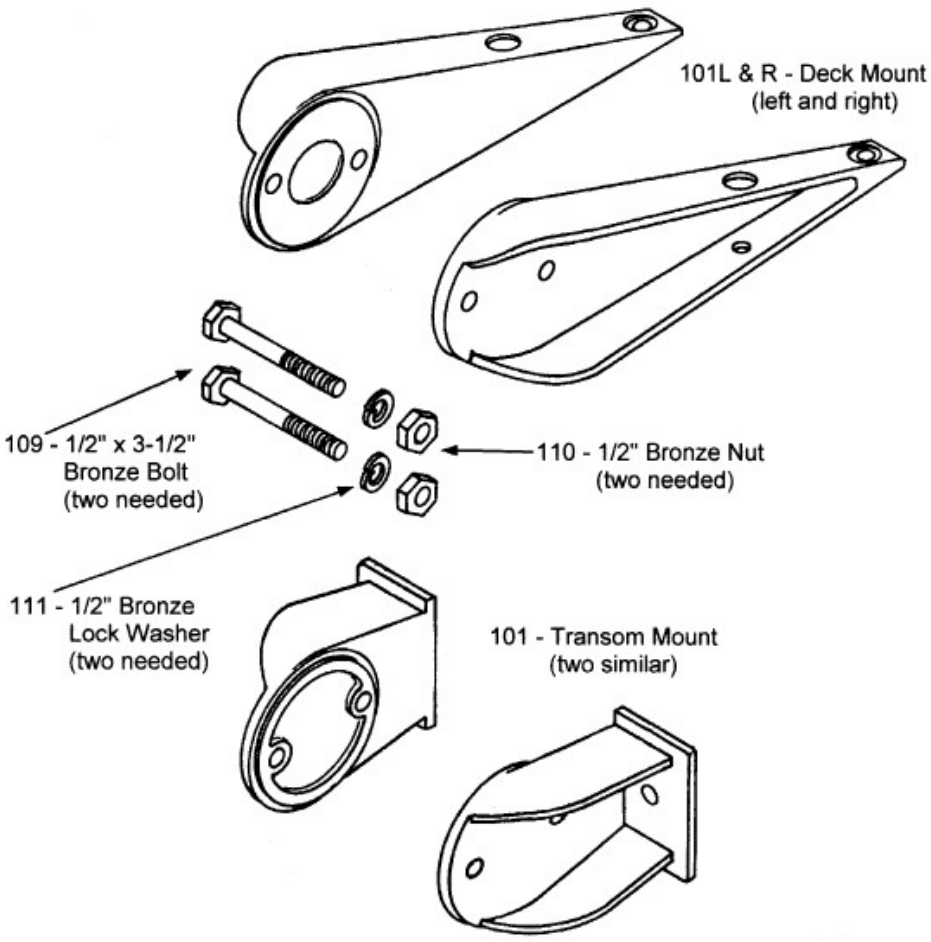
TAB SUSPENSION ASSEMBLY (Diagram 6)

601	1	Locking Pin, Stainless Steel
602	1	Tab Suspension Casting
603	1	Thrust Bearing
604	1	Sensitivity Adjustment Bar, Stainless Steel
605	1	Draw Bolt, Stainless Steel
606	1	1/2" x 20 Nylock Nut, Stainless Steel
607	1	Spring Pin, 1/8" x 1/2"
608	1	3/8"-16 x 1-3/4" Hex Head Bolt, Stainless Steel
609	1	3/8"-16 Nylock Jam Nut, Stainless Steel
610	1	1/4"-20 x 3/4" Hex Head Bolt, Stainless Steel
611	1	1/4"-20 Nylock Nut, Stainless Steel

STABILIZER ASSEMBLY (Diagram 3)

701	1	Tab Counterweight
702	2	U-Bolt
703	4	1/4"-20 Nylock Nut, Stainless Steel
704	4	1/4" Lock Washer, Stainless Steel

SAYE'S RIG PARTS - DIAGRAM 1 OF 6
BASE ASSEMBLY BRACKETS



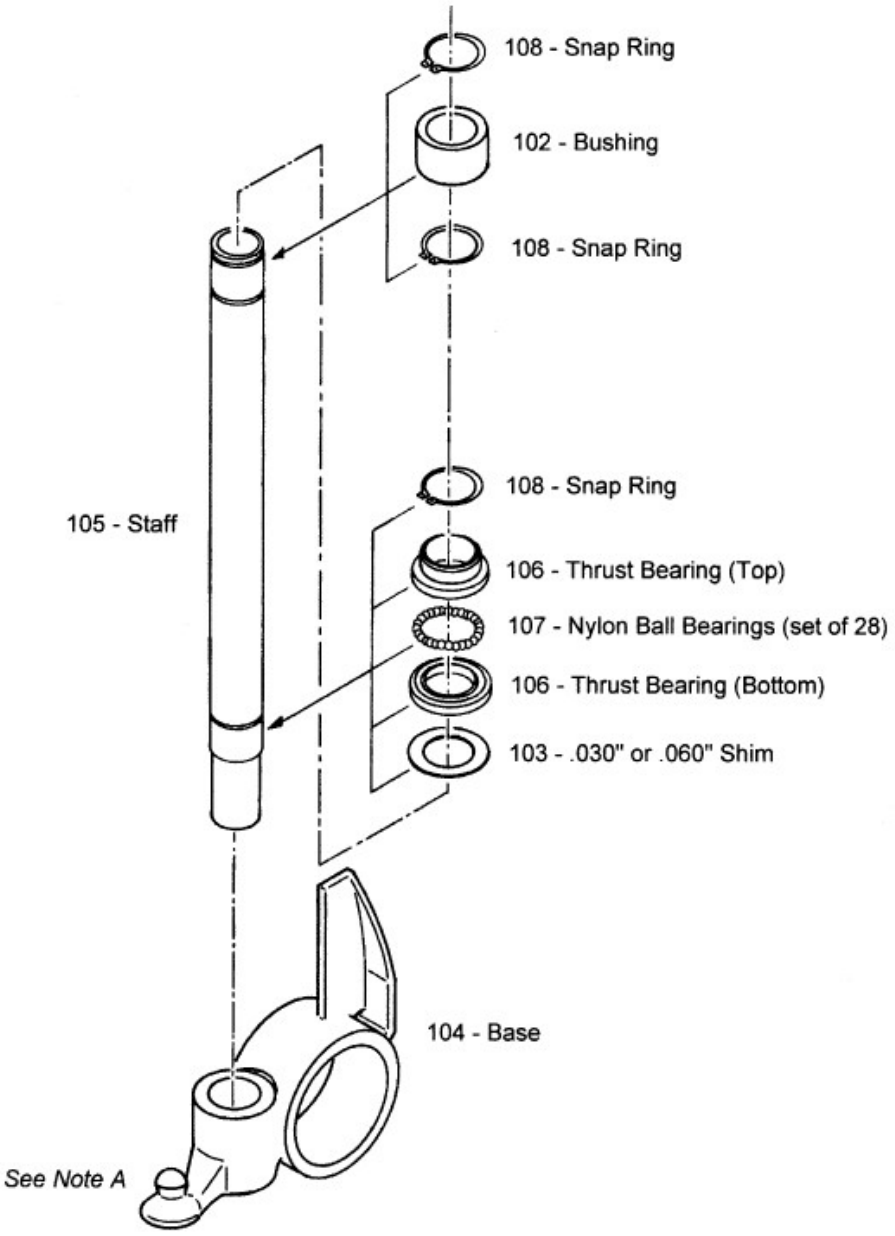
NOTES:

101 Transom Mount- Both sides are the same.

101L & R Deck Mount - There is a left and right piece.

June 2018

SAYE'S RIG PARTS - DIAGRAM 2 OF 6
BASE ASSEMBLY



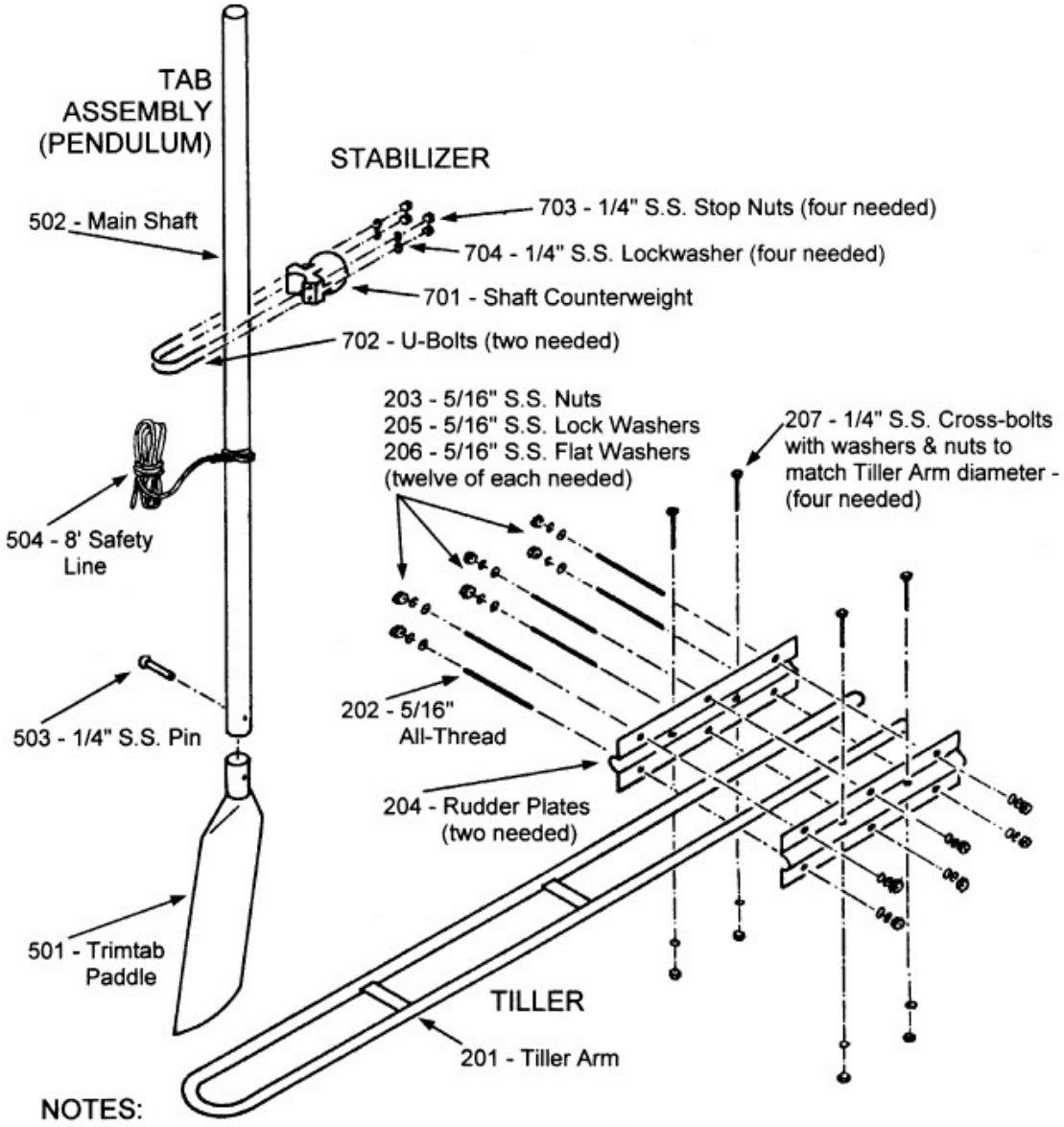
NOTES:

Note A - During factory assembly, bottom of ball mount for tab suspension casting is ground to clear 601 Locking Pin after Thrust Bearing is installed.

104 & 105 - Staff must be pressed into Base. Approx. 1/32" should be left between shoulder of staff and base. Bottom of Staff to be spot-welded to bottom of Base.

106 - Thrust Bearing is sold as a two-piece set.

SAYE'S RIG PARTS - DIAGRAM 3 OF 6
TILLER, STABILIZER & TAB (PENDULUM) ASSEMBLIES



NOTES:

201 - Tiller Arm is 3/4" O.D. up to 5' long; 7/8" O.D. from 5' to 10' long. Longer ones can be welded up.

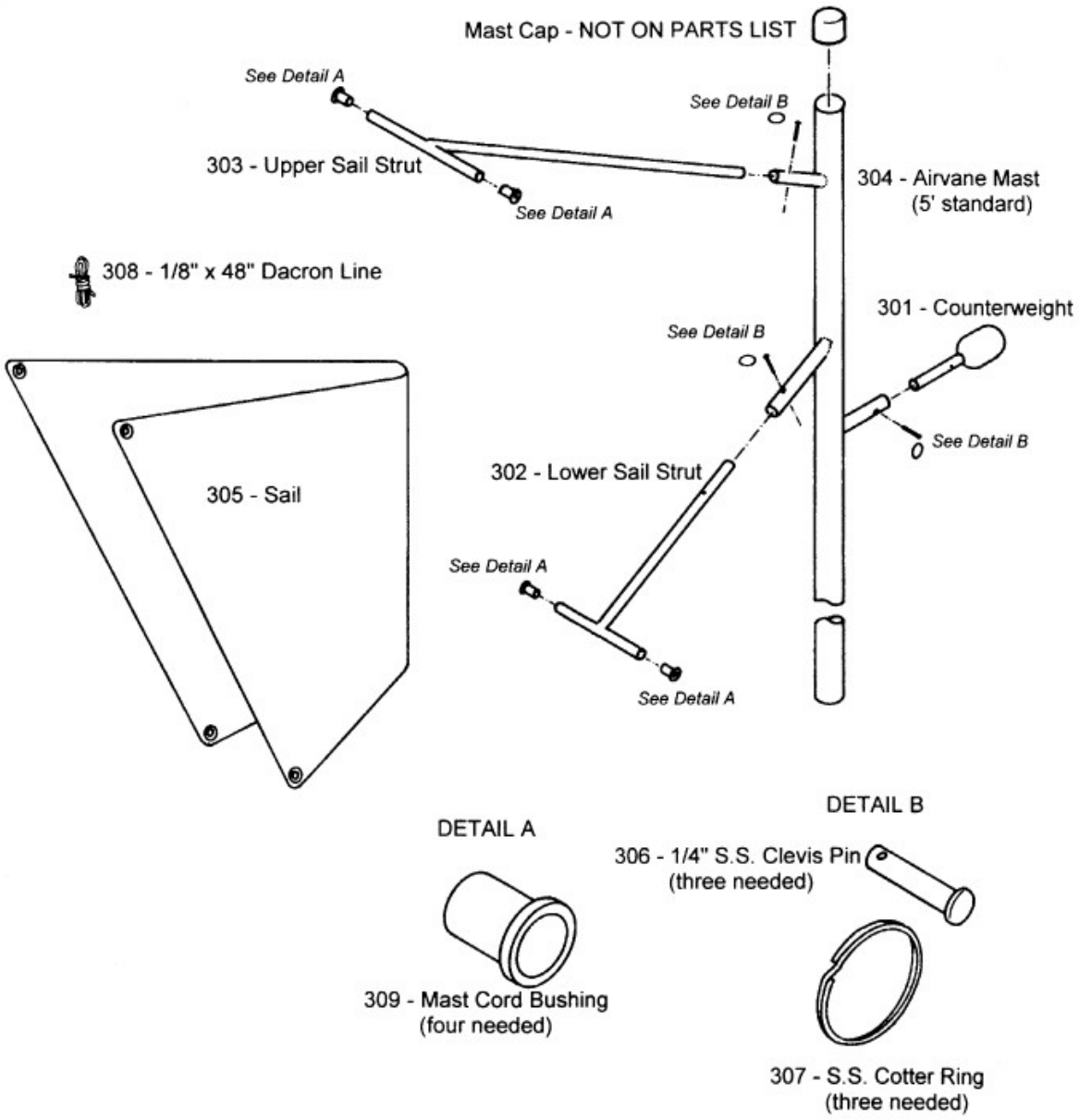
202 - 5/16" All-Thread comes in one 36" length - customer to cut pieces to size.

204 - Rudder Plates - to match Tiller Arm diameter.

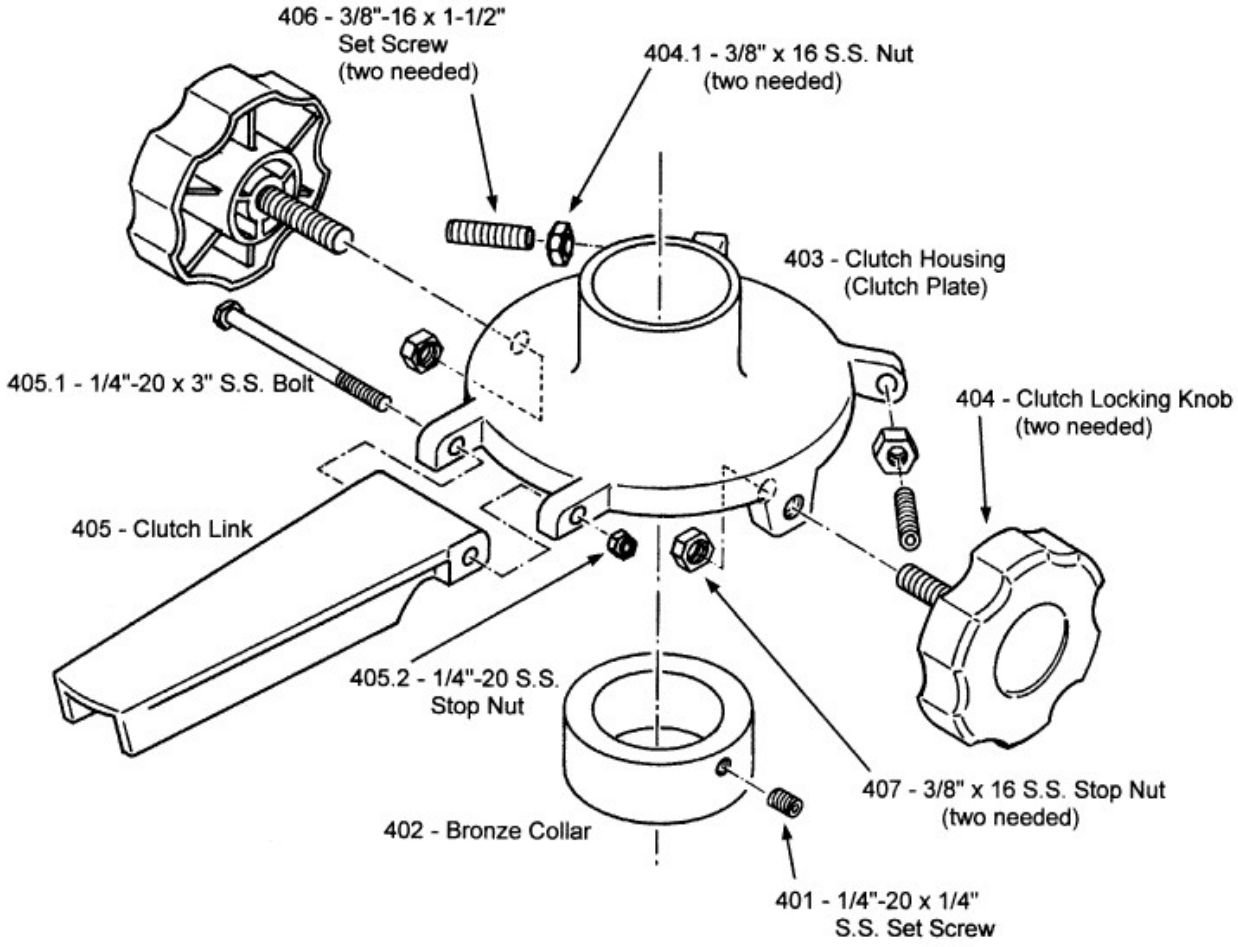
502 - Main Shaft to 8'.

June 2018

SAYE'S RIG PARTS - DIAGRAM 4 OF 6
AIRVANE ASSEMBLY



SAYE'S RIG PARTS - DIAGRAM 5 OF 6
CLUTCH ASSEMBLY

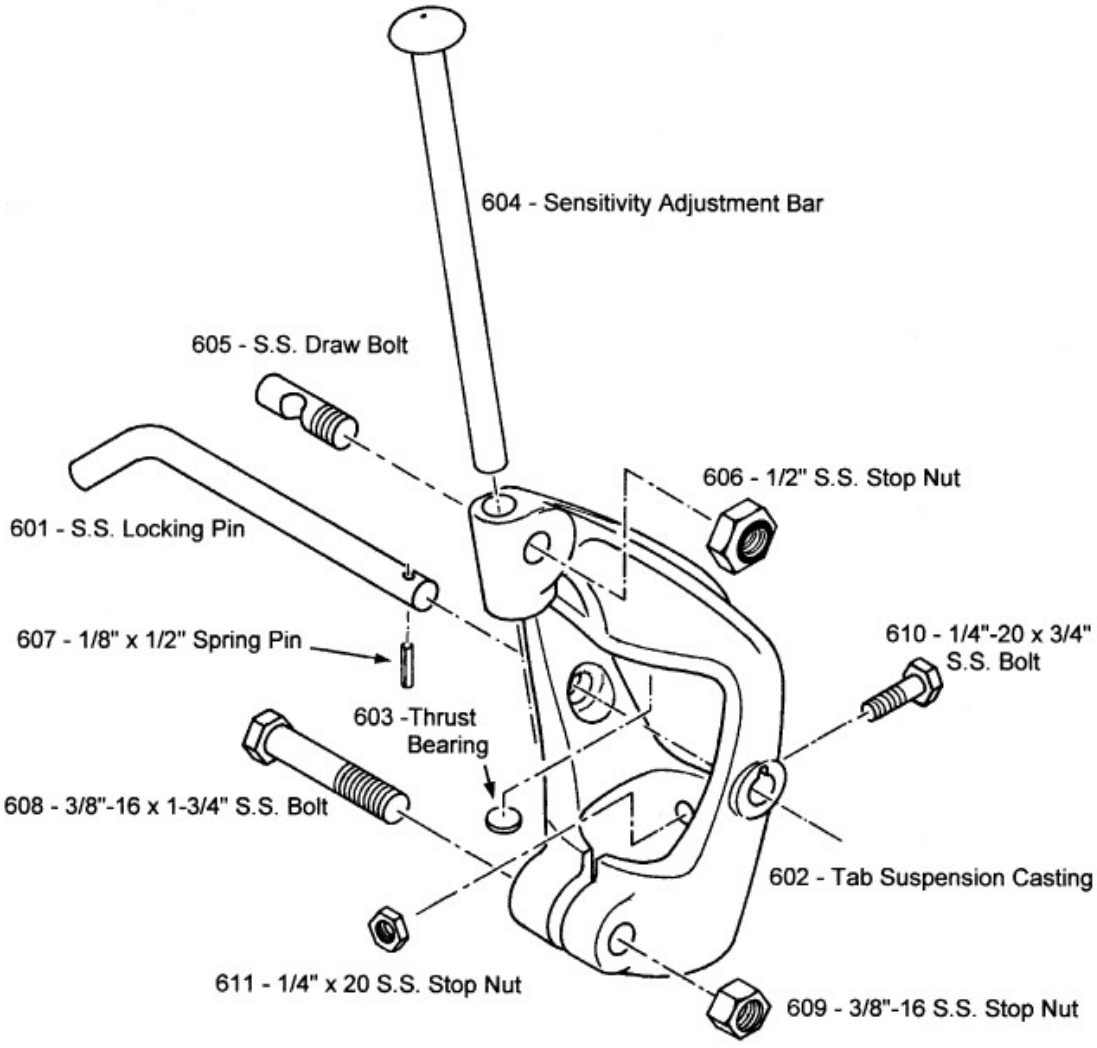


NOTES:
405 - Clutch Link must be ground on sides & top to fit Clutch Plate.

405.1 - Bolt is ground flush to nut in factory installation.

June 2018

SAYE'S RIG PARTS - DIAGRAM 6 OF 6
TAB SUSPENSION ASSEMBLY



NOTES:

603 - Thrust Bearing is epoxied into Tab Suspension.

605 & 606 - Draw Bolt & Stop Nut have been made in both 13- and 20-pitch thread. (Currently 13-pitch). Should be sold as a pair unless customer is sure of pitch.

June 2018