auto-helm

WINDVANE

SCANMAR INTERNATIONAL

Auto-helm Installation and Operation Manual

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AUTO-HELM MANUAL

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1 WELCOME ABOARD

Welcome to the ranks of Auto-helm windvane sailors. We hope you will be as satisfied with the Auto-helm as we are. The Auto-helm is built to give you years of excellent performance and to take the kind of punishment the sea delivers.

Many yachtsmen are still unfamiliar with windvane self- steering gear. They view vane gears as oddities used by single-handed race heroes and circumnavigators. The truth is that a good vane gear like the Auto-helm 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 Auto-helm has been experienced, this will be fully appreciated.

In order to enjoy the experience of self-steering, the vane 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.

This is no excuse for inferior performance. The Auto-helm is built with no corners cut and the greatest consideration for performance and durability.

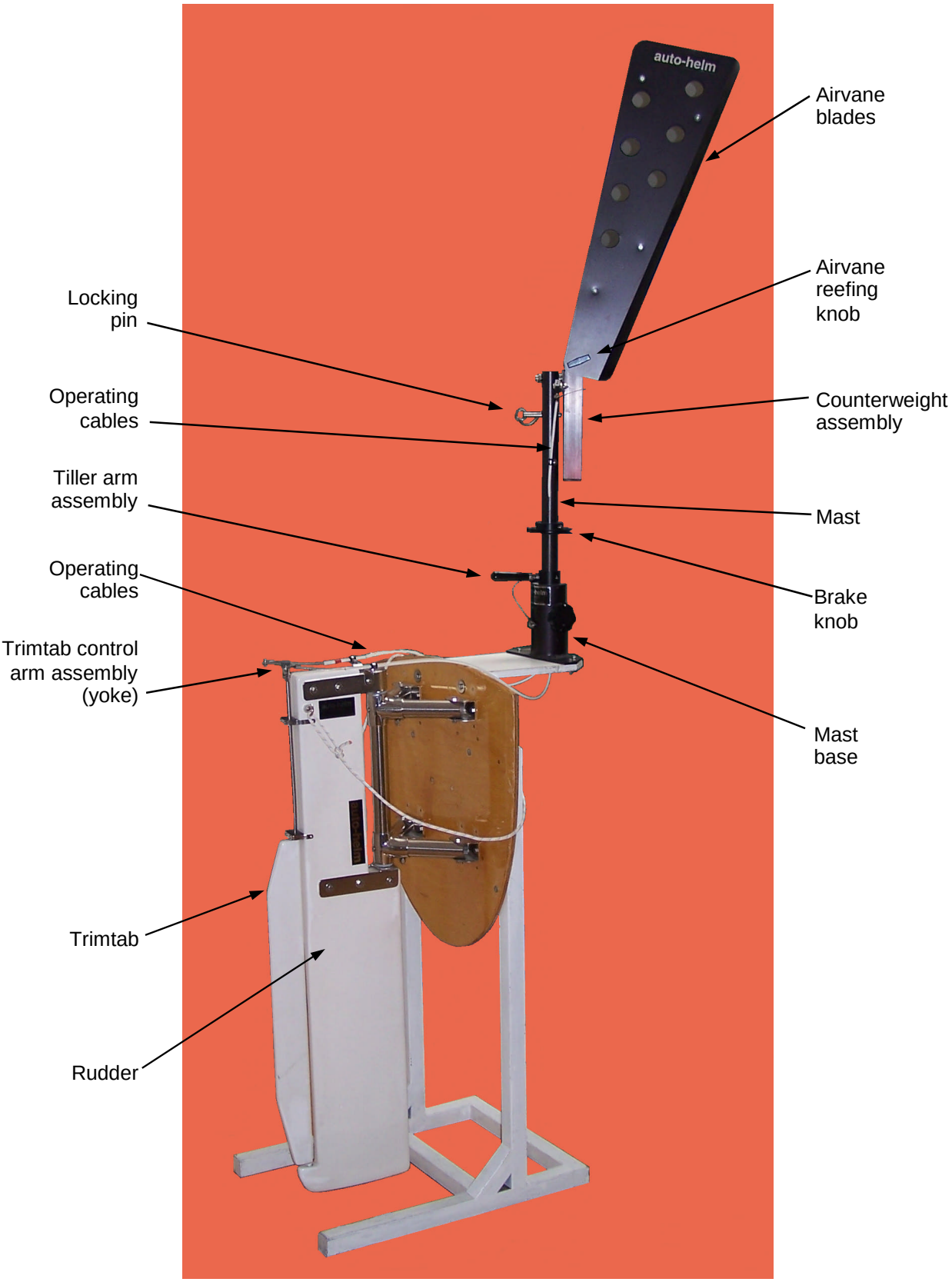
This extensive manual is necessary because airvane self- steering requires you learn about it before you become a perfect operator. Proper installation and proper operation are essential, and we hope the number of pages in this manual will not keep you from reading it.

2 AUTO-HELM DESCRIPTION

The Auto-helm became part of the SCANMAR windvane family in November of 1988. It has been on the market since the mid-seventies, and has an excellent reputation. It is totally independent of the boat's primary steering which means that you have no lines to rig from the windvane to the cockpit. The main rudder is locked and generally used to balance the boat. One big advantage is that the Auto-helm can be used as an emergency rudder. The Auto-helm is very easy to operate and to install.

The Auto-helm comes in two halves - the windvane unit and the rudder unit, which can be totally separated. The connection between the two units is a pair of stainless steel cables running through teflon tubes. The rudder can be mounted at the correct height according to the waterline and the air vane mast can be mounted as high as possible to get clear air. The independent mounting of the airvane mast permits you to deal with boats with high freeboard, davits, boomkins and other obstructions. The horizontal axis airvane is most powerful in the vertical position; but when trimming for sensitivity, it can be reefed gradually by pulling it down. The horizontal position can be useful if clearance for the mizzen boom is necessary when jibing or tacking.

The powerful airvane is only asked to turn about 1 sq. ft. of wetted surface of the trimtab. The flow of the water past the trimtab moves the rudder, which in turn steers


auto-helm
Airvane blades
Airvane reefing knob
Locking pin
Operating cables
Counterweight assembly
Tiller arm assembly
Mast
Operating cables
Brake knob
Trimtab control arm assembly (yoke)
Mast base
Trimtab
Rudder

the boat. The Auto-helm is capable of steering boats up to approximately 48 feet LOA. The rudder is a heavy fiberglass shell filled with high density polyurethane closed cell foam. This makes for a strong rudder which is also buoyant. Due to the buoyancy of the rudder, the Auto-helm's true weight is only 32 lb. Shipping weight is approximately 98 lb. The rudder supports are 316L stainless steel, and there is no metal in the water.

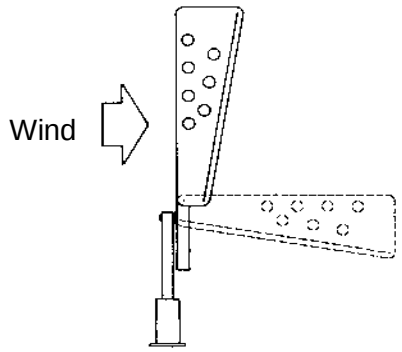
The Auto-helm windvane fits most boats, but it is especially suited for boats with hydraulic or stiff mechanical main steering, a center cockpit, high freeboard, bad weather or lee helm, davits, or when the skipper absolutely cannot tolerate lines in the cockpit.

2.1 Airvane

The Auto-helm airvane is made of two lightweight parallel 1/32" thick hard anodized aluminum plates separated by spacers. It has an aerodynamic shape proven to be very sensitive in very light air and downwind.

The airvane pivots around a horizontal axis rather than around a vertical axis like the flag-type vanes seen on some other gear. The horizontally pivoting vane is more efficient under all circumstances.

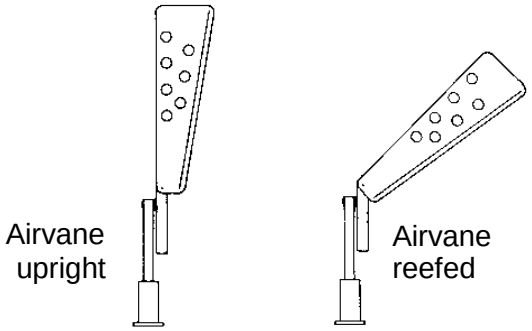
The horizontally pivoting vane should be adjusted with its leading edge facing into the wind when the boat is on the desired heading. The trailing edge, which is the flanged edge, should be facing away from the apparent wind. When the leading edge is turned into the wind, the equal wind pressure on either side of the vane blade will keep the vane upright. If the boat wanders off course, the wind hits only one side of the airvane causing it to pivot.



It is important to remember which windvane edge is the leading edge and which is the trailing one. It is possible to bring the vane upright by turning the back edge into the wind, but this will produce completely reversed reactions in the vane gear taking the boat further off course instead of bringing it back to the desired heading.

The airvane is adjusted by rotating the mast with either the tiller (short handle) or the adjusting pulley located on the mast. The vane is kept in place by tightening the brake located on the vane base mount.

The airvane itself has very little power, even under the best of conditions. To get maximum performance the Auto-Helm airvane pivots on specially made low friction teflon bearing surfaces.
The airvane is most sensitive and powerful when set vertically. However, by moving the top of the airvane down, you can reef it as the wind increases. The correct positions for a given boat must be done by trial and error. In general, if the boat starts oversteering in higher winds or when running, reef the airvane. The vane is also reefed down if you need to provide clearance to tack or gybe a mizzen boom.



The counterweight under the airvane balances the vane. Ideally, it should barely be able to keep the vane upright when there is no wind. The airvane must not be top heavy. Without the counterweight keeping the airvane upright, it would not work at all.

2.2 Flexible Cable Linkage

The pivoting of the airvane is transferred via stainless steel wire cable encased in a teflon tube which is, in turn, encased in a UV-resistant plastic cable cover. The wire cable is attached to the stainless steel trimtab yoke at the top of the trimtab shaft. This linkage in the Auto-helm is strong, direct, and the teflon tube gives minimum friction. The strength coupled with freedom from play and friction in the airvane-to-trimtab linkage is one important key to the superior performance of the Auto-helm windvane.

When the airvane is in the upright on-course position, the trimtab should be lined up exactly fore and aft. This adjustment is initially made during the installation of your Auto-helm. It is accomplished quite easily by adjusting the wire length in the cable blocks at the airvane.

2.3 Rudder

The semi-balanced Auto-helm rudder is built of fiberglass reinforced polyester resin. The exterior is gelcoat. The urethane core is composed of a strong, rigid closed cell urethane.

The near neutral buoyancy of your rudder helps the performance of your boat by reducing total weight, as well as reducing the moment of inertia in the stern.

To avoid marine growth on your Auto-helm, you should paint the underwater parts of the rudder and trimtab with anti fouling paint. When you "bottom" paint your rudder for the first time, particular attention should be paid to the paint manufacture's instructions for preparing the surface. Solvent washing (which should be done) is not enough. The rudder must be sanded heavily to remove the mold-release wax. The upper portion (out of the water) should be left unpainted. If the underwater portion is painted with a dark bottom paint, it should be shielded from the sun when the boat is hauled out of the water to prevent heat build-up.

The gudgeons and their fasteners are 316L Stainless Steel.

2.4 Trimtab

The trimtab is constructed of the same materials as the rudder. The trimtab has a vertical shaft running up to the top of the rudder, with a yoke on top for the operating cables.

2.5 Rudder Mounting Castings And Hull Brackets

The rudder support frame is composed of 1.9" diameter by .065" wall thickness stainless steel tubing and stainless steel castings. Two UHDPE bearings (at top and bottom) inside the vertical mounting tube provide a low friction surface for the 1" stainless steel rudder tube. The rudder tube is held in place by a retaining bolt at the top. Removal of the retaining bolt and rudder tube allows easy removal of the rudder from its frame.

The horizontal mounting tubes are fastened to the hull via stainless steel brackets. All fasteners are 5/16" or 3/8" diameter stainless steel.

The Auto-helm mounting system is universally adaptable to all kinds of stern configurations. It is easy to install, and once installed is extremely rigid and strong.

3 INSTALLING THE AUTO-HELM

3.1 Preliminaries

3.1.1 Important Alignments

Generally the Auto-Helm is attached to the stern with two upper and two lower mounting tubes. Some mounts have an additional intermediate mounting tube and/or diagonal tubes - see the mounting drawing for your boat for details. The mounting tubes are bolted to the boat by means of universal angle brackets.

The gear MUST be mounted on the centerline of the stern vertically and horizontally. These alignments are critical, and great care should be taken that the vane gear is

neither visibly off center nor tilted forward, aft, or to one side. Often it is helpful to mark the vertical centerline with a narrow strip of masking tape.

An off-center mount is NOT recommended. When the boat is heeled over, the rudder will be either too high out of the water, losing steering power, or too low in the water, submerging the lower mounting tubes.

3.1.2 Installing Afloat Or Hauled

It is generally much easier to install the vane gear with the boat afloat, and with the stern backed up to a dock. The boat floats true on its lines, and it is far easier to step from the dock to the boat than to climb a ladder and work off a scaffold. However, the use of safety lines on tools and parts is recommended to avoid dropping them into the water.

3.1.3 Determining The Proper Height Of Installation

A good way to estimate the proper height of installation is to measure the stern wake while you are under full power. This is when the boats really squats. The lower mounting brackets should be three to four inches above this line. Your goal is to avoid burying the mounting hardware while underway. Mounting the unit too high will result in less than optimum rudder in the water.

Keep in mind that the boat may float differently when loaded for cruising (e.g. full water and fuel tanks plus supplies). As a rule of thumb, the average cruising boat will ride one inch lower for every 1,000 pounds of added weight.

3.1.4 Tools

To install an Auto-helm you need:
- A variable-speed electric drill (preferably cordless) with 5/16" and 3/8" bits
- Two 1/2" wrenches
- Adjustable wrench
- Pliers
- Screwdriver
- Mallet (or hammer and wood block)
- Tape measure
- 3/16" Allen wrench (supplied)
- Suitable bedding compound (Boatlife, Sikaflex, etc.)
- Masking tape
- Pencil or marker

3.1.5 The Most Important Installation Instruction

READ THE ENTIRE INSTALLATION PROCEDURE AND BE SURE YOU UNDERSTAND IT ALL BEFORE STARTING THE JOB. If you have any questions, call or email Scanmar before you start drilling - we're always ready to help.

3.2 Fitting the Rudder

With the stern wake height line marked on the hull, you should back the boat into a slip. Press the upper and lower mounting tubes into their castings on the rudder post. Use some lashings to prevent loss of parts. Lift the rudder with a tackle and guide it up against the transom. Twist and adjust the mounting tube brackets so they lay against the transom. Mark the location for the mounting brackets.

SPECIAL NOTE FOR INSTALLATIONS WITH AN INTERMEDIATE MOUNTING TUBE: It's easier to determine where the transom bracket for the intermediate tube is going to go AFTER the rest of the mounting assembly is mounted. Proceed with the upper and lower mounting tube assembly as described below. After everything else is bolted up, insert the intermediate mounting tube into its casting, and raise the casting until the bracket can be laid flat onto the transom. Then drill all holes and bolt up as described for the uppers and lowers - see below.

Once you determine the proper height for the upper and lower mounting tubes, you should remove the rudder from the mounting assembly. This is done by first removing the retaining bolt that holds the rudder post in place. Next remove the rudder post. This will allow the rudder to come free from the mounting brackets. The lower UHDPE bearing is held in place with a set screw to prevent loss when the rudder is removed. Without the rudder in place, you can easily handle the mounting tubes and brackets. Again, use a safety line when handling the mounting assembly!

At this point you need to decide where you are going to mount the Auto-helm airvane and mast unit. If it is mounted on the boat's deck (which normally requires the optional anodized aluminum toerail bracket), it will have no effect on the rudder mounting tubes. If, however, you plan to mount it on the upper mounting tubes, you'll have to insure that the mounting tubes remain long enough (about 9 inches) to provide room for the mast base. For traditional overhanging transoms which require short upper tubes the mast base can be mounted on the stern rail or elsewhere.

Hang the mounting tube assembly against the transom. Rotate the mounting tubes in the castings again, if necessary, to place the mounting brackets over the positioning marks previously made on the transom. This is also the time to cut the tubes in order to mount the rudder as close to the hull as possible, if you wish to deviate from the mounting design shown in your boat's drawing. The tubes are supplied cut to the length specified in the installation drawing normally will provide the best mount possible. Contact Scanmar before doing anything permanent!

Re-mark the position of the mounting brackets and the mounting bolt holes. Be absolutely sure that nothing has shifted while marking the holes!

Drill the bolt holes through the transom using a 3/8" bit. If you have a steel boat, use drilling lubricant and run the drill at low speed with lots of pressure.

Before you bolt the brackets on you need to be sure that the transom is strong enough to withstand the forces of an auxiliary rudder. In the case of most fiberglass hulls backing plates of 1/2" to 3/4" marine plywood behind each mounting bracket are

sufficient. If you have a wooden boat or a very thin skinned fiberglass boat, additional bracing of the transom should be considered.

If you are confident of the strength of the transom, secure the brackets to the hull using bedding compound and plywood backing plates.
The stainless steel castings on the rudder post have pre-drilled holes for the bolts that hold the mounting tubes in place. Drill through the castings and mounting tubes with a 5/16" bit. Insert the bolts, put on the washers and nuts, and tighten all up. Use marine silicon sealer on all bolts and set screws when they are put in for the final time. This provides a little added insurance to prevent them from vibrating off while underway.
Fit the rudder back onto the mounting assembly. Set the upper gudgeon on top of the bushing collar protruding from the upper casting, slide the lower gudgeon under the bushing collar protruding from the lower casting, and insert the inner rudder tube, locking the rudder in place. Put the cross-bolt through the top of the inner rudder tube.

3.3 Airvane Mast

3.3.1 Preliminaries

Determine where the airvane mast is going to be installed. Be sure the operating cables can be run to the top of the rudder with easy curves - no sharp bends, which will crimp the cables.

3.3.2 Installing The Mast Base And Airvane

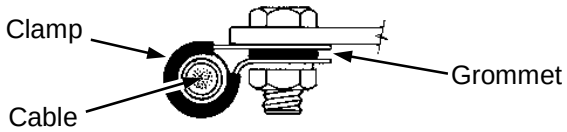
Note that the airvane mast can be shortened if desired, but plan ahead carefully - take into account the swing of the airvane both in the vertical and the horizontal 'reefed' position.

Place the mast assembly on the upper mounting tubes or a base platform bracket on the stern. Drill through the tubes or bracket (if your bracket is not pre-drilled) and through bolt with the 5/16" bolts provided.

After the mast is on, bolt the airvane onto the counterweight assembly. See the parts diagrams for the washer positions.

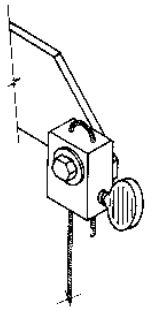
Bolt the trim tab control arm assembly (the 'yoke') to the top of the trim tab shaft, with the arms canted AFT. (If it were a swept-wing airplane, it would be 'flying' forward).

Shorten the cable housing, if desired - be sure that the rudder can swing without binding the cable. Make sure that the cable housing marked PORT (red) goes on the port side of the rudder. Secure the housings to the fairlead bracket assemblies on the rudder head. Note that the grommet goes between the stainless steel straps, to prevent crimping the cables when tightening the bolts.



Attach the shackles on the operating cables to the yoke on the trimtab shaft. Be sure that the shackles are not binding and that the cables move smoothly inside their covers.

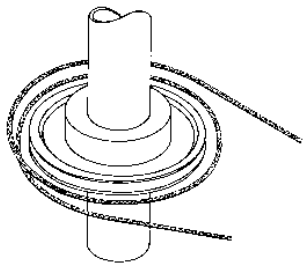
The upper ends of the cables are held by the cable blocks mounted on the ends of the counterweight assembly. Insert a cable UP through the hole on the opposite side from the thumbscrew, then DOWN through the hole nearest the thumbscrew. Leave enough extra cable to grasp for adjustment. It is easier to adjust the cable tension on both sides at once. The cables should be set up with minimum slack without binding. If desired, they can be adjusted for various wind conditions - this will vary from boat to boat.



If the cables are installed incorrectly your Auto-helm will steer backwards. With the leading edge of the airvane facing forward and the counterweight aft of the mast, the airvane and trimtab will move in the same direction. When the airvane is moved to the right, the trimtab should also move to the right.

3.3.3 Adjusting Pulley

Usually the airvane is pointed into the wind by loosening the brake knob and rotating the mast manually with the tiller arm. If remote operation is required, an endless loop of 1/8" diameter line can be run forward into the cockpit. The line should run around the adjusting pulley 1-1/2 times, and the forward end of the loop should be kept under tension with a bungee cord. The adjusting pulley should be as low as possible on the mast for best operation.



This completes the installation procedure.

4 SAILING WITH THE AUTO-HELM WINDVANE

4.1 Becoming A Vane Sailor

The Auto-helm system can usually control a yacht in any wind condition in which it is possible to sail. One of the most important factors to remember is that each boat will respond differently to its control system, and may require its own particular adjustments before accurate self-steering can be established. For instance, after the vane is in operation, it is sometimes necessary to make slight adjustments to the main rudder or sails. It is wise to experiment with these relationships and find the best procedures for your particular yacht.

This part of the Auto-helm manual will make your own introduction a bit speedier. After giving a standard operating checklist and some hints for your first sail with the Auto-helm, the procedure of balancing the boat for self-steering is described.

4.2 Standard Operating Procedure

4.2.1 Ready The Gear

If the gear hasn't been used in a while, you should make sure that the cables are at the correct tension and the trim tab is centered when the airvane is in its upright position. Loosen the rudder restriction lines if tightened.

4.2.2 Assume The Desired Heading

Go sailing! Get out on the water and pick a course.

4.2.3 Balance The Boat

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 work to bring the boat back aiding the vane gear instead of fighting it.

4.2.4 Trim The Airvane And Engage The Vane Gear

With the boat sailing on course, rotate the airvane so the leading edge is pointed into the wind. Pull out the locking pin to allow the airvane to pivot on its horizontal axis. The Auto-Helm is now sailing the boat .

4.3 Your First Sail With The Auto-Helm

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

DO NOT OVER CANVAS. If your boat can be sailed well on a jib alone, you should SET A JIB ONLY, at least for starters. Not having to deal with a lot of sheets, potentially gybing booms, and a boat rushing on with her lee rail under will help you concentrate on the vane gear and making it work on all points of sail. When you are familiar with the workings and operation of the Auto-Helm, you can add more sail area and drive the boat faster while your Auto-Helm steers.

START BY SAILING UPWIND without really pinching. Turn the leading edge of the airvane (the edge facing the mast) into the wind to bring the vane upright and remove the locking pin.

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. Go aft and observe the way the airvane moves and how this movement moves the trim-tab and Auto-helm rudder.

MOVE THE AIRVANE 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 sail sheet if necessary.

When you are satisfied that the boat is sailing well on course, change the airvane setting again with the leading edge pointing further downwind than when you started out. As the vane makes the boat bear off, retrim your jib sheet 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 vane gear settle down after you have made a change. The most common mistake is changing too many things too fast. This prevents you from understanding what is happening and why.

When the yacht is on course, the vane should be more or less straight up. As she goes off course in either direction, it will respond by tipping to one side or other. In some instances, the vane system may be fighting a constant weather or lee helm, and will be cocked to one side during operation. Solutions to this are described in the next section.

4.4 Fine Tuning For Optimum Course-Holding

After you have engaged the vane gear, you should remain at the steering station for a while to check the self-steering performance.

If the vane gear is constantly working to keep the boat from deviating to one side of the course only, an adjustment is necessary. The same is true if the boat spends very little time on the desired heading and more time steering in wide arcs off to each side - a series of "S"-curves.

You should strive to have the boat stay close to the course line. Deviations should be small, on BOTH sides of the course line, and be quickly corrected by the vane gear. This can usually be achieved by fine-trimming which involves adjusting the sails,

compensating with the main rudder, and adjusting the vane gear itself.

After the gear has been engaged, you should always try to work it out by SAIL TRIM FIRST and by adjusting the RUDDER LAST. 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 than would be true if the boat's rudder was off dead center to compensate for an unbalanced sail plan.

The boat's main rudder is used to fine trim the boat. Your Auto-helm might be able to steer the boat with the main rudder free swinging, however, you will probably find that if you use the main rudder as a giant trimtab, the course will be even straighter. Make sure to mark the center position on the wheel. If your Auto-helm now seems to work more on one side than the other, you should help the windvane by moving the steering wheel an inch or two in the direction that you would steer the boat. Lock the wheel in this position and study the course a few minutes. Repeat, if necessary, but be aware that the boat's rudder is very large and powerful and should be moved in small increments. A rudder that is put too far over will create a lot of drag on the boat speed and a lot of strain on the boat itself.

4.5 Balancing For Self-Steering

4.5.1 Problem Boats And Easy Boats

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 vane gear to handle are moderate size, medium displacement, good course stability, moderate response to rudder, little or no helm on all points of sail, and a sail plan which allows many alternative sail combinations.

More tuning is required to steer very large, heavy boats, very light displacement boats with fin keels and spade rudders, and boats with a rig which does not allow many options for sail combinations and trim.

This does not mean that such boats cannot be steered by the Auto-helm. They do, however, require more insight and seamanship from the operator.

4.5.2 Light Air

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

If the boat is very large, it will generally take a larger rudder to steer the boat. The Auto-helm will normally steer boats up to 48 feet LOA. If the boat is much larger, the size of the Auto-helm's rudder might be too small to control the boat in heavy wind. 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 and will remain functional down to about one knot of boat speed with the corresponding wind strength. However, a good sailor, balancing his boat properly, can make the vane gear steer a large yacht in surprisingly light conditions.

In general, the Auto-helm auxiliary rudder system works very well in light winds, slow boat speeds and often exceeds the light air performance of vanes using other self-steering principles.

4.5.3 Running

"Does it work downwind?" This question is more common than 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 downwind sailing using main and jib it is generally more efficient to fall off the wind to either side and make long boards, gibing across the wind from time to time, than to attempt to sail dead downwind.

It should also be noted that the auxiliary rudder will give the boat directional stability since it is mounted further aft than the main rudder, and this will help downwind performance.

THE FIRST AND FOREMOST RULE WHEN SAILING DOWNWIND IS USING THE RIGHT SAILS AND THE RIGHT AMOUNT OF SAIL.

Before the advent of mechanical vane gear, boats were sailed around the world self-steering downwind in the trades by use of twin head sails on poles. The trick to that is to sheet the twins a little bit looser than you would for maximum efficiency alone. 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 you are going to do a lot of downwind cruising, it might be worthwhile to set the boat up for twin head sails. Combined with the Auto-helm this rig gives excellent self-steering even on problem boats. It is efficient as well as being very safe and easy to manage. The only disadvantage is that the boat rolls more than when the main is used.

IF THE MAIN IS CARRIED, THERE SHOULD ALWAYS BE A FORESAIL POLED OUT ON THE OPPOSITE SIDE TO COUNTERACT THE MAIN. Although this set-up could not be used for self-steering by itself, it will be an adequate sail combination for self-steering on almost any yacht using the Auto-helm.

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

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. The 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.

The 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 we pull it from ahead.

The spinnaker is set ahead of the mast and gives good balance as long as nothing goes wrong. The trouble is that a lot of things can go wrong. The tremendous power of the spinnaker makes the boat move faster downwind and consequently magnifies the problem of the weakness in the vane's signals. 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 a spinnaker broach. Therefore, the spinnaker should be used with caution with a mechanical vane gear.

Summing up: DOWNWIND SAILS AT THE BOW GIVE THE BEST BALANCE 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, ESPECIALLY USING A SPINNAKER IN HARD WEATHER WHEN IT CAN EASILY LEAD TO BROACHING.

4.5.4 Reaching

We are seldom asked whether the Auto-helm works well on a reach. In fact, reaching can be harder for the vane 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 gusty weather. With a sloop rig there are few options for using sails well fore and aft to create pressures which make the boat return to the desired heading after it has swung off course.

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 VANE 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 yacht from rounding up when the wind increases in strength.

Twin head sails 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. After that the windward pole 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 vane 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 head sail should be the choice. However, using a head sail on a reach does not necessarily to push the bow downwind unless it is hoisted very far out on a long bowsprit.

When the wind increases, many boats will experience increased weather helm even with only the head sail set. However, this weather helm is very mild compared to what the mainsail would induce under similar circumstances, and the vane gear can easily hold the boat on course.

When the main and head sail 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 SHEETED MUCH LOOSER than you would do in a racing situation. This will slow the boat an almost unnoticeable bit. The effect is to make the sails spill their wind at a much earlier point when the boat wants to round up. The weather helm decreases, and the vane gear is capable of pulling the yacht back on course.

If you continue to have problems, reduce sail area, especially the main, and continue to release more sheet even though the leeches may flutter a bit.

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 head sail(s) and catch all the wind. This will move the pressure behind the mast and make the boat want to round up again.

SUCCESSFUL SELF-STEERING ON A REACH IS ACHIEVED BY AVOIDING EXCESSIVE CANVAS, RELYING PRIMARILY ON THE HEAD SAILS FOR POWER, SHEETING THE SAILS LOOSELY, AND USING SAIL TRIM RATHER THAN THE MAIN RUDDER FOR BALANCING THE YACHT.

4.5.5 Hard To Weather

Most yachts can easily be made to self-steer when hard on the wind without using the vane gear. Consequently, the vane will have little problem keeping the yacht on course. Because the movement is towards the wind, the velocity of the wind working the airvane sensor 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 over sheeting will only heel the boat unnecessarily, inducing great weather helm which may become difficult for the vane to control in a gust.

4.5.6 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 vane gear steer your boat. After you have used the Auto-helm a while, it will steer even better, and you probably will have learned a thing or two about sailing and balancing your boat. Give everything a chance to work and remember that some learning is necessary to get the most from your vane.

4.6 Useful Hints To Get The Most Out Of Your Vane

After you have set up the vane gear to steer your boat, you should remain in the cockpit for a couple of minutes observing the behavior of the yacht.

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

4.6.1 Balance And Trim

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. The goal is to get the boat to sail as close to the desired heading by itself, and have the windvane, autopilot or helmsman do only minor corrections. USUALLY, RELEASING THE MAIN SHEET A BIT WORKS WONDERS IN TAMING TENDENCIES TO ROUND UP.

Start your windvane steering with your boat's rudder locked on boat centerline, and do as much of your course correction as possible with sail trim. Final minor adjustments can be made by using the boat's rudder as a trimtab, but remember that if you trim the boat using mainly the boat's rudder all will be well as long as the wind is constant - as soon as the wind speed changes, though, main rudder will take over and the boat will round up or fall off course.

4.6.2 Friction And Binding

Friction that interferes with the airvane's ability to move the trimtab is a deadly enemy of light air performance. Friction result from incorrectly led cables to the trimtab. The

most common problem is overtightening the trimtab cables. They should be somewhat slack in light air, and the wires should move freely through their sheaths. The airvane should swing easily from side to side. The Auto-helm rudder and trimtab should also be checked periodically for binding - both should move freely.

4.6.3 WIndvane Alignment

Check periodically to be sure that the airvane is dead upright when the trimtab is in line with the rudder centerline.

4.6.4 Airvane Adjustment

A common mistake is reversing the airvane when preparing to selfsteer. The airvane's counterweight should be moved to the lee side of the airvane mast so the straight edges of the airvane blades are into the wind. Under most conditions the airvane will be set up vertically. In strong winds the airvane should be reefed down to about 45 degrees. Experiment to see what's best for your boat.

5 MAINTENANCE AND PROBLEM SOLVING

5.1 Appearance

The Auto-helm is made of hard black anodized aluminum and 316L stainless steel. After fabrication, the individual stainless parts are electropolished in a chemical bath to remove impurities from the surface and welds of the metal. The last step is the assembly of the individual parts to make a finished vane gear.

A periodic fresh-water washdown of the gear to rinse off the salt and airborne grime is recommended. An occasional application of metal polish on the stainless parts will keep them bright and shiny.

5.2 Regular Maintenance

The cables running from the airvane to trimtab are the hardest working part of the Auto-helm vane gear. Inspect them frequently and readjust as needed. Do not over tighten them. They should be slightly slack when correctly adjusted.

The Auto-helm bearings and bushings are made from materials that work better with water on them. Maintenance consists of hosing the gear with fresh water when 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. Do not use oil.

Vibration when under power can occur on some boats. You should therefore check all fastenings from time to time. Make sure that nuts and bolts are tight. Vibration cannot be predicted for any given boat since there are too may variables - prop size and speed as well as hull configuration are just a few. Monitor the characteristics of your boat and reduce speed if necessary.

5.3 Preventing Problems And Damage

5.3.1 Collision -Removing The Rudder

As the rudder is mounted outboard of the hull, it is vulnerable to collision. Unfortunately, vanes sometimes get damaged by being run into by other less than expert skippers. This can happen in a marina as well as in an anchorage. Even a bump may do a lot of damage when it is executed by a yacht weighing several tons.

Be aware of the danger to your vane gear from collision. If possible, berth your boat with the stern in. Be ready to fend off in crowded situations. Plan your own maneuvers with the vane gear in mind.

If you are not using the vane gear for a long period of time, or if there is a serious possibility that the rudder may be damaged, you should remove the rudder.

5.3.3 Locking The Airvane

When you have finished sailing with the Auto-helm, lock the airvane by inserting the 3/8" fastpin in the hole through the counterweight. This will prolong the life of the square airvane bearings. By bringing the airvane down to a horizontal position, the wind will have less pressure on the airvane.

5.3.4 Hard Weather

Hard winds and fast speeds make the Auto-helm very powerful. People have reported using the gear in extreme storm conditions. Your need to take over would be when the boat is threatened by dangerous waves. The Auto-helm cannot see a freak wave and in very big seas there can actually be a lack of wind in the trough between two waves which would interfere with the steering ability of any windvane.

6 MAKING REPAIRS

The sea punishes everything on a boat. The windvane is possibly the hardest working equipment of all on a cruising sailboat. Unfortunately, it cannot be engineered with mammoth dimensions because this would interfere with its ability to steer in anything but a hurricane.

The construction of the Auto-helm combines great strength with the necessary lightness to make the gear efficient in all conditions. We strongly recommend periodic inspections that can correct problems before they become severe. Regular hand tools are most often all that is needed to make repairs. The gear really is logical and easy to understand.

The parts lists and diagrams beginning on the next page will help in disassembling and repairing your Auto-Helm.

AUTO-HELM PARTS LIST

Airvane

V1.1	Airvane Blade, Right
V1.2	Airvane Blade, Left
V2	Airvane Spacer Tube
V3	Aluminum Spacer Bolt
V3.1	Airvane Reefing Knob
V4	Aluminum Lock Nut
V5	Nylon Washer
V6	Counterweight Assembly
V6.4	Counterweight Bushing
V9	Cable Block Thumbscrew
V13	Cable Block Assembly
V16	Counterweight Bolt

Mast And Base

B1	Base
B2	Mast
B3	Mast Bushing
B4	Mast Bushing Spring Pin
B6	Locking Pin
B6.1	Locking Pin Lanyard
B7	Cotter Ring
B8	Standard Cable Set (one pair, 7-foot wire length)
B8.1	S.S. Cable (sold per foot for custom cable sets)
B8.2	Inner Teflon Tubing (sold per foot for custom cable sets)
B8.3	Outer Vinyl Tubing (sold per foot for custom cable sets)
B8.5	Trim Tab Shackle
B9	Cable Clamp Assembly
B10	Brake Pad
B11	Brake Knob
B12	Brake Plate
B13	Tiller Ring
B14	Tiller Arm Assembly
B15	Tiller Arm Set Screw
B16	Tiller Limitation Bolt Assembly
B18	Tiller Limitation Lanyard
B19	Adjusting Pulley

Rudder And Trim Tab

R1	Rudder
R2	Trim Tab
R3	Upper Rudder Gudgeon
R4	Lower Rudder Gudgeon
R5	Trim Tab Gudgeon
R6	Trim Tab Gudgeon Assembly
R7	Fairlead Bracket Assembly
R8	Trim Tab Control Arm Assembly
R9	Trim Tab Bushing
R10	Rudder Bushing
R12	Outer Rudder Tube
R13	Inner Rudder Tube
R16	Rudder Centering Line
R16.1	Ruder Centering Eye Assembly

Mounting Components

T1	Mounting Tubes (sold by the inch)
T2	Single Stainless Steel Casting, with setscrew
T3	Double Stainless Steel Casting, with setscrew
T4	Hull Mounting Bracket ('L'-bracket, 2007 and earlier)
T6	Rail Mounting Bracket For Mast
T7	Mounting Tube/'L'-Bracket Bolt, Lockwasher, Nut & Compression Tube
T8	Hull Mounting Bracket ('U'-bracket, 2008 on)

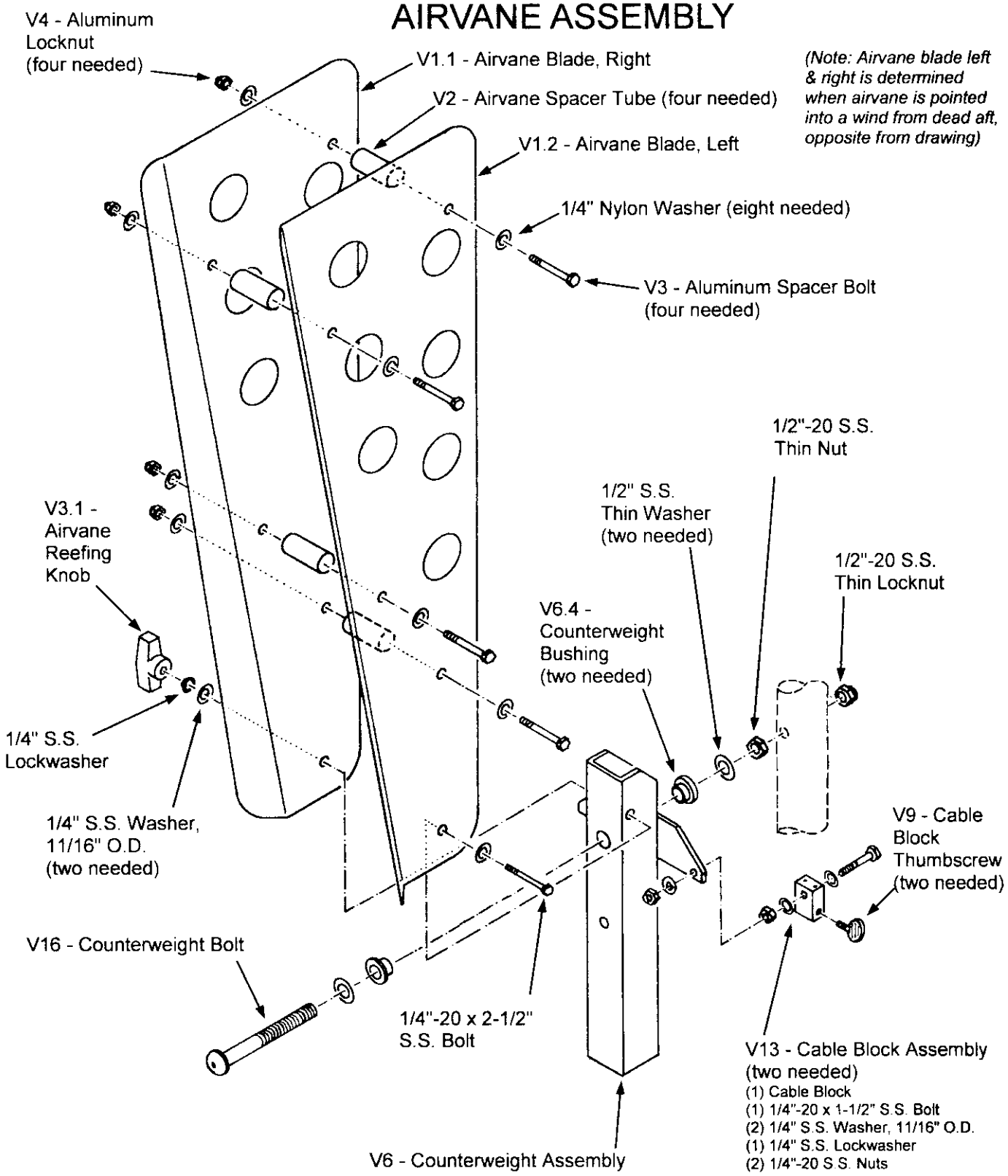
(See next page for Misc. Hardware)

AUTO-HELM PARTS LIST (continued)

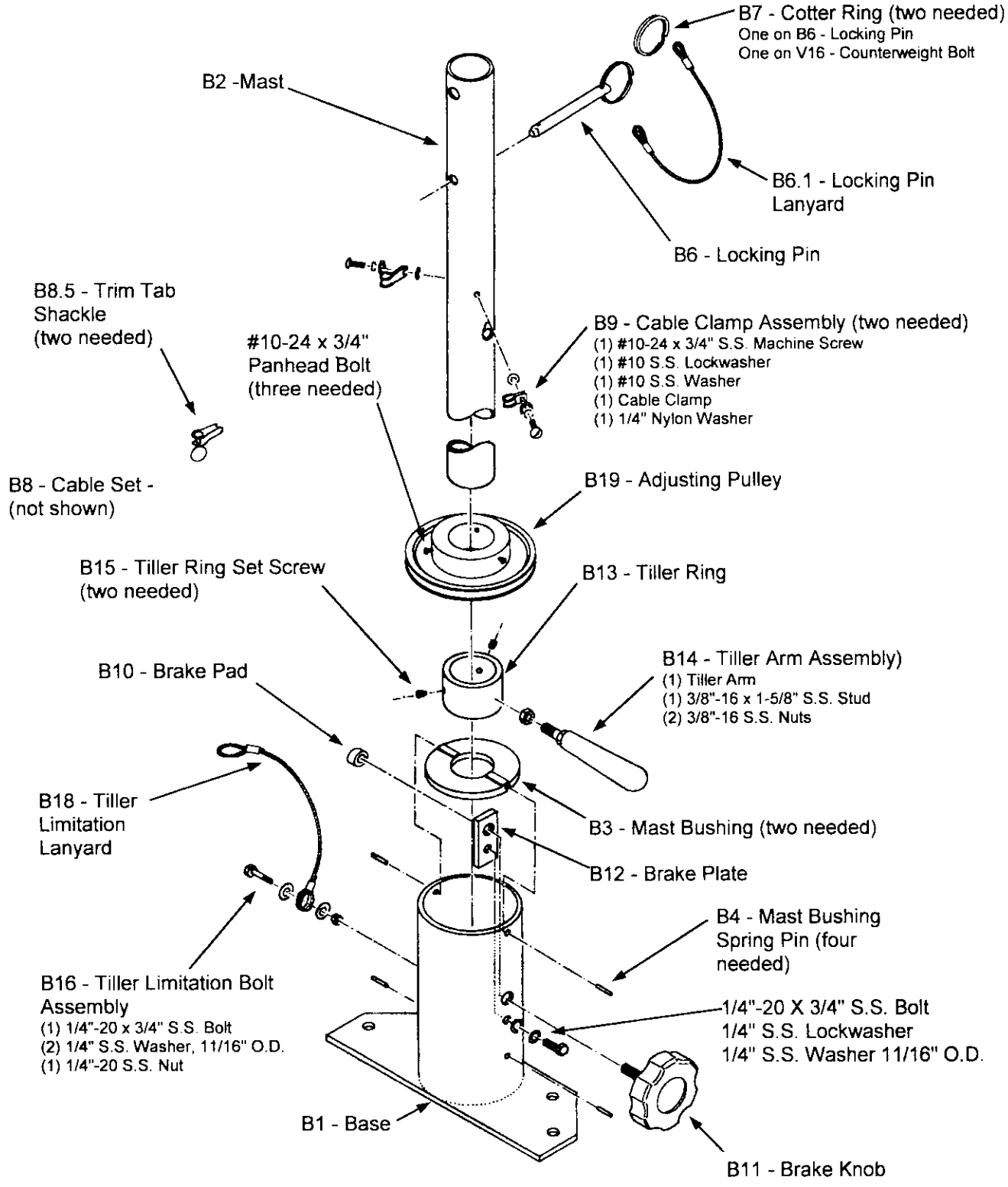
Misc. Hardware (all stainless steel unless otherwise noted. F-numbers are Fasco part numbers)

#10-32 x 1" pan-head bolt, F820
#10-32 nut, F1308
#10-24 x 3/4" pan-head bolt, F809
#10-24 nut, F1307
#10 washer, F1397
#10 lockwasher, F1418
1/4"-20 x 3/4" bolt, F54
1/4"-20 x 1-1/2" bolt, F58
1/4"-20 x 2-1/2" bolt, F62
1/4"-20 x 3-1/2" bolt, F66
1/4"-20 x 4" bolt, F67
1/4"-20 nut, F1310
1/4" washer, F1970
1/4" washer, 11/16" O.D., F1399
1/4" lockwasher, F1420
1/4" nylon washer, F2981
5/16" fender washer, F1431
5/16" lockwasher, F31421
3/8"-16 x 3-1/2" bolt, F30108
38"-16 x 5" bolt, F30111
3/8"-16 nut, F1312
38" washer, F1401
38" lockwasher, F1422
1/2"-20 thin nut, F2882
1/2"-20 thin lock nut, F3357
1/2" thin washer, F3561

AUTOHELM PARTS - DIAGRAM 1 OF 5
AIRVANE ASSEMBLY



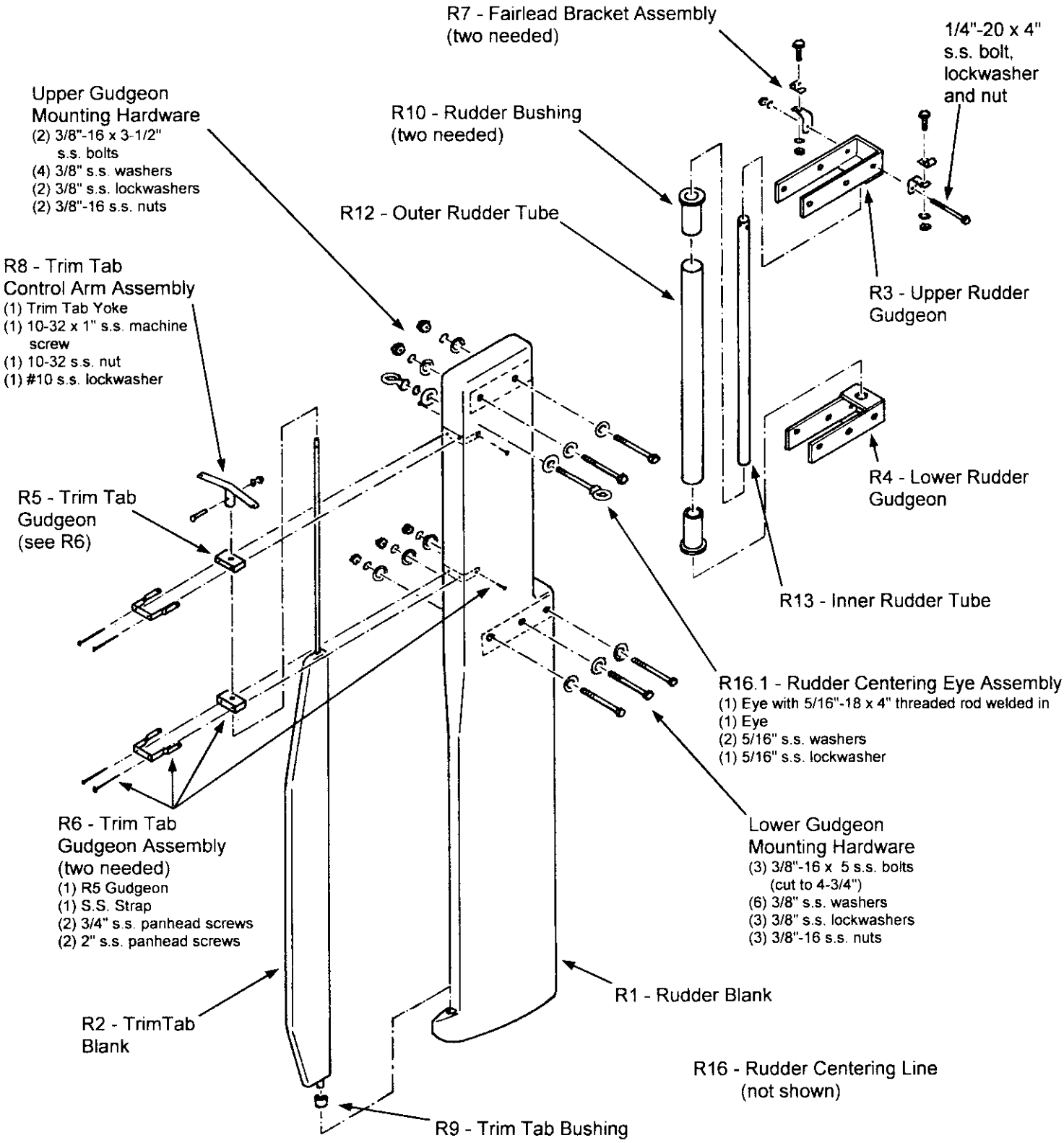
AUTOHELM PARTS - DIAGRAM 2 OF 5
MAST AND BASE ASSEMBLY



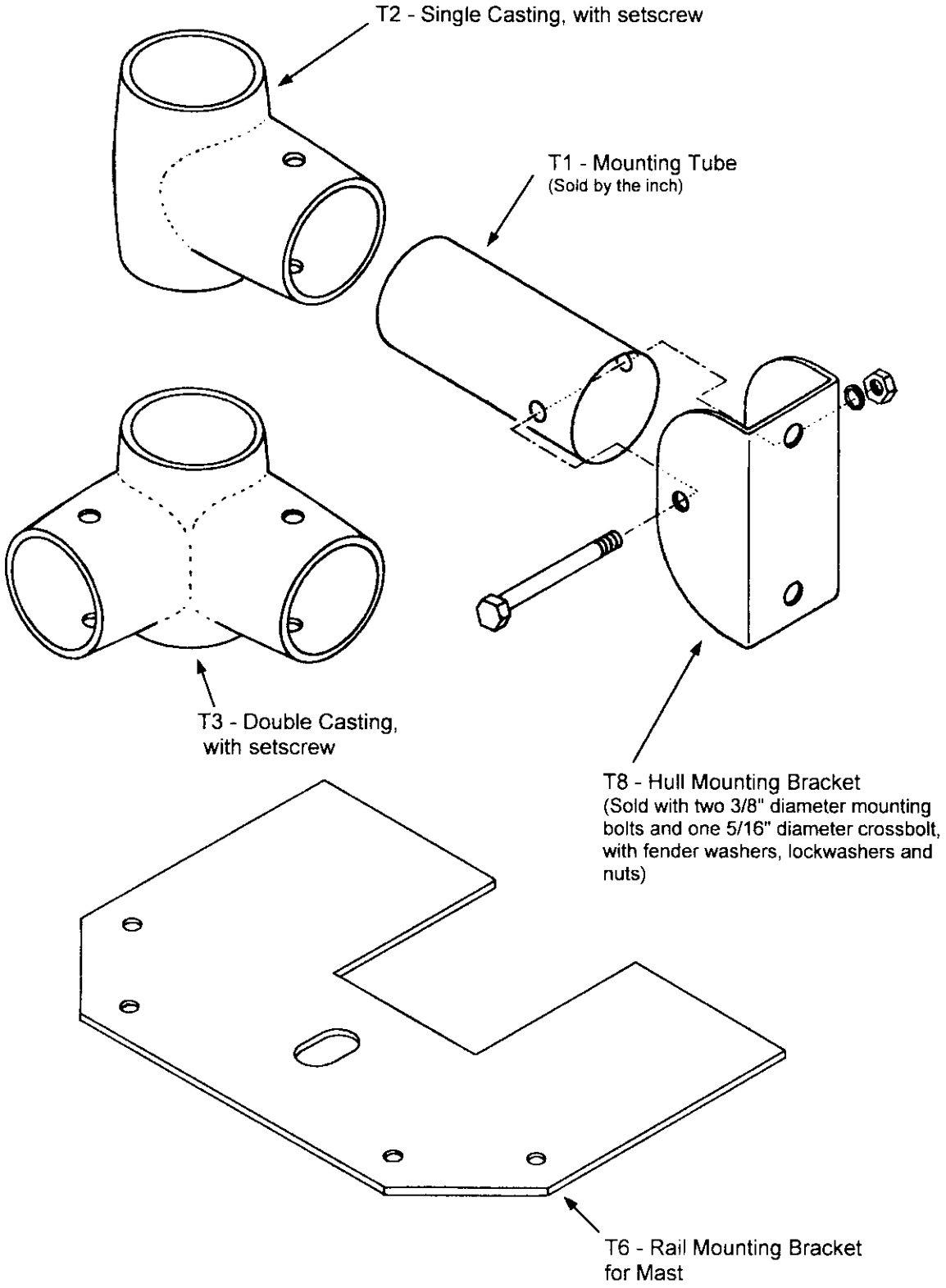
NOTES:

B10 - Brake Pad is tapped, then epoxied and threaded onto end of B11 Brake Knob shaft at factory.

AUTOHELM PARTS - DIAGRAM 3 OF 5
RUDDER ASSEMBLY



AUTOHELM PARTS - DIAGRAM 4 OF 5
MOUNTING COMPONENTS
Mounting brackets from 2008 on



AUTOHELM PARTS - DIAGRAM 5 OF 5

Pre-2008 mounting brackets