

INSTALLATION INSTRUCTIONS

Speed/Temperature Sensor with Valve

Model ST600

U.S. Patents: 4,898,029; 5,186,050. Australian Patent 605,281.
Canadian Patent 1,313,775. Japanese Patent 1851014.

IMPORTANT: Please read the instructions completely before proceeding with the installation. These directions supersede instructions in your instrument manual if they differ.

WARNING: NEVER USE SOLVENTS!

Cleaners, gasoline, paint, sealants and other products may contain strong solvents, such as acetone, which can attack many plastics dramatically reducing their strength.

Applications

- **Plastic** housings are recommended for fiberglass or metal hulls only.
Never install a plastic thru-hull sensor in a wood hull, since swelling of the wood may overstress the plastic causing a fracture.
- **Bronze** housing are recommended for wood or fiberglass hulls only.
Never install a bronze housing in a metal hull, because electrolytic corrosion will occur.
- *Never* install a metal housing in a vessel with a positive ground system.

Tools and Materials Needed

Water-based *or* mineral spirits-based antifouling paint
(Mandatory in salt water)

Safety goggles

Dust mask

Electric drill with 10mm (3/8") or larger chuck capacity

Drill bit: 3 mm *or* 1/8"

Hole saw: 51 mm *or* 2"

Mild household detergent *or* weak solvent (alcohol)

Sandpaper

Marine sealant

Additional washer for aluminum hulls less than
6mm (1/4") thick

Silicone grease *or* petroleum jelly (Vaseline®)

Slip-joint pliers for metal housing

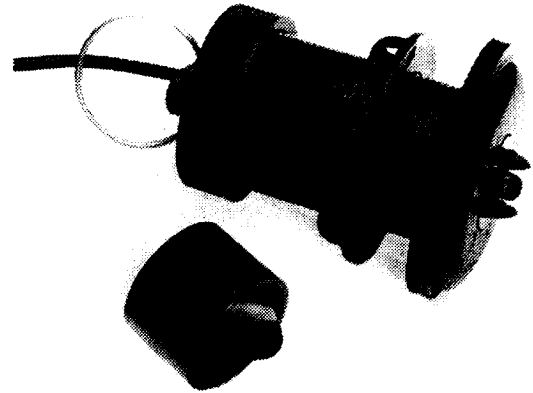
Tie-wraps

For a cored fiberglass hull installation:

Inner hole saw: 60mm *or* 2-3/8"

Fiberglass cloth and resin (see page 4, #5)

or Cylinder, wax, tape, and casting epoxy (see page 4, #5)



Pre-test

Connect the sensor to the instrument and spin the paddlewheel. Check the instrument for a speed reading and the approximate air temperature.

Antifouling Paint

Marine growth can accumulate rapidly on the sensor's surface reducing performance in weeks. Surfaces exposed to salt water must be coated with antifouling paint. Use **water-based or mineral spirits-based** antifouling paint only. Never use ketone-based antifouling paint, since ketones attack polymers and can damage the sensor.

It is easiest to apply antifouling paint before installation, but allow drying time. Paint the following surfaces (see Figure 1):

- Exterior lip of housing
- Bore of housing up 30mm (1-1/4")
- Outside wall below lower O-ring of paddlewheel insert
- Exposed end of paddlewheel insert
- Paddlewheel cavity
- Paddlewheel
- Blanking plug below lower O-ring and exposed end

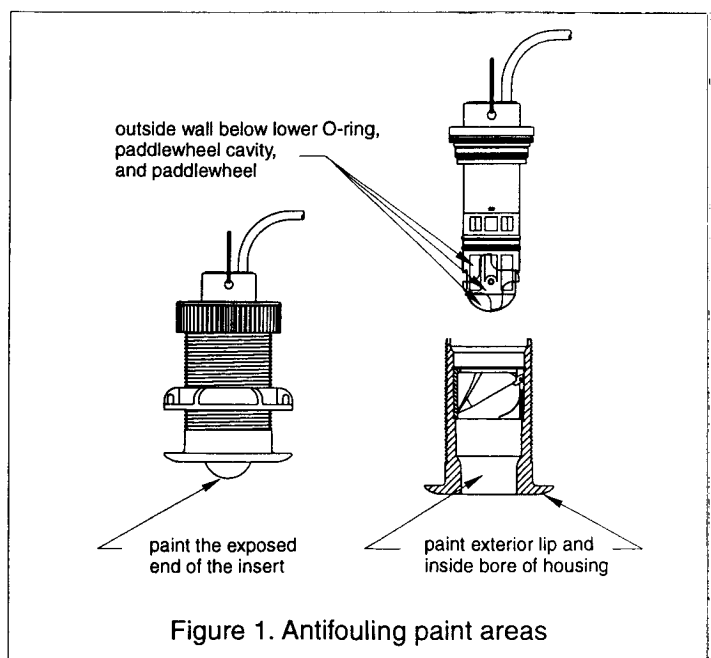


Figure 1. Antifouling paint areas

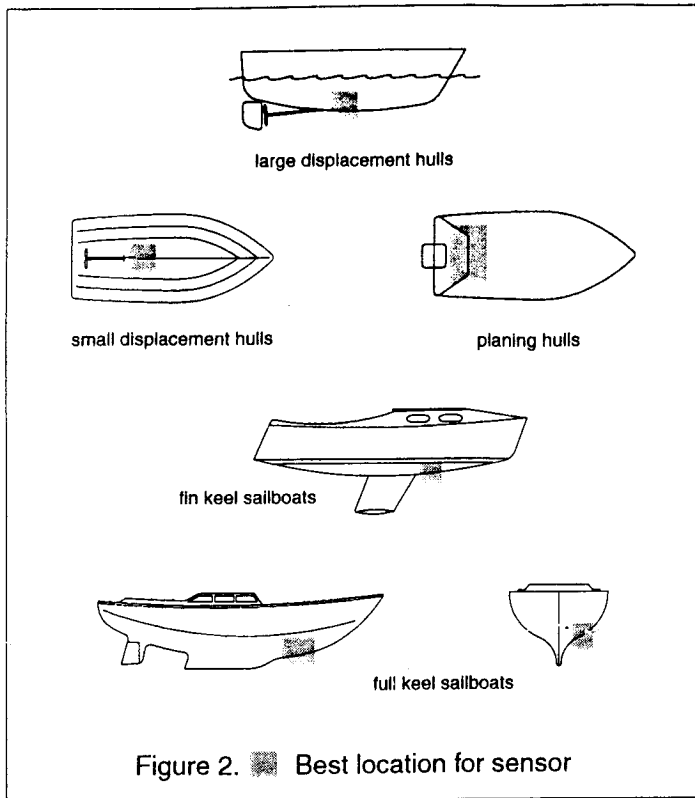


Figure 2. ■ Best location for sensor

Mounting Location

Placement

Choose a location where:

- The water flow is smoothest with a minimum of turbulence (especially at high speeds).
- The sensor will be continuously immersed in water.
- There is adequate access space inside the vessel for the height of the housing, tightening the nuts, and removing the insert. Allow a minimum of 279mm (11").

Boat Types (see Figure 2)

- **Displacement hull powerboats** — Locate the sensor amidships near the centerline.
- **Planing hull powerboats** — Mount the sensor well aft to insure that it is in contact with the water at high speeds.
- **Fin keel sailboats** — Mount the sensor to the side of the centerline and forward of the fin keel 30–60cm (1–2').
- **Full keel sailboats** — Locate the sensor amidships and away from the keel but still in the water when the boat is heeled.

Caution: Do not mount the sensor in a turbulent area:

- Near water intake or discharge openings.
- Behind strakes, fittings, or hull irregularities.
- Near the keel.
- Behind eroding paint (an indication of turbulence).

Caution: Never mount the sensor directly ahead of a depth transducer, because turbulence generated by the paddlewheel's rotation can adversely affect the depth transducer's performance, especially at high speeds.

Installation

Note: Follow separate instructions on page 3 for installing a sensor in a cored fiberglass hull.

Hole Drilling

Warning: Always wear safety goggles and a dust mask.

1. Drill a 3 mm or 1/8" pilot hole from inside the hull. If there is a rib, strut, or other hull irregularity near the selected mounting location, drill from the outside. If the pilot hole is drilled in the wrong location, drill a second hole in a better location. Apply masking tape to the outside of the hull over the incorrect hole and fill it with epoxy.
2. Using the 51 mm or 2" hole saw, cut the hole from outside the hull.
3. Clean and sand the area around the hole, inside and outside, to ensure that the sealant will adhere properly to the hull. If there is any petroleum residue inside the hull, remove it with either mild household detergent or a weak solvent, such as alcohol, before sanding.

Bedding

1. Unscrew the cap nut from the housing. Grasp the paddlewheel insert by the pull ring and pull slowly upward. Remove the hull nut (see Figure 3).
2. Apply a 2 mm (1/16") thick layer of sealant around the lip of the housing that contacts the hull.
3. Apply a 2 mm (1/16") thick layer of sealant up the sidewalls of the housing, 6 mm (1/4") higher than the combined thickness of the hull, washer, and hull nut. This will ensure there is sealant in the threads to seal the hull and to hold the hull nut securely in place.

Installing

Caution: Never pull, carry, or hold the sensor by the cable as this may sever internal connections.

1. From outside the hull, push the housing into the mounting hole using a twisting motion to squeeze out excess sealant.
2. Align the arrow on the lip of the housing to point forward toward the bow and be parallel to the centerline of the boat.
3. From inside the hull, slide the washer used to distribute the force from the hull nut and create a flat surface to tighten against onto the housing (see Figure 3).

Aluminum hulls less than 6 mm (1/4") thick—It is necessary to use an additional washer. Never use bronze, since electrolytic corrosion will occur.

Plastic sensor—Use a plastic, fiberglass, or rubber washer. Never use a wood backing block with a plastic housing, since swelling of the wood can overstress the plastic causing it to fracture.

- Screw the hull nut in place being sure the notch on the upper rim of the housing is still positioned forward toward the bow (see Figure 4).

Plastic—**Hand-tighten** the hull nut. Do not over-tighten.

Metal—Tighten the hull nut with slip-joint pliers.

- Remove any excess sealant on the outside of the hull to ensure smooth water flow over the paddlewheel.
- After the sealant cures, inspect and lubricate the O-rings on the paddlewheel insert with silicone grease or petroleum jelly.
- Hold the cap nut on the paddlewheel insert while sliding it into the housing with the arrow on the top pointing forward toward the bow. Seat it into place with a twisting motion until the key fits into the notch. Be careful not to rotate the outer housing and disturb the sealant.
- Screw the cap nut in place and **hand-tighten** only. Do not over-tighten.

Warning: Always attach the safety wire to prevent the insert from backing out in the unlikely event that the cap nut fails or is screwed on incorrectly.

- Attach the safety wire (see Figure 3).

Plastic housing—Attach the safety wire to one eye in the hull nut. Lead the wire in a counterclockwise direction and thread it through one eye in the cap nut, the pull ring, the second eye in the cap nut, and the second eye in the hull nut. Twist the wire securely to itself.

Metal housing—Wrap one end of the safety wire tightly around the housing and twist it together with the long end. Lead the wire straight up and through the eye in the cap nut. Loop the wire through the pull ring and twist it securely to itself.

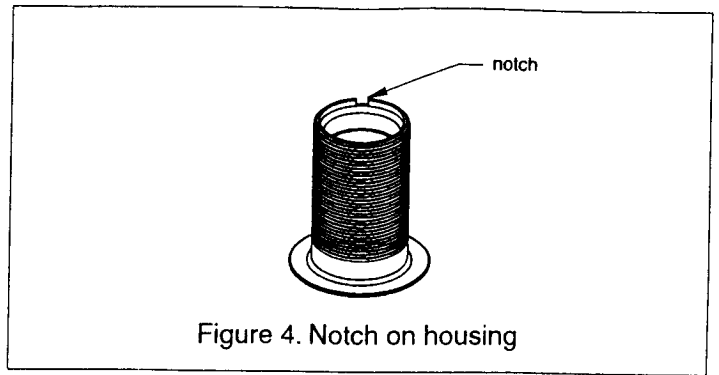


Figure 4. Notch on housing

Caution: If your sensor came with a connector, do not remove it to ease cable routing. If the cable must be cut and spliced, use Airmar's waterproof Junction Box 33-035 and follow the instructions provided. Cutting the cable or removing the connector, except when using Airmar's junction box, will void the warranty.

- Route the cable to the instrument, being careful not to tear the cable jacket when passing it through the bulkhead and other parts of the boat. To reduce electrical interference, separate the sensor cable from other electrical wiring and the engine. Coil any excess cable and secure it in place using tie-wraps to prevent damage.

- Refer to the instrument owner's manual to connect the sensor to the instrument.

Installation in a Cored Fiberglass Hull

To install a thru-hull sensor in a cored fiberglass hull, the core (wood or foam) must be carefully cut and sealed. The core must be protected from water seepage and the hull must be reinforced to prevent it from crushing under the hull nut allowing the housing to become loose.

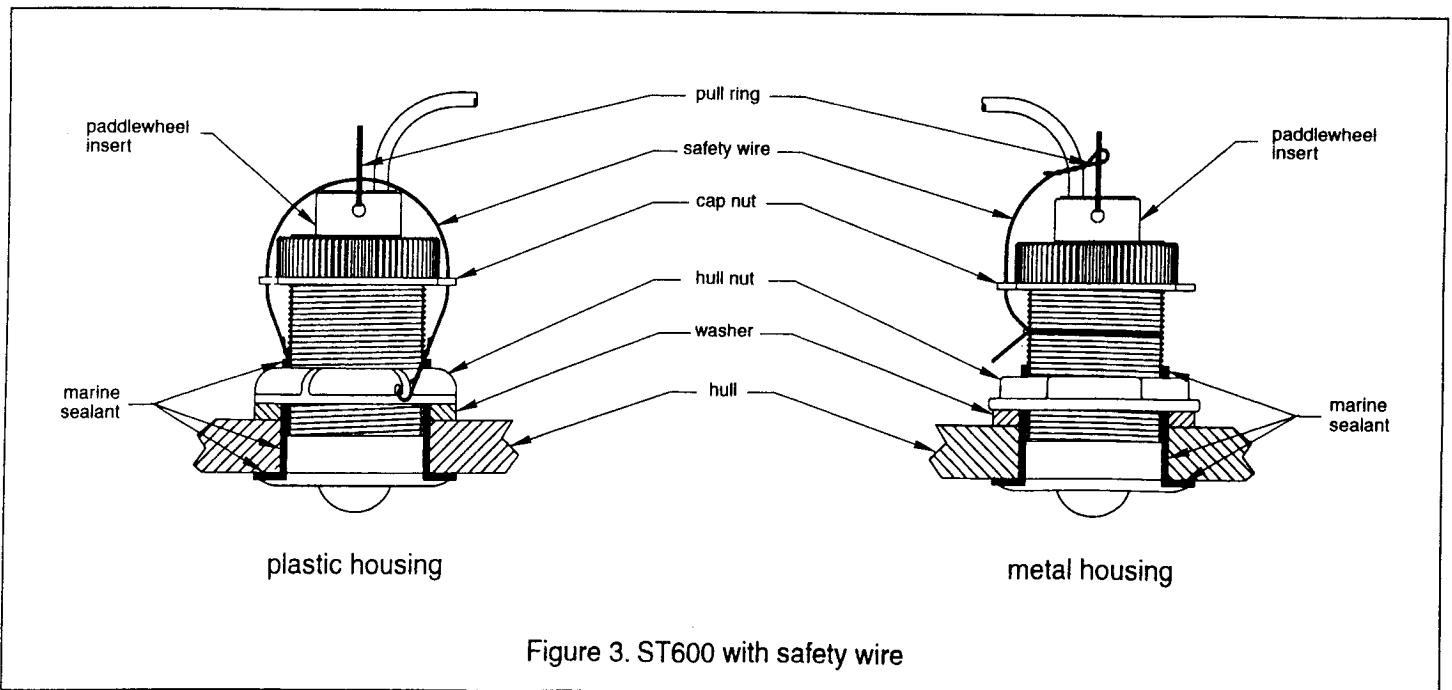
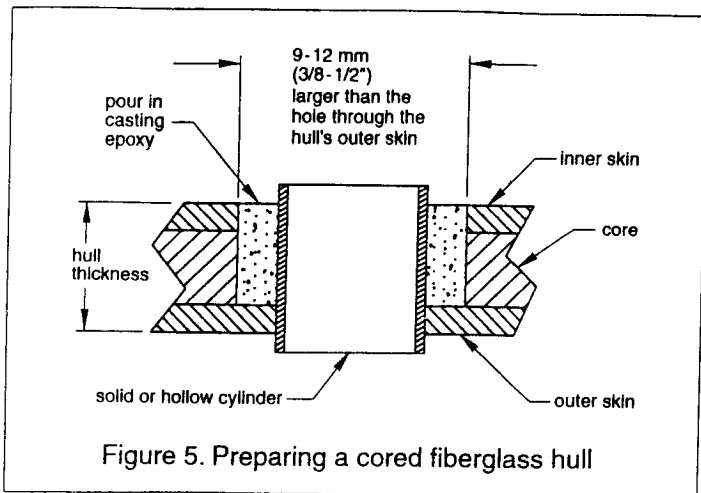


Figure 3. ST600 with safety wire



Warning: Always wear safety goggles and a dust mask.

1. Drill a 3 mm or 1/8" pilot hole from inside the hull. If there is a rib, strut, or other hull irregularity near the selected mounting location, drill from the outside. If the hole is drilled in the wrong location, drill a second hole in a better location. Apply masking tape to the outside of the hull over the incorrect hole and fill it with epoxy.
2. Using the 51 mm or 2" hole saw, cut the hole from outside the hull through the **outer skin** only (see Figure 5).
3. From inside the hull, use the 60 mm or 2-3/8" hole saw to cut through the **inner skin** and most of the core. The core material can be very soft. Apply only light pressure to the hole saw after cutting through the inner skin to avoid accidentally cutting the outer skin.
4. Remove the plug of core material so the inner core of the hull is fully exposed. Clean and/or sand the inner skin, core, and the outer skin (gelcoat) around the hole.

Caution: Always completely seal the hull to prevent water seepage into the core.

5. If you are skilled with fiberglass, saturate a layer of fiberglass cloth with a suitable resin and lay it inside the hole to seal and strengthen the core. Add layers until the hole is the correct diameter.

Alternatively, a hollow or solid cylinder of the correct diameter can be coated with wax and taped in place. Fill the gap between the cylinder and hull with casting epoxy. After the epoxy has set, remove the cylinder (see Figure 5).

6. Clean and sand the area around the hole, inside and outside, to ensure that the sealant will adhere properly to the hull. If there is any petroleum residue inside the hull, remove it with either mild household detergent or a weak solvent, such as alcohol, before sanding.
7. Proceed with the "Bedding" and "Installing" instructions on pages 2 and 3.

Checking for Leaks

Caution: Never install a thru-hull sensor and leave the boat in the water unchecked for several days.

When the boat is placed in the water, **immediately** check around the thru-hull sensor for leaks. Note that very small leaks may not be readily observed. It is best not to leave the boat in the water for more than 3 hours before checking it again. If there is a small leak, there may be considerable bilge water accumulation after 24 hours (probably not enough to cause water damage). If a leak is observed, repeat the "Bedding" and "Installing" procedures immediately.

Maintenance, Repair, and Replacement

Blanking Plug

To protect the paddlewheel, use the blanking plug when:

- The boat is moored in salt water for more than a week.
- The boat is removed from the water.
- Aquatic growth buildup on the paddlewheel is suspected due to inaccurate readings from the instrument.

The ST600 incorporates a self-closing valve which minimizes the flow of water into the vessel when the paddlewheel insert is removed. The curved flap valve in the valve assembly is activated by both a spring and water pressure. The flap valve is pushed upward to block the opening, so there is no gush of water into the boat.

Warning: THIS IS NOT A WATERTIGHT SEAL!

Warning: Always use the blanking plug secured with the safety wire to provide a watertight seal when the paddlewheel insert is removed.

1. Inspect and lubricate the O-rings on the blanking plug with silicone grease or petroleum jelly.
2. Remove the paddlewheel insert from the housing by first removing the safety wire and unscrewing the cap nut (see Figure 3).
3. Grasp the pull ring and remove the paddlewheel insert with a slow pulling motion.

Note: In the unlikely event that the paddlewheel insert cannot be removed, see "Servicing the Valve Assembly" on page 5.

4. Hold the cap nut on the blanking plug while sliding it into the housing with the arrow on the top pointing forward toward the bow. Seat it into place with a twisting motion until the key fits into the notch. Screw the cap nut in place **hand-tightening** only. Do not over-tighten. Reattach the safety wire.

Antifouling Paint

For surfaces exposed to salt water, reapply **water-based** or **mineral spirits-based** antifouling paint every 6 months or at the beginning of each boating season (see Figure 1).

Cleaning the Paddlewheel Insert

Aquatic growth can impede or freeze the paddlewheel's rotation and must be removed. Use a stiff brush or putty knife to remove the growth and clean the surface with mild household detergent. If fouling is severe, push out the paddlewheel shaft using a spare shaft or a 4D finish nail with a flattened point. Then, lightly wet sand the surface with fine grade wet/dry paper.

Replacing the Paddlewheel and O-rings

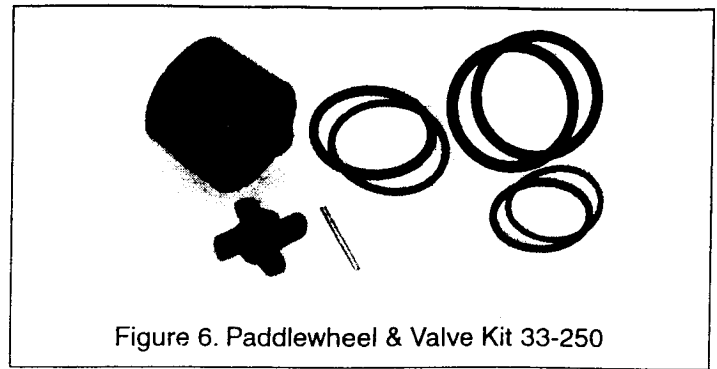
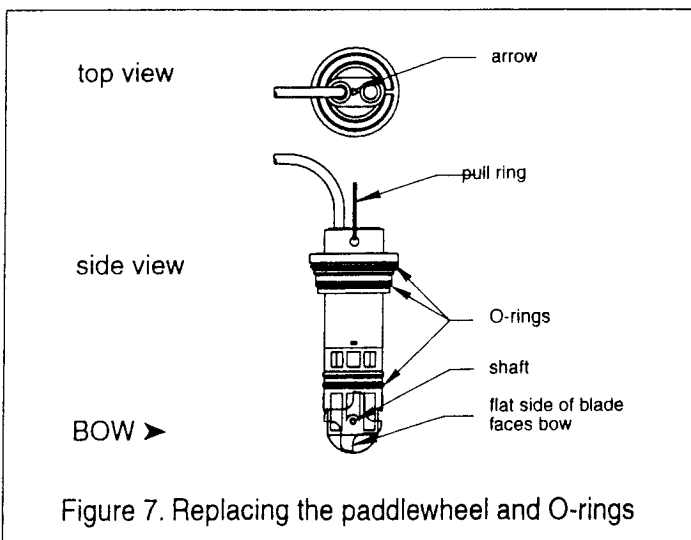
The water lubricated paddlewheel bearings have a life of up to 5 years on low speed boats [less than 10kn (11 MPH)] and 1 year on high-speed vessels. Paddlewheels can fracture and shafts can bend due to impact with water borne objects and mishandling in boat yards. O-rings must be free of abrasions and cuts to ensure a watertight seal. A replacement Paddlewheel & Valve Kit 33-250 is available (see Figure 6).

1. Using the new paddlewheel shaft, push the old shaft out about 6mm (1/4"). With pliers, remove the old shaft (see Figure 7).
2. Place the new paddlewheel in the cavity with the flat side of the blade facing the same direction as the arrow on the top of the insert.
3. Tap the new shaft into place until the ends are flush with the insert.
4. Install the large O-ring near the pull ring, the medium O-ring below it and the small O-ring near the paddlewheel.
5. The remaining O-rings are placed in a similar position on the blanking plug.

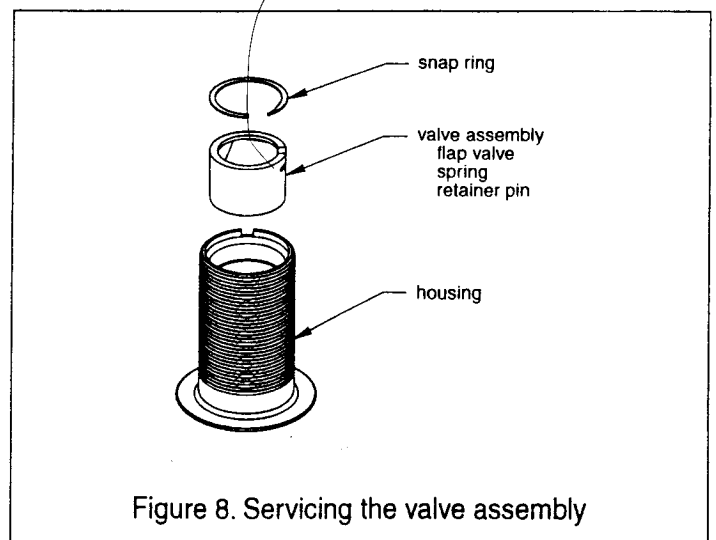
Servicing the Valve Assembly

Should the valve fail, remove it for servicing. A Paddlewheel & Valve Kit 33-250 is available (see Figure 6).

1. Inspect and lubricate the O-rings on the blanking plug with silicone grease or petroleum jelly.



2. Remove the paddlewheel insert from the housing (see Figure 3).
3. Remove the snap ring from the valve assembly using a screwdriver to pry the end of the ring free. Lift the ring out (see Figure 8).
4. Slide the valve assembly upward and out of the housing slowly. The flap valve retainer pin is a loose slip-fit and may slide out when the assembly is removed.
5. Hold the cap nut on the blanking plug (or paddlewheel insert) while sliding it into the housing with the arrow on the top pointing forward toward the bow. Seat the plug with a twisting motion until the key fits into the notch. Screw the cap nut in place **hand-tightening** only. Do not over-tighten. Reattach the safety wire (see Figure 3).
6. Clean, repair, or replace the valve assembly so the flap valve moves freely and seats against the valve housing.
7. To reinstall the valve assembly, first reassemble the flap valve in the valve housing with the retainer pin and spring in place (see Figure 8).
8. Remove the blanking plug. Slide the valve assembly into the housing with the flap valve pointing downward. Insert the snap ring being certain that it **locks into the groove** in the housing wall.



9. Hold the cap nut on the blanking plug or paddlewheel insert while sliding it into the housing with the arrow on the top pointing forward toward the bow. Seat it into place with a twisting motion until the key fits into the notch. Screw the cap nut in place **hand-tightening** only. Do not over-tighten. Reattach the safety wire (see Figure 3).

Caution: Always attach the safety wire to prevent the insert from backing out in the unlikely event that the cap nut fails or is screwed on incorrectly.

Replacement Parts

If you have purchased a plastic housing and have a wood hull or desire the greater strength of a metal housing, purchase an Airmar bronze housing. Obtain the following parts from your marine dealer or instrument manufacturer.

Blanking Plug	Cap Nut	Hull Nut	Housing & Hull Nut	Paddlewheel & Valve Kit
20-600	04-011	04-004 (plastic) 02-030 (bronze)	21-600 (plastic) 21-601 (bronze)	33-250

Sensor Replacement

The information needed to order a replacement Airmar sensor is printed on the *vinyl* tag affixed to the cable near the connector end. Do not abrade the marking or remove this tag. When ordering, specify the date code and part number (see Figure 9).

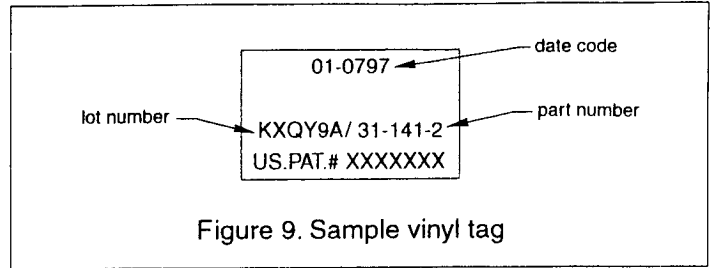


Figure 9. Sample vinyl tag

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