# B&G
# Ultrasonic
# Speed Sensor

User & Installation Manual

# Certification

$$C\,\epsilon$$

# Warnings and Precautions

**Warning:**

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference, the user is encouraged to try to correct the interference by relocating the equipment or connecting the equipment to a different circuit. Consult an authorised dealer or other qualified technician for additional help if these remedies do not correct the problem.

This device meets the requirements for CFR47 Part 15 of the FCC limits for Class B equipment.

The Ultrasonic Speed Sensor meets the standards set out in European Standard EN 60945: 1997 IEC 945: 1996 for maritime navigation and radiocommunication equipment and systems.

The Ultrasonic Speed Sensor system contains no user-serviceable parts. Only an authorised service centre should be used to make repairs. Unauthorised repairs or modifications will void your warranty.

**Trademarks:**

# Contents

## ILLUSTRATIONS

## TABLES

## 1.1    Introduction

The Ultrasonic Speed Sensor offers highly accurate boat speed measurement with a minimum of maintenance due to not having any moving parts. The Ultrasonic Speed Sensor uses ultrasonic pulses to obtain echoes from particles in the water. If the sensor loses contact with the water, or is positioned in a flow of highly aerated water, it will lose its signal and register an incorrect speed measurement. Once good water contact is re-established, boat speed is recovered instantly. The Ultrasonic Speed Sensor is unsuitable for use with high speed 'stepped hull' type boats that induce airflow under the hulls.

Before you begin using the Ultrasonic Speed Sensor, please take the time to read this manual to help you achieve the full potential of your system.

## 1.2    Features

- No moving parts.
- Highly responsive speed measurement.
- Highly accurate from 0.1 to 60 knots.
- Negligible drag.
- Full retrofit with post 1997 'paddlewheel' type speed installations.

## 1.3    Compatibility

The Ultrasonic Speed Sensor requires integration with one of the following systems:

- All B&G Products Post 1989.
- Hydra.
- Hercules.
- HS-2000.
- h1000.
- Network.

## 1.4    Operation

The Ultrasonic Speed Sensor uses ultrasonic pulses to collect echoes from small particles in the water as they pass under the two transducers embedded in the unit (refer to figure 1.1).

These transducers monitor the particles in their respective beams. As the boat travels through the water, both transducers 'view' the same stream of particles. Because it takes time for the particles to travel between the two transducers, the aft transducer detects the particles later than does the forward transducer. By measuring this time lapse, the instrument processor is able to calculate the speed of the boat through the water.
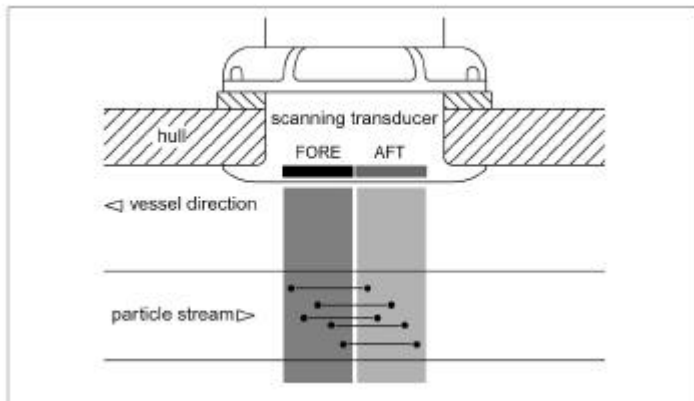


Figure 1.1 - Monitoring particles in the water

## 1.5   Setup

The setup and calibration procedure for the Ultrasonic Speed Sensor is identical to the procedure for calibrating a paddlewheel speed sensor as explained in the relevant section of your system User Manual.

## 1.6   Specifications

| | |
|---|---|
| Ultrasonic frequency | 4.5 MHz |
| Pulse repetition frequency | 5.7 kHz (fixed) |
| Distance to particles | 8 – 13 cm (3 – 5 inches) |
| Thru-hull diameter | 5.1 cm (2 inches) |
| DC voltage supply | 10 – 15 Volts |
| Current | 155 ma @ 12 VDC |
| Operating temperature range | 0 – 40 degrees C (32 – 140 Degrees F) |
| Data update rate | 2 Hz |
| Accuracy | ± (2% + 0.1 knot) |
| Minimum speed | 0.1 knot |
| Maximum speed | 60 knots |
| Outputs | Simulated Hall cell paddlewheel at 20,000 pulses per nautical mile (5.6 Hz per knot) |
| Weight | 1.3 kg (2.8 lbs) |

Table 1.1 - Specifications

## 1.7   Installing the Ultrasonic Speed Sensor Junction Box

1.  Select a suitable dry location ensuring adequate clearance from other equipment or structures.

2.  Use a pencil or other marking device to locate the mounting holes.

3.  Drill the mounting holes for the unit.

4.  Using the self-tapping screws supplied, secure the junction box.

    **Note:** The junction box must not be submerged. Install the unit with the cable entries facing downward to prevent water ingress.
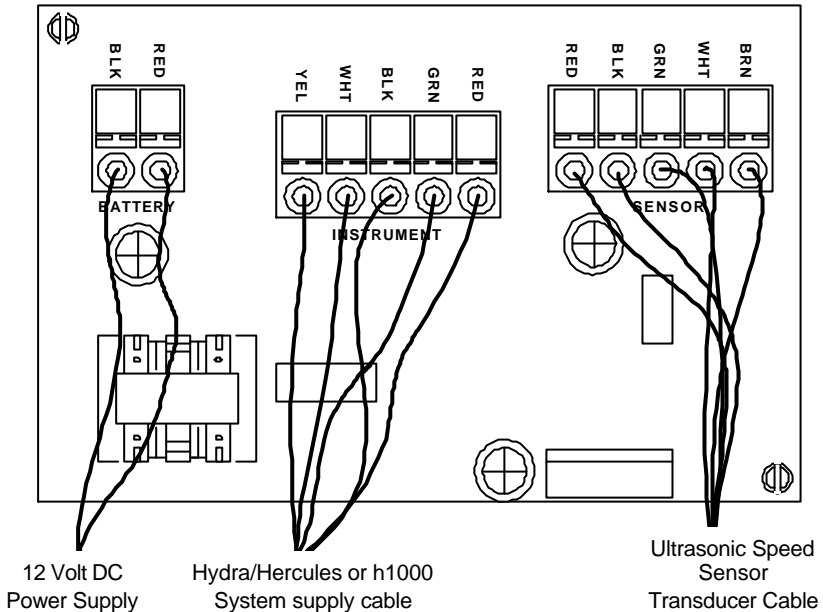
## 1.8   Junction Box Electrical Connections



Figure 1.2 – Junction box electrical connections

**NOTE:** Trim all screens from the cables in the junction box to ensure that they do not make contact with each other or any other wire or component in the junction box.

| Terminal | Function | Wire Colour |
|----------|----------|-------------|
| **SENSOR** | | |
| BRN | SEA TEMP. INPUT | Brown |
| WHT | SEA TEMP. SUPPLY | White |
| GRN | BOATSPEED INPUT | Green |
| BLK | GROUND | Black |
| RED | BOATSPEED SUPPLY | Red |
| **INSTRUMENT** | | |
| RED | BOATSPEED SUPPLY | Red |
| GRN | BOATSPEED OUTPUT | Green |
| BLK | GROUND | Black |
| WHT | SEA TEMP. SUPPLY | White |
| BRN | SEA TEMP. OUTPUT | Yellow |
| **BATTERY** | | |
| RED | 10 – 15V DC | Red |
| BLK | GROUND | Black |

Table 1.2 – Junction box wire functions

## 1.8.1 Ultrasonic Speed Sensor Connections to Hydra/Hercules Processor
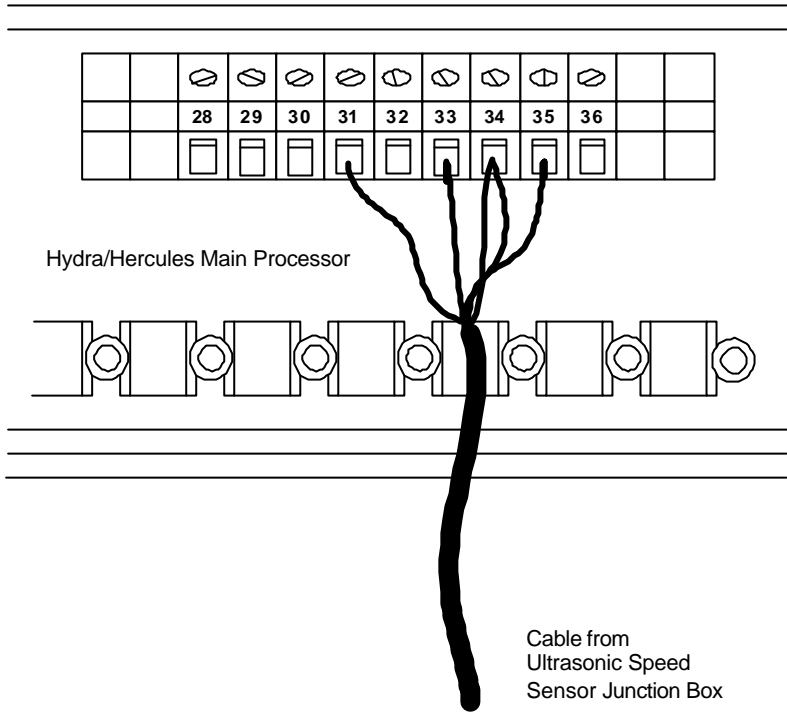


**Note:** All screened wires must have their screen attached to the clamp bar across the front case.

Figure 1.3 - Connections to Hydra/Hercules Processor

| Terminal | Function | Wire Colour |
|----------|----------|-------------|
| 31 | BOATSPEED INPUT | Green |
| 32 | NO CONNECTION | |
| 33 | GROUND | Black |
| 34 | SEA TEMP./PADDLE SUPPLY | Red/White |
| 35 | SEA TEMP. INPUT | Yellow |

Table 1.3 – Speed sensor wire functions (H-Series)

## 1.8.2 Ultrasonic Speed Sensor Connections to h1000 Spd/Dpth Interface Box

To open the connector, carefully push a small flat-headed terminal screwdriver into the slot directly above the relevant terminal number. Push the bare end of the wire into the terminal connector and withdraw the screwdriver.
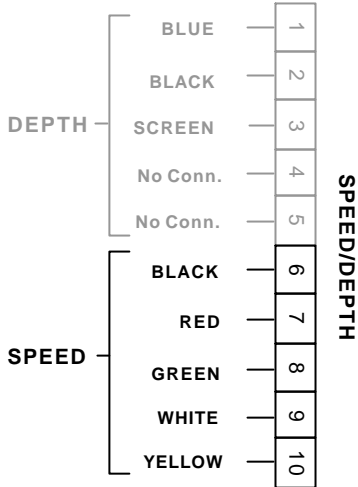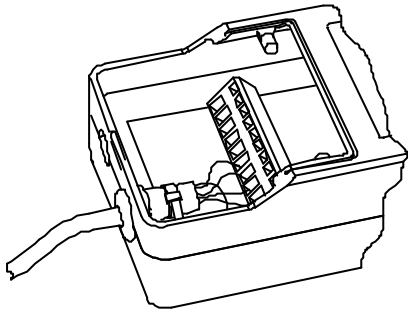


Figure 1.4 – h1000 connection details

| Terminal | Function | Wire Colour |
|----------|----------|-------------|
| 6 | Boatspeed Signal Output (-) | BLACK |
| 7 | 5 – 15 VDC to Sensor | RED |
| 8 | Boatspeed Signal Output (+) | GREEN |
| 9 | Sea Temperature | WHITE |
| 10 | Sea Temperature | YELLOW |

Table 1.4 – Speed sensor wire functions (h1000)

## 1.9   Installation

Select a suitable  location on the boat's hull (refer to  Figure  1). Clean  the chosen area inside the hull using a mild household detergent or a weak solvent such as alcohol to remove traces of fuel, grease etc.
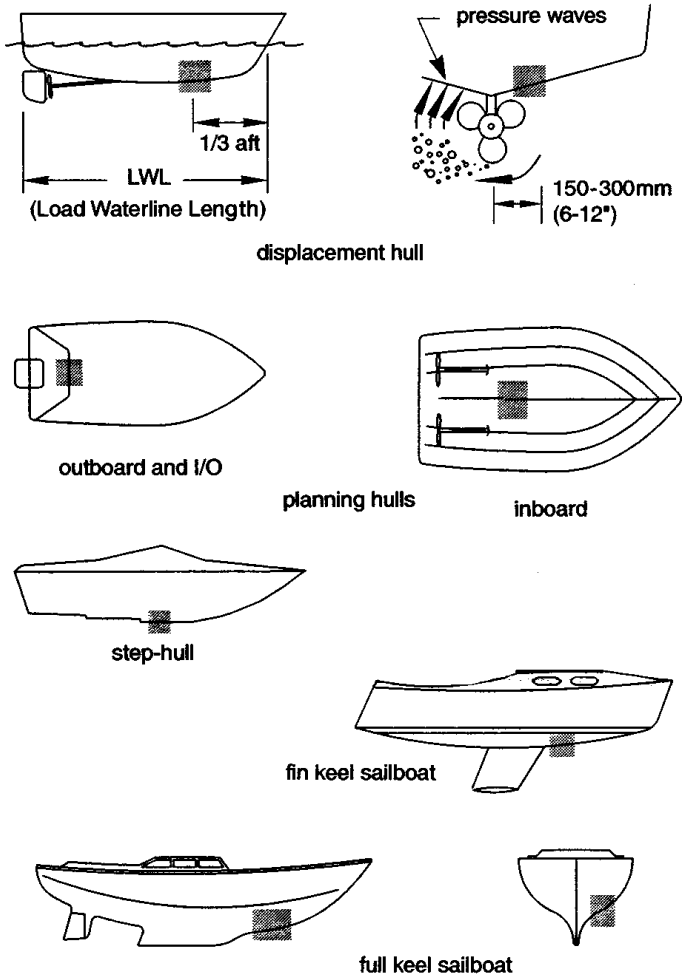


Figure 1.5 - Suitable locations for Thru-hull Sensor Mounting

## 1.9.1   Single Skin Hull

Drill a 3mm (1/8 inch) pilot hole from inside the hull. Using a 51mm (2 inch) hole saw, cut a hole from the outside of the hull. Clean and sand the area around the hole to ensure that the sealant will adhere properly to the hull.
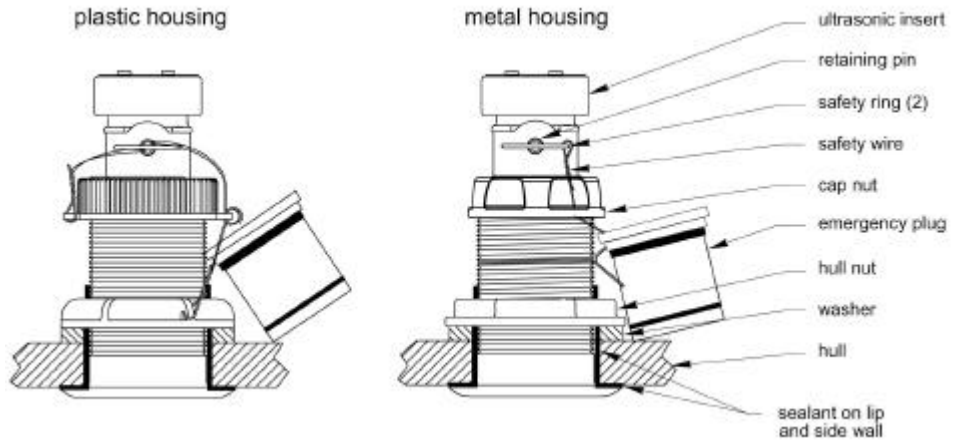


Figure 1.6 - Ultrasonic Speed Sensor Assembly

## 1.9.2   Cored Fibreglass Hull

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

Drill a 3mm (1/8 inch) pilot hole from inside the hull. Using a 51mm (2 inch) hole saw, cut a hole from the outside of the hull through the outer skin only, (refer to figure 3). Using a 60mm (2 3/8 inch) hole saw from inside the hull, cut through the inner skin and most of the core. Apply only light pressure to the hole saw after the inner skin has been cut through as the core material can be very soft and too much force could result in damage to the outer skin.

Remove the plug of core material so that the inside of the outer skin and the inner core are fully exposed. Clean and sand the inner skin, core, and the outer skin around the hole.

There are two methods for preparing the hull to receive the housing:

1.  Saturate layers of fibreglass cloth with a suitable resin and lay the cloth inside the hole to seal and strengthen the core, adding layers until the correct diameter is achieved.

2.  Coat a cylinder of the correct diameter with wax and gently tap it into the hole in the outer skin. Fill the gap between the cylinder and the inner skin with casting epoxy. After the epoxy has set (refer to the manufacturer's instructions), remove the cylinder.

Clean and sand the area around the hole, inside and out, to ensure that the sealant will adhere properly to the hull.

Remove the cap nut, sensor insert, hull nut and washer (refer to figure 4). Apply a 2mm (1/16 inch) thick layer of marine sealant around the lip of the housing. Apply a layer of sealant up the sidewalls of the housing to approximately 6mm (1.4 inch) higher than the total thickness of the hull, washer and hull nut. This will ensure that sufficient sealant will remain in the threads to seal the hull and hold the nut securely in place.

From outside the hull, push the housing into the cut hole using a twisting motion; this will squeeze out the excess sealant.

From inside the hull, slide the washer over the housing. Fit the hull nut and tighten. If you are using a plastic housing, hand-tighten only on the hull nut, if you are using a bronze unit, tighten the hull nut using slip-joint pliers.

After tightening, remove excess sealant on the outside of the hull to ensure smooth water flow over the sensor.

Once the sealant has cured (refer to manufacture's instructions), inspect the O-ring seals on the sensor insert. Lubricate the seals using silicone grease or petroleum jelly; slide the insert into the housing being sure to engage the key in the notch, (a careful pushing twisting motion will ensure engagement). Fit the cap nut and hand-tighten only.
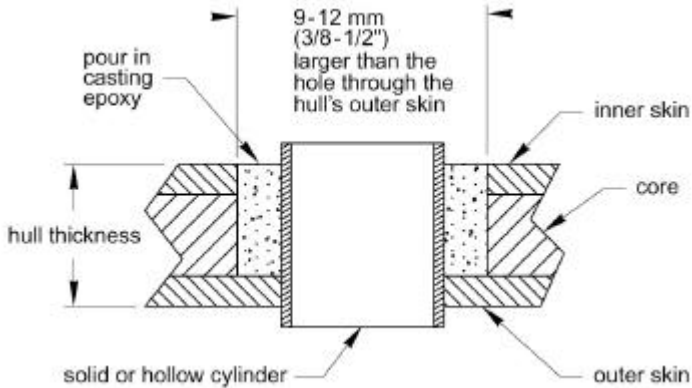
Figure 1.7 - Preparation of a Cored Fireglass Hull

## 1.9.3   Attaching the safety wire

Plastic housing – Attach the wire to one eye of the hull nut. Twist the wire in a anti-clockwise direction and thread it through one of the eyes in the cap nut, then through the pull ring and the other eye of the cap nut, and finally through the opposite eye of the hull nut. Twist the wire onto itself to lock the assembly.

Bronze housing – Wrap one end of the locking wire around the housing and twist it together. Thread the other end up through the eyehole in the cap nut, loop the wire through the pull ring and twist it securely onto itself to lock the assembly.

Route the cables to the interface box being careful not to damage the insulation when passing through bulkheads etc. In order to reduce electrical interference, separate the sensor cables from electrical wiring and other sources of noise.

Immediately after putting the boat into the water check the installation for signs of leakage. Note that small leaks may not be readily observed. It is advised that the boat is not left in the water for more than 3 hours before re-checking the installation for leaks.

If leakage is observed, remove the boat from the water and repeat the installation procedure.

## 1.10    Maintenance

The retractable sensor units are supplied with a blanking plug, which must be used when the Ultrasonic Speed transducer is removed for inspection, maintenance, replacement or storage.

**Removing the Ultrasonic Speed transducer from the 'Flapper-Valve' housing**:

Inspect and lubricate the O-ring seals on the blanking plug using silicone grease or petroleum jelly. Remove and discard the safety wire (Refer to Figure 1.6 on Page 1-9 of this manual).  Remove the safety ring from one end of the retaining pin. Using the remaining safety ring, withdraw the retaining pin from the flapper-valve housing. Hold the blanking plug in one hand, with the other hand pull the transducer out of the flapper-valve housing and replace it with the blanking plug. Seat the blanking plug in place using a twisting motion until the key fits into the notch in the housing. With practice only a small amount of water will enter the boat. Refit the retaining pin and safety ring.

Refitting the Ultrasonic Speed transducer is a reversal of the above procedure. Note: ensure that the key on the transducer is correctly located in the notch on the flapper-valve housing before fitting the retaining pin and pull ring. Secure the assembly as previously described with new locking wire.

**Cleaning the Ultrasonic Speed transducer**:  Aquatic growth can accumulate rapidly on the transducer surface reducing performance. Clean the surface with a soft cloth and mild household detergent. If fouling is severe, use a stiff brush or a putty knife. Take care not to cause scratches on the transducer face. Wet sanding using fine grade wet/dry paper is permissible to remove stubborn deposits.

**Antifouling paint**:   Surfaces exposed to salt water must be coated with antifouling paint (refer to figure 4), Use only water-based antifouling paint. Solvent-based paints must not be used. Solvent-based paints contain 'keytones' which may attack the plastic surfaces and damage the sensor. Re-apply the antifouling paint every six months or at the start of each boating season.
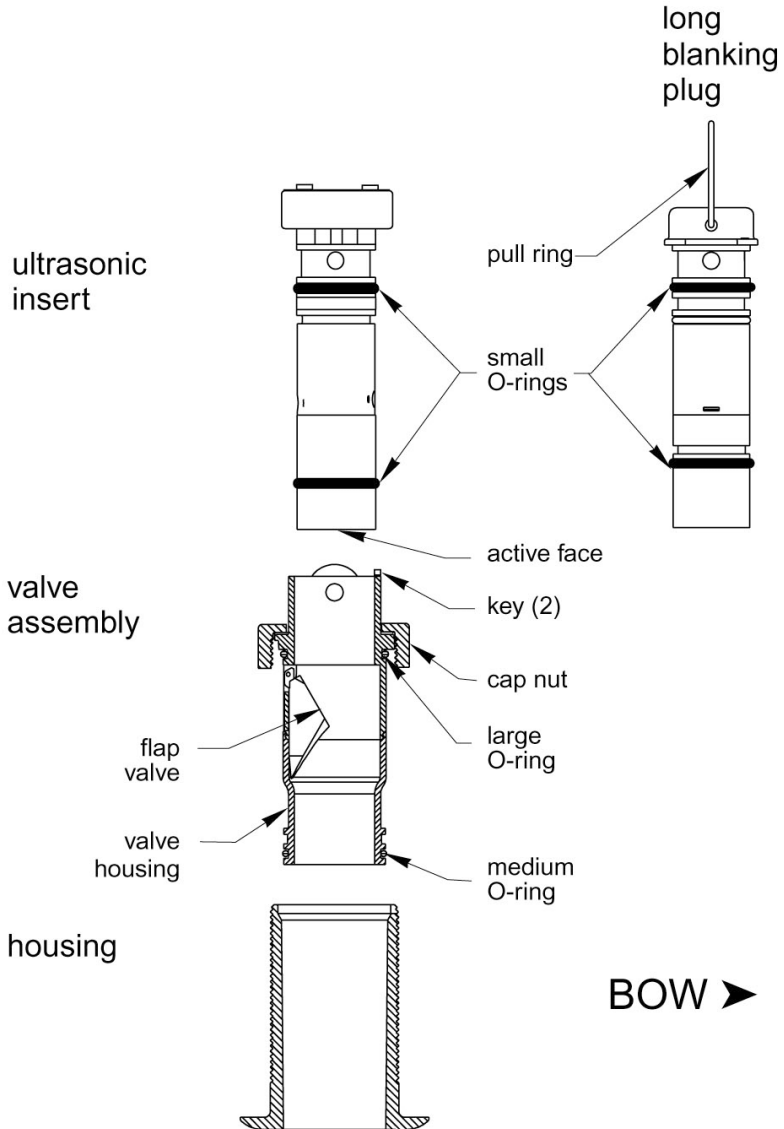
long
blanking
plug

ultrasonic
insert

pull ring

small
O-rings

valve
assembly

active face

key (2)

cap nut

flap
valve

large
O-ring

valve
housing

medium
O-ring

housing

BOW ➤

Figure 1.8 - Maintenance