BMU / BMUA
Hydrometers ½” – 8”

Operation and Maintenance Manual
(For the North American Market)

Updates and Revisions

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1. Introduction

1.1 General Description

A hydrometer combines a water meter and a hydraulic valve in a single unit. The **BMU/BMUA Series Hydrometer** is designed for high pressure, remote control irrigation and industrial applications. The BMU series features a horizontal body and is available in 1½", 2", 3", 4," 6" and 8" sizes. The BMUA series features an 90º angle body and is available in 2", 3", 4", 6" and 8" sizes.

BMU 2" Model

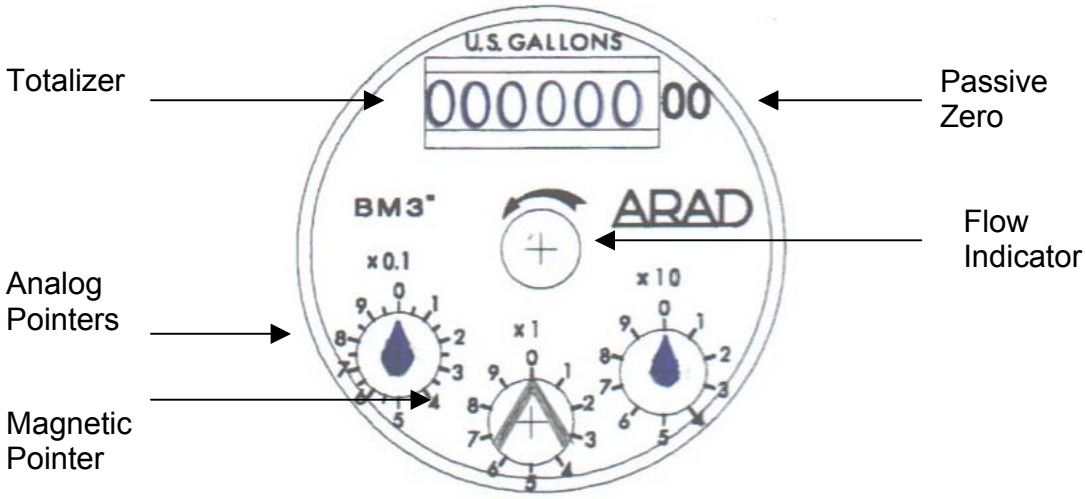
BMU 4" Model

Hydrometer Photographs

The **BMU/BMUA Series Hydrometer** is intended primarily for automatic and remote operation in a variety of applications. Remote operation is possible via an external **Solenoid Valve** activated by a remote computer or control center. Flow rate and volume data are electronically transmitted to the remote controller by means of a transducer inserted into the register dial.

1.1.1 Water Meter

The **BM/BMA Series Hydrometer** contains a dry type magnetic drive transmission water meter, whereby the impeller is the only moving part in contact with the water. The meter may be calibrated to measure either gallons or cubic meters. A hermetically sealed register contains the dial face and all mechanical meter components.



Meter Dial (U.S.gallons)

The dial face contains a totalizer, 3 analog pointers, and a rotating flow indicator. A magnetic pointer, located over one of the analog pointers, measures the flow rate and transmits the data to the reed switch transducer in the register cover.

1.1.2 Hydraulic Valve

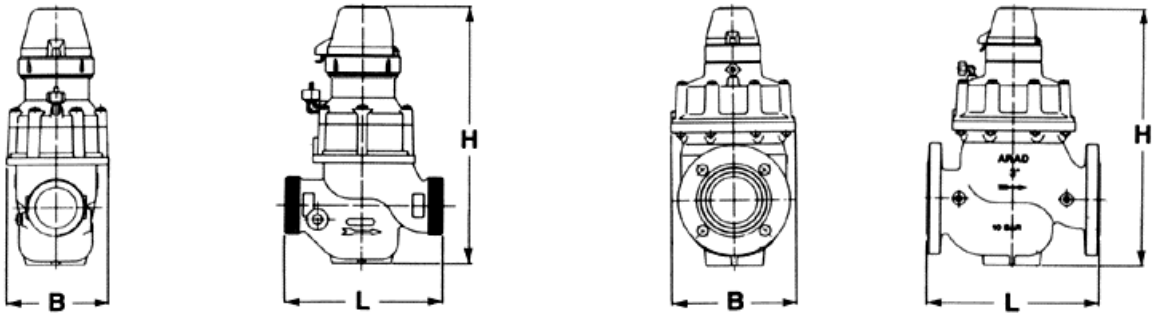
The BM/BMA Series Hydrometer contains a hydraulic valve operated either manually or by remote control. The valve normally remains closed until a command is received to open it. Hydraulic commands are transmitted to te valve via an external solenoid valve.

1.2 Specifications and Dimensions

1.2.1 Technical Specifications

Sizes		**1½"**	**2"**	**3"**	**4"**	**6"**	**8"**
Max Working Pressure	p.s.i	230	230	230	230	230	230
Min Working Pressure	p.s.i	14	14	14	14	14	14
Regulated Pressure	ratio	1:3	1:3	1:3	1:3	1:3	1:3
Max Flow Rate	gpm	66	110	286	528	1320	2377
Min Flow Rate	gpm	6.6	8.8	13	17.6	22	31
Accuracy		±2%	±2%	±2%	±2%	±2%	±2%

1.2.2 BMU Series Dimensions



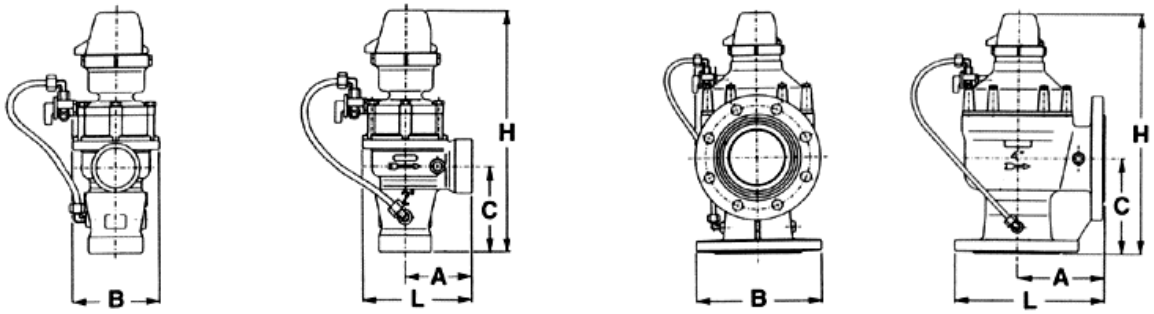
U.S. Units

Sizes BMU		1½"	2"	3"	4"	6"	8"
Length (L)	Inches	6 5/16"	8 5/8"	11 1/2"	14 1/8"	14 7/8""	23 5/8"
Width (B)	Inches	4 3/4""	4 3/4"	8"	9 1/16"	19 11/16"	17 11/16
Height (H)	Inches	10 3/8""	13"	161/2"	17 1/8"	25 1/4"	30 1/8"
Weight	Lbs.	4	8	54	67	264	331

Metric Units

Sizes BMU		1½"	2"	3"	4"	6"	8"
Length (L)	mm	160	219	290	360	350	600
Width (B)	mm	120	120	205	230	500	450
Height (H)	mm	262	330	420	435	645	765
Weight	Kg	2	4.1	24.5	31.5	120	150

1.2.3. BMUA Series Dimensions



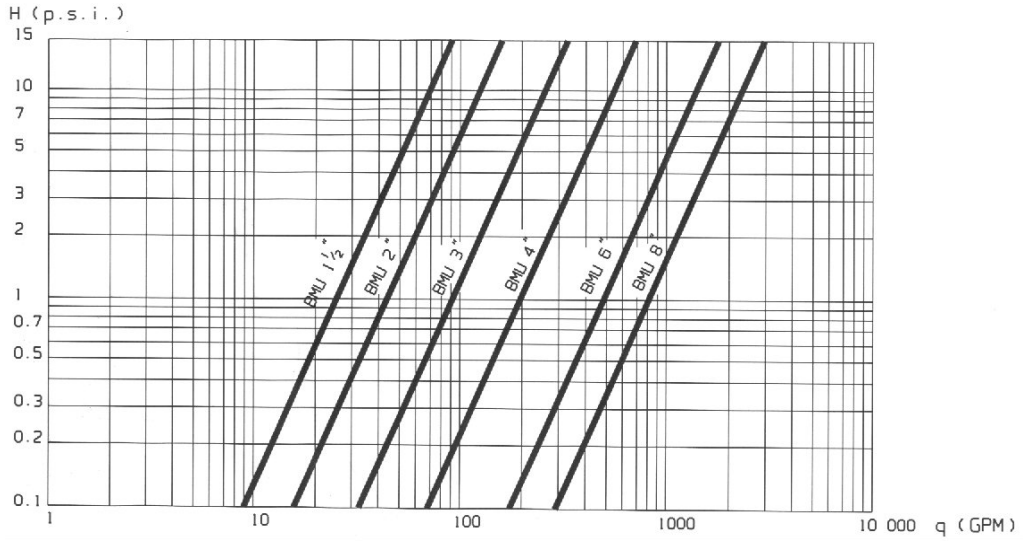
U.S. Units

Sizes BMUA		1½"	2"	3"	4"	6"	8"
Length (L)	Inches	N/A	61/4"	9 9/16"	10 7/8"	17 5/16"	20 11/16"
Width (B)	Inches	N/A	4 3/4"	8 1/4"	9 1/16"	14 15/16"	17 11/16"
Height (H)	Inches	N/A	13 3/4"	16 15/16"	17 11/16"	25 3/8"	26 9/16"
Vertical Offset (A)	Inches	N/A	3 3/4"	5 1/2"	6 1/2"	9 13/16"	11 13/16"
Horizontal Offset (C)	Inches	N/A	4 13/16"	5 1/2"	6 15/16"	11 13/16"	11"
Weight	Lbs.	N/A	7	52	65	262	309

Metric Units

Sizes BMUA		1½"	2"	3"	4"	6"	8"
Length (L)	mm	N/A	158	243	277	440	525
Width (B)	mm	N/A	120	210	230	380	450
Height (H)	mm	N/A	350	430	450	645	675
Vertical Offset (A)	mm	N/A	96	140	162	250	300
Horizontal Offset (C)	mm	N/A	122	140	176	300	280
Weight	Kg	N/A	3.3	23.5	29.5	111	140

Loss of Head Curves



1.3. Electrical Output Specifications

The flow rate is transmitted as periodic electrical pulses as measured by the magnetic pointer in the dial face. The hydrometer is configured to transmit a pulse according to a pre-defined volume interval. The following table summarizes the available volume intervals for various hydrometer sizes in either gallons or cubic meters.

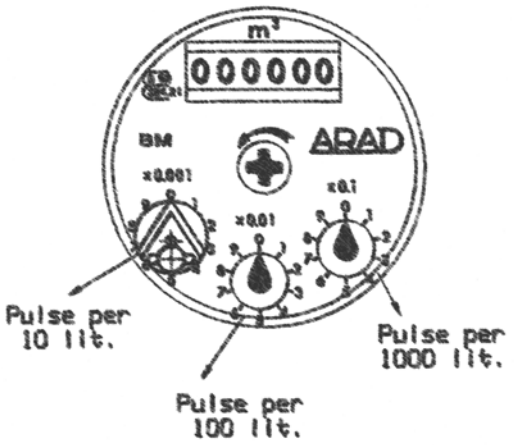
A 3 pointer register, with a magnet installed on one of the pointers.

Output definition: Volume Output
Output type: EV

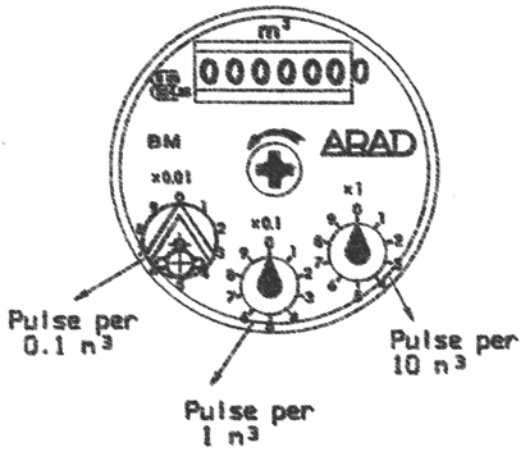
The sensor is installed in a transparent plastic cover that can be mounted on the register in any one of 3 positions facing the pointer with the magnet. 3 values of electrical output are thus available in 1:10:100 ratios.

Examples:

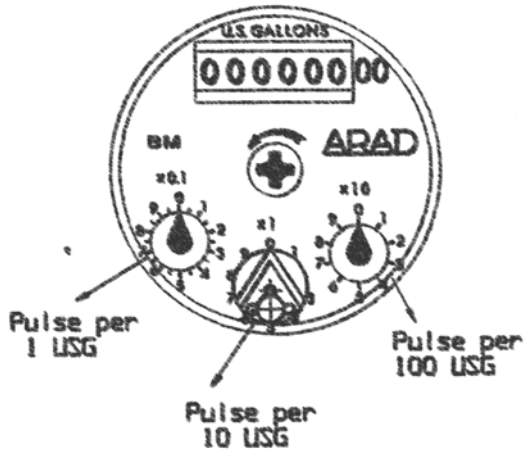
Example 1 (m3) – For sizes 1½", 2", 3", 4": If the pointer with the magnet is set in the left position as shown in the drawing - the output will be 1 pulse per 10 litres.
Example 2 (m3) – For sizes 4", 6", 8": If the pointer with the magnet is set in the left position as shown in the drawing (the scale is multiplied by 10) - the output will be 1 pulse per 100 litres.
Example 3 (USG) – For sizes 1½", 2", 3": If the pointer with the magnet is set in the middle position as shown in the drawing (the scale is multiplied by 100 USG) - the output will be 1 pulse per 10 USG.
Example 4 (USG) – For sizes 4", 6", 8": If the pointer with the magnet is set in the right position as shown in the drawing (the scale is multiplied by 1000 USG) - the output will be 1 pulse per 1000 USG.



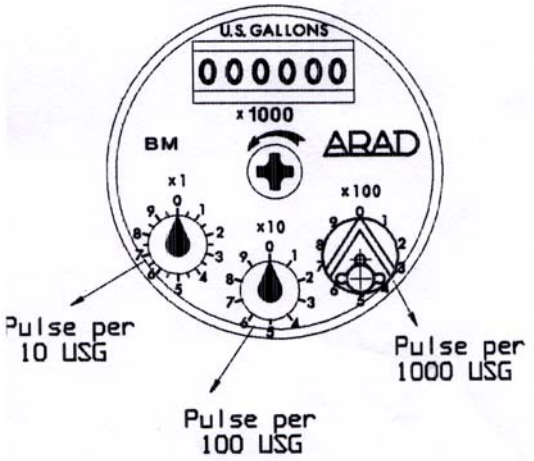
Example 1 (m^3)-For sizes 1½",2",3",4":



Example 2 (m^3)-For sizes 4",6",8":



Example 3 (USG)-For sizes 1½",2",3":



Example 4 (USG)-For sizes 4",6",8":

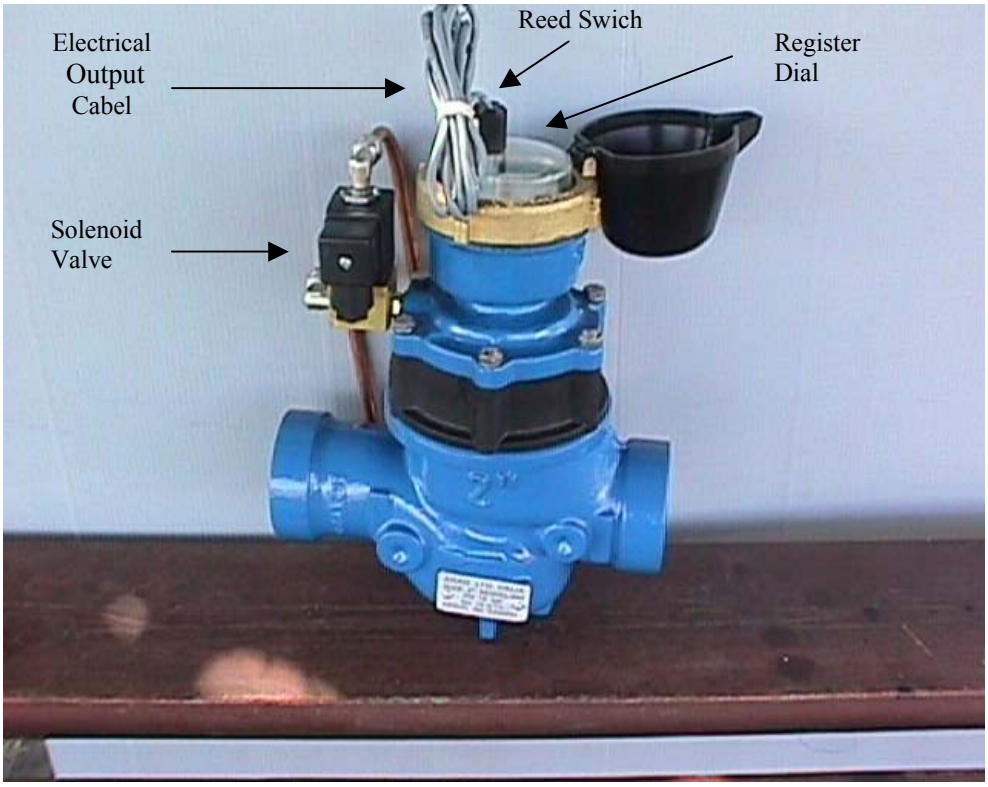
BMU – Available impulse sequences

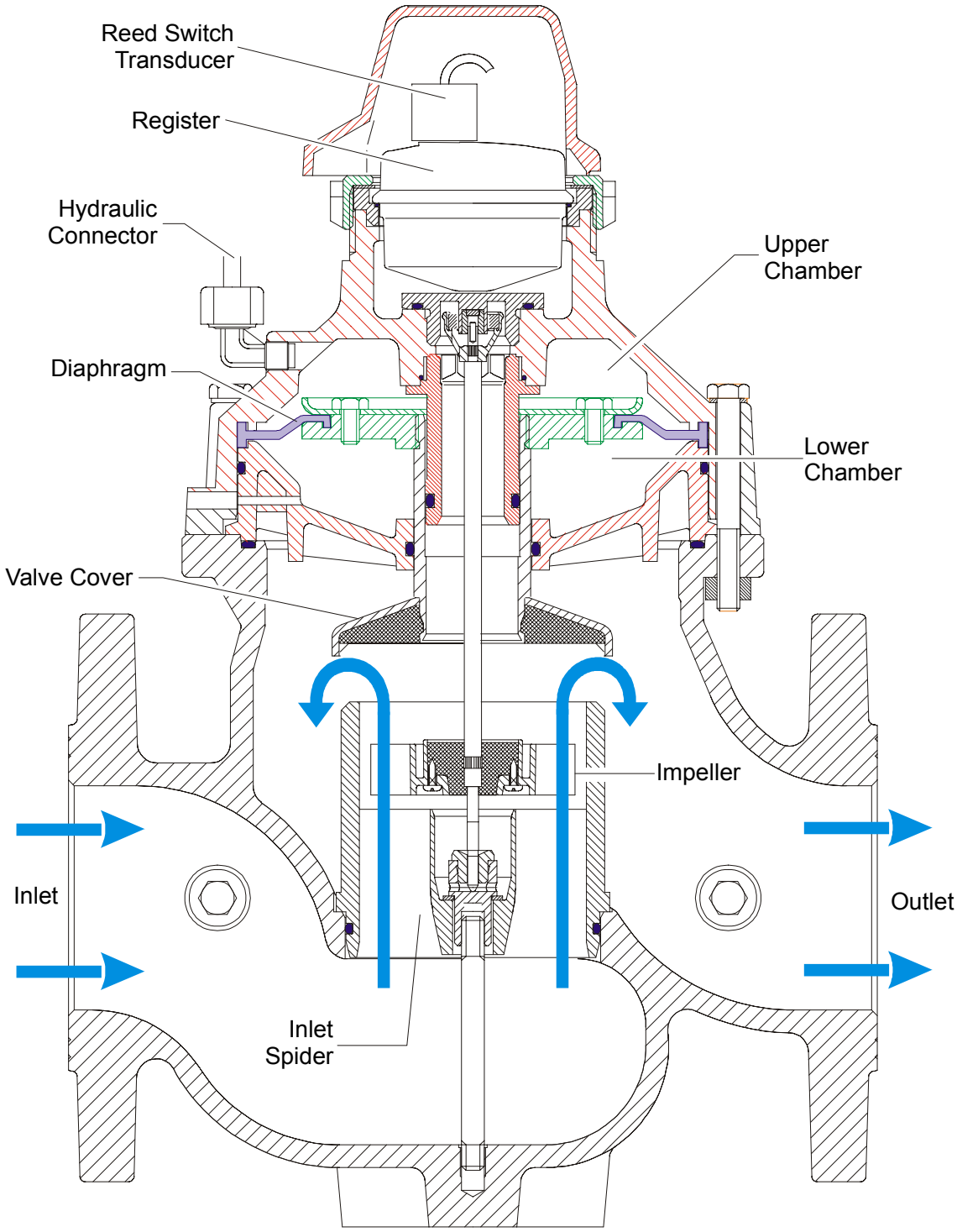
(according to sizes)

ELECTRICAL OUTPUT

Available Outputs (U.S. gallons/pulse)	1½"	2"	3"	4"	6"	8"
1	√	√	√			
10	√	√	√	√	√	√
100	√	√	√	√	√	√
1000				√	√	√

1.4 Location of Principal Components





Hydrometer Internal Components

1.5 Drainage Valve

At the beginning of the winter it is necessary to drain the water from the pipeline in order to prevent the pipes from bursting.

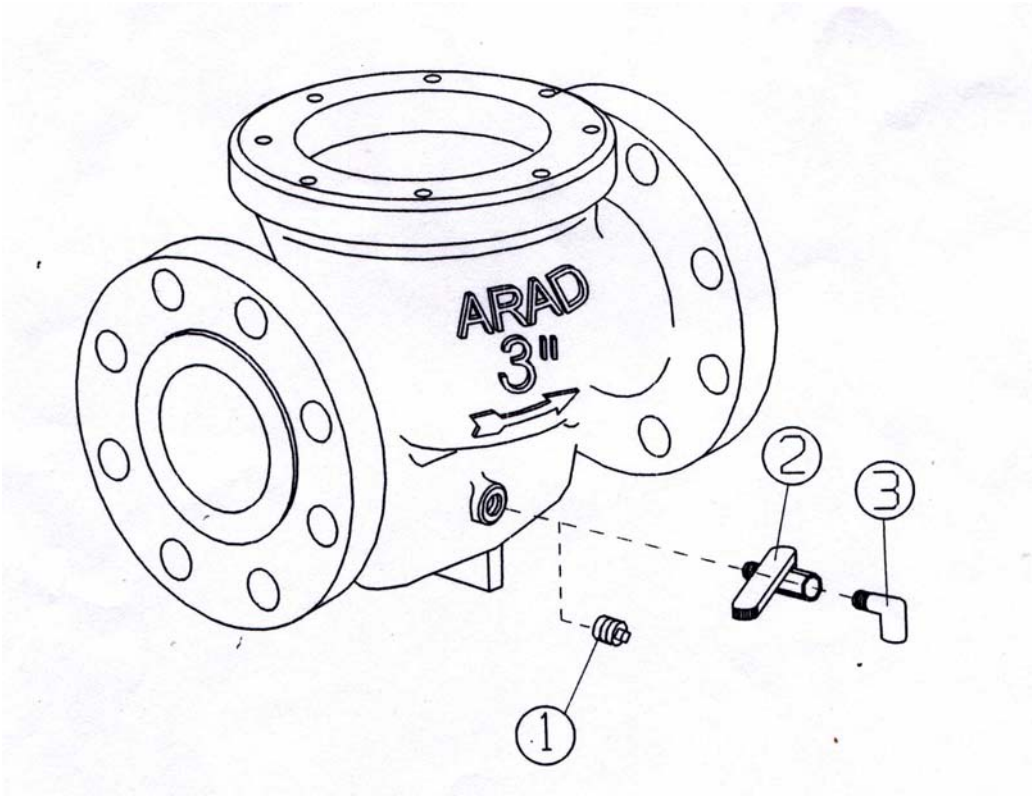
Steps (please refer to the attached drawing):

Disassemble plug No. 1.

Assemble the drainage ball valve No. 2

Assemble elbow No. 3

Before draining, it is very important to ensure that there is no pressure in the line.



2. Installation

2.1 Unpacking

The hydrometer comes fully assembled according to the customer's specifications. The 1-1/2" and 2" models are shipped with the appropriate couplings and gaskets. The customer is expected to supply the necessary installation hardware for larger diameter models.

Pilot valves and other accessories are factory installed and calibrated according to the customer's specifications.

2.2. Installation in Pipeline

2.2.1 Tools

The following tools are required to perform these procedures:

- Flat blade and Phillips head screwdrivers in various sizes
- Open end or box wrenches in various sizes
- Large pipe wrenches
- Pliers
- Dies or pipe threading tools compatible with the pipeline diameter
- Teflon tape or similar pipe sealing material

2.2.2. Preliminary Steps

1. Before beginning the installation you should thoroughly flush the line to remove any foreign matter.

2. Close the inlet valve in order to shut off the water flow to the affected pipeline.

2.2.3. Installing 1½" – 2" Models

The 2" model hydrometer may either be attached directly to a male threaded pipeline or attached to a female threaded pipeline using a coupling. The 1½" model can only be attached using a coupling.

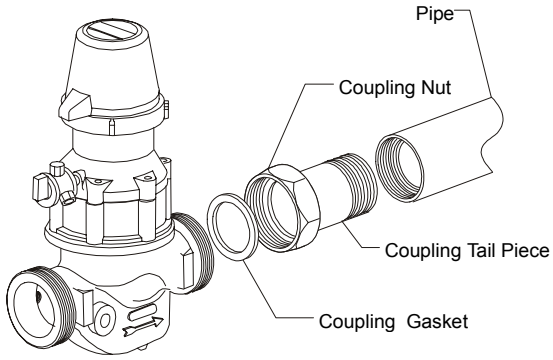
Coupling Connection

Create a female threaded connection on both pipe sections.

Apply Teflon tape or similar material to seal the connections.

Insert the male coupling connections into the pipeline sections and tighten securely.

Place a coupling gasket over each male threaded hydrometer connection and securely tighten the coupling nuts.

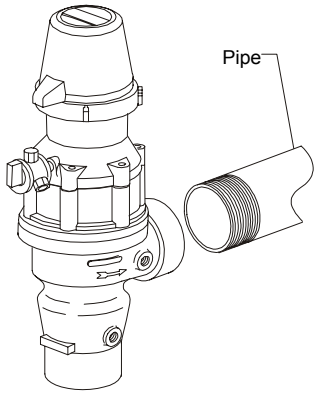


Direct Connection

Create a male threaded connection on both pipe sections that are to be attached.

Apply Teflon tape or similar material to seal the connections.

Insert the male threaded pipe connection into the hydrometer and tighten securely.

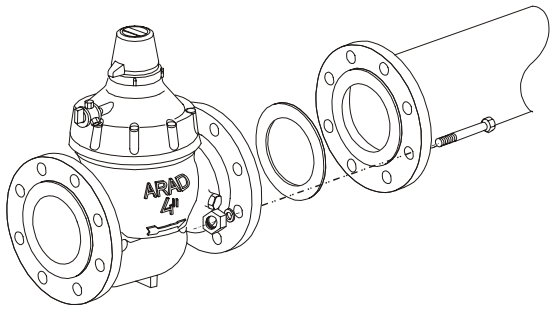


2.2.4. Installing 3" - 8" Models

The end user is expected to supply the appropriate gaskets and bolts according to the diameter of the pipeline.

Place the appropriate gasket onto each flange.

Insert the bolts, nuts and washers and tighten securely.



2.3. Control System Installation

2.3.1. Solenoid Valve Connection

The hydrometer receives commands from the computer or control center via an external solenoid valve. The hydrometer may be ordered with a factory installed solenoid valve or connected to an solenoid valve supplied by the user.

To connect to a factory installed solenoid valve:

1. Connect electric cable from computer to the attached solenoid valve. The Solenoid output is factory installed to the "**Auto**" connection on the **3-Way Control Valve**.

To install a customer supplied external solenoid valve:

1. Connect hydraulic hose from the external solenoid valve to the "**Auto**" connection on the **3-Way Control Valve**.

2. Connect the data cable from the computer to the solenoid valve.

2.3.2. Electrical Output Connection

The **BM/BMA Series Hydrometer** supplies volume and flow rate data to a computer or to an external measuring device via an electrical connection. A reed switch transducer is factory installed in the register dial. The cable attached to the reed switch transducer attaches to the computer or measuring device.

To connect the hydrometer to the computer or measuring device:

1. Install an appropriate connector onto the bare end of the cable exiting from the reed switch. Refer to the user manual of the computer or measuring device for details regarding the specific connector type.

2. Connect the cable to the input port of the computer or measuring device.

2.4. Operational Testing

Before the hydrometer is placed into service, you should perform the following tests to verify that it is operating properly:

To test water flow and manual operation:

1. Set **3-Way Control Valve** to the "**Open**" position.

2. Turn on the water flow to the hydrometer.

3. Visually verify that water is flowing downstream from the hydrometer in appropriate quantities.

4. Verify that the leak detector, pointers and the totalizer are functioning properly. Refer to **Chapter 4** for troubleshooting procedures.

5. Check all hoses, connections, pilot valves etc. for leakage and repair as necessary.

6. Set **3-Way Control Valve** to the "**Close**" position.

7. Verify that the water flow downstream has indeed ceased.

To test automatic and remote operation:

1. Set **3-Way Control Valve** to the "**Auto**" position.

2. Turn on the water flow to hydrometer.

3. Verify that the hydrometer output is correctly received by the computer or control center.

4. Use the computer or control center to close hydrometer valve. Verify that the water flow downstream has indeed ceased.

5. Use the computer software to test operation of the hydrometer under various applications and conditions such as pressure reducing, pressure sustaining and flow regulation. Refer to **Chapter 4** for troubleshooting.

6. Your hydrometer is now ready for routine use.

3. Applications and Operations

The **BM/BMA Series Hydrometer** is designed to operate in a variety of automatic and remote control applications. The hydrometer valve is also capable of manual operation and the register dial may be read as an ordinary water meter.

3.1. Manual Operation

The **BM/BMA Series Hydrometer** may be manually operated using the **3-Way Control Valve**.

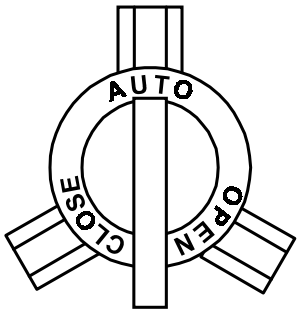


Figure 0-1 3-Way Control Valve

To manually open the valve:

7. Rotate the **3-Way Control Valve** to the "**Open**" position.

To manually close the valve:

1. Rotate the **3-Way Control Valve** to the "**Close**" position.

3.2. Automatic Operation

Automatic operation is made possible by direct hydraulic control from a remote computer or control center. Volume and/or flow data is electronically transmitted to the remote computer by means of a reed switch transducer. The command to open or close the hydrometer valve is transmitted from the computer to a **Solenoid Valve**, which, in turn, transmits a hydraulic command to the hydrometer.

Automatic operation may also be based on a pre-set pressure or flow rate by the use of one or more **Pilot Valves**.

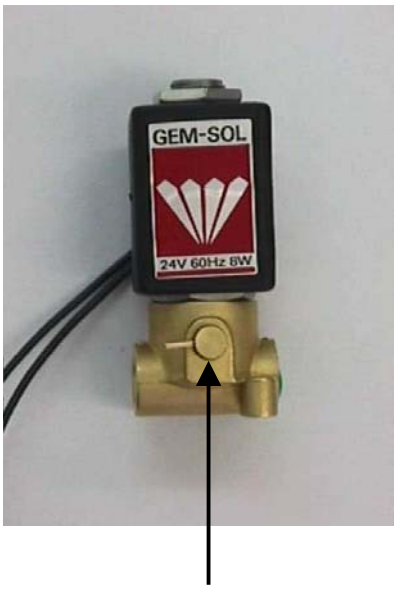
To enable automatic and/or remote operation, rotate the **3-Way Control Valve** to the "**Auto**" position.

3.2.1. Solenoid Operation

The hydrometer is always controlled via an external solenoid valve. A "normally open" (NO), high pressure, 3-Way solenoid valve is required for this purpose.

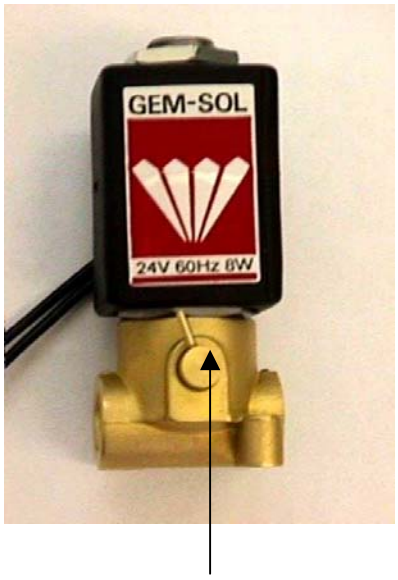
An electric cable connects the computer and the solenoid valve. A narrow control hose runs from the solenoid valve to one of the connectors on a shuttle valve, which is, in turn, attached to the "**Auto**" connection on the **3-Way Control Valve**.

Solenoid valve



Automatic Position

Operated by the controller



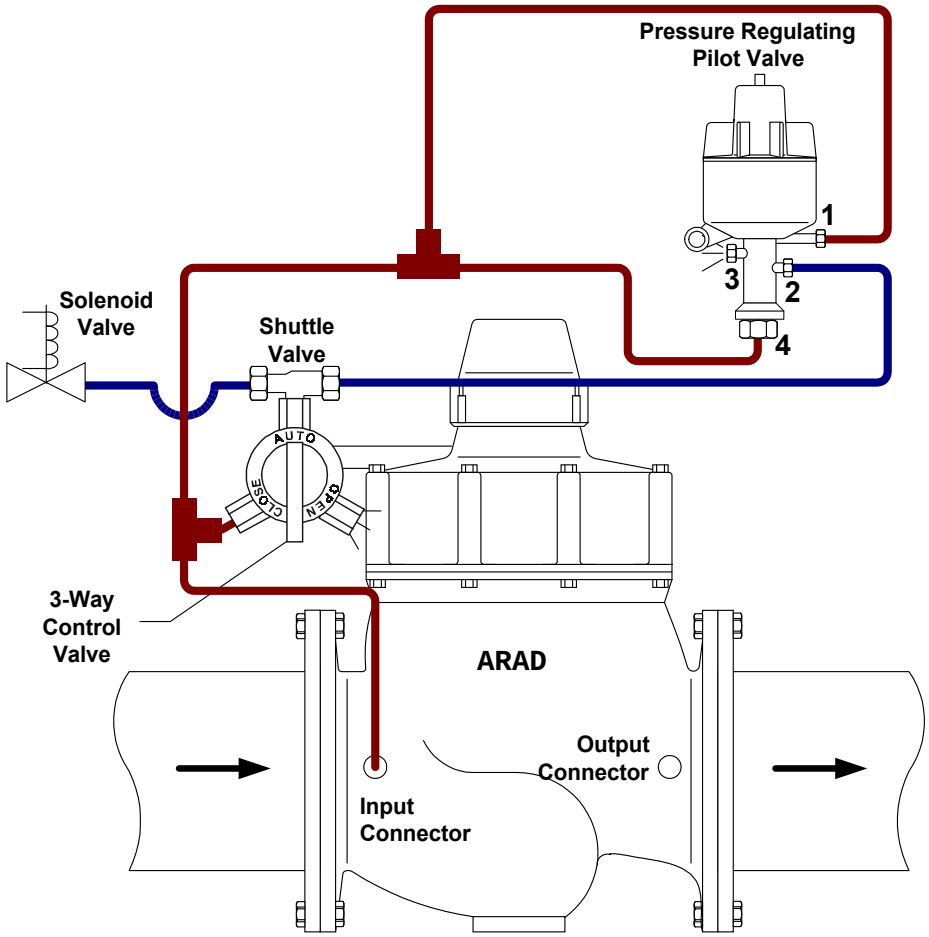
Manual 0veride Open

3.3. Typical Applications

3.3.1. Pressure Sustaining

The pressure sustaining operation prevents the input pressure from falling below a pre-determined value. This application requires an Arad **PC Pressure Regulating Pilot Valve**, or comparable valve. Rotate the adjusting screw atop the pilot valve counterclockwise to increase the desired input pressure and clockwise to reduce the desired input pressure.

Connection Information



The **sensor connection** runs from the input connector on the hydrometer to the controlled input connector (1) on the pilot valve. The sensor connection also branches off to the "**Close**" connector on the **3-Way Control Valve** and to the vent connector (4) on the pilot valve.

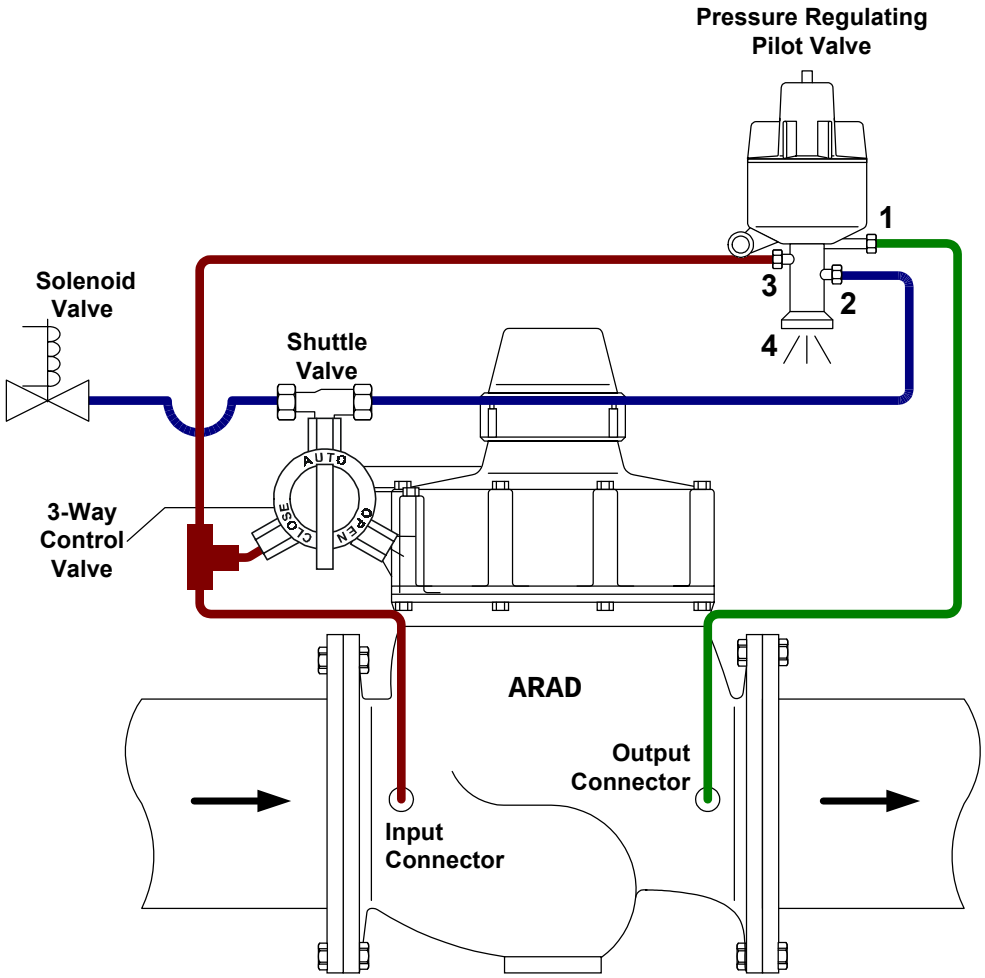
The **command connection** runs from solenoid to the "**Auto**" connector on the **3-Way Control Valve** (via the shuttle valve) and continues on to the pressure controlled input connector (2) on the pilot valve.

The supply connector (3) on the pilot valve serves as a vent. The output connector on the hydrometer is not used.

3.3.2. Pressure Reducing

The pressure reducing operation prevents the output pressure from increasing above a pre-determined value. This application requires an Arad **PC Pressure Regulating Pilot Valve**, or comparable valve. Rotate the adjusting screw atop the pilot valve counterclockwise to increase the desired output pressure and clockwise to reduce the desired output pressure.

Connection Information



The **sensor connection** runs from the output connector on the hydrometer to the pilot valve controlled input connector (1).

The **pressure supply connection** runs from the hydrometer input connection to the pilot valve supply connector (3). This connection branches off to the "Close" connection on the **3-Way Control Valve**.

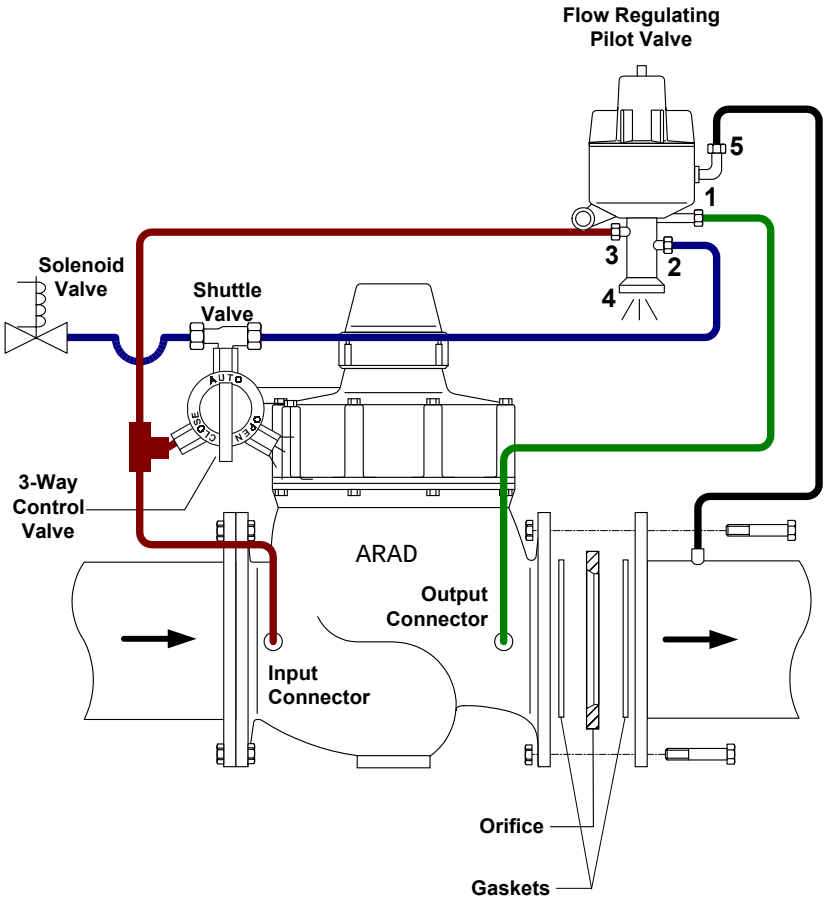
The **command connection** runs from solenoid to the "**Auto**" connector on the **3-Way Control Valve** (via the shuttle valve) and continues on to the pressure controlled input connector (2) on the pilot valve.

The vent connector (4) on the pilot valve serves as a vent.

3.3.3. Flow Regulation

The flow regulation operation prevents the outlet flow rate from increasing above a pre-determined value. This application requires an Arad **FC Flow Regulating Pilot Valve**, or comparable valve. Rotate the pilot valve adjusting screw counterclockwise to increase the flow rate and clockwise to decrease flow rate.

Connection Information



The **sensor connection** runs from the output connector on the hydrometer to the pilot valve controlled input connector (1).

The **pressure supply** connection runs from the hydrometer input connection to the pilot valve supply connector (3). This connection branches off to the "Close" connection on the **3-Way Control Valve**.

The **command connection** runs from solenoid to the "**Auto**" connector on the **3-Way Control Valve** (via the shuttle valve) and continues on to the pressure controlled input connector (2) on the pilot valve.

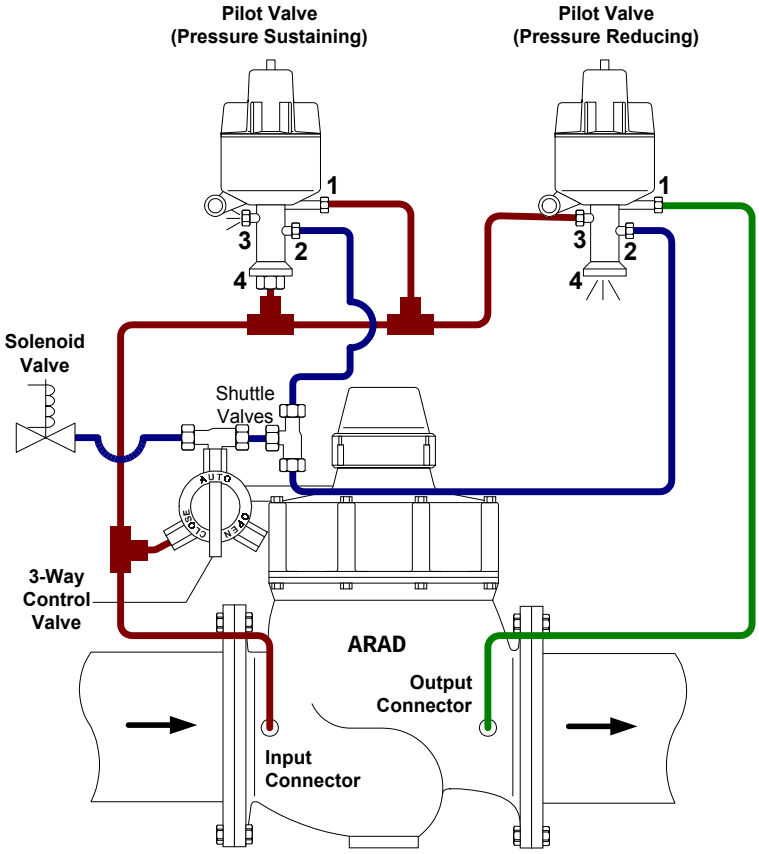
The **cover connection** runs from a connector in the pipeline, downstream from the orifice, to the pilot valve cover connector (5).

The vent connector (4) on the pilot valve serves as a vent.

3.3.4. Two Stage Operation

This application prevents excess water flow during the filling of the pipeline, thus preventing damage to the system. This operation requires two Arad **PC Pressure Regulating** (or comparable) pilot valves. During the filling process, one valve operates as pressure sustaining pilot valve, preventing excess water flow into the system. Once the pipeline is filled, the second pilot valve operates in the normal pressure reducing mode.

Connection Information



The **sensor connection** runs from the output connector on the hydrometer to the pilot valve controlled input connector (1) on the pressure reducing pilot valve.

The **pressure supply** connection runs from the hydrometer input connection to the supply connector (3) on the pressure reducing pilot valve and the controlled input connector (1) on the pressure sustaining pilot valve. This connection also branches off to the "Close" connection on the **3-Way Control Valve**.

The **command connection** runs from solenoid to the "**Auto**" connector on the **3-Way Control Valve** (via the shuttle valves) and continues on to the pressure controlled input connector (2) on the both pilot valves.

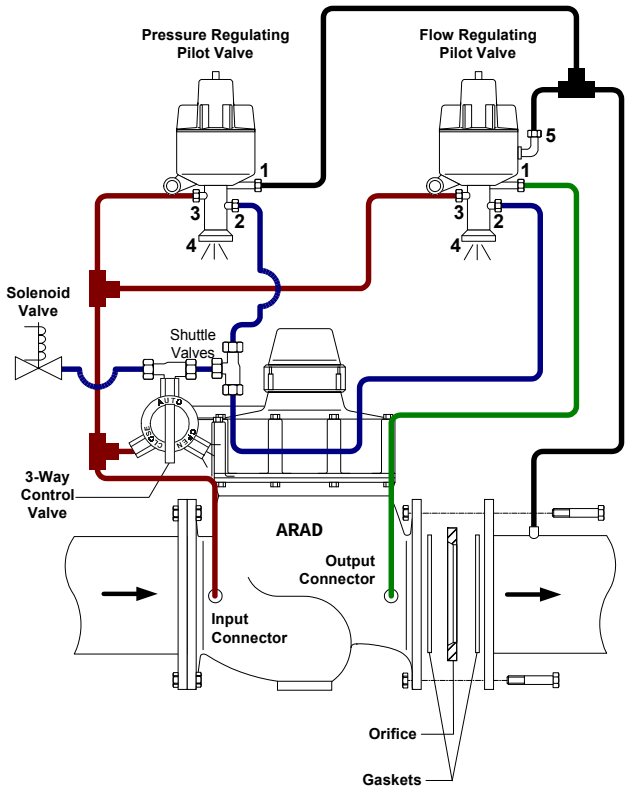
The vent connector (4) on the pressure reducing pilot valve serves as a vent.

3.3.5. Flow and Pressure Regulation

This application prevents excess water flow during the filling of the pipeline, thereby preventing damage to the system. This application requires an Arad **PC Pressure Regulating Pilot Valve**, and an Arad **FC Flow Regulating Pilot Valve** (or comparable valves).

During the filling process, the pressure regulating pilot valve operates as a pressure sustaining pilot valve, preventing excess water flow into the system. Once the pipeline is filled, the flow regulating pilot valve operates in the normal flow regulation mode.

Connection information



The **sensor connection** runs from the output connector on the hydrometer to the pilot valve controlled input connector (1) on the flow regulating pilot valve.

The **pressure supply connection** runs from the hydrometer input connection to the supply connector (3) on both pilot valves This connection also branches off to the "Close" connection on the **3-Way Control Valve**.

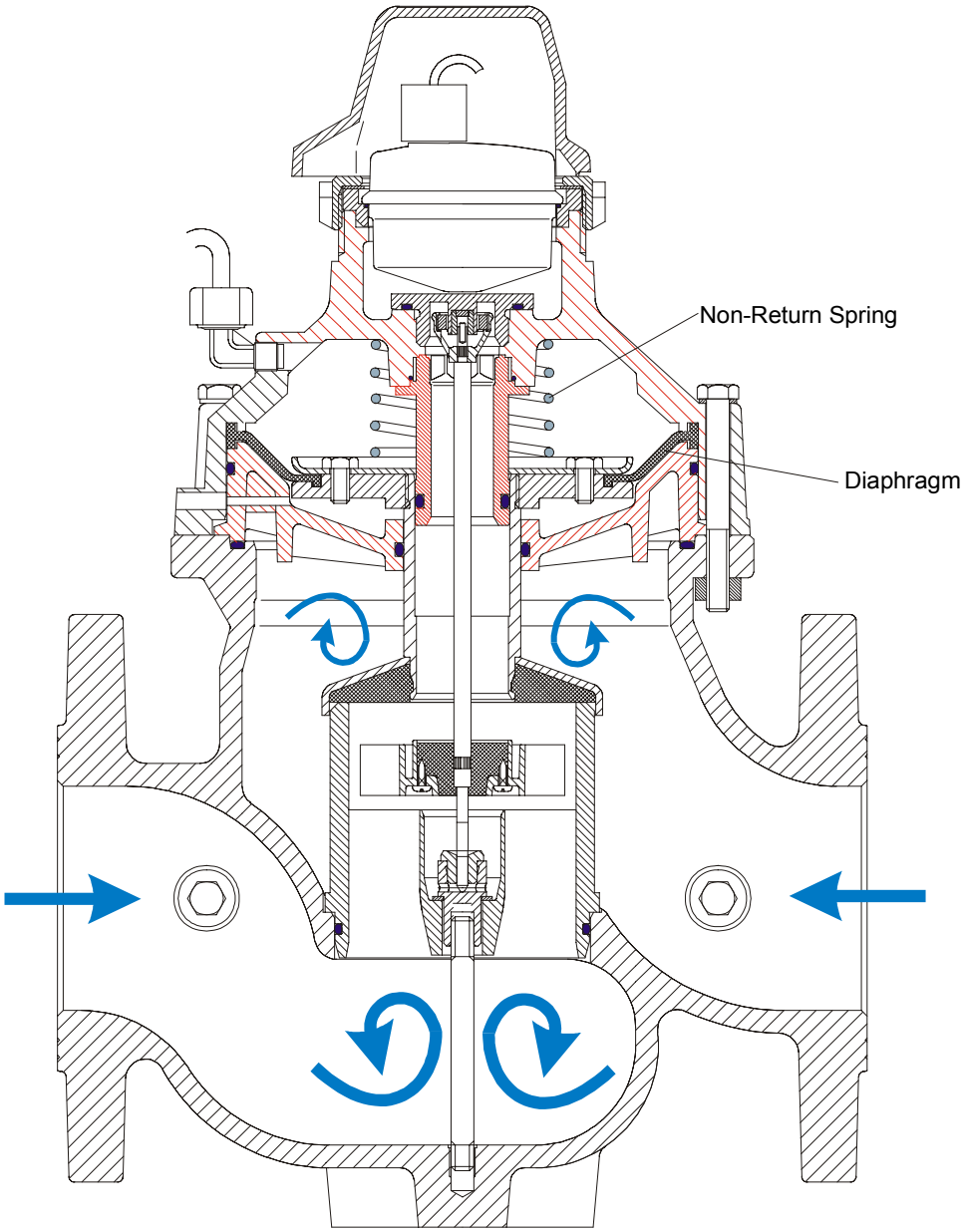
The **command connection** runs from solenoid to the "**Auto**" connector on the **3-Way Control Valve** (via the shuttle valves) and continues on to the pressure controlled input connector (2) on the both pilot valves.

The **cover connection** runs from a connector in the pipeline, downstream from the orifice, to the cover connector (5) on the flow regulating pilot valve and to the controlled input connector (1) on the pressure sustaining pilot valve. The vent connector (4) on t he both pilot valves serves as a vent.

3.3.6. Non-Return Valve

This option allows the hydrometer to close automatically when there is no input pressure, preventing water backflow and damage to pumps and other systems. This option is factory installed and not intended for modification in the field.

This option consists of a non-return spring located inside the hydrometer between the diaphragm and the roof of the upper valve chamber. The spring causes the valve to close when the input pressure falls below approximately 1 bar.



4. Troubleshooting

This chapter provides detailed troubleshooting procedures and solutions for a variety of common problems. The procedures described below are general in nature and are presented in a "Quick Reference" style outline format. If the troubleshooting instructions call for inspection, cleaning or replacement of internal parts, refer to **Chapter 5** for detailed disassembly and replacement procedures.

We recommend that you perform the steps in order until the specific problem is solved. It may not be necessary to complete all of the steps in a given procedure.

4.1.1 Leakage from hydrometer connection to pipeline.

1. Inspect and tighten the couplings or flange bolts. Replace the coupling, bolts and nuts as necessary.

2. Apply Teflon tape, or other similar material, to seal the connection.

3. Inspect and replace gaskets as necessary.

4. Inspect and clean the orifice and associated gaskets (flow control applications only). Replace as necessary.

4.1.2 No electrical output signal from hydrometer.

1. Inspect all cables and electrical connections. Repair or replace cables as necessary.

2. Verify that the reed switch transducer is properly inserted into the register dial.

3. Verify that the computer is functioning properly. If not, restart the computer and make certain that your software is properly configured.

4. Replace the reed switch transducer.

5. Verify that the flow indicator on the meter dial is rotating. If it is not rotating refer to **Section 4.1.4.**

4.1.3. The computer indicates that water is not flowing as instructed.

1. Verify that the computer is functioning properly. If not, restart the computer and verify that your software is properly configured.

2. Move the **3-Way Control Valve** to the "**Open**" position. Check to see if the computer shows water flow. If so, this indicates that the solenoid is not functioning properly. Repair or replace as necessary.

3. Verify that the reed switch transducer is properly inserted into the register dial.

4. Check all electrical connections. Replace cables as necessary.

5. Verify that the flow indicator on the meter dial is rotating. If it is not rotating refer to **Section 0**

4.4.4. No Indication of flow on meter dial.

1. Remove the register assembly as described in **Chapter 5**. Place a small magnet on the bottom of the register assembly and move it in a circular motion. This should cause the flow indicator to rotate freely. If it does not, replace the register.
2. Disassemble the hydrometer as described in **Chapter 5**.
3. Clean or replace the strainer (1½" and 2" models only).
4. Verify that the impeller rotates freely. If it does not, inspect the impeller, impeller shaft and other related components. Replace as necessary.
5. Inspect the diaphragm and O-Rings. Replace as necessary.

4.1.5. Computer indicates that the valve fails to open.

1. Verify that the **3-Way Control Valve** is in the "**Auto**" position. If it is not, turn the switch to the "**Auto**" position and then check to see if the computer indicates that the valve is open.
2. Verify that the computer and your software are functioning properly. If not, restart the computer and make certain that your software is properly configured.
3. Verify if there is water flow downstream from the hydrometer. If there is not, this indicates that the valve is indeed closed.
4. Check the electrical connections as described in **Section 0**
5. Check the register as described in the first step in **Section 0**
6. Remove the **3-Way Control Valve**. Clean or replace as necessary.
7. Verify solenoid operation. Repair or replace as necessary.
8. Disassemble the hydrometer as described in **Chapter 5**.
9. Clean or replace the strainer (1½" and 2" models only).
10. Inspect the diaphragm and O-Rings. Replace as necessary.

4.1.6. Computer indicates that the valve fails to close.

1. Verify that the **3-Way Control Valve** is in the "**Auto**" position. If it is not, turn the switch to the "**Auto**" position and then check to see if the computer indicates that the valve is open.
2. Verify that the computer and your software are functioning properly. If not, restart the computer and make certain that your software is properly configured.
3. Move the **3-Way Control Valve** to the "**Close**" position. Check to see if the computer indicates that the valve is closed. If so, this indicates that the solenoid is not functioning properly. Repair or replace as necessary.

4. Verify if there is water flow downstream from the hydrometer. If there is, this indicates that the valve is indeed open.

5. Check the electrical connections as described **Section 0**

6. Check the register as described in the first step in **Section 0**

7. Remove the **3-Way Control Valve**. Clean or replace as necessary.

8. Remove and clean the finger strainer. Replace if necessary.

9. Disassemble the hydrometer as described in **Chapter 5**.

10. Inspect the diaphragm, valve cover and O-Rings. Replace as necessary.

4.1.7. Leakage from valves or connectors

1. Inspect the control hoses, connectors, shuttle valves and adapters. Tighten and replace as necessary.

4.1.8. Constant drainage from pilot valve.

1. Repair or replace the pilot valve.

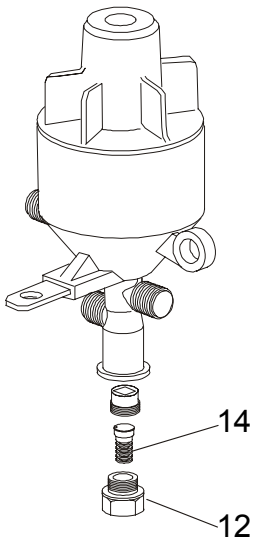
4.1.9. Excess or insufficient output pressure

1. Inspect the control hoses, connectors, shuttle valves and adapters. Replace as necessary.

2. Rotate the adjustment screw atop of the pilot valve. Rotate clockwise to increase pressure or counterclockwise to reduce pressure as necessary.

3. Remove and clean the finger strainer. Replace if necessary.

4. If this fails to balance the pressure, try the following procedure:



- Unscrew and remove the throttle housing (12) at the bottom of the pilot valve.
- Remove the throttle pin (14) from inside the housing.
- Wrap the throttle pin (14) with Teflon tape and re-insert it into the housing.
- Re-insert and tighten the throttle housing into the pilot

5. Replace the pilot valve.

4.1.10. Excess or insufficient input pressure.

1. Inspect the control hoses, connectors, shuttle valves and adapters. Tighten and replace as necessary.

2. Remove and clean the finger strainer. Replace if necessary.

3. Repair or replace the pilot valve.

4.1.11. Excess or insufficient flow rate.

1. Inspect the control hoses, connectors, shuttle valves and adapters. Tighten and replace as necessary.

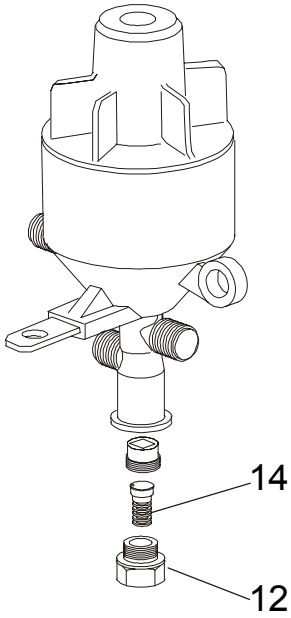
2. Rotate the adjustment screw on the top of the pilot valve. Rotate clockwise to increase flow rate or counterclockwise to reduce the flow rate as necessary.

3. Clean and check the orifice and gaskets. Replace as necessary.

4. Remove and clean the finger strainer. Replace if necessary.

5. If this fails to balance the pressure, try the following procedure:

- Unscrew and remove the throttle housing (12) at the bottom of the pilot valve.
- Remove the throttle pin (14) from inside the housing.
- Wrap the throttle pin (14) with Teflon tape and re-insert it into the



6. Replace the pilot valve.

4.1.12. Non Return Valve fails to prevent backflow.

1. Disassemble the hydrometer as described in **Chapter 5**.

2. Replace the spring located between the diaphragm and the roof of the cover.

5. Maintenance

The **BM/BMA Series Hydrometer** requires no routine periodic maintenance. In the unlikely event that the hydrometer fails to operate as expected, please follow the troubleshooting procedures as outlined in **Chapter 4**. If and when the troubleshooting procedures necessitate the inspection or replacement of internal parts, use the procedures contained in this chapter to perform the required action.

This chapter contains step-by-step instructions for the disassembly of the **BM/BMA Series Hydrometer** as well as the inspection, cleaning and replacement of its component parts.

5.1. Preliminary Steps

The following steps should be undertaken before attempting to remove the hydrometer from the pipeline or performing any repairs:

3. Flush the pipeline to remove impurities and foreign matter.
4. Close the inlet valve in order to shut off the water flow to the affected pipeline. Drain all water from the hydrometer.
5. Remove the reed switch from the register dial. Gently turn and pull the switch mechanism up to release it.
6. Disconnect all control hoses from the inlet and outlet connectors.
7. Disconnect all control hoses and shuttle valves from the 3-Way control valve.

5.2. Tools

The following tools are required to perform these procedures:

- Flat blade and Phillips head screwdrivers in various sizes
- Socket and open end wrenches in various sizes
- Hammer
- Large pipe wrench
- Special box wrench for removal of the upper spindle bolt
- Special extractor tool for removal of the valve cover
- Teflon tape or similar sealing material
- Grease for sealing gaskets and O-rings

5.3. Hydrometer Removal

The BM/BMA Series Hydrometer is designed for easy site repairs. Removal from the pipeline is not required for disassembly and most repairs. The following removal instructions are included in the unlikely event that the hydrometer needs to be disassembled and repaired in the shop.

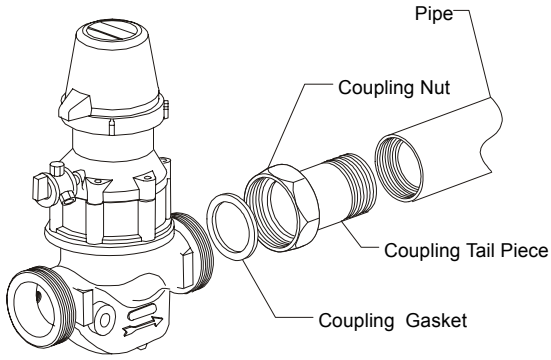
5.3.1. 1½" – 2" Models

The 2" model hydrometer may be attached directly to a male threaded pipeline or to a female threaded pipeline using a coupling. The 1½" model may only be attached, using a coupling, to a male threaded pipeline.

Coupling Connection

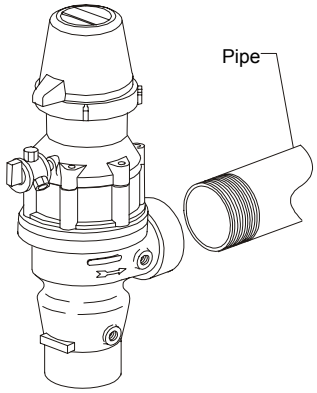
Unscrew the coupling nuts on both sides of the hydrometer counter-clockwise.

Slide the coupling nuts away from the hydrometer and remove the hydrometer from the pipeline. Retain the coupling gaskets.



Direct Connection

If the hydrometer is attached directly to the pipeline, unscrew the pipeline on both sides of the hydrometer. Remove the hydrometer from the pipeline.

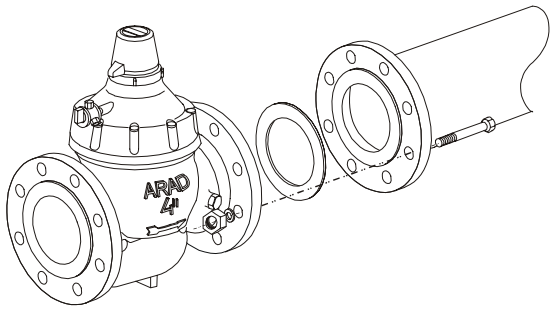


5.3.2. 3" - 8" Models

Unscrew and remove the bolts from the flanged connections on both sides of the hydrometer.

Remove the hydrometer from the pipeline.

Inspect the gaskets and replace as necessary.



5.4. Finger Strainer Cleaning and Replacement

It is not necessary to remove the hydrometer from the pipeline or to disassemble it in order to perform this procedure.

To Remove the Finger Strainer:

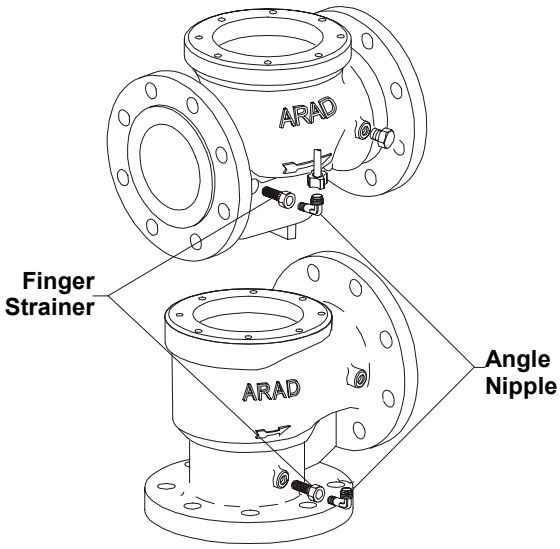
Locate the inlet connection on the hydrometer body.

Remove the angle nipples and other connection devices.

Turn the nut counter-clockwise to loosen the finger strainer.

Gently pull the finger strainer out.

Clean or replace as necessary.



To Replace the Finger Strainer:

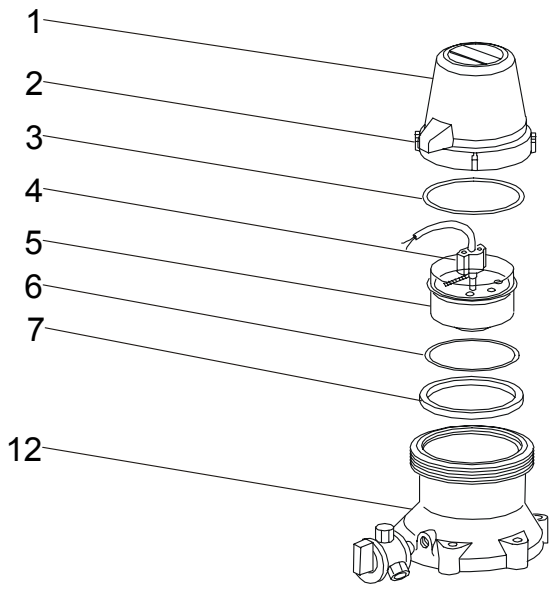
Insert the finger strainer into the inlet connection and turn clockwise to tighten.

2. Apply Teflon tape or similar material to seal the connections.

3. Re-install the angle nipples and other connection devices.

5.5. Register Assembly Removal and Replacement

It is not necessary to disassemble the hydrometer to perform this procedure. Remove the Register Assembly:



Remove the reed switch transducer (4) from the register dial. Gently turn and pull the switch (4) upward to release it.

Close the register cover (1).

Using a large pipe wrench, turn the register cover assembly (1,2) counter-clockwise until you can remove it from the hydrometer cover (12).

Remove and set aside the sliding ring (3).

Lift the register assembly (5) out of the hydrometer body.

Remove the register O-ring (6) and the adapter ring (7) from the register. Inspect and replace as necessary.

To Replace the Register Assembly:

1. Close the register cover (1).

2. Place the register O-ring (6) around the register assembly. Insert the register assembly into the adapter ring (7) and place them inside the hydrometer cover (12).

3. Replace the sliding ring (3) over the register assembly.

4. Replace the register cover assembly (1,2) over the register. Turn it clockwise to tighten.

5. Insert the reed switch (4) into its hole in the register dial. Gently turn the reed switch until it is fully seated.

5.6. Hydrometer Disassembly and Reinstallation 1½" and 2" Models

The discussion of disassembly of the hydrometer is divided into the following logical assemblies:

- Cover Assembly
- Diaphragm/Stem and Base Assemblies
- Inlet Spider/Strainer Assembly

Perform only those procedures necessary to inspect and replace parts as directed by the troubleshooting procedures. It is recommended to replace the various O-rings and gaskets during disassembly as well as to inspect certain other parts. All gaskets and O-rings must be covered with grease prior to installation.

5.6.1. Hydrometer Cover and Base Assemblies

Removal

Remove the register assembly as described in **Section 0**.

Loosen and remove the upper bearing bolt (8) using the specially sized box wrench.

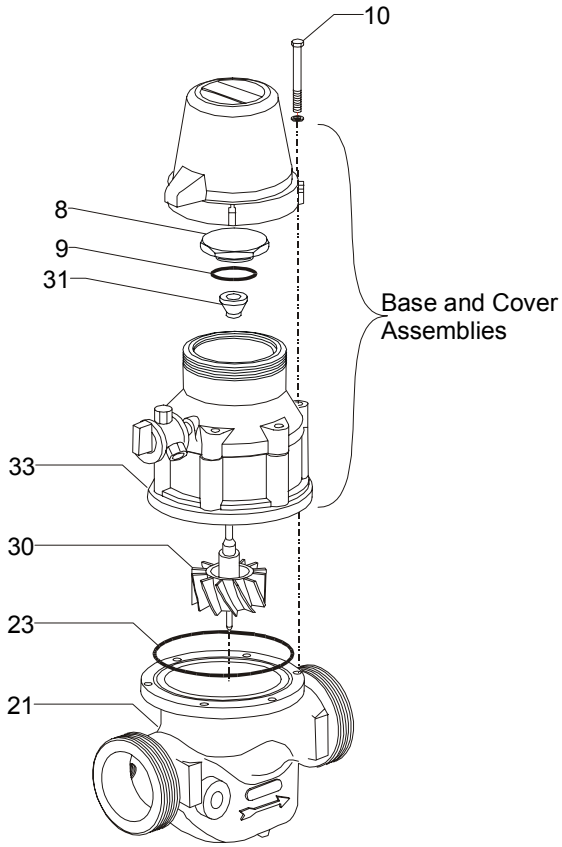
Remove the upper bearing bolt O-ring (9) from the groove in the underside of the bolt. Inspect and replace as necessary.

Loosen and remove the six cover screws (10), together with the washers.

Lift the base and cover assemblies off of the hydrometer body (21). Be especially careful not to damage the impeller.

Place the two assemblies upside down. Pull the impeller (30) up and out. Some force may be required to free the impeller.

Remove the magnet housing (31) from inside the cover assembly. The magnet housing was freed from the impeller shaft during the previous step.



8. Inspect the impeller and its components for signs of excessive wear or damage. Verify that the impeller shaft is straight. Replace as necessary.

Re-assembly

Carefully place the base and cover assemblies over the impeller shaft (30).

Push the magnet housing (31) down over the top of the impeller shaft (which extends through the hole in the cover). Tap the magnet housing with a hammer to ensure that it is properly secured to the shaft.

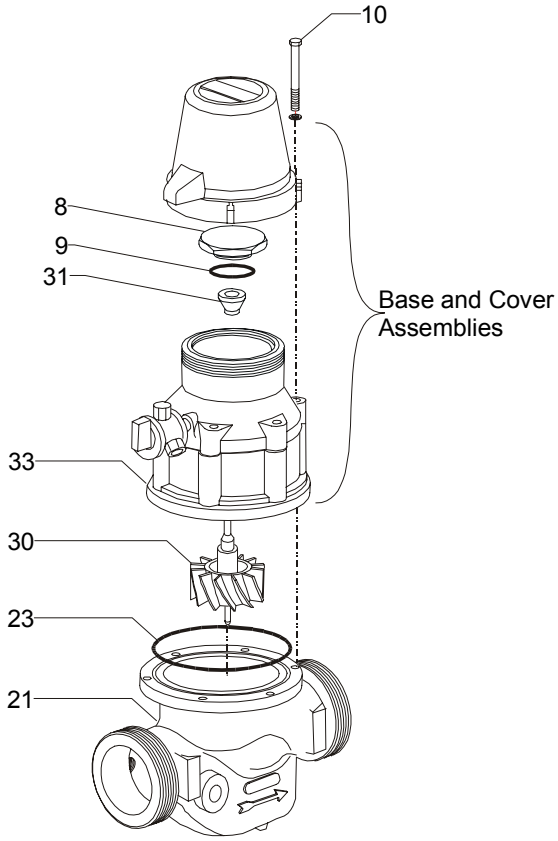
Place the base and cover assemblies onto the hydrometer body (21).

Replace and tighten the six cover screws (10).

Place the upper bearing bolt O-ring (9) into the groove on the underside of the bolt (8).

Screw in the upper bearing bolt "O" (8) using the specially sized box wrench.

Replace the register assembly and cover as described in **Section 0**.



5.6.2 Diaphragm/Stem Subassembly and Base Subassembly

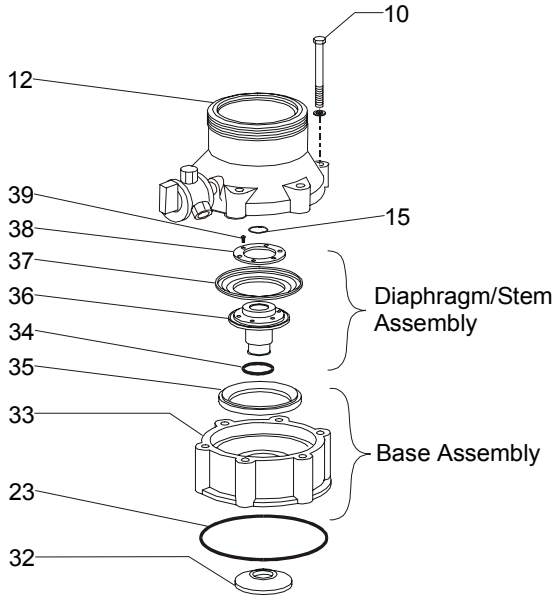
Diaphragm/Stem Disassembly

Separate the base assembly from the cover (12).

Visually inspect the diaphragm (37), valve cover (32) and stem assembly (36) for damage or excessive wear. If replacement is indicated, continue with the following steps.

Remove the six screws (39) from the diaphragm retaining ring (38). Lift the ring off of the diaphragm (37).

Lift the diaphragm (37) off of the stem (36).

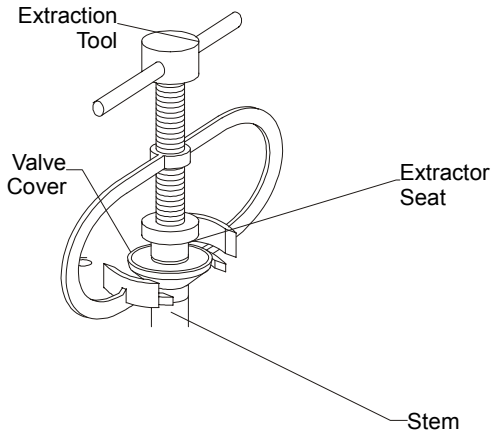


Base and Stem Disassembly

Place the base and stem assemblies upside down on a flat surface.

Use the extraction tool to remove the valve cover (32) as follows:

- Slide the lower prongs of the extraction tool under the cover.
- Turn the bolt on the extraction tool clockwise until the extractor seat fits securely into the stem.
- Continue turning the bolt until the valve cover slides off of the stem (36).



3. Invert the base and pull the stem (36) out of the base (33).

4. Remove the base O-ring (23) from the underside of the base. Inspect and replace as necessary.

5. Remove the stem O-ring (34) from the groove in the hole in the center of the base. Inspect and replace as necessary.

6. Remove the diaphragm support ring (35) from the base (33).

7. Inspect the base (33) for cracks or excessive wear. Replace as necessary.

> **WARNING**
>
> You must use the extraction tool to remove the valve cover. Use of any other tool may damage the valve cover and the stem.

Re-assembly

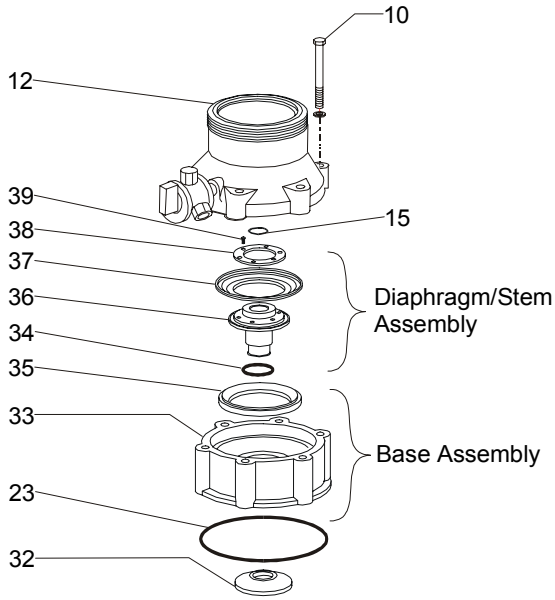
Insert the diaphragm (37) into the grooves on the top of the stem (36).

Place the diaphragm retaining ring (38) over the diaphragm. Secure the ring with the six screws (39). Apply Loctite 270 or similar glue to the screws.

Set the lower diaphragm support ring (35) inside the base (33).

Insert the re-assembled diaphragm and stem assembly into the base.

Push the valve cover (32) up onto the bottom of the diaphragm/stem subassembly. It should easily snap into place.



6. Remove and replace the central bushing O-ring (15) at the bottom of the central bushing (14 not shown), located in the underside of the cover (12).

7. Set the cover (12) onto the re-assembled base subassembly. These subassemblies are now ready for reinstallation onto the hydrometer body.

5.6.3. Inlet Spider and Strainer

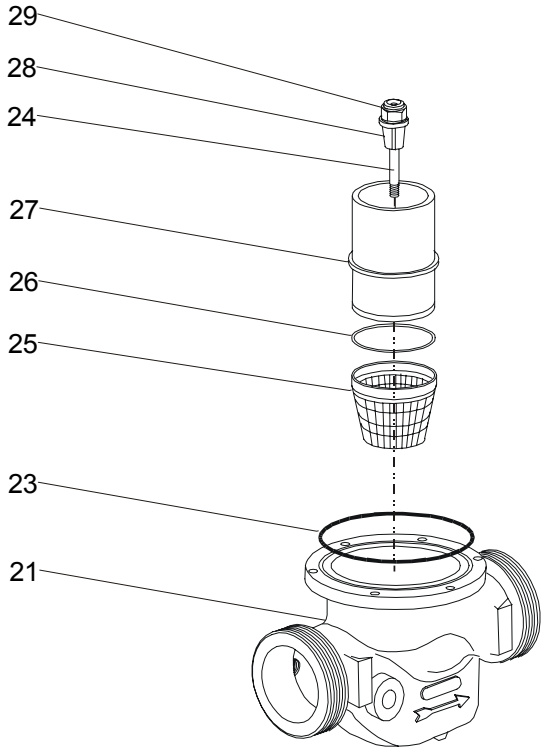
Disassembly

Loosen the impeller bushing (29) located atop the inlet spider screw (24) and bushing (28). Pull the entire inlet spider screw assembly up and out.

Pull the inlet spider (27) upward and remove it from the hydrometer body (21). Inspect for cracks or excessive wear and replace as necessary.

Remove and replace the body O-ring (26).

Remove the strainer (25). Clean and inspect for damage or excessive wear. Replace as necessary.



Re-assembly

1. Place the body O-ring (26) in the small flange inside the hydrometer base.

2. Place the strainer (25) into the hydrometer base.

3. Insert the inlet spider into the body so that the end rests in the top of the strainer and the flange rests over the body O-ring (26).

4. Place the inlet spider screw assembly through the holes in the input spider (27) and strainer (25). Use a socket wrench to tighten the impeller bushing (29) atop the assembly.

5.7. Hydrometer Disassembly and Re-assembly 3” and 4” Models

Discussion of the disassembly of the hydrometer is divided into the following logical assemblies:

- Cover Assembly
- Diaphragm/Stem and Base Assemblies
- Inlet Spider/Strainer Assembly

Perform only those procedures necessary to inspect and replace parts as directed by the troubleshooting procedures. It is recommended to replace the various O-rings and gaskets during disassembly as well as to inspect certain other parts. . All gaskets and O-rings must be covered with grease prior to installation.

5.7.1. Hydrometer Cover and Base Subassemblies

Removal

Remove the register subassembly as described in **Section 0.**

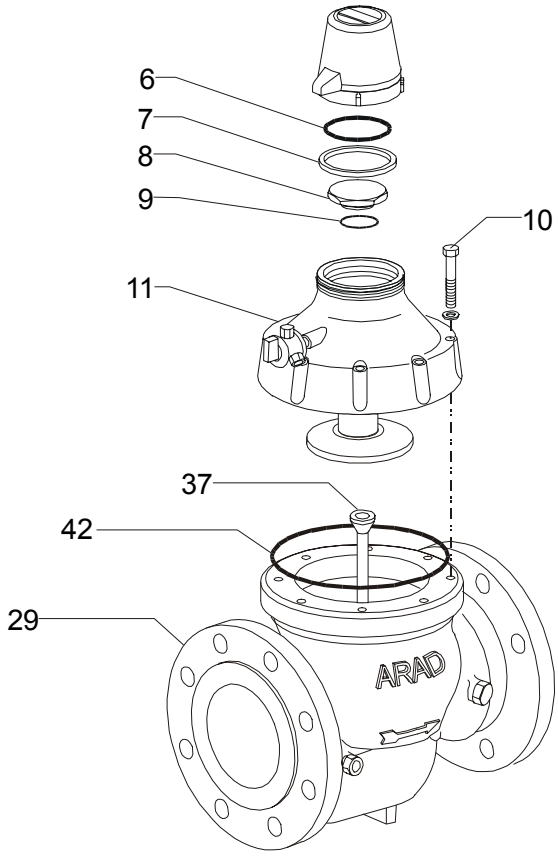
Loosen and remove the cover screws (10) along with the washers.

Lift the cover off of the hydrometer body (29). Be especially careful not to damage the impeller.

Carefully remove the impeller assembly (37) from the hydrometer body.

Inspect the impeller and its components for signs of excessive wear or damage. Verify that the impeller shaft is straight. Replace as necessary.

Inspect the base O-ring (42) for excessive wear or damage. Replace as necessary.



Re-assembly

Insert the impeller (37) into the inlet spider (located inside the hydrometer base).

Insert the base “O” (42) ring into the groove on the upper body flange.

3. Carefully place the cover over the impeller shaft (37) and onto the hydrometer body (29).

4. Replace and tighten the cover screws (10).

5. Replace the register subassembly as described in **Section 0**.

5.7.2. Diaphragm/Stem Assembly and Base Assembly

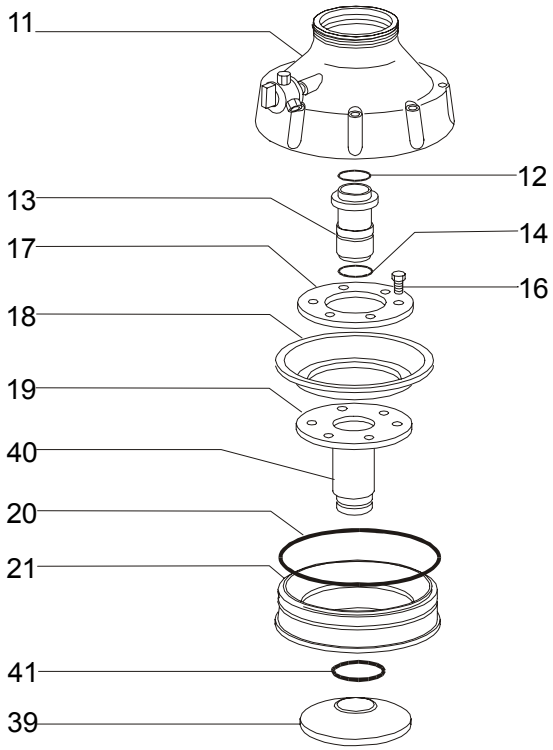
Diaphragm/Stem Disassembly

Pull the diaphragm and stem assemblies up and out from the hydrometer cover (11). The central bushing (13) remains attached to the cover.

Unscrew and remove the central bushing (13) from the cover (11).

Inspect the upper and lower central bushing O-rings (12,14). Replace as necessary.

Visually inspect the diaphragm (18), valve cover (39) and stem (40) for damage or excessive wear. If repair or replacement is required, continue with the following steps.



Diaphragm and Base Disassembly

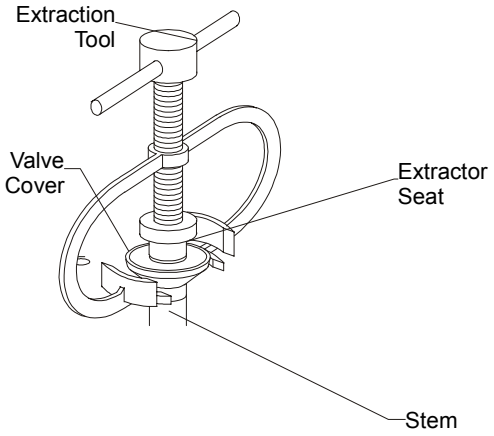
Remove the six screws (16) from the upper diaphragm ring (17). Lift the upper diaphragm ring off of the diaphragm (18).

Lift the diaphragm off of the lower diaphragm support ring (19) and the stem (40). The stem remains attached to lower diaphragm support ring.

Place the stem subassembly upside down on a flat surface.

Use the extraction tool to remove the valve cover (32) as follows:

- Slide the lower prongs of the extraction tool under the valve cover.
- Turn the bolt on the extraction tool clockwise until the extractor seat fits securely into the stem.
- Continue turning the bolt until the valve cover slides off of the stem.



5. Visually inspect the base O-ring (20) and replace as necessary.

6. Visually inspect the stem O-ring (41), located in the groove in the hole in the center of the base. Replace as necessary.

7. Inspect the base (21) for cracks or excessive wear. If replacement is necessary, pull the base off of the stem. Push the replacement base onto the stem as far as it can go.

> **WARNING**
>
> You must use the extraction tool to remove the valve cover (39). Use of any other tool may damage the valve cover and the stem assembly.

Re-assembly

Insert the diaphragm (18) into the grooves on lower diaphragm support ring (19).

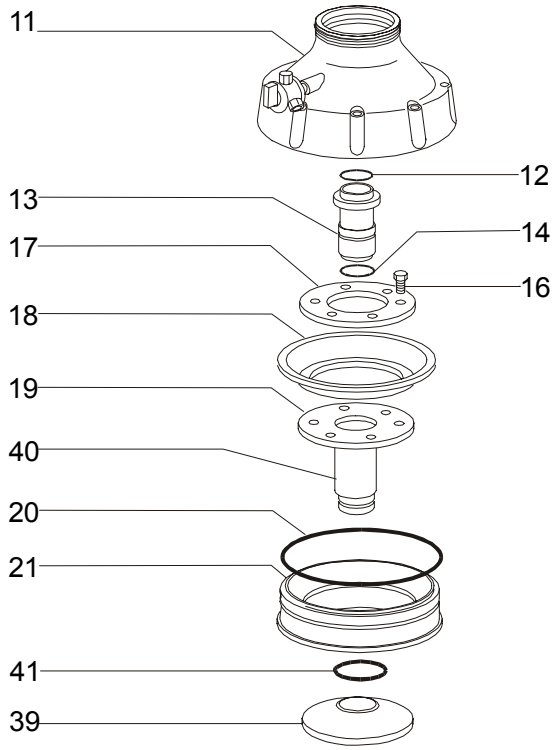
Place the upper diaphragm ring (17) over the diaphragm. Secure it to the lower diaphragm ring (19) with the six screws (16). Apply Loctite 270 or similar glue to the screws.

Push the base up onto the stem as far as it will go.

Push the valve cover (39) up onto the bottom of the stem. It should easily snap into place.

Insert the re-assembled diaphragm, stem base assemblies into the cover (11).

Replace the impeller assembly into the inlet spider, located inside the hydrometer body.



5.7.3. Inlet Spider and Strainer

Disassembly

Loosen and remove the impeller bushing (36), the inlet spider bearing nut (35) and the inlet spider bearing washer (34).

Remove the inlet spider tube (33).

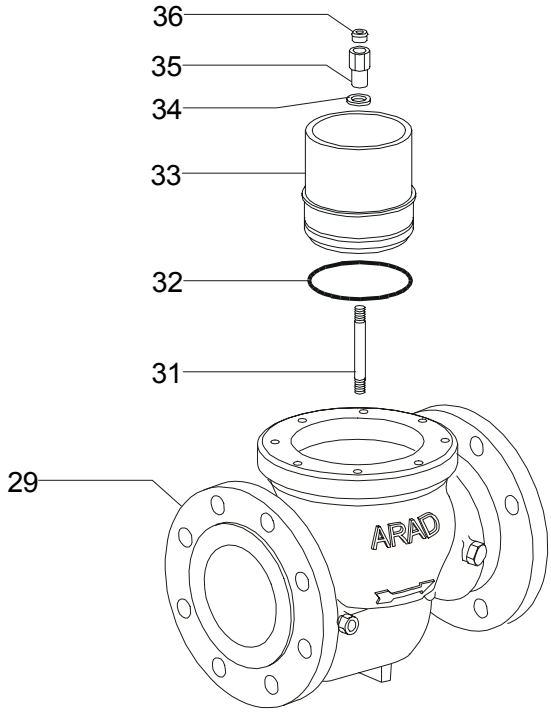
Inspect the inlet spider O-ring (32) and replace as necessary.

Re-assembly

Replace the inlet spider tube (33)

Replace the inlet spider bearing washer (34) and nut (35) onto the inlet spider shaft (31) and tighter.

Replace the impeller bushing (36) into the inlet spider nut (35).



5.8. Hydrometer Disassembly and Re-assembly 6" Models

Discussion of the disassembly of the hydrometer is divided into the following logical subassemblies:

- Register
- Hydrometer Cover
- Diaphragm and Stem Assemblies
- Stem and Valve Seal Assemblies
- Impeller and Flow Tube Assemblies
- Inlet Spider Assembly

Perform only those procedures necessary to inspect and replace parts as directed by the troubleshooting procedures. It is recommended to replace the various O-rings and gaskets during disassembly as well as to inspect certain other parts. All gaskets and O-rings must be covered with grease prior to installation.

5.8.1. Register

Disassembly

Remove the register assembly as detailed in **Section 0**.

Using a large box wrench, unscrew and remove the upper bearing bolt (8).

Inspect the upper bearing O-ring (9). Replace as necessary.

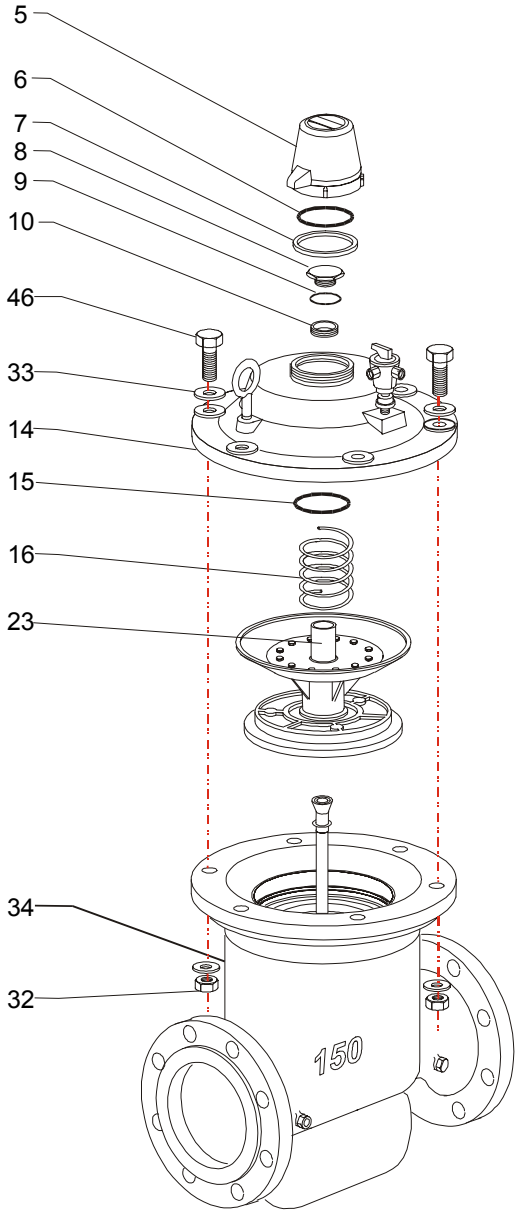
Using a screwdriver or a special key, loosen the guide tube nut (10). It is not necessary to remove the nut.

Re-assembly

Tighten the guide tube nut (10).

Screw the upper bearing bolt (8) back into the cover.

Replace the register assembly.



5.8.2. Hydrometer Cover

Disassembly

Loosen and remove the six cover hex bolts (46) along with their nuts (32) and washers (33).

Remove the spring (16).

Lift out the guide tube (23). Inspect and replace as necessary.

Pull the diaphragm/stem assembly out of the hydrometer body. Be careful not to damage the impeller during removal.

Re-assembly

1. Carefully replace the diaphragm/stem assembly over the impeller shaft and into the hydrometer body. Be careful not to damage the impeller.
2. Place the guide tube (23) over the impeller shaft.
3. Place the spring (16) over the guide tube (23).
4. Replace the hex cover bolts (46) together with their washers and nuts.

5.8.3. Diaphragm and Upper Stem Bearing

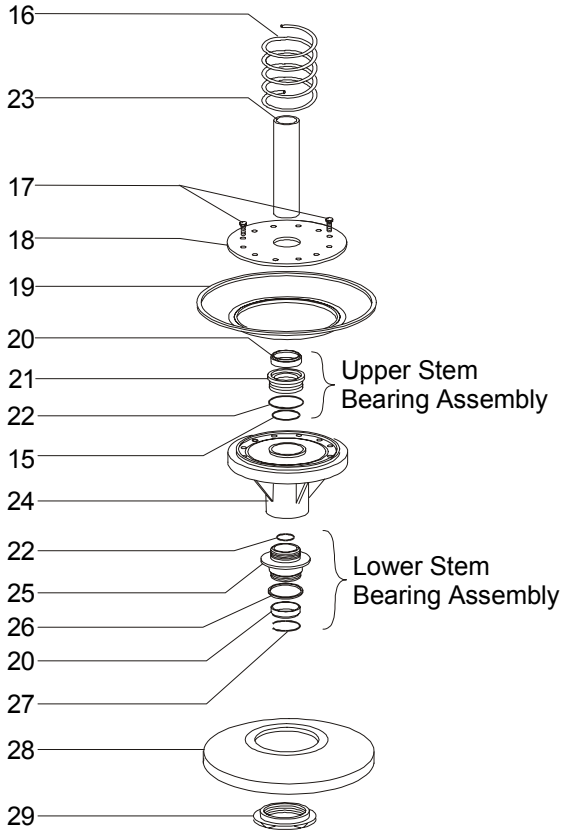
Disassembly

Unscrew and remove the 12 screws (17) and remove the upper diaphragm ring (18).

Remove the diaphragm (19). Inspect for cracks or excessive wear and replace as necessary.

Inspect the upper stem wiper (20) and replace as necessary.

Remove the upper stem bearing (21) from inside the stem (24). Inspect the upper stem bearing (21) along with the upper stem bearing O-ring (22) and the stem O-ring (15). Replace as necessary.



Re-assembly

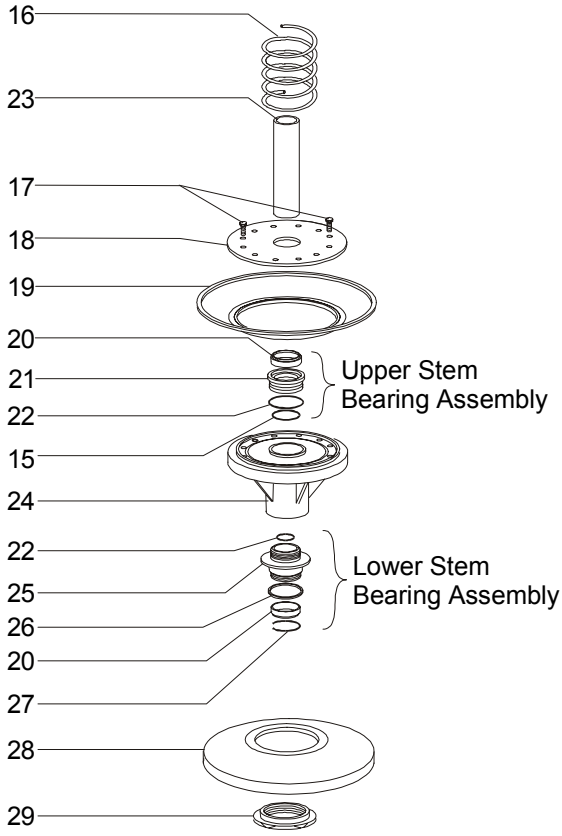
Replace the upper stem wiper (20) onto the upper stem bearing (21)

Replace the upper stem bearing (21) into the stem (24).

Place the diaphragm (19) into the grooves on the stem (24).

4. Place the upper diaphragm ring (18) over the diaphragm and screw the 12 stem screws (17) into place.

5.8.4. Lower Stem Bearing and Valve Cover



Disassembly

Unscrew and remove the stem lock nut (29).

Pull the valve cover (28) from the stem. Inspect the rubber for cracks or excessive wear. Replace as necessary.

Inspect the lower valve cover O-ring (26) and replace as necessary. It is located in a groove inside the valve cover opening.

Using a screwdriver, remove the lock ring (27) from in side the bottom of the stem (24).

Inspect the lower stem bearing wiper (20) and the lower stem bearing O-ring (22) and replace as necessary.

Inspect and replace the lower stem bearing (25) as necessary. Use a pipe wrench to remove it from the stem (24). Apply Loctite 270 or similar glue to the threads of the lower stem bearing (25). Screw it back into the stem (24).

Re-assembly

1. Replace the lower stem wiper (20) into the bottom of the stem (24).

2. Snap the wiper locking ring (27) into the stem (24).

3. Push the valve cover (28) onto the lower stem bearing (25).

4. Apply Loctite 270 or similar glue to the threads of the stem lock nut (29).

5. Screw the stem lock nut (29) into the stem (24). Do not over tighten. Make sure that the valve cover is free to move up and down slightly.

5.8.5. Impeller and Flow Tube Subassemblies

Disassembly

Remove valve seat base (45) from atop the flow tube (41). Be careful not to damage the impeller shaft. Inspect for excessive wear and replace as necessary.

Remove the impeller assembly (43). Inspect for cracks or excessive wear and check that the impeller shaft is perfectly straight. Replace if necessary.

Remove the flow tube (41). Inspect and replace as necessary.

Inspect the upper and lower flow tube O-rings (40) and replace as necessary.

Remove the inlet spider (38) assembly. Inspect and repair as necessary.

Re-assembly

Replace the inlet spider assembly (38) into the hydrometer body.

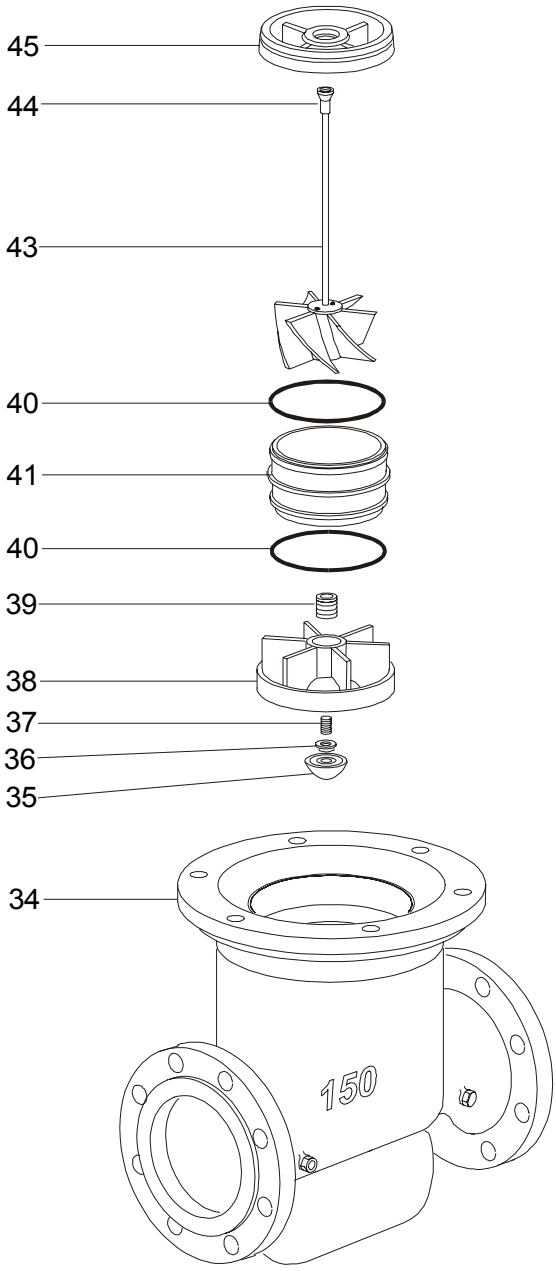
Place the lower flow tube O-ring (40) onto the flow tube (41).

Place the upper flow tube O-ring into the valve seat base (45).

Replace the flow tube (41) atop the inlet spider assembly (38) in the hydrometer body.

Replace the impeller assembly (43) into the flow tube (41) so that the impeller shaft rests in the lower bearing bushing (39).

Place the valve seat base (45) over the impeller shaft so that it rests atop the flow tube (41).



5.8.6. Inlet Spider

Disassembly

Unscrew and remove the cap (35). Inspect and replace as necessary.

Remove the lock nut (36).

Unscrew and remove the lower bearing screw (37) from the inlet spider (38). Inspect and replace as necessary.

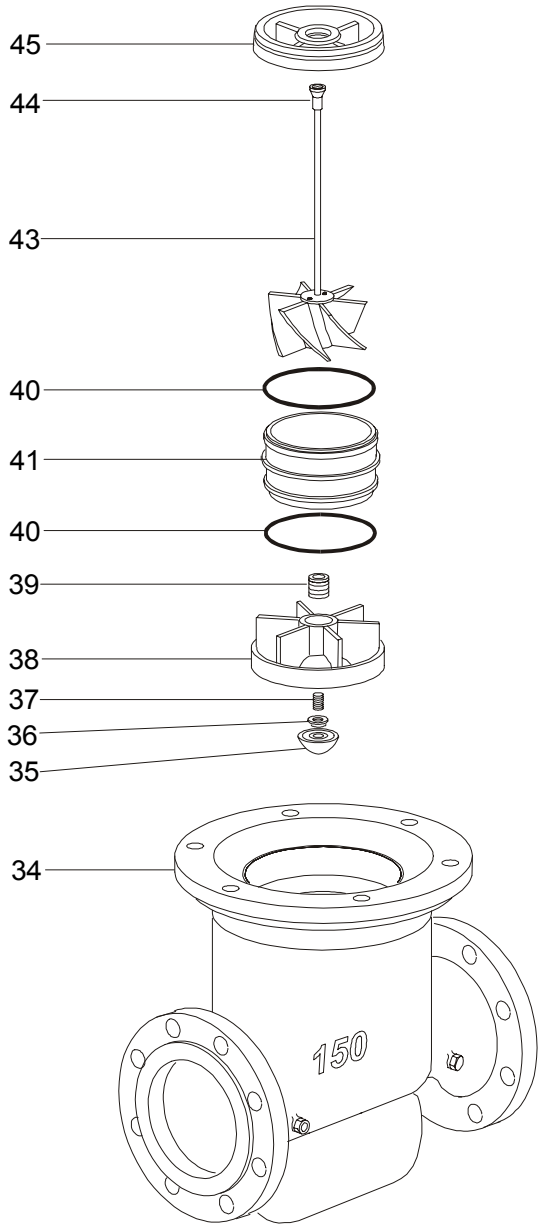
Inspect the inlet spider (38) and the lower bearing bushing (39) and replace as necessary.

Re-assembly

Screw the lower bearing bushing (37) back into the inlet spider (38).

Replace the lower bearing screw (37) into bottom of the inlet spider. Tighten approximately eight turns.

Replace the lock nut (36) and the spider cap (35).



5.9. Hydrometer Disassembly and Re-assembly 8” Models

Discussion of the disassembly of the hydrometer is divided into the following logical assemblies:

- Register
- Hydrometer Cover
- Diaphragm Subassembly
- Lower Chamber Disc Subassembly
- Stem and Valve Cover Subassemblies
- Impeller and Flow Tube Assemblies
- Inlet Spider Assembly

Perform only those procedures necessary to inspect and replace parts as directed by the troubleshooting procedures. It is recommended to replace the various O-rings and gaskets during disassembly as well as to inspect certain other parts. All gaskets and O-rings must be covered with grease prior to installation.

5.9.1. Register

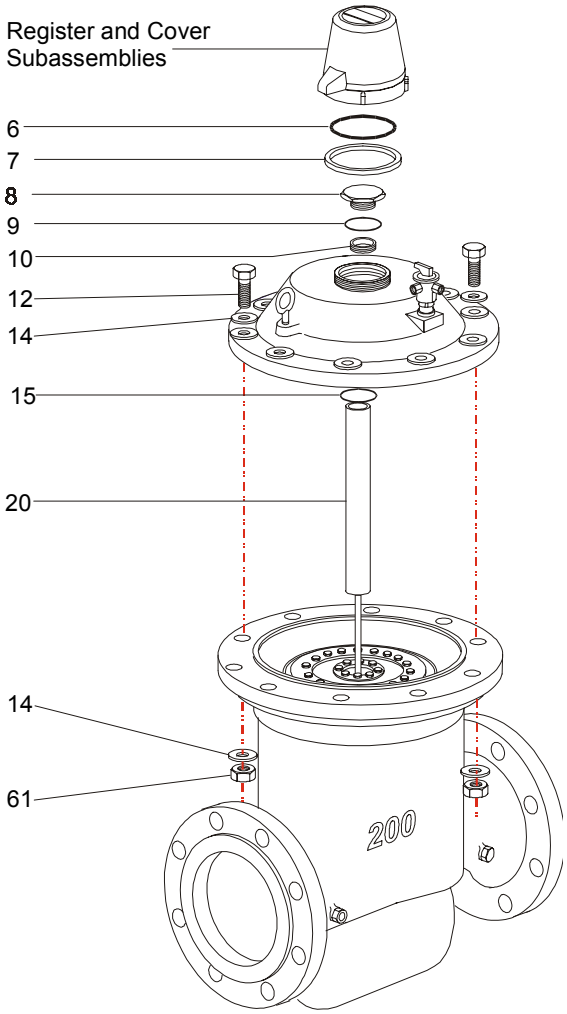
Disassembly

Remove the register assembly as detailed in **Section 0.**

Using a large box wrench, loosen and remove the upper bearing bolt (8).

Remove upper bearing O-ring (9). Inspect and replace as necessary.

Using a screwdriver or a special key, loosen the guide tube nut (10). It is not necessary to remove the nut.



Re-assembly

Re-tighten the guide tube nut (10).

Replace the upper bearing O-ring (9).

Replace and tighten the upper bearing bolt (8).

Replace the register assembly.

5.9.2. Hydrometer Cover

Disassembly

Loosen and remove the cover hex bolts (12) along with their nuts (61) and washers (14).

2. Attach a hoist cable or chain to the rings on the hydrometer cover (14). Use the hoist to lift the cover off of the hydrometer body. Be careful not to damage the impeller shaft.

3. Lift out the guide tube (20). Inspect and replace as necessary.

4. Inspect the cover O-ring (15) and replace as necessary. The O-ring is located on the underside of the cover in the upper opening.

Re-assembly

1. Replace the guide tube (20) over the impeller shaft.

2. Replace the hydrometer cover (24) onto the body.

3. Replace the cover hex bolts (12) along with their washers (14) and nuts (61). Tighten the nuts.

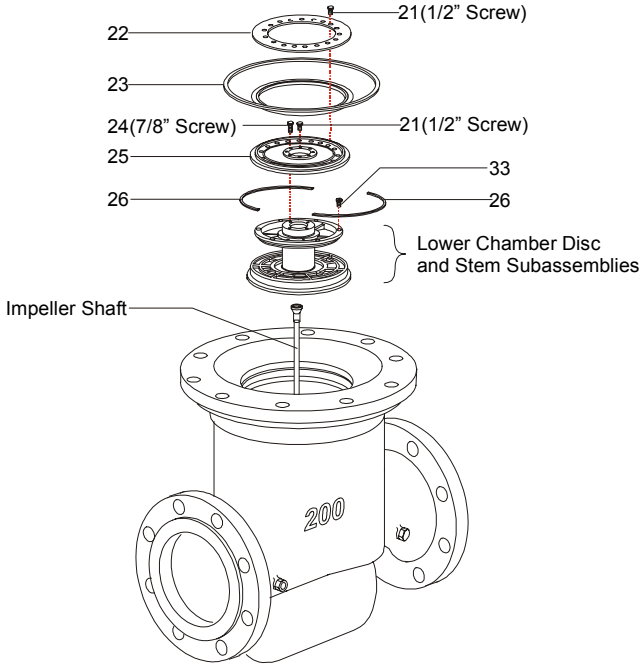
5.9.3. Diaphragm Subassembly

Removal of Diaphragm Assembly

Remove all eight screws from the inner circle of screws on the lower diaphragm disc (25). Four of the screws are ½" in length (21) and four are ⅞" in length (24).

Insert the four ⅞" screws (24) into the holes from which you removed the four ½" (21) screws and tighten. This will lift the entire diaphragm subassembly off of the stem subassembly. Pull the diaphragm subassembly up and remove it from the hydrometer body.

Inspect the diaphragm (23) for cracks or excessive wear. Continue with the following steps to replace the diaphragm only if necessary.



Diaphragm Disassembly and Re-assembly

1. Remove the sixteen ½" screws (21) from the upper diaphragm ring (22).

2. Lift the upper diaphragm ring (22) off of the diaphragm (23).

3. Lift the diaphragm (23) off of the lower diaphragm disc (25).

4. Place the replacement diaphragm (23) onto the lower diaphragm disc (25). Place the upper diaphragm ring (22) over the diaphragm.

5. Replace and tighten the ½" screws (21) into the upper diaphragm ring.

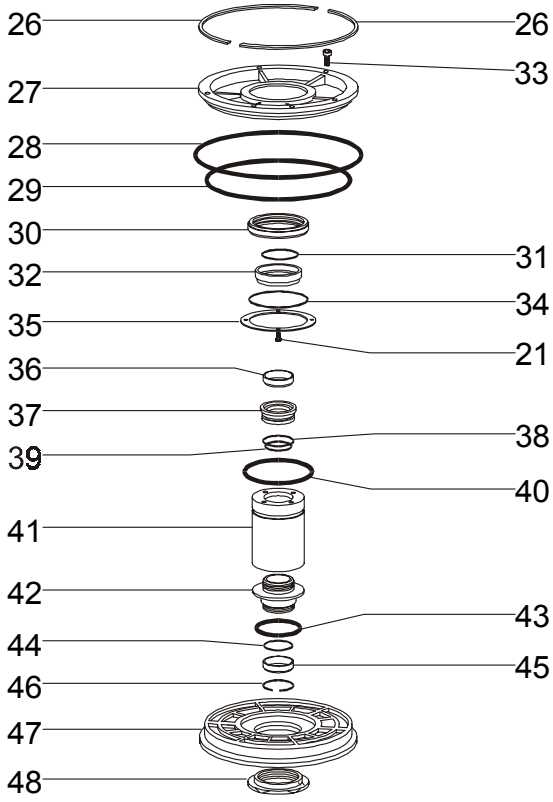
Diaphragm Re-assembly and Replacement in the Body

1. Perform the preceding steps in the reverse order to reassemble the diaphragm assembly.

2. Replace and tighten the four ½" screws (21) and the four ⅞" screws (24) into the lower diaphragm disc (25).

3. Place the diaphragm assembly over the impeller shaft onto the lower chamber disc and stem assemblies.

5.9.4. Lower Chamber Disc Subassembly



Disassembly

The following steps are performed following removal of the diaphragm subassembly as described in **Section 0**

Remove the six 6 mm screws (33) from the top of the lower chamber disc (27).

Remove the two lower chamber disc locking rings (26).

Temporarily replace the diaphragm subassembly onto the lower chamber disc (27).

Insert and tighten the four ⅞" screws (24) into the lower diaphragm disc (innermost ring) on the diaphragm subassembly, temporarily re-attaching it to the stem.

Pull upward and lift to remove the diaphragm subassembly, together with the lower chamber disc and stem subassemblies, from the hydrometer body.

6. Remove, once again, the four ⅞" screws (24) and pull the diaphragm subassembly up from the stem.

7. Lift the lower chamber disc (27) off of the stem (41).

8. Inspect the two lower chamber O-rings (28) and (29) on outside of the lower chamber disc (27). Replace as necessary.

9. Remove the four ½" inch screws (21) that fasten the lower chamber ring (35) to bottom of the lower chamber disc (27) and remove the lower chamber ring.

10. Inspect the lower chamber bearing wiper (32). Replace as necessary.

11. Remove the lower chamber bearing (30) from inside the lower chamber disc (27). Inspect and replace as necessary.

12. Inspect the lower chamber bearing O-rings (31 and 34). Replace as necessary.

Re-assembly

1. Replace the lower chamber bearing (30) into the lower chamber disc.

2. Replace the lower chamber bearing ring (35) onto the lower chamber disc. Insert and tighten the four ½" screws (21).

3. Perform the rest of the above steps in the reverse order.

5.9.5. Stem Subassembly and Valve Cover

Follow this procedure **only** if it is necessary to replace the stem bearings or the valve cover. Otherwise, skip this section.

Disassembly and Re-assembly

Inspect the upper stem bearing wiper (36). Replace as necessary.

Remove the upper stem bearing (37) from the stem (41).

Inspect the upper stem bearing O-rings (38,39). Replace as necessary.

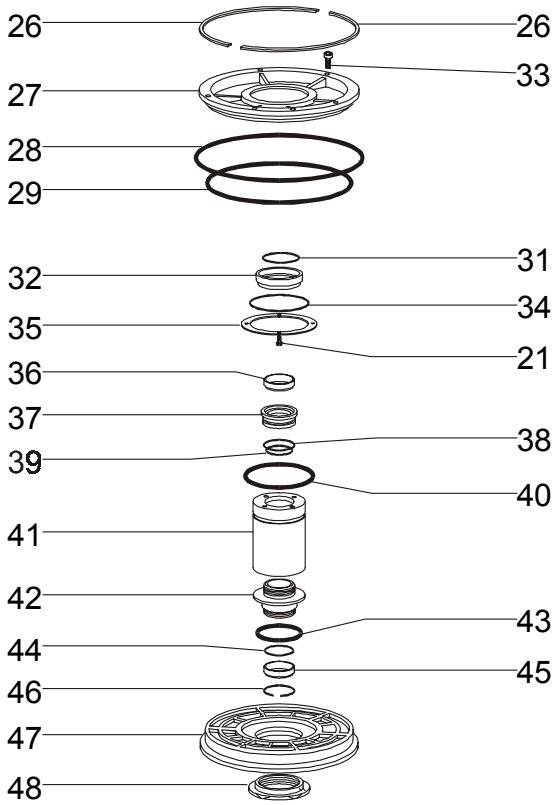
Unscrew and remove the stem locking nut (48), located at the bottom of the stem subassembly.

Remove the valve cover (47) from the stem. Inspect the rubber for cracks and excessive wear. Replace as necessary.

Inspect the valve cover O-ring (43) and replace as necessary.

Remove the retaining ring (46) that holds the lower stem bearing wiper (45) in place. Inspect the lower stem bearing wiper (45) and replace as necessary.

Inspect the lower stem bearing O-ring (44) and replace as necessary.



9. Inspect the lower stem bearing (42) for scratches or wear. Replace as necessary.

10. Apply Loctite 270 or similar glue to the threads of the lower stem bearing and screw it into the stem assembly (41).

11. Replace the valve cover (47) onto the stem assembly.

12. Apply Loctite 270 or similar glue to the threads of the stem locking nut (48) and screw into the stem assembly.

13. Push the upper stem bearing (37) onto the stem assembly.

5.9.6. Impeller and Flow Tube Assemblies.

Disassembly

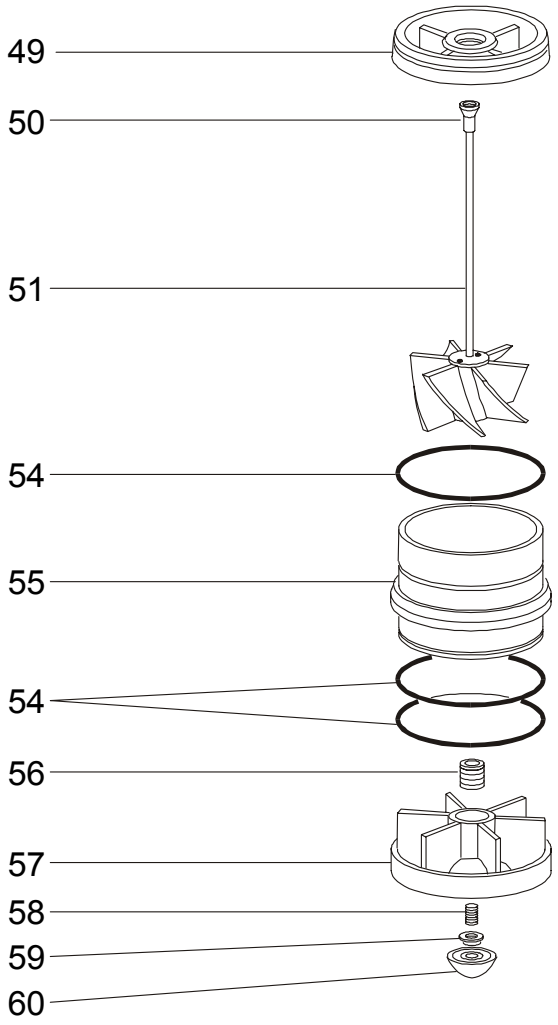
Remove valve seat base (49) from atop the flow tube (55). Be careful not to damage the impeller shaft. Inspect the valve seat base for excessive wear and replace as necessary.

Remove the impeller (50). Inspect for cracks or excessive wear and check that the impeller shaft is perfectly straight. Replace if necessary.

Remove the flow tube (55). Inspect and replace as necessary.

Inspect the upper and lower flow tube O-rings (54) and replace as necessary.

Remove the inlet spider (57) assembly. Inspect and repair as necessary.



Re-assembly

Replace the inlet spider assembly (57) into the hydrometer body.

Place the two lower flow tube O-rings (54) onto the flow tube (55).

Place the upper flow tube O-ring (54) into the valve seat base (49).

Replace the flow tube (55) atop the inlet spider assembly (57) in the hydrometer body.

5. Replace the impeller assembly (51) into the flow tube (55) so that the impeller shaft rests in the lower bearing bushing (56).

6. Place the valve seat base (49) over the impeller shaft so that it rests atop the flow tube (55).

5.9.7. Inlet Spider

Disassembly

Unscrew and remove the cap (60). Inspect and replace as necessary.

Remove the lock nut (59).

Unscrew and remove the lower bearing screw (58) from the inlet spider (57). Inspect and replace as necessary

Inspect the inlet spider (57) and the lower bearing bushing (56) and replace as necessary.

Re-assembly

Screw the upper bearing bushing (56) back into the top of the inlet spider (57).

Replace the lower bearing screw (58) into bottom of the inlet spider. Tighten approximately eight turns.

Replace the lock nut (59) and the cap (60).