AMI

Water Separator Manual
Liquid Rejection Probe

AMI, Inc. Costa Mesa, CA

Contents

Preface

The AMI story

AMI was formed by a group of analyzer professionals with over forty years of experience between them. The company is dedicated to providing the very best and most cost effective solutions to the oxygen analysis problem with a range of analyzers.

Every effort is made to ensure that AMI products provide reliable, effective performance. However there are many pitfalls in achieving correct oxygen analysis, particularly at low ppm levels, and AMI stands ready to provide a complete solution to the analysis problem, from sample system design to on-site troubleshooting and problem analysis. Please feel free to call AMI for help should your results not meet your expectations.

Caution

Read and understand this manual fully before attempting to use the instrument. In particular understand the hazards associated with using flammable or poisonous gases, and associated with the contents of the sensor used.

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The Water Separator

Introduction

Figure 1. Standard Separator

Figure 2. Separator with regulator option

The Advanced Micro Instrument Water Separator provides an effective means of preventing two of the most common mishaps when analyzers are used on natural gas pipelines. The first one is the common occurrence of water slugs that tend to flood the analyzer sample paths, ruining both them and also any sample conditioning components also being used such as regulators, needle valves etc.; and the second being the failure of the upstream compressor causing the downstream compressor to pull a vacuum on the line, thus pulling air from the analyzer exhaust through the analyzer, ruining the sensor and possibly drawing glycol from a back-diffusion trap through the analyzer.

The Water Separator contains in one easily serviced device a water trap and a very low pressure differential reverse-flow check valve. It is designed to be mounted directly onto a ½" nipple and can optionally provide a built-in regulator for high pressure applications.

Features:

- Compact size
- Unique integrated water trap and check valve
- Water drains back into pipeline – no bypass required
- Optional integral regulator

- Low and high pressure options
- Easily serviced

Instrument Warranty:

Any failure of material or workmanship will be repaired free of charge for a period of two years from the original purchase (shipping date) of the instrument. AMI will also pay for one way shipment (back to the user).

Any indication of abuse or tampering will void the warranty.

Operation

Receiving the Water Separator:

When you receive the instrument, check the package for evidence of damage and if any is found, contact the shipper.

Theory of Operation:

The Water Separator consists of two major functional sections, the water separation section and the reverse flow check valve. Physically it is made of three major parts, a base, the center section and a cap, and the two diaphragm sets and O rings that allow it to work.

Water Separation section:

The separator makes use of the well-known fact that certain materials allow gases and vapors to pass with virtually no obstruction, but which require significant pressure for water to penetrate. A typical material will require about 5psi of pressure before water will go through it. A diaphragm of this material is laid on top of a metal diaphragm that has holes everywhere except at its center, and if water is present, deflects so that its center shuts off the flow through a central orifice in the metal block. If water is not present, or only partially present, gas can flow through the material without deflecting the metal diaphragm. The springiness of the metal diaphragm will allow flow to resume once the water has gone away as long as the pressure differential – essentially the pipeline pressure – is less than a certain maximum amount dependent on the diaphragm stiffness. In the case of the low pressure option this is about 80psig.
Once the water slug has left the pipeline, water will drain out of the cavity under the diaphragm back into the pipeline and flow will resume. Note that no water is released locally, and no bypass flow is required.
The plastic separation material will also act as a filter, and can get clogged by excessive loading, oils etc. If so it can readily be replaced, so long as a suitable ball valve has been installed so that you can take the separator off the pipeline while the latter is in service.

Check valve section:

The check valve is provided by another metal diaphragm that acts as a very sensitive and fast responding check valve.

Regulator option:

A surface mount NeSSI compliant regulator may be mounted on the top of the separator. NeSSI is a new international standard for sample system components that essentially allows for modular devices that mount to a common footprint, thus obviating the need for fittings, plumbing etc. This option is provided for high pressure lines, though for low pressure lines the same footprint could be used with a NeSSI compliant needle valve if preferred.

Location:

The Water Separator is designed to be mounted on a ½" nipple vertically above a pipeline. The nipple should include a ball or gate valve so that the separator can be removed for servicing should its diaphragm be clogged. It is important that the nipple be vertical so that any water can drop back into the pipeline. If the area is liable to freeze, it should be placed under an insulating shroud so that the pipeline heat keeps it from doing so.

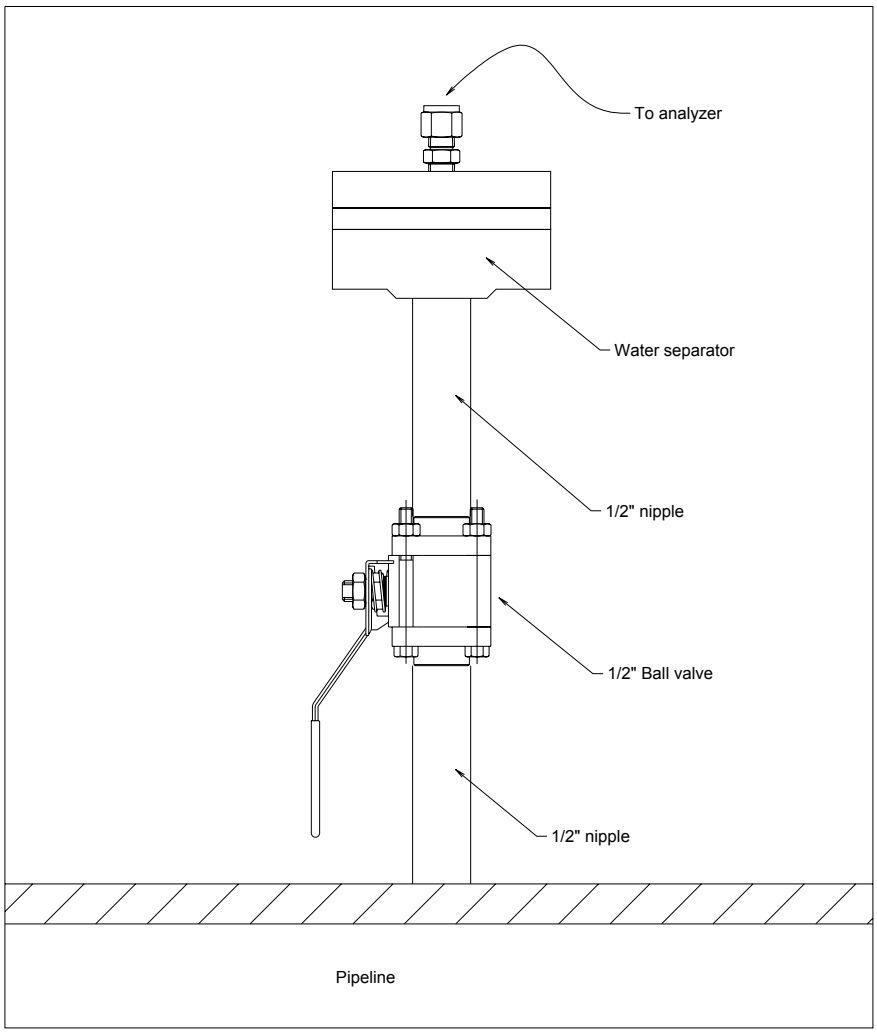

Figure 3. Typical mounting

Safety Considerations:

The maximum pressure the device can take is 1000psi, with a safety factor of 6 times by design. However the separator won't release if used above its pressure rating. The low pressure unit will release below about 300 psig, the high pressure unit below about 500 psig.

Maintenance

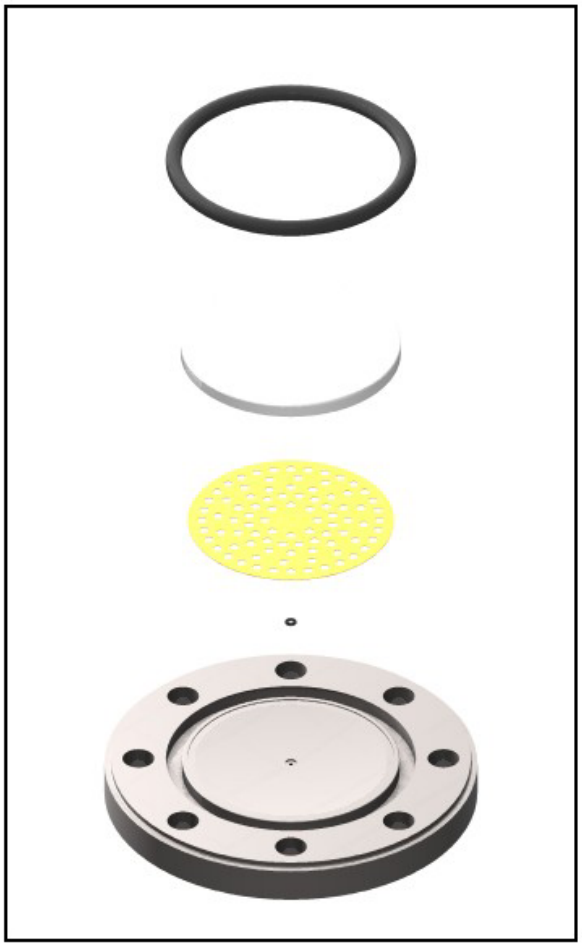

Fig 4. Exploded view of diaphragm assembly

Replacing the diaphragm:

The separation diaphragm can become clogged and if so will have to be replaced. The following operation is rather fiddly, and you may prefer to keep a replacement on hand and send a clogged unit back to AMI for rebuilding.

1. Close the ball valve thus isolating the separator from the pipeline.
2. Unscrew any fittings or tubing attached to the separator.
3. Unscrew the separator from the pipeline nipple.

4. Turn it over, and use a 3/16 Allen key to unscrew all eight socket head cap screws that hold the whole thing together.
5. Lift off the base section (the top one now that you have it upside-down).
6. Dig out the O ring holding down the (originally white) separation membrane.
7. Remove the membrane and discard it.
8. Remove the metal diaphragm, and check that the little O ring under it looks OK. If not replace it.
9. Examine the metal diaphragm. If it is corroded replace it with the appropriate replacement. Make sure it is lying in its little cavity correctly.
10. Place a new membrane on top of the diaphragm so that its edges go into the O ring slot.
11. Place a new O ring into the O ring slot, and press it down all round, making sure that you don't jog the diaphragm out of place while doing so.
12. Put the base back onto the assembly, making sure that the shallower holes align with the screw threads in the center section. The deeper holes align with the through holes in the center section.
13. Screw the center section onto the base using the screws you took out originally. Don't screw into the cap at this point.
14. See if the two lower parts will now lift off the cap. When they won't, unscrew those screws and put them into the holes that mate with the center section per step 11 above (I always mess this up, and no doubt you will too the first time).
15. Lift the whole lower section off the cap, and verify that the O rings in the cap, and the little O ring in the top of the center section look OK. Also verify that the check valve diaphragm looks OK. Replace anything that looks corroded or perished.
16. Reassemble the top end, carefully making sure that the check valve diaphragm is sitting in its little cavity correctly.
17. Screw the top back onto the lower sections.
18. Make sure all the screws are tight.
19. Put some more pipe dope or Teflon tape onto the nipple threads, and screw the separator back onto it.
20. Attach any fittings or tubing you removed.
21. Open the valve.
22. Leak check everything!