

 **A.R.I. D-46**

## Combination Air Valve

The following is a step-by-step narrated description of the A.R.I. D-46 combination air valve installation, operation and maintenance processes.

A.R.I. D-46 air valve has the features of both an Automatic Air Release valve and an Air & Vacuum valve. The Air Release component is designed to automatically release small pockets of air to the atmosphere as they accumulate along a pipeline or piping system when it is full and operating under pressure. The Air & Vacuum component is designed to automatically discharge or admit large volumes of air during the filling or draining of a pipeline or piping system. This valve will open to relieve negative pressures whenever water column separation occurs.



## Table of contents

<b>1. Safety Instructions</b> .....	<b>4</b>
Safety Instructions - General.....	4
Safety Instructions - Handling .....	4
Safety Instructions - Installation .....	4
Safety Instructions - Commissioning and Operation .....	5
Safety Instructions - Maintenance .....	5
Safety Instructions - Before returning to regular operation.....	5
<b>2. Installation</b> .....	<b>6</b>
2.1 Installation Recommendations.....	6
2.2 Conventions and Measurements .....	7
2.3 Installation Instructions.....	8
2.4 Directions for Discharge Outlet .....	8
<b>3. Operation</b> .....	<b>9</b>
<b>4. Periodic Maintenance</b> .....	<b>10</b>
4.1 Preparation.....	10
4.2 Maintaining the Metal Air valve (2" model - Metallic).....	11
4.3 Assembly BOM Table and Drawing – D-46 2" .....	12
4.4 Maintaining the Air valve (3", 4", 6" model).....	13
4.7 Assembly BOM Table and Drawing – D-46 3" & 4" .....	14
4.8 Assembly BOM Table and Drawing – D-46 6" .....	15
<b>5. Troubleshooting</b> .....	<b>16</b>

### Disclaimer

This document is an Installation, Operation and Maintenance (IOM) manual for Aquestia Ltd. The information enclosed herein contains restricted, privileged, proprietary and confidential information, intended only for usage by authorized Aquestia technicians. If you are not a qualified technician, you must not take any action in reliance upon this document, unless otherwise permitted in writing by Aquestia

Aquestia has made every effort to ensure that this document is accurate; Aquestia disclaims liability for any inaccuracies or omissions that may have occurred.

All the procedures, drawings, pictures and/or any other information provided in this document are presented as general information only; they can be altered, removed or changed without Aquestia's prior written approval. Aquestia makes no commitment to update or keep the information in this document current and/or up-to-date, and reserves the right to make improvements, alterations and/or modifications to this document and/or to the products described in this document, at any time without providing any notice with respect thereto. Nothing in this Disclaimer derogates in any way whatsoever from the confidential nature of any document enclosed hereto, including for avoidance of doubt, any mistake or clerical error or other error. None of the procedures provided in this Disclaimer and/or in any document enclosed hereto may be used in any form or by any means without the prior written consent from Aquestia. If you received this Disclaimer and/or in any document enclosed hereto in error or by mistake or if this Disclaimer and/or in any document enclosed hereto is not intended for you, please notify Aquestia in writing immediately.

Aquestia assumes that all users understand the risks involved within this Disclaimer and/or in any document enclosed hereto. Aquestia accepts/assumes no liability whatsoever, whether caused by: accessing and/or relying upon this Disclaimer and/or in any document enclosed hereto including without limitation any links, procedures or materials.

shall NOT assume any liability for any costs, direct or indirect, including loss of income, loss of profits and/or goodwill, legal actions and/or damages of any kind whatsoever including any, damages accidents, equipment damage or bodily injury resulting from and/or related to any of the following:

- product has not been duly installed and thereafter maintained in strict compliance with its designated Maintenance Instructions and/or any other installation and operation manuals provided by Aquestia for the product and/or applicable ordinances and/or codes;
- Repairs made in and to the products by personnel not authorized by Aquestia
- Maintenance or repairs using parts or components other than those specified by Aquestia and in their original condition.
- Operating the products in ways other than the operating procedures described in the manuals provided by Aquestia, or resulting from not following the cautionary remarks and warnings in the product manual.
- Improper storage, workplace conditions and environmental conditions which do not conform to those stated in the Product manual.
- Fires, earthquakes, floods, lightning, natural disasters, or acts of God.

Aquestia does not warrant and hereby disclaims any express or implied warranties that the product will work properly in environments and applications other than its original design purpose, and makes no warranty and representation, either implied or expressed, with respect to the quality, performance, merchantability, or fitness for any other particular purpose. Except as provided herein and to the full extent permitted by law, Aquestia shall not be responsible and/or liable for direct, special, incidental or consequential damages or loss resulting from any breach of the above or under any other legal theory.

This document does not replace any certified drawing, procedure or information provided by Aquestia in reference to a specific customer, site or project. All rights reserved.

## 1. Safety Instructions

### Safety Instructions - General

1. Aquestia products always operate as components in a larger system. It is essential for the system designers, installers, operators and maintenance personnel to comply with all the relevant safety standards.
2. Installation, operation or maintenance of the product should be done only by qualified workers, technicians and/or contractors using only good engineering practices, complying with and observing all conventional safety instructions in order to minimize risk and/or danger and/or hazard to workers, the public or to property in the vicinity in accordance with all relevant local standards.
3. Extra safety considerations should be taken with hot and hazardous liquids or in hazardous environments' applications to avoid bodily/physical harm and damage to public or private property.
4. All individuals installing operating and/or handling the products including all workers should at all times adhere to the occupational safety and health (OSH) instructions and wear safety helmets, goggles, gloves, and any other personal safety equipment required by the local standards and regulations.
5. Use only appropriate standard tools and equipment operated by qualified operators when installing, operating and maintaining the product.
6. Prior to installation, operation, maintenance or any other type of action carried out on the product, read carefully the safety, installation and operation instructions of the product.
7. Please note:
  - Pressurized fluid and/or gas may be discharged from the product without prior warning. Make sure that the product's outlet port is not directed toward electrical elements (pumps) or people.
  - The pressurized fluid and/or gas that can be discharged from the product may create high noise levels. Take this into consideration when installing the product in areas sensitive to noise.
8. Always open and close valves slowly and gradually.
9. Please note that the maximum working pressure indicated at the product's specifications table doesn't include pressure changes caused by water hammer and pressure surge effects. Use the product only according to its designated pressure rate specifications.
10. Use the product only for its intended use as designed by Aquestia. Any misuse of the product may lead to undesired damages and may affect your warranty coverage. Please consult with Aquestia prior to any non-regular use of this product and make no change or modification to the product without a prior written consent to be provided by Aquestia at Aquestia's sole discretion.
11. Please note that Aquestia shall **NOT** assume any liability with respect to any damage losses and/or expenses caused to any person and/or property whatsoever unless the product has been duly installed and thereafter maintained in strict compliance with its designated maintenance Instructions and/or any other installation and operation manuals provided by Aquestia for the product and/or applicable ordinances and/or codes.

### Safety Instructions - Handling

1. Shipping and handling the product must be done in a safe and stable manner and in accordance with the relevant standards and regulations.
2. Storage should be in the original delivery crates or cases. Storage should be off the ground in a clean, dry indoor area.
3. For lifting and positioning the product, use only approved lifting equipment operated by authorized employees and contractors.
4. Prior to the installation visually verify that the product was not damaged during shipment to the installation site.

### Safety Instructions - Installation

1. Install the product according to the detailed Installation Instructions provided with it by Aquestia and according to the description given in this manual.
2. The user should install a manual Isolation Valve under the product's inlet port.
3. In all installation sites, the user should enable good visibility and verify that the work and auxiliary equipment used are done in accordance with the relevant local authorized standards. Extra safety considerations should be taken on hazardous environment sites.
4. Check and re-tighten the bolts connecting the product to the pipeline during commissioning and before operating the product for the first time.

## Safety Instructions - Commissioning and Operation

1. Read carefully the operation instructions prior to any attempt to operate the product.
2. Observe the safety stickers on the product and never perform any operation contradicting the instructions given.
3. In order to achieve maximum performance and smooth operation of the product, it is crucial to perform the startup and first operation procedures exactly as described in this manual.
4. In cases where formal commissioning procedure is required, it should be done by an authorized Aquestia technician prior to the first operation of the product.

## Safety Instructions - Maintenance

Before any maintenance or non-regular operation, please read the following:

1. Servicing the product should be done only by qualified technicians for this type of work.
2. Make sure that you know the exact type of the system fluid. Act accordingly and comply with all the relevant standards and regulations set for handling this type of fluid.
3. Before disconnecting the product from the system and before releasing the residual pressure do **NOT**:
  - loosen or unscrew the product bolts;
  - remove any protection cover;
  - open any service port.
4. Before any maintenance or non-regular operation, shut off the Isolation valve and release the residual pressure:
  - A. For air valves with a pressure release outlet, slowly open the pressure release plug or the ball valve and make sure that all pressure is released. Please note that some air release valves, especially the waste water models, may contain a significant volume of compressed gas with accumulated energy!
  - B. For air valves without a pressure release outlet, slowly unscrew the flange bolts until all the pressure is released from the valve.
5. Make sure the air valve is empty of all liquid prior to commencing maintenance.
6. Remove the product from the line only after ensuring that internal pressure has been released.
7. Place warning signs around the work area as required by the local standards and procedures.
8. Inspect the product's safety stickers and replace any damaged or faded sticker.
9. Manual cleaning of the product and/or its components using high water pressure or steam should be performed in accordance with its specific cleaning instructions, the local standards and regulations and without endangering the operator or the vicinity
10. Manual cleaning of product and/or its components using acid or other chemical agents should be performed in accordance with the specific cleaning instructions, the relevant safety instructions for using that chemical as given by its supplier, the local standards and regulations and without endangering the operator or his vicinity.
11. For products used in potable water systems, if it is required to disinfect the product, do so according to the local water authority standards and regulations before putting the product into service.

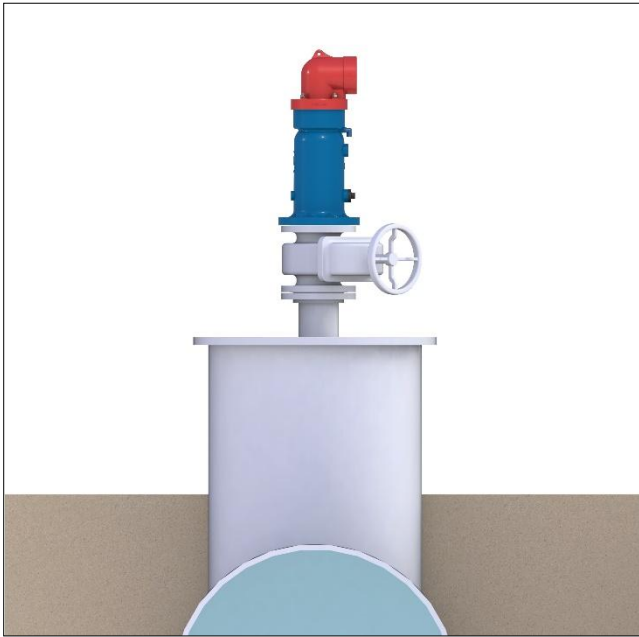
## Safety Instructions - Before returning to regular operation

1. Re-assemble any protection covers or protection mechanisms removed during service or maintenance operations.
2. Make sure that all the tools, ladders, lifting devices, etc. used during the maintenance procedures are taken away from the product area and stored.
3. Remove grease and fat material residues in order to avoid slipping.
4. In order to return the product to regular operation, follow the First Start-up Operation instructions as detailed in your user manual.

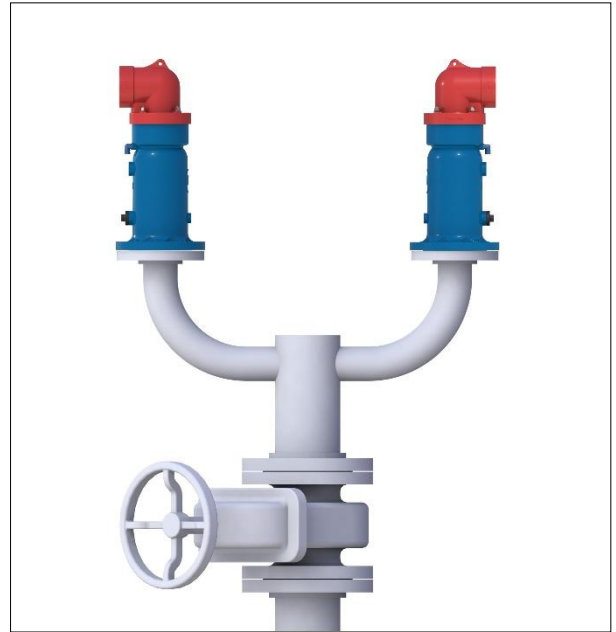
## 2. Installation

**Important:** Before performing any work on the air valve make sure that all workers on site are familiar with the safety instructions and the relevant local and general safety instructions and work regulations.

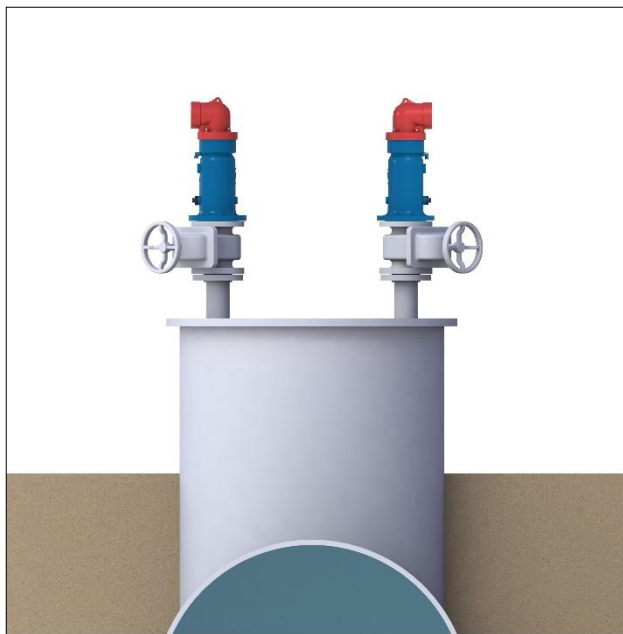
### 2.1. Installation Recommendations



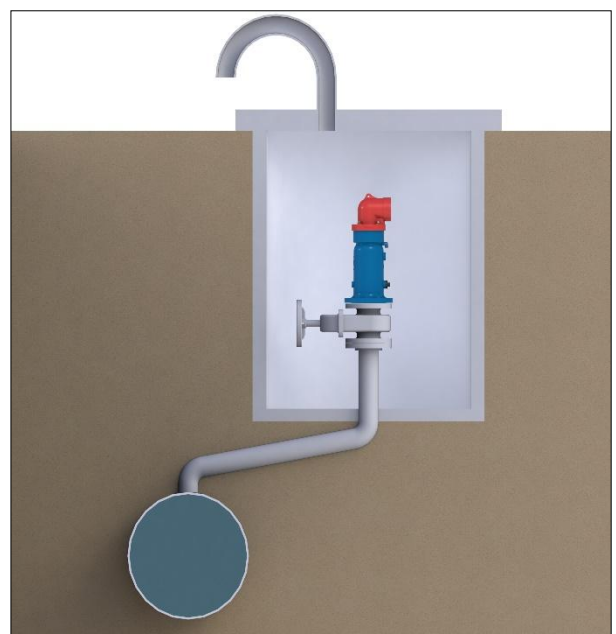
Single Air Valve on an Isolating Valve at 45° to Air Valve outlet



Two Air Valves on a shared Isolating Valve. Air Valves outlets face outward and the Isolating Valve at 45° to Air Valve outlets



Two Air Valves on an Air Trap with separate Isolating Valves. Air Valve outlets face outward and the Isolating Valves at 45° to Air Valve outlets



#### Underground Installations

- Underground installations require a venting pipe from the manhole
- Use an angular installation to bypass an obstacle directly above the pipeline.

## 2.2. Conventions and Measurements

This paragraph presents and explains the terms and measurements used for the Installation process.

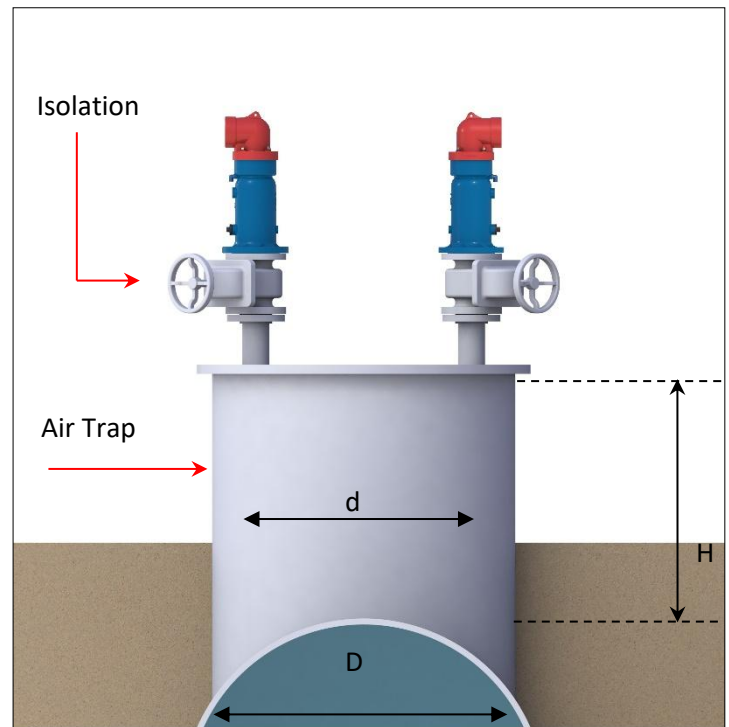
$D$  = Diameter of pipeline

$d$  = diameter of riser

$H$  = Height of riser on the pipeline

(Measured from crown of pipeline)

- For pipelines up to 12" (300mm) in diameter ( $D$ ), the Air Trap diameter ( $d$ ) should be the same as the pipeline diameter.
- For larger pipelines of up to 60" (1500mm) in diameter ( $D$ ), the Air Trap diameter ( $d$ ) should be 60% of the pipeline diameter.
- For larger than 60" (1500mm) pipelines ( $D$ ), the Air Trap diameter ( $d$ ) should be 35% of the pipeline diameter.
- The Air Trap length ( $H$ ) should allow easy access to the air valve from below and should be at least 6" (150mm).



## 2.3. Installation Instructions

1. Flush the system before installing the air valve to avoid any debris or sharp objects getting into the air valve.
2. Carefully remove the air valve from the shipping package. Unload all air valves carefully to a sturdy level surface taking care not to drop them.
3. Air valves fitted with hoist rings should only be lifted and conveyed using these hoist rings.
4. Install an isolating valve below the air valve, connected by a Riser to the crown of the pipe.
5. Mount the air valve carefully on the rubber gaskets of the isolating valve.
6. When installing the D46-2", 3", 4", make sure to use an M16 DIN433 flat washers, as the standard M16 DIN125 washers, do not fit between the bolt and the body.
7. Place washers on each of the bolts & nuts that connect the air valve flange to the isolating valve flange.
8. Tighten all the bolts and nuts using the crossover method.
9. The closure tightness of the bolts and nuts shall be according to the standard torque for their specific size.
10. Use ring wrench keys for the closing and opening of all bolts of the air valve (including the flange bolts).

## 2.4. Directions for Discharge Outlet

1. Recommended to leave the discharge outlet completely open and unhindered:
2. Avoid directing the discharge outlet opening in the direction of workers, bystanders or animals.
3. Avoid directing the discharge outlet opening in the direction of vulnerable equipment that can be damaged, such as electrical equipment, unstable structures, etc.

### 3. Operation

The Air & Vacuum component, with the large orifice, discharges air at high flow rates during the filling of the system, and admits air into the system, at high flow rates, during system's drainage and at water column separation. High velocity air does not blow the float shut. Water lifts the float which seals the valve.

At any time during system operation, if the internal pressure of the system falls below the atmospheric pressure, air enters the system.

The smooth discharge of air reduces pressure surges and other destructive phenomena.

The intake of air in response to negative pressure protects the system from destructive vacuum conditions, and prevents damage caused by water column separation. Air entry is essential to efficiently drain the system.

The automatic air release component releases entrapped air in pressurized systems.

As the system starts to fill, the valve functions according to the following stages:

1. Air in the pipeline is discharged by the valve.
2. Liquid enters the valve, lifting the float which pushes the sealing mechanism to its sealing position.
3. Entrapped air, which accumulates at peaks and along the system, rises to the top of the valve, which in turn displaces the liquid in the valve's body.
4. The float descends, unsealing the rolling seal. The air release orifice opens and the accumulated air is released.
5. Liquid enters the valve and the float rises, pushing the rolling seal back to its sealing position.

When the internal pressure falls below the atmospheric pressure (negative pressure):

1. The floats drop down, immediately opening the Air & Vacuum and the air release orifices.
2. Air enters the system.

## 4. Periodic Maintenance

Please note that the periodic maintenance of the air valve is an integral part of the proper pipeline maintenance regime; it should be maintained at least once a year in accordance with the quality and composition of the fluid in the system.

**Important:** Before performing any work on the air valve, make sure that all workers on site are familiar with the safety instructions as appear chapter of this document and with all the relevant local and general safety instructions, standards and work regulations.

### 4.1. Preparation

#### Releasing Pressure

Shut the isolating valve located on the riser under the air valve.

#### Option A:

- Using two combination spanners, partially unscrew the bolts connecting the air valve to the riser in order to release the pressure. Wait till the pressure is released.

#### Option B. – for air valves with Plug:

- Use a ratchet box wrench to gradually release the Plug of the pressure release port, wait till the pressure is released and then unscrew the Plug completely, remove it and drain the air valve.

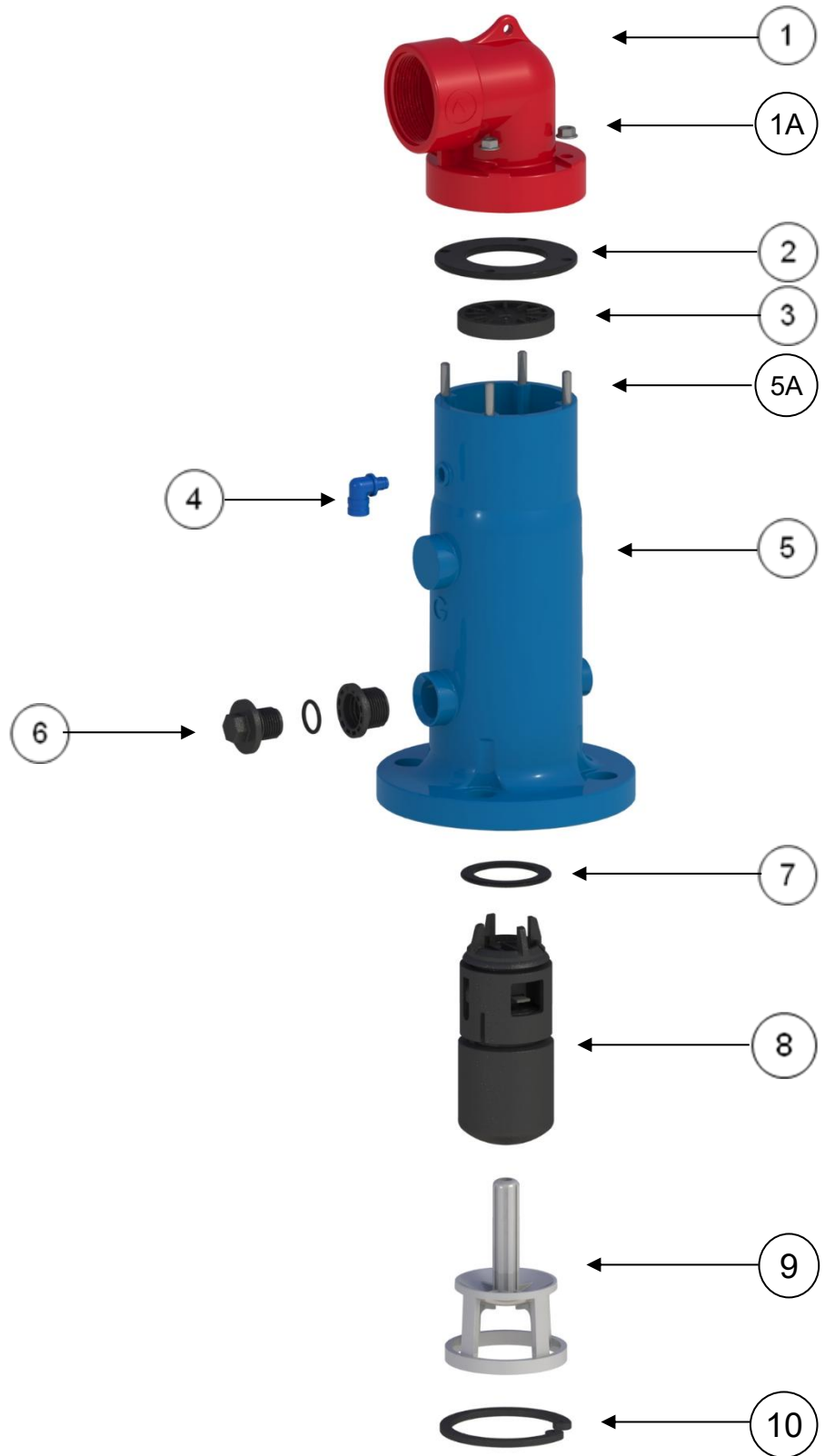
## 4.2. Maintaining the Air valve (2" model)

Refer to the BOM drawing on the next page.

1. Shut the isolating valve below the air valve.
2. Manually remove the Snap Ring (# 10) from the base of the air valve Body (# 5).
3. Remove the Float Seat (# 9) and the Air Release Assembly (#7+#8) by sliding it out from the air valve Body.
4. Wash the Air Release Assembly (# 8) thoroughly under clean running water.
5. Visually examine the Air & Vacuum Seal (#7) for cracks or tears. Remove and replace, if necessary.  
Manually verify the free and unhindered movement of the slots between the Upper and Lower Components of the Air Release Assembly (# 8). Clean any debris that might cause interference.
6. Manually unscrew the Discharge Outlet Nuts (# 1.A), remove the Discharge Outlet (# 1) and Seal (#2) from the air valve Body. Thoroughly wash the Discharge Outlet and the air valve Body (#5) under clean running water. Remove all debris from the Discharge Outlet screen.
7. \*\*Non-Slam version only: wash the Non-Slam Component (# 3) thoroughly under clean running water, Remove all debris.
8. Place the Seal (#2) and the Discharge Outlet (#1) on the Threaded Rods (# 5A) of the air valve Body and manually tighten the Nuts (# 1.A).
9. Slide the Air Release Assembly (#8) into the air valve body, Seal side (#7) first.
10. Insert the Float Seat (# 9) into the air valve Body (#5) and close with the Snap Ring (# 10).
11. Wash the flanged area of the Isolating Valve.
12. Make sure the flange gasket is intact and seated properly.
13. Bolt the D-46 Air Valve to the Isolating Valve by tightening the bolts and nuts using the crossover method. The closure tightness of the bolts and nuts shall be according to the standard torque for their specific size.
14. Slowly open the Isolating Valve. In the event of leakage or float disturbance, close and slowly reopen the isolating valve.

4.3. Assembly BOM Table and Drawing – D-46 2”

1	Discharge Elbow
1a	Nuts
2	Seal
3	Non-Slam Component (Optional)
4	Drain Outlet
5	Body
5a	Threaded Rods
6	Pressure Release Plug
7	Air & Vacuum Seal
8	Air Release / Air & Vacuum Assembly
9	Float Seat
10	Snap Ring



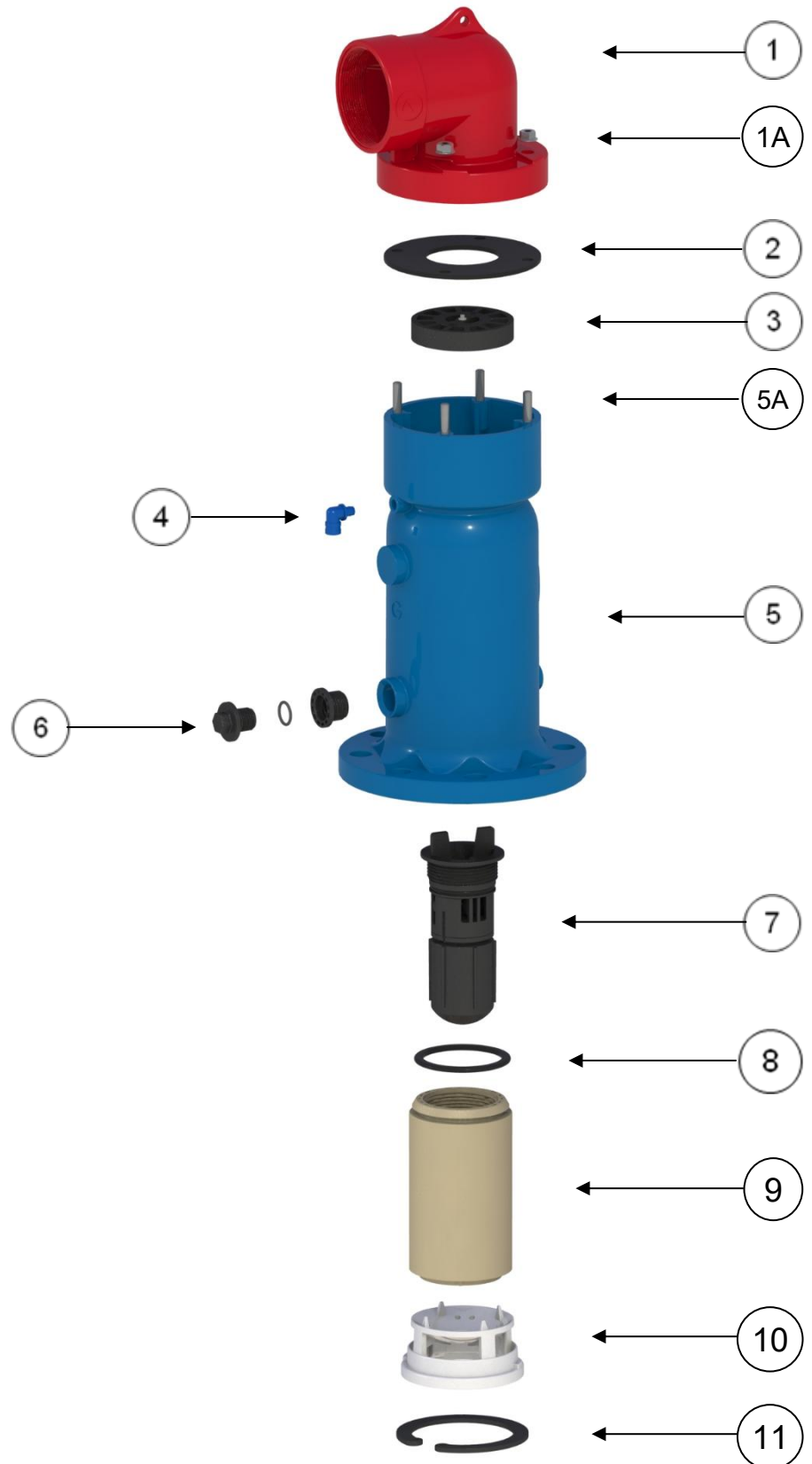
#### 4.4. Maintaining the Air valve (3", 4", 6" model)

Refer to the BOM drawing on the next pages.

1. Shut the isolating valve below the air valve.
2. Manually remove the Snap Ring (# 11) from the base of the air valve Body (# 5).
3. Remove the Float Seat (# 10) and the Float & Seal Assembly (# 7+8+9) by sliding it out from the air valve Body.
4. Unscrew the Air Release Assembly (# 7) from the Air & Vacuum Float (# 9).
5. Wash the Air Release Assembly (# 7) and the Air & Vacuum Float (# 9) thoroughly under clean running water.
6. Visually examine the Air & Vacuum Seal (# 8) for cracks or tears. Remove and replace, if necessary.  
Manually verify the free and unhindered movement of the slots between the Upper and Lower Components of the Air Release Assembly (# 7). Clean any debris that might cause interference.
7. Manually unscrew the Discharge Outlet Nuts (# 1.A), remove the Discharge Outlet (# 1) and the Seal (# 2) from the air valve Body. Thoroughly wash the Discharge Outlet and the air valve Body under clean running water. Remove all debris from the Discharge Outlet screen.
8. \*\*Non-Slam version only: wash the Non-Slam Component (# 3) thoroughly under clean running water, Remove all debris.
9. Place the Seal (#2) and the Discharge Outlet (#1) on the Threaded Rods (# 5A) of the air valve Body and manually tighten the Nuts (# 1.A).
10. Once clean, screw the Air Release Assembly (# 7) back to the Air and Vacuum Float (# 9).
11. Slide the Float and Seal Assembly (# 7+8+9) into the air valve body, Air & Vacuum Seal (#8) side first.
12. Insert the Float Seat (# 10) into the air valve Body and close with the Snap Ring (# 11).
13. Wash the flanged area of the Isolating Valve.
14. Make sure the flange gasket is intact and seated properly.
15. Bolt the D-46 Air Valve to the Isolating Valve by tightening the bolts and nuts using the crossover method. The closure tightness of the bolts and nuts shall be according to the standard torque for their specific size.
16. Slowly open the Isolating Valve. In the event of leakage or float disturbance, close and slowly reopen the isolating valve.

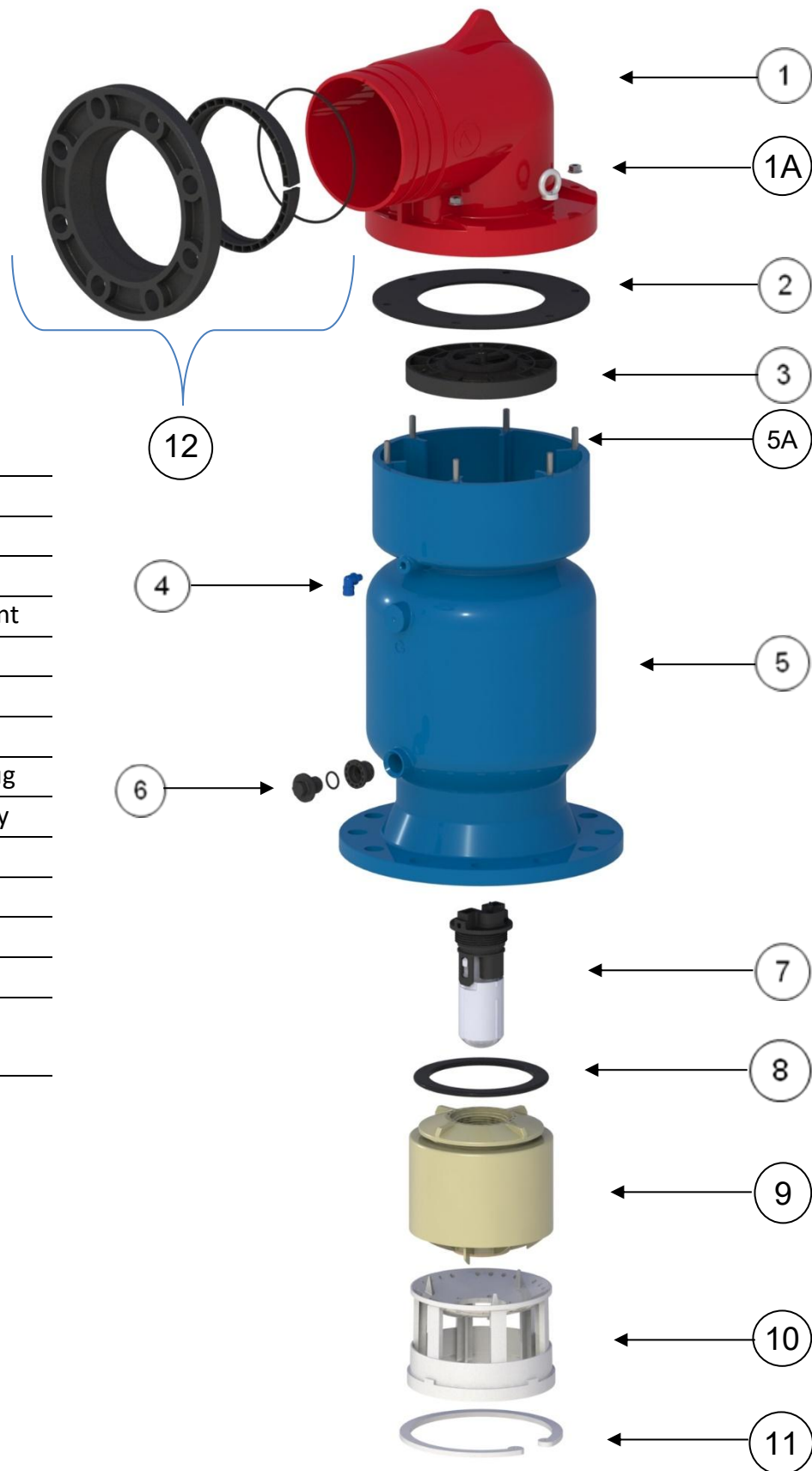
4.7. Assembly BOM Table and Drawing – D-46 3” & 4”

1	Discharge Elbow
1a	Nuts
2	Seal
3	Non-Slam Component (Optional)
4	Drain Outlet
5	Body
5a	Threaded Rods
6	Pressure Release Plug
7	Air Release Assembly
8	Air & Vacuum Seal
9	Air & Vacuum Float
10	Float Seat
11	Snap Ring



4.8. Assembly BOM Table and Drawing – D-46 6”

1	Discharge Elbow
1a	Nuts
2	Seal
3	Non-Slam Component
4	Drain Outlet
5	Body
5a	Threaded Rods
6	Pressure Release Plug
7	Air Release Assembly
8	Air & Vacuum Seal
9	Air & Vacuum Float
10	Float Seat
11	Snap Ring
12	Flange Assembly (optional)



## 5. Troubleshooting

Symptom	Possible Causes	Remedy
Leakage from the valve's outlet	A. Debris or scale buildup on the Rolling Seal. B. Debris caught between the Air & Vacuum Seal and the Body. C. Torn or cracked Rolling Seal and/or Air & Vacuum Seal	Perform periodic maintenance
Discharge Outlet Broken	Air valve was hit or mishandled	Unscrew and replace.
Drain Outlet Plugged	Debris caught in the outlet	Clean the outlet opening with a thin wire and clean running water or a burst of air.