HYDRO
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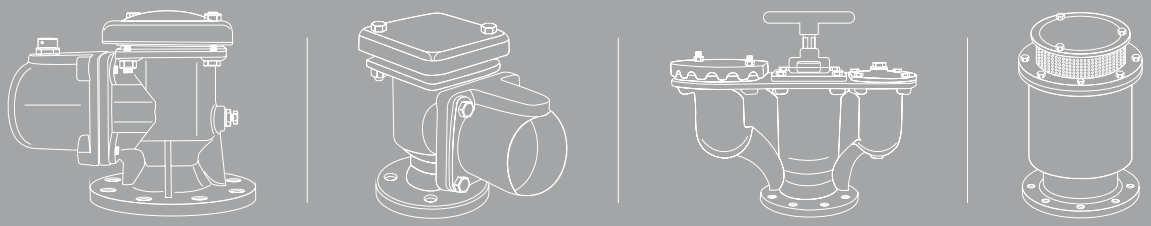

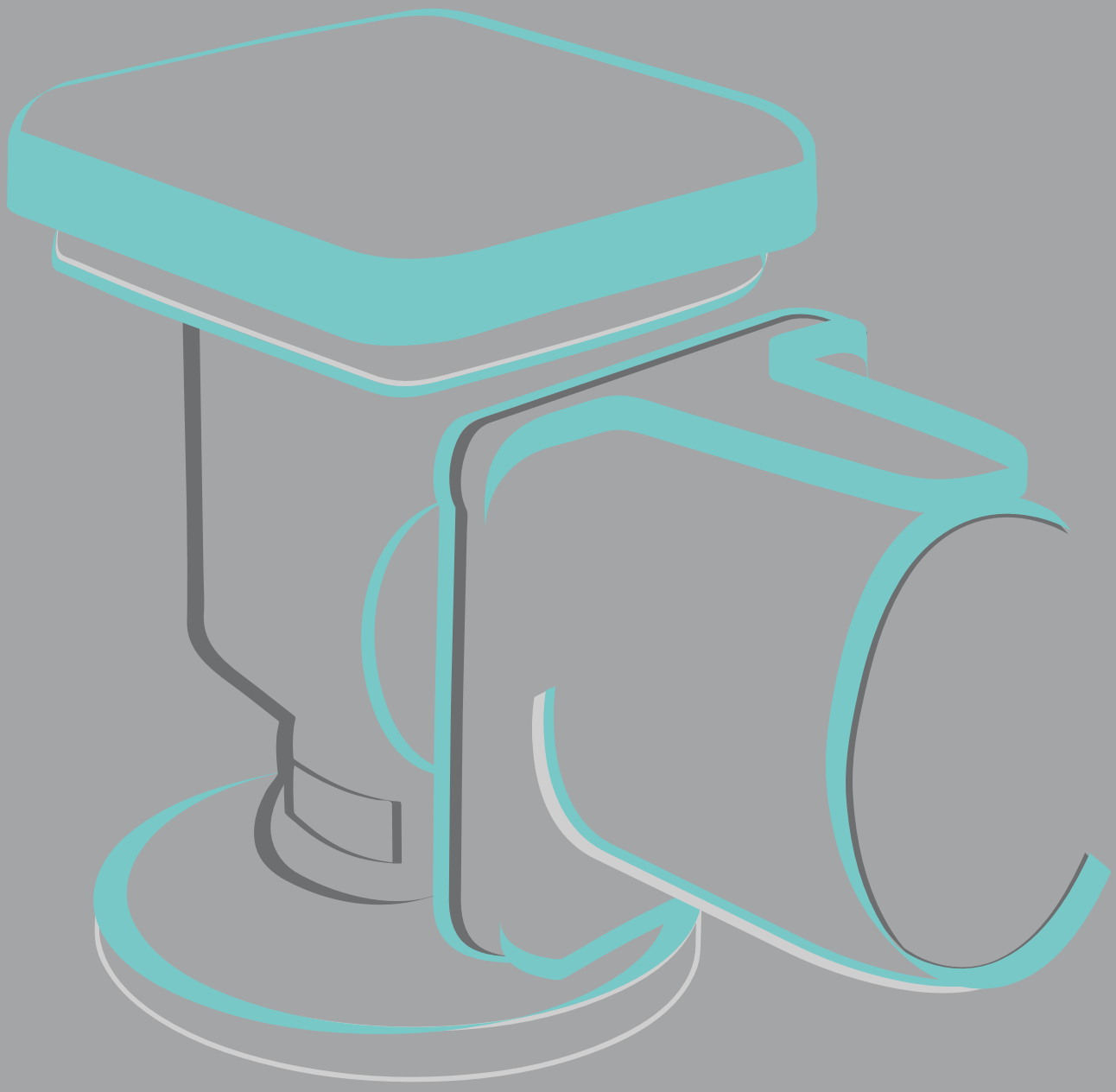

AIR RELIEF VALVES

AIR RELIEF VALVES

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CONTENTS

AIR RELIEF VALVES

Air relief valves are essential equipments for water distribution lines and networks to protect pipelines and increase their efficiency. Various types are available depending on their features and functions.

Intended Use of Valves

1. Ensuring low-pressure and high-capacity air release while filling pipeline with water
2. Ensuring high-pressure and low-capacity air release while filling and/or operating the pipeline
3. Protection against vacuum formation by taking air into the pipeline during discharging
4. Providing non-impact shutdown of the float and continuance of air release from small orifice while filling pipe line with water at an unregulated high-speed

In cases where first and second functions cannot be ensured, water flow can be blocked or limited causing inefficiency in pipelines.

In cases where third function cannot be ensured, vacuum can occur in pipeline. This may cause pipe shrinkage or collapse and damages on mechanical components on the line. In order to avoid vacuum, not only air relief valve but also other equipment, such as impact valve and air chamber should also be used in pipeline as well. In cases where fourth function cannot be ensured, air relief valve throttle sharply and float causes an impact.

Cases Necessitating the Use of Air Relief Valves

- Air relief valves prevent vacuum formation while discharging/emptying the pipeline ensures safety.
- Compressed air pockets act like a semi-closed valve by limiting effective water flow and reducing the system's hydraulic conductivity. In some special cases they may block the flow. Air relief valves prevent this probability.
- Air relief valves prevent high-pressure fluctuations.
- Compressed air in pipe increases the corrosion of steel pipes.
- Compressed air gaps cause a drop in efficiency of pump station, which results in higher energy costs.
- Air relief valves prevents damage to the measuring instruments in water.
- Cavitation and its adverse effects are prevented by air relief valves.
- Air relief valves protect pipeline and mechanical devices by helping to decrease the effect of water hammer.

Air relief valves are classified according to the functions mentioned above. There are the types which can apply one function or all four of the above. Air relief valves are entitled as single orifice (chamber) or dual orifice (chamber) according to their construction.

SMS Air relief valves in accordance with their features and functions are:

- Single Orifice/Single Function Air Relief Valve
- Single Orifice/Double Function Air Relief Valve
- Double Orifice/Triple Function (Kinetic Type) Air Relief Valve
- Single Orifice/Quadruple Function Air Relief Valve (Non-Impact/Antishock/Dynamic Air Relief Valve)

SINGLE ORIFICE / SINGLE FUNCTION AIR RELIEF VALVE

Single orifice/single function air relief valves are used to release air with low flow rate, trapped in the saddles of water-filled pipeline. They may either be used on necessary points of the pipeline or in positive suction pressure pump stations to play an important role in releasing air trapped in pump (Figure 1).

They are manufactured as threaded joints in R(1□□; 1 1/4□□; 1 1/2□□; 2□□) mounting dimensions. During their connection to the pipeline, an isolation valve with appropriate size should be used. Isolation valve is necessary for maintenance, repair and replacement of the air valve under operation. The mounting of this type can be done in two ways as shown in Figure 1.

Ball float that is hinged to the cap of the valve moves upward and downward with the water level in pipeline; floating movement closes the valve or provides air release. To ensure longevity of parts in water, corrosion resistant materials, such as bronze, ABS, rubber are preferred.

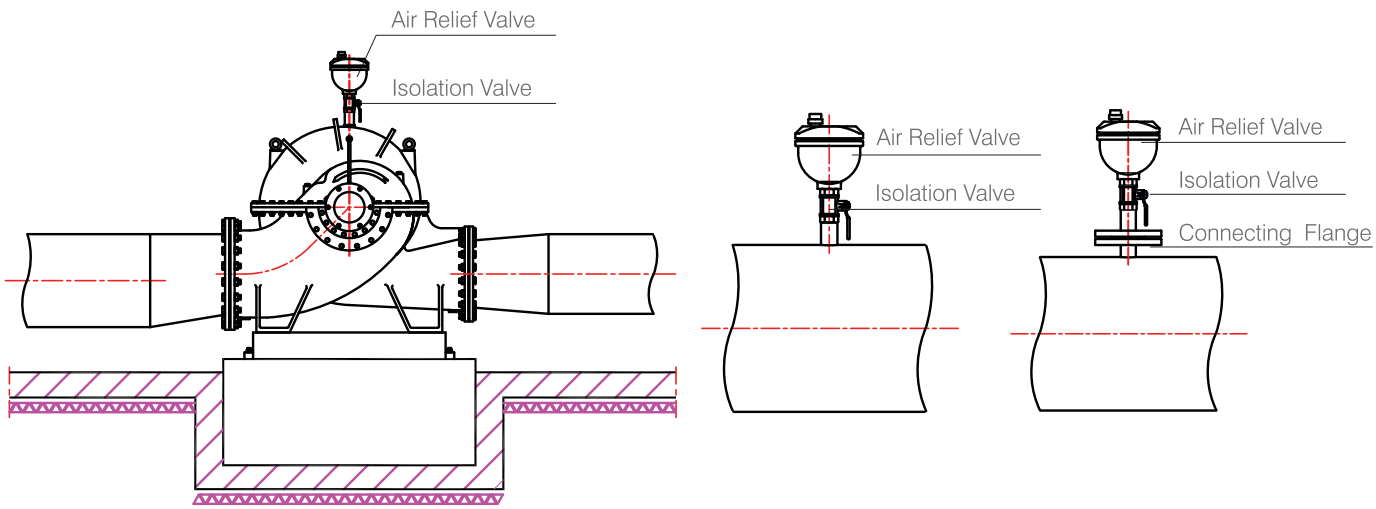
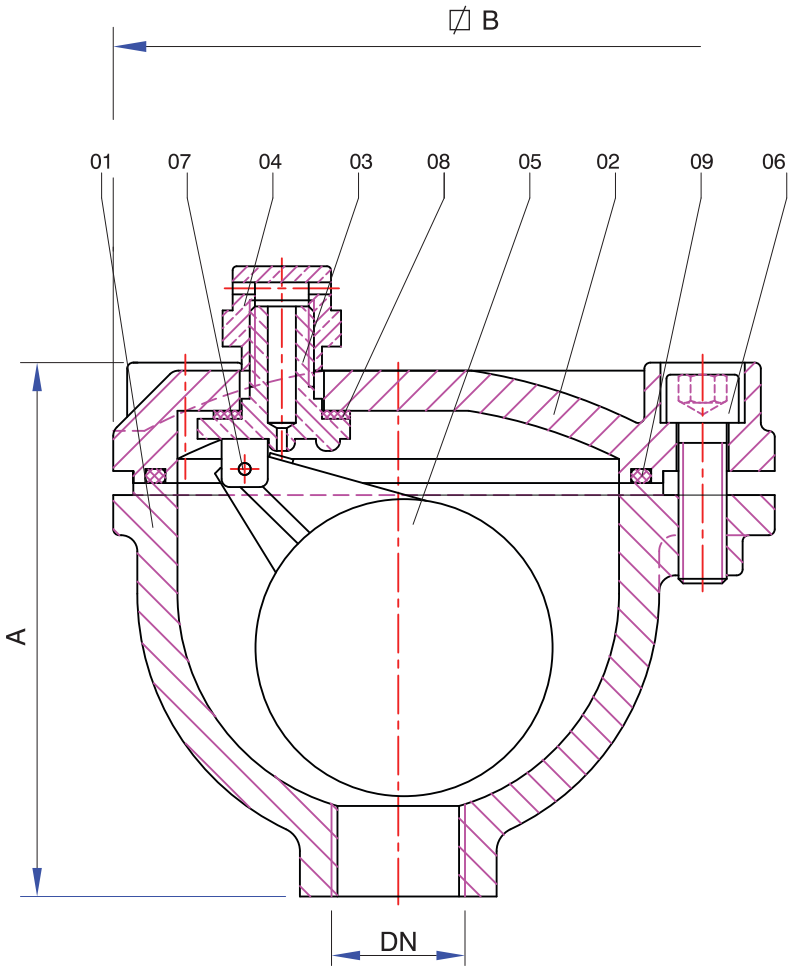


Figure 1: Use and application areas for single orifice/single function air relief valve



No	Part Name	Material
01	Body	EN-GJS-500-7/400-15
02	Cover	EN-GJS-500-7/400-15
03	Vent Hole	Bronze
04	Vent Plug	Bronze
05	Ball Float	ABS
06	Allen Bolt	Galvanized Steel
07	Pin	Bronze
08	Vent Gasket	EPDM
09	Cover Gasket	EPDM

DN	A (mm)	⏍B (mm)	W (kg)
1" - 1 1/4"	135	142	6
1 1/2" - 2"			

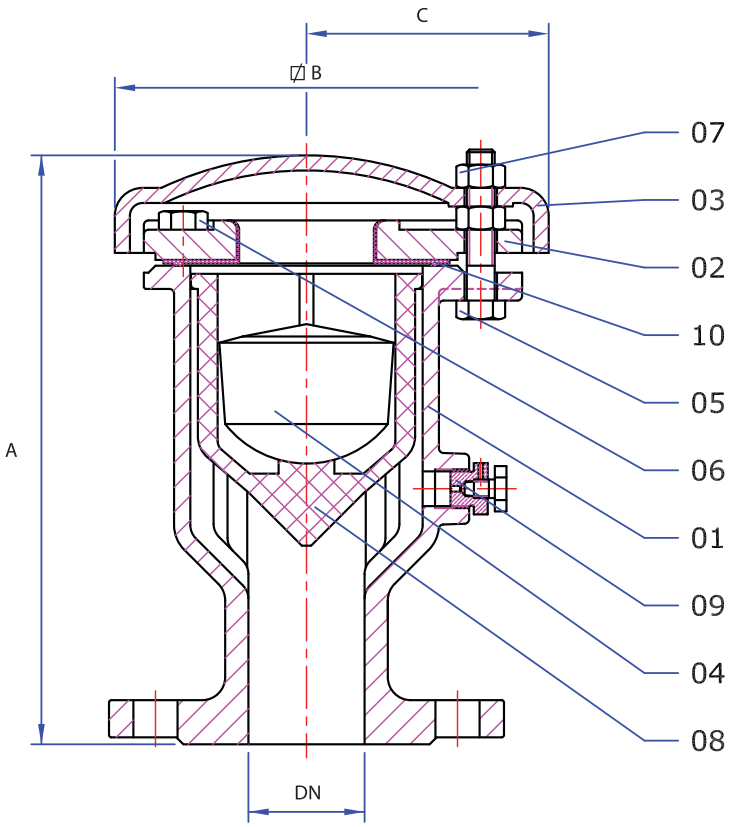
Figure 2: Single orifice/single function air relief valve

SINGLE ORIFICE / DOUBLE FUNCTION AIR RELIEF VALVE

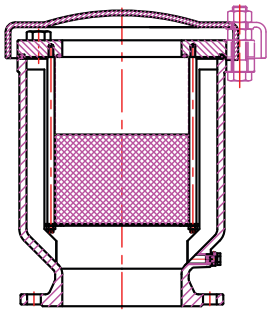
Single orifice/double function air relief valves are used in order to relieve low pressure/high capacity air while filling the pipeline with water and prevent vacuum formation by taking air in during pipeline discharging.

Internal parts of this type of air relief valves are similar to the ones used in triple function kinetic type air relief valves. In so-called Type 400 valves (Figure 3), float made of ABS material operates in guide again made of ABS material. In valves other than type 400, float made of polyethylene (PE) operates in stainless steel guide.

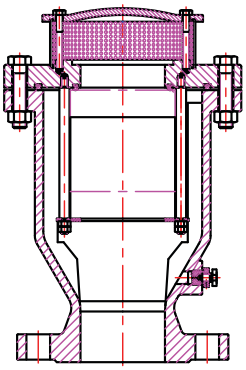
The air relief valves are used with the isolation valve for maintenance-repair and replacement orerations. After the isolation valve is closed, discharge ventil (Figure 3, item 09) is used to release the pressure in the air relief valve.



Type 400



Type
600/900/1200/1500



Type
900/1200/1500
PN40

PN10 - 16 - 25 - 40 /Pressure Class:

No	Part Name	Material
01	Body	EN-GJS-400-15/500-7
02	Cover	EN-GJS-400-15/500-7
03	Protecting Cap	EN-GJS-400-15/500-7
04	Float	ABS for Type 400 and PE for Other Types
05	Bolt	8x8 Galvanized Steel
06	Bolt	8x8 Galvanized Steel
07	Nut	8x8 Galvanized Steel
08	Float Guide	ABS for Type 400 and Stainless Steel for Other Types
09	Discharge Valve	Bronze
10	Sealing Gasket	EPDM

DN	Type	A (mm)	⍁B (mm)	C	W (kg)
40	400	255	165	104.5	11.0
50	400	255	165	104.5	11.5
60	400	255	165	104.5	12.5
65	400	255	165	104.5	12.5
80	600	350	240	151.0	23.0
100	900	410	268	171.0	31.0
125	900	410	268	171.0	33.0
150	1200	470	315	204.0	62.0
200	1500	496	390	241.5	104.0
250	1500	496	390	241.5	108.0
300	1500	496	390	241.5	112.0

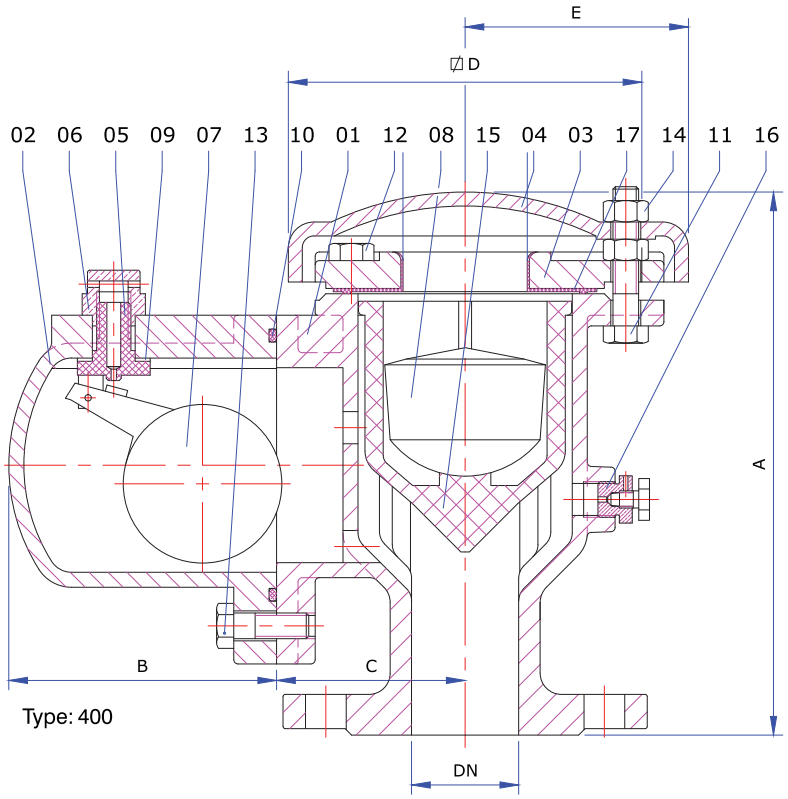
Figure 3: Single orifice/double function air relief valve

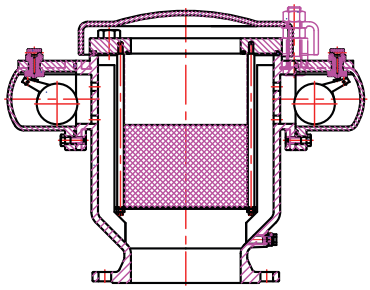
DOUBLE ORIFICE / TRIPLE FUNCTION (KINETIC TYPE) AIR RELIEF VALVE

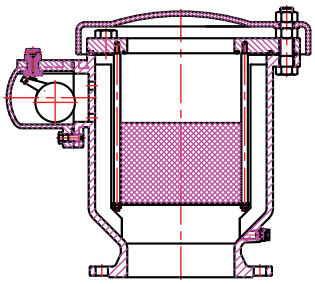
High quantity air relief/intake during filling/emptying the pipeline is maintained by bigger orifice, while low quantity air relief during operation is by smaller orifice.

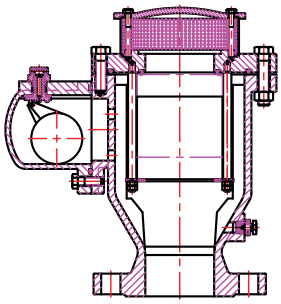
While filling, low pressure but high flow-rate air has to be discharged from the line. Air, to be extracted through the opening between orifice and float, should have a quantity nearly equal to the water entering the line. Floats has to be designed light enough to float on the water but heavy enough not to raise by air and shut the openning for proper functioning. When water level reaches to the float of bigger orifice, i.e. when the line completely filled and bigger orifice is closed, smaller orifice enters to function. Its duty of it is to relieve the smaller quantities of air under high pressures, which accumulate during operation.

When emptying the pipeline, air at atmospheric pressure has to replace with water and prevent vacuum forming. Amount of air flowing into the pipe through bigger orifice is accepted as half of water flow-rate in the pipeline.




Type
1500


Type
600/900/1200


Type
900/1200/1500
PN40

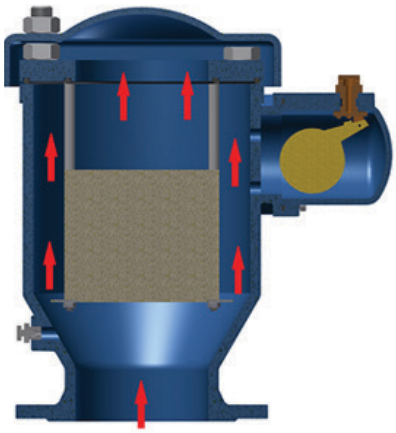
Pressure Class: **PN10 - 16 - 25 - 40**

No	Part Name	Material
01	Body	EN-GJS-400-15/500-7
02	Float Body	EN-GJS-400-15/500-7
03	Cover	EN-GJS-400-15/500-7
04	Protecting Cap	EN-GJS-400-15/500-7
05	Vent Hole	Bronze
06	Vent Plug	Bronze
07	Ball Float	ABS
08	Float	ABS for Type 400 and PE for Other Types
09	Gasket	EPDM
10	Gasket	EPDM
11	Bolt	8x8 Galvanized Steel
12	Bolt	8x8 Galvanized Steel
13	Bolt	8x8 Galvanized Steel
14	Nut	8x8 Galvanized Steel
15	Float Guide	ABS for Type 400 and Stainless Steel for Other Types
16	Discharge Valve	Bronze
17	Sealing Gasket	EPDM

DN	Type	A (mm)	B (mm)	C (mm)	⍁D (mm)	E (mm)	W (kg)
40	400	255	125	88	165	104.5	15.0
50	400	255	125	88	165	104.5	15.5
60	400	255	125	88	165	104.5	16.5
65	400	255	125	88	165	104.5	16.5
80	600	350	125	112	240	151.0	27.0
100	900	410	125	128	268	171.0	35.0
125	900	410	125	128	268	171.0	37.0
150	1200	470	125	158	315	204.0	66.0
200	1500	496	125	200	390	241.5	112.0
250	1500	496	125	200	390	241.5	116.0
300	1500	496	125	200	390	241.5	120.0

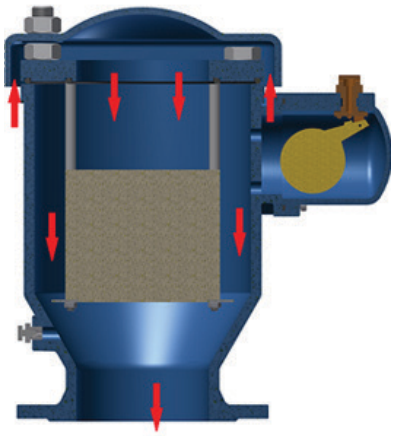
Figure 4: Double orifice/triple function (kinetic type) air relief valve

1st Function



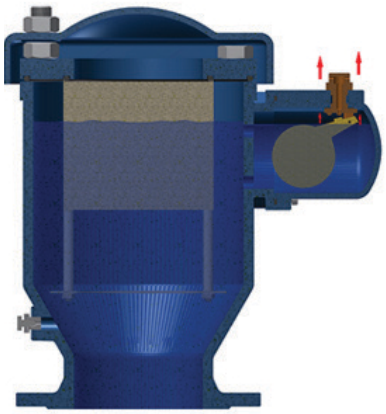
Releasing low pressure and high flow-rate air while filling pipeline with water

2nd Function



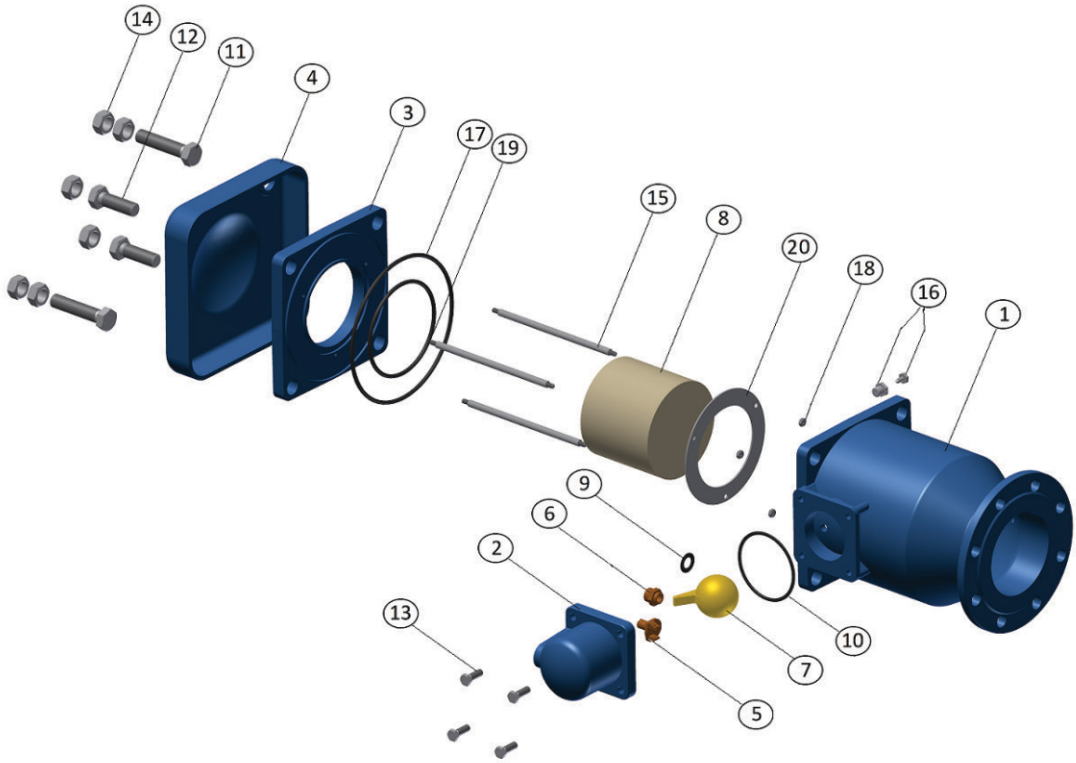
Protection against vacuum formation by admitting air into pipe while pipeline discharging

3rd Function



Releasing high pressure and low flow-rate air while filling pipeline with water or during its operation

Figure 5: Double orifice/triple function (kinetic type) air relief valve

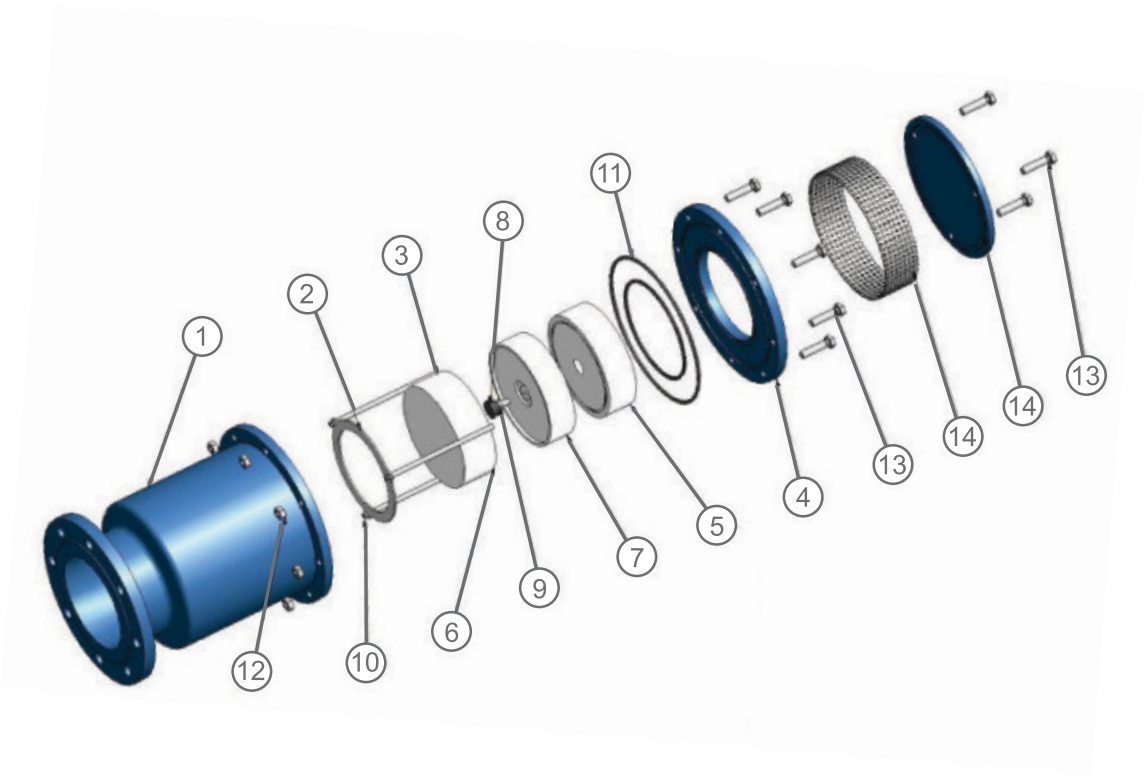


No	Part Name	Quantity	Material
00	Assembly	1	
01	Body	1	EN-GJS-400-15/500-7
02	Float Body	1	EN-GJS-400-15/500-7
03	Cover	1	EN-GJS-400-15/500-7
04	Protecting Cap	1	EN-GJS-400-15/500-7
05	Vent hole	1	CuSn6Zn4Pb2-B
06	Vent Plug	1	CuSn6Zn4Pb2-B
07	Ball Float	1	ABS
08	Float	1	ABS for 400 Type and PE for Other Types
09	Gasket	1	EPDM
10	Gasket	1	EPDM
11	Bolt	2	Galvanized Steel
12	Bolt	2	Galvanized Steel
13	Bolt	4	Galvanized Steel
14	Nut	6	Galvanized Steel
15	Stud	3	Stainless Steel
16	Discharge Valve	1	CuSn6Zn4Pb2-B
17	Gasket	1	EPDM
18	Nut	3	Stainless Steel
19	Gasket	1	EPDM
20	Guide Cap	1	Stainless Steel

Figure 6: Double orifice/triple function (kinetic type) air relief valve

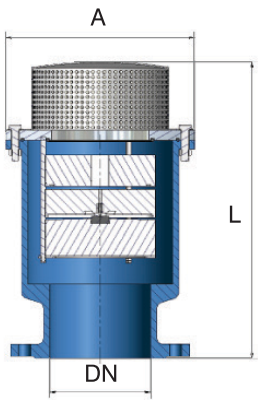
SINGLE ORIFICE / QUADRUPLE FUNCTION AIR RELIEF VALVE (NON-IMPACT / ANTISHOCK / DYNAMIC AIR RELIEF VALVE)

Single orifice / quadruple function air relief valves (non-impact / antishock / dynamic air relief valves) differ from double orifice / triple function in terms of function. During pipeline filling with water, the upper part of the float, consisting of three parts, shuts without impact and air release continues. This is why these types of valves are also called quadruple function valves. Another advantage of this compact type is less space requirement.



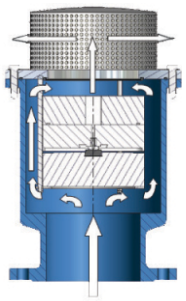
No	Part Name	Material
00	Assembly	
01	Body	EN-GJS-400-15/500-7
02	Guide Flange	Stainless Steel
03	Stud	Stainless Steel
04	Cover	EN-GJS-400-15/500-7
05	Float 1	PE
06	Float 2	PE
07	Float 3	PE
08	Sealing Ring	EPDM
09	Orifice	Stainless Steel
10	Nut	Stainless Steel
11	Gasket	EPDM
12	Nut	Galvanized Steel
13	Bolt	Galvanized Steel
14	Protecting Sheet	Stainless Steel
15	Protecting Cap	EN-GJS-400-15/500-7

Figure 7: Single orifice/quadruple function air relief valve



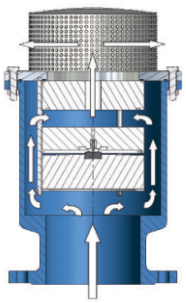
DN	A (mm)	L (mm)
50	205	315
65	205	315
80	220	365
100	250	395
125	310	430
150	320	475
200	415	520
250	490	575
300	490	575

1. 1st Function



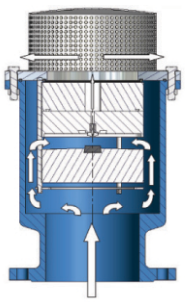
Air release while filling pipeline with water

2. 2nd Function



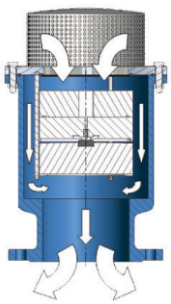
The upper part of the float closes without impact while air release is continuing

3. 3rd Function



Ensuring pressurized air release from fully filled pipeline

4. 4th Function



Providing air in pipeline from the top while the pipeline is emptied

Figure 8: Single orifice/quadruple function air relief valve

MAINTENANCE AND REPAIR OF AIR RELIEF VALVES

Air relief valves are low maintenance components, to be overhauled in case of misfunctioning. Possible causes of misfunctioning are:

- Type of air relief valve is not suitable for the liquid in pipeline
- Uncleaned pipeline, dirty water, clogging the air valve with erection residues, stones, sand, soil, etc
- Improper type air relief valve selection
- Damaged floats
- Closed or semi-open isolation valve

For maintenance and repair, operations given below should be done:

For kinetic type (Figure 6);

- Fully close the isolation valve
- Decrease internal pressure by opening discharge valve (Figure 6, item 16)
- Remove protection cap (Figure 6, item 04)
- Remove cover (Figure 6, item 03) and check the damages on bigger float, cover sealing surface and gasket
- Remove float body (Figure 6, item 02) from main body
- Examine damages on ball float and valve outlet
- Check o-rings and gaskets
- Replace all destructed parts and reassemble air relief valve
- After reassembly, open the isolation valve

For dynamic type (Figure 7);

- Fully close the isolation valve
- Decrease internal pressure by opening discharge valve
- Remove cover (Figure 7, item 04)
- Examine location and damages on sealing gasket at the cover, if necessary replace it
- Examine damage on floats and valve outlet
- Check o-rings and gaskets
- Replace all damaged parts and reassemble air relief valve
- After reassembly, open the isolation valve

PIPE SECTIONS TO PUT AIR RELIEF VALVES ON WATER DISTRIBUTION LINES

There must be a pipeline profile on hand that contains all mechanical equipment to determine the sections where to put air relief valve. Air relief valves should be installed at the points stated below:

- Air relief valve should be installed to the top most point of any existing pump (Figure 9)
- If there is any existing pump in pipeline, then there should also be a check valve. Air relief valve to be placed at discharge line will prevent vacuum formation when the check valve closes (Figure 10)
- If there is any deep well pump, air relief valve should also be installed as seen in figure 11a-11b
- Air relief valves should be installed to uppermost points of pipeline profile (Figure 12)
- Air relief valves should be installed at locations where slope of the pipeline profile changes (Figure 13)
- Without noticing mentioned fluctuations at the pipeline profile, air relief valves should be installed every 50 0 meters (Figure 14)

HIGHLIGHT FOR PROPER INSTALLATION AND USAGE OF AIR RELIEF VALVES

- In order to protect from external effects, air relief valves must strictly be put into valve chambers (Figure 15)
- For their maintenance and repair an isolation valve should be used
- Air relief valves should not be operated without their protection cap, otherwise unwanted materials may enter through bigger orifice and damage internal parts. Open-mouthed bigger orifice is also dangerous for people.
- Before mounting, air relief valve pressure class, type and capacity should be controlled and confirmed
- Must definitely be mounted at an upright position
- Entry and exit holes should be built into valve chambers for ventilation
- Since air relief valves does not have a duty for impact protection, existence and operability of water hammer system should be checked
- Air relief valve and size type should determined according to the specification of the liquid in the pipe
- Before filling pipeline with water, cleanliness of water distribution line should be checked

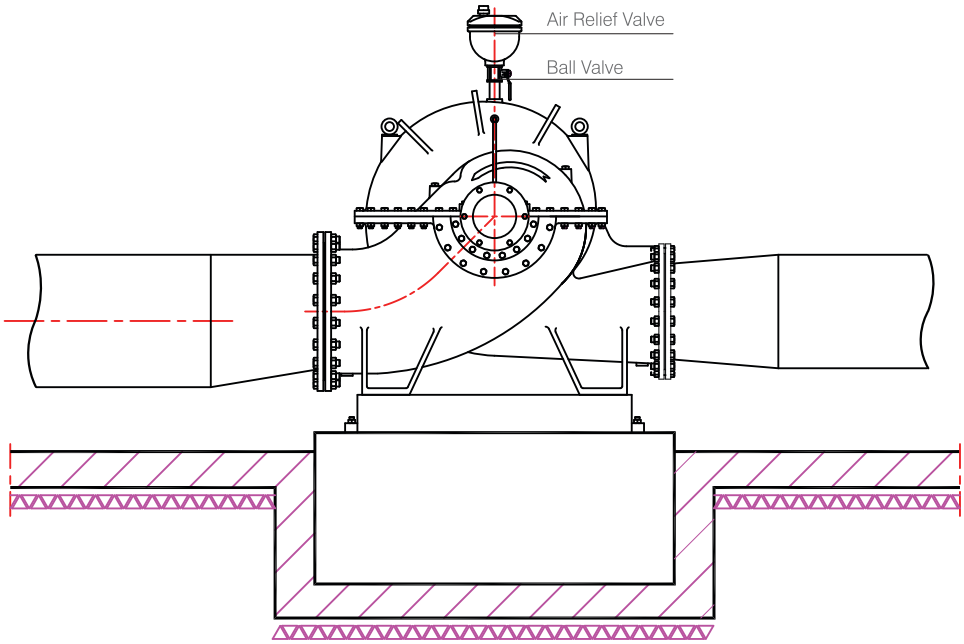


Figure 9: Air relief valve should definitely be placed where positive suction pressure exists in a pumping application

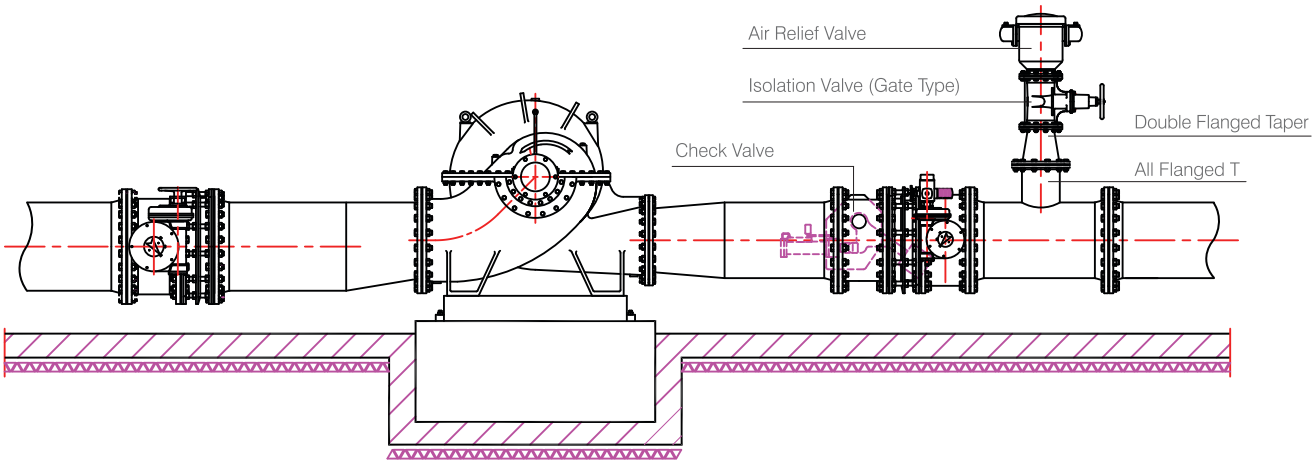


Figure 10: Placing air relief valve after check valve at pump outlet

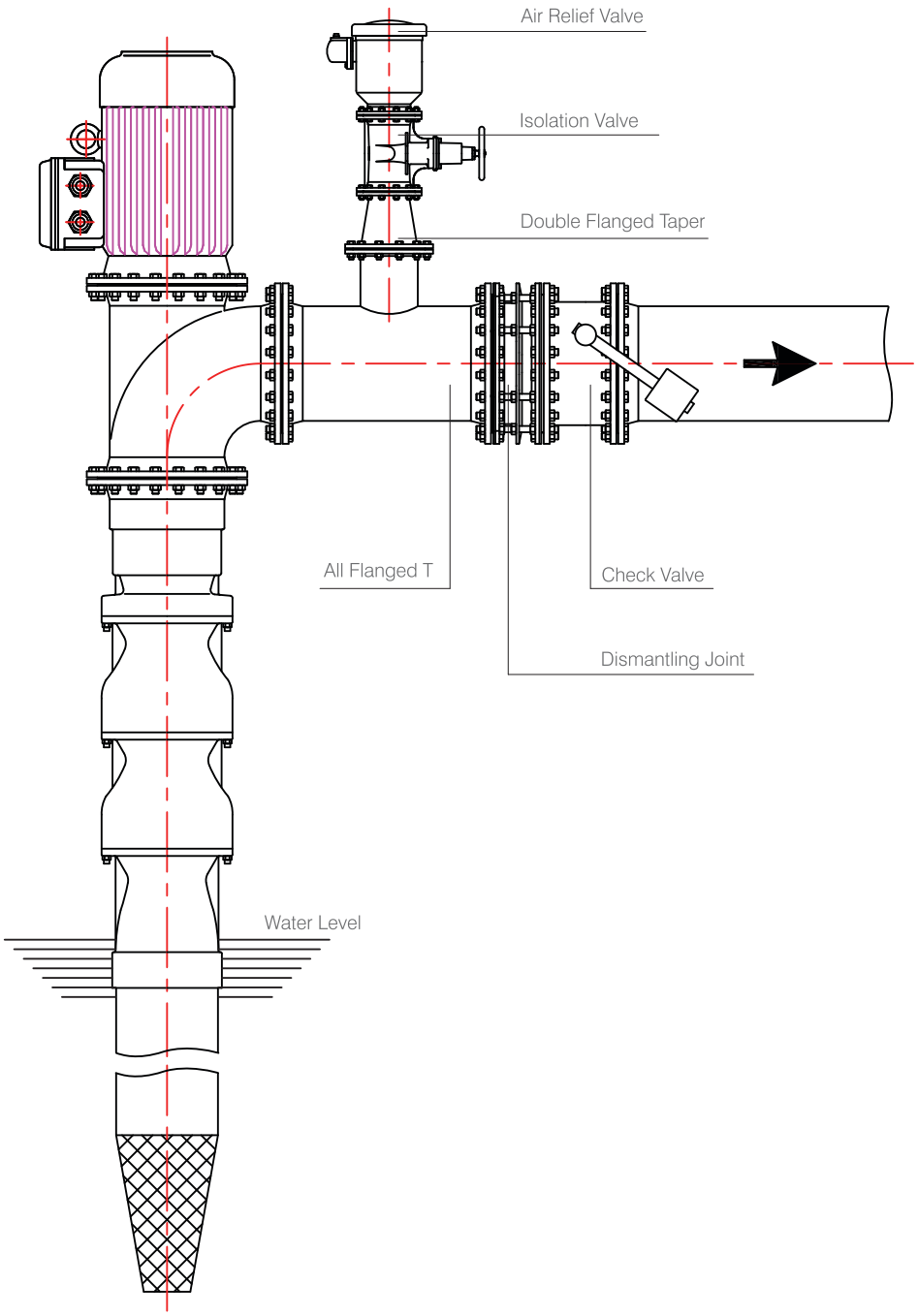


Figure 11a: Vertical turbine pumps

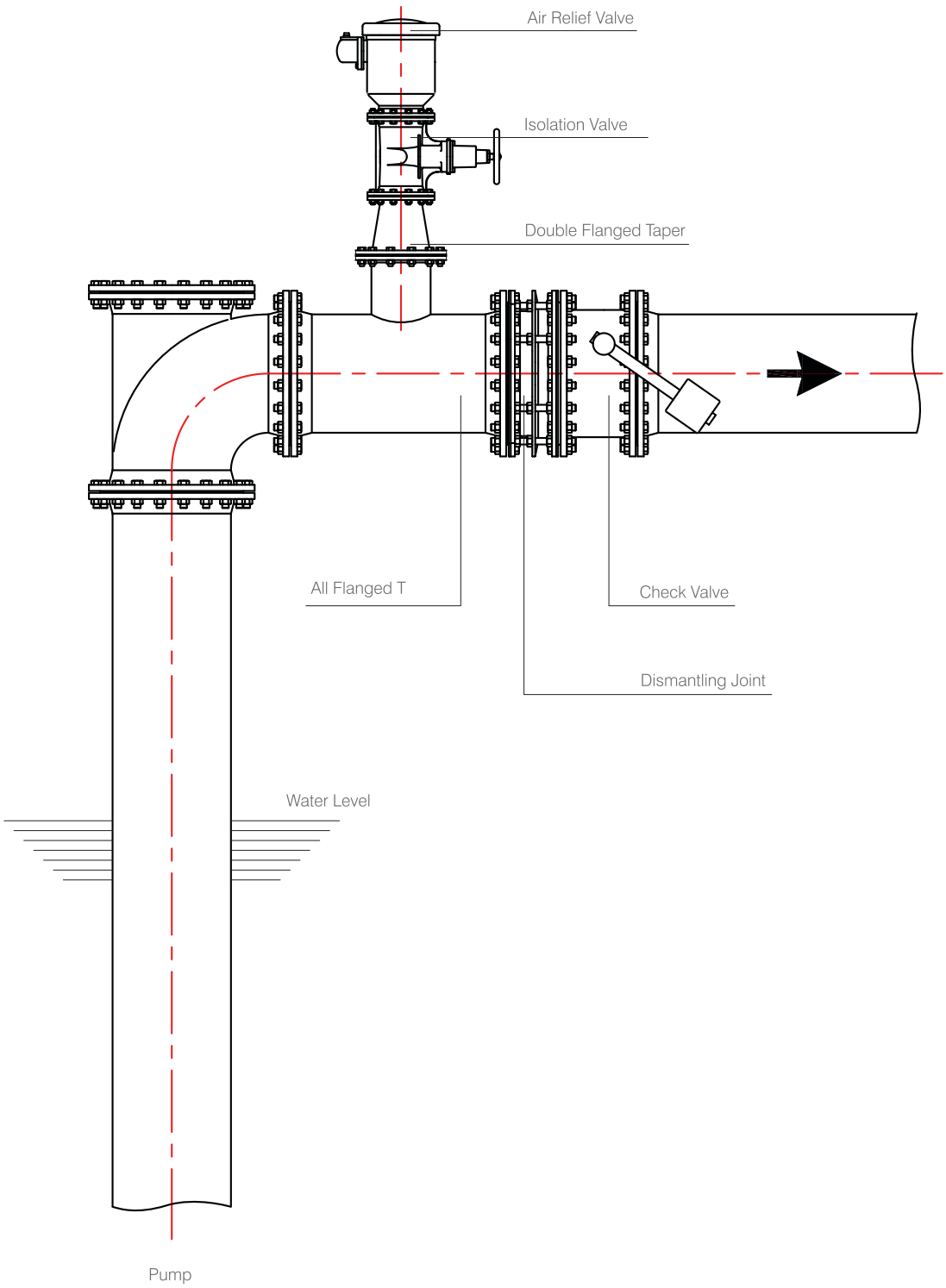


Figure 11b: Submersible pumps

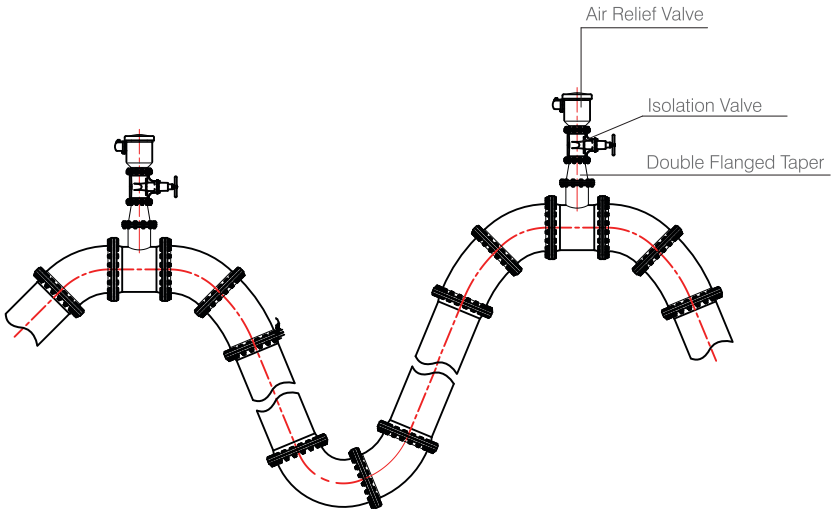


Figure 12: Placing air relief valve to uppermost points of pipeline

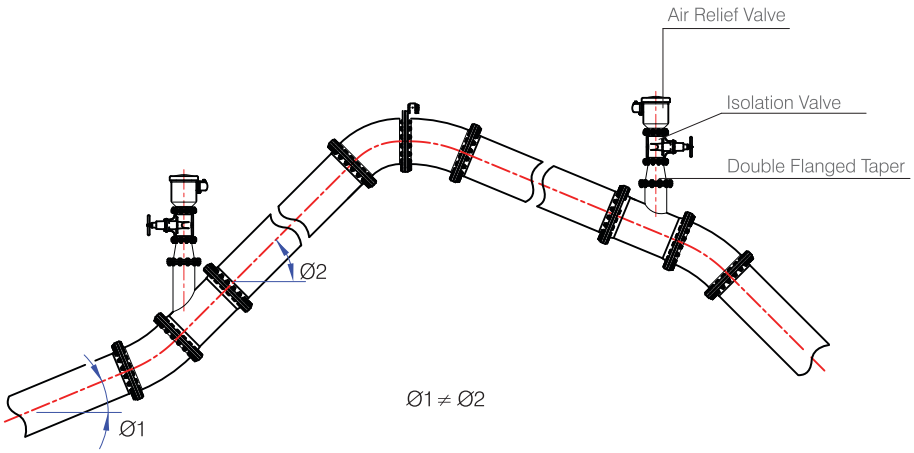


Figure 13: Placing air relief valve at locations where slope of the pipeline profile changes

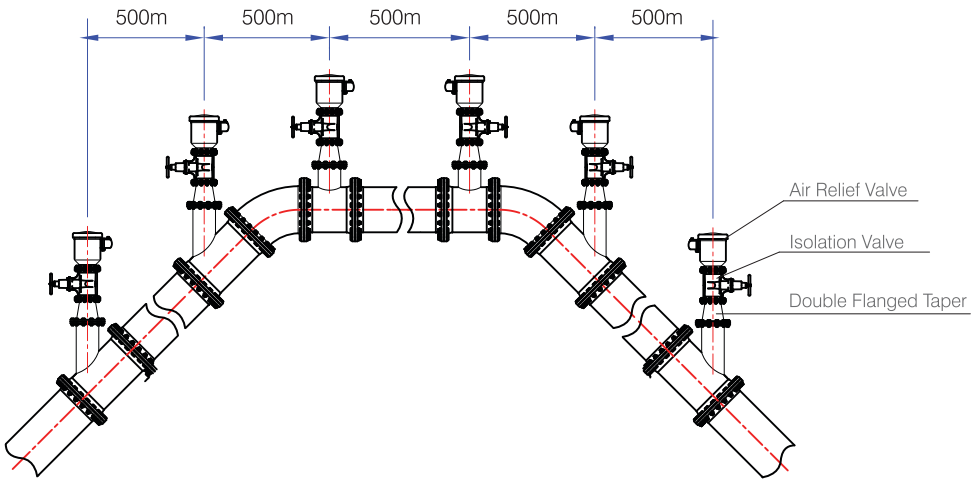


Figure 14: Placing air relief valve every 500 meters without noticing fluctuations at the pipeline

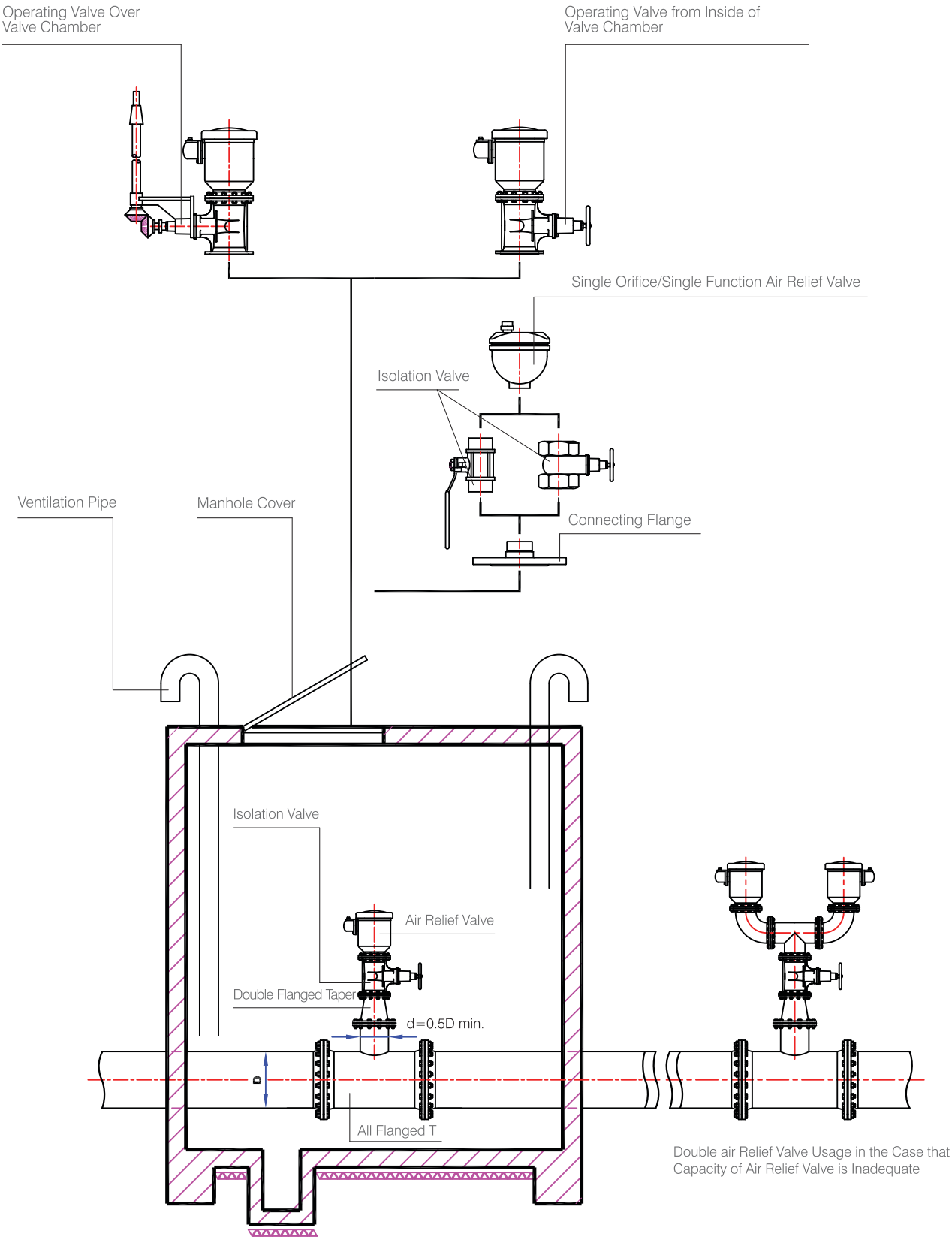


Figure 15: Air relief valve and isolation valve chamber

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Avenue General Eisenhower 68, 1030 Bruxelles - Belgium

Tel. Mobile: +32 477 040 058

e-mail: info@hydrobenelux.be

web: www.hydrobenelux.be