RAPHAEL

Waterworks

RAV SERIES

AIR VALVES

Waterworks Product Catalog

RAPHAEL VALVES INDUSTRIES

GENERAL DESCRIPTION

An air valve is a valve mounted in "TEE" configuration on a pipeline to discharge or admit air into or out of the pipeline.

WHY SHOULD THE AIR IN THE PIPELINE TO BE CONTROLLED?

The existence of trapped air in a pipeline under pressure can cause negative effects on system operation and efficiency.

Air pockets accumulating at slope sign changing high points reduce the effective cross-section of the pipeline in the location of accumulation, which causes a decrease in the flow rate, and the energy needed to pressurize the waterflow is increased.The overall system efficiency is then reduced.

Air pockets beyond some critical quantity in the system even may restrict the whole pipeline from flowing, "locking " the pipeline.

SOURCES OF AIR IN WATER PIPELINES

The existence of air in a pipeline might be because:

• Air under atmospheric conditions might "stay" within the pipeline when the pipeline was filled with water. With the absence of air discharge valves, accumulation of air occur at local "high"points.

• Water at normal conditions, pressure (101,325 kPA) and temperature (25 C), contains approximately 2% (by volume) of dissolved air.

Due to the terrain slopes, variations in flow velocity caused by changing pipe diameters, partially-open valves, etc. the water flow is subjected to changing pressures and temperatures, and the dissolved air may be released from the water mass, forming into gas, accumulating as "air pockets" in the local peak points.

• Air may be drawn into the pipeline at start-up of deep-well pumps, and through leaking joints at zones above the hydraulic gradients (negative pressure points).

Air can also be admitted into the system by air valves operatingon belowatmospheric pressures.

THE TYPES AND FUNCTIONS OF AIR-VALVES:

Kinetic Air / Vacuum Valve (Double Acting or Single orifice valve):

Venting / Kinetic air-release function :Exhaust large quantities of air from the pipeline when it is filled with water, at low pipeline pressure Vacuum Breaking / Kinetic anti-vacuum function :Admit large quantities of air into the pipe when it is drained, or when the internal pressure drops below atmospheric pressure due to transient conditions.

AUTOMATIC AIR RELEASE VALVES:

Releasing small pockets of accumulated air while the pipeline operates under pressure ("Automatic" air-release function).

Combination Air Valves (Triple Acting or Double orifice valve):

• A valve that perform the functions of both the "Kinetic" and "Automatic"operation.

Additional Feature"Non-Slam" or "Anti-shock" operation (Four Action or Triple orifice Valve) :

• A valve that senses the excessive air discharge and so the water approach velocity and reducing the air discharge velocity by intensionally sucking the non-slam float upwards but continuing to discharge at some lower rate inducing an "air cushion" in the pipeline. This function causes the waterflow to pass the critical point slowly and prevents the impact or surge inducing "wet close" of the air valve.

TECHNICAL:

Types:	Single, Double Chamber
Features:	Double, Triple Acting
Sizes:	DN50-DN300
Pressure Range:	PN10 upto PN64
Flanges:	ISO, ANSI
Operating Temp.:	-10 °C to +80 °C
Coating:	EPOXY Powder RAL 5005

CAPACITY & SIZING

Air valve sizing depends on several criteria regarding the pressure differential at which the valve will operate and the consequences that will occur with this operating criterion. The criteria are summarized below:

DESIGN FOR VACUUM

Criterion 1:

Full opening of a discharge valve to empty the pipeline at the and of a "V", with maximum static pressure. Critical Vacuum Condition.

Criterion 2:

Having the same geometry of Criterion 1 with pipe burst opening equal to the nominal pipe size at maximum static pressure condition. The valve at the beginning of the upslope should have sufficient capacity to admit enough air into the pipe to replace the downslope to overcome the vacuum and collapse. The design capacity for vacuum only according to these two criteria above suggests the limit for throttling in the design. In throttling condition, the Delta-P limit value of 0.528 bar (~53 kPa) does not suggest any noticeable change beyond ~0.35 bar. To be on the safe side, the Delta-P value of 0.2 bar should not be exceeded. At a 2:1 "Emptying/Filling Ratio" for the pipe design, this value should be limited to 0.1-0.15 bar. However, even if this value suggests proper operation away from the pipe collapse limit, the vacuum will admit unwanted foreign objects causing contamination into the pipe. This limit value for the design is therefore obsolete according to the design criteria.

DESIGN FOR DISCHARGE

Criterion 3:

When filling the pipeline, choosing a Delta-P of 0,1-0,15 bar for discharge of air. Air flow velocity at this point of operaiton will exceed 124 m/s. However, capacitywise being good suggested from the former criteria, this value is

tremendously high to induce impact on "wet-closing" of the valve upon arrival of water to point.

On non-kinetic designs, this value of air velocity will induce a venturi-effect to suck the float closing prematurely, blocking the flow out.

The air stays trappred and and there is no possibility that the valve opens as the pressure accumulation pushes the float further to close. On kinetic designs, the floats will not be affected fron the venturi-effect, and the air flow will continue until "wet-closing". However, the tests and experience for the last decades show that "wet-closing" at this discharge velocity induces "Surge", which implies local pipe bursts. Most of the pipe bursts occur from uncon-trolled filling rates and/or wrong selection or mislocation of air valves on pipe line design.

Results:

Design of an air valve on limiting capacity for protection from vacuum is not a proper approach.

Vast experience on last decades shows, local discharge of air beyond 0,05 – 0,07 bar Delta-P will induce unbearable Surge in the pipeline. This Delta-P suggests an effective discharge velocity of 30-35 m/s of air a t the uppermost orifice of the air valve. Beyond this limiting value it is suggested that the opertion of the pipelinefilling is refrained.

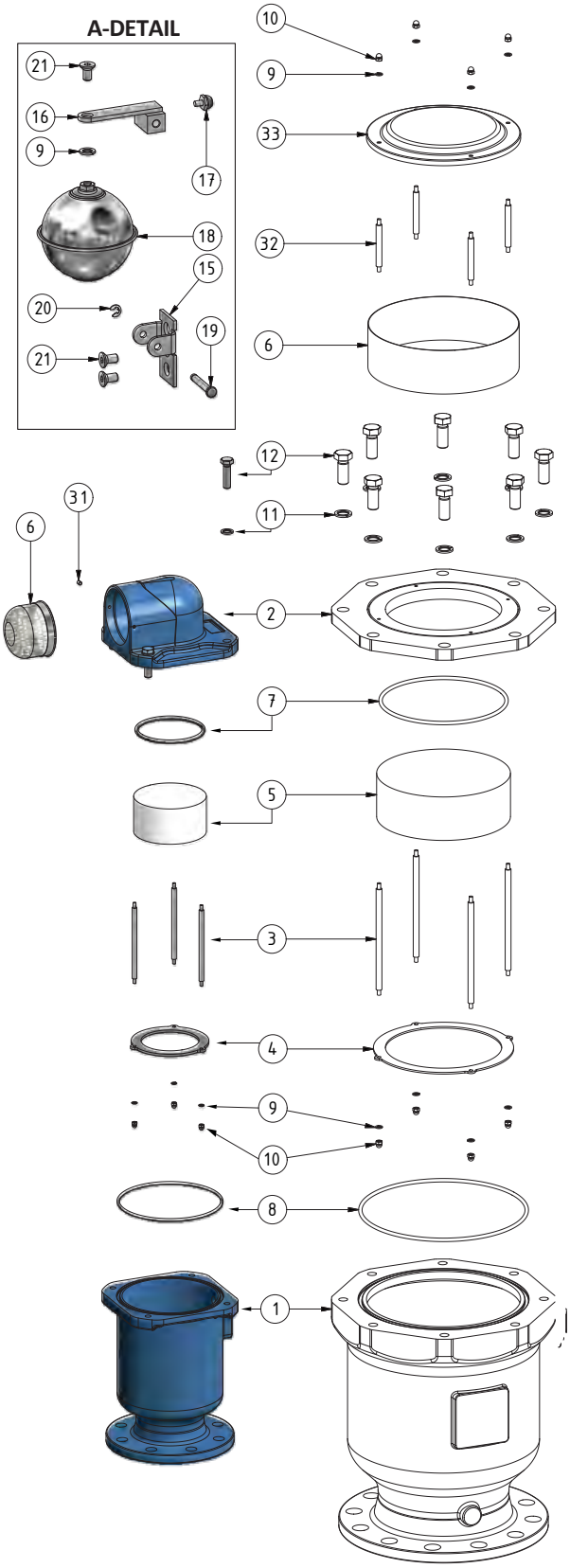
This limiting air discharge condition is also used for the design of the "antishock" or "non-slam" orifices.

Design on capacity curves given on manufacturers is necessary, but not sufficient. The designer should follow the limiting criteria on field of operation. On most critical operation, the selection of the air valve should depend on pipeline filling rate.

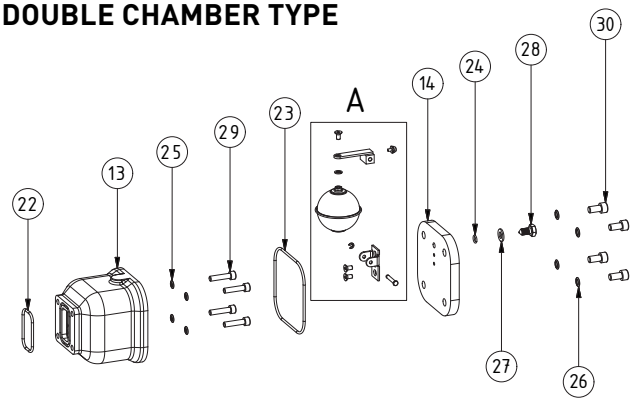
The curves are as in page " CAPACITY CURVES "

PARTS LIST

No.	Product Description	Material
1	Body	Ductile cast iron (GGG40)
2	Cover	Steel (St52-3)
3	Bearing Shaft	Stainless Steel (X5CrNi18 9)
4	Stop Plate	Stainless Steel (X5CrNi18 9)
5	Floater	Polyethylene (PE300)
6	Filter	Stainless Steel (X5CrNi18 9)
7/8	O-ring	Rubber (NBR)
9	Spring Washer	Stainless Steel (A2)
10	Blind Nut Hexagon Head	Stainless Steel (A2)
11	Spring Washer	Galvanized Steel (8.8)
12	Hexagon Head Bolt	Galvanized Steel
13	Floater Body	Ductile cast iron (GGG40)
14	Floater Cover	Steel (St37)
15	Joint Connection Plate	Stainless Steel (X5CrNi18 9)
16	Joint	Stainless Steel
17	Seal	Vulcanized Rubber
18	Floater	Stainless Steel
19	Pin	Stainless Steel
20	Shaft Ring	Stainless Steel (A2)
21	Countersunk Bolt	Stainless Steel (A2)
22/24	O-ring	Rubber (NBR)
25/26	Seal	Polyurethane (PU)
27	Spring	Stainless Steel
28	Camshaft	Stainless Steel (X5CrNi18 9)
29/30	Socket Bolt	Stainless Steel (A2)
31	Bolt Grub	Stainless Steel (A2)
32	Filter Shaft	Stainless Steel (X5CrNi18 9)
33	Filter Housing	Stainless Steel (X5CrNi18 9)



DOUBLE CHAMBER TYPE



DOUBLE CHAMBER AIR VALVE

EFFECT, KINETIC - AUTOMATIC COMBINATION
(Air Discharge, Air Intake, Air Release)

This type of air valve is the new generation design of the well-known "dual chamber" air valve. The 3 functions of the traditional dual chamber design are retained, combining a thermoplastic cylindrical shaped main float for the air inlet and outlet functions with the stainless steel float for the air release function.

This offers an advantage in long term corrosion resistance and longer service life compared to competing designs on the market.

Functions:

1. Discharge of large volumes of air into the pipe to the atmosphere during pipe filling. (Atmospheric function)

2. Entry of large volumes of air into the pipe during pipe emptying (Atmospheric function).

3. Discharge of small volumes of air preventing them from accumulating and forming "air pockets" during pipe operation (Pressurized function)

DIMENSIONS & CAPACITY

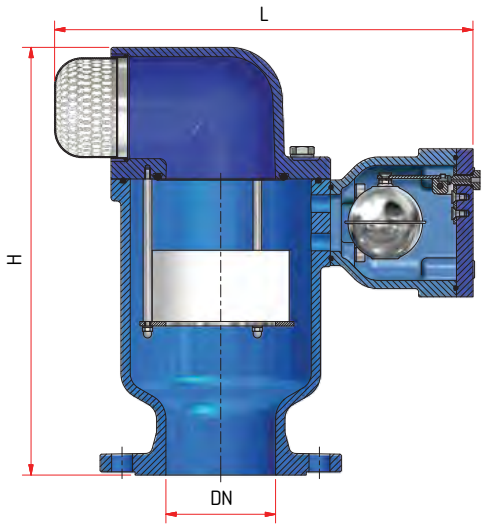
DN (mm)	H (mm)	L (mm)	Weight (kg)	Capacity (nl/s)*
50	280	295	18	60
80	340	350	24	160
100	390	380	33	250
150	415	415	61	520
200	530	495	106	1020
250	655	560	136	1570
300	740	680	196	2260

*Capacity is the limited flowrate with Anti-shock orifice for normal operation.

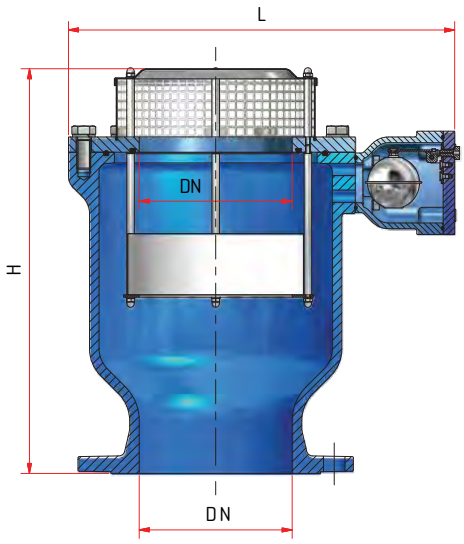
TECHNICAL DATA

Nominal Size:	DN50 - DN300
Nominal Pressure:	PN10 - 16 - 25- 40
Flange Standard:	TS ISO 7005-2 / TS EN 1092-2
Temperature:	-10 °C to +80 °C
Coating:	Electro-static Epoxy Powder RAL5010
Option:	As per request; Body and Cover GSC25, AISI304, AISI316 Floats AISI304

DOUBLE CHAMBER AIR VALVE



2" - 4"



6" - 12"

MATERIALS

BODY & COVER	EN	ASTM	UNS	DIN
Gray Cast Iron GG25	EN GJL-250	A48-40B	F 12801	1691
Ductile Cast Iron	EN	A536/60-40-18	F 32800	1693
Ductile Cast Iron GGG40	GJS-400-15	A536/65-45-12	F 33100	1693
Cast Iron GGG50	EN-GJS-500-7	A216-WCB	J 03002	1.0460
Stainless Steel GS-C25N	-	A351-CF8	J 92600	1.4301
Stainless Steel 304	-	A351-CF8M	4 92900	1.4401
Stainless Steel 316	-	DUPLEX 2205	S 32205	1.4462
Duplex Stainless Steel	-	SMO 254	S 31254	1.4547
SMO254 NiAl Bronze	-	B148	C 95800	2.0976
Floats:	AISI304, AISI316, HDPE, PP			

STANDARD MATERIALS	PRESSURE RATING					
	PN10/16	PN25	PN40	ANSI 150	ANSI 300	ANSI 600
Body	GGG40	GGG40	GSC25	GGG0	GSC25	GSC25
Floats (Double Chamber)	HDPE+AISI304	HDPE+AISI304	SISI304	HDPE+AISI304	AISI304	AISI304
Flange Drillings:	PN10, PN16, PN25, PN40, ANSI150, ANSI300, ANSI600					

SINGLE CHAMBER AIR VALVE

EFFECT, KINETIC - AUTOMATIC COMBINATION + ANTI-SHOCK

(Air Discharge, Air Intake, Air Release + Non-Slam Closure)

This type of air valve is the new generation design of combination air valve to compansate for the pipe-line design and application defects at air discharge criterion. It accomplishes 4 functions in a single chamber rather than the triple funtion in double chamber design, by limiting the air discharge during uncontrolled pipeline filling.

Functions:

1. Discharge of air in high volume in the pipe-line to atmosphere during pipe filling.(Atmospheric Function)

2. Intake of air in high volume into the pipe line during pipe-line emptying (Atmospheric Function)

3. Discharge of low volumes of air preventing them to accumulate and form "air-pockets" during pipe-line operation (Pressurized Function)

4. Limiting of the air flow velocity during disharge when uncontrolled or high velocity pipeline filling.

This causes an air-cushion in the pipe-line, lowering the approach veloity of water running, reducing the risk of induced impact (surge) on reduced speed arrival of water (wet-closure) of the main float.

DIMENSIONS & CAPACITY

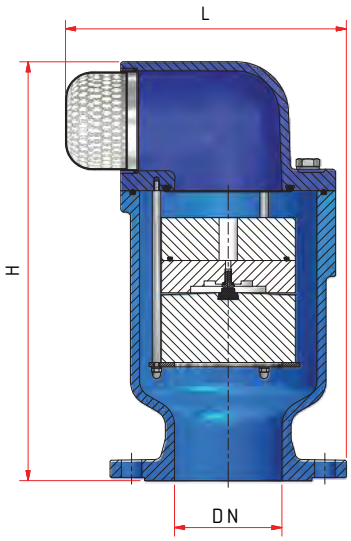
DN (mm)	H (mm)	L (mm)	Weight (kg)	Capacity (nl/s)*
50	280	165	12	60
80	340	220	18	160
100	390	250	27	250
150	415	285	55	520
200	530	365	100	1020
250	655	430	130	1570
300	740	550	190	2260

*Capacity is the limited flowrate with Anti-shock orifice for normal operation.

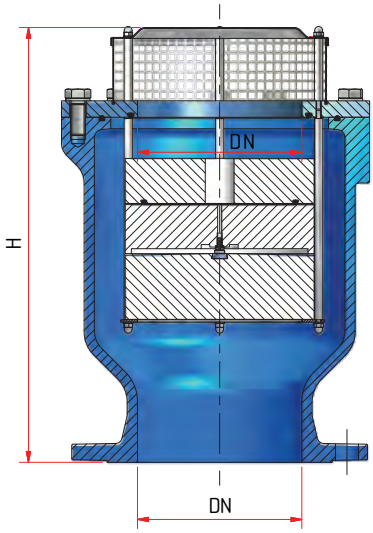
TECHNICAL DATA

Nominal Size:	DN50 - DN300
Nominal Pressure:	PN10 - 16 - 25- 40
Flange Standard:	TS ISO 7005-2 / TS EN 1092-2
Temperature:	-10 °C to +80 °C
Coating:	Electro-static Epoxy Powder RAL5010
Option:	As per request; Body and Cover GSC25, AISI304, AISI316 Floats AISI304

SINGLE CHAMBER AIR VALVE



2" - 4"



6" - 12"

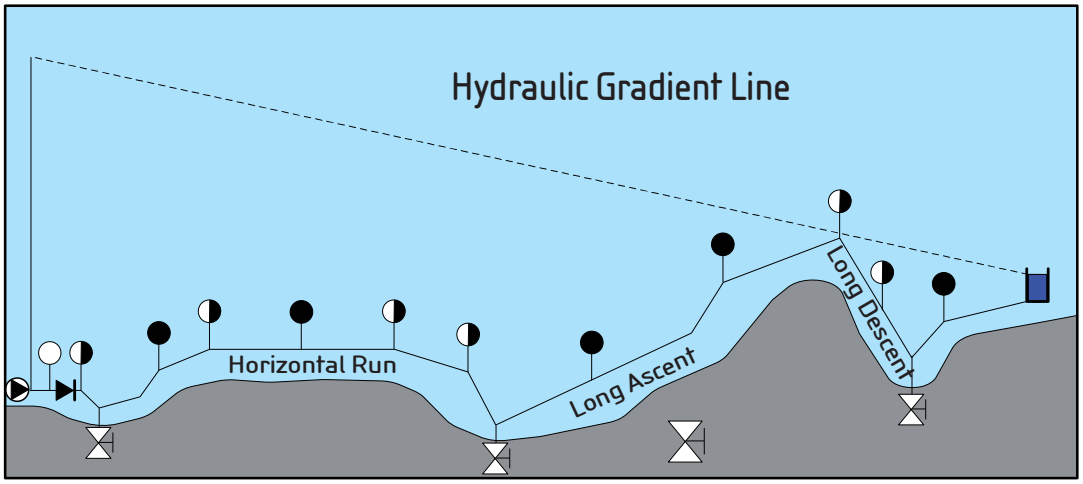
MATERIALS

BODY & COVER	EN	ASTM	UNS	DIN
Gray Cast Iron GG25	EN GJL-250	A48-40B	F 12801	1691
Ductile Cast Iron	EN	A536/60-40-18	F 32800	1693
Ductile Cast Iron GGG40	GJS-400-15	A536/65-45-12	F 33100	1693
Cast Iron GGG50	EN-GJS-500-7	A216-WCB	J 03002	1.0460
Stainless Steel GS-C25N	-	A351-CF8	J 92600	1.4301
Stainless Steel 304	-	A351-CF8M	4 92900	1.4401
Stainless Steel 316	-	DUPLEX 2205	S 32205	1.4462
Duplex Stainless Steel	-	SMO 254	S 31254	1.4547
SMO254 NiAl Bronze	-	B148	C 95800	2.0976
Floats:	AISI304, AISI316, HDPE, PP			

STANDARD MATERIALS	PRESSURE RATING					
	PN10/16	PN25	PN40	ANSI 150	ANSI 300	ANSI 600
Body	GGG40	GGG40	GSC25	GGG0	GSC25	GSC25
Floats (Single Chamber)	HDPE	HDPE	HP	HDPE	PP	-
Flange Drillings:	PN10, PN16, PN25, PN40, ANSI150, ANSI300, ANSI600					

TYPES & LOCATION

AIR VALVE LOCATION ON PIPELINES:



- Kinetic Air Discharge/Vacuum
- Valve Automatic Air Release Valve
- Combination Air Valve
- Pump
- Check Valve
- Drain Valve
- Reservoir

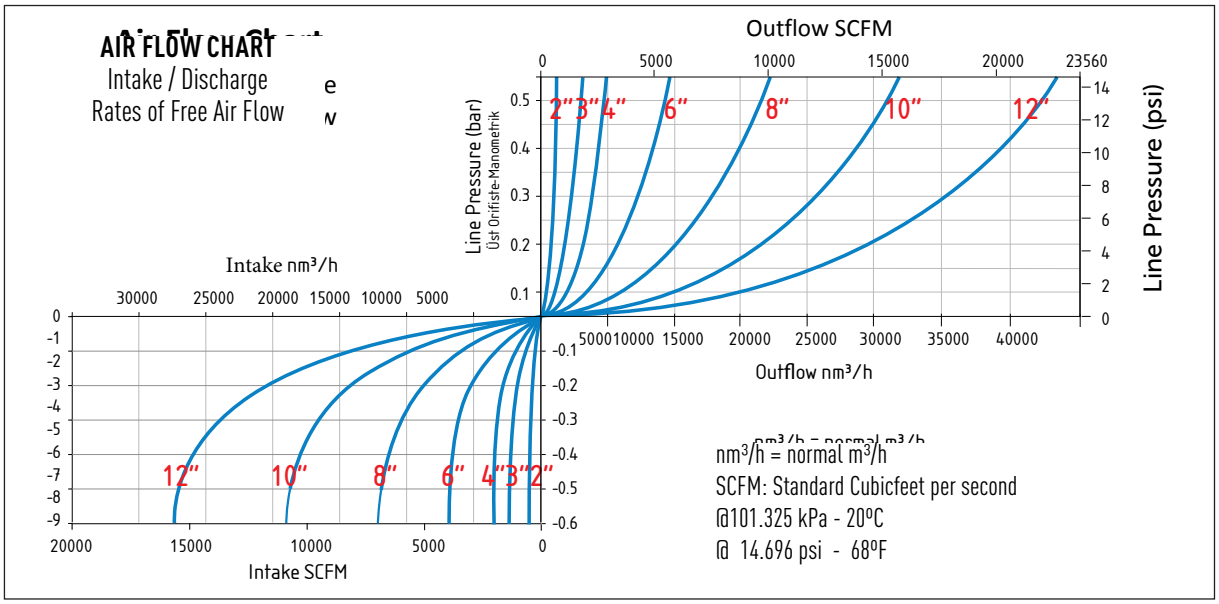
AIR VALVE LOCATION ON PIPELINES:

The AWWA Steel Pipe Manual recommendation on the location of air valves on a pipeline is:

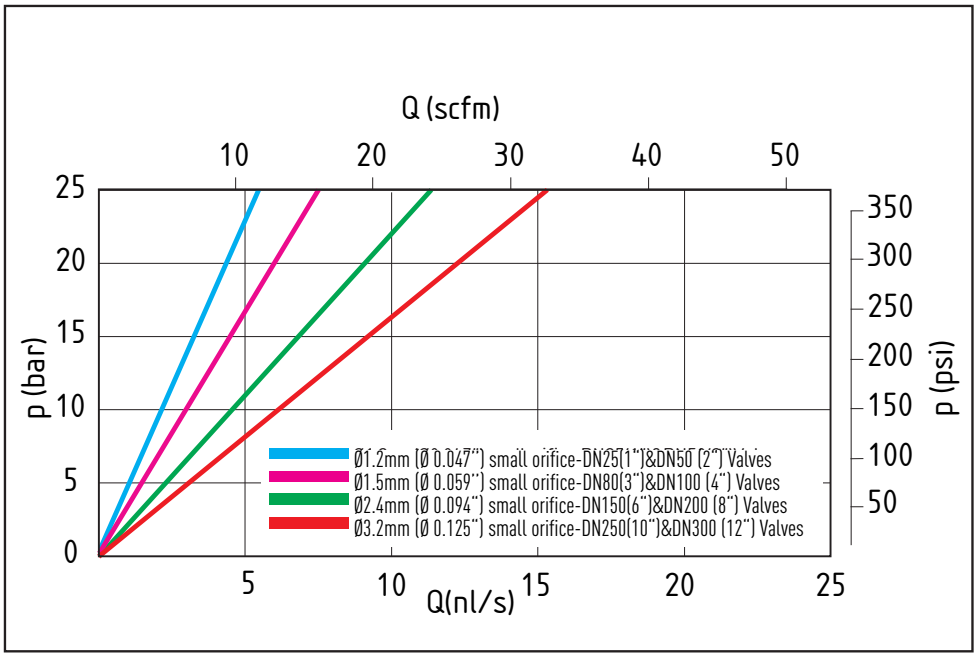
1	High Points	Combination Valve	Triple Acting
2	Long Horizontal Lines	Air Release or Combination Valve (intervals of ~400 m ~750 m)	Triple Acting
3	Long Ascents	Air Vacuum Valve (intervals of ~400 m.-~750 m.)	Double Acting
4	Long Descents	Combination Air Valve (intervals of ~400 m.-~750 m.)	Triple Acting
5	Increasing change on down-slope of line	Combination Air Valve	Triple Acting
6	Decreasing change in up-slope of line	Air Vacuum Valve	Double Acting

PERFORMANCE CHARTS

MAIN ORIFICE DISCHARGE PERFORMANCE CHART

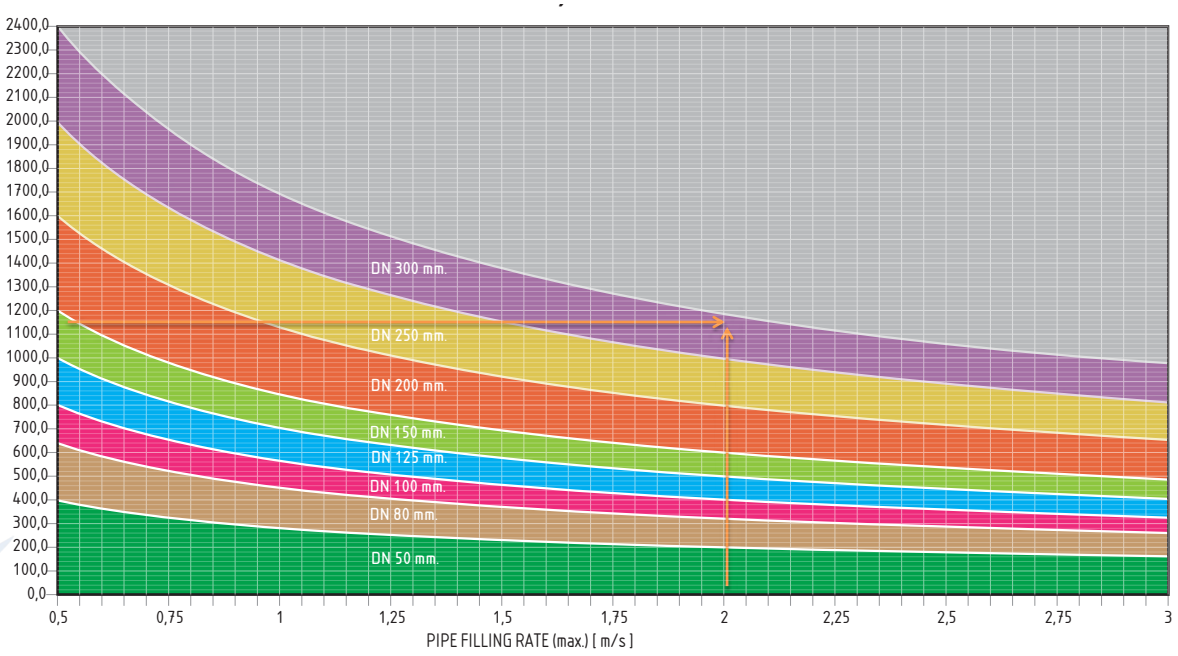


AIR RELEASE ORIFICE DISCHARGE PERFORMANCE CHART

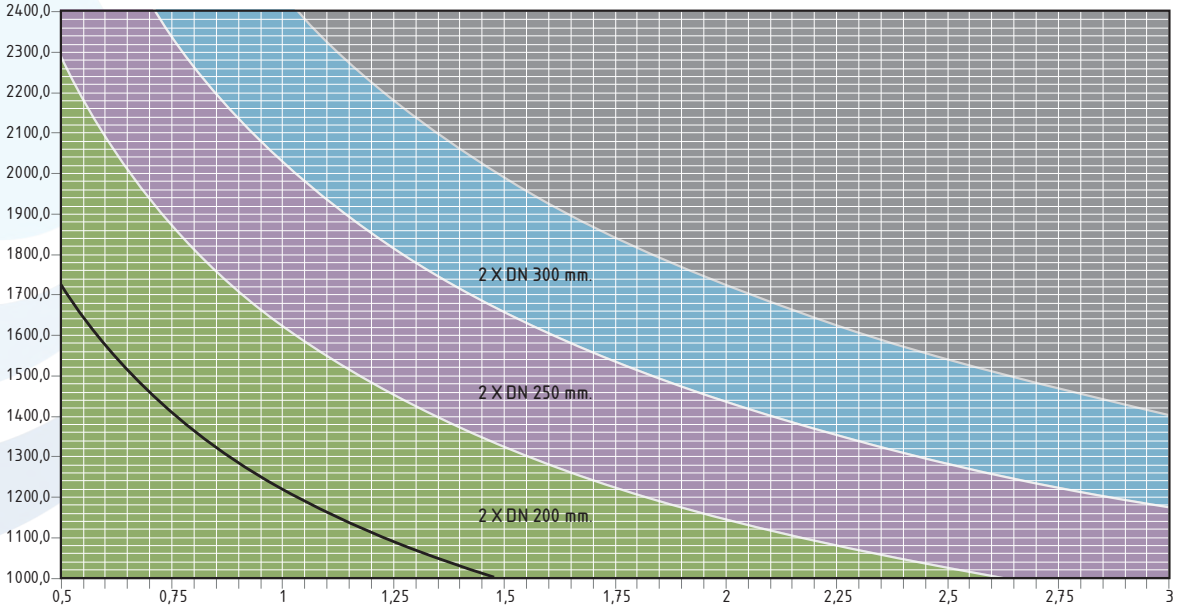


SIZING TO PIPELINE

AIR VALVE SIZING CHART:
KINETIC, FULL BORE DESIGN

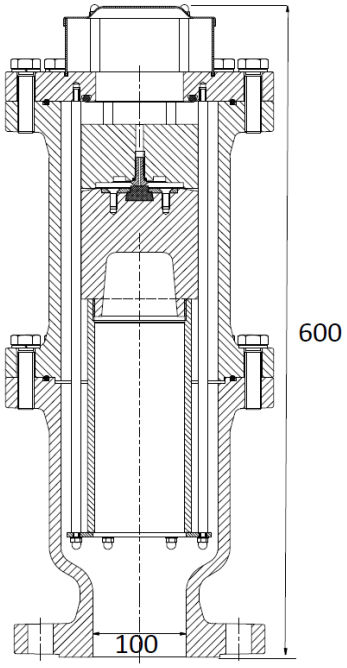


AIR VALVE SIZING CHART TRIPPLE EFFECT:
KINETIC, FULL BORE DESIGN, DOUBLE PARALLEL INSTALLATION



RAV 70

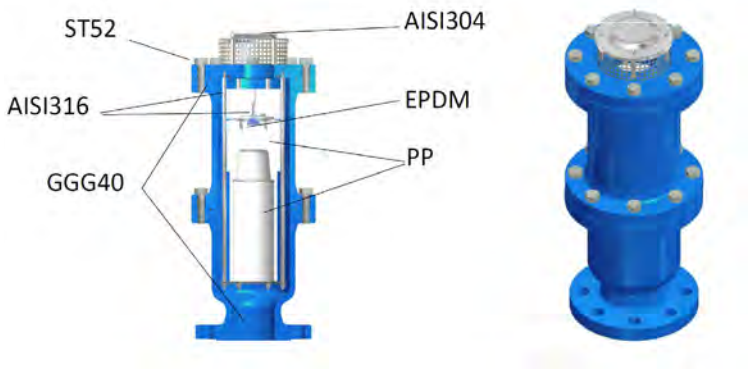
WASTE WATER AIR VALVE (3 Effect, combination)



RAV70 Type of air valve is the new generation design of combination air valve to compensate for the pipe-line design and application defects at air discharge criterion.

RAV70 Type of air valve accomplishes 3 functions in a single chamber design.

PARTS MATERIAL



FUNCTIONS

1. **Atmospheric Function:** Discharge of air in high volume in the pipe-line to atmosphere during pipe filling.
2. **Atmospheric Function:** Intake of air in high volume into the pipe line during pipe-line emptying.
3. **Pressurized Function:** Discharge of low volume of air trapped and accumulated in the body in the form of bubbles.

APPLICATIONS

Waste Water Systems

TECHNICAL DATA

Nominal Size:	DN50 - DN300 (2"-12")
Working Pressure:	0.2- 25 bar
Test Standard	1074-1 / 4 & EN12266
Flange Standard:	ISO 7005-2 / EN 1092-2
Temperature:	-10 °C to +80 °C
Coating:	Electro-static Epoxy Powder RAL5010 (Thermoplastic coating as option)
Option:	As per request; Body and Cover GGG40 (SS316 as option) Floats PP, Trim AISI316.

RAPHAEL, founded in 1949, is the first Israeli manufacturer of water control valves. RAPHAEL´s research department constantly strives to introduce new and innovative products and solutions for water control systems including water works, fire-protection and irrigation systems.

Waterworks | Fire Protection | Irrigation | Smart Solutions

RAPHAEL

RAPHAEL Valves Industries (1975) Ltd.

North Industrial Zone Or Akiva, 3063927 P.O.Box 555, Israel

Tel. +972 4 6263555 | info@raphael-valves.com | raphael-valves.com

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