

VENT-O-MAT[®]

SERIES RBX

“ANTI-SHOCK”

AIR RELEASE AND VACUUM BREAK VALVES

**FOR EFFECTIVE AIR RELEASE VACUUM PROTECTION AND
SURGE ALLEVIATION**



VENT-O-MAT[®]

AIR RELEASE & VACUUM BREAK VALVES SERIES RBX "ANTI - SHOCK"

The Unique defence against pipe bursts and pipeline system damage!

Vent-O-Mat Series RBX has evolved from a long lineage of research and development into a product that has proven unsurpassed for air release, vacuum protection, surge alleviation and pipeline flow enhancement.

The basis of the Vent-O-Mat design is in the understanding of the physical laws that govern air valve and pipeline operation. Reaction to pipeline dynamics is therefore instantaneous and protection provided is relevant to the pipeline's needs.

Vent-O-Mat Series RBX truly represents the pinnacle of valve design evolution. This valve design provides the most comprehensive, effective and efficient pipeline protection relative to initial cost of any other available pipeline component. This can easily be gauged from the below:

Automatic Surge Protection

The unique Series RBX valve incorporates as standard, three design features to automatically protect a pipeline, under all pipeline operating conditions, from the destructive surge and water hammer phenomena. These features are independent of any mechanical devices ensuring reaction in a very low milli second time span.

Effective Air Release

The RBX design ensures effective de-aeration under all pipeline flow and operating conditions, via either one of three discharge orifices.

Vacuum Protection

The RBX series large orifice diameters equal the nominal size of the valve. This ensures the least possible resistance to the intake of air and consequently the least possible negative pressure within a draining pipeline. The use of solid, cylindrical floats ensures instantaneous reaction, discourages the "Venturi" phenomenon and is a further guarantee of effective vacuum protection.

Guaranteed Performance

The RBX has been designed and developed to provide the optimum usable and safe performance relative to all functions. Selection data has been substantiated through third party testing and can therefore be confidently referenced.

The surge protection function of the RBX design has been incorporated in the well-known **SURGE 2000** surge analysis software programme and can be analysed with great accuracy in other commercially available surge analysis programmes such as FLOWMASTER and TRANSAM.

Unparalleled Service

Vent-O-Mat is committed to customer service and to the selling of solutions. Our highly dedicated team is available at all times to assist with air valve sizing and positioning. Assistance is also provided in finding the most cost effective and/or efficient surge protection strategy relevant to the pipeline's needs.

International Representation

Vent-O-Mat is represented in the following countries and regions:

* USA	* Thailand	* South Africa	* Tanzania	* Kuwait
* Canada	* Germany	* Mexico	* Hong Kong	* Brazil
* Caribbean	* Peru	* Chile	* Taiwan	* France
* United Arab Emirates	* Egypt	* Malawi	* New Zealand	* Singapore
* South America	* UK	* Zambia	* Vietnam	* Australia

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PRE NOTES:

1. VENTING OF A FILLING PIPELINE:

The operation of a conventional air release valve is such that fast approaching water is almost instantaneously halted by the valve's closure without the shock cushioning benefit of any retained air in the pipeline. Consequently a transient pressure rise or shock of potentially damaging proportions can be generated in a pipeline system, even at normal filling rates.

In addition to venting through the Large Orifice (1) when water approach velocities are sub critical, the Vent-O-Mat series RBX air release valves feature an automatic "Anti-Shock" Orifice (8) device that serves to decelerate water approaching at excessive speed, thereby limiting pressure rise to a maximum of 1.5 x rated working pressure of the valve.

2. SURGE ALLEVIATION - PIPELINE PRESSURIZED:

In instances where a pipeline experiences water column separation due to pump stoppage, high shock pressures can be generated when the separated water column rejoins.

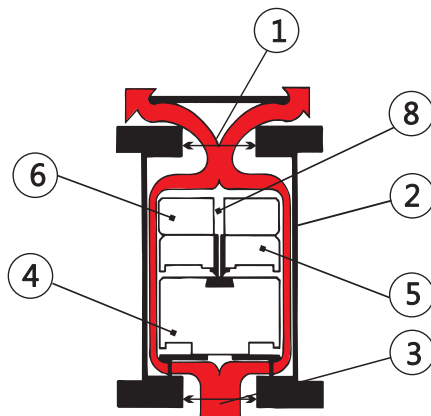
The Vent-O-Mat series RBX takes in air through the unobstructed large orifice when water column separation occurs, but controls the discharge of air through the "Anti-Shock" Orifice as the separated column commences to rejoin. The rejoining impact velocity is thereby sufficiently reduced to prevent an unacceptably high surge pressure in the system. In the same way the series RBX valve prevents high surge pressures resulting from liquid oscillation in a pipeline.

3. PRESSURIZED AIR RELEASE FROM A FULL PIPELINE:

Effective discharge by the valve of pressurized air depends on the existence of a 'CRITICAL RELATIONSHIP' between the area of the Small Orifice (7) and the mass of Control Float (4), i.e., the mass of the float must be greater than the force created by the working pressure acting on the orifice area. If the float is relatively too light or the orifice area relatively too great, the float will be held against the orifice, even when not buoyed, and air discharge will not be effected.

To ensure that the correct 'CRITICAL RELATIONSHIP' exists the requisite 'DROP TEST' described under TEST SPECIFICATION on page 17 must be applied to any air release valve which is intended for discharge of pressurized air.

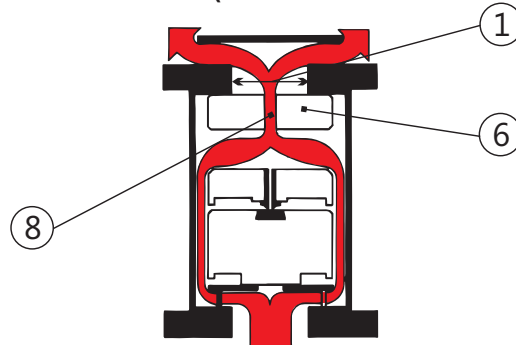
VENTING OF A FILLING PIPELINE (SUB CRITICAL WATER APPROACH VELOCITY)



Air enters Orifice (3), travels through the annular space between the cylindrical floats (4), (5), and (6) and the valve Chamber Barrel (2) and discharges from the Large Orifice (1) into atmosphere.

Series RBX OPERATION

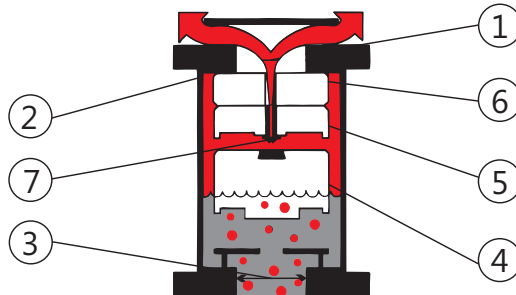
VENTING OF A FILLING PIPELINE (EXCESSIVE WATER APPROACH VELOCITY)



In reaction to increased air flow, Float (6) closes Large Orifice (1) and air is forced through the “Anti-Shock” Orifice (8) resulting in deceleration of the approaching water due to the resistance of rising air pressure in the valve.

Attention is drawn to Pre Note 1 and 2 on page 1.

PRESSURIZED AIR RELEASE FROM A FULL PIPELINE

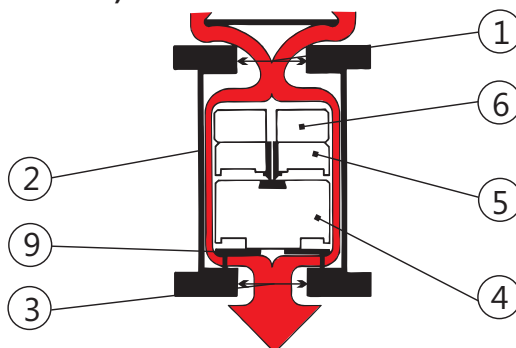


Subsequent to the filling of a pipeline, liquid enters the valve Barrel Chamber (2) and the Floats (4), (5) and (6) are buoyed so that the Large Orifice (1) is closed by Float (6), the valve will then become internally pressurized. A minimal working pressure of 0.5 bar (7.3 psi) acting on the relatively large area of the Orifice (1) will lock Float (6) into the closed position across the Large Orifice (1).

Disentrained air rises through the liquid and accumulates in the valve chamber, when the volume of air is sufficient to displace the liquid, Float (4) will no longer be buoyant and will gravitate downwards thereby opening the Small Orifice (7) and allowing accumulated air to be discharged into atmosphere, as air is discharged the liquid raises Float (4) and re-seals the Small Orifice (7) and prevents escape of liquid

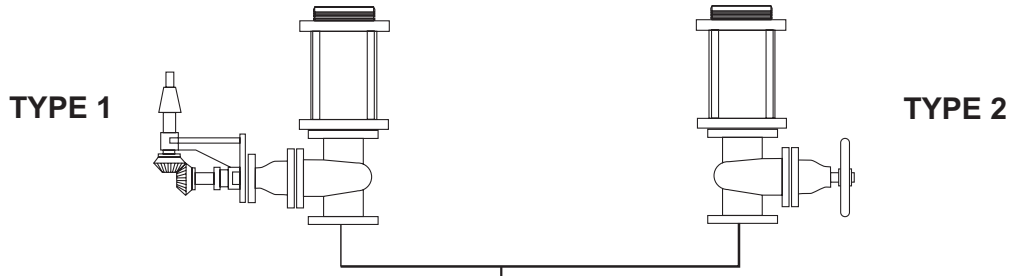
Specific attention is drawn to pre note 3 on page 1.

VACUUM RELIEF (AIR INTAKE) OF A DRAINING PIPELINE

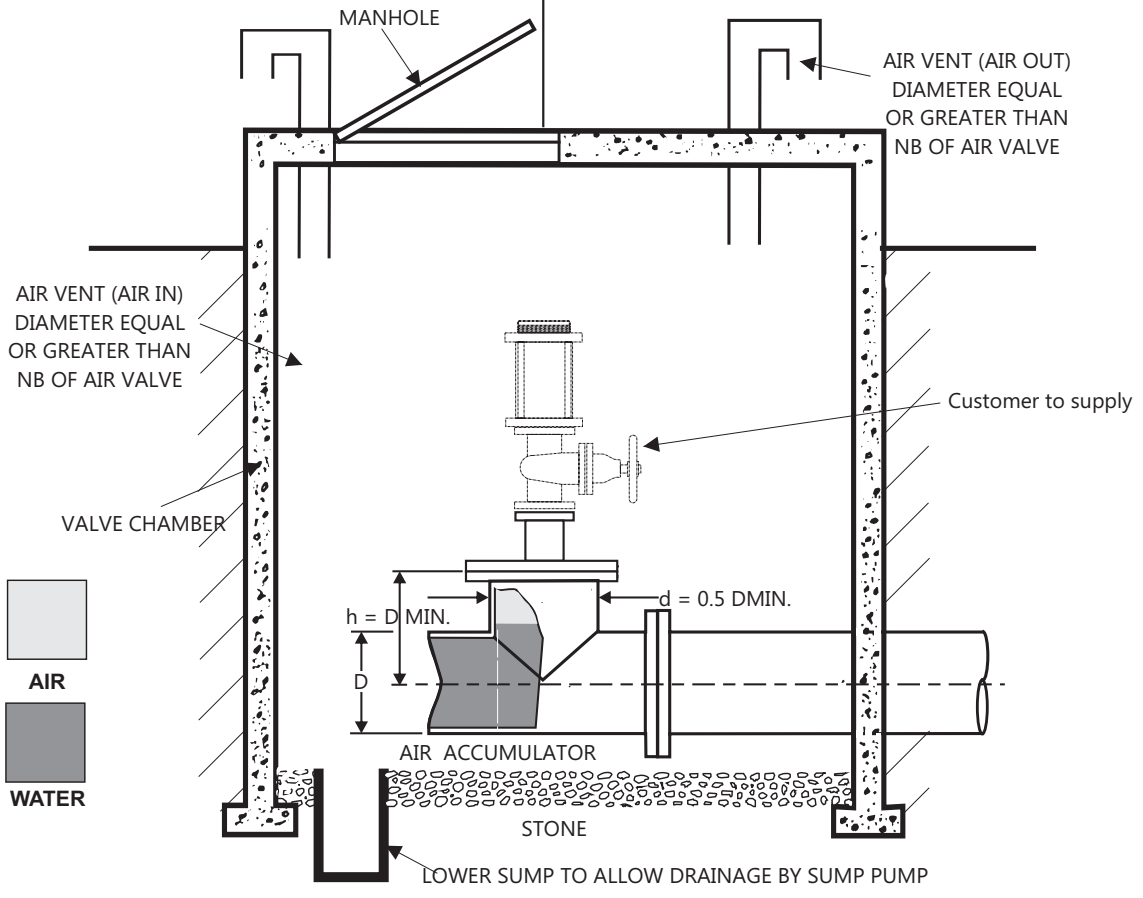


Simultaneous drainage of liquid from Valve Chamber (2) causes Floats (4), (5) and (6) to gravitate downwards onto the Baffle Plate (9), thereby allowing atmospheric air through the valve to rapidly displace draining liquid in the pipeline and prevent potentially damaging internal negative pressure.

RECOMMENDED INSTALLATION ARRANGEMENTS



THE DEGREE OF TOLERANCE ALLOWED FOR THE EFFECTIVE OPERATION OF A VENT-O-MAT AIR RELEASE AND VACUUM BREAK VALVE IS **3 DEGREES FROM VERTICAL**



COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS
SCREWED - 1" & 2"

Type:
 Series RBX - Double Orifice (Small & Large Orifice)
 with Anti Shock Orifice Mechanism.

End Connection:
 Screwed NPT Male (ASME B1.20.1)

Nominal Sizes:

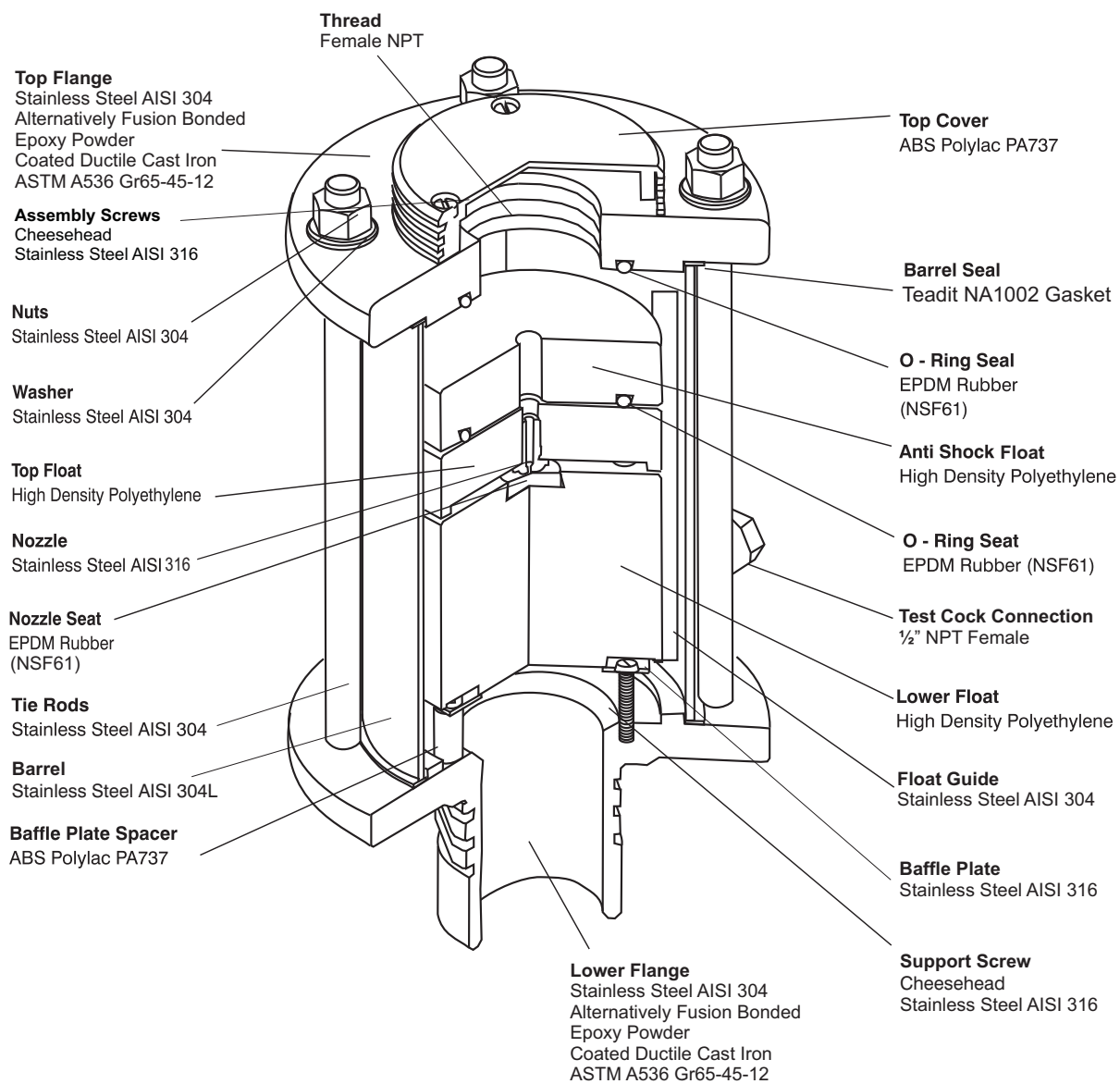
DN25 - 1"
 DN50 - 2"

Model No's:

RBX 2521 _____ NPT _____
 RBX 4021 _____ NPT _____

Pressure Ratings:

363 psi
 580 psi



Valves are available in 316L on request.
 Valves are available in 928psi and 1450psi on request.
 Information subject to change without prior notice

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS

STUDED - 3" TO 8"

Type:

Series RBX - Double Orifice (Small & Large Orifice)
with Anti Shock Orifice Mechanism.

End Connection:

Studded flange (ASME B16.5)

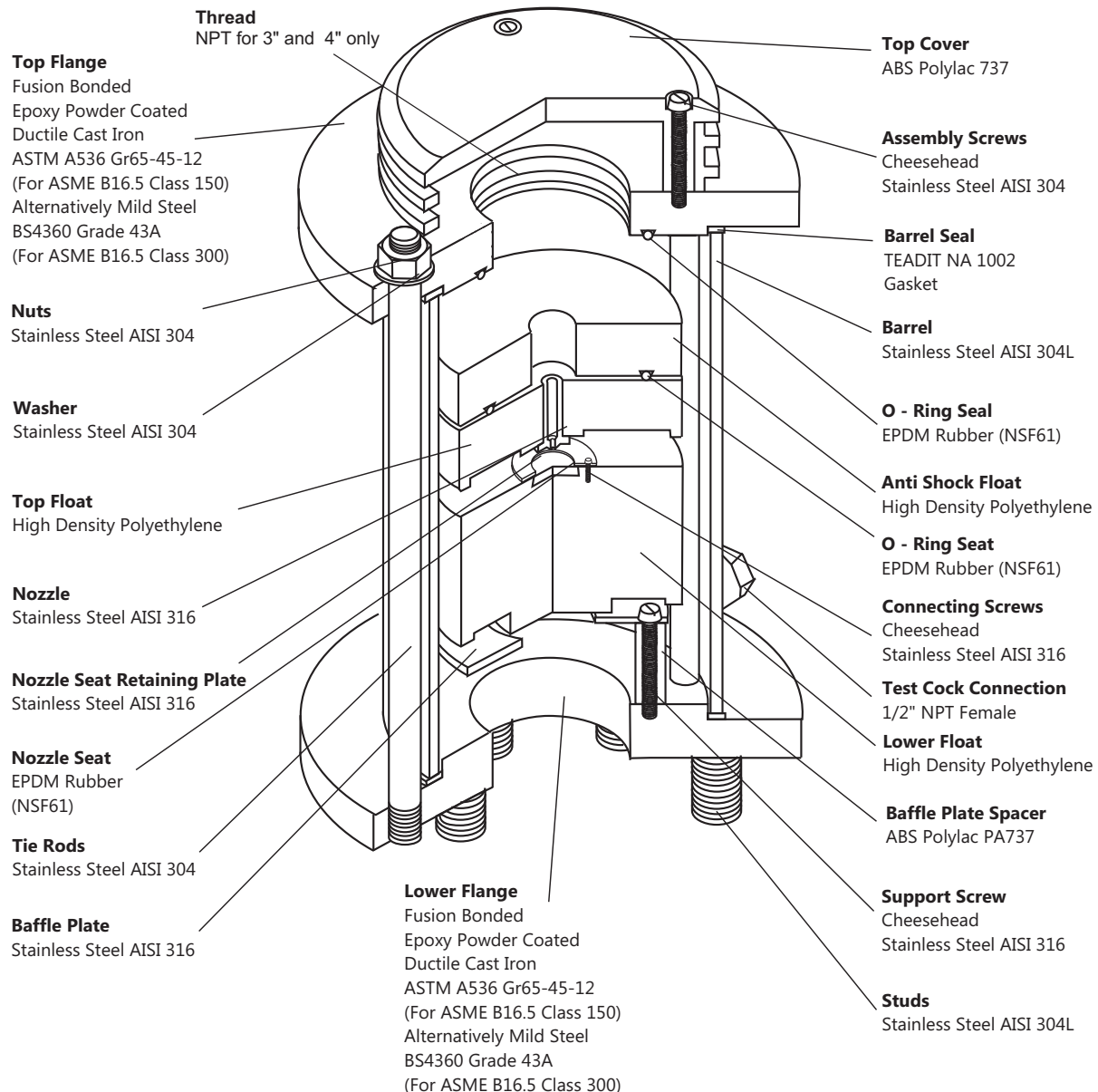
Nominal Sizes:

DN080 - 3"
DN100 - 4"
DN150 - 6"
DN200 - 8"

Model No's:

RBX1931 _____ ANSI 150# _____ 276psi
RBX2531 _____ ANSI 150# _____ 276psi
RBX2551 _____ ANSI 300# _____ 363psi
RBX4051 _____ ANSI 300# _____ 580psi

Pressure Ratings:



Valves available in AISI 304L or 316L on request.
Valves for 928psi available on request.

Information subject to change without prior notice

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS

FLANGED - 3" TO 8"

Type:

Series RBX - Double Orifice (Small & Large Orifice) with Anti Shock Orifice Mechanism.

End Connection:

Flat-faced flange (ASME B16.5)

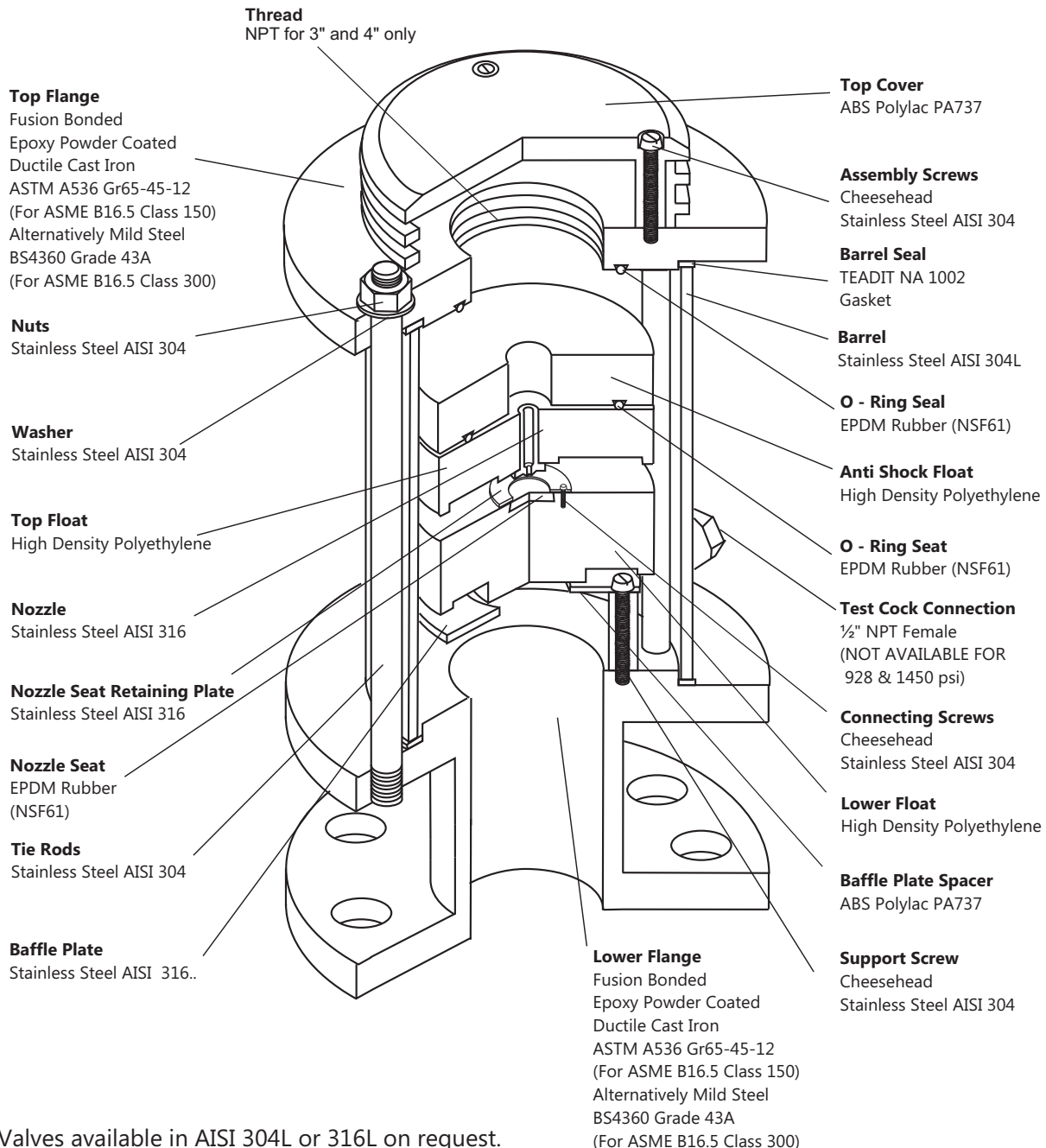
Nominal Sizes:

- DN080 - 3"
- DN100 - 4"
- DN150 - 6"
- DN200 - 8"

Model No's:

- RBX1941 _____ ANSI 150# _____ 276psi
- RBX2541 _____ ANSI 150# _____ 276psi
- RBX2561 _____ ANSI 300# _____ 363psi
- RBX4061 _____ ANSI 300# _____ 580psi

Pressure Ratings:

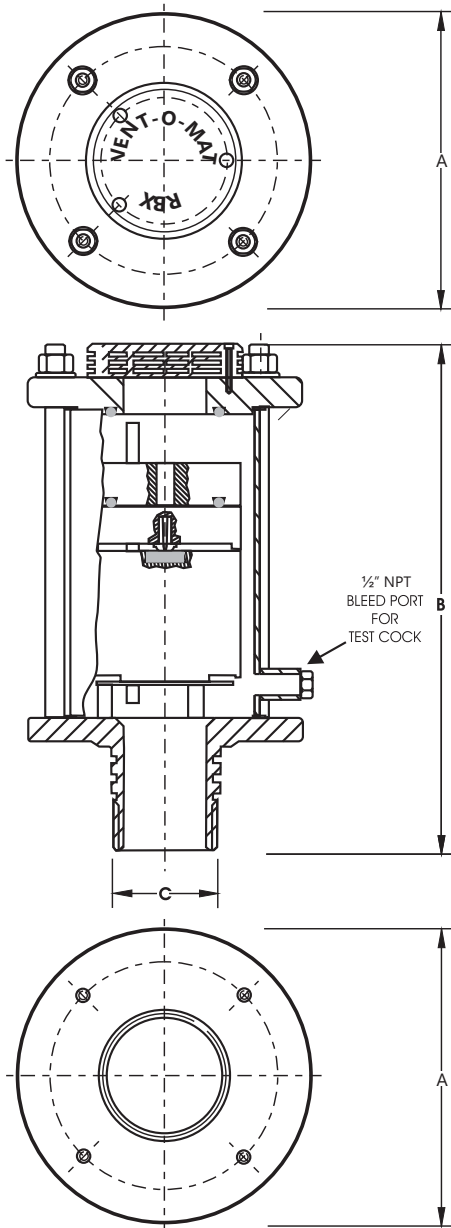


Valves available in AISI 304L or 316L on request.

Valves available for 928 psi on request.

Information subject to change without prior notice

GENERAL SPECIFICATIONS
SCREWED - 1" & 2"



Type:
Double Orifice (Small & Large Orifice) with Anti-Shock Orifice Mechanism.

End Connection:
Screwed NPT Male (ASME B1.20.1)

Nominal Sizes:
1" & 2"

Model No's: RBX 2521 _____ RBX 4021 _____
Operating Pressure Range: 7.25 psi to 363 psi 7.25 psi to 580 psi

Operating Temperature Range:
40° to 176°F

Acceptable Media:
Potable or strained raw water.

Function:

- i) High volume air discharge - pipeline filling.
- ii) High volume air intake - pipeline draining
- iii) Pressurized air discharge - pipeline filled.
- iv) Surge dampening - high velocity air discharge, water column separation & liquid oscillation.

Materials of Construction: - see page 4

Installation:- see page 3

Standard Factory Tests:

- i) Hydrostatic - 1.5 x max. rated working pressure
- ii) Low head leak - 7.25 psi
- iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

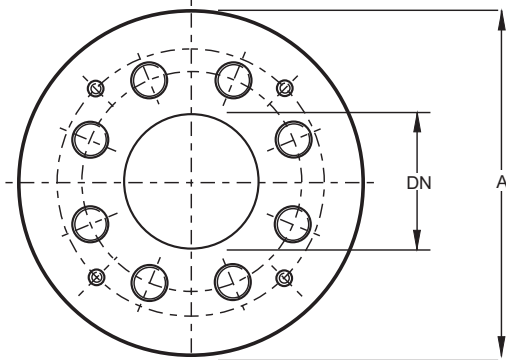
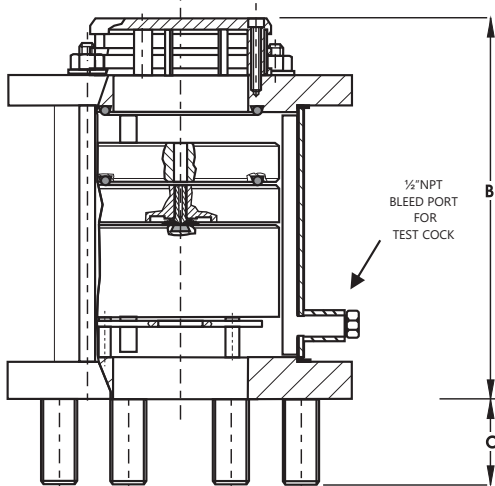
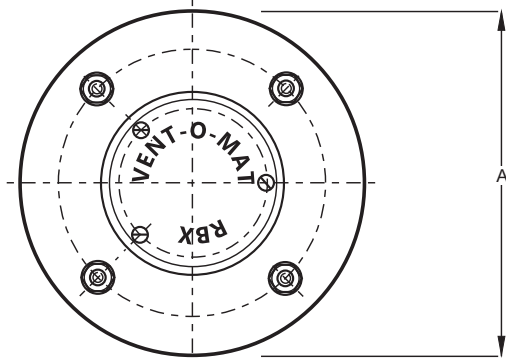
OVERALL DIMENSIONS & WEIGHTS

DN in.	MODEL No.	PRESSURE RATING	A in.	B in.	C	WEIGHT lbs
1"	025 RBX 2521	363 psi	4 ³ / ₄	10 ⁷ / ₁₆	1" NPT	9.5
1"	025 RBX 4021	580 psi	4 ³ / ₄	12 ¹ / ₂	1" NPT	10.7
2"	050 RBX 2521	363 psi	6 ¹ / ₂	12 ⁸ / ₁₀	2" NPT	20
2"	050 RBX 4021	580 psi	6 ¹ / ₂	13 ⁶ / ₁₆	2" NPT	21

Dimensions for higher pressure valves available on request.

Information subject to change without prior notice

**GENERAL SPECIFICATIONS
STUDDED - 3" TO 8"**



Type:
Double Orifice (Small & Large Orifice) with Anti-Shock Orifice Mechanism.

End Connection:
Flange with Screwed Studs for Alignment to;
ANSI B16.5 Class 150 or 300

Nominal Sizes:
3" to 8"

Model No's:	Operating Pressure Rating:
RBX 1931	7.25 psi to 276 psi
RBX 2531	7.25 psi to 276 psi
RBX 2551	7.25 psi to 363 psi
RBX 4051	7.25 psi to 580 psi

Operating Temperature Range:
40°F to 176°F

Acceptable Media:
Potable or strained raw water.

- Function:**
- i) High volume air discharge - pipeline filling.
 - ii) High volume air intake - pipeline draining
 - iii) Pressurized air discharge - pipeline filled.
 - iv) Surge dampening - high velocity air discharge, water column separation & liquid oscillation.

Materials of Construction: - see page 5

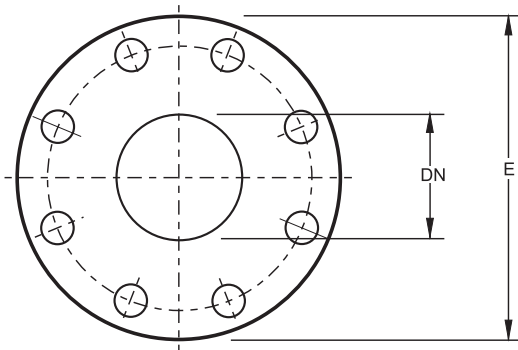
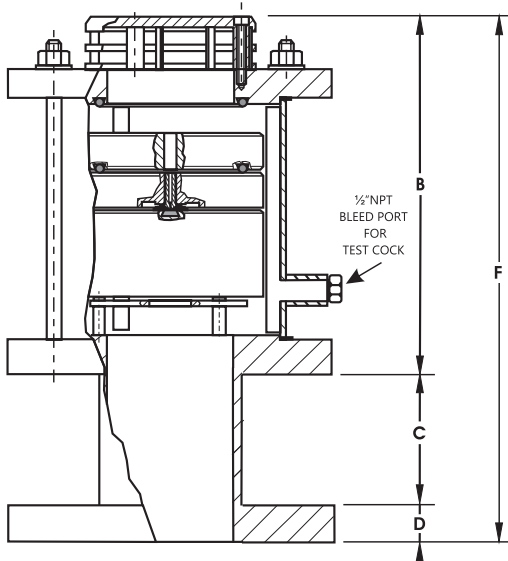
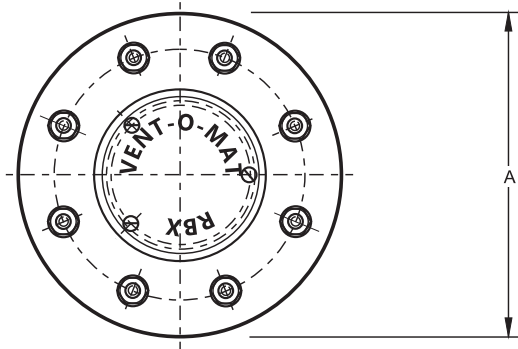
Installation: - see page 3

- Standard Factory Tests:**
- i) Hydrostatic - 1.5 x max. rated working pressure
 - ii) Low head leak - 7.25 psi
 - iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

OVERALL DIMENSIONS & WEIGHTS

DN in	MODEL No.	PRESSURE RATING	A in	B in	C in	WEIGHT lbs
3	RBX 1931/2531	276 psi / 363 psi	9¼	12	2	50.7
3	RBX 4051	580 psi	9¼	12	2	54.0
4	RBX 1931/2531	276 psi / 363 psi	9¼	12½	2	49.6
4	RBX 4051	580 psi	9¼	12½	2	52.9
6	RBX 1931/2531	276 psi / 363 psi	14	18	2	152.7
6	RBX 4051	580 psi	14	18	2	165.3
8	RBX 1931/2531	276 psi / 363 psi	16	21½	2	213.8
8	RBX 4051	580 psi	16	21½	2	238.1

**GENERAL SPECIFICATIONS
FLANGED - 3" TO 8"**



Type:
Double Orifice (Small & Large Orifice) with Anti-Shock Orifice Mechanism.

End Connection:
Flanged for Alignment to;
ANSI B16.5 Class 150 or 300

Nominal Sizes:
3" to 8"

Model No's:	Operating Pressure Range:
RBX 1941	7.25psi to 276psi
RBX 2541	7.25psi to 276psi
RBX 2561	7.25psi to 363psi
RBX 4061	7.25psi to 580psi

Operating Temperature Range:
40°F to 176°F

Acceptable Media:
Potable or strained raw water.

- Function:**
- i) High volume air discharge - pipeline filling.
 - ii) High volume air intake - pipeline draining
 - iii) Pressurized air discharge - pipeline filled.
 - iv) Surge dampening - high velocity air discharge, water column separation & liquid oscillation.

Materials of Construction: - see page 6

Installation: - see page 3

- Standard Factory Tests:**
- i) Hydrostatic - 1.5 x max. rated working pressure
 - ii) Low head leak - 7.25 psi
 - iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

OVERALL DIMENSIONS & WEIGHTS

DN in	MODEL No.	PRESSURE RATING	A in	B in	C in	D in	E in	F in	WEIGHT ± lbs
3	RBX1941/2541	276psi / 363psi	9¼	12	4	15/16	7½	18	65
3	RBX4061	580psi	9¼	12	4	1½	8¼	18	72
4	RBX1941/2541	276psi / 363psi	9¼	12½	3	15/16	9	16½	64
4	RBX4061	580psi	9¼	12½	3	1¼	10	16½	71
6	RBX1941/2541	276psi / 363psi	14	18	5	1	11	24	137
6	RBX4061	580psi	14	18	5	1 1/16	12½	24	171
8	RBX1941/2541	276psi / 363psi	16	21½	6	1½	13½	26	245
8	RBX4061	580psi	16	21½	6	1¾	15	26	250

Dimensions for higher pressure valves available on request
Information subject to change without prior notice

Series RBX

SELECTION & POSITIONING

PRE-NOTES

The functional limits of an air valve are governed by three physical laws namely: Joukowski's Equation Boyle's Law and Pascal's Law. Air valve operation however is also dependent on design and internal configuration, and can vary dramatically from manufacturer's product to manufacturer's product, within the parameters of what is physically possible. The basis of the Vent -O- Mat design is in the understanding of these laws, which have been used to design an air release and vacuum break valve that provides the optimum usable safe performance relative to all functions. The following summary is a general guideline of factors to consider when sizing air valves.

Sizing for Vacuum

Calculate necessary valve orifice sizes independently for each apex point.

Determine the smallest air release and vacuum break valve capable of admitting air into the pipeline equal to the potential water flow out of the pipeline whilst not exceeding a differential pressure that would put the pipeline and gasket joints at risk due to negative internal pressure. We recommend 5 psi Dp or lower. This exercise is simplified on pages 11 and 12 of this catalogue. Be cautious of air valve designs with spherical floats as a low pressure zone is created above the float which causes it to partially close off the large orifice during air intake.

Note that vacuum protection is dependent on valve size selection and orifice size relative to the nominal size of the valve. *In sizing air valves be cautious of designs with restricted orifice diameters, i.e., orifice diameters that are smaller than the nominal size of the valve, as this could lead to insufficient vacuum protection and pipe collapse if not accommodated for.* Vent-O-Mat large orifice diameters and flow path through the valve is equal to the nominal size of the valve e.g. a 4" valve has a 4" orifice. This ensures the least possible resistance to the intake of air and consequently the least possible negative pressure within a draining pipeline.

Sizing for Discharge

If a Vent-O-Mat air valve is sized correctly for air intake, discharge should not be a factor in sizing as all air will be discharged through the large orifice or "Anti-Shock" orifice (refer to RBX operation on pages 1 and 2 of this catalogue). *If this information is used for the sizing of air valves other than Vent-O-Mat, we recommend that a valve be selected that is capable of discharging air equal to the filling rate, whilst not exceeding a differential of 0.725 psi across the large orifice in order to prevent pressure surge and water hammer.*

Pressurized Air Discharge

Effective discharge by an air release and vacuum break valve of pressurised air depends on the existence of a "Critical Relationship" between the area of the small orifice and the mass of the control float, i.e., the mass of the float must be greater than the force created by the working pressure acting on the orifice area. If the float is relatively too light or the orifice area relatively too great, the float will be held against the orifice even when not buoyed, and air discharge will not take place.

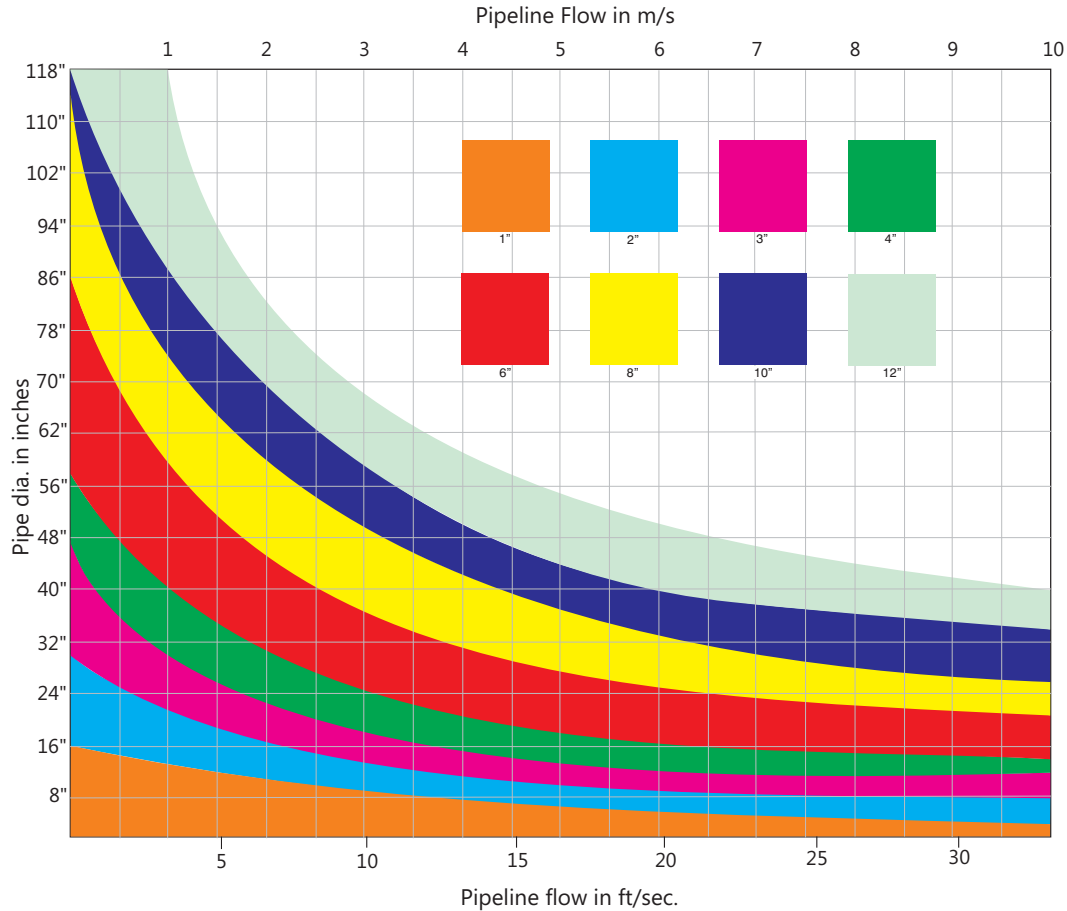
Surge Alleviation

It is imperative, due to the unpredictable nature of pipeline operation, that every air release and vacuum break valve should as standard, incorporate a surge and water hammer alleviation mechanism. This mechanism should only be activated in the instance of high velocity air discharge or pump trip (where the separated liquid columns rejoin at excessive velocities). The alleviation of surge and/or water hammer must be achieved by deceleration of the approaching liquid prior to valve closure (see operation of RBX on pages 1 and 2 of this catalogue). Relief mechanisms that act subsequent to valve closure cannot react in the low millisecond time span required and are therefore unacceptable.

Kindly contact the manufacturer for free copies of the Vent-O-Mat publications; "Points to Consider when Sizing and Position Air Release and Vacuum Break Valves" and "Air Valve Technology Reviewed", should you require more information on the phenomena of surge and water hammer as a result of air release, as well as the functional limits of all available air valve designs and configurations.

Vent-O-Mat has an interactive sizing programme available on the Internet. The website address is: <http://www.ventomat.us>. You can, should you experience any problems, or need additional assistance, contact us at our E Mail address: ventomat@rfvalve.com

SELECTION & POSITIONING



Pipe Dia Inches	2	3	5	7	8	10	11	13	15	16	18	20	21	23	25	26	28	30	31	33
4	78	117	196	274	313	391	431	509	587	626	705	783	822	900	979	1018	1096	1174	1214	1292
6	176	264	440	617	705	881	969	1145	1321	1409	1585	1762	1850	2026	2202	2290	2466	2642	2731	2907
8	313	470	783	1096	1253	1566	1722	2036	2349	2505	2819	3132	3288	3602	3915	4071	4385	4698	4854	5167
10	489	734	1223	1713	1957	2447	2691	3181	3670	3915	4404	4893	5138	5627	6117	6361	6851	7340	7585	8074
12	705	1057	1762	2466	2819	3523	3876	4580	5285	5637	6342	7047	7399	8104	8808	9161	9865	10570	10922	11627
14	959	1439	2398	3357	3836	4796	5275	6234	7193	7673	8632	9591	10071	11030	11989	12469	13428	14387	14866	15825
16	1253	1879	3132	4385	5011	6264	6890	8143	9395	10022	11275	12527	13154	14406	15659	16285	17538	18791	19417	20670
18	1585	2378	3964	5549	6342	7927	8720	10306	11891	12684	14269	15855	16648	18233	19818	20611	22197	23782	24575	26160
20	1957	2936	4893	6851	7830	9787	10766	12723	14680	15659	17616	19574	20552	22510	24467	25446	27403	29361	30339	32297
22	2368	3553	5921	8289	9474	11842	13026	15395	17763	18947	21316	23684	24868	27237	29605	30790	33158	35526	36711	39079
24	2819	4228	7047	9865	11275	14093	15502	18321	21140	22549	25368	28186	29596	32414	35233	36642	39461	42279	43688	46507
26	3308	4952	8270	11578	13232	16540	18194	21502	24810	26464	29772	33080	34734	38042	41350	43004	46312	49620	51274	54582
28	3836	5755	9591	13428	15346	19182	21101	24937	28773	30692	34528	38365	40283	44119	47956	49874	53710	57547	59465	63302
30	4404	6606	11010	15414	17616	22021	24223	28627	33031	35233	39637	44041	46243	50647	55051	57253	61657	66062	68264	72668
32	5011	7516	12527	17538	20044	25054	27560	32571	37582	40087	45098	50109	52614	57625	62636	65142	70152	75163	77669	82680
34	5657	8485	14142	19999	22627	28284	31113	36769	42426	45255	50911	56568	59397	65053	70710	73539	79195	84852	87681	93338
36	6342	9513	15855	22197	25368	31710	34880	41222	47564	50735	57077	63419	66590	72932	79274	82445	88787	95129	98300	104641
38	7046	10599	17665	24731	28265	35331	38864	45930	52996	56529	62671	70661	74194	81261	88327	91860	98926	105992	109255	116591
40	7830	11744	19574	27403	31318	39148	43062	50892	58721	62636	70466	78295	82210	90039	97869	101784	109613	117443	121357	129187
44	9474	14211	23684	33158	37895	47369	52105	61579	71053	75790	85263	94737	99474	108948	118421	123158	132632	142106	146843	156316
48	11275	16912	28186	39461	45098	56373	62010	73284	84559	90196	101471	112745	118382	129657	140931	146569	157843	169118	174755	186029
52	13232	19848	33080	46312	52928	66159	72775	86007	99239	105855	119087	132319	138935	152167	165398	172014	185246	198478	205094	218326
56	15348	23019	38385	53710	61383	76729	84402	98748	115094	122767	138113	153458	161131	176477	191823	199498	214842	230186	237861	253206
60	17616	26425	44041	61657	70466	88082	96890	114507	132123	140931	158548	176164	184972	202589	220205	228013	246630	264246	273054	290671
62	18810	28216	47026	65836	75242	94052	103457	122268	141078	150483	169294	188104	197509	216320	235130	244535	263346	282156	291561	310372
66	21316	31974	53290	74605	85263	106579	117237	138553	159869	170527	191843	213159	223816	245132	266448	277106	298422	319738	330396	351712
70	23978	35967	59945	83923	95912	119889	131878	155856	179834	191823	215801	239779	251768	275746	299724	311713	335690	359668	371657	395635
74	26792	40158	66991	93788	107186	133983	147381	174177	200974	214372	241169	267965	281363	308160	334956	348355	375151	401948	415346	442142
78	29772	44658	74429	104201	119087	148859	163745	193516	223288	238174	267946	297717	312603	342375	372147	387032	416804	446576	461462	491234
82	32904	49355	82259	115162	131614	164518	180969	213873	246777	262228	296132	329035	345487	378391	411294	427746	460649	493553	510005	542908
86	36192	54288	90480	126672	144768	180960	199056	235248	271439	289535	325727	361919	380015	416207	452399	470495	506687	542879	560975	597167
90	39637	59455	99992	138729	158448	198185	218003	257460	297277	317095	356732	396369	416188	455825	495461	515280	554917	594554	614372	654009
94	43238	64858	108996	151335	172954	216192	237812	281050	324289	345908	39146	432385	454004	497243	540481	562100	605339	648577	670197	713435
98	46997	70495	117492	164488	187987	234982	258482	305478	352473	373973	420970	467967	493465	540462	587458	610957	657953	704950	728448	775445
102	50911	76367	127279	178190	203846	254857	280013	330924	381836	407231	458203	509114	534570	585481	636393	661849	712760	738217	789127	840038
106	54983	82474	137457	192440	219311	274914	302005	357388	412371	433962	494845	549828	577319	632302	687285	714776	769759	824742	852233	907216
110	59211	88816	148027	207237	236843	296054	323559	384870	444080	473686	532896	592107	621712	680923	740134	769739	828950	888161	917766	976977
114	63595	95393	158988	222583	254381	317976	349774	413369	476964	507357	572357	635952	667750	731345	794940	826738	890333	953928	985726	1049321
118	68136	102205	170341	238477	272545	340682	374750	442886	511023	545091	613227	681363	715432	783568	851704	885773	953909	1022045	1056113	1124250

Conversion Table ft/sec of Pipeline Velocity to gal/min

SELECTION & POSITIONING

VALVE SELECTION FROM GRAPH

All the relevant information has been condensed into one graph to enable valve selection to be simple and easy and at the same time to allow flexibility to the designer to move within certain parameters which eventually allows the most suited and economically viable valve to be selected.

IMPORTANT NOTE: The graph is based on vacuum breaking and limiting vacuum to 0.34 bar (5 psi) below atmospheric. It is not good practice to go below 10 psi absolute (4.4 psi differential in pipeline at sea level). The graph allows for change in altitude and hence change in atmospheric pressure and is based on the assumption that more than one valve per section is used for vacuum protection and venting.

ACTUAL SELECTION (GRAVITY OR PUMPED PIPELINES)

Selection is based on the premise that pipelines are generally filled at a slower rate than they are drained, scoured or at which separation occurs (a maximum fill/drain ratio of 1:1).

1. Determine the maximum drainage rate in ft/s either for scouring, pipe rupture or column separation for a particular pipeline section. Conversion from gal/min to ft/sec can be done fairly quickly; using the conversion table on page 11.
2. Move vertically on the selection graph (top of page 11) from the ft/s point and move horizontally from the pipe size finding the intersecting point.
3. This point should fall within the operating band of a particular valve size. Consideration must be given to the fact that the upper portion of the band approaches - 5 psi and the lower portion - 1.45 psi for each valve size, this allows the designer to see at a glance if the valve is too close to it's operating limits and to select the next valve size.

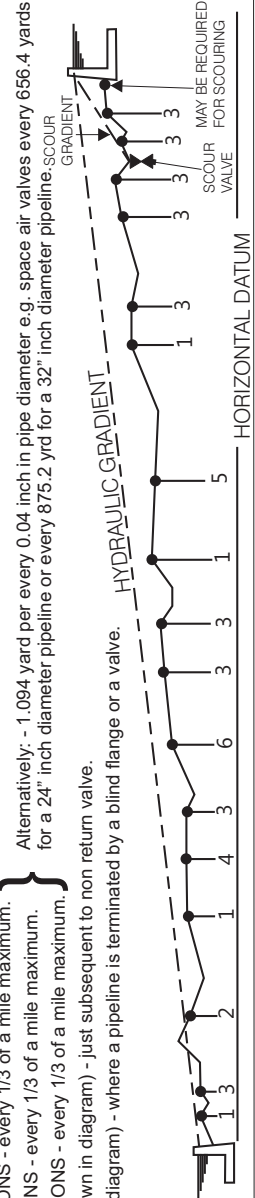
EXAMPLE OF VALVE SIZING (ASSUMING AN INDIVIDUAL SECTION)

A Ø 16" pipeline draining at 99.6 gal/sec which equates to 9.85 ft/s, what valve size should be selected?

From the 9.85 ft/s point, on the graph on page 11, move vertically until the Ø16" pipe size horizontal line is intersected. This places the intersection point in the operating band of a 3" Vent-O-Mat RBX valve. But, if for example, the drainage rate is 132.8 gal/sec which equates to 13.1 ft/s, the valve would be operating close to it's limit and it may be prudent to change to a 4" Vent-O-Mat RBX.

VALVE POSITIONING

1. ON APEX POINTS (relative to hydraulic gradient).
2. 16 FEET BELOW APEX POINTS FORMED BY INTERSECTION OF PIPELINE AND HYDRAULIC GRADIENT - i.e. where pipeline siphoning over gradient an air release valve positioned on the apex would break the siphon. If positioning on apex is required a modified VENT-O-MAT Series RBX can be supplied.
3. NEGATIVE BREAKS (increase in downward slope or decrease in upward slope).
4. LONG HORIZONTAL SECTIONS - every 1/3 of a mile maximum.
5. LONG ASCENDING SECTIONS - every 1/3 of a mile maximum.
6. LONG DESCENDING SECTIONS - every 1/3 of a mile maximum.
7. PUMP DISCHARGE (not shown in diagram) - just subsequent to non return valve.
8. BLANK ENDS (not shown in diagram) - where a pipeline is terminated by a blind flange or a valve.



Series RBX

SURGE & WATERHAMMER PROTECTION

Introduction

The Vent-O-Mat Series RBX "Anti-Shock" air release and vacuum break valve, is the product of extensive research into the development of an efficient, but cost effective solution to surge problems (both mass liquid oscillation and elastic transient phenomena) associated with any operating pipeline. Automatic dampening, relevant to the pipeline's needs is provided by either one of three design features. These special features are unique in a pipeline component of such compact and economic design.

Surge Protection - Initial Filling

The RBX incorporates the additional floating "Anti-Shock" Orifice which is aerodynamically engineered to throttle air discharge when water approach velocity would otherwise become too great and induce an unacceptable pressure rise. The air throttling action increases resistance to the flow of the approaching water which consequently decelerates to a velocity which reduces the pressure rise when the valve closes (see operation of valve on pages 1 & 2). Vent-O-Mat series RBX is an essential precaution for pipeline priming.

Surge Protection - Pump Trip Conditions

In instances where a pipeline experiences water column separation due to pump stoppage, high shock pressures can be generated when the separated water column rejoins.

The Vent-O-Mat series RBX takes in air through the unobstructed large orifice when water column separation occurs, but controls the discharge of air through the "Anti-Shock" Orifice as the separated column commences to rejoin. The rejoining impact velocity is thereby considerably reduced to alleviate high surge pressures in the system (see operation of valve on pages 1 & 2).

Other surge control measures may, dependant on pipeline profile, diameter and operating conditions, be needed to provide the primary surge alleviation function with the Vent-O-Mat air-valves forming an integral and valuable addition in a combined strategy for further reducing surge pressures. The benefit of the "Anti-Shock" Orifice can be readily demonstrated by suitable surge modelling software.

Surge Protection - Pipeline Operating

The operation of valves and similar flow control devices can cause high-pressure transients in an operating pipeline.

The unique, single chamber design of the Vent-O-Mat series RBX valve enables a pocket of air to be trapped in the valve chamber. Automatic operation of the small orifice control float regulates the volume of air entrapped.

The volume maintained in the valve will provide a cushioning benefit to the pipeline for short duration transient pressure "spikes". This effect can be modelled by the design engineer using suitable surge software.

Surge Protection - Primary Pipeline Surge Protection Failure

In instances where air vessels or other alleviation measures are utilised as primary surge protection and these devices fail, excessively high surge pressures will be generated. The same is true if pipeline demands are increased with time without the upgrading of initial surge protection equipment.

SURGE & WATERHAMMER PROTECTION

Protection by Vent-O-Mat Series RBX will provide the benefits already described. The valve in addition, has a pipeline over pressure safety feature which acts as a "rupture-disc". Operation of this feature will be without an explosive effect and without damage to valve. This feature consists of easily replaceable components such as gaskets and seals.

This feature will thus provide surge alleviation in instances where surge pressures are abnormally high. The net alleviation effect can be taken into account by the design engineer using surge modelling software.

Computer Modelling

The effectiveness of Vent-O-Mat series RBX has been substantiated by independent third party testing and by thousands of applications globally. Effective computer modelling, based on practical tests, has been ensured in the well-known and respected commercially available SURGE 2000 surge analysis software programme. Accurate results are also obtained by other commercially available surge analysis software programmes such as FLOWMASTER and TRANSAM.

Holistic Surge & Water Hammer Protection

Vent-O-Mat forms an integral part of a well planned, holistic surge protection strategy that should, according to application needs and financial constraints, include surge vessels, check valves, control valves and/or any other equipment needed to alleviate unacceptable surge behaviour.

Technical and Financial Benefits

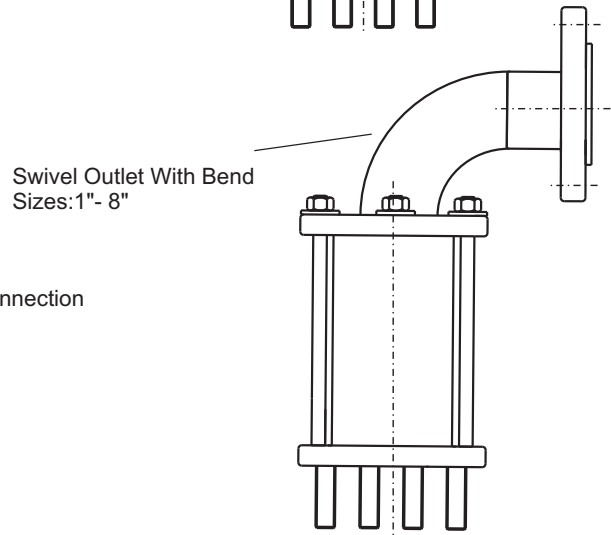
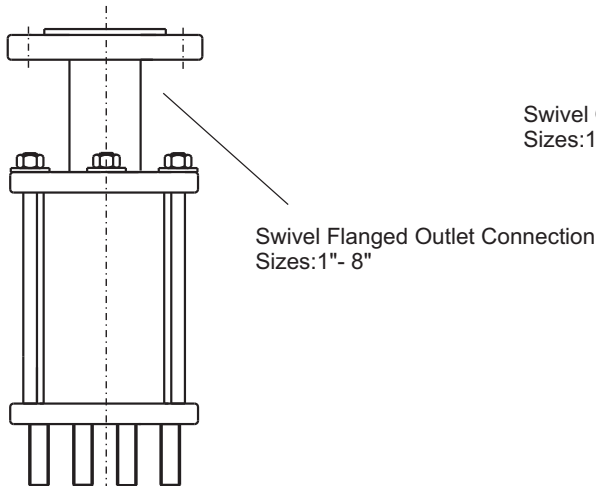
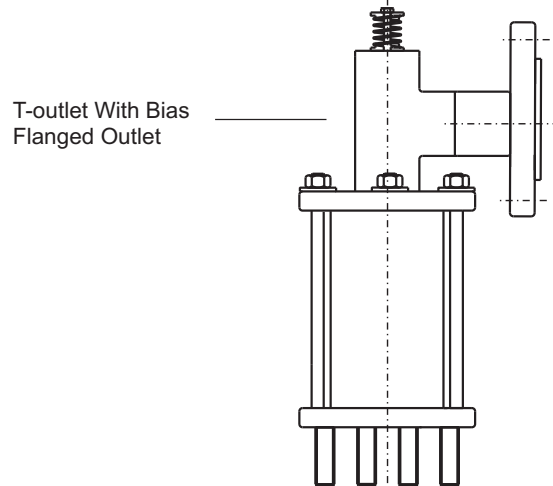
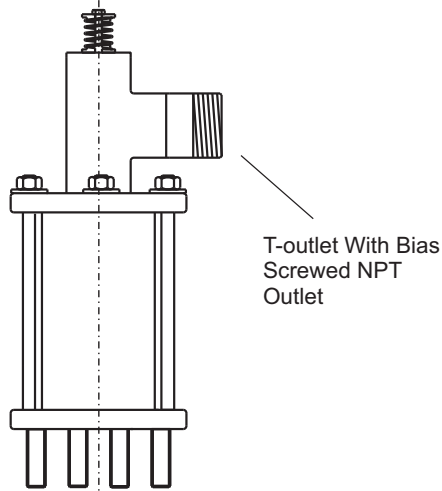
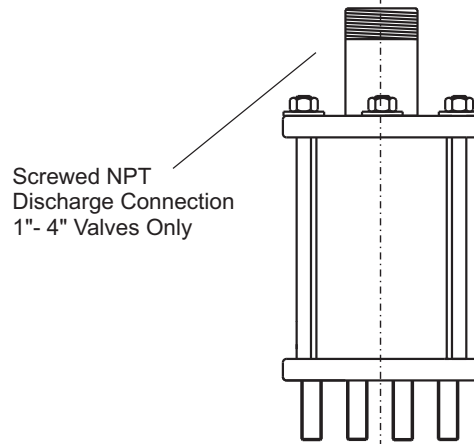
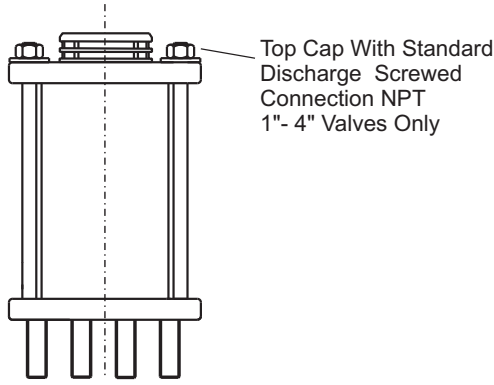
The Vent-O-Mat series RBX valve offers definite financial and technical advantages when incorporated as part of a holistic surge protection strategy. This includes:

1. Improved alleviation of surge behaviour including reduction of:
 - Surge pressure magnitudes by slowing surge velocities
 - Duration of oscillation following a pump trip, as the air-valve continuously absorbs and dissipates the energies of the surge.
2. Potential for reduction in size and/or quantity of conventional surge protection devices such as surge vessels etc.
3. Automatic protection during initial filling when most surge protection devices are not operational.
4. Holistic protection as each air valve installed has design features to automatically damp surges.
5. The valve is virtually maintenance free.

Service

Vent-O-Mat is committed to finding the most cost effective and efficient solution to pipeline complexities. Services include air valve sizing and positioning and assistance to consulting engineers on defining appropriate surge and water hammer protection strategies. Vent-O-Mat has built a sound relationship with many international consulting firms and has gained global recognition for selling solutions!

AVAILABLE DISCHARGE CONNECTIONS
1" TO 8"
10" & 12" VALVES AVAILABLE ON REQUEST

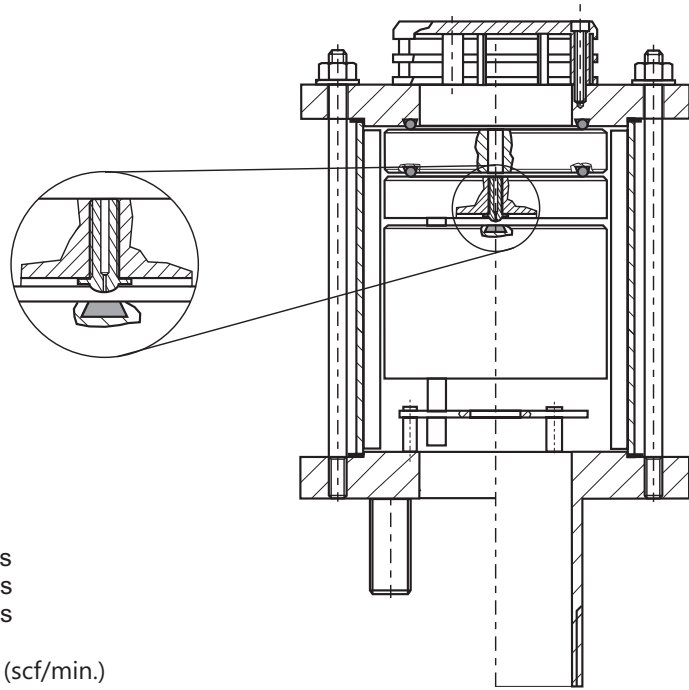


***NOTE**
Discharge Connections Are Equal To Valve Pressure Rating

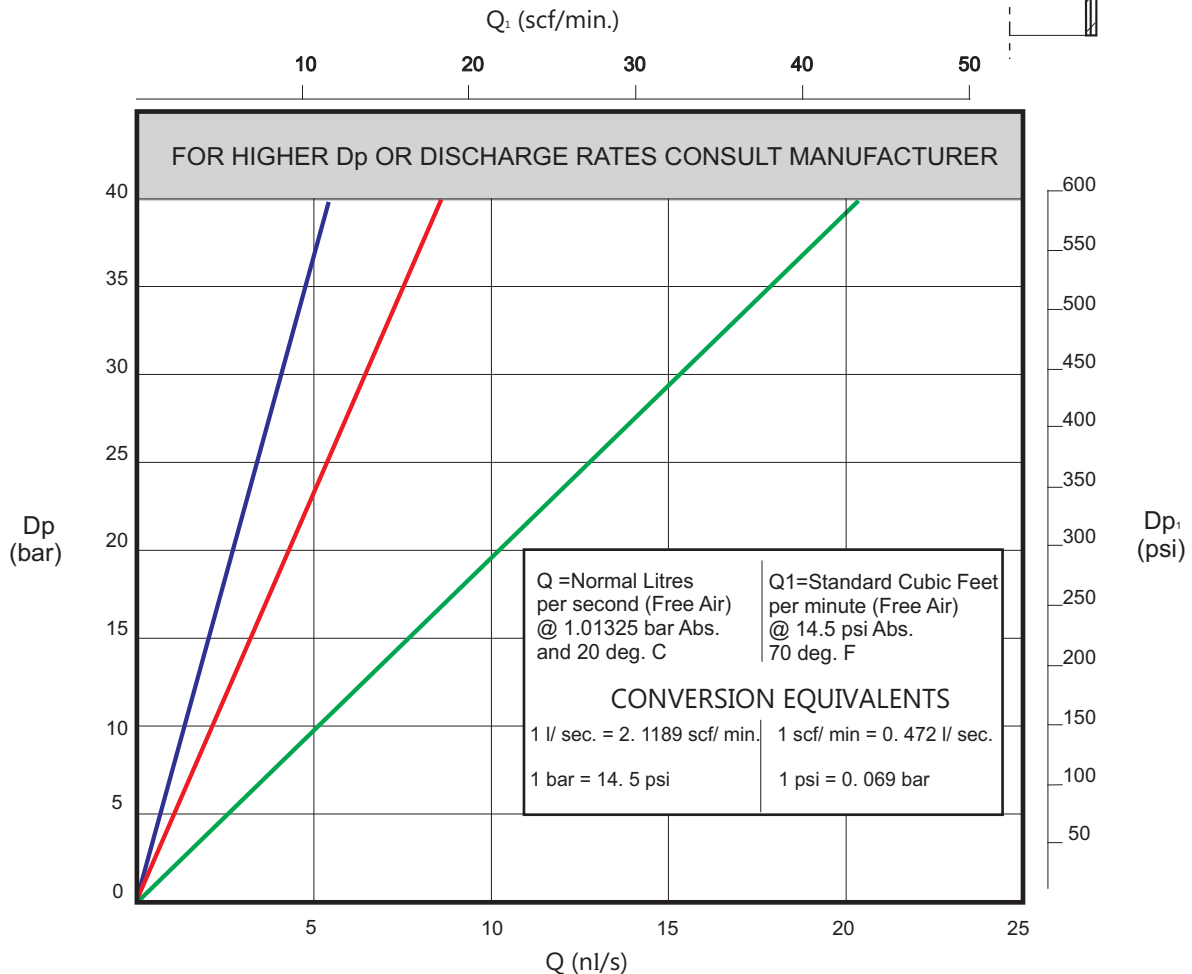
SMALL ORIFICE DISCHARGE PERFORMANCE

Type:
Series RBX - Double Orifice (Small & Large Orifice) with 'Anti-Shock Orifice' Mechanism

Model No's:
RBX 1931 / 2531 / 2551 / 4051
RBX 2521 / 4021



- █ " 0.047" small orifice - 1" & 2" Valves
- █ " 0.059" small orifice - 3" & 4" Valves
- █ " 0.094" small orifice - 6" & 8" Valves



Why?

- **"ANTI-SHOCK" - "ANTI-SURGE"** - The RBX is the only air release valve available that is supplied as standard with a mechanism which operates automatically to prevent pipeline damage from the high induced pressure transients associated with high velocity air discharge. Surge resulting from liquid column separation and liquid oscillation is dramatically reduced as an automatic function of this mechanism.
- **PERFORMANCE** - The RBX has been designed and developed to provide the optimum usable and safe performance relative to all functions. Selection data has been substantiated through CSIR and other testing and can therefore, be confidently referenced.
- **QUALITY** - The RBX economically offers the highest quality construction and materials available in an air release and vacuum break valve. Stringent manufacturing and test procedures are maintained to ensure the best possible service and reliability is given by every valve produced.
- **SERVICEABILITY** - The RBX design facilitates extreme ease of service and maintenance. Components are in corrosion free materials to allow problem free disassembly and reassembly even after many years of operation. All maintenance spares are replaceable without special tools or skills.
- **VACUUM BREAK** - The RBX series large orifice diameters equal the nominal size of the valve, i.e., a 8" valve has a 8" orifice. This ensures the least possible resistance to the intake of air and consequently the least possible negative pressure within a draining pipeline.
- **COMPACTNESS** - Although extremely robust the RBX valve's lightweight and compact construction offers handling transport and installation advantages.
- **BACK UP** - Vent-O-Mat provides highly committed customer orientated sales, service, spares and technical back up - TRY US!!!

PURCHASE SPECIFICATIONS

VENT-O-MAT MODEL NO.

Page 7 - Series RBX - 1" or 2" with NPT, Screwed Male Connection.

Page 8 - Series RBX - 3" or 8" studded connection.

Page 9 - Series RBX - 3" or 8" flanged connection.

CONSTRUCTION & DESIGN

The air release & vacuum break valve shall be of the compact single chamber design with solid cylindrical H.D.P.E. control Floats housed in a tubular Stainless Steel Body with epoxy powder coated Mild Steel or Stainless Steel ends secured by means of Stainless Steel Tie Rods.

The valve shall have an integral 'Anti-Shock' Orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to 1.5 x valve rated working pressure.

The intake orifice area shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice. Large orifice sealing shall be effected by the flat face of the anti-shock float seating against a EPDM rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.

Discharge of pressurized air shall be controlled by the seating & unseating of a Small Orifice Nozzle on a EPDM rubber seal affixed into the control float. The Nozzle shall have a flat seating land surrounding the orifice so that the damage to the rubber seal is prevented.

The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to one and half times the designed working pressure.

The valve design shall incorporate an over pressure safety feature that will fail without an explosive effect, such as is normally the case when highly compressed air is released suddenly. The feature shall consist of easily replaceable components such as Gaskets, Seals or the like.

Connection to the valve inlet shall be facilitated by a screwed NPT male end (1" & 2" only), studded or flanged end conforming to ANSI B16.5 Class 150 or Class 300 Standards.

Studded ends shall be supplied with the requisite number of Stainless Steel screwed studs inserted for alignment to the specified standard. **Nuts and washers shall be included.**

OPERATION

1. Prior to the ingress of liquid into the valve chamber, as when the pipeline is being filled, valves shall vent through the large orifice when water approach velocities are relative to a transient pressure rise, on valve closure, of < 1.5 x valve rated pressure.
At higher water approach velocities, which have a potential to induce transient pressure rises > 1.5 x valve rated pressure on valve closure, the valve shall automatically discharge air through the Anti Shock Orifice and reduce water approach velocity, so that on closure a maximum transient pressure rise of < 1.5 x valve rated pressure is realised.
2. Valves shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 7.25 psi to one and a half times the rated working pressure.
3. Valves shall respond to the presence of air by discharging it through the small orifice at pressures within a specified design range, i.e. 7.25 psi to 276 psi, 363 psi or 580 psi, and shall remain leak tight in the absence of air.
4. Valves shall react immediately to pipeline drainage or water column separation by the full opening of the large orifice so as to allow unobstructed air intake at the lowest possible negative internal pipeline pressure.

ORDERING GUIDE

<p>VALVE SIZE:</p> <p>1" <input type="checkbox"/> 025</p> <p>2" <input type="checkbox"/> 050</p> <p>3" <input type="checkbox"/> 080</p> <p>4" <input type="checkbox"/> 100</p> <p>6" <input type="checkbox"/> 150</p> <p>8" <input type="checkbox"/> 200</p>	<p>VALVE SERIES <input type="checkbox"/> 050 <input type="checkbox"/> RBX</p>	<p>VALVE PRESSURE RATING:</p> <p>276 psi <input type="checkbox"/> 19</p> <p>363 psi <input type="checkbox"/> 25</p> <p>580 psi <input type="checkbox"/> 40</p>	<p>VALVE END CONNECTION:</p> <p>SCREWED - NPT <input type="checkbox"/> 2</p> <p>STUDED - ANSI 150# <input type="checkbox"/> 3</p> <p>FLANGED - ANSI 150# <input type="checkbox"/> 4</p> <p>STUDED - ANSI 300# <input type="checkbox"/> 5</p> <p>FLANGED - ANSI 300# <input type="checkbox"/> 6</p> <p>FLANGED - ANSI 600# <input type="checkbox"/> 7</p>	<p>VALVE TYPE:</p> <p>DOUBLE ACTING <input type="checkbox"/> 1</p>	<p>BODY TYPE:</p> <p>EPOXY COATED FLANGES <input type="checkbox"/> E4</p> <p>304 SS BODY</p> <p>FULL 304 S/S CONSTRUCTION <input type="checkbox"/> S4</p> <p>FULL 316 S/S CONSTRUCTION <input type="checkbox"/> S16</p>
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Note:

1. 10" and 12" valves are available on request.
2. Valves for pressure ratings of 928 psi and 1450 psi are available on request.
3. Valves are available with AISI 304 or AISI 316 Stainless Steel Flanged ends, please specify when ordering.

TEST SPECIFICATIONS

All air release valves supplied shall be subjected to the following testing procedures in the order laid down:

- (A) A high pressure strength and leak test whereby the valve is filled with water and pressurized to 1.5 times the rated working pressure which shall be held for a period of 2 minutes. Any leaking, weeping or sweating shall be reason for rejection.
- (B) A low head leak test whereby the valve is filled with water and pressurized to a maximum of 7.25 psi using a visible water column connected to the test rig. The valve shall be rejected if leak tightness is not maintained for 2 minutes
- (C) Every tenth air release valve of the same size and pressure rating must be subjected to a small orifice function test - "**DROP TEST**" - whereby the valve is filled with water, pressurized to above rated working pressure and isolated from the test rig by closure of an isolating valve. A chamber in the test rig immediately prior to the isolating valve must be filled with compressed air at a pressure equal to that being maintained in the air release valve. The isolating valve is then opened so as to allow the air to rise in the air release valve without the pressure dropping lower than 29 - 44 psi above rated working pressure of the air release valve. The "**DROP TEST**" is then carried out by slowly bleeding off the pressure through a suitable cock until rated working pressure is reached and the float drops away from the orifice to allow discharge. Failure of the air release valve to function in the manner described will be reason for rejection.

On request the manufacturer shall provide batch certificates of test compliance which shall be cross referenced to serial numbers indelibly marked onto the identity label of each valve.

IMPORTANT NOTE: It is impossible to inject air into an incompressible liquid, air injection can only be achieved if the liquid can be displaced which implies that the pressure in the test rig must be reduced to atmospheric, and absolutely nothing is proven by discharge through the small orifice of the air release valve at atmospheric pressure. "**DROP TESTING**" in this manner is not acceptable.

OPERATION

PRE NOTES:

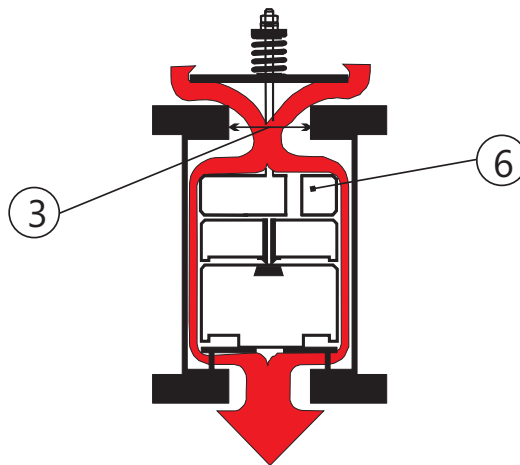
It is good engineering practice, for vertical turbine pumps and deepwell, submersible pump applications, to install air valves prior to the pump discharge check valve. The purpose of these valves is to prevent air entry into the pipeline and to break vacuum in the vertical riser upon pump shutoff.

Operation of conventional air valves in this application is such that the air in the vertical riser is released very rapidly upon pump startup, resulting in very high pressure transients when the water column slams the air valve shut and/or slams into the closed discharge check valve.

The Vent-O-Mat Series RBXb valve has specifically been developed for use on deep well submersible pump and vertical turbine pump applications where they are installed prior to the pump discharge check valve to fulfill the following functions:

- Provide effective and controlled release of air in the vertical riser upon pump startup.
- Dampen surge pressures upon pump startup.
- Provide vacuum protection when the pump stops and the vertical column drains.

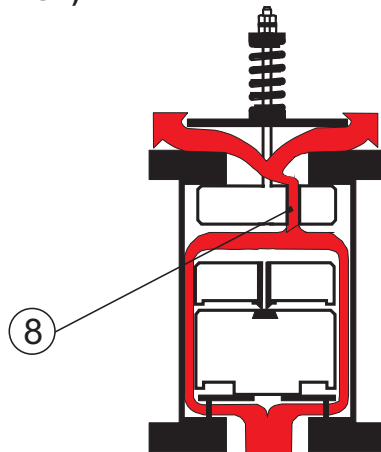
VACUUM RELIEF (AIR INTAKE)



Upon pump stop, the pump discharge check valve closes. Liquid drains from the air valve and the pump's vertical column. The negative differential created by the draining liquid causes atmospheric air to push the "Anti-Shock" Float (6) down, opening the Large Orifice (3) and rapidly displaces the draining liquid to prevent potentially damaging internal negative pressure*.

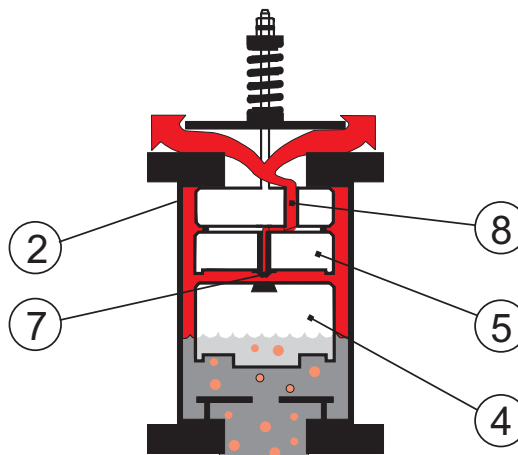
***Note:** A differential pressure of less than 0.725 psi across the Large Orifice (3) is required to open the valve fully under vacuum conditions.

VENTING (PUMP START UP)



Air is forced through the "Anti-Shock" Orifice (8) resulting in the deceleration of the approaching water column due to the resistance of rising air pressure in the valve. This dampens transients when the air valve closes and the water column opens the pump, discharge check valve.

PRESSURIZED AIR RELEASE (PUMP OPERATING)

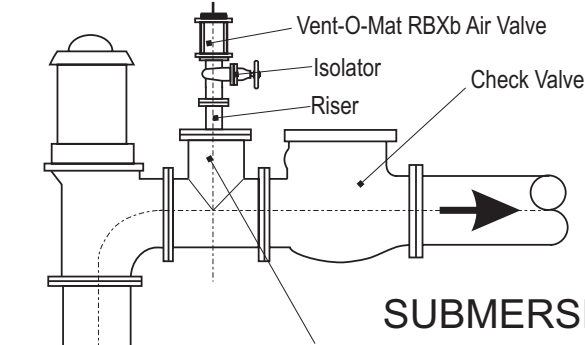


Liquid enters the valve Barrel Chamber (2) and the Floats (4), (5) are buoyed so that the "Anti-Shock" Orifice (8) is closed by the Floats (4), (5) the valve will then become internally pressurized.

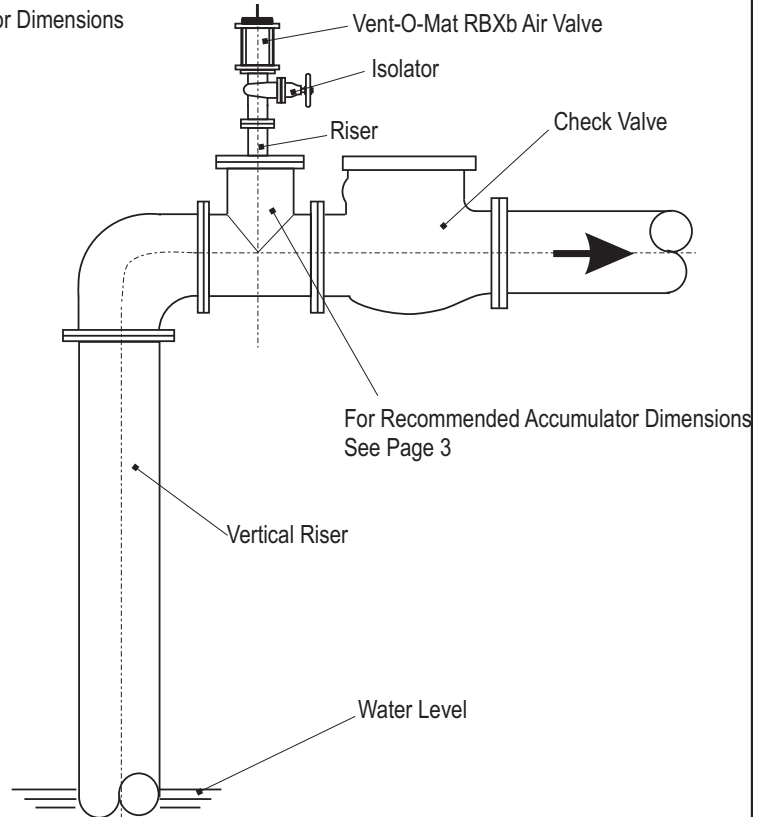
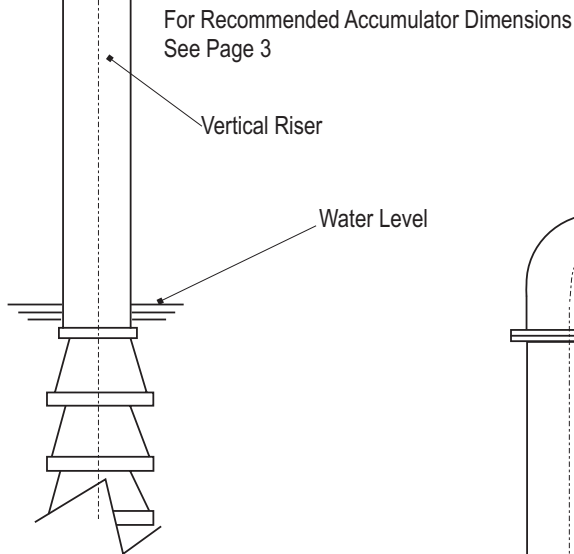
Disentrained air rises through the liquid and accumulates in the valve chamber when the volume of air is sufficient to displace the liquid, Float (4) will no longer be buoyant and will gravitate downwards thereby opening the Small Orifice (7) and allowing accumulated air to be discharged into atmosphere, as the air is discharged the liquid raises the Float (4) and reseals the Small Orifice (7) and prevents escape of liquid.

RECOMMENDED INSTALLATION ARRANGEMENTS

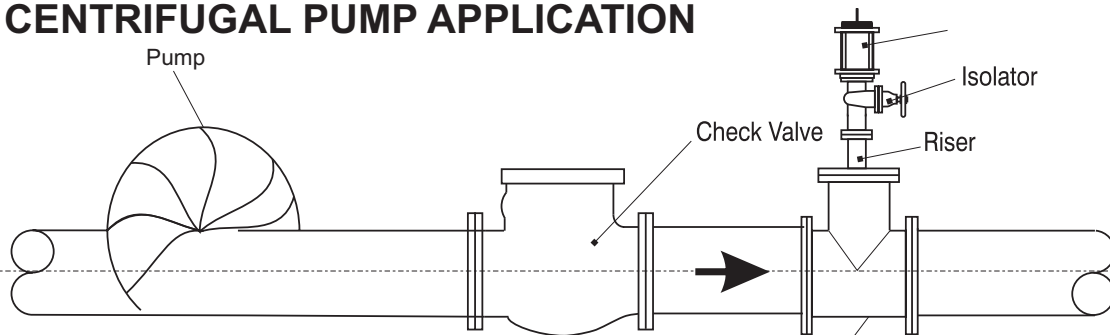
VERTICAL TURBINE PUMP APPLICATION



SUBMERSIBLE/DEEP WELL APPLICATION



CENTRIFUGAL PUMP APPLICATION



For Recommended Accumulator Dimensions See Page 3

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS
SCREWED - 1" & 2"

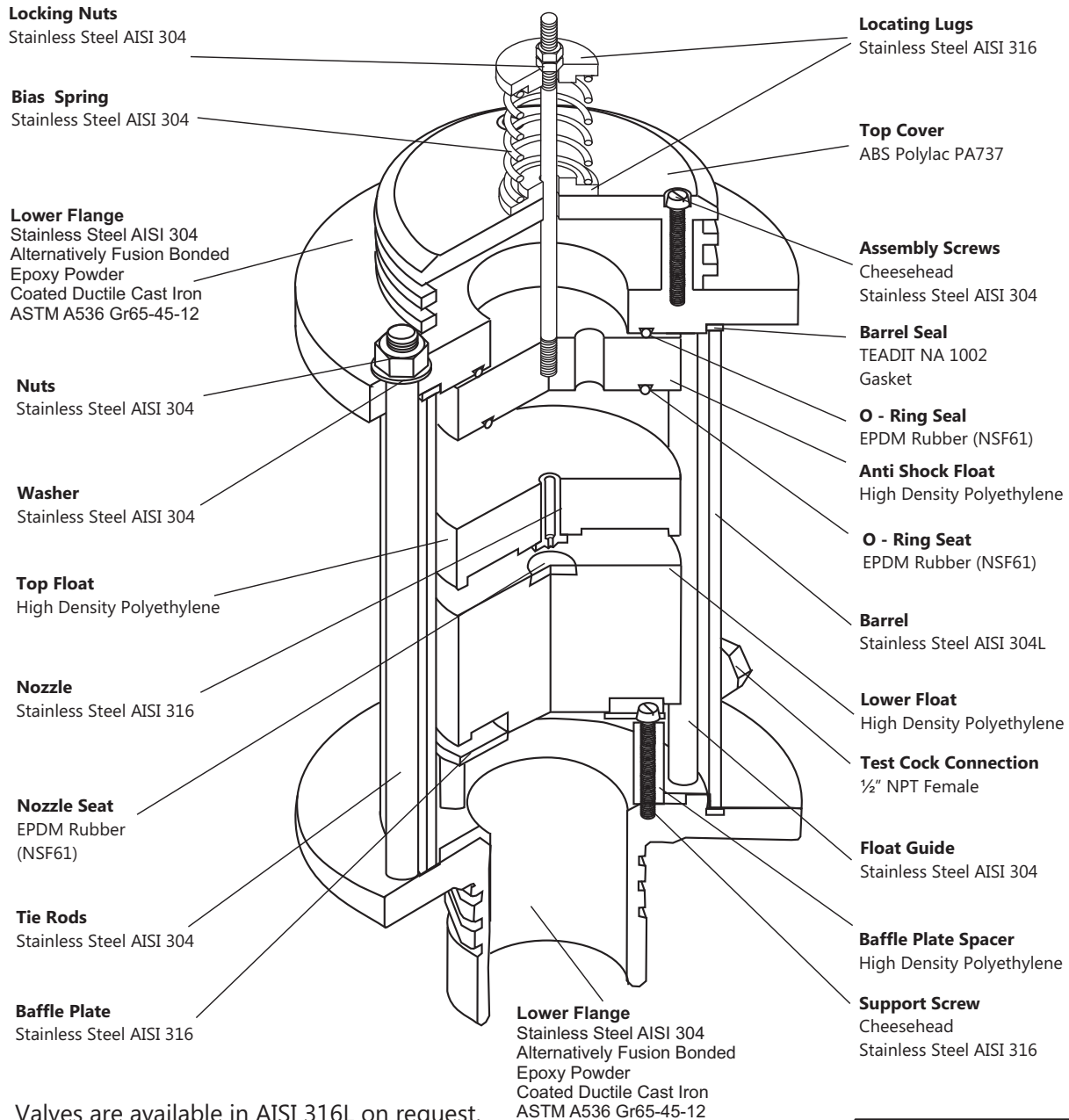
Type:
 Series RBXb - Double Orifice (Small & Large Orifice)
 with Bias Mechanism.

End Connection:
 Screwed NPT Male

Nominal Sizes:
 DN25 - 1"
 DN50 - 2"

Model No's:
 RBXb 2521 ___ NPT ___ 363 psi
 RBXb 4021 ___ NPT ___ 580 psi

Pressure Ratings:



Valves are available in AISI 316L on request.
 Valves are available in 928psi and 1450 psi on request.
 Information subject to change without prior notice

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS STUDED - 3" TO 8"

Type:

Series RBX - Double Orifice (Small & Large Orifice)
with Bias Mechanism.

End Connection:

Studded flange (ASME B16.5)

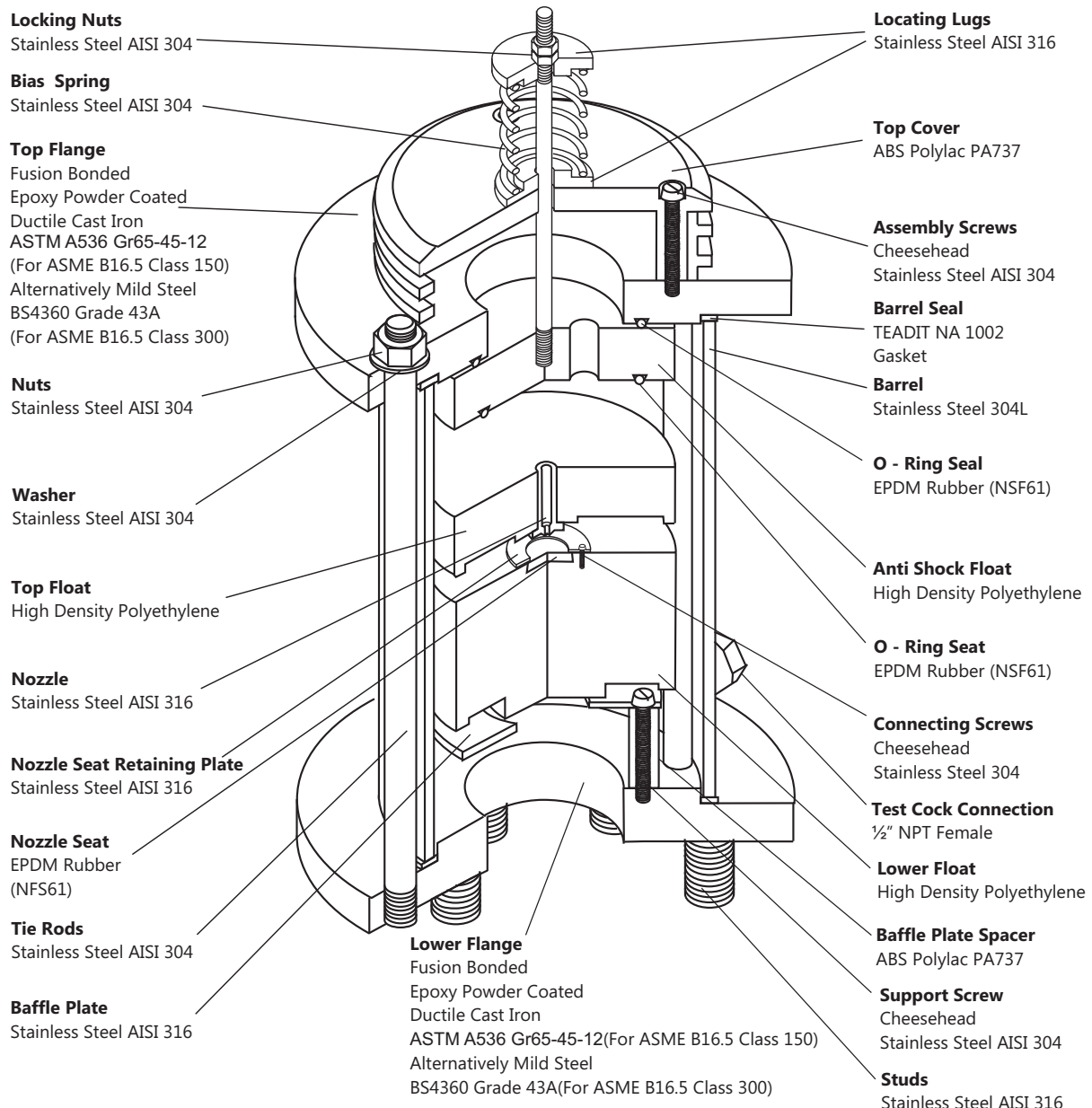
Nominal Sizes:

DN080 - 3"
DN100 - 4"
DN150 - 6"
DN200 - 8"

Model No's:

RBXb1931 _____ ANSI 150# _____ 276psi
RBXb2531 _____ ANSI 150# _____ 276psi
RBXb2551 _____ ANSI 300# _____ 363psi
RBXb4051 _____ ANSI 300# _____ 580psi

Pressure Ratings:



Valves are available in AISI 304L or 316L on request.

Valves are available in 928 psi on request.

Information subject to change without prior notice

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS

FLANGED - 3" TO 8"

Type:

Series RBX - Double Orifice (Small & Large Orifice)
with Bias Mechanism.

End Connection:

Flat-faced Flange (ASME B16.5)

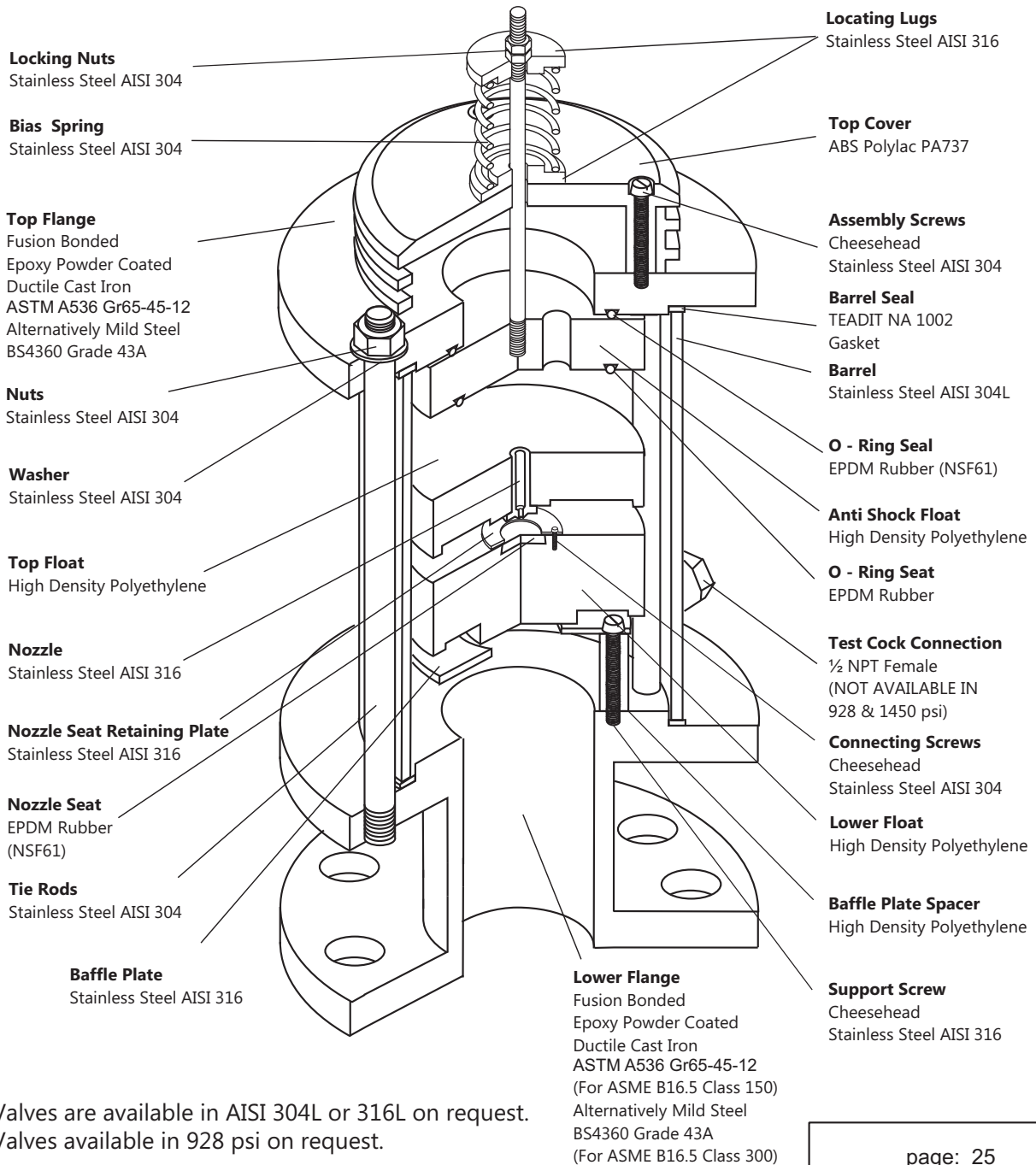
Nominal Sizes:

DN080 - 3"
DN100 - 4"
DN150 - 6"
DN200 - 8"

Model No's:

RBXb1941 _____ ANSI 150# _____ 276psi
RBXb2541 _____ ANSI 150# _____ 276psi
RBXb2561 _____ ANSI 300# _____ 363psi
RBXb4061 _____ ANSI 300# _____ 580psi

Pressure Ratings:

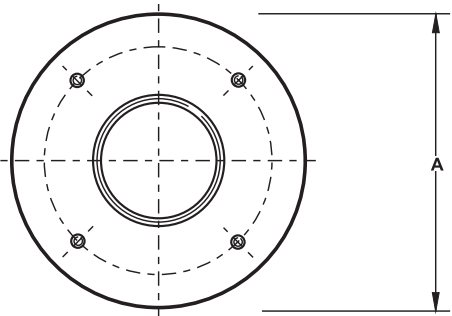
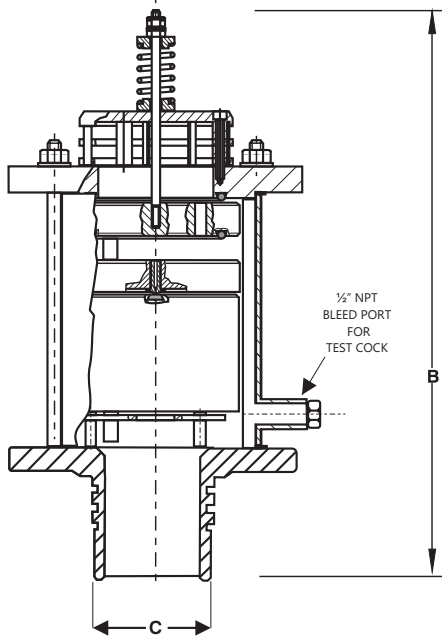
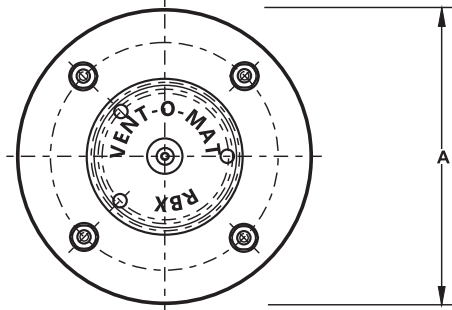


Valves are available in AISI 304L or 316L on request.

Valves available in 928 psi on request.

Information subject to change without prior notice

Series RBXb GENERAL SPECIFICATIONS SCREWED - 1" & 2"



Type:

Double Orifice (Small & Large Orifice) with *Bias* mechanism for large volume air intake and controlled air discharge.

End Connection:

Screwed NPT male (ASME B1.20.1)

Nominal Sizes:

1" & 2"

Model No's:

RBXb 2521
RBXb 4021

Operating Pressure Range:

7.25psi to 363psi
7.25psi to 580psi

Operating Temperature Range:

40°F to 176°F

Acceptable Media:

Potable or strained raw water.

Function:

- i) Controlled air discharge - pipeline filling
- ii) Pressurized air discharge - pipeline filled.
- lii) Surge dampening - high velocity air discharge, water column separation & liquid oscillation.
- iv) High volume air intake - pipeline draining.

Materials of Construction: - see page 22

Installation:- see page 21

Standard Factory Tests:

- i) Hydrostatic - 1.5 x max. rated working pressure
- ii) Low head leak - 7.25 psi
- iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

OVERALL DIMENSIONS & WEIGHTS

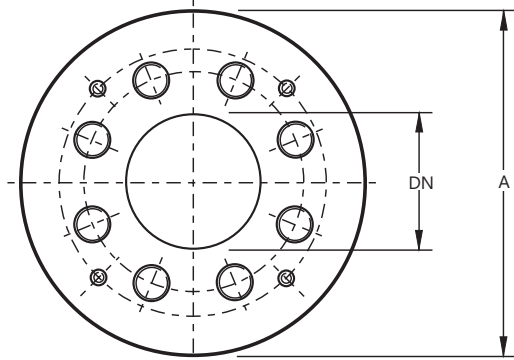
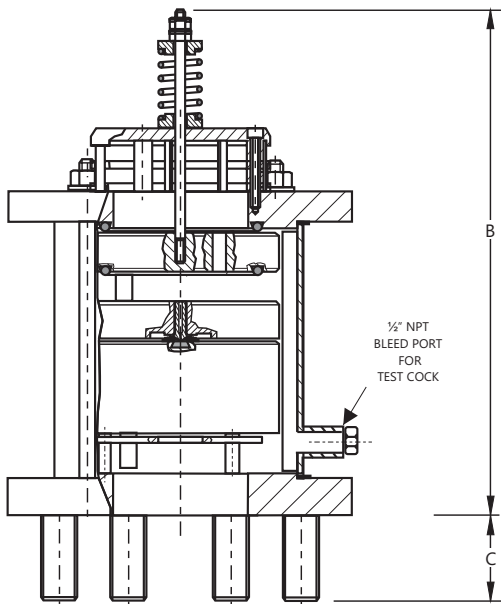
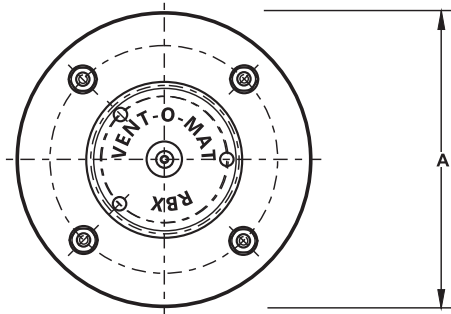
DN in.	MODEL No.	PRESSURE RATING	A in.	B In.	C	WEIGHT lbs
1"	025 RBXb 2521	363 psi	4 3/4	13 3/16	1" NPT	9.5
1"	025 RBXb 4021	580 psi	4 3/4	15 1/4	1" NPT	10.7
2"	050 RBXb 2521	363 psi	6 1/2	15 9/16	2" NPT	20
2"	050 RBXb 4021	580 psi	6 1/2	16 1/7	2" NPT	21

Dimensions for higher pressure valves available on request
Information subject to change without prior notice

Series RBXb

GENERAL SPECIFICATIONS

STUDDED - 3" TO 8"



Type:

Double Orifice (Small & Large Orifice) with *Bias* mechanism for large volume air intake and controlled air discharge.

End Connection:

Flange with Screwed Studs for Alignment to; ANSI B16.5 Class 150 or Class 300

Nominal Sizes:

3" to 8"

Model No's:

- RBXb 1931
- RBXb 2531
- RBXb 2551
- RBXb 4051

Operating Pressure Range:

- 7.25psi to 276psi
- 7.25psi to 276psi
- 7.25psi to 363psi
- 7.25psi to 580psi

Operating Temperature Range:

40°F to 176°F

Acceptable Media:

Potable or strained raw water.

Function:

- i) Controlled air discharge - pipeline filling.
- ii) Pressurized air discharge - pipeline filled.
- iii) Surge dampening - high velocity air discharge, water column separation & liquid oscillation.
- iv) High volume air intake - pipeline draining.

Materials of Construction: - see page 23

Installation: - see page 21

Standard Factory Tests:

- i) Hydrostatic - 1.5 x max. rated working pressure
- ii) Low head leak - 7.25 psi
- iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

OVERALL DIMENSIONS & WEIGHTS

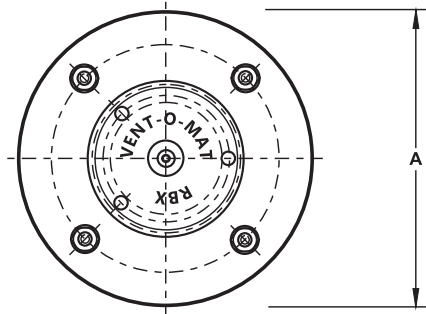
DN in	MODEL No.	PRESSURE RATING	A in	B in	C in	WEIGHT ± lbs
3	RBXb1931 / 2531	276psi / 363psi	9¼	16	2	50.7
3	RBXb4051	580psi	9¼	16½	2	72.0
4	RBXb1931 / 2531	276psi / 363psi	9¼	16¾	2	49.6
4	RBXb4051	580psi	9¼	17½	2	52.9
6	RBXb1931 / 2531	276psi / 363psi	14	24⅞	2	152.1
6	RBXb4051	580psi	14	25	2	165.3
8	RBXb1931 / 2531	276psi / 363psi	16	22	2	213.8
8	RBXb4051	580psi	16	24¾	2	238.1

Dimensions for higher pressure valves available on request
Information subject to change without prior notice

Series RBXb

GENERAL SPECIFICATIONS

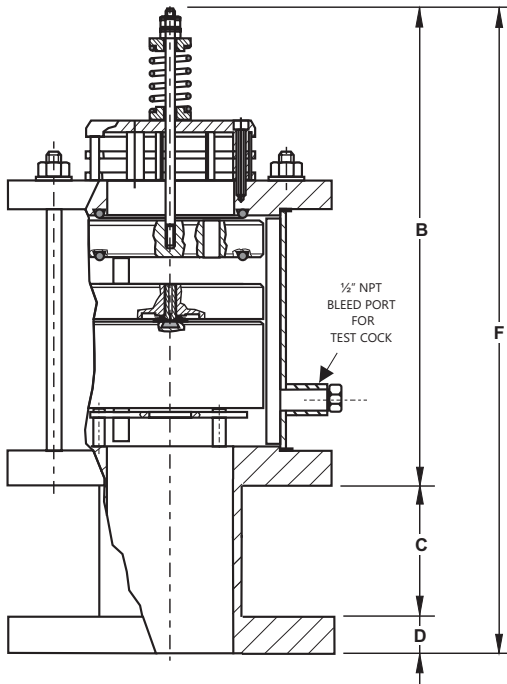
FLANGED - 3" TO 8"



Type:
Double Orifice (Small & Large Orifice) with *Bias* mechanism for large volume air intake and controlled air discharge.

End Connection:
Flanged for Alignment to;
ANSI B16.5 Class 150 or Class 300

Nominal Sizes:
1" to 8"



Model No's:
RBXb 1941
RBXb 2541
RBXb 2561
RBXb 4061

Operating Pressure Range:
7.25psi to 276psi
7.25psi to 276psi
7.25psi to 363psi
7.25psi to 580psi

Operating Temperature Range:
40°F to 176°F

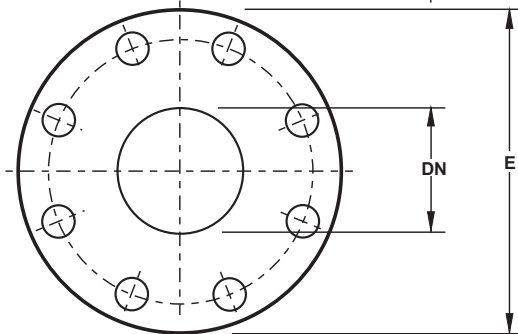
Acceptable Media:
Potable or strained raw water.

- Function:**
- i) Controlled air discharge - pipeline filling.
 - ii) Pressurized air discharge - pipeline filled.
 - iii) Surge dampening - high velocity air discharge, water column separation & liquid oscillation.
 - iv) High volume air intake - pipeline draining.

Materials of Construction: - see page 24

Installation: - see page 21

- Standard Factory Tests:**
- i) Hydrostatic - 1.5 x max. rated working pressure
 - ii) Low head leak - 7.25 psi
 - iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).



OVERALL DIMENSIONS & WEIGHTS

DN in	MODEL No.	PRESSURE RATING	A in	B in	C in	D in	E in	F in	WEIGHT ± lbs
3	RBXb1941 / 2541	276psi / 363psi	9¼	16	4	15/16	7½	20 9/16	64.5
3	RBXb4061	580psi	9¼	16	4	1 1/8	8¾	20 9/16	72.5
4	RBXb1941 / 2541	276psi / 363psi	9¼	16 7/10	3	1 5/16	9	21	64.5
4	RBXb4061	580psi	9¼	16 7/10	3	1 ¼	10	21	71.5
6	RBXb1941 / 2541	276psi / 363psi	14	23 9/10	5	1	11	30	138
6	RBXb4061	580psi	14	23 9/10	5	1 1/16	12 ½	30	172
8	RBXb1941 / 2541	276psi / 363psi	16	24 7/10	6	1 1/8	13 ½	31 1/5	246
8	RBXb4061	580psi	16	24 7/10	6	1 5/8	15	31 1/5	251

Dimensions for higher pressure valves available on request
Information subject to change without prior notice

PURCHASE SPECIFICATIONS

VENT -O- MAT MODEL NO.

Page 25 - Series RBXb - 1" or 2" with NPT, Screwed Male Connection.

Page 26 - Series RBXb - 3" to 8" Studded connection.

Page 27 - Series RBXb - 3" to 8" Flanged connection.

CONSTRUCTION & DESIGN

The air release & vacuum break valve shall be of the compact single chamber design with solid cylindrical H.D.P.E. control floats housed in a tubular Stainless Steel body with epoxy powder coated Mild Steel or Stainless Steel ends secured by means of Stainless Steel Tie Rods.

The valve shall have an integral 'Anti-Shock' Orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to 1.5 x valve rated working pressure.

The intake orifice area shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice.

Large orifice sealing shall be effected by the flat face of the anti-shock float seating against a EPDM rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.

Discharge of pressurized air shall be controlled by the seating & unseating of a Small Orifice Nozzle on a EPDM rubber seal affixed into the control float. The Nozzle shall have a flat seating land surrounding the orifice so that the damage to the rubber seal is prevented.

The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to one and a half times the designed working pressure.

The valve design shall incorporate an over pressure safety feature that will fail without an explosive effect, such as is normally the case when highly compressed air is released suddenly. The feature shall consist of easily replaceable components such as gaskets, seals or the like.

Connection to the valve inlet shall be facilitated by a screwed NPT male end (1" & 2" only), studded or flanged end conforming to ANSI B16.5 Class 150 & Class 300 Standards.

Studded ends shall be supplied with the requisite number of Stainless Steel screwed studs inserted for alignment to the specified standard. **Nuts and washers shall be included.**

OPERATION

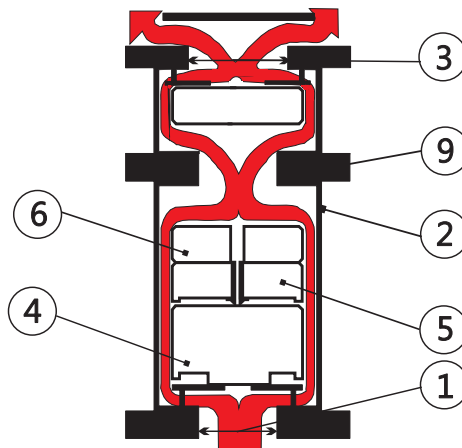
1. Prior to the ingress of liquid into the valve chamber, as when the pipeline is being filled, valves shall vent through the "Anti-Shock" Orifice and reduce water approach velocity, so that on closure a maximum transient pressure rise of < 1.5 x valve rated pressure is realised.
2. Valves shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 7.25 psi to one and half times the rated working pressure.
3. Valves shall respond to the presence of air by discharging it through the small orifice at any pressures within a specified design range, i.e. 7.25 psi to 276 psi, 363psi or 580 psi, and shall remain leak tight in the absence of air.
4. Valves shall react immediately to pipeline drainage or water column separation by the full opening of the large orifice so as to allow unobstructed air intake at the lowest possible negative internal pipeline pressure.

PRE NOTES:

There are instances where the hydraulic gradeline falls below a peak point during normal operation and where air inflow would adversely affect the normal operation and surge characteristic of the pipeline. Air intake may also be undesirable under pump trip conditions for pipelines running through a marsh (surge protection in these instances would be in the form of surge vessels and/or the pipeline will be designed for full vacuum).

Vent-O-Mat offers the Series RBXv valve which has specifically been developed to ensure effective air release under all pipeline conditions but will not allow air entry under any operating condition.

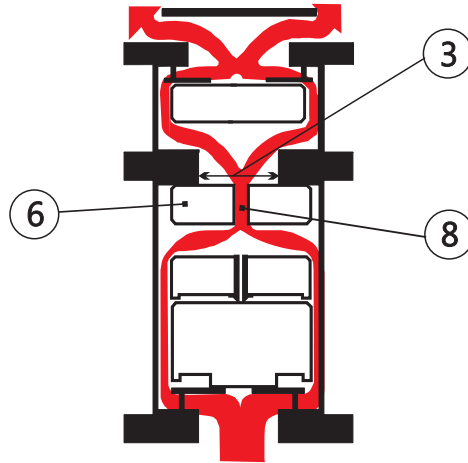
VENTING OF A FILLING PIPELINE (SUB CRITICAL WATER APPROACH VELOCITY)



Air enters Orifice (1), travels through the annular space between the cylindrical floats (4) , (5), (6) and discharges through the Large Orifice (3) into atmosphere.*

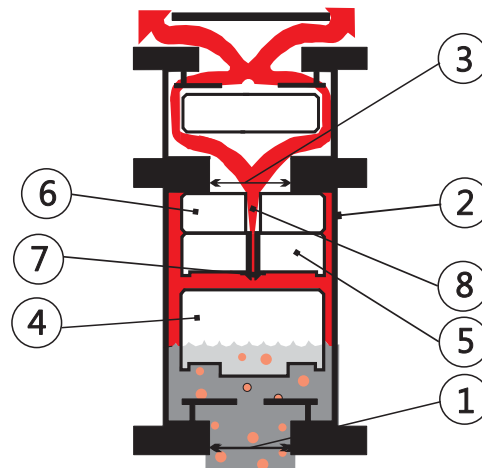
***Note:** A relatively low flow discharge rate is required to lift float and ensure air release. Float will seat on the Middle Flange (9) under vacuum conditions, effectively preventing air Entry.

VENTING OF A FILLING PIPELINE (EXCESSIVE WATER APPROACH VELOCITY)



In reaction to increased air flow, Float (6) closes Large Orifice and air is forced through the "Anti-Shock" Orifice resulting in deceleration of the approaching water due to the resistance of rising air pressure in the valve.

PRESSURIZED AIR RELEASE FROM A FULL PIPELINE



Subsequent to the filling of a pipeline, liquid enters the valve Barrel Chamber (2) and the Floats (4), (5) and (6) are buoyed so that the "Anti-Shock" Orifice (8) is closed by the Float (5) and the valve will then become pressurized. A minimal working pressure of 7.25 psi acting on a relatively large area of the Orifice (1) will lock Floats (4), (5) and (6) into the closed position across the Large Orifice (3).

Disentrained air rises through the liquid and accumulates in the valve chamber, when the volume of air is sufficient to displace the liquid, Float (4) will no longer be buoyant and will gravitate downwards thereby opening the Small Orifice (7) and allowing accumulated air to be discharged into atmosphere, as air is discharged the liquid raises Float (4) and reseals the Small Orifice (7) and prevents escape of liquid.

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS
SCREWED - 1" & 2"

Type:
 Series RBXv - Triple Orifice with "Anti-Surge" Mechanism

End Connection:
 Screwed NPT Male

Nominal Sizes:
 DN25 - 1"
 DN50 - 2"

Model No's:
 RBXv 2521 _____ NPT _____
 RBXv 4021 _____ NPT _____

Pressure Ratings:
 363 psi
 580 psi

Top Cover
 ABS Polyac PA737

Top Flange
 Stainless Steel AISI 304
 Alternatively Fusion Bonded
 Epoxy Powder
 Coated Ductile Cast Iron
 ASTM A536 Gr 65-45-12

Nuts
 Stainless Steel AISI 304

Washer
 Stainless Steel AISI 304

Baffle Plate
 Stainless Steel AISI 316

Top Float
 High Density Polyethylene

Nozzle
 Stainless Steel AISI 316

Nozzle Seat
 EPDM Rubber
 (NSF61)

Tie Rods
 Stainless Steel AISI 304

Baffle Plate
 Stainless Steel AISI 316

Baffle Plate Spacer
 ABS Polyac PA737

Lower Flange
 Stainless Steel AISI 304
 Alternatively Fusion Bonded
 Epoxy Powder
 Coated Ductile Cast Iron
 ASTM A536 Gr 65-45-12

Assembly Screws
 Stainless Steel AISI 304

Float Guides
 Stainless Steel AISI 304.
 Barrel
 Stainless Steel AISI 304L

Float
 High Density Polyethylene

Middle Flange
 Mild Steel AISI 304

Barrel Seal
 TEADIT NA 1002
 Gasket

O - Ring Seal
 EPDM Rubber (NSF61)

Anti Shock Float
 High Density Polyethylene

O - Ring Seat
 EPDM Rubber NSF61)

Barrel
 Stainless Steel AISI 304L

Lower Float
 High Density Polyethylene

Test Cock Connection
 1/2" NPT Female

Float Guide
 Stainless Steel AISI 304

Baffle Plate Spacer
 ABS Polyac PA737

Support Screw
 Cheesehead
 Stainless Steel AISI 316

Valves are available in AISI 316L on request.
 Valves are available in 928psi and 1450psi on request.
 Information subject to change without prior notice

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS

STUDED - 3" TO 8"

Type:
Series RBXv - Triple Orifice with "Anti-Surge" Mechanism

End Connection:
Studded flange (ASME B16.5)

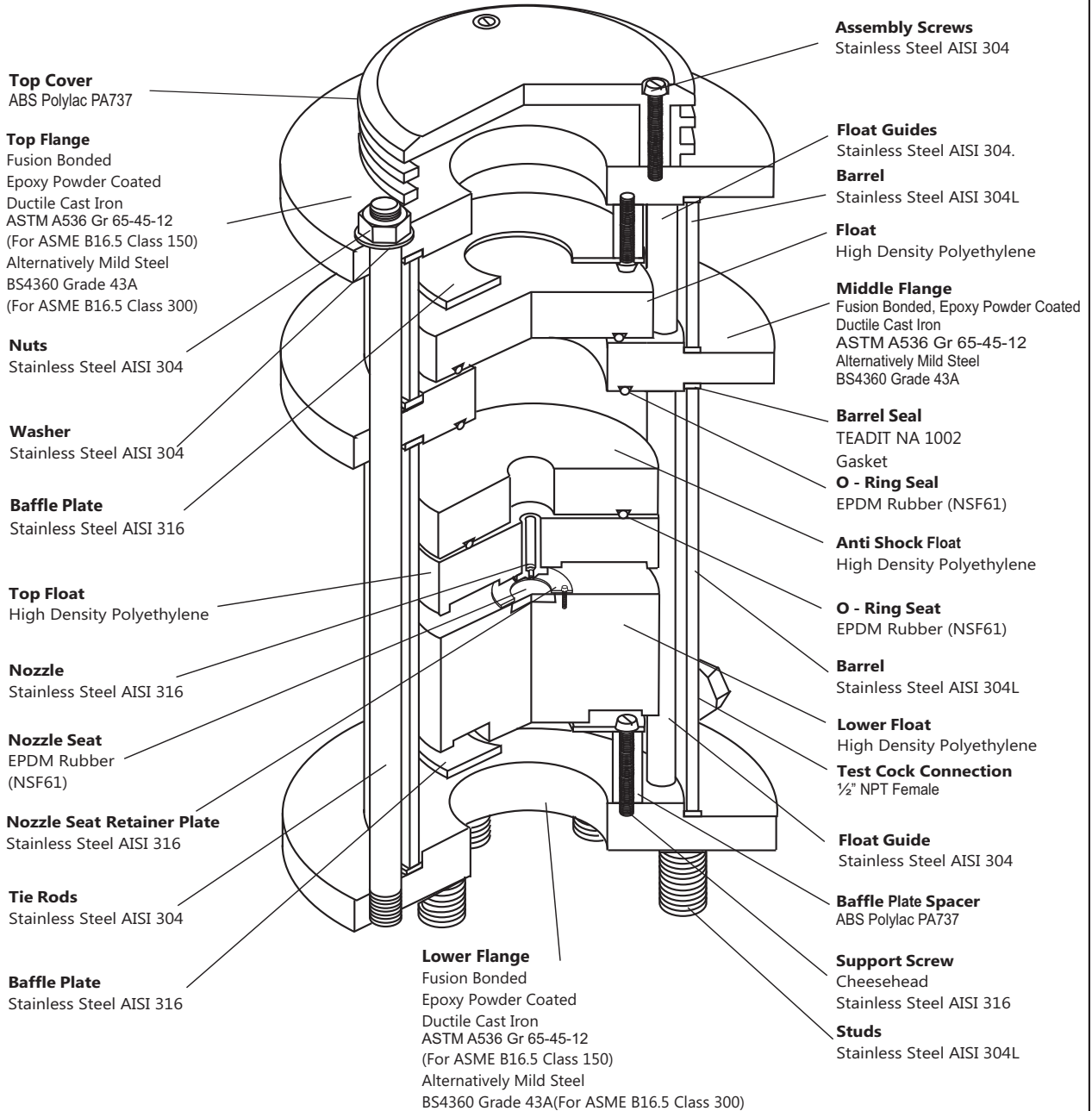
Nominal Sizes:

- DN080 - 3"
- DN100 - 4"
- DN150 - 6"
- DN200 - 8"

Model No's:

- RBXv 1931 _____ ANSI 150# _____ 276psi
- RBXv 2531 _____ ANSI 150# _____ 276psi
- RBXv 2551 _____ ANSI 300# _____ 363psi
- RBXv 4051 _____ ANSI 300# _____ 580psi

Pressure Ratings:



Valves are available in AISI 304 or 316L on request.
Valves are available in 928psi on request.
Information subject to change without prior notice

COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS FLANGED - 3" TO 8"

Type:
Series RBXv - Triple Orifice with "Anti-Surge" Mechanism

End Connection:
Flat-faced Flange (ASME B16.5)

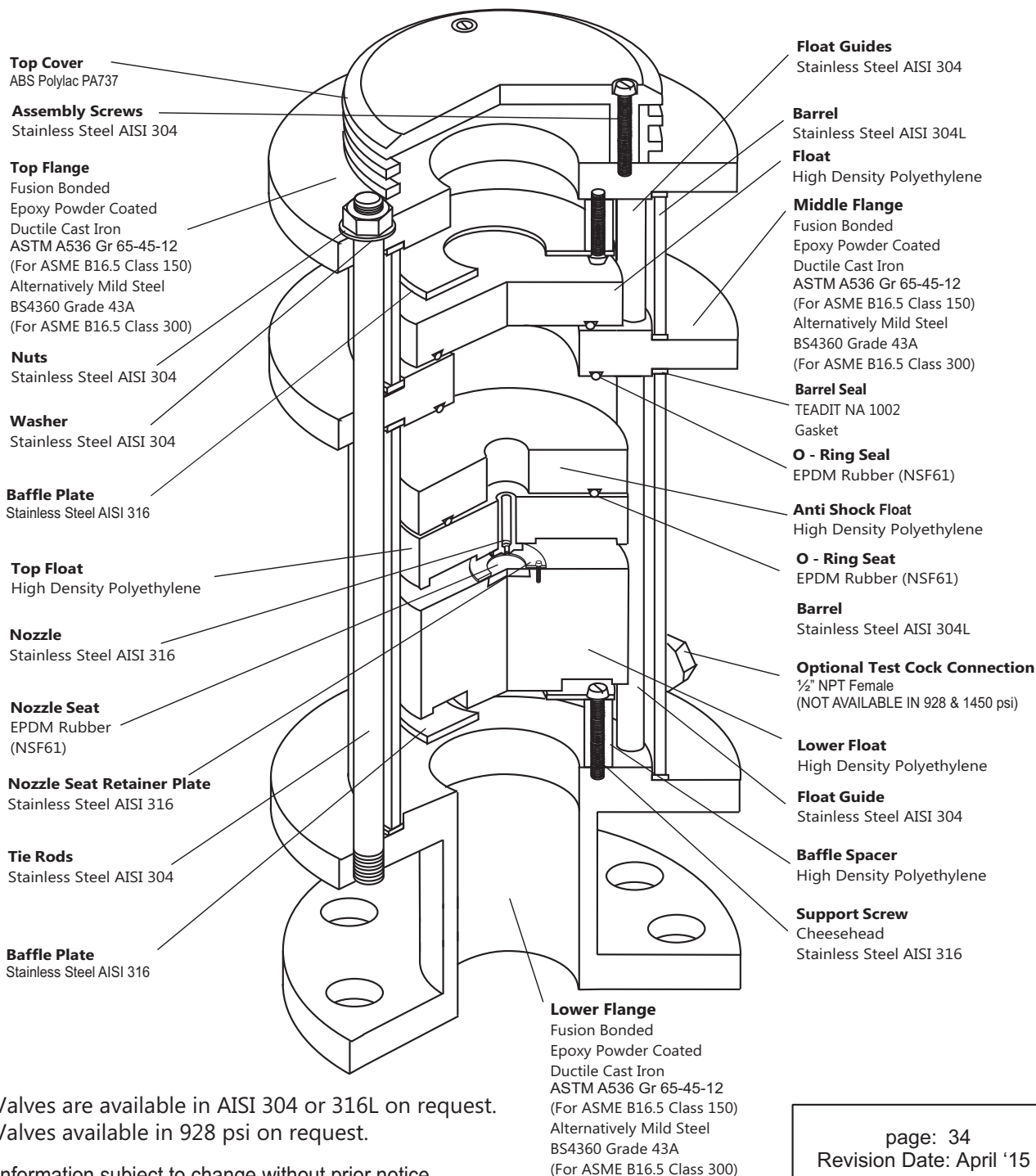
Nominal Sizes:

- DN080 - 3"
- DN100 - 4"
- DN150 - 6"
- DN200 - 8"

Model No's:

- RBXv 1941 _____ ANSI 150# _____ 276psi
- RBXv 2541 _____ ANSI 150# _____ 276psi
- RBXv 2561 _____ ANSI 300# _____ 363psi
- RBXv 4061 _____ ANSI 300# _____ 580psi

Pressure Ratings:



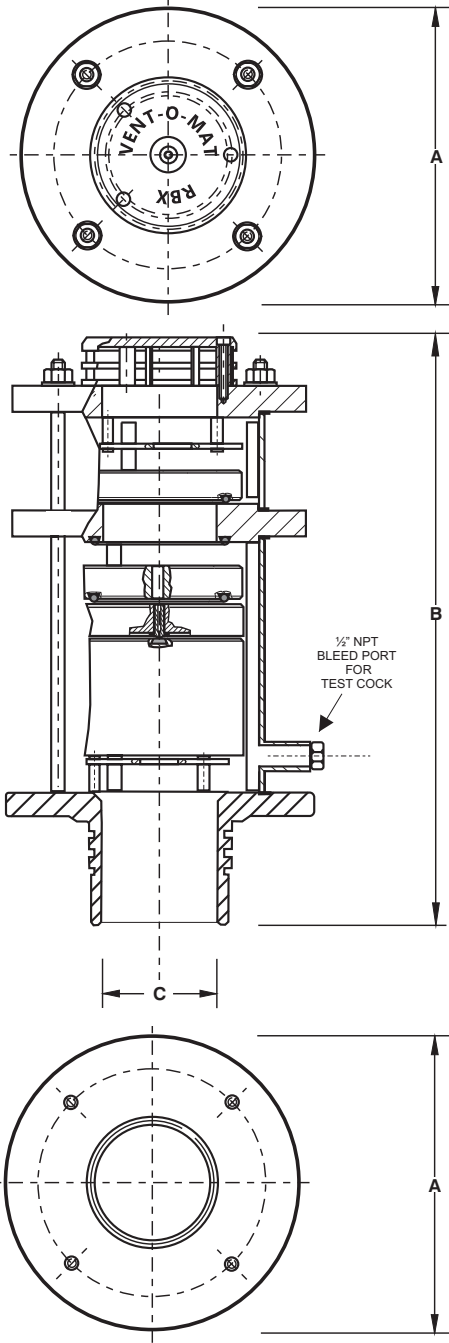
Valves are available in AISI 304 or 316L on request.
Valves available in 928 psi on request.

Information subject to change without prior notice

Series RBXv

GENERAL SPECIFICATIONS

SCREWED - 1" & 2"



Type:
Triple Orifice Air Vent Valve for air discharge but not air re-entry.

End Connection:
Screwed NPT male (ASME B1.20.1)

Nominal Sizes:
1" & 2"

Model No's:		Operating Pressure Range:
RBXv 2521	_____	7.25psi to 363psi
RBXv 4021	_____	7.25psi to 580psi

Operating Temperature Range:
40°F to 176°F

Acceptable Media:
Potable or strained raw water.

Function:

- i) High volume air discharge - pipeline filling
- ii) Pressurized air discharge - pipeline filled.
- iii) Surge dampening - high velocity air discharge.

Materials of Construction: - see page 31

Installation:- see page 3

Standard Factory Tests:

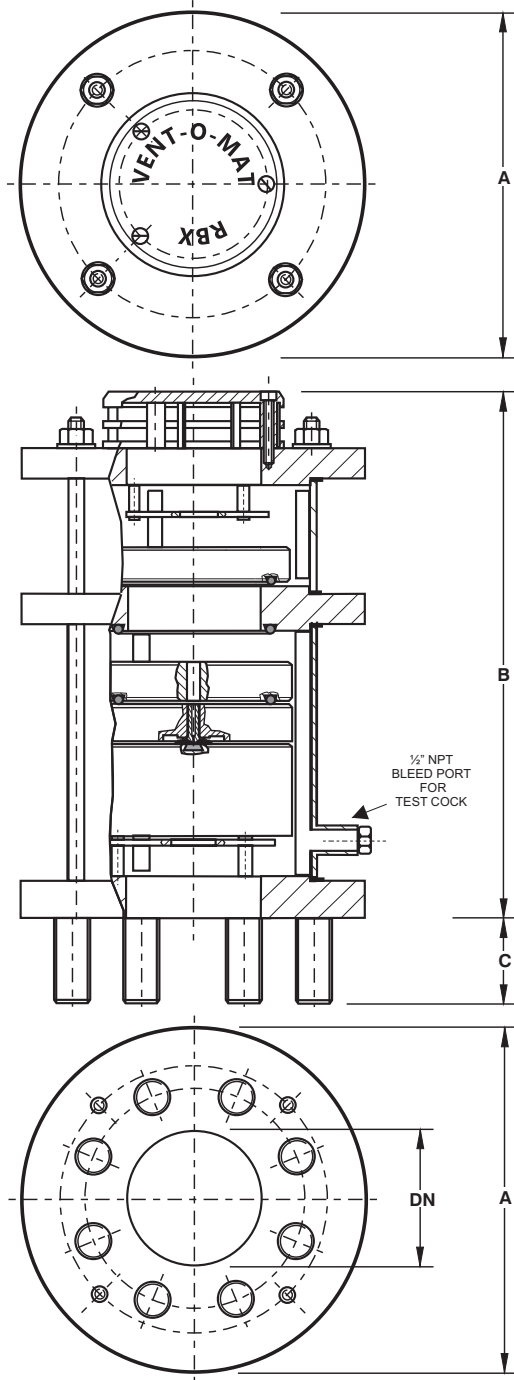
- i) Hydrostatic - 1.5 x max. rated working pressure
- ii) Low head leak - 7.25 psi
- iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

OVERALL DIMENSIONS & WEIGHTS

DN in.	MODEL No.	PRESSURE RATING	A in.	B In.	C	WEIGHT lbs
1"	025 RBXv 2521	363 psi	4 ³ / ₄	12 ⁹ / ₁₀	1" NPT	12.8
1"	025 RBXv 4021	580 psi	4 ³ / ₄	14 ¹⁵ / ₁₆	1" NPT	13.9
2"	050 RBXv 2521	363 psi	6 ¹ / ₂	17	2" NPT	27.6
2"	050 RBXv 4021	580 psi	6 ¹ / ₂	17 ⁶ / ₁₀	2" NPT	28.8

Dimensions for higher pressure valves available on request
Information subject to change without prior notice

**Series RBXv
GENERAL SPECIFICATIONS
STUDED - 3" TO 8"**



Type:
Triple Orifice Air Vent Valve for air discharge but not air re-entry.

End Connection:
Flange with Screwed Studs for Alignment to;
ANSI B16.5 Class 150 or Class 300

Nominal Sizes:
3" to 8"

Model No's:	Operating Pressure Range:
RBXv 1931	7.25psi to 276psi
RBXv 2531	7.25psi to 276psi
RBXv 2551	7.25psi to 363psi
RBXv 4051	7.25psi to 580psi

Operating Temperature Range:
40°F to 176°F

Acceptable Media:
Potable or strained raw water.

Function:

- i) High volume air discharge - pipeline filling.
- ii) Pressurized air discharge - pipeline filled.
- iii) Surge dampening - high velocity air discharge.

Materials of Construction: - see page 32

Installation: - see page 3

Standard Factory Tests:

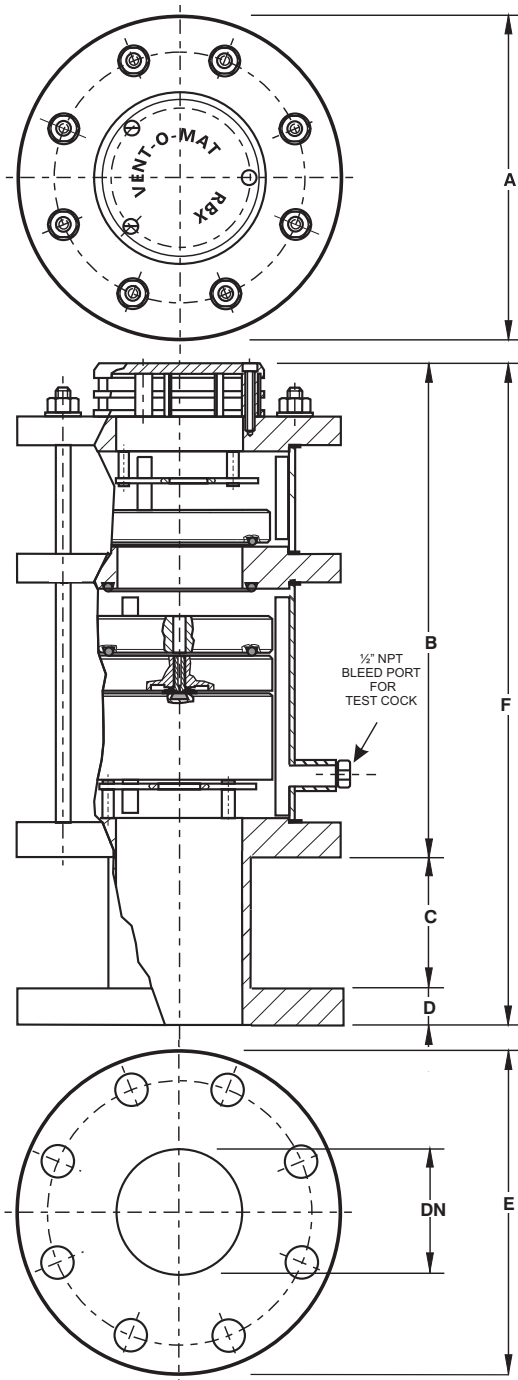
- i) Hydrostatic - 1.5 x max. rated working pressure
- ii) Low head leak - 7.25 psi
- iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

OVERALL DIMENSIONS & WEIGHTS

DN in	MODEL No.	PRESSURE RATING	A in	B in	C in	WEIGHT ±lbs
3	RBXv1931 / 2531	276 psi / 363psi	9 ¹ / ₄	17 ⁶ / ₁₀	2	57
3	RBXv4051	580 psi	9 ¹ / ₄	17 ⁶ / ₁₀	2	58
4	RBXv1931 / 2531	276 psi / 363psi	9 ¹ / ₄	18	2	99
4	RBXv4051	580 psi	9 ¹ / ₄	18	2	101
6	RBXv1931 / 2531	276 psi / 363psi	14	24 ⁶ / ₁₀	2	223
6	RBXv4051	580 psi	14	24 ⁶ / ₁₀	2	225
8	RBXv1931 / 2531	276 psi / 363psi	16	25 ⁶ / ₁₀	2	330
8	RBXv4051	580 psi	16	25 ⁶ / ₁₀	2	332

Dimensions for higher pressure valves available on request
Information subject to change without prior notice

Series RBXv GENERAL SPECIFICATIONS FLANGED - 3" TO 8"



Type:

Triple Orifice Air Vent Valve for air discharge but not air re-entry.

End Connection:

Flange for Alignment to;
ANSI B16.5 Class 150 or Class 300

Nominal Sizes:

3" to 8"

Model No's:

RBXv 1941
RBXv 2541
RBXv 2561
RBXv 4061

Operating Pressure Range:

7.25psi to 276psi
7.25psi to 276psi
7.25psi to 363psi
7.25psi to 580psi

Operating Temperature Range:

40°F to 176°F

Acceptable Media:

Potable or strained raw water.

Function:

- i) High volume air discharge - pipeline filling.
- ii) Pressurized air discharge - pipeline filled.
- iii) Surge dampening - high velocity air discharge.

Materials of Construction: - see page 33

Installation: - see page 3

Standard Factory Tests:

- i) Hydrostatic - 1.5 x max. rated working pressure
- ii) Low head leak - 7.25 psi
- iii) Small orifice function at max. rated working pressure (minimum 1 valve in 10).

OVERALL DIMENSIONS & WEIGHTS

DN in	MODEL No.	PRESSURE RATING	A in	B in	C in	D in	E in	F in	WEIGHT ± lbs
3	RBXv 1941 / 2541	276psi / 363psi	9/4	17 ⁹ / ₁₀	4	1 ⁵ / ₁₆	7 ¹ / ₂	22 ⁷ / ₅	64.5
3	RBXv 4061	580psi	9/4	17 ⁹ / ₁₀	4	1 ¹ / ₈	8 ³ / ₄	22 ⁷ / ₅	74.5
4	RBXv 1941 / 2541	276psi / 363psi	9/4	18	3	1 ⁵ / ₁₆	9	23	105
4	RBXv 4061	580psi	9/4	18	3	1 ¹ / ₄	10	23	111
6	RBXv 1941 / 2541	276psi / 363psi	14	24 ⁹ / ₁₀	5	1	11	30 ⁹ / ₁₀	248
6	RBXv 4061	580psi	14	24 ⁹ / ₁₀	5	1 ⁷ / ₁₆	12 ³ / ₂	30 ⁹ / ₁₀	268
8	RBXv 1941 / 2541	276psi / 363psi	16	25 ⁵ / ₁₀	6	1 ¹ / ₈	13 ¹ / ₂	32 ¹ / ₂	346
8	RBXv 4061	580psi	16	25 ⁵ / ₁₀	6	1 ¹ / ₈	15	32 ¹ / ₂	358

Dimensions for higher pressure valves available on request

Information subject to change without prior notice

PURCHASE SPECIFICATIONS

VENT-O-MAT MODEL NO.

Page 35 - Series RBXv - 1" or 2" with NPT, Screwed Male Connection.

Page 36 - Series RBXv - 3" to 8" studded connection.

Page 37 - Series RBXv - 3" to 8" flanged connection.

CONSTRUCTION & DESIGN

The air vent valve shall be of the compact single chamber design with solid cylindrical H.D.P.E. control floats housed in a tubular Stainless Steel Body with epoxy powder coated Mild Steel ends or Stainless Steel ends secured by means of Stainless Steel Tie Rods.

The valve shall have an integral 'Anti-Shock' Orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to 1.5 x valve rated working pressure.

The discharge orifice area shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice.

Large orifice sealing shall be effected by the flat face of the anti-shock float seating against a EPDM rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.

Discharge of pressurized air shall be controlled by the seating & unseating of a Small Orifice Nozzle on a EPDM rubber seal affixed into the control float. The Nozzle shall have a flat seating land surrounding the orifice so that the damage to the rubber seal is prevented.

The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure.

The valve design shall incorporate an over pressure safety feature that will fail without an explosive effect, such as is normally the case when highly compressed air is released suddenly. The feature shall consist of easily replaceable components such as gaskets, seals or the like.

Connection to the valve inlet shall be facilitated by a screwed NPT Male end (1" & 2" only), studded or flanged end conforming to ANSI B16.5 Class 150 & Class 300 Standards.

Studded ends shall be supplied with the requisite number of Stainless Steel screwed studs inserted for alignment to the specified standard. **Nuts and washers shall be included.**

OPERATION

1. Prior to the ingress of liquid into the valve chamber, as when the pipeline is being filled, valves shall vent through the large orifice when water approach velocities are relative to a transient pressure rise on valve closure of 1.5 x valve rated pressure

At higher water approach velocities, which have a potential to induce transient pressure rises >1.5 times valve rated pressure on closure, the valve shall automatically discharge through the "Anti-Shock" Orifice and reduce water approach velocity, so that on closure a maximum transient pressure rise of <1.5 x valve rated pressure is realised.

2. Valves shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 7.25 psi to 1.5 times rated working pressure.
3. Valves shall respond to the presence of air by discharging it through the small orifice at any pressures within a specified design range, i.e. 7.25 psi to 276 psi, 363 psi or 580 psi, and shall remain leak tight in the absence of air.

ORDERING GUIDE

<p>VALVE SIZE:</p> <p>1" - 025</p> <p>2" - 050</p> <p>3" - 080</p> <p>4" - 100</p> <p>6" - 150</p> <p>8" - 200</p>	<p>VALVE SERIES:</p>	<p>SPECIAL APPLICATION:</p> <p>BIAS AIR IN <input type="checkbox"/> b</p> <p>BIAS AIR OUT <input type="checkbox"/> v</p>	<p>VALVE PRESSURE RATING:</p> <p>276 psi <input type="checkbox"/> 19</p> <p>363 psi <input type="checkbox"/> 25</p> <p>580 psi <input type="checkbox"/> 40</p>	<p>VALVE END CONNECTION:</p> <p>SCREWED - NPT <input type="checkbox"/> 2</p> <p>STUDDERED - ANSI 150# <input type="checkbox"/> 3</p> <p>FLANGED - ANSI 150# <input type="checkbox"/> 4</p> <p>STUDDERED - ANSI 300# <input type="checkbox"/> 5</p> <p>FLANGED - ANSI 300# <input type="checkbox"/> 6</p> <p>FLANGED - ANSI 600# <input type="checkbox"/> 7</p>	<p>BODY TYPE:</p> <p>EPOXY COATED FLANGES <input type="checkbox"/> E4</p> <p>304 SS BODY</p> <p>FULL 304 S/S CONSTRUCTION <input type="checkbox"/> S4</p> <p>FULL 316 S/S CONSTRUCTION <input type="checkbox"/> S6</p>	<p>VALVE TYPE:</p> <p>DOUBLE ACTING <input type="checkbox"/> 1</p>
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Note:

1. 10" and 12" valves are available on request.
2. Valves for pressure ratings of 928 psi and 1450 psi are available on request.
3. Valves are available with AISI 304 or AISI 316 Stainless Steel Flanged ends, please specify when ordering.

TEST SPECIFICATION

All air release valves supplied shall be subjected to the following testing procedures in the order laid down:

- (A) A high pressure strength and leak test whereby the valve is filled with water and pressurized to 1.5 times the rated working pressure which shall be held for a period of 2 minutes. Any leaking, weeping or sweating shall be reason for rejection.
- (B) A low head leak test whereby the valve is filled with water and pressurized to a maximum of 7.25 psi using a visible water column connected to the test rig. The valve shall be rejected if leak tightness is not maintained for 2 minutes.
- © Every tenth air release valve of the same size and pressure rating must be subjected to a small orifice function test - **"DROP TEST"** - whereby the valve is filled with water, pressurized to above rated working pressure and isolated from the test rig by closure of an isolating valve. A chamber in the test rig immediately prior to the isolating valve must be filled with compressed air at a pressure equal to that being maintained in the air release valve. The isolating valve is then opened so as to allow the air to rise in the air release valve without the pressure dropping lower than 29 - 44 psi) above rated working pressure of the air release valve. The **"DROP TEST"** is then carried out by slowly bleeding off the pressure through a suitable cock until rated working pressure is reached and the float drops away from the orifice to allow discharge. Failure of the air release valve to function in the manner described will be reason for rejection.

On request the manufacturer shall provide batch certificates of test compliance which shall be cross referenced to serial numbers indelibly marked onto the identity label of each valve.

IMPORTANT NOTE: It is impossible to inject air into an incompressible liquid, air injection can only be achieved if the liquid can be displaced which implies that the pressure in the test rig must be reduced to atmospheric, and absolutely nothing is proven by discharge through the small orifice of the air release valve at atmospheric pressure. **"DROP TESTING"** in this manner is not acceptable.



RF Valves, Inc.

(Hereinafter referred to as Seller)

STANDARD TERMS AND CONDITIONS

1. CONTROLLING PROVISIONS: These terms and conditions shall control with respect to any purchase order or sale of Seller's products. No waiver, alteration or modification of these terms and conditions whether on Buyer's purchase order or otherwise shall be valid unless waiver, alteration or modification is specifically accepted in writing and signed by an authorized representative of Seller.

2. DELIVERY: Seller will make every effort to complete delivery of products as indicated on Sellers acceptance of an order, but Seller assumes no responsibility or liability, and will accept no back charge for loss or damage due to delay or inability to deliver caused by acts of God, war, labor difficulties, accident, delays of carriers, by contractors or suppliers, inability to obtain materials, shortages of fuel and energy or any other causes of any kind whatever beyond the control of Seller. Seller may terminate any contract of sale of its products without liability of any nature, by written notice to Buyer, in the event that the delay in delivery or performance resulting from any of the aforesaid causes shall continue for a period of sixty (60) days. Under no circumstances shall Seller be liable for any special or consequential damages or for loss, damage or expense (whether or not based on negligence) directly or indirectly arising from delays or failure to give notice of delay.

3. WARRANTY: Seller warrants RF Pinch and RF-SKG for one year and Vent-O-Mat for limited 10 years from the date of shipment Seller's manufactured products to the extent that Seller will replace those having defects in material or workmanship when used for the purpose and in the manner which Seller recommends. Vent-O-Mat 10 year limited warranty applies to internal parts only. If Seller's examination shall disclose to its satisfaction that the products are defective, and an adjustment is required, the amount of such adjustment shall not exceed the net sales price of the defective products only and no allowance will be made for labor or expense of repairing or replacing defective products or workmanship or damage resulting from same. Seller does not guarantee resistance to corrosion, erosion, abrasion, or other sources of failure, nor does Seller guarantee a minimum length of service, or that the product shall be fit for any particular service. Seller warrants the products which it sells of other manufacturers to the extent of the warranties of their respective makers. Where engineering design or fabrication work is supplied, Buyer's acceptance of Seller's design or of delivery of work shall relieve Seller of all further obligation, other than as expressed in Seller's product warranty. THIS IS SELLER'S SOLE WARRANTY. SELLER MAKES NO OTHER WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE WHICH EXCEED SELLER'S AFORESTATED OBLIGATION ARE HEREBY DISCLAIMED BY SELLER AND EXCLUDED FROM THIS WARRANTY. Seller neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of its engineering designs or products. This warranty shall not apply to any products or parts of products which (a) have been repaired or altered outside of Seller's factory, in any manner; or (b) have been subjected to misuse, negligence or accidents; or (c) have been used in a manner contrary to Seller's instructions or recommendations. Seller shall not be responsible for design errors due to inaccurate or incomplete information supplied on Valve Data Sheet(s) by Buyer or its representatives. The laws of the State of Maryland shall govern, apply and construe all questions and interpretations hereunder.

4. SELLER'S LIABILITY: Seller will not be liable for any loss, damage, cost of repairs, incidental or consequential damages of any kind, whether based upon warranty (except for the obligation accepted by Seller under "Warranty", above), contract or negligence arising in connection with the design, manufacture, sale, use or repair of the products or of engineering designs supplied to Buyer.

5. STORAGE: Valves shall be stored indoors free from job site dirt, mud, and temperature changes. If indoor storage is not possible, the valve must be stored above possible water or snow level and remain covered in the original shipping container. Failure to store valves in this fashion or to follow storage requirements for electrical components or other auxiliary equipment will void their warranty.

RETURNS: Seller cannot accept return of any products unless it has been issued a Returned Goods Authorization (RGA) number and form from RF Valves' Customer Service Dept. at (410) 850-4404 or email to Support@rfvalve.com.

All credits for returned goods are subject to the following: (a) All material returned must be clearly marked with the RGA#, and on its arrival at Seller's plant, be found to be in first-class condition; if not, cost of putting in salable condition will be deducted from credit memoranda; (b) a minimum \$50 or 5% handling charge will be made from all credit memoranda issued for material returned; (c) Transportation charges, if not prepaid, will be deducted from credit memoranda.

Credits, subject to above, apply only within 90 days after shipment:

i) 75% - standard manual/air release valve(s), in original packaging

ii) 50% - standard automated valve(s), in original packaging

iii) 75% - standard accessories unused

iv) Special purpose valve(s) or accessories designed to customer specifications returned for non-warranty reasons - credit determined on a case-by-case basis subject to inspection.

6. ORDER CANCELLATIONS or CHANGE ORDERS: Cancellations subject to the following charges as a percentage of total order amount; **10%** order entered; **30%** released for manufacture; **50%** assembly in process or awaiting shipment, unless product is a non-standard, special purpose valve, in which case **100%** or as agreed upon in writing case-by-case. **Change Orders** - Changing standard accessories, manufacturer's re-stocking fee, plus cost of new item(s). Change of valve structure or design from standard valve design or following release to manufacture, **25%** of order, **50%** of order when assembly in process or awaiting shipment, unless product a non-standard, special purpose valve, in which cost agreed upon in writing on case-by-case basis.

7. SHIPMENTS: All products sent out will be carefully examined, counted and packed. The cost of any special packing or special handling caused by Buyer's requirements or requests shall be added to the amount of the order. No claim for shortages will be allowed unless made in writing within ten (10) days of receipt of shipment. Claims for products damaged or lost in transit should be made on the carrier, as Seller's responsibility ceases, and title passes, on delivery to the carrier.

8. SPECIAL PRODUCTS: Orders covering special or non-standard products are not subject to cancellation except on such terms as Seller may specify on application.

9. PRICES AND DESIGNS: Prices and designs are subject to change without notice. All prices are F.O.B. Point of Shipment, unless otherwise stated. In the absence of a special agreement, Buyer agrees to pay 1.5% monthly interest on all past due invoices. If Seller shall have any doubt at any time as to Buyer's financial responsibility, Seller may decline to make deliveries except of cash or satisfactory security.

10. TAXES: The amount of any sales, excise, or other taxes, if any, applicable to the products covered by this order, shall be added to the purchase price and shall be paid by Buyer unless Buyer provides Seller with an exemption certificate acceptable to the taxing authorities.

11. MINIMUM ORDER: \$500.00 plus transportation on complete valve assemblies. \$50 plus transportation on replacement spare parts.

12. TERMS: Cash, net 30 days unless otherwise specified

WARNING - RF Valves, Inc. VALVES ARE DESIGNED AND MANUFACTURED USING GOOD WORKMANSHIP AND MATERIALS, AND MEET INDUSTRY STANDARDS. THESE VALVES ARE AVAILABLE WITH COMPONENTS OF VARIOUS MATERIALS, AND THEY SHOULD BE USED ONLY IN SERVICES RECOMMENDED BY A COMPANY VALVE ENGINEER. MISAPPLICATION OF THE PRODUCT MAY RESULT IN INJURIES (INCLUDING DEATH) OR PROPERTY DAMAGE. A SELECTION OF VALVE COMPONENTS OF THE PROPER MATERIAL CONSISTENT WITH THE PARTICULAR PERFORMANCE REQUIREMENT IS IMPORTANT FOR PROPER APPLICATION. IF THE VALVE EXHIBITS ANY INDICATION OF LEAKAGE, DO NOT OPERATE. ISOLATE VALVE AND EITHER REPAIR OR REPLACE.

Revised: April 2015





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Revision Date April 2015 Catalogue RBX0006