
GUNN
PRODUCT SERVICES

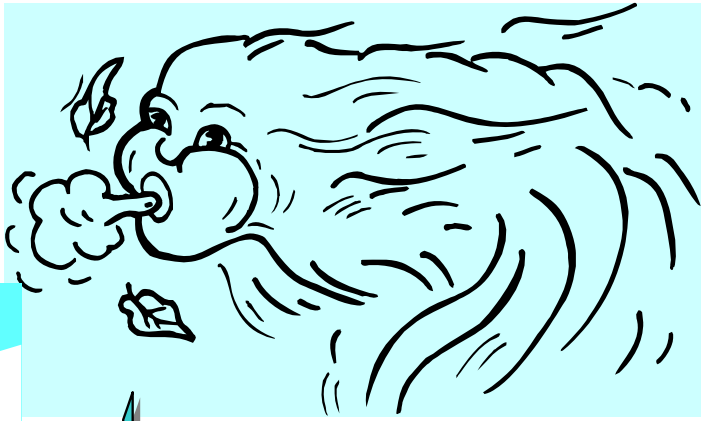

A.R.I.

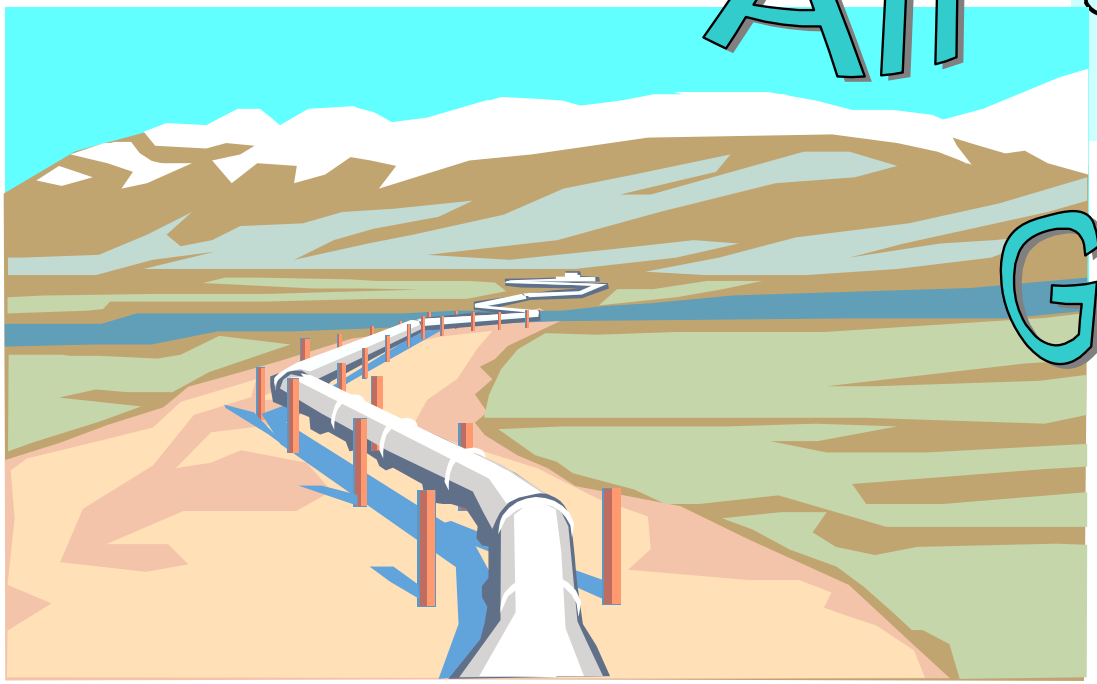
Agenda (Continued)

- Choosing and locating air valves
- Installing air valves
  - Manifolding
  - Manufacturers recommendations
- Venting
- Accessories
- New Products

Why do you need air valves?

How Does Air Get Into Pipes





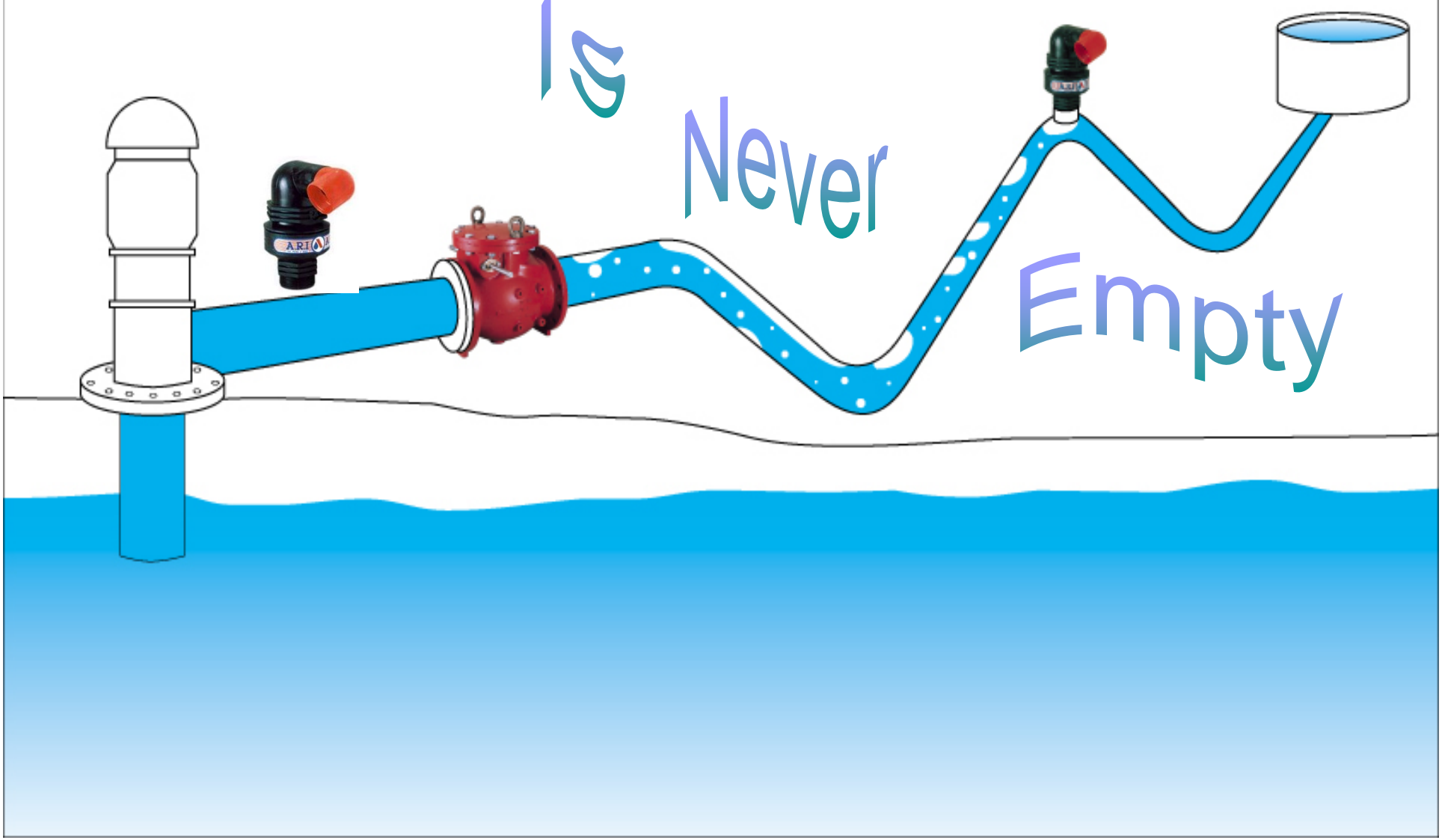
Vapor Pressure

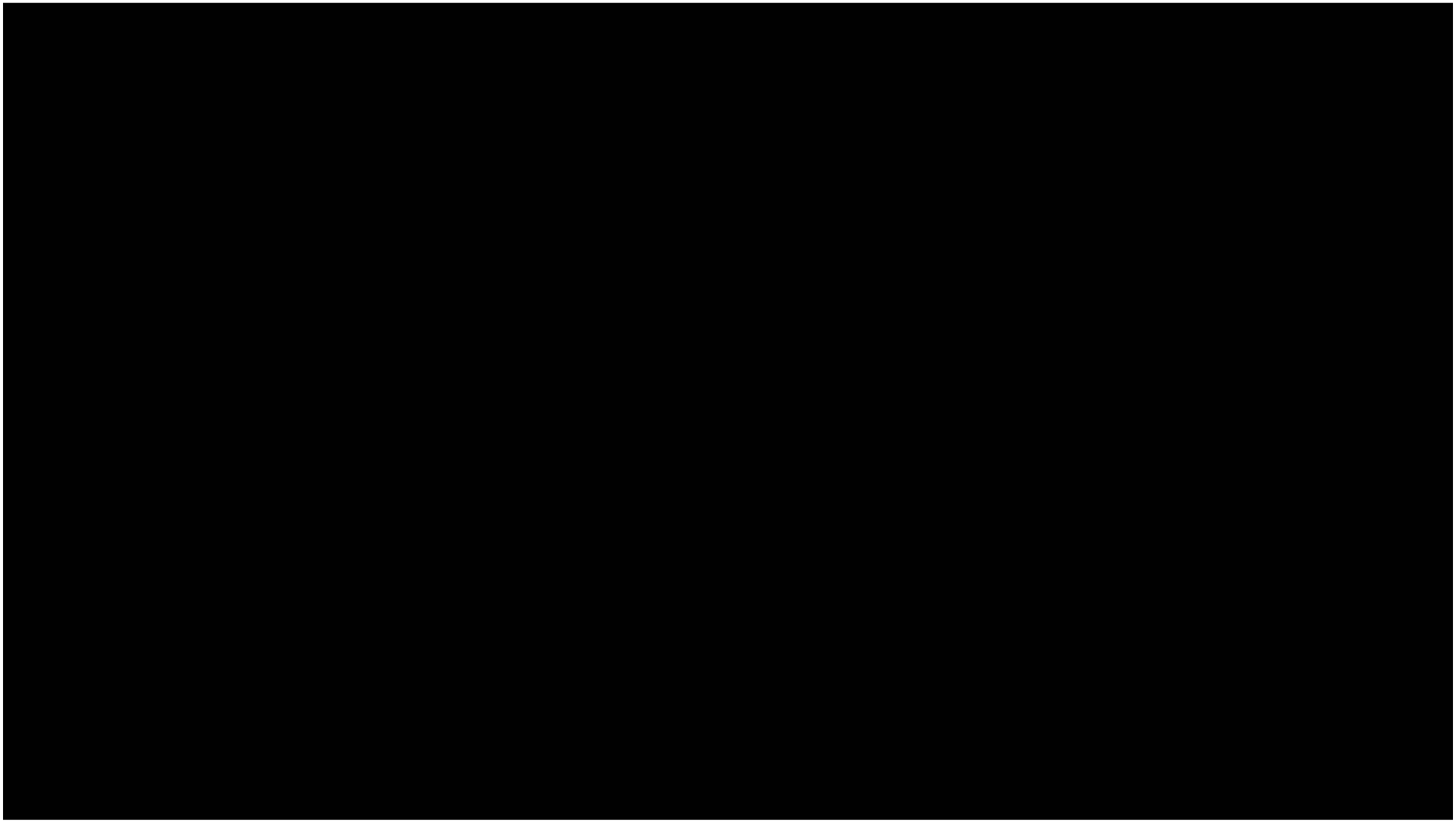
TEMP. °F	Vapor Pressure in Hg	Vapor Pressure psi
32	0.18	0.0139
41	0.26	0.1265
50	0.36	0.1781
59	0.50	0.2473
68	0.69	0.3392
77	0.94	0.4594
86	1.25	0.6153
95	1.62	0.7963
104	2.18	1.3899
113	2.83	1.7819
122	3.63	2.2825

TEMP. °F	Vapor Pressure in Hg	Vapor Pressure psi
131	4.65	2.2825
140	5.88	2.8885
149	7.38	3.6264
158	9.20	4.5190
167	11.38	5.5903
176	13.98	6.8665
185	17.07	8.3844
194	20.70	10.1665
203	24.96	12.2576
212	29.92	14.6959

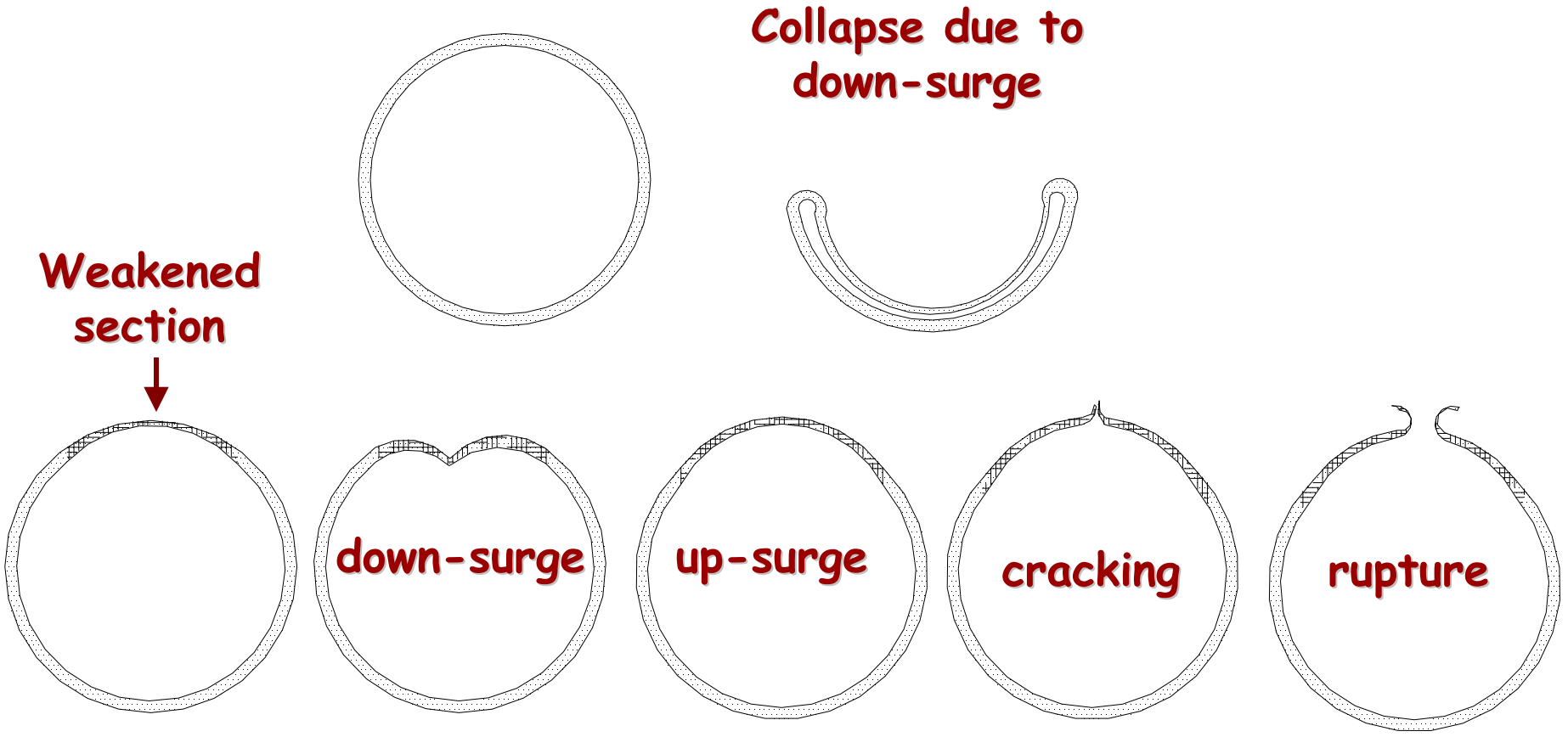
Is a pipeline ever empty?

A Pipeline Is Never Empty



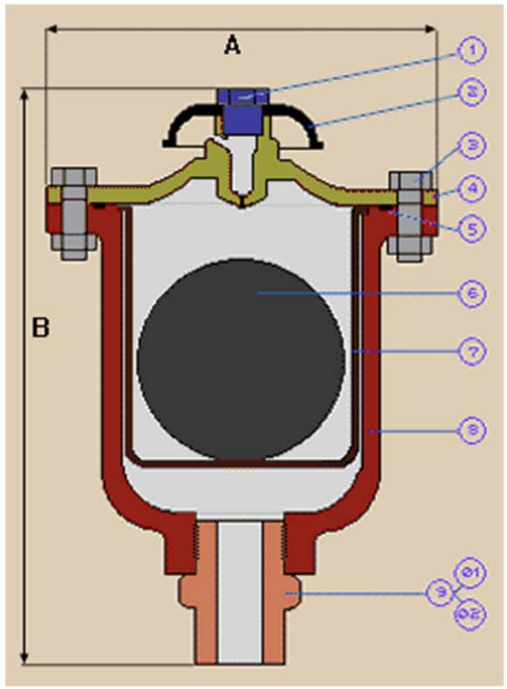


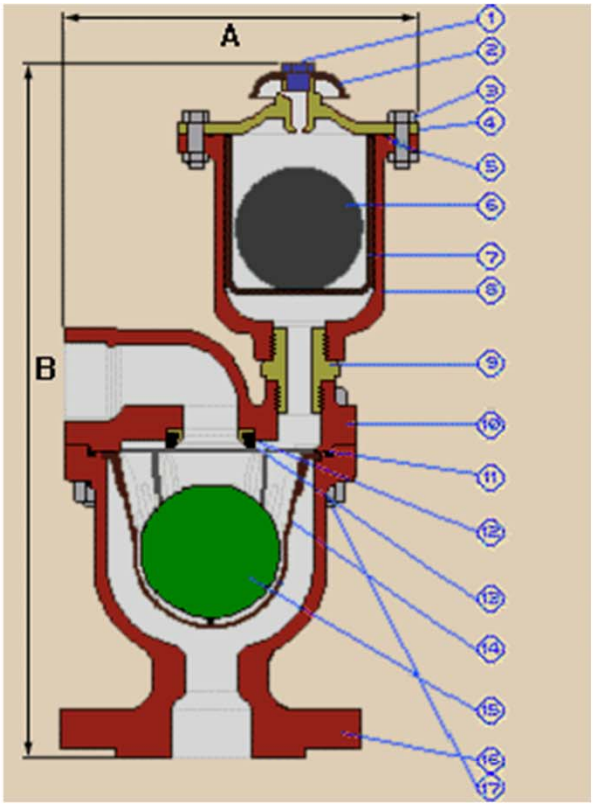
SURGES DUE TO WATER COLUMN SEPARATION

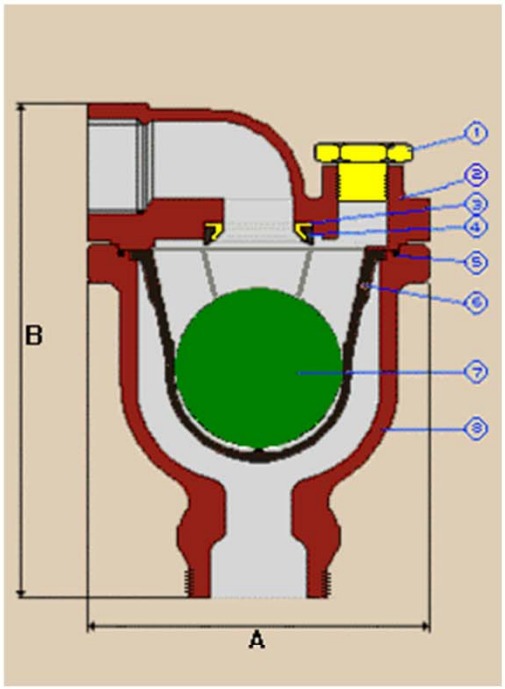


PIPELINE WITHOUT THE PROTECTION OF AIR VALVES

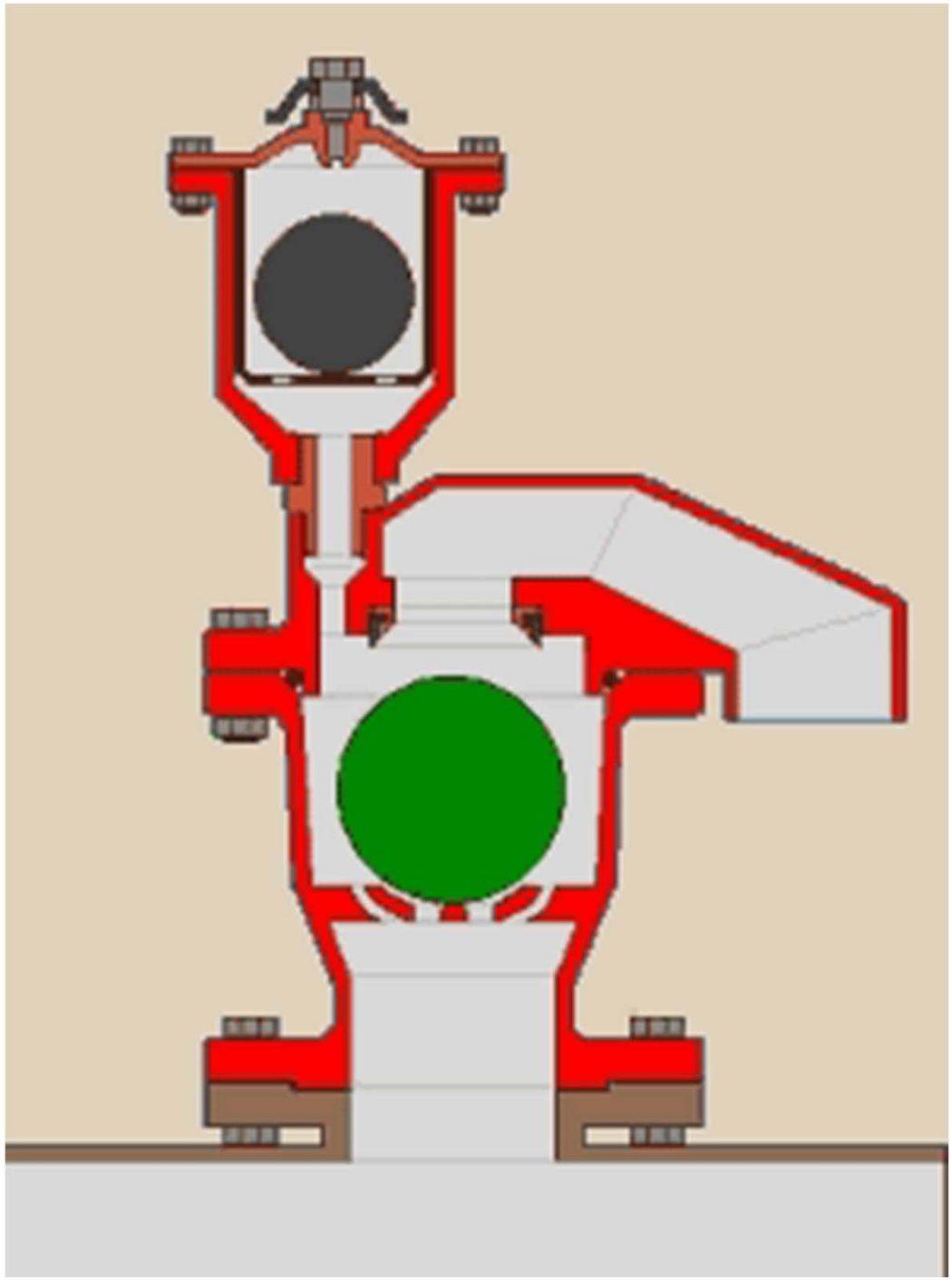

AN ANCIENT “AIR VALVE”
IN AN ANTIQUE ROMAN PIPELINE,
GALILLE, ISRAEL

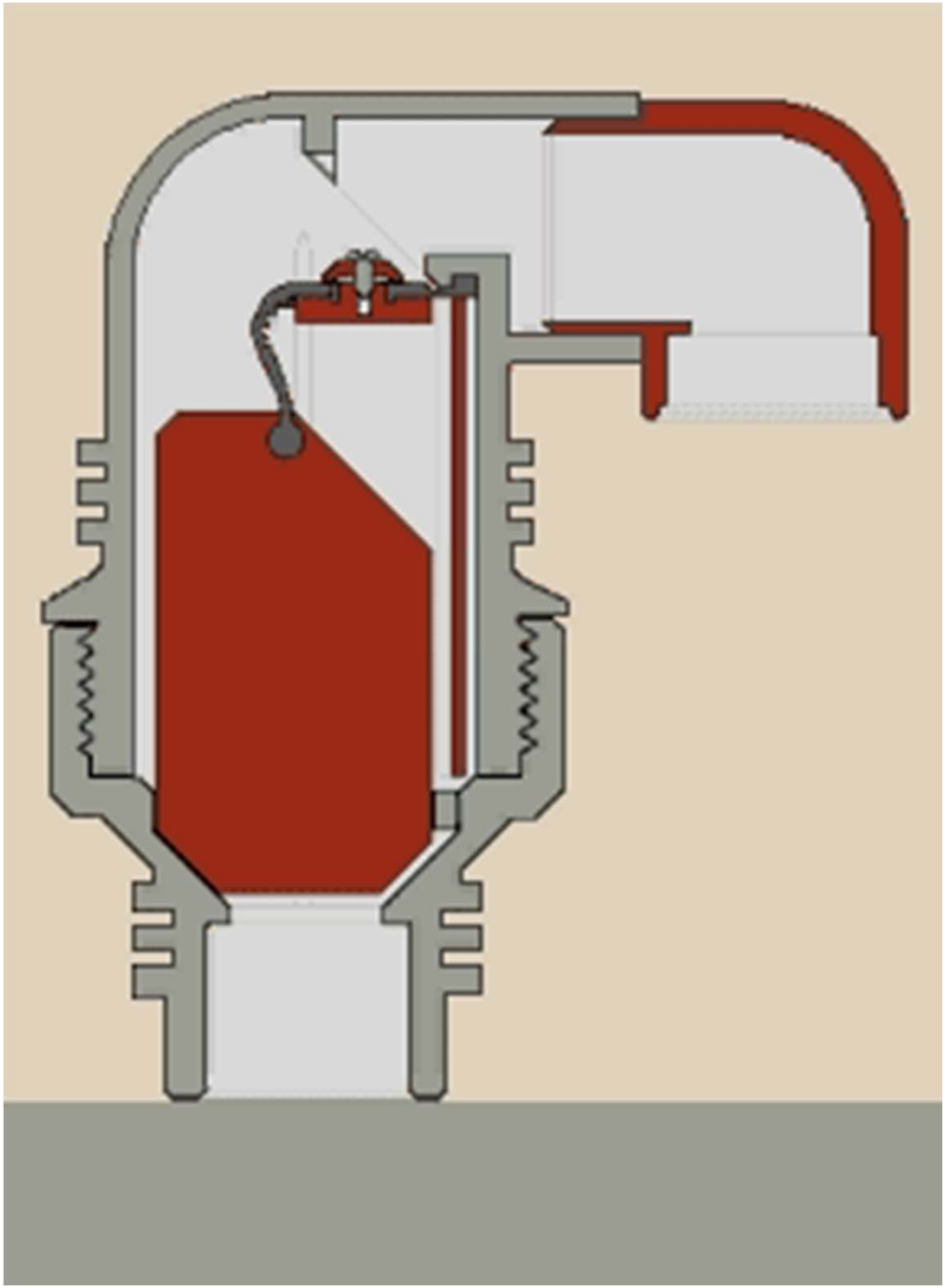






3 Types of Air Valves





Sizing & Locating Air Valves

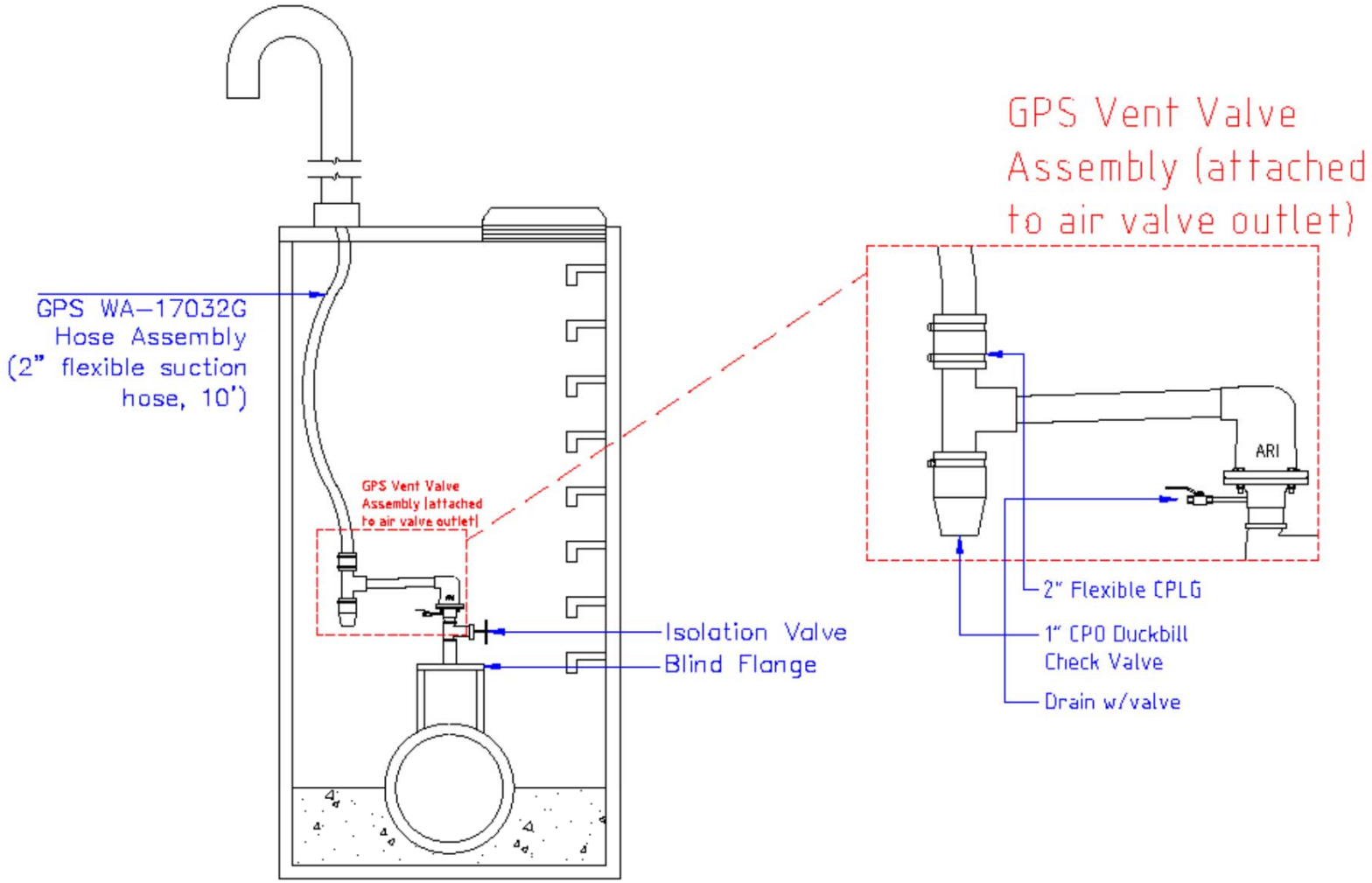
- Kinetic air discharge usually equal to the pipe filling flow-rate.
  - Smaller discharge rates are sometimes used in sections along pipeline to throttle fill rate so as to reduce the risk of pressure surges during pipe filling.
- Air intake requirements usually considered the determining factor in air valve sizing
  - Use Hazen-Williams equation for pipe burst

Water Column Separation and Pressure Surges

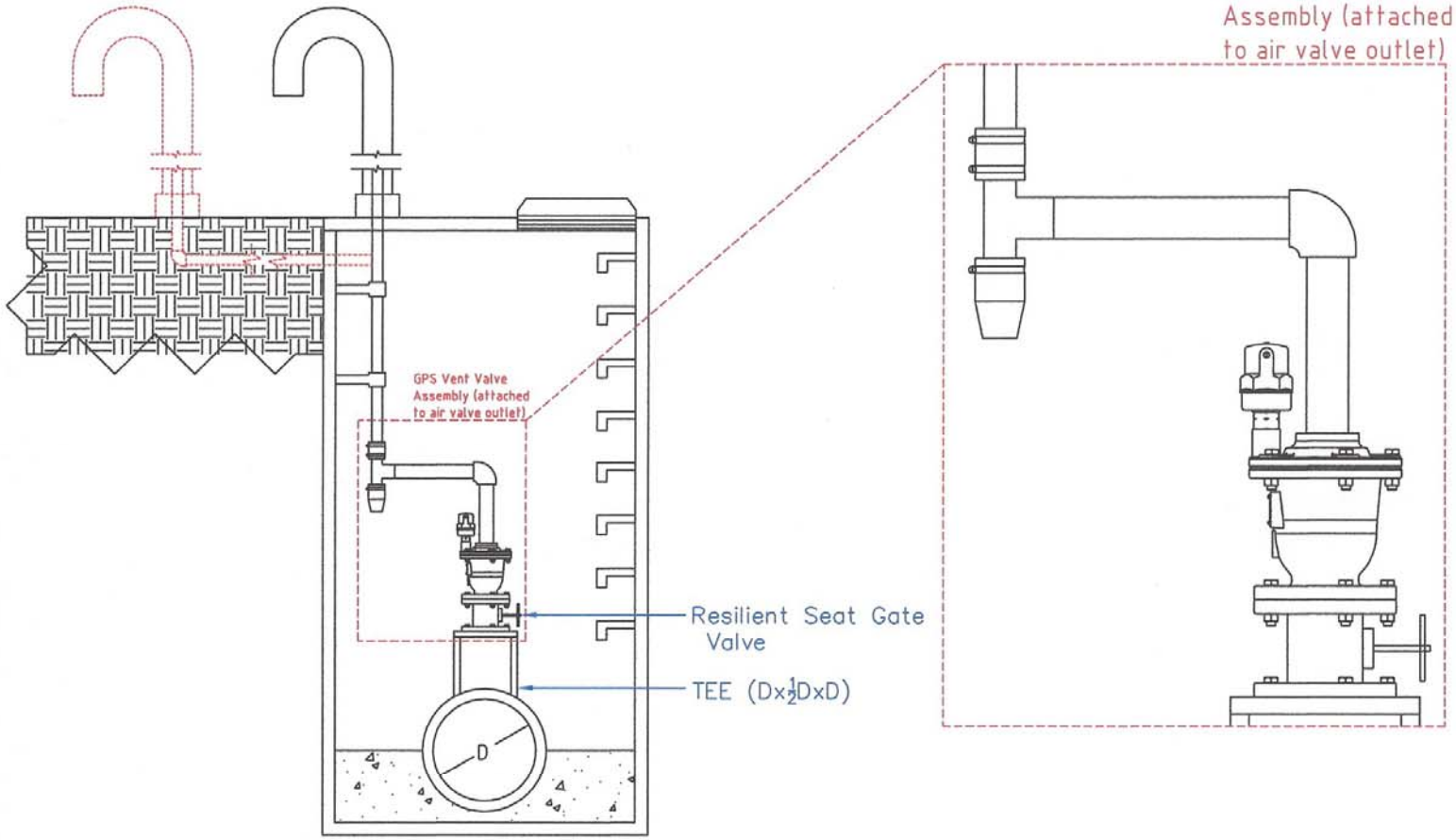
- Pump tripping, sudden in-line valve closing causes water column separation.
  - Sometimes water column separation is caused by more usage than available flow.
  - Vapour cavity develops behind fluid flow and causes down-surge pressure slam
  - When fluid flow bounces back off fitting an upsurge results in additional pressure hit

Air Valves and Pressure Surges

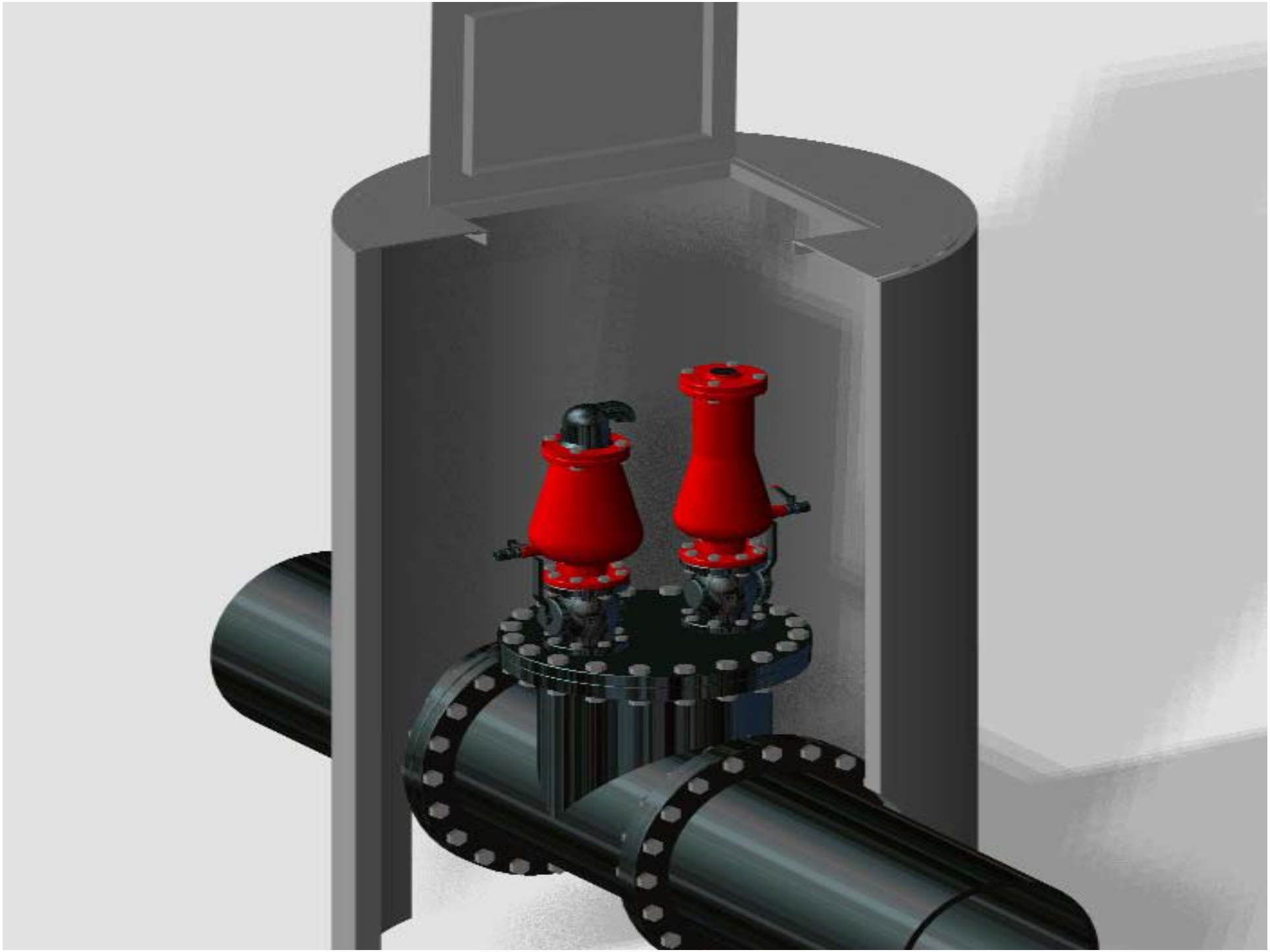
- Down surges corrected by air valve opening pipeline to atmosphere.
  - Sizing determined by factor of safety desired.
- Up surges corrected by air valve controlling the rate of discharging air to atmoshere.
  - Use a throttling device to reduce air outlet orifice size under discharge only.



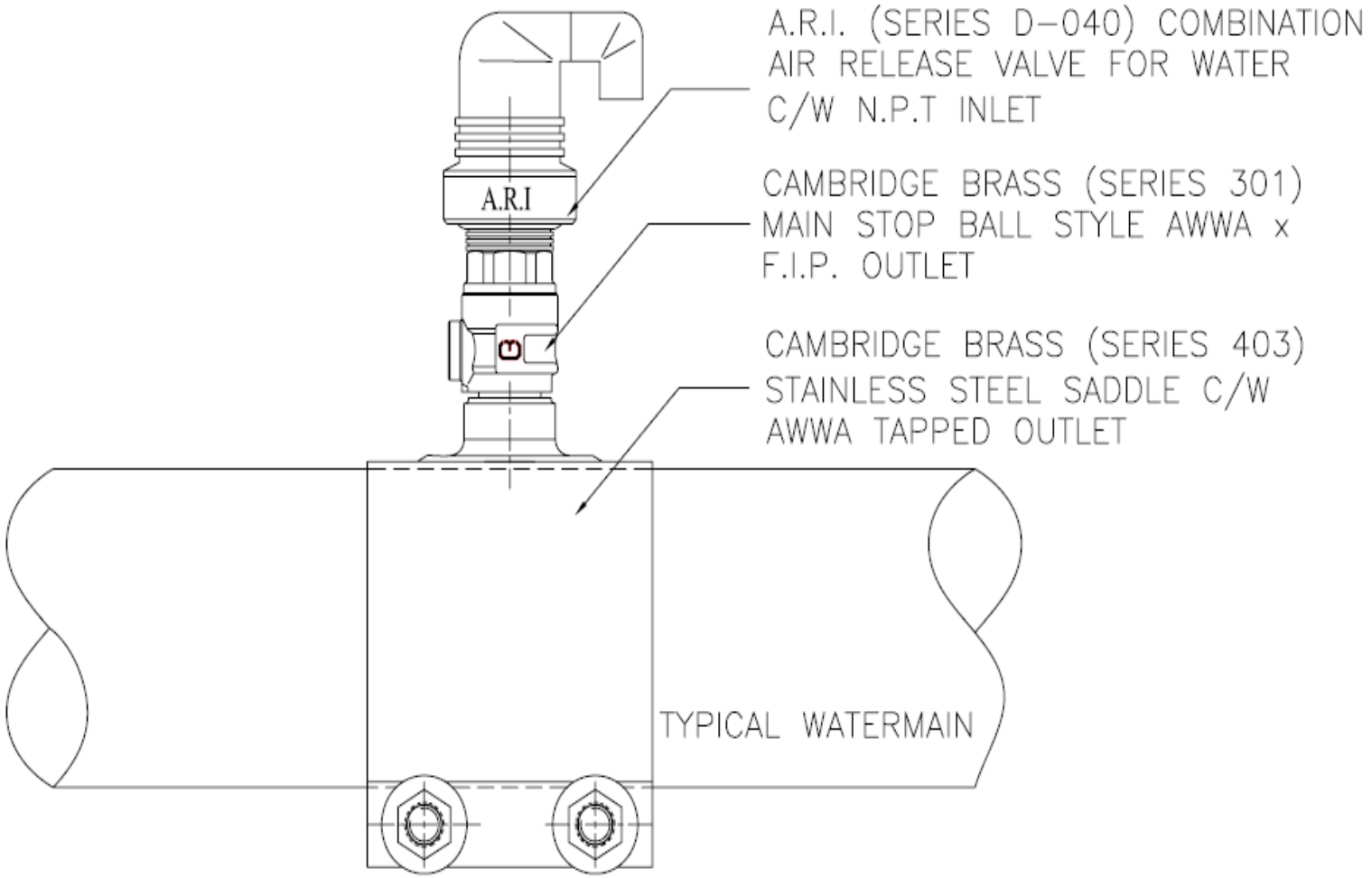
Air Valve Chamber	
D-040C-02 DR	



Air Valve Chamber	GUNN PRODUCT SERVICES
D-060 Air Valve	



Installation Drawing



City of Brantford

Procedure for Inspecting Air Valves

Air Valve Construction

- “All City of Brantford air release valves installed in the distribution system must be equipped with a drain valve located at the bottom of the air release assembly to check for a complete shutdown of the control valve isolating the air release from the distribution main it’s attached to.
- The drain valve will be used to properly test both functions of the air/vac assembly.

City of Brantford (Continued)

- Using the drain valve, open and flush the air release chamber of any stagnant water or debris that may be present.
- Close the isolation valve and check that you have a complete shutdown…..
- After the air/vac chamber has been completely drained, close the drain valve and slowly open the isolation valve.

City of Brantford (Continued)

- The air should freely discharge discharge from the top of the air release assembly and stop when all the air has been exhausted.
- Check to ensure there is no water continuing to drip from the discharge pipe”.

Russell Simpson is water system operations supervisor for Markham Waterworks, Markham, Ontario, Canada.

O_2-B-Gone Grabs Third Place

BY RUSSELL SIMPSON

For many years, the Markham Waterworks Department has recognized the importance of installing combination air release–vacuum breaker valves at high points within its water distribution system. Our distribution system has about 765 km (480 mi) of water main, with more than 200 air valves. However, the utility didn't have a preventive maintenance program for the air valves.

Early in 2006, the utility embarked on a preventive and corrective valve maintenance program. The impetus for the program came from several sources. During operator training prompted by Ontario Safe Drinking Water Act regulations, the trainer presented several examples of corroded, seized-up, and failed valves, including air valves. Staff members began thinking about the condition of air valves already in the system.

The first task was to locate all air valves in the system using the town's asset management system and to inspect valve conditions. The inspection program also identified several air valves that weren't already included in the inventory. Not surprisingly, because little maintenance had occurred since the 1960s, many valves showed severe buildup of corrosion and iron bacteria that impaired the valves' function.

Operators also found that most air valves had been installed without a test port drain valve to allow draining, flushing, and testing. Several valves also lacked isolation valves to allow removal of the valve from the live main. Consequently, it was decided to replace valves older than 40 yr and to remove and recondition valves newer than 10 yr.

Because operators determined that reconditioning and testing the air valves on-site was impractical, the utility purchased new air valves to replace the oldest valves and to swap out newer valves while they were reconditioned. Reconditioning consisted of removing rust by stripping away loose rust, iron bacteria, and thereso rape with a high-pressure spray wand. Necessary parts were replaced or repaired. The valve exteriors were painted with a heavy-duty rust paint, and a test port valve was installed. A reconditioned valve was then ready to be tested.

CONSTRUCTION

It was at this point that we invented O_2 B Gone, a simple device to test valves to ensure the air release–vacuum breaking floats and orifice functioned properly. O_2 B Gone is made of a 4 ft length of 6-in. PVC water main with restrained end caps on each end that are tapped and valved to allow a garden hose connection in one cap and an air hose connection in the other. A 6 in. by 2 in. service saddle was tapped into the center of the water main.

MATERIALS

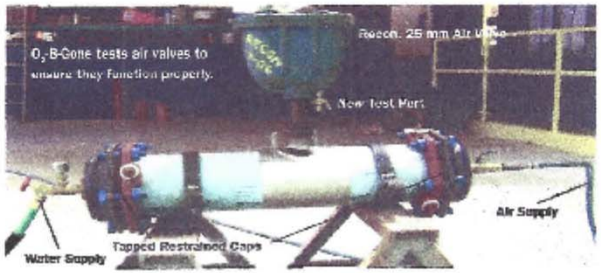
1	4 ft length of 6 in. C900 PVC pipe	scrap
2	6-in. MJ tapped cap 2 in.	$106.00
2	Mega-Lug restrainers	50.00
1	6-in. by 2-in. service saddle	42.00
1	¾ in. brass hose bib	6.00
1	¾-in. brass tee	3.00
1	¾-in. brass ball valve	5.75
1	oil-filled static pressure gauge	13.25
	Total	$218.00

OPERATION

For testing, the air valve is threaded into the service saddle, and O_2 B Gone is filled with water via the garden hose connection and brought up to an interna water pressure equal to the system pressure. Then the water supply valve is closed and a small amount of air is injected by opening the air hose connection. If the valve is functioning properly, the air bubble will be released immediately from the main orifice, evidenced by a spray of mist and a distinctive "whoosh" sound. Next the test port on the air valve is opened, pressure is released, and water is drained from the air valve. As the water in the valve bowl drains, the operator listens for air being drawn into the valve through the main orifice. This sound is less distinctive, but water won't drain from the bowl unless the main orifice opens to allow inflowing air to displace the water. A strong, steady flow of draining water verifies the orifice and floats are working.

In a little more than 2 mo, four Markham Waterworks operators had replaced or reconditioned all valves in the system.

Author's Note: *Thanks to the following Markham Waterworks employees for their assistance with this column: Robert Flindell, Kyle Edon, Graham Beach, Marcos Tungcol, and Richard Gonsalves.*



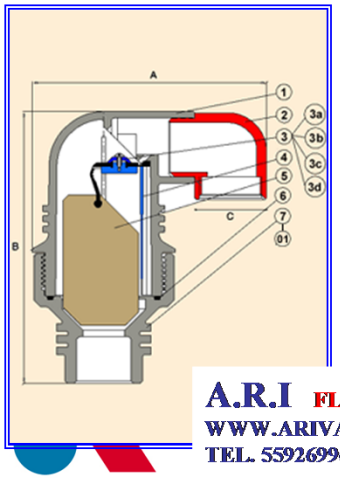
COMBINATION AIR VALVE
BARAK, MODEL D-040
MAINTENANCE INSTRUCTIONS

GENERAL INSTRUCTIONS

1. Routine service is an integral part of the standard procedure for maintenance of a water supply system.
2. Recommended routine maintenance– once or twice a year, according to the quality and kinds of the fluids in the system.

PROCEDURE:

1. Close the service valve under the valve base, before servicing.
2. Turn , release and remove the valve body (1).
3. Check the soundness of the seal plug assembly (3) by washing it with water. Replace the seal assembly in case it is torn.
4. Check and wash the body (1) and the float (5) with clean water. Replace the float if it is damaged.
5. Clean the drainage elbow (2) to remove insects and debris.
6. While you are closing the body of the valve by turning it, be sure that the O-ring (6) is located in its place in the base of the valve (7).
7. Do not forget to open the service valve after the servicing.



PARTS SPECIFICATION

NO.	DESCRIPTION	MATERIAL
1.	BODY	REINFORCED NYLON
2.	DRAINAGE ELBOW	POLYPROPYLENE
3.	SEAL PLUG ASSEMBLY	
4.	CLAMPING STEM	REINFORCED NYLON
5.	FLOAT	FOAMED POLYPROPYLENE
6.	O-RING	BUNA-N
7.	BASE	REINFORCED NYLON/ BRASS

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MAINTENANCE INSTRUCTIONS
COMBINATION AIR VALVE FOR SEWAGE
MODEL "SAAR" D-020

A. Installation

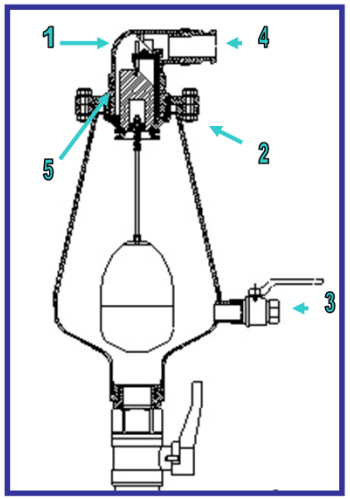
1. The sewage air valve should be installed vertically on the upper portion of the pipe line.
2. A gate valve should be installed underneath the air valve.
3. Do not turn separately the plastic head (1) of the air valve. To change the direction of drainage connecting, one must turn the whole valve or the upper cover, by loosening the screws (2) and turning the head at a 90^0 angle (turning the plastic head may damage the valve performance due to air escape).

B. Periodic Maintenance

1. Shut the gate valve underneath the air valve.
2. Open the drainage tap (3).
3. Attach quick release connection to the outlet plug (4) on top of the valve. Turn on the water for back flush.
4. Flush till the valve is clean.
5. Shut off the drainage tap (3)
6. Remove the quick release conncetion.
7. Reopen the gate valve.

C. Comprehensive Periodic Maintenance

1. Shut the gate valve underneath the air valve.
2. Open the drainage tap (3) and drain the air valve.
3. Open the 4 screws on top cover of air valve (2).
4. Pull out the mechanism. Rinse the mechanism and the inside of the air valve.
5. Reassemble back the mechanism and tighten the screws (1/2") (2). Pay attention to correct placing of seal's O-Ring (5).
6. Close the drainage tap (3).
7. Reopen the gate valve.



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Follow the Rules

- Confined Space
- Set up procedure
  - Document each step and follow precisely


A.R.I.

Air Relief Valves for Water Service

- Breakdown of the D-060 HF high flow combination air valve
  - Top vent cover can be removed to utilize threaded outlet
  - Shown with brass base S-050 air valve

providing a means of rodding out or back flushing the valve. A typical air valve installation for a force main is shown in Fig. 9-12.

Automatic air-release valves should not be installed if their use can be avoided. From past experience it has been found that automatic air-release valves require frequent maintenance in order for them to function as intended. Inadequate maintenance causes these valves to clog and malfunction, often soon after they are installed. In most cases, manual air valves could be used instead of automatic air valves. For example, if after the force main has been put into service, the need develops for frequent use of a manually operated valve to relieve entrapped air or gas, the valve may be left at a part-open setting for continuous bleeding of air or sewage. As a last resort, an automatic air-release valve may be installed.

Automatic air-release valves, if used, must be specially designed to keep the valve operating mechanism free from contact with sewage to inhibit clogging and resulting malfunction. They must be located in a manhole or vault and protected against freezing. Automatic air valves should be installed on top of the force main with a shutoff valve close to the force main. A 25-m (1-in)

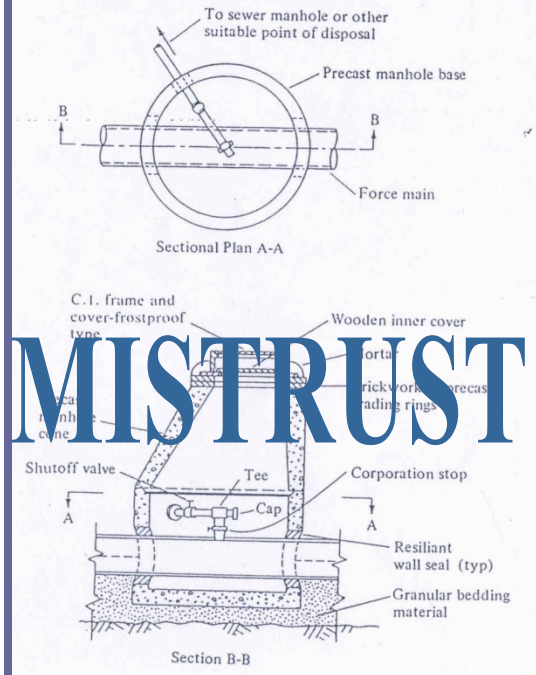
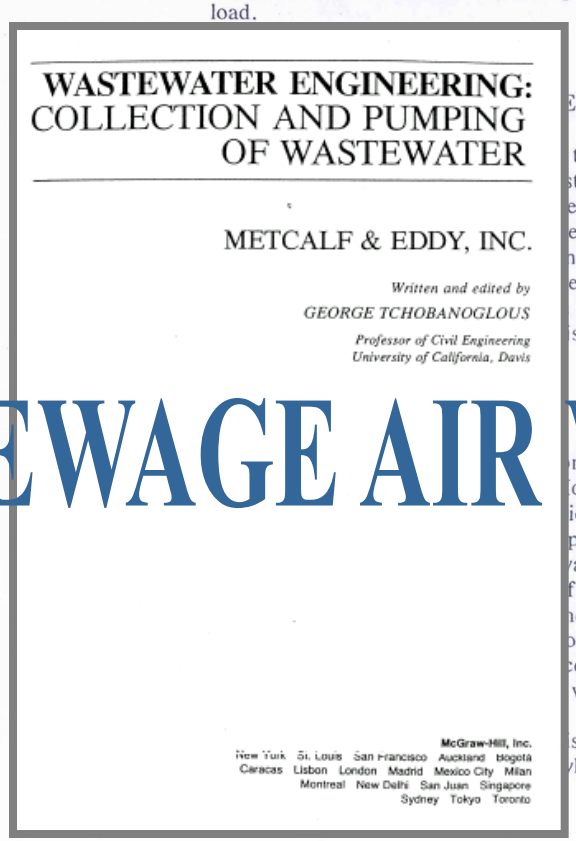


Figure 9-12 Typical air valve installation for wastewater force main.

blowoff valve should be installed either above the shutoff valve or on the air valve body. A back-flushing connection should be provided by the valve manufacturer.

Automatic air and vacuum valves have been used to allow the quick automatic admission of air that might be needed to prevent collapse of a thin-walled pipeline during the fast drainage that would take place through a broken force main, or during water-column separation following a power failure. They also have been used for venting air during the filling of the force main. However, these valves are subject to maintenance problems similar to those of air-release valves. Furthermore, their malfunction could create additional waterhammer problems.

In general, automatic air and vacuum valves should not be used on sewage force mains. Instead, the problem of possible collapse of force main pipes because of internal pressures less than atmospheric should be solved by the use of pipe having walls sufficiently strong to withstand the induced added crushing load.



EWATER FORCE MAINS

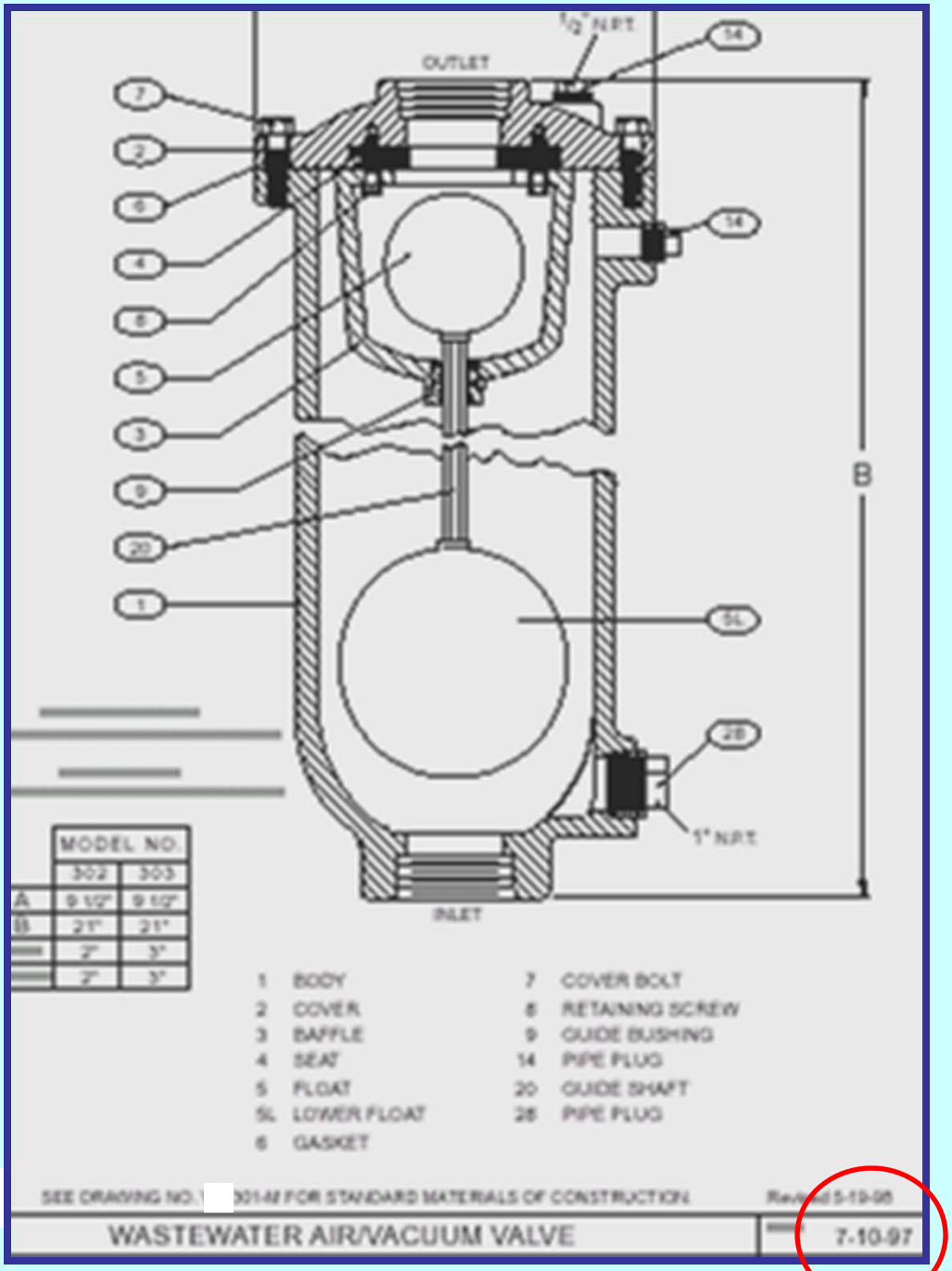
the velocity of flow in force mains and startup, pump shutdown, or power failure e in pressure. The change in pressure can egative (below normal) and is sometimes oise. This transient pressure and flow e pipes is known as *waterhammer*. The generally result during pump shutdown s, and control of waterhammer are dis-

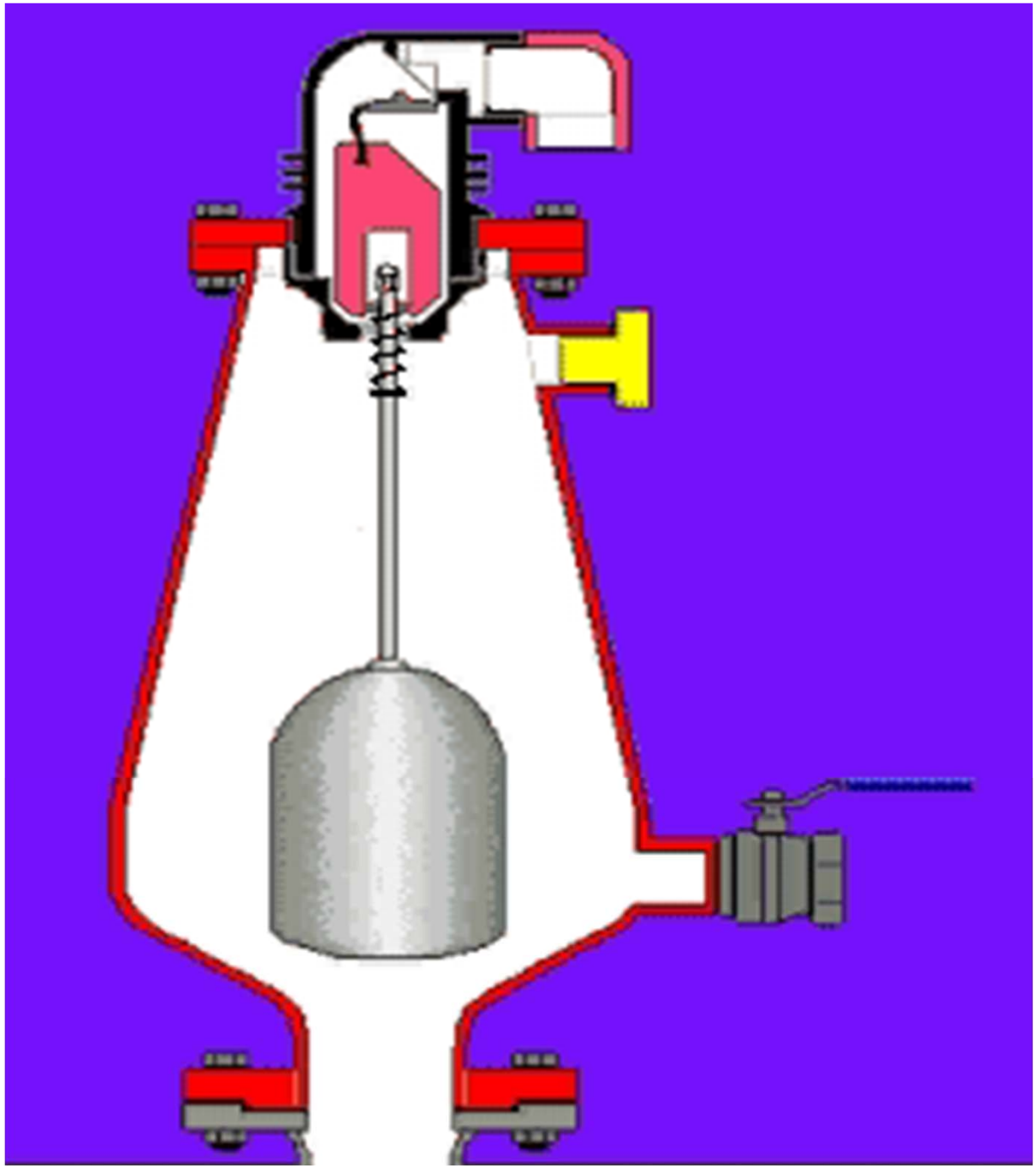
r power failure the flow and velocity in owever, when the power supply to the idly decelerates from full speed to zero pump discharge into the force main. This ave (below normal pressure) that rapidly f the force main to its discharge end. This he flow in the force main in accordance on. When this negative-pressure wave e main, it is reflected back toward the wave, which further decelerates the flow

s completed when the positive-pressure here it is again reflected and a second

MISTRUST OF SEWAGE AIR VALVES

Traditional Sewage Air Valve





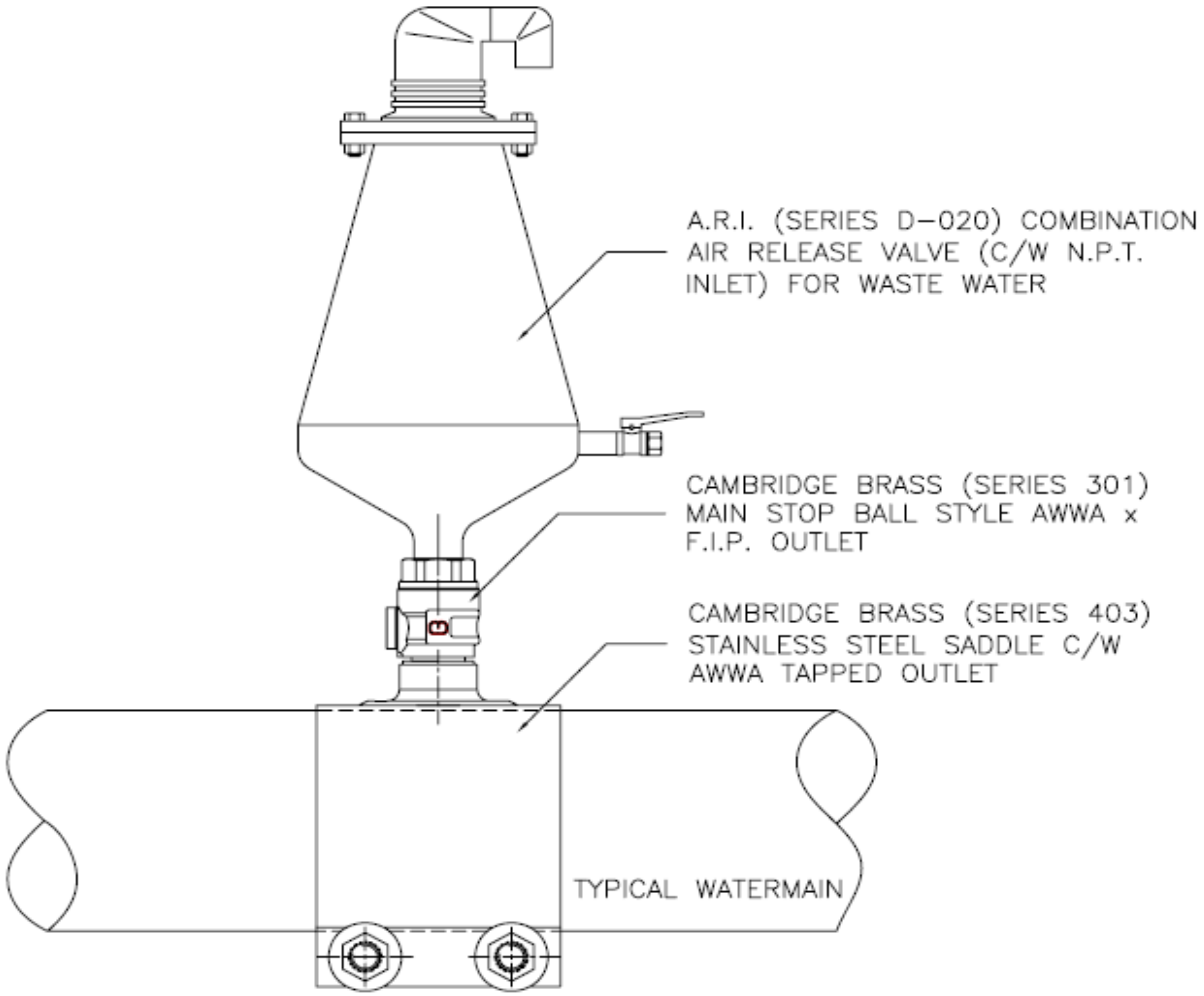
Air Relief Valves for Waste Water

- D-020 Combination air valve
  - Shown here in SAE 316 Stainless Steel
  - Most widely popular and specified in Ontario.
  - 25 inch height & 25 lbs
  - 3 psi – 250 psi working pressure
  - 2”NPT or 2”-6” flanged

Air Relief Valves for Waste Water

- City of Hamilton
  - Camlock connection for cleaning
  - This connection can be removed leaving an 11/2” iron pipe connection for insertion of vent tube

Installation Drawing

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ZEP