



DIAPHRAGM TYPE WATER HAMMER ARRESTER

The occurrence and prevention of water hammer effect:

When the fluid flows in the pipe, if the gate closes suddenly and stops the flow, the kinetic energy will be changed into elastic resilience and create a serial positive and negative pressure wave vibrating back and forth in the pipe until the energy is lost by friction. Especially when the pump stops, the fluid still flows by inertia and gravity also causes the fluid to flow back, and these two forces will cause the positive and negative pressure waves. The friction caused by the two waves will make the pipe vibrate and create noise. Hence, the life of the pump and the piping accessories will be affected and, at the same time, cause the uncomfortable noise under such situation, to set up one or more sets of water hammer arrester will improve the situation.

Our company make use of the airbag principle to design water hammer arresters which will reduce the vibration by pressing air when the in-pipe pressure transfer to air chamber.

The features of water hammer arresters :

- ▶ The airbag adopts the ball-pressing-type design, which without friction, less function progresses, prompt and quick response and has obvious result. In addition, the life of the arrester will be increased several times.
- ▶ The arrester will absorb water hammer directly and has the functions of water hammer prevention and absorption.
- ▶ Special design of the air diaphragm rubber will not release pressure and its life won't be affected by the bad water quality.
- ▶ To prevent the air leakage, the pressed air chamber is covered by permeating prevention rubber.
- ▶ The design of structure is excellent and easy to maintain.

The fluid pressure of the water hammer effect.

The water hammer effect caused by closing the valve should be added at the largest water head in the pipe to calculate the height of the pressure water head and fluid pressure .

Vensano's formula :

$$Z_o = \frac{2LV_o}{gT}$$

Ho = the pressure water head before closing the valve

Vo = the flow speed before closing the valve

T = the time needed to close the valve

L = the pipe length between the inlet and outlet of free water surface

Zo = the largest pressure water head increased by water hammer effect

H = full pressure water head after adding water hammer at the end of the pipe

Remark: the transferring speed of in-pipe pressure and acceleration
(about 1000 m / second)

Example : Assume Vo = 5 m/ sec, Ho = 72 m, L = 210 m, if the it takes 3 seconds to close the valve, then, what is the pressure of water hammer?

$$Z_o = \frac{2LV_o}{gT} = \frac{2 \times 210 \times 5}{9.81 \times 3} = \frac{2100}{29.43} = 71.35 \text{ m}$$

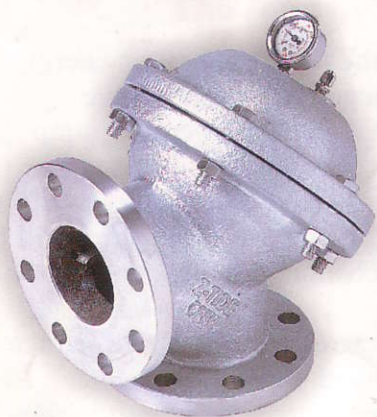
The full pressure water head including water hammer is : $H = Z_o + H_o = 71.35 + 72 = 143.35 \text{ m}$

Assume the pressure water head $10 \text{ m} = 1 \text{ kgf/cm}^2$

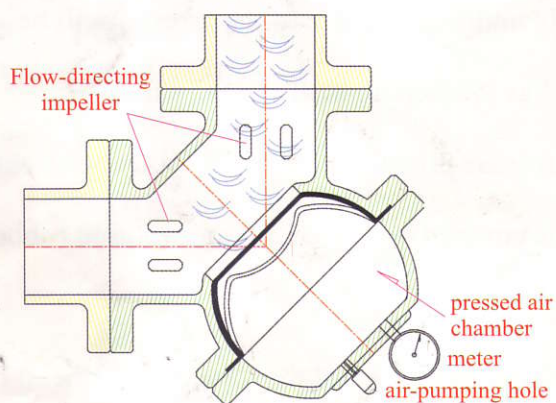
Then, The fluid pressure including water hammer is : $143.35 / 10 = 14.335 \text{ kgf/cm}^2$



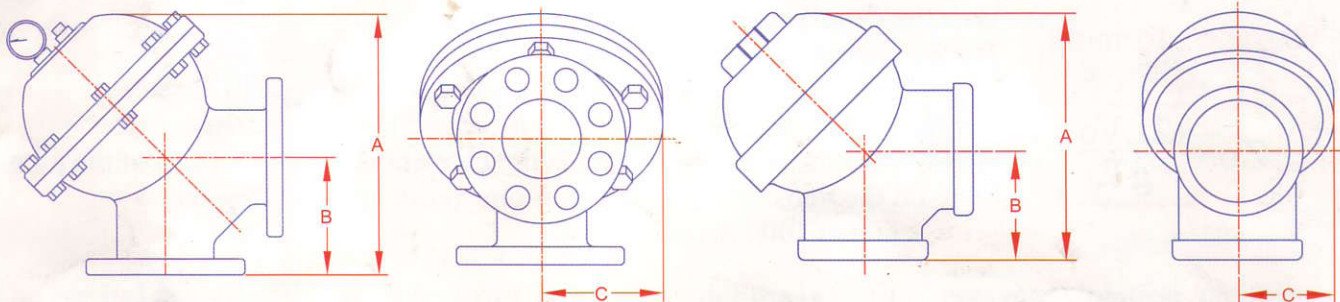
L STYLE WATER HAMMER ARRESTER



- ▶ The flow-directing mechanism in the valve can guide the flow and stabilize pressure.
- ▶ In the corner of pipe, the water hammer is the most obvious. The design is for meeting the requirement and set the arrester at the corner directly. This design not only saves the space and is easy to set up, but also can replace the traditional crooked head to reduce the cost of setting up.
- ▶ L style absorbs water hammer effect in two ways and brings excellent result.



- ▶ The test pressure of valve body
Cast iron : 21 kgf/cm²
Stainless steel : 35 kgf/cm²
- ▶ Applied conditions : Fluid
- ▶ Applied temperature : -15~80°C
- ▶ Maximum applied pressure :
Cast iron and Bronze : 12 kgf/cm²
Stainless steel 316 : 20 kgf/cm²
(1 kgf/cm²=14.2 psi)



Flange type (Material : Cast Iron or Stainless Steel)					
Item No	Size	A(mm)	B(mm)	C(mm)	Air Chamber(cm ³)
ALF-50	2"	230	110	105	1490
ALF-65	2.5"	260	130	115	2130
ALF-80	3"	275	140	125	2465
ALF-100	4"	345	155	150	5535
ALF-150	6"	467	200	200	15325
ALF-200	8"	560	235	232	27230

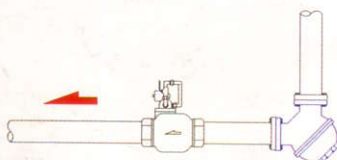
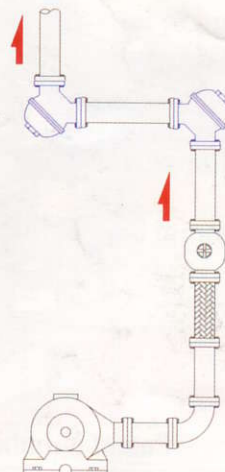
Thread type (Material : Bronze)					
Item No	Size	A(mm)	B(mm)	C(mm)	Air Chamber(cm ³)
ALT-15C	1/2"	50	25	25	17
ALT-20C	3/4"	65	30	30	30
ALT-25C	1"	80	35	35	65
ALT-32C	1.2"	95	43	45	130
ALT-40C	1.5"	115	50	50	250
ALT-50C	2"	170	110	68	650

THE INSTALLATION CONDITIONS OF L STYLE WATER HAMMER ARRESTER

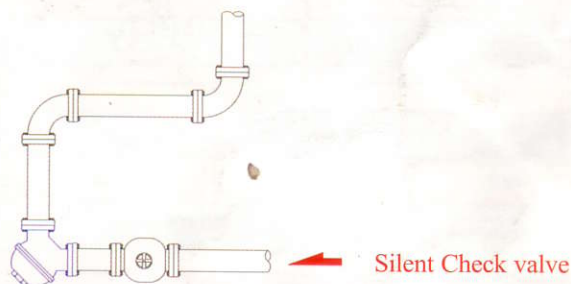
When pump shuts off, pressure decreases instantly and forms unstable gap of positive and negative pressure that causes water hammer effect and creates noise and pipe vibration. To set up water hammer arrester at the pipe corner upside of the pump (shown as the figure) can prevent the water hammer effect and protect the machine.

► Remark :

When lift is longer than 50m and pressure is above 5 kgf/cm², we suggest to set up arresters each at the downside of the long pipe and the upside corner of the check valve.



It's easy to cause water hammer effect when the gate closes fast. To set up arrester at the first corner away from the fast-shut-down valve can Absorb and prevent the water hammer effect directly and eliminate the noise.



When the fluid flow through the serial corner, the change of flow speed and direction and friction effect will cause unstable pressure wave, which will lead to vibration and noise. To set up arrester and silent check valve can eliminate the pressure wave.

Remark

- The pressure meter on the valve will show the air chamber pressure before piping and show the pipe pressure after piping.
- To leave a 10 cm opening between valve and wall for easy to maintain.
- Considering the high-pressure situation, cast iron or stainless steel valve body is suggested for the valve which diameter is larger than 2".
- When lift is longer than 50m and pressure is above 5 kgf/cm², we suggest to set up arrester each at the downside of the long pipe and the corner upside of the check Valve.
- Before installation, make sure the pressure of water hammer arrester air chamber is lower than pipe pressure.
- When the pressure of the air chamber of the water hammer arrester is maintained at the 60% ~ 90% of pipe pressure, the arrester will have the best water-hammer-preventing result.
- If the water pressure in the pipe is lower or the air pressure of the arrester air chamber is lower, both can be corrected by pumped into air or release air from the air-pumping hole at the top of the arrester.
- When the outlet is under open pressure like float valve, bathroom equipment and faucet, input pressure 1 ~ 1.3 kgf/cm² is preferred.