Air Pressure Vacuum Relief Valves
Theory of Operation

All Bayco air relief valves are spring-loaded system-pressure actuated devices consisting of a valve disc held in a closed position against a valve seat by means of a spring.

The pressure in the system to be protected acts on the valve disc and tends to open the valve; however, the spring load is set to ensure that at normal operating pressures, the pressure in the system is insufficient to open the valve. However, when the system pressure builds to a level where the pressure load on the valve disc is equal or near to the load exerted by the spring, the valve will begin to open. If the pressure in the system were to be held at this level, the load due to system pressure and the spring load would remain in equilibrium and the valve would be neither opened nor closed. In such circumstances the valve will tend to flutter on the valve seat and may release a small amount of air but will not be relieving significant pressure from the system. This point is known as the Warning Pressure, Cracking Pressure or Hissing Pressure.

If the pressure in the system continues to rise, the load acting on the face of the valve will also rise and will begin to exceed the load exerted by the spring. When the load due to system pressure exceeds the spring load, the valve will open and will remain open as long as the system pressure remains sufficient. This point is known as the Opening Pressure or Set Pressure (also referred to as Rated or Popping Pressure). The difference between the Crack Pressure and Opening Pressure varies between valves and is related to the system flow rate. However, the two should not be confused as there is a significant difference in pressure between the two points. If the system pressure continues to rise, the valve will continue to open and will relieve more and more air until the valve is fully open. At this point the valve will be relieving close to its maximum airflow rate; further increase in system pressure will show only relatively minor increases in flow rate. If the system pressure decreases, the relieving airflow rate will reduce and the valve will start to close. However, the valve will not fully re-seat until some pressure below the Opening pressure. This pressure is known as the Reseating Pressure and the difference between the two pressures is known as “Blowdown”.

In practice the valve should be matched to the system to be protected such that the maximum airflow rate of the valve is never utilized, i.e. the valve should be capable of relieving a sufficient volume flow rate of air at the opening pressure to ensure that the system pressure drops significantly. If the valve is open and the system pressure continues to rise above the opening pressure then the valve is relieving less air than is being put into the system. This is a potentially dangerous situation that may lead to over pressurization. The relieving airflow rate of an air relief valve at the maximum allowable system pressure, and ideally at the Opening Pressure, should be well in excess of the system input flow rate at that same pressure.