

# ANTI PRESSURE SURGE (for ANSI 150lb and 300lb valves)

## A DESIGN FOR SEVERE PUMP APPLICATIONS

In pump applications where pressure surge and water hammer problems are anticipated, correct check valve selection is critical. Historically, process and piping engineers when confronted with high system decelerations have invariably selected the large size, high weight and, consequently, high cost nozzle check valve. To a lesser extent, the damped swing check valve or swing check valve with bypass is occasionally used in such instances but these, likewise, suffer from high cost, size and weight and are, generally, a maintenance problem.

Goodwin can calculate and determine the dynamic performance of its check valves for given system decelerations. Where the demands of the application are beyond the capabilities of a standard Goodwin check valve, Goodwin will employ its APS<sup>#</sup> device. The APS device extends the suitability of the Dual Plate Check Valve into those pump applications which have previously been in the domain of the nozzle check valve.

APS stands for Anti Pressure Surge and is effected in the Goodwin Dual Plate Check Valve by fitting a pressure-sensitive flow-relieving valve in each plate. Essentially, the APS consists of a large piston valve held closed by Belleville washers whose pre-set load will not allow flow through the piston valve from the downstream side of the check valve until the downstream pressure exceeds by 10% the maximum static flow pressure on the downstream side of the valve.

The main function of the APS is not to relieve high pressure but to prevent it from occurring in the first place. It does this by allowing flow which releases excess pressure energy from the downstream side of the valve as the pressure increases on valve closure to the upstream of the valve thereby avoiding the occurrence of full downstream pressure increase. This downstream pressure increase is caused by the instantaneous halt of the column of fluid when the check valve closes and was determined in 1898 by Joukowsky who formulated the equation:

Pressure rise = speed of sound in the fluid line x Vr max x the fluid density  
(where Vr max is the maximum reverse velocity of the fluid and is a function of the system deceleration and check valve type.)

Tests carried out at the Delft Hydraulics Laboratory in The Netherlands recorded a 40% reduction in the Joukowsky pressure that would have been seen in any check valve not fitted with APS had the same reverse flow velocity occurred and is little more than is experienced with the nozzle check valve.

### The cost effective solution

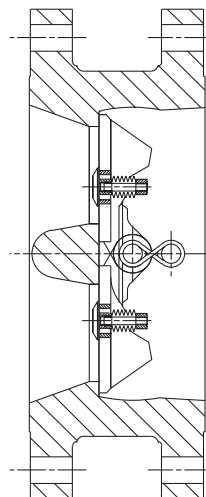
By utilizing the Dual Plate Check Valve fitted with APS the piping engineer avoids the following problems:

- a) The higher pressure drops generally experienced in Nozzle Type Check Valves.
- b) The size and weight penalty of the Nozzle and damped Swing Check Valves.
- c) The very severe cost penalty (300 % and more) of the Nozzle and Swing Check Valves.

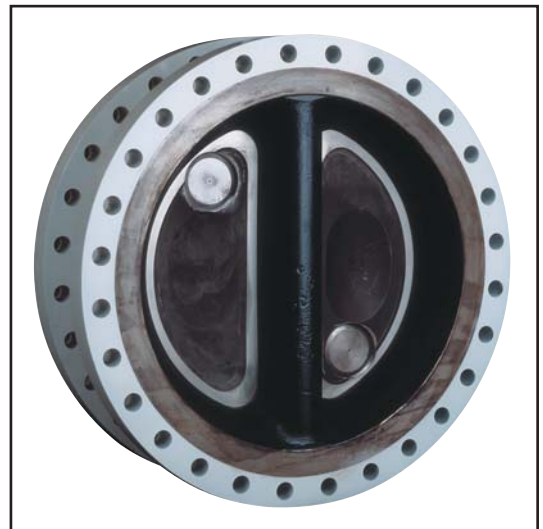
The APS can be fitted in all Goodwin Check Valves 12" and larger.

Goodwin requires the following data to establish if its check valve should be fitted with the APS device to meet the demands of its application:

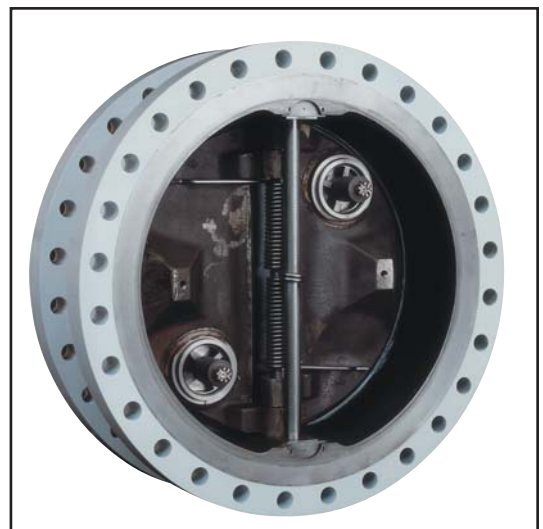
- Valve Size & Pressure Class
- Fluid
- Fluid Density
- Flowrate
- Line Operating Pressure
- Line Design Pressure
- Temperature
- Line Velocity
- System Deceleration
- Downstream pressure in the no flow condition, i.e. when the plates are closed



Schematic of a 32" 150lb Valve with APS.



32" ANSI 150lb Dual Plate Check Valve with APS, as viewed from valve upstream side.



32" ANSI 150lb Dual Plate Check Valve with APS, as viewed from valve downstream side.

# Patent applied for.