

Pseudo-Q Value

(Courtesy Hoerbiger Corporation of America)

The "pseudo-Q value" is a term used at Hoerbiger which is an indicator of the "adequacy" of a valve. In other words, is there enough or too little valve for the application?

The pseudo-Q value is a dimensionless value developed by Hoerbiger and Ariel to indicate the adequacy of a compressor valve. It is defined as the average pressure drop through the valve divided by flange pressure, expressed as a percentage. The pseudo-Q value must be between 1% and 15%. With high and low pseudo-Q values the compressor calculation model is not able to accurately predict the horsepower losses, preheating of the gas during the intake event or the volumetric efficiency (capacity).

On the suction valves the Q - value is the pressure drop across the valve in percent of line pressure:



where Ps = gas density

Ps = suction pressure

V = mean valve velocity (calculated with equivalent area)

Ariel and Hoerbiger require Pseudo-Q values between 1% and 15%

• Pseudo-Q value less than 1%

If Q drops below 1%, it becomes difficult to achieve good valve dynamics, since the pressure drop which the valve springs work against is too low and a tendency towards valve flutter is great. This is what is commonly referred to as having "too much valve". This can happen when compressing <u>low</u> <u>molecular weight gases</u> (hydrogen, helium, etc.). The solution is to lower the valve lift, lowering lift area and equivalent area, and creating a larger pressure drop across the valve.

• Pseudo-Q value greater than 15%

If Q is 15% or higher, the pressure drop across the valve is too high for the cylinder pressure to recover to line pressure at the end of the suction stroke. The valve does not close at the end of the stroke as



Figure: Theoretical vs. Actual VE

designed. Gas backflows through the valve as the piston is beginning the compression stroke, which slams the valve closed. Volumetric efficiency is also reduced since the cylinder does not have a full charge of gas (due to a backflow out of the cylinder bore), in addition to the high horsepower losses associated with the large pressure drop across the valve. High q-values can occur when compressing high molecular weight gases(CO₂, propane, etc.). In most cases, lift cannot be added to valve without sacrificing durability. Slower rotating speeds will lower q-values by decreasing piston speed and gas velocity through the valve. Selecting a different cylinder may result in lowering the pseudo-Q value due to valve flow areas differences., etc.).