Compression Ratio

Compression ratio is defined as the discharge pressure divided by the suction pressure of a given stage of compression. Compression ratio is used in the equations for discharge temperature, volumetric efficiency, discharge event, power and rod load.

Compression ratios are typically in the range of 2 to 4 for gathering applications and typically below 2 for pipeline applications.

Higher compression ratios will result in higher discharge temperatures, lower volumetric efficiencies and lower valve discharge events. Typically, the upper end of the compression ratio is limited by reaching a maximum discharge temperature or low volumetric efficiency. Some gasses with lower ratio of specific heat values (k or N) can reach higher compression ratios before being limited by discharge temperature. Some cylinders with lower volumetric clearance can reach higher compression ratios before being limited by volumetric efficiency. This makes limiting the upper end of compression ratio subjective.

The main difficulty with higher compression ratios is the loss of flexibility of operating conditions. Higher compression ratios result in a greater sensitivity to changes in suction and discharge pressure. This can limit the useful operating range of an application. Higher ratios also have an adverse effect on compressor valve performance and reliability.

Rod load is a function of the suction and discharge pressures within a cylinder, so are also impacted by the compression ratio. High compression ratios generally result in higher rod load values. Small changes in pressures at higher ratios can result in larger changes in rod load.

When compression ratios are in the higher range, any clearance pocket devices should be checked for full range use. With higher ratios, clearance has a much greater effect on the volumetric efficiency. If the clearance pockets cannot be used fully at the higher compression ratios, considerations should be made to either limit the use of the pockets, or to omit clearance pocket devices from the cylinders.

When no other flags exist, a good practical limit for the higher end of the compression ratio range is 4.5 ratios. A warning has been placed in the performance software to flag this ratio to help draw attention to the possible difficulties. When this warning flag occurs, the specific application must be reviewed for the applicability of the compression ratio for the specific operating range.