Cylinder Action, Single Acting

A single acting cylinder compresses gas on only either the instroke or outstroke of the piston. Double acting cylinders can be operated in a single acting mode by removing the suction valves from one end, by using valve plate depressor type suction valve unloaders, or by using a head end bypass unloader.

All single acting operating cases need special review. Single acting conditions can create low crosshead pin reversal, torsional resonance responses or acoustical resonance responses. A full review of the potential operating conditions in single acting mode must be made. This is to include across the entire pressure range and speed range.

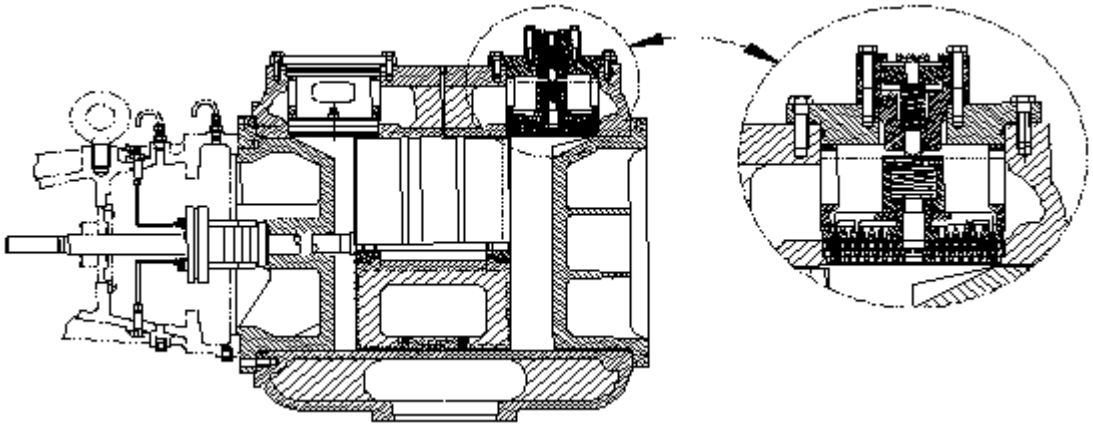
Removing Suction Valves to Single Act

All suction valves on one end of the cylinder can be removed for single acting configuration. Typically head end suction valves are removed, allowing compression on the crank end of the cylinder. Suction valve removal is the most efficient method of single acting, but does require the unit to be shutdown and gas pressure removed to change the configuration. Removal will include the valve, valve seat gasket and retainer. Washers can be installed on all of the cap bolts, under the caps, to allow for easier removal of the valve cap for maintenance, and to indicate that the valve has been removed

Higher pressure forged steel cylinders may require the suction valves to be in place in order for the gas seal at the valve cap to correctly seal. If the gas seal is located between the valve cap and the valve retainer, the valve body must remain in place. Single acting in this instance can be done by removing the valve plates and springs, but reinstalling the "empty" suction valve body in the cylinder. If the valve cap includes a pressure activated seal assembly, the suction valve, seat gasket, and retainer can be removed to single act.

Suction valve Unloader

Suction valve unloaders are typically applied on the head end of the cylinder, allowing compression only on the crank end. Ariel requires installing suction valve unloaders on all suction valves of a cylinder end to be single acted to reduce horsepower losses.

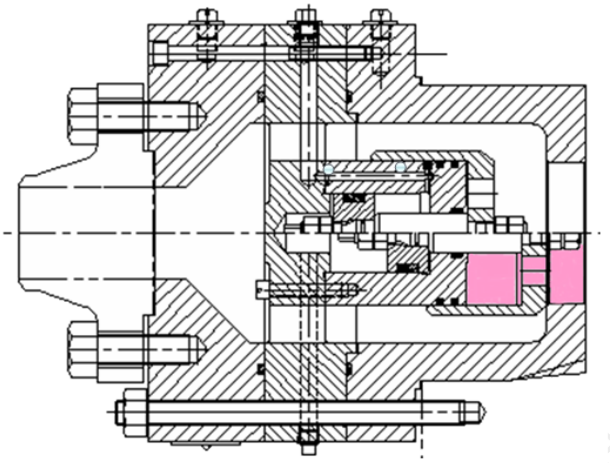


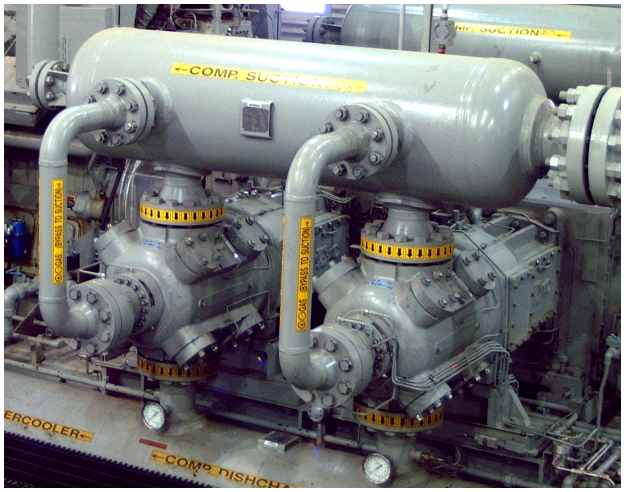
In order to maintain proper rod load reversal, the head end of the cylinder is usually deactivated. This will help maintain rod load reversal due to the differential areas between the crank end and the head end of the cylinder (due to the rod area in the crank end). In some cases it is possible to deactivate the crank end and maintain rod load reversal due to the inertia load.

Suction valve unloaders are limited to suction pressures below 1000 psi. Above this level, valve removal or head end bypass unloaders may be applied.

Head End Bypass Unloader

Head end bypass unloaders are pneumatically actuated ports on the head end of the cylinder that allows the head end compression to be open to the suction gas pressure. This fully deactivates the head end of the cylinder for single acting configuration. The pneumatic actuator is smaller, to fit within the unloader, so requires a higher actuation pressure, often in the few to several hundred psi level. Each application and cylinder size will require a specific actuation pressure. These can be found in the Ariel performance software on the device datasheet. Most often, process gas can be regulated to the appropriate pressure and applied as the actuation gas. Clean, dry actuation gas is required. Sour actuation gas (greater than 100 ppm H_2S) is NOT to be used as the actuation gas. If the process gas contains hydrogen sulfide, nitrogen may be used for the actuation.





Single acting cylinder operating cases should be included in the analyses for torsional responses and acoustical pulsation responses. Single Acting cylinders can present the worst case scenario for a torsional analysis due to a more dynamic torque effort curve and for an acoustical pulsation analysis due to a change in the number of pulses per cycle. High torsional vibration and / or high acoustically driven vibration can result from single acting cylinder operation when not considered in these analyses.

Some restrictions may apply to operating a cylinder single acting at higher speeds. The performance software should flag higher speed single acting conditions that require review and approval.