Virtual Engineer: Pneumatic Technologies

Help for Arc-of-Motion Actuator

General Items

Please note – This sizing software does not simply apply filters to Parker's product list based on user inputs. There are a significant number of calculations taking place to simulate the performance of Parker's products in the application. Occasionally, these calculations may cause a slower than expected response, but the result is a more accurate approximation of performance.

Generate Results – After entering application information, click this button. Calculations will run in the background to determine which cylinders are capable of meeting the needs of the application.

Compare – Once calculations have been completed, click the compare button to generate a table of information enabling the comparison of all qualified potential solutions.

Save Progress – Click this button at any time to save your progress in the My Projects section.

Reset Parameters – Click this button to return all inputs to their default settings.

Operating Parameters

Operating Pressure – Pressure (gauge) supplied to the valve inlet (P1). Products not capable of this operating pressure will be eliminated as possible solutions.

Temperature Min – Products not capable of this temperature will be eliminated as possible solutions. The mid-point between min and max temps is used in calculations to determine performance.

Temperature Max – Products not capable of this temperature will be eliminated as possible solutions. The mid-point between min and max temps is used in calculations to determine performance.

Tubing Length – The length of the pneumatic tubing, or air lines, from the port of the valve to the port of the actuator. The length is assumed to be the same for both ports.

Motion Details

Required Life (cycles) – The minimum number of cycles the actuator is expected to perform in the application. The cycle life presented in this tool is a calculated projection of bearing life based on the inputs provided. Evaluating and approving actual performance in the application is the customer's responsibility. This is not intended to convey expected seal life.

Extend, Air/Spring – Determine whether the actuator will extend using pneumatic force, or spring force. This input in conjunction with *Retract, Air/Spring* defines the actuator as a single acting, or double acting cylinder.

Extend Time – The amount of time the actuator will take to travel from fully retracted to fully extended. This will be treated as a maximum. Based on this input, a window of acceptable extend time will be established and used to qualify actuators that will then be presented in the compare table.

Dwell – The amount of time the cylinder is in the fully extended position before beginning to retract.

Retract, Air/Spring – Determine whether the actuator will retract using pneumatic force, or spring force. This input in conjunction with *Extend, Air/Spring* defines the actuator as a single acting, or double acting cylinder.

Retract Time – The amount of time the actuator will take to travel from fully extended to fully retracted. This will be treated as a maximum. Based on this input, a window of acceptable retract time will be established and used to qualify actuators that will then be presented in the compare table.

Dwell – The amount of time the cylinder is in the fully retracted position before beginning to extend.

Hours Per Day – Number of hours each day that the actuator will be operating.

Days Per Week – Number of days each week that the actuator will be operating.

Weeks Per Year – Number of weeks each year that the actuator will be operating.

Cycle Time Seconds – Number of seconds defining the full extend and retract cycle.

Cycles Per Minute – Number of times a cycle is completed each minute.

Cycles Per Hour – Number of times a cycle is completed each hour.

Arc of Motion

Choose a lever class – The class of lever is determined by the positions of the cylinder force, load, and pivot point relative to one another. The selected lever class determines the template for required inputs and the reference image shown in the inputs section.

Basic – The basic set of inputs. Class 1, Class 2, Class 3, and Torque Generation are all selectable as basic input templates. These basic templates assume the lever arm to be straight, the cross-sectional area of the lever arm to be consistent, the center of gravity of the lever arm to be located at the midpoint of its length, the load (input F) to be perpendicular to the lever arm throughout the range of motion, and the plane containing the application to be vertical (roll orientation, input G).

Advanced – The Advanced set of inputs is independent of the four basic templates. Using the advanced inputs, the angle (input J) between the lever arm connection to the cylinder (input C) and the lever arm connection to the load (input F) can be modified. The load, or applied force, application angle (input K) can also be modified and defined as being constant with respect to either the lever arm, or horizontal. The angle of the plane containing the application (roll orientation, input G) can also be modified from the basic vertical orientation. The cross-sectional area of the lever arm is assumed to be consistent for center of gravity and moment of inertia calculations.

CG Override – The CG (Center of Gravity) Override set of inputs adds three inputs to the Advanced set. The additional inputs enable the location of the CG to be specified using an initial angle from horizontal (input H) and radial distance (input I). The moment of inertia input should be entered in conjunction with the CG location to insure more accurate calculations.

Lever start angle from horizontal (A) – The initial angular position of the lever arm is a positive value measured from horizontal in the counterclockwise direction. These inputs define the "Extend" motion of the cylinder. The input constraints and calculations are arranged such that, as the cylinder extends, it must result in the lever rotating in a clockwise direction. Therefore, the "Lever finish angle from horizontal" (input B) must be defined as an angle that occurs between 0 and 180 degrees of clockwise rotation from the "Lever start angle from horizontal" (input A). Example: If input A = 120, input B can be any angle defined by 0 <= B < 120, or 300 < B < 360.

Lever finish angle from horizontal (B) – The final angular position of the lever arm is a positive value measured from horizontal in the counterclockwise direction. These inputs define the "Extend" motion of the cylinder. The input constraints and calculations are arranged such that, as the cylinder extends, it must result in the lever rotating in a clockwise direction. Therefore, the "Lever finish angle from horizontal" (input B) must be defined as an angle that occurs between 0 and 180 degrees of clockwise rotation from the "Lever start angle from horizontal" (input A). Example: If input A = 120, input B can be any angle defined by 0 <= B < 120, or 300 < B < 360.

Distance from pivot to cylinder (C) – The radial distance from the lever arm pivot point to the point where the cylinder attaches to the lever arm. This input, in conjunction with input F, defines the length of the lever arm over which the lever arm mass is assumed to be evenly distributed (length = C+F for Class 1, length = C for Class 2 and Torque Generator, and length = F for Class 3).

Cylinder start angle from lever (D) – The initial angle between the lever arm and the cylinder is a positive value measured from the lever arm in a clockwise direction. This angle must be between 0 and 180 degrees.

Cylinder pivot to lever arm (E) – This is the fully retracted pin-to-pin dimension defined by the application that the cylinder is intended to utilize. Performance will be evaluated for actuators with pin-to-pin lengths equal to, or less than, this dimension. For actuators with a pin-to-pin length less than this dimension, the necessary rod extension will be assumed and used in calculations. The rod extension for each cylinder will be presented in the compare table. If appropriate for the application, small calculated rod extension values may be determined to be within the range of adjustability of the mounting hardware. Also, if appropriate for the application, the E dimension can be reduced and the calculations repeated until the necessary rod extension value is within an acceptable range.

Distance from pivot to force (F) – The radial distance from the lever arm pivot point to the point where the load, or force, is applied. This input, in conjunction with input C, defines the length of the lever arm over which the lever arm mass is assumed to be evenly distributed (length = C+F for Class 1, length = C for Class 2 and Torque Generator, and length = F for Class 3).

Roll orientation (G) – The application is defined in a 2-dimensional plane. This plane is assumed to be vertical, with the negative Z axis aligned with the gravitational force vector. The Roll Orientation input enables the application plane to be rotated around the X axis to change its orientation with respect to gravity. The initial, vertical orientation, is considered to be 0 degrees. From the positive X axis looking toward the negative X axis direction, the roll orientation angle is measured as a counterclockwise rotation from the positive Z axis.

Lever arm mass – The mass of the lever arm. This mass is assumed to be distributed evenly over the length of the lever arm, unless the CG Override set of inputs is used to enter externally calculated values. Inputs C and F define the length of the lever arm over which the lever arm mass is assumed to be evenly distributed (length = C+F for Class 1, length = C for Class 2 and Torque Generator, and length = F for Class 3).

Force applied – The externally applied force (load) that needs to be overcome during the lever's rotation. Using the Basic lever class input templates, the force is assumed to be perpendicular to the lever arm throughout the range of motion. Using the Advanced, or CG Override, input templates, the applied force application angle (input K) can be modified and defined as being constant with respect to either the lever arm, or horizontal.

CG start angle from horizontal (H) – The initial angle between the horizontal and a radial line from the lever pivot point to the center of gravity is a positive value measured from the horizontal in a counterclockwise direction.

Distance from pivot to CG (I) – Radial distance to the center of gravity from the lever pivot point.

Force arm angle from lever arm (J) – The angle between the lever arm and the force arm is a positive value measured from the lever arm in a counterclockwise direction.

Force angle from horizontal (K) – The initial angle between the applied force and the horizontal is a positive value measure from the horizontal in a counterclockwise direction. Regardless of the selection for the "Constant force angle to horizontal, or lever arm" input, the initial angle is defined relative to the horizontal.

Constant force angle to horizontal, or lever arm – The initial force angle (input K), in conjunction with inputs A and J, define the initial force angle with respect to the force arm of the lever. The resulting angle between the force and force arm can be held constant throughout the range of motion by choosing "lever arm". The angle of the force relative to the horizontal can be held constant throughout the range of motion by choosing "horizontal".

Moment of Inertia override – Enter an externally calculated moment of inertia value.