Virtual Engineer: Pneumatic Technologies

Help for Linear 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.

Metric/Imperial – The preset units throughout the input screen can be toggled using this button. Note that this does not convert any values already entered by the user.

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.

Application Type

Cantilever – Actuators designed for cantilever applications change their overall length when extending and retracting. The working area for the tooling plate, or rod end, is at one end of the cylinder and is used to travel in and out of the application. All guided and non-guided products capable of cantilever applications will be evaluated as possible solutions, regardless of the representative image selected by the user. Non-guided cylinders will be eliminated as possible solutions if the application contains a roll moment.

Pivot – Actuators designed for pivot applications are the same as those for cantilever applications, but require that both the cylinder mount and the rod end are capable of handling minor arc motion. Pivot applications also require that the load is rigidly guided. *Coefficient of Friction, Load Support* is a required input field for pivot applications.

Span – Actuators designed to span an application maintain their overall length during the extend and retract cycle. The working area for the tooling plate is between the ends of the actuator. All rodded and rodless products

capable of spanning an application will be evaluated as possible solutions, regardless of the representative image selected by the user.

Stopper – Actuators designed for stopper applications are the same as those for cantilever applications, but require that only plain bearings are used to support the guide rods. Selecting *Stopper* will require additional inputs in the Orientation of Actuator section to define the mass impacting the actuator.

Load Attachment, Fixed – If the load is attached to the actuator in a manner that prevents relative motion from occurring between the load and the actuator, then this box should be selected.

Load Attachment, Pivot – If the load is attached to the actuator in a manner that enables minor arc rotation relative motion to occur between the load and the actuator, then this box should be selected.

Customer provided load support, Not Guided or Supported – If the application will be designed with the intent that the actuator is the support for the attached mass and any forces and moments that may occur, then this box should be checked.

Customer provided load support, Rigidly Guided – If the application will be designed with a carriage and guide rail system to support the movement of the attached mass and an actuator to simply move the carriage, then this box should be checked. When this box is checked, the X/Y/Z offsets are turned off in the *Orientation of Actuator* and *External Forces* sections. *Coefficient of Friction, Load Support* is a required input field for these applications.

Customer provided load support, Supported but not Rigidly Guided – If the application will be designed with a support that prevents movement of the attached mass in the direction of gravity, but that does not otherwise constrain movement of the attached mass, then this box should be checked. *Coefficient of Friction, Load Support* is a required input field for these applications.

Orientation of Actuator

Initial – This button will return the image to its original view. Does not affect user inputs.

X-Y View – This button will show the image in the global X-Y plane. Does not affect user inputs.

Y-Z View – This button will show the image in the global Y-Z plane. Does not affect user inputs.

X-Z View – This button will show the image in the global X-Z plane. Does not affect user inputs.

Reset Orientation – This button will reset the *Roll*, *Pitch*, and *Rotate View* inputs to zero.

Attached Mass – The mass of any fixtures and devices that are attached to the actuator and expected to move with the actuator throughout the extend and retract cycle should be included. Any mass that will be moved with the actuator in only one direction, or for only part of the stroke, should be entered separately in the External Forces section.

X Axis – The local X axis offset of the attached mass. The offset is measured from the center point on the primary face of the tooling plate, or from the shoulder of the piston rod for rodded cylinders without tooling plates, to the center of gravity of the attached mass.

Y Axis – The local Y axis offset of the attached mass. The offset is measured from the center point on the primary face of the tooling plate, or from the shoulder of the piston rod for rodded cylinders without tooling plates, to the center of gravity of the attached mass.

Z Axis – The local Z axis offset of the attached mass. The offset is measured from the center point on the primary face of the tooling plate, or from the shoulder of the piston rod for rodded cylinders without tooling plates, to the center of gravity of the attached mass.

Roll – The rotation angle around the centerline of the actuator. This is a rotation around the actuator's local X axis.

Pitch – The angle of inclination of the actuator relative to the horizontal. This is a rotation around the global Y axis.

Rotate View – Adjust the view as desired. This input does not affect calculations.

Mass – The mass of the object that will be impacting the actuator is entered here.

Impact Point, X Axis – The local X axis offset of the impact point. The offset is measured from the center point on the primary face of the tooling plate to the impact point.

Impact Point, Y Axis – The local Y axis offset of the impact point. The offset is measured from the center point on the primary face of the tooling plate to the impact point.

Impact Point, Z Axis – The local Z axis offset of the impact point. The offset is measured from the center point on the primary face of the tooling plate to the impact point.

Velocity – The velocity of the mass that will be impacting the actuator.

Approach Angle – The angle from which the mass will be approaching the actuator. The approach angle is defined in the local Y-Z plane of the actuator and is always assumed to be perpendicular to the centerline of the actuator (local X axis).

Motion Details

Stroke Length – Stroke length, or end-to-end travel, of the actuator. If the actuator will be unable to travel this full distance in the application because travel is limited by external stops, define those using the *External Stops* inputs in the *External Forces* section.

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.

External Forces

Is there an external stop? – Yes should be selected if an actuator's travel is being limited externally. Examples would be when the stroke of an actuator is fine-tuned in an application using stroke adjusters, stop collars, shock absorbers, or when an actuator is expected to clamp an object. If a stop is expected to limit full travel, define that limitation using external stops. If something compressible is being used, the limitation at solid height should be defined here and the spring rate leading up to full compression can be defined in the *Additional Forces, Spring* input below.

External Stop Start – Define the resulting fully retracted position with the external stop in place. If, when fully retracted, the actuator is at 25mm of its designed stroke length, then enter 25mm.

External Stop End - Define the resulting fully extended position with the external stop in place. If, when fully extended, the actuator is at 25mm less than its 200mm designed stroke length, then enter 175mm.

Customer provided load support – The selection made for *Customer provided load support* in the *Application Type* section will be displayed here. The selection will affect which inputs are made available in this section.

Coefficient of Friction, Load Support – If the selection made for *Customer provided load support* in the *Application Type* section is either *Rigidly Guided*, or *Supported but not Rigidly Guided*, then this becomes a required input. The coefficient of friction for the carriage and guide rail system, or the simple support, should be defined here. If left at zero, the system would be considered frictionless which may result in an undersized actuator being selected.

Coefficient of Friction, Pushed Mass – If the actuator is pushing a mass along a surface, the coefficient of friction between the pushed mass and the surface supporting it should be defined here. If left at zero, the system would be considered frictionless which may result in an undersized actuator being selected.

Forces, Action – Designate whether this force will be acting on the actuator during the extend stroke, retract stroke, or both.

Forces, Start/End – Define where along the stroke length the force should be applied. The actuator position when fully retracted is zero and when fully extended equals the stroke length.

Forces, X/Y/Z – Define forces using local X, Y, and Z axis components.

Moments, Action – Designate whether this moment will be acting on the actuator during the extend stroke, retract stroke, or both.

Moments, Start/End – Define where along the stroke length the moment should be applied. The actuator position when fully retracted is zero and when fully extended equals the stroke length.

Moments, X/Y/Z – Define moments using local X, Y, and Z axis components.

Additional Forces, Attached Mass, Action – Designate whether this additional mass will be attached to the actuator during the extend stroke, retract stroke, or both.

Additional Forces, Attached Mass, Start/End – Define where along the stroke length the additional mass should be applied. The actuator position when fully retracted is zero and when fully extended equals the stroke length.

Additional Forces, Attached Mass, X/Y/Z – Define offsets along the local X, Y, and Z axes. The offsets are measured from the center point on the primary face of the tooling plate, or from the shoulder of the piston rod for rodded cylinders without tooling plates, to the center of gravity of the attached mass.

Additional Forces, Attached Mass, Mass – Any mass that will be moved with the actuator in only one direction, or for only part of the stroke.

Additional Forces, Pushed Mass, Action – Designate whether this mass will be pushed during the extend stroke, retract stroke, or both.

Additional Forces, Pushed Mass, Start/End – Define where along the stroke length the mass will be pushed. The actuator position when fully retracted is zero and when fully extended equals the stroke length.

Additional Forces, Pushed Mass, Y/Z – Define offsets along the local Y and Z axes. The offsets are measured from the center point on the primary face of the tooling plate, or from the shoulder of the piston rod for rodded cylinders without tooling plates, to the center of gravity of the attached mass.

Additional Forces, Pushed Mass, Mass – The mass that will be pushed by the actuator. This mass does not include any mass that is attached to the actuator.

Additional Forces, Spring, Action – Designate whether this spring will be engaged during the extend stroke, retract stroke, or both.

Additional Forces, Spring, Start/End – Define where along the stroke length the spring will be engaged. The actuator position when fully retracted is zero and when fully extended equals the stroke length.

Additional Forces, Spring, Y/Z – Define offsets along the local Y and Z axes. The offsets are measured from the center point on the primary face of the tooling plate, or from the shoulder of the piston rod for rodded cylinders without tooling plates, to the center of gravity of the attached mass.

Additional Forces, Spring, Rate – The spring rate defines the amount of spring force increase per increment of engagement, or compression, length.

Additional Forces, Spring, Preload – The spring preload defines the initial force from the spring that needs to be overcome before additional compression can occur.

External Forces, Display, Moments/Forces and Retract/Extend – The *Moments/Forces* and *Retract/Extend* toggles are used in combination to update the display image. Arrows are shown representing any forces, or moments, being applied that meet the selected criteria.