

Double-Acting Hydraulic Cylinder

This block represents a double-acting hydraulic cylinder. The model of the cylinder is constructed from the Translational Hydro-Mechanical Converter, and Translational Hard Stop blocks. The rod motion is limited with the mechanical Translational Hard Stop block.

Connections R and C are mechanical translational conserving ports corresponding to the cylinder rod and cylinder clamping structure, respectively. Connections A and B are hydraulic conserving ports. Port A is connected to converter A and port B is connected to converter B. The block directionality is adjustable and can be controlled with the Cylinder Orientation parameter.

Settings

Basic parameters	Hard stop properties	Initial conditions
Piston area A:	9.1	cm ²
Piston area B:	9.1	cm ²
Piston stroke:	18.4	cm
Dead volume A:	1e-04	m ³
Dead volume B:	1e-04	m ³
Specific heat ratio:	1.4	
Cylinder orientation:	Acts in positive direction	

OK Cancel Help Apply

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Settings

Basic parameters	Hard stop properties	Initial conditions
Contact stiffness:	1e+8	N/m
Contact damping:	15000	N/(m/s)
Hard stop model:	Full stiffness and damping applied at bounds, damped rebound	

OK Cancel Help Apply

Block Parameters: Cylinder

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Settings

Basic parameters	Hard stop properties	Initial conditions
Piston initial distance from cap A:	9.2	cm
Chamber A initial pressure:	0	Pa
Chamber B initial pressure:	0	Pa

OK Cancel Help Apply

Block Parameters: Fluid Properties

Hydraulic Fluid

The block assigns working fluid for all components assembled in a particular loop. The loop detection is performed automatically and the block is considered as part of the loop if it is hydraulically connected to at least one of the loop components. The block offers wide selection of fluids to choose from. The custom fluid is assigned with the Custom Hydraulic Fluid block from the Simscape foundation library. If neither Hydraulic Fluid nor Custom Hydraulic Fluid block is connected to the loop, the default properties of the Custom Hydraulic Fluid block are assigned.

Parameters

Hydraulic fluid: Oil-30W

Relative amount of trapped air: 0.005

System temperature (C): 60

Viscosity derating factor: 1

Pressure below absolute zero: Error

Fluid Properties:

OK Cancel Help Apply

Block Parameters: Pump

Fixed-Displacement Pump

This block models a pump with constant volumetric displacement that supplies mechanical energy to an hydraulic liquid network. It accounts for losses due to leakage flow and friction torque. The pump may operate in both the forward and reverse directions depending on the rotation of the shaft. It may also operate as a motor that drives the shaft.

Right-click on the block and select Simscape-> Block choices to select between parameterization options. For Analytical or tabulated data parameterization, right-click on the block and select Fluids > Plot Characteristic to visualize characteristic curves. Consult the block reference page for description of variants and block inputs.

Connections P and T are hydraulic conserving ports associated with the pump outlet and inlet, respectively. Connection S is a mechanical rotational conserving port associated with the pump driving shaft. The block positive direction is from port T to port P. This means that the pump transfers fluid from T to P if shaft S rotates in positive direction.

Settings

Parameters

Displacement: 1.14e-06 m³/rad

Leakage and friction parameterization: Analytical

Nominal shaft angular velocity: 188 rad/s

Nominal pressure gain: 1e+07 Pa

Nominal kinematic viscosity: 18 cSt

Nominal fluid density: 900 kg/m³

Volumetric efficiency at nominal conditions: 0.92

No-load torque: 0 N*m

Friction torque vs. pressure gain coefficient: $1 \times (1.14 \times 10^{-6}) \times ((0.92)/(0.8) - 1)$ N*m/Pa

Check if lower side pressure violating minimum valid condition: None

OK Cancel Help Apply

Block Parameters: Pressure Relief Valve

Pressure Relief Valve

This block represents a hydraulic pressure relief valve as a data sheet-based model. The valve remains closed while pressure at the valve inlet is lower than the valve preset pressure. When the preset pressure is reached, the valve control member is forced off its seat, thus creating a passage between the inlet and outlet. Some fluid is diverted to a tank through this orifice, thus reducing the pressure at the inlet. If this flow rate is not enough and pressure continues to rise, the area is further increased until the control member reaches its maximum.

Connections A and B are hydraulic conserving ports. The block positive direction is from port A to port B.

Settings

Parameters

Opening area parameterization:Linear area-pressure relationship

Maximum passage area:0.46cm²

Valve pressure setting:12bar

Valve regulation range:2.1bar

Flow discharge coefficient:0.7

Leakage area:1e-9m²

Laminar transition specification:Pressure ratio

Laminar flow pressure ratio:0.999

Opening dynamics:Do not include valve opening dynamics

OK

Cancel

Help

Apply

Block Parameters: Pipe A

Hydraulic Pipeline

This block models hydraulic pipelines with circular and noncircular cross sections. The block accounts for friction loss along the pipe length and for fluid compressibility, and by extent of idealization it takes an intermediate place between the Resistive Tube and the Segmented Pipeline blocks. The block does not account for fluid inertia. The model is built of Resistive Tube and Constant Volume Chamber building blocks.

Connections A and B are hydraulic conserving ports. The block positive direction is from port A to port B. This means that the flow rate is positive if fluid flows from A to B, and the pressure loss is determined as $p = p_A - p_B$.

Settings

Parameters

Pipe cross section type:Circular

Pipe internal diameter:6mm

Geometrical shape factor:64

Pipe length:1.8m

Aggregate equivalent length of local resistances:1m

Internal surface roughness height:1.5e-05m

Laminar flow upper Reynolds number limit:2e+03

Turbulent flow lower Reynolds number limit:4e+03

Pipe wall type:Rigid

Specific heat ratio:1.4

Initial pressure:0Pa

OK

Cancel

Help

Apply