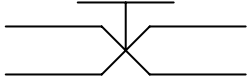




Variable or Equation	Symbol	Description	Units	Calculation	Electrical Analogy
q (flow)		A “through” variable. What goes in comes out (except for a capacitor).	m^3/s (\dot{V})		i (current)
p (pressure)		An “across” variable—defined as the difference of this quantity across the element.	$Pa = N/m^2$		v (voltage)
$p = qR$		Resistance, due to pipe or constriction. In real life, it is often nonlinear.	$R = p/q = Pa/(m^3/s)$ Can also write: $Pa \cdot s/m^3 = N \cdot s/m^5$	Discussed separately	$v = iR$
$q^2 R = p^2 / R$	This is a valve symbol; sometimes used without the handle for a non-variable resistor. Often just a pipe is shown.	Dissipation	W		$i^2 R = v^2 / R$
$p = I \frac{dq}{dt}$		Inertance. Momentum and kinetic energy of water in pipe	$Pa/(m^3/s^2) = Pa \cdot s^2/m^3$ $kg/m^4 = N \cdot s^2/m^5$	$I = \rho \cdot A$ where ρ and A are length and cross-sectional area of the pipe, and ρ is density of the fluid.	$v = L \frac{di}{dt}$
$E = \frac{1}{2} I q^2$		Energy	J		$E = \frac{1}{2} L i^2$
$P(s) = Q(s) I s$		Impedance	$Pa \cdot s/m^3 = N \cdot s/m^5$ (same as resistance)		$V(s) = I(s) L s$
$q = C \frac{dp}{dt}$ (one end usually “grounded”)		Fluid capacitor, such as a tank or pressure chamber. Sometimes called an accumulator.	$(m^3/s)/(Pa/s) = m^3/Pa = m^5/N$	$C = A/(\rho g)$ For an open tank; pressure chambers discussed separately.	$i = C \frac{dv}{dt}$
$E = \frac{1}{2} C p^2$		Energy	J		$E = \frac{1}{2} C v^2$
$P(s) = Q(s) \frac{1}{sC}$		Impedance	$Pa \cdot s/m^3 = N \cdot s/m^5$ (same as resistance)		$V(s) = I(s) \frac{1}{sC}$