Fire Hose Friction Loss and Pump Pressure

Friction loss in a fire hose by Darcy–Weisbach with the Colebrook factor, the elevation loss and the pump discharge pressure needed for a nozzle pressure.

Method: Darcy–Weisbach with Colebrook

Input parameters

Unit system: SI

Parameter	Value	Unit
Flow	500.00	L/min
Hose inside diameter	65.000	mm
Hose length	120.00	m
Lining roughness	0.020000	mm
Nozzle height above the pump	10.000	m
Nozzle pressure required	5.0000	bar

Calculated results

Parameter	Value	Unit
Velocity	2.5113	m/s
Reynolds number	162,617	
Darcy friction factor	0.018218	
Friction loss	1.0587	bar
Elevation loss	0.97890	bar
Pump discharge pressure	7.0376	bar

Notes for this case

• Hose flow is fully turbulent, so the Darcy–Weisbach loss f(L/D)ρv²/2 with the Colebrook friction factor applies; water at 20 °C is assumed. Loss rises with the square of flow and roughly the fifth power of diameter, which is why large-diameter supply lines feed long relays. The pump must supply nozzle pressure plus friction plus elevation (about 0.1 bar per metre). Fire service rules of thumb (FL = C·Q²·L) are this law with fitted coefficients; couplings, appliances and kinks add further loss.

Formula and method

$$\Delta p_f = f\frac{L}{D}\frac{\rho v^2}{2}, \quad p_p = p_n + \Delta p_f + \rho g \Delta z$$

Variables

Q	Flow	m³/s
D	Hose inside diameter	m
L	Hose length	m
ε	Lining roughness	m
Δz	Nozzle height above the pump	m
p_n	Nozzle pressure required	Pa
v	Velocity	m/s
Re	Reynolds number	-
f	Darcy friction factor	-
Δp_f	Friction loss	Pa
Δp_z	Elevation loss	Pa

p_p	Pump discharge pressure	Pa

Method and standards

Hose loss.

Assumptions and limits

- Water at 20 °C; straight hose; no fittings.

References

Darcy–Weisbach with Colebrook

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/piping/fire-hose-friction-loss

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.