Static Regain Duct Sizing of the Next Section

Diameter of a downstream duct section so the static regain from slowing the air equals that section's friction loss, keeping static pressure equal at each branch.

Method: Static regain method

Input parameters

Unit system: SI

Parameter	Value	Unit
Velocity in the upstream section	12.000	m/s
Flow in the next section	7,200.0	m³/h
Equivalent length of the next section	12.000	m
Regain coefficient	75.000	%
Duct roughness	0.090000	mm
Air density	1.2000	kg/m³
Air viscosity	0.018100	mPa·s

Calculated results

Parameter	Value	Unit
Next section diameter	509.69	mm
Next section velocity	9.8024	m/s
Static regain	21.561	Pa
Friction loss of the next section	21.561	Pa

Notes for this case

• Solve R·ρ(v₁² − v₂²)/2 = f(L/D)ρv₂²/2 for D: the velocity drop after each branch recovers enough static pressure to overcome the next section's friction, so every outlet sees the same static pressure. Regain coefficients of about 0.5–0.9 allow for losses in the transition. Round to the next standard size and recheck.

Formula and method

$$R\frac{\rho(v_1^2 - v_2^2)}{2} = f\frac{L}{D_2}\frac{\rho v_2^2}{2}, \quad v_2 = \frac{4Q_2}{\pi D_2^2}$$

Variables

v_1	Velocity in the upstream section	m/s
Q_2	Flow in the next section	m³/s
L	Equivalent length of the next section	m
R	Regain coefficient	-
ε	Duct roughness	m
ρ	Air density	kg/m³
μ	Air viscosity	Pa·s
D_2	Next section diameter	m
v_2	Next section velocity	m/s
Δp_r	Static regain	Pa
Δp_f	Friction loss of the next section	Pa

Method and standards

Static regain.

Assumptions and limits

- Round ducts; incompressible air; Colebrook friction.

References

Static regain method

Report details

Report reference	FCC-B8PQ-EF0Q (the same inputs always give the same reference)
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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/hvac/ducts/static-regain-duct-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.