Mine Airways in Series and Parallel: Resistance and Flow Split

Equivalent resistance of up to four mine airways in series or in parallel splits, the pressure for a total flow and the natural division of air between splits.

Method: Peele (ed.); Mining Engineers' Handbook; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Arrangement	Parallel (splits begin and end together)	
Resistance of airway 1 (N·s²/m⁸)	0.080000	
Resistance of airway 2 (0 if none)	0.12000	
Resistance of airway 3 (0 if none)	0.20000	
Resistance of airway 4 (0 if none)	0	
Total air flow	90.000	m³/s

Calculated results

Parameter	Value	Unit
Equivalent resistance (N·s²/m⁸)	0.013339	
Pressure drop across the group	108.05	Pa
Flow in airway 1	36.750	m³/s
Flow in airway 2	30.007	m³/s
Flow in airway 3	23.243	m³/s
Flow in airway 4	0	m³/s

Notes for this case

• Peele's laws: resistances add in series; in parallel the conductances 1/√R add and the air divides in proportion to them. N equal splits give R/N². Regulators change the natural split by adding resistance to the free-flowing splits.

Formula and method

$$R_{series} = \sum R_i, \quad \frac{1}{\sqrt{R_{par}}} = \sum \frac{1}{\sqrt{R_i}}, \quad Q_i = Q\sqrt{\frac{R_{par}}{R_i}}$$

Variables

$\mathrm{arrangement}$	Arrangement	-
R_1	Resistance of airway 1 (N·s²/m⁸)	-
R_2	Resistance of airway 2 (0 if none)	-
R_3	Resistance of airway 3 (0 if none)	-
R_4	Resistance of airway 4 (0 if none)	-
Q	Total air flow	m³/s
R_{eq}	Equivalent resistance (N·s²/m⁸)	-
p	Pressure drop across the group	Pa
Q_1	Flow in airway 1	m³/s
Q_2	Flow in airway 2	m³/s
Q_3	Flow in airway 3	m³/s
Q_4	Flow in airway 4	m³/s

Method and standards

Square-law combination of airways.

Assumptions and limits

- Square law; no cross-connections.

References

- Peele (ed.)
- Mining Engineers' Handbook
- 3rd ed. (Wiley, 1941)
- sec. 14
- Mine Ventilation
- art. 13 (series flow, parallel or split flow, natural splitting)

Report details

Report reference	FCC-MVQS-KMAS (the same inputs always give the same reference)
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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

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Reopens the calculator with the inputs of this report.