Rapid Filter Run Volumes, Recovery and Required Filter Area

Unit filter run, backwash and filter-to-waste volumes, recovery, net production rate and the filter area for a plant flow with one filter out of service.

Input parameters

Unit system: SI

Parameter	Value	Unit
Filtration rate	7.5000	m/h
Filter run length	36.000	h
Filter-to-waste time	15.000	min
Backwash rate	55.000	m/h
Backwash duration	10.000	min
Other out-of-service time per cycle (draining, refilling)	30.000	min
Net plant flow to produce	20,000	m³/d
Area of one filter	40.000	m²

Calculated results

Parameter	Value	Unit
Unit filter run volume	270.00	m
Unit backwash volume	9.1667	m
Unit filter-to-waste volume	1.8750	m
Filter recovery	95.910	%
Net production rate averaged over the cycle	7.0625	m/h
Filter area needed in service	117.99	m²
Filters needed, plus one out of service	4.0000	

Notes for this case

- Filter-to-waste time is part of the run; backwash and other down time are not. Recovery above 95 % is the usual target; a UFRV below about 200 m³/m² is poor.

Formula and method

$$UFRV = v t_r, \quad UBWV = v_{bw} t_{bw}, \quad UFWV = v t_{fw}, \quad r = \frac{UFRV - UBWV - UFWV}{UFRV}$$

$$v_{net} = \frac{UFRV - UBWV - UFWV}{t_r + t_{bw} + t_{down}}, \quad A = \frac{Q}{v_{net}}$$

Variables

v	Filtration rate	m/s
t_r	Filter run length	s
t_{fw}	Filter-to-waste time	s
v_{bw}	Backwash rate	m/s
t_{bw}	Backwash duration	s
t_{down}	Other out-of-service time per cycle (draining, refilling)	s
Q	Net plant flow to produce	m³/s

A_f	Area of one filter	m²
$UFRV$	Unit filter run volume	m
$UBWV$	Unit backwash volume	m
$UFWV$	Unit filter-to-waste volume	m
r	Filter recovery	-
v_{net}	Net production rate averaged over the cycle	m/s
A	Filter area needed in service	m²
n	Filters needed, plus one out of service	-

Method and standards

Filter water balance per unit area.

Assumptions and limits

- Steady cycle; equal filters.

Report details

Report reference	FCC-EAP1-MHRJ (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Rapid Filter Run Volumes, Recovery and Required Filter Area
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/environmental/drinking-water/filter-net-water-production

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.