HTST Holding Tube Length

Holding tube length for a minimum hold time from flow, bore and the ratio of fastest to mean velocity (2 laminar and transitional, about 1.2 fully turbulent), with Reynolds number.

Method: Mass and energy balances (definitions): fastest-particle velocity 2 × mean in laminar flow (Poiseuille) and about 1.2 × mean in turbulent flow

Input parameters

Unit system: SI

Parameter	Value	Unit
Flow	20.000	m³/h
Tube inner diameter	60.500	mm
Minimum holding time	15.000	s
Product density	1,020.0	kg/m³
Product viscosity	0.50000	cP

Calculated results

Parameter	Value	Unit
Mean velocity	1.9325	m/s
Reynolds number	238,513	
Fastest-particle factor used	1.2000	
Holding tube length	34.786	m

Notes for this case

- Regulations require the fastest particle to be held; laminar flow halves the effective tube length.

Formula and method

$$\bar{v} = \frac{4\dot{V}}{\pi d^2}, \quad L = k\,\bar{v}\,t, \quad k = 2\ (Re < 10\,000),\ 1.2\ (Re \geq 10\,000)$$

Variables

$\dot{V}$	Flow	m³/s
d	Tube inner diameter	m
t	Minimum holding time	s
ρ	Product density	kg/m³
μ	Product viscosity	Pa·s
$\bar{v}$	Mean velocity	m/s
Re	Reynolds number	-
$v_{max}/\bar{v}$	Fastest-particle factor used	-
L	Holding tube length	m

Method and standards

Residence time of the fastest particle.

Assumptions and limits

- Newtonian product; isothermal tube. For non-Newtonian products (cream, purées) the fastest-particle ratio differs from 2 and 1.2; the viscosity input does not make the calculation valid for them, so use the ratio from a validated study.

References

• Mass and energy balances (definitions): fastest-particle velocity 2 × mean in laminar flow (Poiseuille) and about 1.2 × mean in turbulent flow

Report details

Report reference	FCC-S94B-4BMH (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	HTST Holding Tube Length
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 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/chemical/food-dairy/htst-holding-tube

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.