Casting Gating System: Choke Area, Runner and Gates

Choke area to pour a casting in a set time from mass, metal density, sprue height and efficiency, with runner and gate areas from the gating ratio.

Method: Bernoulli flow through the choke A_c = W/(ρtc√(2gh)) (Campbell, Castings, 2nd ed.; Rao, Manufacturing Technology: Foundry)

Input parameters

Unit system: SI

Parameter	Value	Unit
Poured mass (casting + gating)	50.000	kg
Liquid metal density	7,000.0	kg/m³
Pouring time	20.000	s
Effective sprue height	0.30000	m
Efficiency (discharge) factor	0.80000	
Runner area ratio to choke	2.0000	
Total gate area ratio to choke	2.0000	

Calculated results

Parameter	Value	Unit
Choke area	184.04	mm²
Round choke diameter	15.308	mm
Runner area	368.08	mm²
Total gate area	368.08	mm²
Velocity at the choke	1.9406	m/s

Notes for this case

• Effective height: h for top gating, h − p/2 for parting-line gating, h − p²/(2c) for bottom gating (p = casting height above the gate). Pressurised ratios (1:2:2) suit iron; unpressurised (1:4:4) suit aluminium.

Formula and method

$$A_c = \frac{W}{\rho t c \sqrt{2gh}}, \quad A_r = r_r A_c, \quad A_g = r_g A_c$$

Variables

W	Poured mass (casting + gating)	kg
ρ	Liquid metal density	kg/m³
t	Pouring time	s
h	Effective sprue height	m
c	Efficiency (discharge) factor	-
r_r	Runner area ratio to choke	-
r_g	Total gate area ratio to choke	-
A_c	Choke area	m²
d_c	Round choke diameter	m
A_r	Runner area	m²
A_g	Total gate area	m²
v_c	Velocity at the choke	m/s

Method and standards

Bernoulli at the choke.

Assumptions and limits

- Steady flow; constant head.
- The choke velocity is not checked against the critical gate velocity for surface turbulence (Campbell gives about 0.5 m/s for most liquid metals at the gate): gates are normally enlarged so the metal enters slowly.

References

- Bernoulli flow through the choke A_c = W/(ρtc√(2gh)) (Campbell, Castings, 2nd ed.; Rao, Manufacturing Technology: Foundry)

Report details

Report reference	FCC-KVC0-GP47 (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	Casting Gating System: Choke Area, Runner and Gates
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/mechanical/manufacturing/gating-choke-area

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.