Casting Feeder Head Check: Caine's Curve and Wlodawer

Checks a cylindrical feeder head on a steel casting by Caine's freezing-ratio curve and by Wlodawer's metal utilisation, with casting and head moduli.

Method: Beeley; Foundry Technology; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Casting volume	7,500.0	cm^3
Casting cooling surface area	3,800.0	cm^2
Feeder head diameter	15.000	cm
Head height to diameter	1.5000	
Solidification shrinkage of the alloy (steel 3–5 %)	4.0000	%
Feeder head type	Cylindrical, normal feeding compound (14 %)	

Calculated results

Parameter	Value	Unit
Head volume	3,976.1	cm^3
Casting modulus V/A	1.9737	cm
Head modulus V/A	3.2143	cm
Freezing ratio (casting SA/V over head SA/V)	1.6286	
Head volume / casting volume	0.53014	
Minimum head volume ratio by Caine (steel)	0.24091	
Largest casting the head can feed (Wlodawer)	9,940.2	cm^3

Notes for this case

- Caine: the head volume is sufficient for steel.
- Wlodawer: the head holds enough feed metal for the casting.
- Caine's constants (a = 0.12, b = 0.05, c = 1.0) are for steel in sand. Wlodawer also asks for a head modulus at least 1.2 times the casting modulus; with an exothermic sleeve the effective modulus is larger than the geometric one.

Formula and method

$$x = \frac{(A/V)_c}{(A/V)_r}, \quad y = \frac{V_r}{V_c}, \quad x = \frac{0.12}{y - 0.05} + 1.0, \quad V_{max} = V_r \frac{\eta - S}{S}$$

Variables

V_c	Casting volume	m^3
A_c	Casting cooling surface area	m^2
D	Feeder head diameter	m
H/D	Head height to diameter	-
S	Solidification shrinkage of the alloy (steel 3–5 %)	-
head	Feeder head type	-
V_r	Head volume	m^3
M_c	Casting modulus V/A	m
M_r	Head modulus V/A	m

x	Freezing ratio (casting SA/V over head SA/V)	-
y	Head volume / casting volume	-
y_{min}	Minimum head volume ratio by Caine (steel)	-
V_{max}	Largest casting the head can feed (Wlodawer)	m^3

Method and standards

Caine's curve and Wlodawer's utilisation.

Assumptions and limits

- Steel in sand; cylindrical head.

References

- Beeley
- Foundry Technology
- 2nd ed. (Butterworth-Heinemann, 2001)
- ch. 3
- fig. 3.12 (Caine) and fig. 3.17 (Wlodawer)

Report details

Report reference	FCC-M43A-TD9X (the same inputs always give the same reference)
Generated	17 November 2026, 19:36 UTC
Calculator	Casting Feeder Head Check: Caine's Curve and Wlodawer
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 17 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/materials/steelmaking-foundry/feeder-head-caine-wlodawer

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.