# Riser Size by Chvorinov's Rule (Modulus Method)

Solidification time of a casting by Chvorinov's rule and the diameter of a cylindrical riser whose modulus exceeds the casting's by your factor.

**Method:** Chvorinov (1940): $t = B(V/A)^2$; riser modulus ≥ k × casting modulus; cylinder modulus rD/(2 + 4r) (Campbell; Kalpakjian)

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Casting volume | 4.0000 | L |
| Casting cooling surface area | 0.16000 | m² |
| Mould constant (s/mm²)<br>From trial castings in your sand and metal. | 2.0000 | |
| Riser modulus / casting modulus | 1.2000 | |
| Riser height to diameter ratio | 1.0000 | |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Casting modulus V/A | 25.000 | mm |
| Casting solidification time B M² | 20.833 | min |
| Riser diameter | 180.00 | mm |
| Riser height | 180.00 | mm |

### Notes for this case

- The riser volume is 115 % of the casting volume: check that its feed metal (riser volume times its feeding efficiency) exceeds the casting's solidification shrinkage. The modulus rule alone does not check this.
- Add insulating sleeves if used: they raise the riser's effective modulus.

## Formula and method

$$t_s = B\left(\frac{V}{A}\right)^2, \quad M_r = kM_c, \quad D_r = M_r\,\frac{2+4r}{r}$$

### Variables

| | | |
|---|---|---|
| $V_c$ | Casting volume | m³ |
| $A_c$ | Casting cooling surface area | m² |
| $B$ | Mould constant (s/mm²) | - |
| $k$ | Riser modulus / casting modulus | - |
| $H/D$ | Riser height to diameter ratio | - |
| $M_c$ | Casting modulus V/A | m |
| $t_s$ | Casting solidification time B M² | s |
| $D_r$ | Riser diameter | m |
| $H_r$ | Riser height | m |

### Method and standards

Chvorinov and modulus.

### Assumptions and limits

- Sand casting, simple shapes.
- Side riser: the cylinder cools on its top, bottom and side (M = rD/(2 + 4r)). A top riser whose base sits on the casting, or one with

an insulated top, has a larger modulus for the same size.
- Feed volume is not checked: the note gives the riser volume as a share of the casting for that check.

### References
- Chvorinov (1940): $t = B(V/A)^2$; riser modulus ≥ k × casting modulus
- cylinder modulus rD/(2 + 4r) (Campbell; Kalpakjian)

## Report details

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|---|---|
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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/chvorinov-riser

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.