# RH Degasser Decarburisation Time and Rate Constant

Overall decarburisation rate constant of an RH degasser from circulation rate, vessel steel mass and reaction constant, and the time to reach a carbon target.

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Steel in the ladle | 250.00 | t |
| Metal circulation rate | 7,200.0 | t/h |
| Steel in the RH vessel | 15.000 | t |
| Decarburisation rate constant in the vessel | 15.000 | 1/min |
| Initial carbon | 350.00 | ppm |
| Equilibrium carbon | 5.0000 | ppm |
| Target carbon | 20.000 | ppm |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Overall rate constant | 0.31304 | 1/min |
| Circulation limit Q/W | 0.48000 | 1/min |
| Time to the target carbon | 10.016 | min |
| Carbon after 10 min | 20.076 | ppm |

**Notes for this case**

• When the circulation rate is low, K approaches Q/W and the rate is circulation-controlled; newer RH units have large snorkels for this reason. Hydrogen removal follows the same form with a larger vessel constant.

## Formula and method

$$\ln\frac{[\%C]-[\%C]_e}{[\%C]_0-[\%C]_e}=-Kt,\quad K=\frac{Q}{W}\left(\frac{kW_{RH}}{kW_{RH}+Q}\right)$$

### Variables

| | | |
|---|---|---|
| $W$ | Steel in the ladle | kg |
| $Q$ | Metal circulation rate | kg/s |
| $W_{RH}$ | Steel in the RH vessel | kg |
| $k$ | Decarburisation rate constant in the vessel | 1/s |
| $[\%C]_0$ | Initial carbon | - |
| $[\%C]_e$ | Equilibrium carbon | - |
| $[\%C]^*$ | Target carbon | - |
| $K$ | Overall rate constant | 1/s |
| $Q/W$ | Circulation limit Q/W | 1/s |
| $t$ | Time to the target carbon | s |
| $[\%C]_{10}$ | Carbon after 10 min | - |

### Method and standards

Two-zone RH decarburisation model.

### Assumptions and limits

- Approximate solution; constant rate constant.

## Report details

| | |
|---|---|
| Report reference | FCC-SW3R-CFVZ (the same inputs always give the same reference) |
| Generated | 23 November 2026, 17:50 UTC |
| Calculator | RH Degasser Decarburisation Time and Rate Constant |
| 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/materials/steelmaking-foundry/rh-degasser-decarburisation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.