Carbon Equivalent (CE IIW) and Pcm for Welding

Carbon equivalent of a steel by the IIW formula and the Ito–Bessyo Pcm from its chemical analysis, used to judge weldability and preheat.

Method: IIW carbon equivalent; Ito–Bessyo Pcm; EN 1011-2 Annex C

Input parameters

Unit system: SI

Parameter	Value	Unit
Carbon	0.18000	%
Manganese	1.2000	%
Silicon	0.30000	%
Chromium	0.10000	%
Molybdenum	0.050000	%
Vanadium	0.020000	%
Nickel	0.10000	%
Copper	0.15000	%
Boron	0	%

Calculated results

Parameter	Value	Unit
Carbon equivalent (IIW)	0.43067	%
Cracking parameter (Ito–Bessyo)	0.26950	%

Notes for this case

• Use the ladle or certificate analysis. Preheat comes from your welding code (for example EN 1011-2 or AWS D1.1) using CE or Pcm with thickness, hydrogen level and heat input.

Formula and method

$$CE_{IIW} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

$$P_{cm} = C + \frac{Si}{30} + \frac{Mn + Cu + Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$$

Variables

C	carbon	mass %
Mn	manganese	mass %
Si	silicon	mass %
Cr	chromium	mass %
Mo	molybdenum	mass %
V	vanadium	mass %
Ni	nickel	mass %
Cu	copper	mass %
B	boron	mass %
CE_{IIW}	carbon equivalent	mass %
P_{cm}	cracking parameter	mass %

Method and standards

IIW carbon equivalent and the Ito–Bessyo cracking parameter, both as given in EN 1011-2 Annex C.

Assumptions and limits

- Steel analysis in mass %; formulas apply to carbon and low-alloy steels.
- CE and Pcm come out in mass % (shown as, for example, 0.43 %); codes quote the same number without the % sign (CE = 0.43).

References

- IIW carbon equivalent; Ito–Bessyo Pcm; EN 1011-2 Annex C

Report details

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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/welding/carbon-equivalent-iiw

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.