# Compressor Discharge Temperature

Gas temperature leaving each compressor stage from inlet temperature, pressure ratio, isentropic exponent and stage efficiency, ideal and actual.

**Method:** Thermodynamics of ideal-gas compression (isentropic)

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Inlet temperature (each stage, after intercooling) | 35.000 | °C |
| Inlet pressure (absolute) | 1.0132 | bar |
| Final discharge pressure | 7.0000 | bar g |
| Isentropic exponent<br>1.4 for air; about 1.3 for natural gas and $CO_2$. | 1.4000 | |
| Number of stages | 1 stage | |
| Isentropic efficiency of the stage | 80.000 | % |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Actual discharge temperature | 345.27 | °C |
| Ideal (isentropic) discharge temperature | 283.22 | °C |
| Temperature rise per stage | 310.27 | K |
| Pressure ratio per stage | 7.9085 | |

**Notes for this case**

- Discharge above 200 °C: lubricated compressors risk oil carbonisation and fire; add a stage or cool better.

## Formula and method

$$r_s = \left(\frac{p_2}{p_1}\right)^{1/z} \qquad T_{2s} = T_1\, r_s^{(k-1)/k} \qquad T_2 = T_1\left[1 + \frac{r_s^{(k-1)/k} - 1}{\eta_{is}}\right] \qquad \Delta T = T_2 - T_1$$

### Variables

| | | |
|---|---|---|
| $T_1$ | inlet temperature (each stage) | K |
| $p_1$ | inlet pressure | Pa |
| $p_2$ | final discharge pressure | Pa |
| $k$ | isentropic exponent | – |
| $z$ | number of stages | – |
| $\eta_{is}$ | stage isentropic efficiency | – |
| $T_2$ | actual discharge temperature | K |
| $T_{2s}$ | ideal discharge temperature | K |
| $\Delta T$ | rise per stage | K |
| $r_s$ | ratio per stage | – |

### Method and standards

Isentropic ideal-gas relation with the stage isentropic efficiency defined on enthalpy (constant cp).

### Assumptions and limits

- Dry, oil-free compression; constant specific heat.
- Oil-injected screw compressors discharge far cooler (typically 80–100 °C) because the injected oil absorbs the heat: this dry

adiabatic value does not apply to them. The 200 °C warning is for lubricated reciprocating machines.

### References

• Thermodynamics of ideal-gas compression (isentropic)

## Report details

| | |
|---|---|
| Report reference | FCC-ZBGT-2ZWA (the same inputs always give the same reference) |
| Generated | 17 November 2026, 19:44 UTC |
| Calculator | Compressor Discharge Temperature |
| Method last reviewed | 12 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/mechanical/compressors/compressor-discharge-temperature

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.