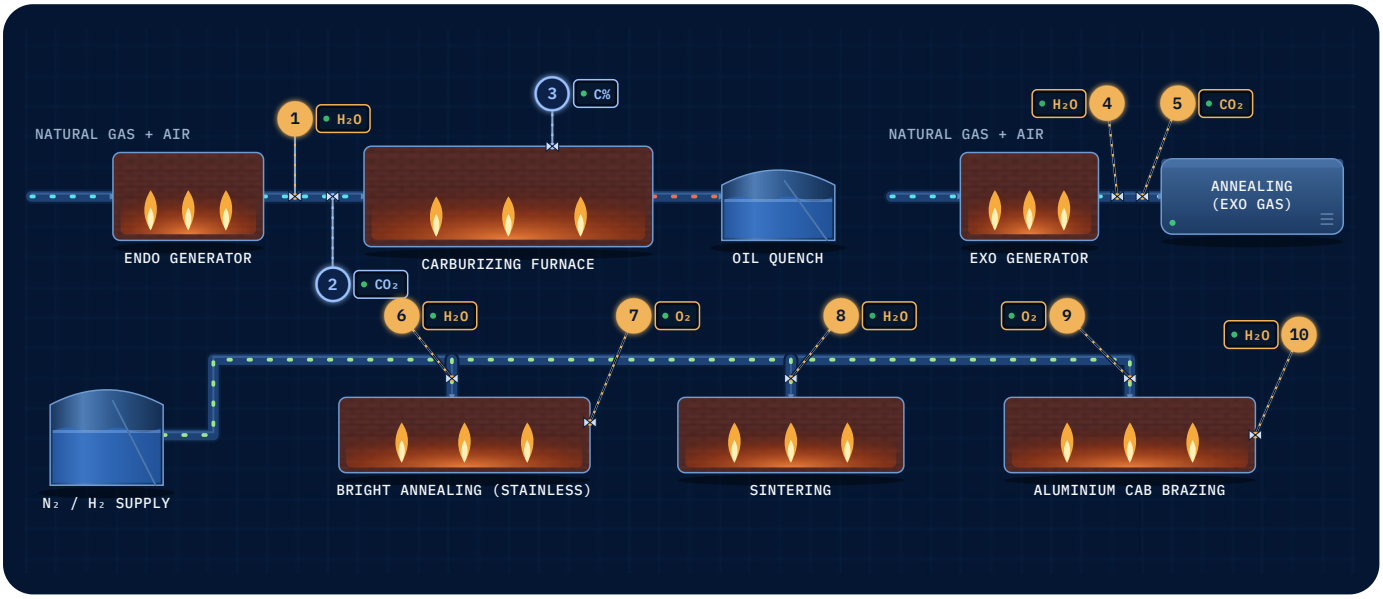
# Heat treatment atmospheres: where to measure dew point, $O_2$ and $CO_2$

Follow the atmosphere from the gas generators and the nitrogen–hydrogen supply into each furnace. Each numbered point shows what is measured, why it matters and the instrument that fits.




● YORK instrument ○ Integrated system (supplied through YORK)

## How the process works

Furnace atmospheres protect the parts from oxidation and, in carburizing, add carbon to the surface. Their quality comes down to a few gases: water vapour, oxygen, $CO_2$, CO and methane.

1. **Endothermic generator.** Natural gas reacts with a little air over a hot catalyst to give a carrier gas of about 20 % CO, 40 % $H_2$ and 40 % $N_2$.
2. **Carburizing.** The endothermic gas carries carbon into the steel. The furnace controls the carbon potential, then the parts are quenched.
3. **Exothermic generator.** Natural gas burns with more air to give a cheaper, more oxidizing gas for annealing and brazing of less sensitive metals.
4. **Nitrogen–hydrogen atmospheres.** Bright annealing of stainless steel and sintering need a very dry, oxygen-free atmosphere of nitrogen and hydrogen.
5. **Aluminium brazing.** Controlled atmosphere brazing (CAB) runs in nitrogen with flux; oxygen and moisture must stay low for good joints.

Interactive version with animation:
https://www.yorkinstrument.ae/guides/heat-treatment-atmosphere-measurement-points/

## Measurement points

| # | POINT | MEASURES | TYPICAL VALUE / LIMIT | RECOMMENDED SOLUTION |
|---|---|---|---|---|
| 1 | Endothermic gas to the furnace | Dew point | Set point follows the carbon potential required for the steel | DM9200, DM9600 |
| 2 | Endothermic gas to the furnace | $CO_2$, CO and $CH_4$ | Nominally 20 % CO, 40 % $H_2$, 40 % $N_2$, with 0.25–0.5 % $CO_2$ and ≤ 0.5 % $CH_4$ | Integrated system: three-gas NDIR analyzer (CO / $CO_2$ / $CH_4$) |
| 3 | Carburizing furnace chamber | Carbon potential (oxygen probe) | Controlled to the carbon level specified for the case depth | Integrated system: in-situ zirconia carbon probe |
| 4 | Exothermic gas to the annealing furnace | Dew point | Set by the generator's gas cooler; check it against the process requirement | DM9600 |
| 5 | Exothermic gas to the annealing furnace | $CO_2$ (%) | Percent level, depending on the air-to-gas ratio | PGA520, PGA620 |
| 6 | Bright annealing furnace (stainless steel) | Dew point of the $N_2$–$H_2$ atmosphere | Very dry: typically around −60 °C or lower | DPT990-EX, DM9800 |
| 7 | Bright annealing furnace (stainless steel) | Trace oxygen | Low ppm | PGA500-EX |
| 8 | Sintering furnace | Dew point of the $N_2$–$H_2$ atmosphere | Dry enough to reduce surface oxides; set per alloy | DPT990-EX, DPT830 |
| 9 | Aluminium CAB brazing furnace | Trace oxygen in $N_2$ | ≤ 40 ppm $O_2$ | POA200, PGA500 |
| 10 | Aluminium CAB brazing furnace | Dew point | Kept dry; agree the limit with the brazing furnace supplier | DPT830 |

Typical values from published standards, regulations and technical literature. Your contract, licensor or plant specification always governs. Integrated systems are supplied by YORK through its partner integration factory.

## Key references

1. Furnace Atmospheres — Thermal Processing

2. Nadolny et al., Management and Production Engineering Review 14(3) 2023: controlled atmosphere brazing — Polish Academy of Sciences