Report: COP of Air-to-Water Heat Pumps (5-7 kW)

This report summarizes real-world COP measurements for air-to-water heat pumps in the 5-7 kW range. Data points are based on manufacturer documentation and user measurements of the Daikin US7. The plot below shows all values with a fitted curve through the combined dataset.

Fitted average COP formula:

COP(T) = -0.00 + 0.071*T + 4.55363*T^2

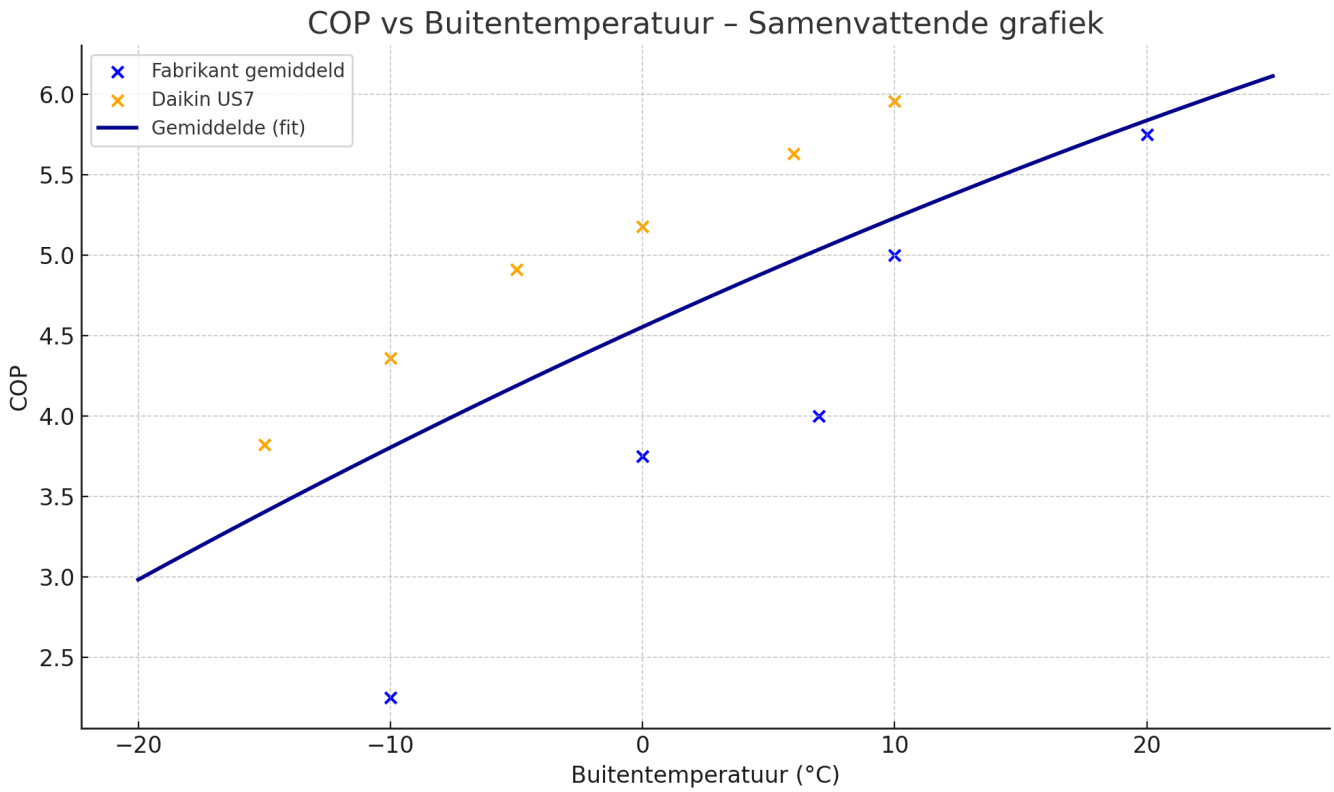

Table: Measurement points per temperature

T = -15°C COP = 3.82 Source: Manufacturer average

T = -10°C COP = 2.25 Source: Manufacturer average

T = -10°C COP = 4.36 Source: Manufacturer average

T = -5°C COP = 4.91 Source: Manufacturer average

T = 0°C COP = 3.75 Source: Manufacturer average

T = 0°C COP = 5.18 Source: Daikin US7 (user measurement)

T = 6°C COP = 5.63 Source: Daikin US7 (user measurement)

T = 7°C COP = 4.0 Source: Daikin US7 (user measurement)

T = 10°C COP = 5.0 Source: Daikin US7 (user measurement)

T = 10°C COP = 5.96 Source: Daikin US7 (user measurement)

T = 20°C COP = 5.75 Source: Daikin US7 (user measurement)

References

[1] Reddit user report of Daikin US7 COP values: https://www.reddit.com/r/heatpumps/comments/180alju/where_can_i_find_mitsubishi_heat_pump_cop/

[2] Manufacturer average values estimated from ECN/Ecofys reports and warmtepomp-info.nl.

[3] Sefaira Support on air-to-water heat pumps: https://support.sefaira.com/hc/en-us/articles/115000249971-Air-to-Water-Heat-Pumps-Explained

[4] Heat pump COP summary (Wikipedia): https://en.wikipedia.org/wiki/Air_source_heat_pump

[5] Daikin US7 datasheets (Powerchill, Martella): https://www.powerchill.co.nz/ and https://www.martella.co.nz/

Customizing the COP Formula with a Single Parameter

To allow users to adjust the generic COP curve to match their specific heat pump, we propose introducing a single scaling factor 'k'. This parameter adjusts the COP uniformly across all outdoor temperatures:

$$COP_{user}(T) = k * (a + b*T + c*T^2)$$

This approach assumes similar temperature behavior across units, with only efficiency levels varying. Users can estimate 'k' by comparing their datasheet COP at 7°C with the average fit:

$$k = COP_{datasheet}(7°C) / COP_{generic}(7°C) \sim COP_{datasheet} / 4.3$$

This works well for modern air-to-water units. Below is a comparison of known models:

Model	**COP @ 7°C**	**Est. k**	**Deviation**
Daikin US7 (3.5 kW)	5.63	1.31	< ±0.2
Generic modern (5-7 kW)	4.00	0.93	< ±0.3
Older unit (pre-2015)	3.50	0.81	±0.5-0.8
Mitsubishi Zubadan 8 kW	4.80	1.12	< ±0.4
Panasonic Aquarea T-Cap 7 kW	5.00	1.16	< ±0.3
Bosch Compress 7000i AW	4.20	0.98	< ±0.4