Chiller Performance and COP — Report

DOCUMENT

Plant / project	**Example Plant**
Equipment tag / system	**CH-01**
Calculation / document no.	**CALC-PE-110**
Revision	**0**
Prepared by	**Your name**
Checked by	**—**
Date	**07-Nov-2026**
Calculation basis	Power: measured kW · Capacity: water side · Chilled-water fluid: water (IAPWS-IF97) · Carnot reference: refrigerant saturation temperatures · Part-load weights: AHRI-style 1/42/45/12 % · Part-load average aligned with the publicly documented AHRI 550/590 weighting concept; a certified IPLV needs the standard rating conditions
Status	✓ **Inputs OK** · ℹ️ **2 default value(s) in use: compressor motor efficiency, motor heat rejected to the refrigerant**

KEY INPUTS (values used; Proposed shows the Actual value where it was left blank)

Input	Unit	Design	Actual	Proposed
Chilled-water flow	m³/h	549.0	520.0	520.0
Chilled-water entering (return) temperature	°C	12.20	12.10	12.10
Chilled-water leaving (supply) temperature	°C	6.70	6.80	6.80
Condenser water flow	m³/h	632.0	603.0	603.0
Condenser water entering temperature	°C	29.40	30.00	27.50
Condenser water leaving temperature	°C	35.00	35.60	33.00
Evaporating (saturation) temperature	°C	5.60	4.50	5.40
Condensing (saturation) temperature	°C	36.10	37.90	34.10
Compressor motor input power	kW	590.0	652.0	560.0

RESULTS

Result	Unit	Design	Actual	Proposed	Actual − Design	Proposed − Actual
Cooling capacity, water side	kW	3,518.1	3,211.1	3,211.1	-307.0	0.0
Cooling capacity, refrigerant side	kW	3,516.7	3,242.3	3,242.3	-274.4	0.0
Cooling capacity used	kW	3,518.1	3,211.1	3,211.1	-307.0	0.0
Load (% of the rated capacity)	%	100.0	91.3	91.3	-8.7	0.0
Compressor motor input power	kW	590.0	652.0	560.0	62.0	-92.0

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Calculation summary | PlantCalcKit v1.0

Coefficient of performance (COP)	-	5.963	4.925	5.734	-1.038	0.809
Specific power (kW/TR)	kW/TR	0.5898	0.7141	0.6133	0.1243	-0.1008
Energy efficiency ratio (EER)	BTU/Wh	20.35	16.80	19.57	-3.54	2.76
Water side minus refrigerant side	%	0.04	-0.96	-0.96	-1.00	0.00
Chilled-water temperature difference	K	5.50	5.30	5.30	-0.20	0.00
Chilled-water mass flow	t/h	549.0	520.0	520.0	-29.0	0.0
Carnot COP (reference temperatures)	-	9.139	8.313	9.706	-0.826	1.393
Carnot fraction (second-law efficiency)	%	65.2	59.2	59.1	-6.0	-0.2
Temperature lift of the Carnot reference	K	30.50	33.40	28.70	2.90	-4.70
Weighted part-load COP (IPLV-style)	-	7.522	5.425	5.425	-2.097	0.000
Weighted part-load specific power (IPLV-style)	kW/TR	0.4675	0.6483	0.6483	0.1808	0.0000
Weighted part-load EER (IPLV-style)	BTU/Wh	25.67	18.51	18.51	-7.16	0.00
Condenser heat rejection, energy balance	kW	4,108.1	3,863.1	3,771.1	-245.0	-92.0
Condenser heat rejection, water side	kW	4,087.8	3,899.4	3,833.4	-188.4	-66.0
Condenser heat balance closure	%	-0.49	0.94	1.65	1.43	0.71
Condenser water temperature difference	K	5.60	5.60	5.50	0.00	-0.10
Evaporator approach	K	1.10	2.30	1.40	1.20	-0.90
Condenser approach	K	1.10	2.30	1.10	1.20	-1.20
Evaporator UA	kW/K	1,146.1	724.2	948.6	-422.0	224.4
Condenser UA	kW/K	1,318.9	859.2	1,248.8	-459.7	389.6
Evaporator UA (% of design)	%	100.0	63.2	82.8	-36.8	19.6
Condenser UA (% of design)	%	100.0	65.1	94.7	-34.9	29.5
Power change per K, condenser water	%/K	3.28	2.99	3.48	-0.28	0.49
Power change per K, chilled-water setpoint	%/K	-3.64	-3.35	-3.84	0.28	-0.49

FINDINGS AND RECOMMENDATIONS

⚠ **Correct soon** — The Carnot fraction is 6.0 points below the design value: check the approaches and the heat exchanger fouling.

⚠ **Correct soon** — The condenser UA is 65 % of the design value: effective heat transfer has dropped (fouling or air in the condenser).

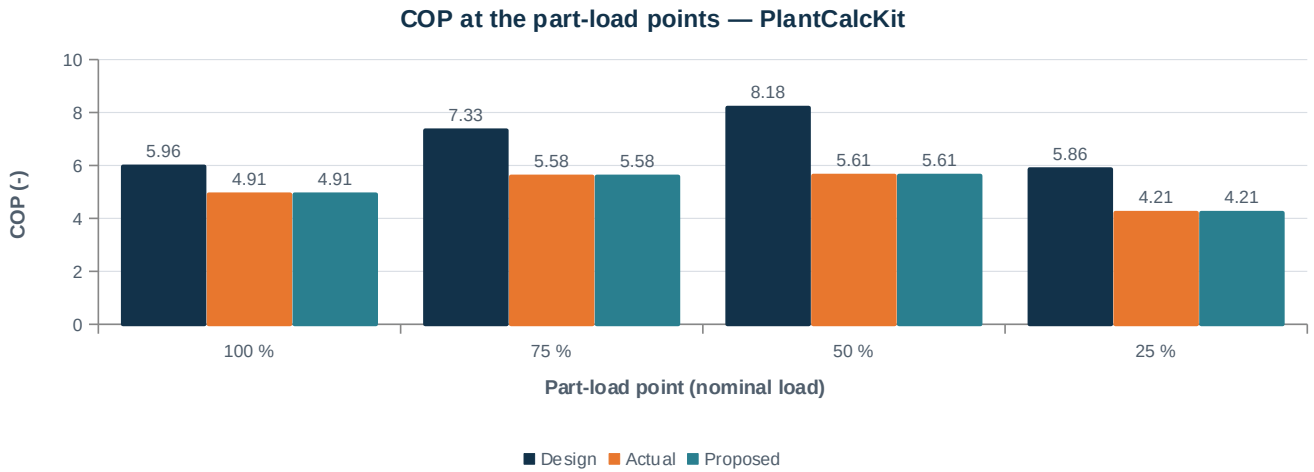
⚠ **Correct soon** — The evaporator UA is 63 % of the design value: effective heat transfer has dropped (fouling, low charge or oil logging).

⚠ **Correct soon** — The weighted part-load COP is 27.9 % below the design value (5.42 against 7.52): the chiller loses more at part load than designed.

◆ **Opportunity** — The proposed case changes the compressor power by -92 kW (-14.1 %) and the COP from 4.93 to 5.73.

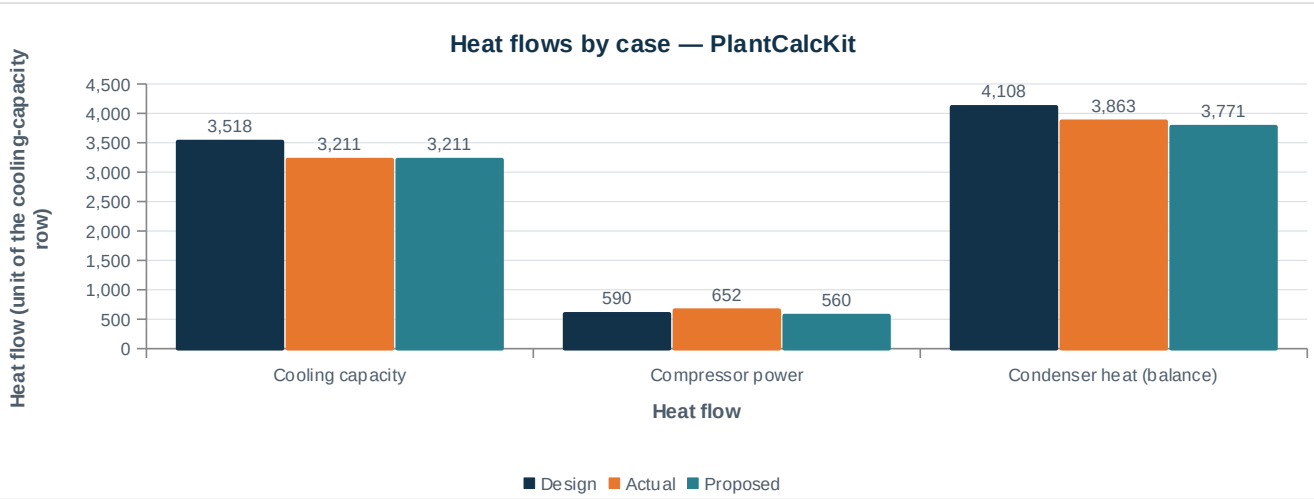
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CHARTS



Observations — part-load efficiency

[Write your observations here]



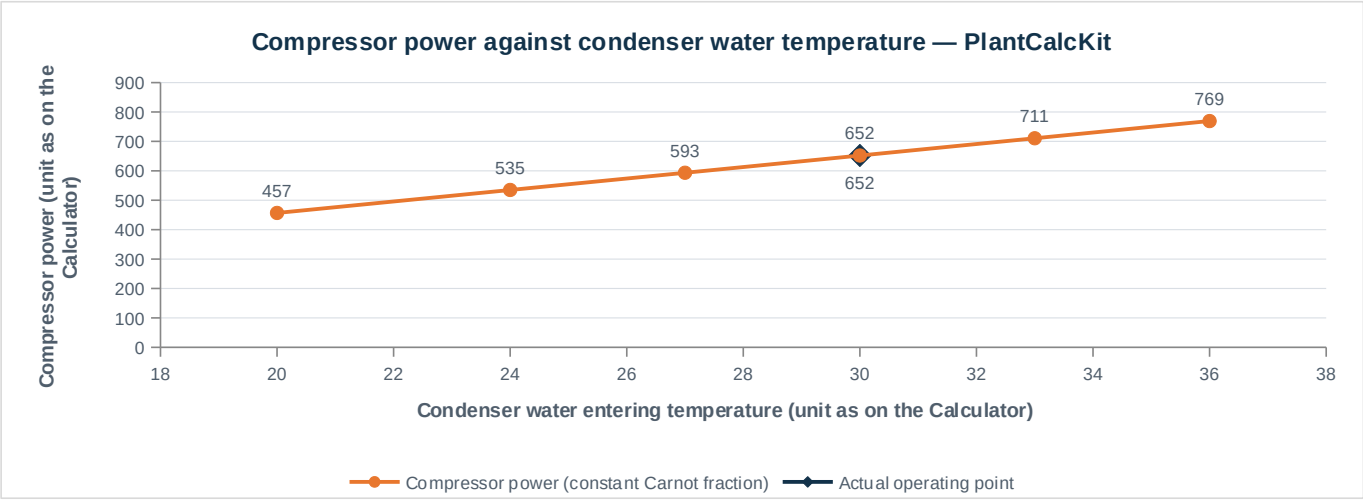
Observations — heat flows

[Write your observations here]

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Calculation summary | PlantCalcKit v1.0



Observations — condenser water temperature

[Write your observations here]

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