Corrigendum for: High Performance Heat Pumps Using Tailored Refrigerants

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EDITORIAL NOTE

This corrigendum explains changes to a previously published manuscript [1]. The changes have been peer reviewed by the journal editorial board. The revised version is available at https://doi.org/10.69997/sct.149523.

REASON FOR CORRIGENDUM

The compressor model that was used to model the heat pump in the accepted version of this manuscript was erroneous. The fluid at the outlet of the compressor was assumed to only be in the single-phase vapour region while computing the thermodynamic properties of this stream in the erroneous model. However, the fluid at the outlet of an isentropic compressor could either be in the two-phase region or the single-phase region. The authors noticed their error and hence have performed their computational experiments with the correct compressor model given below. (The equations of the compressor are not given in the manuscript.)

UPDATED COMPRESSOR MODEL

Consider the isentropic compression of a pure-component fluid from state (T_1, P_1) to state (T_2^S, P_2). The stream is a vapour at the inlet of the compressor and at the outlet is either a vapour-liquid mixture or a single-phase vapour. Thus, the temperature at the outlet of an isentropic compressor can be determined by solving the following equation:

$$S = \begin{cases} \alpha S^{liq}(T^*(P_2), P_2) + (1-\alpha) S^{vap}(T^*(P_2), P_2), \ldots \\ T_2^S = T^*(P_2), \text{If the fluid is in a two-phase} \ldots \\ \text{region, where } \alpha \in (0,1) \\ S^{vap}(T^*(P_2) + \Delta T, P_2),\ T_2^S = T^*(P_2) + \Delta T \ldots \\ \text{If the fluid is a superheated vapour} \end{cases} \quad (1)$$

S denotes the molar entropy of the fluid at state 1 and at the outlet of an isentropic compression. $S^L(T,P)$ and $S^V(T,P)$ yield the molar entropy of a saturated liquid and saturated vapour phase respectively (using the corresponding volume roots) at temperature T and pressure P. $\alpha \in (0,1)$ denotes the liquid fraction of a two-phase mixture. $T^*(P)$ is the saturation temperature at pressure P.

The state of the fluid at the outlet of a real compressor is given by solving the following equation:

$$H(T_2^S, P_2) - H(T_1, P_1) = \eta\big(H(T_2, P_2) - H(T_1, P_1)\big)$$

$H(T,P)$ denotes the molar enthalpy of a fluid at temperature T and pressure P and η is the isentropic efficiency of the compressor.

We further impose the inequality constraint that

$$T_2 \geq T^*(P_2) + \epsilon$$

to ensure the vapour at the outlet of the compressor is in the vapour phase, where $\epsilon > 0$.

IMPLEMENTATION

To implement equation (1) that is non-differentiable at $T = T^*(P_2)$, a T-S flash routine, which is external to the model equations and provided by gPROMS properties, is used.

In the corrected version of this manuscript, we have updated our compressor model and presented the ensuing results.

REFERENCES

1. Sandham FM, Muumbo A, Mathew K, Sinha S, Gopinath S. High Performance Heat Pumps Using Tailored Refrigerants. Systems and Control Transactions 5:2066-2073 (2026) https://doi.org/10.69997/sct.149523

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