Beregning af Phi ud fra målte temperaturer i systemet.

Dette bestemmes ud fra energibalancerne for kølemidlet og luften, over fordamperen:

$q_{mR} \cdot (h_{R,4} - h_{R,1}) + \Phi_{0,R} = 0$ *Energibalance for kølemidlet over fordamper*

$q_{mL} \cdot (h_{L,1} - h_{L,2}) - \Phi_{0,L} = 0$ *Energibalance for luften over fordamper*

---------------------------- Måledata indtastes her: --------------------------

$p_{R,f} = (2.27 + 1) \cdot 1$ [bar] *tryk i kølemiddel på fordampersiden*

$p_{R,k} = (10.1 + 1) \cdot 1$ [bar] *tryk i kølemiddel på kondensatorsiden*

$t_{R,3} = 34.1$ [C] *temperatur i kølemiddel efter kondensator*

$t_{R,1} = 11$ [C] *temperatur i kølemiddel efter fordamper*

$p_L = 1$ [bar] *luftens tryk*

$t_{L,1} = 18.5$ [C] *luftens temperatur før fordamper*

$t_{L,2} = 12.9$ [C] *luftens temperatur efter fordamper*

$rpm = 4000 \cdot \left| 0.016666667 \cdot \frac{1/s}{1/min} \right|$ *kompressors rpm*

$c_L = 3$ [m/s] *strømningshastighed af luft over fordamper*

$A_f = \left[\frac{0.21}{2} \right]^2 \cdot \pi - 0.083^2$ *Tværsnitsareal af luftens vej over fordamper*

--------------------------- Alt herunder beregnes ----------------------------

-------------------------Entalpier:--------------------------------

Kølemiddel

der antages at entalpien er konstant over ekspansionventilen

$h_{R,4} = \mathbf{h}(R134a, T = t_{R,3}, P = p_{R,k})$ *Entalpi af kølemidlet før fordamper beregnet ud fra tryk og temp efter kondensator.* $h_{R,4} = h_{R,3}$

$h_{R,1} = \mathbf{h}(R134a, T = t_{R,1}, P = p_{R,f})$ *Entalpi af kølemidlet efter fordamper*

Luft

$h_{L,1} = \mathbf{h}(Air_{ha}, T = t_{L,1}, P = p_L)$ *Entalpi af luft før fordamper*

$h_{L,2} = \mathbf{h}(Air_{ha}, T = t_{L,2}, P = p_L)$ *Entalpi af luft efter fordamper*

------------------------------- massestrømme: -----------------------------

Luft

$t_{L,m} = \frac{t_{L,1} + t_{L,2}}{2}$ *luftens middeltemperatur*

$\rho_L = \rho(Air_{ha}, T = t_{L,m}, P = p_L)$

luftens densitet

$q_{VL} = c_L \cdot A_f$ *luftens volumenstrøm*

$q_{mL} = q_{VL} \cdot \rho_L$ *luftens massestrøm*

$disp = 5.08 \cdot \left| 0.000001 \cdot \frac{m3}{cm3} \right|$

kølemiddel

$q_{mR} = q_{vr} \cdot \rho_{r1}$ *massestrøm af kølemiddel*

$q_{vr} = q_{vs} \cdot \eta_v$ *volumenstrøm af kølemiddel*

$q_{vs} = disp \cdot rpm$ *slagvolumenstrøm af kølemiddel*

$\eta_v = -0.01696 \cdot \frac{p_{R,k}}{p_{R,f}} + 0.79144$ *volumetrisk virkningsgrad*

$\rho_{r1} = \rho\left(R134a, T = t_{R,1}, P = p_{R,f}\right)$ *densitet af kølemiddel før kompressor*

$t_{fordamp} = \mathbf{T}_{sat}\left(R134a, P = p_{R,f}\right)$ *fordampningstemperatur*

$t_{kondens} = \mathbf{T}_{sat}\left(R134a, P = p_{R,k}\right)$ *kondenseringstemperatur*

$overhedning = t_{R,1} - t_{fordamp}$ *overhedning gennem fordamper*

$underkøl = t_{kondens} - t_{R,3}$ *underkøling gennem kondensator*

usikkerheder

$U_t = 1.397505$ [K]

$U_p = 0.065765$ [bar]

Unit Settings: SI C bar J mass deg

Variable±Uncertainty	Partial derivative	% of uncertainty
overhedning = 7.932±1.509 [C]		
$p_{R,f}$ = 3.27±0.06577 [bar]	$\partial overhedning / \partial p_{R,f}$ = -8.658	14.24 %
$p_{R,k}$ = 11.1±0.06577 [bar]	$\partial overhedning / \partial p_{R,k}$ = 0	0.00 %
$t_{L,1}$ = 18.5±1.398 [C]	$\partial overhedning / \partial t_{L,1}$ = 0	0.00 %
$t_{L,2}$ = 12.9±1.398 [C]	$\partial overhedning / \partial t_{L,2}$ = 0	0.00 %
$t_{R,1}$ = 11±1.398 [C]	$\partial overhedning / \partial t_{R,1}$ = 1	85.76 %
$t_{R,3}$ = 34.1±1.398 [C]	$\partial overhedning / \partial t_{R,3}$ = 0	0.00 %
$\Phi_{0,L}$ = 565.8±199.7 [W]		
$p_{R,f}$ = 3.27±0.06577 [bar]	$\partial \Phi_{0,L} / \partial p_{R,f}$ = 0	0.00 %
$p_{R,k}$ = 11.1±0.06577 [bar]	$\partial \Phi_{0,L} / \partial p_{R,k}$ = 0	0.00 %
$t_{L,1}$ = 18.5±1.398 [C]	$\partial \Phi_{0,L} / \partial t_{L,1}$ = 100.1	49.04 %
$t_{L,2}$ = 12.9±1.398 [C]	$\partial \Phi_{0,L} / \partial t_{L,2}$ = -102	50.96 %
$t_{R,1}$ = 11±1.398 [C]	$\partial \Phi_{0,L} / \partial t_{R,1}$ = 0	0.00 %
$t_{R,3}$ = 34.1±1.398 [C]	$\partial \Phi_{0,L} / \partial t_{R,3}$ = 0	0.00 %
$\Phi_{0,R}$ = 612.8±15.97 [W]		
$p_{R,f}$ = 3.27±0.06577 [bar]	$\partial \Phi_{0,R} / \partial p_{R,f}$ = 211.4	75.76 %

$p_{R,k}$ = 11.1±0.06577 [bar]	$\partial\Phi_{0,R} / \partial p_{R,k}$ = -4.3	0.03 %
$t_{L,1}$ = 18.5±1.398 [C]	$\partial\Phi_{0,R} / \partial t_{L,1}$ = 0	0.00 %
$t_{L,2}$ = 12.9±1.398 [C]	$\partial\Phi_{0,R} / \partial t_{L,2}$ = 0	0.00 %
$t_{R,1}$ = 11±1.398 [C]	$\partial\Phi_{0,R} / \partial t_{R,1}$ = 0.4614	0.16 %
$t_{R,3}$ = 34.1±1.398 [C]	$\partial\Phi_{0,R} / \partial t_{R,3}$ = -5.604	24.04 %

No unit problems were detected.

A_f = 0.02775 [m^2]	c_L = 3 [m/s]
disp = 0.00000508 [m^3]	η_v = 0.7339
$h_{L,1}$ = 291837 [J/kg]	$h_{L,2}$ = 286204 [J/kg]
$h_{R,1}$ = 407554 [J/kg]	$h_{R,4}$ = 247666 [J/kg]
overhedning = 7.932 [C]	$\Phi_{0,L}$ = 565.8 [W]
$\Phi_{0,R}$ = 612.8 [W]	p_L = 1 [bar]
$p_{R,f}$ = 3.27 [bar]	$p_{R,k}$ = 11.1 [bar]
q_{mL} = 0.1004 [kg/s]	q_{mR} = 0.003833 [kg/s]
q_{VL} = 0.08324 [m3/s]	q_{vr} = 0.0002485 [m3/s]
q_{vs} = 0.0003387 [m3/s]	ρ_L = 1.207 [kg/m^3]
ρ_{r1} = 15.42 [kg/m^3]	rpm = 66.67 [1/s]
$t_{fordamp}$ = 3.068 [C]	$t_{kondens}$ = 43.29 [C]
$t_{L,1}$ = 18.5 [C]	$t_{L,2}$ = 12.9 [C]
$t_{L,m}$ = 15.7 [C]	$t_{R,1}$ = 11 [C]
$t_{R,3}$ = 34.1 [C]	underkøl = 9.194 [C]
U_p = 0.06577 [bar]	U_t = 1.398 [K]

No unit problems were detected.

KEY VARIABLES

$\Phi_{0,L}$ = 565.8 [W]	*kuldeydelse fra luft*
overhedning = 7.932 [C]	
$\Phi_{0,R}$ = 612.8 [W]	*kuldeydelse fra kølemiddel*