Basis
50 000 ton (t.) FAB/in/year(y) 65% DM
Product out: 85% DM
Uptime: 5060 h/y
Calculation
FAB in/s = 50 000/5060 x 3600 = 2,745 kg/s
100% DM/y = 32 500 t./y
Product out, 85% DM/y = 38 235 t/y
Product out, 85% DM/h = 7.556 t./h
Product out, 85% DM/s = 2.099 kg/s

Dehumidification/y = 50 000 – 38 235 = 11765 t./y
Dehumidification/h = 11 765/5060 = 2.325 t./h
Dehumidification/s = 2325/3600 = 0,646 kg/s

Water balance
100% H_2O/s = 0.35 x 50 000/5060 x 3600 ≅ 0.961 kg/s
15% H_2O I product out/s = 0.15 x 2.099 ≅ 0.315 kg/s
Condensate = 0.961 – 0.315 = 0.646 kg/s
Dehumidification is equal to the condensate, as it should be

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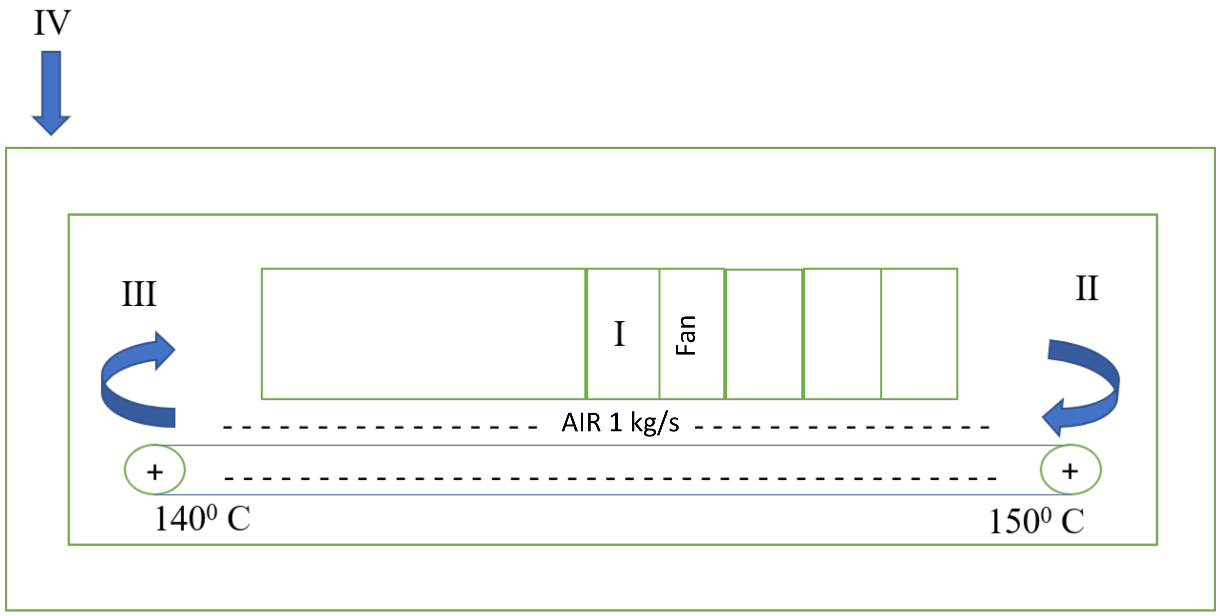


The drying temperature is 150^0 C in the calculation below.

Energy

I. 30^0 C, $\varphi = 1$, x = 0.0276 kg H_2O/kg clean air.

i_1 = 30 x 1.005 + 0.0276(2500+30x1.86) = 101kJ/kg clean air

II. 150^0 C, x = 0.0276/kg clean air

i_2 = 150 x 1.005 + 0.0276(2500+150x1.86) ≅ 227 kJ/kg clean air

III. 140^0 C, x = 0.0276 + 0.646 = 0.674/kg clean air

i_3 = 140 x 1.005 + 0.674(2500+140x1.86) ≅ 2000 kJ/kg clean air

IV. Added energy in FAB in: 2.745 x 3 x 15 ≅ 124 kJ/s

V. Abducted energy in product out: 2.099 x 1.8 x 50 ≅ 189 kJ/s

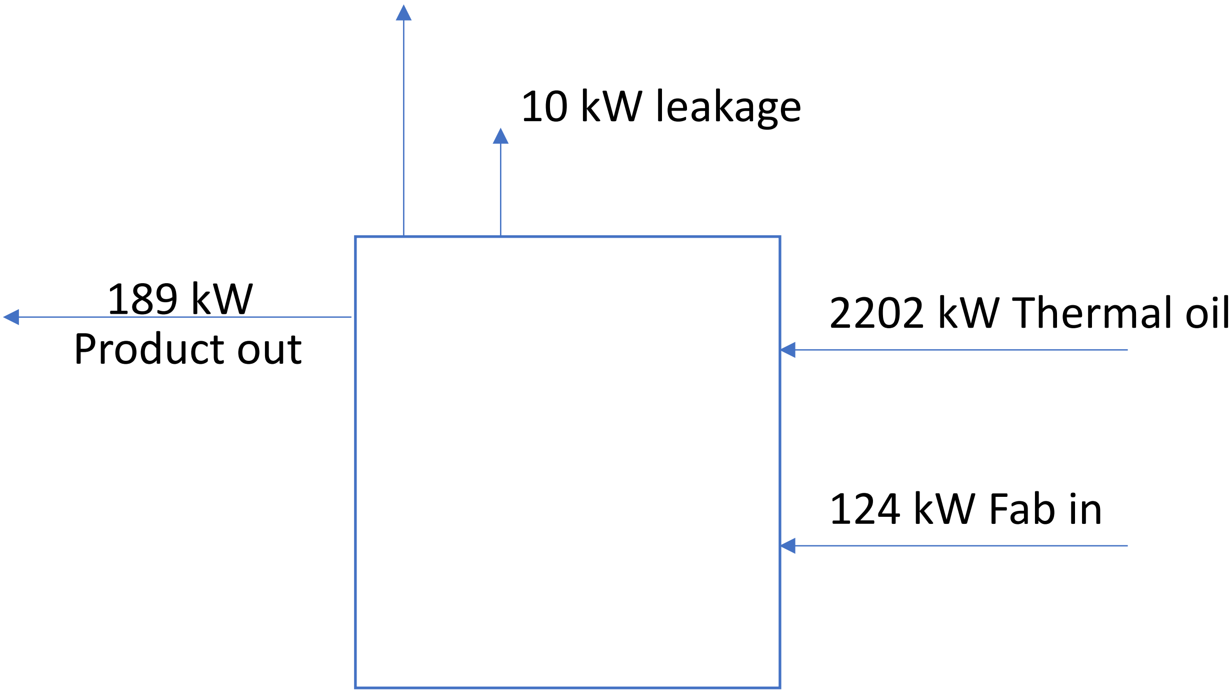
VI. Heat leakage: 200x120x0.5 ≅ 10kW

Energy consumption:

III – I + II – IV + V + VI =

2000 – 100 + 227 – 124 + 189 + 10 = 2202 kJ/s = 2202 kW

Energy Balance
Dehumidification: **III – I + II** = 2127 kW



If we can use the condensation energy:
Condensate 0.646 kg/s
Temperature: ~ 50^0 C
Condensate enthalpy: 2382 kJ/kg
Condensation effect:
2382 x 0.646 ≅ 1539 kW
Can be used to heat FAB in.

Mass balance