Thermal Transfer Coefficient

Assumptions

1. Standard atmospheric pressure of 30.0 mmHg @ 77°F
2. Enclosure is isothermal and isoflux having a constant temperature and constant heat input along it's length and width
3. The airflow at the leading edge if the heat sink must be in a condition having a Reynolds number of less than 4x10^5
4. The airflow along the heat sink surface must be parallel with the length of the extrusion and with natural convection air speed of 3280 ft/hr
5. Enclosure length is 0.525 ft (160mm)

Finding Heat Transfer Coefficient

$$\frac{\boldsymbol{Hc}}{D * Cp * V} * (Cp * \frac{Dv}{K})^{0.66} = \frac{0.664}{(D * V * \frac{L}{Dv})^{0.5}}$$

Solve for **Hc**

Variable	Value	Units	Description
Hc	0.873	BTU/h ft^2 °F	Heat Transfer Coefficient
D	0.075	lbs/ft^2	Air Density @ 77°F
Cp	0.241	BTU/lb ft	Specific Heat @ 77°F
V	3280	ft/h	Velocity of Air
Dv	0.044	lb/h ft	Dynamic Viscosity of air @ 77°F
K	0.014	BTU/h F ft^2/ft	Thermal Conductivity of Air @ 77°F
L	0.525	ft	Enclosure length

Finding Thermal Transfer Coefficient

$$R_{SA} = \frac{60}{Hc * A * 17.57 * 1.8}$$

Variable	Value	Units	Description
Rsa	1.580	C/W	Thermal Transfer Coefficient
A	1.376	ft^2	Enclosure outside surface area

Conversions

17.57 converts BTU/min to W
1.8 converts °F to °C
60 converts h to min

Enclosure Thermal Transfer Coefficient

Enclosure	A	Rsa
1455NHD	1.367	1.58

Resources

"Simplified Method for Estimating Heat Sink Thermal Resistance - Rsa Forced Convection Applications." Wakefield Solutions Thermodynamics 24 July 2011: 2-6

"Absolute and Kinematic Viscosity of Air at Standard Atmospheric Pressure." Chart. The Engineering Toolbox. 29 Nov. 2013 <http://www.engineeringtoolbox.com/air-absolute-kinematic-viscosity-d_601.html>.

"Temperature, density, specific heat, thermal conductivity, expansion coefficient, kinematic viscosity and Prandtl's number for temperatures ranging -150 - 400 °C." Chart. The Engineering Toolbox. 29 Nov. 2013 <http://www.engineeringtoolbox.com/air-properties-d_156.html>.