Heating & Cooling

Water Chiller

The process of selecting water chiller includes two parts: calculation of refrigerating capacity and calculation of cooling water capacity.

Calculation of Refrigerating Capacity

$Q=SH\times M\times T_d\times S_1+P_{HT}\times 860\times S_2+P_{IMM}\times 860\times S_3$

Notes:

Q=Required refrigerating power (kcal/hr)

SH=Material specific heat (kcal/kg.℃)

M=Molding machine productivity(kg/hr)

T_d=Molding-demolding temperature difference (200℃)

S_1=Safety factor (1.5~2.0)

P_{HT}=Hot runner power (kW)

S_2=Power on time factor of hot runner (0.6~0.8)

P_{IMM}=Oil pump power of molding machine (kW)

S_3=Oil pump power factor of molding machine (0.35~0.5)

Calculation of Cooling Water Capacity

Besides meeting the requirement of refrigerating power, it's also necessary to calculate the required cooling water flow. The larger the cooling water flow is in unit time, the more heat can be taken away, which brings better cooling effect.

$L_1=Q/(SH\times T_d\times SD)/1000$

Notes:

L_1=Cooling water flow(m^3/hr)

Q=Required refrigerating power(kcal/hr)

SH=Specific heat of water (kcal/kg.℃), which usually is 1.

T_d=Inlet-outlet temperature difference of mold (5)

SD=Specific gravity of water (kg/L), which usually is 1.

If it's water-cooled water chiller, it's necessary to calculate the cooling water flow:

$L_2=(Q+P_C\times 860)/(SH\times T_d\times SD)/1000$

Notes:

L_2=Cooling water flow (m^3/hr)

Q=Required refrigerating power (kcal/hr)

P_C=Compressor power (kW)

SH=Specific heat of water (kcal/kg.℃), which usually is 1.

T_d=Inlet-outlet temperature difference of mold (5)

SD=Specific gravity of water (kg/L), which usually is 1.

Mold Temperature Controller

Mold temperature controller can be selected according to the following formula under the condition of meeting the requirement of highest working temperature and heating medium.

Calculation of heating efficiency

$Q_H=SH\times M\times T_d\times S_1/T_H$

Notes:

Q_H=Required heating power (kcal/hr)

SH=Specific heat of mold material (kcal/kg.℃), which usually is 0.109.

M=Weight of mold (kg)

T_d=Environment-mold temperature difference (℃)

S_1=Safety factor (1.5~2.0)

T_H=Required heating time (hr)

Calculation of cooling capacity

$Q_C=SH\times M\times T\times S_1+P_{HT}\times 860\times S_2$

Notes:

Q_C=Required cooling power (kcal/hr)

SH=Specific heat of material (kcal/kg.℃)

M=Productivity of molding machine (kg/hr)

T=Molding - demolding temperature difference 200℃

S_1=Safety factor (1.5~2.0)

P_{HT}=Hot runner power (kW)

S_2=Power on time factor of hot runner (0.6~0.8)

Calculation of pump flow

$L_1=Q_C/(SH\times T_d\times SD)/1000$

Notes:

L_1=Required pump flow (m^3/hr)

Q_C=Required cooling power (kcal/hr)

SH_W=Specific heat of water (kcal/kg.℃), which usually is 1.

T_d=Inlet-outlet temperature difference of mold (5)

SD_W=Specific gravity of water (kg/L), which usually is 1.

SH_W=Specific heat of heat conducting oil (kcal/kg.℃), which usually is 0.57.

SD_W=Specific gravity of heat conducting oil (kg/L), which usually is 0.8.

Unit Conversion

	Before Conversion	After Conversion	Conversion Value
Temp.	°F ℃	℃ °F	(°F-32)×5/9=℃ (℃+32)×9/5=°F
Unit Volume	GPM CFM L/min	m^3/hr m^3/hr m^3/hr	0.2271 1.6992 0.06
Unit Weight	PSI bar Kpa	kg/m^2 kg/m^2 kg/m^2	0.2271 1.6992 0.06
Length	inch foot dm	mm mm mm	25.4 304.8 100
Volume	cu inches cu feet L(dm^3) L(dm^3)	L(dm^3) L(dm^3) m^3 cm^3	0.0164 28.3168 0.001 1000
Power	kw kw kw kw kw	kcal/hr BTU/hr hp kj/hr RT	860 3413 1.341 3612 3.5163
Heat	kcal kj BTU	kj kcal kcal	4.2 0.2381 0.252
Weight	kg pounds	pound kg	2.2046 0.4536
Area	sq inches m^2 sq feet	cm^2 cm^2 m^2	6.4516 10000 0.0929