PMMDA GUIDE TO CHILLERS

Guide to CHILLERS

Guidelines for Enthalpy of Materials and Processes

These guidelines are the agreed basis for the calculation of cooling capacity requirements and are expressed in kilocalories per kilogram per hour of material throughput.

Material	KCal/kg/hr
ABS	130
Acrylic	75
Nylons	180
PET (General)	150
Polycarbonate	70
High Density Polythene	200
Low Density Polythene	180
Polypropylene	150
Polystyrene	120
PVC (Unplasticised)	120
PVC (+30% Plasticiser)	130

Process Adjustment Factors

Process	Factor
Injection Moulding	1
Extrusion Blow Moulding	0.8
Extrusion (Profile & Pipe)	0.8
Inj. & Inj. Stretch Blow Moulding	0.8

Other Factors and Constants
Un-insulated Hot Runner = 80%of installed power in kW
Insulated Hot Runner = 60% of installed power in kW
Throat Cooling 2.3 kCals/hr per kg.

Conversion to kW: kCal/hr ÷ 806 = kW

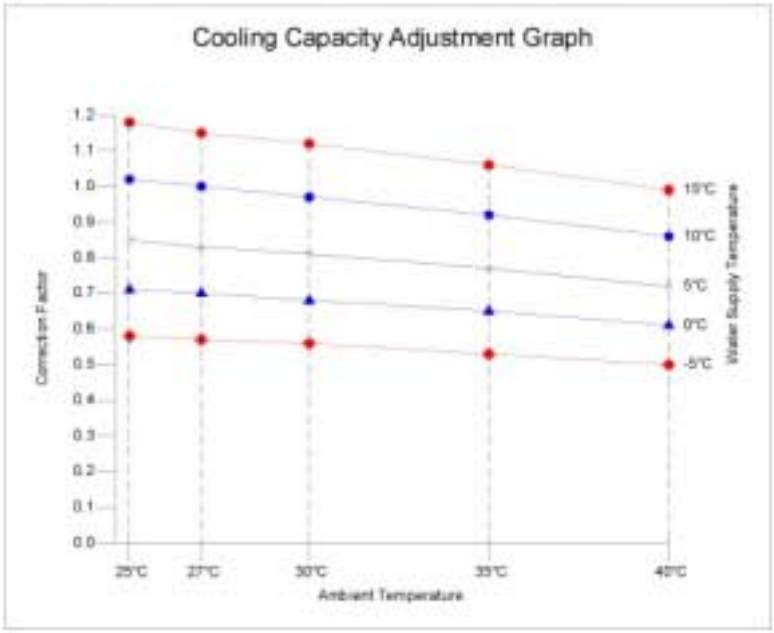
Machine Cooling - Injection Moulding Machines - Hydraulic Motor expressed in kW
1. General cycling (cycle time more than 10 seconds) 35% of hydraulic motor capacity in kW
2. Fast cycling (cycle time 10 seconds or below3) - 50% of hydraulic motor capacity in kW
3. Accumulator assisted - 60% of hydraulic motor kW

Extrusion - Vacuum calibrators motor kW @80%

The Cooling Capacity of an Air Cooled Water chiller is affected by the ambient air temperature and the water leaving temperature. The PMMDA Nominal Chiller Rating (see next page) is based on an ambient temperature of 27°C and a water leaving temperature to the process 10°C.

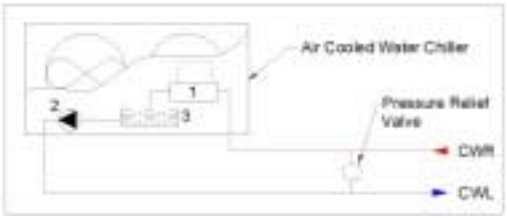
The graph below can be used to adjust the cooling capacity if either or both these variables are changed to meet customers individual requirements which is expressed as the "RATED COOLING CAPACITY".
For example, if a chiller has a "NOMINAL COOLING CAPACITY" of 15 kW but the ambient temperature is 30°C and the water leaving temperature is 5°C. The correction factor is 0.83. The "RATED COOLING CAPACITY" is therefore 15kW x 0.83 = 12.5kW.

Note – this is for guidance only, exact performance at specification should be confirmed by the chiller manufacturer/supplier.



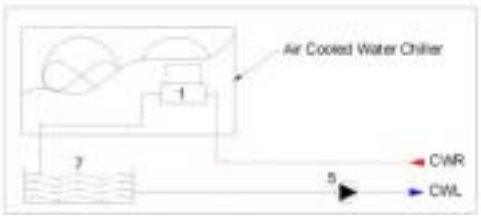
Examples of Chillers and Cooling

Circuit diagram
Packed chiller with integral tank and pump



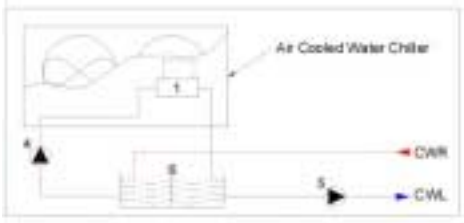
Application
For small to medium closed circuit cooling duties i.e. injection moulding machines.

Circuit diagram
Chiller without tank and pump.



Application
For closed circuit cooling duties where tanks and pumps cannot be installed in the chiller, or larger than standard are required to meet specific consumer needs.

Circuit diagram
Chiller without tank and pump.



Legend

1 - evaporator	7	- buffer tank
2 - integral pump	CWL	- chiller water/glycol leaving
3 - integral tank	CWR	- chiller water/glycol return
4 - external chiller pump(s)	- - -	- refrigerant circuit
5 - external consumer pump(s)	———	- chilled water circuit
6 - weir tank	———	- return water circuit

Application
For medium to large closed circuit cooling duties where there are a number of consumers requiring variable flow rates.

GLOSSARY

Compressor	-	Heat of the refrigeration system, pumps the refrigerant around the circuit.
Evaporator	-	Heat exchanger which absorbs the heat from the consumer cooling water/glycol via the refrigerant. Can be plate, shell or tube, or submerged coil type.
Condenser	-	Rejects heat from the refrigerant either to atmosphere in air cooled chillers or via cooling towers or dry air coolers, for example in water cooled chillers. Water cooled condensers can be plate or shell and tube type.
Condenser Fan	-	CENTRIFUGAL - High pressure type fan ideal for ducting the hot air from the air cooled condenser into the factory for winter heating and out of the factory for summer ventilation.
	-	AXIS - Free air discharge, not suitable for connection to duct work.
Refridgerant	-	The heat transfer gas to the refrigeration system.
Expansion Valve	-	Controls the flow of liquid refrigerant to the evaporator depending on the consumer demands.
Safety Controls	-	HP SWITCH - Protects the refrigeration system from, for example, over pressure, caused by high ambient temperatures, restricted air flow on air cooled and water flow on water cooled chillers or over demands from the consumer.
	-	LP SWITCH - Protects the refrigeration system from, for example under pressure caused by low levels of refrigerant or low ambient temperatures.
	-	FREEZESTAT - Protects evaporator against freezing.
	-	LOW SWITCH - Also protects evaporator against freezing by detecting low water/glycol flow.
	-	OIL PRESSURE SWITCH - Protects compressor against lack of lubrication.
Capacity Control	-	To reduce capacity and running costs of the chiller in the event that the consumer demands are lower. Compressors can be off loaded mechanically or stepped in the case of multi circuit.
Water Pump	-	Circulates the medium to be cooled, usually water or water/glycol around the consumer.
Pressure Relief Valve	-	Protects the pump in the event that all consumer water/glycol circuits are dosed.
Glycol	-	Antifreeze solution added to water. NOTE: Depending on quantities, will reduce the efficiency of the chiller.
Buffer Tank	-	Either installed inside the chiller or external for larger systems. The tank acts as a thermal buffer to cope with fluctuating consumer loads
Free Cooling	-	During low ambient conditions, energy costs can be reduced by circulating the cooling medium (water/glycol), through a "free cooling" coil. This can be either built into the air cooled chiller or be independent of it. Fans draw cold air across the coil, pre-cooling the water/glycol and in best conditions, completely removed the need for mechanical refrigeration to take place.
Weir Tank	-	Installed outside the chiller and with two pumps, enables the consumer and chiller to operate at their own design flow rates.

QUOTATION GUIDE

Chiller Model Number and Reference (Air or water cooled) _____

Specification

Description	Unit	Customer Rated Values	PMMDA Nominal Values
Calculated Cooling Capacity	kW		
CONDENSOR TYPE			
Water/Glycol entering temperature	°C		
Water/Glycol return temperature	°C		
Percentage Glycol required	%		
CONDENSOR RATING (Air/Water cooled)			
Ambient air temperature	°C		27
Air volume	m3/s		
Or			
Water/Glycol entering temperature	°C		15
Water/Glycol leaving temperature	°C		10
Water/Glycol flow rate	l/s		
Percentage Glycol required	%		
PUMP RATING			
Size	kW		
Flow rate	l/s		
Available pressure	Bar		
Tank volume (ltrs) where fitted	l		
FAN RATING			
Type	Centrifugal ☐	Axial ☐	Multistage ☐
Number	kW		
Power input (each fan)	Pa		
Static pressure			
EVAPORATOR TYPE	Plate ☐	Shell or tube ☐	Submerged Coil ☐
COMPRESSOR RATING			
Type Hermetic scroll	Hermetic ☐	Semi Hermetic ☐	Screw ☐
Power input kW each	kW		
No. of compressors			
No. of steps			
CHILLER ELECTRICAL RATING			
Electrical supply	v/ph/Hz		
Total compressor power input	kW		
Total pump power input	kW		
Total fan power input	kW		
Total installed power	kW		
CHILLER DIMENSIONS (L x W x H)	mm		
Dry weight	kg		
Operating weight	kg		
Consumer connection type	Flanged/screwed		
Consumer connection sizes	Inches		
Condenser connections (if applicable)	Inches		

This equipment conforms to CE Mark Regulations YES / NO

Guarantee:
The PMMDA warranty requires that all water chilling equipment is guaranteed for 12 months from the date of installation and commissioning or the date of delivery to the customer, whichever is the earlier, against faulty workmanship or materials. This warranty states that all parts will be replaced free of charge including labour costs of removal and replacement. This warranty specifically excludes the cost of repairs caused by freezing due to inappropriate use, negligence, or failure to operate the chiller in accordance with the manufacturers or suppliers written instructions.
Cooling Capacity Correction Factors

The " GUIDE TO .. " series are produced by PMMDA

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