5 Sizing Steps for Chillers in Plastic Process Cooling

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No matter what your application, there is a single formula for determining the size of chiller you need. Before you begin, you must know three variables:

1. The incoming water temperature
2. The chilled water temperature required
3. The flow rate

For our example, we will calculate what size chiller is required to cool 40 GPM (gallons per minute) from 70 °F to 58 °F? Use the following five steps and general sizing formula:

1. Calculate Temperature Differential (ΔT°F)

ΔT°F = Incoming Water Temperature (°F) - Required Chilled Water Temperature.

- Example: ΔT°F = 70°F - 58°F = 12°F

2. Calculate BTU/hr.

BTU/hr. = Gallons per hr x 8.33 x ΔT°F

- Example: 40 gpm x 60 x 8.33 x 12°F = 239,904 BTU/hr.

3. Calculate tons of cooling capacity

Tons = BTU/hr. ÷ 12,000

- Example: Ton capacity = 239,904 BTU/hr. ÷ 12,000 = 19.992 tons

4. Oversize the chiller by 20%

Ideal Size in Tons = Tons x 1.2

- Example: 19.992 x 1.2 = 23.9904

5. You have the ideal size for your needs

- Example: a 23.9904 (or 25-Ton) chiller is required

Plastic Process Cooling Applications

There also industry-specific, rules-of-thumb for chiller sizing. These may vary depending upon the application. The below guidelines and formula may be used for sizing chillers for plastic process cooling applications. In our example, we will calculate what size chiller is needed for a polypropylene molding operation that incorporates a 6oz. "Shot Size" and a 18 second cycle time with a 3 H.P. hydraulic motor. We will use Charts 1 and 2 as references.

1. Calculate the pounds of material per hour being processed.

- Example: 6 oz. / 18 sec. = 19.99 oz/min (20.00 oz./min)
- 20 oz. / min x 60 min. = 1200 oz/hr
- 1200/16 = 75 lbs. / hr

2. Determine how many pounds per hour are required for each ton of cooling capacity using Chart 1.

- Example: Polypropylene requires 1 ton of cooling capacity for every 35 lbs./hr processed
- 75 lbs. ÷ 35 lbs. = 2.14 tons of cooling

3. Determine if the extruder or any auxiliary equipment will require chilled water using Chart 2. If not, go to step #5.

- Example: A hydraulic motor requires 0.1 ton/HP of cooling capacity
- 3 HP x 0.1 ton/HP = 0.3 ton of capacity

4. Combine the process and auxiliary equipment cooling requirements.

- Example: 2.14 tons + 0.3 ton = 2.44 tons

5. Size your chiller by rounding up to the closest standard unit.

- Example: This application will require a 3-ton unit

Chart 1: Plastic Material Process Cooling Requirements

Injection Molding	30#/hr H.D. Polyethylene	1 ton
	35#/hr L.D. Polyethylene/Polypropylene	1 ton
	40#/hr Nylon	1 ton
	50#/hr Polystyrene or ABS	1 ton
	65#/hr PVC or Polycarbonate	1 ton
	70#/hr P.E.T	1 ton
Extrusion		
	50#/hr Polyethylene/Polypropylene	1 ton
	75#/hr Polystyrene	1 ton
	80 #/hr PVC	1 ton
Blow Molding	35#/hr Polyolefins	1 ton

Chart 2: Auxiliary Equipment and Extruder Cooling Requirements

Extruder Cooling	Gear box cooling	1 ton/100 hp
	Feed throat: 3” screw or less	1 ton
	Feed throat: larger than 3” screw	2 ton
	Barrel or screw cooling (per inch of screw diameter)	1 ton/inch
Auxiliary Equipment Cooling		
	Air compressor (no aftercooler)	0.16 ton/hp
	Air compressor (with aftercooler)	0.2 ton/hp
	Vacuum pump	0.1 ton/hp
	Hydraulic cooling	0.1 ton/hp

	Hot runner mold	0.1 ton/hp
	Water pump in circuit	0.1 ton/hp
	Feed throat: less than 400 ton	0.5 ton
	Feed throat: greater than 400 ton	1 ton