EXTRUSION SYSTEM COOLING

In a sheet extrusion process, molten resin is passed through an extrusion die and perhaps across a set of chilled rolls. Profile extrusions similarly pass through a die and are typically passed into a tank or extrusion bath with chilled water flowing countercurrent to the direction of product flow. Molten resins are melted by both heat and friction within the screw and throat of the extruder. Some extrusion baths are cooled by tower water, others by chilled water depending on the process and resin used.

Vacuum pumps are also used in some extrusion processes for profiles. The vacuum pump helps shape the extruded part in a die as the plastic flows from the die. In most situations, cooling water will flow from the die and continue to the vacuum pump. In some configurations, the vacuum pump will have its own source of cooling water from tower service.

See illustration of a typical extrusion bath and cooling system in this section.

Calculating Extrusion Bath Heat Loads

If the extrusion process passes the extruded shape into a cooling bath, calculate the heat load as follows:

Q = Lbs per hour x Specific Heat x Delta-T

Calculating Chilled Roll Cooling

Is is safe to use the above formula for calculating the roll heat load provided the chilled roll is designed to produce the entire temperature change from semi-molten to solidified state. However, in practical application, the entire Delta-T as typical in injection molding is less in extrusion. Refer to the customer or manufacturer of equipment to determine the correct temperature change across the chilled roll, or if this information is not available, calculate based on the entire heat load and qualify this fact with the customer.

Q = Lbs per hour x Specific Heat x Delta-T

Calculating Vacuum Pump Heat Load

Provided the extrusion process produces profiles that require a vacuum pump, it is best to determine the cooling source whether it is by chilled water or service water. In the process, only a portion of the total input kW from the vacuum pump results in heat added to the cooling water heat load. A rule of thumb is to allocate 60% of the total kW input:

Btuh = Total Pump HP x 2544 x 60%

Calculating Throat Cooling Load

The generally recognized rule of thumb for throat cooling is to allow 12,000 Btuh per inch of throat diameter.

Btuh = Total diameter of all throats x 12,000 Btuh