Fulton Heating Solutions, Inc.

Engineering Guide

Condensing Hydronic Boilers

Calculating Flow Rate

To calculate hydronic heating system flow rate, use the heat transfer equation below. The information required will include the boiler output and/or heating load (Q) in BTU/hr, the fluid type heat capacity (c_p), and the design delta-T (ΔT):

$$Q = \dot{m} \times c_p \times \Delta T$$

Solve for $\dot{m}$ and for simplicity, convert the flow rate units from lbs/hr to gallons/minute (60 min/hr × 8.34 lbs/gal = 500.4):

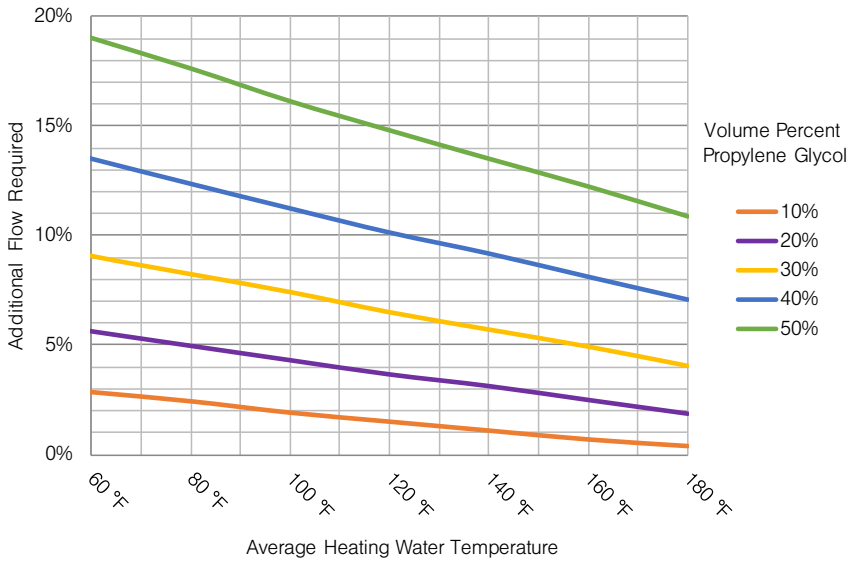
$$GPM = \frac{Q}{500.4 \times c_p \times \Delta T}$$

For water systems (no glycol), c_p is assumed as 1.0. Glycol solutions will require the correct c_p is used, reference the table below:

Volume Percent Propylene Glycol

Heating Water Temperature	10%	20%	30%	40%	50%
60°F	0.972	0.947	0.917	0.881	0.840
80°F	0.976	0.953	0.924	0.890	0.850
100°F	0.981	0.959	0.931	0.899	0.861
120°F	0.985	0.965	0.939	0.908	0.871
140°F	0.989	0.970	0.946	0.916	0.881
160°F	0.993	0.976	0.953	0.925	0.891
180°F	0.996	0.982	0.961	0.934	0.902

The boiler itself is not de-rated when using glycol, however, due to the lower c_p of a glycol solution compared to water additional flow will be required to maintain the same BTU/hr and delta-T conditions. The chart below is a simplified reference to determine the additional flow required over a water (no glycol) system expressed as a percentage:



Notes:

1. Specific heat values obtained in engineering data from Dow DOWFROST® Propylene Glycol heat transfer fluids.
2. Glycol systems utilizing Endura+ boilers require a minimum 30 psi system pressure measured at the boiler outlet.