Bell & Gossett CounterPoint™

Volume 2 Issue 2 March 1995

Baseboard Loop Rules of Thumb

The copper-fin baseboard loop is probably the most popular type of residential hydronic heating there is. Contractors love baseboard loops because they're easy to install and usually run trouble-free. There are times, however, when problems can appear, even with a system as simple as this one. The funny thing is, it's usually the simplicity of the system that creates the problems in the first place!

You can avoid problems if you keep a few simple rules of thumb in mind.

Flow is the "train" that carries the heat.

Heat moves on the flow of water like a passenger on a train. The heat gets on in the boiler and off in the radiators. To keep things simple, heating professionals usually work with a 20-degree temperature difference from supply to return. That means that if the water leaves the boiler at, say, 190 degrees on a very cold day, it will return from the radiators at about 170 degrees. That gives you an average water temperature in the baseboard radiation of 180 degrees.

Now, at 180 degrees, each linear foot of copper fin-tube baseboard (1/2" and 3/4" sizes) will give off about 600 BTU/Hr. Let's say you were sizing baseboard for a room with a heat loss of 6,000 BTU/Hr. You'd probably install 10 feet of either 1/2" or 3/4" baseboard. That would keep everyone warm on the coldest day of the year.

There's a rule of thumb that makes flow rate easy to figure. **Divide the boiler's D.O.E. Heating Capacity by 10,000 to get the flow rate at a 20-degree temperature difference.** So, for instance, if you had a boiler with a D.O.E. Heating Capacity rating of 140,000, you'd usually be pumping 14 gpm around the system. From there, you'd decide how much you need to send to each zone.

How Much Flow Will a Pipe Carry?

That's a good question! You have to have the right size pipe if you're going to get the heat to where the people are. With hydronic heat, you have to take care not to oversize your circulators. You can't force water through a too-small pipe. If you try, the water will make a whistling sound as it moves through the house. That's a sure source of callbacks!

Here are the flow rate rules of thumb for common residential pipe sizes. Follow them, and you'll always be okay:

Pipe Size	Flow Rate in GPM	Heat Load in BTU/Hr.
1/2" copper	1-1/2	15,000
3/4" copper	4	40,000
1" copper	8	80,000
1-1/4" copper	14	140,000
1-1/4" steel	17	170,000
1-1/2" copper	22	220,000
1-1/2" steel	25	250,000

Naturally, if you were bringing two, 3/4" lines together, you'd use 1" pipe. Can you see how connecting the two lines into a 3/4" manifold would choke down the flow to both of them? This is a mistake many contractors make with loop systems. Don't let it happen to you.

Notice, too, how a 1-1/4" steel pipe can support 160,000 BTU/Hr. Stop for a minute and think about the size of the supply and return tappings in a boiler with a D.O.E. Heating Capacity of 160,000 BTU/Hr. It's probably 1-1/2", right? Now you know why. We all follow the same rules of thumb.

How Much Baseboard?

If you connect too much fin-tube to a single loop, you may run into problems on a cold day. The water can get too cool to meet the temperature needs of the last rooms on the zone. This is especially true if the people close the doors to the rooms as they probably would with a zone that ran through bedrooms.

If you want to stay out of trouble, follow these rules of thumb:

- **Never feed more than 25 linear feet of active baseboard element with a 1/2" line.**
- **Never feed more than 67 linear feet of active baseboard element with a 3/4" line.**

By "active baseboard element," we mean element that has a full flow of air moving through it. You'll appreciate this rule of thumb if you've ever made the mistake of running, say, 125 feet of 3/4" baseboard off a 3/4" line. Remember how that last bedroom was always too cool when the outdoor temperature plummeted? The water was in the loop too long. It gave up too much of its heat. Follow the rule, and you'll avoid callbacks.

How Long Can the Total Loop Be?

If the loop is too long, the pressure drop will be too high for the circulator to handle. The flow of water will slow and cool down to a point where it can't heat the last rooms on the coldest days. The problem looks just like an air problem, but it's really a flow problem.

To stay out of trouble, follow these rules of thumb:

- **When you're using a Series 100 circulator, keep your total loop under 130 feet.**
- **When you're using an SLC circulator, keep your total loop under 170 feet.**

Here, the "total loop" includes the baseboard radiation, the piping to and from the baseboard radiation, and the boiler itself.

For even more Rules of Thumb, ask your ITT Bell & Gossett representative for a copy of our popular Zoning Made Easy Rules of Thumb card. It's free!