

ENGINEERING NEWS

HOFFMAN SPECIALTY CO.
INDIANAPOLIS 7, IND.

PANEL HEATING

Panel Heating has come well to the front during the past few years. The Hoffman Hot Water Controlled Heat Series 90 is well adapted for use on such systems. In fact it is now being used for controlling many such installations, and with a marked degree of success.

You are, of course, familiar with the Hoffman Hot Water Controlled Heat Series 90, but nevertheless it may not be amiss to go through the various parts in a general way, before discussing their application to panel heating.

The system consists of five major parts, namely--

- 1 - The Hoffman Temperature Controller, of which there are four basic models, C-93, C-98, C-97 and C-99.
- 2 - The Hoffman Circulating Pipe, which bypasses the boiler.
- 3 - The Hoffman Control Valve, of which there are two types. The heat motor operated valve (D-2) is used on smaller systems, that is up to and including 2". For sizes of 2-1/2" and larger, a motor operated valve is used.
- 4 - The Hoffman Union with Orifice is a calibrated orifice, and balances the circuits through the boiler and the Hoffman circulating pipe. It is so sized that two times as much water flows through the boiler as flows through the circulating pipe, when the control valve is wide open. The size of the orifice depends only on the resistance of flow through the control valve, and since every control valve has a definite orifice to go with it, it need not be specified separately.
- 5 - The Hoffman Circulator comes in all sizes from 1" to 3" inclusive. Except for special cases, they are furnished in the same size as the control valve. On systems larger than 3" a larger pump than the one which we regularly handle must be used. At times an Economy pump will fit into the picture, or one of the larger types of B&G circulators, such as the belt driven model, or the Universal Pump.

SERIES 90 APPLIED TO PANEL HEATING:

All of the standard parts are used when the Series 90 is applied to panel heating.

Temperature Controller: The brains of the Series 90 system is of course the Temperature Controller. It is the function of the Hoffman Temperature Controller to supply water to the heating system at the temperature demanded by the outdoor temperature existing at the moment. In order, however, to set it properly so that it may perform this function in a satisfactory manner, it is necessary that the designer of the panel heating system tell us what water temperature he desires at several outdoor temperatures. As a rule, the water temperature of panel heating systems is expressed as a mean temperature - that is the average between the supply and return. We must, therefore also know for what temperature drop (difference between supply and return) the system was designed when operating at the lowest outdoor temperature (design temperature). The following is the information necessary:-

- 1 - Room air temperature.
- 2 - Design temperature (lowest outdoor).
- 3 - Mean water temperature at design temperature.
- 4 - Mean water temperature at outdoor temperature of +40F or some other definite but relatively high temperature.
- 5 - Maximum temperature drop for which the system was designed.

From this information the controller can be set at the factory and we can guarantee that it will supply the correct water temperature for any outdoor temperature, provided of course the information transmitted to us was correct.

Sometimes a designer will calculate a system based on a published empirical formula and cannot give the information in the above shape. In that case, the following information is necessary so we can make a fairly accurate calculation of the water temperature for different outdoor temperatures:

- 1 - Describe the panel. Does the system consist of a floor, a ceiling or a wall type panel? In case it is a combination of several, describe each panel separately.
- 2 - Size and spacing of the pipe in each panel.
- 3 - The calculated output of each panel in Btu per sq.ft. per hour.
- 4 - The design temperature (lowest outdoor temperature).
- 5 - The room air temperature to be maintained.
- 6 - Maximum temperature drop between supply and return.

In addition to the information necessary to set the Hoffman Temperature Controller, we must also have the mechanical specifications for this instrument. There are four basic models of the controller, namely-- C-93, C-98, C-97 and C-99.

The C-93 and C-98 are used when the system employs a heat motor operated valve, and this should never be used on installations over 2". The two controllers differ from each other inasmuch as the C-93 is built to handle 115V a.c., whereas the C-98 is built to handle 220V a.c.

The C-97 and C-99 are again similar but are designed to function with a motor operated valve, and this is used on all installations of 2-1/2" and larger. They differ from each other only inasmuch as the C-97 is built for 115V a.c., and the C-99 is for 220V a.c.

There are six variations of each of these four basic models. These variations consist only in difference of construction and length of the capillary tubing leading from the controller to the water bulb and the outdoor bulb. There are six such variations as shown on the attached table, viz.,

Both capillaries plain, 25 ft. each.

Both capillaries plain, 50 ft. each.

Both capillaries plain, one leading to the outdoor bulb 50 feet in length and the one leading to the water bulb 25 feet in length.

The other three variations use these same lengths, but the capillaries are surrounded by a protecting armor.

Some engineers and architects specify that the capillary tubing must be protected. It is not good practice to remove the bellows, capillary and the bulb assembly from the control box and pull it through a conduit, therefore we suggest that where a protection is specified, that one of our models having armored capillary be used.

You will note from the table* that the "model parts list" designates which of these various capillary assemblies is to be used in the controller. Our standard assemblies are C-93-A2, C-98-B2, C-97-C2 and C-99-D2. In other words, the plain capillary, 25 ft. long, to each bulb is our standard equipment and should be specified whenever possible.

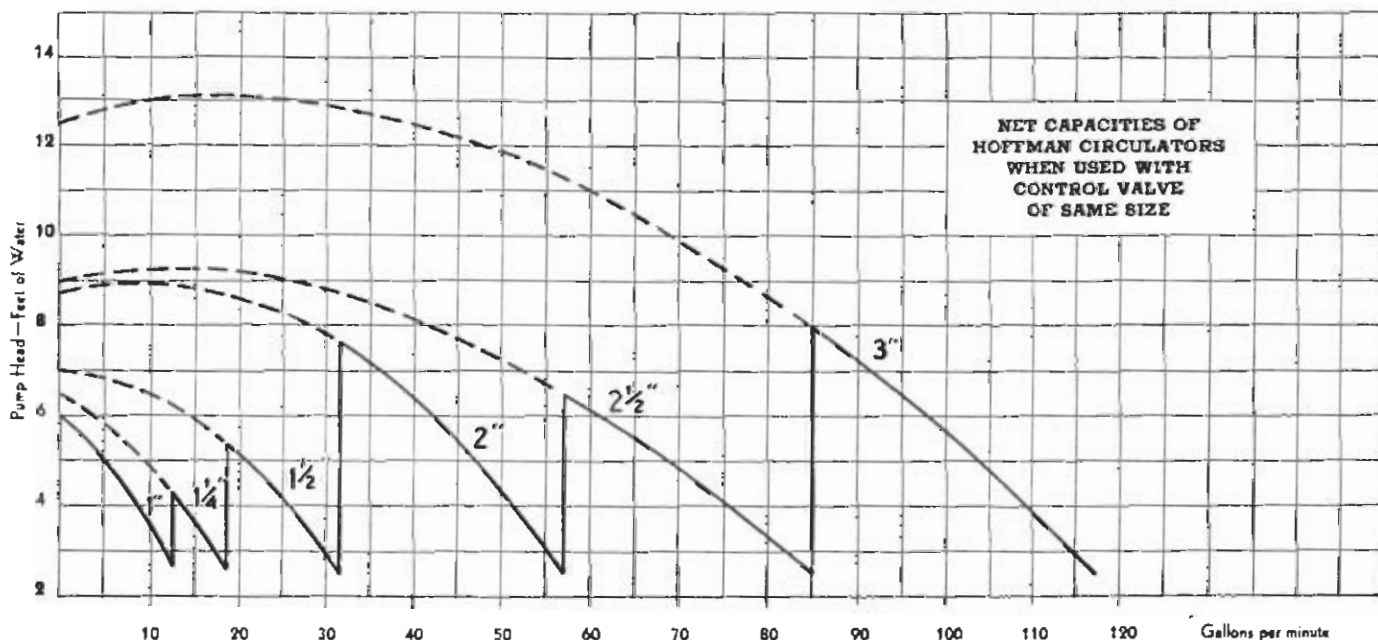
When you order a 115V controller for a smaller size (not over 2") and desire to have a perfectly standard instrument with 25 ft. plain capillary to each bulb, please specify a Model C-93-A2. If your customer desires to have, for example, an instrument equipped with 50 ft. of armored capillary to the outdoor bulb,

* see page 6.

and 25 ft. armored capillary to the water bulb for a 1-1/2" valve, the controller to operate on 220V a.c., then specify a Model C-98-B9.

Control Valve: In addition to specifying the model of the temperature controller, you must of course specify the size of the Control Valve. The size of the valve is usually specified by the designer of the heating system, and is the same size as his return piping into the boiler. The union and orifice need not be specified, since it is included with the Control Valve.

Circulator: Ordinarily the size of the circulator is also the same as the return piping, and therefore the same size as the valve. In Panel Heating, however, the resistance of all the piping including that of the panel coils may be so high that this same size circulator will not be large enough. In addition to that, a panel heating system is frequently designed for only a 10° temperature drop between supply and return. This, in itself, means that the circulator must handle twice the amount of water as in an ordinary radiator system designed for the usual 20° drop. You should point this out to your customer, and have him tell you how much water he is going to pump and against what resistance. To aid you in the selection of the proper circulator size, I am attaching a chart showing the capacity of our various size circulators.



On this chart, the resistance of our control valve has already been subtracted, and that, therefore, need cause you no worries. You will note that on the chart, part of the lines are

solid, and part of them are dotted. The solid curves show the usual range in an ordinary radiator system for which each size circulator is used. In a Panel Heating System, however, you may use the dotted portion of the various curves. For example - for delivering 70 gpm a 2-1/2" circulator would usually be used in an ordinary radiator system, and this size would deliver this quantity of water against practically a 5 ft. head. Substituting, however, a 3" circulator we find from the chart that this size circulator delivers 70 gpm against practically a 10 ft. head. If your customer cannot give you information regarding the quantity of water and the resistance against which it must be pumped, you can calculate it from the data given on Chapter 15 of the ASH&VE Guide 1945. It is of course necessary that you have a piping layout of the job and know the temperature drop between supply and return, and the total Btu output of the system under maximum conditions. If you need any help in working this out, I shall be glad to have you get in touch with me.

I fully realize that this dissertation may not be as clear as it should be. If there are any points which are not clear to you, I shall be very glad indeed to have you drop me a line, and I will see if I can help you. Also, if you have any information on new systems, new uses for our temperature controller, or anything which you think would be of Engineering value, pass it along.



Ferdinand Jehle.
Director of Engineering.

HOFFMAN TEMPERATURE CONTROLLER.
Basic Models and Their Variations

Basic Model	Model Parts List	Voltage	Capillary	Switch	Valve and Transformer.
C-93	A-2	115 a.c.	Outside 25 ft. Water 25 ft.	Single Pole Single Throw A-87	Heat Motor D-2 Bell Ringing B-4 Transformer Use only on sizes up to and including 2".
C-93	A-3	115 a.c.	Outside 50 ft. Water 50 ft.		
C-93	A-6	115 a.c.	Outside 25 ft. armored Water 25 ft. armored		
C-93	A-7	115 a.c.	Outside 50 ft. armored Water 50 ft. armored		
C-93	A-9	115 a.c.	Outside 50 ft. armored Water 25 ft. armored		
C-93	A-10	115 a.c.	Outside 50 ft. Water 25 ft.		
C-98	B-2	220 a.c.	Outside 25 ft. Water 25 ft.	Single Pole Single Throw A-87	Heat Motor D-2 Bell Ringing B-19 Transformer. Use only on sizes up to and including 2".
C-98	B-3	220 a.c.	Outside 50 ft. Water 50 ft.		
C-98	B-6	220 a.c.	Outside 25 ft. armored Water 25 ft. armored		
C-98	B-7	220 a.c.	Outside 50 ft. armored Water 50 ft. armored		
C-98	B-9	220 a.c.	Outside 50 ft. armored Water 25 ft. armored		
C-98	B-10	220 a.c.	Outside 50 ft. Water 25 ft.		
C-97	C-2	115 a.c.	Outside 25 ft. Water 25 ft.	Single Pole Double Throw A-167	Reversing Motor Power Transformer (fused). Use on sizes 2-1/2" and larger.
C-97	C-3	115 a.c.	Outside 50 ft. Water 50 ft.		
C-97	C-6	115 a.c.	Outside 25 ft. armored Water 25 ft. armored		
C-97	C-7	115 a.c.	Outside 50 ft. armored Water 50 ft. armored		
C-97	C-9	115 a.c.	Outside 50 ft. armored Water 25 ft. armored		
C-97	C-10	115 a.c.	Outside 50 ft. Water 25 ft.		
C-99	D-2	220 a.c.	Outside 25 ft. Water 25 ft.	Single Pole Double Throw A-167	Reversing Motor Power Transformer (fused). Use on size 2-1/2" and larger.
C-99	D-3	220 a.c.	Outside 50 ft. Water 50 ft.		
C-99	D-6	220 a.c.	Outside 25 ft. armored Water 25 ft. armored		
C-99	D-7	220 a.c.	Outside 50 ft. armored Water 50 ft. armored		
C-99	D-9	220 a.c.	Outside 50 ft. armored Water 25 ft. armored		
C-99	D-10	220 a.c.	Outside 50 ft. Water 25 ft.		