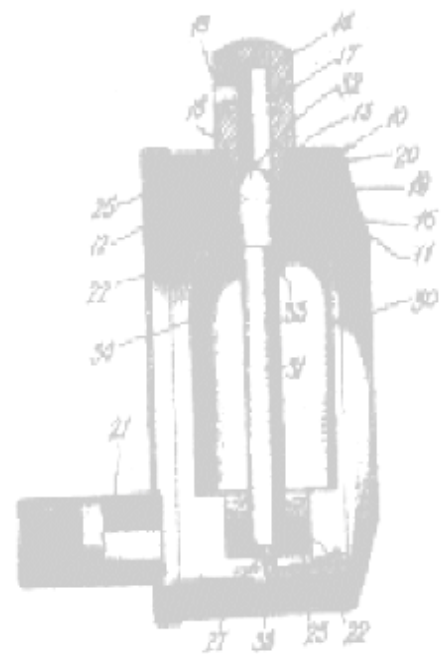
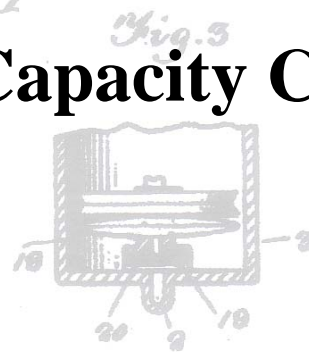
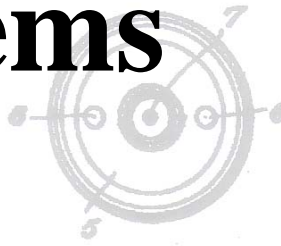
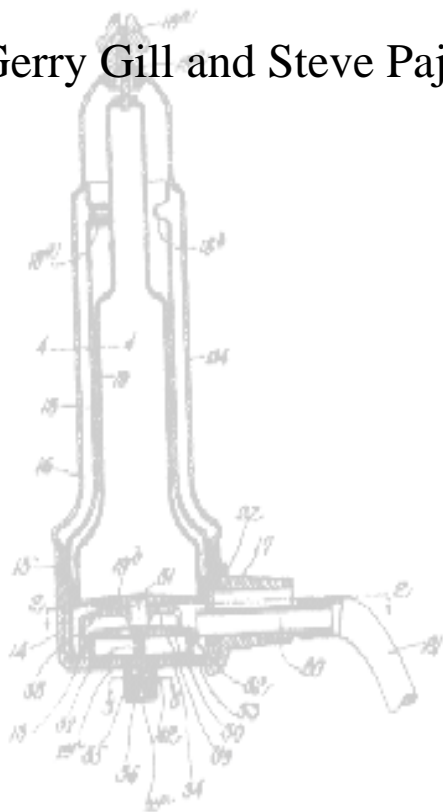


# Balancing Steam Systems

## Using a Venting Capacity Chart

By Gerry Gill and Steve Pajek



## **Venting Steam Systems Using A Capacity Chart**

A while back, Steve Pajek and I had a reason to question how much air a radiator trap could pass, since until steam hits the radiator trap, it's an air vent, or at least a venting means.

This led us to procure a quantity of Dwyer Company flowmeters and start testing devices to determine their venting capacities. We, of course, couldn't resist testing actual air vents also. What came out of these tests is the material presented in the venting capacity chart.

We presented our findings to Dan Holohan, who asked us to put together our method of using this information so that it would be presentable as more than just numbers. As he put it, "The numbers have to be used for something or they are just numbers."

So here is our methodology to balancing steam systems:

First, we would like to say that very little here is an original idea. Our methodology is compiled from those who share their insights on Heatinghelp.com's community web page known as The Wall. To Dan Holohan and all the Wallies, we say thank you.

### **Venting the steam mains**

We are firm believers in venting the main pipes as quickly as possible, and this includes the vertical main to perhaps a third floor. We don't feel that steam knows horizontal from vertical. And, if you desire to have adequate heat on the third floor as quickly as on the first floor, then the vertical riser needs a main vent at its top. So, our first step is to vent the mains, and this is how we do it.

This is a method we procured from Noel Murdough who now works for the Slant/Fin Corp. He may not even be aware that he taught us this, as it's been so long that we don't remember if he gave it to us directly, or just implied it. That's the power of The Wall. In any event, we've come to refer to this as the Noel Method. Here it is:

Take the vent off the end of the main and fire the boiler. Once the header pipe gets hot, time how long it takes for steam to get to the open pipe where you removed the vent. Let's say it takes three minutes, for example. If it takes three minutes to get steam from the header to the open pipe, then you would need to install as many main air vents as it takes, to get steam to the same point (the open pipe), in as close to three minutes as possible, but with the air vents installed. For example, if it takes three minutes with an open pipe, and it takes six minutes with a Gorton #2 air vent in place, you would add another Gorton #2 and time it again. If it now takes 3-1/2 minutes to get steam to the end of the main with two Gorton #2 air vents in place, that's only 30 seconds more than what you'd get from an open pipe. At this point, you have to make a decision as to the cost of another main vent verses a 30-second increase in speed.

Why would you get only 30 more seconds speed if adding another vent, when adding a second vent gave you 2-1/2 minutes of speed increase? Because you will not be able to vent any faster

than the open pipe did, irregardless of how many air vents you use at this point. You would be venting the main as quickly as possible with the existing tapping. The only way to increase the speed beyond this point would be to increase the diameter of the tapping, say, from ¾" to 1", or to add another tapping and start all over again.

You would then do the vertical main in the same manner.

At this point, you may be wondering what do the capacity numbers have to do with all of this. Well, it gives you an idea of where to start. Consider that ¾" pipe tapping for example. If you want to achieve the same speed as you would get from that open pipe, then you have to be able to vent the same amount of cubic feet, right? So, if an open, ¾" pipe can vent 9.5 cubic feet per minute (at 3 ounces of pressure from the boiler), then your starting point would be either to use four Gorton #2 air vents, or 10 Hoffman #75 air vents, or 23 Ventrite #77 air vents. Your choice and your dollars.

Here's how the manifolding of main vents and the chart of capacities work together.

Picture a ½" pipe tapping, with a 90-degree elbow and two Gorton #2 vents on the horizontal manifold. The combined venting of the two Gorton #2 vents (at 2 ounces of pressure from the boiler) would be 3.4 cfm (1.7 each) instead of the 1.75 cfm each is capable of venting separately. Why? Because the ½" pipe can only deliver 3.4 cfm. Divide that by two and you get 1.7.

The same setup with two Gorton #2 air vents on a ¾" pipe will vent at 3.5 cfm at 2 ounces of pressure from the boiler. That's more than an open ½" pipe will give you, and it's equal to the capacity of both vents at that pressure. See how it works? With the ½" pipe, we were limited in venting capacity by the pipe's ability to deliver cfm. With the ¾" pipe, we have plenty of pipe capacity, and the only thing limiting us now is the venting rate of the vents themselves.

In short, using more than two Gorton #2 air vents on a ½" pipe would be a waste of time and money.

A ¾" pipe at 3 ounces pressure from the boiler will pass 9.5 cfm. A Gorton #2 air vent at 3 ounces of pressure will pass 2.2 cfm. So  $9.5 \div 2.2 = 4.31$  Gorton #2 vents. Now if four Gorton #2 air vents deliver 8.8 cfm at 3 ounces of pressure, is the fifth Gorton #2 vent worth the money to gain just .7 cfm? We don't think so, but a Gorton #1 as your fifth air vent would max out the cfm potential, and that would be a good choice. Simple, isn't it?

## Venting the radiators

So now we have vented the steam mains as quickly as practical. Let's turn our attention to venting the actual radiators on a 1-pipe-steam heating system.

First, there are a couple of things to understand as far as methods go. You can size your radiators' individual air vents by using various methods. One method is to mathematically add the cubic feet of air in the runout pipes to the radiators, and the air in the radiators themselves. Put all of this together and you'll know how much air you need to vent. Divide this figure by an

arbitrary number of minutes at the end of which you'd like to see the radiator hot all the way across. Then match this cubic foot per minute rate to an appropriate air vent. We use three minutes at that arbitrary number, and that's plenty fast for us.

The next method is the geography method. You would put a certain size radiator vent on a certain radiator based upon the radiator's size and location relative to the boiler or the main. Now I'm not going to tell you one method is better than the next. Frankly, we blend both methods by sizing the vents according to the math method, and then adjusting a bit by using some applied logic and experience that is straight out of the geography method.

For instance, let's take the system in Drawing #1, for example. We like to vent everything quickly, so we will use the 1-ounce-of-pressure scale and we'll allow three minutes to get heat to the end of the radiator. By using the math-only method, you'll see in orange the size of the vents that we'd use for the radiators. Now, we accept the fact that the runouts will try to steal some steam, so we adjust upward on certain radiators, especially if they are near the mains end on a top floor. This is reflected by the green color. You'll notice in the system drawings that I'm not concerned with the mains, as they have already been vented. Let's take a look at the 40-square-foot-EDR radiator with the 20 foot of 1 1/2" runout on the left top of system drawing #1.

Referring to charts 1 & 2 (from Dan Holohans "Dead Men Steam School's" workbook), the runout has .014 cubic feet of air per linear foot of pipe. Multiply this by 20 and you'll see that the whole runout pipe contains .28 cubic feet of air. The radiator has .013 cubic foot of air for each square foot EDR. Multiply that by 40 sq. ft. and you'll see that you have .52 cubic feet of air inside the radiator when it's cold. So the total amount of air we have to vent is .52 cubic feet, plus .28 cubic feet, which gives us a total of .80 cubic feet. We said that three minutes sounded reasonable to get the steam from the main to the end of the radiator, right? Thus .80 divided by 3 = .26 cubic feet per minute, and that's our venting rate. Now go to the Vent Capacity chart (we're using Gorton vents here – you can use any manufacturer's). A Gorton "C" would handle the capacity that we need. But notice how close we are to its limits. And the radiator is not that close to the main. So we'll blend a little geography into this and raise that vent to a Gorton "D". Not that difficult, is it?

Let's look at the system in Drawing #2. Here we'll use the 2-ounce chart. Notice what it does, how it gives us smaller air vents. Why? Because at a higher pressure, a smaller air vent can yield higher venting rates. The same radiator, that at 1-ounce of pressure we would adjust from a Gorton "C" to a Gorton "D", we would now leave with a "C". Notice, too, that nothing else has changed. We have the same amount of air to vent, the same size pipes; everything is the same except for the pressure scale we used to determine which air vent to use.

Look at what happened in Drawing #3 when we use the 3-ounce scale. There are now much smaller air vents although there are a few (highlighted in green) that we would adjust upward in size. Why? Well, let's look at the same radiator. It's the one on the top left, the one with the 20-foot runout. A Gorton "6" at 3-ounces of pressure will pass .30 cfm. We have .26 to deal with, and that's close, so we would raise it to a Gorton "C". You may not want to, strictly a choice issue.

So why use three different scales? Good question. It's because we like to vent fast. We want steam quickly. Can you vent too fast? You bet. You might vent so fast that you get water hammering, or you might even cause the boiler to flood (although this hasn't happened to us yet). So you may feel more comfortable venting slower, and if that's the case, use the 2-ounce or 3-ounce scales. The pitch and the size of the pipes will determine if you made the appropriate choice.

Onward to radiator traps. You may ask, why care about the venting rate of a radiator trap? After all, a radiator trap is a radiator trap, is a radiator trap, right?

Well, no totally. Before the radiator trap handles any steam, it's actually an air vent. Its job is to pass the air in the radiator and the radiator runouts into the return pipes. Sounds sort of like an air vent now, doesn't it? But before we discuss the air venting capability of a radiator trap, let's understand something here. If you have 10 radiator traps, each capable of passing one cubic foot of air per minute into a return pipe that has an installed air vent capable of relieving say 3 cfm of air. How much air can these 10 radiators pass in one minute? The answer is 3 cfm, not 10 cfm. Can you see it? Even if the radiator traps can pass a hundred cfm it won't matter. What matters is how well the return pipe is vented. You would size this venting capacity in the same way as you sized the steam main. Serious venting of the return pipe is what you're looking for.

Let's assume the return pipe is well-vented and get back to the radiators. Let's say you're on a service call and there are a couple of bad steam traps on radiators. You notice they are Dunham #1 traps. Using the vent capacity chart, you determine from the 1-ounce column that the Dunham #1 passes 1.45 CFM of air. Using the same column, you can select a suitable replacement trap that doesn't throw off the balance of the system. A Monash #38 would work, as would a Barnes & Jones #122.

Knowing how much air a radiator trap can pass is also useful for add-on work. Suppose you're adding a trap to a system. You're installing 30 feet of new branch main, but there really is no place for a main vent. The house has existing Marsh radiator traps. You look at the chart and see that this trap can pass .53 CFM at 1-ounce of pressure from the boiler. You can now select a larger capacity trap to also handle the new mains air, something like a Monash #30 or Illinois 1G.

Question – If you have a system with existing Ideal thermostatic traps that pass air at 1.53 CFM and you replace that radiator trap with a Sarco that passes .5 CFM, how quickly do you think that radiator will heat up? Likewise, if you have a whole system of Sarco A125s and you replace one with a Barnes & Jones #122, do you think that radiator will get hot? Oh, it will be smoking, but the problem is that the rest of the radiators may not. It's a balancing game, and the vents may not look like vents, they may look like radiator traps.

Question – Is a Dunham crossover trap a radiator trap, a steam trap, or an air vent?

Answer – All and none. It's a thermostatically operated valve. Nothing more, and nothing less.

## Some Parting Thoughts

Dan Holohan (from “Dead Men’s Steam School” video) “Where there is air, there cannot be steam”.

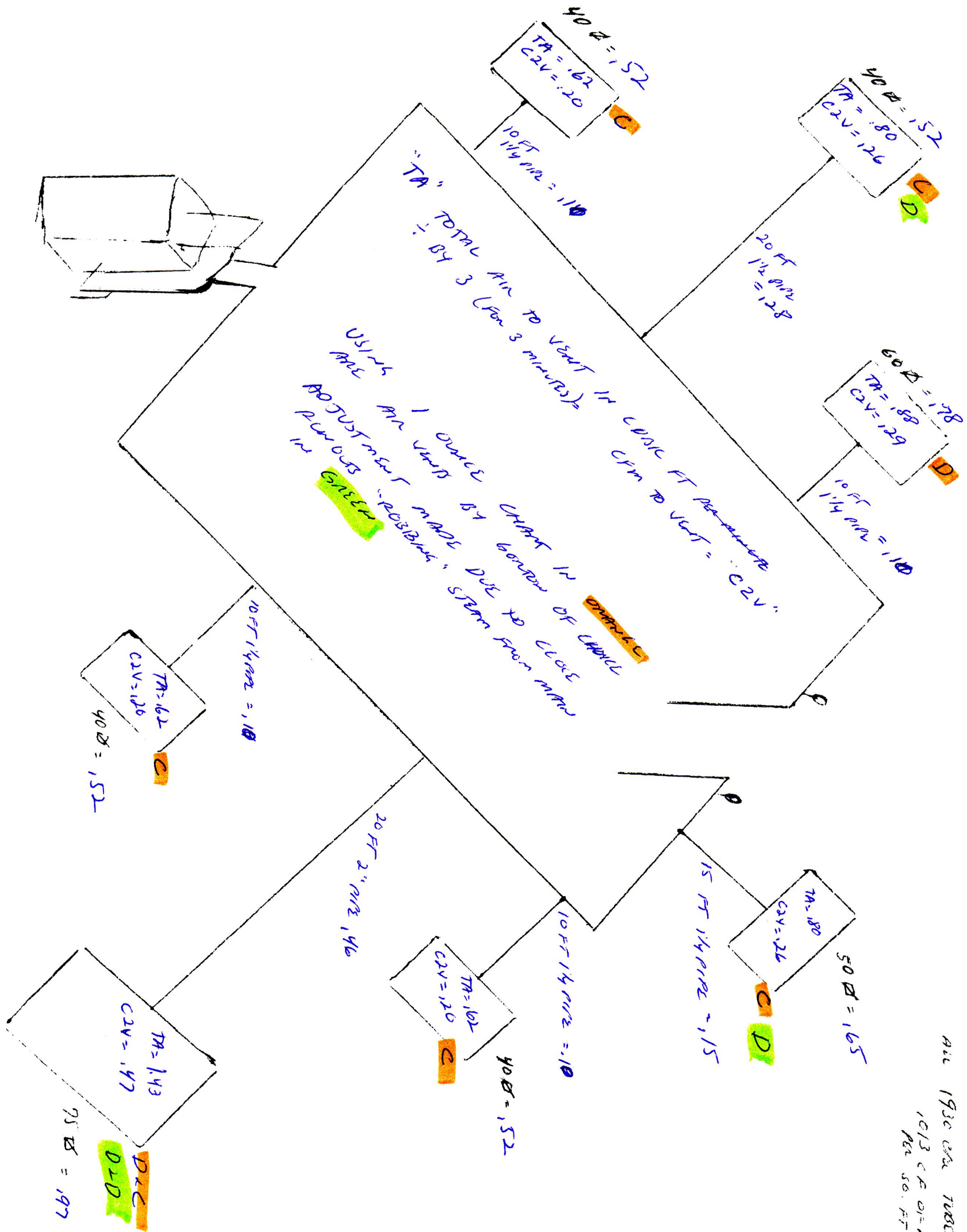
Patrick Linhardt (from “Linhardts Field Guide To Steam Heating”) “Steam up – **air out** – water back”.

Warren Webster & Co. – “The type and capacity of the trap required depend upon the point of application, **the amount of air**, and water to be removed, the character of the heating surface, and the pressure and vacuum carried. It is important that all of these conditions shall be **studied carefully**, before selection is made of the size & type of trap for specific applications”.

Gerry Gill – “Before a radiator trap is a radiator trap, it’s an air vent”.

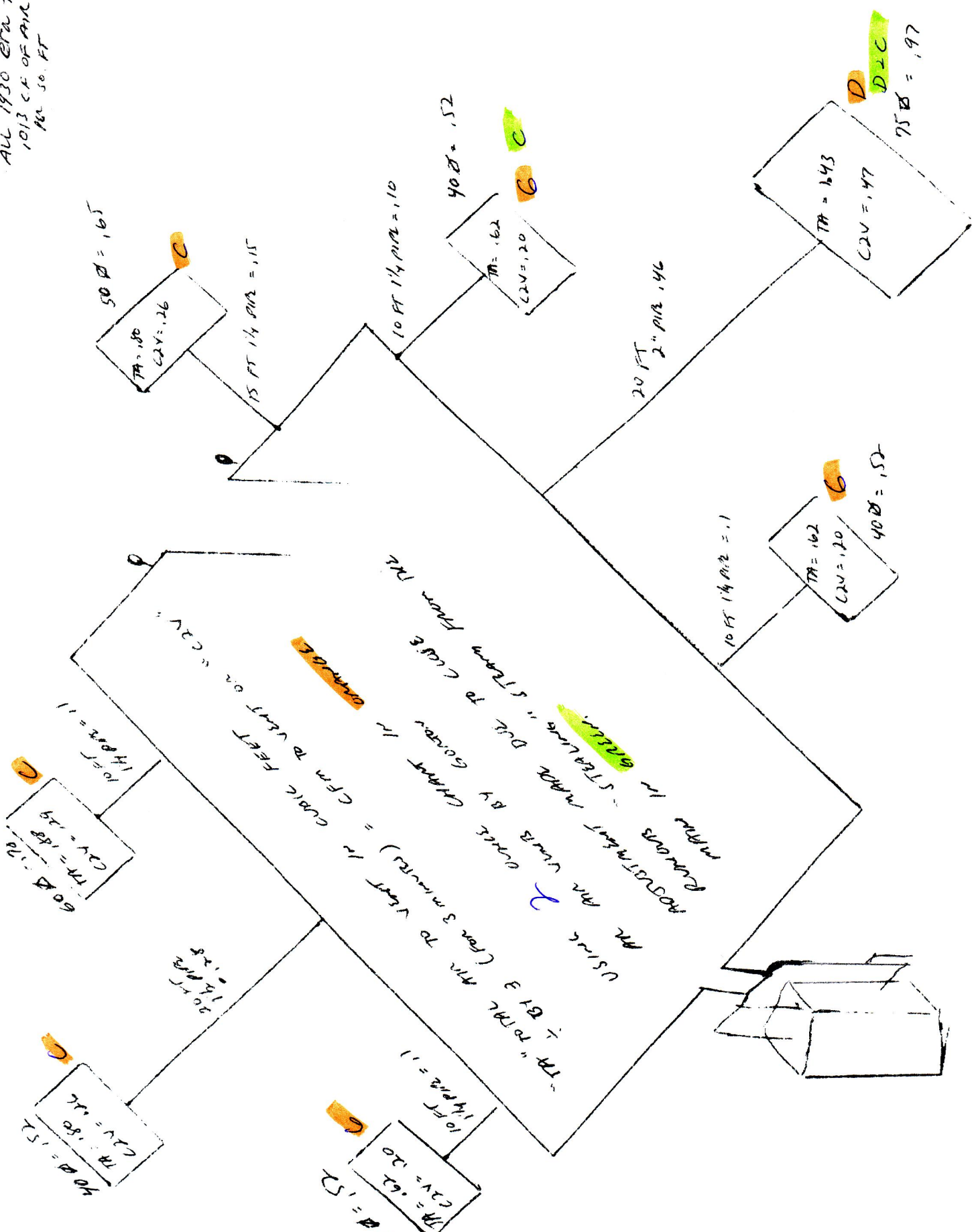
Special thanks to John Shea of Grosse Point Farms Michigan for his assistance in this project by sending pieces and parts of old steam systems from the Detroit area for capacity testing.

ALL 1930 GEA TUBE RADIATORS  
 10/3 CF OF AIR  
 PER 50. FT



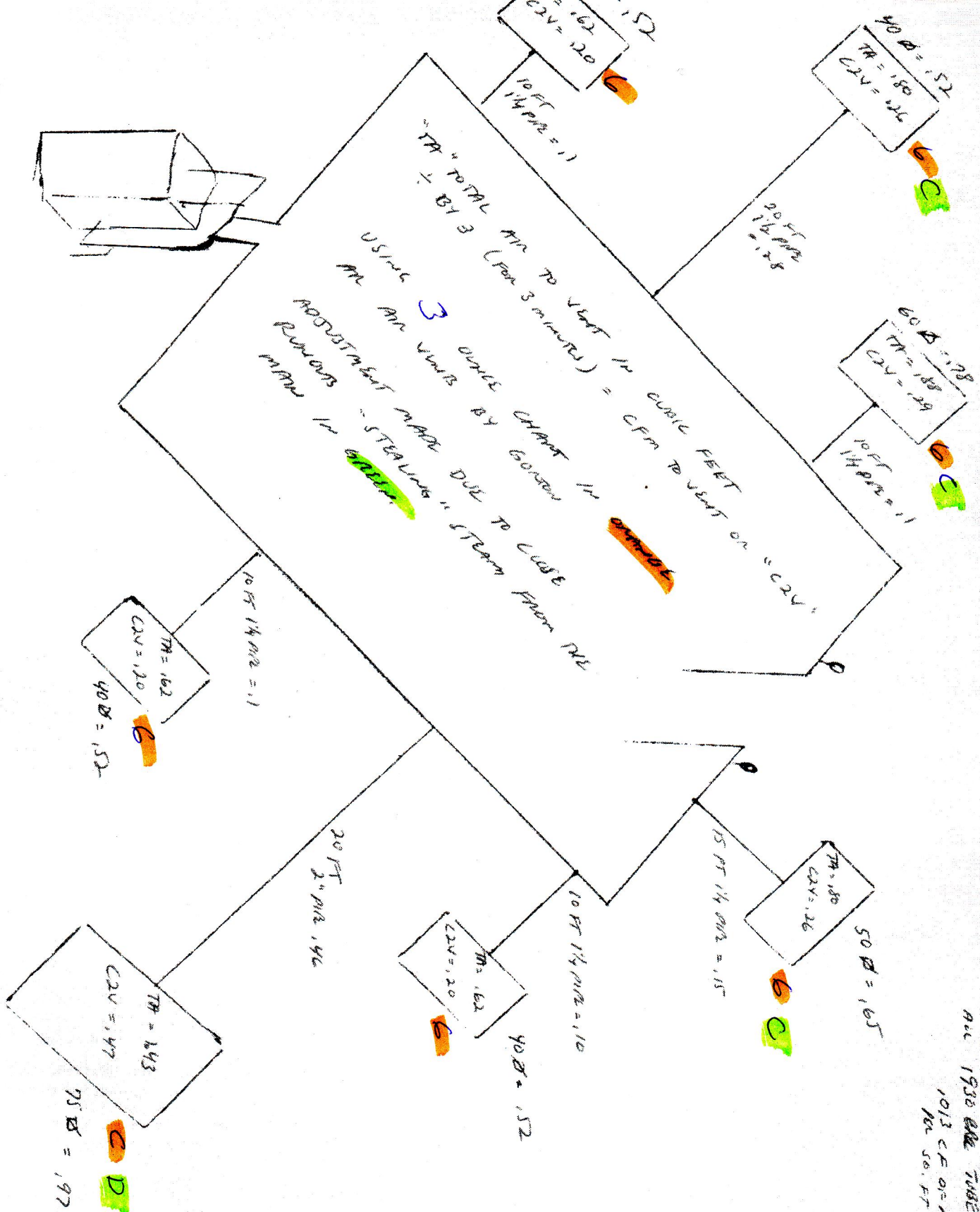
SYSTEM DRAWINGS #1

ALL 1930 ERA TUBE RADIATORS  
 1013 CF OF AIR  
 PER 50 FT



SYSTEM DRAWING 2





ALL 1930 BARE TUBE RADIATORS  
 1013 C.F. OF AIR  
 ALL 50' FT

SYSTEM DRAWINGS

VENTING CAPACITIES (in ounces)			
	<u>1OZ. CFM</u>	<u>2OZ. CFM</u>	<u>3OZ CFM</u>
<b><u>MAIN VENTS</u></b>			
Open 1/8" Steel Pipe	1.200	2.000	2.500
Open 1/2" Steel Pipe	2.600	3.400	4.800
Open 3/4" Steel Pipe	*Note 1	*Note 1	9.500
Open 1" Steel Pipe	*Note 1	*Note 1	11.000
American Radiator Co. Ideal Vac-Vent #822 - - (obsolete)	0.100	0.158	0.200
Barnes & Jones QV 1 - - (obsolete)	0.583	1.580	2.000
Barnes & Jones Ventrите #75 - - (obsolete)	0.116	0.175	0.225
Detroit Controls #841 Quick Vent - - (obsolete)	0.333	0.550	0.700
Dole #5 Quick Vent	0.066	0.116	0.150
Gorton #1	0.330	0.540	0.700
Gorton #2	1.100	1.750	2.200
Hoffman #4	0.060	0.110	0.130
Hoffman #4A	0.133	0.216	0.266
Hoffman #6 Vacuum Valve - - (obsolete)	0.033	0.083	0.108
Hoffman #10 Vapor Vent - - (obsolete)	2.033	2.500	3.700
Hoffman #11 Vapor Vacuum Vent - - (obsolete)	1.000	2.410	3.330
Hoffman #15 Vacuum Vent - - (obsolete) Differential Loop	1.283	2.750	3.416
Hoffman #16 Vacuum Valve - - (obsolete)	0.066	0.116	0.150
Hoffman #16A Vacuum Valve - - (obsolete)	0.100	0.183	0.241
Hoffman #75	0.500	0.750	0.960
Hoffman #76 Vacuum Valve	0.383	0.666	0.833
Ideal Htg. Co. "Wafer Style" - - (obsolete)	0.090	0.130	0.166
Maid-O-Mist #1 Straight Pattern	0.333	0.590	0.766
Marsh #55	0.010	0.021	0.033
Mouat Cast Iron 'Bullet' Style - - (obsolete)	0.530	0.910	1.110
Mouat Tri Tube - - (obsolete)	1.160	1.800	2.000
Squires Co. Mouat Series Cast Iron Bullet Style - - (obsolete)	0.530	0.910	1.110
Trane Cast Iron Bullet Style - - (obsolete)	0.780	1.330	1.700
Vent Rite #35	0.110	0.200	0.250
Vent Rite #75 (Barnes & Jones Issue) - - (obsolete)	0.116	0.175	0.225
Vent Rite #77	0.190	0.310	0.400
Watts SVS-3	0.070	0.116	0.150
Warco #3 - - (obsolete)	0.050	0.108	0.150
Warco #87 - - (obsolete)	0.108	0.175	0.233
Warren Webster #40-15 Vent Trap - - (obsolete)	1.166	1.866	2.366
*Note 1 - Due to the size of the flowmeter and pipe, at least 3 ounces was required to procure a reading			
<b><u>RADIATOR VENTS</u></b>			
Airmatic #1 - - (obsolete)	0.045	0.222	0.100
American Radiator Co. Detroit Controls #500 Airid - - (obsolete)	0.036	0.061	0.080
ARCO Detroit Controls Multiport Setting 1 - - (obsolete)	**Note 3	**Note 3	**Note 3
ARCO Detroit Controls Multiport Setting 2 - - (obsolete)	**Note 3	**Note 3	**Note 3
ARCO Detroit Controls Multiport Setting 3 - - (obsolete)	**Note 3	**Note 3	0.011
ARCO Detroit Controls Multiport Setting 4 - - (obsolete)	0.021	0.028	0.038
ARCO Detroit Controls Multiport Setting 5 - - (obsolete)	0.045	0.075	0.100
ARCO Detroit Controls Multiport Setting 6 - - (obsolete)	0.050	0.108	0.141
ARCO Detroit Controls Multiport Setting 7 - - (obsolete)	0.066	0.116	0.158
ARCO Detroit Controls Multiport Setting 8 - - (obsolete)	0.083	0.141	0.191
ARCO Detroit Controls Multiport Setting 9 - - (obsolete)	0.100	0.158	0.208
ARCO Detroit Controls Multiport Setting 10 - - (obsolete)	0.116	0.183	0.241
Detroit Controls #5000 Airid Variport - - (obsolete) Low setting	NONE	0.011	0.016
Detroit Controls #5000 Airid Variport - - (obsolete) Med setting	0.036	0.051	0.061
Detroit Controls #5000 Airid Variport - - (obsolete) High setting	0.066	0.125	0.166
Dole 1933	0.033	0.055	0.070

**VENTING CAPACITIES (in ounces)**

	<u>1OZ. CFM</u>	<u>2OZ. CFM</u>	<u>3OZ CFM</u>
Dole 1A Setting 1	0.045	0.071	0.125
Dole 1A Setting 2	0.068	0.116	0.150
Dole 1A Setting 3	0.083	0.125	0.166
Dole 1A Setting 4	0.091	0.150	0.191
Dole 1A Setting 5	0.125	0.208	0.266
Dole 1A Setting 6	0.133	0.216	0.283
Dole 1A Setting 1 Modern Version W/Plastic Tongue *Note 4	0.061	0.111	0.148
Dole 1A Setting 2 Modern Version W/Plastic Tongue *Note 4	0.084	0.141	0.186
Dole 1A Setting 3 Modern Version W/Plastic Tongue *Note 4	0.108	0.183	0.228
Dole 1A Setting 4 Modern Version W/Plastic Tongue *Note 4	0.116	0.201	0.254
Dole 1A Setting 5 Modern Version W/Plastic Tongue *Note 4	0.129	0.210	0.266
Dole 1A Setting 6 Modern Version W/Plastic Tongue *Note 4	0.133	0.220	0.274
Dole 1A Setting 7 Modern Version W/Plastic Tongue *Note 4	0.143	0.233	0.295
Dole 1A Setting 8 Modern Version W/Plastic Tongue *Note 4	0.147	0.245	0.283
Dole 1A Setting 9 Modern Version W/Plastic Tongue *Note 4	0.152	0.268	0.289
Dole 1A Setting 10 Modern Version W/Plastic Tongue *Note 4	0.152	0.269	0.289
Dole 1A Cap Removed Modern Version W/Plastic Tongue	0.212	0.339	0.431
Flair #51 - - (obsolete)	0.116	0.191	0.250
Gorton 4	0.025	0.040	0.055
Gorton 5	0.080	0.130	0.160
Gorton 6	0.150	0.235	0.300
Gorton C	0.270	0.450	0.570
Gorton D	0.330	0.540	0.700
Heat Timer Varivalve Min Setting Angle Pattern	0.065	0.158	0.200
Heat Timer Varivalve 50% Setting Angle Pattern	0.340	0.580	0.766
Heat Timer Varivalve Max Setting Angle Pattern	0.516	0.850	1.130
Heat Timer Varivalve Min Setting Straight Pattern	0.060	0.083	0.330
Heat Timer Varivalve 50% Setting Straight Pattern	0.530	0.800	1.030
Heat Timer Varivalve Max Setting Straight Pattern	0.660	1.080	1.360
Hoffman #1 - - (obsolete)	0.016	0.075	0.100
Hoffman 1A Setting 1	0.020	0.026	0.033
Hoffman 1A Setting 2	0.026	0.043	0.056
Hoffman 1A Setting 3	0.100	0.158	0.200
Hoffman 1A Setting 4	0.108	0.160	0.210
Hoffman 1A Setting 5	0.140	0.220	0.290
Hoffman 1A Setting 6	0.145	0.225	0.300
Hoffman #2 Vacuum Vent Non Adjustable - - (obsolete)	0.016	0.066	0.100
Hoffman #2 Vacuum Vent Setting 1 - - (obsolete)	0.001	0.021	0.025
Hoffman #2 Vacuum Vent Setting 2 - - (obsolete)	0.006	0.024	0.028
Hoffman #2 Vacuum Vent Setting 3 - - (obsolete)	0.008	0.025	0.033
Hoffman #2 Vacuum Vent Setting 4 - - (obsolete)	0.010	0.026	0.036
Hoffman #2 Vacuum Vent Setting 5 - - (obsolete)	0.013	0.029	0.040
Hoffman #2 Vacuum Vent Setting 6 - - (obsolete)	0.016	0.031	0.045
Hoffman #2A Vacuum Vent Setting 1 - - (obsolete)	0.001	0.023	0.025
Hoffman #2A Vacuum Vent Setting 2 - - (obsolete)	0.018	0.030	0.043
Hoffman #2A Vacuum Vent Setting 3 - - (obsolete)	0.021	0.038	0.053
Hoffman #2A Vacuum Vent Setting 4 - - (obsolete)	0.028	0.058	0.068
Hoffman #2A Vacuum Vent Setting 5 - - (obsolete)	0.036	0.063	0.088
Hoffman #2A Vacuum Vent Setting 6 - - (obsolete)	0.041	0.083	0.116
Hoffman #3 (Paul Vent)	0.175	0.283	0.416
Hoffman 40	0.042	0.067	0.087
Hoffman 41	0.058	0.100	0.125
Hoffman #70 Airport Non Adjustable - - (obsolete)	0.050	0.108	0.141
Hoffman #70 Airport Setting #1 - - (obsolete)	0.045	0.078	0.125
Hoffman #70 Airport Setting #2 - - (obsolete)	0.050	0.087	0.150
Hoffman #70 Airport Setting #3 - - (obsolete)	0.053	0.116	0.166
Hoffman #70 Airport Setting #4 - - (obsolete)	0.056	0.141	0.183

VENTING CAPACITIES (in ounces)			
	<u>1OZ. CFM</u>	<u>2OZ. CFM</u>	<u>3OZ CFM</u>
Hoffman #70 Airport Setting #5 - - (obsolete)	0.060	0.150	0.191
Hoffman #70 Airport Setting #6 - - (obsolete)	0.066	0.150	0.191
Hoffman #74 Unit Heater Vent	0.033	0.083	0.108
Hoffman #500	0.066	0.112	0.142
Homart #775.8812	0.083	0.133	0.175
Marsh Paul Vent (circa 1901) - - (obsolete)	0.350	0.583	0.750
Marsh #3 (Paul Vent) - - (obsolete)	0.183	0.295	0.375
Maid-O-Mist 4	0.028	0.045	0.060
Maid-O-Mist 5	0.100	0.158	0.200
Maid-O-Mist 6	0.150	0.241	0.300
Maid-O-Mist C	0.283	0.450	0.583
Maid-O-Mist D	0.341	0.600	0.783
M.S. Little Co. #L-15 - - (obsolete)	0.026	0.045	0.055
National Steam Specialty Co. Paul Vent - - (obsolete)	0.150	0.266	0.333
U.S. Radiator #3 Triton - - (obsolete)	0.023	0.033	0.041
Ventrite #1 Setting 1	Off	Off	Off
Ventrite #1 Setting 2	0.033	0.020	0.021
Ventrite #1 Setting 3	0.025	0.036	0.046
Ventrite #1 Setting 4	0.030	0.053	0.066
Ventrite #1 Setting 5	0.045	0.071	0.091
Ventrite #1 Setting 6	0.056	0.091	0.116
Ventrite #1 Setting 7	0.070	0.108	0.133
Ventrite #1 Setting 8	0.083	0.125	0.158
Ventrite #2 IVS (obsolete Anderson Manufacturing)	0.028	0.053	0.078
Ventrite #11	0.060	0.100	0.116
Watts SV	0.066	0.108	0.133
Watts SVA setting 1/8	0.030	0.063	0.075
Watts SVA setting 1/4	0.066	0.108	0.133
Watts SVA setting 1/2 ** (see note 2)	0.066	0.108	0.133
Watts SVA setting 3/4 ** (see note 2)	0.066	0.108	0.133
Watts SVA setting 7/8 ** (see note 2)	0.066	0.108	0.133
Watts SVA setting Full ** (see note 2)	0.066	0.108	0.133
**Note 2 - This Watts SVA made in Taiwan brand new out of the bag gave these readings. This is not a typographical error.			
**Note 3 - The venting rate at this setting was so insignificant as to be imperceptible on the flow meter.			
*Note 4 - The anomaly is caused by the fact that there is a screw on top of the lid. This injects a human factor. Depending on how tight one makes the screw, effects the ability of the device to vent. This data was the average of four vents tested. The cap removed readings are probably the most accurate, as a human factor is not in the equation.			
<u>RADIATOR TRAPS</u>	<u>1OZ. CFM</u>	<u>2OZ. CFM</u>	<u>3OZ CFM</u>
Barnes & Jones 1/2" #122	1.500	1.800	2.700
Dunham #1 1/2" - - (obsolete)	1.450	2.410	3.000
Dunham #1 W/B&J Cage Unit	0.730	1.160	1.500
Dunham - Bush #1E - - (obsolete)	1.080	1.800	2.250
Dunham - Bush #1E W/B&J Cage Unit	0.710	1.130	1.410
Hoffman 17C 1/2" W/Dura-Stat Capsule	0.530	0.850	1.100
Hoffman 17C W/B&J Cage Unit	1.300	2.116	2.700
Hoffman 17D 1/2" Model 1939 - - (obsolete)	1.450	2.380	3.000
Ideal Heating Co. Thermostatic 1/2" - - (obsolete)	1.530	2.330	3.080
Ideal W/B&J Cage Unit Installed	1.250	2.000	2.580
Illinois 1/2" #1G	0.860	1.200	1.600
Marsh #1 Reflux - - (obsolete)	1.130	1.830	2.360

VENTING CAPACITIES (in ounces)			
	<u>1OZ. CFM</u>	<u>2OZ. CFM</u>	<u>3OZ CFM</u>
Marsh #1 Reflux W/B&J Cage Unit	0.730	1.160	1.500
Marsh 1N 1/2"	0.530	0.910	1.160
Mepco 1/2" #1E	1.080	1.400	1.900
Mepco 1/2" #1R	1.080	1.400	1.900
Milvaco Model #0 - - (obsolete)	1.080	1.710	2.130
Milvaco Model #0 W/B&J Cage Unit	1.000	1.580	1.966
Monash #30 1/2"	0.860	1.200	1.600
Monash #34 1/2"	1.210	2.000	2.500
Monash #38 1/2"	1.450	2.450	3.080
Mouat Model 1924 Thermostatic 1/2" - - (obsolete)	1.530	2.330	3.080
Mouat 1924 W/B&J Cage Unit Installed	1.250	2.000	2.580
Mouat #35 1/2" - - (Obsolete)	1.330	1.660	2.080
Mouat #35 1/2" W/B&J Cage Unit Installed	1.366	2.330	2.910
Mouat #36 1/2" - - (Obsolete)	1.083	1.533	1.830
Mouat #36 1/2" W/B&J Cage Unit Installed	1.266	2.000	2.500
Mouat Water Seal Trap 1/2" Oval - - (obsolete)	2.000	2.400	3.400
Mouat Water Seal Trap 1/2" Round - - (obsolete)	2.000	2.400	3.600
Nicholson #N125	1.530	2.530	3.080
Sarco A125 1/2"	0.500	0.780	1.000
Sterling 7-50-A-1/2"	1.080	1.750	2.160
Trane B1 W/Original Bellows - - (obsolete)	0.500	0.750	1.000
Trane B1 W/Modern Trane Element	0.780	1.250	1.580
Trane B1 W/B&J Cage Unit	0.750	1.200	1.500
Trane 1/2" (no number) - - (obsolete)	1.580	2.660	3.330
Warren Webster 02H 1/2" W/B&J Cage Unit	0.783	1.333	1.750
Warren Webster 02H 1/2" W/Tunstall Capsule	0.616	0.966	1.210
Warren Webster 512H 1/2" W/512A seat (5/16") - - (obsolete)	1.080	1.750	2.250
Warren Webster 512H 1/2" W/512S seat (1/4") - - (obsolete)	0.783	1.280	1.660
Warren Webster 512H 1/2" W/B&J Cage Unit	1.360	2.250	2.830
Warren Webster 712HB 1/2" W/H57 Seat (.368") - - (obsolete)	0.750	1.233	1.433
Warren Webster 712 HB 1/2" W/522S Seat (.332") - - (obsolete)	0.500	0.800	1.250
Warren Webster 712 HB 1/2" W/B&J Cage Unit	1.550	2.550	3.216
Barnes & Jones 3/4" #134A	1.360	2.280	2.880
Hoffman 8C 3/4"	1.000	1.580	2.000
Mepco 3/4" 2E	1.530	2.550	3.160
Monash #48 3/4"	2.160	3.500	5.000
Sterling 3/4" #753A	1.250	2.000	2.580
<b><u>FLOAT &amp; THERMOSTATIC TRAPS (F&amp;T TRAPS)</u></b>			
Spirax Sarco	0.500	0.750	0.966
All of the following Spirax Sarco F&T traps utilize the same air vent assembly and therefore would vent air at roughly the same rate regardless of the trap size. FT-15; FT-30; FT-75; FT-125; FT-150; FT-200; FT-20; FTB-20; FTB-30; FTB-125; FTB-175; FTI-15; FTI-30; FTI-75; FTI-125; FTI-200			
Hoffman	0.500	0.750	0.950
FT015H; FT015C; FT015X; FT015I; 55 series; all use the same air vent module regardless of trap size.			
Sterling	1.300	2.083	2.666
All Sterling vac. to 15 lb. use the same air vent module regardless of trap size.			
Barnes & Jones	0.750	1.200	1.500
All Barnes & Jones vac. to 15 lb. use the same air vent module regardless of trap size.			

## How much air is in a pipe?

<u>Pipe size</u>	<u>Cubic feet of air in each linear foot of pipe</u>
1-1/4"	.010
1-1/2"	.014
2"	.023
2-1/2"	.03
3"	.053
3-1/2"	.07
4"	.09
5"	.14
6"	.2
8"	.36

## How much air is in a radiator?

<u>Radiator type</u>	<u>Cubic feet of air per square foot EDR</u>
Cast-iron flue (antique radiators)	.029
Cast-iron wall- or ceiling-mounted	.028
Cast-iron column (circa 1900)	.025
Cast-iron tube (circa 1930)	.013
Cast-iron thin tube (as made today)	.009
Cast-iron radiant radiator (5" deep)	.008
Cast-iron baseboard (10"-high)	.07
Cast-iron convector (in cabinet)	.0003
Unit heater	.0002



## Update – Winter 2005, 2006

### **Can you vent too fast?**

The question has been answered. As a proponent of the “get the air out so I can get the steam in” school, I’ve made a practice of pushing the envelope on how fast I could vent one pipe steam radiators. Now keep in mind, I’ve never had a problem doing this till the balance from hell job. I ran across an apartment building that was 3 stories tall and 4 units wide. There were no main vents on this building and steam seems to favor the short side of the building (as measured from the boiler room out). I added 4 Gorton #2 main vents to the slow side of the building and then both ends of this building got steam at roughly the same time. So far, so good. All the radiation in this building had very slow venting Watts SVA radiator vents on them. Now keep in mind who you’re dealing with here. Since I’d been testing radiator vents and know the fastest vent out there is a Heatimer Vari Valve, I installed some of these on the top floor. Now this building has risers that go up and have back-to-back radiators taken off of a runout at each floor. Also keep in mind the radiators did heat before I got there (I was reminded of this by the apartment owner several times). Here’s what happened. One radiator would get hot all the way across. I mean scorching. The radiator next to it, from the same riser and runout would be ice cold. You know that kind of “you may not get paid for awhile cold”. So as I’m standing there with my jaw on the floor as one radiator gets screaming hot and the other side by side to it is cold, I do what anyone would do. I take its air vent off. Can’t vent faster than the open hole right? Huh, still nothing. I disconnect the radiator from the valve. Still no steam. Now picture this; I’m standing there with one radiator screaming hot, the other radiator is an open valve. It’s not even connected. My jaw is on the floor. Sweats forming on my brow. The building owner is again reminding me of the fact it heated before I got there, all be it slowly. I had to back up and regroup as I was getting my butt kicked by an inanimate object. I just hate that. Took me a bit, but I figured it out. Here was what was happening; sometimes you have to “think like steam”. Close your eyes and “be the steam”. By putting the extremely fast venting Heatimer Vari Valve on the radiators, there was little if any resistance (or back pressure), so the steam in its own unique way found which radiator had just a tad bit less resistance to get into. Of course the steam is really moving fast, right! I saw to that. I had it moving so fast that once it decided to go into a particular radiator, what happened next had to be seen to believed. The steam was going into the radiator it chose and it was going in with momentum. Of course, the steam is condensed upon entering, right. Condensed a lot of steam and made a pretty wicked vacuum in that radiator. So wicked I could take the other radiator off of its valve and still no steam appeared. Remember, same riser. Why, cause high pressure goes to low pressure as Dan says. The steam was plowing itself into the radiators it chose and they were under a vacuum, from the condensing steam. So I could do what ever I wanted with the other radiator and still the best I could come up

with would be atmospheric pressure. Which wins, the vacuum or the atmospheric pressure? The vacuum every time. Once I realized what was going on, it was an easy fix. I shut the boiler down. Let the vacuum all die. Then replaced the Heatimers with Gorton D's and C's. All's better now. I had to slow the venting down a little here to make the steam distribute itself evenly. You may say how's that an improvement"? Well, the Gorton C and D vents are seriously faster than the Watts that were there before. I am venting faster. Is there anything wrong with the Heatimer Vari Vent? No, of course not. Remember, the risers served runouts that fed two radiators side-by-side or back-to-back. Bad application of a very fast vent that's all. Point I'm trying to make is the "can you vent a one pipe radiator too fast question" has been answered. Learn from others or you'll learn from yourself.