

the draft would only be increased from 10 to 40 percent if all friction and cooling could be eliminated.

The available draft for short chimneys can perhaps be determined most readily by using Equation 13, Fig. 8, and Table 1. Fig. 8 shows the relationship between effective chimney height, inlet flue gas temperature, and the ideal draft that would be produced for two values of outside temperature if there were neither friction nor cooling of the gases as they traversed the chimney. After obtaining the ideal draft for a given chimney height and entering flue gas temperature from Fig. 8 and selecting the appropriate efficiency value from Table 1, the available draft can be computed from Equation 13. Fig. 8 can be used in reverse in conjunction with efficiency

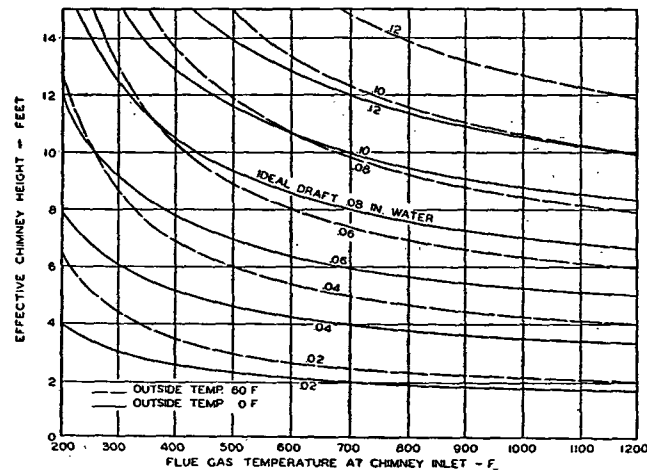


FIG. 8. IDEAL DRAFT FOR SHORT CHIMNEYS AT OUTSIDE TEMPERATURES OF 0 F AND 60 F.

values from Table 1 to determine what chimney height is required to produce the required draft at rated output for a given heating appliance.

Fig. 7 shows that the efficiency of a given chimney varies with the mass flow rate of gases and with the entering flue gas temperature. The efficiency also varies with the height for a given construction and depends somewhat on the method used to connect the smokepipe to the chimney and the amount of exposure to the outdoor air. Experimental data are not sufficiently complete to tabulate efficiencies that take into account all of these variables. However, recommended values of efficiency for several sizes of domestic chimneys of masonry materials and of metal have been selected from the literature^{6,7,8,9} and summarized in Table 1 for use with Fig. 8 in determining the available draft produced by short chimneys of 15 ft in height or lower. In parts A and B of Table 1 the value of efficiency chosen from the range cited should be increased as the chimney inlet temperature increases over the applicable range. In part C of Table 1 the efficiency values listed will yield the available draft for the range of mass flows, inlet flue gas temperatures, and chimney height shown within 10 percent.

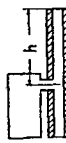
In the application of short chimneys, observance of the following pre-

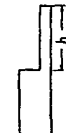
Chimneys and Draft Calculations

cautions will assist in obtaining the highest practicable draft and may cure unsatisfactory operation of the chimney and heating plant in certain instances:

1. Use a minimum length of horizontal smokepipe between the heater and chimney.
2. Insulate the smokepipe and the chimney itself, if made of metal. Insulation of the chimney liner in masonry chimneys reduces the heat loss from the flue gases and the infiltration of cold air.

TABLE 1. EFFICIENCY OF SHORT CHIMNEYS

A. MASONRY CHIMNEYS					
	Height h ft	Flue Gas Flow Rate lb/hr	Internal Liner Size, in.		
			Dia. 7	7 x 7	7 x 11 and Dia. 10
	5 to 15	90 200 315	Efficiency, Percent		
			75-82	65-76	65-80
83-84			67-85	82-88	
		75-89	67-86	81-89	
					(Inlet Flue Gas Temp 200 to 1000)

B. UNINSULATED METAL CHIMNEYS					
	Height h ft	Flue Gas Flow Rate lb/hr	Internal Diameter, in.		Efficiency, Percent
			6	8	
	4 to 8	90 200 315	90-100	85-95	
			"	83-88	
"			70-80		
					(Inlet Flue Gas Temp. 200 to 600 F)

C. METAL CHIMNEYS ^b					
	Height h ft	Uninsulated	1-in. insulation with dead air space around chimney	1-in. insulation with 1-in. open air space around chimney	Efficiency, Percent
	8 to 14		76	85	81

^a Six-inch chimney not recommended for these flow rates.

^b Internal dia. 6-in.; flue gas flow rate 50 to 125 lb/hr; inlet flue gas temp. 200 to 1000 F.

3. Do not use an oversized chimney because larger chimneys produce greater cooling of the flue gases.
4. Avoid downdrafts by proper construction above the roof or by the use of a suitable chimney cap.
5. Avoid the use of barometric dampers in the smokepipe of natural-draft heaters since most barometric dampers permit enough cold air to leak into the chimney to reduce the draft appreciably.
6. Avoid air leaks in the smokepipe and chimney.
7. Avoid connecting more than one heating device to a single chimney.
8. Use construction materials of low heat capacity if the chimney draft must increase quickly for an intermittently-fired heating device.
9. Do not operate a kitchen exhaust fan unless an air intake of ample area is used to prevent lowering the house pressure.
10. Avoid tight utility closets so the chimney draft will not be required to do the added work of drawing combustion air into the closet from the surroundings.