

$H_t + \frac{H_i}{2}$. If a building has no interior walls or partitions, whatever air enters through the cracks on the windward side must leave through the cracks on the leeward side, and only half of the total crack should be used in computing the infiltration for each side and end of the building. Under these conditions it is sufficiently accurate to use the total calculated heat loss (H) for the building. If the average wind velocity during the heating season differs from that upon which H_i was derived, the value of H should be corrected accordingly.

Of course, where the required heating surface is estimated by empirical or rule-of-thumb methods, refinements in approximating fuel consumption are not warranted, but rule-of-thumb methods often lead to unsatisfactory results and should be avoided in heating work where more accurate methods are available. It should be emphasized that the value of H in Equation 1 is the total heat loss of the building after making the proper allowance for infiltration.

CALORIFIC VALUES AND HEATING EFFICIENCIES

The calorific values of fuel oils and gas can be ascertained with reasonable accuracy. The values for various grades of oil are given in Table 2, Chapter 27. The calorific value of gas can always be obtained from the local utility company. Values for natural gas are given in Table 3, Chapter 27; manufactured gas usually has a calorific value of about 535. Coals have a larger range and may vary for the same type of coal, depending on its ash content. For general purposes where specific data are lacking, values can be taken from the top curve of Fig. 1, Chapter 27.

To decide on the correct efficiency to use is a more difficult matter, particularly if the estimate is being made without a full knowledge of the equipment for burning the fuel and the care the furnace will receive. Efficiencies usually are given in the catalogs of manufacturers of furnaces and boilers, but these values are obtained under test conditions and do not allow for poor attendance, defects in installation, or poor draft. On the other hand, such efficiencies assume that all the heat radiated from the outside of the heaters or casings as sensible heat of the flue gases is lost, whereas, if the heater is installed in the building being heated, a considerable portion of these losses may help to heat the building²; how much of this it is legitimate to use in increasing the value of E will depend on whether H included the heat losses in the cellar, and on the construction of the chimney. Except for an interior chimney, the heat transferred through the chimney wall to the building will be very small. Chimney allowances should be greater for lower test efficiencies. Thus an insulated furnace will give a high efficiency on test but will not heat the cellar. A modern gas furnace will have a high efficiency with a correspondingly low flue gas temperature and hence there will be very little heat from the flue pipe.

For great exactitude the value for E should take care of inefficiency in the heat distribution in the building because of such losses as excessive heating of the walls behind the radiators and excessive stratification. It

²Analysis of the Over-All Efficiency of a Residence Heated by Warm Air, by A. P. Kratz and J. F. Quereau (A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929).

TABLE 1. DEGREE-DAYS FOR CITIES IN THE UNITED STATES AND CANADA^a

Col. A	Col. B	Col. C	Col. A	Col. B	Col. C
State	City	Degree-Days	State	City	Degree-Days
Ala.....	Birmingham.....	2,408	Nev.....	Reno.....	5,891
	Mobile.....	1,471	N. H.....	Concord.....	6,852
Ariz.....	Flagstaff.....	7,145	N. J.....	Atlantic City.....	5,175
	Tucson.....	1,845		Trenton.....	4,934
Ark.....	Hot Springs.....	2,665	N. M.....	Santa Fe.....	6,063
	Little Rock.....	2,811	N. Y.....	Albany.....	6,889
Calif.....	Los Angeles.....	1,504		Buffalo.....	6,821
	San Francisco.....	3,264		New York.....	5,348
Colo.....	Colorado Springs.....	6,553	N. C.....	Raleigh.....	3,234
	Denver.....	5,873		Wilmington.....	2,302
Conn.....	New Haven.....	5,895	N. D.....	Bismarck.....	8,498
D. C.....	Washington.....	4,626	Ohio.....	Cincinnati.....	4,702
Fla.....	Jacksonville.....	890		Cleveland.....	6,154
Ga.....	Atlanta.....	2,891		Columbus.....	5,323
	Savannah.....	1,490	Okla.....	Oklahoma City.....	3,613
Idaho.....	Boise.....	4,558	Ore.....	Portland.....	4,468
	Lewiston.....	4,924		Salem.....	4,629
Ill.....	Chicago.....	6,315	Pa.....	Philadelphia.....	4,855
	Springfield.....	5,370		Pittsburgh.....	5,235
Ind.....	Evansville.....	4,164	R. I.....	Providence.....	6,014
	Indianapolis.....	5,297	S. C.....	Charleston.....	1,769
Iowa.....	Des Moines.....	6,373		Spartanburg.....	3,257
	Sioux City.....	7,023	S. D.....	Sioux Falls.....	7,683
Kan.....	Dodge City.....	5,034	Tenn.....	Memphis.....	2,950
	Topeka.....	5,301		Nashville.....	3,578
Ky.....	Lexington.....	4,616	Texas.....	Austin.....	1,578
	Louisville.....	4,180		Dallas.....	2,455
La.....	New Orleans.....	1,023		Houston.....	1,157
Me.....	Eastport.....	8,531		San Antonio.....	1,202
	Portland.....	7,012	Utah.....	Logan.....	6,735
Md.....	Baltimore.....	4,333		Salt Lake City.....	5,553
Mass.....	Springfield.....	6,464	Vt.....	Burlington.....	7,620
	Boston.....	6,145	Va.....	Fredericksburg.....	4,243
Mich.....	Detroit.....	6,494		Norfolk.....	3,349
	Marquette.....	8,692		Richmond.....	3,725
Minn.....	Duluth.....	9,480	Wash.....	Seattle.....	4,868
	Minneapolis.....	7,851		Spokane.....	6,353
Miss.....	Vicksburg.....	1,822	W. Va.....	Morgantown.....	5,016
Mo.....	Kansas City.....	5,202		Parkersburg.....	4,884
	St. Louis.....	4,585	Wis.....	Fond du Lac.....	7,612
Mont.....	Billings.....	7,115		Green Bay.....	7,823
	Havre.....	8,699		La Crosse.....	6,690
Neb.....	Lincoln.....	6,231		Milwaukee.....	7,372
	Omaha.....	6,128	Wyo.....	Cheyenne.....	7,462

Province	City	Degree-Days	Province	City	Degree-Days
B. C.....	Victoria.....	5,777	Ont.....	Toronto.....	7,732
	Vancouver.....	5,976	Que.....	Montreal.....	8,705
	Kamloops.....	6,724		Quebec.....	8,628
Alb.....	Medicine Hat.....	8,152	N. B.....	Fredericton.....	9,099
Sask.....	Qu'Appelle.....	11,261	N. S.....	Yarmouth.....	7,694
Man.....	Winnipeg.....	11,166	P. E. I.....	Charlottetown.....	8,485
Ont.....	Port Arthur.....	10,803			

^aFrom *Industrial Gas Series, House Heating* (third edition) published by the American Gas Association. These degree-days are based on daily mean temperatures. Base, 65 F.