

the fuel rate, the flue-gas rate in pounds per hour may be determined for any fuel.

It should be noted that at the higher flows, simulating operation with stoker equipment, the error due to friction losses will increase as the flow increases, but a reliable determination of the available draft may still be had with only a slight increase in error.

DETERMINING CHIMNEY SIZES FOR DOMESTIC CHIMNEYS

The flue size for the small domestic chimney is governed by the Building Code of the *National Board of Fire Underwriters*. It should be noted that these sizes are subject to revision; hence, the latest edition of the Building Code must be referred to for current minimum chimney-flue areas.

By calculating the available draft for the chimney in question, and comparing it with the performance values of the heating unit, either natural

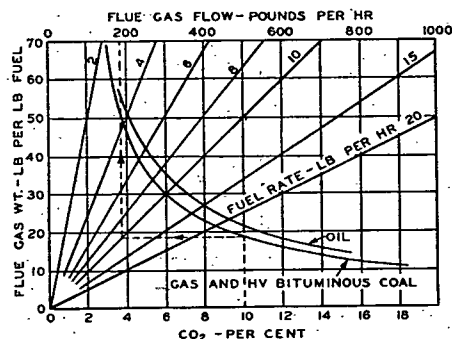


FIG. 6. GRAPHICAL EVALUATION OF RATE OF FLUE GAS FLOW FROM PER CENT CO_2 AND FUEL RATE*

* Average density gas 0.045 lb per cu ft, 62 F. Average weight oil 7.08 lb per gal, 60 F.

draft or stoker equipment, at full rating, it is possible to determine whether the chimney is adequate for the particular heating unit it serves.

Any of the described methods of determining available draft may be used, but a graphical solution to the problem may be had for the 8 x 8-in. chimney from Figs. 4 and 6. This solution can be best explained by a numerical example.

Example 3. Determine if a 13-ft, 8 x 8-in. nominal-size flue is sufficient for a coal-heating unit rated at 0.03 in. of water draft at 400 F inlet temperature, fuel rate being 10 lb per hr of bituminous coal, with 10 per cent CO_2 .

Solution. From Fig. 6, a flue-gas rate of approximately 180 lb per hr is obtained. The available draft for a 180 lb per hr fuel rate, and an inlet temperature of 400 F, obtained from Fig. 4, is 0.056 in. of water. This indicates that the chimney is adequate.

RELATIVE PERFORMANCE OF VARIOUS TYPES OF DOMESTIC CHIMNEYS

The clay-lined brick chimney is the most commonly used chimney, but recently other building materials have been used with varying degrees of success. Table 3 shows a comparison of the observed draft for two com-

mon brick chimneys, and a group of chimneys constructed of various building materials.⁸

The following list describes these chimneys:

Chimney 1. Common brick having 6 core holes, 11-in.-diam, 7 x 11-in. fire clay flue liner surrounded by air space, 8-in.-diam metal thimble.

Chimney 2. Common brick, 7 x 11-in. fire clay flue liner grouted in with mortar, 8-in.-diam metal thimble.

Chimney 5. Shale multi-cored tile 3½ x 4 x 12-in. in size, 7 x 11-in. fire clay liner surrounded by an air space, 8-in.-diam thimble of tile.

Chimney 6. Fire clay multi-cored tile 4 x 5 x 12 in. in size, 7 x 11-in. fire clay tile liner surrounded by an air space, 8-in.-diam thimble of tile.

Chimney 7. Shale partition tile having webs and shells approximately 1½-in. thick, 7 x 11-in. fire clay tile liner with an air space, 8-in.-diam thimble of tile.

Chimney 10. Cinder concrete building block having two cells, 7 x 7-in. fire clay flue liner with an air space, 7-in.-diam steel thimble.

Chimney 11. Same as Chimney 10 except that solid cinder blocks were used.

TABLE 3. COMPARISON OF OBSERVED DRAFT AT STANDARD CONDITIONS FOR A GROUP OF CHIMNEYS CONSTRUCTED OF VARIOUS BUILDING MATERIALS AND TWO COMMON BRICK CHIMNEYS

LINER, 7 x 7 IN.			LINER, 7 x 11 IN.		
DRAFT IN. WATER			DRAFT IN. WATER		
INLET FLUE-GAS TEMP. F.	COMMON BRICK CHIMNEY	CINDER-CONCRETE BLOCK CHIMNEYS (10, 11, 13, 14)	INLET FLUE-GAS TEMP. F.	COMMON BRICK CHIMNEY	BRICK, SHALE-TILE, AND CINDER-CONCRETE BLOCK CHIMNEYS (1, 2, 5, 6, 7, 12)
Rate of Gas Flow, 20 cfm.					
250	0.053	0.044-0.053	275	0.055	0.053-0.057
400	.072	.067-.075	600	.088	.087-.095
600	.086	.083-.096	1000	.108	.112-.121
1000	.115	.119-.123			
Rate of Gas Flow, 70 cfm.					
200	0.053	0.041-.051	200	0.052	0.043-.055
400	.079	.078-.087	600	.102	.108-.113
600	.102	.103-.112	1000	.131	.138-.144
1000	.127	.133-.140			

Chimney 12. Cinder concrete chimney unit blocks 17 x 22 x 8 in., designed to be used with 7 x 11-in. fire clay liner. Except for a spacing boss at the midlength of each side, the liner was spaced ¼ in. from the interior of the unit.

Chimney 13. Cinder concrete chimney unit blocks 16 x 16 x 8 in., 7 x 7-in. fire clay liner grouted in solid with mortar, 7-in.-diam thimble of tile.

Chimney 14. Same as Chimney 13, except that the liner was grouted only at the joints.

These chimneys were all approximately 15.5 ft high, and the drafts have been corrected to 29.92 in. Hg at 32 F.

There are several lightweight chimneys that have been recently approved by the *National Board of Fire Underwriters* for use with all types of fuel. These chimneys are constructed of precast masonry or vitreous enameled steel insulated with an insulating material. The characteristics of these chimneys can be assumed to be approximately those presented in Table 3.

DRAFT REQUIREMENTS OF DOMESTIC APPLIANCES

Typical flue-gas temperatures and drafts required at rated output for several kinds of domestic heating appliances⁹ are contained in Table 4.