TABLE 2. FIRST STORY WARM-AIR DUCTS[a]

UNIT NO.	LEADER PIPE DIAMETER, IN.	REGISTER SIZE, IN.		
		Floor	Baseboard	
			Size	Extension
1	8	8 x 10	10 x 8	2¼
2	9	9 x 12	12 x 8	2¼
3	10	10 x 12	12 x 9	3¼
4	12	12 x 14	13 x 11	5¼
5	14	14 x 16	.....	.....

TABLE 3. SECOND STORY WARM-AIR DUCTS—SINGLE WALL STACKS AND FITTINGS

UNIT NO.	LEADER PIPE DIAMETER, IN.	STACK[b] SIZE IN.	REGISTER SIZE, IN.			
			Floor	Baseboard		Sidewall
				Size	Extension	
11	8	10 x 3¼	8 x 10	10 x 8	2¼	10 x 8
12	9	12 x 3¼	8 x 12	12 x 8	2¼	12 x 8
13	9	13 x 3¼	8 x 14	12 x 8	2¼	12 x 8
14	10	14 x 3¼	8 x 14	12 x 8	2¼	12 x 8
15	12	12 x 5¼	.....	12 x 10	3¼	.....
16	12	14 x 5¼	.....	13 x 11	3¼	.....

TABLE 4. SECOND STORY WARM-AIR DUCTS—DOUBLE WALL STACKS AND FITTINGS

UNIT NO.	LEADER PIPE DIAMETER, IN.	STACK SIZE, IN.		REGISTER SIZE, IN.			
		Internal	External	Floor	Baseboard		Sidewall
					Size	Extension	
21	8	2½[c] x 10	3⅛[c] x 10⅝	8 x 10	10 x 8	2¼	10 x 8
22	8	3 x 10	3⅝ x 10⅝	8 x 10	10 x 8	2¼	10 x 8
23	9	2½[c] x 12	3⅛[c] x 12⅝	8 x 12	12 x 8	2¼	12 x 8
24	9	3 x 12	3⅝ x 12⅝	8 x 12	12 x 8	2¼	12 x 8

[a]When the calculations indicate a requirement for a given room greater than Unit No. 4, two or more smaller units totalling the required capacity are recommended.
[b]Recommended stack sizes. Tables may also be applied to 3 in. and 3¼ in. stack depths.
[c]Commercial sizes vary ⅛ in. from values shown.

furnace, and not more than 14 in. above the floor in the case of oil or gas furnaces. In order to accomplish this the shoe is made wide.

OUTLINE OF DESIGN PROCEDURE

The data underlying the design procedure are given in detail in a circular[2] issued by the University of Illinois. In this procedure the design of the warm-air duct system is considered as an entire unit, so that for a given heat loss the sizes of leaders, stacks, boots, stackheads, and registers are

[2]Simplified Procedure for Selecting Capacities of Duct Systems for Gravity Warm-Air Heating Plants, by A. P. Kratz and S. Konzo (*University of Illinois, Engineering Experimental Station Circular* 45, Dec., 1942).

TABLE 5. RETURN AIR DUCTS

UNIT NO.	DUCT DIA. IN.	AREA AT SHOE CONNECTION, SQ IN.	METAL GRILLE SIZES			WHEN JOIST LINING IS USED[d]		WHEN DUCT IS USED	
			Choose One			No. of Joists Lined	Minimum[e] Depth, In.	Choose One	
			A	B	C				
31	10			8 x 14	10 x 12	1	7	14 x 6	12 x 8
32	12		6 x 30	8 x 24	12 x 14	1	9	22 x 6	16 x 8
33	14	170	8 x 30	10 x 24	14 x 16	1	12	28 x 6	22 x 8
34	16	220	10 x 30	12 x 24		2	8	28 x 8	22 x 10
35	18	280	12 x 30	14 x 24		2	10	36 x 8	28 x 10
36	20	340	14 x 30	18 x 24		2	12.5	36 x 10	30 x 12
37	22	420	18 x 30			2	15.0	42 x 10	36 x 12
						3	10.0	42 x 10	36 x 12
38	24	500	20 x 30			2	18.0	42 x 12	36 x 14
						3	12.0	42 x 12	36 x 14

[d]Based on 14 in. space between joists.
[e]Use full depth of joist except when joist depth is less than minimum depth required, *when pan must be used.*

all correlated. Similarly in the case of return ducts, the selection specifies a complete unit consisting of return grille, return duct, and shoe connection.

Recommended Standard Sizes

For the purpose of simplification and standardization, selected combinations of commercial sizes of warm air pipes, return air pipes, ducts, grilles, fittings, and registers are designated as *units*. The unit numbers assigned and the combinations selected as standard are listed in the following tables[3]:

Table 2—Units 1 to 5—First Story Warm Air Ducts and Registers.
Table 3—Units 11 to 16—Second Story Warm Air Ducts, Single Wall Stacks, Fittings, and Registers.
Table 4—Units 21 to 24—Second Story Warm Air Ducts, Double Wall Stacks, Fittings, and Registers.
Table 5—Units 31 to 38—Returns Air Ducts, Fittings, and Grilles.

The selected types of boots are shown in Fig. 2. It is essential that free areas be maintained throughout fittings.

The selected types of return air ducts and fittings are shown in Fig. 3.

Carrying Capacity

The Btu carrying capacities of the selected units of warm air and return air combinations are shown in Tables 6, 7 and 8:

Table 6—Units 1 to 5—Warm Air Carrying Capacities to first story registers with 1 to 5 elbows and with leaders 4 to 24 ft long.
Table 7—Units 11 to 16 and 21 to 24—Warm Air Carrying Capacities to second story registers with 1 to 5 elbows and with leaders 4 to 24 ft long.
Table 8—Units 31 to 38—Return Air Carrying Capacities for types *A*, *B*, *C*, *D* and *E* return combinations.

[3]Standard Code Application Manual for Gravity Warm Air Heating Systems, First Edition, 1941, *National Warm Air Heating and Air Conditioning Association.*