

used for taking up thermal expansion. The amount of pipe, L , required in each of these bends may be computed from the following formula:

$$L = 6.16 \sqrt{D \Delta} \quad (2)$$

where

L = length of pipe, feet.

D = outside diameter of the pipe used, inches.

Δ = the amount of expansion to be taken up, inches.

This formula, based on the use of mild-steel pipe with wall thicknesses not heavier than extra-strong, assumes a maximum safe value of fiber stress of 16,000 lb per square inch. When square type bends are used, the width of the bend should not exceed about two times the height. It is

TABLE 3. DIMENSIONS OF WELDED WROUGHT-IRON PIPE

NOMINAL PIPE SIZE	OUTSIDE DIAMETER	NOMINAL WALL THICKNESSES FOR SCHEDULE NUMBERS					
		Schedule 10	Schedule 20	Schedule 30	Schedule 40	Schedule 60	Schedule 80
1/8	0.405	-----	-----	-----	0.070*	-----	0.098*
1/4	0.540	-----	-----	-----	0.090*	-----	0.122*
3/8	0.675	-----	-----	-----	0.093*	-----	0.129*
1/2	0.840	-----	-----	-----	0.111*	-----	0.151*
3/4	1.050	-----	-----	-----	0.115*	-----	0.157*
1	1.315	-----	-----	-----	0.136*	-----	0.183*
1 1/4	1.660	-----	-----	-----	0.143*	-----	0.195*
1 1/2	1.900	-----	-----	-----	0.148*	-----	0.204*
2	2.375	-----	-----	-----	0.158*	-----	0.223*
2 1/2	2.875	-----	-----	-----	0.208*	-----	0.282*
3	3.5	-----	-----	-----	0.221*	-----	0.306*
3 1/2	4.0	-----	-----	-----	0.231*	-----	0.325*
4	4.5	-----	-----	-----	0.242*	-----	0.344*
5	5.563	-----	-----	-----	0.263*	-----	0.383*
6	6.625	-----	-----	-----	0.286*	-----	0.441*
8	8.625	-----	-----	0.283*	0.329*	-----	0.510*
10	10.75	-----	-----	0.313*	0.372*	0.510*	0.606
12	12.75	-----	-----	0.336*	0.414	0.574	0.702
14 O. D.	14.0	0.250	0.312	0.375	0.437	0.625	0.750
16 O. D.	16.0	0.250	0.312	0.375	0.500	0.687	-----
18 O. D.	18.0	0.250	0.312	0.437	0.562	0.750	-----
20 O. D.	20.0	-----	0.375	0.500	0.562	-----	-----

All dimensions are given in inches.

The decimal thicknesses listed for the respective pipe sizes represent their nominal or average wall dimensions and include an allowance for mill tolerance of 12.5 per cent under the nominal thickness.

*Thicknesses marked with an asterisk in Schedules 30 and 40 are identical with thicknesses for standard-weight pipe in former lists; those in Schedules 60 and 80 are identical with thicknesses for extra-strong pipe in former lists.

The Schedule Numbers indicate approximate values of the expression $1000 \times P/S$.

further assumed that the corners are made with screwed or flanged elbows or with arcs of circles having radii five to six times the pipe diameter.

All risers must be anchored and safeguarded so that the difference in length when hot from the length when cold shall not disarrange the normal and orderly provisions for drainage of the branches.

It is especially necessary with light-weight radiators so to anchor the piping and so to give it freedom for expansion that no strain therefrom shall be allowed to distort the radiators. When expansion strains from the pipes are permitted to reach these light metal heaters they usually emit sounds of distress which are exceedingly troublesome.

PIPE THREADS

All threaded pipe for heating and ventilating installations uses the American Standard taper pipe thread which is made with a taper of 1 in 16 measured on the diameter of the pipe so as to secure a tight joint. Threads of fittings are tapped to the same taper. The number of threads

TABLE 4. NOMINAL WEIGHTS OF WELDED WROUGHT-IRON PIPE

NOMINAL PIPE SIZE (INCHES)	SCHED. 10	SCHED. 20	SCHEDULE 30		SCHEDULE 40		SCHEDULE 60	SCHEDULE 80
	Plain Ends	Plain Ends	Plain Ends	Threads and Couplings	Plain Ends	Threads and Couplings	Plain Ends	Plain Ends
1/8	-----	-----	-----	-----	0.25*	0.25*	-----	0.32*
1/4	-----	-----	-----	-----	0.43*	0.43*	-----	0.54*
3/8	-----	-----	-----	-----	0.57*	0.57*	-----	0.74*
1/2	-----	-----	-----	-----	0.86*	0.86*	-----	1.09*
3/4	-----	-----	-----	-----	1.14*	1.14*	-----	1.48*
1	-----	-----	-----	-----	1.68*	1.69*	-----	2.18*
1 1/4	-----	-----	-----	-----	2.28*	2.29*	-----	3.00*
1 1/2	-----	-----	-----	-----	2.72*	2.74*	-----	3.64*
2	-----	-----	-----	-----	3.66*	3.68*	-----	5.03*
2 1/2	-----	-----	-----	-----	5.80*	5.82*	-----	7.67*
3	-----	-----	-----	-----	7.58*	7.62*	-----	10.3*
3 1/2	-----	-----	-----	-----	9.11*	9.21*	-----	12.5*
4	-----	-----	-----	-----	10.8*	10.9*	-----	15.0*
5	-----	-----	-----	-----	14.7*	14.9*	-----	20.8*
6	-----	-----	-----	-----	19.0*	19.2*	-----	28.6*
8	-----	-----	24.7*	25.0*	28.6*	28.8*	-----	43.4*
10	-----	-----	34.3*	35.0*	40.5*	41.2*	54.8*	54.4
12	-----	-----	43.8*	45.0*	53.6	55.0	73.2	88.6
14 O. D.	36.0	44.8	53.6	-----	62.2	-----	87.6	104.0
16 O. D.	41.3	51.4	61.4	-----	81.2	-----	111.0	-----
18 O. D.	46.5	57.9	80.5	-----	103.0	-----	136.0	-----
20 O. D.	-----	77.0	103.0	-----	115.0	-----	-----	-----

Weights are given in pounds per linear foot and are for pipe with plain ends except for sizes which are commercially available with threads and couplings for which both weights are listed.

*Weights marked with an asterisk in Schedules 30 and 40 are identical with weights for standard-weight pipe in former lists; those in Schedules 60 and 80 are identical with weights for extra-strong pipe in former lists.

The Schedule Numbers indicate approximate values of the expression $1000 \times P/S$.

per inch varies with the different pipe sizes. All threaded pipe should be made up with a thread paste suitable for the service under which the pipe is to be used.

HANGERS

Heating system piping requires careful and substantial support. Where changes in temperature of the line are not large, such simple methods of support may be utilized as hanging the line by means of rods or perforated strip from the building structure, or supporting it by brackets or on piers.

When fluids are conveyed at temperatures of 150 F or above, however, hangers or supporting equipment must be fabricated and assembled to permit free expansion or contraction of the piping. This can be accomplished by the use of long rod hangers, spring hangers, chains, hangers or