SELLERS

TECHNICAL BULLETIN
1004
DECEMBER 1, 2007

STACK AND BREECHING GUIDELINE

Common stacks and breechings can be designed as follows:

1. Determine volume of flue gases from Chart 1. Chart shows flue gas CFM per 100 HP. Use actual stack temperature or 100 to 200 deg. F. above the water operating temperature.

   Example: With 200 HP boiler operating at 200 degrees F. and flue outlet temperature of 350 degrees (300 degrees average stack temperature), flue gas volume for natural gas is 1,247 x 2 = 2,494 CFM at 10% CO_2.

2. Layout breeching and stack. Estimate stack diameter based on boiler flue outlet. See Table 1 if using rectangular ducts. Determine total equivalent length of stack and breeching by adding together the actual length plus the extra equivalent length of bends. See Chart 2 for equivalent length of bends.

   If more than one diameter is used, find the total equivalent length for each diameter.

   Example: For the above boiler with an 18 in. stack (or 10 x 28) stack, breeching layout is 2 ft. vertical rise, 90 deg. elbow, 8 ft. horizontal run to 90 in. elbow and 30 ft. vertical stack.

   Equivalent length of 2-18 in. by 90 deg. elbows from Chart 2 is 2x18x1.42=51 ft.

   Total equivalent length is 2 ft. + 8 ft. + 30 ft. + 51 ft. = 91 ft.

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3. Determine friction loss using Chart 3. Generally, friction loss should not exceed .2 in. w.c. for the breeching and stack.

   Example: For the 200 HP with 2,494 CFM of flue gas through the above stack, Chart 3 shows the flue loss is .12 in. per 100 ft. Loss for total length is
   .12 in. x 91/100 = .109 in. w.c.

4. Using Chart 4, find stack effect using the average stack temperature.

   Example: For the above boiler with 350 deg. F. flue gas and 300 deg. average stack temperature in a 30 ft. high stack, draft effect is .136 in. w.c.

5. Determine net draft by subtracting the stack effect (paragraph 4) from friction loss (paragraph 3). The net draft result should be in the ideal range shows:

   + ▲ Back Pressure - Possible Leakage
   + .08 Unacceptable
   + .00
   - .02 Ideal
   - .04 Draft
   - .10 Unacceptable
   - ▼ Excessive Draft - Use Barometric Damper

   Example: For the above boiler: .109 - .136 = .027 inc. w.c. draft. This is in the acceptable range.

   If draft is not in the acceptable range, changes in the stack diameter or height can be made to correct the performance.

Some do's and don'ts of stack design follow.

FLUE GAS VOLUME

Chart 1

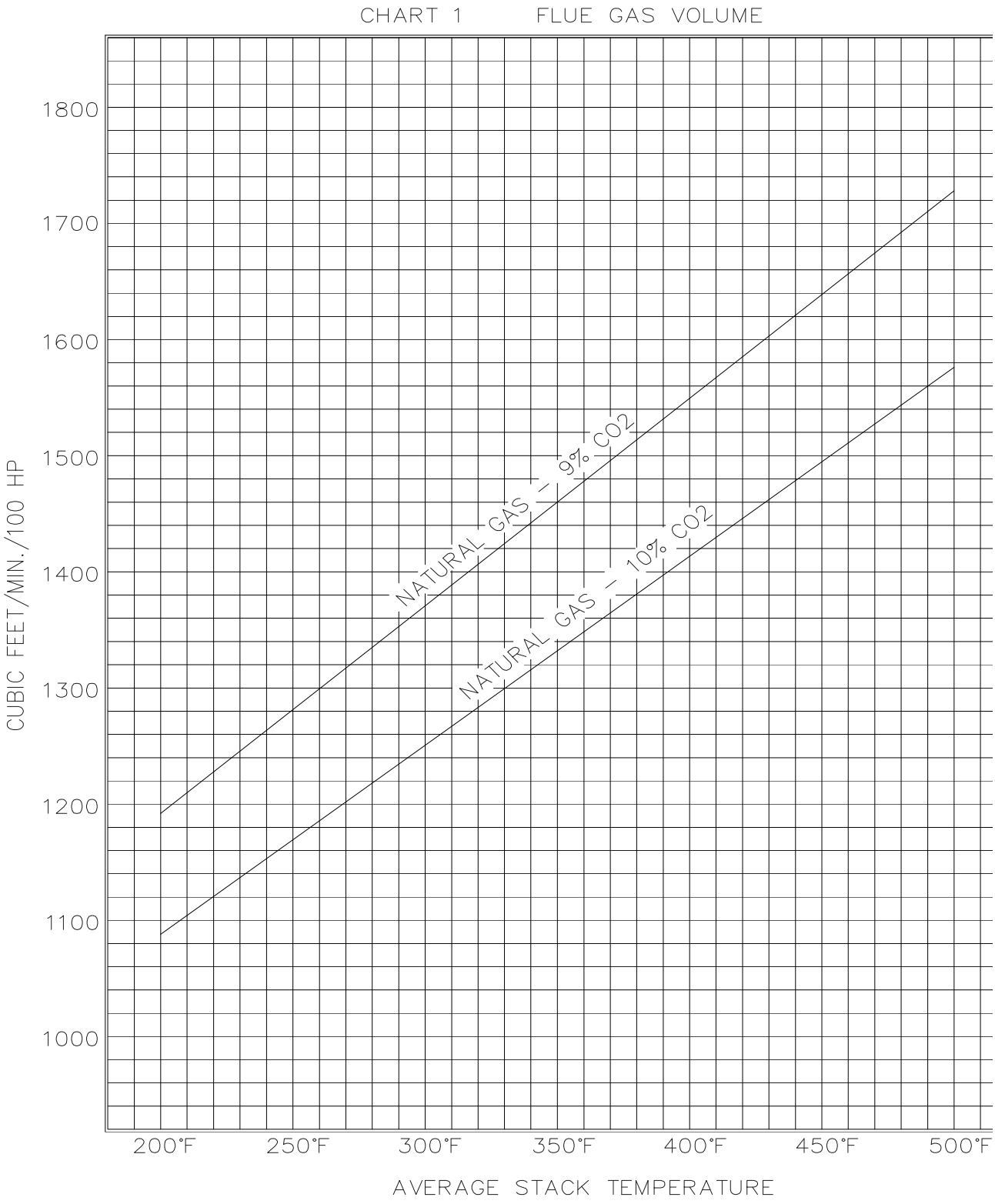


Table 1

CIRCULAR EQUIVALENTS

Round equivalents of rectangular ducts with equal capacity and friction

RECTANGULAR DUCT SIZE

DIMENSIONS IN INCHES

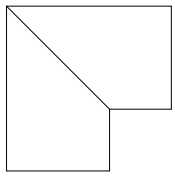
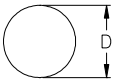
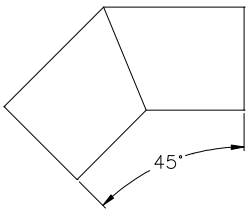
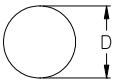
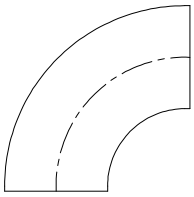
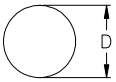
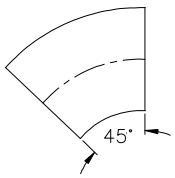
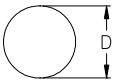
	10	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30
10	10.9															
11	11.4	12.0														
12	11.9	12.5	13.1													
13	12.4	13.0	13.6	14.2												
14	12.9	13.5	14.2	14.7	15.3											
15	13.3	14.0	14.6	15.3	15.8	16.4										
16	13.7	14.4	15.1	15.7	16.3	16.9	17.5									
17	14.1	14.9	15.5	16.1	16.8	17..4	18.0	18.6								
18	14.5	15.3	16.0	16.6	17.3	17.9	18.5	19.1	19.7							
19	14.9	15.6	16.4	17.1	17.8	18.4	19.0	19.6	20.2	20.8						
20	15.2	15.9	16.8	17.5	18.2	18.8	19.5	20.1	20.7	21.3	21.9					
22	15.9	16.7	17.6	18.3	19.1	19.7	20.4	21.0	21.7	22.3	22.9	24.1				
24	16.6	17.5	18.3	19.1	19.8	20.6	21.3	21.9	22.6	23.2	23.9	25.1	26.2			
26	17.2	18.1	19.0	19.8	20.6	21.4	22.1	22.8	23.5	24.1	24.8	26.1	27.2	28.4		
28	17.7	18.7	19.6	20.5	21.3	22.1	22.9	23.6	24.4	25.0	25.7	27.1	28.2	29.5	30.6	
30	18.3	19.3	20.2	21.1	22.0	22.9	23.7	24.4	25.2	25.9	26.7	28.0	29.3	30.5	31.6	32.8
32	18.8	19.8	20.8	21.8	22.7	23.6	24.4	25.2	26.0	26.7	27.5	28.9	30.1	31.4	32.6	33.8
34	19.3	20.4	21.4	22.4	23.3	24.2	25.1	25.9	26.7	27.5	28.3	29.7	31.0	32.3	33.6	34.8
36	19.8	20.9	21.9	23.0	23.9	24.8	25.8	26.6	27.4	28.3	29.0	30.5	32.0	33.0	34.6	35.8
38	20.3	21.4	22.5	23.5	24.5	25.4	26.4	27.3	28.1	29.0	29.8	31.4	32.8	34.2	35.5	36.7
40	20.7	21.9	23	24.0	25.1	26.0	27.0	27.9	28.8	29.7	30.5	32.1	33.6	35.1	36.4	37.6

	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62
32	35.0															
34	36.0	37.2														
36	37.0	38.2	39.4													
38	38.0	39.2	40.4	41.6												
40	39.0	40.2	41.4	42.6	43.8											
42	39.9	41.1	42.4	43.6	44.8	45.9										
44	40.8	42.0	43.4	44.6	45.8	46.9	48.1									
46	41.7	43.0	44.3	45.6	46.8	47.9	49.1	50.3								
48	42.6	43.9	45.2	46.5	47.8	48.9	50.2	51.3	52.6							
50	43.5	44.8	46.1	47.4	48.8	49.8	51.2	52.3	53.6	54.7						
52	44.3	45.7	47.1	48.3	49.7	50.8	52.2	53.3	54.6	55.8	56.9					
54	45.0	46.5	48.0	49.2	50.6	51.8	53.2	54.3	55.6	56.8	57.9					
56	45.8	47.3	48.8	50.1	51.5	52.7	54.1	55.3	56.5	57.8	58.9	61.3				
58	46.6	48.1	49.6	51.0	52.4	53.7	55.0	56.2	57.5	58.8	60.0	62.3				
60	47.3	48.9	50.4	51.8	53.3	54.6	55.9	57.1	58.5	59.8	61.0	63.3	65.7			
62	48.0	49.7	51.2	52.6	54.2	55.5	56.8	58.0	59.4	60.7	62.0	64.3	66.7			

FRICTION LOSS IN FLUE PIPE ELBOWS

Determines equivalent feet of straight pipe

Chart 2

90° MITERED 	SQUARE 	L = 6.2 x D	24" SQUARE 90° ELBOW---MITERED L = 6.2 x 24 = 149 Ft. STRAIGHT DUCT
	ROUND 	L = 5.4 x D	30" ROUND 90° ELBOW---MITERED L = 5.4 x 30 = 162 Ft. STRAIGHT DUCT
45° MITERED 	SQUARE 	L = 3.1 x D	18" SQUARE 45° ELBOW---MITERED L = 3.1 x 18 = 56 Ft. STRAIGHT DUCT
	ROUND 	L = 2.7 x D	20" ROUND 45° ELBOW---MITERED L = 2.7 x 20 = 54 Ft. STRAIGHT DUCT
90° ROUNDED 	SQUARE 	L = .92 x D	36" SQUARE 90° ELBOW---ROUNDED L = .92 x 36 = 33 Ft. STRAIGHT DUCT
	ROUND 	L = 1.42 x D	36" ROUND 90° ELBOW---ROUNDED L = 1.42 x 26 = 37 Ft. STRAIGHT DUCT
45° ROUNDED 	SQUARE 	L = .46 x D	12" SQUARE 45° ELBOW---ROUNDED L = .46 x 12 = 6 Ft. STRAIGHT DUCT
	ROUND 	L = .71 x D	32" ROUND 45° ELBOW---ROUNDED L = .71 x 32 = 23 Ft. STRAIGHT DUCT

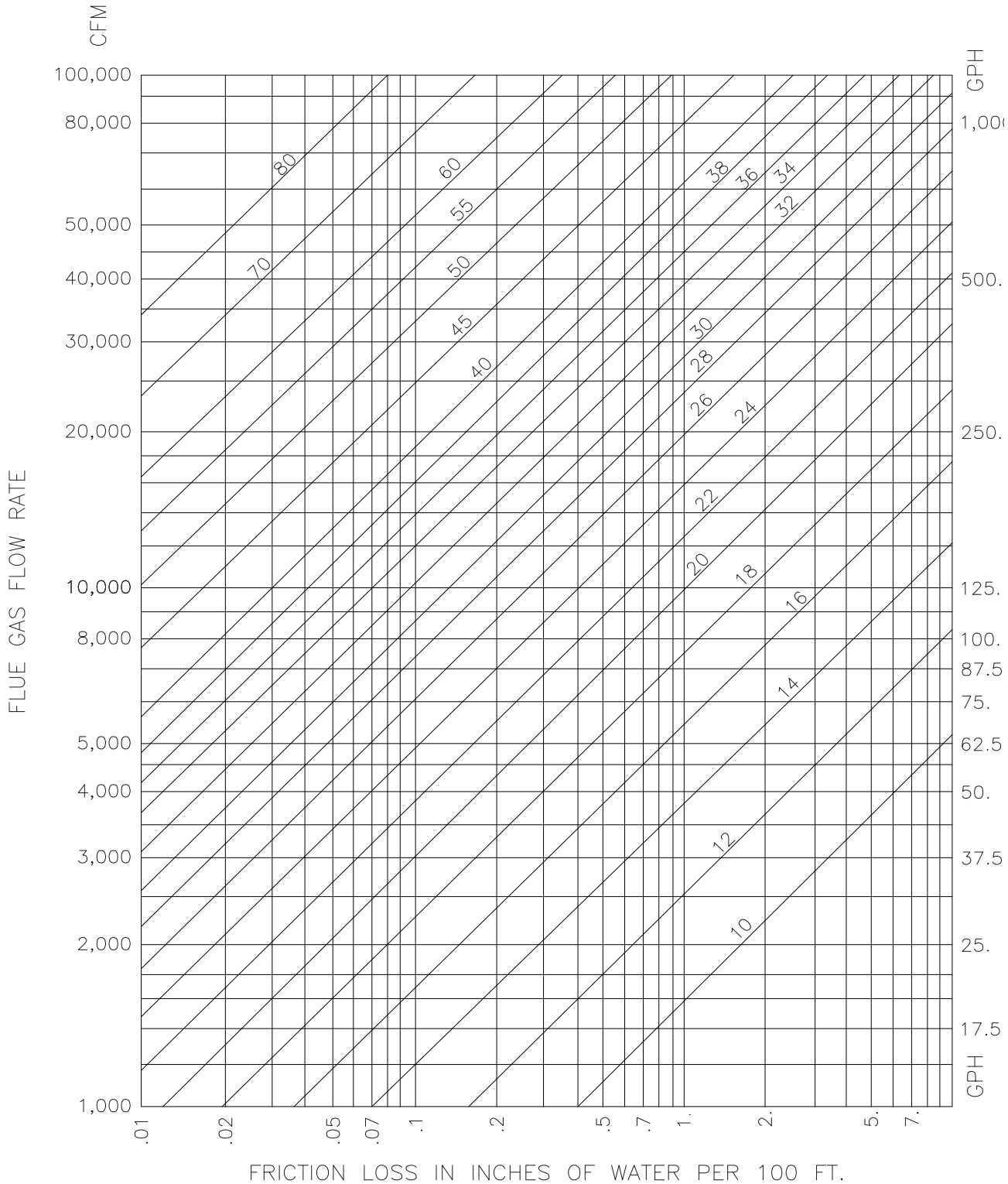
L is expressed in feet
D is expressed in inches

Note: Based on $\frac{R}{D}\ 2 + \frac{R}{W}\ 3$

FRICTION LOSS IN ROUND DUCTS

Flue gas draft loss in ducts and chimneys at 600° F.

Chart 3

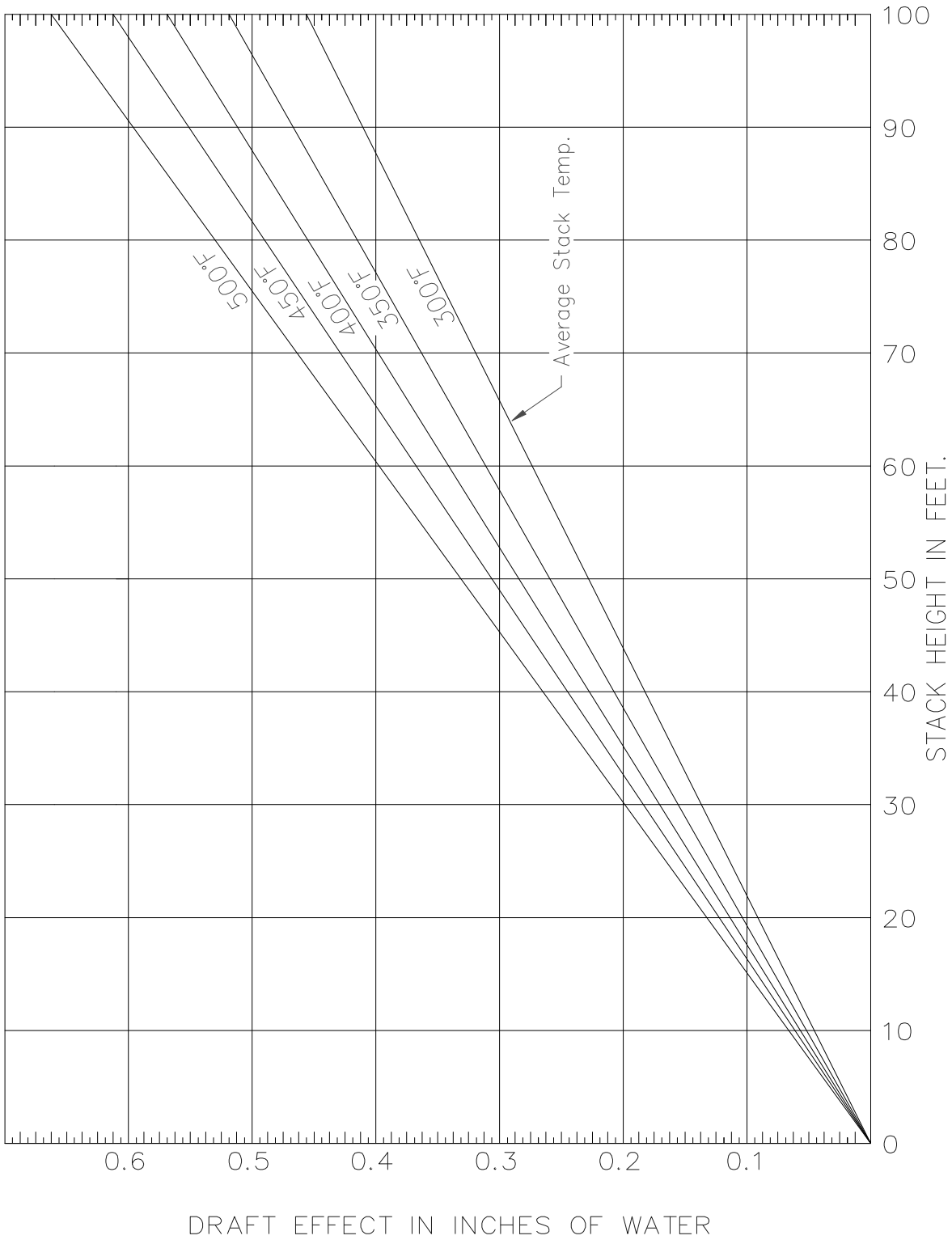


NOTE: Diagonal Lines Are Breeching Diameters In Inches

FRICTION LOSS IN ROUND DUCTS

Flue gas draft loss in ducts and chimneys at 600° F.

Chart 4



STACK BREECHING
INSTALLATION AND DESIGN CRITERIA

The Sellers Heater is provided with a power burner to permit operation under adverse situations. These burners can overcome many of the inadequacies of a poor installation, but they are not a cure-all. To help insure that you have a good installation, comply with the following suggestions:

DO:

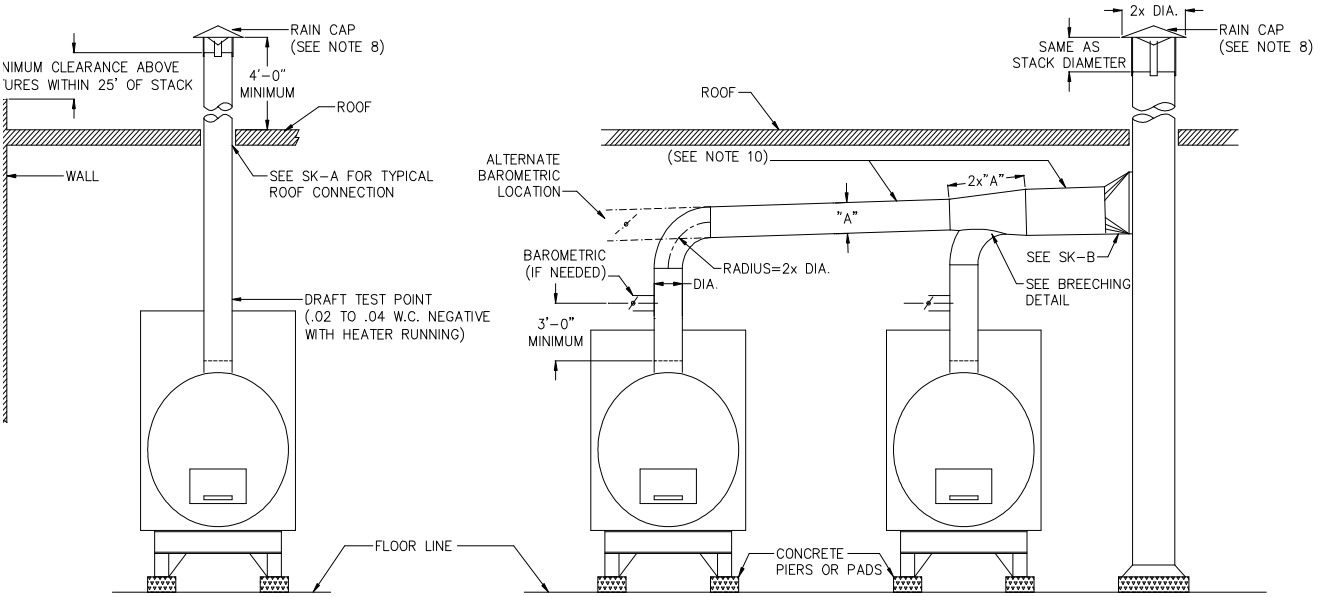
1. Keep breeching short, straight and round, if possible. (Provide at least 5% more area in rectangular ducts than in round ducts.)
2. Change shapes of breechings slowly and smoothly. Slope on sides of transition pieces should be 10 deg. (20 deg. minimum). Separate stacks for each unit of a multiple installation are preferred to collector breechings and a central common stack.
3. Use a pressure tight double wall or insulated stack and breeching suitable for forced draft firing without a draft hood. Such stacks are commercially available from Metalbestos, Van Packer and others. Fabricated 16 gauge or heavier steel stacks with insulation may also be acceptable. Check all codes to be sure proper stack is selected.
4. Keep breeching and stack area equal to or larger than flue openings.
5. Use barometric draft controls to reduce or control high natural drafts (.10" w.c. or more). Barometric controls should be installed near the flue gas outlet of the unit. For multiple installations connected to a common breeching, install the barometric in the connector between the flue outlet and the common breeching. Barometrics should be mounted in a collar equal in length to the diameter of the breeching or longer. This keeps the swinging gate of the barometric away from the velocity of the flowing flue gases.
6. Design breeching and stack to provide .02" to .04" w.c. negative static draft at flue outlet test point. For multiple unit installations on combined breechings, design breeching using equal pressure drop techniques. (Calculations should be based on flue gas velocities of approximately 1300 to 2000 fpm. Each 1,000,000 Btu/hr. of natural gas input creates approximately 465 cfm of flue gas volume.)
7. Slope breeching upward 1" per foot to eliminate gas pockets.
8. Use a rain cap such as the "coolie". Locate "coolie" cap a full pipe diameter above top of stack.
9. Use power flue gas exhauster if long horizontal breeching runs, unavoidable downdrafts, or erratic winds due to architectural design are encountered. Available exhausters include Wing, Breidert, Tjhernlund, DeBothezat, etc.
10. Increase breeching size for multiple unit installations: See SK285-3. Area "B" of breeching to be 200 deg. of Area "A" (150% minimum).
11. Consult local codes to insure full compliance with special local regulations.

DON'T:

1. Don't use more than 2 - 90 deg. elbows on breeching.
2. Don't use more than 100 ft. of horizontal breeching without checking to be sure proper draft will be available at the flue outlet.
3. Don't use bullhead tees or mitered elbows.
4. Don't use vertical or horizontal draft diverters.

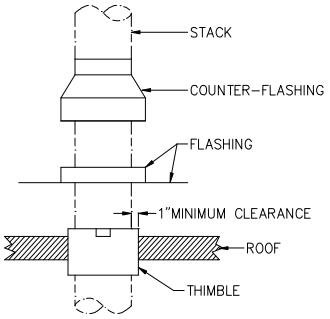
See Service Section of Owner's Manual for more details on stack operation or stack servicing.

SUGGESTED STACK ARRANGEMENTS FOR WATER HEATERS AND BOILERS

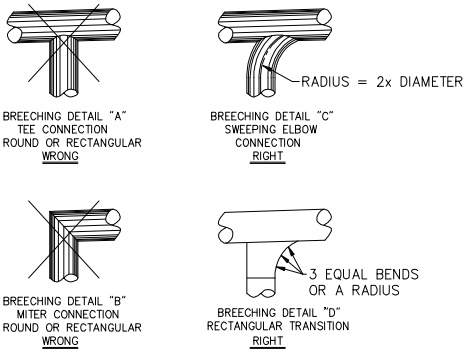


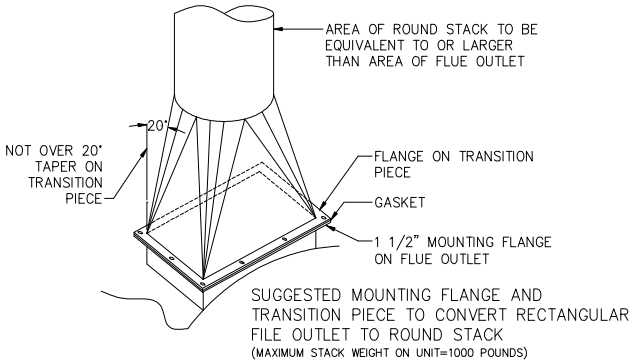
PREFERRED STACK ARRANGEMENT

ALTERNATE STACK ARRANGEMENT
FOR ONE OR MORE HEATERS

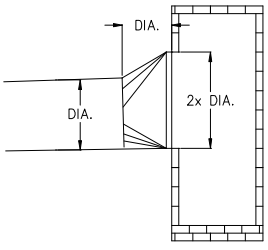


SK-A





SUGGESTED MOUNTING FLANGE AND TRANSITION PIECE TO CONVERT RECTANGULAR FILE OUTLET TO ROUND STACK
(MAXIMUM STACK WEIGHT ON UNIT=1000 POUNDS)



SK-B
STACK TRANSITION
DETAIL

Sellers ENGINEERING COMPANY
P.O. Box 48 · Danville, Kentucky 40423-0048
Phone: 859/236-3181
Web-site: www.sellersengineering.com