4-4 COMPENSATING FOR EXTRA ELBOWS

Capacities shown for individual vents with laterals make allowance for two 90 degree turns anywhere in the system. Fittings for these turns may be:

A. Two 90 degree elbows
B. One 90 degree elbow and one tee
C. Four 45 degree elbows
D. Two 45 degree elbows and one tee

When more than two 90 degree turns are needed, there is a 10 percent reduction in maximum (MAX) capacity for each added turn. (Minimum capacity is not affected.) Thus, with more than two turns, use the following factors:

Three 90 degree turns: 90 percent of MAX capacity
Four 90 degree turns: 80 percent of MAX capacity

4-5 IN-BETWEEN HEIGHTS (INTERPOLATION)

There is no need to use the next highest height or an oversize vent for in-between situations, providing that a little calculation is employed. Assume the following problem:

A. A FAN furnace rated at 210,000 BTU per hour
B. It has a 6" outlet
C. The vent needs to be only 12-1/2' high to meet termination requirements
D. There will be a 2' lateral

Table I shows the following MAX capacities for a 5" vent

- at 15': 226,000 BTU
- at 10': 194,000 BTU
- 32,000 BTU difference

For 12-1/2', take one-half the difference (1/2 x 32) or 16,000 and add it to 194,000. Result: 210,000 or just right for this situation.

Comment: This example also illustrates how the tables may be used to reduce vent size if there is adequate height and capacity to do so.

This interpolation process can also be used to estimate in-between capacities for intermediate lengths of laterals, as well as in-between minimum capacities.

CAUTION! There is no way to estimate in-between capacity between a zero lateral (straight vertical vent) and a 2' lateral (which has two elbows). If the vent has just one 90 degree turn, use the 2' lateral capacity.

4-6 THE IDEAL VENT

Whenever possible, any individual vent should be located directly over the appliance outlet. If the outlet is horizontal, one 90 degree elbow should be used with the vent directly over it. A straight vertical vent is easily supported by the appliance, or by firestops, or it may be suspended from its flashing and storm collar.

There is no need to offset the vertical vent so as to include a tee and bracket. The use of a tee for cleanout or inspection purposes is quite unnecessary for three reasons. First, using a Metalbestos top keeps debris out, as well as birds. Second, clean-burning gas does not produce any deposits needing removal. Third, Metalbestos vent joints are easily opened to inspect the inside of the piping.

Should an offset be needed, the use of two elbows for the purpose will provide somewhat greater capacity than an elbow and a tee.

SECTION 5 CONNECTORS FOR COMBINED VENT SYSTEMS

5-1 GENERAL CONSIDERATIONS

Combined vent systems for two or more gas appliances of either type (FAN or NAT) must be designed to prevent draft hood spillage for natural draft (NAT) appliances and to avoid positive pressure for fan-assisted (FAN) appliances. The connector and common vent tables have been computed by examining the most critical situation for any operating combination. The connector tables are based on the most critical condition for that particular appliance when operating by itself, while the common vent tables show sizes that assure adequate capacity and draft whether one or all appliances are operating simultaneously.

All the parts of a combined vent must be checked for capacity. For connectors, the size must be determined from the tables, particularly for low height vents or where headroom restricts available connector rise.

5-2 A FUNCTIONAL DEFINITION FOR THE CONNECTOR

The connector in a combined vent system is defined here as the piping from a draft hood or flue collar to the junction of the common vent or to a junction in a vent manifold. Proper connector design is vital to obtaining adequate capacity. The connector must produce its share of the total draft, for its NAT or FAN appliance, and must deliver enough heat to the common vent so that the common vent can contribute the balance of draft needed.

From a code installation point of view, the Type B gas vent connector is a "gas vent." It is essential, however, for system design purposes to use the word "connector" so that its rise and configuration may be explained and tabulated.
The connector tables for combined vents show MIN and MAX capacities only for FAN appliances because it has been found that no minimums are needed for NAT appliances with Type B gas vent connectors.

Important factors in connector design include:

- Connector Material
- Connector Length
- Connector Rise
- Number
- Appliance location as it affects the piping arrangement
- Number of attached appliances or different connector sizes
- Connection to an offset or manifold rather than directly to the vertical common vent.

5-3 CONNECTOR LENGTH AND CAPACITY

The calculated capacity for both Metalbestos and single wall metal connectors serving a combined vent is based on a length in feet of 1-1/2 times the diameter in inches as in the table below:

<table>
<thead>
<tr>
<th>SIZE</th>
<th>3&quot;</th>
<th>4&quot;</th>
<th>5&quot;</th>
<th>6&quot;</th>
<th>7&quot;</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
<th>24&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH</td>
<td>4.5'</td>
<td>6'</td>
<td>7.5'</td>
<td>9'</td>
<td>10.5'</td>
<td>12'</td>
<td>15'</td>
<td>18'</td>
<td>36'</td>
</tr>
</tbody>
</table>

Increasing the length of the connector increases minimum capacity and decreases maximum capacity. A rule-of-thumb for maximum capacity only is that doubling connector length reduces its capacity by 10%. Also, a 1' difference (more or less) will not have a noticeable affect. Figure 7 shows that both vertical and horizontal vent piping must be included in connector length.

When horizontal lengths in excess of those stated above are necessary, the minimum capacity of the system should be determined by referring to the corresponding single appliance table. In this case, for each appliance the entire vent connector and common vent from appliance to vent termination should be treated as a single appliance vent (of the same size as the common vent), as if the others were not present. Any appliance failing to meet the MIN input may be prone to creating excessive condensation or insufficient draft within the vent system if operated by itself. In such case, options may include relocation of appliances, selective sequential or simultaneous operation of appliances, or separate vent installations.

5-4 CONNECTOR RISE ESTIMATION

In combined venting, connector rise is the vertical distance traveled by the hot gases between the appliance draft hood outlet or flue collar up to the point in a junction or interconnection where mixing occurs with gases from another appliance.

Examples of various connector arrangements in Figure 8 show how to estimate rise. If a small connector enters a much larger manifold fitting, rise is based on the height of the smaller connector to where it enters the larger one. To be conservative and obtain full capacity, it is best to underestimate the rise.

5-5 IMPORTANCE OF CONNECTOR RISE

Taking advantage of connector rise can result in using lower heights for the common vent. The connector rise table shows how this works. Assume a 63,000 BTU per hour NAT appliance with a 4" outlet is to be vented in combination with a much larger one. The following total heights are tabulated for a 4" size connector using Table 111.

<table>
<thead>
<tr>
<th>CONNECTOR RISE</th>
<th>TOTAL HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'</td>
<td>50' (49' of common vent)</td>
</tr>
<tr>
<td>2'</td>
<td>15' (13' of common vent)</td>
</tr>
<tr>
<td>3'</td>
<td>8' (5' of common vent)</td>
</tr>
<tr>
<td>5'</td>
<td>5' (self-venting, needs no common vent)</td>
</tr>
</tbody>
</table>

The benefit of greater connector rise is illustrated in Figure 9.
5-6 CONNECTOR TURN LIMITS ELBOWS AND TEES
To obtain full capacity, connectors for a combined vent should be limited to two 90 degree turns; either two elbows or an elbow and a tee as previously shown in Figure 3. If more turns are needed, there are three choices:
A. Use the next size larger connector (this may increase minimum capacity)
B. Use 1' more rise, if this is possible
C. Reduce connector maximum capacity by 10 percent for each added turn
Choices A and B are illustrated in Figure 10.

If the larger draft hood exceeds the restrictions shown, the choices are:
A. Increase the rise of the smaller connector by 1'. Use 2' of rise to get the same capacity as shown for 1' of rise. This choice is illustrated in Figure 11.
B. Use the next larger connector, but make sure that it will operate at greater than its minimum capacity.

5-7 CONNECTOR SIZE COMBINATIONS
Computations for the combined vent tables give capacities for combining any two sizes of Metalbestos connectors, from two of the same size, up to allowing a larger connector having six times the area of the smaller. This limit also allows up to seven appliances having the same size connectors to be attached to a manifold or common vent.

The combined vent tables apply to combining any two draft hood or flue outlet sizes in the following ranges:
When the smaller is 3" 4" 5" 6" 7" 8" 10"
The larger may not exceed 7" 10" 12" 14" 16" 20" 24"

5-8 CHOICES FOR CONNECTOR CONFIGURATION
As long as connector rise and length requirements are met, it does not matter if the connector runs vertically then laterally, or laterally then vertically, or is sloped at any angle up to the common vent connection. The piping arrangements shown in Figure 12 for draft hood appliances are equally suitable for fan-assisted appliances.

5-9 USE AVAILABLE HEADROOM FOR BEST OPERATION
The rise in the connector of a combined vent system can be its most effective part. Take advantage of Type B gas vents 1" minimum clearance to ceilings or floor structure either for better venting or to eliminate the need for a possible size increase. This means that the interconnection tee is best located as high as possible as shown in Figure 13.
5-10 WHEN IN DOUBT USE LARGER CONNECTOR

Especially for combined vents, the maximum input for a connector may not allow it to be the same size as the draft hood or flue collar and a size increase may be needed. Also, if there is any uncertainty that connector rise may be insufficient, use the next larger size and increase the size directly at the draft hood outlet. This simple size increase precaution will help avert draft hood spillage or positive pressure problems with a fan-assisted appliance.

5-11 SELF-VENTING CONNECTORS

If any connector attached to a combined vent system has a rise of 5' or more, it may be installed as though it were an individual vent, using the appropriate individual vent table. This rule applies, for example, where Metalbestos Type B connectors enter the common vent in an attic. Allowance must be made in such cases for lateral length and number of turns. An attic interconnection is shown in the lower right hand corner of Figure 14.

SECTION 6

COMMON VENTS

For purposes of this Handbook, the common vent is any part of the system carrying gases from two or more appliances. Thus, a manifold at the lower end of the system is also a part of the common vent. Common vents may be vertical above an interconnection tee, or they may have an offset. The first part of this discussion treats common vents serving two or more appliances at one level or floor. Multi-story common vents are covered in Section 7.

For low attics and flat roofed construction, a common vent system may be more expensive and less desirable than two individual vents. The installation of two individual vents as shown in Figure 15 eliminates two elbows, one tee, and possibly can use smaller sizes of Type B gas vent.

6-1 APPLIANCES WHICH CAN USE COMMON VENTS

Both draft hood and fan-assisted appliances may be common vented in any combination, as indicated by the headings in the common vent table. Appliance types include:

- Central heating furnaces
- Central heating boilers (hot water and steam)
- Water heaters
- Unit heaters
- Duct furnaces
- Room heaters
- Floor furnaces

*If these have draft hoods, an appropriate design input increase of 40 percent is recommended in order to use the tables (see Section 4-1 also).

6-2 APPLIANCES WHICH CANNOT USE COMMON VENTS

The common vent tables do not apply to:

A. Gas cooking appliances, which should be vented into an appropriate ventilator hood.
B. Forced draft, commercial or industrial hot water or steam boilers without draft hoods. For this equipment see Sections 10 and 11.
C. Clothes dryers which have high positive pressure exhaust systems and can also cause lint clogging.
D. Categories II, III, or IV gas-burning equipment, for which the equipment manufacturer’s venting instructions must be used.
E. Gas-fired incinerators.