3.1415927

APPLICATION BULLETIN

VENTING OF THE HIGH ECONOMY FURNACES

IH, IC and IL-SERIES

AREA OF 1ST VENT + 50% OF AREA OF ALL ADDITIONAL VENTS

= AREA OF THE SIZE OF VENT REQUIRED

	AREA SQ IN
3"	= 7.0686
4"	= 12.566
5"	= 19.635
6"	= 28.274
7"	= 38.485
8"	= 50.265

7.06
3.5343

GENERAL

The IH, IC & IL-Series High Economy furnaces are designed for zero vent pressure. Zero vent pressure operation means that the flow energy created by the furnace inducer is completely depleted inside the furnace; therefore, the vent system must move the flue products out of the house with its buoyant head. Buoyant head is a result of the flue product temperature and the vent system height. Because undiluted flue product temperatures of the High Economy furnaces are comparable to diluted flue product temperatures of existing natural draft furnaces, a satisfactory buoyant head results. Vent systems with little or no height will not provide sufficient buoyant head for satisfactory venting of either the High Economy or natural draft furnaces. For this reason, horizontal venting through a side wall will not provide satisfactory venting for existing natural draft furnaces or the zero vent pressure High Economy furnaces.

In addition, side wall vent terminations expose the vent system to much greater wind pressures than conventional vent terminations. This wind pressure can result in unsatisfactory venting. The High Economy furnaces must not be vented horizontally through a side wall. DO NOT install the High Economy with vent systems of this type because they are not designed, tested, or A.G.A. design-certified for use with such a vent system. For more information regarding venting of these furnaces, refer to the Installation Instructions and Procedures, and the National Fuel Gas Code. Because of local environmental conditions, local codes may have additional criteria which must also be followed.

The High Economy furnaces operate with less heat input (loss) to the vent system than the conventional drafthood type furnaces. Flow up the vent essentially stops during the off cycle when the inducer motor is off and the vent cools. Relief (dilution) air flow is eliminated during the on cycle. Therefore, the temperature of the flue products is higher than if they were mixed with the cooler relief (dilution) air. The higher temperature helps to reheat the vent quickly. Lack of dilution air, however, also means the flue products have proportionately more water vapor and have a higher dew point temperature. Dew point temperature is that temperature below which the water turns to liquid (condenses). A marginal vent operating at too low a temperature (below the dew point temperature) encounters condensation problems.

A.G.A. CERTIFICATION

The IH,IC and IL-Series High Economy Furnaces are A.G.A. design-certified and tested for use with an approved chimney or type B1 vent. Type B-1 double-wall vent systems are recommended but Type C single-wall vent connector may be used in some installations if the vent connector is short. Single-wall vent connectors must be aluminum pipe. Minimum clearances for both types of vent are shown on the furnace rating plate. When type "B-1" vent is used, an adapter is required between the draft blower outlet and the "B-1" vent.

COMMON VENTING

These furnaces are suitable for common venting with another gas appliance such as a gas water heater. The addition of a field installed Common Venting Kit is required. Refer to Common Venting information in Installation Instructions and later in this bulletin. Proper venting is covered in the Installation Instructions packaged with each furnace, and in the National Fuel Gas Code (NFPA 54-1984 or ANSI Z223.1-1984). Local codes may have additional criteria which, because of local environmental conditions, must be followed.

A.G.A. conducted Engineering Report No. ER28-47 dated February 28, 1984 titled "Study of Vent Connector Static Pressure in IH-Series Induced Draft Forced Air Furnaces" and was used as the basis for this bulletin as well as A.G.A.'s determination of suitability for common venting as described in the Installation Instructions.

The same venting considerations that have always applied to a new installation or a replacement furnace installation still apply with the High Economy furnaces. Since all higher efficiency gas-fired appliances, however, send less heat out the vent, marginal vents are more susceptible to condensation problems.

Furthermore, a downsized replacement furnace, resulting from a decrease in the design heat loss due to the addition of insulation to the building or other energy-saving measures, could cause an existing vent system to become marginal.

Most installing dealers check the suitability of the vent or chimney when installing a replacement furnace. Their observations and experience have produced a set of guidelines for judging the suitability of the vent or chimney. Generally, these guidelines have proven workable. They have been modified over a period of years, taking successes and setbacks into account. For the last 30 years, furnace technology has remained relatively constant. That technology is now changing. With the benefits that new technology brings, we must all re-evaluate our past practices and make changes where needed. For those who, as a matter of course, check add-on and replacement vents according to the provisions contained in the National Fuel Gas Code (NFPA 54-1984 or ANSI Z223.1-1984), this booklet contains only supporting information. For those who do not currently ensure that the existing vents satisfy these requirements, we provide the following cautions and guidelines.

MARGINAL EXISTING VENT SYSTEMS (Replacement Furnaces)

Undersized Vents

The High Economy furnaces have a special control circuit in which the pressure switch that proves operation of the combustion air blower and adequate combustion air will also respond to an undersized or restricted vent system and shut down the furnace before the combustion characteristics go "sour" and could potentially be forced out at the burner opening.

Oversized Vents

With an oversized vent or massive chimney, the flue products are sometimes unable to heat the inside surface of the chimney or vent pipe to a temperature above the dew point temperature. This also makes the establishment of a proper draft more difficult during the start-up of a cold furnace.

Other Factors

Several additional factors may contribute to condensate formation in the vent. The physical mass of the vent is as important as size. Unlined masonry chimneys are unsatisfactory because the flue products do not contain enough heat to warm the massive brick wall of the chimney. In addition, unlined chimneys are less resistant to condensate than lined chimneys. Finally, exposure of the vent to low outdoor temperatures will also contribute to condensate formation.

PRE-SALE INSPECTION

The following information will describe for distributors, dealers, and installing contractors, a method for identifying a marginal vent before the furnace is installed.

Existing vents must always be inspected before furnace installation. Most replacement dealers conduct this vent inspection and this practice is heartily endorsed. Vent inspections are doubly important when high-efficiency furnaces are installed, because of the reduced heat input to the vent. This inspection should be conducted before the sale of the furnace. Venting conditions should also be addressed, before the sale, by specifically stating that the quoted price either does or does not include modifications to the vent system. In any case, the inspection must be conducted before installation. This practice will reduce the possibility of call-backs to correct venting problems, and will increase customer satisfaction.

INSPECTION CHECK LIST

In addition to compliance with the National Fuel Gas Code, certain vent system conditions should be avoided to minimize the possibility of condensation. Before the sale or installation of a replacement furnace, the following conditions should be noted:

1. Unlined masonry chimneys are unacceptable.

2. Underground vent connectors or flue gas passages are unacceptable.

3. Tile-lined masonry chimneys with one or more sides exposed to outdoor air may be a problem. In areas with very low outdoor temperatures, a metal liner, as suggested in Section 7.4.4(c) of the National Fuel Gas Code, may have to be installed. Or it may be necessary to provide a condensate drain, as suggested in Section 7.8.2. Running B-1 vents up the outside of an exterior wall is unacceptable unless insulated and framed in.

   NOTE: It is recommended that the chimney be utilized as a path for venting to the outside using B-1 vent.

   a) Type "B-1" vent must be installed in accordance with the terms of their listings and the vent manufacturer's instructions. When type B-1 vent is used an adapter is required between the draft blower outlet and B-1 vent.

   b) The B-1 vent must be mechanically supported in the masonry chimney to maintain 1 inch clearance.

   c) The bottom of the B-1 vent cap must be at least 6 inches above masonry chimney.

   d) DO NOT install this type liner in/or connect this furnace to a masonry chimney used to vent a solid fuel appliance.

   WARNING: If the remaining free area between the type "B-1" gas vent liner and the masonry chimney is to be used for venting another appliance, be sure the remaining area is adequate to vent that appliance. Be sure the "B-1" liner does not block the opening where the other vent enters the chimney.

4. Tile-lined masonry chimneys which are grossly oversized, use heavy wall tile, or have no air gap between liner and chimney are also possible problems. Again, in areas with very low outdoor temperatures, a metal liner or a condensate drain may be required.

5. Cracks in or adjacent to the chimney, missing grout between tiles or other structural defects may be a problem. Air leakage into the chimney reduces draft and can contribute to condensate formation.

6. Tightly constructed houses with negative pressure producing devices (such as fireplaces, exhaust fans and clothes driers) located very close to the furnace may be a problem. This negative pressure can cause down drafts in the flue during the off cycle which may chill the chimney to the point that excessive condensation will occur on furnace start-up.

   This problem may be corrected by relieving the negative pressure at the furnace or by installing a metal liner in the chimney.

7. Indications of condensation will signal a problem. These signs include: loose or crumbling masonry joints, water stains or corrosion on metal vent joints, and rusty or stained furnace and water heater draft diverters.

8. Evidence of contaminated combustion air will also indicate a problem. These signs include: extremely rusty heat exchangers or burners and badly corroded metal vents. Contaminants in the combustion air will raise the flue gas dew point temperature, and increase the probability of flue gas condensation.

Combustion air must be free of acid-forming chemicals, such as sulfur, fluorine, and chlorine. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, air fresheners, paint and varnish removers, refrigerants and many other household products. Vapors from these products, when burned in a gas flame, form acid compounds. These acid compounds increase the dew point temperature of the flue products, and are highly corrosive after they condense.

If such contaminants are known to be present, 100% outside air must be ducted separately to the furnace room, and the furnace room must be sealed off from the surrounding area.

WARNING: It is not permissible to seal the combustion air openings (louvers) on the furnace and duct outside air directly into furnace casing.

In general, any situation that lowers the flue gas temperature or raises its dew point temperature should be avoided.

SUGGESTED VENT REMEDIES

The following actions are suggested to improve vent system operation:

1. For any venting problem:

   a) Set furnace to full input rate, *and

   b) adjust blower temperature rise within nameplate range.

   *NOTE: Care must be taken to derate furnaces installed at elevations more than 2,000 ft. above sea level.

2. Vent Connectors:

   a) Avoid unnecessary elbows, bends, or restrictions in the flue system.

   b) Insulate any long single-wall metal vent connectors or replace with double-wall pipe.

   c) Avoid blowing conditioned air from the plenum or outside combustion air directly across the vent connector leaving the furnace. It may be necessary to insulate the vent connector to avoid this problem.

   d) When appliances are common vented, the common venting information in the Installation Instructions and in the back of this bulletin must be adhered to.

3. For an unlined masonry chimney:

   a) Install a suitable metal liner inside the chimney, or

   b) Install a new vent system.

4. For excess condensate in a tile-lined masonry chimney:

   a) Install a suitable metal liner inside the chimney, or

   b) provide suitable drainage from the chimney base, or

   c) install a new vent system.

5. For excess condensate from a type B-1 vent:

   a) Insulate those sections of the vent exposed in unheated spaces and outdoors, or

   b) provide suitable drain.

SUGGESTED VENT REMEDIES (Cont)

6. For recurring lockout of the Positive Pressure Sensor:

   a) Check for adequate supply of combustion air. A very tight basement or furnace room can create air starvation which will trip the Positive Pressure Sensor. An outdoor air supply to the furnace room or a louvered door may be required.

   b) Remove all unnecessary elbows or restrictions from the vent system, especially in the first foot of vent connector above the furnace.

   c) Check the vent system for any obstructions and correct as necessary.

   d) Insulate vent connectors or replace them with double wall pipe.

   e) If vent is undersized, replace it with a new properly sized vent.

DESIGNING THE VENT SYSTEM (New Building Installations)

New building installations are generally easier than replacement furnace installations in that the vent system can be tailored to the application and is based solely upon the known Btu input rating of the furnace or the furnace/water heater combination.

The basic venting requirements are covered in the Installation Instructions packaged with each furnace. The same information is also shown below as general information.

VENTING CONNECTIONS

This furnace must be vented directly to the outside through a suitable chimney. This furnace as shipped from the factory is suitable for dedicated flue only. It is not a power or direct vent system and may not be vented horizontally through a side wall. With the addition of optional field-installed Common Venting Kit 8620-005, -006 or -011 it is suitable to common vent this furnace along with another gas burning appliance to a single chimney for ease of installation. Refer to section on Common Venting in this instruction manual for complete details. The vent must be installed in compliance with the National Fuel Gas Code (ANSI Standard Z223.1-1984,) and these instructions.

GENERAL INSTRUCTIONS

1. The vent connector must be aluminum pipe and shall be the same size as the flue outlet on the furnace. Keep the vent as short and direct as possible. Type B-1 pipe is recommended.

2. Maintain a minimum clearance of 6" (1" for B-1) to any portion of the vent connector from any adjacent combustible materials. Single wall vent connector is permitted only within the same space (room or area) as the furnace. B-1 vent is required whenever the vent is enclosed or passes through floors, walls, ceilings, roofs or furred-out spaces. Joists, studs, floors, dry wall, paneling, sheating, rafters, roofing and other materials classified as combustible must not be closer than 1" clearance to the B-1 vent.

3. If connected into masonry chimney, the vent pipe must be inserted into, but not beyond the inside wall of the chimney.

4. The gas vent must extend at least 2 feet above the highest point where it passes through the roof of a building (3 feet for a chimney) and at least 1 foot higher than any portion of a building within a horizontal distance of 10 feet. See Figure 1.

5. The vent pipe system shall be installed so as to avoid excessive turns which create unnecessary resistance to flow of vent gases.

6. Horizontal runs shall be as short and direct as possible. The maximum length of a single-wall vent pipe shall not exceed 75 percent of the height of the vent system. The maximum length of a Type B-1 double wall flue connection shall not exceed 100 percent of the height of the vent system.

7. All horizontal vent pipe shall be pitched upward from the furnace at least 1/4 inch per foot.

8. All vent systems shall be adequately supported to maintain proper clearances, to prevent physical damage, and to prevent separation of the joints.

9. Vents passing through an exterior combustible wall must use a ventilated wall thimble. See Figure 2.

10. Vents passing through floors or ceilings must be fire-stopped. See Figure 3 and Figure 4.

FIG. 1 — CHIMNEY OR VENT CAP INSTALLATION

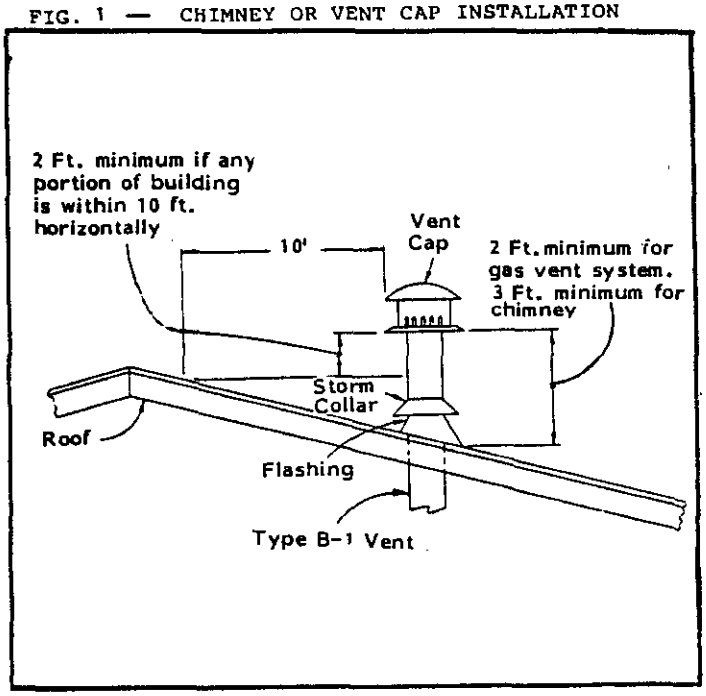
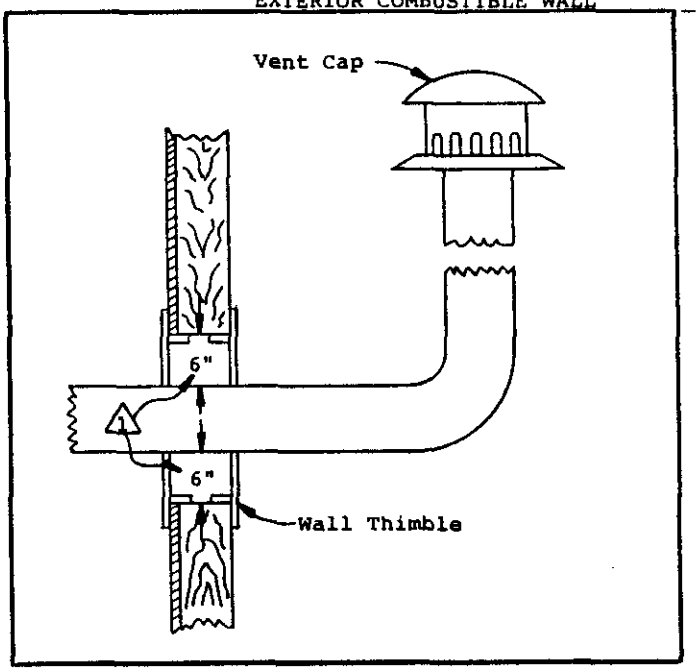


FIG. 2 — VENT PASSING THROUGH AN EXTERIOR COMBUSTIBLE WALL



1 Clearance may be 1 inch when Type B-1 vent is used.

FIG. 3 — VENT THROUGH FLOOR

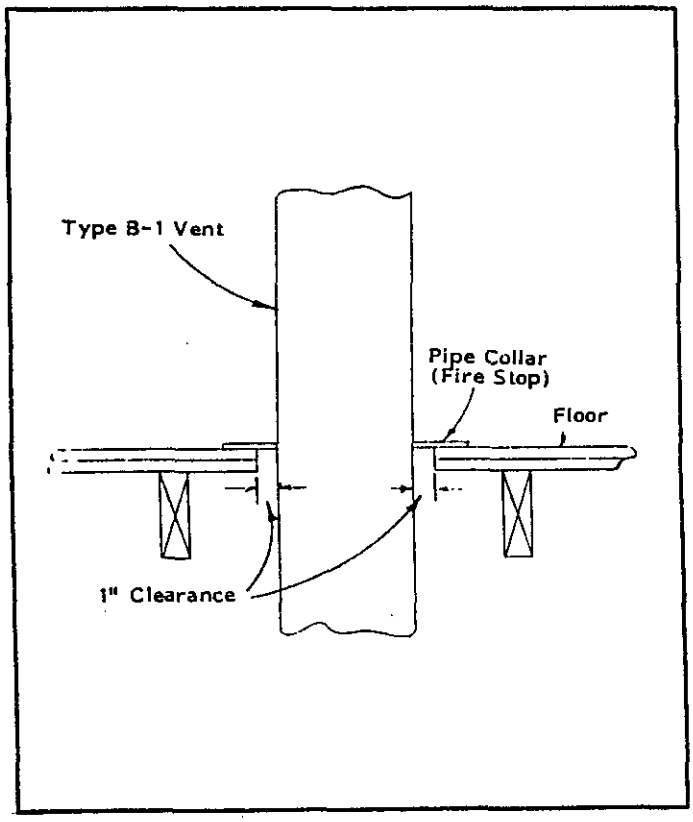


FIG. 4 — VENT THROUGH CEILING

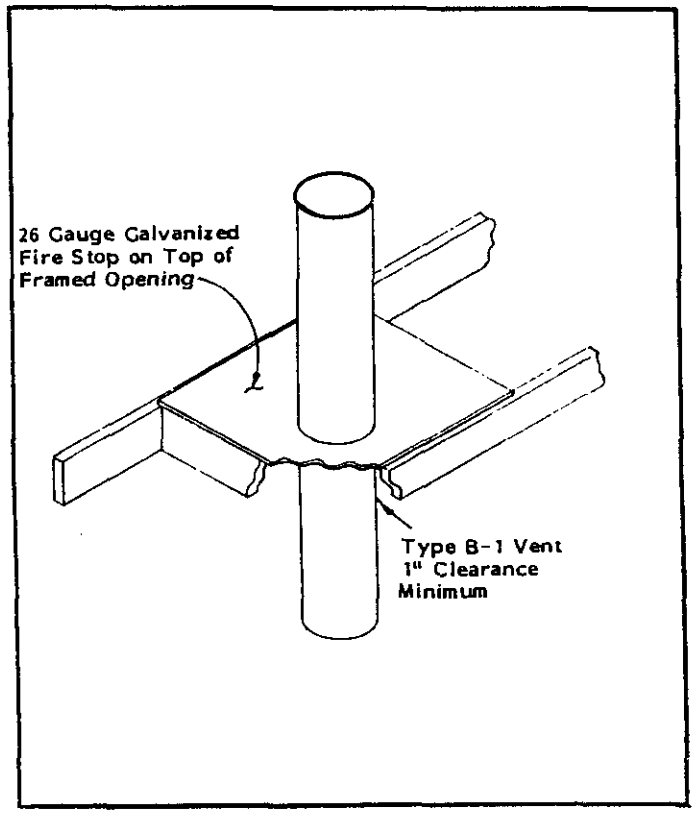


Table 1 details the vent system design and minimum requirements to assure proper venting of the flue products and to minimize the possibility of condensate forming in the vent system. Figure 5 shows a typical dedicated (single appliance) vent system and depicts certain installation requirements.

TABLE 1. DEDICATED VENT SYSTEM (SINGLE APPLIANCE)

Rated Input Btu/h	Single Wall Vent Connector ①			B-1 Vent System			Minimum Total Vent System Height in Feet ③
	Vent Size-Inches	Elbows	Horizontal Length Range in Feet ②	Vent Size-Inches	Elbows	Horizontal Length Range in Feet	
58,000	3	0	0	3	0	0	0
		2	1-5		2	1-10	10
		3	1-5		3	1-10	11
		4	1-5		4	1-10	13
86,000	3	0	0	3	0	0	8
		2	1-5		2	1-10	20
	4	2	1-5	4	2	1-10	10
		3	1-5		3	1-10	10
		4	1-5		4	1-10	10
115,000	4	0	0	4	0	0	0
		2	1-5		2	1-10	10
		3	1-5		3	1-10	12
		4	1-5		4	1-10	14
	5	4	1-5	5	4	1-10	10
145,000	4	0	0	4	0	0	8
		2	1-5		2	1-10	16
		3	1-5		3	1-10	20
	5	3	1-5	5	3	1-10	10
		4	1-5		4	1-10	10

① If used, single wall vent connector must be aluminum pipe) must be used only to connect to an approved B-1 vent system within the same space (room or area) as the furnace. The National Fuel Gas Code (ANSI Standard Z223.1-1984) prohibits use of single wall pipe through a ceiling, floor or interior wall. See Figure 5.
② Horizontal length requirements greater than 5 feet must be B-1 vent. 10 feet maximum.
③ Total vent system height may be a combination of single wall vent connector and B-1 vent. See Figure 5.

COMMON VENTING REQUIREMENTS

For common venting this furnace with another gas burning appliance, the addition of a Common Venting Kit is required. This kit is field installed by the installing contractor following the instructions packaged with the kit. It is a very simple procedure requiring only the removal and reinsertion of two screws and the reconnection of one wire. The kits that are required are detailed below.

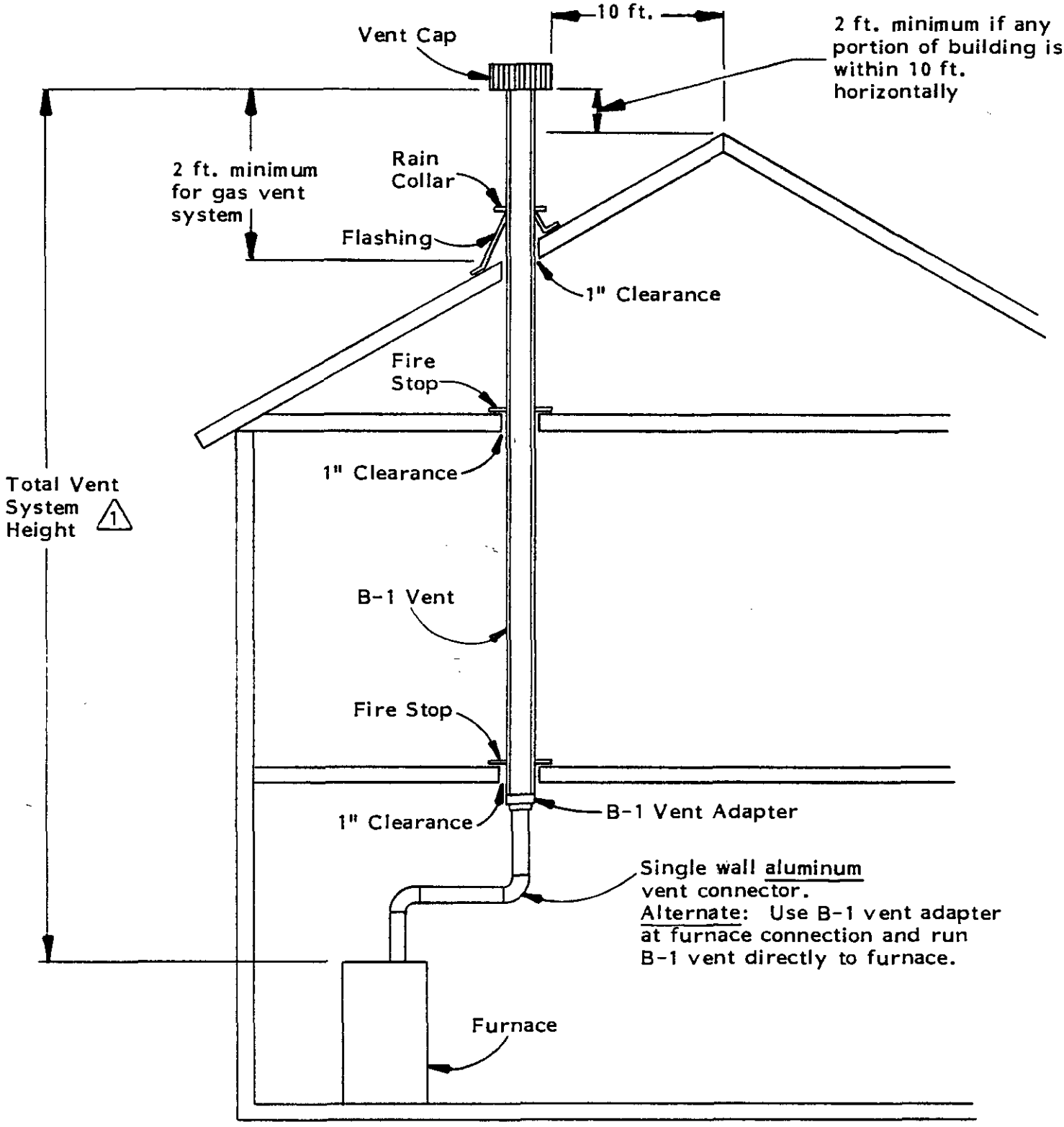
Furnace Model	Input Rating Btu/Hour	Common Venting Kit No.
IH60D36A,B,C IH85D48A,B,C IH115D48A,B,C	58,000 86,000 115,000	8620-005 8620-006 8620-006
IC60D36A,C IC85D42A,C IC115D48A,C	58,000 86,000 115,000	8620-011 8620-011 8620-011
IL85D42A,C IL115D48A,C IL145D60A,C	86,000 115,000 145,000	8620-006 8620-006 8620-005

There are some minimum specifications that apply to the common venting system design. These are outlined with additional reference made to the illustrations as shown.

Furnace Model	Minimum Total Vent Height "H"	Furnace Vent Connector Size	Minimum Common Vent Pipe Connector	
			3" Water Heater	4" Water Heater
IH60D36A,B,C IH85D48A,B,C IH115D48A,B,C	8' 8' 8'	3" 3" 4"	4" 4" 5"	4" 4" 5"
IC60D36A,C IC85D42A,C IC115D48A,C	8' 8' 8'	3" 4" 4"	4" 4" 5"	4" 4" 5"
IL85D42A,C IL115D48A,C IL145D60A,C	8' 8' 8'	3" 4" 4"	4" 5" 5"	4" 5" 5"

See the following figure illustrations for common venting arrangements.

Furnace Model	Vented With 3" Water Heater	Vented With 4" Water Heater
IH60D36A,B,C	Fig. 6, 7	Fig. 8, 9
IH85D48A,B,C	Fig. 6, 7	Fig. 8, 9
IH115D48A,B,C	Fig. 10, 11	Fig. 10, 11
IC60D36A,C	Fig. 6, 7	Fig. 8, 9
IC85D42A,C	Fig. 6, 7	Fig. 8, 9
IC115D48A,C	Fig. 10, 11	Fig. 10, 11
IL85D42A,C	Fig. 12, 13	Fig. 14, 15
IL115D48A,C	Fig. 16, 17	Fig. 16, 17
IL145D60A,C	Fig. 16, 17	Fig. 16, 17



1 Total vent system height may be a combination of single wall vent connector and B-1 vent as shown.

FIGURE 5.

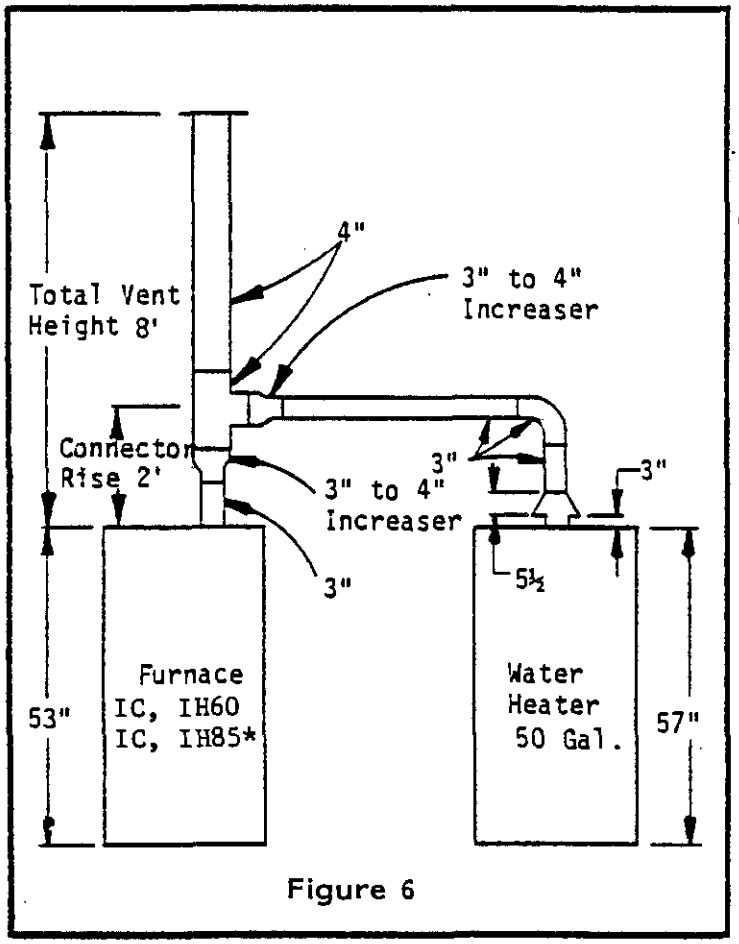


Figure 6

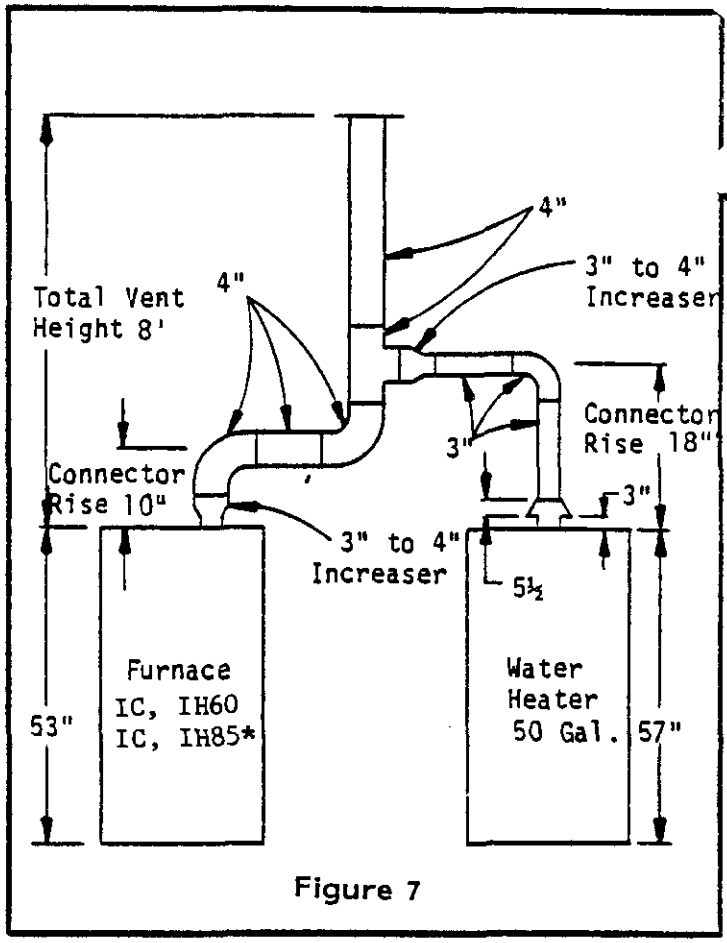


Figure 7

*With Additional Suffix

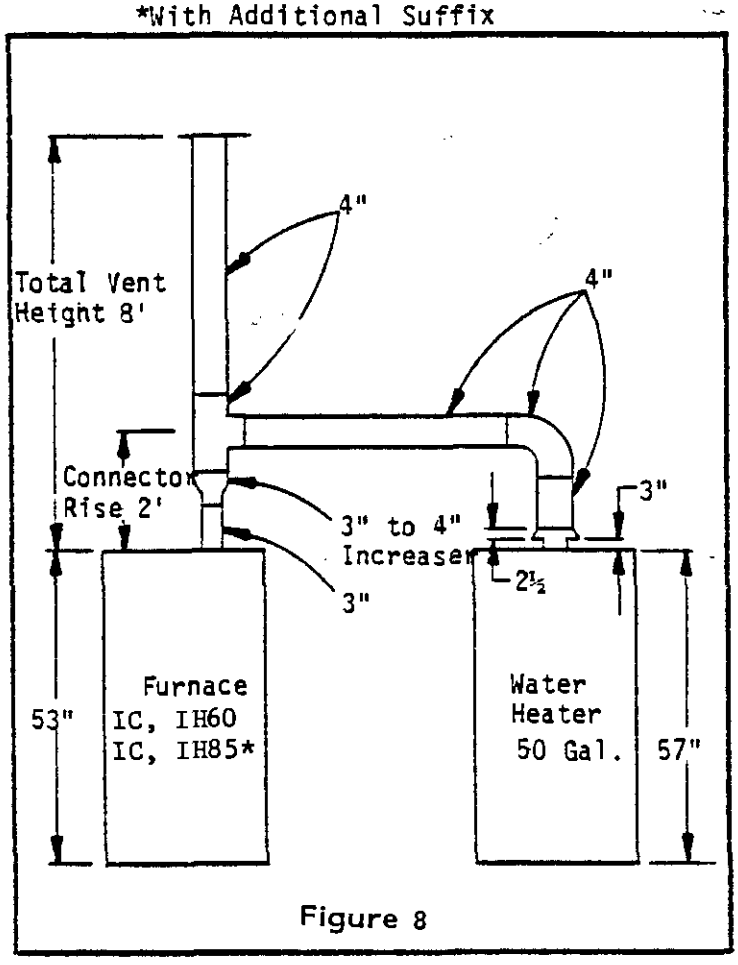


Figure 8

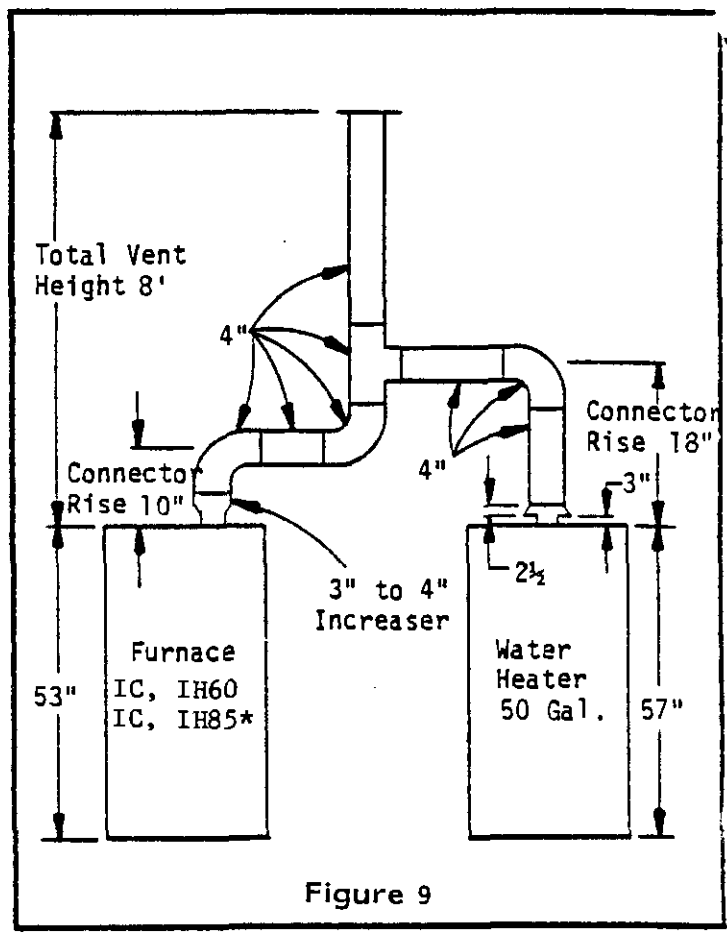


Figure 9

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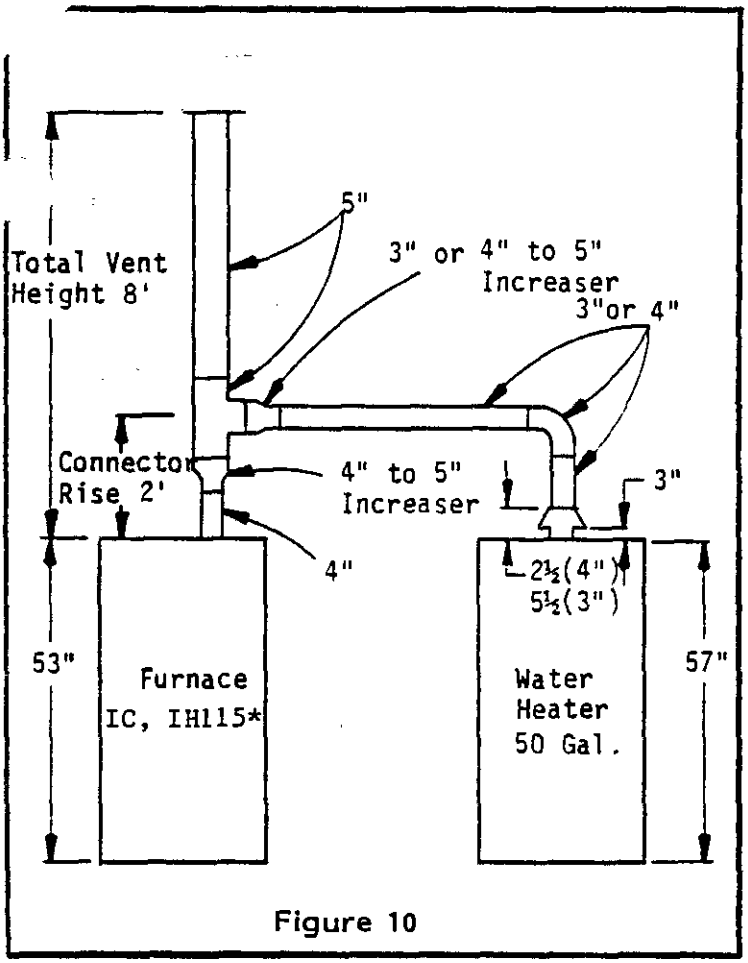

Figure 10

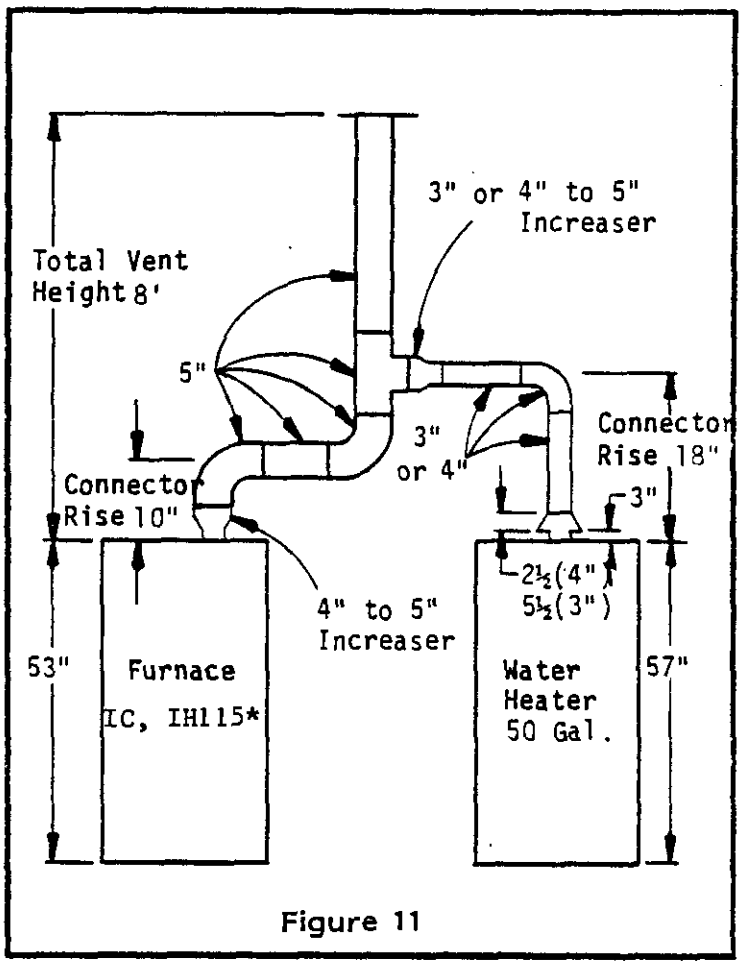

Figure 11

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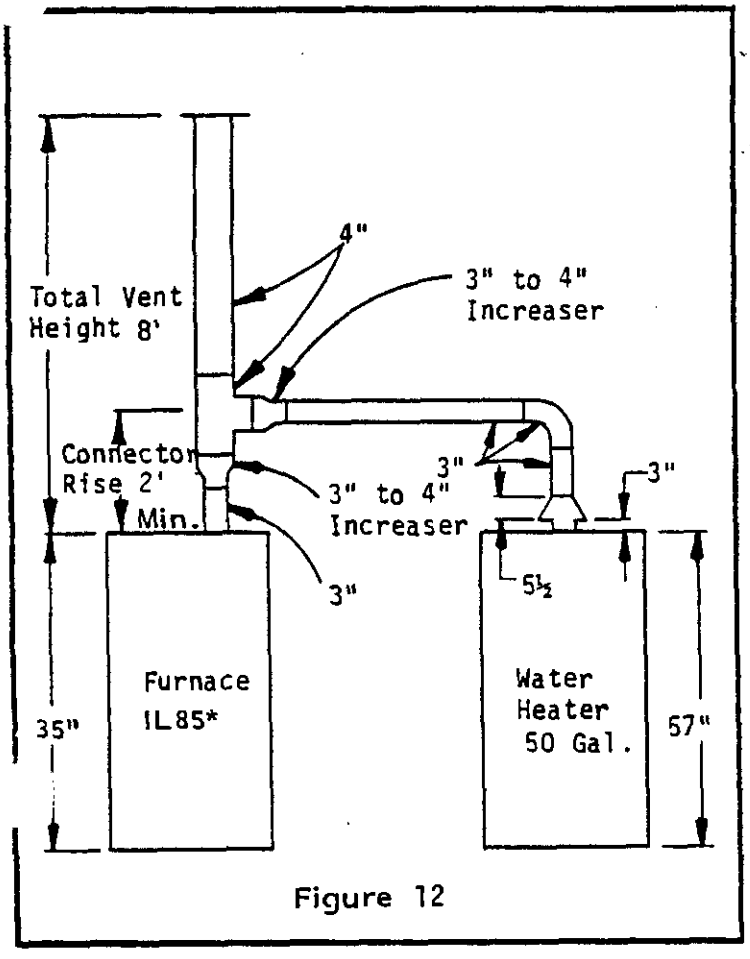
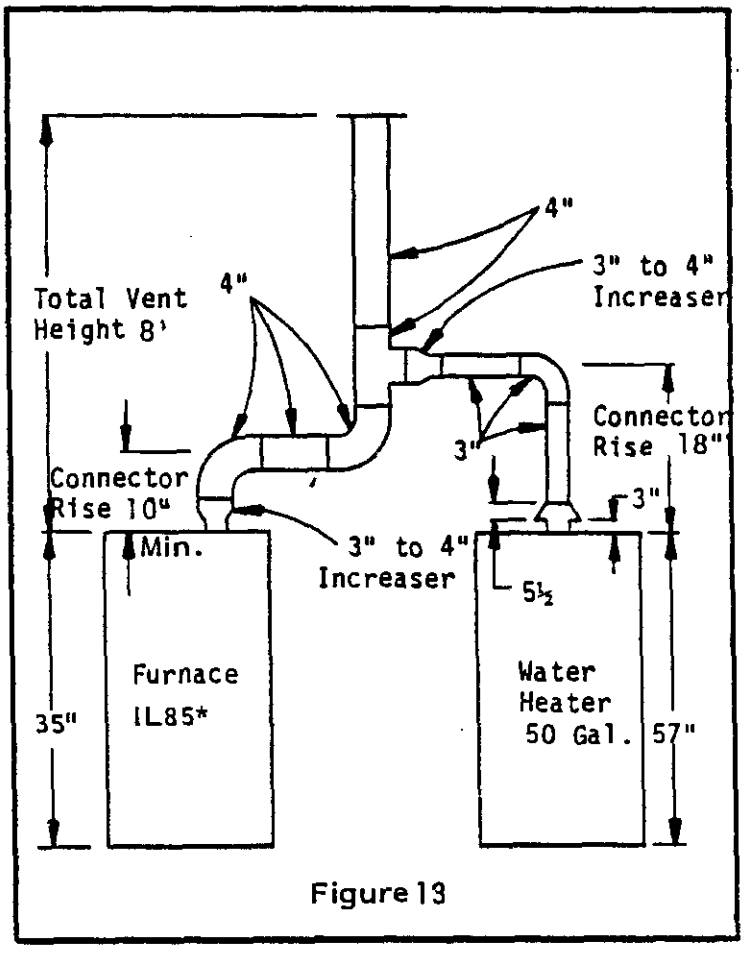


Figure 12



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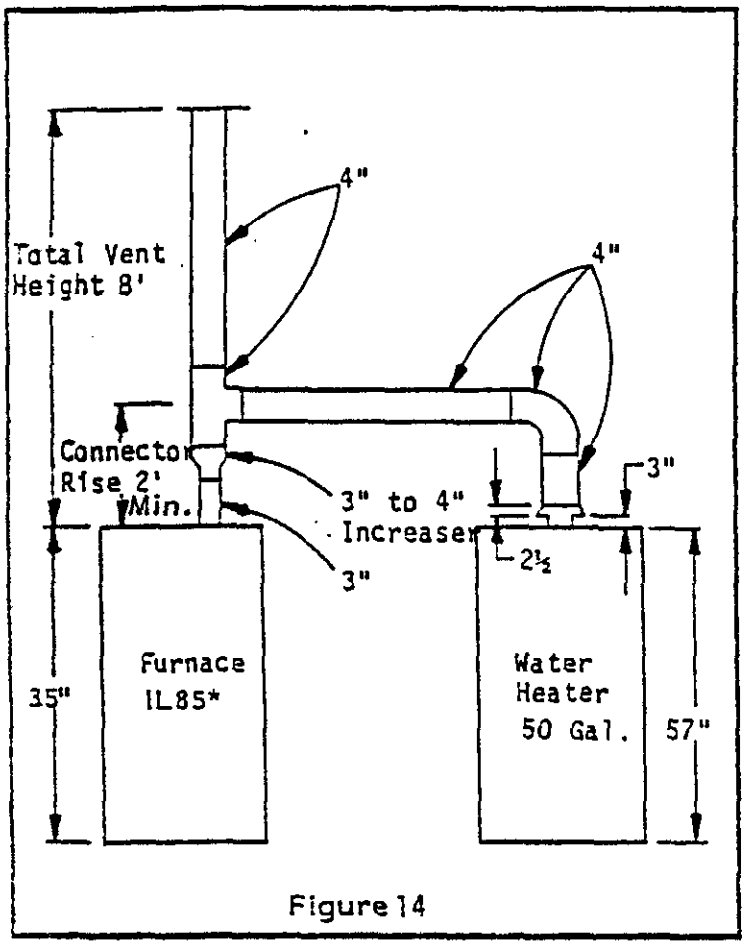

Figure 14

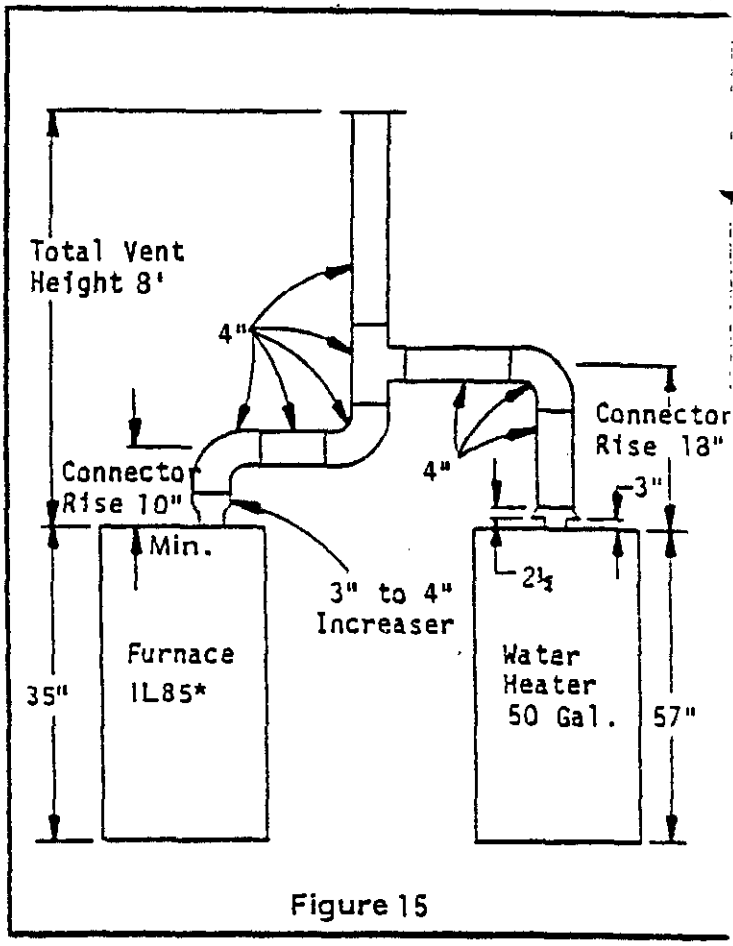

Figure 15

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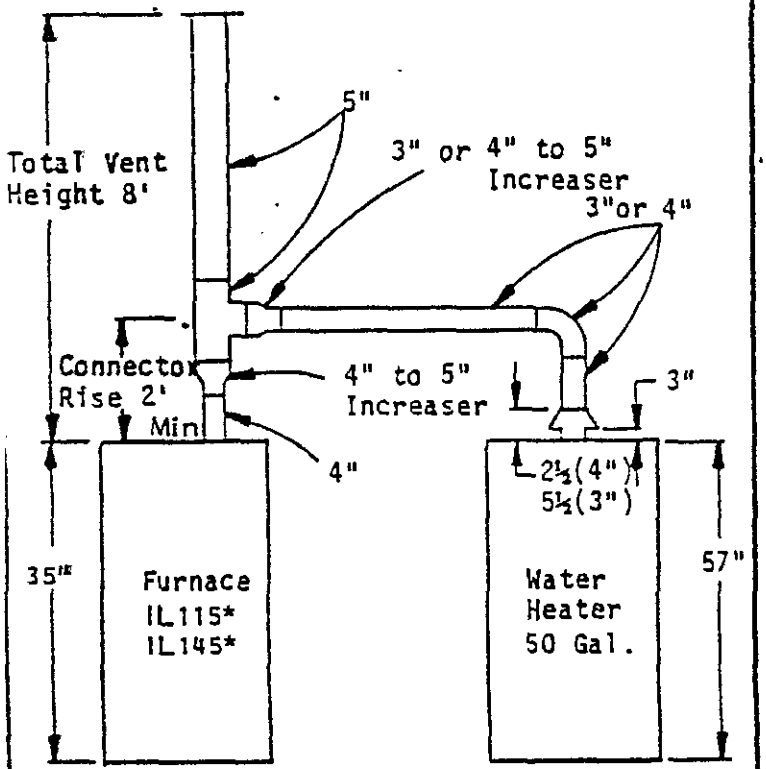

Figure 16

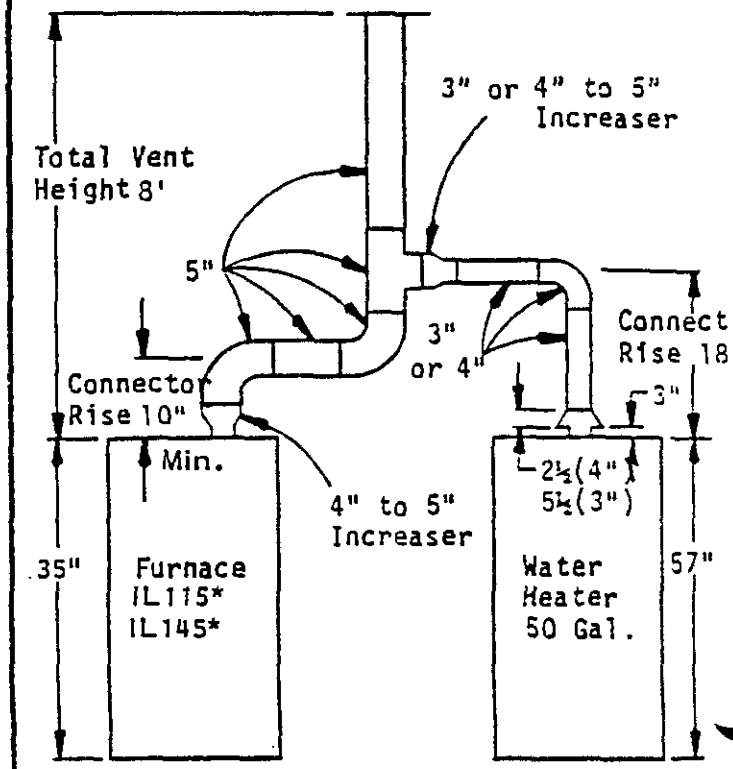

Figure 17

*With Additional Suffix