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# Good Practices for Gas Piping and Appliance Installations

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**QUESTAR**<sup>®</sup>  
*Gas*

- JUNE 2015 -

## GREEN STICKER

The proper installation and adjustments of a natural gas appliance is the responsibility of the installer. This book contains tables listing the Btu content (heat value) and specific gravity of gas, deration factors and altitudes throughout Questar's service area. When natural gas space heaters (furnaces, boilers, etc.) and water heating equipment installations have been completed and properly adjusted for the heat value of the gas and derated for altitude according to the manufacturer's installation instructions, the installer shall fill out and post a 'GREEN STICKER' on the appliance where it will be visible by the customer. The green sticker is an identifier which will let the customer or a repairman know that the appliance has been properly adjusted.

Effective July 1, 2002, any contractor installing or servicing natural gas appliances in Utah must have proof with him/her on the job site that (s)he has completed an approved certification exam, a Journeyman Exam, or a Residential Journeyman Plumber Exam in accordance with the requirements of Utah Admin. Code R156-55a-308b.

## **SECTION I - General**

### **(PREFACE)**

The information contained in this booklet consists of guidance for plumbing and heating contractors engaged in the installation of gas-fired equipment in the area served by Questar Gas Company (the Gas Company).

Information contained herein has been extracted from local codes adopted and incorporated by local authorities into heating or plumbing ordinances or codes and hence mandatory; however, this booklet does not attempt to set forth all requirements of any such ordinances or codes. Questar Gas Company recommends all plumbing and heating contractors become thoroughly familiar with the requirements of the applicable ordinances or codes, contained in the International Fuel Gas Code, International Residential Code, International Mechanical Code, International Plumbing Code, National Electrical Code, American Gas Association standards, National Board of Fire Underwriters, as well as with the information contained herein so gas installations made by them will measure up to the proper standards of quality and workmanship.

**QUESTAR GAS COMPANY 1-800-323-5517**

Gas line breaks, leaks, odor or pressure problems **ONLY** please call 1-800-541-2824.

Questar Gas Ask-a-Tech week days 8 a.m. to 5 p.m., 1-800-695-7375.

Additions and/or changes made to the Good Practice Book are indicated by a line in the right margin.

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## General Statement

Questar Gas Company is not responsible for the safe or proper installation of gas piping, equipment or appliances beyond its meter and does not, by the publication and distribution of this information, assume any such responsibility. However, if Questar Gas Company finds a gas-burning installation or appliance beyond its meter which it considers to be unsafe, it is authorized to refuse gas supply or gas service to such installation or appliance until the defect or condition which renders it unsafe is corrected.

All persons who are not authorized by Questar Gas Company are prohibited from connecting or disconnecting Questar Gas Company's meters or service pipes or in any way altering or interfering with Questar Gas Company's meters or service pipes. Upon receipt of notice Questar Gas Company will promptly attend to any work required in connection with its meters or service pipes. For connections requiring removal of the gas meter, contact Questar Gas Company for removal of the meter.

## Problems Not Covered By This Information

Architects, contractors, engineers, plumbers, heating contractors and fitters are invited to consult with Questar Gas Company on piping or appliance problems and industrial applications not covered by this information.

## General Safety Precautions

Before leaving any appliance installation or repair, the **installer** shall make certain all orifices, regulators or any other devices which limit gas quantities are so installed and adjusted so the appliance will be furnished gas in an amount not greater than the rated Btu per hour input of the appliance when properly derated for altitude when required.

Pipe and fittings shall never be tested for leaks with an open flame. Leak detection soap or a gas detecting device may be used.

Odor Fading – Odor fading is caused by physical and chemical processes and is most likely to occur in new steel pipe. It is more pronounced in larger diameter long pipelines with low or stagnant flow rates; however, it may also occur in plastic pipe and smaller diameter, shorter pipelines such as new fuel line systems. New Questar Gas steel high pressure pipelines are “pickled” with liquid odorant before they are placed into service to reduce the chance of odorant fade, but other factors may cause odorant fade such as the presence of pipeline liquids, rust and other pipeline contaminants. Installers should never rely on their sense of smell to determine the presence of natural gas but should use natural gas detection equipment to test for the presence of natural gas.

Any gas piping found to be leaking must be shut off, except while testing for leaks. Under no circumstance shall workers leave premises without either stopping all leaks or shutting off the gas service.

If meters or service regulators are found to be leaking, Questar Gas Company shall be notified at once.

Before lighting pilots, make sure all valves have been turned off for several minutes and the appliance has been thoroughly purged of any unburned gas. When starting or inspecting any automatic gas appliance, special attention shall be given to pilots. Do not attempt to turn pilot lights too low. **Follow manufacturer's lighting instructions.**

Questar Gas Company welcomes inquiries and will be glad to instruct anyone in the method of calculation of heat input, pipe capacities or other technical requirements dealing with natural gas service.

**NOTE: Manufacturer's installation instructions of all gas appliances shall be followed unless there is a conflict with local code.**

## SECTION II - Definitions

**ACCESSIBLE** - Having access to but which first may require the removal of an access panel, door or similar obstruction covering the item described.

**ACH** – Air change per hour.

**AIR MIXER** - That portion of an injection (Bunsen) type burner into which the primary air is introduced.

**AIR SHUTTER** - An adjustable device for varying the size of the primary air inlet or inlets.

**AMBIENT TEMPERATURE** - The surrounding or encompassing temperature.

**A.G.A.** - American Gas Association

**APPLIANCE** - A gas appliance is any device which utilizes gas fuel to produce heat, power or light.

**APPLIANCE FUEL CONNECTOR** - An assembly of listed and approved semi-rigid or flexible tubing and fittings to carry fuel between a fuel piping outlet and a fuel burning appliance.

**APPROVED** - As to materials, workmanship, and type of construction, means approved by the Administrative Authority as the result of investigation, inspection, or test conducted by a **recognized testing agency** or authority.

**AUTOMATIC IGNITION** - Automatic ignition shall be interpreted as means which provide for ignition of the gas at a burner when the gas burner valve controlling the gas to that

burner is turned on, and will affect re-ignition if the flames of the gas to that burner have been extinguished by means other than closing the gas burner valve.

**AUTOMATIC PILOT** - Consists of an automatic pilot device and pilot burner securely assembled in fixed relationship.

**AUTOMATIC PILOT DEVICE** - A device employed with gas-burning equipment which will automatically shut off the gas supply to the burner being served by either direct or indirect means when the pilot flame is extinguished. The pilot burner may or may not be constructed integrally with the device.

**BAFFLE** - An object placed in an appliance to change the direction of or retard the flow of air, air-gas mixtures or flue gases.

## **BOILER**

- a. Low pressure hot-water heating: A boiler furnishing hot water at pressures not exceeding 160 pounds per square inch and at temperatures not exceeding 250° F.
- b. Low pressure steam heating: A boiler furnishing steam at pressures not exceeding 15 pounds per square inch.

**BOILER HORSE POWER** - One boiler horse power equals approximately 33,475 Btu input.

**BONDING** - The permanent joining of metallic parts to form an electrically conductive path and continuity to safely conduct any current likely to be imposed.

**BRANCH LINE** - Gas piping which conveys gas from a supply line to the appliance.



BTU - (British Thermal Unit) The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit.

BURNER - A device for the final conveyance of the gas or a mixture of gas and air to the combustion zone.

- a. Power Burner: A burner in which either gas, air or both are supplied at pressures exceeding, for gas, the line pressure, and for air, atmospheric pressure; this added pressure being applied at the burner.
- b. Pressure Burner: A burner which is supplied with an air-gas mixture under pressure (usually from 0.5 in. to 14 in. of water column {w.c.} and occasionally higher).
- c. Primary Air Burner (Bunsen): The air introduced into a burner and which mixes with the gas before it reaches the port or ports.
- d. Secondary Air Burner (Luminous or Yellow Flame): A burner in which secondary air is depended on for the combustion of the gas.

CSST - Corrugated Stainless Steel Tubing - Used as an integral gas piping system.

CENTRAL HEATING GAS APPLIANCE - A gas appliance normally used as the primary means of heating premises. Ordinarily this includes gas boilers, warm air furnaces, and floor furnaces; but does not include unit heaters, room or space heaters, nor industrial gas boilers.

**CHIMNEY, TYPE "A"** - Chimneys or vents of masonry reinforced concrete, iron smoke stacks or listed factory all-fuel chimneys.

**CIRCUIT** –

- a. **Parallel:** One in which the current has two or more paths to follow.
- b. **Series:** One where the current has only one path to follow.

**COMBUSTIBLE MATERIAL** - Pertaining to materials adjacent to or in contact with heat-producing appliance vent connectors, gas vents, chimneys, steam and hot water pipes, and warm air ducts, shall mean materials made of or surfaced with wood, compressed paper, plant fibers or other materials that will ignite and burn. Such materials shall be considered combustible, even though flame-proofed, fire retardant treated or plastered.

**COMBUSTION** - Refers to the rapid oxidation of fuel gases accompanied by the production of heat or heat and light.

**COMBUSTION AIR** - Air necessary for complete combustion of fuel.

**CONCEALED** - When placed in a finished building, would require removal of permanent construction to gain access.

**CONDENSATE (CONDENSATION)** - The liquid which separates from a gas (including flue gas) due to a reduction in temperature.

**CONDENSING APPLIANCE** - An appliance which condenses part of the water vapor generated by the burning of

hydrogen in fuel by means of a secondary, recuperative, or condensing coil.

**CONTROL** - A device designed to regulate the gas, air, water, and electrical supply to a gas appliance. It may be manual or automatic.

**CONVERSION BURNER** - A burner designed to supply gaseous fuel to an appliance originally designed to utilize another fuel.

**CUBIC FOOT OF GAS (standard)** - The amount of gas which would occupy one cubic foot when at a temperature of 60 degrees Fahrenheit, saturated with water vapor and under a pressure equivalent to that of 30 inches of mercury.

**DAMPER** – A valve or plate for regulating draft.

**DECATHERM** - Equal to 10 therms or 1,000,000 Btu.

**DECORATIVE APPLIANCE** - Vented appliance whose primary function is the appearance of the flame.

**DEMAND** - The maximum amounts of gas required per unit of time, usually expressed in cubic feet per hour or Btu per hour, required for the operation of the appliance or appliances supplied.

**DILUTION AIR** - Air which enters a draft hood and mixes with the flue gases.

**DIRECT VENT APPLIANCE** - Appliances which are so constructed and installed that all air for combustion is derived from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

**DRAFT HOOD** - A device built into an appliance, or made a part of the flue or vent connector from an appliance, which is designed to: (1) ensure the ready escape of the products of combustion in the event of no draft, back draft, or blockage beyond the draft hood; (2) prevent a back draft from entering the appliance, and; (3) neutralize the effect of stack action of the vent or chimney upon the operation of the appliance.

**ELEVATED PRESSURE** - Pressure more than fourteen (14) inches of water column.

**EQUIVALENT HYDRAULIC DIAMETER (EHD)** - Measurement of the hydraulic efficiency between different tubing sizes. The higher the number EHD, the greater the capacity of tubing. This number is used when sizing corrugated stainless steel tubing (CSST).

**EXCESS AIR** – Air which passes through the combustion chamber and the appliance flues in excess of that which is theoretically required for complete combustion.

**EXTERIOR MASONRY CHIMNEY** - Masonry chimney exposed to the outdoors on one or more sides below the roof line.

**FLAME SAFE GUARD** - A device designed to shut off fuel in the event of flame failure.

**FLAMES** -

- a. **Yellow, Luminous, or Non-Bunsen:** The flame produced by burning gas without any premixing of air with the gas.
- b. **Bunsen:** The flames produced by premixing some of the air required for combustion with the gas before it reaches the burner ports or point of ignition.

**FLUE COLLAR-** The portion of an appliance designed for the attachment of a draft hood, vent connector or venting system

**FLUE GASES** - Products of combustion plus excess air in appliance flues or heat exchangers.

**FUEL LINE** - The independent pipe from the meter to an appliance or appliances.

**FURNACES** –

- a. **GRAVITY-TYPE WARM-AIR FURNACE:** A warm-air furnace depending primarily on circulation of air through the furnace by gravity. This definition also includes any furnace approved with a booster-type fan which does not materially restrict free circulation of air through the furnace when the fan is not in operation.
- b. **FORCED AIR TYPE CENTRAL FURNACE:** A central furnace equipped with a fan or blower which provides the primary means for circulation of air.
  - 1) **Horizontal-type Central Furnace:** A furnace designed for low headroom installations with air flow through the appliance in a horizontal path.
  - 2) **Upflow-type Central Furnace:** A furnace designed with air flow essentially in a vertical path, discharging air at or near the top of the furnace.
  - 3) **Downflow-type Central Furnace:** A furnace designed with air flow essentially in a vertical path, discharging air at or near the bottom of the furnace.

4) Multi Position Furnace: A furnace designed to be installed upflow, downflow and horizontal.

- c. RECESSED FURNACE: A self-contained appliance complete with grilles or equivalent, designed for incorporation in or permanent attachment to a wall, floor, ceiling, or partition; either taking air for combustion from the space to be heated, or having a sealed combustion system the inlet and outlet of which communicates only with the outside air, and furnishing heated air circulated by gravity or by a fan directly into the space to be heated through openings in the casing.

GAS HOSE - A gas conduit which depends for tightness on joint packing on any wall structure other than that formed by a continuous one-piece metal tubing member. Listed gas hose connectors shall be used in accordance with the terms of their listings.

GAS PIPING - Any installation of pipe, valves or fittings used to convey fuel gas, installed on any premises or in any building, but shall not include:

- a. Any portion of the service piping.
- b. Any approved piping connection 6 feet (1.8 m) or less in length between an existing gas outlet and a gas appliance in the same room with the outlet.

HAZARDOUS LOCATION – Any location considered to be a fire hazard for flammable vapors, dust and combustible materials.

HEATING VALUE (TOTAL) – The number of British Thermal Units produced by the combustion at constant pressure of one cubic foot of gas when the products of combus-

tion are cooled to the initial temperature of the gas and air, when the water vapor formed during combustion is condensed, and when all the necessary corrections have been applied.

HUD - Housing and Urban Development.

IGNITION SOURCE – A flame, spark or hot surface capable of igniting flammable vapors or fumes. Sources include appliance burners, burner ignitors and electrical switching devices.

INDIVIDUAL MAIN BURNER VALVE - A valve which controls the gas supply to an individual main burner.

LEAK LIMITER - A device limiting the escape of gas from the regulator vent opening in the event of diaphragm failure.

LIMIT CONTROL - A safety device responsive to changes in pressure or temperature or liquid level for turning on, shutting off, or throttling the gas supply to an appliance.

LISTED - Appliance or material included in a list published by a nationally recognized testing laboratory, inspecting agency or other which specifies approval.

LOG LIGHTER - A manually operated solid fuel ignition appliance for installation in a vented solid fuel burning fireplace (turned off manually after the wood fire is capable of sustaining combustion).

MAIN BURNER - A device or group of devices essentially forming an integral unit for the final conveyance of gas or a mixture of gas and air to the combustion zone, and on which

combustion takes place to accomplish the function for which the appliance is designed.

**MAIN BURNER CONTROL VALVE** - A valve which controls the gas supply to the main burner manifold.

**MAKE-UP AIR** – Air being provided to replace air being exhausted.

**MANIFOLD** – The conduit of an appliance which supplies gas to the individual burners.

**MANOMETER** – Instrument for measuring gas pressure.

**MANUAL MAIN SHUT-OFF VALVE** - A manually operated valve in the gas line for the purpose of completely turning on or shutting off the gas supply to the appliance, except to pilot or pilots which are provided with independent shut-off valves.

**MECHANICAL DRAFT SYSTEM** - A device installed in and made a part of the vent which will provide a positive induced draft.

**METER** - An instrument installed to measure the volume of gas being delivered.

**MICROAMPERE** - One millionth of an ampere.

**MILLIAMPERE** - One thousandth of an ampere.

**MILLIVOLT** - One thousandth of a volt.

**MIXER** - The combination of mixer head, mixer throat and mixer tube.



- a. Mixer Head: That portion of an injection (Bunsen) type burner, usually enlarged, which primary air flows to mix with the gas stream.
- b. Mixer Throat: That portion of the mixer which has the smallest cross-sectional area and lies between the mixer head and the mixer tube
- c. Mixer Tube: That portion of the mixer which lays between the throat and the burner head.

MP – Medium pressure – 1.5 psi – 60 psi.

#### OCCUPANCY –

- a. GROUP “A”: Group A occupancies include the use of a building or structure, or a portion thereof, for the gathering together of 50 or more persons for purposes such as civic, social or religious functions, recreation, education or instruction, food or drink consumption, or awaiting transportation. A room or space used for assembly purposes by less than 50 persons and accessory to another occupancy shall be included as part of that major occupancy. Assembly occupancies shall include the following:
  - 1) Division 1: A building or portion of a building having an assembly room with an occupant load of 1,000 or more and a legitimate stage.
  - 2) Division 2: A building or portion of a building having an assembly room with an occupant load of less than 1,000 and a legitimate stage.

- 3) Division 2.1: A building or portion of a building having an assembly room with an occupant load of 300 or more without a legitimate stage, including such buildings used for educational purposes and not classed as a Group B or E Occupancy.
- 4) Division 3: A building or portion of a building having an assembly room with an occupant load of less than 300 without a legitimate stage, including such buildings used for educational purposes and not classed as a Group B or E Occupancy.
- 5) Division 4: Stadium, reviewing stands and amusement park structure not included within other Group A occupancies. Specific and general requirements for grandstands, bleachers and reviewing stands are to be found in Chapter 10 of the Building Code.

**EXCEPTION:** Amusement buildings or portions thereof which are without walls or a roof and constructed to prevent the accumulation of smoke in assembly area.

b. Group E Occupancies:

- 1) Division 1: Any building used for educational purposes through the 12<sup>th</sup> grade by 50 or more persons for more than 12 hours per week or four hours in any one day.
- 2) Division 2: Any building used for educational purposes through the 12<sup>th</sup> grade by less than 50 persons for more than 12 hours per week or four hours in any one day.

- 3) Division 3: Any building or portion thereof used for day-care purposes for more than six persons

c. Group I Occupancies:

- 1) Division 1.1: Nurseries for the full-time care of children under the age of six (each accommodating more than five children). Hospitals, sanitariums, nursing homes with non-ambulatory patients and similar buildings (each accommodating more than five patients).
- 2) Division 1.2: Health-care centers for ambulatory patients receiving outpatient medical care which may render the patient incapable of unassisted self-preservation (each tenant space accommodating more than five such patients).
- 3) Division 2: Nursing homes for ambulatory patients and homes for children six years of age or over (each accommodating more than five patients or children).
- 4) Division 3: Mental hospitals, mental sanitariums, jails, prisons, reformatories and buildings where personal liberties of inmates are similarly restrained.

ODS – Oxygen Depletion Safety Shut-Off – A system designed to act to shut off the gas supply to the main and pilot burners if the oxygen in the surrounding atmosphere is reduced below a predetermined level.

OFFSET (VENT) - Combination of approved bends making two changes in direction bringing one section of the vent out of line but into a line parallel with the other section.

**ORIFICE** - The opening in a cap, spud or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.

**ORIFICE CAP (HOOD)** - A movable fitting having an orifice which permits adjustment of the flow of gas by the changing of its position with respect to a fixed needle or other device.

**ORIFICE SPUD** - A removable plug or cap containing an orifice which permits adjustment of gas flow either by substitution of a spud with a different sized orifice or by the motion of a needle with respect to it.

**PB** - Polybutylene, primarily use to pipe for potable water systems.

**PILOT** - A small flame which is utilized to ignite the gas at the main burner or burners.

**PILOT GENERATOR** - Several single thermocouples in a series to produce sufficient current required for the operation of a complete control system.

**PLENUM** - An air compartment or chamber including uninhabited crawl spaces, areas above a ceiling or below a floor, including air spaces below raised floors of computer/data processing centers, or attic spaces, to which one or more ducts are connected and which forms part of either the supply-air, return-air or exhaust-air system other than the occupied space being conditioned.

**POWER EXHAUSTER** – A device installed in and made a part of the vent which will provide a positive induced draft.

**PRESSURE DROP** - The loss in pressure due to friction, valves, fittings or regulators.

**PRESSURE RELIEF DEVICE** - A pressure-actuated valve or rupture member designed to automatically relieve excessive pressure.

**PURGE** - To free a gas conduit of air, gas or a mixture of gas and air.

**QUICK DISCONNECT DEVICE** - A hand-operated device which provides a means for connecting and disconnecting an appliance or an appliance connector to a gas supply which is equipped with an automatic means to shut off the gas supply when the device is disconnected.

**READY ACCESS (TO)** – That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel, door or similar obstruction.

**REGULATOR** - A device for controlling and maintaining a uniform gas supply pressure.

**RELIEF OPENING** - The opening provided in a draft hood to permit the ready escape to the atmosphere of the flue products from the draft hood in the event of no draft, back draft, or stoppage beyond the draft hood, and to permit dilution air into the draft hood in the event of a strong chimney updraft.

**REQUIRED VOLUME** – A room or space having a volume equal to at least 50 cubic feet per 1000 Btu/hr of the aggregate input rating of all fuel burning appliances installed in that space. And including rooms communicating directly with the space in which the appliances are installed through open-

ings not furnished with doors and through combustion air openings.

**ROOM HEATER (VENTED)** - A self-contained, vented, gas-burning, air-heating appliance intended for installation in the space being heated and not intended for duct connection. This definition shall not include unit heaters, central heating gas appliances or garage heaters.

**SECONDARY AIR** - The air externally supplied to the flame at the point of combustion.

**SEMI-RIGID TUBING** - A gas conduit having semi-flexible metal wall structure.

**SERVICE PIPING** - The pipe which brings the gas from the main to the meter.

**SHUT-OFF VALVE** - A valve used in piping to control the gas supply to any section of a piping system or to an appliance.

**SPECIFIC GRAVITY** - As applied to gas, specific gravity is the ratio of the weight of a given volume to that of the same volume of air, both measured under the same conditions.

**TEMPERATURE & PRESSURE RELIEF DEVICE** - A temperature and pressure-actuated valve or rupture member designed to automatically relieve excessive temperature or pressure.

**THERM** - A quantity of heat equal to 100,000 Btu.

**THERMOCOUPLE** - Two wires, of dissimilar metals, welded at one end to form the hot junction. When the hot junction

or end of thermocouple is placed in a gas flame an electrical current is generated simply by the application of heat to the junction of the two metals. The amount of current produced is basically dependent upon two factors, the type of metal used and the difference in temperature between the hot and cold junctions.

**THERMOSTAT** - An automatic device actuated by temperature changes, designed to control the gas supply to a burner, or burners in order to maintain temperatures between predetermined limits.

**UNIT HEATER** – A self-contained, automatically controlled, vented appliance for installation in space to be heated without the use of ducts. equipped with an integral means for circulation of air.

**VENT** - A listed factory-made vent pipe and vent fittings for conveying flue gases to the outside atmosphere that extends in a generally vertical direction.

**VENTS** –

- a. Type “A” Gas Vents: See Chimney, Type “A”.
- b. Type “B” Gas Vents: Factory-made gas vents listed by a nationally recognized testing agency for use with appliances with draft hoods and other Category I appliances. Vent requires 1" clearance from combustibles.
- c. Type “C” Gas Vents: Unlisted single wall vent constructed of iron or aluminum that has not been tested by a testing agency and requires a minimum of 6" clearance from combustibles.

- d. Type “B-W” Gas Vents: Factory-made gas vents listed by a nationally recognized testing agency for venting listed or approved gas-fired vented recessed wall heaters.
- e. Type “L” Gas Vents: A venting system for use with appliances listed for use with Type L or Type B vents.
- f. Special Gas Vent: A vent listed and labeled for use with listed Category II, III, IV appliances
- g. Listed Single Wall Gas Vents: When listed single wall vent material is used, clearances and installation shall be in accordance with the listing and the manufacturer’s installation instructions.

VENT COLLAR - That portion of an appliance designed for the attachment of the draft hood or vent connector.

VENT CONNECTOR - That portion of the vent system which connects the gas appliance to the gas vent or chimney.

VENT SYSTEM - The gas vent or chimney and vent connector, if used, assembled to form a continuous open passageway from the gas appliance to the outside atmosphere for the purpose of removing flue gases.

#### VENTED APPLIANCE CATEGORIES –

- a. Category I: An appliance which operates with a non-positive vent pressure and with a vent gas temperature that avoids excessive condensate production in the vent.
- b. Category II: An appliance which operates with a non-positive vent pressure and with a vent gas temperature



that is capable of causing excessive condensate production in the vent.

- c. Category III: An appliance which operates with a positive vent pressure and with a vent gas temperature that avoids excessive condensate production in the vent.
- d. Category IV: An appliance which operates with a positive vent pressure and with a vent gas temperature that is capable of causing excessive condensate production in the vent.

VENTILATION AIR - Enough air to ventilate appliances to within safe operating temperature.

WATER HEATER -

- a. Automatic Instantaneous: The type which heats the water as it is drawn.
- b. Automatic Storage: The type which combines a water heating element and water storage tank, gas to the main burner being controlled by a thermostat.
- c. Circulating Type: For use with an external storage vessel.

### SECTION III – Gas Piping Installation

1. Meter Locations: Questar Gas Company determines the location of its meters. Meters should be set outside for easy accessibility and service. Meters shall be in an approved location and/or provided with structures designed to protect the fuel gas meter and surrounding piping from physical damage, including falling, moving, or migrating ice and snow. Meters should not be set under roof valleys or other places where excessive amounts of water, snow or ice would drip from the roof onto the meter set and freeze. Remote meter sets are discouraged. (IFGC 404.9.1 Utah code amendment)

Meters, when set inside, will be installed immediately adjacent to and in the same room where the gas service line enters the building. All gas meters will be placed where they will be easily accessible, not exposed to extreme heat sources and located at least 3 feet from any ignition source, electrical panel or electrical meter. If the meter and regulator are located in a partially excavated space under a building, they will be accessible through an opening in the outside wall not less than 36 inches high by 36 inches wide. (QGCSP 2-76-01) (CFR 192.353) (NFGC 5.7.2.3)

Meters are to be located in ventilated spaces accessible for examination, reading, replacement and maintenance. (NFGC 5.7.2.1)

Questar Gas requires the service line riser, meter and regulator be located 3 feet away from any permanent opening into the building. (QGCSP 3-10-05)

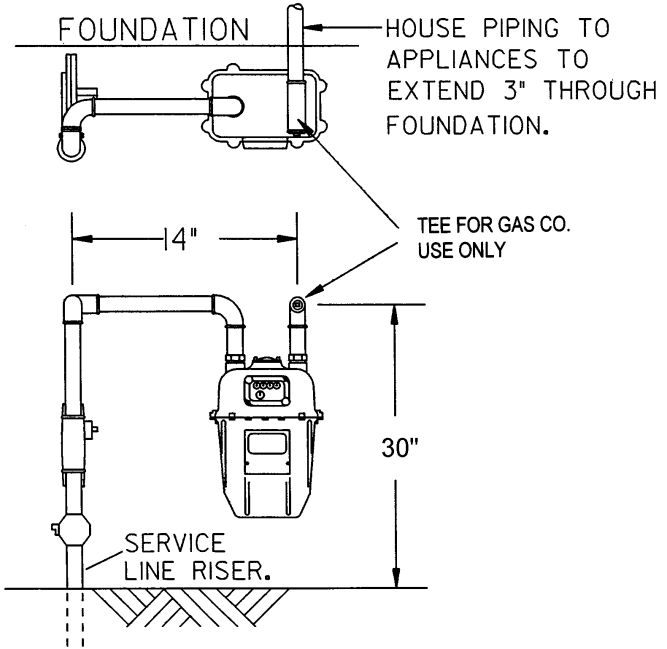
2. Meter / Riser Protection - Meter/Riser locations not requiring protection are preferred. If a customer insists on a location where damage to the meter is likely, meter protection will be required at the customer's expense.

Locations of specific concern are described as follows: service line risers on the driveway side of a structure where there is not at least 5 feet from the driveway to the building, proximity to roadways, alleyways, parking lots, dock areas, garage areas, and any other areas where vehicle accessibility would warrant a barrier. (QGCPP 06-00-01)

3. Service Connections: All house piping should be extended to a point 14 inches on the right-hand side of the location provided for the gas service line and 30 inches above ground level. For multiple meter installations where two or more house lines terminate at a multiple meter set, they should be spaced not less than 10 inches nor more than 12 inches apart for each additional meter location and the fuel lines should extend 3 inches past exterior surface of structure i.e. brick, siding, stucco etc. (See Figure 1, Page 35 and Figure 2, Page 36) (QGCPP 06-00-01)

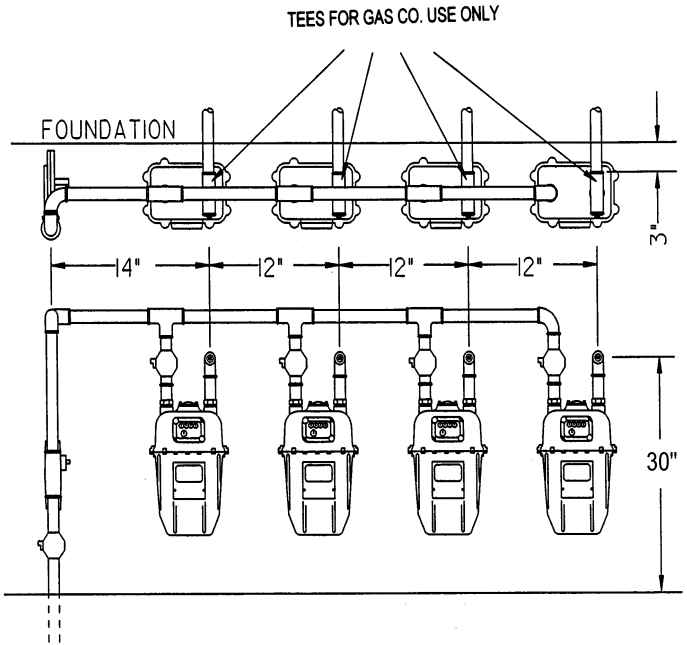
Gas piping at multiple meter installations shall be plainly marked by a metal tag or other permanent means attached to the pipe by the installing agency, designating the building or the part of the building being supplied. Apartments should be permanently and clearly marked before meters will be set. (NFGC 5.7.5)

## METER SET



**Figure 1: Meter Set**

# MULTIPLE METER SET



**Figure 2: Multiple Meter Set**

COMMERCIAL METER SPREAD		
4 ounces – 5 pounds		
Any set larger than 7,000 CFH, contact Questar Gas for proper sizing.		
CONSUMPTION	METER SPREAD (fuel line to riser)	PAD SIZE
600 – 999 CFH	3 feet	2' x 3'
1,000 – 6,999 CFH	5 feet	3' x 4'

Table 1: Commercial Meter Spread

For large commercial or industrial installations, consult Questar Gas Company for location of the service line, meter and fuel line.

4. **Piping Plan:** It is recommended before proceeding with the installation of a gas piping system a piping sketch or plan be prepared showing the proposed location of the piping as well as the pipe size of different branches. Adequate consideration should be given to future demands and provisions made for added gas service. If a piping plan is provided, Questar Gas Company will be glad to review it without charge or obligation. (IFGC 402.1)
  
5. **Gas Piping Materials:** These requirements apply to all gas piping run on the customer's side of the meter. Since gas piping will form a permanent part of the building, inside and above ground piping shall be standard weight iron or steel (galvanized or black schedule 40), malleable iron fittings and approved shut-off valves or corrugated stainless steel tubing system. (IFGC 403) For ferrous gas piping underground installation see Page 44.

Copper pipe or tubing shall not be installed or used for gas in Questar Gas Service area due to the hydrogen sulfide content in the gas. (IFGC 403.4.3 & 403.5.2)

6. Plastic Piping Material: Plastic polyethylene pipe materials and compression couplings must be approved for natural gas applications and must be installed underground. All plastic pipe and fittings must be marked "GAS" and conform to ASTM D2513 (60 psi and above high density pipe approved 3408 / 4710). (IFGC 403.6)

Plastic pipe shall be installed outdoors underground only. Plastic pipe shall not be used within or under any building or slab. (IFGC 404.17.1)

EXCEPTION: Plastic pipe shall be permitted under outdoor patio, walkway and driveway slab provided burial depth of 12" minimum is maintained

Plastic pipe shall be joined in accordance with qualified procedures and by individuals qualified in the heat fusion method of connecting pipe and fittings or approved mechanical fittings. (IFGC 403.11)

A minimum number 18 insulated yellow copper tracer wire shall be installed with underground non-metallic gas piping and shall terminate above grade at each end. Tracer wire shall not come in contact with plastic piping. (IFGC 404.17.3)

Risers and prefabricated risers inserted with plastic pipe shall conform to ASTM D2513, shall be metallic and have a space of 10 inches from the bottom of the service valve to finished grade. (IFGC 403.6.1) (QGCSP 3-10-05)

When a riser connects underground to plastic pipe, the underground horizontal metallic portion of the riser shall

extend at least 12 inches before connecting to the plastic pipe by means of an approved transition fitting, adapter or heat fusion. It is recommended an anodeless riser be used. If anode-type riser is used, a properly sized anode shall be installed.

Plastic pipe used underground for customer fuel lines must be buried a minimum of 12 inches. It shall not be used inside buildings or above ground. PVC (Polyvinyl Chloride) is not approved for piping systems in Questar Gas's service area. Individual gas lines (metallic or plastic) to single outside appliance (outside lights, grilles, etc.) shall be installed a minimum of 8 inches below grade, provided such installation is approved and installed in locations not susceptible to physical damage. (IFGC 404.12, 404.12.1)

7. Corrugated Stainless Steel Tubing (C.S.S.T.): Approved corrugated stainless steel tubing may be used for gas piping provided it is part of a system where tubing and fittings have been tested and listed for such gas piping system. System shall be installed as per manufacturer's installation instructions and local codes. All new installation of CSST piping systems are required to be bonded to the electrical service grounding electrode system at the point where the fuel line enters the building with a minimum 6AWG copper wire or equivalent. The bonding requirements are intended to reduce the chances of damage to the CSST from lightning induced electric energy. Refer to **Figure 3** for bonding requirements. (IFGC 404.2)



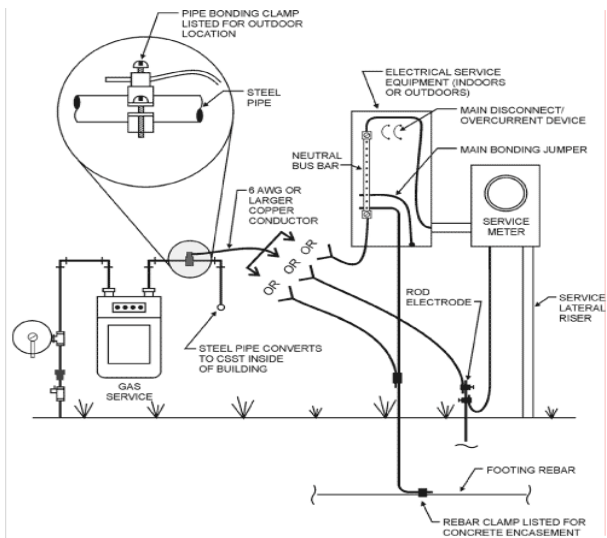


Figure 3: CSST Bonding

For sizing a CSST system, use the manufacturer’s installation sizing charts or the IFGC CSST tables.

CSST is not allowed underground (directly buried) unless it is designed and listed for underground applications. Some manufactures allow CSST to be “indirectly” buried by installing the tubing within a nonmetallic water tight conduit

CSST installed along the side of a structure between the ground and a height of 6ft shall be installed in a location that will not subject the piping to mechanical damage or be protected inside a conduit.

CSST shall terminate at a listed and properly secured termination plate or secured outside the applicable cabinet to rigid piping with a shut-off valve and union.

CSST may terminate inside the firebox of a fireplace if the yellow plastic jacket is removed from the tubing inside of the firebox enclosure.

CSST Termination at the meter location shall be properly secured to the wall. If installed on a wood or sided wall, a 2" x 4" minimum size header shall be installed behind the siding. Screws long enough to penetrate deep enough into the 2" x 4" header to securely hold the termination plate in place shall be used.

CSST Termination when installed on brick, proper anchoring shall be used. (Do not anchor into mortar joints.)

When CSST tubing passes through a fire stop (2hr. fire rated wall), the jacket shall not be removed. Seal between the building and the CSST shall be in accordance with manufacture specifications.

CSST may be installed in combination with schedule 40 rigid steel pipe.

Clearance holes and inside diameter of protection conduit shall be a minimum 1/2 inch greater than outside diameter of the tubing.

CSST Recommended minimum bending radius is 3 inch for sizes up to and including 3/4" for all manufacturers. Larger diameter tubing recommended minimum bend radius varies per manufacturer.

It is unnecessary to repair a dent less than 1/3 the diameter of CSST. Any crease, kink or any dent greater than 1/3 the diameter shall be cut out and replaced.

CSST shall not be installed on the bottom of floor joists in an unfinished basement unless it is in a location that will not be penetrated such as in narrow spaces between a duct and a wall, in a boxed-in location or between two ducts.

When drilling the holes for CSST in the joists or using the knockouts on TJI trusses, 3 inches is required from the hole to a penetrating edge. (2 ½ inches from the bare wood with ½ inch sheetrock will provide 3 inches.)

CSST manifolds should be installed close to the highest BTU consuming appliance. The manufactured manifold or approved fittings and nipples may be used.

Do not install CSST manifold in walls unless boxed in, sealed airtight with a ventilation opening into the room at the top portion of the door on the box and approved by the administrative authority. Do not violate fire walls.

8. Workmanship and Defects: Gas piping shall be gas-tight and built along lines which are unlikely to cause physical injury to inhabitants or weakness in the building structure. All pipe shall be either new or be in good condition, adequate for use with natural gas, free from internal obstruction and burred ends reamed to the full bore of the pipe.

In no case is it acceptable to repair defects in pipe or fittings. The defective pipe, fitting or threaded joint having been located shall be removed and replaced with sound material. (IFGC 403.7)

9. LP Gas: When changing from LP gas to natural gas, the supply line from the LP gas tank must be disconnected and plugged before natural gas will be turned into the building. A fuel line or piping system shall not be connected to a LP gas tank and natural gas meter at the same time. (QGCPP 07-00-01)

10. Installation of Gas Piping: All joints in an iron piping system, unless welded, shall be threaded joints, having approved standard threads. Threaded joints shall be made up with approved pipe thread compound or teflon tape on male threads only. (IFGC 403.9, and 403.9.3)

Gas piping downstream of the point of delivery (fuel line) is not allowed to enter or exit a building at a point below grade. This requirement is intended to lessen the possibility of gas leakage entering a building through a foundation wall penetration, gas piping shall enter and exit a building at a point above grade and the annular space between the pipe and the wall shall be sealed. (IFGC 404.6)

Fuel lines extending through a foundation or wall above ground, shall have protective coating, wrap or sleeve. Where piping is encased in a protective sleeve, the annular space between the piping and the sleeve shall be sealed (IFGC 404.9)

Location Limitations: Gas piping inside any building shall not be run in or through an air duct, clothes chute, chimney or vent, ventilating duct, dumbwaiter or elevator shaft. (IFGC 404.3)

Piping installed downstream of the point of delivery shall not extend through any townhouse unit other than the unit served by such piping. (IFGC 404.3)

Changes in direction of gas pipe shall be made by the use of fittings, factory bends or field bends. Refer to IFGC 405.2 for field bend requirements.

All rigid gas piping shall be adequately supported by metal straps or hooks at intervals not to exceed those listed: (IFGC 415.1)

1/2"	6 feet
3/4 " or 1"	8 feet
1 1/4" or larger (horizontal)	10 feet
1 1/4" or larger (vertical)	Every floor level

**Table 2: Pipe Support Intervals**

Gas piping exposed in exterior locations shall be protected from corrosion and physical damage. Gas piping shall be 3 1/2" above grade or roof surface. (IFGC 404.9)

Ferrous gas piping installed underground in exterior locations shall be protected from corrosion by approved coatings. All gas pipe protective coatings shall be approved types, factory applied, and conform to recognized standards. Field primer and wrapping shall provide equivalent protection and is restricted to those short sections and fittings necessarily stripped for threading or welding. Zinc coatings (galvanizing) shall not be deemed adequate protection for piping below ground. (IFGC 404.11.2)

At the time of installation all horizontal metallic piping shall have at least 12 inches of earth cover or other equivalent protection. (IFGC 404.12) Underground ferrous gas piping shall be electrically isolated from the rest of the gas system with listed or approved isolation fittings installed a minimum of 6 inches above grade. (IFGC 404.10)

New installations of underground ferrous gas piping shall be **cathodically protected**. It is recommended existing

underground ferrous gas piping be cathodically protected or replaced with approved plastic gas piping and anodeless risers. (QGCPP 07-00-01)

Underground natural gas distribution service and mains (metallic or plastic) shall have a clearance of 3 feet when running parallel or 12 inch vertical direction when crossing from any underground facility (water, sewer, electric, etc.). (QGCSP 3-10-05, 7.2)

**EXCEPTION:** Unless installed under the joint trenching agreement.

**NOTE:** Underground gas piping shall not be covered or concealed until inspected by the Administrative Authority.

The maximum design operating pressure for piping systems located inside buildings shall not exceed 5 psig except where one or more of the following conditions are met: (IFGC 402.6)

- 1) The piping system is welded
- 2) The piping is located in a ventilated chase or otherwise enclosed for protection against accidental gas accumulation.
- 3) The piping is located inside buildings or separate areas of buildings used exclusively for:
  - a. Industrial processing or heating;
  - b. Research;
  - c. Warehousing; or
  - d. Boiler or mechanical rooms.
- 4) The piping is a temporary installation for buildings under construction.
- 5) The piping serves appliances or equipment used for

agricultural purposes.

11. Concealed Piping, Fittings and Devices: Unions, bushings, regulators, shut-off valves, flex connectors, gas hoses and automatic valves shall not be concealed. (IFGC 404.5)

EXCEPTIONS: Fittings listed for concealment

12. Shut-off Valves: Valves used in connection with gas piping shall be approved types. An accessible approved shut-off valve shall be installed in the fuel supply piping outside of each appliance and ahead of the union or connector within 6 feet of the appliance and in the same room. Appliance shutoff valves located in the firebox of a fireplace shall be installed in accordance with appliance manufacturer's instructions. (IFGC 409.5)

EXCEPTION: When approved by the authority having jurisdiction, shut-off valves for listed, vented decorative appliances and room heaters, may be accessibly located in an area remote from the appliance. Such valve shall be permanently identified and shall serve no other equipment. (IFGC 409.5.2)

A listed shut-off valve shall be installed upstream of each MP regulator. (IFGC 409.4)

Shut-off valves shall be located to provide for ready access of operation and installed in a location where it will not be damaged. Installation of valves under appliances, such as wall heaters and fireplaces, should be installed in such a manner where the appliance can be removed without removal of the valve. Valves are prohibited in

concealed locations and furnace plenums. (IFGC 409.1.2, 409.1.3)

Gas outlets for a barbecue shall have a shut-off valve outside the building and connected to the rigid gas piping.

Gas piping supplying more than one building on any one premises shall be equipped with separate shut-off valves to each building, arranged so the gas supply can be turned on or off to any individual or separate building. Such shut-off valve shall be located outside the building it supplies and shall be readily accessible. (IFGC 409.3.1, 409.3.2)

Shut-off valves on multiple unit fuel lines from a master meter shall be installed to isolate the gas service to each unit. Each shut-off valve shall be marked for identification and be accessible to the tenant. (IFGC 409.3.3)

Questar Gas Company will install and maintain necessary service line valves on its service pipes for shutting off the supply of gas to the customer's premises. (IFGC 409.2)

13. **Pressure Testing:** Before the piping system is put in service and considered satisfactory, the piping shall be tested with a minimum pressure test of 3 psig, and shall hold this pressure for 10 minutes with no drop. The range of the gauge shall not be greater than five times the test pressure. Where extensions are made to existing house piping through which gas is being used, the installer shall make all necessary tests and checks. (IFGC 406.4, 406.4.1, 406.4.2)



**WARNING:** To avoid damage to appliances, before performing pressure test, isolate or disconnect appliances. (IFGC 406.3.3)

Piping carrying gas at pressures in excess of 2 psig pressure shall be tested at 1 ½ times the proposed maximum working pressure. (IFGC 406.4.1)

**NOTE:** This is a minimum pressure test.

If a drop in pressure occurs while gas piping is under test pressure, the affected portion of the piping system shall be repaired or replaced and retested. (IFGC 406.5.2)

The test medium shall be air, nitrogen, carbon dioxide or an inert gas. (IFGC 406.2)

14. **Meter Spot Test:** Where no changes have been made in the house piping the following procedures may be used:

Connect all appliances to gas piping system. (IFGC 406.6.3 and 406.6.2)

Before meter spot test, cap or plug unused outlets.

Turn each appliance shut-off valve to the on position and turn appliance control valve to the off position. (If an appliance is equipped with an 'A' valve and a pilot 'B' valve, shut both off and spot test meter to this point.)

When all connections and unused outlets have been verified, slowly release gas into piping, all appliances to remain off.

Observe if meter test dial has stopped. If movement on test dial continues, shut off all gas at the meter service line valve and find where consumption is going. If test dial stops, apply meter spot test for leakage. Watch the test dial of the meter to see if gas is passing through the meter. Begin test with the test hand on the upstroke. Test times for various meter dials are indicated on Table 3.

Dial Styles Cubic Feet	Test Time/Minutes
Manometer Test	5
¼	5
½	5
1	7
2	10
5	20
10	30

Table 3: Test Times for Meter Dials

After meter spot test determines there are no leaks, purge air from piping and place appliance in the proper operating condition. (IFGC 406.7.3)

**CAUTION:** When purging air from piping ensure there is no source of ignition and area is well ventilated.

15. **Appliance Connectors:** Each appliance shall be connected with a ground joint union or an approved flexible connector. Appliance connectors shall have the capacity not less than the demand of the connected appliance.(IFGC 411.1)

Examples of approved flexible connectors:

- Z21.24 - Listed single wall flex connector.
- Z21.41 Listed Rubber coated Quick Disconnect.

- Z21.45 -Listed other than all metal connector.
- Z21.54 –Listed Gas hose connector for portable outdoor gas fired appliances.
- Z21.69 Listed movable commercial appliance connector
- Z21.75 Listed outdoor appliance/fuel line connector.
- AGA3-87-Listed outdoor flex connector with PVC coating.
- IAPMO TSC-9 Listed Mobile Home fuel line connector

Flexible connectors shall have an overall length not to exceed 6 feet and are to be limited to one connector per appliance. (IFGC 411.1.3.1)

Appliances may be connected to the fuel gas piping by means of an approved listed quick-disconnect device with an approved shut-off valve connected to the rigid gas piping.(IFGC 411.1)

Commercial appliances equipped with casters and appliances that are moved for cleaning shall be equipped with approved flexible connector (Z.21.69 - movable appliances) and tether line for that use. (IFGC 411.1.1)

Flexible connectors shall not be concealed within or extended through walls, floors, partitions or ceilings or appliance housings.

**EXCEPTIONS:** Fireplace inserts that are factory equipped with grommets, sleeves or other means of protection in accordance with the listing of the appliance. (IFGC 411.1.3.3)

Unless otherwise prohibited by appliance manufacture or connector manufacture, listed connectors are permitted to extend through an opening in an appliance housing, cabinet or casing where the connector is protected against damage.

(IFGC 411.1.3.3)

16. **Required Gas Supply:** Gas piping shall be sized using CFH. To obtain the cubic-feet-per-hour of gas required, divide the input of appliances by the average Btu heating value per cubic foot of the gas. See Table 13 starting on Page 123 or consult Questar Gas Company for the average Btu per cubic foot if it is not known. (IFGC 402.1)

Example: 100,000 Btu/h rated furnace installed in an area with 890 Btu per cubic foot.

$$\frac{100,000}{890} = 112 \text{ CFH}$$

17. **Required Gas Piping Size:** When installing a main fuel supply line to a water heater and furnace location, a 1-inch minimum pipe size is recommended to allow for future appliance load. Questar Gas Co. requires a 3/4" minimum pipe size through the wall for meter set support. (QGCPP 07-00-01, 17.2 – 17.3)

When an additional appliance is to be served through present gas piping, capacity of the existing piping shall be properly sized and replaced with larger piping if necessary.

**LONGEST RUN SIZING METHOD:** Use one line from chart that is equal or greater than the distance to the most remote appliance out let in system from the gas meter.

#### BRANCH PIPE SIZING METHOD:

- (a) Size each section of pipe from meter to outlet (this sizes the drop or leg of pipe from trunk to appliance outlet)
- (b) Size each branch section (trunk line) using the length of pipe from meter to most remote outlet in each branch and the load of that section.

Longest Run Example - To determine the size of any section of pipe in a system, proceed as follows:

- (a) Calculate the gas demand in cubic feet per hour of the appliance to be attached to each outlet. See Required Gas Supply, Paragraph 16 to calculate demand.
- (b) Measure the length of pipe from the meter to the most remote outlet.
- (c) In **Table 4**, Page 55, select the distance, or the next longer distance if the table does not give the exact length.
- (d) Use this horizontal line to locate all gas demand figures for this particular system of piping.
- (e) Starting at the most remote outlet, find the horizontal line just selected, determine the gas demand for the outlet. If the exact figure of demand is not shown, choose the next larger figure in the horizontal line.

- (f) Above the demand figure will be the correct size of gas piping.
- (g) Proceed in a similar manner for each outlet and each section of gas piping. For each section of piping, determine the total gas demand by that section as follows (using an assumed gas content of 890 Btu/Cu. Ft.).

### EXAMPLES OF SIZING A HOUSE PIPING SYSTEM

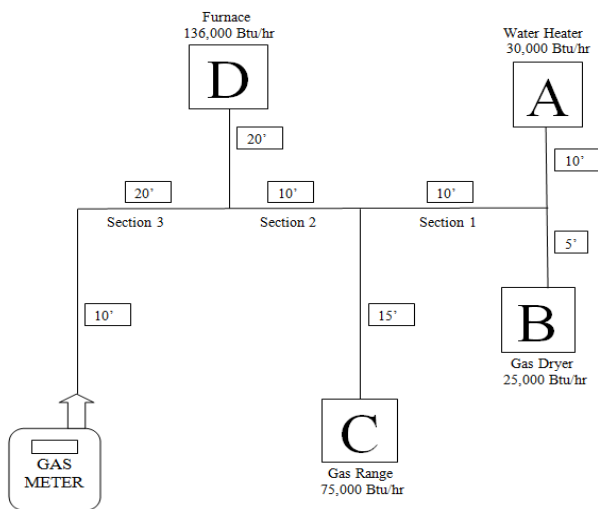


Figure 4: Examples of Sizing a House Piping System

**SOLUTION AND EXAMPLE: (Rated Input/890 Btu/Cfh)**

(a) Maximum demand for outlet "A"	34 CFH
Maximum demand for outlet "B"	29 CFH
Maximum demand for outlet "C"	85 CFH
Maximum demand for outlet "D"	<u>153 CFH</u>
Total Demand	301 CFH

(b) The length of pipe from the gas meter to the most remote outlet (Outlet "A") is 60 feet. THIS IS THE ONLY DISTANCE USED.

(c) Using horizontal line marked 60 feet:

Length	½	¾	1	1 ¼	1 ½	2	2 ½	3
60	65	137	257	528	791	1,520	2,430	4,290

Outlet "A" supplying 34 cubic feet an hour requires 1/2-inch pipe.

Outlet "B" supplying 29 cubic feet an hour requires 1/2-inch pipe. Section 1 supplying outlets "A" and "B", 62 cubic feet an hour requires 1/2-inch pipe.

Outlet "C" supplying 85 cubic feet an hour requires 3/4-inch pipe. Section 2 supplying outlets "A", "B", and "C", 146 cubic feet an hour requires 1-inch pipe.

Outlet "D" supplying 153 cubic feet an hour requires 1-inch pipe. Section 3 supplying outlets "A", "B", "C", and "D", 301 cubic feet an hour requires 1 1/4-inch pipe.

# MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR

**-4 OUNCES-**

Schedule 40 Metallic Pipe

(Inlet Pressure less than 2 PSI and a Pressure Drop of 0.5 Inch Water Column and .60 Specific Gravity Gas)

CAPACITIES BASED ON NUMBERS FROM IFGC

## STANDARD PRESSURE

PIPE SIZE (inch)								
Nominal	½	¾	1	1 ¼	1 ½	2	2 ½	3
Actual ID	0.62	0.824	1.049	1.380	1.610	2.067	2.469	3.068
Length (ft)	Capacity in Cubic Feet of Gas Per Hour							
10	172	360	678	1390	2090	4020	6400	11300
20	118	247	466	957	1430	2760	4400	7780
30	95	199	374	768	1150	2220	3530	6250
40	81	170	320	657	985	1900	3020	5350
50	72	151	284	583	873	1680	2680	4740
60	65	137	257	528	791	1520	2430	4290
70	60	126	237	486	728	1400	2230	3950
80	56	117	220	452	677	1300	2080	3670
90	52	110	207	424	635	1220	1950	3450
100	50	104	195	400	600	1160	1840	3260
125	44	92	173	355	532	1020	1630	2890
150	40	83	157	322	482	928	1480	2610
175	37	77	144	296	443	854	1360	2410
200	34	71	134	275	412	794	1270	2240
250	30	63	119	244	366	704	1120	1980
300	27	57	108	221	331	638	1020	1800
350	25	53	99	203	305	587	935	1650
400	23	49	92	189	283	546	870	1540
450	22	46	86	177	266	512	816	1440
500	21	43	82	168	251	484	771	1360
550	20	41	78	159	239	459	732	1290
600	19	39	74	152	228	438	699	1240

Table 4: Maximum Capacity of Pipe - 4 ounces



# MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR

**-2 psi-**

Schedule 40 Metallic Pipe

(Inlet Pressure 2 PSI)

\*\*Table based on a 1.0 PSI pressure drop.\*\*

## ELEVATED PRESSURE

Nominal	½	¾	1	1 ¼	1 ½	2	2 ½	3
Actual ID	0.62	0.824	1.049	1.380	1.610	2.067	2.469	3.068
Length (ft)	Capacity in Cubic Feet of Gas Per Hour							
10	1510	3040	5560	11400	17100	32900	52500	92800
20	1070	2150	3930	8070	12100	23300	37100	65600
30	869	1760	3210	6590	9880	19000	30300	53600
40	753	1520	2780	5710	8550	16500	26300	46400
50	673	1360	2490	5110	7650	14700	23500	41500
60	615	1240	2270	4660	6980	13500	21400	37900
70	569	1150	2100	4320	6470	12500	19500	35100
80	532	1080	1970	4040	6050	11700	18600	32800
90	502	1010	1850	3810	5700	11000	17500	30900
100	462	934	1710	3510	5260	10100	16100	28500
125	414	836	1530	3140	4700	9060	14400	25500
150	372	751	1370	2820	4220	8130	13000	22900
175	344	695	1270	2601	3910	7530	12000	21200
200	318	642	1170	2410	3610	6960	11100	19600
250	279	583	1040	2140	3210	6180	9850	17400
300	253	528	945	1940	2910	5600	8920	15800

Table 5: Maximum Capacity of Pipe - 2 psi

## CORREGATED STAINLESS STEEL TUBING (CSST)

Natural Gas (Pressure: 2.0 psi) (Pressure Drop: 1.0 psi)

*EHD	3/8"		1/2"		3/4"		1"		1-1/4"
Tube Size	13	15	18	19	23	25	30	31	37
Length (ft)	MAXIMUM CAPACITY in Cubic Feet Per Hour								
10	270	353	587	700	1098	1372	2592	2986	4509
25	166	220	374	444	709	876	1620	1869	2887
30	151	200	342	405	650	801	1475	1730	2642
40	129	172	297	351	567	696	1273	1470	2297
50	115	154	266	314	510	624	1135	1311	2061
75	93	124	218	257	420	512	922	1066	1692
80	89	120	211	249	407	496	892	1031	1639
100	79	107	189	222	366	445	795	920	1471
150	64	87	155	182	302	364	646	748	1207
200	55	75	135	157	263	317	557	645	1049
250	49	67	121	141	236	284	497	576	941
300	44	61	110	129	217	260	453	525	862

\*EHD – Equivalent Hydraulic Diameter

Table 6: CSST - Pressure 2.0 psi

## CORREGATED STAINLESS STEEL TUBING (CSST)

Natural Gas (Pressure: 5 psi) (Pressure Drop: 3.5 psi)

*EHD	3/8"		1/2"		3/4"		1"		1-1/4"
Tube Size	13	15	18	19	23	25	30	31	37
Length (ft)	MAXIMUM CAPACITY in Cubic Feet Per Hour								
10	523	674	1084	1304	1995	2530	4923	5659	8295
25	322	420	691	827	1289	1616	3077	3543	5311
30	292	382	632	755	1181	1478	2803	3228	4860
40	251	329	549	654	1031	1284	2418	2786	4225
50	223	293	492	586	926	1151	2157	2486	3791
75	180	238	403	479	763	944	1752	2021	3112
80	171	230	391	463	740	915	1694	1955	3016
100	154	205	350	415	665	820	1511	1744	2705
150	124	166	287	339	548	672	1228	1418	2221
200	107	143	249	294	478	584	1060	1224	1931
250	95	128	223	263	430	524	945	1092	1732
300	86	116	204	240	394	479	860	995	1585

\*EHD – Equivalent Hydraulic Diameter

Table 7: CSST- Pressure 5 psi

**CORREGATED STAINLESS STEEL  
TUBING (CSST)  
(4 oz meter set)**

Natural Gas (Pressure: 7 - 8 inches W.C.) (Pressure Drop: .5 inch W.C.)

*EHD	3/8"		1/2"		3/4"		1"		1-1/4"
Tube Size	13	15	18	19	23	25	30	31	37
Length (ft)	MAXIMUM CAPACITY in Cubic Feet Per Hour								
5	46	63	115	134	225	270	471	546	895
10	32	44	82	95	161	192	330	383	639
15	25	35	66	77	132	157	267	310	524
20	22	31	58	67	116	137	231	269	456
25	19	27	52	60	104	122	206	240	409
30	18	25	47	55	96	112	188	218	374
40	15	21	41	47	83	97	162	188	325
50	13	19	37	42	75	87	144	168	292
60	12	17	34	38	68	80	131	153	267
70	11	16	31	36	63	74	121	141	248
80	10	15	29	33	60	69	113	132	232
90	10	14	28	32	57	65	107	125	219
100	9	13	26	30	54	62	101	118	208
150	7	10	20	23	42	48	78	91	171
200	6	9	18	21	38	44	71	82	148

\*EHD – Equivalent Hydraulic Diameter

Table 8: CSST - Pressure 7-8 inches W.C.

**CORREGATED STAINLESS STEEL  
TUBING (CSST)  
(Outlet side of MP regulator)**

Natural Gas (Pressure: 7 - 8 inches W.C.) (Pressure Drop: 3.0 inch W.C.)

*EHD	3/8"		1/2"		3/4"		1"		1-1/4"
Tube Size	13	15	18	19	23	25	30	31	37
Length (ft)	MAXIMUM CAPACITY in Cubic Feet Per Hour								
5	120	160	277	327	529	649	1182	1365	2141
10	83	112	197	231	380	462	828	958	1538
15	67	90	161	189	313	379	673	778	1254
20	57	78	140	164	273	329	580	672	1090
25	51	69	125	147	245	295	518	599	978
30	46	63	115	134	225	270	471	546	895
40	39	54	100	116	196	234	407	471	778
50	35	48	89	104	176	210	363	421	698
60	32	44	82	95	161	192	330	383	639
70	29	41	76	88	150	178	306	355	593
80	27	38	71	82	141	167	285	331	555
90	26	36	67	77	133	157	268	311	524
100	24	34	63	73	126	149	254	295	498
150	19	27	52	60	104	122	206	240	409
200	17	23	45	52	91	106	178	207	355

\*EHD – Equivalent Hydraulic Diameter

Table 9: CSST - Pressure 7-8 inches W.C. Outlet side of MP regulator

**18. Gas Pressure Regulators:**

Z21.18 the ANSI standard for appliance regulators, intended for application in natural gas systems.

Z21.80 the ANSI standard for line pressure regulators, intended for application in natural gas systems.

A gas pressure regulator or gas equipment pressure regulator shall be installed where the gas appliance is de-

signed to operate at a lower pressure than the fuel gas system.

Access shall be provided to pressure regulators and regulators shall be protected from physical damage. Regulators installed on the exterior of the building shall be approved for outdoor installation. (IFGC 410.1)

19. MP Regulators: MP (medium pressure) regulators installed in the system shall comply with the following. (IFGC 410.2)
- (a) The MP regulator shall be approved and shall be suitable for the inlet and outlet gas pressures for the application.
  - (b) The MP regulator shall maintain a reduced outlet pressure under lockup (no-flow) conditions. The Z21.80 standard requires the use of an over-pressure protection device (OPD) for supply pressure above 2 psi tested and approved with the regulator
  - (c) The capacity of the MP regulator, determined by the published ratings of its manufacturer, shall be adequate to supply the appliance(s) served.
  - (d) The MP pressure regulator shall be accessible for servicing. Where located indoors, the regulator shall be vented to the outdoors or shall be equipped with a leak limiting device.
  - (e) A tee fitting with one opening capped or plugged shall be installed between the MP regulator and its upstream shut-off valve. Tee fitting shall be posi-

tioned to allow connection of a pressure-measuring instrument and to serve as a sediment trap.

- (f) A tee fitting with one opening capped or plugged shall be installed not less than 10 pipe diameters downstream of the MP regulator outlet. Tee fitting shall be located to allow connection of a pressure measuring instrument.

20. Venting of MP Regulators: Pressure regulators that require a vent shall be vented directly to the outdoors. The vent shall be designed to prevent the entry of insects, water and foreign objects. (IFGC 410.3)

EXCEPTION: A vent to the outdoors is not required for regulators equipped with and labeled for utilization with approved vent-limiting devices and must be installed according to manufacturer's installation instructions.

Vent piping for relief vents and breather vents shall be constructed of materials allowed for gas piping. Vent piping shall not be smaller than the vent connection on the regulator. Vent piping serving relief vents and combination relief and breather vents shall be run independently to the outdoors and shall serve only a single device vent. (IFGC 410.3.1)

Vent piping serving only breather vents is permitted to be manifolded when sized in accordance with approved design. Regulator vent piping shall not exceed the length specified in regulator manufactures instructions. (IFGC 410.3.1)

MP Regulators  
Maximum Inlet pressure 2psi

Regulator	Pipe Size	Capacity	Leak Lim-iter
Maxitrol 325-3L	3/8" & 1/2"	250CFH	12A09
Maxitrol 325-5AL	1/2"	425 CFH	12A39
Maxitrol 325-5AL	3/4" & 1"	550 CFH	12A39
Maxitrol 325-7L	1 1/4" & 1 1/2"	1250 CFH	12A49
300 O.A.R.A.	1/2"	250 CFH	"O" 3-18
600 O.A.R.A.	3/4"	550 CFH	"O" 6-38
"FAGAS F-BH2	1/2"	250 CFH	#F

Maxitrol Maximum Individual Load

Largest single appliance served by the regulator.

325-3L .....	140,000 Btu/hr
325-5AL .....	300,000 Btu/hr
325-7AL .....	1,250,000 Btu/hr

Vent Protectors for Outdoor Applications

325-3L .....	13A15
325-5AL .....	13A15-5
325-7AL .....	13A25

MP Regulators  
 Installations exceeding 2 psi  
 With Overpressure Protection Device (OPD)  
 Outlet pressure range 7-11" w.c.



Factory preassembled and supplied to the field as a unit

Regulator	Pipe Size	Capacity	Leak Limiter
Maxitrol 325-3L47	3/8" & 1/2"	125CFH	12A09
Maxitrol 325-3L48	1/2"	200CFH	12A09
Maxitrol 325-5AL48	1/2"	235 CFH	12A39
Maxitrol 325-5AL48	3/4"	320 CFH	12A39
Maxitrol 325-5AL600	3/4"	425CFH	12A39
Maxitrol 325-5AL600	1"	465CFH	12A39
Maxitrol 325-7AL210	1 1/4" & 1 1/2"	1250CFH	12A49

Maximum Individual Load/Capacity

325-3L47 (3/8", 1/2") (w/OPD 47 attached)...	125,000 Btu/hr
325-3L48 (1/2") (w/OPD 48 attached).....	200,000 Btu/hr
325-5AL48 (1/2") (w/OPD 48 attached).....	235,000 Btu/hr
325-5AL48 (3/4") (w/OPD 48 attached).....	320,000 Btu/hr
325-5AL600 (3/4") (w/OPD 600 attached)....	425,000 Btu/hr
325-5AL600 (1") (w/OPD 600 attached).....	465,000 Btu/hr
325-7AL210D (1 1/2", 1 1/4") (w/OPD 210D attached)	
.....	1,250,000 Btu/hr



## Vent Protectors for Outdoor Applications

325-3L.....	13A15
325-5AL.....	13A15-5
325-7AL.....	13A25
OPD 48.....	13A15
OPD 600.....	13A15
OPD 210D.....	13A15-5

## MP Regulators (cont.)

GOVERNER Regulators 2psig	With OPD 5psig	Pipe Size	2psig Inlet Capacity
30051	30051DC	½	928
30052	30052DC	¾	1,155
30053	30053DC	1	1,501
30150	30150DC	½	2,205
30151	30151DC	¾	2,785
30152	30152DC	1	3,308
30153	30153DC	1 ¼	7,891
30154	30154DC	1 ½	8,240
30155	30155DC	2	15,087
30157/F	30157DC	3	23,202
30158/F	30158DC	4	40,612

## SECTION IV – Appliance Installation

1. Accessibility and Clearances: Every gas appliance shall be located with respect to building construction and other equipment so sufficient clearance shall be maintained to permit cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connectors; the lubrication of moving parts, where required, and the adjustment and cleaning of burners and pilots. Refer to manufacturer's installation instructions when required. (IFGC 306.1)

All appliances shall be installed with clearances from combustible material in accordance with A.G.A listings, U.L. (Underwriters Laboratories), National Board of Fire Underwriters publications, and local requirements. Minimum clearances shall be maintained between combustible walls and gas appliances and their venting systems. **Gas equipment shall not be installed on carpeting unless the equipment is listed for such installation.**

Permanently installed heating equipment must have an electrical disconnect located on the supply side of fuse and must be within site of the heating equipment. (IRC Table E4101.5)

Appliance in Crawl Space. Gas appliances installed in a furred space or crawl space (under floor) shall be accessible by an opening not less than 22 inches by 30 inches and a passageway not less than 30 inches high by 22 inches wide. The passageway shall not be more than 20 feet in length from the access opening to the equipment and its controls. A level workspace 30 inches wide and 30 inches deep shall be provided on the control side of the equipment. (IFGC 306.4)

Appliance in Attic. The passageway for gas appliance installed in the attic shall be at least 30 inches high and 22 inches wide and have continuous solid flooring not less than 24 inches wide and not be more than 20 feet in length. A working space shall not be less than 30 inches deep by 30 inches wide on the control side of the equipment. The access opening shall be a minimum of 20 inches by 30 inches. The access opening and passageway shall be large enough for removal of the largest piece of equipment installed in the space. (IFGC 306.3)

EXCEPTIONS:

- (a) Where the passageway is not less than 6 feet high for its entire length, the passageway shall be not greater than 50 feet in length.
- (b) A working platform need not be provided when the equipment can be serviced from the required access opening.

In attics and crawl spaces, a permanent electrical outlet and lighting fixture controlled by a switch located at the required passageway opening shall be provided at or near the equipment. NFPA 70 (IFGC 306.4.1)

- 2. Special Conditions Created by Mechanical Exhausting or Fireplace: Operation of exhaust fans, kitchen ventilation systems, clothes dryers, swamp coolers or fireplaces may create conditions requiring special attention to avoid unsatisfactory operation of installed gas appliances.

Gas-burning appliances installed in rooms ventilated by exhaust fans shall be protected against the possibility of the fan pulling a down draft on the appliance vents. This may be done by the installation of makeup air, a permanent fresh air opening(s) to the room from the outside. (IFGC 304.4)

3. Installation in Garages: Gas designed appliances may be installed in a garage under the following conditions:

- (a) Elevation of Ignition source. Equipment and appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches above the floor in hazardous locations and public garages, repair garages, motor dispensing facilities and parking garages. Rooms or spaces not part of the living space communicating directly with a private garage through openings shall be considered part of the private garage. (IFGC 305.3)

EXCEPTION: Elevation of ignition source is not required for appliances that are listed as flammable vapor ignition resistant (FVIR)

Residential garages. In residential garages where appliances are installed in a separate, enclosed space having access only from the outside of the garage, such appliances shall be permitted to be installed at floor level provided that the required air is taken from the exterior of the garage. (IFGC 305.3.1)

- (b) Parking garages. Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule (entry) provid-

ing a two-doorway separation, except that a single door is permitted where sources of ignition in the appliance are elevated in accordance with IFGC 305.3. (IFGC 305.3.2)

- (c) Public Garages. Appliances located in public garages, motor fuel-dispensing facilities, repair garages or other areas frequented by motor vehicles shall be installed a minimum of 8 feet above the floor. Where motor vehicles are capable of passing under an appliance, the appliance shall be installed at the clearance required by the appliance manufacturer and not less than 1 foot higher than the tallest vehicle garage door opening. (IFGC 305.4)
  
- (d) Repair garages. Appliances installed in repair garages shall be installed in a detached building or room, separated from repair areas by walls or partitions, floors or floor-ceiling assemblies that are constructed so as to prohibit the transmission of vapors and having a fire resistant rating, and that have no openings in the wall separating the areas within 8 feet of the floor, air for combustion shall be obtained from outdoors. (IFGC 305.10)

**EXCEPTIONS:**

1. Overhead heaters where installed 8 feet above the floor.
  
2. Heating appliances for vehicle repair areas where there is no dispensing or transfer of flammable or combustible liquids or liquefied petroleum gas.

- (e) Private garages. Appliances located in private garages shall be installed with a minimum clearance of 6 feet above the floor.

EXCEPTION: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with section 305.3 of IFGC. (IFGC 305.5)

NOTE: Appliances installed in a garage must have required air for combustion.

- 4. Hazardous and Prohibited Locations: Gas appliances shall not be installed in any hazardous location, unless listed and approved for that specific location. **Gas fired appliances shall not be located in sleeping rooms, bathrooms, toilet rooms or in a space that opens into such rooms or spaces except where the installation complies with one of the following exceptions.** (IFGC 303.3)

**EXCEPTIONS:** This shall not apply to the following appliances:

- (a) Direct vent appliances installed in accordance with manufacturers instructions.
- (b) Vented room heaters, wall furnaces, vented gas fireplaces, vented decorative appliances and vented decorative appliances designed to be installed in solid fuel-burning fireplaces, provided the room the appliance is installed in meets the required volume criteria of IFGC 304.5.
- (c) Appliances installed in a dedicated enclosure that only opens into a bedroom or bathroom and all

combustion air is taken directly from outdoors and the enclosure is equipped with a solid door that is weather stripped and is equipped with an approved self-closing device.

- (d) A single wall mounted unvented room heater in a bathroom that has an input rating no greater than 6,000 Btu/h and meets the required volume criteria.
- (e) A single wall mounted unvented room heater installed in a bedroom that has an input rating no greater than 10,000 Btu/h and meets the required volume criteria.

5. **Warm Air Furnace Return Air Inlets:** Return air inlets shall not be located within 10 feet of any appliance firebox, solid fuel burning appliance or draft diverter in the same enclosed room, this does not apply to direct vent appliances. (IFGC 618.4.)

Return air inlets may be in the same room provided they are 10ft away from a draft hood or atmospheric combustion chamber or burner and provide that the volume of supply air discharged back into the same space is equal to the volume of return air taken from the space.

Return air openings shall not be located in a closet, bathroom, toilet room, kitchen, garage, boiler room or furnace room.

6. **Vented Wall Furnaces:** Vented wall furnaces shall be installed in accordance with their listing. Panels, grilles and access doors of appliances which must be removed for normal servicing operation shall not be attached to the building construction. Vented wall furnaces shall be

located so as not to cause a fire hazard to walls, floors, combustible furnishings or doors. (IFGC 608.1 – 608.6)

7. Floor Furnaces: Floor furnaces shall have 18 inches clearance on the control side of the appliance and 12 inches clearance on the remaining sides and back. There will be 6 inches clearance on bottom of appliance. (IFGC 609.4)
8. Suspended Unit Heaters: Shall be installed according to the manufacturer's installation instructions and its listing. (IFGC 620)
  - (a) A unit heater shall not have duct work attached unless listed in the installation instructions for such use. (IFGC 620.3)
  - (b) A unit heater shall be installed with clearances to combustible material of not less than 18 inches at the sides, 12 inches at the bottom and 6 inches above the top unless stated otherwise in appliance installation instructions. (IFGC 620.4)
9. Boilers: Shall be installed according to the manufacturer's installation instructions and its listing. (Utah Boiler & Pressure Vessel Compliance) (IFGC 631.1) (IMC 1004, 1006, 1007, 1010)

Boilers shall be equipped with controls and limit devices as required by the manufacture's installation instructions and the conditions of the listing. (IMC 1006.7)



(HOT WATER) Minimum required safeties:

- Aquastat
- Pressure/Temperature gauge
- Pressure relief valve
- Proof of flame
- Low water cut off \*

\* When required by mfg. local jurisdiction or insurance companies

(STEAM) Minimum required safeties:

- Pressuretrol
- Pressure gauge and water gauge glass
- Low water cutoff
- Pressure relief valve
- Proof of flame

NOTE: Pool and Spa heaters are required to have a temperature-relief valve (IRC M2006.3) unless it is not required by local building code. Relief valve must not exceed the working pressure listed on boiler rating plate. The relief valve capacity must also be equal or more than the Btu input of the heater.

10. Log Lighters: Approved log lighters, where properly installed, may be used for the lighting of wood fires only.(IFGC 603.1)
11. Unvented Room Heaters: One or more unvented room heaters shall not be used as the sole source of comfort heating in a dwelling unit. (IFGC 621)
  - (a) Unvented room heaters shall not have an input rating greater than 40,000 Btu/h. (IFGC 621.3)

- (b) Unvented room heaters shall not be installed in occupancies in use Groups *A, E* and *I*. (IFGC 621.4)
  - (c) Unvented room heaters shall be equipped with an oxygen depletion sensitive (ODS) safety shut-off system. ODS's may be cleaned but shall not be adjusted or altered which will result in the changing of the appliance set point. (IFGC 621.6)
  - (d) A single wall-mounted unvented room heater installed in a bedroom shall be no larger than 10,000 Btu and a single wall-mounted unvented room heater installed in a bathroom shall be no larger than 6,000 Btu.(IFGC 303.3)
  - (e) Unvented room heaters shall not be installed in a room that does not have required volume. (IFGC 621.5)
12. Gas Logs and Decorative Appliances: Approved gas logs (ANSI Z21.60 ignitor, pilot, or direct ignition. ANSI Z21.84 manually lighted decorative appliance) may be installed in solid fuel burning fireplaces provided the following conditions are met: (IFGC 602),
- (a) The gas log is installed in accordance with the manufacturer's installation instructions.
  - (b) If the fireplace is equipped with a damper, it shall be permanently blocked open a sufficient amount to prevent spillage of combustion products into the room. (See appliance installation instructions)
  - (c) Decorative appliances for installation in an approved solid fuel-burning fireplace, with the exception of

those tested in accordance with ANSI Z21.84, shall utilize a direct ignition device, an ignitor or a pilot flame to ignite the fuel at the main burner and shall be equipped with a flame safeguard device. (IFGC 602.2)

- (d) Prohibited installation. Decorative appliances for installation in fireplaces shall not be installed where prohibited by IFGC 303.3 (IFGC 602.3) (See paragraph 4.)

13. Water Heaters: Water heaters shall be installed according to their listings and shall be equipped with a temperature and pressure relief valve conforming to ANSI Z21.22 and shall have a temperature setting of not more than 210<sup>0</sup>F and a pressure setting not exceeding the tank rated working pressure or 150 psi whichever is less. (IPC 504.5)

Required discharge piping connected to a pressure relief valve shall be rated ASME A112.4.1 or be constructed of materials listed in section 605.4 of the 2012 IPC. No size reduction on drain tube is allowed, and a single drain tube can only serve a single relief device and cannot have a threaded end at termination. (IPC 504.6)

Seismic supports. Appliances designed to be fixed in position shall be fastened or anchored in an approved manner. Water heaters shall be anchored or strapped to resist horizontal displacement caused by earthquake motion. Strapping shall be at points within the upper one-third and lower one-third of the appliance's vertical dimensions. At the lower point, strapping shall maintain a minimum distance of 4 inches above the controls. (IPC 502.4 Utah amendment)

Water heaters used in combination as space heating and potable water supply shall be listed for application and shall be equipped with a tempering valve to limit the temperature of the potable distribution side to 140°F. (IFGC 624.2) (IMC 1002) (IPC 501.2)

Required pan. Where a storage type tank type hot water heater or storage tank is installed in a location where water leakage from the tank will cause damage, the tank shall be installed in a galvanized pan or other pans approved for such use. (IPC 504.7)

14. Gas Ranges: Shall be installed according to the manufacturer's installation instructions and applicable codes. Cooking appliances designed and tested, listed and labeled for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur. (IFGC 623.1, 623.2, 623.3)
15. Clothes Dryer: Shall be installed according to the manufacturer's installation instruction and applicable codes.(IFGC 613.1)

Where a closet is designed for the installation of a clothes dryer, an opening having an area of not less than 100 square inches - shall be provided in the closet enclosure for make-up air.(IFGC 614.5) (IMC 504.5)

Clothes dryers shall be exhausted in accordance with the manufactures instructions. Dryer exhaust systems shall be independent of all other systems, shall convey the moisture and any products of combustion to the outside of the building. (IFGC 614.1)

Unless permitted or required by the dryer manufacturer's installation instructions and approved by the building official, domestic dryer moisture exhaust ducts shall not exceed a total combined horizontal and vertical length of 35 feet, this does not include transition duct. Deduct 5 feet for each 90-degree elbow and 2 1/2 feet for every 45-degree elbow. (614.6.5.1)

Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is listed and labeled in accordance with UL 2158A. Transition ducts shall be a maximum of 8 feet in length and shall not be concealed in construction. (614.6.4)

Exhaust ducts shall be supported at 4 foot intervals and secured in place. The insert end of the duct shall extend into the adjoining duct in the direction of airflow. Ducts shall not be joined with screws or similar fasteners that protrude into the inside of the duct. (IFGC 614.6.2)

Clothes dryer exhaust ducts shall not be connected to a vent connector, vent or chimney. Clothes dryer exhaust ducts shall not extend into or through ducts or plenums. (IFGC 614.4)

Moisture exhaust ducts shall terminate on the outside of the building and shall be equipped with a back-draft damper. (IMC 504.4)

Protective shield plates shall be placed where nails or screws are likely to penetrate the dryer exhaust duct. (IMC 504.6.7) (IFGC 614.6.3)

Exhaust ducts shall have a smooth interior finish and shall be constructed of metal a minimum of .016 inch thick. The exhaust duct size shall be 4 inches nominal diameter. (IFGC 614.6.1)

16. Commercial Clothes Dryer: The installation of dryer duct serving Type 2 clothes dryers shall comply with the appliance manufacture's installation instructions. Exhaust fan motors in exhaust systems shall be located outside of the air stream. In multiple installations, the fan shall operate continuously or be interlocked to operate when any individual unit is operating. Ducts shall have a minimum clearance of 6 inches to combustible materials. (IMC 504.7 & IFGC 614.7)

Each vertical duct riser for dryers listed to ANSI Z21.5.2 (Type 2) shall be provided with a cleanout or other means for cleaning the interior of the duct (IFGC 614.3)

## SECTION V – Combustion and Ventilation Air

1. Air for Combustion and Ventilation: Appliances shall be installed in a manner and in a location with sufficient ventilation to permit complete combustion of the gas, proper venting of the appliance, and to maintain safe operating temperature and proper supply of air. Direct vent appliances, and gas appliances of other than natural draft design and vented Category I shall be provided with combustion, ventilation and dilution air in accordance with the appliance manufactures installation instructions. (IFGC 304.1)
  - (a) Openings and ducts shall not connect appliance enclosures with a space in which the operation of an exhaust fan may adversely affect the flow of combustion air. Where exhaust fans, kitchen ventilation, clothes dryers and fireplaces interfere with the operation of appliances, make-up air must be provided. (IFGC 304.4)
  - (b) Combustion air openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors. (IFGC 304.6.1)
  - (c) Combustion air ducts and openings shall not be installed so as to pass through construction where fire dampers are required.
  - (d) Minimum dimensions of air openings shall not be less than 3 inches.
  - (e) Combustion air supply shall not be obtained from any hazardous location or from any area in which

objectionable quantities of flammable vapor, lint or dust are given off. Combustion air shall not be taken from a refrigeration machinery room.(IFGC 304.12)

2. Combustion Air Ducts: Combustion air ducts shall comply with the following: (IFGC 304.11)
  - (a) Ducts shall be constructed of galvanized steel complying with chapter 6 of the IMC code or material having equivalent corrosion resistance, strength and rigidity.

EXCEPTION: Within dwelling units, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one required fireblock is removed.

NOTE: Flexible duct shall not be used for combustion air ducts.

- (b) Ducts shall terminate in an unobstructed space allowing for free movement of combustion air to the appliance.
- (c) Ducts shall serve a single enclosure.
- (d) Ducts shall not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
- (e) Ducts shall not be screened where terminating in an attic space.



- (f) Horizontal upper combustion air ducts shall not slope downward toward the source of combustion air.
- (g) The remaining space surrounding a chimney liner, gas vent, special gas vent or plastic piping installed within a masonry, metal or factory-built chimney shall not be used to supply combustion air.

Round Duct Size Inches

3	4	5	6	7	8	9	10	11	12
---	---	---	---	---	---	---	----	----	----

Nominal Area Square Inches

7.06	12.56	19.63	28.27	38.48	50.27	63.62	78.54	95.03	113.10
------	-------	-------	-------	-------	-------	-------	-------	-------	--------

NOTE: Manually-operated dampers shall not be installed in combustion air ducts.

3. **Louvers and Grilles:** In calculating free area as required, consideration shall be given to the blocking effects of louvers, grilles, or screens protecting such opening. If the free area through the design of louver or grille is known, it shall be used in calculating the size of opening required to provide the free area specified. If the design and free area is not known it may be assumed that wood louvers will have 25% free area and metal louvers and grilles will have 75% free area. Louvers and grilles shall be fixed in an open position.(IFGC 304.10)

Grille and screen openings cannot be smaller than 1/4 inch.

EXAMPLE 1: If a metal grille is used and 100 square inches of free area is required

$$\frac{100}{.75} = 133.3 \text{ or } 134 \text{ square inches of metal grille to allow 100 square inches of free area measured across the grille opening.}$$

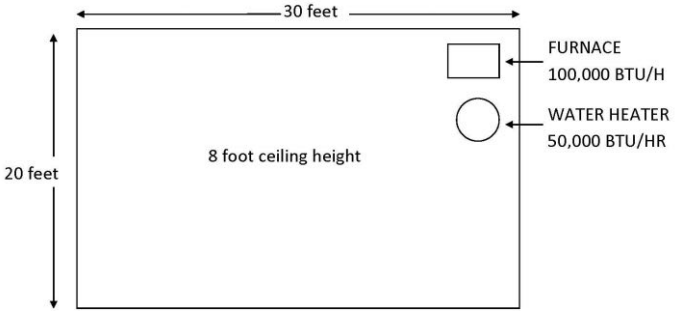
EXAMPLE 2: If a wood louver is used and 100 square inches of free area is required

$$\frac{100}{.25} = 400 \text{ square inches of wood louver to allow 100 square inches of free area measured across the grille opening.}$$

4. **Required Volume:** If the volume of the room or space in which fuel-burning appliances are installed is equal to or greater than 50 cubic feet per 1,000 Btu/h of combined input rating of all appliances in the space, this may be regarded as having required volume to provide combustion air (see **WARNING**). Rooms communicating directly with the space in which the equipment is installed may be considered part of the calculated space as long as openings between them have no doors. Exclude from the calculation the input ratings of listed direct vent appliances. (IFGC 304.5.1)

**WARNING:** Homes built in accordance with current energy codes or green codes typically do not have sufficient infiltration to supply the combustion air requirements of gas fired open combustion appliances, a new home today typically has an infiltration rate of 0.35 ACH, which is less than the required 0.40 ACH and combustion air from outside will likely be necessary.

To determine if air is required, use the following example:



**Figure 5: Air Required Example**

$$\frac{150,000}{1,000} = 150 \text{ BTU} \times 50 = 7500 \text{ CU. FT. REQUIRED (MINIMUM)}$$

$$20 \times 30 \times 8 = 4800 \text{ CU. FT.} = \text{THIS WOULD NOT HAVE THE REQUIRED VOLUME AND ADDITIONAL COMBUSTION AIR WILL BE REQUIRED}$$

The combustion air supply for gas appliances may be obtained by application of one of the methods in Paragraphs 5 through 7.

5. All Air from Inside the Building: Where the space in which the appliances are installed does not meet the required volume rule, the space shall be provided with two permanent openings communicating with other spaces of sufficient volume so the combined volume of all spaces meets the criteria for the required volume rule. One opening located within the upper 12 inches of the encl-

sure and one opening located within the lower 12 inches of the enclosure. Each opening shall have a free area of not less than 1 square inch per 1,000 Btu per hour of total input rating of all appliances within the enclosure with a minimum requirement of 100 square inches free area. (See **Figure 6**) (IFGC 304.5.3)

**COMBINING SPACES IN DIFFERENT STORIES:** Different stories in dwellings are considered connected when connected by one or more openings in doors or floors having a total minimum free area of 2 square inches per 1,000 Btu of all appliances. (IFGC 304.5.3.2)

# ALL AIR FROM INSIDE THE BUILDING

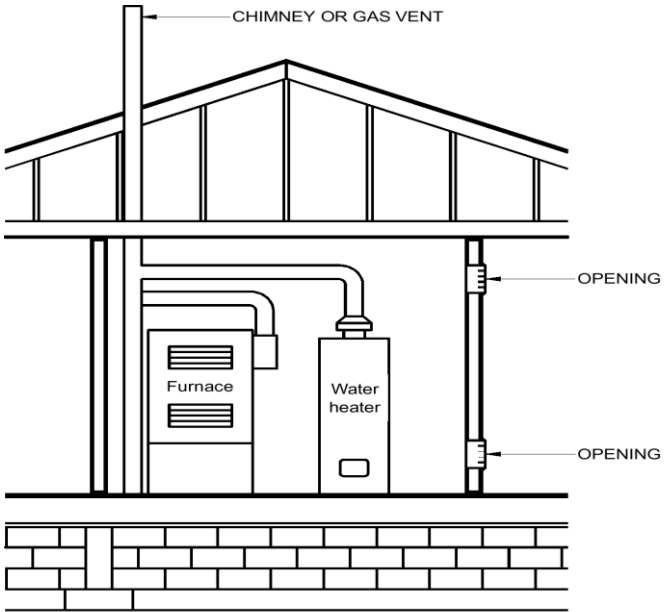


Figure 6: All Air From Inside Building

6. Outside Air: All air from the outdoors shall be obtained using one of the following methods. (IFGC 304.6)
  - (a) Two Openings - The confined space shall be provided with two permanent openings, one located within the top 12 inches and one located within the bottom 12 inches of the enclosure. The openings shall communicate directly or by ducts with the outdoors or spaces (properly ventilated crawl space or attic) freely communicating with the outdoors. (IFGC 304.6.1)
    - 1) Vertical or Direct (1-4,000). When directly communicating through an outside wall or by vertical ducts, each opening shall have a minimum free area of 1 square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure. (See **Figure 7** and **Figure 8**)

ALL AIR FROM OUTDOORS—INLET AIR FROM PROPERLY VENTILATED CRAWL SPACE AND OUTLET AIR TO PROPERLY VENTILATED ATTIC

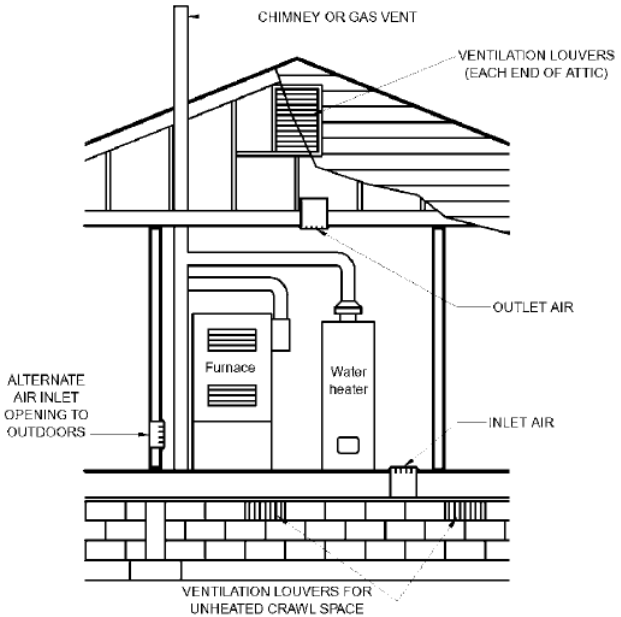


Figure 7: Inlet Air from Ventilated Crawl

Notice the upper openings may not be taken from a crawl space.

ALL AIR FROM OUTDOORS  
THROUGH PROPERLY VENTILATED ATTIC

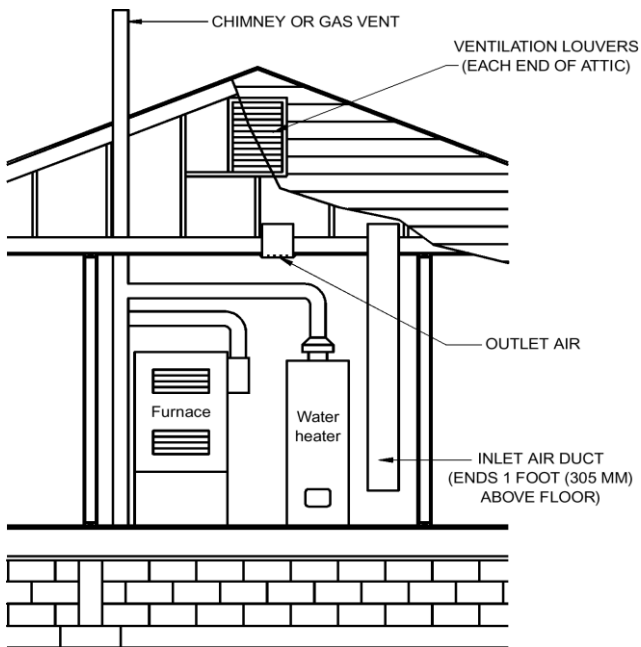


Figure 8: Outdoors through Ventilated Attic



- 2) Horizontal (1-2,000). When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of not less than 1 square inch per 2,000 Btu per hour of the total input rating of all equipment in the enclosure. (See **Figure 9**)

### ALL AIR FROM OUTDOORS HORIZONTALLY

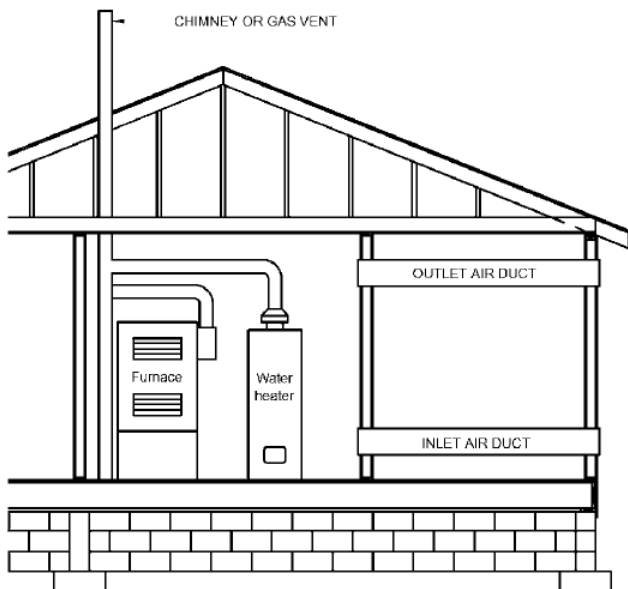


Figure 9: Air from Outdoors Horizontally

- (b) One Opening (1-3,000). The confined space shall be provided with one permanent opening located within the top 12 inches of the enclosure. The opening shall communicate directly or by duct to the outdoors. All the appliances in the enclosure shall have minimum clearances of 1 inch on the sides and back and 6 inches on the front. The opening shall be a minimum of 1 square inch per 3,000 Btu/h of total input rating of all appliances in the enclosure and not less than the combined cross sectional area of the appliance vent connectors in the confined space. (IFGC 304.6.2)  
(See **Figure 10**)

# SINGLE COMBUSTION AIR OPENING, ALL AIR FROM OUTDOORS

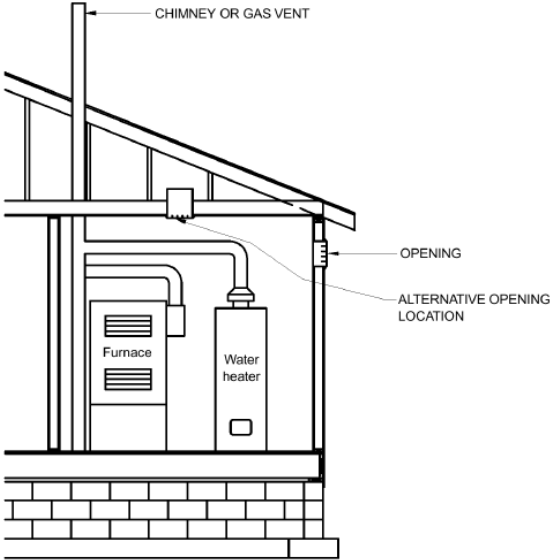


Figure 10: Single Combustion, Air from Outdoors

## 7. Combination Indoor and Outdoor Combustion

Air: For combined use of inside and outside combustion air refer to the IFGC, Section 304.7.1 through 304.7.3.

**WARNING:** Homes built in accordance with current energy codes or green codes typically do not have sufficient infiltration to supply the combustion air requirements of gas fired open combustion appliances, a new home today typically has an infiltration rate of 0.35 ACH, which is less than the required 0.40 ACH and combustion air from outside will likely be necessary.

$$\left[ 1 - \left( \frac{\text{available indoor volume}}{\text{volume required by Section 304.5}} \right) \right] \times \begin{array}{l} \text{full size opening} \\ \text{required by} \\ \text{Section 304.6} \end{array} = \begin{array}{l} \text{reduced size} \\ \text{outdoor air} \\ \text{openings} \end{array}$$

### Example:

#### Given:

7,500 ft<sup>3</sup> of indoor volume is required if all indoor air is to be used.

4,950 ft<sup>3</sup> of indoor volume is available.

One opening to the outdoors is desired and must be 50 in.<sup>2</sup> if all outdoor air is to be used.

$$\left[ 1 - \left( \frac{4,950 \text{ ft}^3}{7,500 \text{ ft}^3} \right) \right] \times 50 \text{ in.}^2 = \text{reduced outdoor opening size}$$

0.34 x 50 in.<sup>2</sup> = 17 in.<sup>2</sup> outdoor opening size

8. Combustion Air Supply and Ventilation of Boiler Room: A permanent source of outside air shall be provided for each boiler room to permit satisfactory combustion of the fuel as well as proper ventilation

Input (BTU/HR)	Required Air (CFM)	Minimum Net Louvered Area (SQ Feet)
500,000	125	1
1,000,000	250	1
2,000,000	500	1.6
3,000,000	750	2.5
4,000,000	1,000	3.3
5,000,000	1,250	4.1
6,000,000	1,500	5
7,000,000	1,750	5.8
8,000,000	2,000	6.6
9,000,000	2,250	7.5
10,000,000	2,500	8.3

$(\text{BTU}/10,000) \times 2.5 = \text{CFM}/300 = \text{square foot of net required area}$

Example: 5,000,000 divided by 10,000 = 500 X 2.5 = 1,250  
divided by 300 = 4.166 square ft. of net required area.

### Alternate Formula

$(\text{BTU}/4,000) = \text{CFM}/300 = \text{square ft. of net required area.}$

Example: 5,000,000 divided by 4000 = 1,250 divide by  
300 = 4.166 cubic ft. of louvered area.

(Square ft. is 144 square inches multiply by 4.166cf is 600sq  
inches)

## SECTION VI – Venting

1. **Responsibility:** Responsibility for the proper venting of appliance rests with the installing agency.
2. **General:** Every appliance shall discharge the products of combustion to the outdoors except for appliances exempted by IFGC 501.8 (IFGC 501.2)

Venting of Category II, III and IV shall be in accordance with the appliance manufacture installation instructions. (IFGC 501.14)

Listed appliances with integral venting systems such as direct vent appliances shall be installed in accordance with the manufactures instructions. (IFGC 503.2.4)

Mechanical draft systems shall be listed and installed in accordance with manufactures installation instructions for both the appliance and the mechanical draft system. (IFGC 503.3.3)

Vent connectors serving gravity vent type appliances shall not be connected to a venting system served by a mechanical draft system operating under positive pressure. (IFGC 503.3.3)

When a mechanical draft system is employed, provision shall be made to prevent the flow of gas to the main burners when the draft system is not performing so as to satisfy the operating requirements of the appliance for safe performance.(IFGC 503.3.3)

A connector entering a masonry chimney shall extend through the wall to the inner face of the liner, but not be-

yond, and shall be firmly cemented to masonry. A thimble may be used to facilitate removal of the connector for cleaning, in which case the thimble shall be permanently cemented in place with high-temperature cement. (IFGC 503.10.10, 501.7.3)

An appliance shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel. (IFGC 503.5.7.1)

Connectors shall connect to a masonry chimney not less than 12 inches above the lowest portion of the interior of the chimney. (IFGC 501.9)

Masonry chimney shall be provided with a cleanout opening having a minimum height of 6 inches. The upper edge of the opening shall be located not less than 6 inches below the lowest chimney inlet opening. The cleanout shall be provided with a tight-fitting noncombustible cover (IFGC 501.15.3.)

NOTE: If 6 inches is not available, a clean out shall be provided by installing a capped tee in the connector next to the chimney.

Venting systems shall be designed and constructed as to develop a positive flow adequately conveying all combustion products to the outside atmosphere. (IFGC 503.3)

The venting system on all gas appliances shall be examined to ensure they are properly installed, have adequate draft and the products of combustion are going up the vent connector and vent properly.

An appliance shall be located as close as practical to the venting system. (IFGC 504.3.2)

Venting systems shall not extend into or pass through any air duct or furnace plenum (IFGC 503.3.5)

Appliances which are connected to a common venting system shall be located within the same story of the building (IFGC 503.6.10) see exception.

**EXCEPTION:** Appliance installations where all the appliances served by the common vent are located in rooms separated from occupiable space. Each of these rooms shall have provisions for adequate supply of combustion, ventilation and dilution air that is supplied from the outdoors. (IFGC 503.6.10.1)

The appliance enclosures shall not communicate with the occupiable areas of the building. Where the same vertical vent or chimney is used for gas appliances on more than one floor, all appliances except those on the lowest floor shall be provided with as much vertical vent connector rise as possible before connecting into the common vent.

In concealed locations, venting installed through holes or notches in studs, joists or rafters and within 1-1/2" inches of penetrating edge shall be protected by shield plates. (IFGC 502.7)

3. **Draft Hoods:** Every appliance designed with a draft hood shall have a draft hood installed in the position for which it was designed and shall be located so the draft hood relief opening is at least 6 inches from any surface other than the appliance it serves, measured in a direction



90 degrees to the plane of the relief opening. When a greater or lesser clearance is indicated on the equipment label, the clearance shall not be less than that specified on the label.(IFGC 503.12.7)

Draft hoods shall be installed in the same room as the appliance as to prevent any difference in pressure between the draft hood, burner and combustion air supply (IFGC 503.12.5)

When the appliance is equipped with a draft hood, to ensure proper draft, a match test will be made both before and after indoor blower starts to run on appliances so equipped. (QGCPP 03.00.02)

4. Vent Materials: Materials for vents or vent connectors on domestic or small commercial installations shall be such as to resist the corrosive action of flue gases and condensate. In general, this requirement prohibits the use of black iron, galvanized iron, or copper for vents or vent connectors for gas designed appliances. (IFGC 503.10.2)

NOTE: Aluminum vent is required for most residential and commercial applications. For commercial installations see manufacture installation instructions.

Appliances incorporating integral venting means shall be installed in accordance with the manufactures instructions. (IFGC 503.2.4)

Plastic vent pipe may be used in accordance with the terms of the listing and the appliance manufacturer's installation instructions. (IFGC 503.4.1) where primer is

required it shall be of a contrasting color (IFGC 503.4.1.1)

5. **Vent Clearances:** Vents and vent connectors shall be installed with minimum clearances from combustible material as set forth by the National Board of Fire Underwriters and by local regulating agencies.

The remaining space surrounding a chimney liner or gas vent installed within a masonry chimney shall not be used to vent another appliance (IFGC 503.5.10)

Type “C” (unlisted single wall) gas vent material used as a vent connector shall not pass through any floor, ceiling or attic and shall have 6 inches clearances to combustible material. The entire length of Type “C” vent must be accessible for inspection, cleaning and replacement.

Listed single wall vent material shall be installed according to its listing. (IFGC 503.7.6 and 503.10.13)

Where vents pass through insulation in attic, an insulation shield constructed of steel shall be installed to provide specified manufacture clearance between the vent and the insulation material, the shield shall terminate not less than 2 inches above insulation material. (IFGC 502.4)

6. **Vent Connectors:** Connectors shall be used to connect fuel-burning appliances to a vertical chimney or vent unless the chimney or vent is attached directly to the appliance. Such connectors shall be installed within the space or area in which the appliance is located and shall be connected to a chimney or vent in such a manner as to maintain the clearance to combustibles as required by the

listing and the manufacturer's installation instructions. (IFGC502.2)

Each vent connector of a multiple venting system shall have the greatest possible rise consistent with the headroom available between the draft hood outlet or the vent collar and the point of interconnection to a manifold or to a common vent. (IFGC 503.10.4)

Every portion of a vent connector shall have a rise of not less than 1/4 inch per linear foot from the appliance to the vertical vent or chimney. (IFGC 503.10.7)

When the connector used for a Category I gas appliance must be located or pass through an unconditioned space, that portion of the connector shall be listed Type "B" or Type "L" vent material and shall not be covered with insulation. (IFGC 503.10.2.2)

The entire length of a vent connector shall be provided with ready access for inspection, cleaning, and replacement. (IFGC 503.10.11)

Connectors shall be securely supported for the design and weight of the materials employed to maintain proper clearances. (IFGC 503.10.9)

Joints between sections of connector piping and connections to flue collar or draft hood outlets shall be fastened by sheet metal screws or other approved means and in accordance with the manufacturer's instructions. (IFGC 503.10.6)

Screws, rivets and other fasteners shall not penetrate the inner wall of double-wall gas vents, except at the transi-

tion from the appliance draft hood outlet, a flue collar or a single-wall metal connector to a double-wall vent (IFGC 503.6.13)

7. **Vent Dampers:** Automatically operated vent dampers, heat reclaimers, and recuperators shall be of a listed type and installed in accordance with the terms of their listings and the manufacturer's installation instructions. They shall be arranged to prevent the initiation or increase of firing unless the damper is opened to a safe position. (IFGC 503.14, 503.15)

Manually operated dampers shall not be placed in connectors of gas-burning appliances. Fixed baffles shall not be classified as dampers. (IFGC 503.13)

8. **Gas Vent Termination:** Vents shall extend above the roof surface, through a flashing, and terminate in a **LISTED** vent cap installed in accordance with its listing and the manufacturer's installation instructions. (IFGC 503.6.6)

A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except direct vent appliances and mechanical draft systems installed in accordance with manufacturer's instructions. (IFGC 503.6.8, 503.2.3, 503.3.3)

Venting systems shall terminate not less than 3 feet above any forced air inlet located within 10 feet. This provision shall not apply to the combustion air intake of a direct vent appliance. (IFGC 503.6.7)

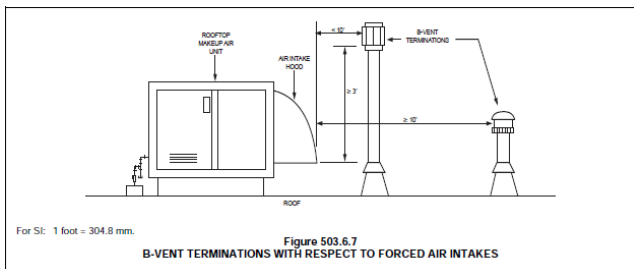


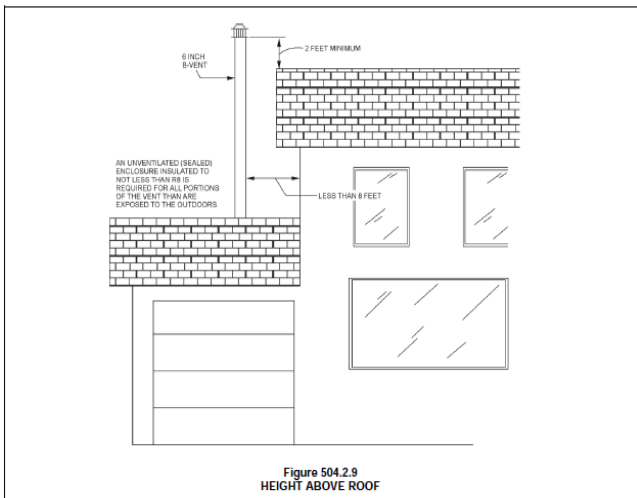
Figure 11: Vent Terminations

Gravity-type venting systems, other than a Type “BW” gas-venting system or a venting system which is an integral part of a listed appliance shall terminate not less than 5 feet above the highest vent collar which it serves. Type “BW” gas vents shall terminate at least 12 feet vertically above the bottom of the wall furnace. (IFGC 503.6.5)

Decorative shrouds shall not be installed at termination vents unless listed and labeled for use with that specific venting system and installed according to manufacturer’s installation instructions. (IFGC 503.5.4, 503.6.4.1)

Type “B” or “BW” gas vent shall terminate as follows:

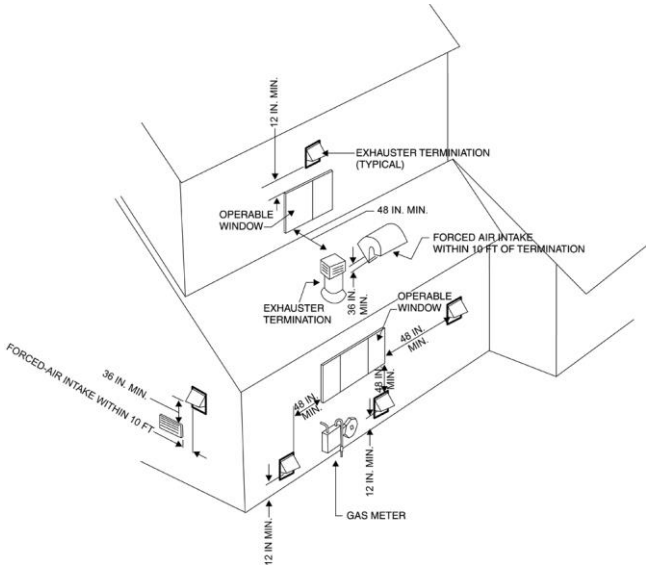
Gas vent caps having an internal diameter of 12 inches or less shall be permitted to be terminated in accordance with Table 10, provided they are located at least 8 feet from a vertical wall or similar obstruction. All other Type “B” gas vent shall terminate not less than 2 feet above the highest point where they pass through the roof and at least 2 feet higher than any portion of a building within 10 feet. (IFGC 503.6.4)



ROOF SLOPE	MINIMUM HEIGHT FROM ROOF TO BOTTOM OF CAP (feet)
Flat to 6/12	1.0
Over 6/12 to 7/12	1.25
Over 7/12 to 8/12	1.5
Over 8/12 to 9/12	2.0
Over 9/12 to 10/12	2.5
Over 10/12 to 11/12	3.25
Over 11/12 to 12/12	4.0
Over 12/12 to 14/12	5.0
Over 14/12 to 16/12	6.0
Over 16/12 to 18/12	7.0
Over 18/12 to 20/12	7.5
Over 20/12 to 21/12	8.0

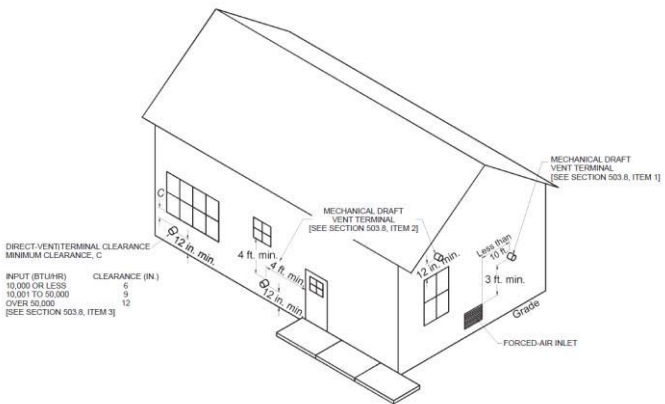
Table 10: Terminated Gas Vent Caps

9. **Mechanical Draft Termination:** Appliances shall not terminate less than 4 feet below or 4 feet horizontally, nor less than 1 foot above, any door, operable window or gravity air inlet into any building. The bottom of the vent shall be 12" above grade.



10. **Direct Vent Termination:** Vent terminations of direct vent appliances with input ratings less than 10,000 Btu/h shall terminate not less than 6 inches from any opening which products of combustion could enter the building. Appliances over 10,000 Btu/h but not exceeding 50,000 Btu/h shall terminate not less than 9 inches from any opening. Appliances with ratings over 50,000 Btu/h shall terminate not less than 12 inches from any opening into the building.





**NOTE:** Both vent and air intake shall be located at least 12 inches above grade.

11. **Masonry Chimneys:** Masonry chimneys shall be installed according to local building codes and lined with approved clay flue lining, or a listed chimney lining system that resists corrosion, erosion, softening or cracking from vent gases. (IFGC 503.5.3)

- (a) Category I appliances. The effective area of the chimney when connected to more than one draft hood equipped appliance shall be not less than the area of the largest vent or chimney connector plus 50 percent of the area of the additional vent or chimney connectors, nor greater than seven times the smallest draft-hood outlet area. (IFGC 503.5.5)
- (b) Automatically controlled gas appliances connected to a chimney which also serves equipment burning liquid fuel shall be equipped with an automatic pilot. A gas appliance vent connector and a chimney con-

nector from an appliance burning liquid fuel may be connected into the same chimney through separate openings, provided they are at different levels, or both may be connected through a single opening if joined by a suitable fitting located at the chimney. (IFGC 503.5.7.2)

- (c) The chimney passageway shall be examined to ascertain it is clear and free of obstructions and shall be properly cleaned if previously used for venting solid- or liquid-fuel-burning appliances.

When inspection reveals an existing chimney is not safe for the intended application, it shall be rebuilt to conform to chimney standards of the Building Code or replaced with an approved gas vent or factory-built chimney.

- 12. **Prohibited Installations:** Outside vents or chimneys should not be used except for large industrial installations.

Vent Tables 1 through 4 shall be used only for chimneys and vents not exposed to the outdoors below the roof line (IFGC 504.3.20)

A vent connector shall not be connected to a chimney serving a fireplace unless the fireplace opening is permanently sealed and the fireplace discontinued for use.

Gas appliances shall not be common vented with a chimney serving a separate appliance designed to burn solid fuel.

No portion of a venting system shall pass through any circulating air duct or furnace plenum.

13. Sizing Vents and Connectors Servicing only Draft-hood Equipped Appliances and Pre-vent Table Installations:

Vent systems shall be sized and constructed so as to develop a flow adequate to convey all combustion products to the outside atmosphere.

The area of the vent shall not be less than the area of the largest vent connector inlet.

Type B gas vent shall terminate at least 5ft above the tallest connected appliance draft hood or flue collar, Type B-W gas vent shall terminate at least 12feet above the bottom of wall furnace. (IFGC 503.6.5)

When sizing an individual gas vent for a single, draft hood-equipped appliance the area of the connector and the gas vent shall not be less than the appliance draft hood outlet, nor greater than seven times the draft hood outlet area.(IFGC 503.6.9.1)

Type B and L vent sized in accordance with IFGC 503.6.9.1 shall extend in a general vertical direction with offsets not exceeding 45 degrees, any offset greater than a 45 degree is considered horizontal.

The total horizontal distance of a vent plus the horizontal vent connector serving draft hood equipped appliances shall not be greater than 75 percent of the vertical height of the vent. (IFGC 503.6.9.2)

A connector shall be as short and straight as possible. The horizontal run of an uninsulated connector to a natural draft chimney shall be not more than 75 percent of the height of the vertical portion of the chimney above the connector, unless part of an engineered system.(IFGC 503.10.8)

The horizontal run of an insulated connector to a natural draft chimney shall be not more than 100 percent of the height of the vertical portion of the chimney above the connector, unless part of an engineered system.(IFGC 503.10.8)

Common connector/manifold. Where two or more appliances are vented through a common vent connector or vent manifold, the common vent connector or manifold shall be located at the highest level consistent with available head room and the required clearance to combustible material and shall be sized in accordance with vent tables (IFGC 503.10.3.4)

As an alternate manifold sizing method applicable only when two or more draft hood equipped appliances, the effective area of the common vent connector or vent manifold and all junction fittings shall not be less than the area of the larger vent connector plus 50% of the areas of all additional inlets nor greater than seven times the smaller draft-hood outlet area.

Where two or more connectors enter a common vent, chimney flue or single wall metal pipe, the smaller connector shall enter at the highest level consistent with available head room or clearance to combustible material. (IFGC 503.10.4)

Where two or more connectors enter a chimney or flue vent, the openings shall be at different levels, or the connectors shall be attached to the vertical portion of the chimney or vent at an angle of 45 degrees or less. (IFGC 503.10.4.1)

The following shows the size of vents and cross-sectional areas.

Vent Size Inches						
3	4	5	6	7	8	9
Nominal Area Square Inches						
7.06	12.56	19.63	28.27	38.48	50.27	63.62
50% Square Area Inches						
3.53	6.28	9.82	14.14	19.24	25.13	31.81

Table 11: Vent Sizes and Cross-sectional Areas

The cross-sectional area can be determined by using the following formula:

$$D^2 \times .7854 = \text{Nominal area square inches}$$

Example: A 6" vent has 28.27 nominal area square inches.

$$6" \times 6" \times .7854 = 28.27 \text{ sq. inches}$$

The common vent size can be determined by using the nominal area square inches formula and using the nominal area square inches of the largest vent connector inlet plus 50% of the nominal area square inches of all additional inlets provided all the appliances are draft hood equipped.

Another means of determining a common vent size can be achieved by using the square root method.

Example: A 4" and 5" vent connector:

$$5" \times 5" \times 1(100\%) = 25"$$

$$4" \times 4" \times .5(50\%) = 8"$$

$$25" + 8" = 33"$$

Common vent size required is 6"

$$6" \times 6" = 36" \text{ (square root of } 36" \text{ is } 6")$$

36" is greater than but not less than the 33" needed. If the square root works out to be a lesser number, use a larger number that will be just larger than the number needed.

#### 14. Category 1 Appliance Venting:

For proper vent and vent connector sizing of Category I fan assisted appliances refer to the vent tables and instructions provided by the manufacturer with each Category I appliance and IFGC Section 504.

Vent Tables do not apply to: wall furnaces, decorative gas appliance or Category II, II or IV gas appliances.

Vent Tables 1 through 4 shall be used only for chimneys and vents not exposed to the outdoors below the roof line (IFGC 504.3.20)

Type B vent or listed chimney lining system passing through an unused masonry shall not be considered to be exposed to the outdoors, where vents extend above the roof more than 5ft, the vent shall be enclosed with a chase and insulated to a value not less than R8. (IFGC 504.2.9)

FAN/NAT Max. The maximum Btu input rating of the appliance.

FAN/NAT Min. The minimum Btu input rating. (Derated input or Low fire rating) (IFGC 504.2.6)

NOTE: On appliances with multiple input ratings, the FAN Min determined from the tables shall be less than the lowest input rating. (IFGC 504.2.6)

### VENT OFFSETS AND DEDUCTIONS

Table 1 and 2 with zero Lateral lengths shall have no elbows.

Table 1 and 2 with lateral lengths include two 90 degree elbows.

Table 3 and 4 include two 90 degree elbows in the connector.

### VENT TABLE DEDUCTIONS ARE TAKEN OFF THE MAX.

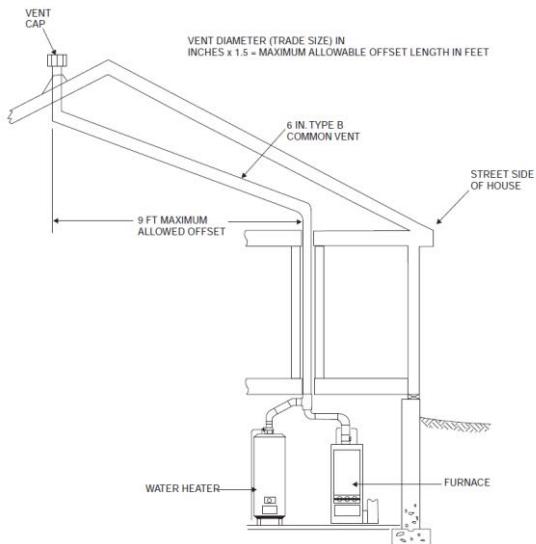
- 5% Reduction for each additional elbow up to 45 degrees.
- 10% Reduction for additional elbow greater than 45 degrees up to 90 degrees.
- 10% Reduction for manifold prior to common vent. (this reduction is for the elbow)
- 10% Reduction for connector length exceeding 1-1/2 times the diameter. (tables 3 and 4)
- 20% Reduction for corrugated chimney liner plus additional deductions for any bend or offset in liner. (Note: the 20% reduction for corrugated chimney liner system includes an allowance for one long radius 90-degree turn at the bottom of the liner)

- 20% Reduction for 90 degree offset in common vent, offset lateral cannot exceed 1-1/2 times the diameter of the vent. (Or 10% for two 45 degree elbows creating the offset.)

### VENT TABLE RULES

Common vent cannot exceed 7 times the flow area of the listed appliance categorized vent area, flue collar, or draft hood outlet. (IFGC 504.2.8)

Common vent offset shall not exceed 1-1/2 feet for each inch of common vent diameter, or the total horizontal length of multiple offsets shall not exceed 1-1/2 feet for each inch of common vent diameter. (IFGC 504.3.5)





Vent connector manifold length cannot exceed 1-1/2 feet for each inch of connector diameter (IFGC 504.3.4)

Where the vent size determined from the tables is smaller than the appliance draft hood outlet or flue collar, the smaller size shall be permitted to be used provided that all of the following requirements are met: (IFGC 504.2.2)

NOTE: Verify using installation instructions, minimum vent connector size requirements.

- (a) The total vent height is at least 10 feet.
- (b) Vents for appliance draft hood outlets or flue collars 12 inches in diameter or smaller are not reduced more than one table size.
- (c) Vents for appliance draft hood or flue collars larger than 12 inches in diameter are not reduced more than two table sizes.
- (d) The maximum capacity listed in the tables for a fan-assisted appliance is reduced by 10 percent.
- (e) The draft hood outlet is greater than 4 inches in diameter. Do not connect a 3-inch-diameter vent to a 4-inch-diameter draft hood outlet. This provision shall not apply to fan-assisted appliances.

NOTE: See appliance installation instructions for minimum vent connector size.

Vent connectors shall not be increased in size more than two sizes greater than the listed appliance categorized vent diameter, flue collar diameter or draft hood outlet diameter. (IFGC 504.2.11)

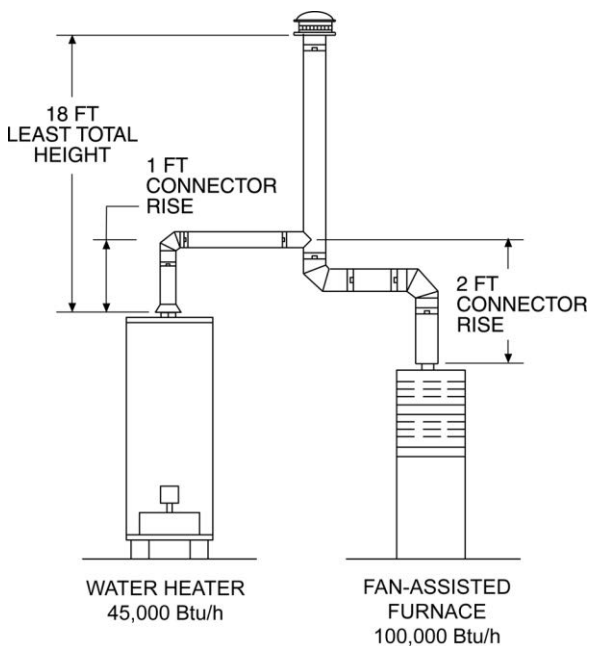
In a single run of vent or vent connector, different diameters and types of vent and connector components shall be permitted, provided that all sizes and types are permitted by the tables. (IFGC 504.2.12)

Where the vertical vent has a larger diameter than the vent connector, the vertical vent diameter shall be used to determine the minimum vent capacity and the connector diameter shall be used to determine the maximum vent capacity. (IFGC 504.2.8)

MEASUREMENT EXAMPLE:

(R) Connector rise measurement shall be measured from the draft hood outlet or flue collar to the centerline where the vent gas streams come together. (IFGC 504.3.11)

(H) Vent height measurement for multiple appliances located on one floor, the available total height shall be measured from the highest draft hood or flue collar up to the level of the outlet of the common vent. (IFGC 504.3.12)



## Category 1 Vent Tables

<b>TABLE 1</b>		<b>DOUBLE WALL COMMON VENT W/ DOUBLE WALL CONNECTOR, SINGLE APPLIANCE</b>														
Height H (Ft)	Lateral L (Ft)	3"			4"			5"			6"			7		
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max
6	0	0	78	46	0	152	86	0	251	141	0	375	205	0	524	285
	2	13	51	36	18	97	67	27	157	105	32	232	157	44	321	217
	4	21	49	34	30	94	64	39	153	103	50	227	153	66	316	211
	6	25	46	32	36	91	61	47	149	100	59	223	149	78	310	205
8	0	0	84	50	0	165	94	0	276	155	0	415	235	0	583	320
	2	12	57	40	16	109	75	25	178	120	28	263	180	42	365	247
	5	23	53	38	32	103	71	42	171	115	53	255	173	70	356	237
	8	28	49	35	39	98	66	51	164	109	64	247	165	84	347	227
10	0	0	88	53	0	175	100	0	295	166	0	447	255	0	631	345
	2	12	61	42	17	118	81	23	194	129	26	289	195	40	402	273
	5	23	57	40	32	113	77	41	187	124	52	280	188	68	392	263
	10	30	51	36	41	104	70	54	176	115	67	267	175	88	376	245
15	0	0	94	58	0	191	112	0	327	187	0	502	285	0	716	390
	2	11	69	48	15	136	93	20	226	150	22	339	225	38	475	316
	5	22	65	45	30	130	87	39	219	142	49	330	217	64	463	300
	10	29	59	41	40	121	82	51	206	135	64	315	208	84	445	288
15	35	53	37	48	112	76	61	195	128	76	301	198	98	429	275	
20	0	0	97	61	0	202	119	0	349	202	0	540	307	0	776	430
	2	10	75	51	14	149	100	18	250	166	20	377	249	33	531	346
	5	21	71	48	29	143	96	38	242	160	47	367	241	62	519	337
	10	28	64	44	38	133	89	50	229	150	62	351	228	81	499	321
	15	34	58	40	46	124	84	59	217	142	73	337	217	94	481	308
20	48	52	35	55	116	79	69	206	134	84	322	206	107	464	295	
30	0	0	100	64	0	213	128	0	374	220	0	587	336	0	853	475
	2	9	81	56	13	166	112	14	283	185	18	432	280	27	613	394
	5	21	77	54	28	160	108	36	275	176	45	421	273	58	600	385
	10	27	70	50	37	150	102	48	262	171	59	403	261	77	580	371
	15	33	64	NR	44	141	96	57	249	163	70	389	249	90	560	357
	20	56	58	NR	53	132	90	66	237	154	80	374	237	102	542	343
	30	NR	NR	NR	73	113	NR	88	214	NR	104	346	219	131	507	321

## Category 1 Vent Tables

TABLE 2		DOUBLE WALL COMMON VENT W/ SINGLE WALL CONNECTOR, SINGLE APPLIANCE																
Height H (Ft)		Lateral L (Ft)		3"			4"			5"			6"			7"		
				FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max
6	0	38	77	45	59	151	85	85	249	140	126	373	204	165	522	284		
	2	39	51	36	60	96	66	85	156	104	123	231	156	159	320	213		
	4	NR	NR	33	74	92	63	102	152	102	146	225	152	187	313	208		
	6	NR	NR	31	83	89	60	114	147	99	163	220	148	207	307	203		
8	0	37	83	50	58	164	93	83	273	154	123	412	234	161	580	319		
	2	39	56	39	59	108	75	83	176	119	121	261	179	155	363	246		
	5	NR	NR	37	77	102	69	107	168	114	151	252	171	193	352	235		
	8	NR	NR	33	90	95	64	122	161	107	175	243	163	223	342	225		
10	0	37	87	53	57	174	99	82	293	165	120	444	254	158	628	344		
	2	39	61	41	59	117	80	82	193	128	119	287	194	152	400	272		
	5	52	56	39	76	111	76	105	185	122	148	277	186	190	388	261		
	10	NR	NR	34	97	100	68	132	171	112	188	261	171	237	369	241		
15	0	36	93	57	56	190	111	80	325	186	116	499	283	153	713	388		
	2	38	69	47	57	136	93	80	225	149	115	337	224	148	473	314		
	5	51	63	44	75	128	86	102	216	140	144	326	217	182	459	298		
	10	NR	NR	39	95	116	79	128	201	131	182	308	203	228	438	284		
	15	NR	NR	NR	NR	NR	72	158	186	124	220	290	192	272	418	269		
20	0	35	96	60	54	200	118	78	346	201	114	537	306	149	772	428		
	2	37	74	50	56	148	99	78	248	165	113	375	248	144	528	344		
	5	50	68	47	73	140	94	100	239	158	141	363	239	178	514	334		
	10	NR	NR	41	93	129	86	125	223	146	177	344	224	222	491	316		
	15	NR	NR	NR	NR	NR	80	155	208	136	216	325	210	264	469	301		
	20	NR	NR	NR	NR	NR	NR	186	192	126	254	306	196	309	448	285		
30	0	34	99	63	53	211	127	76	372	219	110	584	334	144	849	472		
	2	37	80	56	55	164	111	76	281	183	109	429	279	139	610	392		
	5	49	74	52	72	157	106	98	271	173	136	417	271	171	595	382		
	10	NR	NR	NR	91	144	98	122	255	168	171	397	257	213	570	367		
	15	NR	NR	NR	115	131	NR	151	239	157	208	377	242	255	547	349		
	20	NR	NR	NR	NR	NR	NR	181	223	NR	246	357	228	298	524	333		
	30	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	389	477	305		

## Category 1 Vent Tables

<b>TABLE 3</b>		<b>DOUBLE WALL COMMON VENT W/ DOUBLE WALL CONNECTOR, TWO OR MORE APPLIANCES</b>														
Height H (Ft)	Rise R (Ft)	3"			4"			5"			6"			7"		
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max
6	1	22	37	26	35	66	46	46	106	72	58	164	104	77	225	142
	2	23	41	31	37	75	55	48	121	86	60	183	124	79	253	168
	3	24	44	35	38	81	62	49	132	96	62	199	139	82	275	189
8	1	22	40	27	35	72	48	49	114	76	64	176	109	84	243	148
	2	23	44	32	36	80	57	51	128	90	66	195	129	86	269	175
	3	24	47	36	37	87	64	53	139	101	67	210	145	88	290	198
10	1	22	43	28	34	78	50	49	123	78	65	189	113	89	257	154
	2	23	47	33	36	86	59	51	136	93	67	206	134	91	282	182
	3	24	50	37	37	92	67	52	146	104	69	220	150	94	303	205
15	1	21	50	30	33	89	53	47	142	83	64	220	120	88	298	163
	2	22	53	35	35	96	63	49	153	99	66	235	142	91	320	193
	3	24	55	40	36	102	71	51	163	111	68	248	160	93	339	218
20	1	21	54	31	33	99	56	46	157	87	62	246	125	86	334	171
	2	22	57	37	34	105	66	48	167	104	64	259	149	89	354	202
	3	23	60	42	35	110	74	50	176	116	66	271	168	91	371	228
30	1	20	62	33	31	113	59	45	181	93	60	288	134	83	391	182
	2	21	64	39	33	118	70	47	190	110	62	299	158	85	408	215
	3	22	66	44	34	123	79	48	198	124	64	309	178	88	423	242

### COMMON VENT TABLE ALL DOUBLE WALL VENTING

Vent Height H (ft)	4"			5"			6"			7"		
	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT
	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT
6	92	81	65	140	116	103	204	161	147	309	248	200
8	101	90	73	155	129	114	224	178	163	339	275	223
10	110	97	79	169	141	124	243	194	178	367	299	242
15	125	112	91	195	164	144	283	228	206	427	352	280
20	136	123	102	215	183	160	314	255	229	475	394	310
30	152	138	118	244	210	185	361	297	266	547	459	360

## Category 1 Vent Tables

<b>TABLE 4</b>		<b>DOUBLE WALL COMMON VENT W/ SINGLE WALL CONNECTOR, TWO OR MORE APPLIANCES</b>														
Height H (Ft)	Rise R (Ft)	3"			4"			5"			6"			7		
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max
6	1	NR	NR	26	NR	NR	46	NR	NR	71	NR	NR	102	207	223	140
	2	NR	NR	31	NR	NR	55	NR	NR	85	168	182	123	215	251	167
	3	NR	NR	34	NR	NR	62	121	131	95	175	198	138	222	273	188
8	1	NR	NR	27	NR	NR	48	NR	NR	75	NR	NR	106	226	240	145
	2	NR	NR	32	NR	NR	57	125	126	89	184	193	127	234	266	173
	3	NR	NR	35	NR	NR	64	130	138	100	191	208	144	241	287	197
10	1	NR	NR	28	NR	NR	50	119	121	77	182	186	110	240	253	105
	2	NR	NR	33	84	85	59	124	134	91	189	203	132	248	278	183
	3	NR	NR	36	89	91	67	129	144	102	197	217	148	257	299	203
15	1	NR	NR	29	79	87	52	116	138	81	177	214	116	238	291	158
	2	NR	NR	34	83	94	62	121	150	97	185	230	138	246	314	189
	3	NR	NR	39	87	100	70	127	160	109	193	243	157	255	333	215
20	1	49	56	30	78	97	54	115	152	84	175	238	120	233	325	165
	2	52	59	36	82	103	64	120	163	101	182	252	144	243	346	197
	3	55	62	40	87	107	72	125	172	113	190	264	164	252	363	223
30	1	47	60	31	77	110	57	112	175	89	169	278	129	226	380	175
	2	51	62	37	81	115	67	117	185	106	177	290	152	236	397	208
	3	54	64	42	85	119	76	122	193	120	185	300	172	244	412	235

### COMMON VENT TABLE ANY SINGLE WALL VENTING

Vent Height H (ft)	4"			5"			6"			7"		
	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT
	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT	+FAN	+NAT	+NAT
6	NR	78	64	NR	113	99	200	158	144	304	244	196
8	NR	87	71	NR	126	111	218	173	159	331	269	218
10	NR	94	76	163	137	120	237	189	174	357	292	236
15	121	108	88	189	159	140	275	221	200	416	343	274
20	131	118	98	208	177	156	305	247	223	463	383	302
30	145	132	113	236	202	180	350	286	257	533	446	349

## SECTION VII

### Procedures to be followed to Place an Appliance in Operation

1. Procedure: Under this heading appears the fundamental procedure to be followed in placing an appliance in operation and instructing the customer in its safe and satisfactory use. It is the responsibility of the installing agency to put into effect the procedures in the following paragraphs.
2. Burners to be adjusted: The purpose for burner input adjustment is to maintain a ratio of 1 part fuel to 10 parts air. Not adjusting the appliance for the elevation and local Btu value will cause over firing, combustion problems, and lost efficiency. Over firing may render an appliance unsafe and cause premature failure to the combustion chambers. The appliance adjustment is the responsibility of the installer and should be completed at the time of installation, following procedures outlined in the installation instructions.

Appliance control valve shall be checked for proper input pressure. Failure to check for proper appliance control valve pressure may over fire the burners and render the appliance unsafe. Most appliance manufacturers allow a plus or minus .3 inch water column adjustment. Consult installation instructions for proper control valve adjustment.

To convert from inches of water column to ounces of gas pressure, see **Table 12**.



**CONVERSION OF INCHES OF WATER COLUMN TO  
OUNCES OF GAS PRESSURE**

Inches of Water Column	Ounces of Gas Pressure
1.73	1
3.46	2
5.19	3
6.92	4
8.62	5
10.38	6
12.11	7
13.84	8
15.57	9
17.30	10
19.03	11
20.76	12
22.49	13
24.22	14
25.95	15
27.68	16
29.41	17
31.14	18
32.89	19
34.60	20

Table 12: Conversion of Water Column to Ounces of Gas Pressure

To convert from inches of water column to ounces per square inch – multiply by the factor 0.5780.

3. Appliance Rating: Appliance ratings are established by American Gas Association Testing Laboratories at sea level.

NOTE: For proper deration procedures, see appliance installation instructions.

Appliances may not require any deration, 2% per 1,000 or 4% per 1,000. The following is an example to derate an appliance 4% per 1,000.

$$\text{Formula: } \frac{\text{Elevation}}{1,000} \times .04 = \mathbf{X}$$

$$1.00 - \mathbf{X} = \text{deration factor (multiplier)}$$

Example: Salt Lake City ~ 4,350 ft. elevation

$$\frac{4,350}{1,000} \times .04 = .174$$

$$1.00 - .174 = .826 \text{ (round to nearest hundredth .83)}$$

.83 will be the deration factor (multiplier)

Proper deration of the appliance will be accomplished by the use of the following formula:

$$\frac{\text{appliance input} \times \text{deration factor (multiplier)}}{\text{Btu per cubic foot}}$$

Example: Salt Lake City ~ 100,000 Btu rated appliance

$$\frac{100,000 \times .83}{890} = 93.258 \text{ CFH}$$

See **Table 13** for deration factors, specific gravity and Btu/cubic ft., or if the Btu/cubic ft. is not listed contact Questar Gas.

## STANDARD DERATION FACTORS

Center	Deration Factor (Multiplier)		Elevation	Specific Gravity	BTU/Cubic FT.
	4%	2%			
<b>SALT LAKE</b>	.83	.91	4350	0.60	890
Alta	.66	.83	8600	0.60	755
Snowbird	.69	.84	7800	0.60	778
<b>HEBER</b>	.77	.89	5660	0.60	843
Coalville	.78	.89	5586	0.60	846
Deer Valley	.70	.85	7500	0.60	786
Francis	.74	.87	6560	0.60	815
Henefer	.79	.89	5355	0.60	851
Jeremy Ranch	.74	.87	6400	0.60	821
Kamas	.74	.87	6473	0.60	817
Midway	.78	.89	5550	0.60	847
Oakley	.74	.87	6475	0.60	818
Park City	.72	.86	7000	0.60	803
Pinebrook	.74	.87	6400	0.60	821
Summit Park	.72	.86	7000	0.60	803
Wanship	.76	.88	5900	0.60	837
Woodland	.76	.88	6000	0.60	833
<b>TOOELE</b>	.80	.90	4900	0.60	867
Grantsville	.82	.91	4400	0.60	883
<b>PRICE</b>	.77	.89	5680	0.62	896
Castledale	.78	.89	5660	0.56	800
Clear Creek	.74	.87	8743	0.56	773
East Carbon	.75	.87	6300	0.62	877
Ferron	.76	.88	5930	0.56	843
Helper	.76	.88	5900	0.62	891
Kenilworth	.74	.87	6604	0.62	865
<b>ROOSEVELT</b>	.79	.90	5150	0.62	913
Altamont	.75	.87	6375	0.62	873
Bonanza	.78	.89	5450	0.62	904
Duchesne	.78	.89	5518	0.62	904
Dutch John	.74	.87	6400	0.60	845
Vernal	.79	.89	5300	0.62	908
<b>MOAB</b>	.84	.92	4025	0.60	923
Monticello	.72	.86	7066	0.60	820

**Table 13: Standard Deration Factor**

## STANDARD DERATION FACTORS

Center	Deration Factor (Multiplier)		Elevation	Specific Gravity	BTU/Cubic FT.
	4%	2 %			
<b>PROVO</b>	.83	.91	4350	0.56	868
Birds Eye	.78	.89	5400	0.56	834
Cedar Fort	.79	.90	5125	0.56	851
Eagle Mountain	.80	.90	5000	0.60	887
Nephi	.80	.90	5100	0.56	842
Santaquinn	.80	.90	4900	0.56	843
Springville	.83	.91	4350	0.56	868
Woodland Hills	.77	.89	5650	0.56	828
<b>OGDEN</b>	.83	.91	4350	0.60	890
Morgan	.80	.90	5000	0.60	862
Ogden Valley	.80	.90	5000	0.60	862
<b>LAYTON</b>	.83	.91	4350	0.60	890
<b>BRIGHAM CITY</b>	.83	.92	4220	0.60	890
Mantua	.79	.90	5175	0.60	856
Tremonton	.83	.91	4325	0.60	890
<b>LOGAN</b>	.82	.91	4500	0.60	880
<b>FILLMORE</b>	.80	.90	5100	0.60	885
Beaver	.76	.88	5900	0.60	862
Delta	.81	.91	4650	0.60	900
Holden	.78	.90	5150	0.60	883
Kanosh	.79	.90	5200	0.60	882
Leamington	.81	.91	4700	0.60	898
Lynndyl	.81	.90	4800	0.60	895
Meadow	.81	.90	4800	0.60	895
Milford	.80	.90	4950	0.60	889
Minersville	.79	.89	5300	0.60	879
Oak City	.80	.90	5105	0.60	885
Scipio	.79	.89	5300	0.60	879
<b>RICHFIELD</b>	.79	.89	5290	0.56	838
Aurora	.80	.90	5150	0.56	841
Axtell	.80	.90	5150	0.56	841
Centerfield	.80	.90	5100	0.56	842
Central Anna- bella	.79	.90	5340	0.56	836
Chester	.78	.89	5510	0.56	832

TABLE 13 (continued)

## STANDARD DERATION FACTORS

Center	Deration Factor (Multiplier)		Elevation	Specific Gravity	BTU/Cubic FT.
	4%	2 %			
Richfield (cont.)					
Circleville	.76	.88	6060	0.56	815
Elsinore	.79	.89	5330	0.56	836
Ephraim	.78	.89	5515	0.56	831
Fairview	.76	.88	5960	0.56	819
Fayette	.80	.90	5060	0.56	844
Fountain Green	.77	.89	5750	0.56	825
Glenwood	.79	.89	5300	0.56	838
Gunnison	.80	.90	5100	0.56	842
Indianola	.76	.88	6000	0.56	818
Joseph	.78	.89	5435	0.56	834
Junction	.76	.88	6020	0.56	817
Manti	.78	.89	5560	0.56	830
Marysvale	.76	.88	5920	0.56	820
Mayfield	.78	.89	5540	0.56	831
Monroe	.79	.89	5375	0.56	835
Moroni	.78	.89	5520	0.56	831
Mount Pleasant	.77	.88	5840	0.56	822
Panguich	.74	.87	6624	0.56	797
Redmond	.80	.90	5100	0.56	842
Salina	.79	.90	5140	0.56	841
Sevier	.78	.89	5542	0.56	830
Sigurd	.79	.89	5260	0.56	838
Spring City	.77	.88	5800	0.56	823
Sterling	.78	.89	5560	0.56	830
Venice	.79	.89	5260	0.56	838
Wales	.78	.89	5500	0.56	832
<b>CEDAR CITY</b>	.77	.89	5720	0.56	825
Brian Head	.61	.80	9800	0.56	708
Enoch	.77	.89	5720	0.56	825
Enterprise	.79	.89	5300	0.60	879
Hamilton Fort	.77	.89	5647	0.56	828
Kanarraville	.78	.89	5480	0.56	832
New Castle	.79	.90	5200	0.60	882
Paragonah	.77	.88	5860	0.56	822
Parowan	.76	.88	6060	0.56	815
Summit	.76	.88	5950	0.56	817

TABLE 13 (continued)

## STANDARD DERATION FACTORS

Center	Deration Factor (Multiplier)		Elevation	Specific Gravity	BTU/Cubic FT.
	4%	2 %			
<b>ST. GEORGE</b>	.89	.94	2760	0.56	919
Central	.79	.90	5200	0.60	882
Dameron Valley	.82	.91	4606	0.56	859
Diamond Valley	.81	.91	4660	0.56	855
Hurricane	.87	.94	3250	0.56	903
Ivins	.88	.94	2960	0.56	912
LaVerkin	.87	.94	3200	0.56	906
Leads	.86	.93	3460	0.56	896
Santa Clara	.89	.94	2760	0.56	919
Springdale	.84	.92	3913	0.56	883
Toquerville	.85	.92	3760	0.56	886
Veyo	.82	.91	4500	0.60	905
Washington	.89	.94	2760	0.56	919
Winchester Hills	.84	.92	3900	0.56	883
<b>ROCK SPRINGS</b>					
	.75	.87	6300	0.62	877
Baggs	.75	.87	6250	0.62	878
Granger	.75	.87	6260	0.62	878
Green River	.75	.87	6300	0.62	877
Wamsutter	.75	.87	6740	0.62	862
<b>EVANSTON</b>					
	.73	.86	6800	0.60	809
Big Piney	.73	.86	6820	0.62	860
Kemmerer	.72	.86	6958	0.60	800
LaBarge	.74	.87	6600	0.62	867
Lyman	.73	.87	6700	0.62	863
Randolph	.75	.87	6280	0.60	825
Woodruff	.75	.87	6340	0.60	823

TABLE 13 (continued)

4. Clocking Burner Input: To check the appliance input, the test hand on the meter shall be timed for at least one revolution and the input determined by using this time. For smaller test dials (1/4 and 1/2) allow at least two revolutions on larger input appliances. Test dials are generally marked 1/2, 1, 2, or 5 cubic feet per revolution, depending upon the size of the meter.

$$\frac{60 \times 60 \times \text{dial size}}{\text{Number of seconds for one revolution}}$$

EXAMPLE: 1/2 foot test hand takes 11 seconds for one revolution

$$60 \times 60 \times 1/2 = 1800 \qquad \frac{1800}{11} = 164 \text{ CFH}$$

(For elevated pressure, use above formula and multiply CFH by pressure factor from service regulator badge. For elevated pressure sets use Table 14.)



**PRESSURE FACTOR MULTIPLIER**

MULTIPLIER TO OBTAIN FOUR OUNCES FLOW RATE					
NOTE: ROUND TO THE CLOSEST ELEVATION					
Elevation Feet	Atmospheric Pressure, psi	Meter Pressure, psig			
		1	2	5	10
2,000	13.70	1.0540	1.1259	1.3417	1.7021
3,000	13.52	1.0547	1.1275	1.3462	1.7112
4,000	12.70	1.0581	1.1356	1.3681	1.7561
4,350	12.60	1.0586	1.1366	1.3709	1.7620
5,000	12.20	1.0604	1.1410	1.3828	1.7864
6,000	11.80	1.0624	1.1457	1.3955	1.8125
7,000	11.30	1.0651	1.1519	1.4126	1.8476
8,000	10.90	1.0675	1.1574	1.4273	1.8799
9,000	10.50	1.0700	1.1632	1.4432	1.9105

**Table 14: Pressure Factor Multiplier**

Multipliers for reducing gas volumes to a pressure base of four ounces above an average atmospheric pressure of each elevation.

5. Adjusting Burner Input: The input rate shall be adjusted to the required rate by changing a fixed orifice size, changing the adjustment of an adjustable orifice or by readjusting the gas pressure regulator outlet pressure as per manufacturer’s instructions, normally plus or minus .3" water column. For convenience in determining the proper orifice size for standard deration, consult **Table 15**, starting on Page 130, use the table corresponding with the specific gravity of the gas in your location. After adjusting input, install a Green sticker on the front of the appliance, visible to the customer, listing company

name and date. (Stickers available through Questar Gas Ask-a-Tech, 1-800-695-7375.)

EXAMPLE: 93 cf/h is required for an appliance with four burners. Specific gravity of the gas is .60 and manifold pressure is 3.5 inches water column.

$93 \div 4 = 23.25$  cf/h per burner, a number 44 orifice will be required.

## ORIFICE CAPACITIES

specific gravity = 0.56

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 1/2" WC CFH	3" WC CFH
1	233.01	215.73	196.93	176.14	164.76	152.54
2	218.92	202.68	185.02	165.48	154.80	143.31
3	203.34	188.25	171.85	153.71	143.78	133.11
4	195.80	181.28	165.48	148.01	138.45	128.18
5	189.30	175.26	159.99	143.10	133.85	123.92
6	186.56	172.72	157.67	141.02	131.92	122.13
7	181.08	167.65	153.04	136.88	128.04	118.54
8	177.48	164.32	150.00	134.17	125.50	116.19
9	172.18	159.40	145.52	130.15	121.75	112.72
10	167.78	155.34	141.80	126.83	118.64	109.84
11	163.50	151.37	138.18	123.60	115.61	107.04
12	160.14	148.26	135.34	121.05	113.23	104.83
13	153.40	142.02	129.65	115.96	108.47	100.42
14	148.49	137.48	125.50	112.25	105.00	97.21
15	145.24	134.47	122.75	109.79	102.70	95.08
16	140.45	130.03	118.70	106.17	99.31	91.94
17	134.17	124.22	113.39	101.42	94.87	87.83
18	128.75	119.20	108.81	97.32	91.04	84.28
19	123.50	114.34	104.37	93.35	87.33	80.85
20	116.19	107.57	98.20	87.83	82.16	76.07
21	113.34	104.92	95.79	85.68	80.14	74.20
22	110.49	102.29	93.38	83.52	78.12	72.33
23	106.32	98.43	89.86	80.37	75.18	69.60
24	103.58	95.90	87.54	78.30	73.24	67.81
25	100.16	92.73	84.65	75.71	70.82	65.57
26	95.82	88.71	80.98	72.43	67.75	62.73
27	92.97	86.07	78.57	70.28	65.74	60.86

Table 15: Orifice Capacities

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

ORIFICE CAPACITIES

specific gravity = 0.56

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 1/2" WC CFH	3" WC CFH
28	88.40	81.84	74.71	66.82	62.51	57.87
29	82.92	76.77	70.08	62.68	58.63	54.28
30	73.96	68.47	62.51	55.91	52.30	48.42
31	64.54	59.76	54.55	48.79	45.64	42.25
32	60.32	55.85	50.98	45.60	42.65	39.49
33	57.24	52.99	48.38	43.27	40.47	37.47
34	55.24	51.14	46.69	41.76	39.06	36.16
35	54.22	50.19	45.82	40.98	38.34	35.49
36	50.85	47.08	42.97	38.44	35.96	33.29
37	48.45	44.86	40.95	36.63	34.26	31.72
38	46.17	42.74	39.02	34.90	32.65	30.22
39	44.40	41.11	37.52	33.56	31.40	29.07
40	43.03	39.84	36.37	32.53	30.43	28.17
41	41.32	38.25	34.92	31.23	29.22	27.05
42	39.21	36.30	33.14	29.64	27.72	25.67
43	35.50	32.86	30.00	26.83	25.10	23.24
44	33.16	30.70	28.02	25.06	23.45	21.71
45	30.13	27.90	25.47	22.78	21.31	19.73
46	29.39	27.21	24.84	22.22	20.78	19.24
47	27.62	25.57	23.34	20.88	19.53	18.08
48	25.91	23.99	21.90	19.59	18.32	16.96
49	23.91	22.14	20.21	18.08	16.91	15.65
50	21.97	20.34	18.57	16.61	15.54	14.38
51	20.15	18.65	17.03	15.23	14.24	13.19
52	18.09	16.75	15.29	13.68	12.79	11.84
53	15.87	14.69	13.41	11.99	11.22	10.39
54	13.58	12.57	11.48	10.27	9.60	8.89

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

TABLE 15 (continued)

**ORIFICE CAPACITIES**

specific gravity = 0.56

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 ½" WC CFH	3" WC CFH
55	12.10	11.20	10.23	9.15	8.55	7.92
56	9.69	8.97	8.19	7.33	6.85	6.34
57	8.29	7.67	7.00	6.26	5.86	5.42
58	7.90	7.32	6.68	5.97	5.59	5.17
59	7.53	6.97	6.37	5.69	5.33	4.93
60	7.17	6.64	6.06	5.42	5.07	4.70
61	6.82	6.31	5.76	5.16	4.82	4.46
62	6.47	5.99	5.47	4.89	4.58	4.24
63	6.13	5.68	5.18	4.64	4.34	4.02
64	5.81	5.38	4.91	4.39	4.11	3.80
65	5.49	5.08	4.64	4.15	3.88	3.59
66	4.88	4.52	4.12	3.69	3.45	3.19
67	4.59	4.25	3.88	3.47	3.24	3.00
68	4.31	3.99	3.64	3.26	3.05	2.82
69	3.82	3.54	3.23	2.89	2.70	2.50
70	3.52	3.25	2.97	2.66	2.49	2.30
71	3.03	2.81	2.56	2.29	2.14	1.98
72	2.80	2.59	2.37	2.12	1.98	1.83
73	2.58	2.39	2.18	1.95	1.82	1.69
74	2.27	2.10	1.92	1.72	1.61	1.49
75	1.97	1.83	1.67	1.49	1.40	1.29
76	1.79	1.66	1.51	1.35	1.27	1.17
77	1.45	1.34	1.23	1.10	1.02	0.95
78	1.15	1.06	0.97	0.87	0.81	0.75
79	0.94	0.87	0.80	0.71	0.67	0.62
80	0.82	0.76	0.69	0.62	0.58	0.53

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

TABLE 15 (continued)

**ORIFICE CAPACITIES**

specific gravity = 0.60

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 1/2" WC CFH	3" WC CFH
1	225.11	208.41	190.25	170.17	159.18	147.37
2	211.49	195.80	178.74	159.87	149.55	138.45
3	196.44	181.87	166.02	148.50	138.91	128.60
4	189.16	175.13	159.87	142.99	133.76	123.84
5	182.88	169.31	154.56	138.24	129.31	119.72
6	180.23	166.86	152.32	136.24	127.44	117.99
7	174.94	161.96	147.85	132.24	123.70	114.52
8	171.47	158.75	144.92	129.62	121.24	112.25
9	166.34	154.00	140.58	125.74	117.62	108.89
10	162.09	150.07	136.99	122.53	114.62	106.11
11	157.96	146.24	133.50	119.41	111.69	103.41
12	154.71	143.23	130.75	116.95	109.39	101.28
13	148.20	137.21	125.25	112.03	104.79	97.02
14	143.46	132.82	121.24	108.44	101.44	93.92
15	140.32	129.91	118.59	106.07	99.22	91.86
16	135.68	125.62	114.67	102.57	95.94	88.83
17	129.62	120.00	109.55	97.98	91.65	84.86
18	124.38	115.16	105.12	94.02	87.95	81.43
19	119.31	110.46	100.83	90.19	84.36	78.11
20	112.35	103.93	94.87	84.85	79.37	73.49
21	109.50	101.37	92.54	82.77	77.43	71.68
22	106.74	98.82	90.21	80.69	75.48	69.88
23	102.71	95.09	86.81	77.64	72.63	67.24
24	100.07	92.64	84.57	75.64	70.76	65.51
25	96.76	89.58	81.78	73.14	68.42	63.34
26	92.57	85.70	78.24	69.98	65.46	60.60
27	89.81	83.15	75.91	67.89	63.51	58.80

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

TABLE 15 (continued)

## ORIFICE CAPACITIES

specific gravity = 0.60

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 1/2" WC CFH	3" WC CFH
28	85.40	79.07	72.18	64.56	60.39	55.91
29	80.11	74.17	67.70	60.56	56.65	52.44
30	71.45	66.15	60.39	54.01	50.53	46.78
31	62.36	57.73	52.70	47.14	44.09	40.82
32	58.28	53.95	49.25	44.05	41.21	38.15
33	55.30	51.20	46.74	41.80	39.10	36.20
34	53.37	49.41	45.11	40.34	37.74	34.94
35	52.38	48.49	44.27	39.59	37.04	34.29
36	49.12	45.48	41.52	37.13	34.74	32.16
37	46.81	43.34	39.56	35.38	33.10	30.64
38	44.60	41.29	37.70	33.72	31.54	29.20
39	42.89	39.71	36.25	32.42	30.33	28.08
40	41.57	38.49	35.13	31.42	29.40	27.21
41	39.92	36.96	33.74	30.17	28.23	26.13
42	37.88	35.07	32.01	28.63	26.78	24.80
43	34.29	31.75	28.98	25.92	24.25	22.45
44	32.03	29.66	27.07	24.21	22.65	20.97
45	29.11	26.95	24.60	22.01	20.58	19.06
46	28.39	26.29	24.00	21.46	20.08	18.59
47	26.68	24.71	22.55	20.17	18.87	17.47
48	25.03	23.17	21.15	18.92	17.70	16.39
49	23.10	21.39	19.52	17.46	16.33	15.12
50	21.23	19.65	17.94	16.05	15.01	13.90
51	19.46	18.02	16.45	14.71	13.76	12.74
52	17.48	16.18	14.77	13.21	12.36	11.44
53	15.33	14.19	12.95	11.59	10.84	10.03
54	13.12	12.15	11.09	9.92	9.28	8.59

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use  
pressure of 7 inches water column.

TABLE 15 (continued)

## ORIFICE CAPACITIES

specific gravity = 0.60

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 ½" WC CFH	3" WC CFH
55	11.69	10.82	9.88	8.84	8.26	7.65
56	9.36	8.67	7.91	7.08	6.62	6.13
57	8.01	7.41	6.77	6.05	5.66	5.24
58	7.64	7.07	6.45	5.77	5.40	5.00
59	7.28	6.74	6.15	5.50	5.15	4.76
60	6.93	6.42	5.86	5.24	4.90	4.54
61	6.59	6.10	5.57	4.98	4.66	4.31
62	6.25	5.79	5.28	4.73	4.42	4.09
63	5.93	5.49	5.01	4.48	4.19	3.88
64	5.61	5.20	4.74	4.24	3.97	3.67
65	5.30	4.91	4.48	4.01	3.75	3.47
66	4.71	4.36	3.98	3.56	3.33	3.09
67	4.43	4.10	3.75	3.35	3.13	2.90
68	4.16	3.85	3.52	3.15	2.94	2.73
69	3.69	3.42	3.12	2.79	2.61	2.42
70	3.40	3.14	2.87	2.57	2.40	2.22
71	2.93	2.71	2.47	2.21	2.07	1.92
72	2.71	2.51	2.29	2.05	1.91	1.77
73	2.49	2.31	2.11	1.88	1.76	1.63
74	2.19	2.03	1.85	1.66	1.55	1.44
75	1.91	1.77	1.61	1.44	1.35	1.25
76	1.73	1.60	1.46	1.31	1.22	1.13
77	1.40	1.30	1.18	1.06	0.99	0.92
78	1.11	1.03	0.94	0.84	0.78	0.73
79	0.91	0.84	0.77	0.69	0.64	0.60
80	0.79	0.73	0.67	0.60	0.56	0.52

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

TABLE 15 (continued)



**ORIFICE CAPACITIES**

specific gravity = 0.62

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 ½" WC CFH	3" WC CFH
1	221.45	205.02	187.16	167.40	156.59	144.97
2	208.05	192.62	175.84	157.27	147.12	136.20
3	193.25	178.91	163.32	146.08	136.65	126.51
4	186.09	172.28	157.27	140.67	131.58	121.82
5	179.90	166.56	152.05	136.00	127.21	117.78
6	177.30	164.15	149.85	134.03	125.37	116.07
7	172.09	159.33	145.45	130.09	121.69	112.66
8	168.68	156.17	142.56	127.51	119.27	110.43
9	163.63	151.50	138.30	123.70	115.71	107.12
10	159.46	147.63	134.77	120.54	112.75	104.39
11	155.39	143.86	131.33	117.46	109.88	101.73
12	152.19	140.90	128.62	115.04	107.61	99.63
13	145.79	134.97	123.21	110.21	103.09	95.44
14	141.13	130.66	119.27	106.68	99.79	92.39
15	138.03	127.79	116.66	104.34	97.60	90.36
16	133.48	123.58	112.81	100.90	94.38	87.38
17	127.51	118.05	107.77	96.39	90.16	83.48
18	122.36	113.28	103.41	92.49	86.52	80.10
19	117.37	108.66	99.20	88.72	82.99	76.84
20	110.43	102.24	93.33	83.47	78.08	72.29
21	107.72	99.72	31.04	81.42	76.17	70.52
22	105.00	97.21	88.74	79.37	74.25	68.74
23	101.04	93.55	85.40	76.38	71.45	66.15
24	98.44	91.14	83.20	74.41	69.61	64.44
25	95.19	88.13	80.45	71.95	67.31	62.31
26	91.06	84.31	76.96	68.84	64.39	59.62
27	88.35	81.80	74.67	66.79	62.47	57.84

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

TABLE 15 (continued)

## ORIFICE CAPACITIES

specific gravity = 0.62

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 1/2" WC CFH	3" WC CFH
28	84.01	77.78	71.00	63.51	59.41	55.00
29	78.81	72.96	66.60	59.57	55.72	51.59
30	70.29	65.08	59.41	53.14	49.70	46.02
31	61.34	56.79	51.84	46.37	43.38	40.16
32	57.33	53.08	48.45	43.34	40.54	37.53
33	54.40	50.66	45.98	41.12	38.47	35.61
34	52.50	48.61	44.37	39.69	37.12	34.37
35	51.53	47.70	43.55	38.95	36.43	33.73
36	48.33	44.74	40.84	36.53	34.17	31.64
37	46.05	42.63	38.92	34.81	32.56	30.15
38	43.88	40.62	37.08	33.17	31.03	28.72
39	42.20	39.07	35.66	31.90	29.84	27.62
40	40.89	37.86	34.56	30.91	28.92	26.77
41	39.27	36.35	33.19	29.68	27.77	25.71
42	37.26	34.50	31.49	28.17	26.35	24.39
43	33.74	31.23	28.51	25.50	23.85	22.09
44	31.51	29.17	26.63	23.82	22.28	20.63
45	28.64	26.51	24.20	21.65	20.25	18.75
46	27.93	25.86	23.61	21.11	19.75	18.29
47	26.25	24.30	22.19	19.84	18.56	17.19
48	24.62	22.80	20.81	18.61	17.41	16.012
49	22.73	21.04	19.21	17.18	16.07	14.88
50	20.88	19.33	17.65	15.78	14.77	13.67
51	19.15	17.73	16.18	14.47	13.54	12.53
52	17.19	15.92	14.53	13.00	12.16	11.26
53	15.08	13.96	12.74	11.40	10.66	9.87
54	12.91	11.95	10.91	9.76	9.13	8.45

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

TABLE 15 (continued)

**ORIFICE CAPACITIES**

specific gravity = 0.62

ORIFICE DRILL SIZE	7" WC CFH	6" WC CFH	5" WC CFH	4" WC CFH	3 ½" WC CFH	3" WC CFH
55	11.50	10.65	9.72	8.69	8.13	7.53
56	9.21	8.53	7.78	6.96	6.51	6.03
57	7.88	7.29	6.66	5.95	5.57	5.16
58	7.51	6.95	6.35	5.68	5.31	4.92
59	7.16	6.63	6.05	5.41	5.06	4.69
60	6.82	6.31	5.76	5.15	4.82	4.46
61	6.48	6.00	5.48	4.90	4.58	4.24
62	6.15	5.69	5.20	4.65	4.35	4.03
63	5.83	5.40	4.93	4.41	4.12	3.82
64	5.52	5.11	4.67	4.17	3.90	3.61
65	5.22	4.83	4.41	3.94	3.69	3.42
66	4.64	4.29	3.92	3.51	3.28	3.04
67	4.36	4.04	3.69	3.30	3.08	2.85
68	4.09	3.79	3.46	3.10	2.90	2.68
69	3.63	3.36	3.07	2.75	2.57	2.38
70	3.34	3.09	2.82	2.53	2.36	2.19
71	2.88	2.67	2.43	2.18	2.04	1.89
72	2.66	2.47	2.25	2.01	1.88	1.74
73	2.45	2.27	2.07	1.85	1.73	1.60
74	2.16	2.00	1.82	1.63	1.53	1.41
75	1.88	1.74	1.59	1.42	1.33	1.23
76	1.70	1.58	1.44	1.29	1.20	1.11
77	1.38	1.28	1.16	1.04	0.97	0.90
78	1.09	1.01	0.92	0.82	0.77	0.71
79	0.89	0.83	0.76	0.68	0.63	0.59
80	0.78	0.72	0.66	0.59	0.55	0.51

NOTES: Discharge coefficient of orifice is 0.90

For appliances not equipped with an appliance regulator, use pressure of 7 inches water column.

TABLE 15 (continued)

6. Primary Air Adjustment: The primary air for injection (Bunsen) type burner shall be adjusted for proper flame characteristics in accordance with the manufacturer's instructions. Normally, the primary air adjustment shall first be set to give a soft blue flame having luminous tips and then increased to a point where the yellow tips just disappear. After setting the primary air, the adjustment means shall be secured in position. (QGCPP 03-00-02)

NOTE: After all adjustments are made, a CO test should be performed.

7. Automatic Pilots: When an automatic pilot is provided it shall be checked for proper operation and adjustment in accordance with the manufacturer's instructions. If the pilot safety does not function properly, it shall be replaced. (QGCPP 03-00-02)
8. Protective Devices: All protective devices furnished with the appliances such as a limit control, fan control, low water cut-off device, manual operating features, etc., shall be operational. (QGCPP 03-00-02)
9. Checking the Draft: On vent connected appliances, the appliance shall be operated for a few minutes and the installation checked to see that the products of combustion are going up the vent properly by passing a lighted match or taper around the edge of the relief opening. If drawing properly, the match flame will be drawn into the draft hood. If not, the products of combustion will tend to extinguish this flame. If the products of combustion are escaping from the relief opening of the draft hood, the appliance shall not be left in operation unless and until

proper adjustments or repairs are made to ensure adequate draft through the vent. (QGCPP 03-00-02)

10. Instructions to the Customer: The customer shall be thoroughly instructed on the operation of the appliance.
11. Operations / Installation Instructions:  
**MANUFACTURER'S OPERATING AND  
INSTALLATION INSTRUCTIONS SHALL BE  
LEFT WITH THE CUSTOMER**

## SECTION VIII – Manufactured Home (Mobile Home), Modular Home and Park Trailer

1. Manufactured Home (Mobile Home): A structure, transportable in one or more sections, which in the traveling mode, is 8 body feet or more in width and 40 body feet or more in length or when erected on site is 320 or more square feet and is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning and electrical systems contained therein. If above specifications are not met, consult manufacturer's tag on home or contact Manufactured Housing Division of the State for approval to convert to natural gas. Mobile homes are built under the Federal Standard (Part CFR 3280) in accordance with HUD's Construction and Maintenance standards. Manufactured homes may be connected to the natural gas system if tagged for combination use. See **Figure 12** and Figure 13, Pages 142 and 143. (HUD CFR 3280.2)
2. Identification of Gas Supply Connection: Each manufactured home shall have a tag of 3 inches by 1 3/4 inches minimum size permanently attached to the exterior skin at or near each gas supply connection or the end of the pipe, which reads (combination LP-gas and natural gas system) depending upon the fuel used. See **Figure 12**, Page 142 or Figure 13, Page 143. (HUD CFR 3280.705 (k) )

3. **Modular Homes:** Modular homes designed only for erection or installation on a site-built permanent foundation. The structure is not designed to be moved once erected or installed on a site-built permanent foundation. Modular and site-built homes are constructed to the same building code required by the state. Building additions to modular and mobile homes are governed by local building codes.

**COMBINATION LP-GAS AND  
NATURAL GAS SYSTEM**

This gas piping system is designed for use of either liquefied petroleum gas or natural gas.

NOTICE: BEFORE TURNING ON GAS, BE CERTAIN APPLIANCES ARE DESIGNED FOR THE GAS CONNECTED AND ARE EQUIPPED WITH CORRECT ORIFICES. SECURELY CAP THIS INLET WHEN NOT CONNECTED FOR USE.

When connecting to site outlet, use a listed gas supply connector rated at

- 100,000 BTUH or more
- 250,000 BTUH

Before turning on gas, make certain all gas connections have been made tight, all appliance valves are turned off, and any unconnected outlets are capped.

After turning on gas, test gas piping and connections to appliances for leakage with soapy water or bubble solution and light all pilots.

Figure 12: Combination LP Gas and Natural Gas System

## **LP-GAS SYSTEM**

This gas piping system is designed for use of liquefied petroleum gas only.

**DO NOT CONNECT NATURAL GAS TO THIS SYSTEM.**

**CONTAINER SHUT-OFF VALVES SHALL BE CLOSED DURING TRANSIT.**

When connecting to site outlet, use a listed gas supply connector rated at

- 100,000 BTUH or more
- 250,000 BTUH

Before turning on gas, make certain all gas connections have been made tight, all appliance valves are turned off, and any unconnected outlets are capped.

After turning on gas, test gas piping and connections to appliances for leakage with soapy water or bubble solution and light all pilots.

**Figure 13: LP Gas System**



4. Recreation Vehicle: A vehicular type unit primarily designed for recreational camping, travel or seasonal use which has its own mode of power or is mounted on or towed by another vehicle. The basic entities are: travel trailer, folding camping trailer, park trailer, truck camper, motor home and multi-use vehicles. Recreation vehicles cannot be connected to the natural gas system.
  
5. Gas Piping: The mobile home must be supported in a manner which will permit safe installation of a house piping connection. Follow installation instructions and standards for manufactured housing and the model being installed. When installation instructions are not available follow Appendix E of 2012 IRC. (HUD 3280.705)

Refer to gas piping section of this Good Practice Book for proper sizing, installation and piping material.

The minimum size of piping outlet at the gas supply or meter connection, for a mobile home shall be three-quarters (3/4) inch.

The gas piping supply system shall not exceed 14 inches water column (1/2 psi) and not less than 7 inches water column.

All materials used for gas piping shall be new and free from defects.

The gas piping outlet from the meter shall be installed in a proper and secure manner.

A gas piping lateral terminating in a mobile home lot where the riser is surrounded by a concrete slab, shall not be required to be installed in a conduit, provided the con-

crete slab is entirely outside the wall line of the mobile home, is not continuous with any other concrete slab and is used for stabilizing other utility connections.

The mobile home fuel line piping shall extend outside the mobile home skirting, the connection shall not be located beneath an exit door and shall be connected to the meter set outlet using an approved coated outdoor flex connector listed for use on a mobile home conforming to AGA3-87 & TSC-9 standard or ANSI Z21.75. The flexible connector must not exceed 6 feet in length and be sized to adequately supply the total demand of the connected mobile home.

Where a mobile home is located in a mobile home park and served by a master meter, a shut-off valve of the locking type shall be installed upstream of the flexible connector on the gas riser to the mobile home, kept locked off at all times and the open end of the connector plugged or capped when gas is not being supplied to the mobile home. The customer shall supply the locks.

Where fuel gas piping is to be installed in both portions of an expandable or multiple unit mobile home, all points of crossover shall be readily accessible from the exterior of the home. The design and construction of the crossover may be solid pipe, solid pipe with a shut-off valve and a ground joint union, a shut-off valve and an approved outdoor coated flex connector conforming to TSC-9 standard, or ANSI Z21.75 or a quick disconnect device. The shut-off valve or quick disconnect device fitting shall be installed on the **SUPPLY** side of the gas system ahead of the point of crossover. (See **Figure 14**)

**CROSSOVER for a MANUFACTURED HOME**  
*EXAMPLES*

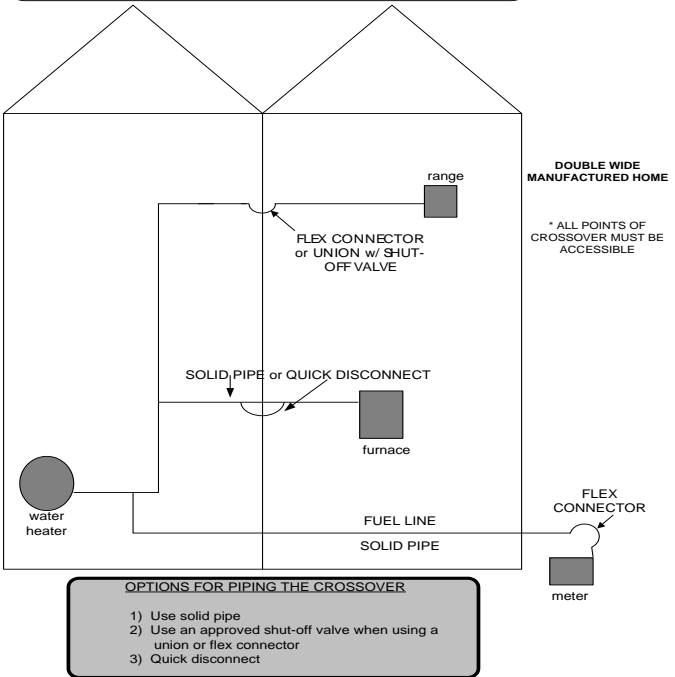


Figure 14: Crossover for a Manufactured Home

**Valves** - A shut-off valve shall be installed in the fuel piping at each appliance inside the mobile home structure, upstream of the union or connector in addition to any valve on the appliance and so arranged to be accessible to permit servicing of the appliance and removal of its components. The shut-off valve shall be located within 6 feet of a cooking appliance and within 3 feet of any other appliance. (HUD 3280.706)

Listed appliance connectors when used shall not run through walls, floors, ceilings or partitions, except for cabinetry and shall be 3 feet or less in length or 6 feet or less for cooking appliances. (HUD 3280.705(2))

Gas Piping System Openings - all openings in the gas piping system shall be closed gas tight with threaded pipe plugs or pipe caps when not in use.

Gas piping shall not be used for an electrical ground, bonding is acceptable. The fuel line shall be considered properly bonded when the fuel line is connected to the terminal on the chassis by clamps, solder-less connectors or suitable grounding type straps. (HUD 3280.705(5))

Hangers and Supports - All gas piping shall be adequately supported by galvanized or equivalently protected metal straps or hangers at intervals of not more than 4 feet, except where adequate support and protection is provided by structural members. Solid iron pipe gas supply connection(s) shall be rigidly anchored to a structural member within 6 inches of the supply connection(s). (HUD 3280.705)

6. Venting: The venting as required by HUD 3280 shall be accomplished by one of the following methods. (HUD 3280.710)
  - (a) An integral vent system listed as part of the appliance.
  - (b) A venting system consisting entirely of listed components, including roof jack installed in accordance with the terms of the appliance listing and appliance manufacture instructions.

No exhaust or venting shall terminate underneath a manufactured home.

Venting system terminations shall not be less than three feet from any motor-driven air intake discharging into habitable areas.

7. Appliance Installation: Heat-producing appliances and vents, roof jacks and chimneys necessary for their installation in manufactured mobile home shall be listed or certified for use in manufactured homes. (HUD 3280.707)

The installation of each appliance shall conform to the terms of its listing and the manufacturer's instructions. Every appliance shall be secured in place to avoid displacement. For the purpose of servicing and replacement, each appliance shall be both accessible and removable. (HUD 3280.709)

All fuel burning appliances except ranges, ovens and clothes dryers shall be installed to provide for the complete separation of the combustion system from the interior atmosphere of the mobile home. Combustion air inlets and flue gas outlets shall be listed or certified as components of the appliance. The required separation may be obtained by: (HUD 3280.709 d)

- (a) The installation of direct vent system (sealed combustion system) appliances.
- (b) The installation of appliances within enclosures so which separate the appliance combustion system from the interior atmosphere of the manufactured

home. There shall not be any door, removable access panel or other opening into the enclosure from the inside of the mobile home. Any opening for ducts, piping, wiring, etc. shall be sealed.

A corrosion resistant water drip collection and drain pan must be installed under each water heater and drain to the exterior of the manufactured home, or to a drain. (HUD 3280.709 h.)

8. Conversion of Appliances Located in Mobile Homes: Fuel-burning appliances shall not be converted from one fuel to another fuel unless converted in accordance with the terms of their listings and the appliance manufacture manufacturer's instructions. (HUD 3280.707)

Each fuel-burning appliance shall bear permanent marking designating the type(s) of fuel for which it is listed. (HUD 3280.712)

When changing from LP gas to natural gas the LP tank must be disconnected and plugged before natural gas will be turned into the mobile home gas lines.

All gas appliances shall conform to the minimum standards and recommendations as contained in this booklet, all applicable local laws or ordinances and with the most recent standards and the Manufactured Home Construction & Safety Standards 3280 CFR.

## FORMULAS AND NUMBERS

### **DERATION:**

Derated CFH = BTUs X deration factor divided by heat content.

Example:  $120,000 \times .83$  divided by  $890 = 111.9$  cfh

Derated BTU = BTUs X deration factor.

Example:  $120,000 \times .83 = 99,600$  Btu's

Deration factor formula- Elevation divided by 1000 X .04

Example:  $5,625$  ft. divided by  $1000 = 5.625 \times .04 = .225$

Subtract  $.225$  from  $1 = .77$  (deration factor)

### **COMBUSTION AIR GRILL SIZING:**

To determine grille size needed

1. Determine rule to be used and divide total Btu's by that rule = free area required.
2. Free area required multiplied by  $.75$ (metal) or  $.25$ (wood) = area of grill needed.

To determine free area of existing grille

1. Measure square inches of louvered area.
2. Multiply square inches by  $.75$ (metal)  $.25$ (wood) = free area of the grille

Example:

Metal grille-  $12'' \times 11'' = 132 \times .75 = 99$  sq'' of free area.

Wood grille-  $32'' \times 28'' = 896 \times .25 = 224$  sq'' of free area

## **REQUIRED VOLUME:**

To determine if inside air can be considered (1/50 rule)

Total BTUs divided by 1000 X 50 = cubic ft. of air required.

Example:

$(150,000/1,000) \times 50 = 7500$  of cubic feet needed

Area size example = 12'W X 15'L X 8'H = 1440 cubic feet

## **CFH FOR PIPE SIZING:**

CFH for pipe sizing = BTUs divided by heat content of gas

Example: 125,000Btu's divided by 890 = 140.4 cfh

## **CLOCKING METERS:**

60 X 60 X dial size divided by number of seconds = CFH

60 X 60 X dial size divided by CFH = number of seconds

## **CLOCKING PRESSURE SETS**

60 X 60 X dial size X multiplier, divided by # of seconds = CFH

60 X 60 X dial size X multiplier, divided by CFH = # of seconds

## **SQUARE INCHES IN A ROUND DUCT:**

Formula =  $(D^2) \times .7854$

Example: 8" round duct

$8 \times 8 \times .7854 = 50.27$  square inches of area in duct.



Round Duct Size Inches

3	4	5	6	7	8	9	10	11	12
---	---	---	---	---	---	---	----	----	----

Nominal Area Square Inches

7.06	12.56	19.63	28.27	38.48	50.27	63.62	78.54	95.03	113.10
------	-------	-------	-------	-------	-------	-------	-------	-------	--------

**CO Air Free Formula:**

$$\frac{20.9}{(20.9 - O_2)} \times CO = CO \text{ Air Free}$$

**Example:**

$$(20.9 - 11.5 \text{ oxygen reading}) = 9.4$$

$$20.9 \text{ divided by } 9.4 = 2.22$$

$$(140 \text{ ppm CO reading}) \times 2.22 = 310.8 \text{ ppm air free CO read}$$

$$\frac{20.9}{(20.9 - 11.5)} \times 140 = 310.8 \text{ AF CO}$$

**Table 20: ANSI STANDARDS  
For AIR FREE CO READS**

<b>CODE</b>	<b>APPLIANCE</b>	<b>PPM</b>
<b>Z21.1</b>	<b>Household cooking appliance</b>	<b>800</b>
<b>Z21.5.1</b>	<b>Gas clothes dryer</b>	<b>400</b>
<b>Z21.5.2</b>	<b>Gas clothes dryer (commercial)</b>	<b>400</b>
<b>Z21.10.1</b>	<b>Gas fire water heaters</b>	<b>200</b>
<b>Z21.10.3</b>	<b>Water heater with input over 75,000 circulating and instantane- ous water heaters</b>	
	<b>- natural draft</b>	<b>200</b>
	<b>- induced draft</b>	<b>400</b>
	<b>- direct vent</b>	<b>400</b>
	<b>- power burner</b>	<b>400</b>
<b>Z21.11.1</b>	<b>Vented room heater</b>	<b>200</b>
<b>Z21.11.2</b>	<b>Unvented room heaters</b>	<b>200</b>
<b>Z21.13</b>	<b>Low PSI steam and hot water boilers</b>	<b>400</b>
<b>Z21.17</b>	<b>Domestic conversion burner</b>	<b>400</b>
<b>Z21.19</b>	<b>Gas fired refrigerator</b>	<b>300</b>
<b>Z21.40.1</b>	<b>Air conditioner</b>	<b>400</b>
<b>Z21.42</b>	<b>Illuminating appliances</b>	<b>500</b>
<b>Z21.44</b>	<b>Direct vent wall furnace</b>	<b>400</b>
<b>Z21.47</b>	<b>Central furnaces</b>	<b>400</b>
<b>Z21.48</b>	<b>Floor furnaces</b>	<b>400</b>
<b>Z21.49</b>	<b>Vented wall furnace</b>	<b>200</b>
<b>Z21.50</b>	<b>Decorative appliance</b>	<b>400</b>
<b>Z21.55</b>	<b>Gas fired sauna heater</b>	<b>200</b>
<b>Z21.56</b>	<b>Gas fired pool heater</b>	<b>200</b>
<b>Z21.57</b>	<b>Recreational cooking appliance</b>	<b>800</b>
<b>Z21.58</b>	<b>Outdoor cooking appliance</b>	<b>800</b>

<b>Z21.60</b>	<b>Decorative appliance for installation in vented fireplace</b>	<b>400</b>
<b>Z21.61</b>	<b>Gas fired toilet</b>	<b>400</b>
<b>Z21.64</b>	<b>Direct vent furnace</b>	<b>400</b>
<b>Z21.88</b>	<b>Vented gas fire place heater</b>	
	<b>- gravity vent</b>	<b>200</b>
	<b>- direct vent</b>	<b>400</b>
	<b>- induced draft</b>	<b>400</b>
<b>Z83.4</b>	<b>Make-up air heaters</b>	<b>*</b>
<b>Z83.6</b>	<b>Infrared heaters</b>	<b>400</b>
<b>Z83.7</b>	<b>Construction heaters</b>	<b>50 *</b>
<b>Z83.9</b>	<b>Duct furnaces</b>	<b>400</b>
<b>Z83.11</b>	<b>Range and unit broiler</b>	<b>800</b>
<b>Z83.12</b>	<b>Baking / roasting ovens</b>	<b>800</b>
<b>Z83.13</b>	<b>Deep fat fryers</b>	<b>800</b>
<b>Z83.14</b>	<b>Counter appliances</b>	<b>800</b>
<b>Z83.15</b>	<b>Kettles / steam / stern cookers</b>	<b>800</b>
<b>Z83.16</b>	<b>Commercial / industrial heaters</b>	<b>*</b>

\*Special Conditions Apply

## FURNACE SAFETY CHECKS

- Proper installation/application
- Proper combustion air, grilles, ducts
- Proper vent size, type, secure, clearance, listed cap
- Limits and safeties wired in
- Inspect combustion chambers for cracks, holes, soot
- Burners and pilot clean and in position
- Fire door in position

### **Light Furnace/Turn Thermostat Up**

- Verify pilot/burner safety function properly
- Verify fan door switch wired and working
- Verify filter clean and positioned correctly
- Verify safety sticker posted on fan door and filter access
- Verify that no cold air return openings in furnace room  
*\*exceptions do exist*
- Verify no flame disturbance ( **before and after fan starts**)
- Verify draft, match test diverter (**before and after fan starts**)
- CGD/soap controls while in operation
- Verify thermostat operates burners, turn thermostat down
- Verify burner and indoor blower fan shut off

### **Misc**

- Outside air is required when infiltration air is inadequate
- Shut off valve within 6ft or 3ft in mobile home
- Flex connector length 6ft max/3ft in mobile home
- Flex connector should not pass through or be in furnace cabinet unless permitted by connector manufacture and is protected against damage.

### **Air Free CO limits**

400ppm

## **WATER HEATER SAFETY CHECKS**

- Proper installation/application
- Proper combustion air, grilles and ducts
- Proper vent size, secure, clearance, listed cap
- Proper T&P for tank rating, relief opening not reduced.
- Proper drain tube, ASME A112.4.1 or approved material.
- Controls knobs, dials, and buttons intact and working
- Burner and pilot clean and positioned correctly
- Earthquake strap installed at top 1/3 and bottom 1/3 of tank

### **Light Water Heater And Turn Burner On**

- Verify pilot/burner safety function properly
- Verify **ECO** and/or limits are wired in
- Verify Inner fire door
- CGD/soap controls with burner on and door in place
- Match test diverter with burner on and door in place
- Match test with common vented appliances operating
- Set thermostat to safe setting (**LOW**, 125°)
- Verify and/or post safety stickers.

### **Misc**

- Shut off valve within 6ft of appliance
- Flexible connector length 6ft max/3ft mobile home
- Install water heater in a drip pan in mobile homes and locations where water leakage will cause damage, must drain outside or to a floor drain
- Temperature actuated mixing valve required when used as combination potable water heating and space heating

### **Air Free CO limits**

- 200ppm Natural draft.
- 400ppm Induced draft, Direct vent, Power burner.

## **RANGE SAFETY CHECKS**

- Listed for Installation (commercial or Residential)
- Controls and knobs are present and operational
- Anti-tip bracket installed where required by Mfg.

### **Burner Inspection And Operation**

- Verify pilots and burners clean and in position
- Verify operation of surface, broiler and oven burners
- Inspect burners for proper ignition and uniformity
- CGD/soap all controls valves and tubing with burners on  
(DO NOT remove or pull on sealed top surface of range)

### **Misc.**

- Avoid sliding range and damaging flooring
- CGD/soap flex connect and shut off valve when possible
- Shut off valve installed within 6ft
- Flex connector 6ft max length/6ft in mobile home
- Flex connector cannot be concealed in wall or cabinet construction

### **Air Free CO limits**

800ppm @ oven vent

## **DRYER SAFETY CHECKS**

- Minimum 100sq” make up air when installed in closet
- 8ft max approved flexible exhaust connector
- Flexible exhaust connector cannot be concealed in wall
- Exhaust duct must be semi ridged
- Do not use screws to secure exhaust duct or connector
- Exhaust duct must terminate **outside only**
- Exhaust duct must terminate with approved back draft damper
- Verify filter is clean, louvers on back of dryer are un-obstructed for proper air flow

### **Select Heat Setting And Start Dryer**

- CGD controls or around seams on dryer cabinet when controls are not accessible
- Verify door safety switch (open door) drum and burner should stop

### **Misc.**

- Shut off valve within 6ft or 3ft in mobile home
- Flexible gas connector 6ft max/ 3ft in mobile home
- Dryer secured to floor when installed in mobile home with Mfg. approved kit

### **Air Free CO limits**

- 400ppm at dryer vent termination

## VENTED FIREPLACE/GAS LOG SAFETY CHECKS

- Proper installation/application.
- Proper combustion air or direct vent
- Proper venting /flue is clear, proper termination.
- Proper vent termination location (window/door proximity etc.)
- Damper secured open enough to exhaust properly. (match test)
- Pilot and burner clean and positioned.
- Must have direct ignition and flame safeguard with the exception of Z21.84 listing for manually lighted appliance.
- Burner must be secured when flex connector is tied to burner
- Logs clean and positioned correctly (see log map if sooted)
- Limits wired in when applicable
- Glass and seal in place and secured when applicable

### **Light Fireplace and Turn Burner On**

- Verify pilot/burner safety function properly
- Verify draft, match test draft hood/damper when applicable
- CGD/soap controls with burner in operation
- Verify that switch, thermostat, operator valve control burner

### **Misc.**

- Shut off valve within 6ft of appliance
- Remote shut off valve ok on **listed decorative** appliance when provided with ready access, permanently identified and serve no other appliance.
- Flex connector must not be installed in heat zone



- Log lighter not for use as gas log.
- Thermostat **not** approved for decorative appliance  
Z21.50

### **Air Free CO limits**

- Natural draft 200ppm, Direct vent or Induced draft 400ppm.
- Sample CO read 12" above flame or take ambient read around glass when vent termination is not accessible. If air free read is not obtained air free formula must be used.

## **UNVENTED ROOM HEATER SAFETY CHECKS**

- Proper installation /application (see installation instructions)
- Proper volume of air required for input
- Pilot and burner clean and positioned (DO NOT ADJUST)
- Must be equipped with oxygen-depletion safety shut off (ODS)
- Logs or ceramics are clean and in position

### **Light Heater And Turn Main Burner On**

- Verify pilot/burner safety function properly
- Verify oxygen-depletion safety shut off (ODS)
- CGD/soap controls with burners in operation
- Verify controls, thermostat operate burner

### **Room Limitations And Requirements**

- Cannot be used as the sole source of heat
- Cannot have input rating greater than 40,000 btu/h
- A single wall mounted unvented heater in a bedroom cannot exceed 10,000 btu/h
- A single wall mounted unvented heater in a bathroom cannot exceed 6,000 btu/h

### **Misc.**

- Flex connector 6ft max
- Shut off valve within 6ft
- Free standing units must be secured to floor or per Mfg.

### **Air Free CO limits**

- 200ppm  
Sample CO 12" above burner, if air free read is not obtained air free formula must be used.

## **BOILER SAFETY CHECKS**

- Proper installation/application
- Proper safeties and limits and controls wired in
- Pilot and burners clean and in position
- Proper vent size, type, secure, clearance, listed cap
- Proper combustion air, grilles and ducts
- *State Boiler requirements for combustion air on boilers 400,000 btu/h and above:*  
 $(\text{BTU}/10,000) \times 2.5 = \text{CFM}$   
 $\text{CFM}/300 = \text{sq ft. minimum net louvered area required}$

## **Required Boiler Safeties And Controls**

<u>Low pressure <i>Steam</i> boiler</u>	<u>Low pressure <i>Hot Water</i> boiler</u>
-pressure relief	-pressure relief
-proof of flame	-proof of flame
-pressure-trol	-aquastat
-low water cut off	-altitude gauge
	-low water cut off when required

## **Light Boiler And Turn Thermostat Up**

- Verify pilot/burner safety function properly
- Verify draft, match test diverter with burners on
- CGD/soap controls with burners on
- Verify thermostat or aquastat operates the burner

## **Misc**

- Shut off valve within 6ft
- Flex connector 6ft max
- Low pressure steam boiler *15psi or less*
- Low pressure hot water boiler *160psi* and less than *250 °F*

## **Air free CO limits**

400ppm Low pressure steam and hot water boilers

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