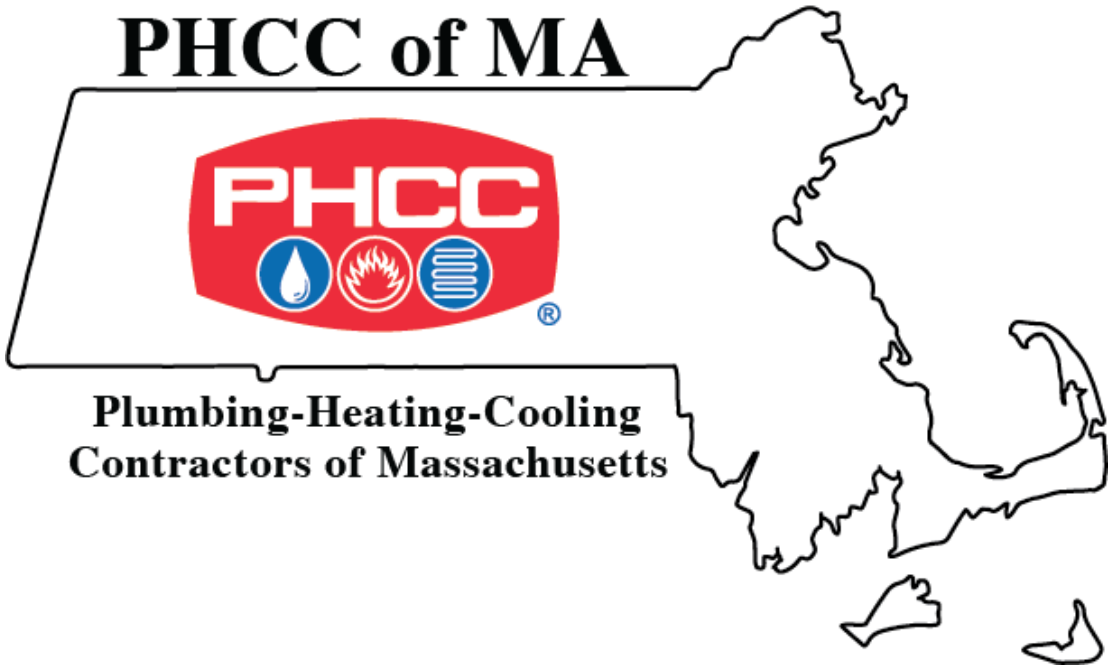
Welcome


PHCC of MA
PHCC
Plumbing-Heating-Cooling
Contractors of Massachusetts

Introduction
PSI Exams

JOURNEYMAN PLUMBER (PART 1 - WRITTEN)		
# of Questions	**% Required to Pass**	**Time Allowed**
80	**70%**	**160 minutes**

Content Outline

Subject Area	# of Questions
General regulations, Inspections, Permits MGL 142 Administrative (248 CMR Sections 3 – 11) Safety & Excavation	**9**
Gas Piping, Equipment & Appliances Design, Material & Components Inspection Testing & Purging Underground Installation CSST Gas Piping Regulators Combustion Air Specific Equipment Equipment Testing Modifications (Sections 4.00-5.00)	**21**
Venting Positive & Non-Positive Natural Draft Chimneys Sizing Proper Materials	**12**
Traps and Cleanouts	**2**
Fixtures, Equipment & Clearances	**2**

Subject Area	# of Questions
Water Heaters MGL 142 Hot water Tanks & Heaters	**3**
Piping, Valves and Controls	**3**
Water Supply Materials Backflow Prevention Water Temperature	**6**
Hangers and Supports	**2**
Drain, Waste and Vent Materials Storm Drain Sanitary Indirect Waste Special Waste Venting	**13**
Separators Interceptors & Grease Traps Grease Interceptors Holding Tanks Gas, Oil Separators	**5**
Total Questions	**80**

JOURNEYMAN PLUMBER (PART 1 - PRACTICAL)		
# of Questions	% Required to Pass	Time Allowed
40	70%	160 minutes

Subject Area	# of Questions
Isometric Analysis	20
General Trade Calculations	5
Gas Piping	7
Gas Venting	8
Total Questions	40

EXAM INFORMATION

All questions are multiple choice with 4 answers to choose from. Both written and practical

2017 revisions are not included in the current exam

If you pass one section and fail the other, you have one year to retest

This test is conducted at the following test centers:

City/State	Address	Driving Directions
Auburn, Massachusetts	48 Sword Street, Unit 204	Going South on Southbridge ST/MA-12, turn right on Sword St.
Charlestown, Massachusetts	56 Roland St, Suite 305	From the North: Take I-93 South. Exit 28 -Boston/Sullivan Sq./Charlestown. Merge into Mystic Ave. Take I-93S Ramp to Boston/Sullivan Sq./Charlestown (take ramp do not get on highway). Make slight left turn onto Maffa Way. Make slight right turn onto Cambridge Street. At first light, make left on to Carter Street. Turn right onto Roland Street. End at 56 Roland. Enter through North lobby. From the South: Take I-93 North. Exit 28 - Rt 99/Sullivan Sq./Somerville. Make left onto Cambridge St. At first light, make left onto Carter Street. Turn right onto Roland Street. End at 56 Roland Street (Building on left, Parking lot on right). Enter through North lobby. ***NO PARKING IN BUILDING LOT*** Vehicles will be towed at owner's expense. Street or nearby garages are the best options for parking.
FALL RIVER, Massachusetts	218 SOUTH MAIN ST, SUITE 105	From North: Take Rte 24S to Rte 195W. Take Plymouth Ave Exit,bearing right and turn Left at bottom of Off Ramp, then stay to right. Turn Right at second Traffic Light at Walgreens, then proceed to third set of Traffic Lights, then turn Rightonto S. Main Street. 218 S. Main Street is on right approx 3 blocks from light. From South or East: Take Rte 195W. Take Plymouth Ave Exit, bearing right, and turn Left at bottom of Off Ramp, then stay to right. Turn Right at second Traffic Light at Walgreens, then proceed to third set of Traffic Lights, then turn Right onto S. Main Street. 218 S. Main Street is on right approx 3 blocks from light. From West: Take Rte 195E. Take Plymouth Ave Exit bearing left, and turn right at end of Off Ramp, then bear right. Turn Right at next Traffic Light at Walgreens, then proceed to third set of Traffic Lights, then turn Right onto S. Main Street. 218 S. Main Street is on right approx 3 blocks from light.
Lawrence, Massachusetts	1 Ballard Way, Suite 104	From the North: Take Rte. I-93 S to Exit 45, River Rd./S. Lawrence. Take the ramp toward River Rd/S Lawrence. Take a slight right onto River Rd. River Road becomes Andover St. Turn right onto Ballard Rd. Turn left onto Ballard Way. There is a sign for N-Tek, Inc. on the right. Turn left into the parking lot marked Still Water Place, Ballard Way. PSI is located on the left side of the building, and suite 104 is on the first floor on the right. From the South: Take I-93 N to Exit 45, River Rd./ S. Lawrence. Take the River Rd. ramp toward River Rd/ S. Lawrence. Turn left on River Rd. River Rd. becomes Andover St. Turn right onto Ballard Rd. Turn left onto Ballard Way. There is a sign for N-Tek, Inc. on the right. Turn left into the parking lot marked Stillwater Place, Ballard Way. PSI is located on the the left side of the building, and suite 104 is on the first floor on the right.
WEST SPRINGFIELD, Massachusetts	1111 ELM STREET, SUITE 32A	TAKE MASS PIKE (RT. 90). EXIT 4-WEST SPRINGFIELD/HOLYOKE. TURN RIGHT ON WEST SPRINGFIELD/RT. 5 SOUTH. CONTINUE ON RT. 5 APPROXIMATELY TWO MILES. TURN RIGHT ON ELM ST.- IMMEDIATELY AFTER SHOWCASE CINEMAS. OFFICE IS APPROXIMATELY 1/4 MILE ON THE RIGHT.

Security to the Examination Area:

Calculator - only non-programmable, non-printing, silent, battery-operated, non-alphabet keys.

During the examination – only writing on the scrap paper that is provided by PSI will be allowed during the exam.

- Candidates may take only approved items into the exam room.
- All personal belongings of candidates, with the exception of close-fitting jackets or sweatshirts, should be placed in the secure storage provided at each site prior to entering the examination room.

Items not allowed in the Examination Area:

Electronic devices of any type, including cellular / mobile phones, recording devices, electronic watches, cameras, pagers, laptop computers, tablet computers (e.g., iPads), music players (e.g., iPods), smart watches, radios, or electronic games.

- **Bulky or loose clothing or coats** that could be used to conceal recording devices or notes, including coats, shawls, hooded clothing, heavy jackets, or overcoats.
- **Hats or headgear not worn for religious reasons** or as religious apparel, including hats, baseball caps, or visors.

- **Other personal items**, including purses, notebooks, reference or reading material, briefcases, backpacks, wallets, pens, pencils, other writing devices, food, drinks, and good luck items.

SCORES

Your scores will be based on the number of questions you answered correctly. A passing score is a MINIMUM of 70% on each part See Examinations.

- At the end of the examination all candidates will receive a printed Score Report.

- Veterans as defined in clause forty-three of section seven of chapter four shall be granted a credit of five percent to each part of the examination. DD214 must be submitted with application.

SCORE REPORT

If you did not pass the examination, a Score Report will indicate your overall score and the number of questions answered correctly on each major section of the examination. This information may help you prepare for reexamination.

This detail is not shown on your Score Report if you received a passing score.

SCORE REPORT

An Examination Score report shall be given to candidates, on site, for no additional charge after completing their respective examination or part thereof.

Your Examination Score report will state whether you have passed or failed and explain what part(s) of your examination you failed, showing your strengths and weaknesses in content areas.

It will also inform you of your right to review the questions that you answered incorrectly on your examination.

A request to review examination questions shall be made to PSI **within 30-days from the date of examination**.

REVIEWING A FAILED EXAM

Failing candidates will review their examination in a secure environment and may challenge any questions or answers that they feel should be eliminated, changed, or given credit.

A Request for a Review of Questions shall be made to PSI within 30-days from your examination date

The fee for this service is the same as the cost of reexamination.

During the review you will be presented with the questions you answered incorrectly and the correct answer to those questions.

Math

While ordering plumbing materials, the bill was $4,860.00. You also received discounts of 20%, 10% and 2% from the $4,860.00 amount. How much was the final bill.

A. $3,367.77
B. $3,429.21
C. $3,449.41
D. $3,559.18

While ordering plumbing materials, the bill was $4,860.00. You also received discounts of 20%, 10% and 2% from the $4,860.00 amount. How much was the final bill.

Multiply $4,860 x .80 to get the first discount

4,860 x .80 = 3,888

Multiply $3,888 x .90 to get the second discount

3,888 x .90 = 3,499.20

Multiply $3,499.20 x .98 to get the final discount

3,499.20 x .98 = $3,429.21

Correct Answer

A. $3,367.77

B. $3,429.21

C. $3,449.41

D. $3,559.18

While ordering plumbing materials, the bill was $6,229.00. You also received discounts of 25%, 5% and 2% from the $6,229.00 amount. How much was the final bill.

A. $4,449.41
B. $4,349.40
C. $4,595.18
D. $4,387.21

While ordering plumbing materials, the bill was $6,229.00. You also received discounts of 25%, 5% and 2% from the $6,229.00 amount. How much was the final bill.

Multiply $6,229 x .75 to get the first discount

6,229 x .75 = 4,671.75

Multiply $4,671.75 x .95 to get the second discount

4,671.75 x .95 = 4,438.16

Multiply $4,438.16 x .98 to get the final discount

4,438.16 x .98 = $4,349.40

Correct answer

A. $4,449.41

B. $4,349.40

C. $4,595.18

D. $4,387.21

If 3 inches of rain was trapped on a 62’ long x 40’ wide roof, how many gallons would that equal?

First you need to find the total cubic feet of the water on the roof

Length x width x depth

62 x 40 x .25 = 620

Now multiply that by 7.5

620 x 7.5 = 4,650 gallons

If 3 inches of rain was trapped on a 62’ long x 40’ wide roof, how many gallons would that equal?

Correct answer

A. 4,600 gallons

B. 4,650 gallons

C. 4,700 gallons

D. 4,750 gallons

If your material cost before discount was $976.00 and you received a 37-1/2 percent discount, how much would the final cost be?

A. $600

B. $610

C. $620

D. $630

Multiply $976 x .625 to get the discount

976 x .625 = 610

An Apprentice Plumber is paid $565 a weeks work for 48 weeks over the year. He is taxed at a rate of 31%. What is his net pay for the year?

Multiply 565 per week x 48 weeks to get his gross pay

565 x 48 = 27,120

Multiply 27,120 x .69 to get his net pay

27,120 x .69 = 18,712.80

His net pay for the year is $18,712.80

The labor cost for a plumbing job is $800 and the material cost is $1,100. What would be the profit percentage if the total bill was $2,800?

Add the labor and material cost

800 + 1,100 = 1,900

Subtract 1,900 from the 2,800 total bill

2,800 – 1,900 = 900

Divide 900 by 2,800 to get the net profit

900 divide by 2,800 = 32.25% profit

What is the capacity in gallons of a 3” pipe which is 27” long?

Capacity = diameter in inches squared x length x .0034

Diameter in inches squared: 3 x 3 = 9

Diameter squared x length: 9 x 27 = 243

243 x .0034 = .8262 or .83 gallons capacity

A water storage tank contains 6,500 gallons of water.
The tank is 1/3 full and supplied water at a rate of 75gpm
The tank empties at a rate of 32 gpm
How long will it take to fill the tank?

Note:

1/3 full = 2/3 empty which is where you get .66

75gpm – 32gpm = 43gpm

Multiply 6,500 x .66 = 4,290

Divide 4,290 by 43 = 99.7 minutes

How many square feet of insulation is required to wrap the outside of a storage tank which is 18” in diameter and 5’ long?

Insulation = circumference x length of the circle

Length of the circle = pi x the diameter (pi = 3.14)

To find the length of the circle multiply 3.14 (pi) x 1.5 (18)

3.14 x 1.5 = 4.71

Now multiply 4.71 x 5’ (length of the tank)

4.71 x 5 = 23.55 square feet

23.55 square feet of insulation needed to cover the main body of the tank

Now let's figure out how to cover the two ends of the tank.

Formula

Each end of the tank = Diameter squared in inches (D^2) x .7854

18" x 18" = 324"

324" x .7854 = 254.47 square inches

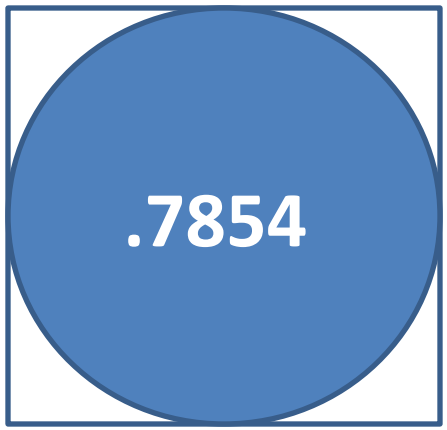
254.47 x 2 = 508.93 square inches

Now you need to convert square inches to square feet

508.93 / 144 = 3.53 square feet

Now add 3.53 to the length which is 23.55

23.55 + 3.53 = 27.08 square feet of insulation



A 5” diameter building drain 56 feet long would contain how many gallons of water when full?

Diameter squared in inches x the length of the drain in feet x .0408

5” x 5” = 25” x 56’ = 1,400

1,400 x .0408 = 57.12 gallons

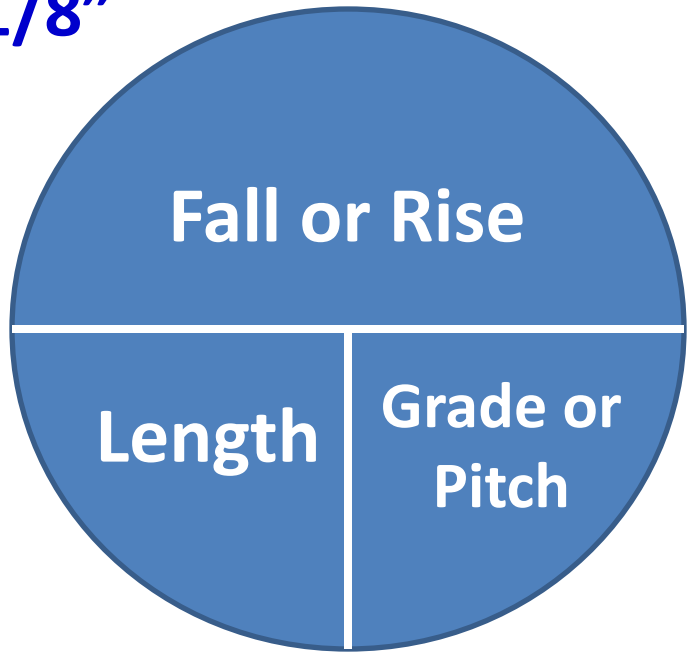
How much does 57.12 gallons of water weigh?

1 gallon of water weighs 8.33 lbs.

8.33 x 57.12 = 475.80 lbs.

1 horizontal drain is 160 feet long. If it rises 20 inches, what is the grade or pitch per foot in inches?

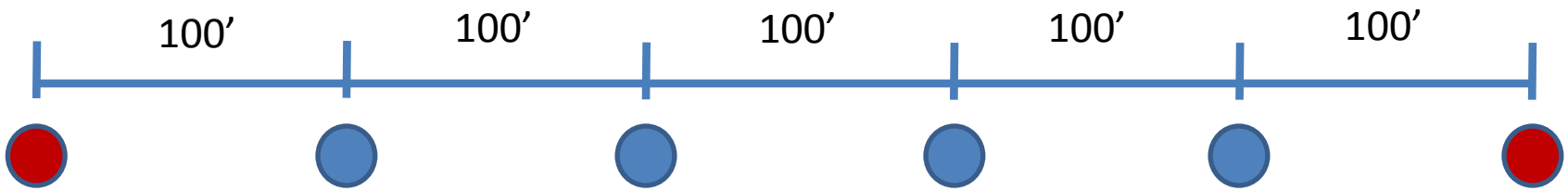
Divide the length into the fall or rise
20 divided by 160 = 0.125
0.125 is equal to 1/8”
Grade or pitch per foot is 1/8”



If you have a 6” horizontal sanitary drain 550’ long and there is a cleanout at the very beginning and the very end, how many additional cleanouts are needed? *

Determine the drain size and the maximum distance between cleanouts
A 6” drain needs a 4” cleanout every 100’

You need 4 additional cleanouts



You are installing a sewer ejector system in a small commercial building. The ejector will be serving a ladies room with three toilets and a men's room with two toilets. Using the proper table, what is the minimum GPM discharge of the pump?

Number of toilets to be Served by each Ejector	G.P.M. Discharge of each Pump
1	20
2 – 3	75
4 – 5	100
6 – 7	125
8 – 10	150
11 – 15	200
16 – 20	250
21 – 25	300
26 – 30	350
31 – 35	375

You are installing a duplex sewer ejector system in a commercial building. The ejector will be serving 16 single user rest rooms on the same floor. What is the minimum GPM discharge of each pump for this system?

Number of toilets to be Served by each Ejector	G.P.M. Discharge of each Pump
1	20
2 – 3	75
4 – 5	100
6 – 7	125
8 – 10	150
11 – 15	200
16 – 20	250
21 – 25	300
26 – 30	350
31 – 35	375

Size the retention capacity in lbs. of a grease interceptor for a sink 48” long by 24” wide by 12” deep? *

First, determine the capacity of the 3-bay sink
Multiply length x width x depth
48 x 24 x 12 = 13,814
1 gallon = 231 cubic inches
Now divide 13,814 by 231
13,814/ 231 = 59.8 gallons
Now determine the actual drainage load of 75%
59.8 x .75 = 44.9 gallons
Now calculate the flow rate for a 2 minute period
44.9 / 2 = 22.5 gallons
Choose the size based 10.09 Table 3

*

Total Flow Through Rating (GPM)	Grease Interceptor Retention Capacity lbs.
4	8
6	12
7	14
9	18
10	20
12	24
14	28
15	30
18	36
20	40
25	50
35	70
50	100

You must step up to the larger size. In this case 22.5 becomes 25

General Regulations
Inspections
Permits

How long must a licensee retain their Continuing Education certificates?

A. **One renewal cycle**

B. **Two renewal cycles**

C. **Three renewal cycles**

D. **Four renewal cycles**

11.04 Mandatory Continuing Education

(2) Requirements for License Renewal.

(b) Each licensee shall retain all Mandatory Continuing Education documentation for no less than **three renewal cycles** and shall furnish this documentation to the Board for verification of completion of the Continuing Education requirements· if requested by the Board.

248 CMR - 263

For building owned or used by the Commonwealth of Massachusetts, a gas fitting permit shall be filed with:

A. **the local city or town Plumbing Inspector**

B. **the local serving gas supplier**

C. **State Board of Examiners of Plumbers and Gas Fitters**

D. **the Massachusetts Department of Public Safety**

Chapter 142: Section 21. Buildings owned, used and constructed by commonwealth Section 21. The examiners shall formulate rules relative to the construction, alteration, repair and inspection of all plumbing and gas fitting work in buildings owned, used and constructed by the commonwealth and in buildings owned, used and constructed by the University of Massachusetts Building Authority, Massachusetts Turnpike Authority, Massachusetts Bay Transportation Authority, Massachusetts Port Authority, Metropolitan district commission and the government center commission, subject to the approval of the department of public health, and all plans for plumbing and gas fitting in such buildings shall be subject to the approval of the examiners.

MGL 142 - 21

Who has the authority to revoke a LP Installer's license?

A. **the local city or town Plumbing Inspector**

B. **the local serving gas supplier**

C. **State Board of Examiners of Plumbers and Gas Fitters**

D. **The State Plumbing & Gas Inspector**

Chapter 142: Section 6. Territorial coverage, transfer, term, renewal, fee, suspension and revocation of licenses; names of licensees forwarded to towns; registration
Any such license or certificate may, after notice and hearing, be suspended or **revoked by the examiners**

MGL 142 - 6

When plans and specifications are required, the inspector may review the plans, prior to issuing a permit, for up to:

A. **10 days**

B. **20 days**

C. **30 days**

D. **40 days**

3.05 (2)

(2) Plans and Specifications.

(a) Whenever plans and specifications are necessary or requested by the Inspector for any plumbing or gas fitting work, the applicant shall submit such plans to the Inspector. The Inspector may review the plans for up to **30 days** prior to issuing the Permit.

248 CMR -22

During each renewal cycle, Gas Fitters and Undiluted Liquefied Petroleum Gas Installers must complete how many hours of continuing education?

A. two

B. four

C. six

D. eight

11.04

(2) Requirements for License Renewal.

(a) Except as otherwise permitted in 248 CMR 11. 00, each journeyman and master plumber, journeyman and master gas fitter, or undiluted liquefied petroleum gas installer shall, as a condition of license renewal, complete the following as applicable:

1. 12-clock hours of approved continuing education courses for plumbers with an approved provider; and

2**. six-clock hours** of approved continuing education courses for **gas fitters** or undiluted liquefied petroleum gas installers with an approved provider.

248 CMR -263

According to OSHA, when a trench is 4’ deep or more, a ladder must be provided as a form of egress if the trench is longer than how many feet? *

A. 10

B. 15

C. 20

D. 25

OSHA Trenching and Excavation Safety Manual

OSHA requires employers to provide ladders, steps, ramps, or other safe means of egress for workers working in trench excavations 4 feet or deeper. The means of egress must be located so as not to require workers to travel more than 25 feet laterally within the trench.

What scenario would qualify a journeyman gas fitter for an exemption from Continuing Education?

A. I turned 65 during the current license cycle

B. I turned 65 prior to the current license cycle

C. I turned 60 during the current license cycle

D. I turned 60 prior to the current license cycle

11.04

(3) License Qualifications for Exemption.

5. A Licensee who has appropriately petitioned the Board will be eligible for an exemption from the continuing education requirement **starting the first full renewal cycle after the Licensee has attained 65 years of age**, The Licensee shall still be responsible for completing continuing education in the renewal cycle in which they turn 65

248 CMR -263

How long does an apprentice need to retain their W-2 forms after passing the journeyman exam?

A. 4 years

B. 5 years

C. 7 years

D. 10 years

3.03
(2) Apprentices
(A) General Provisions
6. Apprentices must retain all W-2 records demonstrating their employment throughout their apprenticeship as well as for a period of at least **seven years after** obtaining a journeyman license.

248 CMR - 14

All plumbing variances submitted to the Board must include:

A. A uniform application provided by the Board

B. Written notification the Board of Health has been notified

C. The location of the proposed variance

D. All of the above

3.04 (2) (c)

Name the ways a plumbing inspector must accept a properly filled out plumbing/gas permit:

A. If submitted in person

B. If submitted by mail

C. If the town has online permitting

D. All of the above

3.05 Permits and Inspections
(1) Permits
(g) Permit Applications and Fees
1. Permit applications must be accepted by the Inspector if submitted in person or by mail, however, applicants may choose to utilize electronic means if offered by the Inspector.
2. The Inspector must issue the Permit to the applicant in person, by mail, or the inspector may utilize other electronic means if acceptable to the permit applicant.

248 CMR - 21

A plumbing permit would not be valid if the work is not started within how many days?

A. 30

B. 45

C. 60

D. 90

3.05 Permits and Inspections
(1) Permits
(e) Invalidity. Permits shall be invalid if work is not started within **90 days of the date of the Permit**, unless the holder of the Permit or Permits can satisfactorily prove that failure to start within the 90 day period was beyond his or her control.

248 CMR - 21

What must a Journeyman or master include on all advertising of their business?

A. Business Name

B. Business Address

C. License Number

D. Type of work

MGL 142 Section 3
The license or certificate of a master plumber or a master gas fitter shall at all times be displayed conspicuously within his place of business. Any sign, listing or advertisement of a master plumber, a master gas fitter, a journeyman plumber or a journeyman gas fitter shall contain his designation and license number.

MGL 142 Section 3

How many hours per license cycle of continuing education does a plumbing & gas inspector need?

A. 8

B. 12

C. 18

D. 24

Chapter 142: Section 11B. Plumbing and gas fitting inspectors; continuing education
Section 11B. Notwithstanding any general or special law to the contrary, inspectors of plumbing and inspectors of gas fitting shall complete a minimum of 12 hours per year of continuing education which shall include the review and interpretation of plumbing and fuel gas codes and related codes, rules and regulations.

MGL 142 Section 11B

How many days does a licensee have to respond to a letter from the Board?

A. 5

B. 10

C. 15

D. 20

3.06
(3) Ethical Standards and Professional Conduct. Requirement to respond to the Board: (a) A Licensee shall respond **within ten days** to a written communication from the Board or its designee and shall make available to the Board any relevant and authorized records with respect to an inquiry or complaint about the Licensee.· The ten-day period commences on the date the Board sends the communication to the Licensee's last known address. This deadline may be extended by the Board or its designee with good cause.

248 CMR -24

Who appoints the local plumbing and gas inspector for each city or town?

A. **Board of Examiners of plumbers and gas fitters**

B. **Local Building Inspector**

C. **Local Board of Selectmen or City Council**

D. **Town Manager**

Chapter 142: Section 11. Inspectors appointed from civil service list; approval of plumbing or gas fitting; exemption

Section 11. The said inspector of buildings, if any, otherwise the board of health, of each city and town, shall, within three months after it becomes subject to sections one to sixteen, inclusive, appoint from the classified civil service list one or more inspectors of plumbing and one or more inspectors of gas fitting

MGL 142 - 11

What type of plumbing business is not required to get a business license through the Plumbing Board?

A. Corporation

B. Sole Proprietorship

C. Limited Liability Company

D. Partnership

11.04

(1) Business Licensure.

(a) Licenses Required. **All corporations, LLC's, partnerships**, or other such entities that have plumbing or gas fitting employees are required to maintain a business license. Such business entities shall be properly constituted and chartered business organization recognized by the Secretary of the Commonwealth, such as a general partnership, limited partnership (LP), limited liability partnership (LLP), limited liability company (LLC), corporation or professional corporation (PC). Individuals practicing under their own name or DBA do not require a business license.

248 CMR -12

A licensed Massachusetts Master plumber submitting an application to become a corporation must be:

A. An officer of the corporation

B. A manager of the corporation

C. The owner of the corporation

D. A partner in the corporation

11.04
(1) Business Licensure.
4. Corporations.
c. The applicant for a plumbing corporation must be a master plumber who is a listed officer of the corporation

248 CMR -13

Written
Gas Questions

At what pressure does gas piping need to be welded?

A. **Over ½ PSI**

B. **Over 2 PSI**

C. **Over 4 PSI**

D. **Over 5 PSI**

248 CMR 5.05 (4) Replace sub-section 5.5.1 with the following
5.5.1 Maximum Design Operating Pressure
(b) Elevated Pressure
3. When the maximum design operating pressure **exceeds five PSIG**, all piping shall be welded in accordance with subsection 5.6.2.2.1.

Elevated pressure gas piping must be labeled at?

A. a minimum of every six feet

B. a minimum of every eight feet

C. a minimum of every ten feet

D. a minimum of every twelve feet

248 CMR 5.05 (4) Replace sub-section 5.5.1 with the following
5.5.1 Maximum Design Operating Pressure
(a) General Rules
See 248 CMR 4.03(1)(b)
(b) Elevated Pressure
4. Elevated pressure piping shall be labeled in the following manner:
i. **At a minimum of every ten feet**;

When gas is above what pressure is it no longer considered to be low pressure?

A. 0.5 P.S.I.G

B. 1 P.S.I.G

C. 2 P.S.I.G

D. 5 P.S.I.G

4.03: Scope of the Massachusetts Fuel Gas Code and Adoption of Relevant Codes
The Massachusetts Fuel Gas Code is comprised of the following:

(1) For most installations of gas piping systems in Massachusetts, the Board adopts NFPA 54 as modified by 248 CMR 5.00. The scope of this adoption shall be governed by NFPA 54 Chapter 1, Administration, subject to the following modifications:

(b): Replace NFPA 54 sub-section 1.1.1.1(B) with the following:
All gas piping systems shall be **low pressure, not in excess of 0.5 P.S.I.G**. or 14 inch water column. Systems may exceed these requirements if designed and installed in accordance with 248 CMR 5.05(4) (B).

248 CMR - 26

Installation of unlisted gas appliances, equipment and accessories is only allowed?

A. with approval of the local inspector

B. with a variance issued by the plumbing board

C. with approval by the state inspector

D. if allowed by the equipment manufacturer

248 CMR 5.09 (3) Delete sub-section 9.1.1.3 and replace with the following:
9.1.1.3 Unlisted appliances, equipment, and accessories
Acceptance of unlisted gas appliances, equipment, and accessories shall require a variance by the Board.

248 CMR - 41

When installing a gas line underground inside a building, what is not required with the conduit installed around the gas line?

A. It must terminate a minimum of 4’ above grade
B. It must be of the same material as the gas pipe
C. It terminates outside of the building
D. The conduit vent must be sized at least 50% of the gas line

248 CMR 5.07 (1) Replace section 7.1.6 with the following:
7.1.6. Piping Underground Beneath Buildings
(a) Conduit Ventilation
1. Conduit vents shall be sized no less than fifty percent of the conduit.
2. Conduit vents shall terminate at the exterior of the building or structure, be a minimum of four feet above finished grade, and shall be installed so as to prevent the entrance of water and insects.

When testing a low pressure gas piping system in excess of one million BTU per hour, what is not a requirement?

A. **The minimum test pressure will be at least 100 PSI**
B. **test must be ten times the working pressure of the system**
C. **maximum test duration is 24 hours**
D. **test duration must be one hour for every 100’ of piping**

248 CMR 5.08 (1) Delete sub-section 8.1.1* and replace with the following:
8.1.1* General
3. Gas piping systems in excess of one million BTU input shall be tested at a pressure not less than ten times the proposed maximum working pressure of the gas system and:
i. the test duration shall be not less than one hour per 100 linear feet of piping or a fraction thereof: and:
ii. The maximum test duration shall not exceed a 24 hour time period irrespective of the piping system design, and:
iii. The maximum test pressure shall not exceed 100 PSIG.

248 CMR - 40

Gas regulator vent lines terminating outside of a building must be located no less than:

A. two feet away from any building opening or air intake
B. four feet away from any building opening or air intake
C. six feet away from any building opening or air intake
D. eight feet away from any building opening or air intake

248 CMR 5.09 (5) Add a new sub-section 9.1.19.1 as follows:

9.1.19.1 Vent Lines

(c) Vent lines that terminate outside a building or structure shall be located no less than:

1. four feet away from any building opening or air intake; and
2. ten feet away from forced air intakes.

248 CMR - 41

Flexible gas hoses used to connect portable and mobile industrial appliances shall not exceed:

A. 5 feet

B. 10 feet

C. 15 feet

D. 20 feet

248 CMR 5.09 Modifications to Chapter 9, Appliances, Equipment and Accessory Installation
(10) Add a new sub-section 9.6.3.5 as follows:
9.6.3.5 Flexible gas hoses used to connect portable and mobile industrial appliances shall not exceed a length of 20 feet.

248 CMR - 43

Copper and brass tubing shall not be used if the gas contains more than an average of how much Mercaptan or Hydrogen Sulfide per 100 square feet of gas? *

A. .3 grains

B. .6 grains

C. .9 grains

D. .12 grains

5.6.3.2* Copper and Brass. Copper and brass tubing shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 square feet of gas

A.5.6.2.3 An average of 0.3 grains of hydrogen sulfide per 100 square feet of gas is equivalent to a trace as determined by ANSI/ ASTM D 2385, *Method of Test for Hydrogen Sulfide and Mercaptan Sulfur in Natural Gas*

NFPA54 – 54-19

Which of the following gas appliance do not require "Product Acceptance" from the Board:

A. **Stove**

B. **Boiler**

C. **Outdoor Fire Pit**

D. **Swimming Pool Heater**

248 CMR 5.10 (40) Delete sub-section 10.32.2 and replace with the following: Listed outdoor open flame decorative appliances do not require any product acceptance under 248 CMR 3.00.

248 CMR – 44.2

Exposed PVC piping used for combustion air or to discharge flue gases must be labeled every:

A. four feet

B. Six feet

C. Eight feet

D. Ten feet

248 CMR 5.12 (4) Add a new sub-section 12.6.7.6.1 as follows:
12.7.6.1 Marking of schedule 40 PVC and other non-metallic piping
Schedule 40 PVC and other non-metallic piping used for ventilation, make-up, or combustion air intake shall be labeled as follows:
(a) Throughout the entire developed length;
1. Labels must be placed every ten feet for exposed/visible piping

248 CMR – 44.3

Manually operated dampers are allowed in what type of gas appliances

A. Incinerators
B. Steam boilers
C. Ranges
D. No gas appliances

12.14 Manually Operated Dampers. A manually operated damper shall not be placed in any appliance vent connector. Fixed baffles shall not be classified as manually operated dampers.

NFPA54 54-93

What BTU input threshold do the requirements of 248 CMR 7.00 begin?

A. 300,000 BTU

B. 400,000 BTU

C. 500,000 BTU

D. 1,000,000 BTU

The maximum horizontal length of a single-wall connector shall not exceed what percent of the height of the chimney?

A. 25 percent

B. 50 percent

C. 75 percent

D. 100 percent

12.11.8* Length of Vent Connector.
12.11.8.1 The maximum horizontal length of a single-wall connector shall be 75 percent of the height of the chimney or vent, except for engineered systems.

NFPA 54 54-92

Gas piping systems with an operating pressure greater than 10 PSI and less than or equal to 70 PSI shall be tested at:

A. **75 PSIG**

B. **100 PSIG**

C. **125 PSIG**

D. **150 PSIG**

248 CMR 5.05 (6) Add a new sub-section 5.6.2.2.1 as follows:
5.6.2.2.1 Welding of Steel and Wrought Iron Pipe.
2. The test pressure used during an Inspection complies with the following:
i. Systems with a maximum operating pressure of ten P.S.I.G. or less shall be tested to a minimum of three P.S.I.G. or ten times the operating pressure, whichever is greater.
ii. Systems with an operating pressure greater than ten P.S.I.G. and less than or equal to 70 P.S.I.G. **shall be tested at 100 P.S.I.G.**

248 CMR - 34

Before a gas piping system is put into operation, it must be pressure tested for a period of:

A. **5 Minutes**

B. **10 Minutes**

C. **15 Minutes**

D. **20 Minutes**

248 CMR 5.08 (1) Delete sub-section 8.1.1* and replace with the following:
8.1.1* General
(a) Inspection of a new or rough gas piping system: Inspections shall conform to the requirements of 248 CMR 3.00 in addition to the following:
2. Gas piping systems that extend from the outlet of the service meter assembly to the closed shutoff valve at each appliance shall satisfy the following:
i. withstand a pressure test of not less than six inches of mercury or three PSIG for a period of not less than **ten minutes** without showing any drop in pressure;

248 CMR - 40

When installing plastic gas piping outside underground it must be:

A. installed in a trench separate from all other utilities
B. transitioned to steel above ground before entering a building
C. installed a minimum of 30 inches below grade
D. installed with a corrosion resistant tracer wire

7.1.7.3 Tracer Wire. An electrically continuous corrosion resistant tracer wire (minimum AWG 14) or tape shall be buried with the plastic pipe to facilitate locating. One end of the tracer wire or tape shall be brought aboveground at a building wall or riser.

NFPA54- 54 - 60

When installing CSST outside underground, marking tape must be placed no more than:

A. 6 inches below grade

B. 8 inches below grade

C. 10 inches below grade

D. 12 inches below grade

(j) CSST Used Underground
1. When in contact with the earth or other material that could corrode the piping, the CSST shall be installed within a sleeve designed to withstand the superimposed loads.
2. Except for pre-engineered sleeves that are Product-accepted by the Board, the sleeve shall allow free movement of the CSST.
3. All sleeve ends shall be sealed liquid tight.
4. An acceptable tape marking system shall be in place no more than **six inches** from the top of the grade indicating that a gas line is below.

248 CMR - 36

What is the minimum depth for installation of CSST outside underground:

A. **12 inches below grade**

B. **18 inches below grade**

C. **24 inches below grade**

D. **30 inches below grade**

(j) CSST Used Underground

1. When in contact with the earth or other material that could corrode the piping, the CSST shall be installed within a sleeve designed to withstand the superimposed loads.
2. Except for pre-engineered sleeves that are Product-accepted by the Board, the sleeve shall allow free movement of the CSST.
3. All sleeve ends shall be sealed liquid tight.
4. An acceptable tape marking system shall be in place no more than **six inches** from the top of the grade indicating that a gas line is below.
5. The minimum depth for buried gas piping as describe herein is **18 inches** from the top of grade.

248 CMR - 36

In a gas piping system, cast iron is allowed for:

A. **Fittings over 4” IPS**
B. **valves**
C. **piping**
D. **Commercial installation**

248 CMR 5.05 (11) Replace sub-section 5.6.8.4 (5) with the following:
(5) Cast Iron is only permitted for flanges, **valves**, strainers and filters.

When replacing a gas fryer under a hood system in a commercial kitchen, what is not required:

A. a solenoid valve or a draft proving switch

B. a carbon monoxide detector

C. a test of the building's complete gas system

D. Product Acceptance for the fryer

248 CMR 5.12 (1) Delete sub-section 12.4.4.2 and replace with the following: 12.4.4.2 Venting via a damper or with a power means of exhaust Where gas appliances or equipment are vented through a ventilating or exhaust system equipped with a damper or with a power means of exhaust, provisions shall be made to allow the flow of gas to the main burners only when the damper is open to a position to properly vent the appliance or equipment when the power means of exhaust is in operation.

248 CMR – 44.2

Plastic pipe and fittings used to vent gas appliances must:

A. **be pitched away from the equipment**

B. **have a condensate pump installed**

C. **terminate at least 3 feet above grade**

D. **be installed as per the appliance manufacturer's installation instructions**

248 CMR 5.12 (2) Delete sub-section 12.5.2 and replace with the following:
Plastic piping may only be used for venting appliances when explicitly allowed by the appliance manufacturer’s installation instructions.

248 CMR– 44.2

Which is not an allowance when utilizing an unlined chimney for the replacement of a gas appliance:

A. a category I Vented Appliance is being installed

B. a vent cap is installed on the chimney top

C. the appliance must draft properly

D. the interior area of the chimney is no greater than seven times the area of the smallest flue to be connected to that chimney

248 CMR 5.12 (3) Replace sub-section 12.6.4.2 Exception with the following:
Exception: Chimneys which do not meet the requirements of sub-section 12.6.4.2 may be utilized with the replacement or installation of a gas appliance, including a gas appliance replacing an oil appliance, when:
(a) a Category I Vented Appliance is being installed;
(b) the interior area of the chimney is no greater than seven times the area of the smallest flue to be connected to that chimney; and
(c) the appliance must draft properly

248 CMR– 44.3

A gas appliance shall not be connected to a chimney flue serving a separate appliance designed to burn:

A. Solid fuel

B. Natural gas

C. Propane gas

D. oil

12.6.5 Chimney Serving Appliances Burning Other Fuels.
12.6.5.1 An appliance shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel. NFPA54 54-87

A chimney for medium-heat equipment shall extend at least how much higher than any portion of a building within 25 feet?

A. 4 feet

B. 6 feet

C. 8 feet

D. 10 feet

12.6.2.2 A chimney for medium-heat appliances
shall extend at least **10 ft** higher than any portion of any building within 25 ft.

NFPA54 54-86

The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry chimney:

A. **Shall not be used to vent another appliance unless allowed by the authority having jurisdiction**
B. **May be used to vent another appliance**
C. **Shall not be used to vent another appliance**
D. **May be used to vent a solid fuel burning appliance**

12.6.8 Space Surrounding Lining or Vent.
12.6.8.1 The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry chimney **shall not be used to vent another appliance.**

NFPA54 54-88

When using the gas venting tables, extrapolation beyond the table entries:

A. **Shall be permitted for sizing two or more appliances**
B. **Shall be permitted when sizing one appliance only**
C. **May be permitted using a 10% reduction in vent size**
D. **Shall not be permitted**

13.1.16 Extrapolation. Extrapolation beyond the table entries **shall not be permitted**.

NFPA54 54-101

What is required prior to installing a vent connector in a chimney that was previously used to vent a liquid fuel burning appliance?

A. **Obtain written approval from the local building official**

B. **Obtain written approval from the local gas inspector**

C. **Have the chimney lined**

D. **Have the chimney cleaned**

12.6.4 Inspection of Chimneys.
12.6.4.1 Before replacing an existing appliance or connecting a vent connector to a chimney, **the chimney passageway shall be examined to ascertain that it is clear** and free of obstructions and shall be cleaned if previously used for venting solid or liquid fuel-burning appliances or fireplaces.

NFPA54 54-87

When installing a gas appliance on a roof, what is the minimum distance from the appliance to the edge of the roof?

A. 4 feet
B. 6 feet
C. 8 feet
D. 10 feet

9.4.2 Installation of Appliances on Roofs.
9.4.2.1 Appliances shall be installed in accordance with the manufacturers' installation instructions.
9.4.2.2 Appliances shall be installed on a well-drained surface of the roof. **At least 6 ft** (1.8 m) of clearance shall be available between any part of the appliance and the edge of a roof or similar hazard

NFPA54 54-69

When positive means of supplying air for combustion to a burner is used, the following shall be provided:

A. **An oversized fan**

B. **A burner full modulating control**

C. **A damper on the boiler with an automatic actuator**

D. **An interlock to prevent the flow of gas if the fan is not working**

9.3.6 Mechanical Combustion Air Supply. Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 ft3/min/1000 Btu/hr (0.034 m3/min/kW) for all appliances located within the space.

9.3.6.1 Where exhaust fans are installed, additional air shall be provided to replace the exhausted air.

9.3.6.2 **Each of the appliances served shall be interlocked to the mechanical air supply** system to prevent main burner operation where the mechanical air supply system is not in operation.

NFPA54 54-68

In gas equipment over 400,000 BTU, the safety control for the burner must be what voltage:

A. **208 three phase**
B. **220 volt with a separate disconnect**
C. **150 volts or less**
D. **480 volts**

7.03: Installation of Burners and Controls
(2) Control Application.
(e) The safety-control circuit shall be two-wire, one side grounded, having a nominal voltage of **150 volts or less.**

248 CMR 52

Burners with a firing rate of 1,000,000 BTU shall be equipped with the following:

A. **A proven low-fire start**
B. **An industrial risk gas train**
C. **A full modulating control**
D. **A 3rd manually operated safety control**

7.03: Installation of Burners and Controls
(6) Combustion (Input) Control Systems.
(c) Burners having a firing rate per combustion chamber of l, 000,000 Btu per hour and **over shall be equipped with a proven low-fire start**.

248 CMR 54

When two or more vents connectors enter a common gas vent or chimney flue, the smaller of the two shall enter the vertical:

A. **Below the larger**
B. **At the same level**
C. **Above the larger**
D. **Not allowed**

12.11.4 Two or More Appliances Connected to a Single Vent.
12.11.4.2 Where two or more vent connectors enter a common vent, chimney flue, or single-wall metal pipe**, the smaller connector shall enter at the highest level** consistent with the available headroom or clearance to combustible material.

NFPA54 - 92

When two or more appliances are connected to a vertical vent or Chimney, the flow area of the largest section of the vertical vent shall not exceed how many times the smallest?

A. 3 times

B. 5 times

C. 7 times

D. 9 times

13.2.18 Vertical Vent Size Limitation. Where two or more appliances are connected to a vertical vent or chimney, the flow area of the largest section of vertical vent or chimney shall not exceed seven times the smallest listed appliance categorized vent areas, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods.

NFPA54 - 111

The maximum horizontal length of a single wall connector shall not exceed more than what percent of the height of the chimney or vent?

A. **25 percent**
B. **50 percent**
C. **75 percent**
D. **100 percent**

12.11.8* Length of Vent Connector.
12.11.8.1 The maximum horizontal length of a **single-wall connector shall be 75 percent** of the height of the chimney or vent, except for engineered systems.

NFPA54 – 54-92

The maximum horizontal length of a Type B double-wall connector shall not exceed more than what percent of the height of the chimney or vent?

A. **25 percent**
B. **50 percent**
C. **75 percent**
D. **100 percent**

12.11.8* Length of Vent Connector.
12.11.8.2 The maximum horizontal length of a **Type B double-wall connector shall be 100** percent of the height of the chimney or vent, except for engineered systems. The maximum length of an individual connector for a chimney or vent system serving multiple appliances, from the appliance outlet to the junction with the common vent or another connector shall be 100 percent of the height of the chimney or vent.

NFPA54 – 54-92

Vent Connections serving equipment vented by natural draft shall not be connected into the following:

A. **Type B double-wall pipe connecting to a masonry chimney**

B. **Any portion of the mechanical draft system operating under positive pressure**

C. **A masonry chimney used for venting of oil fired equipment**

D. **Factory built, Board approved metal chimney**

12.4.3 Mechanical Draft Systems.

12.4.3.4 Vent connectors serving appliances vented by natural draft **shall not be connected into any portion of mechanical draft systems operating under positive pressure**.

NFPA54 – 54-86

Corrugated vent connectors for gas appliances shall not be :

A. larger than the flue collar diameter

B. smaller than the flue collar diameter

C. larger than the draft hood outlet diameter

D. larger than the listed appliance vent damper

13.1.12 Corrugated Vent Connector Size. **Corrugated vent connectors shall not be smaller** than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter.

NFPA54 – 54-101

When removing a solid or liquid fuel appliance from a chimney and replacing it with a gas appliance, what needs to be installed? *

A. A smoke detector

B. An accessible cleanout

C. A chimney liner

D. A secondary gas shut off valve

12.6.7 Cleanouts. Where a chimney that formerly carried flue products from liquid or solid fuel-burning appliances is used with an appliance using fuel gas, an accessible clean out shall be provided. The cleanout shall have a tight-fitting cover and be installed so its upper edge is at least 6 in. (150 mm) below the lower edge of the lowest chimney inlet opening.

NFPA54 – 54-88

A vent connector shall be installed without any dips or sags and have a slope of:

A. **0 in per foot sloped upward toward the vent or chimney**

B. **1/8 in per foot sloped upward toward the vent or chimney**

C. **1/4 in per foot sloped upward toward the vent or chimney**

D. **1/2 in per foot sloped upward toward the vent or chimney**

12.11.7 Slope. A vent connector shall be installed without any dips or sags and shall slope upward toward the vent or chimney **at least 1/4 inch per foot**

NFPA54 – 54-92

When a double acting barometric is used, it shall be equipped with a device to automatically shut off fuel to the burner in case of flue gas spillage in what period of time?

A. **30 seconds**

B. **60 seconds**

C. **90 seconds**

D. **120 seconds**

248 CMR 7.02 General Provisions
(4) Venting of Flue Gases
(c) Draft Control
2. A double-acting barometric draft regulator, if used, shall be equipped with a device with a manual reset which will automatically shut off the fuel to the burner in the event flue gas **spillage exceeds 60 seconds.**

248 CMR - 51

When induced or forced draft devices are used to insure proper combustion, what provisions must be made to prevent the flow of gas to the burner:

A. **Provide a manually operated cast iron damper**
B. **Increase the size of the breeching by a minimum of fifteen percent**
C. **Provide a secondary manual shut off**
D. **Provide a device to prevent the flow of gas upon failure of forced draft device**

248 CMR 7.02 General Provisions
(4) Venting of Flue Gases
(c) Draft Control
d. When induced or forced draft devices are used, provision shall be made to prevent flow of gas to the burners upon failure of these devices.

Which gas equipment is not required to be vented?

A. **Commercial duct furnace**

B. **Residential incinerator**

C. **Direct gas-fired make-up air heater**

D. **Category IV condensing furnace**

12.3.2 Appliances Not Required to Be Vented. The following appliances shall not be required to be vented:
(9**) Direct gas-fired make-up air heaters**

NFPA54 54-85

Vented gas fireplaces that are installed in bedrooms or bathrooms shall:

A. **be equipped with an oxygen depletion sensor**

B. **require a carbon monoxide detector installed in the same room**

C. **obtain all air for combustion directly from outdoors**

D. **obtain all air for combustion from another room**

248 CMR 5.10 (13) Delete sub-section 10.7.1 and replace with the following:
10.7.1 Prohibited Installations
Vented gas fireplaces installed in bedrooms or bathrooms shall be Direct Vent Appliances as defined in sub-section 3.3.6.3.

248 CMR - 44

When installing CSST for a fireplace log, which of the following is required?

A. protection of the CSST piping within the fire box

B. a proper termination fitting at the entrance to the fire box

C. proper support for the CSST piping within the fire box

D. installation of a carbon monoxide detection device

248 CMR 5.05 (8) Replace sub-section 5.6.3.4 with the following:
5.6.3.4 Corrugated Stainless Steel
(h) Fireplace Log Installations
1. CSST shall terminate with a termination fitting at the entrance to the masonry fire box.

When a vented decorative appliance is installed in a vented fireplace, the flue damper must be:

A. **Screwed in place**

B. **removed or welded in the open position**

C. **anchored with stainless steel rods**

D. **secured open with a factory supplied clip**

10.6.1 Prohibited Installations.

(a) Decorative appliances that are designed for installation in vented fireplaces when installed in bedrooms or bathrooms shall be Direct Vent Appliances as defined in sub-section 3.3.6.3

(b) When decorative appliances are installed in vented fireplaces other than bedrooms and bathrooms, **the flue damper shall be removed or welded in a fully open position.**

248 CMR - 43

A chimney for residential-type or low-heat gas equipment shall extend through the roof at least how far above the highest point and how much higher than any portion of the building at least 10 feet away?

A. **2.5 feet and 2.5 feet**

B. **3 feet and 2 feet**

C. **3.5 feet and 3 feet**

D. **4 feet and 2 feet**

12.6.2 Termination.

12.6.2.1 * A chimney for residential-type or low-heat appliances shall extend at **least 3 ft** above the highest point where it passes through a roof of a building **and at least 2 ft** higher than any portion of a building within a horizontal distance of 10 ft.

NFPA54- 86

Mechanical draft systems when exiting above a public walkway shall be a minimum of how many feet above finish grade?

A. 4 feet

B. 5 feet

C. 6 feet

D. 7 feet

12.4.3.6 The exit terminals of mechanical draft systems **shall be not less than 7 ft** (2.1 m) above finished ground level where located adjacent to public walkways and shall be located as specified in 12.9.1 and 12.9.2.

NFPA54- 86

When installing two 45 degree elbows in a vertical common gas vent, the capacity of that vent drops by what percent?

A. five

B. ten

C. fifteen

D. twenty

13.1.3 Elbows. Single-appliance venting configurations with zero (0) lateral lengths in Table 13.1(a), Table 13.1(b), and Table 13.1(e) shall not have elbows in the venting system. Single-appliance venting with lateral lengths include two 90 degree elbows. For each additional elbow up to and including 45 degrees, the maximum capacity listed in the venting tables shall be reduced by 5 percent. For each additional elbow greater than 45 degrees up to and including 90 degrees, the maximum capacity listed in the **venting tables shall be reduced by 10 percent.**

NFPA54-101

Single wall metal flue pipe shall not originate in:

A. A concealed space
B. A crawl space
C. A basement
D. An occupied space

12.8.4.3 Single-wall metal pipe shall not originate in **any un-occupied attic or concealed space** and shall not pass through any attic, inside wall, concealed space, or floor.

NFPA54-90

No portion of a venting system shall extend or pass through:

A. **any concealed space**
B. **A combustible exterior wall**
C. **A basement**
D. **A circulating air duct**

12.4.5 Circulating Air Ducts, Above-Ceiling Air-Handling Spaces, and Furnace Plenums.
12.4.5.1 Venting systems s**hall not extend into or pass through any fabricated air duct or furnace plenum.**

NFPA54-86

The gas train for a 950,000 BTU gas boiler must have

A. a firing rate control
B. a high pressure switch
C. a low pressure switch
D. a safety shut off valve

248 CMR 7.04 Figure 3A

The gas train on boiler rated at 800,000 BTU per hour must have

A. a pressure regulator
B. a high pressure switch
C. a low pressure switch
D. two safety shut off valves

248 CMR 7.04 Figure 3A

For other than LP gas systems the point of delivery, where no meter is provided shall be at:

A. **The outlet of the first stage regulator**

B. **the point of entry into the building**

C. **the outlet of the service shut off valve**

D. **within 10' of the service regulator**

248 CMR 4.03

(1)

(a): Replace NFPA 54 sub-section 1.1.1.1(A) with the following:

Jurisdiction of gases as defined in subsection 3.3.51 of NFPA 54 shall extend from the point of delivery to the provided connections with each gas utilization device as follows:

1. For natural and manufactured gas systems, the point of delivery shall be considered the outlet of the service meter assembly or the **outlet of the service regulator or service shut off valve where no meter is provided.**

A gas heater in a commercial repair garage must be at least how high off the floor to the bottom of the unit?

A. 7’

B. 8’

C. 9’

D. 10’

9.1.11 Installation in Commercial Garages.
9.1.11.2 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 that have a fire resistance rating of not less than 1 hour, and that have no openings in the wall separating the repair area within 8 ft off the floor.
Exception No.1: Overhead heaters where installed **not less than 8ft** above the floor shall be permitted.

NFPA54 54-66

When combustion air is supplied to a confined space, the openings must begin within how many inches of the floor and ceiling?

A. **6 inches**

B. **12 inches**

C. **18 inches**

D. **24 inches**

9.3.2.3 Indoor Opening Size and Location. Openings used to connect indoor spaces shall be sized and located in accordance with the following:

(1) *Combining spaces on the same story. Each opening shall have a minimum free area of 1 in.2/1000 Btu/hr of the total input rating of all appliances in the space but not less than 100 in. One opening shall commence within **12 in.** of the top of the enclosure and one opening shall commence within 12 in. of the bottom of the enclosure

NFPA54 54-68

What is the minimum vertical height a type B-Vent may terminate above an appliance draft hood?

A. 3 feet

B. 4 feet

C. 5 feet

D. 6 feet

12.7.2 Gas Vent Termination. The termination of gas vents shall comply with the following requirements:
(2) A Type B or a Type L gas vent shall terminate at least 5 ft. in vertical height above the highest connected appliance draft hood or flue collar.

NFPA54 54-88

Gas equipment installed in residential garages must be installed so that the ignition device is a minimum of how many inches above the floor?

A. **12 inches**

B. **18 inches**

C. **24 inches**

D. **30 inches**

9.1.10 Installation in Residential Garages. 9.1.10.1 Appliances in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that all burners and burner ignition devices are located **not less than 18 in. above the floor**

NFPA54 54-66

What is the maximum distance from a gas cock to the appliance it serves?

A. 2’

B. 4’

C. 6’

D. 8’

9.6.4 Appliance Shutoff Valves and Connections. Each appliance connected to a piping system shall have an accessible, approved manual shutoff valve with a non-displaceable valve member, or a listed gas convenience outlet. Appliance shutoff valves and convenience outlets shall serve a single appliance only and shall be installed in accordance with

9.6.4.1. **The shutoff valve shall be located within 6 ft** of the appliance it serves except as permitted in 9.6.4.2 or 9.6.4.3.

NFPA54 54-70

Exposed or visible plastic gas vent piping for a side wall vented appliance must be labeled at a minimum of every ____ feet?

A. 5’

B. 10’

C. 15’

D. 20’

248 CMR 5.12 (4) Add a new sub-section 12.6.7.6.1 as follows:
12.7.6.1 Marking of schedule 40 PVC and other non-metallic piping Schedule 40 PVC and other non-metallic piping used for ventilation, make-up, or combustion air intake shall be labeled as follows:
(a) Throughout the entire developed length;
1. Labels must be **placed every ten feet** for exposed/visible piping

248 CMR 44.3

At what height would you not need to hang a gas vent sign when installing a sidewall vented appliance?

A. 48”

B. 60”

C. 72”

D. 84”

248 CMR 5.12 (6) Add a new sub-section 12.9.7 as follows:
12.9.7 Signage
Whenever any through-the-wall vent is installed **less than seven feet above the finished grade**, a metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight feet above grade directly in line with the exhaust vent terminal. The sign shall read, in print size no less than 0.5 inches in size, “GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS”.

248 CMR 44.3

CSST may be directly connected to an interior gas meter that is securely affixed to the building as long as the CSST is secured to the building and at least how many inches of the tubing us exposed?

A. 12”

B. 18”

C. 20”

D. 24”

248 CMR 5.05 (8) Replace sub-section 5.6.3.4 with the following:
5.6.3.4 Corrugated Stainless Steel
(d) Interior Meter Connections
Interior meter connections may be directly connected to the CSST system as long as the meter is securely affixed to the building, and the CSST is secured to the building structure when **24 inches or more of tubing is exposed**.

248 CMR 35

When testing a gas system with a maximum operating pressure of ½ PSI, what is the correct pressure and length on test?

A. **3 PSIG for 5 minutes**

B. **3 PSIG for 10 minutes**

C. **5 PSIG for 5 minutes**

D. **5 PSIG for 10 minutes**

248 CMR 5.08 (1) Delete sub-section 8.1.1* and replace with the following:

8.1.1* General

(a) Inspection of a new or rough gas piping system: Inspections shall conform to the requirements of 248 CMR 3.00 in addition to the following:

2. Gas piping systems that extend from the outlet of the service meter assembly to the closed shutoff valve at each appliance shall satisfy the following:

i. withstand a pressure test of not less than six inches of mercury or **three PSIG for a period of not less than ten minutes** without showing any drop in pressure;

248 CMR 40

Decorative fireplace appliances installed in bedrooms or bathrooms must:

A. **Vented into a fireplace**

B. **Obtain combustion air from outside the bedroom**

C. **Be a direct vented appliance**

D. **Be a category III appliance**

10.7 Gas Fireplaces, Vented.
248 CMR 5.10 (13) Delete sub-section 10.7.1 and replace with the following:
10.7.1 Prohibited Installations
Vented gas fireplaces installed in bedrooms or bathrooms shall be **Direct Vent Appliances** as defined in sub-section 3.3.6.3.

248 CMR 44

Unvented gas room heaters shall have a maximum BTU input of:

A. **20,000 BTU**

B. **30,000 BTU**

C. **40,000 BTU**

D. **50,000 BTU**

248 CMR 5.10 (30) Delete sub-section 10.23.2 and replace with the following:
10.23.2 Unvented Room Heaters
(f) Unvented room heaters shall not exceed a **maximum of 40,000 BTU** input per room or space.

248 CMR 44.1

An appliance that operates with a positive vent static pressure and with a vent gas temperature that can cause excessive condensate:

A. **Category I**

B. **Category II**

C. **Category III**

D. **Category IV**

3.3.6.11 *Vented Appliance.*

3.3.6.11.4 ***Category IV Vented Appliance.*** An appliance that operates with a positive vent static pressure and with a vent gas temperature that can cause excessive condensate

NFPA54 – 54-10

An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate :

A. **Category I**
B. **Category II**
C. **Category III**
D. **Category IV**

3.3.6.11 *Vented Appliance.*
3.3.6.11.1 * ***Category I Vented Appliance****.* An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

NFPA54 – 54-10

An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that can cause excessive condensate.

A. **Category I**

B. **Category II**

C. **Category III**

D. **Category IV**

3.3.6.11 *Vented Appliance.*

3.3.6.11.2 Category II Vented Appliance. An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that can cause excessive condensate production in the vent. NFPA54 – 54-10

An appliance that operates with a positive vent static pressure and with a vent gas temperature that avoids excessive condensate

A. **Category I**

B. **Category II**

C. **Category III**

D. **Category IV**

3.3.6.11 *Vented Appliance.*

3.3.6.11.3 Category III Vented Appliance. An appliance that operates with a positive vent static pressure and with a vent gas temperature that avoids excessive condensate

NFPA54 – 54-10

Plastic gas pipe and fittings may only be used:

A. **Concealed in a wall**

B. **In a crawl space**

C. **In unoccupied areas of a building**

D. **Outside underground**

7.1.7 Plastic Piping.

7.1.7.1 Connection of Plastic Piping. Plastic piping shall be installed **outdoors, underground only.**

NFPA54 – 54-59

A residential gas appliance connector shall not exceed what length?

A. 24”

B. 36”

C. 48”

D. 60”

248 CMR 5.09 (9) Add a new sub-section 9.6.1.4 as follows:
9.6.1.4 General Requirements for connectors.
(a) The maximum length of a connector **shall not exceed 48 inches**; however, this restriction shall not apply to connectors utilized for a gas appliance subject to the provisions of sub-section 9.6.1(4) or sub-section 9.6.1.1.

248 CMR - 42

How many tests need to be done when installing a CSST piping system?

A. **Two**

248 CMR 5.05 (8) Replace sub-section 5.6.3.4 with the following:
5.6.3.4 Corrugated Stainless Steel
(n)Testing Requirements for CSST Systems
1. Before any piping is covered, when CSST piping systems are installed in new construction or remodeling, the system shall be tested as part of the Inspection as prescribed under Section 7.1 as modified under 248 CMR 5.05.
2. Before piping is connected to any appliance the licensed plumber or gas fitter shall do a second test of the system.
3. A tag shall be:
i. affixed to the meter or service manifold acknowledging this test; and
ii. signed and dated by the licensed plumber or gas fitter.

248 CMR - 36

When purging gas to an outside location from a piping system, how far away from a source of ignition must the termination be?

A. 5 feet

B. 10 feet

C. 15 feet

D. 20 feet

8.3.1.3 Outdoor Discharge of Purged Gases. The open end of a piping system being pressure vented or purged shall discharge directly to an outdoor location. Purging operations shall comply with all of the following requirements:
(1) The point of discharge shall be controlled with a shutoff valve.
(**2) The point of discharge shall be located at least 10' from sources of ignition, at least 10' from building openings and at least 25' from mechanical air intake openings.**

NFPA54 – 54-65

How far away from a forced air intake does the discharge vent line from a gas pressure regulator need to be terminated?

A. 5 feet

B. 10 feet

C. 15 feet

D. 20 feet

248 CMR 5.09 (5) Add a new sub-section 9.1.19.1 as follows:

9.1.19.1 Vent Lines

(c) Vent lines that terminate outside a building or structure shall be located no less than:

1. four feet away from any building opening or air intake; and
2. **ten feet away from forced air intakes.**

How far through the roof does the termination point from a gas pressure regulator need to be extended?

A. 12 inches

B. 18 inches

C. 24 inches

D. 30 inches

248 CMR 5.09 (5) Add a new sub-section 9.1.19.1 as follows:

9.1.19.1 Vent Lines

(d) Vent lines that penetrate roofs and sidewalls shall be run through metallic sleeves that are sealed from the weather and insects, and:

1. **extend no less than eighteen inches above a roof surface when penetrating the roof**

248 CMR - 41

How far through a side wall does the termination point from a gas pressure regulator vent need to be extended?

A. 6 inches

B. 12 inches

C. 18 inches

D. To a safe location

248 CMR 5.09 (5) Add a new sub-section 9.1.19.1 as follows:

9.1.19.1 Vent Lines

(d) Vent lines that penetrate roofs and sidewalls shall be run through metallic sleeves that are sealed from the weather and insects, and:

2. terminate through the sidewall to a safe location.

248 CMR - 41

What needs to be installed upstream of a gas regulator in a gas piping system?

A. An appliance

B. A Solenoid valve

C. A union

D. A manual shut off valve

7.9 Manual Gas Shutoff Valves.

7.9.1 Valves at Regulators. An accessible gas shutoff valve shall be provided upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve shall not be required at the second regulator.

NFPA54 – 54-62

Can liquid household soap be used to test for a leak on a CSST piping system?

A. No

248 CMR 5.05 (8) Replace sub-section 5.6.3.4 with the following:
5.6.3.4 Corrugated Stainless Steel
(o) Liquid Leak Detector
No corrosive liquids shall be used in the testing of the CSST system. Some household soaps and detergents may be corrosive to gas and plumbing products.

Can vents from appliance regulators be manifolded together before venting to the outside?

A. No

248 CMR 5.09 (5) Add a new sub-section 9.1.19.1 as follows:
9.1.19.1 Vent Lines
(f) Appliance pressure regulators shall not be connected to a common manifold.

Practical Water Pipe Sizing

TABLE 1
MINIMUM SIZE OF FIXTURE WATER SUPPLY LINES AND FACTOR VALUES

TYPE OF FIXTURE OR DEVICE	Nominal Pipe Size (inches)	Factor Value
Bathtubs	1/2	2
Combination Sink and Tray	1/2	2
Drinking Fountain	3/8	1
Dishwasher (Domestic)	1/2	2
Kitchen Sink (Residential)	1/2	2
Kitchen Sink (Commercial)	3/4	6
Lavatory	3/8	1
Laundry Tray: 1, 2 or 3 compartments: See **Note 1**	1/2	2
Shower (Single Head)	1/2	2
Sinks (Service Stop)	1/2	2
Sinks (Flushing Rim)	3/4	6
Urinal (Flush Tank)	1/2	2
Urinal (Direct Flush Valve)	3/4	6
Water Closet (Tank Type)	3/8	1
Water Closet (Flush Valve Type)	1	12
Hose Bibbs	1/2	2
Wall Hydrant	1/2	2

These are located in your chart book

Note 1: If washing machine connections are used in place of a laundry tray, use laundry trap pipe sizes in determining capacity values.

TABLE 2

Occupancy Use	Demand Factors
RESIDENTIAL	
One or Two Family Dwelling	0.50
Multi-Residential	0.35
Hotel	0.70
SCHOOL	
General	0.75
Shower Room	1.00
INSTITUTIONAL	
General	0.45
ASSEMBLY	
General	0.25
Restaurant, Café	0.70
Club House	0.60
BUSINESS	
General	0.25
Laundry	1.00
INDUSTRIAL	
General, Exclusive of Process Piping	0.90

These are located in your chart book

TABLE 3

Nominal Pipe Tubing Sizes (inches)		Capacity Value
3/8		1
1/2		1.1 to 4
3/4		4.1 to 9
1		9.1 to 16.5
1-1/4		16.6 to 28
1-1/2	**These are located in your chart book**	28.1 to 55
2		55.1 to 107.5
2-1/2		107.6 to 182.5
3		182.6 to 287.5
3-1/2		287.6 to 425
4		425.1 to 700
5		700.1 to 1100
6		1100.1 to 1300

WATER PIPE SIZING

PROBLEM #1

What size hot water main would be required for a School Shower Room consisting of 1 men's shower with 10 heads and 1 ladies shower with 8 heads

Use TABLES 1, 2 and 3 on pages 151 – 152 to determine the proper size

Determine factor values using TABLE 1

TABLE 1
MINIMUM SIZE OF FIXTURE WATER SUPPLY LINES AND FACTOR VALUES

TYPE OF FIXTURE OR DEVICE	Nominal Pipe Size (inches)	Factor Value
Bathtubs	1/2	2
Combination Sink and Tray	1/2	2
Drinking Fountain	3/8	1
Dishwasher (Domestic)	1/2	2
Kitchen Sink (Residential)	1/2	2
Kitchen Sink (Commercial)	3/4	6
Lavatory	3/8	1
Laundry Tray: 1, 2 or 3 compartments: See **Note 1**	1/2	2
Shower (Single Head)	1/2	2
Sinks (Service Stop)	1/2	2
Sinks (Flushing Rim)	3/4	6
Urinal (Flush Tank)	1/2	2
Urinal (Direct Flush Valve)	3/4	6
Water Closet (Tank Type)	3/8	1
Water Closet (Flush Valve Type)	1	12
Hose Bibbs	1/2	2
Wall Hydrant	1/2	2

Note 1: If washing machine connections are used in place of a laundry tray, use laundry trap pipe sizes in determining capacity values.

WATER PIPE SIZING

- **Men's Room has 10 showers**
  - ✓ **10 x 2 = 20 (hot only)**
- **Ladies Room has 8 showers**
  - ✓ **8 x 2 = 16 (hot only)**

20 + 16 = 36 Factor Value

Find the proper Demand Factor using TABLE 2

TABLE 2

Occupancy Use	Demand Factors
RESIDENTIAL	
One or Two Family Dwelling	0.50
Multi-Residential	0.35
Hotel	0.70
SCHOOL	
General	0.75
Shower Room	1.00
INSTITUTIONAL	
General	0.45
ASSEMBLY	
General	0.25
Restaurant, Café	0.70
Club House	0.60
BUSINESS	
General	0.25
Laundry	1.00
INDUSTRIAL	
General, Exclusive of Process Piping	0.90

WATER PIPE SIZING

What we know so far

FACTOR VALUE = 36

DEMAND FACTOR = 1.00

Now multiply the FACTOR VALUE buy the DEMAND FACTOR To get the CAPACITY VALUE

36 x 1 = 36 CAPACITY VALUE

Find the proper Capacity Value using TABLE 3

TABLE 3

Nominal Pipe Tubing Sizes (inches)	Capacity Value
3/8	1
1/2	1.1 to 4
3/4	4.1 to 9
1	9.1 to 16.5
1-1/4	16.6 to 28
1-1/2	28.1 to 55
2	55.1 to 107.5
2-1/2	107.6 to 182.5
3	182.6 to 287.5
3-1/2	287.6 to 425
4	425.1 to 700
5	700.1 to 1100
6	1100.1 to 1300

Correct answer is 1-1/2”

WATER PIPE SIZING

PROBLEM #2

What size water main would be required for a single family residence containing 3 water closets (tank type), 3 lavatories, 1 bathtub, 2 single head shower stalls, 1 kitchen sink, one laundry tray (one compartment), 2 hose bibbs and 1 domestic dishwasher?

Use TABLES 1, 2 and 3 on pages 151 – 152 to determine the proper size

TABLE 1 - Factor Values

Water Closets (Tank Type)	3	CW: 1 x 3 = 3	
Lavatories	3	CW: 1 x 3 = 3	HW: 1 x 3 = 3
Bathtubs	1	CW: 2 x 1 = 2	HW: 2 x 1 = 2
Shower Stalls (single head)	2	CW: 2 x 2 = 4	HW: 2 x 2 = 4
Kitchen Sink	1	CW: 2 x 1 = 2	HW: 2 x 1 = 2
Laundry Tray	1	CW: 2 x 1 = 2	HW: 2 x 1 = 2
Hose Bibbs	2	CW: 2 x 2 = 4	
Dishwashers:	1		HW: 2 x 1 = 2
		20	15

Now total up the Factor Values

Total Factor Values = 35

TABLE 2 - Demand Factor

RESIDENTIAL

One or two family dwelling	0.50

Now multiply the FACTOR VALUE		35
by the DEMAND FACTOR		0.50
To get the CAPACITY VALUE	=	17.5

Find the proper Capacity Value using TABLE 3

TABLE 3

Nominal Pipe Tubing Sizes (inches)	Capacity Value
3/8	1
1/2	1.1 to 4
3/4	4.1 to 9
1	9.1 to 16.5
1-1/4	16.6 to 28
1-1/2	28.1 to 55
2	55.1 to 107.5
2-1/2	107.6 to 182.5
3	182.6 to 287.5
3-1/2	287.6 to 425
4	425.1 to 700
5	700.1 to 1100
6	1100.1 to 1300

Correct answer is 1-1/4”

WATER PIPE SIZING

PROBLEM #3

What size cold water main would be required for a club house containing 12 flush valve toilets, 12 lavatories, 12 flush valve urinals, 1 commercial kitchen sink and 2 hose bibbs?

Use TABLES 1, 2 and 3 on pages 151 – 152 to determine the proper size

TABLE 1 - Factor Values

Water Closets (flush valve)	12	CW: 12 x 12	=	144
Lavatories	12	CW: 1 x 12	=	12
Kitchen Sink (comm)	1	CW: 6 x 1	=	6
Urinals (flush valve)	12	CW: 6 x 12	=	72
Hose Bibbs	2	CW: 2 x 2	=	4
				238

Now total up the Factor Values

Total Factor Values = 238

TABLE 2 - Demand Factor

ASSEMBLY	
Club House	.60

Now multiply the FACTOR VALUE		**238**
by the DEMAND FACTOR		**.60**
To get the CAPACITY VALUE	**=**	**142.8**

Find the proper Capacity Value using TABLE 3

TABLE 3

Nominal Pipe Tubing Sizes (inches)	Capacity Value
3/8	1
1/2	1.1 to 4
3/4	4.1 to 9
1	9.1 to 16.5
1-1/4	16.6 to 28
1-1/2	28.1 to 55
2	55.1 to 107.5
2-1/2	107.6 to 182.5
3	182.6 to 287.5
3-1/2	287.6 to 425
4	425.1 to 700
5	700.1 to 1100
6	1100.1 to 1300

Correct answer is 2-1/2”

WATER PIPE SIZING

PROBLEM #4

What size hotwater main would be required for a club house containing 12 flush valve toilets, 12 lavatories, 12 flush valve urinals, 1 commercial kitchen sink and 2 hose bibbs?

Use TABLES 1, 2 and 3 on pages 151 – 152 to determine the proper size

TABLE 1 - Factor Values

Water Closets (flush valve)	12	No Hot Water	
Lavatories	12	HW: 1 x 12 =	12
Kitchen Sink (comm)	1	HW: 6 x 1 =	6
Urinals (flush valve)	12	No Hot Water	
Hose Bibbs	2	No Hot Water	

18

Now total up the Factor Values

Total Factor Values = 18

TABLE 2 - Demand Factor

ASSEMBLY	
Club House	.60

Now multiply the FACTOR VALUE		**18**
by the DEMAND FACTOR		**.60**
To get the CAPACITY VALUE	**=**	**10.8**

Find the proper Capacity Value using TABLE 3

TABLE 3

Nominal Pipe Tubing Sizes (inches)	Capacity Value
3/8	1
1/2	1.1 to 4
3/4	4.1 to 9
1	9.1 to 16.5
1-1/4	16.6 to 28
1-1/2	28.1 to 55
2	55.1 to 107.5
2-1/2	107.6 to 182.5
3	182.6 to 287.5
3-1/2	287.6 to 425
4	425.1 to 700
5	700.1 to 1100
6	1100.1 to 1300

Correct answer is 1”

Practical Roof Drain Sizing

(2) Size of Building Storm Drain.

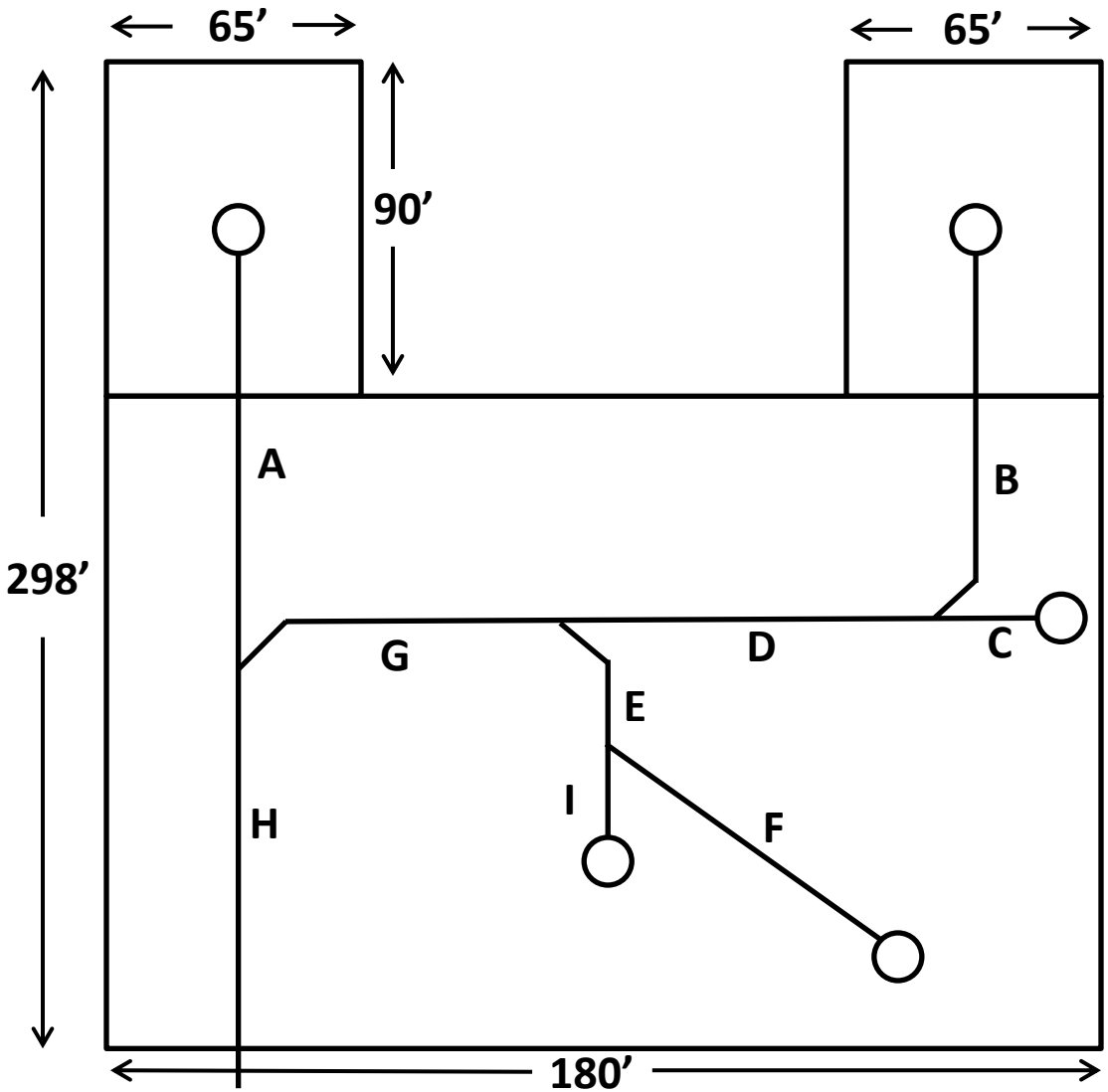
The size of the building storm drainage system including all horizontal branches having a slope of ½ inch or less per foot, shall be based upon the maximum projected roof or paved surface area to be handled according to 248 CMR 10.17(2): Table I.

TABLE 1
SIZE OF HORIZONTAL STORM DRAINS

Diameter of Drain In Inches	Maximum Projected Roof Area for Storm Drains of Various Slopes		
	1/8 Inch Slope	¼ Inch Slope	½ Inch Slope
	Square Feet	Square Feet	Square Feet
3		1,160	1,644
4	1,880	2,650	3,760
5	3,340	4,720	6,680
6	5,350	7,550	10,700
8	11,500	16,300	23,000
10	20,700	29,200	41,400
12	33,300	47,000	66,600
15	59,500	84,000	119,000

Table 1 is based on a maximum rate of rainfall four inches per hour.

SIZING STORM DRAINS



3 STEPS TO SIZING

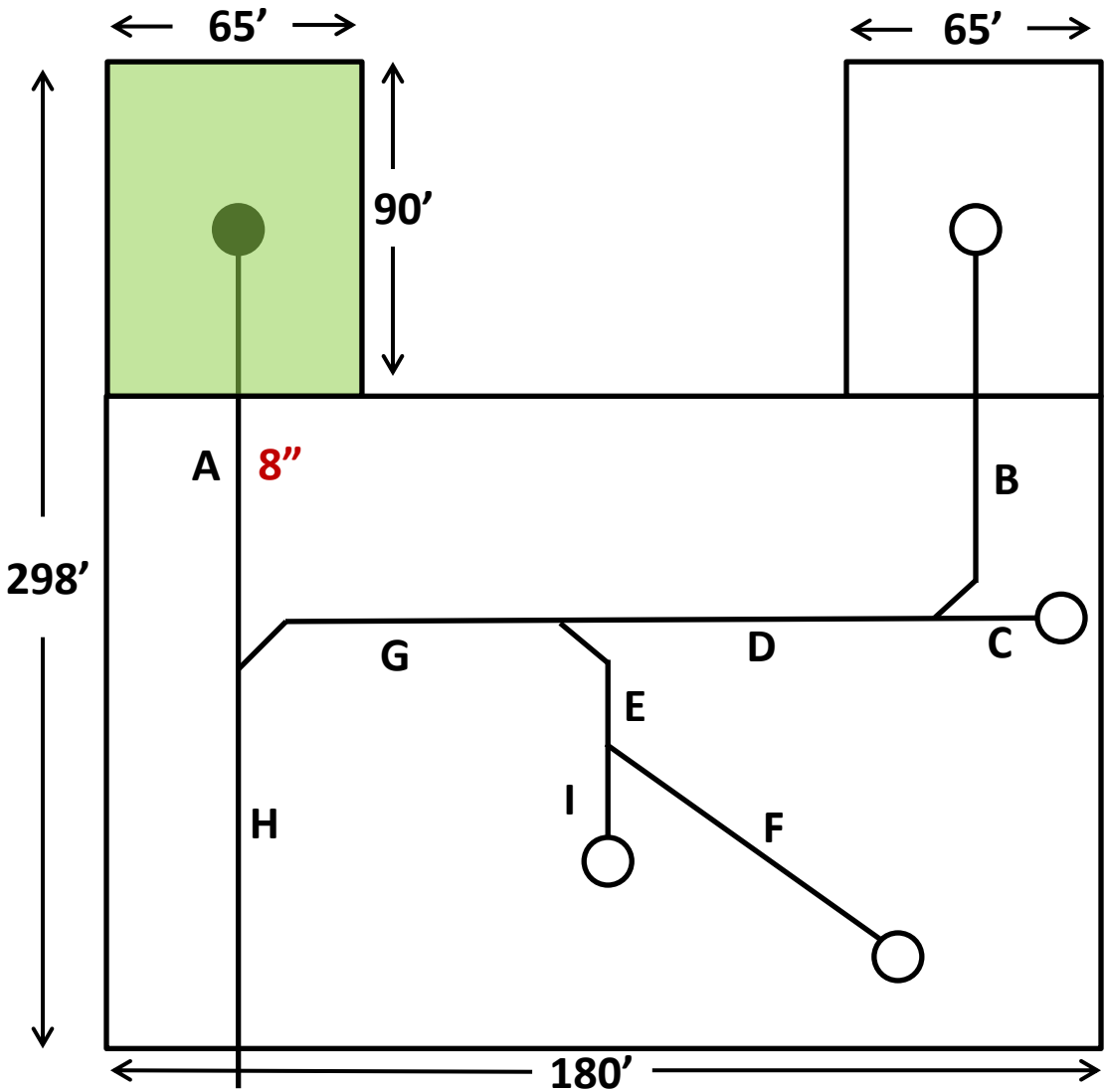
1. Determine the area covered by each roof drain (length x width)

2. Use TABLE 1 to determine the sizes of A through K

3. Choose the proper slope from TABLE 1

SIZING STORM DRAINS

1/8” per foot

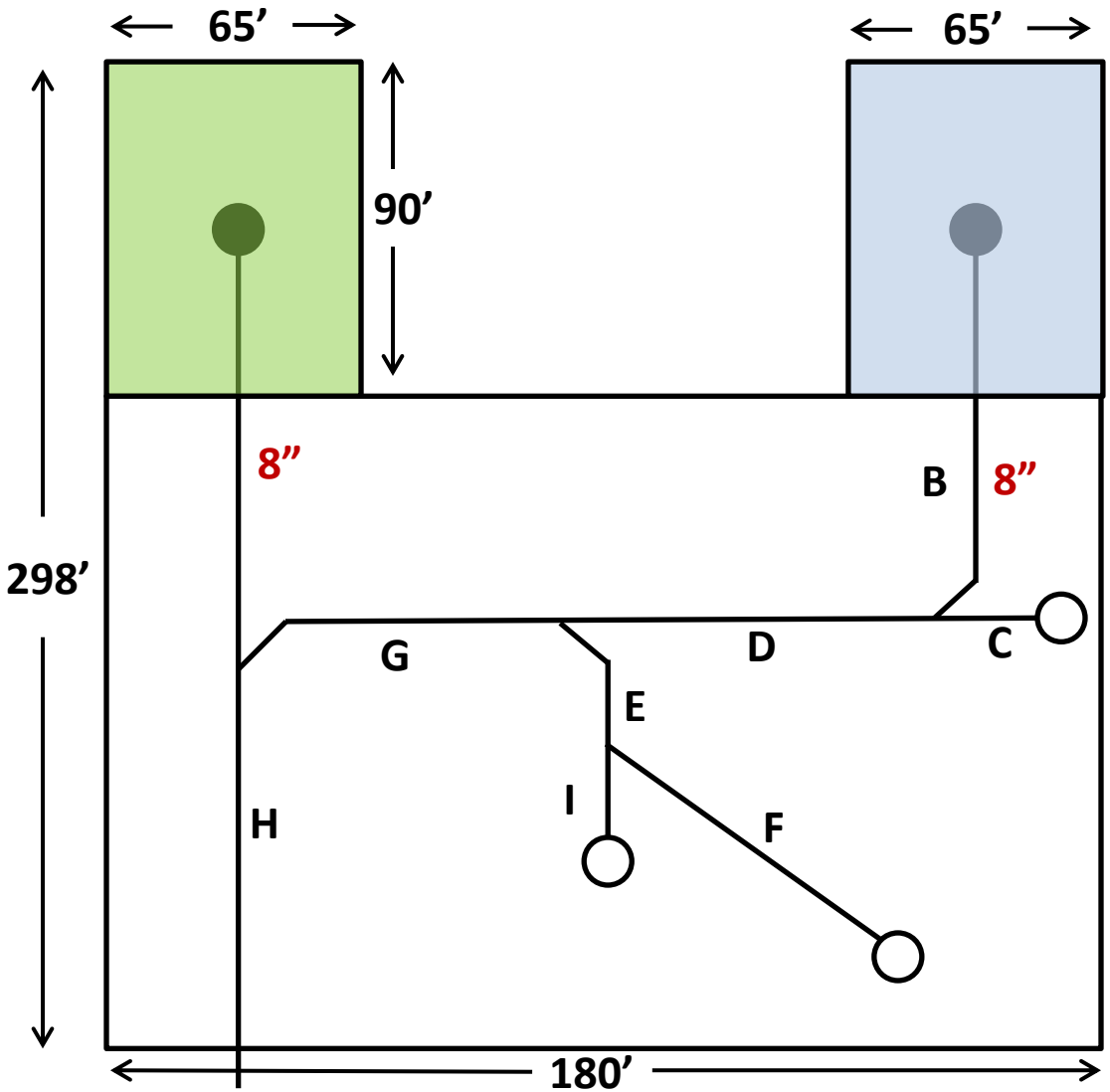


65 x 90 = **5,850**
Use 1/8 Inch slope column
6” drain allows 5,350 sq ft
8” drain allows 11,500 sq ft

A = 8”

SIZING STORM DRAINS

1/8” per foot

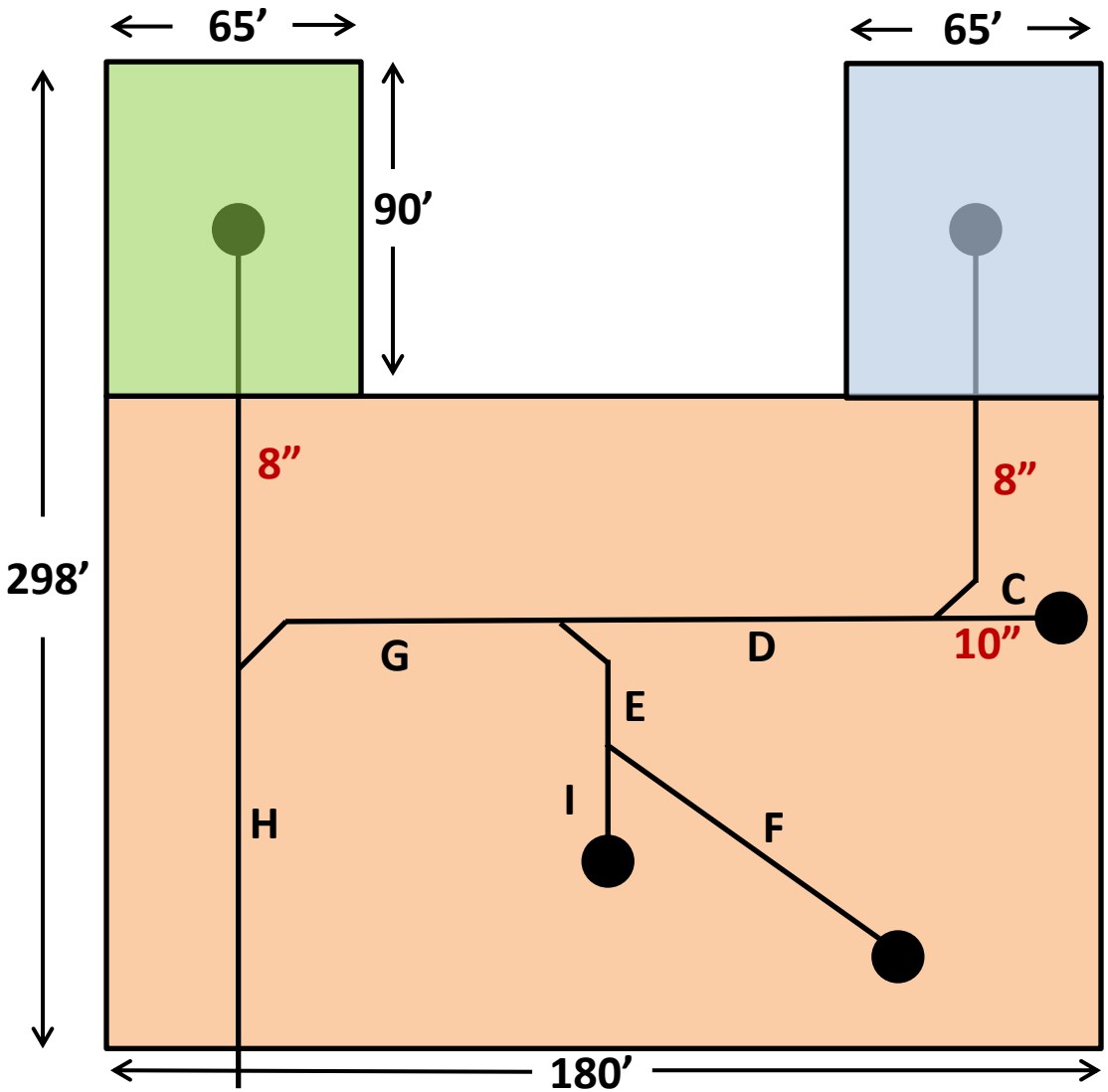


65 x 90 = **5,850**
Use 1/8 Inch slope column
6” drain allows 5,350 sq ft
8” drain allows 11,500 sq ft

B = 8”

SIZING STORM DRAINS

1/8” per foot

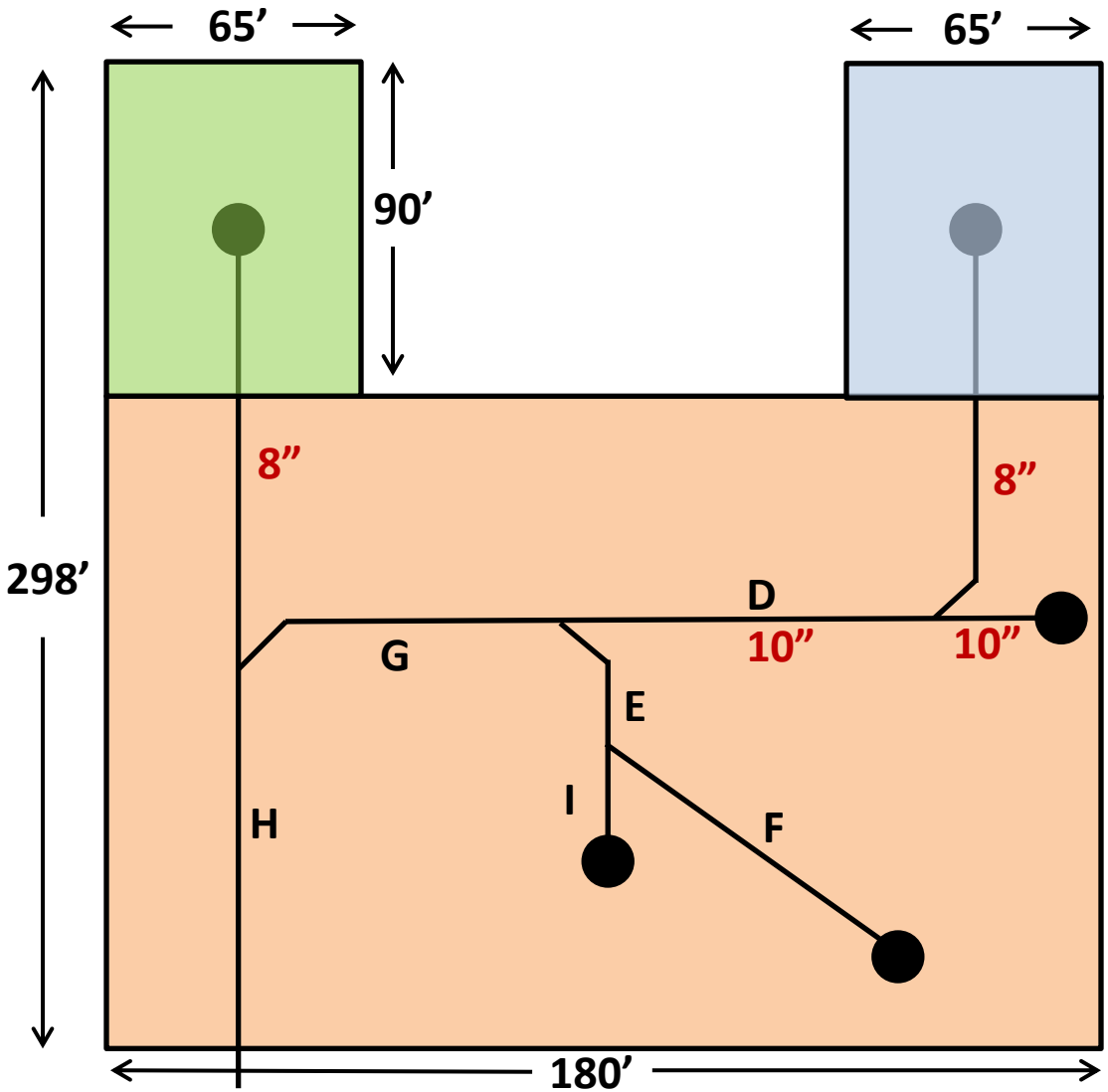


298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
Use 1/8 Inch slope column
8” drain allows 11,500 sq ft
10” drain allows 20,700 sq ft

C = 10”

SIZING STORM DRAINS

1/8” per foot

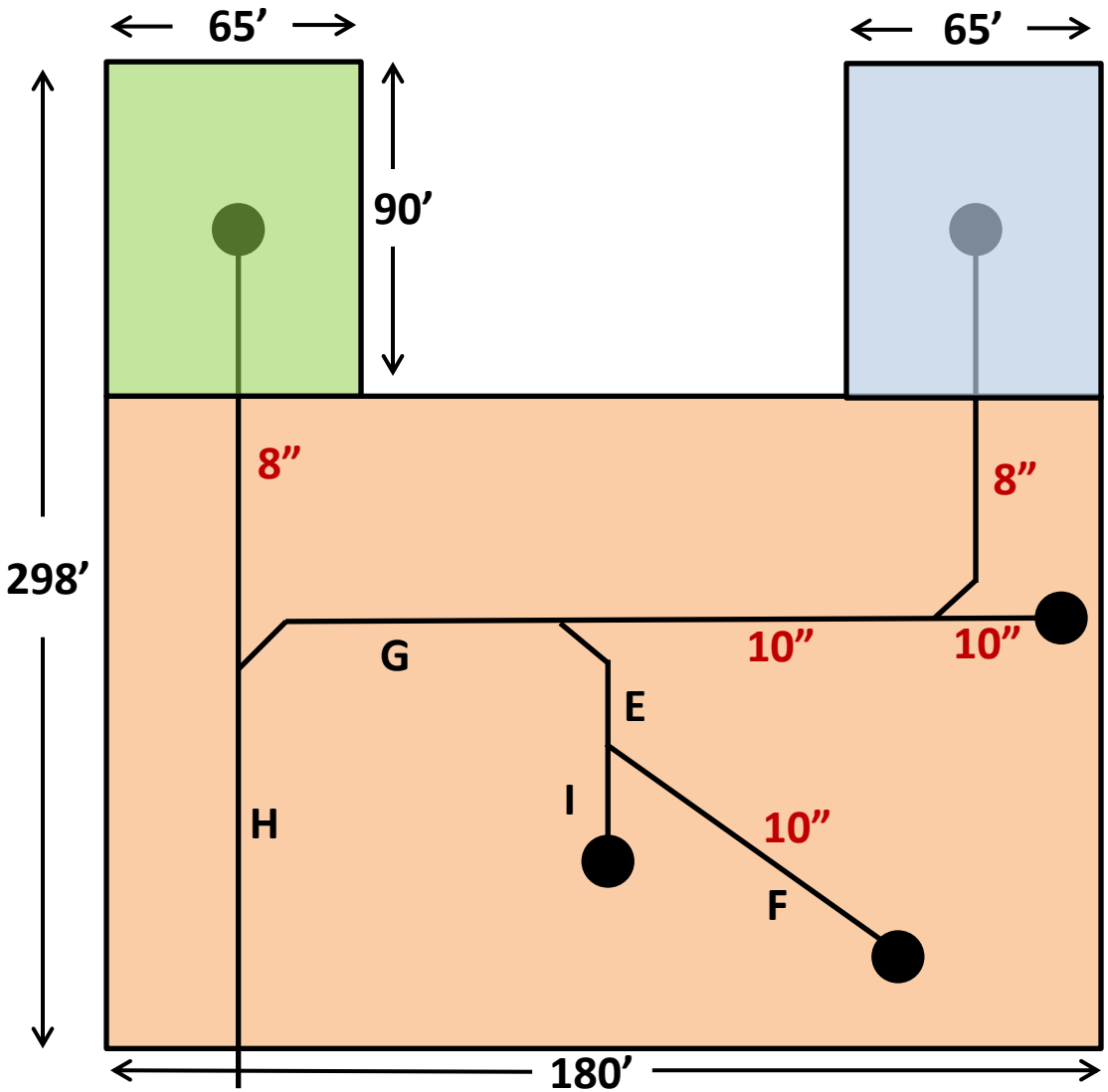


65 x 90 = **5,850**
298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
12,480 + 5,850 = 18,330
Use 1/8 Inch slope column
8” drain allows 11,500 sq ft
10” drain allows 20,700 sq ft

D = 10”

SIZING STORM DRAINS

1/8” per foot

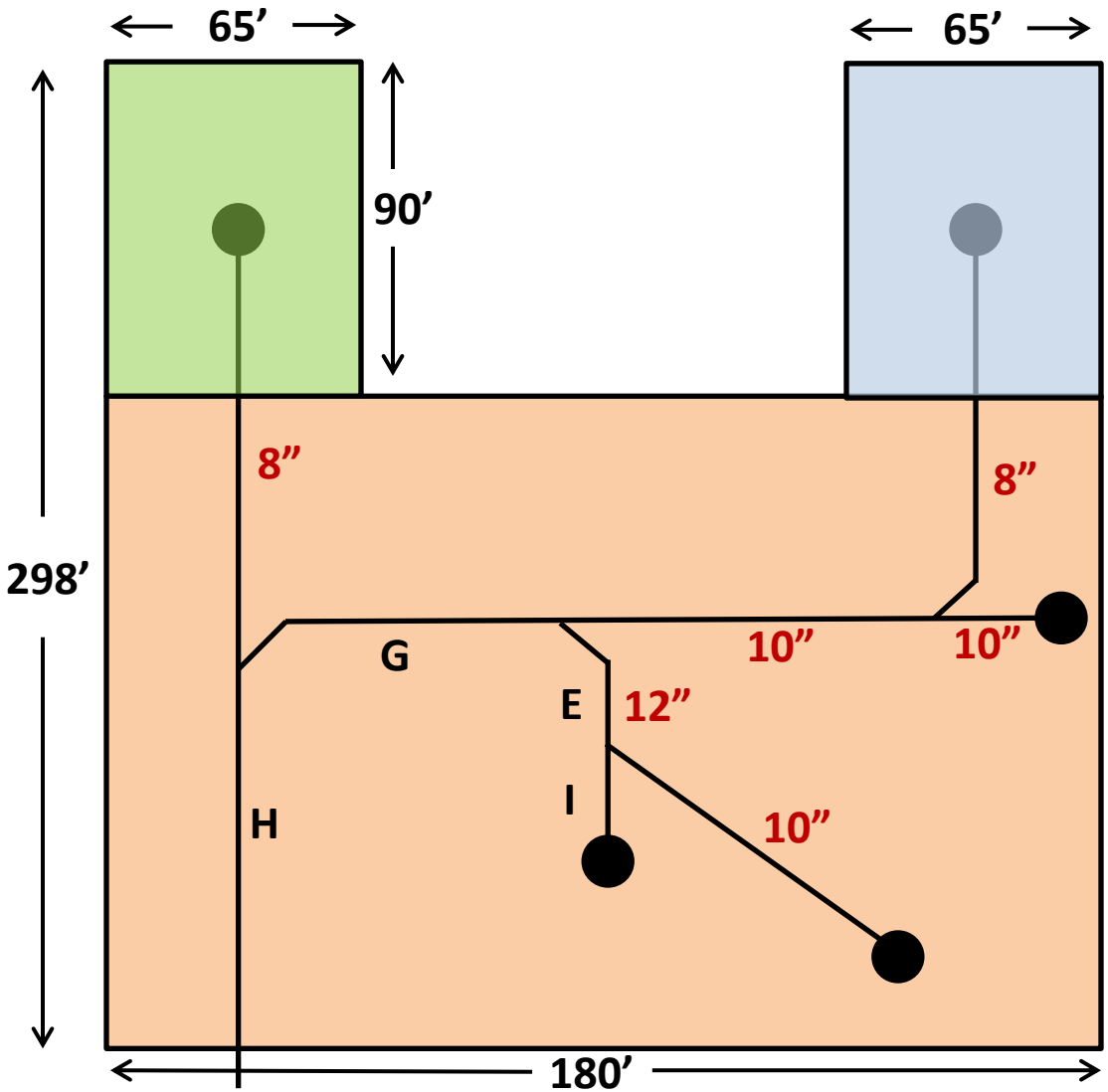


298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
Use 1/8 Inch slope column
8” drain allows 11,500 sq ft
10” drain allows 20,700 sq ft

F = 10”

SIZING STORM DRAINS

1/8” per foot

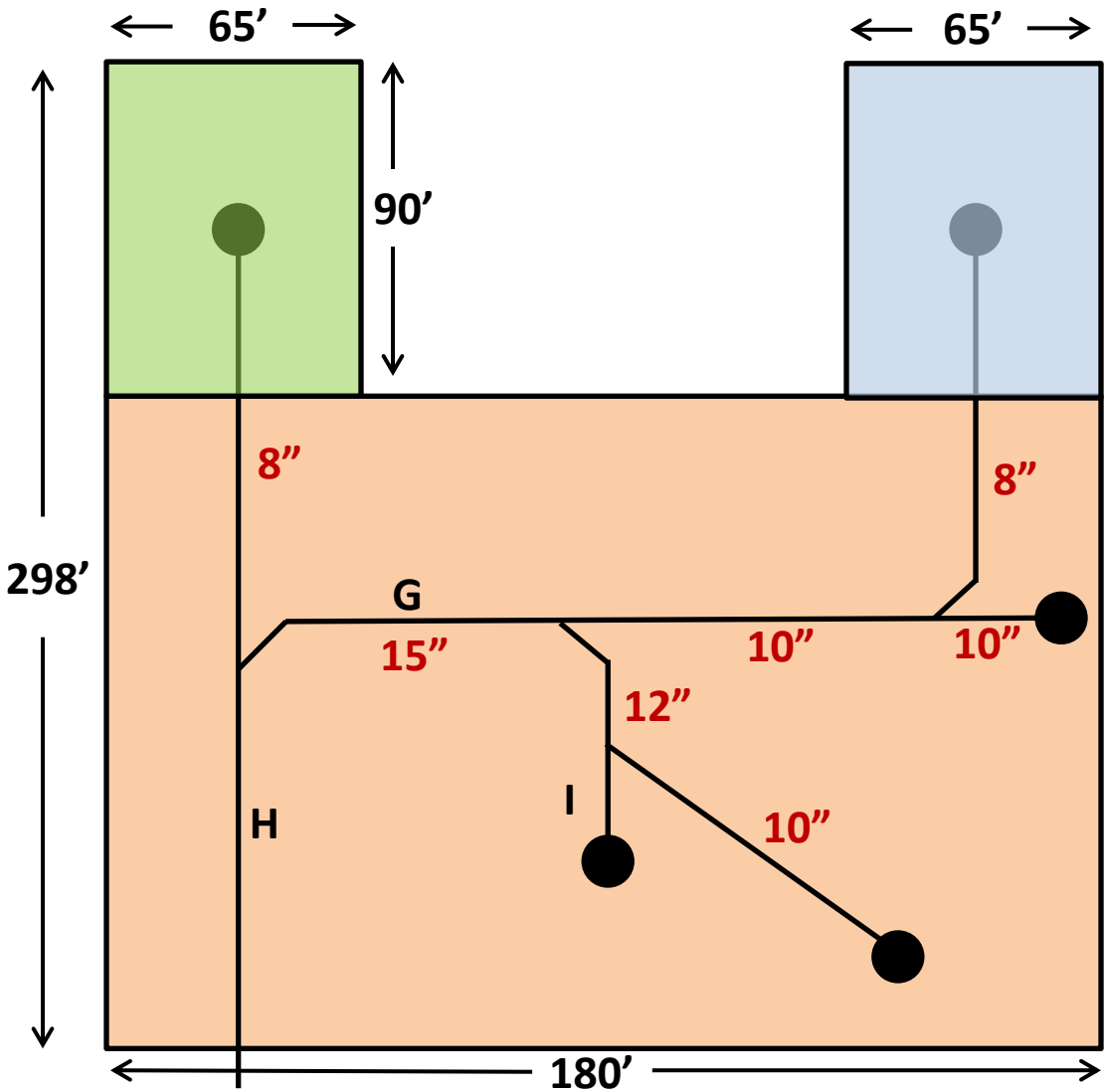


298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = 12,480
12,480 x 2 = **24,960**
Use 1/8 Inch slope column
10” drain allows 20,700 sq ft
12” drain allows 33,300 sq ft

E = 12”

SIZING STORM DRAINS

1/8” per foot

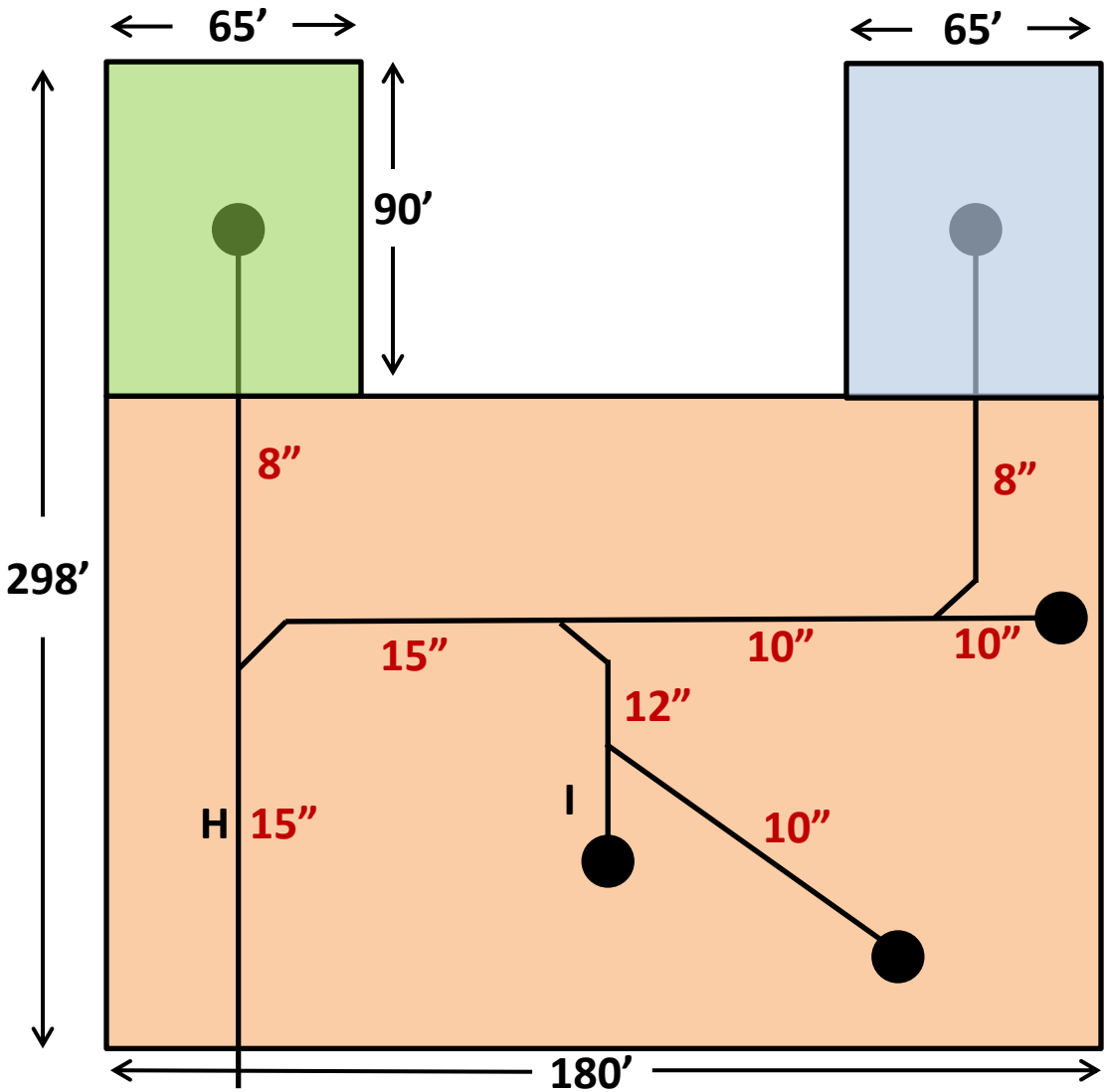


65 x 90 = **5,850**
298 – 90 = 208
208 x 180 = **37,440**
37,440 + 5850 **= 43,290**
Use 1/8 Inch slope column
12” drain allows 33,300 sq ft
15” drain allows 59,500 sq ft

G = 15”

SIZING STORM DRAINS

1/8” per foot

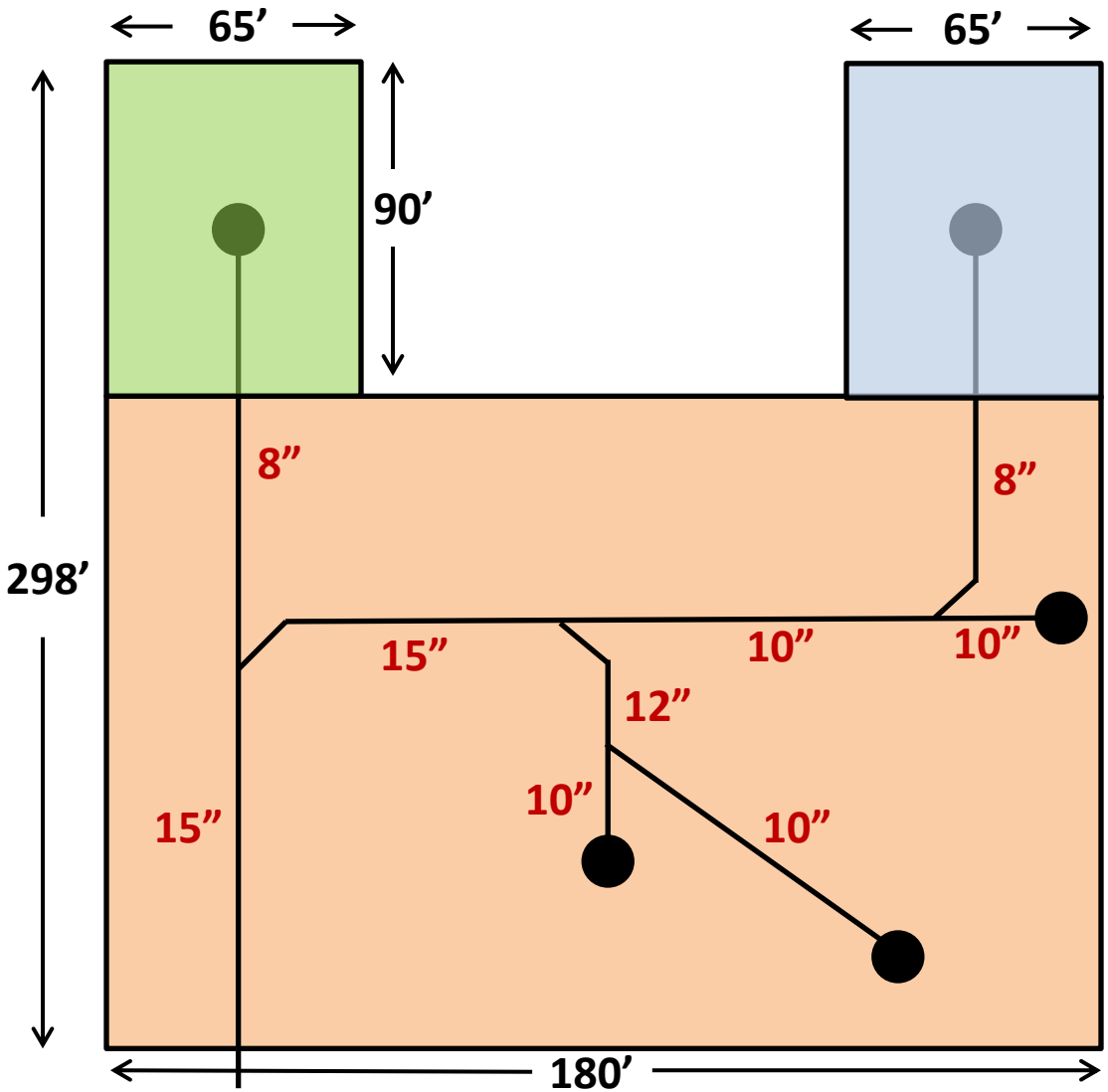


65 x 90 = 5,850
5,850 x 2 = **11,780**
298 – 90 = 208
208 x 180 = **37,440**
37,440 + 11,780 **= 49,140**
Use 1/8 Inch slope column
12” drain allows 33,300 sq ft
15” drain allows 59,500 sq ft

H = 15”

SIZING STORM DRAINS

1/8” per foot

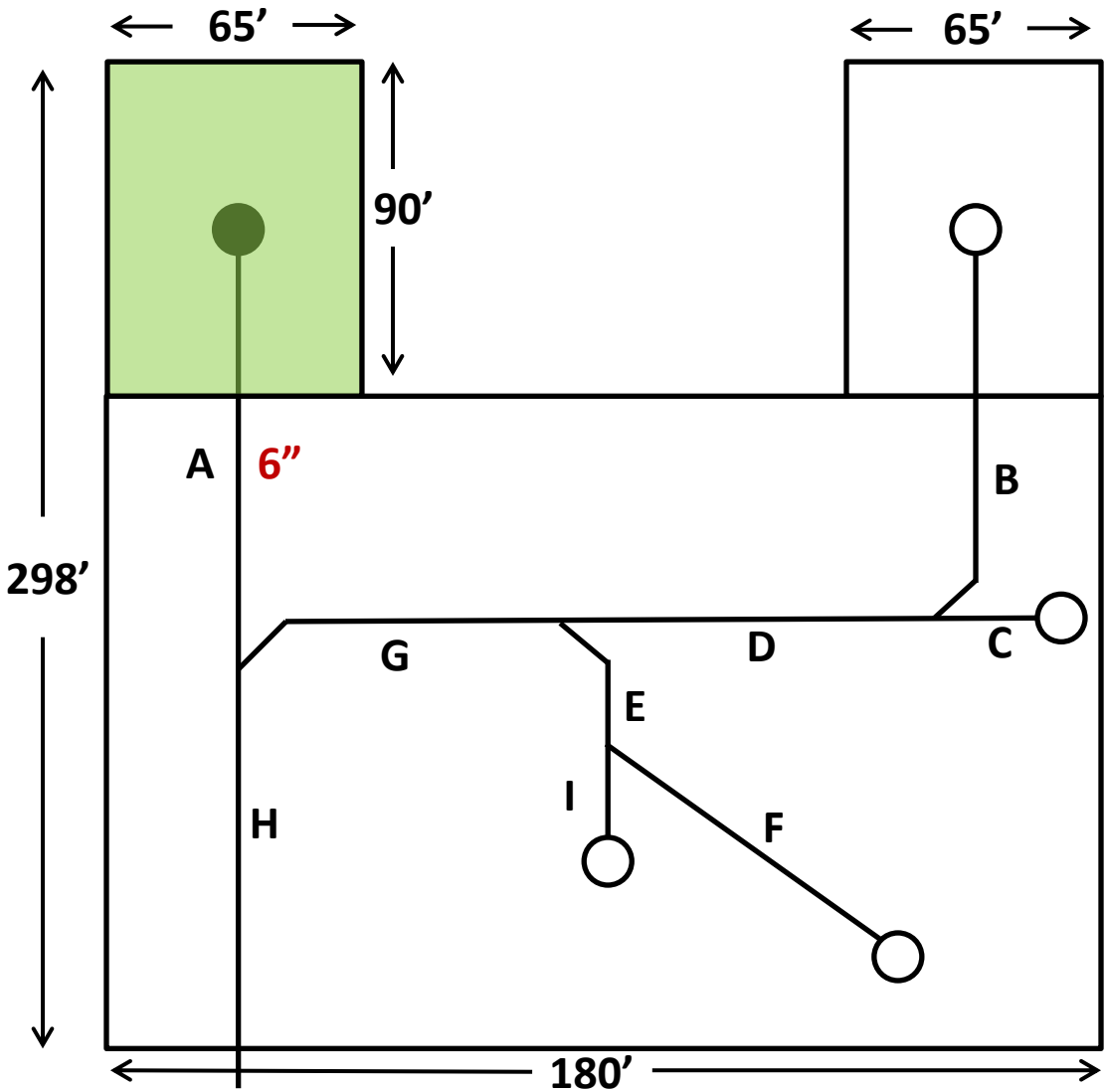


298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
Use 1/8 Inch slope column
8” drain allows 11,500 sq ft
10” drain allows 20,700 sq ft

I = 10”

SIZING STORM DRAINS

1/4” per foot

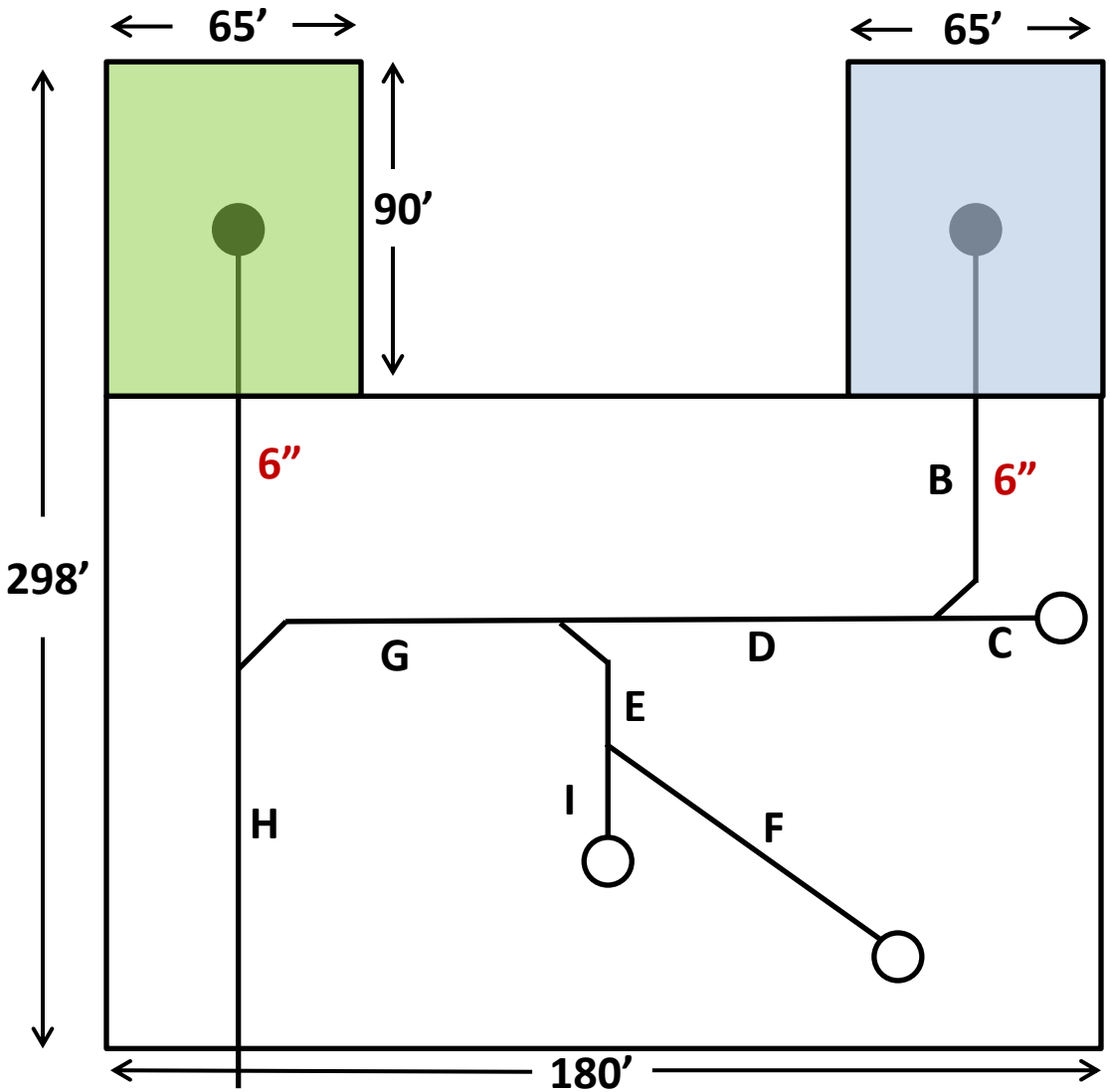


65 x 90 = **5,850**
Use 1/4 Inch slope column
5” drain allows 4,720 sq ft
6” drain allows 7,550 sq ft

A = 6”

SIZING STORM DRAINS

1/4” per foot

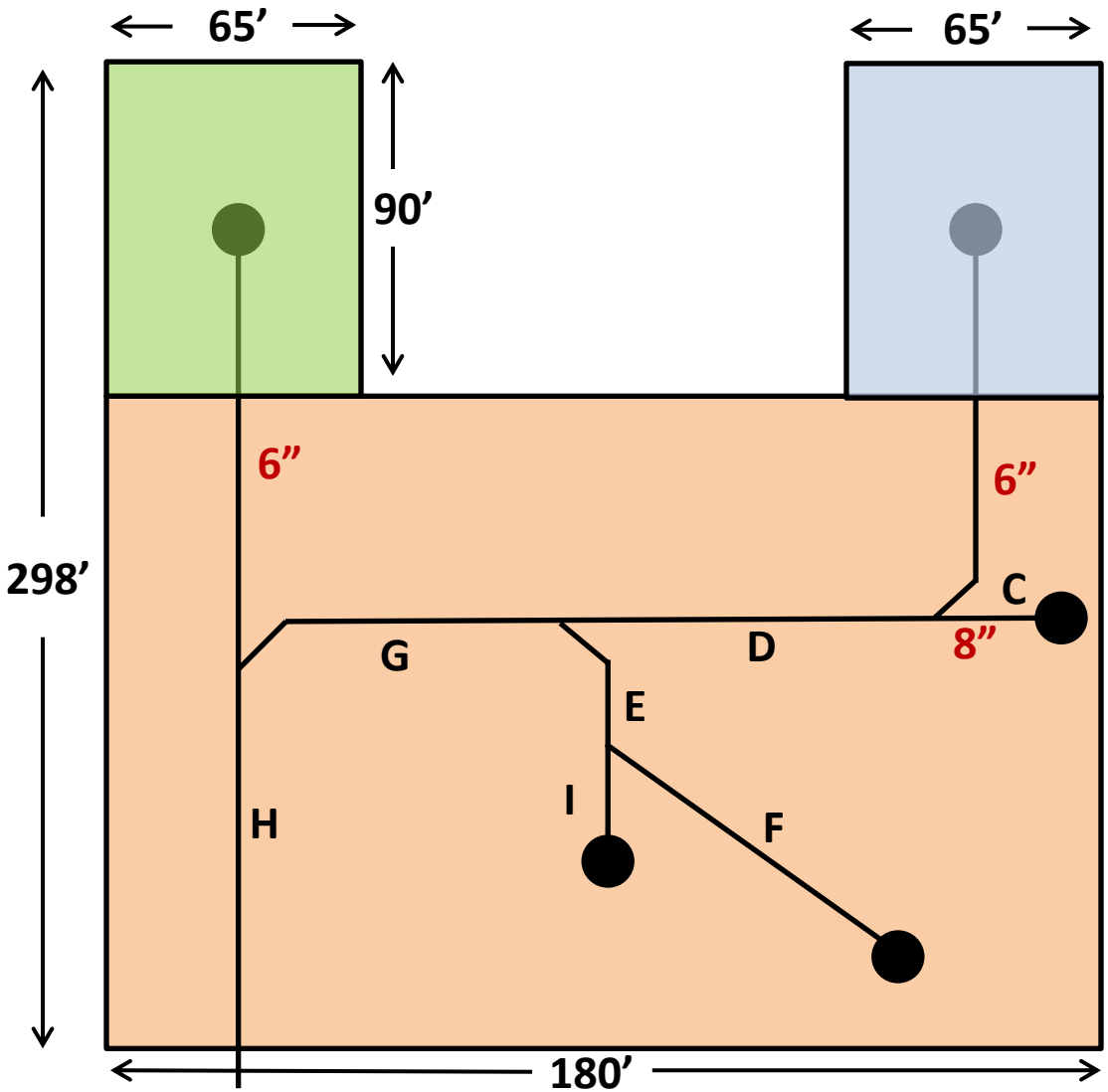


65 x 90 = **5,850**
Use 1/4 Inch slope column
5” drain allows 4,720 sq ft
6” drain allows 7,550 sq ft

B = 6”

SIZING STORM DRAINS

1/4” per foot

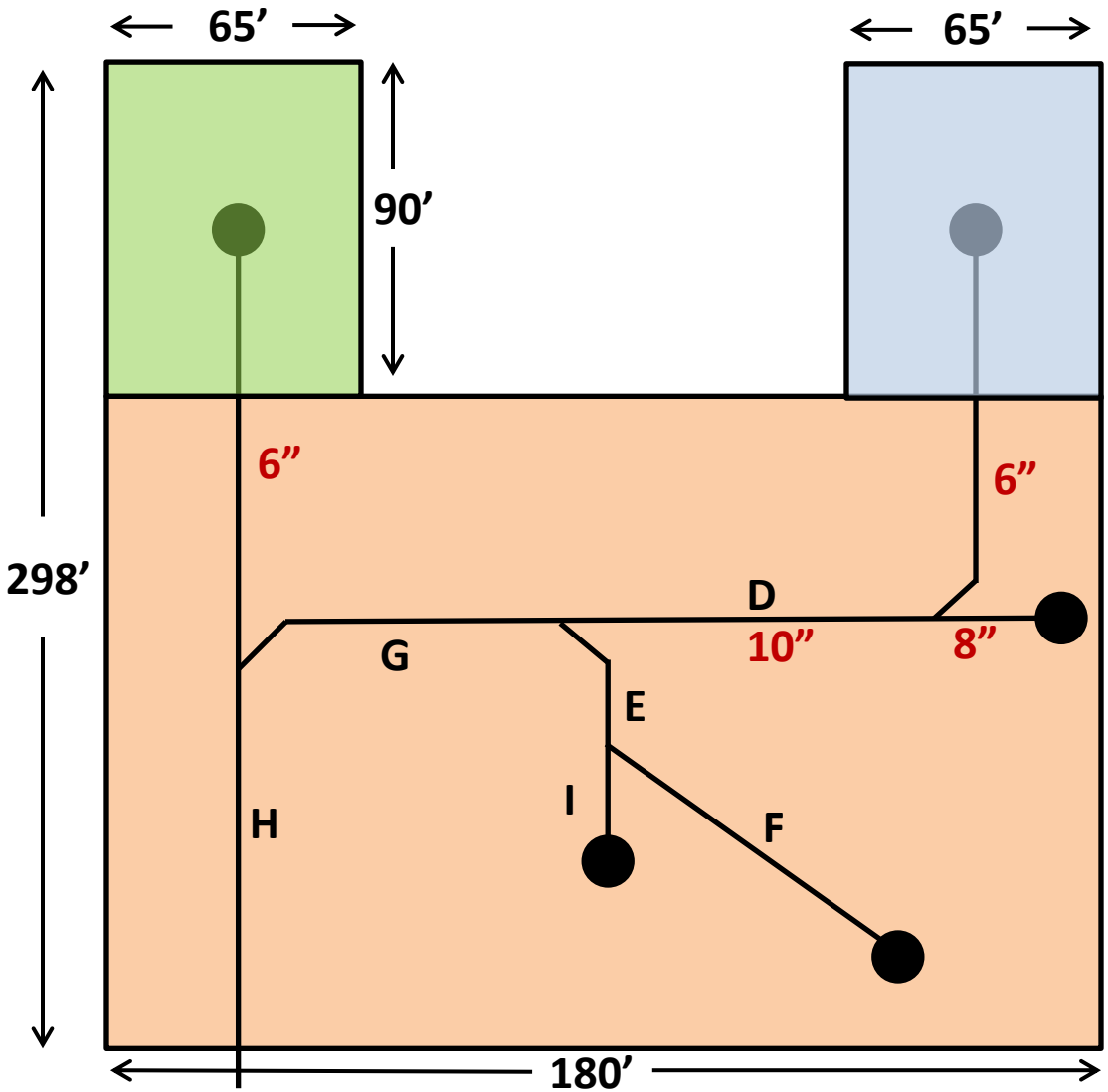


298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
Use 1/4 Inch slope column
6” drain allows 7,550 sq ft
8” drain allows 16,300sq ft

C = 8”

SIZING STORM DRAINS

1/4” per foot

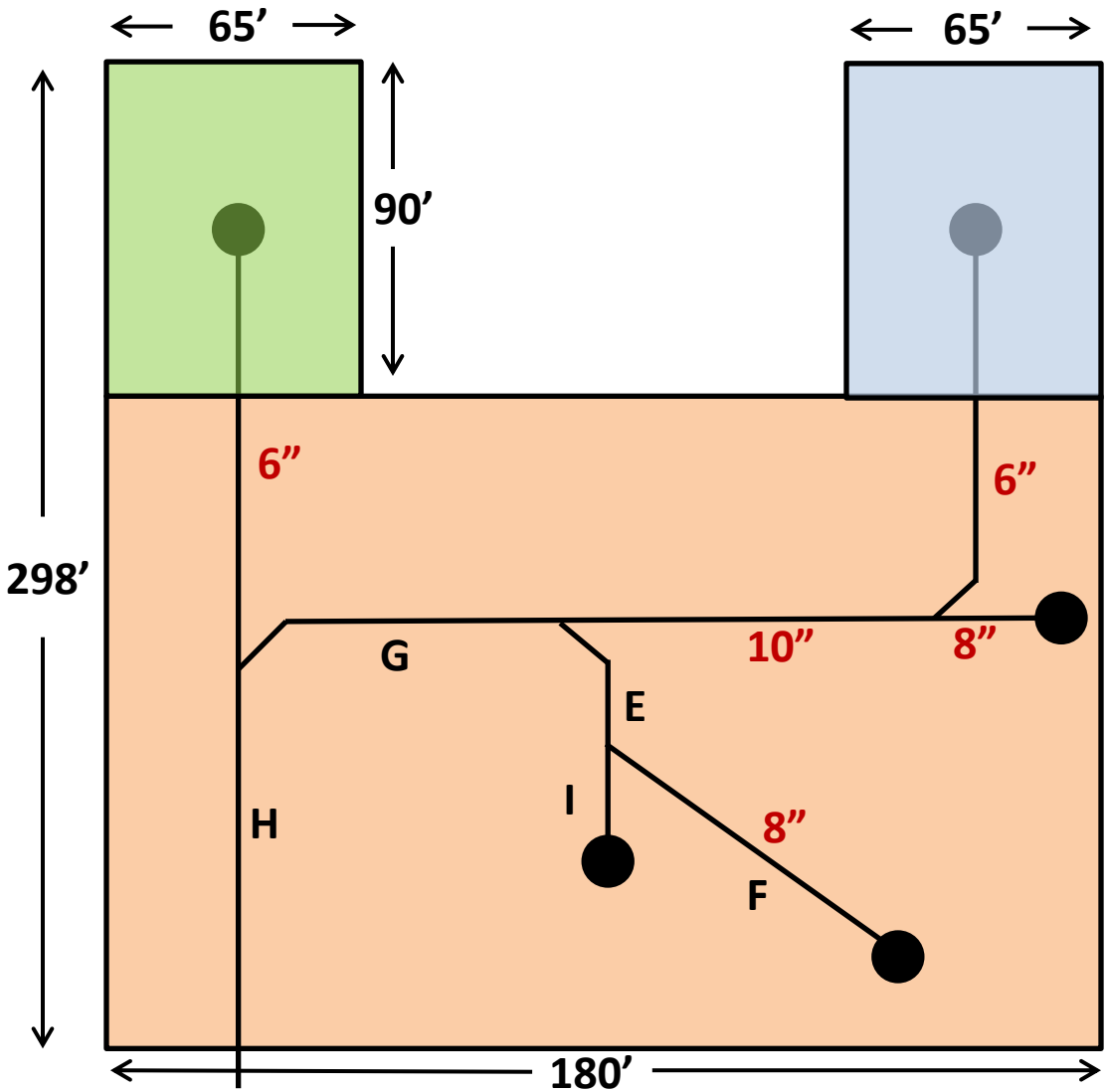


65 x 90 = **5,850**
298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
12,480 + 5,850 = 18,330
Use 1/4 Inch slope column
8” drain allows 16,300 sq ft
10” drain allows 29,200 sq ft

D = 10”

SIZING STORM DRAINS

1/4” per foot

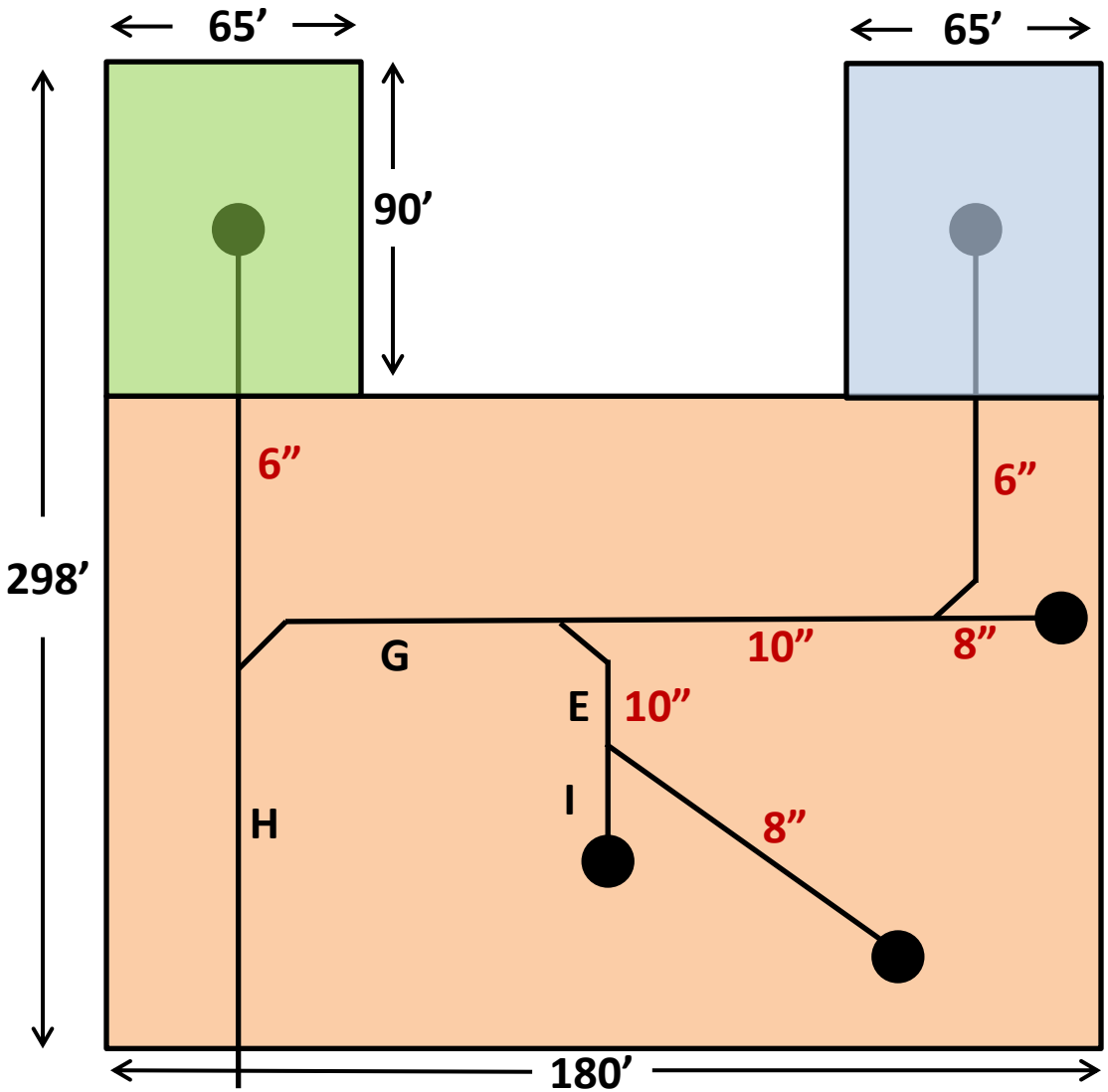


298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
Use 1/4 Inch slope column
6” drain allows 7,550 sq ft
8” drain allows 16,300 sq ft

F = 8”

SIZING STORM DRAINS

1/4” per foot

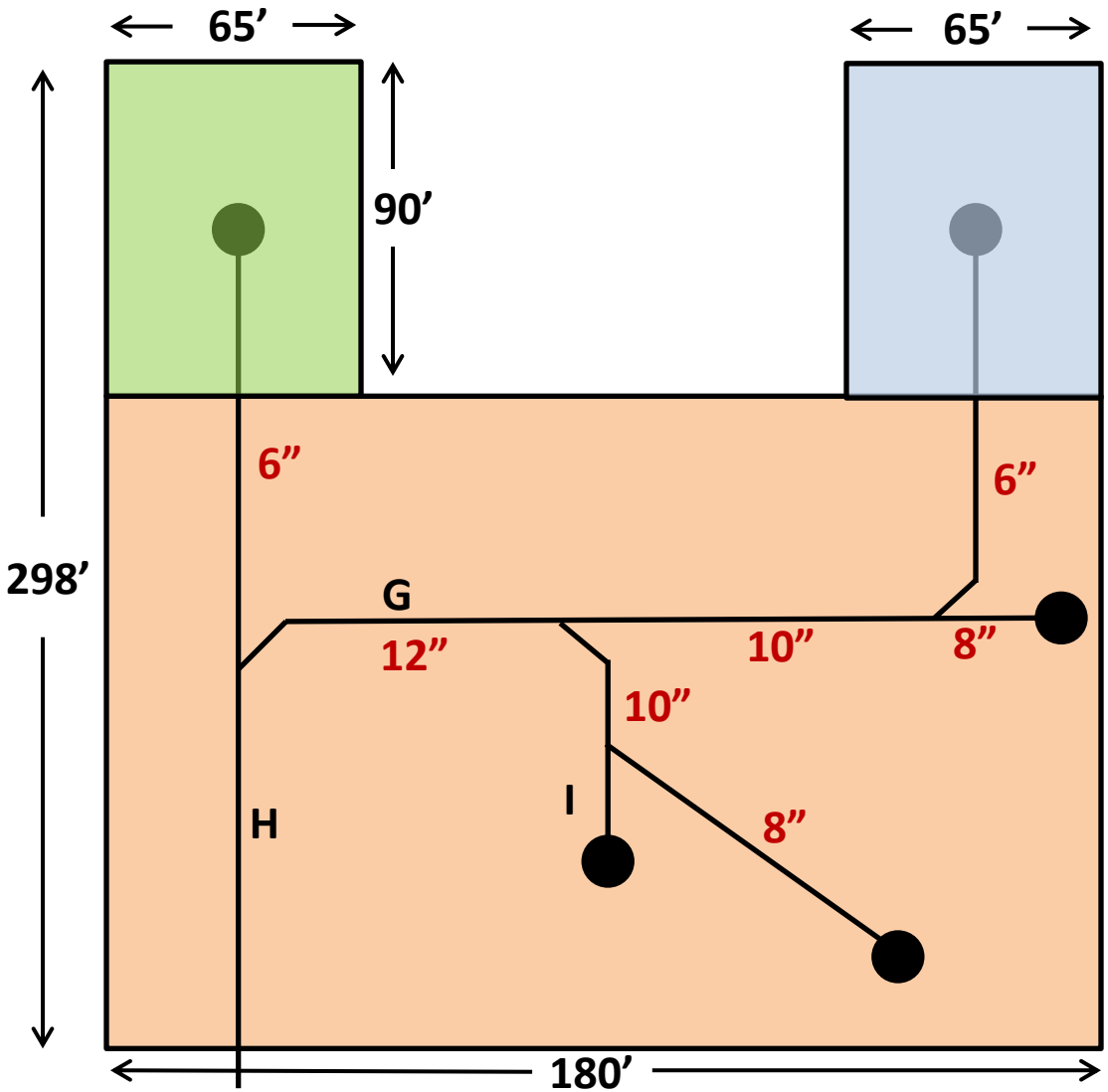


298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = 12,480
12,480 x 2 = **24,960**
Use 1/4 Inch slope column
8” drain allows 16,300 sq ft
10” drain allows 29,200 sq ft

E = 10”

SIZING STORM DRAINS

1/4” per foot

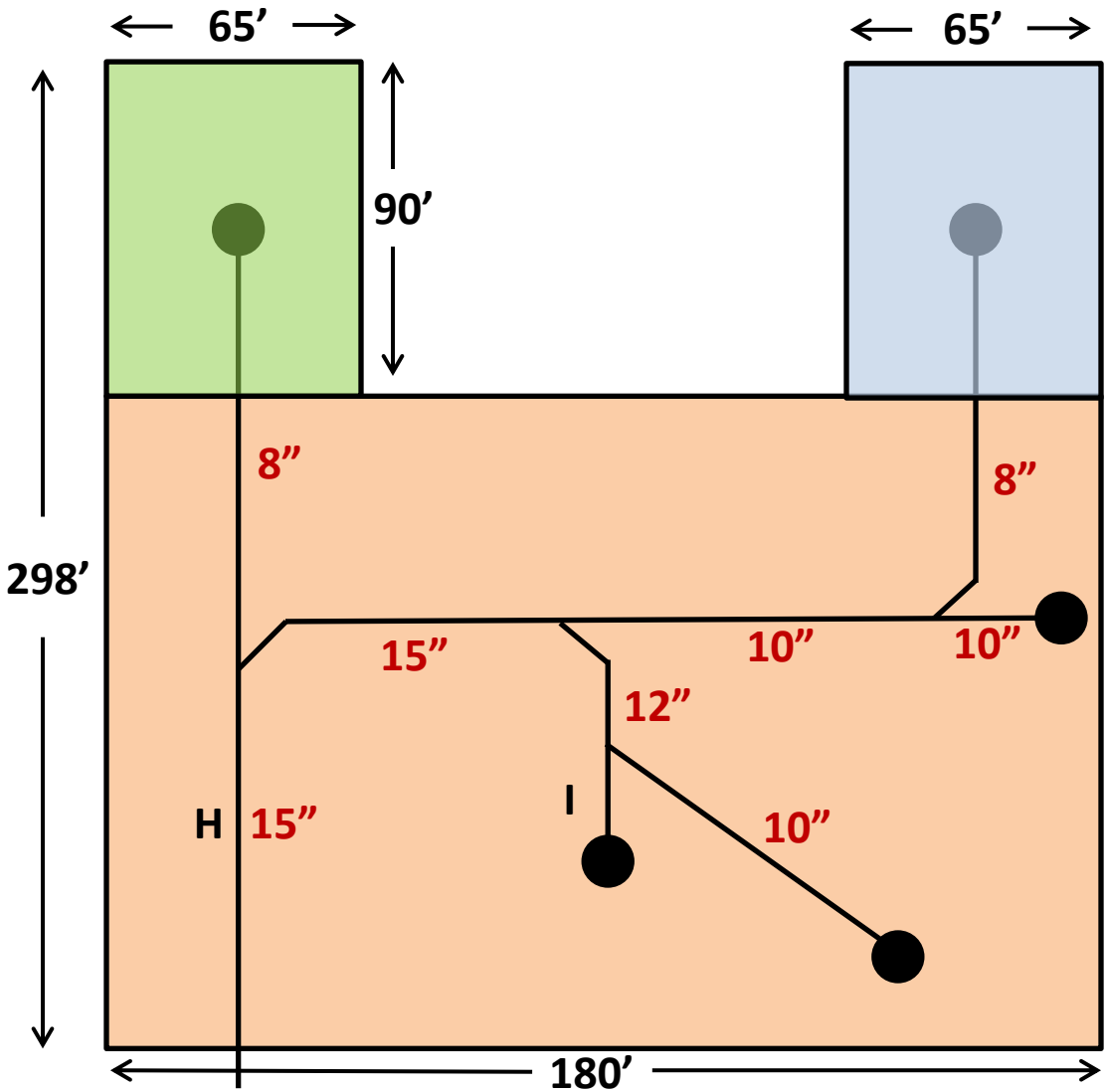


65 x 90 = **5,850**
298 – 90 = 208
208 x 180 = **37,440**
37,440 + 5850 **= 43,290**
Use 1/4 Inch slope column
10” drain allows 29,200 sq ft
12” drain allows 47,000 sq ft

G = 12”

SIZING STORM DRAINS

1/4” per foot

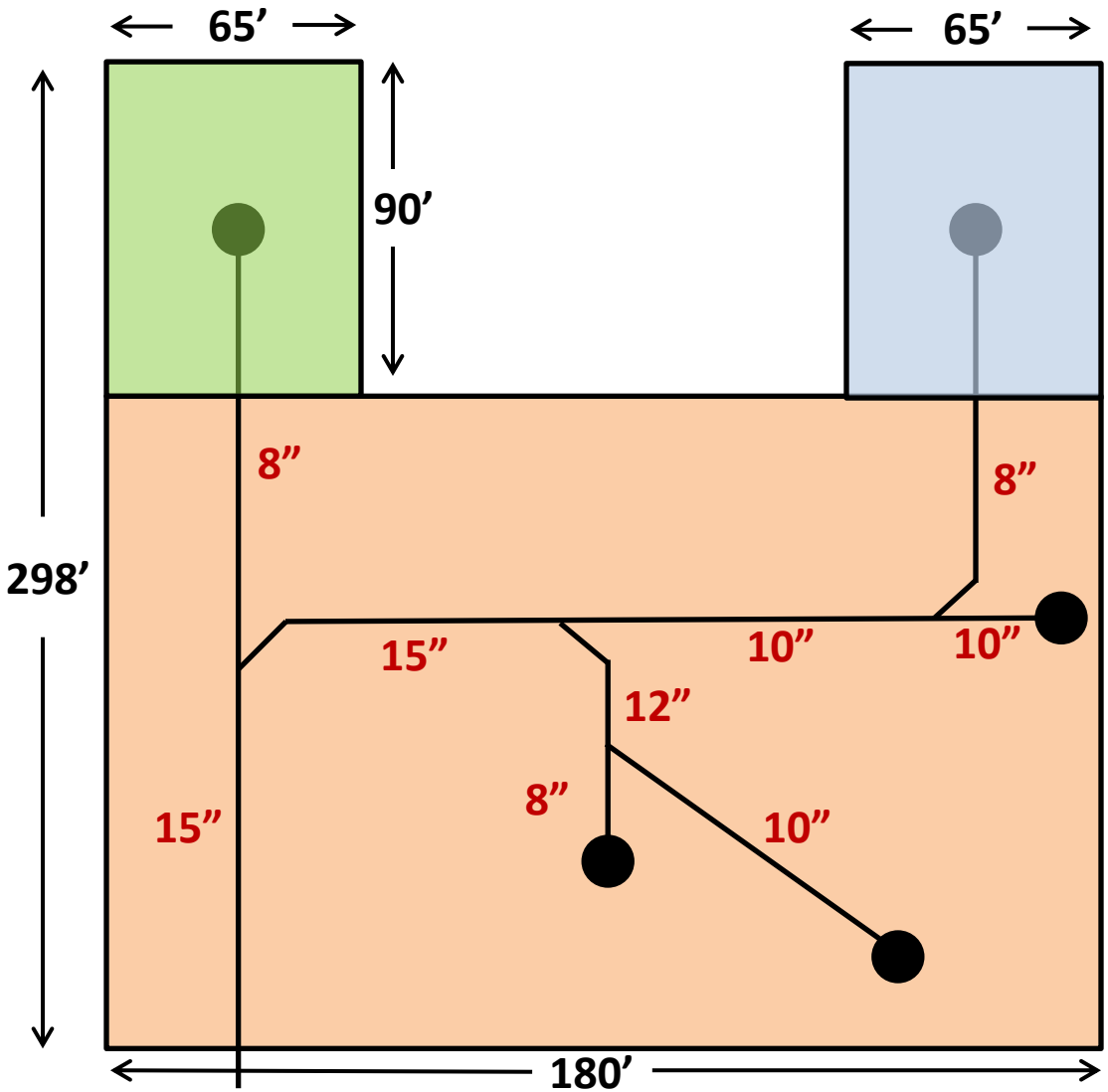


65 x 90 = 5,850
5,850 x 2 = **11,780**
298 – 90 = 208
208 x 180 = **37,440**
37,440 + 11,780 **= 49,140**
Use 1/4 Inch slope column
12” drain allows 47,000 sq ft
15” drain allows 84,000 sq ft

H = 15”

SIZING STORM DRAINS

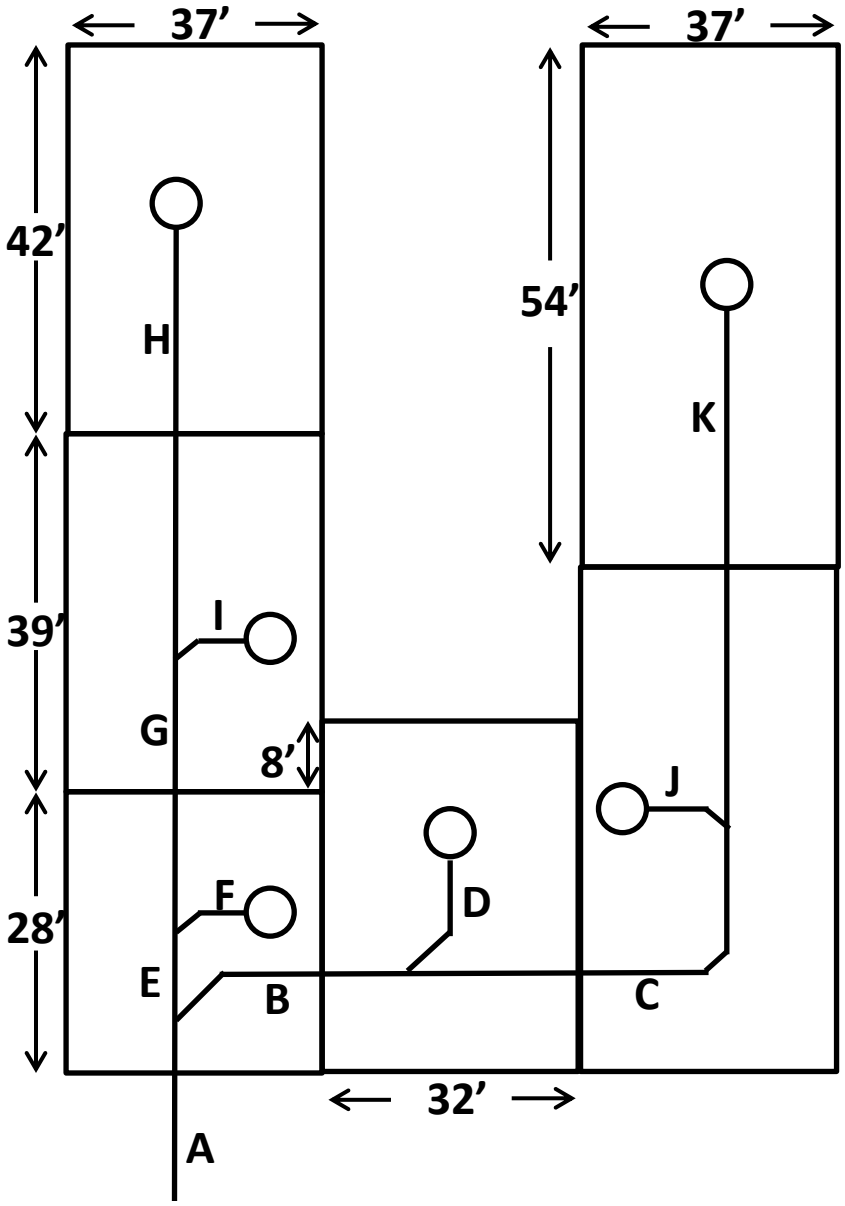
1/4” per foot



298 – 90 = 208
208 x 180 = 37,440
37,440 / 3 = **12,480**
Use 1/4 Inch slope column
6” drain allows 7,550 sq ft
8” drain allows 16,300 sq ft

I = 8”

SIZING STORM DRAINS

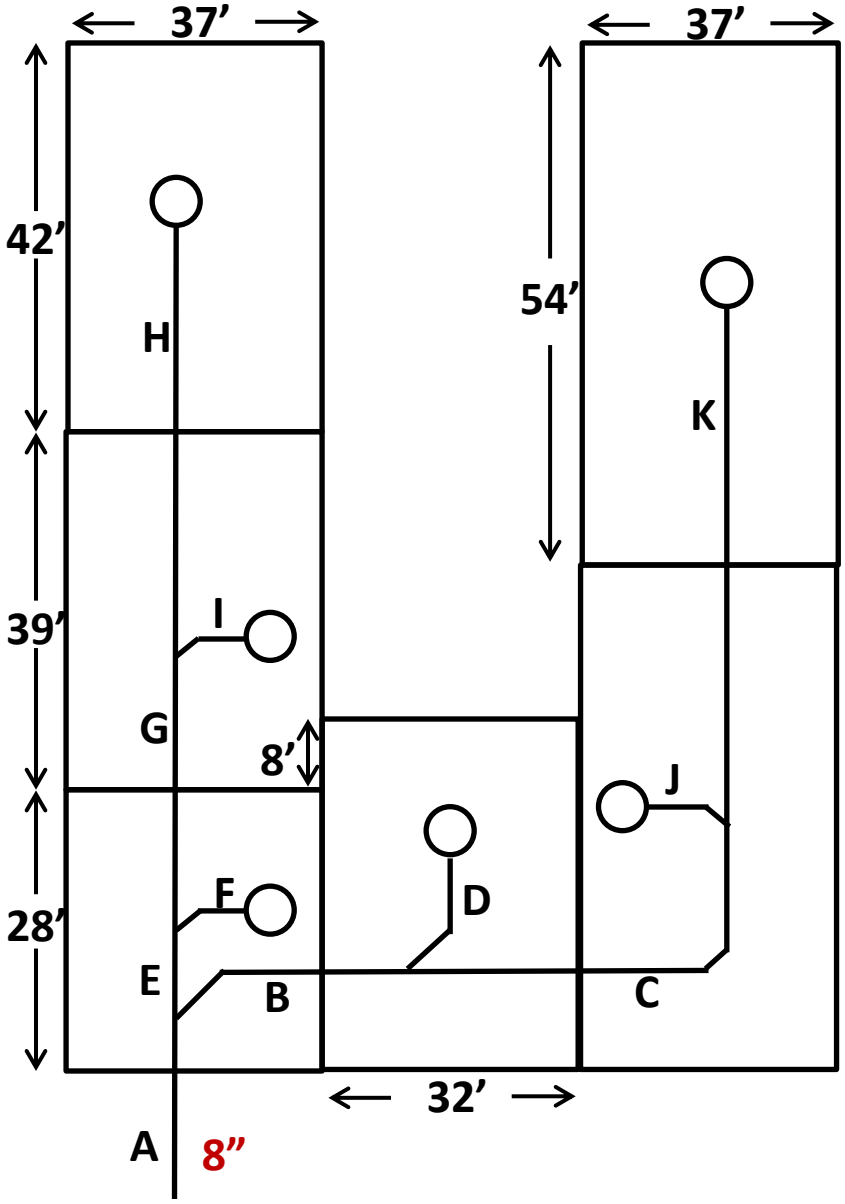


3 STEPS TO SIZING

1. Determine the area covered by each roof drain (length x width)
2. Use TABLE 1 to determine the sizes of A through K
3. Choose the proper slope from TABLE 1

SIZING STORM DRAINS

1/8” per foot



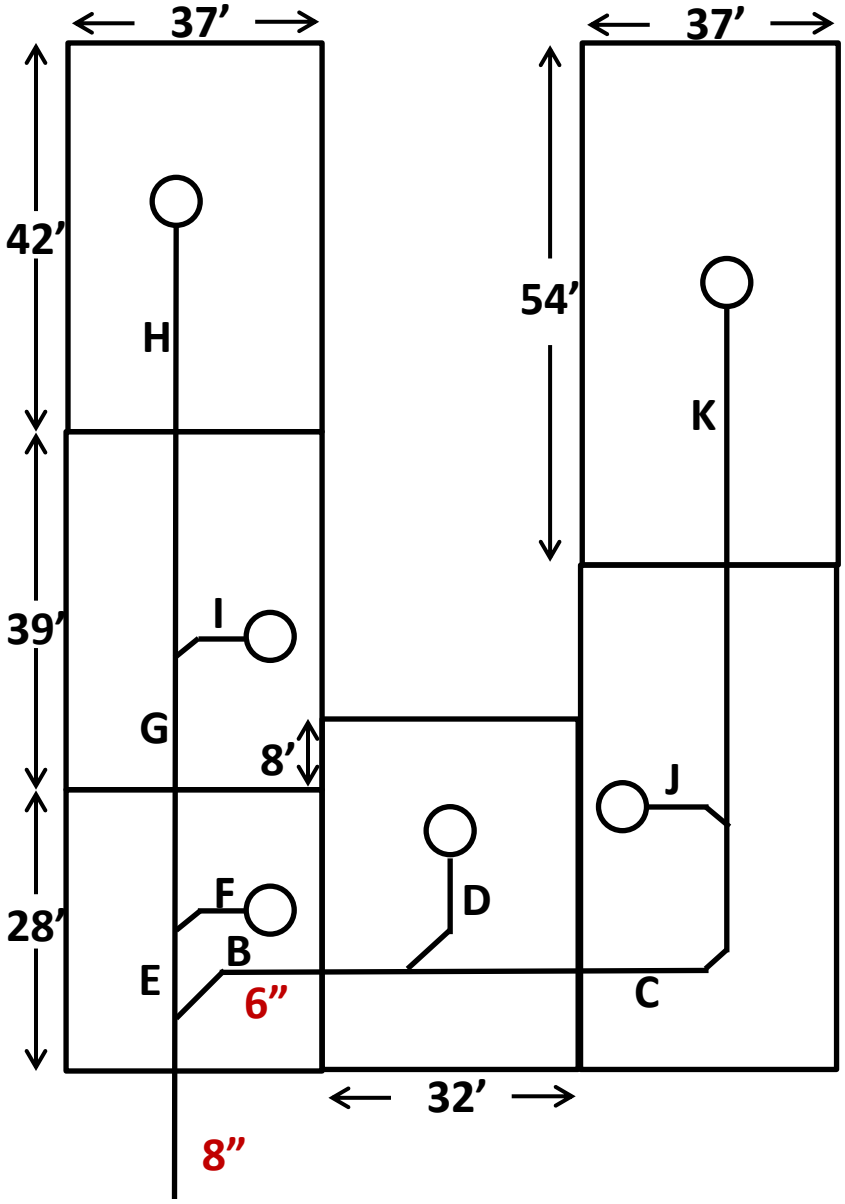
H: 42’ x 37’ =	1,554
I: 39’ x 37’ =	1,443
F: 28’ x 37’ =	1,036
D: 28’+8’ x 32’ =	1,152
J: 42+39+28-54 = 55 x 37 =	2,035
K: 54’ x 37’ =	1,998
Total:	9,218

Total Load = **9,218**
6” drain allows 5,350 sq ft
8” drain allows 11,500 sq ft

Determine A

A = 8”

SIZING STORM DRAINS



1/8” per foot

D: 28’+8’ x 32’ =	1,152
J: 42+39+28-54 = 55 x 37 =	2,035
K: 54’ x 37’ =	1,998
Total:	**5,185**

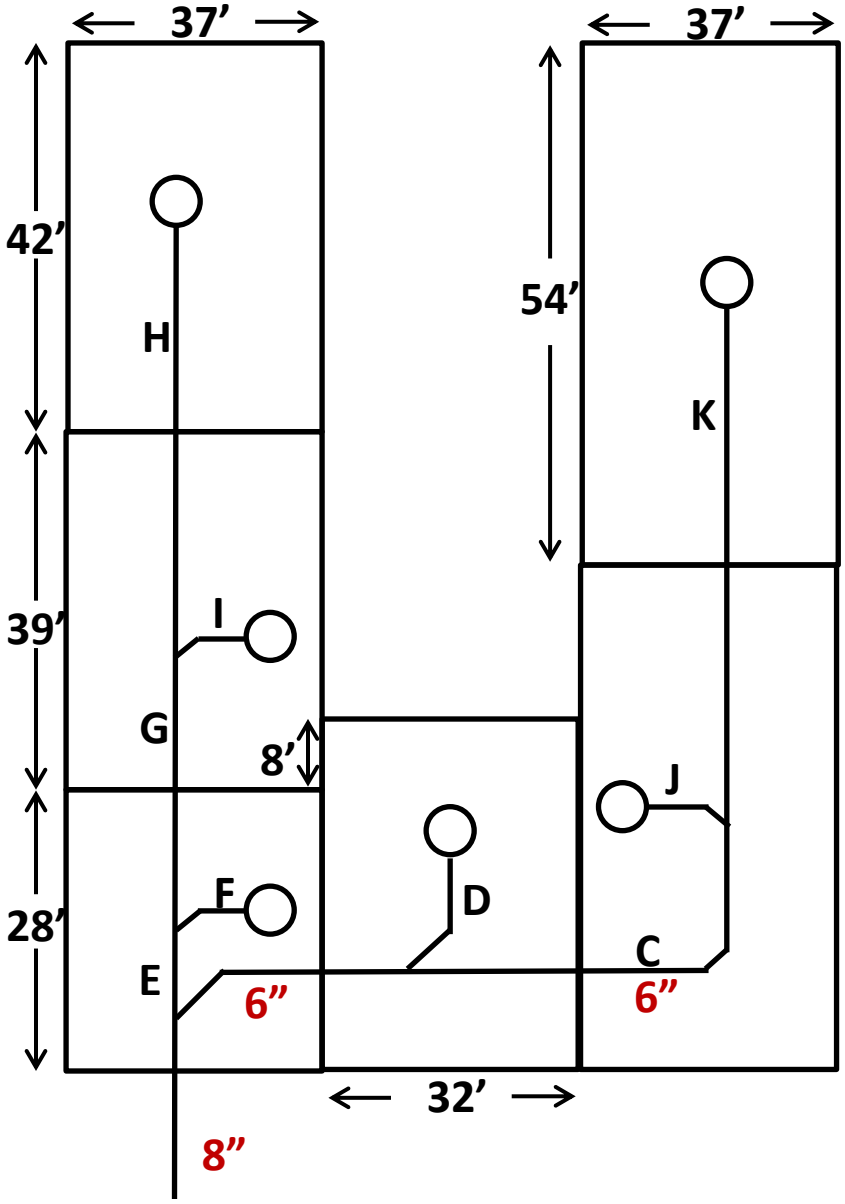
5” drain allows 3,340 sq ft
6” drain allows 5,350 sq ft

Determine B

B = 6”

SIZING STORM DRAINS

1/8” per foot



J: 42+39+28-54 = 55 x 37 = 2,035
K: 54’ x 37’ = 1,998

Total: **4,033**

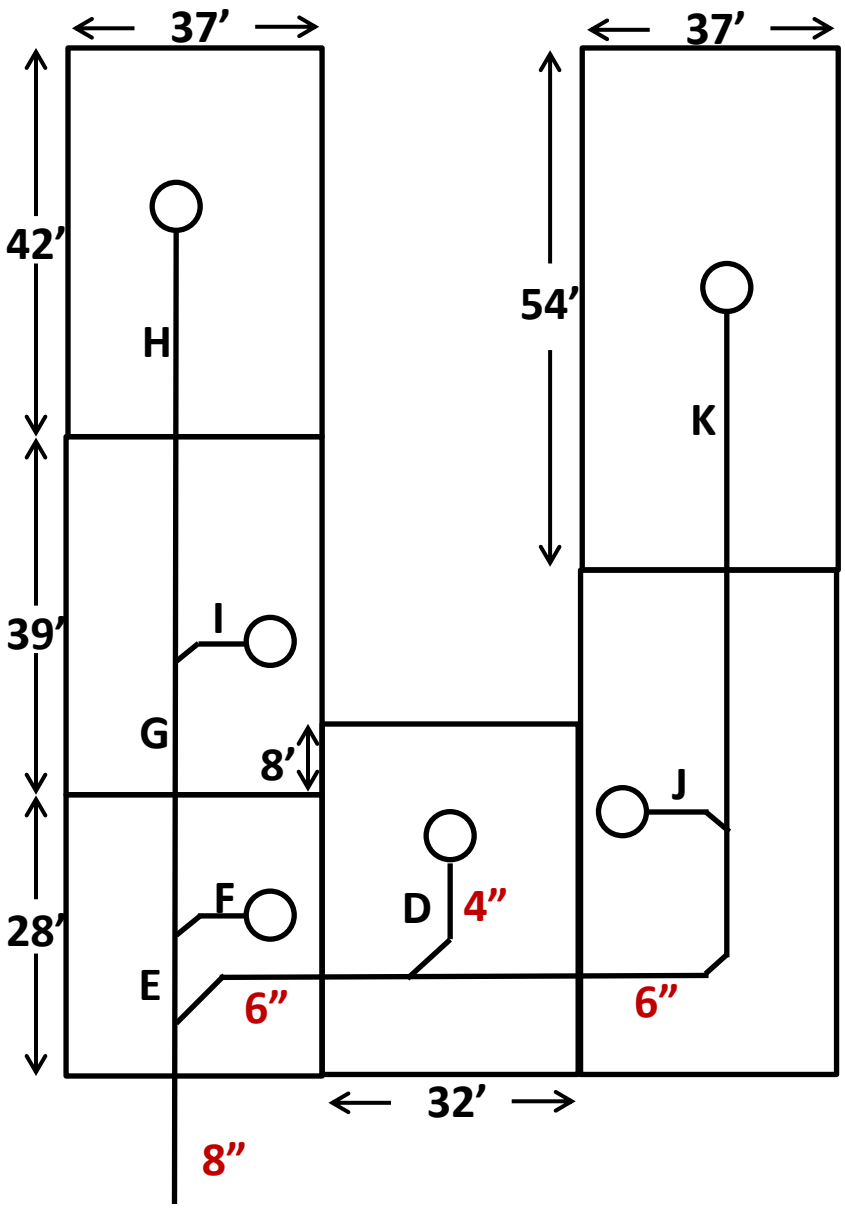
5” drain allows 3,340 sq ft
6” drain allows 5,350 sq ft

Determine C

C = 6”

SIZING STORM DRAINS

1/8” per foot



D: 28’+8’ x 32’ =	1,152
Total:	**1,152**

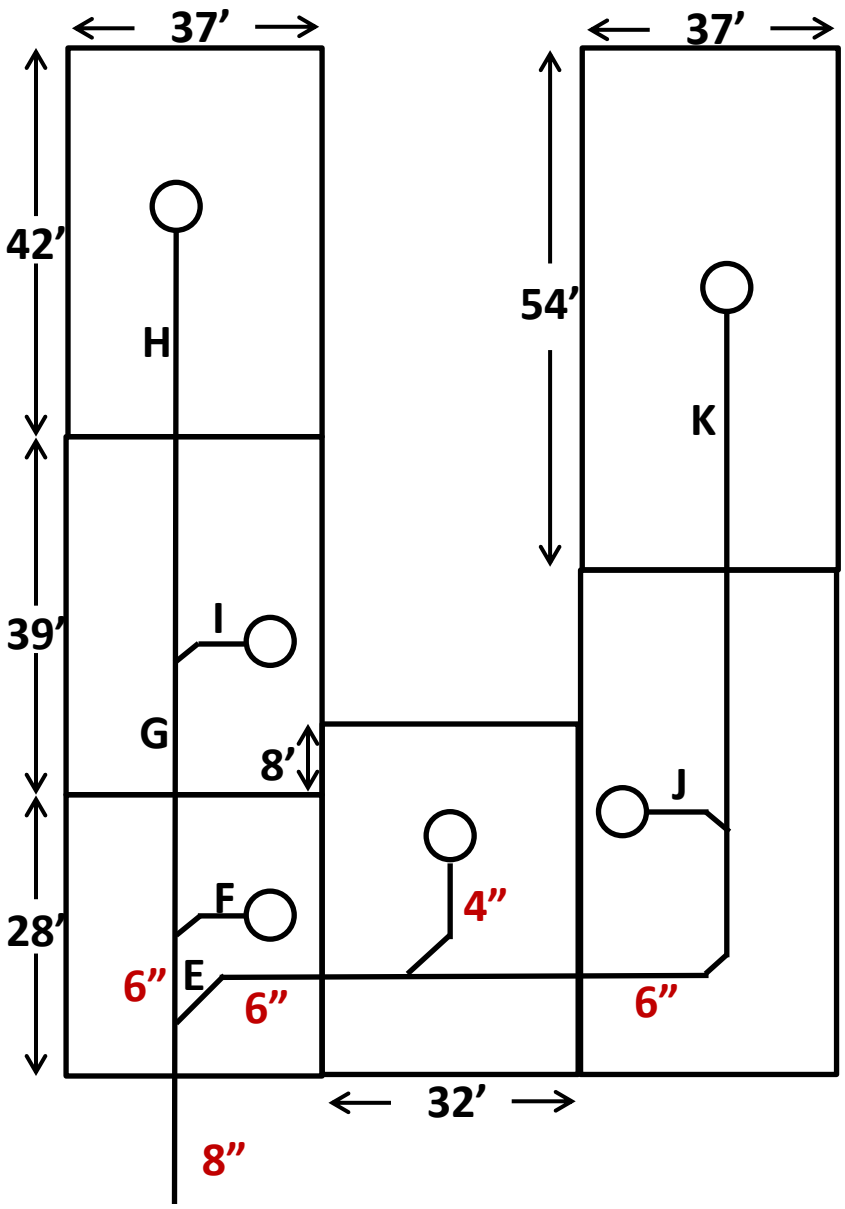
4” drain allows 1,880 sq ft
5” drain allows 3,340 sq ft

Determine D

D = 4”

SIZING STORM DRAINS

1/8” per foot



H: 42’ x 37’ =	1,554
I: 39’ x 37’ =	1,443
F: 28’ x 37’ =	1,036
Total:	**4,033**

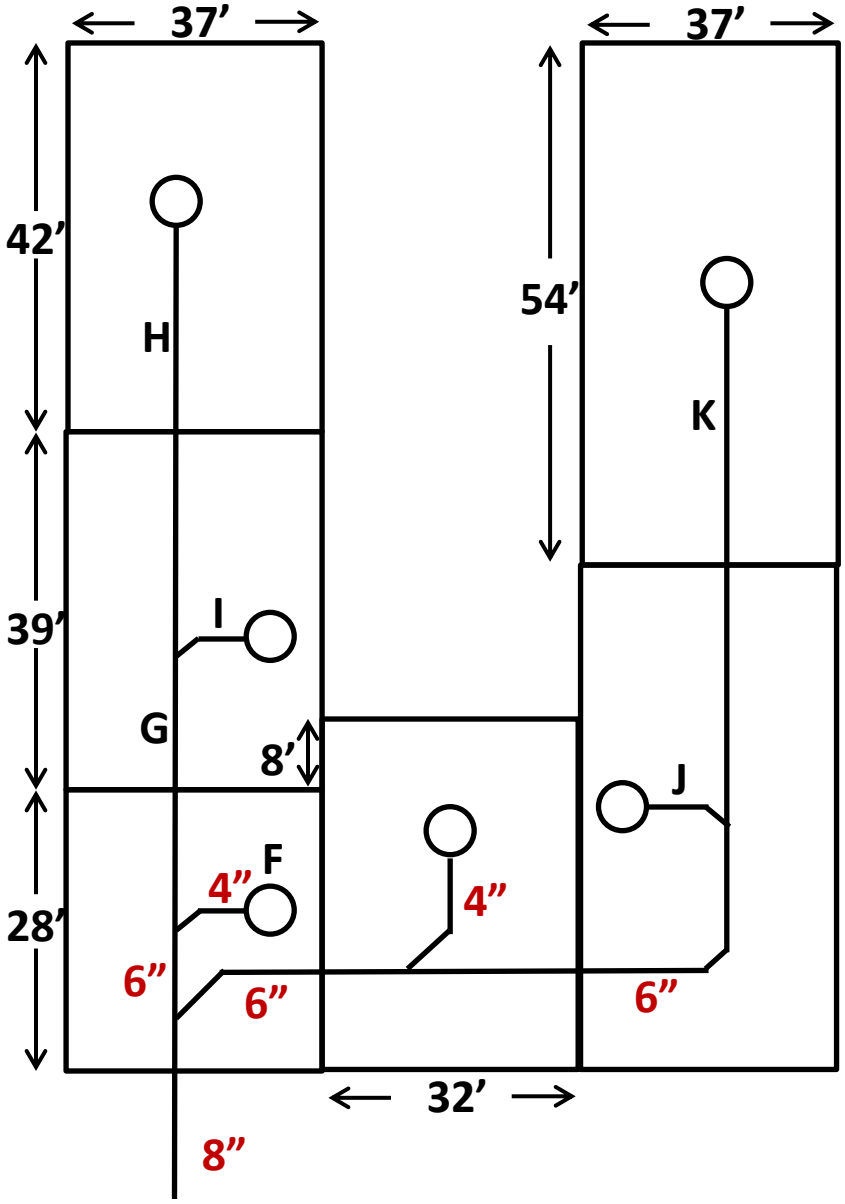
5” drain allows 3,340 sq ft
6” drain allows 5,350 sq ft

Determine E

E = 6”

SIZING STORM DRAINS

1/8” per foot



F: 28’ x 37’ = 1,036

Total: **1,036**

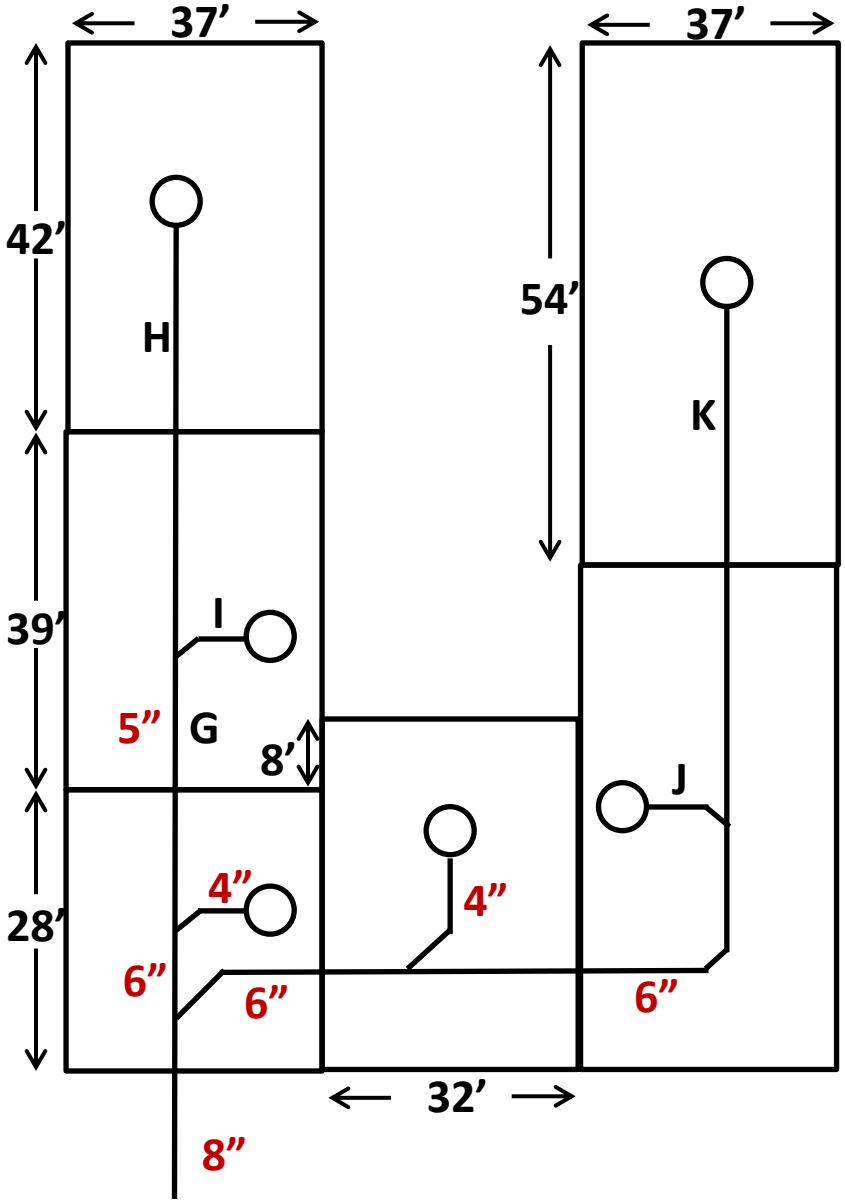
4” drain allows 1,880 sq ft
5” drain allows 3,340 sq ft

Determine F

F = 4”

SIZING STORM DRAINS

1/8” per foot



H: 42’ x 37’ =	1,554
I: 39’ x 37’ =	1,443
Total:	**2,997**

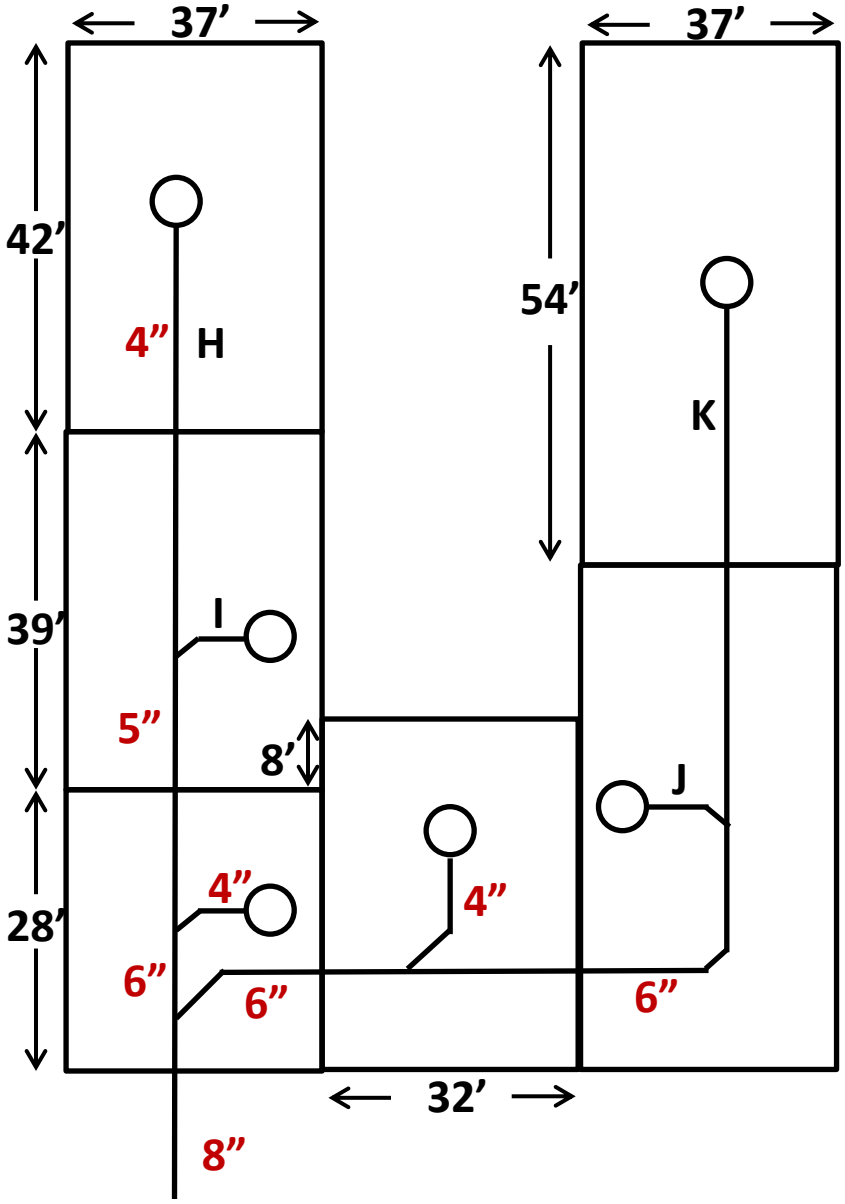
G = 1,443
H = 1,554
Total **= 2,997**
4” drain allows 1,880 sq ft
5” drain allows 3,340 sq ft

Determine G

G = 5”

SIZING STORM DRAINS

1/8” per foot



H: 42 x 37’ =	1,554
Total:	**1,554**

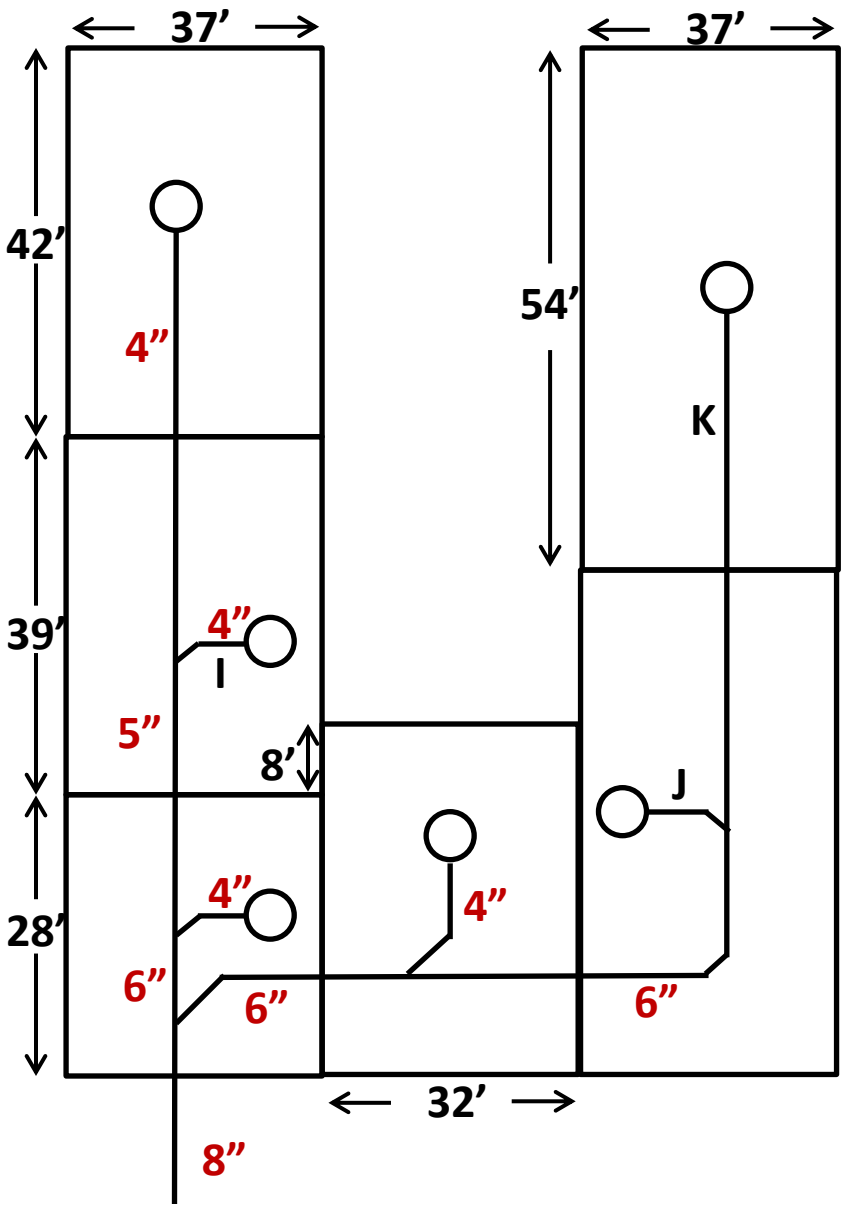
4” drain allows 1,880 sq ft
5” drain allows 3,340 sq ft

Determine H

H = 4”

SIZING STORM DRAINS

1/8” per foot



I: 39’ x 37’ =	1,443
Total:	**1,443**

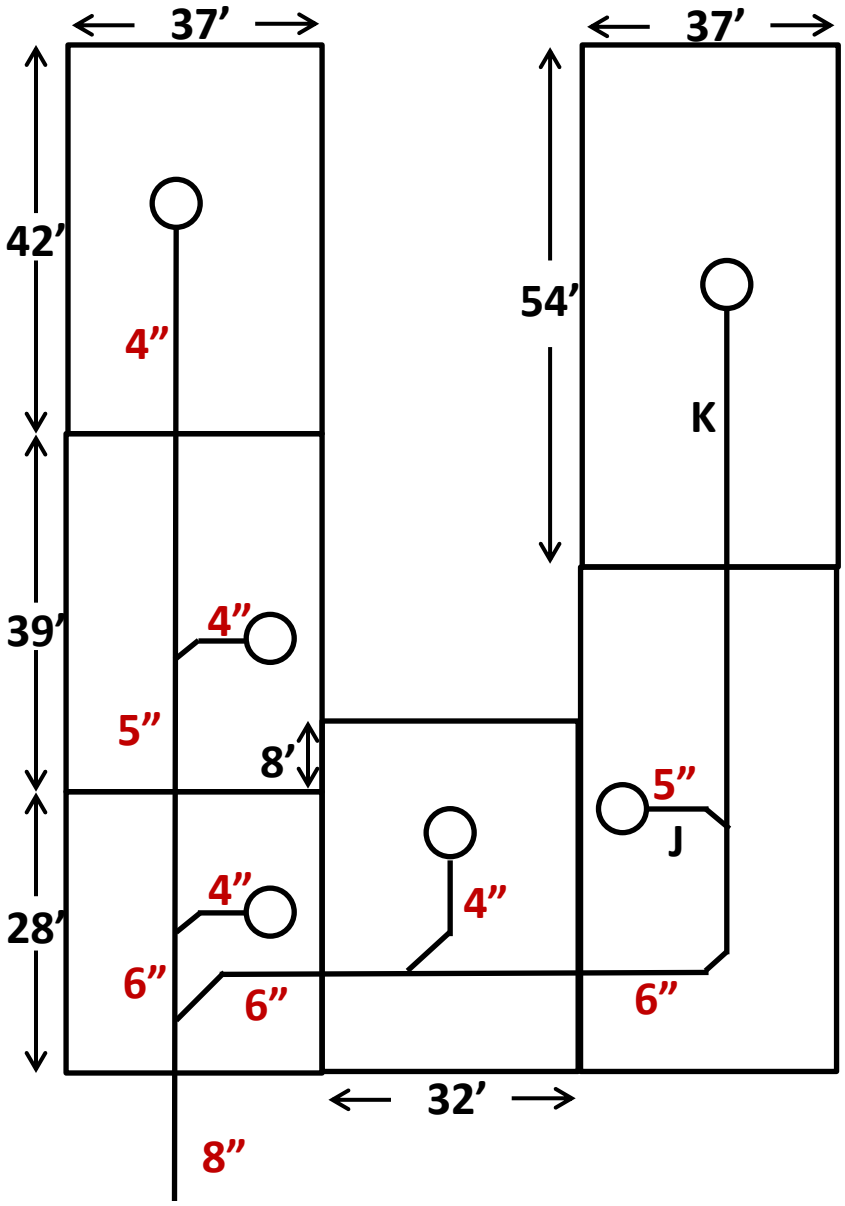
4” drain allows 1,880 sq ft
5” drain allows 3,340 sq ft

Determine I

I = 4”

SIZING STORM DRAINS

1/8” per foot



J: 42+39+28=109 – 54 = 55 x 37 = 2,035

Total: **2,035**

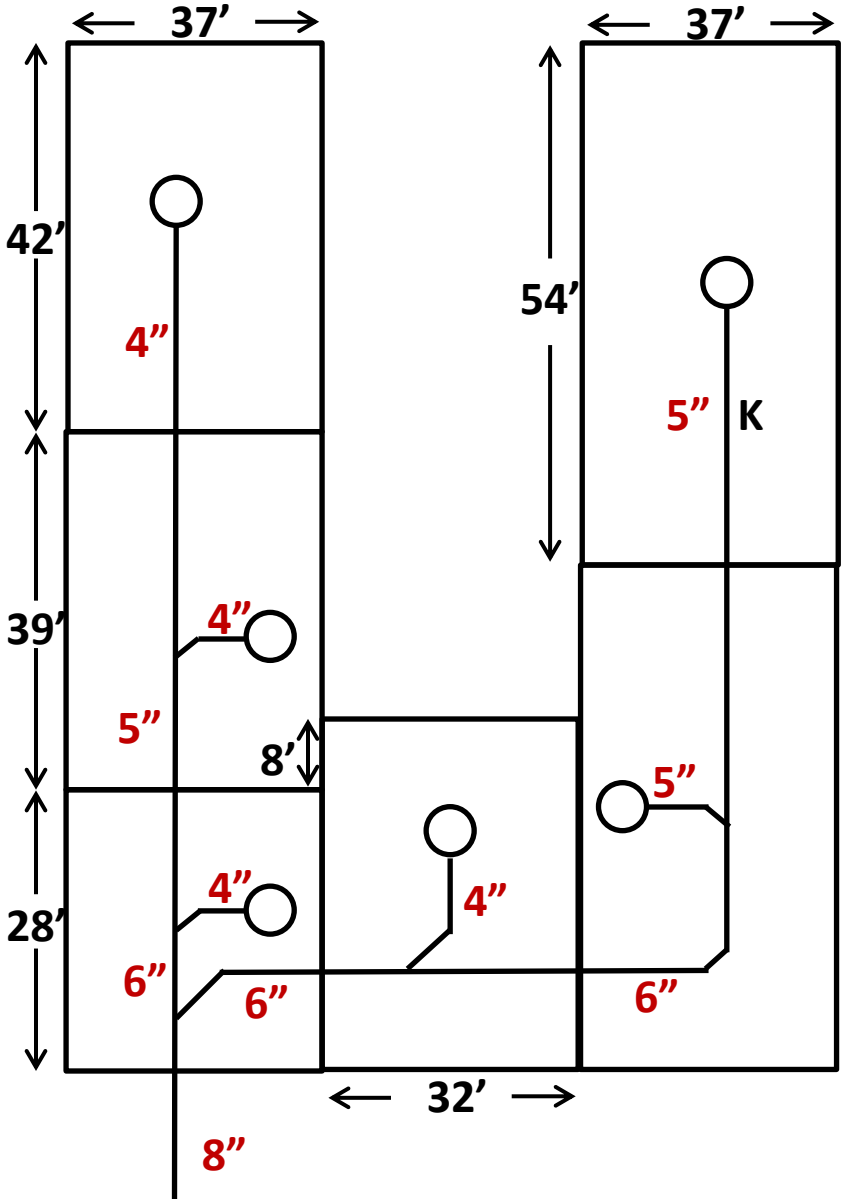
4” drain allows 1,880 sq ft
5” drain allows 3,340 sq ft

Determine J

J = 5”

SIZING STORM DRAINS

1/8” per foot

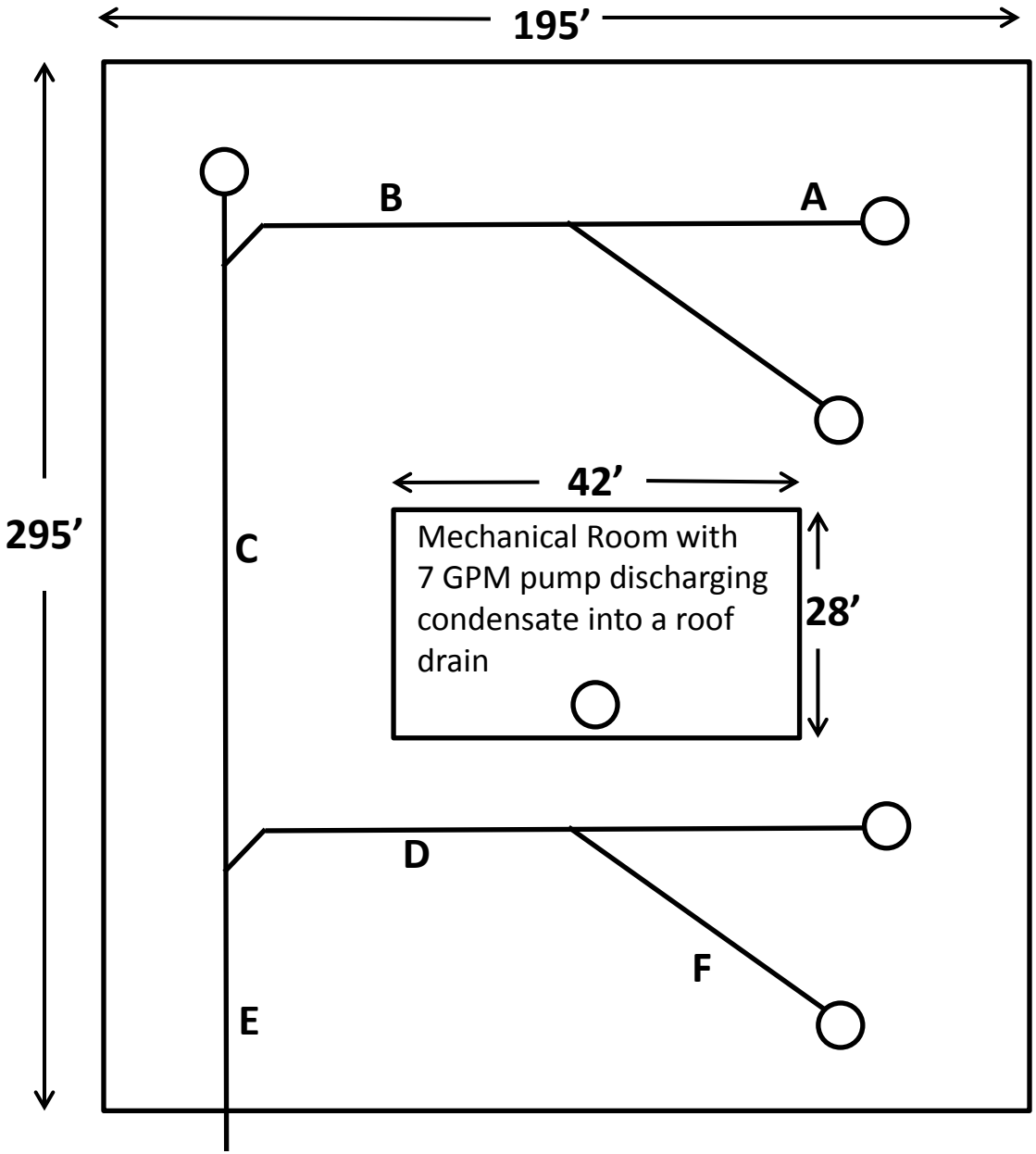


K:	54’ x 37’ =	1,998
Total:		**1,998**

4” drain allows 1,880 sq ft
5” drain allows 3,340 sq ft

Determine K
K = 5”

SIZING STORM DRAINS



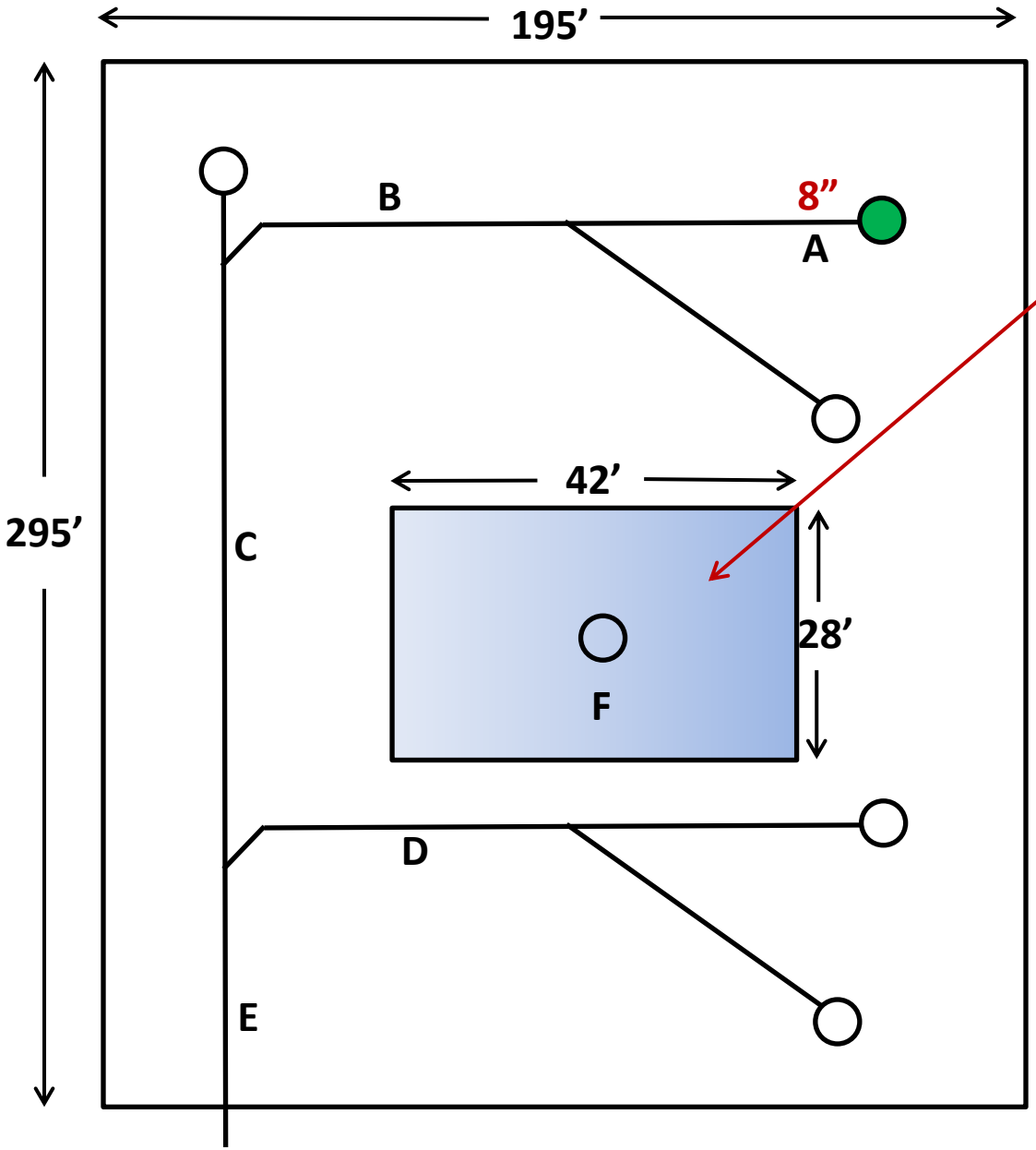
3 STEPS TO SIZING

1. Determine the area covered by each roof drain (length x width)

2. Use TABLE 1 to determine the sizes of A through K

3. Choose the proper slope from TABLE 1

SIZING STORM DRAINS



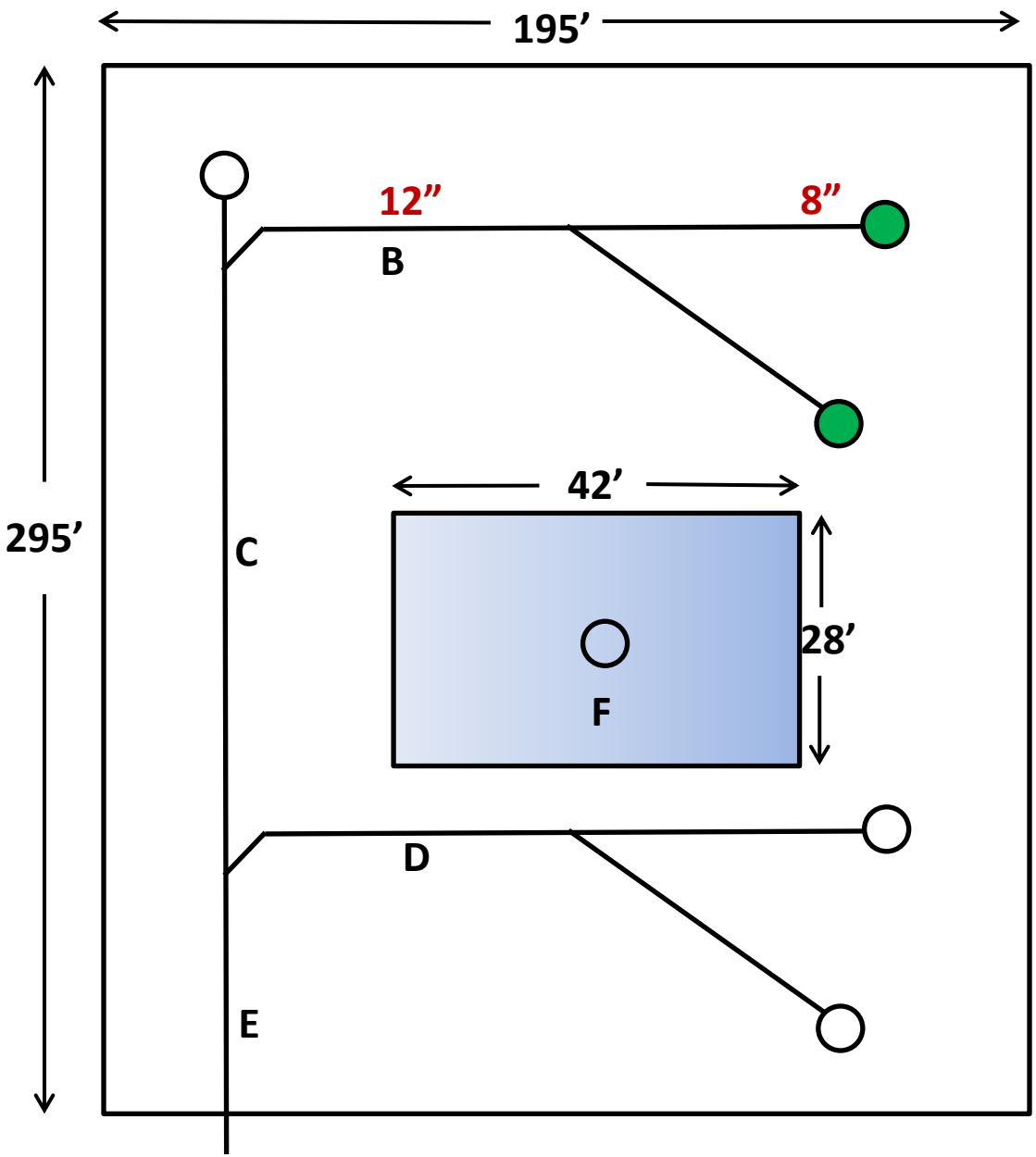
Mechanical Room on the roof with a 7 GPM pump discharging condensate into a roof drain which runs independently from this system

Use **1/8** Inch slope column
295 x 195 = 57,525
57,525 – 1,176 = 56,349
56,349 / 5 = **11,269.8**
6” drain allows 5,350 sq ft
8” drain allows 11,500 sq ft

Determine A

A = 8”

SIZING STORM DRAINS

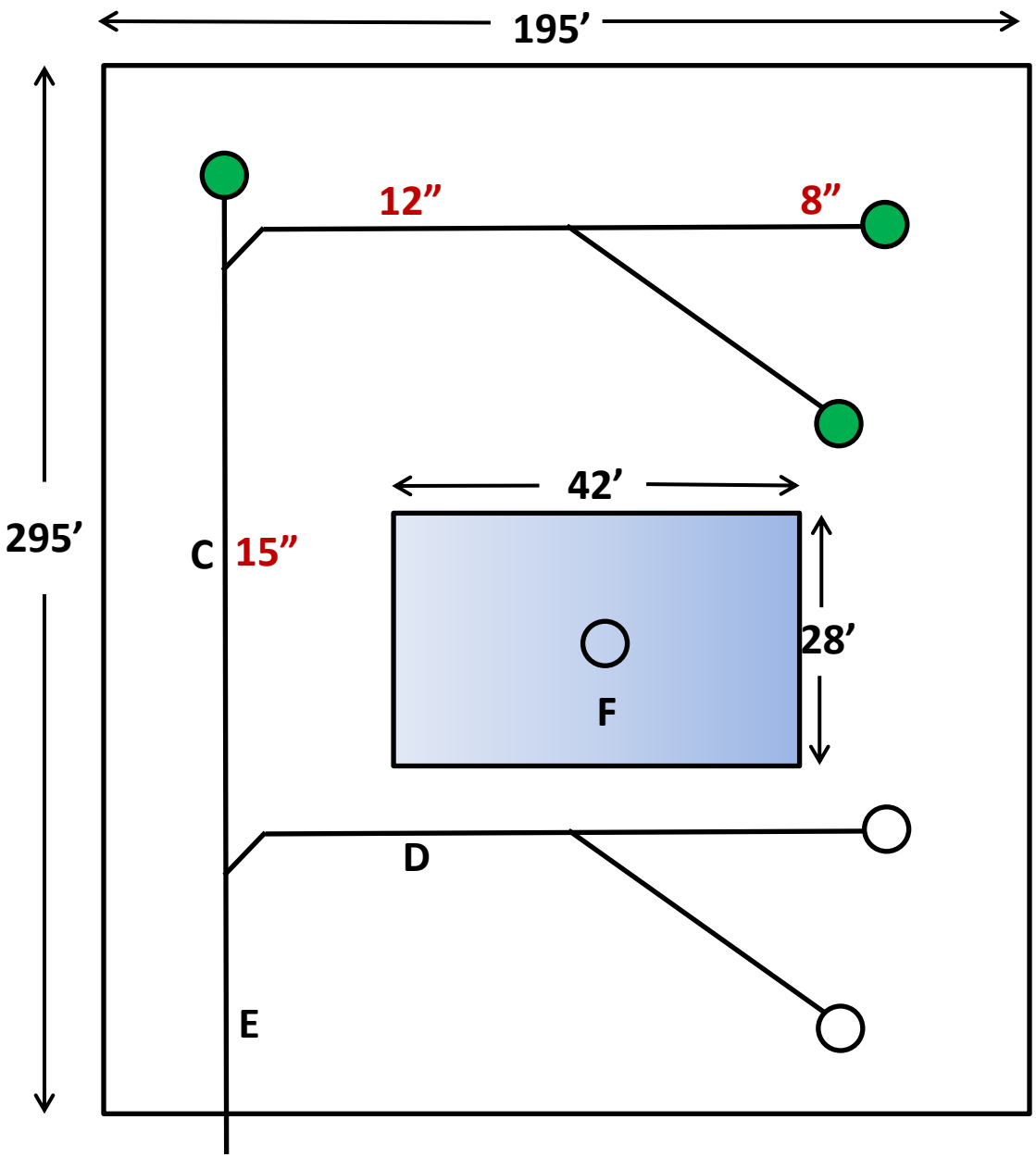


Use **1/8** Inch slope column
295 x 195 = 57,525
57,525 – 1,176 = 56,349
56,349 / 5 = 11,269.8
11,269.8 x 2 = **22,539.6**
10” drain allows 20,700 sq ft
12” drain allows 33,300 sq ft

Determine B

B = 12”

SIZING STORM DRAINS

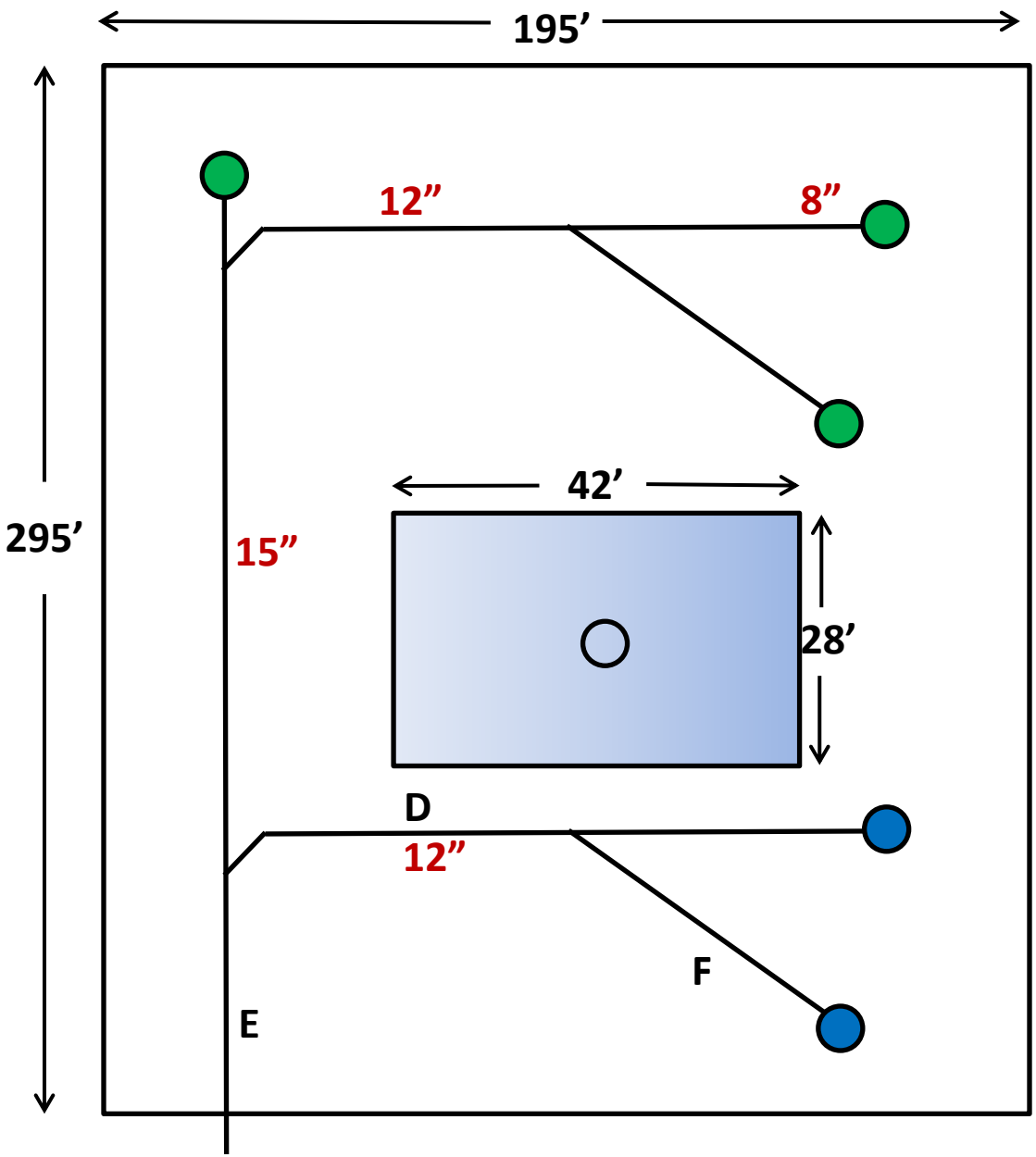


Use **1/8** Inch slope column
295 x 195 = 57,525
57,525 – 1,176 = 56,349
56,349 / 5 = 11,269.8
11,269.8 x 3 = **33,809.4**
12” drain allows 33,300 sq ft
15” drain allows 59,500 sq ft

Determine C

C = 15”

SIZING STORM DRAINS



Use **1/8** Inch slope column
295 x 195 = 57,525
57,525 – 1,176 = 56,349
56,349 / 5 = 11,269.8
11,269.8 x 2 = **22,539.6**
10” drain allows 20,700 sq ft
12” drain allows 33,300 sq ft

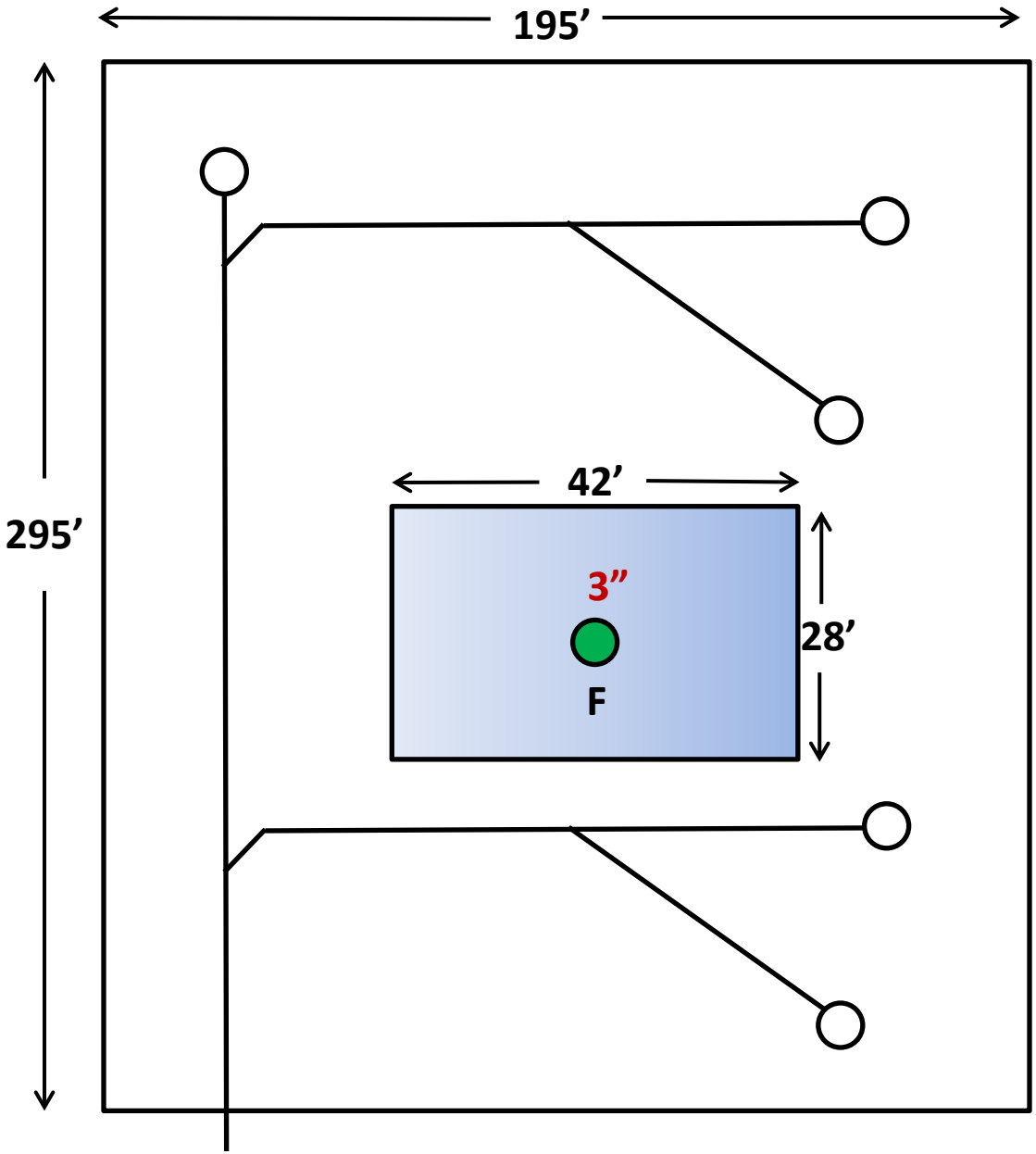
Determine D

D = 12”

248 CMR 10.17 Storm Drains

(3) Values for Continuous Flow. Where there is a continuous or semi-continuous discharge into the building storm drain or building storm sewer, as from a condensate pump, ejector, air conditioning equipment, or similar device discharging clear water waste, **each gallon per minute of such discharge shall be computed as being equivalent to 24 square feet** of roof area, (based upon a four-inch rainfall.)

SIZING STORM DRAINS



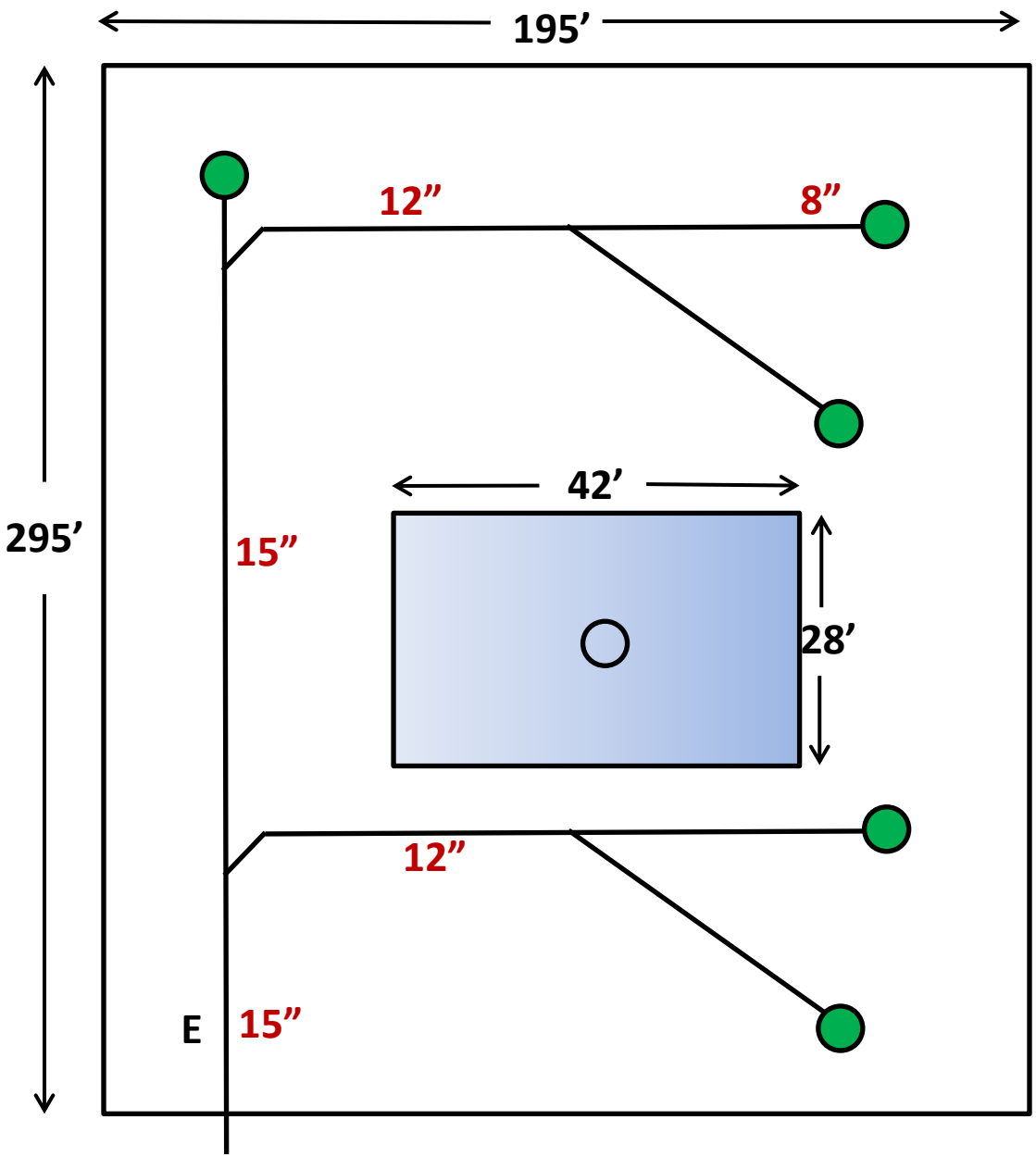
Mechanical Room on the roof with a **7 GPM** pump discharging condensate into a roof drain which runs independently from this system

Use **1/8** Inch slope column
42 x 28 = 1,176
7 GPM x 24 sq ft = 168
168 + 1,176 = **1,344**
3” drain allows less than 1,880

Determine F

F = 3”

SIZING STORM DRAINS



Use **1/8** Inch slope column
295 x 195 = 57,525
57,525 – 1,176 = **56,349**
12” drain allows 33,300 sq ft
15” drain allows 59,500 sq ft

Determine E

E = 15”

TABLE 2
SIZE OF VERTICAL STORM DRAIN CONDUCTORS AND OUTSIDE LEADERS

Maximum Projected Roof Area (Square Feet)	Diameter of Storm Conductor or Outside Leader (Square Feet)	Maximum Projected Roof Area (Square Feet)	Diameter of Storm Conductor or Outside Leader (Square Feet)
720	2	720	5
1,300	2-1/2	1,300	6
2,200	3	29,000	8
4,600	4	8	8

Written
Plumbing Questions

The acceptable range for a ph adjustment tank in an acid neutralization system is?

A. **Five to nine**

B. **Six to nine**

C. **Six to ten**

D. **Seven to ten**

(9) pH Adjuslment Tanks.
3. The tank will also have a sensor, to detect the pH of tank contents, within a range of two to 12 (alkaline), where the sensor shall be electrically connected to a control panel. This control panel is to be connected to acid/alkaline pumps. Acid/alkaline pumps are to be inserted into tanks containing neutralizing agents to bring tank contents up from an acid pH or down from an alkaline pH to a range of **six to nine.**

248 CMR - 147

When installing a water heater that has a capacity of 6 gallons or more in a closet on the second floor of a residence, you must:

A. **install a safe waste pan**

B. **locate the heater a minimum of 12 inches from combustible walls**

C. **install shut off valves on both hot and cold lines**

D. **install a recirculating line**

10.12: Indirect Waste Piping

(1) Indirect Wastes Required.

(h) **Safe Waste Required.**

1. A safe waste pan shall be installed under a water heater or hot water storage tank that is installed in a position elevated above any occupied space.

248 CMR - 140

An electric water heater installed in a commercial application having a storage capacity of over 120 gallons must have:

A. a safe waste pan installed

B. a dedicated cold water feed from the water meter

C. an ASME rating

D. recovery rate of at least 30 GPM

10.14 (9) Hot Water Tanks or Heaters

(g) ASME Requirements for Large Volume Water Heaters and Storage Tanks.

1. Water heaters shall be constructed to conform to the specific sections of the ASME Code when the heaters have the following features:

a. Installed in other than a private residence.

b. Having a storage capacity of **over 120 gallons** and/or a recovery equal to 200,000 B.T.U.

248 CMR - 164

Allowable plumbing materials for installation in a commercial office building may include:

A. PEX for water piping

B. PVC for indirect waste piping

C. ABS for storm drainage

D. Cast iron for sanitary waste piping

10.06 (2) Allowable Materials.

248 CMR - 102

Grease interceptors shall not be installed on individual fixture waste branches for:

A. **Wok stations**

B. **Pot sinks**

C. **Pre-rinse dishwasher sink**

D. **Commercial food waste grinders**

10.09
(2) Grease Traps and Interceptors
(f) Food Waste Grinders and Pre-Rinse Sinks
3. The waste discharge from a commercial food waste grinder (garbage disposal) **shall not discharge to the sanitary drainage system through a grease trap.** Dishwasher pre-rinse sinks equipped with food waste grinders shall be discharged in accordance with 248 C:MR 10.10(8)(b) through (d).

Vented flow control devices for grease interceptors:

A. **do not need to be vented to the sanitary venting system**
B. **are required for interceptors with a retention capacity of 20 min or less**
C. **are required for interceptors with a retention capacity of 30 min or less**
D. **shall be installed between the fixture and the interceptor**

10.09
(2) Grease Traps and Interceptors
(i) Flow Control Device.
1. Grease traps and interceptors shall be equipped with flow control devices. A flow control device may be equipped with a vented (air intake) or be of an integral non-vented design. Integral non-vented flow control device shall be placed in accordance with manufacturers' recommendations. **A flow control device is required to be installed between the fixture and the grease trap/interceptor** in accordance with manufacturers' instructions.

248 CMR - 124

Floor drains discharging into a gasoline, oil and sand separator are required in condominium garages with a vehicle capacity of over:

A. **Four cars**

B. **Five cars**

C. **Six cars**

D. **Seven cars**

10.09
(1) Interceptors Separators and Holding Tanks
(b) Separation
2. Exceptions
b. Multi-family, condominium and apartment garages which are sufficiently small that they could only hold a maximum **of six motor vehicles**

248 CMR - 122

Product-approved material for Special Hazardous Waste Systems shall include

A. **High Silicon Cast Iron (14.5% cast iron)**

B. **Hard drawn type k copper tubing**

C. **Extra heavy cast iron soil pipe**

D. **ABS plastic pipe**

10.13 Piping and Treatment of Special Hazardous Wastes
(2) Product-accepted Materials: Fixtures and Piping Systems.
(a) List of Fixture Materials.
PRIMARY
1. High silicon (14.5% cast iron)

248 CMR - 143

Tempered water serving and emergency wash station shall have a temperature range of:

A. **50 degrees F to 70 degrees F**

B. **60 degrees F to 80 degrees F**

C. **70 degrees F to 90 degrees F**

D. **80 degrees F to 100 degrees F**

10.13 Piping and Treatment of Special Hazardous Wastes

(1) General

(l) Emergency Wash Systems Shall Meet the Following Requirements

5. The systems shall be tempered to between **70°F and 90°F** and be installed in a manner that prevents the stagnation of water in the piping that supplies permanently mounted showers and face/eye wash stations.

248 CMR - 143

What is the maximum pitch per foot allowed for horizontal storm drains?

A. 1/8” per foot
B. 1/4” per foot
C. 3/8” per foot
D. 1/2” per foot

10.17: Storm Drains

(2) Size of Building Storm Drain. The size of the building storm drainage system including all horizontal branches having a slope of 1/2 inch or less per foot, shall be based upon the maximum projected roof or paved surface area to be handled according to 248 CMR 10.17(2): Table I.

248 CMR - 181

What additional value must be added to the total roof area when an air conditioning unit discharges clear water waste into the storm system?

A. 24 cubic feet

B. 24 square feet

C. 26 cubic feet

D. 26 square feet

248 CMR 10.17 Storm Drains

(3) Values for Continuous Flow. Where there is a continuous or semi-continuous discharge into the building storm drain or building storm sewer, as from a condensate pump, ejector, air conditioning equipment, or similar device discharging clear water waste, **each gallon per minute of such discharge shall be computed as being equivalent to 24 square feet** of roof area, (based upon a four-inch rainfall.)

248 CMR - 182

The inlet area of the strainer for a roof drains may not be less than____ times the area of the conductor.

A. 1-1/2

B. 2

C. 2-1/2

D. 3

(b) Roof Drain Strainers .
1. General Use.
b. Strainers shall have an available inlet area, that lays upon the roof level, of not less than **1-1/2 times** the area of the conductor to which the roof drain assembly is connected.

248 CMR - 183

What is the minimum height a roof drain strainer/dome must be extended above the roof surface?

A. 2”

B. 3”

C. 4”

D. 5”

(b) Roof Drain Strainers .
1. General Use.
a. All roof areas, except those draining to hanging scuppers and gutters, shall be equipped with roof drain assemblies having strainers that extend not less **than four inches** above the surface of the roof that is immediately adjacent to the roof drain assembly.

248 CMR - 183

A receptacle designed to collect surface or storm water from an open area is called;

A. **Area drain**
B. **Trough drain**
C. **Trench drain**
D. **Floor sink**

10.03: Definitions

Area Drain. A receptacle designed to collect surface or storm water from an open area.

248 CMR - 84

A safe waste pan must be installed for a water heater above an occupied space when the heater is ___ gallons or larger?

A. 2-1/2

B. 6

C. 20

D. 30

(i) Safe Waste Pans.

2. Safe waste pans shall be installed for hot water storage tanks that are **six gallons in capacity or larger**. See 248 CMR 10.22: Figure 14.

What is an acceptable type of joining method when using copper tubing underground inside of a building? *

A. Flared

B. Soldered

C. Compression

D. Ground joint

10.07: Joints and Connections

(2) Types of Joints for Piping Materials.

(a) Copper Tubing Joints (Potable Water Supply Systems in Buildings).

1. Joints shall be made with one of the following:

a. Copper water tube complying with ASTM B88.

b. Cast bronze fittings complying with ANSI Standard B16-18.

c. Wrought copper fittings complying with ANSI-ASME B16-22.

d. Flared or brazed connections for all underground piping inside the building. The joining method of copper underground shall be brazed or flared fittings.

248 CMR - 114

What is the minimum distance from a 3” cleanout cover to a facing wall?

A. 12”

B. 18”

C. 24”

D. 36”

10.08 Traps and Cleanouts
(j) Cleanout Clearances.
1. Large Pipe - **18 Inch Clearance**.
Cleanouts on three inch or larger pipes shall be so installed that there is a clearance of not less than 18 inches for the purpose of clearing stoppages.

248 CMR - 121

Connecting a vent pipe to a vent stack must be made at least how many inches above the flood level rim of the highest fixture?

A. 6”

B. 12”

C. 18”

D. 24”

(5) Vent Stacks and Stack Vents.

(a) Vent Stack Required.

1. Any structure, in which a building drain is installed, shall have as minimum one full size main stack vent or a vent stack no less than three inches in diameter, Buildings that incorporate three or more branch intervals in which plumbing is installed shall have no less than one main vent stack, (See 248 CMR 10.15(5)) that shall run undiminished in size and as directly as possible, from the building drain through to the open air above the roof or connect back to a main stack vent six inches above the flood level rim of the highest fixture being served.

What is the maximum temperature allowed for a lavatory faucet in a public rest room?

A. **100 degrees**

B. **110 degrees**

C. **115 degrees**

D. **120 degrees**

(3) Conservation of Water.

(a) Conservation of Hot Water

2. Lavatory faucets in public toilet facilities shall:

b. **Be equipped or installed with devices which limit the outlet temperature to a maximum of 110 °F.**

248 CMR - 149

A plumbing vent going through a flat roof being used as a garden must extend a minimum of how many feet above the roof?

A. 6’

B. 8’

C. 10’

D. 12’

(6) Vent Terminals.
(a) Extension above Roof.
2. If the roof area is used for gardening a parking deck, observation deck or similar purposes the vent shall extend no less than eight feet above the roof and be increased one pipe diameter.

248 CMR - 175

What is the maximum allowable temperature for hot water in a residence?

A. 110 degrees

B. 120 degrees

C. 130 degrees

D. 140 degrees

(3) Conservation of Water.
3. The maximum temperature of the domestic hot water in residential buildings shall not exceed 130 °F. Plumbing fixtures requiring higher temperatures for their proper use and function, such as dishwashers and hot water dispensers shall be exempted from 248 CMR 10.14.

248 CMR - 149

Grease interceptors must have a retention capacity of * not less than how many pounds of grease for each GPM of flow?

A. 1

B. 2

C. 3

D. 4

10.09: Interceptors, Separators and Holding Tanks

(2) Grease Traps and Interceptors When Installed Inside of Buildings.

(h) Capacity. Installed grease traps and interceptors shall have a grease retention capacity of not less than two pounds of grease for each G.P.M (gallon-per-minute) of flow.

248 CMR - 124

The developed distance between the fixture outlet and the trap weir shall not exceed how many inches?

A. 12

B. 18

C. 24

D. 30

10.08: Traps and Cleanouts

(1) Fixture Traps.

(a) Separate Traps for Each Fixture

1. Separate Trapping Required

b. The developed length distance from the fixture outlet to the trap weir shall not exceed 24 inches.

248 CMR - 119

What is the maximum temperature water can enter the sanitary drainage system?

A. 130 degrees

B. 150 degrees

C. 170 degrees

D. 180 degrees

10.21: Boiler Blow-off Tank

(1) Boiler Blow-off Tank.

A vessel designed to receive the discharge from a boiler blow-out outlet and to cool the discharge to a temperature of **150 °F or less which permits its safe discharge to the drainage system**. **The temperature of water entering drainage piping from discharge of blow-off· equipment shall not exceed 150°**

248 CMR - 194

What is the maximum distance allowed between cleanouts in a 4” horizontal sanitary drain?

A. 25’

B. 50’

C. 75’

D. 100’

10.08: Traps and Cleanouts

(2) Drainage Pipe Cleanouts

(a) Location. Cleanouts shall not be placed more than 50 feet apart in all horizontal drainage piping and branch drain piping that is **four inch** nominal diameter or less.

248 CMR - 119

A restaurant that can seat a minimum of how many patrons kicks in the requirement to install a food waste grinder ?

A. 15

B. 20

C. 25

D. 30

(8) Food-waste Grinder Units.

(d) Commercial Food-waste Grinders Required. All establishments summarized in 248 CMR. 10.09(2)(a), (restaurants, cafeterias, hotels ...) that are served by a municipal sanitary sewer and can seat **20 patrons or more** shall incorporate food waste grinders.

248 CMR - 129

Over what gallon capacity for a tank type water heater begins the requirement to be ASME rated?

A. 100

B. 120

C. 200

D. 220

10.14 Water Supply and the Water distribution System

(9) Hot Water Tanks or Heaters.

(g) ASME Requirements for Large Volume Water Heaters and Storage Tanks

1. Water heaters shall be constructed to conform to the specific sections of the ASME Code when the heaters have the following features:

b. Having a storage capacity of **over 120 gallons** and/or a recovery equal to 200,000 B.T.U.

248 CMR - 164

The smallest neutralizing sump allowed for a single laboratory sink would be a maximum of how many gallons

A. **5 gallons**
B. **10 gallons**
C. **15 gallons**
D. **20 gallons**

10.13: Piping and Treatment of Special Hazardous Wastes

(7) Sizing for Neutralizing Sump

(b) The smallest size sump to be used should have a capacity of **five gallons** which will handle a single laboratory sink or a cup sink.

248 CMR - 145

When installing water piping to a specific fixture, said piping shall be full size to within how many inches of the fixture itself?

A. 12”

B. 20”

C. 30”

D. 36”

10.14 Water Supply and the Water distribution System

7. Size of Fixture Supplies.

a. The minimum sizes of a fixture water supply pipe shall be as shown in 248 CMR 10.14(4):

b. The fixture water supply pipe shall be extended to within at **least 30 inches** of the point of connection to the fixture.

248 CMR - 150

At what point do you need to install a recirculating line on a hot water piping system?

A. **When it exceeds 100 feet**

B. **When it exceeds 125 feet**

C. **When it exceeds 150 feet**

D. **When it exceeds 175 feet**

10.14 Water Supply and the Water distribution System

(4) Designing and Sizing the Building Water Distribution System.

(h) Return Circulation. Where Required. Hot water supply systems in buildings where the developed length of hot water piping from the source of the hot water supply to the farthest fixture supply **exceeds 100 feet** shall be:

248 CMR - 153

PEX tubing may be used in residential structures up to how many stories in height?

A. 2

B. 3

C. 5

D. 10

10.06 (2) Allowable Materials

(m) Water Distribution Piping above Ground Inside Building.

7. Cross linked Polyethylene (PEX) Tubing and Fittings.

a.PEX may be used for residential dwellings/ buildings if the installation conforms to the following requirements:

i. The PEX tubing is used for hot and cold water distribution in residential dwelling/buildings up to and including **three stories in height**.

248 CMR - 106

PEX tubing may be used up within how many inches of final connection to a water heater?

A. 6”

B. 12”

C. 24”

D. 30”

10.06 (2) Allowable Materials

(m) Water Distribution Piping above Ground Inside Building).

7. Cross linked Polyethylene (PEX) Tubing and Fittings.

a.PEX may be used for residential dwellings/ buildings if the installation conforms to the following requirements:

ii. PBX tubing shall not be installed closer than **24-inches** to any connection to a direct-fired water heater

248 CMR - 106

What is the minimum size residential laundry drain allowed through the foundation wall when connecting to dry-well approved by the local Board of Health? *

A. 1-1/2”

B. 2”

C. 3”

D. 4”

(7) Size of Underground Drainage Piping.

(b) Sanitary Piping Installed Through the Foundation Wall.

1. Sanitary pipes that pass through an exterior foundation wall shall be no less than four inches in diameter, except:

b. When serving a domestic laundry, wherein the laundry drain is conducted to a separate (Local Board of Health Authorized) dry-well disposal system and may be two inches in diameter.

248 CMR - 167

What is the maximum distance allowed between hangers when installing 1” CPVC or smaller piping? *

A. 5’

B. 4’

C. 3’

D. 2’

10.11: Hangers and Supports

(4) Intervals of Supports.

(b) Horizontal Piping. Horizontal pipe of the following materials shall be supported at not more than the following distance intervals.

11. CPVC pipe sizes one inch or less shall be supported at three-foot intervals

248 CMR - 138

What is the maximum distance allowed between hangers when installing 1-1/4” CPVC or larger piping?

*

A. 4’

B. 5’

C. 6’

D. 8’

10.11: Hangers and Supports

(4) Intervals of Supports.

(b) Horizontal Piping. Horizontal pipe of the following materials shall be supported at not more than the following distance intervals.

11. CPVC pipe sizes one inch or less shall be supported at three-foot intervals and sizes 1¼ and greater shall be supported at four-foot intervals.

248 CMR - 138

What is the maximum distance allowed between hangers when installing 1-1/4” CPVC or larger piping?

*

A. 4’

B. 5’

C. 6’

D. 8’

10.11: Hangers and Supports

(4) Intervals of Supports.

(b) Horizontal Piping. Horizontal pipe of the following materials shall be supported at not more than the following distance intervals.

11. CPVC pipe sizes one inch or less shall be supported at three-foot intervals and sizes 1¼ and greater shall be supported at four-foot intervals.

248 CMR - 138

What type of valve must be installed on the discharge side of a water meter? *

A. Ball valve

B. Globe valve

C. Stop and waste valve

D. Full port valve

10.14: Water Supply and the Water Distribution System

(5) Installing The Building Water Distribution System.

(a) Meter Valve.

A gate valve or other full-port valve shall be installed in the water supply main on the discharge side of each water meter.

248 CMR - 153

HOT WATER is defined in the Plumbing Code as water of what minimum temperature?

A. 110 degrees

B. 120 degrees

C. 130 degrees

D. 140 degrees

10.03 Definitions
Hot Water. Water at a temperature of at least **120** °F.

248 CMR - 89

PVC schedule 40 pipe and fittings may be used in residential structures up to how many stories in height?

A. 3

B. 6

C. 8

D. 10

10.06 (2) Allowable Materials

(o) PVC Plastic Pipe and Fittings

2. PVC, Schedule 40 Pipe and Fittings, may be used for the drains, waste and vent piping that serve the sanitary or storm drainage systems in the following buildings

f. and that are no greater than **ten stories in height.** `

248 CMR - 107

A branch vent that serves two or more floor outlet fixtures that are battery wasted beginning in between the last 2 fixtures and ending on the upstream side of the horizontal branch is a?

A. **Loop Vent**

B. **Battery Relief Vent**

C. **Yoke Vent**

D. **Circuit Vent**

10.03 Definitions

Circuit Vent.

A branch vent that serves two or more floor-outlet :fixtures that are battery wasted. Said vent extends from the top of the horizontal soil and/or waste branch in front of the last fixture waste and connects to a vent stack adjacent to the upstream end of the horizontal branch.

1-1/2” Schedule 40 PVC piping installed horizontally must be supported a minimum of every ___ feet ?

A. 3

B. 4

C. 5

D. 6

10.11. Hangers and Supports

(4) Intervals of Supports.

(b) Horizontal Piping

5. Plastic (PVC and ABS) pipe **(1-1/2 inches or less)** -- three-foot intervals, (two inches or over) --- four-foot intervals.

248 CMR - 138

Relief vents are required for laundry stacks in multi story buildings over ___?

A. 2 branch intervals

B. 3 branch intervals

C. 4 branch intervals

D. 5 branch intervals

10.15 Sanitary Drainage System

(9) Drainage Pipe Installation

(e) Laundries in Multi-Story Buildings.

1. Where laundries are installed in buildings with **more than three Branch intervals**, laundries shall be connected to an independent laundry stack

248 CMR - 171

Fixture traps shall have a liquid seal of not less than how many inches?

A. 1

B. 2

C. 3

D. 4

10.08. Traps and Cleanouts

(1) Fixture Traps

(f) Trap Seal. Each fixture trap shall have a liquid seal of **not less than two inches**

248 CMR - 120

Fixture traps shall have a liquid seal of not more than how many inches?

A. 2

B. 3

C. 4

D. 5

10.08. Traps and Cleanouts

(1) Fixture Traps

(f) Trap Seal. Each fixture trap shall have a liquid seal of **not less than two inches** and **not more than four inches.**

248 CMR - 120

What is the minimum size wet vent?

A. 1-1/2

B. 2

C. 3

D. 4

10.16 Vents and Venting

(8) Wet Venting

(d) Miscellaneous Wet Venting.

1. A **two inch or larger** waste pipe installed with drainage fittings may serve as a wet vent.

248 CMR - 175

What is the maximum distance from the drain to the vent for a 2” indirect waste main? *

A. 2’

B. 4’

C. 8’

D. No trap allowed

10.12. Indirect Waste

(5) Installation of Indirect Waste Piping.

(d) Traps.

Prohibited. A trap shall not be installed on an indirect waste main or on an indirect waste branch main.

248 CMR - 141

A pressure reducing valve is required if the pressure in the water main exceeds what PSI?

A. 80

B. 90

C. 100

D. 110

10.14 Water Supply and the Water Distribution System

(4) Designing and Sizing the Building Water Distribution System.

(g) Excessive Water Pressure.

1. When the municipal service or other water service source provides water to a building that **exceeds 80 PSI** a pressure reducing valve shall be installed in the water main pipe at the point of water service entrance to the building.

248 CMR - 153

What is the minimum size floor area of a shower stall?

A. 800 square inches

B. 900 square inches

C. 1,000 square inches

D. 1,100 square inches

10.10 Plumbing Fixtures

(7) Shower Baths, Stalls and Compartments

(c) Shower Compartments.

1. Shower compartments and stalls shall have at **least 900 square inches** of floor area and be not less than 30 inches in minimum dimension measured from its finished interior dimension as the side of a rectangle, altitude of a triangle or diameter of a circle or other angular shape.

248 CMR - 128

What is the minimum distance horizontally a vent terminal needs to be from a window if it is not less than 2 feet above the top of the window?

A. 3 feet

B. 5 feet

C. 8 feet

D. 10 feet

10.16 Vents and Venting
(6) Vent Terminals
(d) Location of Vent Terminal.
1. No vent terminal shall be located:
a. directly beneath any door, window, or other ventilating opening of the building or of an adjacent building;
b. within **ten feet horizontally** of such an opening unless it is no less than two feet above the *top* of such opening.

248 CMR - 175

What is the minimum distance horizontally a vent terminal needs to be from a fresh air intake?

A. **10 feet**

B. **15 feet**

C. **20 feet**

D. **25 feet**

10.16 Vents and Venting
(6) Vent Terminals
(d) Location of Vent Terminal.
2. Plumbing vent terminals shall be located no less than **25 feet horizontally** from all fresh air intakes.

248 CMR - 175

If a gas/oil separator is in an area subject to freezing, it must be set a minimum of how many feet below grade? *

A. 2

B. 3

C. 4

D. 5

FIGURE 15
Drawing of the sand oil separator. Language used to be part of this drawing. It was removed when the drawing was revised in 2017 but the question is still on the exam.

248 CMR - 213

A 2% slope is equal to ____ pitch per foot?

A. 1/8

B. 1/4

C. 1/3

D. 1/2

What is the minimum pitch per foot for a 4” sanitary drain?

A. 1/16”

B. 1/8”

C. 1/4”

D. 1/2”

10.05 General Regulations

(2) Pitch of Horizontal Drain Piping

(c) Horizontal drainage piping which is larger than three inches in diameter shall be installed with a minimum uniform pitch of **1/8 inch per foot:**

248 CMR - 98

What is the minimum pitch per foot for a 3” sanitary drain?

A. 1/16”

B. 1/8”

C. 1/4”

D. 1/2”

10.05 General Regulations

(2) Pitch of Horizontal Drain Piping

(b) Horizontal drainage piping which is three inches in diameter or smaller shall be installed with a minimum uniform pitch of **1/4 inch per foot**.

248 CMR - 98

What is the minimum size drain line to be installed underground?

A. 1-1/2”

B. 2”

C. 3”

D. 4”

10.15. Sanitary Drainage System

(2) Size of Underground Drain Piping

(a) Underground or Basement Floor. No portion of the drainage system installed underground or below a basement floor, shall be less than two inches in diameter.

248 CMR - 167

Of the items listed below, what is a requirement in a hospital ? *

A. All fixtures must be individually vented
B. There must be two completely independent water services
C. There must be two completely independent sanitary wastes
D. There must be two completely independent storm systems

10.18 Hospitals
(18) Water Supply.
(a) Water Service. All hospitals shall have dual services installed in a manner to provide an uninterrupted supply of water in case of a water main break.

248 CMR - 190

What is the minimum size cleanout for a 10” horizontal sanitary waste line? *

A. 4”

B. 6”

C. 8”

D. 10”

10.08: Traps and Cleanouts

(2) Drainage Pipe Cleanouts.

(i) Cleanout Size. Cleanouts shall be of the same nominal size as the pipes up to four inches and not less than four inches for larger piping.

248 CMR - 120

What is the maximum distance from the trap to the vent for this 1-1/2” horizontal lavatory drain

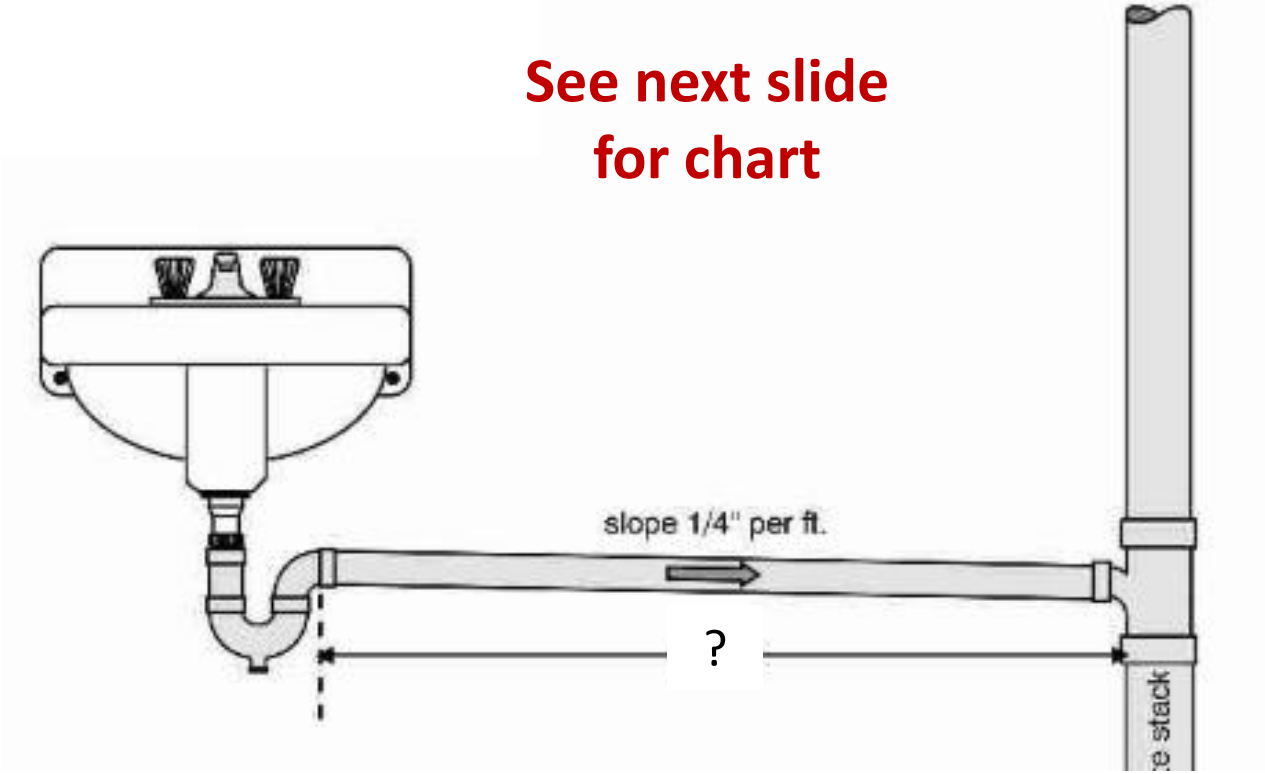
A. 2 feet

B. 3 feet

C. 4 feet

D. 5 feet

See next slide for chart



(12) Fixture Vents.

(a) Distance of Trap from Vent. Each fixture trap shall have a protecting vent so located that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in 248 CMR 10.16(12): *Table 1*.

248 CMR - 178

TABLE 1
DISTANCE OF FIXTURE TRAP FROM VENT

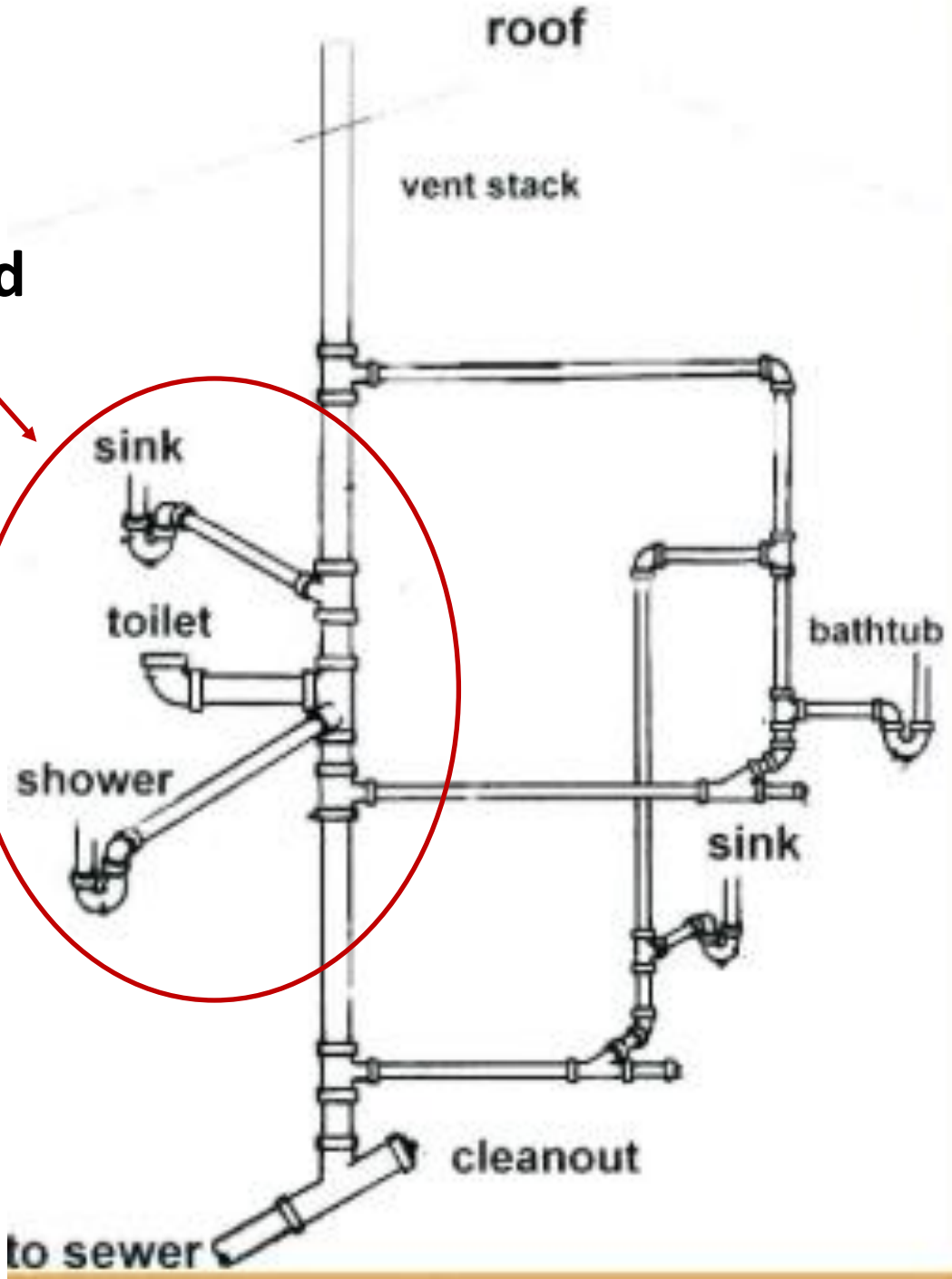
Size of Fixture Drain, Inches	Distance Trap to Vent, Feet
1½	5'
2	6'
3	8'
4	10'
slope not to exceed ¼-inch per foot	

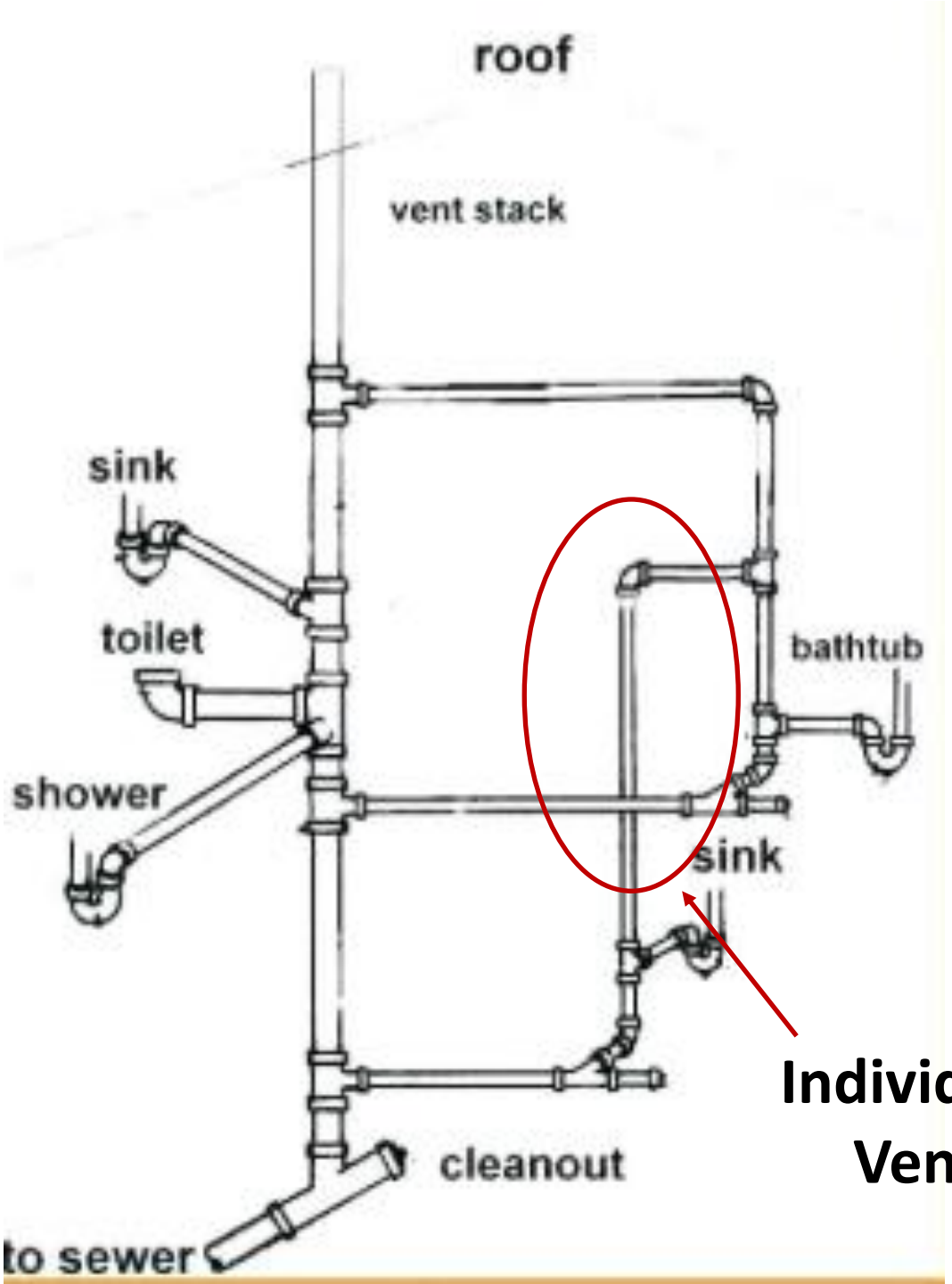
10.16 Vents and Venting

(12) Fixture vents

(a) Distance from trap to vent

Stack Vented




roof
vent stack
sink
toilet
shower
bathtub
sink
cleanout
to sewer
Individual
Vent

If a waste stack is 3”, what is the maximum size horizontal waste branch that can connect to it?

A. 1-1/2”

B. 2”

C. 3”

D. 4”

10.15 Sanitary Drainage System

(4) Minimum Size of Soil and Waste Stacks. No soil or waste stack shall be **smaller than the largest horizontal waste branch** connected thereto. *See* 248 CMR 10.15(7): *Table 1* and *Table 3*. Exception: a 4 x 3 toilet connection shall not be considered as a reduction in pipe size.

Any structure with a building drain must have at least one stack vent or vent stack of at least what pipe size undiminished in size through the roof?

A. 1-1/2”

B. 2”

C. 3”

D. 4”

10.15 Sanitary Drainage System
(5) Minimum Size of the Stack Vent or Vent Stack. Any structure, in which a building drain is installed, shall have as a minimum one stack vent or a vent stack **not less than three inches in diameter,** (*see* 248 CMR 10.16(7): *Table 2* for fixture unit values when determining appropriate stack vent or vent stack sizing) that shall be carried undiminished in size through the roof.

What is the minimum size that a sanitary waste line can be run through a foundation wall?

A. 1-1/2”

B. 2”

C. 3”

D. 4”

10.15 Sanitary Drainage System

(7) Size of Underground Drainage Piping.

(b) Sanitary Piping Installed Through the Foundation Wall.

1. Sanitary pipes that pass through an exterior foundation wall shall be no less than **four inches** in diameter

248 CMR - 167

What is the minimum size drain allowed for a kitchen sink?

A. 1-1/2”

B. 2”

10.15 Sanitary Drainage System

(9) Drainage Piping Installations.

(b) Kitchen Sink Wastes (Domestic).

Not less than a **1½ inch** branch waste or waste outlet shall be provided to receive the fixture drain from a kitchen sink, which shall connect independently to the sanitary drainage system.

248 CMR - 171

What needs to be installed under every kitchen sink?

A. A garbage disposal

B. An extra shut off valve for a future kitchen sink

C. A wye branch for a dishwasher

D. A cleanout which is the same size as the drain it connects to

10.15 Sanitary Drainage System

(9) Drainage Piping Installations.

(d) Kitchen Sink Clean-outs.

An **end or dandy clean-out fitting** the same size as the drain to which it connects shall be installed under all kitchen sinks.

All ejector sumps must have a holding capacity sufficient to meet the demand of a period not to exceed how many hours?

A. 6

B. 8

C. 10

D. 12

10.15 Sanitary Drainage System

(10) Sumps and Ejectors.·

(g) Size of Sumps and Pumps.

1. All sumps shall have a holding capacity sufficient to meet the demand of a period not to exceed **12 hours.**

248 CMR - 172

Cross connections between an individual water supply and a potable public supply shall not be made unless specifically approved by :

A. **Board of Examiners of Plumbers and Gas Fitters**

B. **City or Town Board of Health**

C. **Local Plumbing Inspector**

D. **Mass. Department of Environmental Protection**

10.14 (7) Protection of Potable Water Supply.

(d) Interconnections.

1. Individual Water Supplies. Cross connections between an individual water supply and a potable public supply shall not be made unless specifically approved by the Massachusetts Department of Environmental Protection.

248 CMR - 157

In single-family dwellings, a sewage-ejector sump receiving the discharge of toilets and other fixtures shall be equipped with a sewage-ejector pump that provides a minimum discharge capacity of how many gallons per minute?

A. 15

B. 20

C. 25

D. 30

10.15 Sanitary Drainage System

(10) Sumps and Ejectors.·

(g) Size of Sumps and Pumps.

2. In single-family dwellings, a sewage-ejector sump receiving the discharge of toilets and other fixtures shall be equipped with a sewage-ejector pump that provides a minimum discharge capacity of **20 gallons per minute**.

248 CMR - 172

What is the minimum size vent which can be run through the roof?

A. 1-1/2”

B. 2”

C. 3”

D. 4”

10.16 Vents and Venting

(5) Vent Stacks and Stack Vents.

(b) Connections at Base and Top.

1. All vent pipes shall extend undiminished in size above the roof, or shall be reconnected with the main soil or waste stack above the highest fixture connection discharging into it. The **minimum size of any vent through the roof shall be two inches** in diameter.

248 CMR - 174

A plumbing vent run through the roof must extend no more than___ and no less than ___ inches?

A. 20 + 10

B. 24 + 18

C. 30 + 24

D. 36 + 30

10.16 Vents and Venting

(6) Vent Terminals.

(a) Extension above Roof.

The vent extension through a roof shall be no less than two inches in diameter and shall extend not more than **24 inches and not less than 18 inches** through the roof.

248 CMR - 175

The change in the diameter of a vent terminal shall be made by the use of an increaser and occur no less than how far below the roof?

A. 6”

B. 12”

C. 18”

D. 24”

10.16 Vents and Venting

(6) Vent Terminals.

(a) Extension above Roof.

3. Increaser. The change in the diameter of a vent terminal shall be made by the use of an increaser; and occur no less than **one foot below the roof surface**.

248 CMR - 175

Which of the following waste and vents may not be used as a wet vent?

A. A lavatory

B. A drinking fountain

C. A service sink

D. A kitchen sink

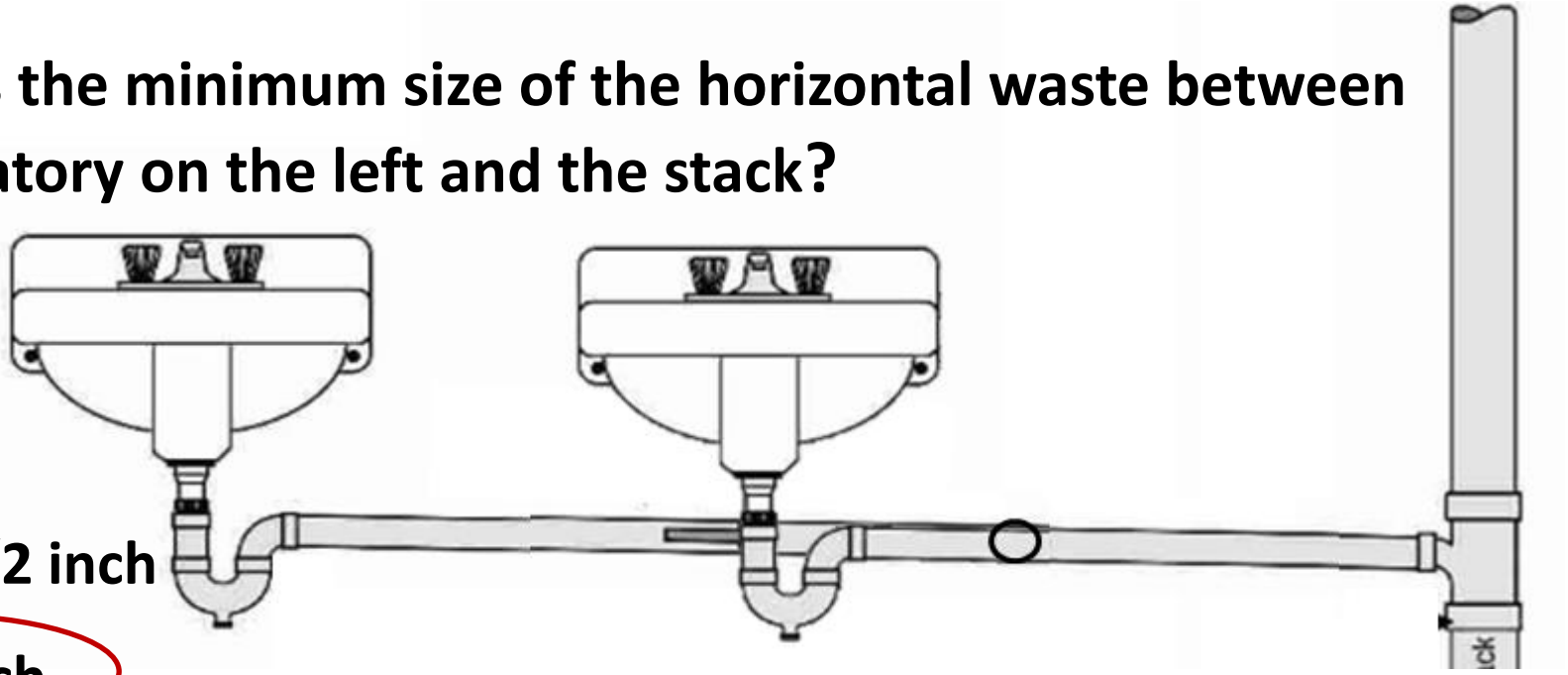
10.16 Vents and Venting

(8) Wet Venting.

(e) Piping Not to Serve as Wet Vents. A waste and vent that serves a **kitchen sink**, a garbage disposal, a dish washer, or other fixture installed for culinary use, or one that receives the discharge from a **clothes washing machine** may not serve as a wet vent for any other fixture.

248 CMR - 176

What is the minimum size of the horizontal waste between the lavatory on the left and the stack?



A. 1-1/2 inch

B. 2 inch

C. 3 inch

10.16 Vents and Venting

(10) Common Vents.

(e) Horizontal Waste Branch.

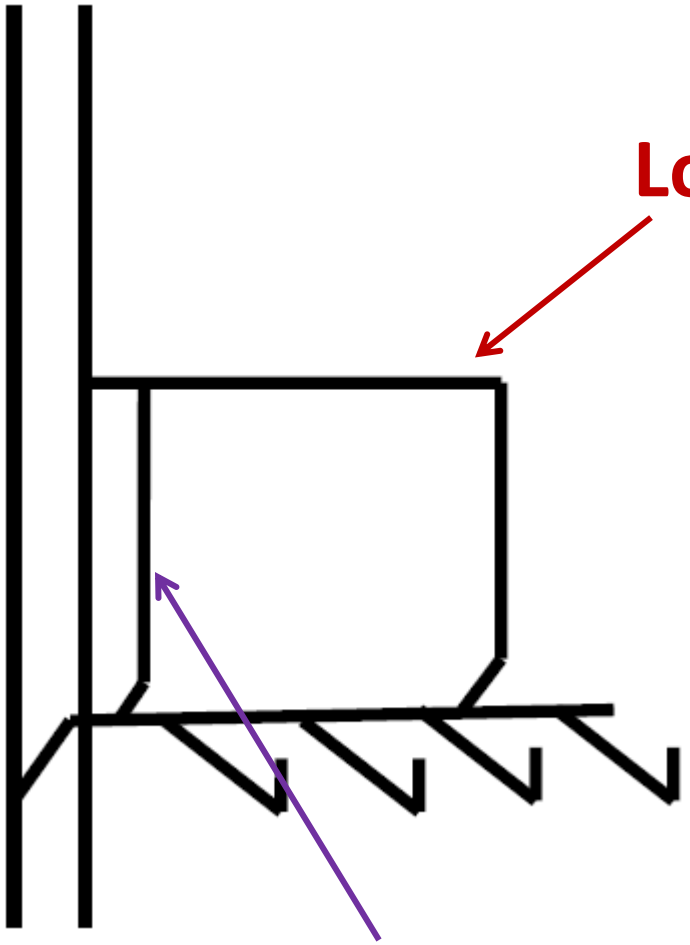
1. Two lavatories or similar fixtures installed adjacent or back-to-back within six feet of a main vented stack, proper wet vent, or continuous waste and vent, may be installed on a two inch horizontal waste branch without re-venting, provided:

a. the horizontal waste branch is not less than two inches throughout its entire length; and

b. the fixture wastes are connected into the side center of the branch.

248 CMR - 177

What type of venting is depicted in this drawing?

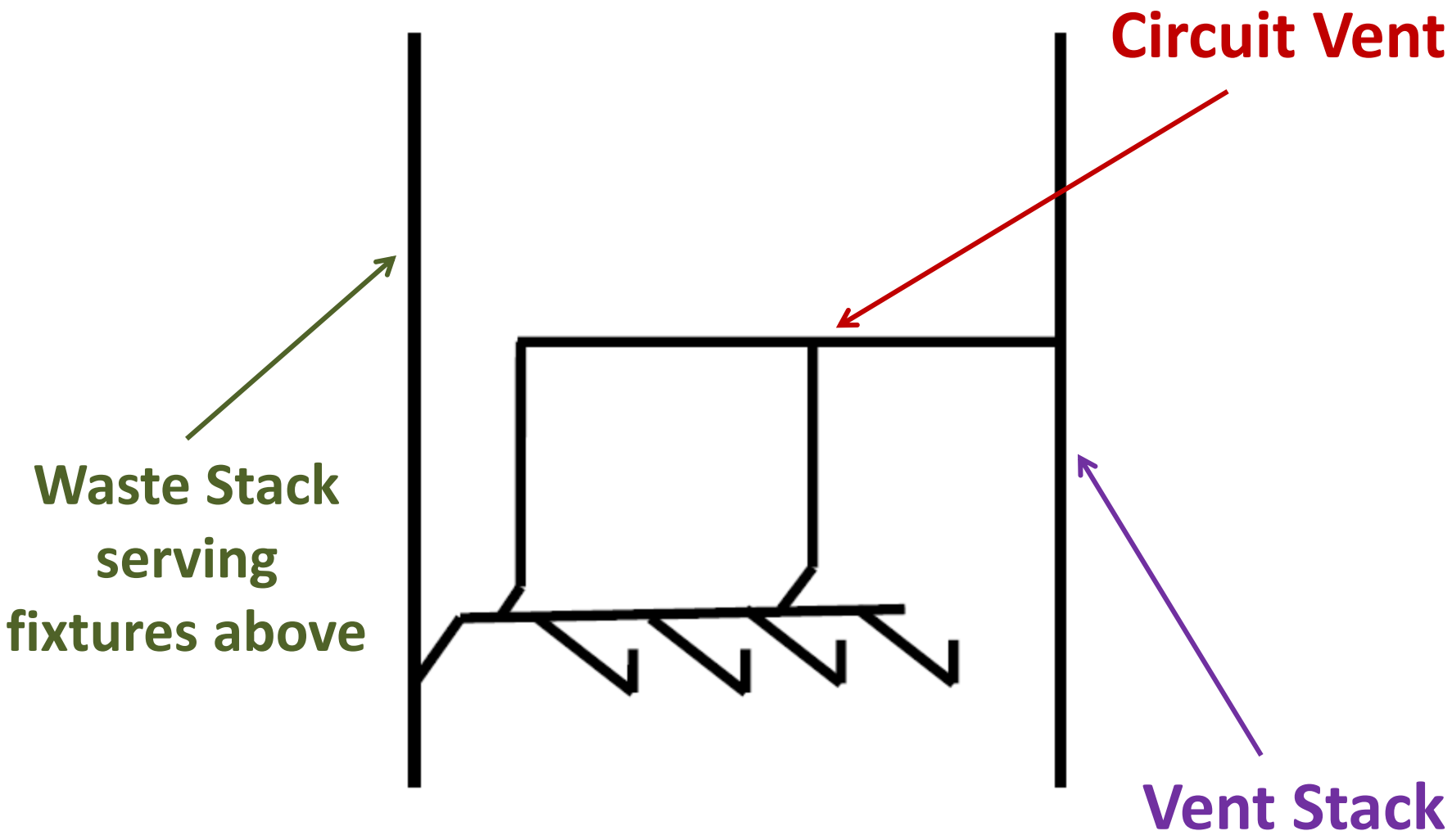


Loop Vent

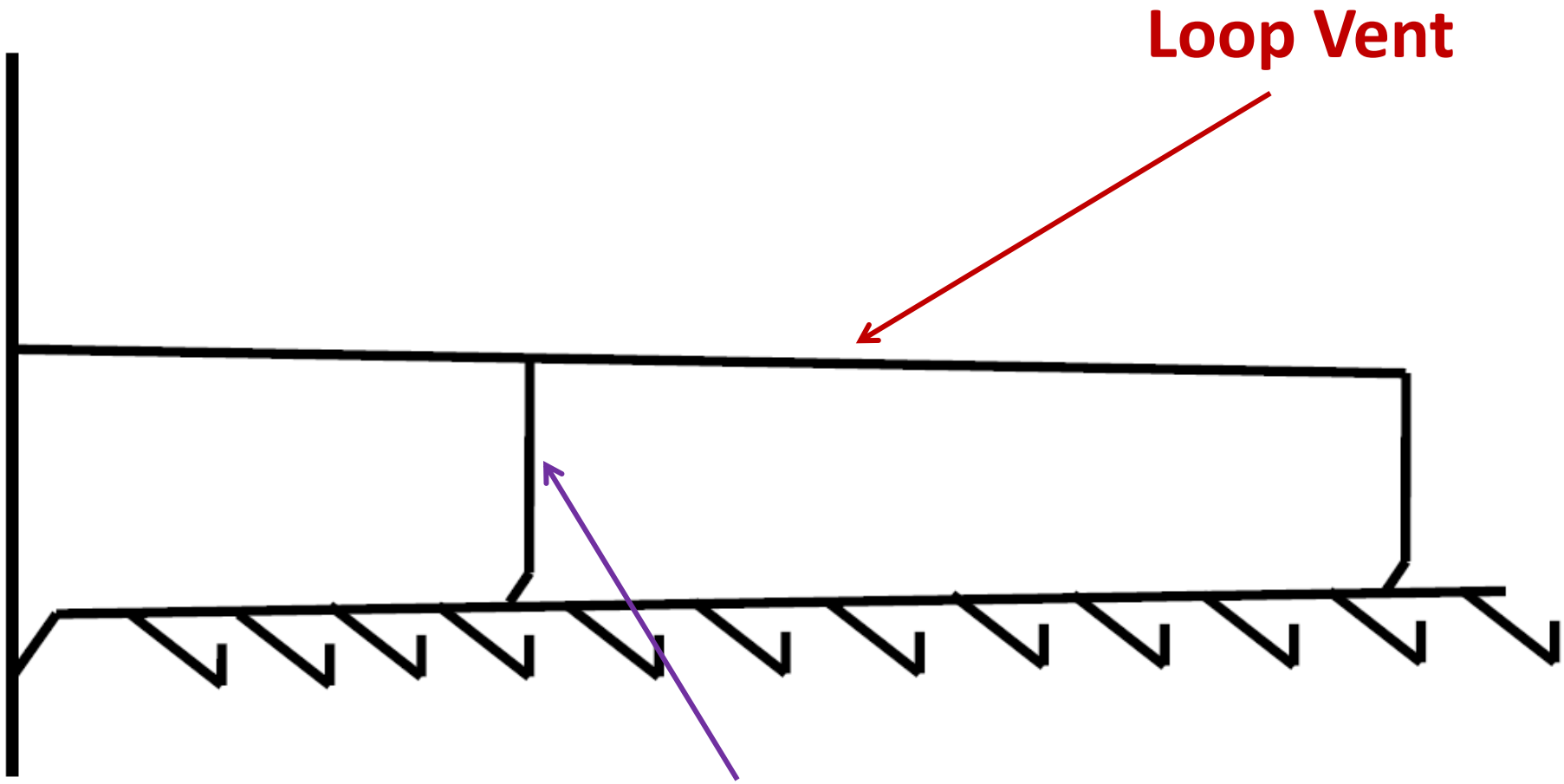
Waste Stack serving fixtures above

Relief Vent downstream of the first fixture

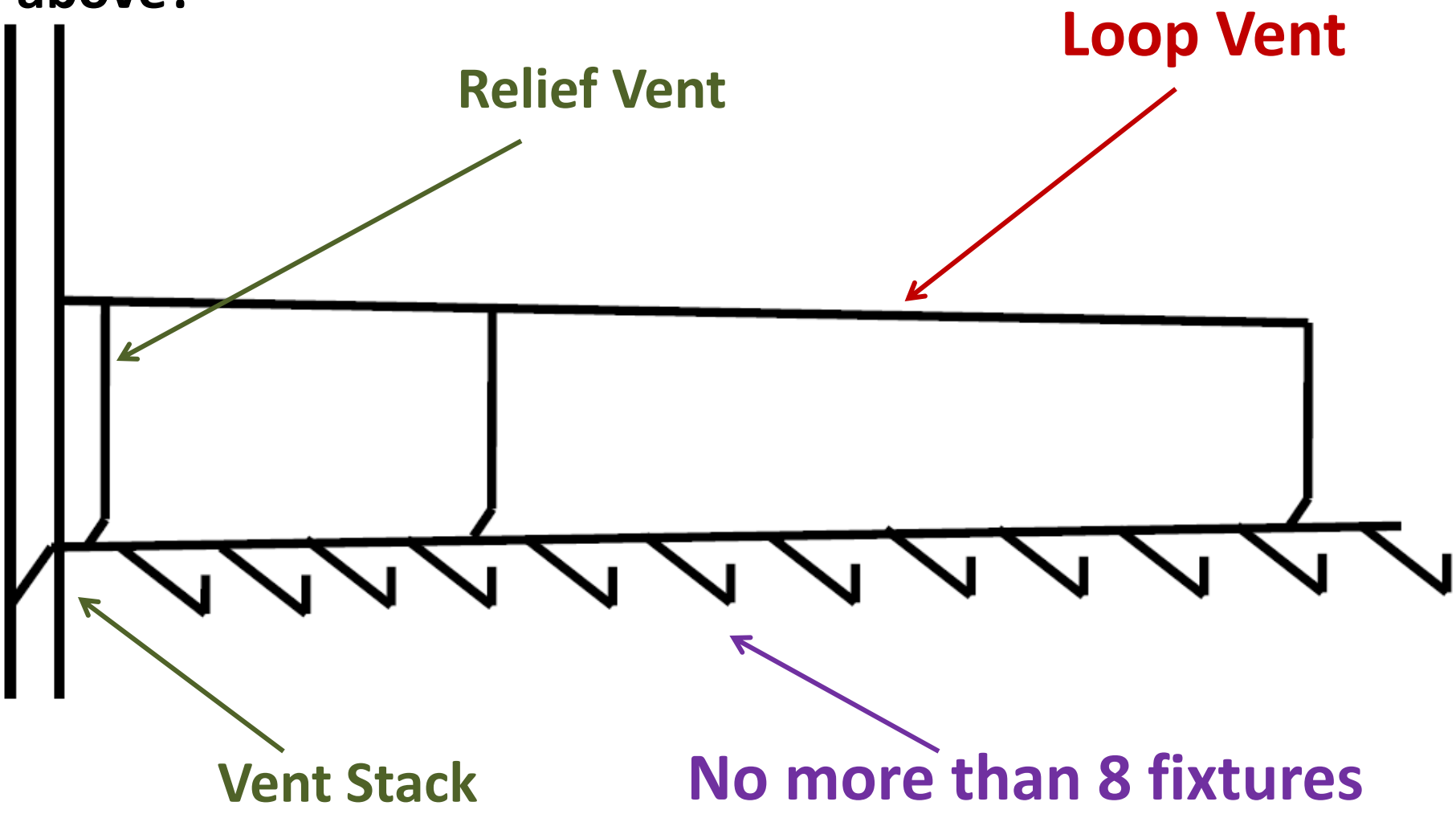
What type of venting is depicted in this drawing?



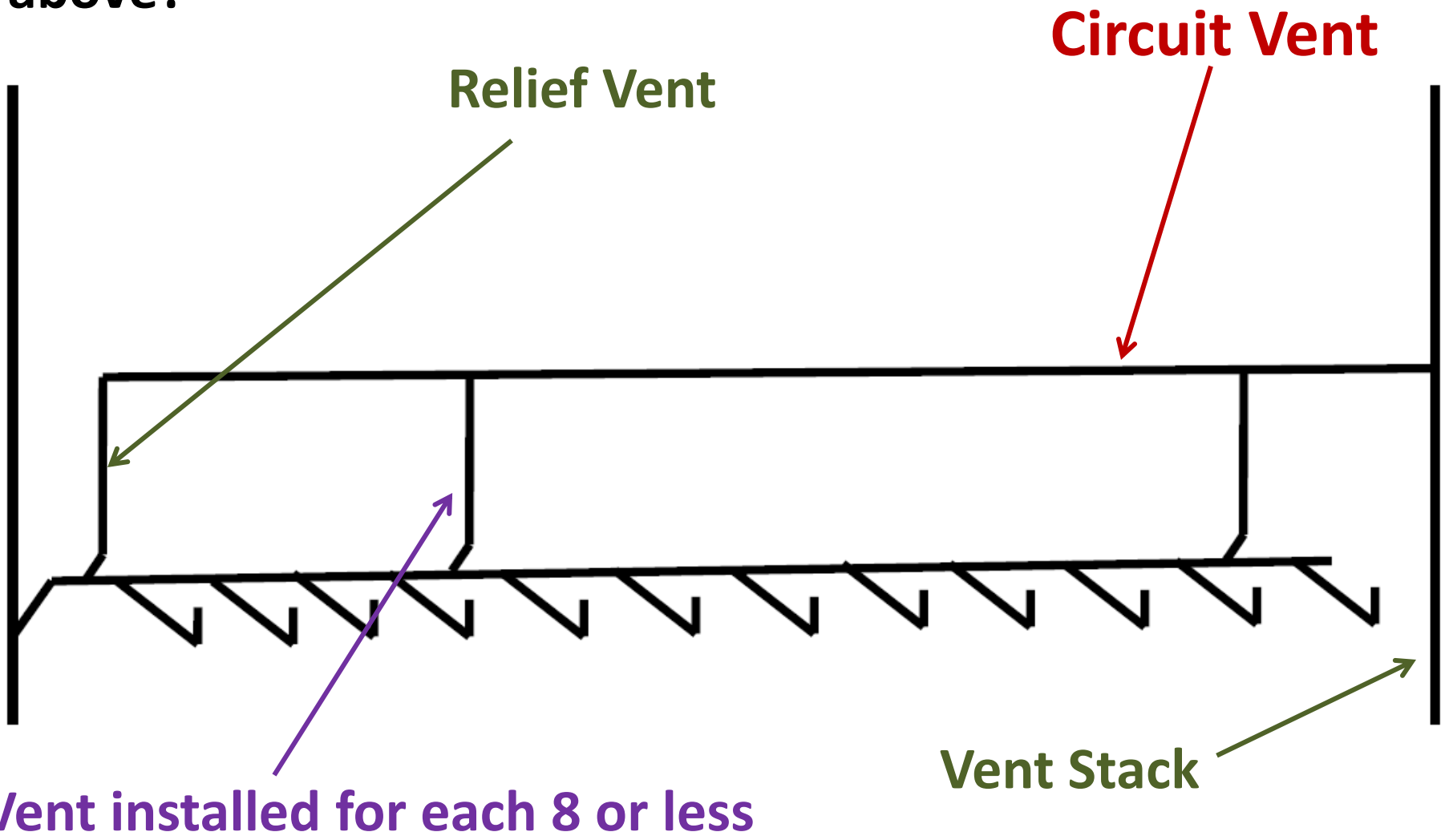
What type of venting is depicted in this drawing of waste and vent piping on a single floor with no fixtures above?



What type of venting is depicted in this drawing of 12 fixtures with additional fixtures located on floors above?



What type of venting is depicted in this drawing of 12 fixtures with additional fixtures located on floors above?



What are the requirements when installing a future vent?

A. **It must be accessible**

B. **It shall be a minimum of 2”**

C. **It must be dripped and labeled**

D. **All of the above**

10.16 Vents and Venting

(14) Future Venting.

(a) In the basement of every building there shall be an **accessible** future vent connection.

(b) Buildings that require a main vent stack shall have a future vent connection full size of the vent stack. In all other buildings (including residential) there shall be a minimum of a **two inch** future vent connection.

(c) All future vent connections shall be **drip** connected identified and **labeled** “*Future Vent*”.

248 CMR - 179

The installation of a thermal expansion tank may be required or necessary on the cold water supply system of a water heater when:

A. a reduced pressure backflow preventer is installed

B. multiple vacuum valves are installed

C. a tank drain is not installed at the lowest point

D. special permission is required by the Board

10.14 (9)

(e) Cold Water Supply

1. A check valve shall not be installed in the cold water supply to any hot water heater or hot water storage tank, unless Special-permission has been granted by the Board.
2. A thermal expansion tank may be required or necessary on any cold water supply system where installation of **Backflow Prevention Devices** or pressure reducing valves would create a closed system and constitute an operating hazard or nuisance.

248 CMR -163

The actual capacity of a hot water tank must be within what percent of the capacity stamped on the tank itself?

A. 2.5%

B. 5%

C. 7.5%

D. 10%

Chapter 142: Section 18. Construction, installing, relocating and repairing requirements; capacity; strength; solder; pressure

A. The actual capacity of a hot water tank shall be within **seven and one half per cent** of the capacity stamped on the tank.

MGL 142 - 18

A reduced pressure zone backflow preventor is equipped with what?

A. One check valve

B. One check valve and intermediate vent

C. Two check valves

D. Two check valves and one intermediate vent

What is the minimum size discharge indirect waste for a safe waste pan?

A. 3/4”

B. 1”

C. 1-1/4”

D. 1-1/2”

10.12: Indirect Waste Piping

(5) Installation of Indirect Waste Piping

(h) Safe Waste Required.

1. A safe waste pan shall be installed under a water heater or hot water storage tank that is installed in a position elevated above any occupied space.

2. The safe waste pan shall be installed underwater heaters and hot water storage tanks where there is occupancy below and shall be piped indirectly to a properly trapped and vented fixture.

3. The Minimum size waste pipe is to be 1-1/4” pipe.

248 CMR - 140

Which of these fixtures in a commercial kitchen need to be protected by a grease interceptor?

A. **Vegetable Prep Sink**

B. **Hand washing sink**

C. **dishwasher**

D. **Pre-rinse sink**

E. **Wok station**

(c) Plumbing fixtures to be protected by grease traps and interceptors shall include:

1. pot sinks (with bowl depths exceeding 10”);
2. scullery sinks (with bowl depths exceeding 10”),
3. floor drains;
4. floor sinks;
5. **automatic dishwashers regardless of temperature;**
6. **pre-rinse sinks;**
7. soup kettles or similar devices;
8. **wok stations;**

248 CMR - 123

True or false. You may install a trap on an indirect waste main:

A. True

B. False

10.12: Indirect Waste Piping

(5) Installation of Indirect Waste Piping

(d) Traps.

1. Prohibited. A trap shall not be installed on an indirect waste main or on an indirect waste branch main.

248 CMR - 140

Are you allowed to indirect waste a pre-rinse sink for a dishwasher in a commercial kitchen:

A. No

B. Yes

10.12: Indirect Waste Piping

(1) Indirect Wastes Required.

(a) Food Handling Establishments.

2. **Dishwashing pre-rinse sinks installed in combination with a commercial dishwasher, pot sinks, scullery sinks and other sinks are excluded from the indirect waste requirement and shall be directly connected to the sanitary drainage system**

248 CMR - 139

What is the best form of backflow prevention?

A. Atmospheric vacuum breaker

B. Air gap

C. Backflow preventor with intermediate atmospheric vent

D. Double check valve

TABLE8A
ACCEPTABLE TYPES OF BACKFLOW PREVENTERS FOR PREVENTION OF CROSS CONNECTIONS ON POTABLE WATER

248 CMR - 161

Practical
Gas Pipe Sizing

STEPS TO SIZING

1. Determine the total BTU load for all equipment
2. Determine the total CFH load for all equipment
3. Determine the distance from the meter to the furthest appliance (Longest length method)
4. Determine the proper table in NFPA54

Piping material – Schedule 40 Metallic Pipe

Type of gas - Natural

Less than 2 PSI

0.5 Pressure drop

3 STEPS TO SIZING

1. Determine BTU input for each outlet

2. Choose the Sizing method you wish to use

6.1.1 * **Longest Length Method.** The pipe size of each section of gas piping shall be determined using the longest length of piping from the point of delivery to the most remote outlet and the load of the section.

Page 54-23

6.1.2* **Branch Length Method.** Pipe shall be sized as follows: (1) Pipe size of each section of the longest pipe run from the point of delivery to the most remote outlet shall be determined using the longest run of piping and the load of the section. (2) The pipe size of each section of branch piping not previously sized shall be determined using the length of piping from the point of delivery to the most remote outlet in each branch and the load of the section.

Page 54-23

3. Choose sizing Table from NFPA 54 2012

Tables begin on Page 54-24

1st SIZING PROBLEM

LONGEST LENGTH METHOD

6.1.1 * Longest Length Method. The pipe size of each section of gas piping shall be determined using the longest length of piping from the point of delivery to the most remote outlet and the load of the section. **Page 54-23**

OUTLETS

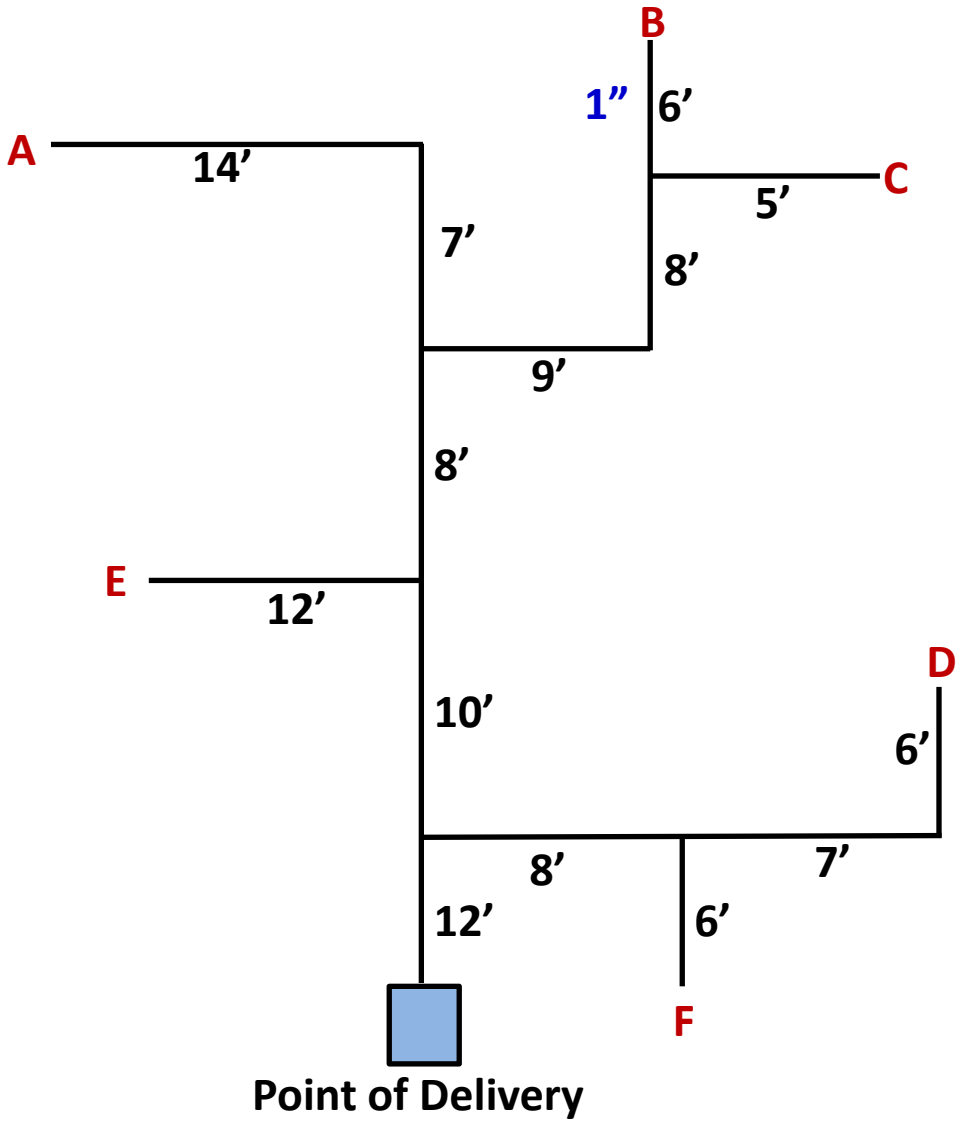
A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Table 6.2 (b)

Page 54-25

GAS PIPE SIZING



OUTLET	
B	= 225,000 BTU
Total:	225,000 BTU

Determine B

Longest Run

12 + 10 + 8 + 9 + 8 + 6 = **53’**

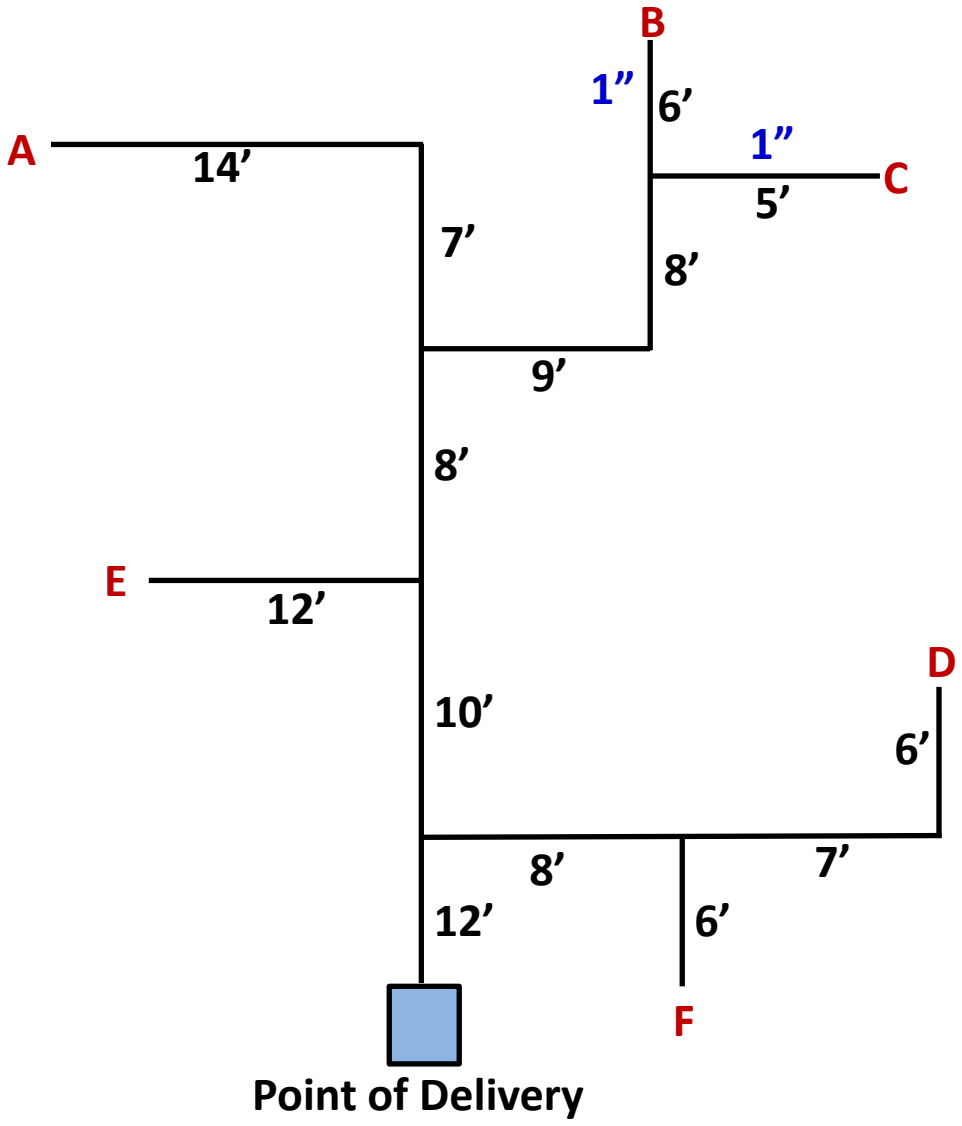
Use 60’ on Chart

3/4”” = 157,000 Maximum

1”” = 257,000 Maximum

B = 1”

GAS PIPE SIZING



OUTLET	
C	180,000 BTU
Total:	**180,000 BTU**

Determine C

Longest Run

12 + 10 + 8 + 9 + 8 + 6 = **53’**

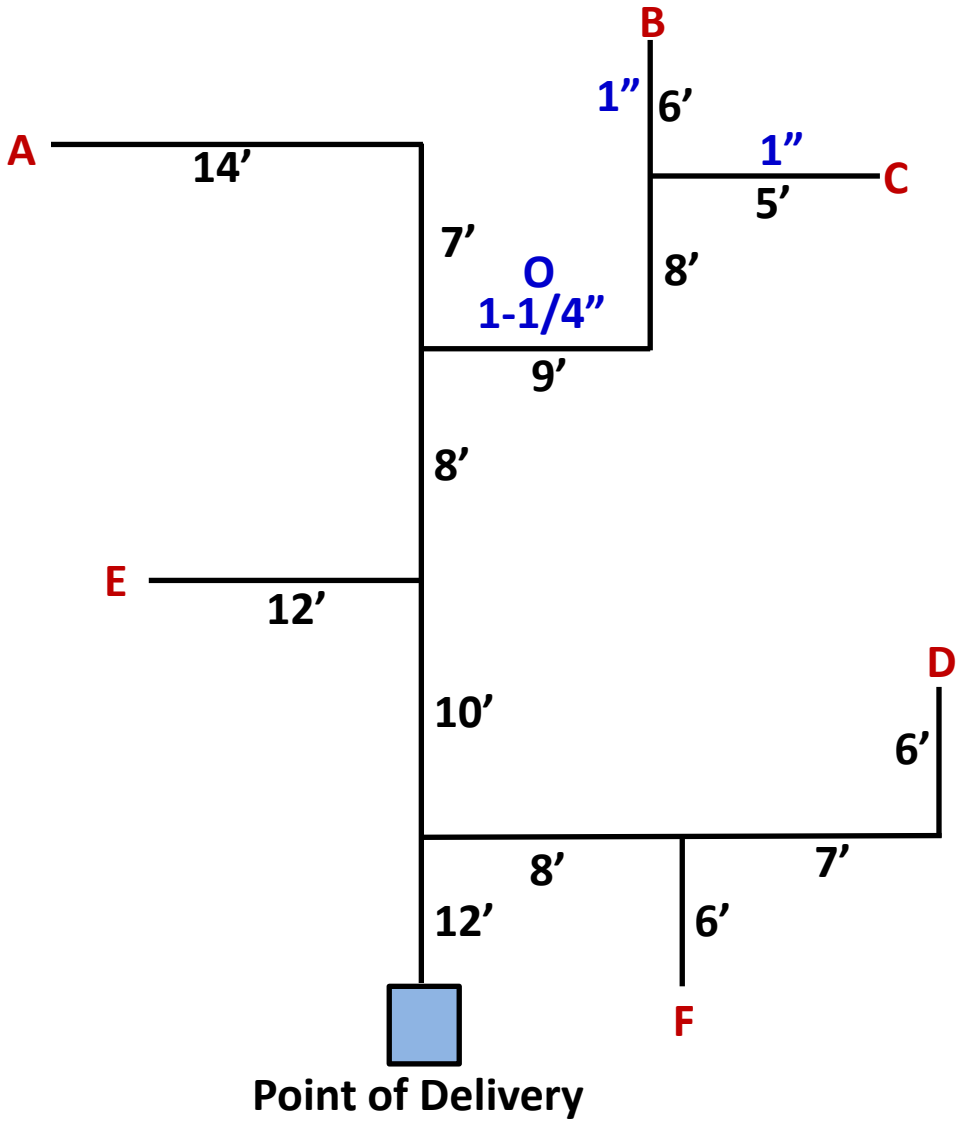
Use 60’ on Chart

3/4”” = 157,000 Maximum

1”” = 257,000 Maximum

C = 1”

GAS PIPE SIZING



OUTLETS

B = 225,000 BTU

C = 180,000 BTU

Total: 405,000 BTU

Determine O

Longest Run

12 + 10 + 8 + 9 + 8 + 6 = **53’**

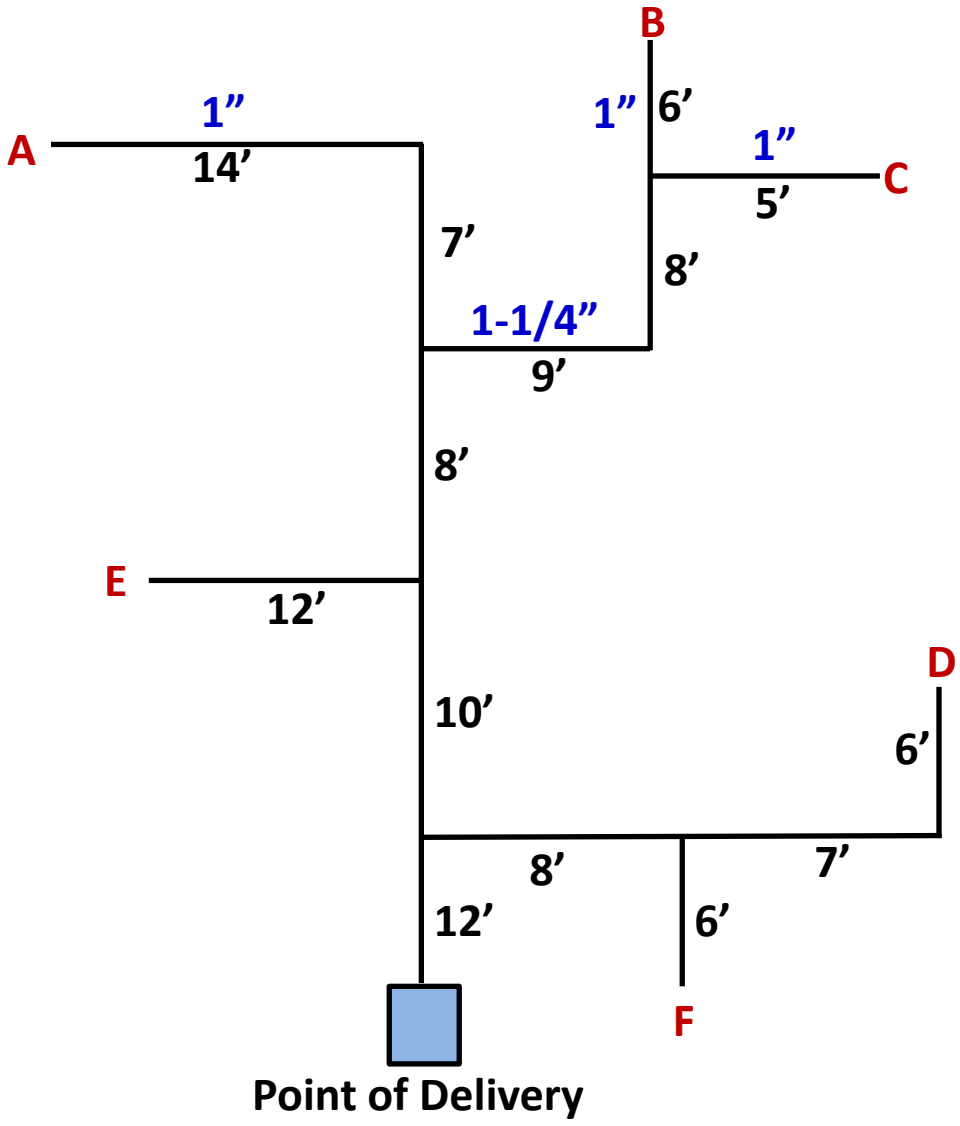
Use 60’ on Chart

1”” = 257,000 Maximum

1-1/4”” = 528,000 Maximum

O = 1-1/4”

GAS PIPE SIZING



OUTLET	
A	= 140,000 BTU
Total:	140,000 BTU

Determine A

Longest Run

12 + 10 + 8 + 9 + 8 + 6 = **53’**

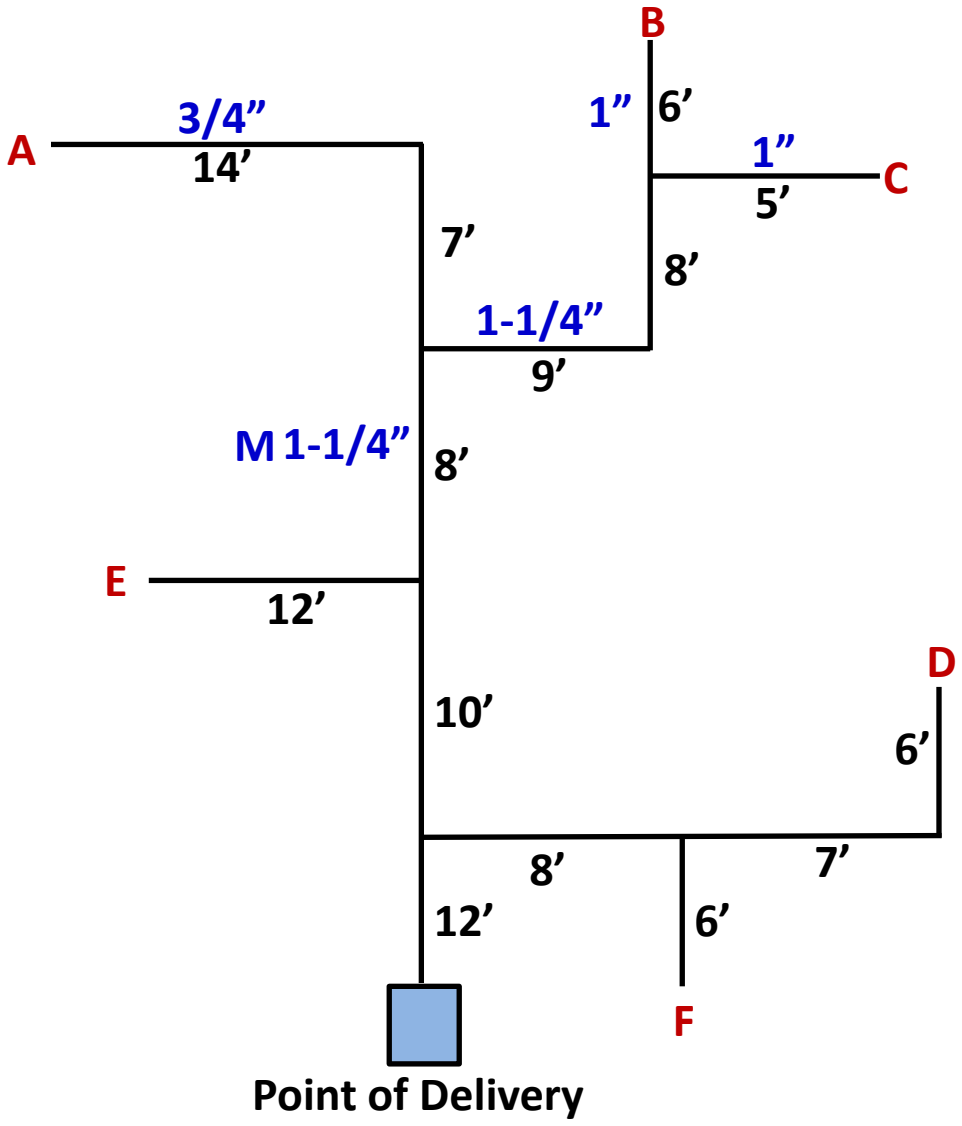
Use 60’ on Chart

1/2”” = 65,000 Maximum

3/4”” = 157,000 Maximum

A = 3/4”

GAS PIPE SIZING



OUTLET	
A	= 140,000 BTU
B	= 225,000 BTU
C	= 180,000 BTU
Total:	545,000 BTU

Determine M

Longest Run

12 + 10 + 8 + 9 + 8 + 6 = **53'**

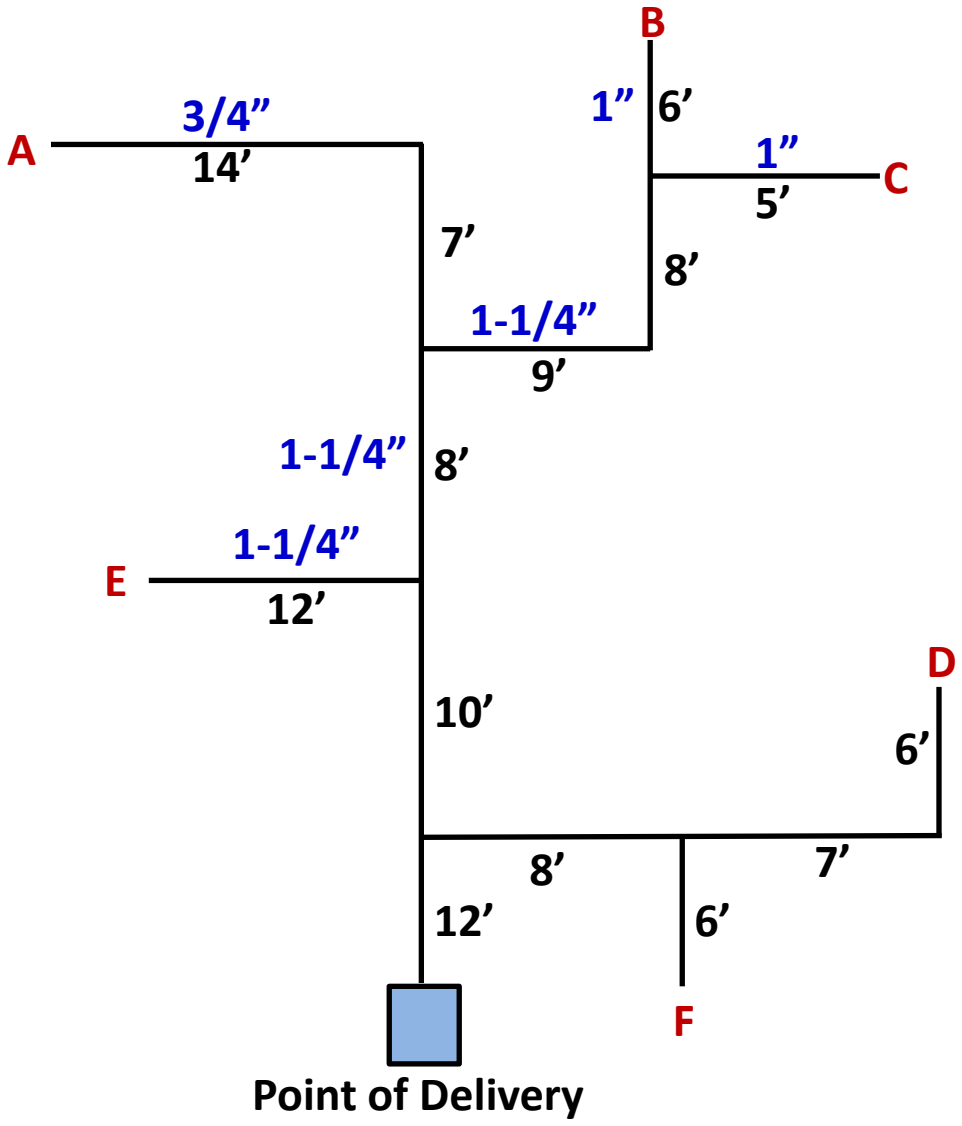
Use 60' on Chart

1-1/4"" = 528,000 Maximum

1-1/2"" = 791,000 Maximum

M = 1-1/4"

GAS PIPE SIZING



	OUTLET
	E = 285,000 BTU
Total:	285,000 BTU

Determine E

Longest Run

12 + 10 + 8 + 9 + 8 + 6 = **53'**

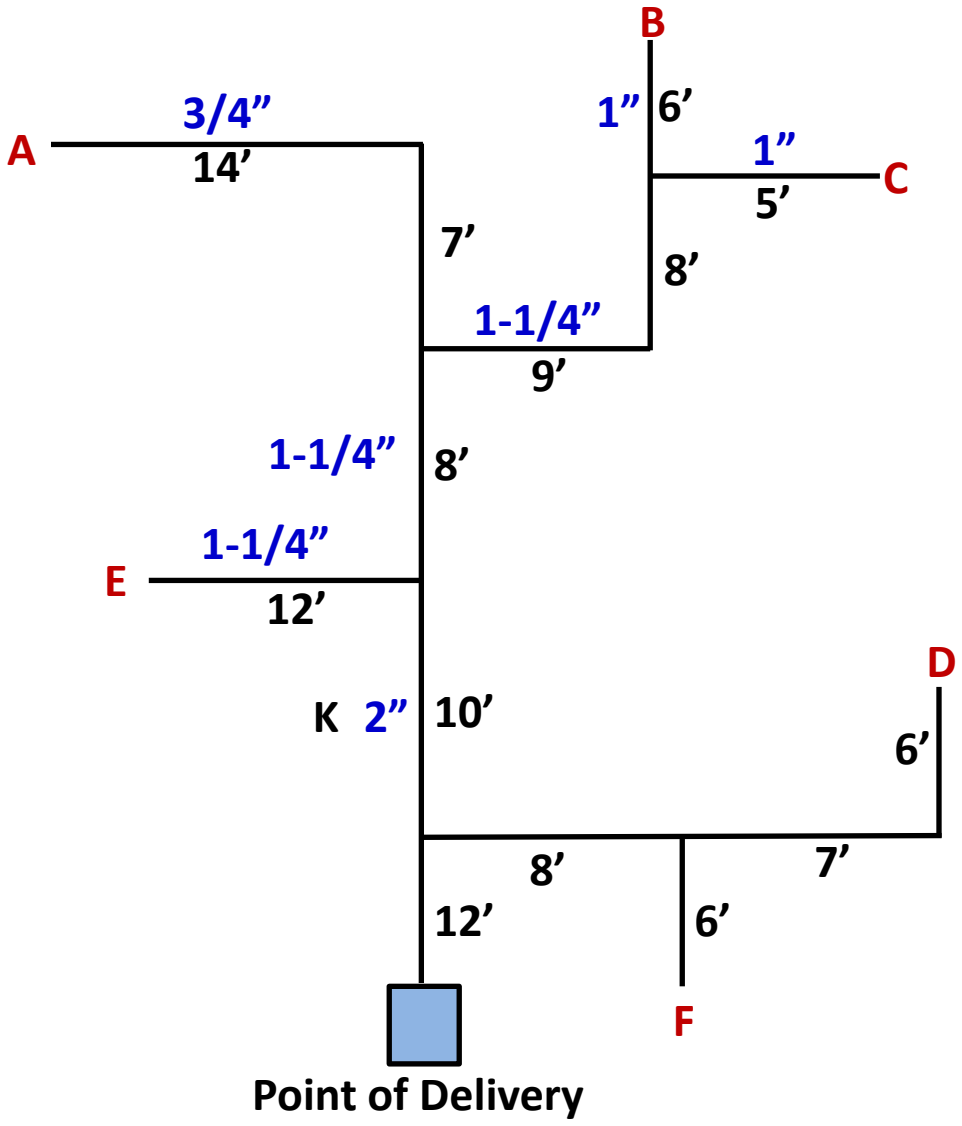
Use 60' on Chart

1" = 257,000 Maximum

1-1/4"" = 528,000 Maximum

E = 1-1/4"

GAS PIPE SIZING



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
E = 285,000 BTU

Total: 830,000 BTU

Determine K

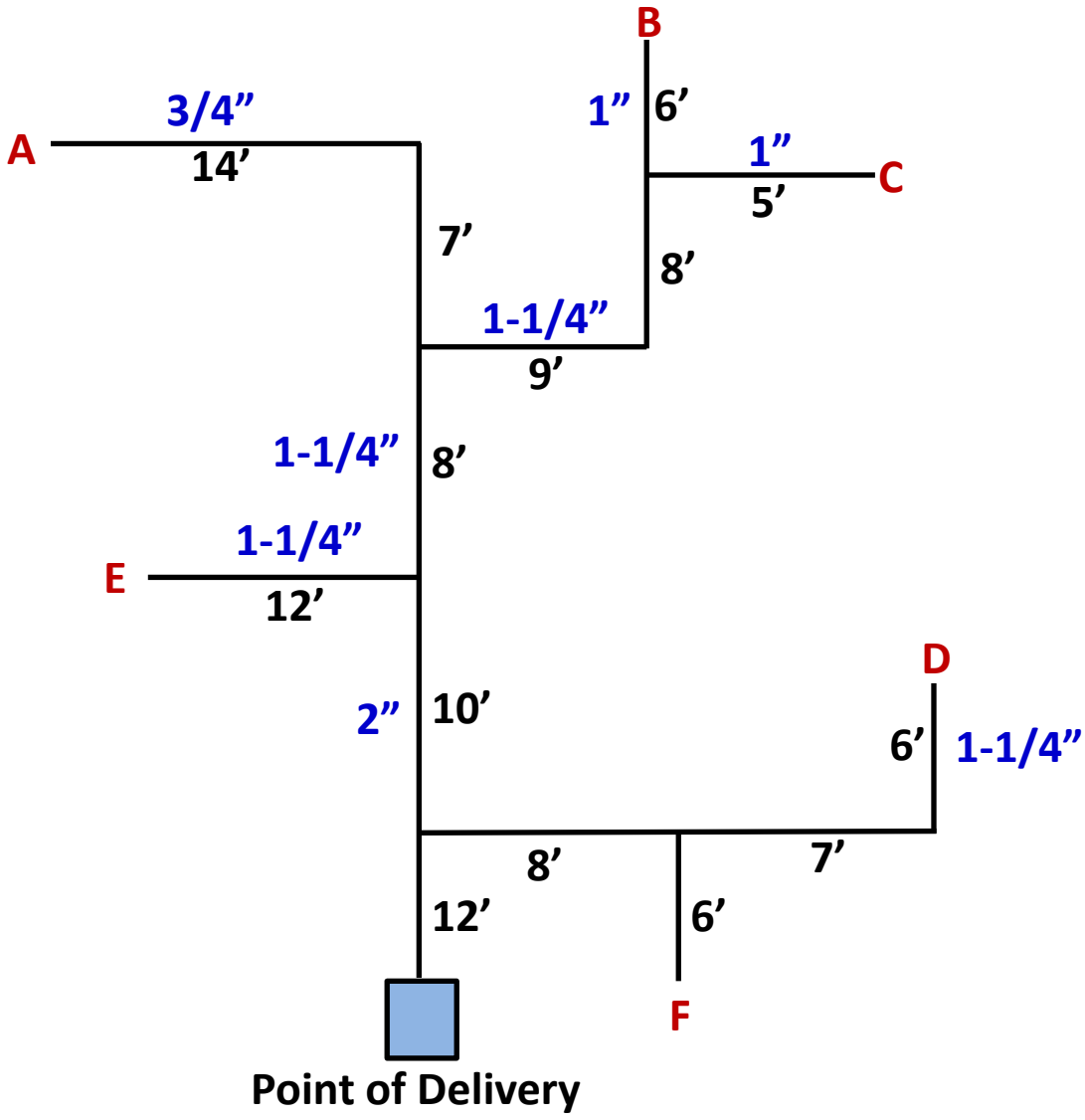
Longest Run
12 + 10 + 8 + 9 + 8 + 6 = **53’**
Use 60’ on Chart

1-1/2” = 791,000 Maximum

2” = 1,520,000 Maximum

K = 2”

GAS PIPE SIZING



OUTLETS
D = 285,000 BTU

Determine D

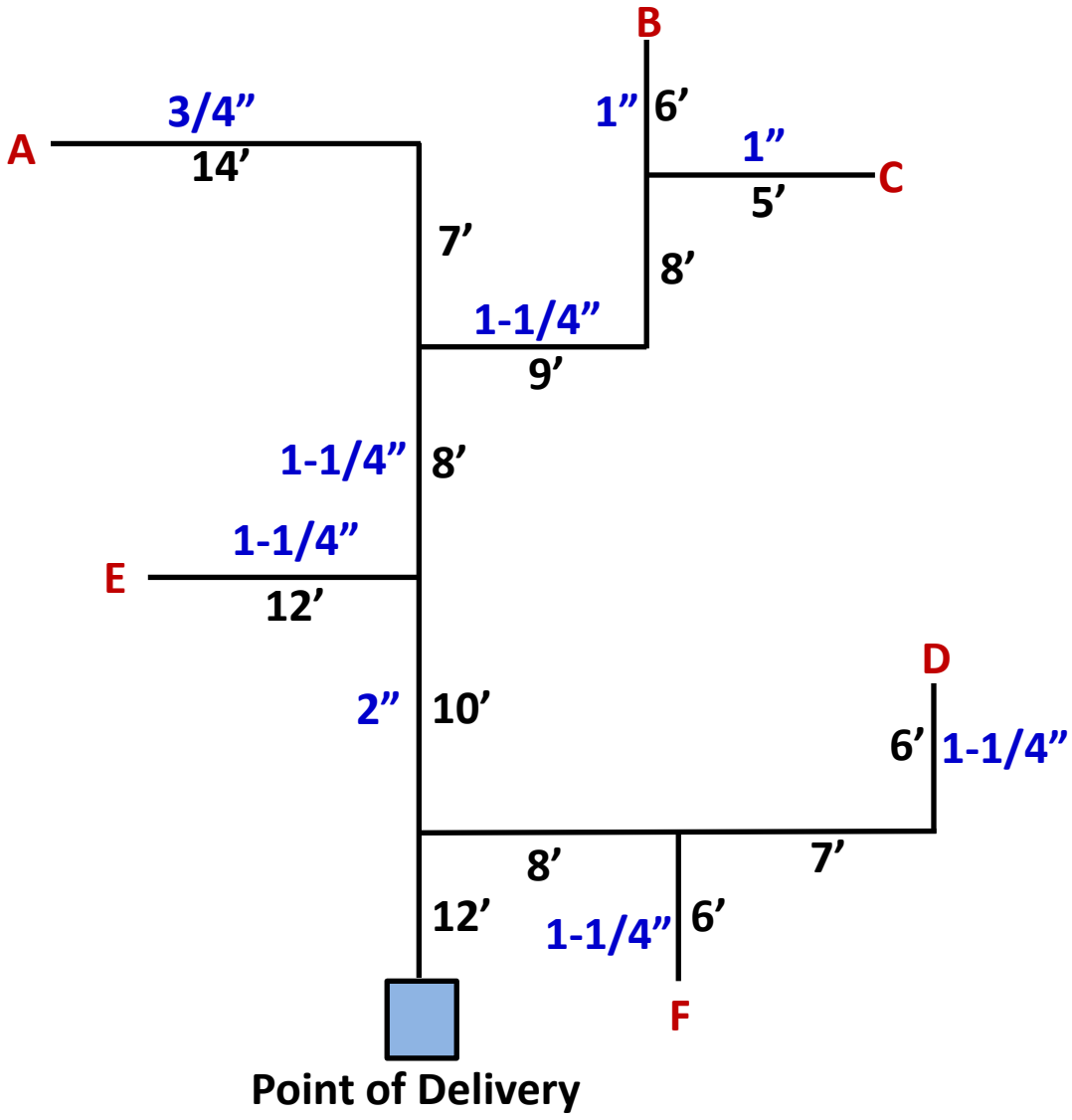
Longest Run
12 + 10 + 8 + 9 + 8 + 6 = **53’**
Use 60’ on Chart

1” = 257,000 Maximum

1-1/4” = 528,000 Maximum

D = 1-1/4”

GAS PIPE SIZING



OUTLETS
F = 360,000 BTU

Determine F

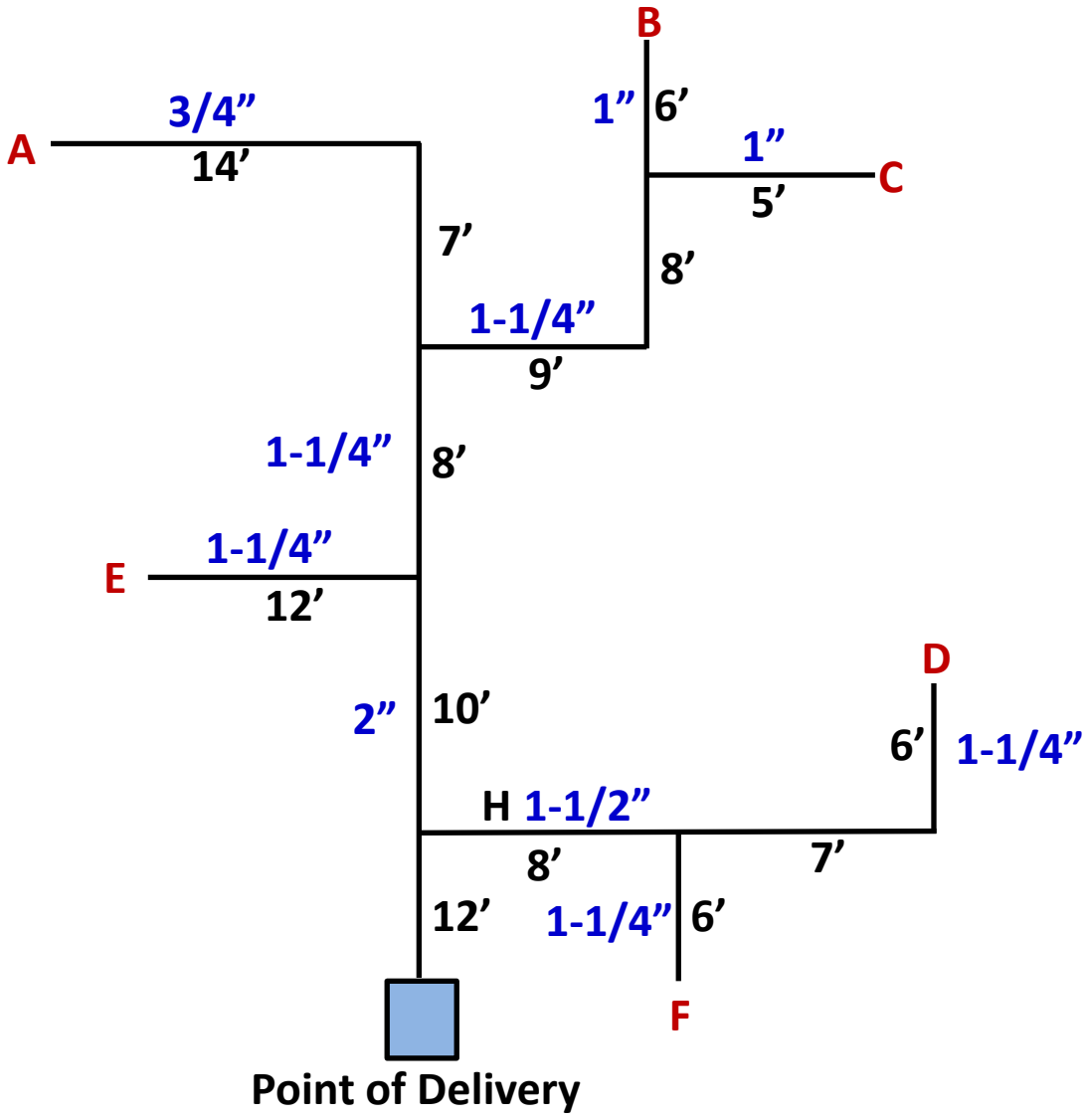
Longest Run
12 + 10 + 8 + 9 + 8 + 6 = **53’**
Use 60’ on Chart

1” = 257,000 Maximum

1-1/4” = 528,000 Maximum

F = 1-1/4”

GAS PIPE SIZING



OUTLETS

D = 285,000 BTU

F = 360,000 BTU

Total: 645,000 BTU

Determine H

Longest Run

12 + 10 + 8 + 9 + 8 + 6 = **53’**

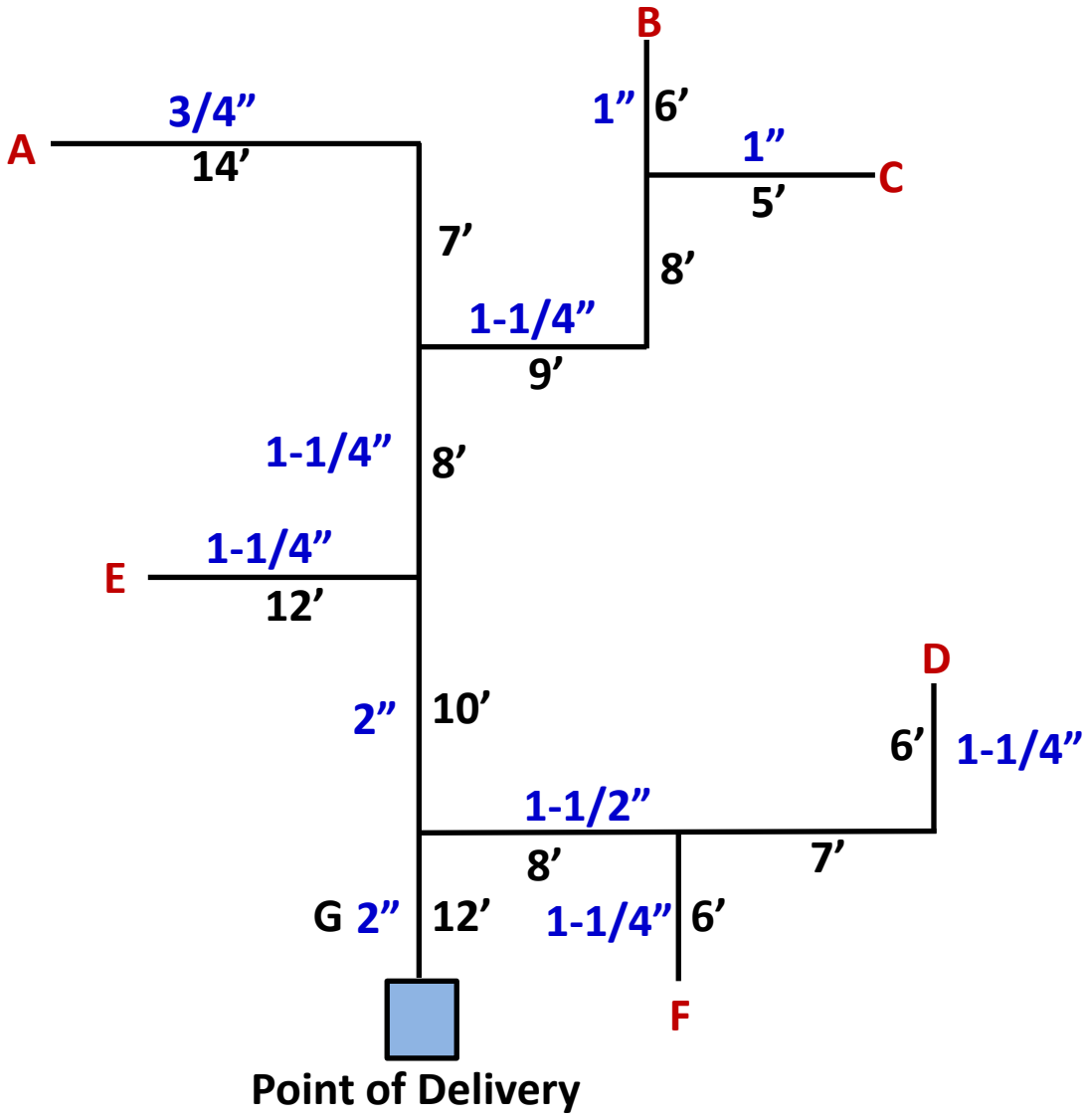
Use 60’ on Chart

1-1/4” = 528,000 Maximum

1-1/2” = 791,000 Maximum

H = 1-1/2”

GAS PIPE SIZING



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine G

Longest Run
12 + 10 + 8 + 9 + 8 + 6 = **53’**
Use 60’ on Chart
1-1/2” = 791,000 Maximum

2” = 1,520,000 Maximum

G = 2”

NOW SIZE THE SAME PIPING LAYOUT USING THE BRANCH METHOD

6.1.2* Branch Length Method.

Pipe shall be sized as follows:

(1) Pipe size of each section of the longest pipe run from the point of delivery to the most remote outlet shall be determined using the longest run of piping and the load of the section.

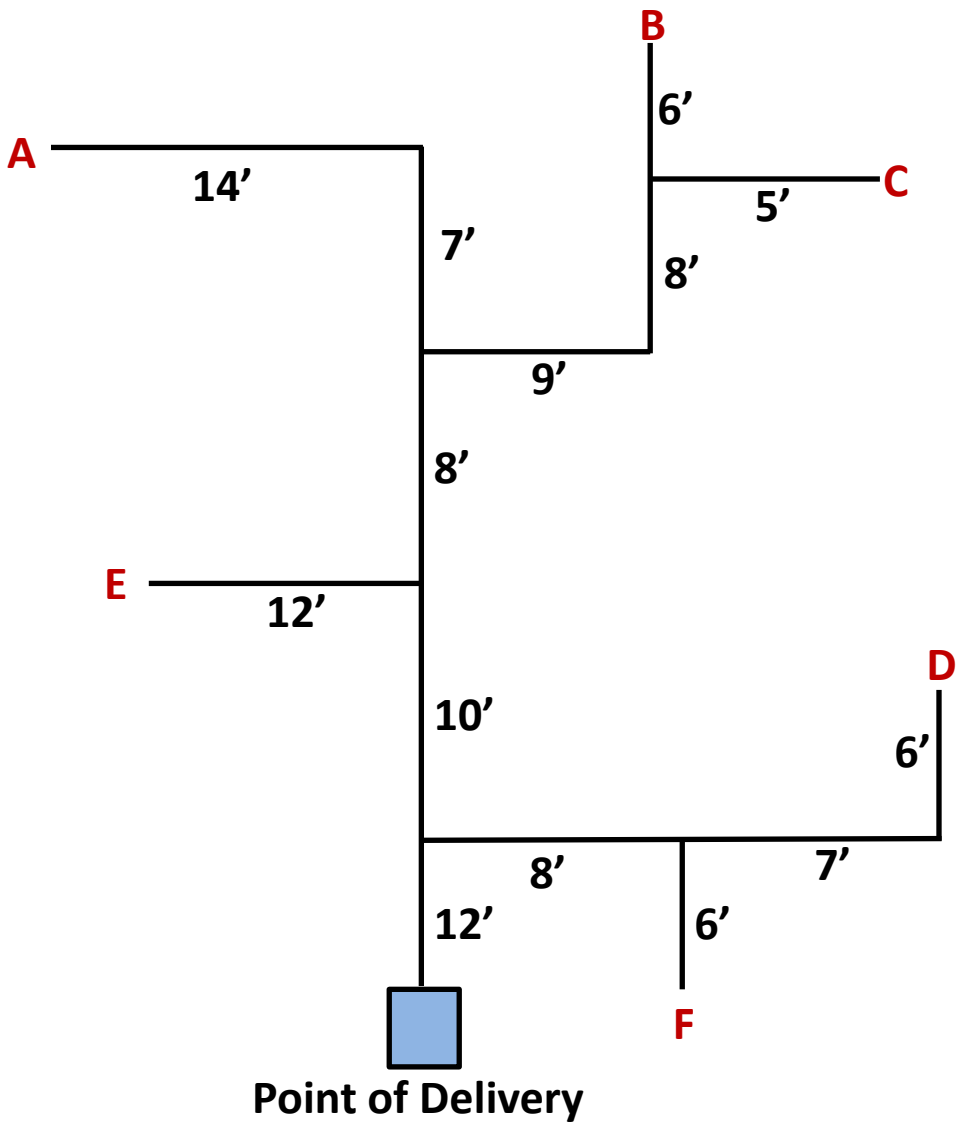
(2) (2) The pipe size of each section of branch piping not previously sized shall be determined using the length of piping from the point of delivery to the most remote outlet in each branch and the load of the section.

Table 6.2(b) Schedule 40 Metallic Pipe

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	0.5 in. w.c.
Specific Gravity:	0.60

	Pipe Size (in.)													
Nominal:	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
Actual ID:	**0.622**	**0.824**	**1.049**	**1.380**	**1.610**	**2.067**	**2.469**	**3.068**	**4.026**	**5.047**	**6.065**	**7.981**	**10.020**	**11.938**
Length (ft)	**Capacity in Cubic Feet of Gas per Hour**													
10	172	360	678	1,390	2,090	4,020	6,400	11,300	23,100	41,800	67,600	139,000	252,000	399,000
20	118	247	466	957	1,430	2,760	4,400	7,780	15,900	28,700	46,500	95,500	173,000	275,000
30	95	199	374	768	1,150	2,220	3,530	6,250	12,700	23,000	37,300	76,700	139,000	220,000
40	81	170	320	657	985	1,900	3,020	5,350	10,900	19,700	31,900	65,600	119,000	189,000
50	72	151	284	583	873	1,680	2,680	4,740	9,660	17,500	28,300	58,200	106,000	167,000
60	65	137	257	528	791	1,520	2,430	4,290	8,760	15,800	25,600	52,700	95,700	152,000
70	60	126	237	486	728	1,400	2,230	3,950	8,050	14,600	23,600	48,500	88,100	139,000
80	56	117	220	452	677	1,300	2,080	3,670	7,490	13,600	22,000	45,100	81,900	130,000
90	52	110	207	424	635	1,220	1,950	3,450	7,030	12,700	20,600	42,300	76,900	122,000
100	50	104	195	400	600	1,160	1,840	3,260	6,640	12,000	19,500	40,000	72,600	115,000

Branch Method

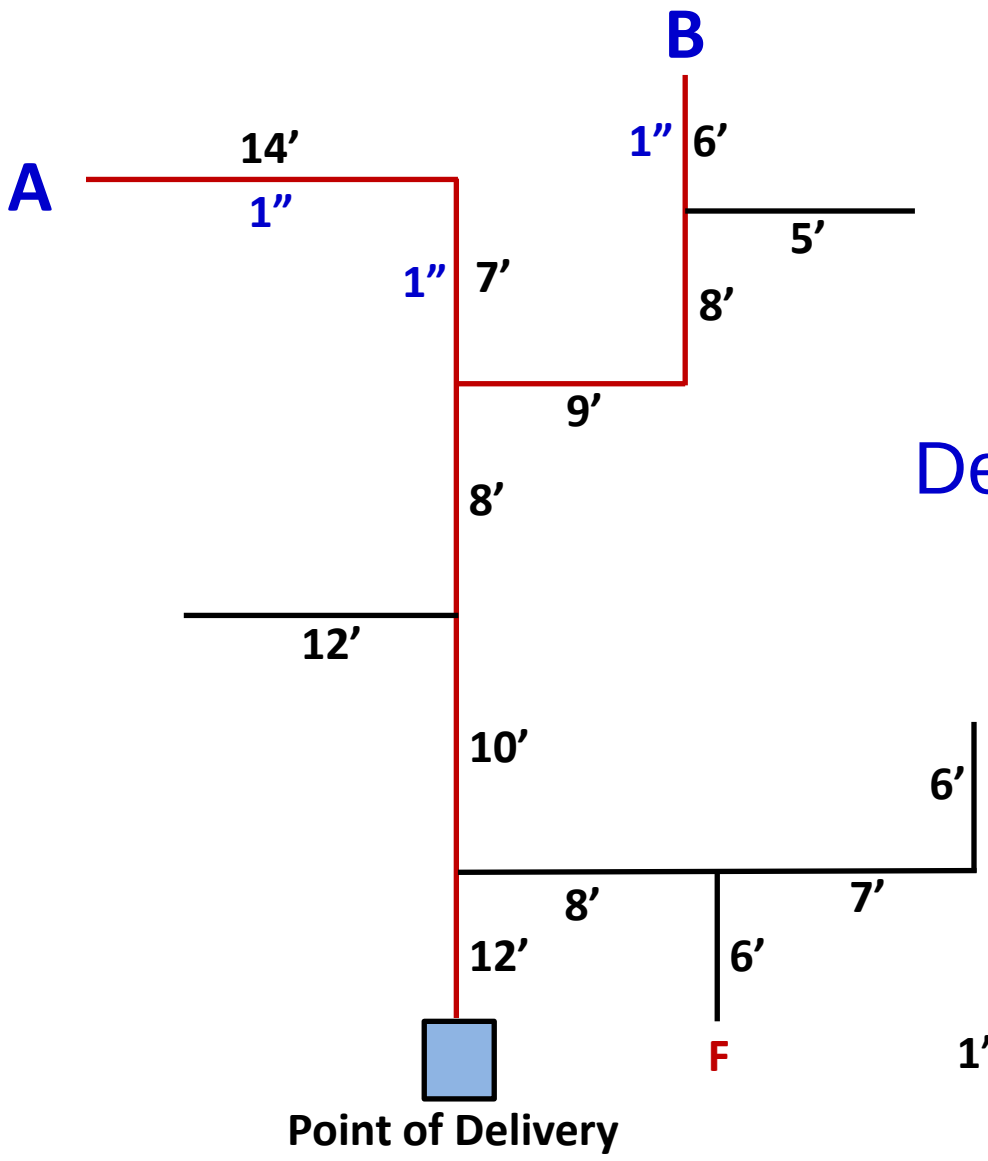


OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine B – 225,000

Distance from Meter to B = **53’**
Use 60’ on Chart

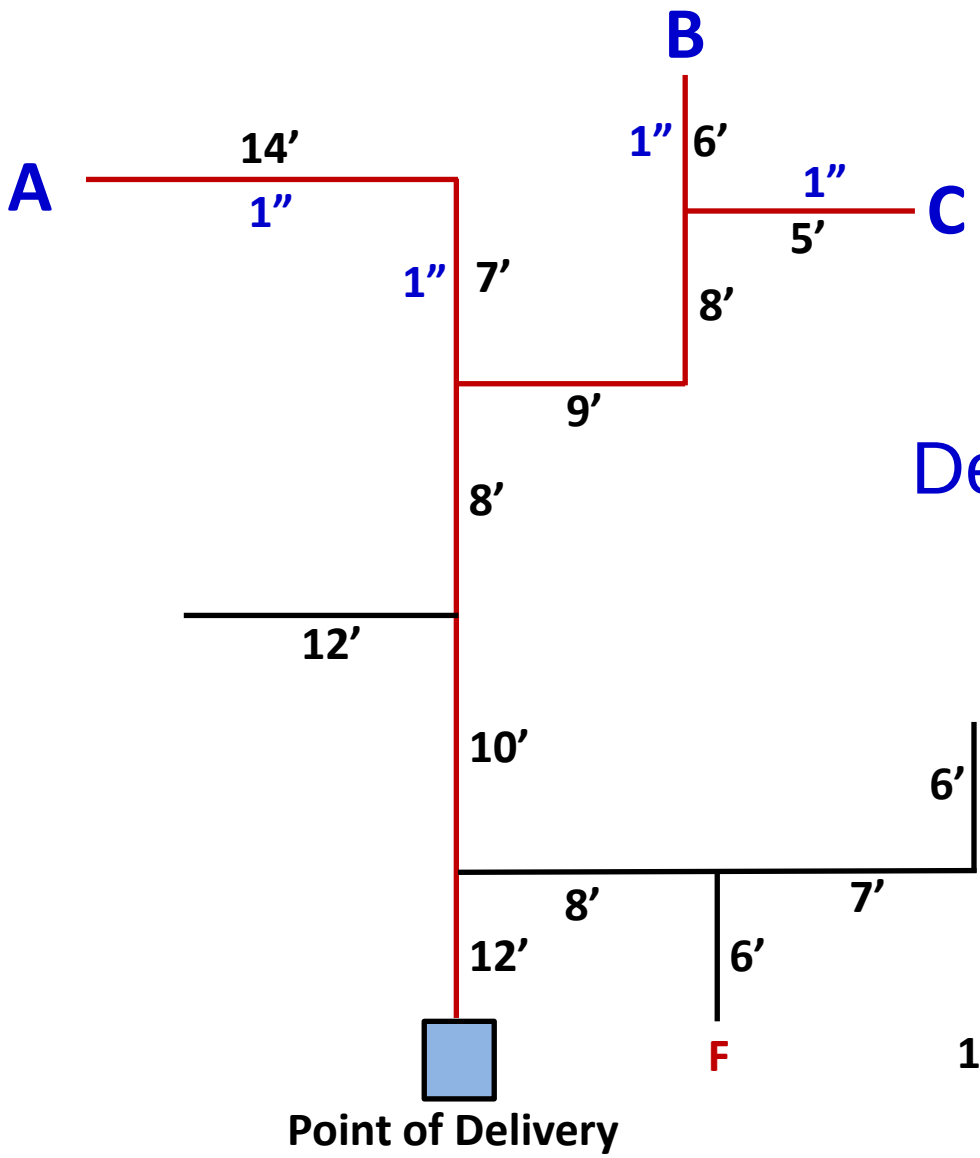
3/4” = 137,000 Maximum

1” = 257,000 Maximum

B = 1”

1” is the size for the final 6’ only

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine C – 180,000

Distance from Meter to C = **52’**
Use 60’ on Chart

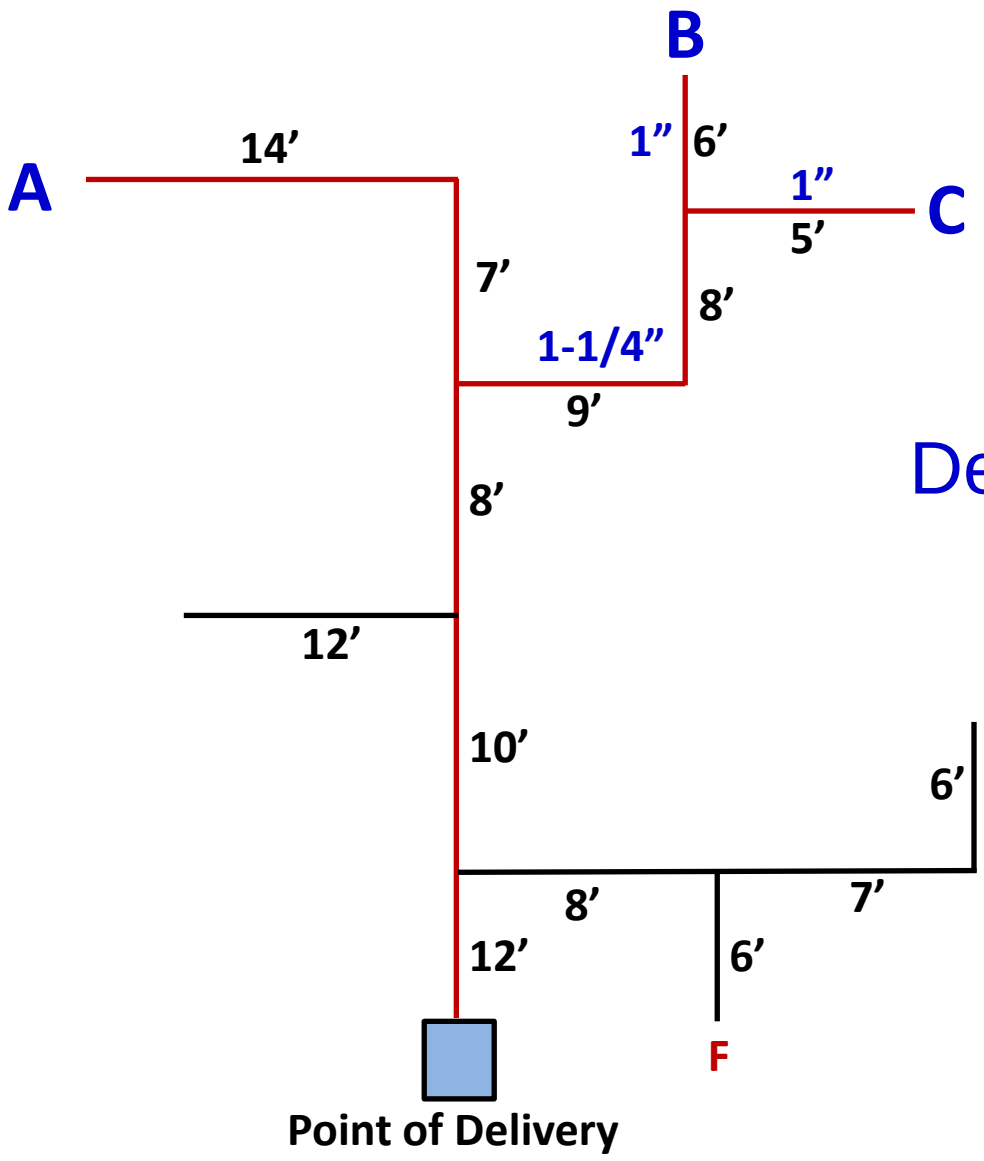
3/4” = 137,000 Maximum

1” = 257,000 Maximum

C = 1”

1” is the size for the final 5’ only

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine O – 405,000

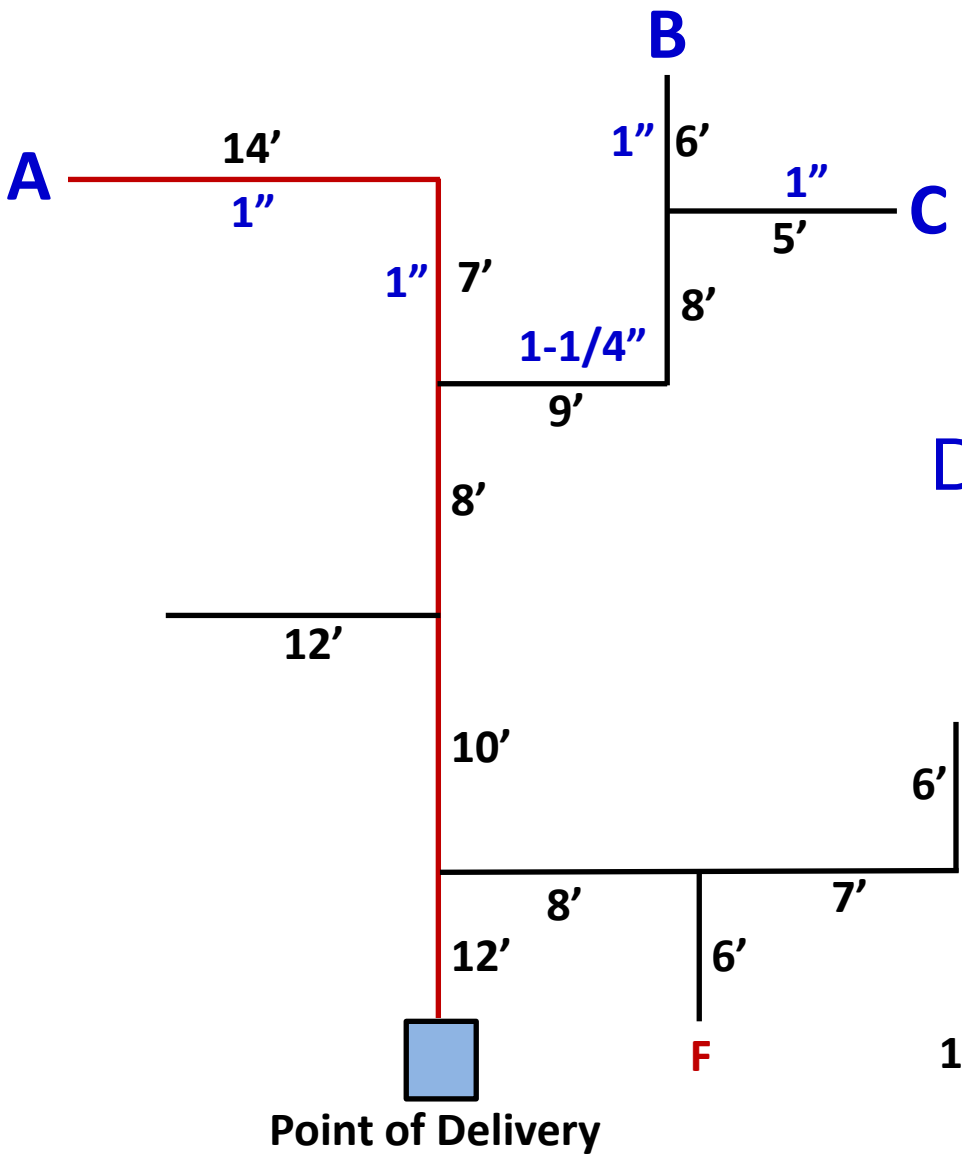
Distance from Meter to B = **53’**
Use 60’ on Chart

1” = 257,000 Maximum

1-1/4” = 528,000 Maximum

O = 1-1/4”

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine A – 140,000

Distance from Meter to A = **51’**
Use 60’ on Chart

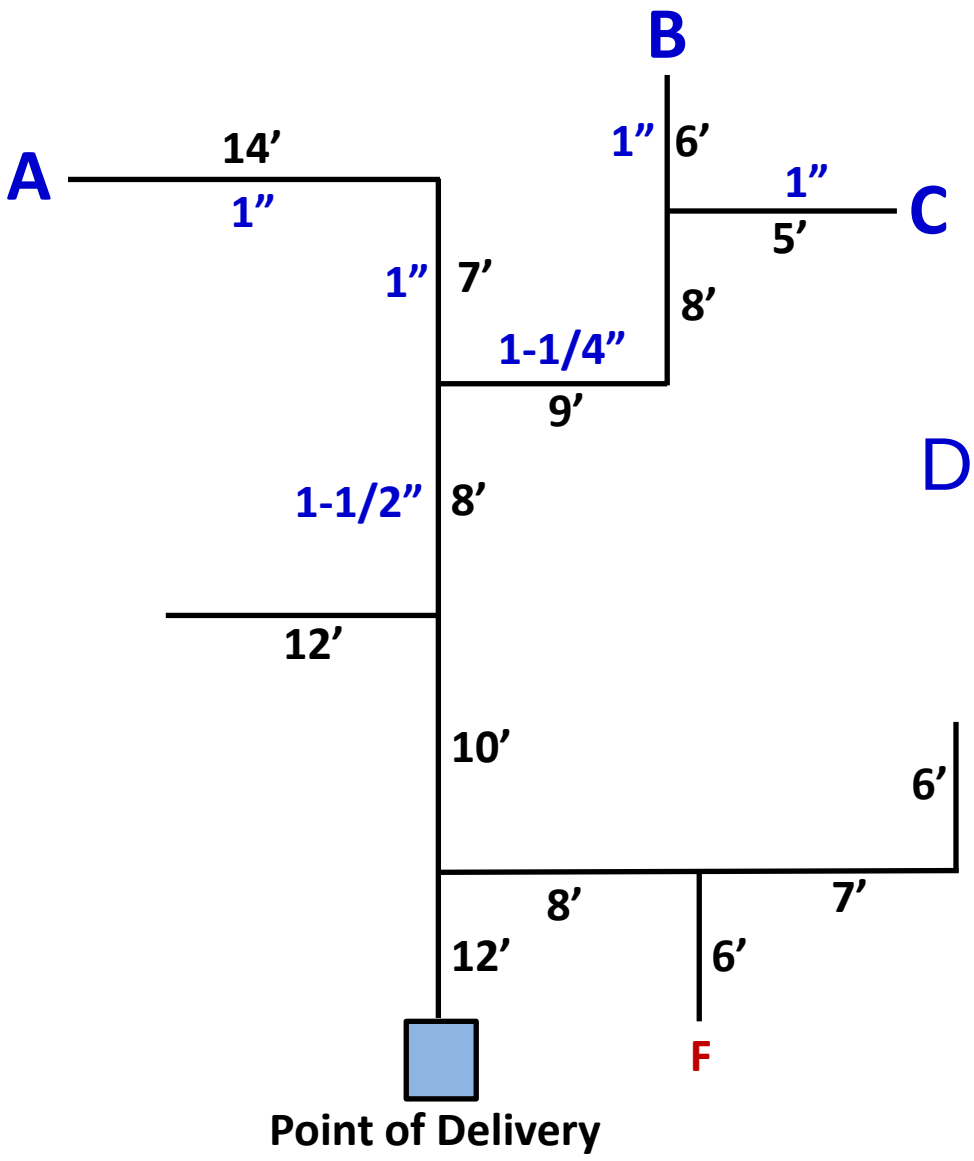
3/4” = 137,000 Maximum

1” = 257,000 Maximum

A = 1”

1” is the size for the final 21’ only

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine M – 545,000

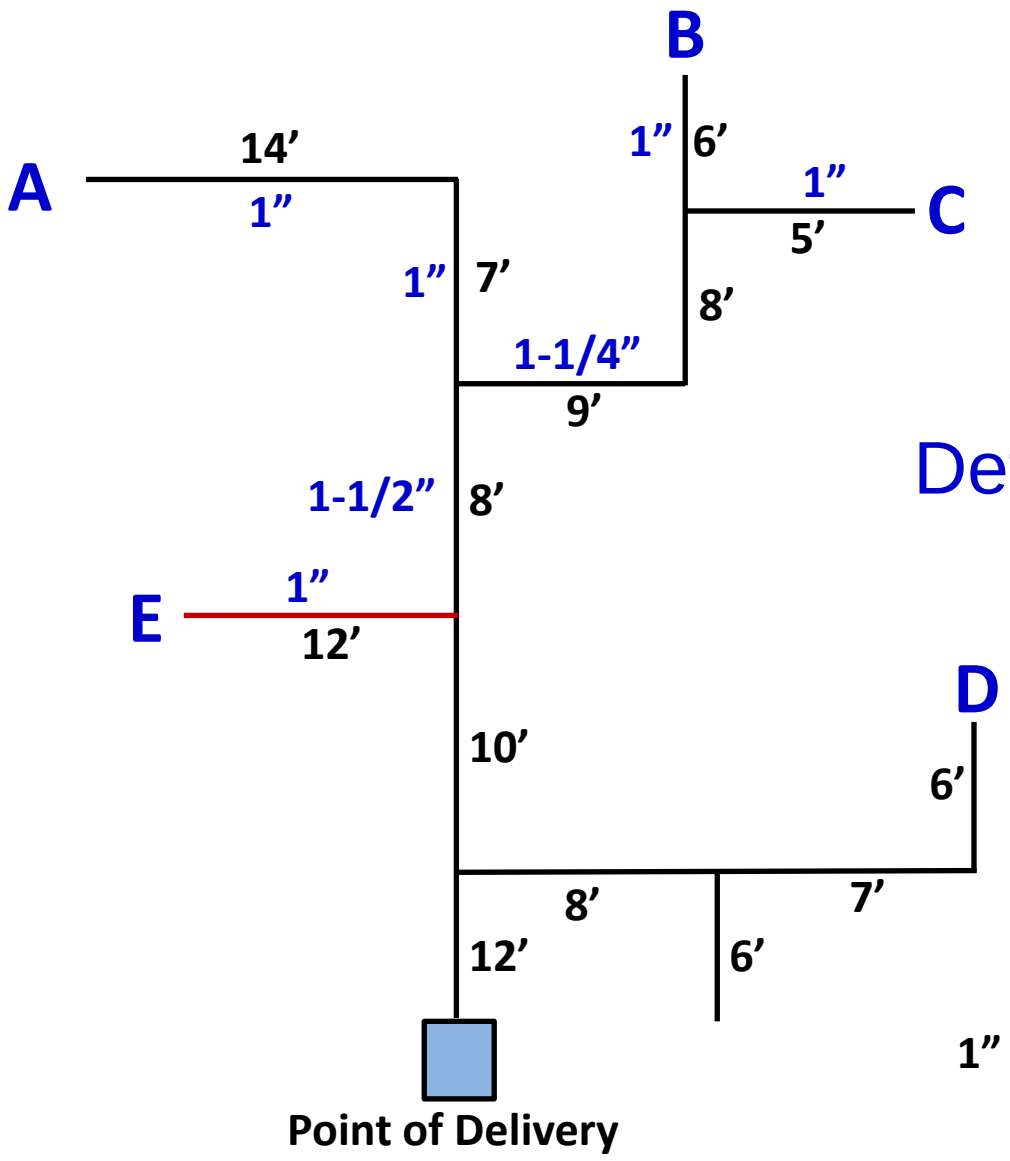
Distance from Meter to A = **53’**
Use 60’ on Chart

1-1/4” = 528,000 Maximum

1-1/2” = 791,000 Maximum

M = 1-1/12”

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine E – 285,000

Distance from Meter to E = **34’**
Use 40’ on Chart

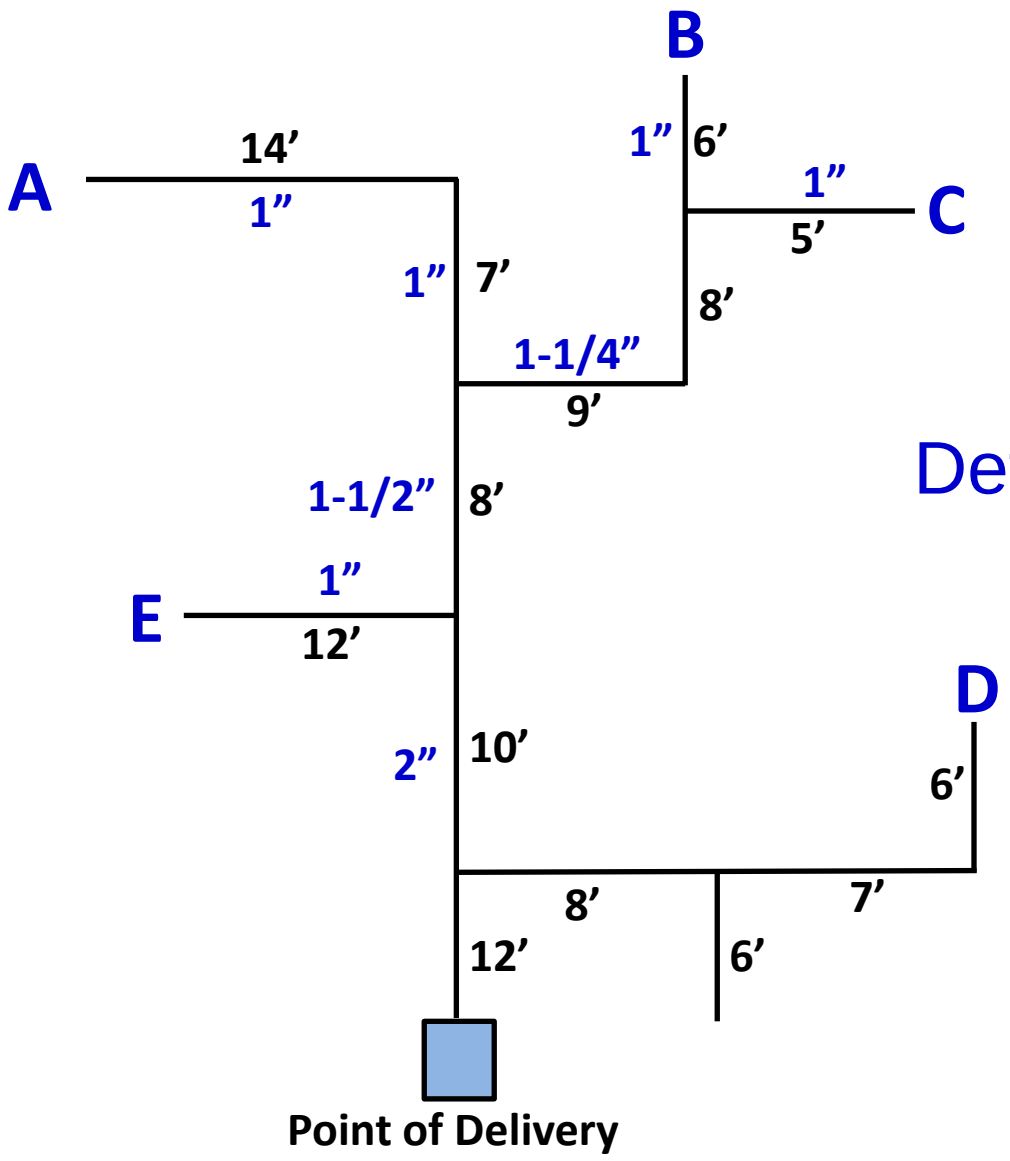
3/4” = 170,000 Maximum

1” = 320,000 Maximum

E = 1”

1” is the size for the final 12’ only

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine K – 830,000

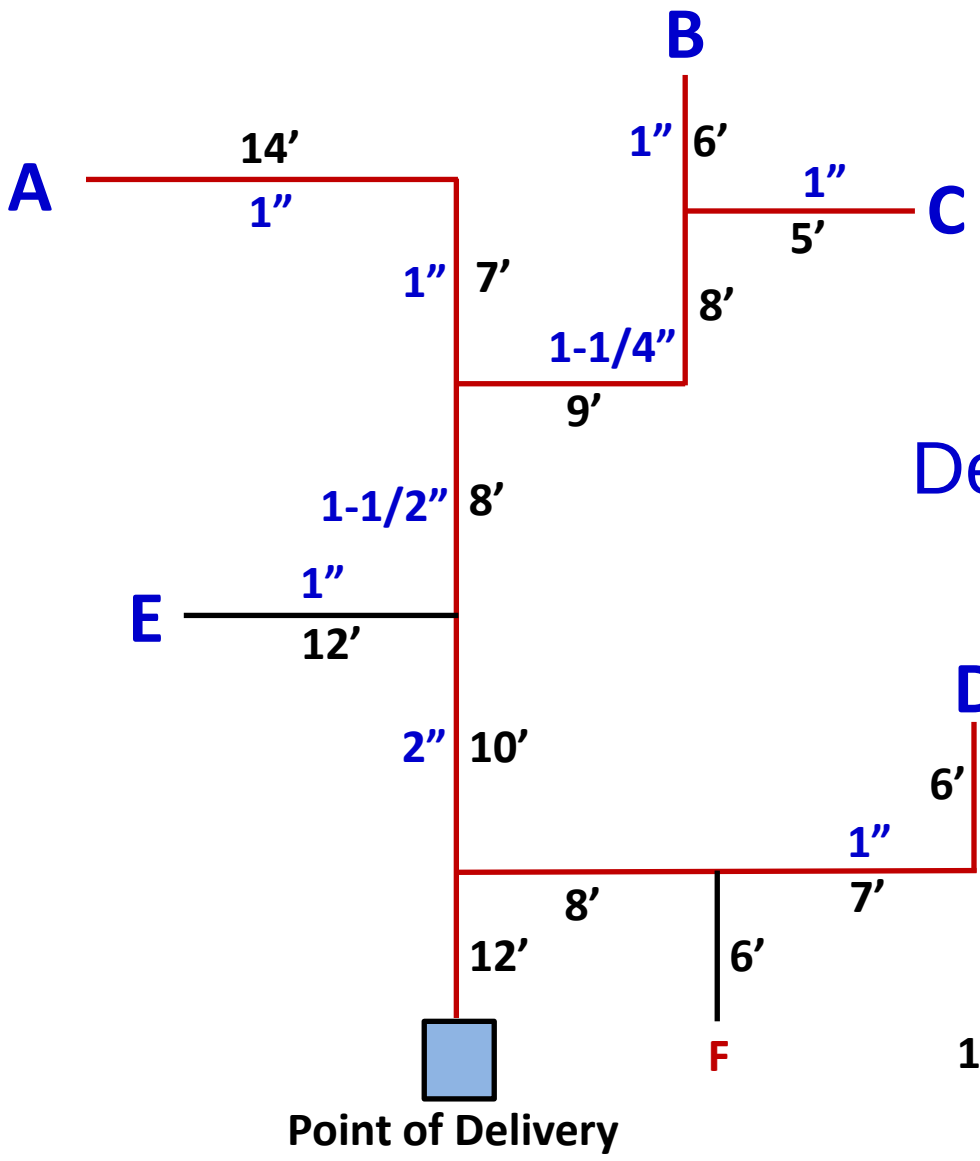
Distance from Meter to B = **53’**
Use 60’ on Chart

1-1/2” = 791,000 Maximum

2” = 1,520,000 Maximum

K = 2”

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine D – 285,000

Distance from Meter to D = **33’**
Use 40’ on Chart

3/4” = 170,000 Maximum

1” = 320,000 Maximum

D = 1”

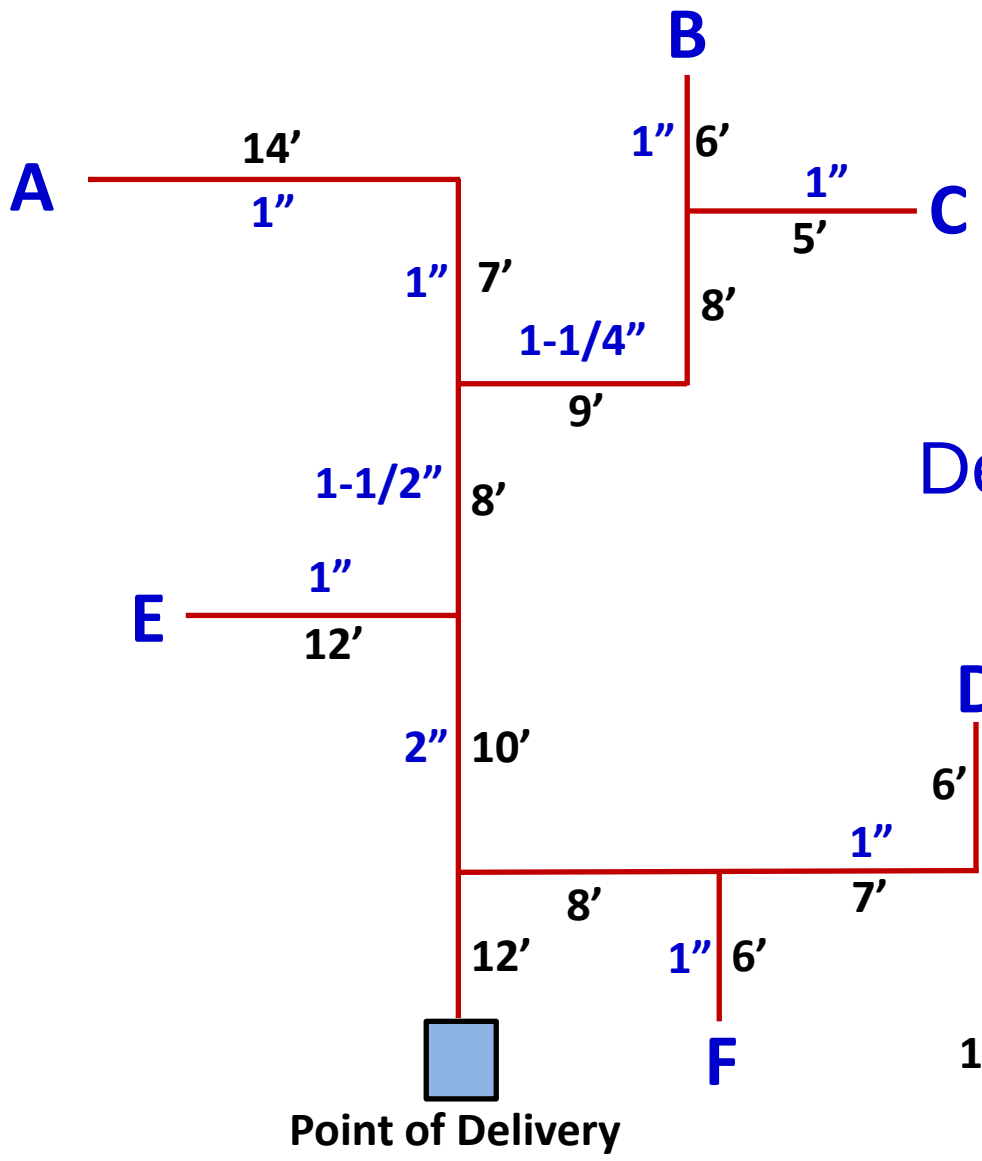
1” is the size for the final 13’ only

Branch Method

OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000



Determine F – 360,000

Distance from Meter to F = **26’**
Use 30’ on Chart

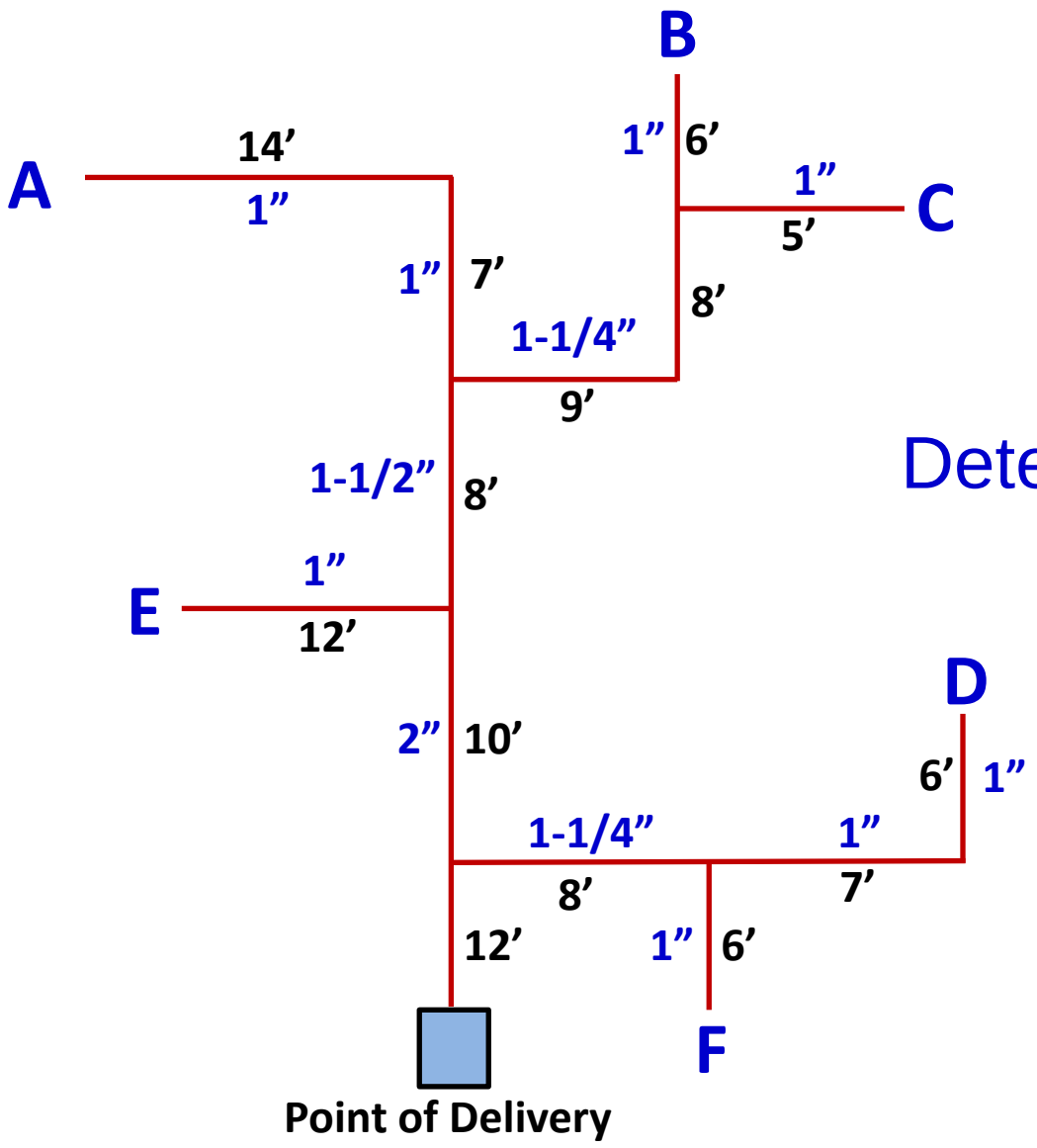
3/4” = 199,000 Maximum

1” = 374,000 Maximum

F = 1”

1” is the size for the final 6’ only

Branch Method



OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000

Determine H – 645,000

Distance from Meter to D = **33’**
Use 40’ on Chart

1” = 320,000 Maximum

1-1/4” = 657,000 Maximum

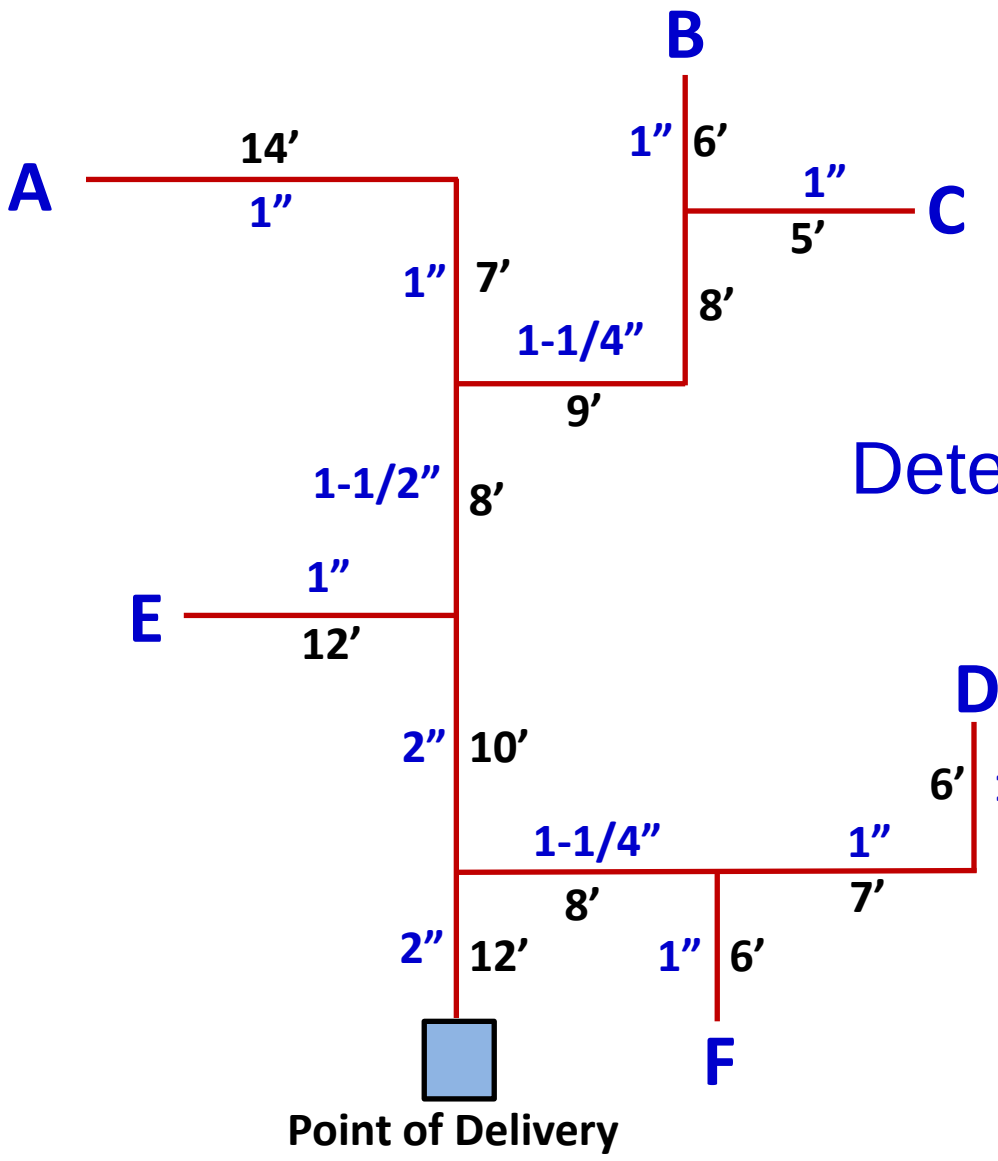
H = 1-1/4”

Branch Method

OUTLETS

A = 140,000 BTU
B = 225,000 BTU
C = 180,000 BTU
D = 285,000 BTU
E = 285,000 BTU
F = 360,000 BTU

Total Load 1,475,000



Determine G – 1,475,000

Distance from Meter to B = **53’**
Use 60’ on Chart

1-1/2” = 891,000 Maximum

2” = 1,520,000 Maximum

G = 1-1/4”

Table 6.2(b) Schedule 40 Metallic Pipe

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	0.5 in. w.c.
Specific Gravity:	0.60

	Pipe Size (in.)													
Nominal:	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
Actual ID:	**0.622**	**0.824**	**1.049**	**1.380**	**1.610**	**2.067**	**2.469**	**3.068**	**4.026**	**5.047**	**6.065**	**7.981**	**10.020**	**11.938**
Length (ft)	**Capacity in Cubic Feet of Gas per Hour**													
10	172	360	678	1,390	2,090	4,020	6,400	11,300	23,100	41,800	67,600	139,000	252,000	399,000
20	118	247	466	957	1,430	2,760	4,400	7,780	15,900	28,700	46,500	95,500	173,000	275,000
30	95	199	374	768	1,150	2,220	3,530	6,250	12,700	23,000	37,300	76,700	139,000	220,000
40	81	170	320	657	985	1,900	3,020	5,350	10,900	19,700	31,900	65,600	119,000	189,000
50	72	151	284	583	873	1,680	2,680	4,740	9,660	17,500	28,300	58,200	106,000	167,000
60	65	137	257	528	791	1,520	2,430	4,290	8,760	15,800	25,600	52,700	95,700	152,000
70	60	126	237	486	728	1,400	2,230	3,950	8,050	14,600	23,600	48,500	88,100	139,000
80	56	117	220	452	677	1,300	2,080	3,670	7,490	13,600	22,000	45,100	81,900	130,000
90	52	110	207	424	635	1,220	1,950	3,450	7,030	12,700	20,600	42,300	76,900	122,000
100	50	104	195	400	600	1,160	1,840	3,260	6,640	12,000	19,500	40,000	72,600	115,000

Total BTU load? 625,000

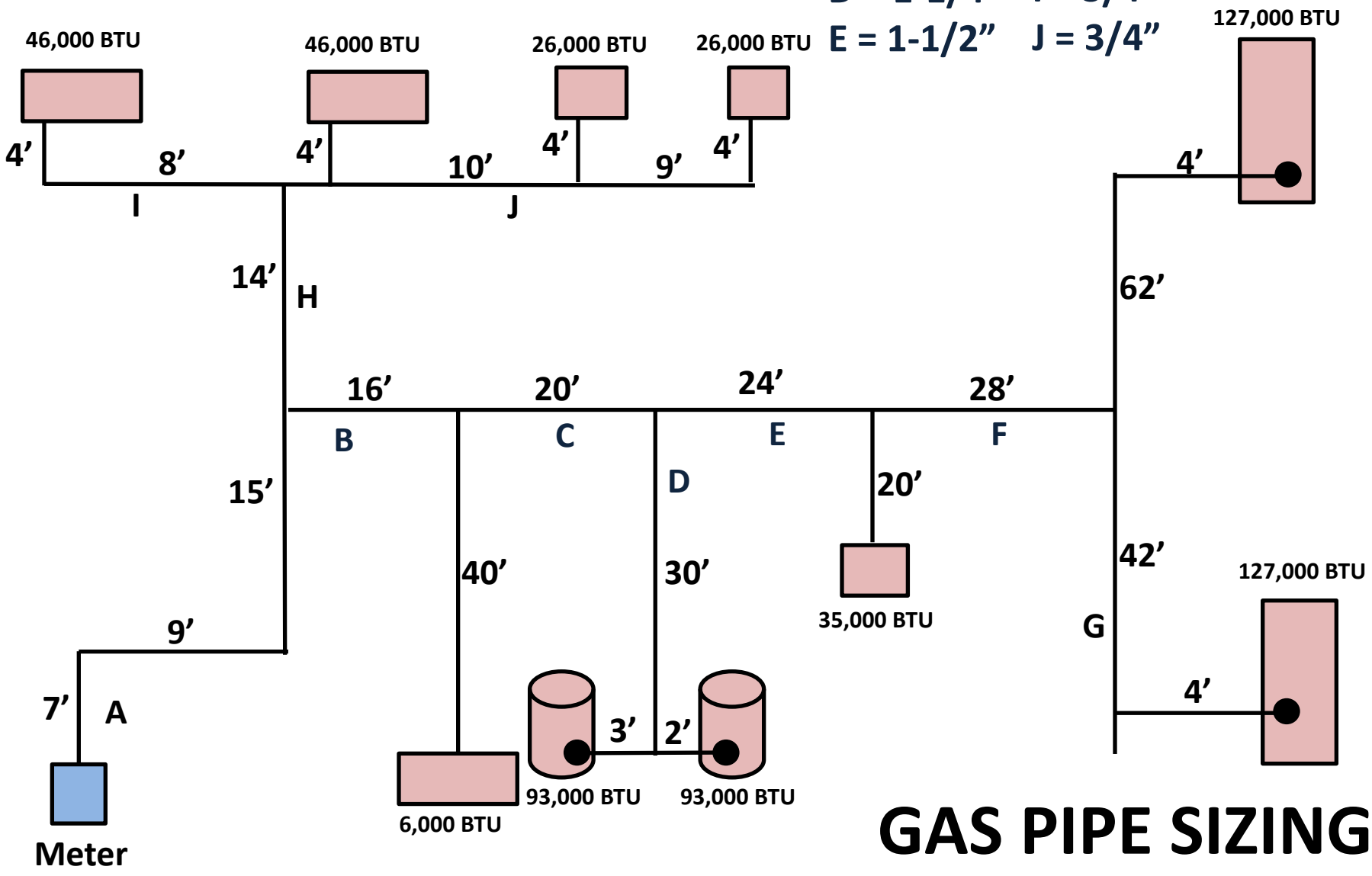
Total CFH load = 625

Longest length = 185 feet

Table = 6.2 (b)

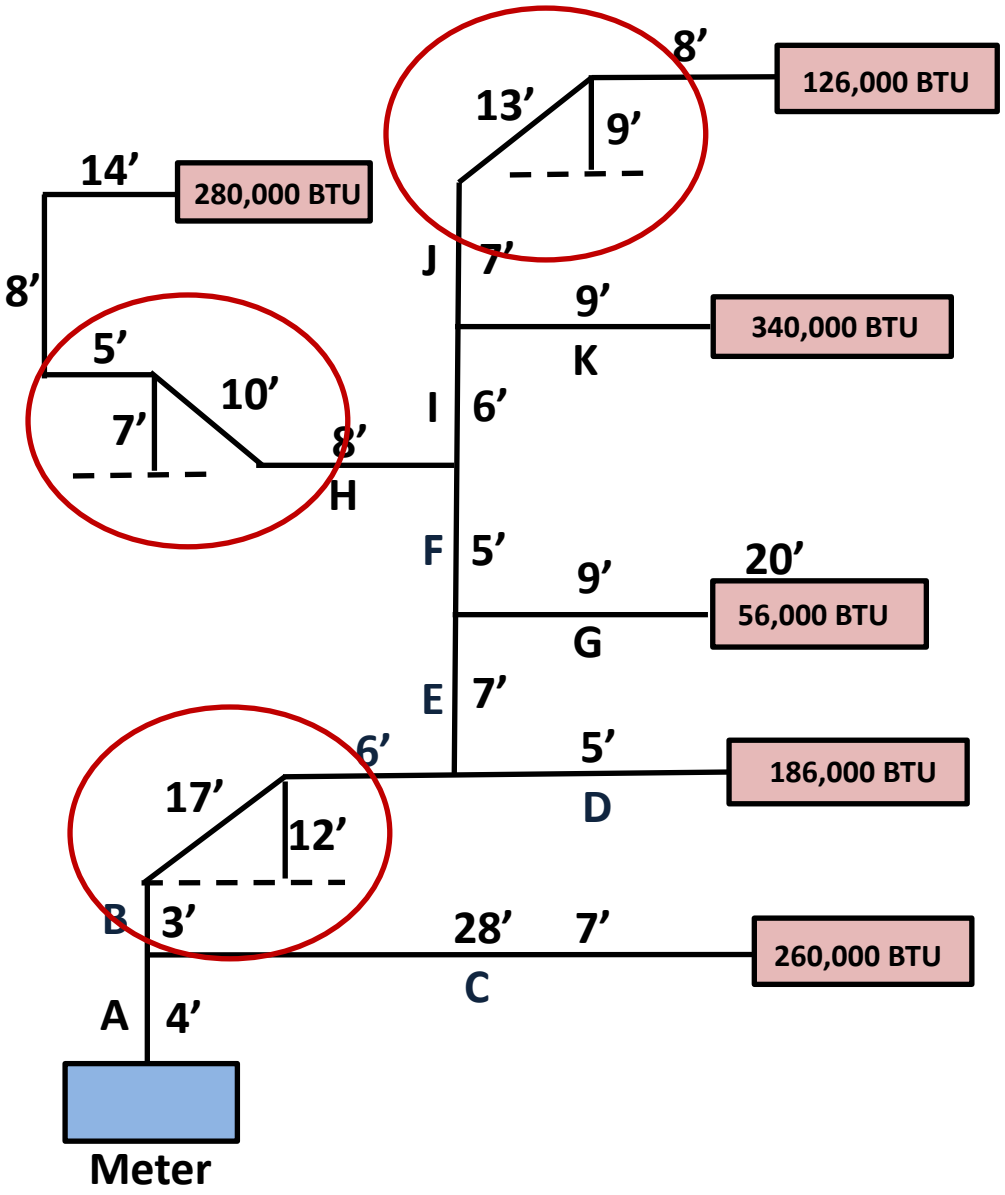
Column = 200’

A = 2”
B = 2”
C = 2”
D = 1-1/4”
E = 1-1/2”
F = 1”
G = 1-1/4”
H = 1-1/4”
I = 3/4”
J = 3/4”



GAS PIPE SIZING

First you need to determine the length of each 45 degree offset



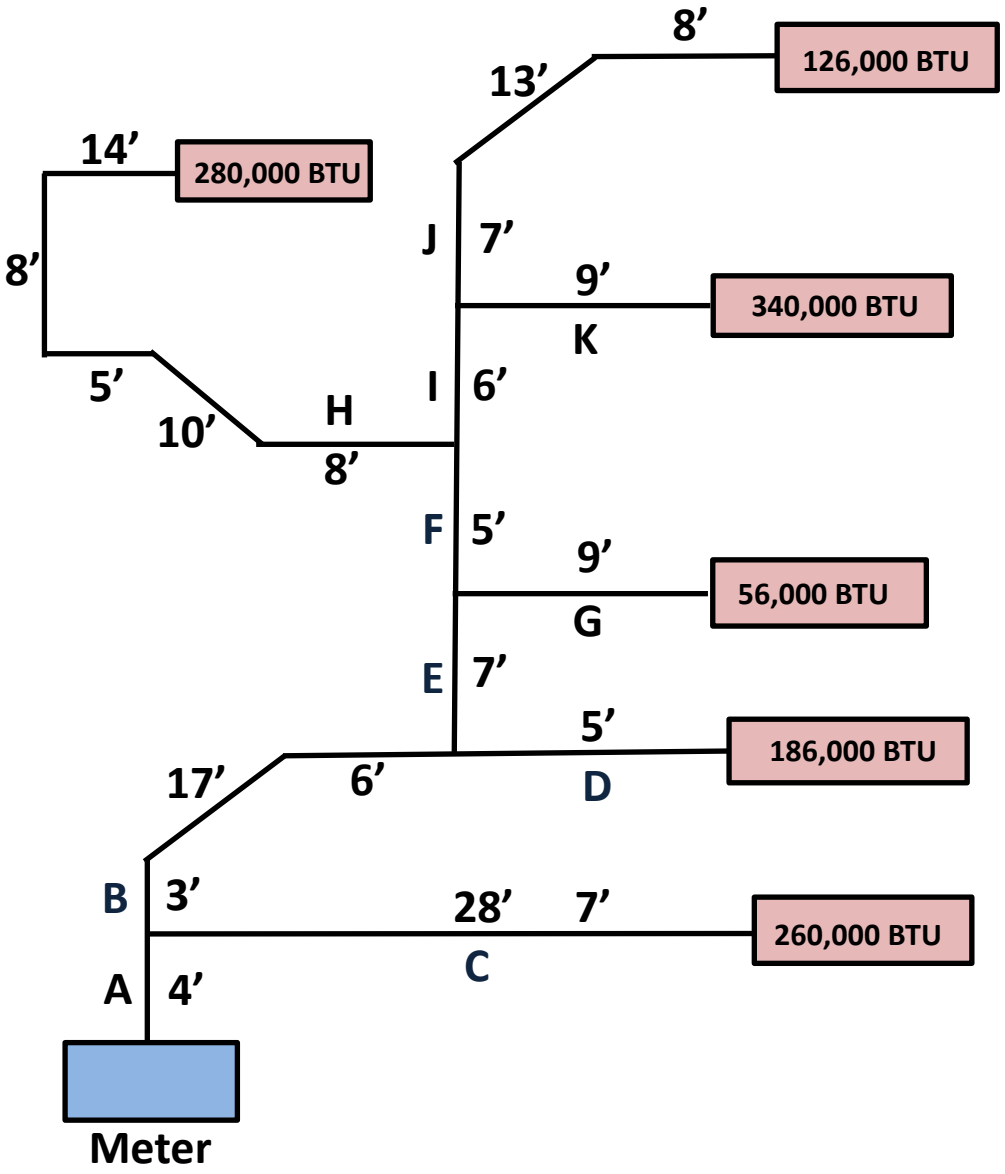
Formula:

Height x 1.41 = length

9 x 1.41 = 12.69’ = 13’

7 x 1.41 = 9.78’ = 10’

12 x 1.41 = 16.92’ = 17’



Total BTU load = 1,248,000

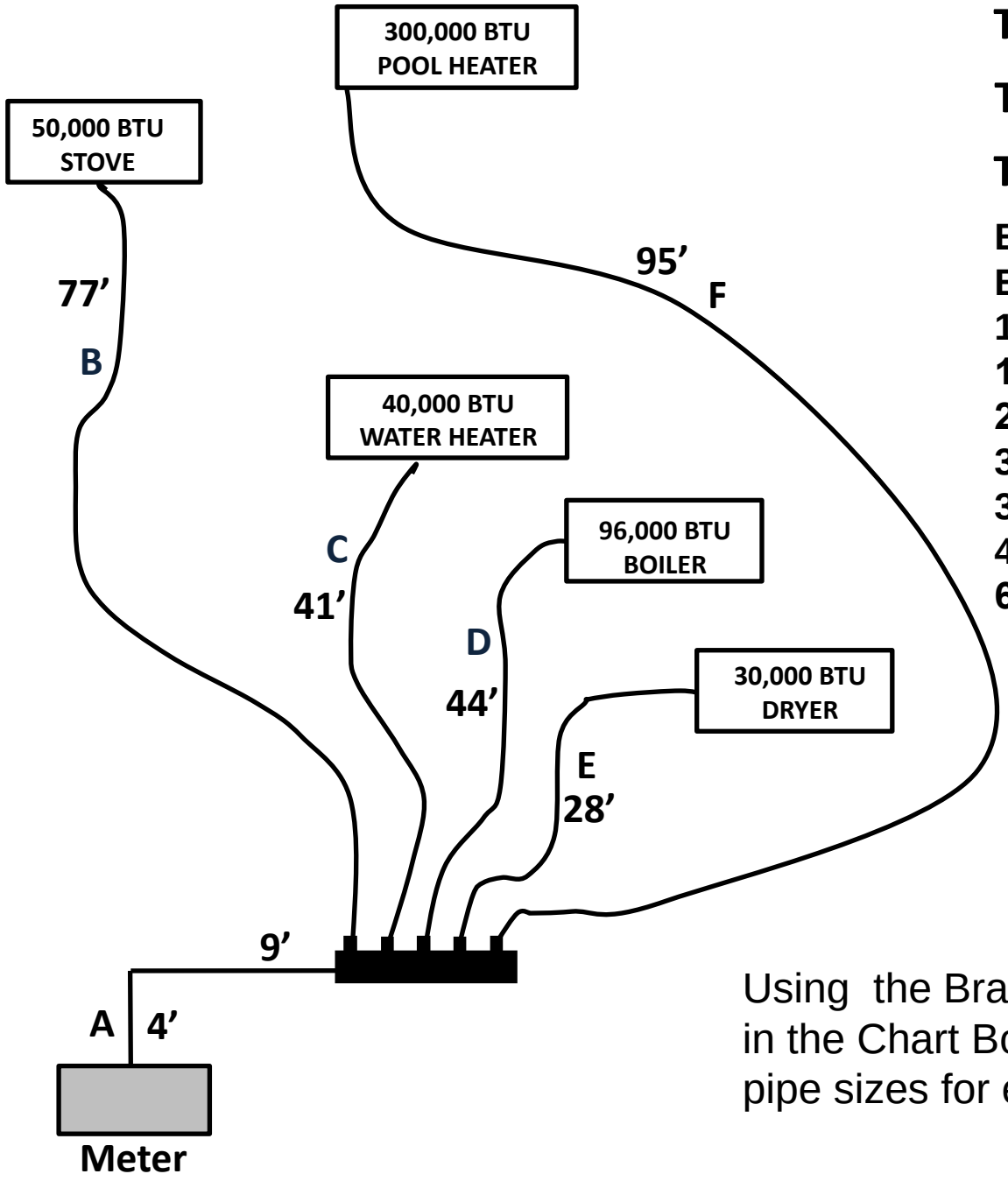
Total CFH load = 1,248

Longest Run = 87 feet

Table = 6.2 (b)

Column = 90’

A = 2-1/2”	F = 2”
B = 2”	G = 3/4”
C = 1-1/4”	H = 1-1/4”
D = 1”	I = 1-1/2”
E = 2”	J = 1”
	K = 1-1/4”



Total BTU load = 514,000

Total CFH load = 514

Table = 6.2 (o)

EHD Tube Size Equivalent

15 = 3/8”
19 = 1/2”
25 = 3/4”
31 = 1”
39 = 1-1/4”
46 = 1-1/2”
62 = 2”

A _____

B _____

C _____

D _____

E _____

Using the Branch method and Table 6.2 (o) in the Chart Booklet determine the minimum pipe sizes for each run

Practical Venting & Combustion Air

A wood louver with the dimensions of 30 inches by 10 inches will have a free area of how many square inches?



SIZING STEPS

Find the area of the wood louver

10 x 30 = 300 square inches of space

A wood louver has only 25 percent free area or space

Multiply 300 x .25 = 75 square inches of free area

9.3.7 Louvers, Grilles, and Screens.

9.3.7.1 Louvers and Grilles. The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver, grille, or screen is known, it shall be used in calculating the size opening required to provide the free area specified. Where the louver and grille design and free area are not known, it shall be assumed that **wood louvers have 25 percent free area**, and metal louvers and grilles have 75 percent free area. Non-motorized louvers and grilles shall be fixed in the open position.

NFPA54 - 54-68

A metal louver with the dimensions of 30 inches by 10 inches will have a free area of how many square inches?



Find the area of the metal louver
10 x 30 = 300 square inches of space
A metal louver has 75 percent free area of space
Multiply 300 x .75 = 225 square inches of area

9.3.7 Louvers, Grilles, and Screens.
9.3.7.1 Louvers and Grilles. The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver, grille, or screen is known, it shall be used in calculating the size opening required to provide the free area specified. Where the louver and grille design and free area are not known, it shall be assumed that wood louvers have 25 percent free area, and **metal louvers and grilles have 75 percent free area**. Non-motorized louvers and grilles shall be fixed in the open position.

NFPA54 - 54-68

How do I determine if the gas equipment is being installed in a confined space?

Add up the BTU input of all gas appliances in the space
Divide the total BTU input by 20

That will give you the minimum cubic feet of space needed to install this equipment without bringing in any additional combustion air.

EXAMPLE

The total input of the equipment going into this space is 192,000 BTU

Divide 192,000 by 20 = 9,600 cubic feet

So, if the space is 40’ long x 30’ wide by 8’ high can I install the equipment in this room?

40 x 30 x 8 = 9,600 = YES

In a room 40' long by 30' wide by 8' high with a 135,000 BTU boiler, a 50,000 BTU water heater and a 22,000 BTU clothes dryer, additional combustion air would be required to allow for how many BTU.

10,000

15,000

20,000

25,000

9.3.2 Indoor Combustion Air. The required volume of indoor air shall be determined in accordance with the method in 9.3.2.1 or 9.3.2.2 except that where the air infiltration rate is known to be less than 0.40 *ACH* (air change per hour), the method in 9.3.2.2 shall be used. The total required volume shall be the sum of the required volume calculated for all appliances located within the space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, and through combustion air openings sized and located in accordance with 9.3.2.3, are considered a part of the required volume.

9.3.2.1 * Standard Method. The minimum required volume shall be 50 cubic feet divided by 1000 Btu/hr.

NFPA54 54-67

Total up the BTU's of the three appliances
135,000 + 50,000 + 22,000 = 207,000 BTU

Find the cubic feet of the room where the appliances are located
40 x 30 x 8 = 9,600
Now divide 9,600 by 50 = 192 cubic feet

Add three zeros to convert 192 cubic feet to BTU = 192,000

207,000 – 192,000 = 15,000

The correct answer is 15,000

When using the Two Permanent Openings Method and air for combustion is taken directly from the outdoors through vertical ducts, how many square inches of free area would be required to make up 240,000 BTUs

40

50

60

70

9.3.3.1 Two Permanent Openings Method. Two permanent openings, one commencing within 12" of the top of the enclosure and one commencing within 12" of the bottom of the enclosure, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors, as follows:

(1)*Where directly communicating with the outdoors or where communicating to the outdoors through **vertical ducts**, each opening shall have a minimum free area of 1 square inch per **4,000 BTU** of total input rating of all appliances in the enclosure.

(2)*Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 BTU of total input rating of all appliances in the enclosure.

NFPA54 54-68

Simply divide the total BTU 240,000 by 4,000
240,000 divided by 4,000 = 60

You will need 60 square inches of free space to make up 240,000 BTU

Using metal louvers what is the minimum size required for each louver?

Multiply 60 square inches time 1.25 which will allow for the 75% when using a metal louver

60 x 1.25 = 75 square inches for each louver

When using the Two Permanent Openings Method and air for combustion is taken directly from the outdoors through vertical ducts, how many square inches of free area would be required to make up 130,000 BTUs

31.5

32.5

33.5

34.5

Simply divide the total BTU 130,000 by 4,000

130,000 divided by 4,000 = 32.5

You will need 32.5 square inches of free space to make up 130,000 BTU

Using wood louvers what is the minimum size required for each louver?

Multiply 32.5 square inches time 1.75 which will allow for the 25% when using a wood louver

32.5 x 1.75 = 56.875 or 57 square inches for each wood louver

When using the Two Permanent Openings Method and air for combustion is taken directly from the outdoors through horizontal ducts, how many square inches of free area would be required to make up 240,000 BTUs

80

100

120

140

9.3.3.1 Two Permanent Openings Method. Two permanent openings, one commencing within 12" of the top of the enclosure and one commencing within 12" of the bottom of the enclosure, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors, as follows:

(1)*Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4,000 BTU of total input rating of all appliances in the enclosure.

(2)*Where communicating with the outdoors through **horizontal ducts**, each opening shall have a minimum free area of 1 square inch per **2,000 BTU** of total input rating of all appliances in the enclosure.

NFPA54 54-68

Simply divide the total BTU 240,000 by 2,000

240,000 divided by 2,000 = 120 square inches

You will need 120 square inches of free space to make up 240,000 BTU

When using the One Permanent Opening Method and air for combustion is taken directly from outdoors, how many square inches of free area would be required to make up 270,000 BTUs.

85

90

95

100

9.3.3.2* One Permanent Opening Method. One permanent opening, commencing within 12" of the top of the enclosure, shall be provided. The appliance shall have clearances of at least 1" from the sides and back and 6" from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of the following:

(1) 1 square inch per 3000 Btu/hr of the total input rating of all appliances located in the enclosure

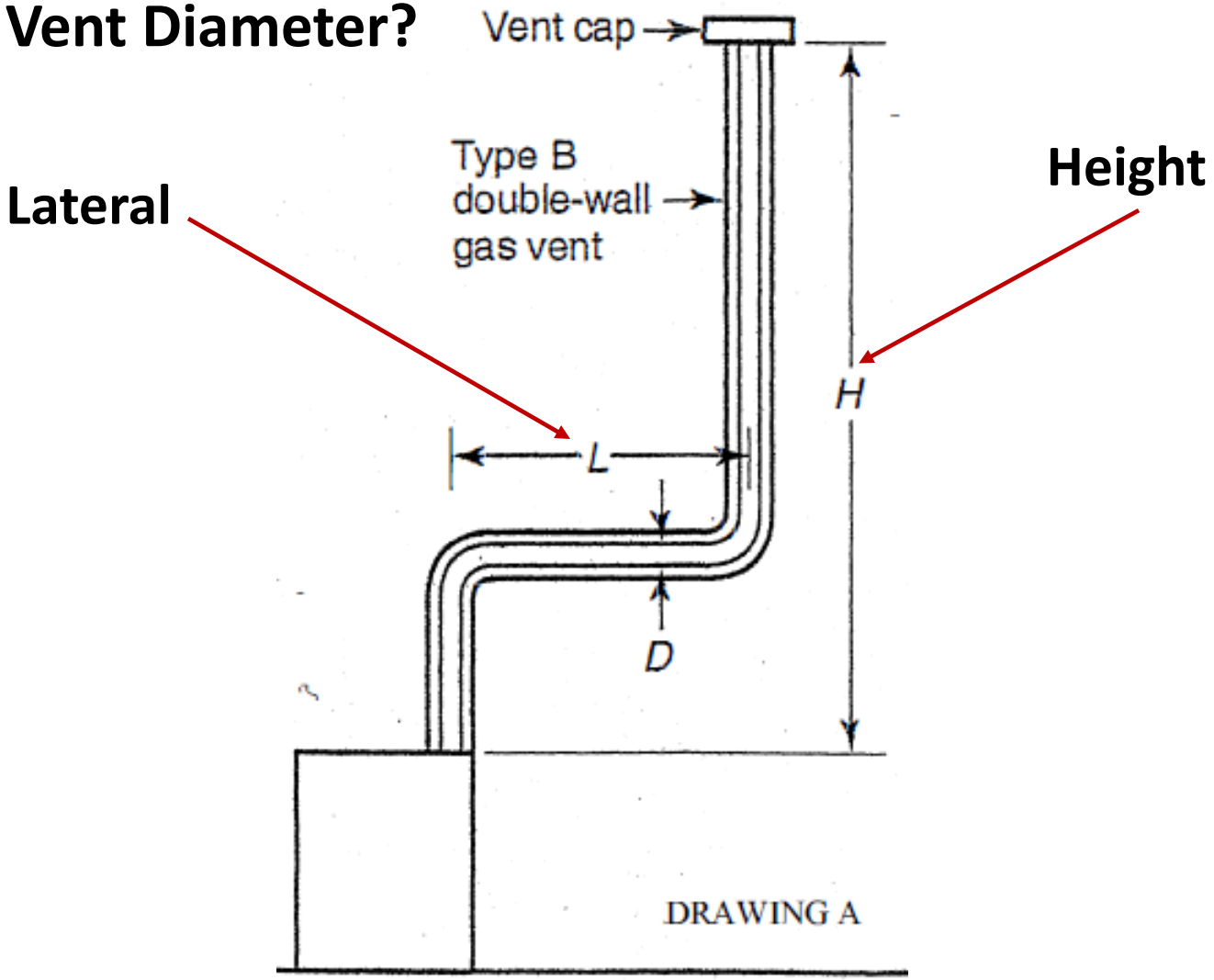
NFPA54 54-68

Simply divide the total BTU 270,000 by 3,000

270,000 divided by 3,000 = 90

You will need 90 square inches of free space to make up 240,000 BTU

A Type B gas vent has height of 30' and a lateral of 5'. The natural draft boiler connected to it has an input of 160,000 BTU. Using Drawing A and the appropriate Chart, what is the minimum Vent Diameter?



A Type B gas vent has height of 30' and a lateral of 5'. The natural draft boiler connected to it has an input of 160,000 BTU. Using Drawing A and the appropriate Chart, what is the minimum Vent Diameter?

4 inch
5 inch
6 inch
7 inch

To find the correct chart, you need to look for:

Type B gas vent
Number of Appliances: Single
It is a natural draft boiler: Category I
Appliance Vent Connection: Connected Directly to Vent

The correct Chart should be Table 13.1(a)

CHOOSING THE CORRECT CHART

Type B Gas Vent **One Appliance** **Natural Draft Boiler**

Table 13.1(a) Type B Double-Wall Gas Vent

Number of Appliances:	Single
Appliance Type:	Category I
Appliance Vent Connection:	Connected Directly to Vent

		Vent Diameter — *D* (in.)																			
		3			4			5			6			7			8			9		
		Appliance Input Rating in Thousands of Btu per Hour																			
Height *H* (ft)	Lateral *L* (ft)	FAN		NAT	FAN		NAT	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	Max	Min	Max	Max
6	0	0	78	46	0	152	86	0	251	141	0	375	205	0	524	285	0	698	370	0	897	470

Connected Directly to the Appliance

A Type B gas vent has height of 30' and a lateral of 5'. The natural draft boiler connected to it has an input of 160,000 BTU. Using Drawing A and the appropriate Chart, what is the minimum Vent Diameter?

Using Chart Table 13.1(a):

In the far left column under height, look for the row that covers 30’

Under the Lateral column within the 30’ section, find the row that covers 5’

Each column under pipe size has sections called FAN and NAT. Go across the row with the 5’ lateral until you find the NAT amount which will allow a 160,000 BTU appliance

160 is more that 108 and less than 176 so you must use the 176 column

The correct answer would be 5”

A Type B gas vent has height of 20' and a lateral of 10'. The natural draft commercial boiler connected to it has an input of 340,000 BTU. Using Drawing A and the appropriate Chart what is the minimum Vent Diameter?

6 inch
7 inch
8 inch
9 inch

To find the correct chart, you need to look for:

Type B gas vent
Number of Appliances: Single
It is a natural draft boiler: Category I
Appliance Vent Connection: Connected Directly to Vent

The correct Chart should be Table 13.1(a)

A Type B gas vent has height of 20' and a lateral of 10'. The natural draft commercial boiler connected to it has an input of 340,000 BTU. Using Drawing A and the appropriate Chart what is the minimum Vent Diameter?

Using Chart Table 13.1(a):

In the far left column under Height, look for the row that covers 20’

Under the Lateral column within the 20’ section, find the row that covers 10’

Each column under pipe size has sections called FAN and NAT. Go across the row with the 10’ lateral until you find the NAT amount which will allow a 340,000 BTU appliance

340 is more that 321 and less than 443 so you must use the 443 column

The correct answer would be 8”

A Type B gas vent has height of 20' and a lateral of 10'. The fan assisted warm air furnace connected to it has an input of 80,000 BTU. Using Drawing A and the appropriate Chart, what is the minimum Vent Diameter?

3 inch
4 inch
5 inch
6 inch

To find the correct chart, you need to look for:

Type B gas vent
Number of Appliances: Single
It is a fan assisted furnace: Category I
Appliance Vent Connection: Connected Directly to Vent

The correct Chart should be Table 13.1(a)

A Type B gas vent has height of 20' and a lateral of 10'. The fan assisted warm air furnace connected to it has an input of 80,000 BTU. Using Drawing A and the appropriate Chart, what is the minimum Vent Diameter?

Using Chart Table 13.1(a):

- **In the far left column under Height, look for the row that covers 20’**
- **Under the Lateral column within the 20’ section, find the row that covers 10’**
- **Each column under pipe size has sections called FAN and NAT.**
- **Notice under the word FAN it says Min and Max. You will need to locate the correct size under the Max column.**

A Type B gas vent has height of 20' and a lateral of 10'. The fan assisted warm air furnace connected to it has an input of 80,000 BTU. Using Drawing A and the appropriate Chart, what is the minimum Vent Diameter?

Using Chart Table 13.1(a):

Go across the row with the 10’ lateral until you find the FAN Max amount which will allow a 80,000 BTU Fan Assisted appliance

80 is more that 64 and less than 133 so you must use the 133 column

The correct answer would be 4”

A Type B vent chimney with a single wall metal connector has total height of 30' and a lateral of 8'. The natural draft water heater has an input of 75,000 BTU. Using Drawing B and the appropriate Chart, what is the size of the vent?

3 inch
4 inch
5 inch
6 inch

To find the correct chart, you need to look for:

Type B gas vent	
Number of Appliances:	**Single**
It is a natural draft water heater:	**Category I**
Appliance Vent Connection:	**Single wall connector**

The correct Chart should be Table 13.1(b)

A Type B vent chimney with a single wall metal connector has total height of 30' and a lateral of 8'. The natural draft water heater has an input of 75,000 BTU. Using Drawing B and the appropriate Chart, what is the size of the vent?

Using Chart Table 13.1(b):

In the far left column under Height, look for the row that covers 30’

Under the Lateral column within the 8’ section, find the row that covers 8’

Each column under pipe size has sections called FAN and NAT. Go across the row with the 10’ lateral until you find the NAT amount which will allow a 75,000 BTU NAT appliance. 75 is less than 98 in the NAT column so you must use the 98 column

The correct answer would be 4”

A Type B gas vent with a single wall vent connector has total height of 6' and a lateral of 6'. The fan assisted furnace has an input of 175,000 BTU. Using Drawing B and the appropriate Chart, what is the size of the vent?

4 inch
5 inch
6 inch
7 inch

To find the correct chart, you need to look for:

Type B gas vent	
Number of Appliances:	**Single**
It is a fan assisted furnace:	**Category I**
Appliance Vent Connection:	**Single wall connector**

The correct Chart should be Table 13.1(b)

A Type B gas vent with a single wall vent connector has total height of 6' and a lateral of 6'. The fan assisted furnace has an input of 175,000 BTU. Using Drawing B and the appropriate Chart, what is the size of the vent?

Using Chart Table 13.1(b):

In the far left column under Height, look for the row that covers 6’

Under the Lateral column within the 6’ section, find the row that covers 6’

Each column under pipe size has sections called FAN and NAT. Go across the row with the 6’ lateral until you find the FAN amount which will allow a 170,000 BTU FAN assisted appliance.

170 is more that the FAN Max of 147 and less than the FAN Max of 220 so you must use the 220 column

The correct answer would be 6”

A Type B vent with a single vent connector has total height of 40' and a lateral of 10'. The fan assisted furnace has an input of 200,000 BTU. Using Drawing B and the appropriate Chart, what is the size of the vent?

4 inch
5 inch
6 inch
7 inch

To find the correct chart, you need to look for:

Type B gas vent
Number of Appliances: Single
It is a fan assisted furnace: Category I
Appliance Vent Connection: Single wall connector

The correct Chart should be Table 13.1(b)

A Type B vent with a single vent connector has total height of 40' and a lateral of 10'. The fan assisted furnace has an input of 200,000 BTU. Using Drawing B and the appropriate Chart, what is the size of the vent?

Using Chart Table 13.1(b):

In the far left column under Height, look for the row that covers 40'. In this case it would go to 50.

Under the Lateral column within the 50' section, find the row that covers 10'

Each column under pipe size has sections called FAN and NAT. Go across the row with the 10' lateral until you find the FAN amount which will allow a 200,000 BTU FAN assisted appliance.

200 is more that the FAN Max of 160 and less than the FAN Max of 292 so you must use the 292 column

The correct answer would be 5"

A lined masonry chimney with interior dimension of 9" x 8" and a Type B vent connector has total height of 20' and a lateral of 5'. The fan assisted furnace has an input of 225,000 BTU. Using Drawing C and the appropriate Chart, what is the size of the vent connector?

7 inch
8 inch
9 inch
10 inch

To find the correct chart, you need to look for:

Lined masonry chimney	
Number of Appliances:	**Single**
It is a fan assisted furnace:	**Category I**
Appliance Vent Connection:	**Type B Vent Connector**
Interior dimensions of chimney:	**9” x 8” = 72”**

The correct Chart should be Table 13.1(c)

A lined masonry chimney with interior dimension of 9" x 8" and a Type B vent connector has total height of 20' and a lateral of 5'. The fan assisted furnace has an input of 225,000 BTU. Using Drawing C and the appropriate Chart, what is the size of the vent connector?

Using Chart Table 13.1(c):

In the far left column under Height, look for the row that covers 20’.

Under the Lateral column within the 20’ section, find the row that covers 5’

Each column under pipe size has sections called FAN and NAT. Go across the row with the 5’ lateral until you find the FAN Max amount which will allow a 225,000 BTU FAN assisted appliance.

A lined masonry chimney with interior dimension of 9" x 8" and a Type B vent connector has total height of 20' and a lateral of 5'. The fan assisted furnace has an input of 225,000 BTU. Using Drawing C and the appropriate Chart, what is the size of the vent connector?

The first column you will find with a FAN Max BTU is 505 so you must use the 505 column
Check the Minimum internal area of chimney near the bottom of the chart.
The column you are using allows a 50 square inch minimum which is smaller than the 72 square inches of the chimney

The correct answer would be 7”

A lined masonry chimney with interior dimension of 8" x 8" and a Type B vent connector has total height of 30' and a lateral of 10'. The fan assisted furnace has an input of 350,000 BTU. Using Drawing C and the appropriate Chart, what is the size of the vent connector?

7 inch
8 inch
9 inch
10 inch

To find the correct chart, you need to look for:

Lined masonry chimney
Number of Appliances: Single
It is a fan assisted furnace: Category I
Appliance Vent Connection: Type B Vent Connector
Interior dimensions of chimney: 8” x 8” = 64”

The correct Chart should be Table 13.1(c)

A lined masonry chimney with interior dimension of 8" x 8" and a Type B vent connector has total height of 30' and a lateral of 10'. The fan assisted furnace has an input of 350,000 BTU. Using Drawing C and the appropriate Chart, what is the size of the vent connector?

Using Chart Table 13.1(c):

In the far left column under Height, look for the row that covers 30’.

Under the Lateral column within the 10’ section, find the row that covers 10’

Each column under pipe size has sections called FAN and NAT. Go across the row with the 10’ lateral until you find the FAN Max amount which will allow a 350,000 BTU FAN assisted appliance.

A lined masonry chimney with interior dimension of 8" x 8" and a Type B vent connector has total height of 30' and a lateral of 10'. The fan assisted furnace has an input of 350,000 BTU. Using Drawing C and the appropriate Chart, what is the size of the vent connector?

The first column you will find with a FAN Max BTU is 709 so you must use the 709 column
Check the Minimum internal area of chimney near the bottom of the chart.
The column you are using allows a 63 square inch minimum which is smaller than the 64 square inches of the chimney

The correct answer would be 8”

A natural draft heating boiler with a 15' lateral single wall vent connector has an input of 175,000 BTU. The masonry chimney has interior dimensions of 7.5" x 7.5" and is 15' high . Using Drawing D and the appropriate Chart, what is the size of the vent connector?

7 inch
8 inch
9 inch
10 inch

To find the correct chart, you need to look for:

Masonry chimney
Number of Appliances: Single
natural draft boiler: Category I
Appliance Vent Connection: Single Wall Connector
Interior dimensions of chimney: 7.5” x 7.5” = 56.25”

The correct Chart should be Table 13.1(d)

A natural draft heating boiler with a 15' lateral single wall vent connector has an input of 175,000 BTU. The masonry chimney has interior dimensions of 7.5" x 7.5" and is 15' high . Using Drawing D and the appropriate Chart, what is the size of the vent connector?

Using Chart Table 13.1(c):

In the far left column under Height, look for the row that covers 15’.

Under the Lateral column within the 15’ section, find the row that covers 15’

Each column under pipe size has sections called NAT. Go across the row with the 15’ lateral until you find the NAT amount which will allow a 175,000 BTU natural draft appliance.

A natural draft heating boiler with a 15' lateral single wall vent connector has an input of 175,000 BTU. The masonry chimney has interior dimensions of 7.5" x 7.5" and is 15' high . Using Drawing D and the appropriate Table, what is the size of the vent connector?

175 is more that the NAT of 138 and less than the NAT of 198 so you must use the 198 column
Check the Minimum internal area of chimney near the bottom of the chart.
The column you are using allows a 50 square inch minimum which is smaller than the 56.25 square inches of the chimney

The correct answer would be 7”

A fan assisted warm air furnace with a 2' lateral single wall vent connector has an input of 210,000 BTU. The masonry chimney has interior dimensions of 8" x 8" and is 15' high . Using Drawing D and the appropriate Chart, what is the size of the vent connector?

5 inch
6 inch
7 inch
8 inch

To find the correct chart, you need to look for:

Masonry chimney
Number of Appliances: Single
Fan assisted furnace: Category I
Appliance Vent Connection: Single Wall Connector
Interior dimensions of chimney: 8” x 8” = 64”

The correct Chart should be Table 13.1(d)

A fan assisted warm air furnace with a 2' lateral single wall vent connector has an input of 210,000 BTU. The masonry chimney has interior dimensions of 8" x 8" and is 15' high . Using Drawing D and the appropriate Chart, what is the size of the vent connector?

Using Chart Table 13.1(d):

In the far left column under Height, look for the row that covers 15’.

Under the Lateral column within the 2’ section, find the row that covers 2’

Each column under pipe size has sections called FAN Min and FAN Max. Go across the row with the 2’ lateral until you find the FAN Max amount which will allow a 210,000 BTU FAN assisted appliance.

A fan assisted warm air furnace with a 2' lateral single wall vent connector has an input of 210,000 BTU. The masonry chimney has interior dimensions of 8" x 8" and is 15' high . Using Drawing D and the appropriate Chart, what is the size of the vent connector?

Follow the row across and you will find the first FAN Max amount listed is 473 which is larger than 210 so you must use the 473 column
Check the Minimum internal area of chimney near the bottom of the chart.
The column you are using allows a 50 square inch minimum which is smaller than the 64 square inches of the chimney

The correct answer would be 7”

A 150,000 BTU fan assisted furnace and a 40,000 BTU natural draft water heater both having a 2' vent connector rise connect to a 30' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the vent connector for the water heater.

3 inch
4 inch
5 inch
6 inch

To find the correct chart, you need to look for:

B-Vent chimney
Number of Appliances: Two
Fan assisted furnace
& natural draft water heater: Category I
Appliance Vent Connection: B-Vent

The correct Chart should be Table 13.2(a)

A 150,000 BTU fan assisted furnace and a 40,000 BTU natural draft water heater both having a 2' vent connector rise connect to a 30' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the vent connector for the water heater.

Using Chart Table 13.2(a):

In the far left column under Height, look for the row that covers 30’.

Under the Connector Rise column within the 30’ section, find the row that covers 2’

Each column under pipe size has sections called NAT. Go across the row connector rise until you find the NAT amount which will allow a 40,000 BTU natural draft appliance.

A 150,000 BTU fan assisted furnace and a 40,000 BTU natural draft water heater both having a 2' vent connector rise connect to a 30' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the vent connector for the water heater.

40 is more that the NAT amount of 39 and less than the NAT amount of 70 so you must use the 70 column

The correct answer would be 4”

A 150,000 BTU fan assisted furnace and a 40,000 BTU natural draft water heater both having a 2' vent connector rise connect to a 30' high B-Vent chimney. Using Drawing E and the appropriate Chart, what is the size of the common vent for the 2 appliances?

5 inch
6 inch
7 inch
8 inch

To find the correct chart, you need to look for:

B-Vent chimney
Number of Appliances: Two
Fan assisted furnace
& natural draft water heater: Category I
Appliance Vent Connection: B-Vent

The correct Chart should be Table 13.2(a)

A 150,000 BTU fan assisted furnace and a 40,000 BTU natural draft water heater both having a 2' vent connector rise connect to a 30' high B-Vent chimney. Using Drawing E and the appropriate Chart, what is the size of the common vent for the 2 appliances?

Using Chart Table 13.2(a):

This chart has two sections:

Vent Connector Capacity (upper section)

Common Vent Capacity (lower section)

You need to use the lower section for the chart for this exercise because you are sizing the common vent.

In the far left column under Height, look for the row that covers 30’.

On each row you have three choices:

FAN + FAN FAN + NAT NAT + NAT

A 150,000 BTU fan assisted furnace and a 40,000 BTU natural draft water heater both having a 2' vent connector rise connect to a 30' high B-Vent chimney. Using Drawing E and the appropriate Chart, what is the size of the common vent for the 2 appliances?

150,000 + 40,000 = 190,000
Going across the 30’ Vent height row you will see that 210,000 is allowed for a 5” pipe under FAN + NAT

The correct answer would be 5”

A 150,000 BTU fan assisted furnace and a 125,000 BTU fan assisted furnace both having a 2' vent connector rise connect to a 40' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the vent connector for the 150,000 BTU furnace?

4 inch
5 inch
6 inch
7 inch

To find the correct chart, you need to look for:

B-Vent chimney	
Number of Appliances:	**Two**
Fan assisted furnace x 2	**Category I**
Appliance Vent Connection:	**Single Wall**

The correct Chart should be Table 13.2(b)

A 150,000 BTU fan assisted furnace and a 125,000 BTU fan assisted furnace both having a 2' vent connector rise connect to a 40' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the vent connector for the 150,000 BTU furnace?

Using Chart Table 13.2(b):

This chart has two sections:

Vent Connector Capacity (upper section)

Common Vent Capacity (lower section)

You need to use the upper section for the chart for this exercise because you are sizing the vent connector for the 150,000 BTU furnace.

In the far left column under Height, look for the row that covers 40’.

In this case, you would use the 50’ Vent Height column

A 150,000 BTU fan assisted furnace and a 125,000 BTU fan assisted furnace both having a 2' vent connector rise connect to a 40' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the vent connector for the 150,000 BTU furnace?

Within the 50’ Vent height column find the 2’ connector rise. Going across the you will find a column with 114 FAN Min and 215 FAN Max falling within the 150,000 BTU range

The correct answer would be 5”

A 150,000 BTU fan assisted furnace and a 125,000 BTU fan assisted furnace both having a 2' vent connector rise connect to a 40' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the common vent diameter serving both appliances?

4 inch
5 inch
6 inch
7 inch

To find the correct chart, you need to look for:

B-Vent chimney	
Number of Appliances:	**Two**
Fan assisted furnace x 2	**Category I**
Appliance Vent Connection:	**Single Wall**

The correct Chart should be Table 13.2(b)

A 150,000 BTU fan assisted furnace and a 125,000 BTU fan assisted furnace both having a 2' vent connector rise connect to a 40' high B-Vent chimney. Using Drawing F and the appropriate Chart, what is the size of the common vent diameter serving both appliances?

Using Chart Table 13.2(b):

This chart has two sections:

Vent Connector Capacity (upper section)

Common Vent Capacity (lower section)

You need to use the lower section for the chart for this exercise because you are sizing the common vent for both appliances.

In the far left column under Height, look for the row that covers 40’. Use 50’

A 150,000 BTU fan assisted furnace and a 125,000 BTU fan assisted furnace both having a 2' vent connector rise connect to a 40' high B-Vent chimney. Using Drawing F and the appropriate Table, what is the size of the common vent diameter serving both appliances?

On each row you have three choices:

FAN + FAN FAN + NAT NAT + NAT

Within the 50’ Vent height column find the 2’ connector rise. Going across the you will find a column with 114 FAN Min and 215 FAN Max falling within the 150,000 BTU range

The correct answer would be 5”

Practical Waste & Vent Sizing

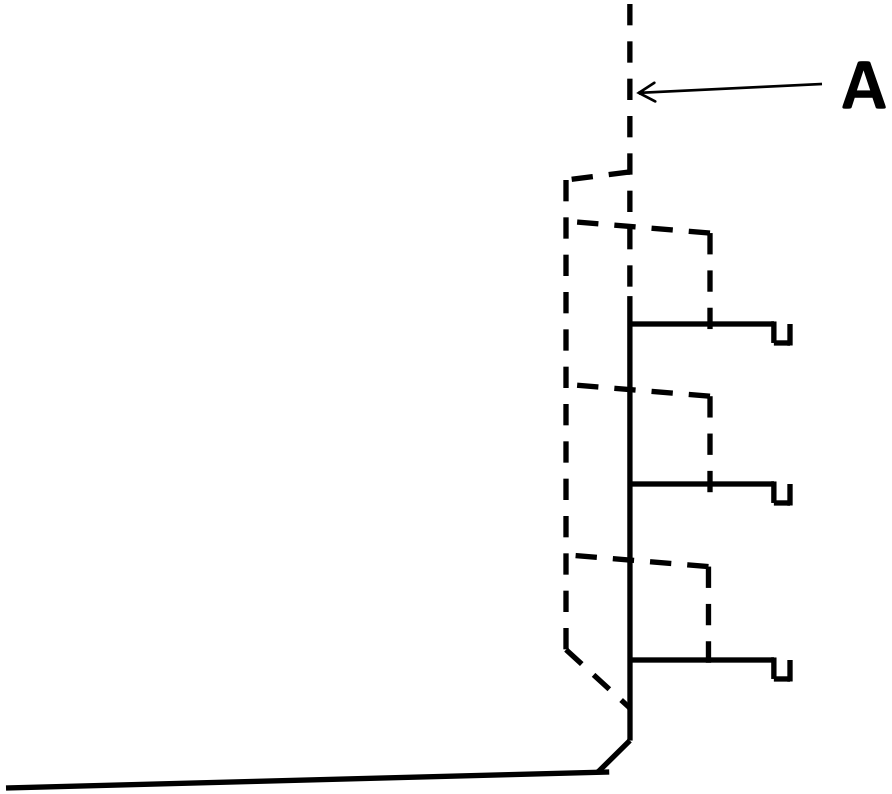
Pipe A would be considered what type of vent?

A. Relief Vent

B. Wet Vent

C. Vent Stack

D. Stack Vent



Stack Vent. The portion of a soil or waste stack that is six inches above the highest flood level rim of the highest fixture connected to the stack. The stack vent terminates in compliance with. 248 CMR 10.16.

Stack

248 CMR 93

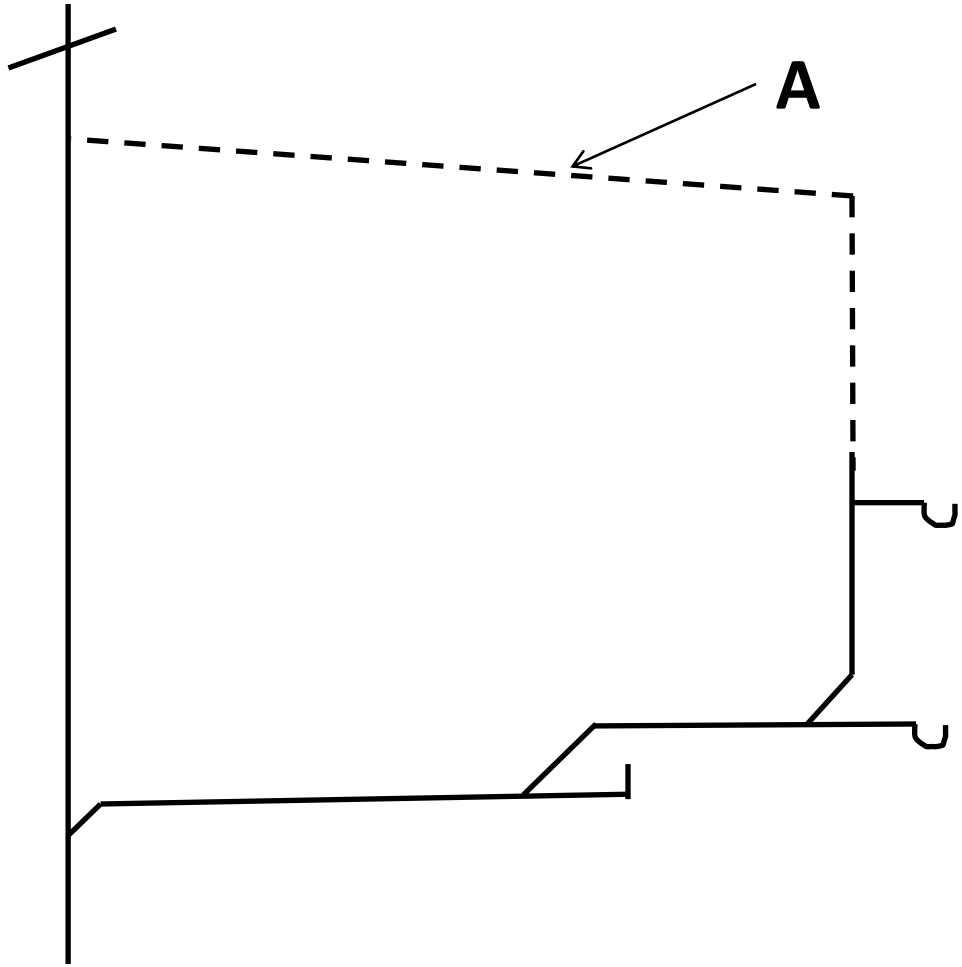
Pipe A would be considered what type of vent?

A. Relief Vent

B. Wet Vent

C. Vent Stack

D. Stack Vent



Wet Vent. A waste pipe that also serves as a vent, on the same floor level.

248 CMR 95

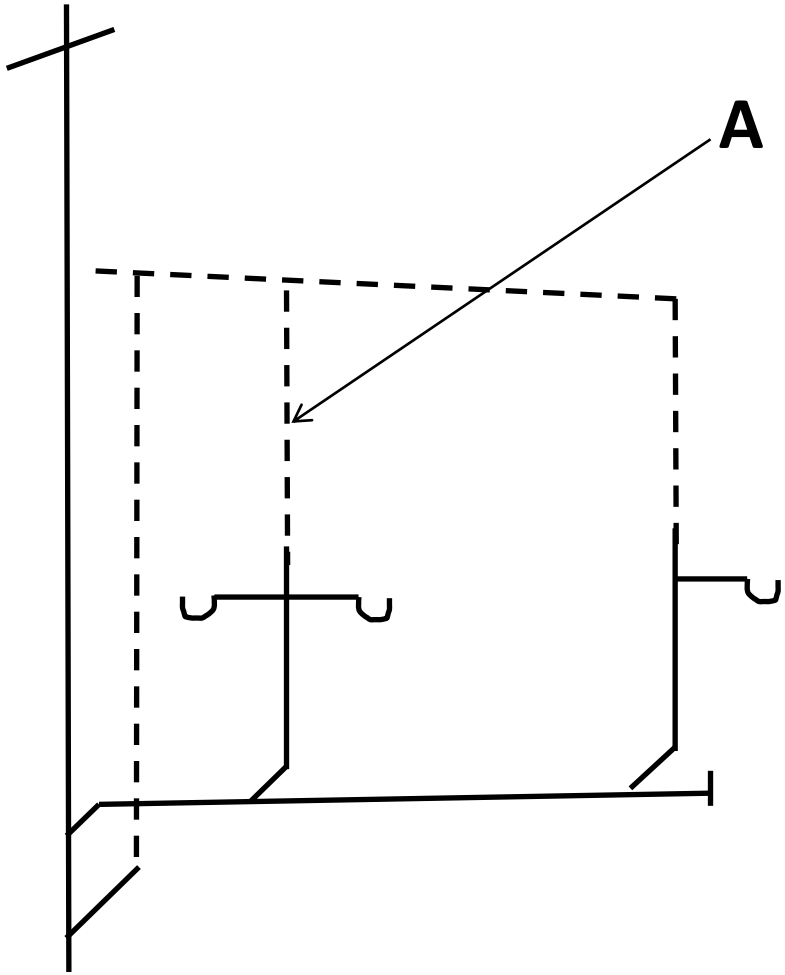
Pipe A would be considered what type of vent? *

A. Relief Vent

B. Wet Vent

C. Individual Vent

D. Common Vent

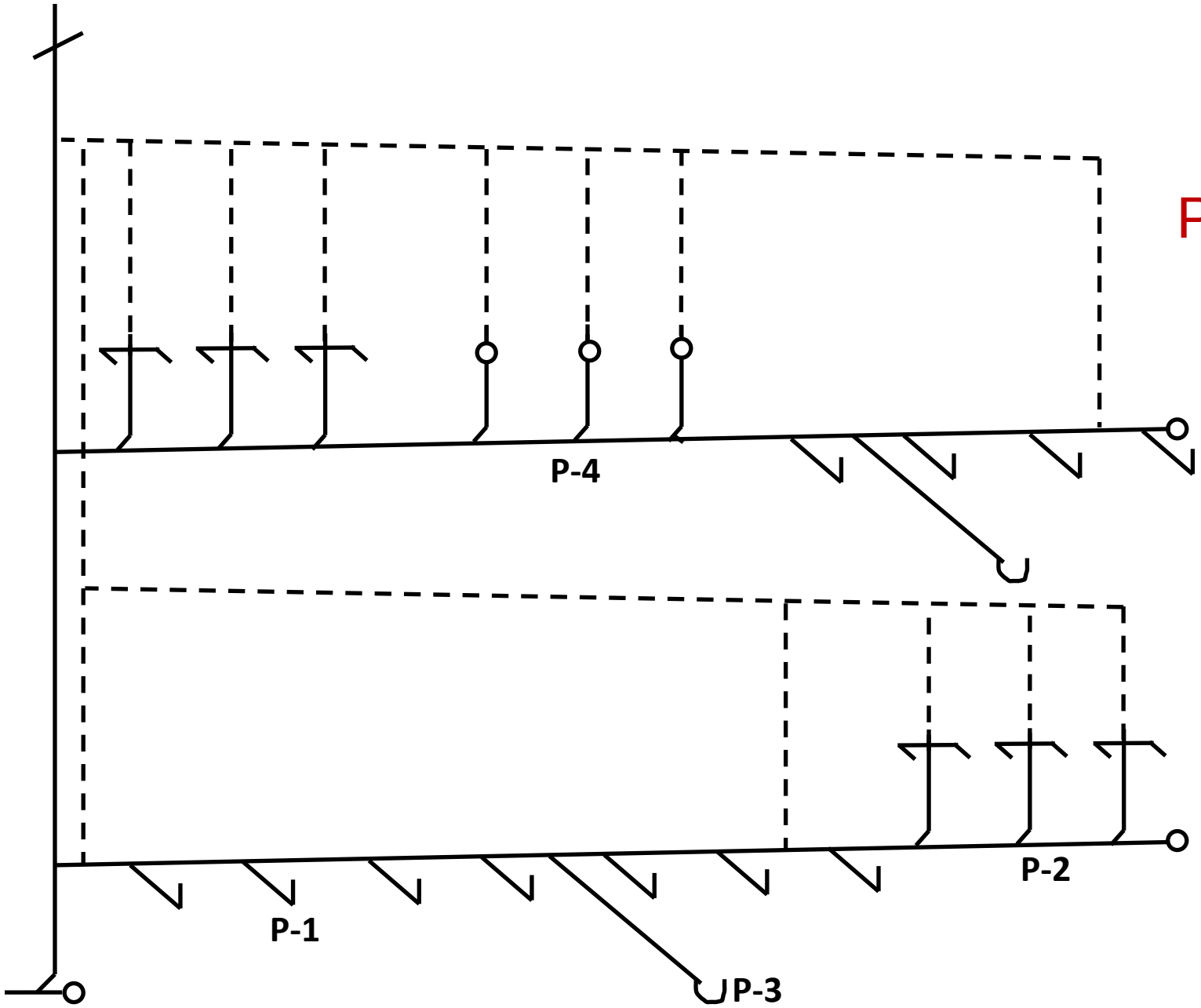


(10) Common Vents.

(a) Individual Vent as Common Vent. An individual vent, installed vertically, may be used as a common vent for two fixture traps when both fixture drains connect with a vertical drain at the same level.

248 CMR 176

Drain Sizing Problem



Use the FIXTURE UNIT VALUES TABLE 1 found in your CHART BOOKLET or page 168 to figure the totals for the first floor:

P-1 = Toilet, valve operated
P-2 = Lavatory
P-3 = Floor Drain
P-4 = Urinal, wall lip

P-1 = 7 Toilets x 6 = 42
P-2 = 6 Lavs x 1 = 6
P-3 = 1 FD x 3 = 3
Total = 51

Fixture units for the first floor = 51

Now use the MAXIMUM LOADS IN FUXTURE UNITS FOR HORIZONTAL DRAINS TABLE 2 found on page 169 to figure the size of the horizontal drain for the first floor:

TABLE 2
MAXIMUM LOADS IN FIXTURE UNITS FOR HORIZONTAL DRAINS (F.U.)

Diameter of drain (inches)	Horizontal fixture branch[1] (F.U.)	Building drain or building sewer[2]		
		⅛ in./ft. (F.U.)	¼ in./ft. (F.U.)	½ in./ft. (F.U.)
1½	3	---	---	---
2	6	---	---	---
2½	12	---	---	---
3	34[3-4]	---	40[3-4]	48[3-4]
4	160	180	216	250
5	360	390	480	575
6	620	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

Size of the horizontal first floor drain = 4”

Use the FIXTURE UNIT VALUES TABLE 1 found on in your CHART BOOKLET or page 168 to figure the totals for the second floor:

P-1 = Toilet, valve operated
P-2 = Lavatory
P-3 = Floor Drain
P-4 = Urinal, wall lip

P-1 = 4 Toilets x 6 = 24
P-2 = 6 Lavs x 1 = 6
P-3 = 1 FD x 3 = 3
P-4 = 3 Urinals x 4 = 12
Total = 45

Fixture units for the second floor = 45

Now use the MAXIMUM LOADS IN FUXTURE UNITSFOR HORIZONTAL DRAINS TABLE 2 found on page 169 to figure the size of the horizontal drain for the first floor:

TABLE 2
MAXIMUM LOADS IN FIXTURE UNITS FOR HORIZONTAL DRAINS (F.U.)

Diameter of drain (inches)	Horizontal fixture branch[1] (F.U.)	Building drain or building sewer[2]		
		⅛ in./ft. (F.U.)	¼ in./ft. (F.U.)	½ in./ft. (F.U.)
1½	3	---	---	---
2	6	---	---	---
2½	12	---	---	---
3	34[3-4]	---	40[3-4]	48[3-4]
4	160	180	216	250
5	360	390	480	575
6	620	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

Second floor horizontal drain = 4”

Use the MAXIMUM LOADS IN FIXTURE UNITS FOR SOIL AND WASTE STACKS HAVING ONE OR TWO BRANCH INTERVALS TABLE 3 found on page 169 to figure the total for the waste stack:

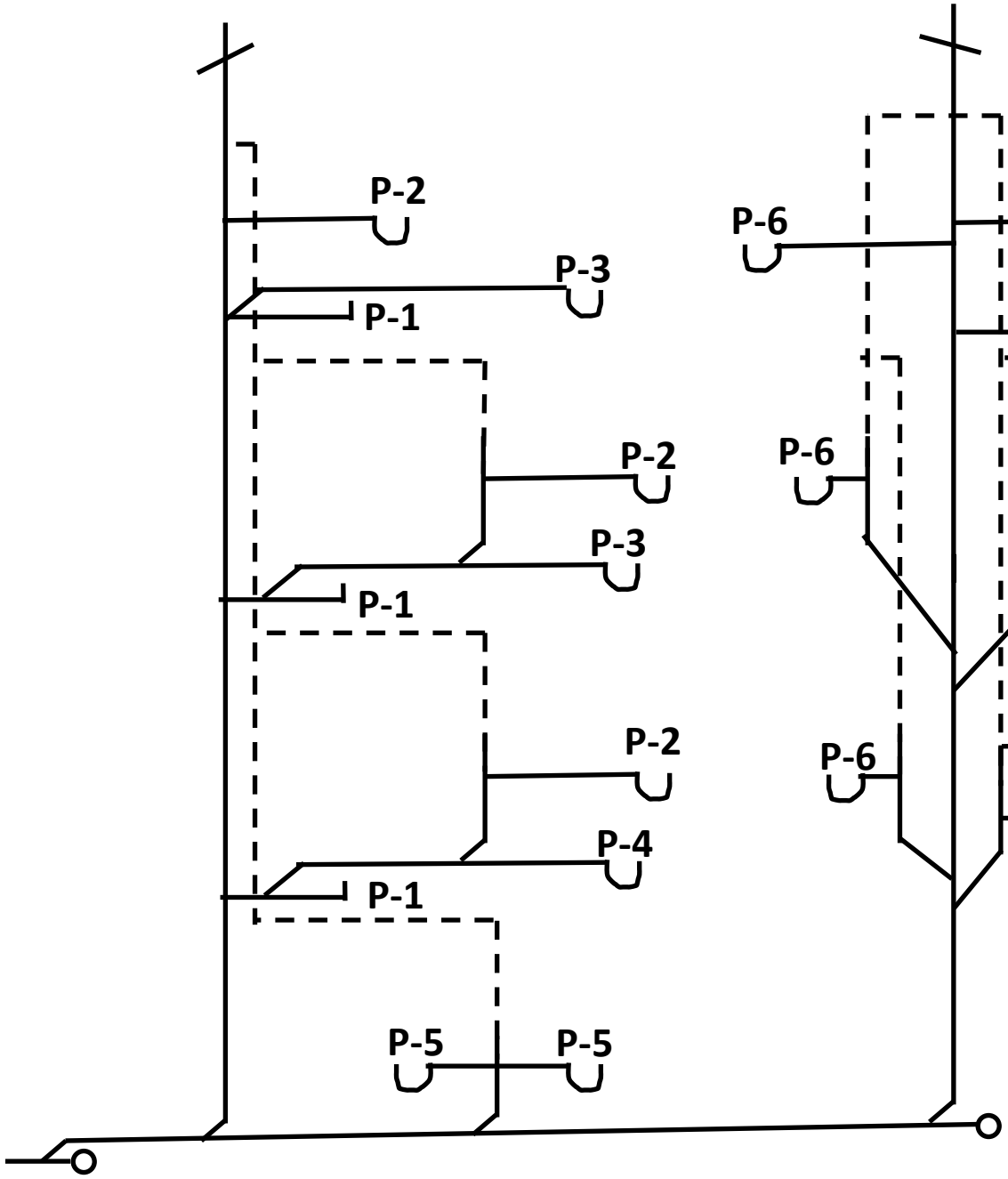
TABLE 3
MAXIMUM LOADS IN FIXTURE UNITS FOR SOIL AND WASTE STACKS HAVING ONE OR TWO BRANCH INTERVALS

Diameter of Sack (inches)	Maximum Load on Stack (F.U.)
1½	4
2	8
2½	20
3	48 **
4	240
5	540
6	930
8	2,100
10	3,750
12	5,850
15	10,500

First floor = 51
Second Floor = 45
Total = 96

Waste Stack Size = 4”

Drain Sizing Problem

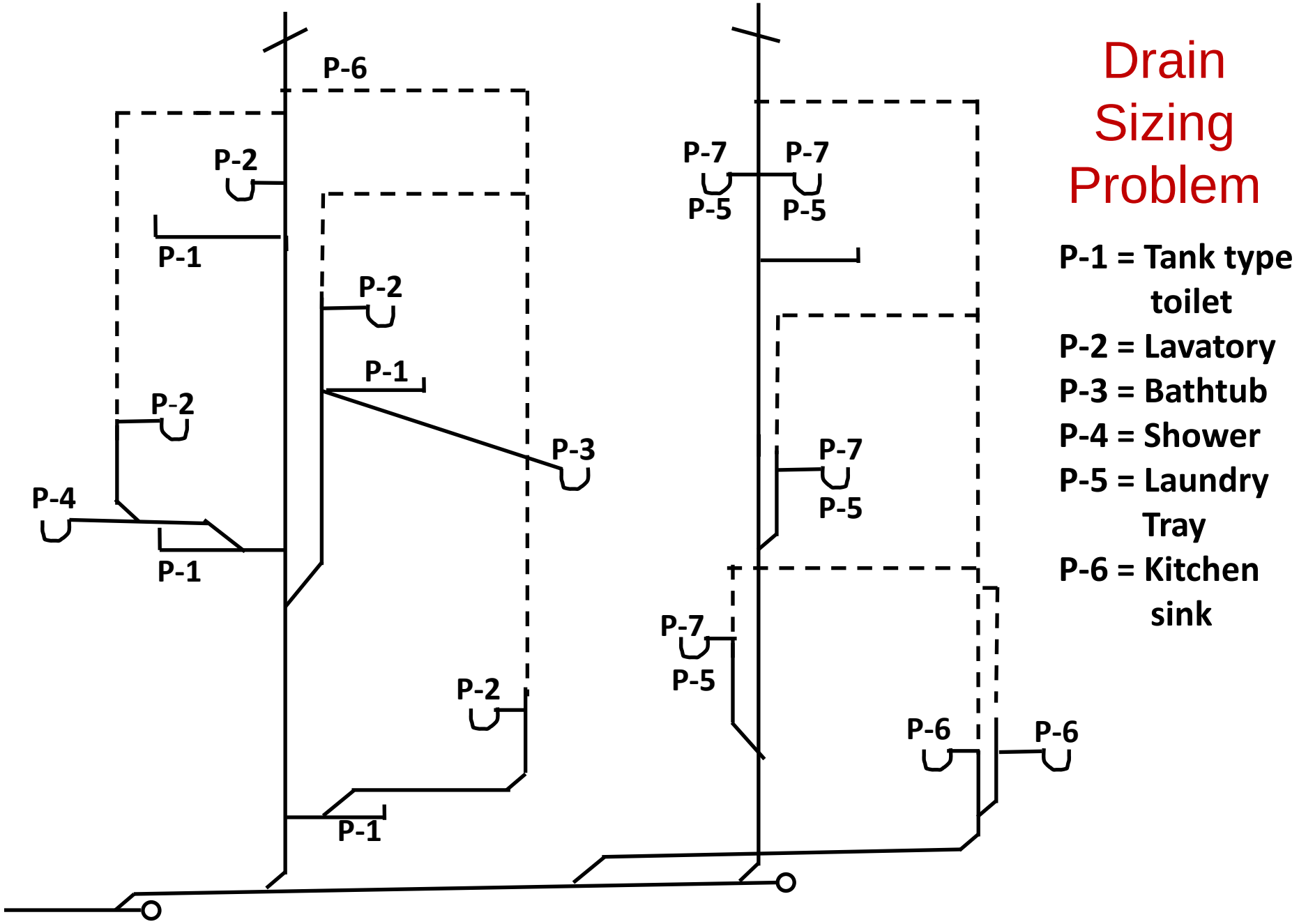


P-1 = Tank type toilet
P-2 = Lavatory
P-3 = Bathtub
P-4 = Shower
P-5 = Laundry Tray
P-6 = Kitchen sink

Use the FIXTURE UNIT VALUES TABLE 1 found on page 168 to figure the totals for the building:

P-1 = 6 Tank type toilets x 4 = 24
P-2 = 6 lavatories x 1 = 6
P-3 = 2 bathtubs x 2 = 4
P-4 = 1 shower x 2 = 2
P-5 = 2 laundry trays x 2 = 4
P-6 = 3 kitchen sinks x 2 = 6

Fixture units for the building = 46



Drain Sizing Problem

P-1 = Tank type toilet
P-2 = Lavatory
P-3 = Bathtub
P-4 = Shower
P-5 = Laundry Tray
P-6 = Kitchen sink

Use the FIXTURE UNIT VALUES TABLE 1 found on page 168 to figure the totals for the building:

P-1 = 4 Tank type toilets x 4 = 16
P-2 = 4 lavatories x 1 = 4
P-3 = 1 bathtubs x 2 = 2
P-4 = 1 shower x 2 = 2
P-5 = 4 kitchen sinks x 2 = 8
P-6 = 2 laundry trays x 2 = 6
P-7 = 4 Dishwashers x 1 = 4

Fixture units for the building = 26

What is the minimum pipe size for A? *

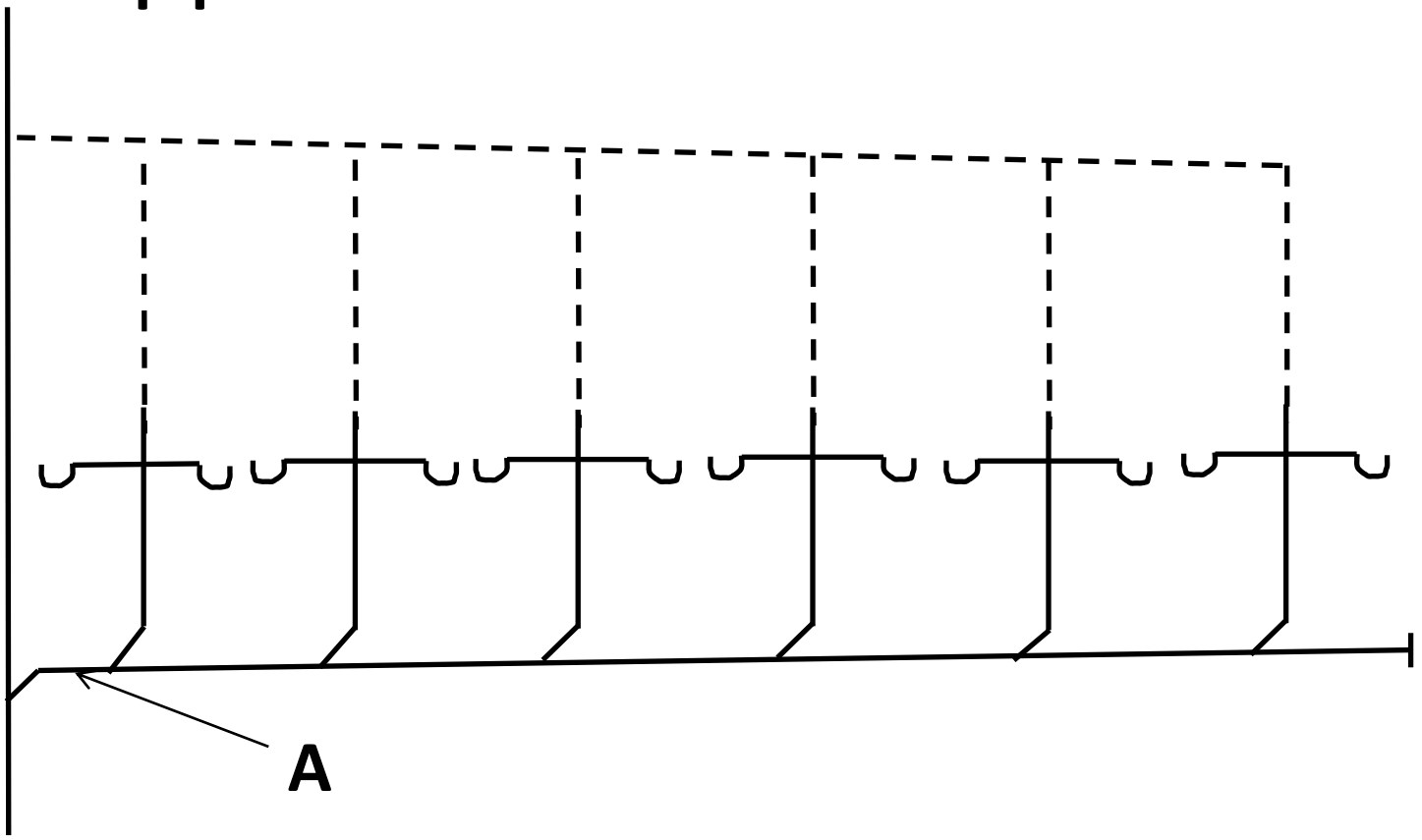
Note: All fixtures are commercial washing machines with 2” standpipes.

A. 2”

B. 3”

C. 4”

D. 5”



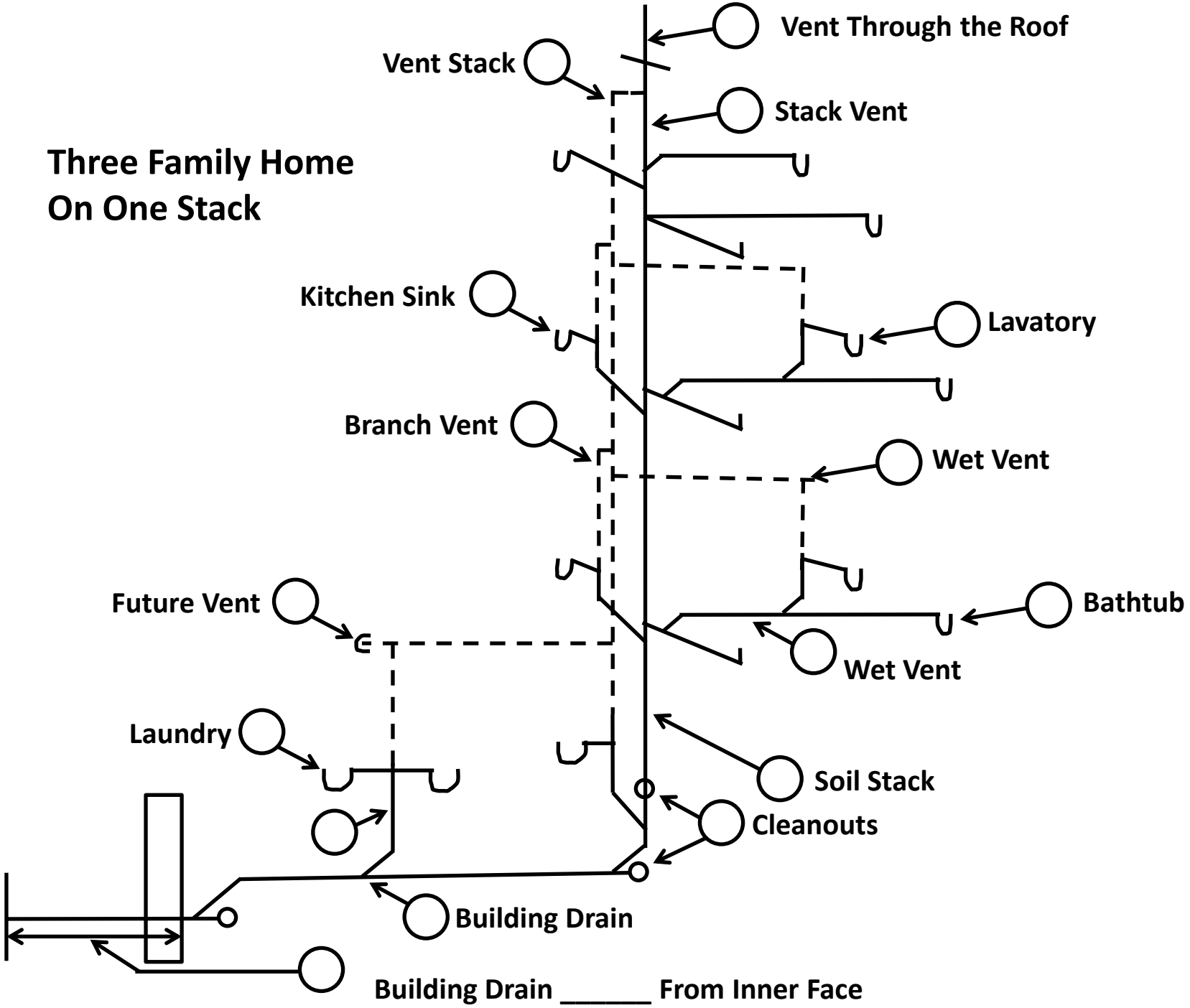
Use the FIXTURE UNIT VALUES TABLE 1 found on page 168 * to figure the totals for the building:

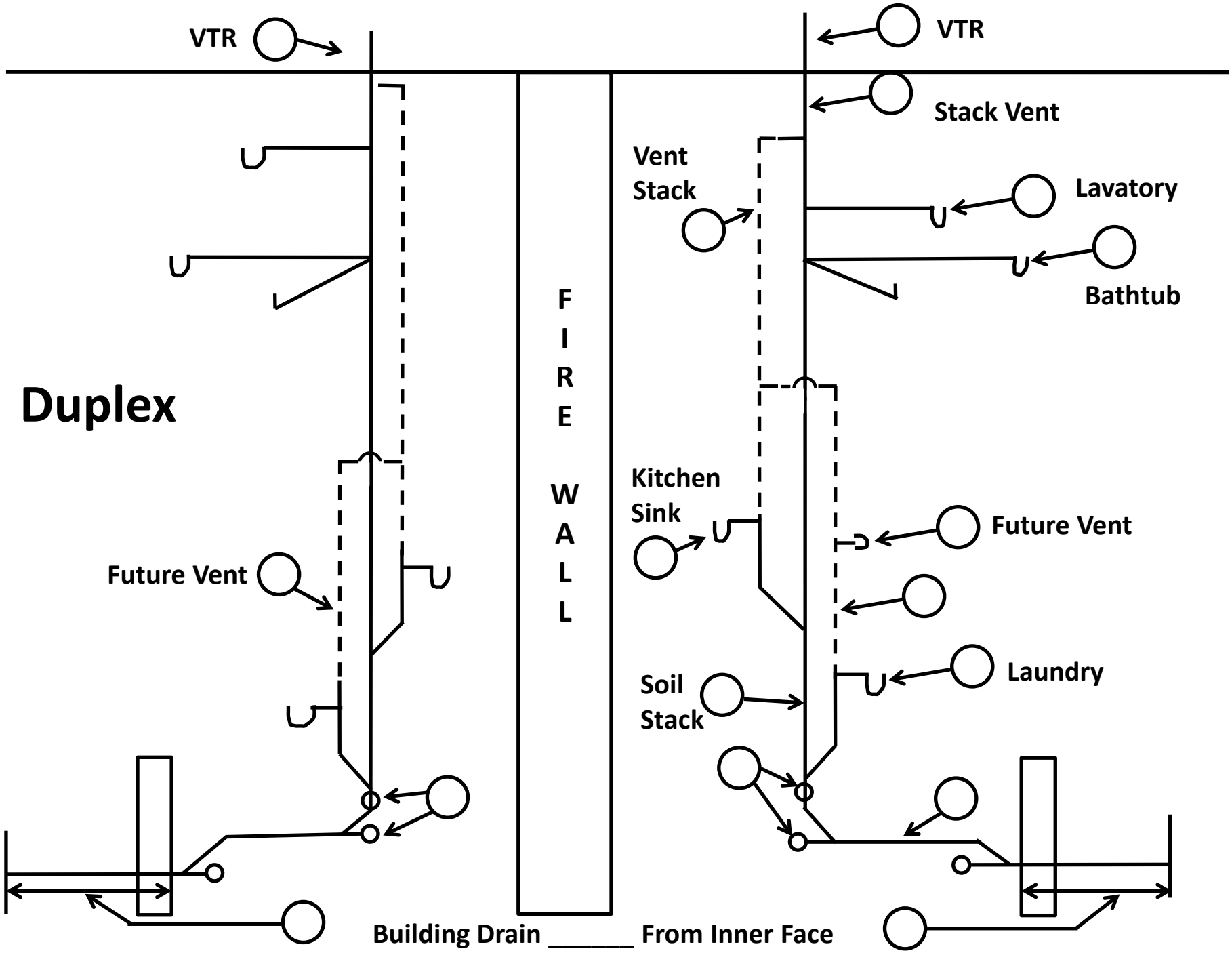
12 Automatic Clothes Washers (2” standpipe) = 36

Fixture units for the washing machine horizontal waste = 36

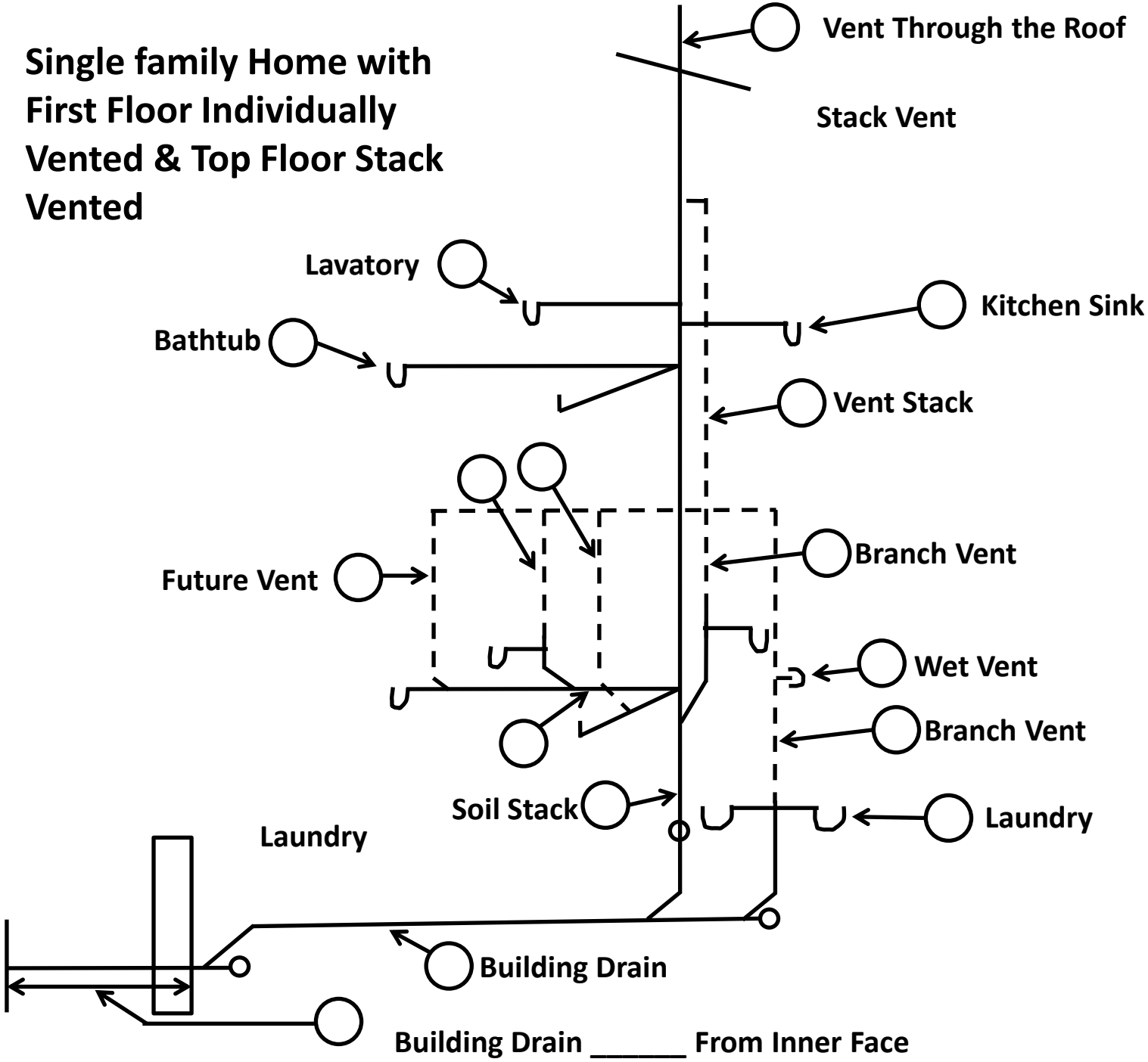
Use the MAXIMUM LOADS IN FIXTURE UNITS FOR HORIZONTAL DRAINS found on page 169 to figure the DRAIN SIZE:

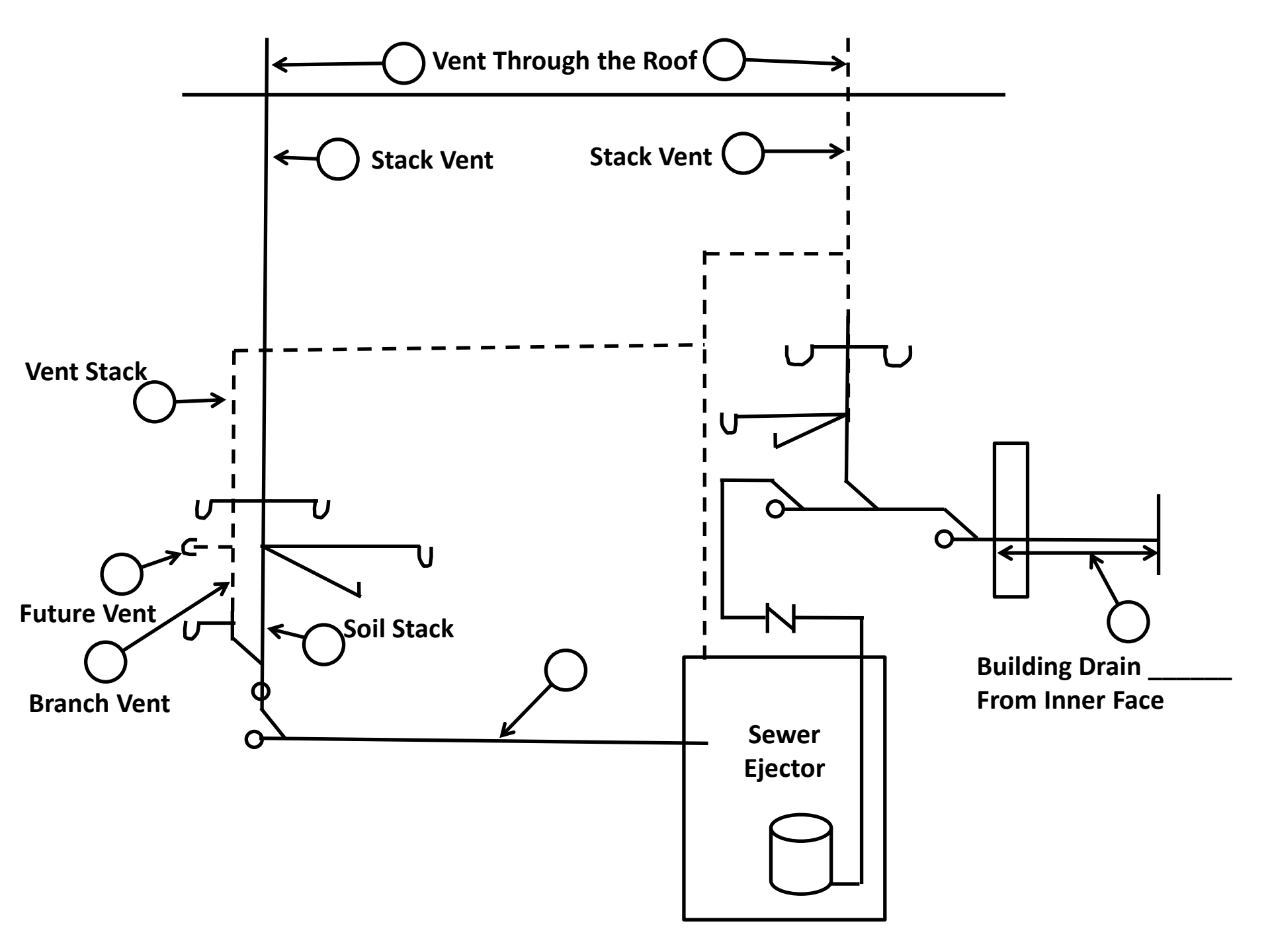
36 Fixture units needs a minimum 4” drain


Three Family Home
On One Stack
Vent Through the Roof
Vent Stack
Stack Vent
Kitchen Sink
Lavatory
Branch Vent
Wet Vent
Future Vent
Bathtub
Wet Vent
Laundry
Soil Stack
Cleanouts
Building Drain
Building Drain _____ From Inner Face


VTR
VTR
Stack Vent
Vent
Stack
Lavatory
Bathtub
Duplex
F
I
R
E
W
A
L
L
Kitchen
Sink
Future Vent
Future Vent
Soil
Stack
Laundry
Building Drain _____ From Inner Face

Single family Home with First Floor Individually Vented & Top Floor Stack Vented




Vent Through the Roof
Stack Vent
Stack Vent
Vent Stack
Future Vent
Branch Vent
Soil Stack
Building Drain _____
From Inner Face
Sewer
Ejector

Categories of Vented Appliances

3.3.6.11 ***Vented Appliance.***
3.3.6.11.1 * ***Category I Vented Appliance.*** An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

3.3.6.11.2 Category II Vented Appliance*.* An appliance that operates with a non-positive vent static pressure and with a vent gas temperature that can cause excessive condensate production in the vent.

3.3.6.11.3 Category III Vented Appliance. An appliance that operates with a positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

3.3.6.11.4 Category IV Vented Appliance*.* An appliance that operates with a positive vent static pressure and with a vent gas temperature that can cause excessive condensate production in the vent.