Self-Certification Plumbing

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Plumbing Introduction

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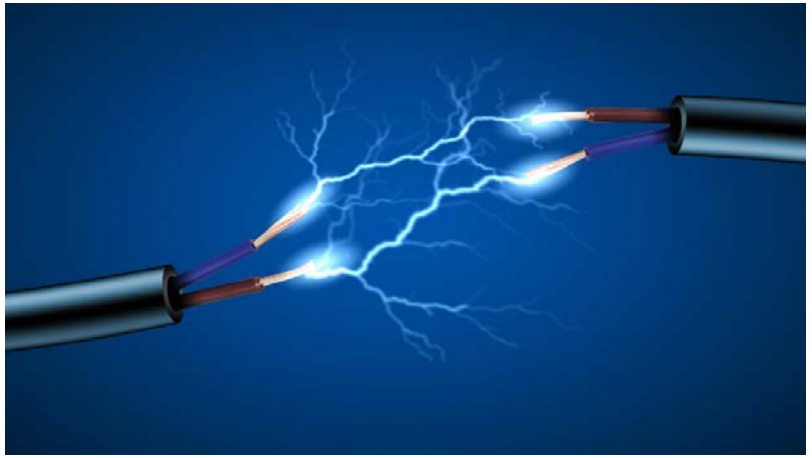
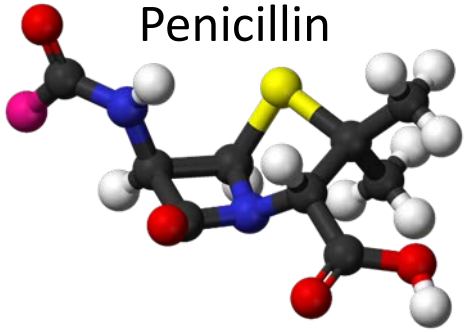
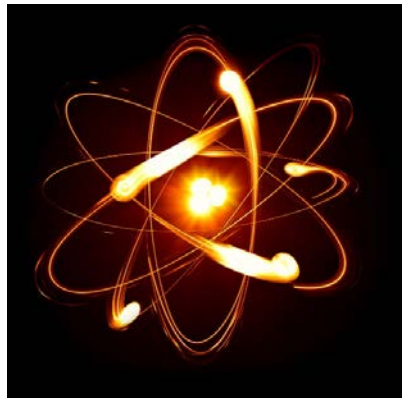
Some of our greatest inventions / discoveries



Penicillin





Plumbing Introduction

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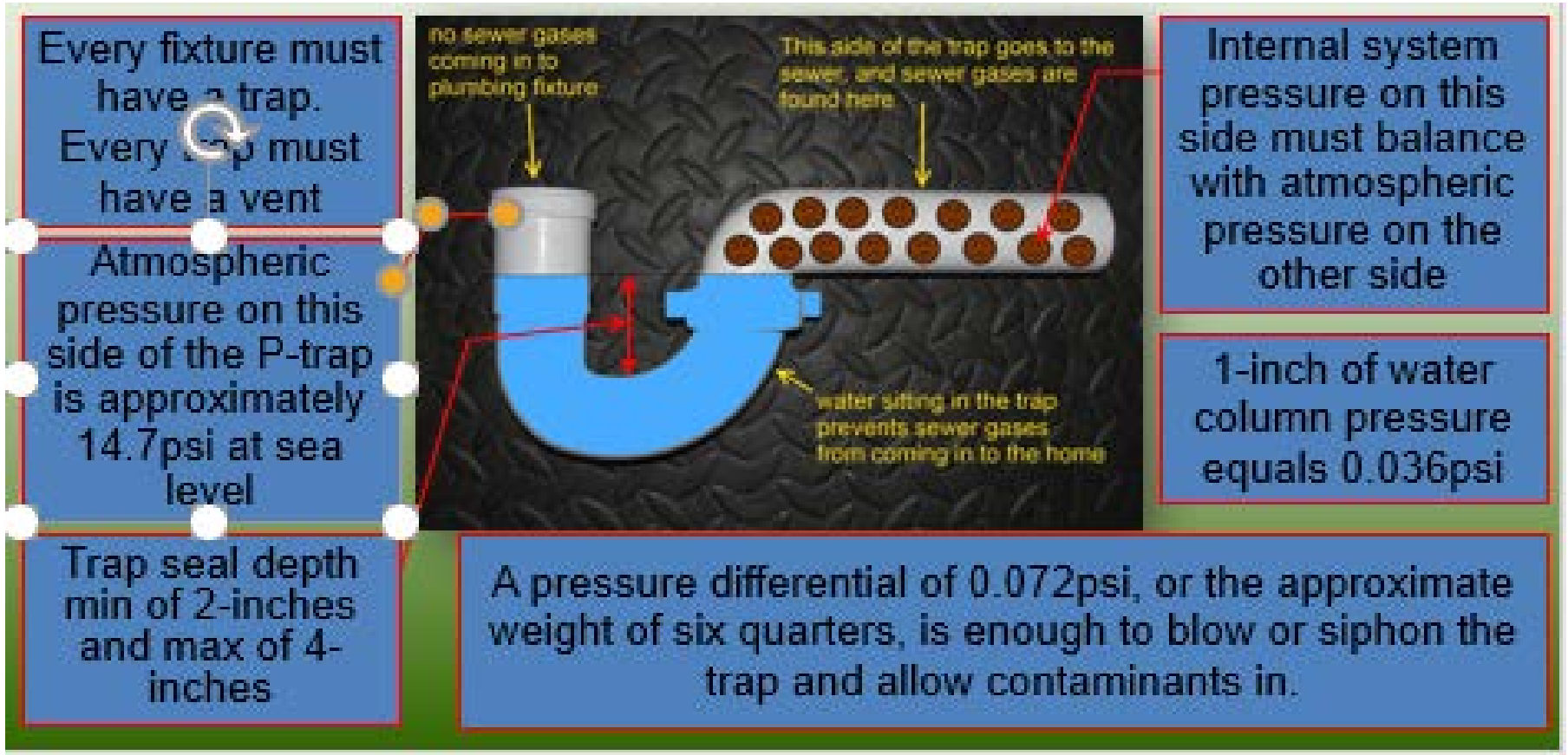
Perhaps the greatest invention / discovery?



Plumbing Health and Safety

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What are some common concerns in sanitary waste design?

a) Trap seal integrity keeps disease and contaminants on their side of the trap

✓ *Cholera, diarrhea,, salmonella, typhoid, whipworm, hookworm, hepatitis A, meningitis, legionnaires, ringworm, tinea,*

b) Sufficient diameter & proper gravity slope ensures:

✓ *Self scouring, solids in suspension, sanitary venting throughout the system*

c) A gas and watertight system protects against:

✓ *Aquifer contamination, mold, foul objectionable odors from vents*

Plumbing Health and Safety

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What are some common concerns in domestic water design?

a) Circulation throughout the system, no dead ends, helps prevent:

✓ *Legionella bacteria growth, risk increased 68°F - 113°F (20-45°C)*

b) Sufficient diameter ensures:

✓ *Erosion, corrosion of piping material is minimized*

c) A watertight system protects against:

✓ *Mold, structural compromise, water waste*

Plumbing Health and Safety

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What are some common concerns in fuel gas design?

a) Proper venting and combustion air provisions prevent:

✓ *Carbon monoxide poisoning, 170 deaths / year, non-automotive related*

✓ *The Building code requires CO sensors in 908.7, I & R occupancies*

b) Can not enter or exit a building below grade – IFGC 404.6

✓ *A slow buildup of gas can go undetected and may result in a catastrophic event if not discovered.*

c) A compliant design and installation ensures:

✓ *Life safety, durability of use when operating appliances*

Overview

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- Plumbing Code Resources
- Plumbing Code Use & Amendments
- Sewer and Water Service
- On-Site Utility Plans
- Common Plumbing Issues
- Environmental Services aka Pollution Control
- Technical Guidelines
- Special Inspection and Observation
- Summary

Adopted Codes & Guide Books

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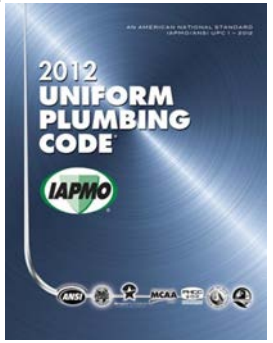
- 2018 Uniform Plumbing Code (UPC)

  lapmo.org



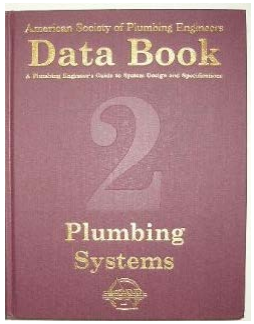
- 2018 International Plumbing Code (IPC)

  Iccsafe.org

City of Phoenix amendments available at
http://www.phoenix.gov/pdd/devcode/buildingcode

- 2018 International Fuel Gas Code (IFGC)
- American Society of Plumbing Engineers

ASPE Data Book Chapter 3: Cold Water Systems



2018 Plumbing Code Amendments

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- Rainwater drainage systems

➢ Hourly rate of 3-inches / hour

➢ Scuppers ok for primary or secondary roof drainage

➢ Scupper openings shall be 4-inches high minimum and the width equal to the circumference of the required drain

➢ Secondary roof drain systems shall be sized as primary drains

➢ Combined sanitary and storm system not approved

2018 Plumbing Code Amendments

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- Adopted Appendix E & F in IPC

➢ Appendix E contains additional water pipe sizing methods

➢ Appendix F contains structural safety for cutting and notching of framing members

- Adopted Appendix A, B & I in UPC

➢ Appendix A contains additional water pipe sizing methods

➢ Appendix B contains additional information on combination waste and vent systems

➢ Appendix I contains installation standards for various piping systems

New and Existing Water Meters

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- Water and sewer service to be verified and/or approved before submitting plan for permit
  - Check as-builts at counter 8,
  - Pot hole the onsite location
- Use of existing domestic water meter to be verified at Counter 8 and submit Information Request Form (see Plumbing handouts)
  - Tap may be abandoned,
  - Meter supply may not be adequate

Water Meter / Drainage Fixture Unit Worksheet

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2) **Total number of drainage fixture units:** (2018 UPC Table 702.1 or 2018 IPC Table 709.1. Attach additional sheets if necessary)

TYPE OF FIXTURE	NUMBER OF FIXTURES		DRAINAGE FIXTURE UNIT VALUE		TOTAL FIXTURE UNITS
Water Closet (Flush Valve)	3	x	4	=	12
Water Closet (Flush Tank)		x		=	
Urinal	1	x	2	=	2
Lavatory	2	x	1	=	2
Shower		x		=	
Sink/Dishwasher	1	x	2	=	2
Floor Sink	1	x	1	=	1
Other (Specify) Drinking Fountain	1	x	0.5	=	0.5
Other (Specify)		x		=	
Other (Specify)		x		=	
				Total Drainage Fixture Units	19.5

See handout page 1.

Water Meter / Water Fixture Unit Worksheet

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- 1)Total number of new and existing water supply fixture units : (2018 UPC Table 610.3, Appendix A or 2018 IPC Table E103.3(2). Attach additional sheets if necessary)

TYPE OF FIXTURE	NUMBER OF FIXTURES		WATER FIXTURE UNIT VALUE		TOTAL FIXTURE UNITS
Water Closet (Flush Valve)	3	x	5	=	15
Water Closet (Flush Tank)		x		=	
Urinal	1	x	4	=	4
Lavatory	2	x	1	=	2
Drinking Fountain	1	x	0.5	=	0.5
Sink/Dishwasher	1	x	1.5	=	1.5
Hose Bibb	1	x	2.5	=	2.5
Other (Specify)		x		=	
Other (Specify)		x		=	
Other (Specify)		x		=	

See handout page 1.

Total Water Supply Fixture Units 25.5

Water Meter / Water Fixture Unit Worksheet

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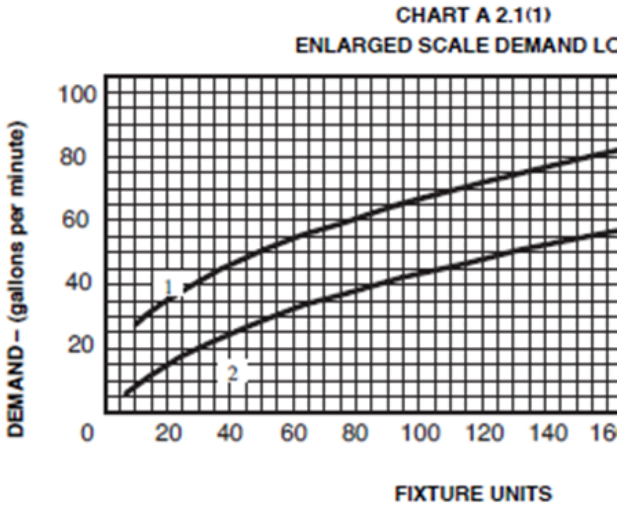
3) Converting the water supply fixture units to gallons per minute and determining the total water use

Total water supply fixture units = 25.5 System is predominately __ Flush Tank x Flush Valve

Converted water demand in GPM (from 2012 UPC Chart A-2 or Chart A-3 or 2012 IPC Figure E103.3(2) to E103.3(7)) = 39 GPM

Additional water usage (landscape irrigation, cooling towers, process equipment, etc.) = 20 GPM

Total water demand in GPM (add previous two GPM values) = 59 GPM



Water Meter / Water Fixture Unit Worksheet

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4) Calculating the Water Pressure available for design purposes:

Base Water Pressure at Service Tap: (Actual measured value or obtained from Water Services Department**)**	**55.0** psi
Water meter loss (_____ inch): (Use UPC Appendix A Chart A-1 or IPC Tables E103.3(4) through E103.3(6))	**2.8** psi
Special Equipment: (Deduct all pressure losses caused by special equipment such as a backflow preventer, water filter, or water softener. Pressure loss data shall be obtained from the manufacturer of such equipment.	**4.2** psi
Elevation Difference: (Where the highest water supply outlet is located above the source of supply, multiply the difference in elevation in feet by 0.43. The result is the loss in static pressure in psi.)	**6.5** psi
Residual pressure required for plumbing fixtures: For UPC, the available residual pressure shall not be less than 15 psi for flush valve fixtures and 8 psi for flush tank fixtures. For IPC, see Table 604.3.	**20.0** psi
Adjusted Water Pressure: (The amount of pressure available for the domestic water supply system)	**21.5** psi

Water Meter / Drainage Fixture Unit Worksheet

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5) Determine the total developed length of piping in the domestic water supply system and calculate the maximum allowable pressure loss per 100 feet of piping.

Pipe Length (Tap to Meter)	30	ft.
Pipe Length (Meter to farthest fixture)	80	ft.
Vertical length	15	ft.
Equivalent length of fittings (assume 25%)	35	ft.
Total Developed Length	160	ft.
Maximum Allowable Pressure Loss = (Adjusted Water Pressure / Total Developed Length) x 100	13.44	psi/100 ft

6) Summary of required water meter, supply piping sizing and drainage fixture units.

21.5 / 160 x 100 =

Water Meter Size: 1-1/2 in (Per DSD Technical Guideline for Water Meter Sizing)

☐ New ☐ Existing

Supply Line Size: 2 in (Per 2018 UPC Table 610.4 or IPC APDX E)

Drainage Fixture Units: 19.5 (from table above. For multifamily, provide the number of drainage fixture units per building. Attach additional sheets if needed.

Water Meter Sizing (UPC)

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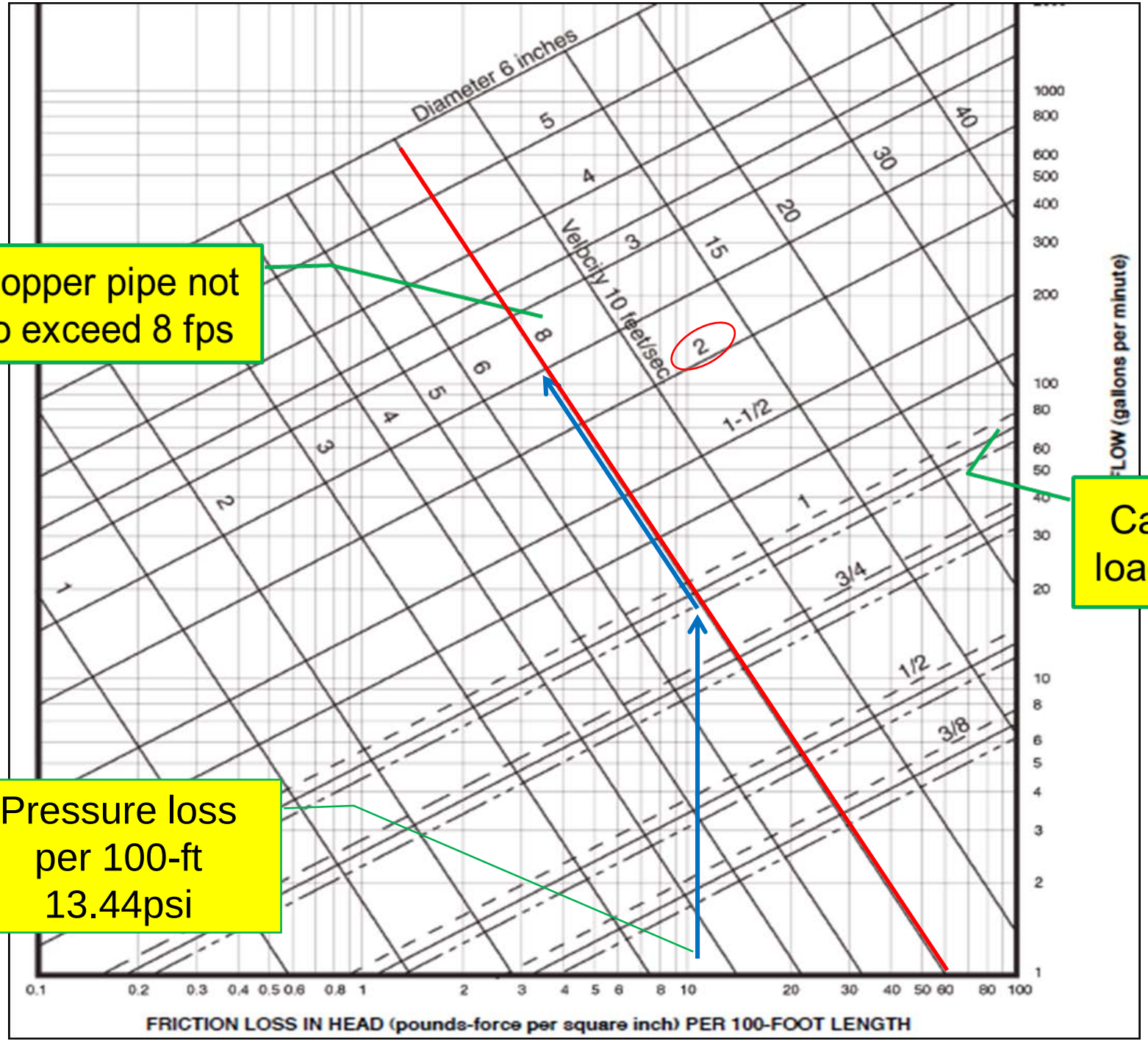
Calculated Load = 59 gpm

POLICY Water meters shall be sized in accordance with the following table. The columns list the maximum allowable gallons per minute (gpm) and associated water supply fixture units allowed for any given meter size and type. Project designs which exceed the listed gpm unit values must be upsized to the next larger meter. The Water Meter Sizing Table is also available in the city's Water and Wastewater Design Standard's Manual.

Column 1	Column 2	Column 3		Column 4	
METER SIZE & DESCRIPTION	WSD & P&D MAXIMUM ALLOWABLE G.P.M.	MAXIMUM FLUSH TANK FIXTURE UNITS		MAXIMUM FLUSH VALVE FIXTURE UNITS	
		UPC	IPC/IRC	UPC	IPC/IRC
5/8" x 3/4"	20	30	21	0	7
3/4" x 3/4"	30	54	53	13	14
1"	50	127	129	48	50
1-1/2"	100	380	375	245	245
2"	160	692	696	631	625
3" COMPOUND	320	1,926	1,955	1,926	1,955
4" COMPOUND	500	3,620	3,728	3,620	3,728
6" COMPOUND	1,000	8,300	(1)	8,300	(1)
8" COMPOUND	1,600	14,500	(1)	14,500	(1)

(1) The design method of the IPC is limited to 593 GPM maximum.



Copper pipe not to exceed 8 fps

Calculated load 59 gpm

Pressure loss per 100-ft 13.44psi

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Water Meters Continued

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- Sizing information for new or existing water meters to follow the criteria of Water Meter Sizing Technical Guideline
- Water Meter/Drainage Fixture Unit Worksheet
- All Development Occupational Fees (DOF), Water Resource Acquisition Fees (WRA), and Impact fees related to water and sewer service to be paid

New or Revised Plans

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- Projects that require new or revised domestic water supply and building sewer connection shall submit an on-site utility plan in compliance with the 2018 Uniform Plumbing Code or 2018 International Plumbing Code

- On-site utility plan may be prepared by a civil or plumbing designer

- All on-site utility code compliance issues to be resolved before submitting for permit

Septic Systems

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- Use of septic systems to be pre-approved by Water Services and permitted by Maricopa County

➢ Water Services may require a public main extension

- Verify that on-site utility plans match plumbing drawings for size and location

➢ Sizing and alignment often not coordinated

Water/Sewer Crossing Lots

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On-site Utilities

- UPC & IPC prohibit private water and sewer utilities from crossing property lines unless a legal easement and maintenance agreement is established
- Plumbing Code Modification Requirements for water/sewer property line crossings
- Water Services Department approval required first
- Private Utility Easement
- Final easement with required signatures to be recorded at Maricopa County Recorder before City approval
- Approved documentation to be provided before permit

Low Slope Sewers

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- UPC 718.1 and IPC 704.1 require a minimum installed slope for building sewers
- Projects that cannot technically meet minimum sewer slopes shall submit a completed Low Slope Sewer Installation Certificate
- Owner’s signature with notary and Design Engineer’s seal and signature required

Pollution Control Approval

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- Water Services Department / Environmental Services Division requires approval of all waste treatment devices before obtaining a building permit
- All restaurants are required to be served by grease collection devices
- For information on which plumbing fixtures are designated to the grease waste system and for sizing of all grease collection devices, contact:

  Ruben Martinez, Senior Water Quality Inspector
  Office: 602-495-0278

Common Plumbing Issues

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- Sewer, Water and Gas Calculations & Coordination
- Water heaters
- Domestic water supply
- Drain, waste, vent & sewer systems
- Indirect wastes
- Traps and interceptors
- Rainwater collection systems
- Fuel gas piping

Common Plumbing Issues

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Comment #	Plumbing Comments	Points	Note
1.	IPC 1101, 1102, 1106 Civil G&D plans show several locations where storm drain piping passes under buildings. Civil is referencing this information to the Plumbing Drawings. Detail on the Plumbing drawings storm drain pipe sizing, materials and locations.	1	
2.	IPC 701.2 Sheet P1.1.1 Cannot locate the building sewer connection for the grease waste on Private Sewer Plan Sheet WS5.	1	
3.	IPC 710 Sheet WS5 Provide the engineering calculations that demonstrate that the 8 inch building sewer can handle the proposed number of drainage fixture units shown on this plan sheet. Drainage fixture unit maximum for an 8 inch building sewer at 0.5% is 1400 per Table 710.1(1).	1	
8.	Sheet P5.4. IFGC 402.3 Decide if the natural gas supply system is 2 psi or 7" W.C.. If using 2 psi, provide a letter from Southwest Gas Corporation to confirm that medium pressure gas will be provided.	1	
10.	IPC 604 Provide a Water Calculation for the non-residential domestic water supply system. Check the square footage of each tenant space and make sure that unisex restrooms will be allowed (up to 50 occupants in Group B and M)	1	
	Plumbing Total	9	

Coordination

Coordination

Sewer Calcs

Gas Calcs

Water Calcs

Restroom Facilities Calcs

Common Plumbing Issues

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- Water Heaters

➢ Permits required for all new water heater installations

➢ Show T & P discharge terminal compliance

➢ Show Combustion air calcs & requirements per IFGC

➢ Venting methods to be detailed on plans

➢ Provide cut sheets for direct vent equipment

➢ Show access & clearance compliance to equipment

Common Plumbing Issues

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- **Water Heaters**

Leaking T & P valve plugged

Internal pressure and temperature rise

Vessel integrity weakens

Vessel breach occurs at the weakest point

Energy released is more than 1-lb of dynamite

Structure will have to be demolished

azcentral.com
ARIZONA'S HOME PAGE

Home's water heater explodes, hurtles 135 yards

by Thomas Demano and Matt Culbertson - Aug. 14, 2008 12:09 PM
12 News and azcentral.com

A water heater that apparently had its pressure valve shut exploded and hurtled 135 yards Thursday morning, causing "catastrophic damage" to the Phoenix home, authorities said.

No injuries were reported, and the house's sole occupant was unharmed.

At about 5:40 a.m., the water heater was blown out of a garage near Thunderbird Road and 38th Street. The damaged home will most likely have to be torn down, authorities said.

Common Plumbing Issues / Water Heaters

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[redacted]

Common Plumbing Issues / Water Supply and Distribution

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- Detail source of potable water up to meter
- Backflow protection
- Specify materials for potable water piping systems
- Water pressure regulators required over 80 psi
- Provide drains for all relief valves
- Sizing of potable water piping to be on plans
- Landscape irrigation water meters per PCC 37-53
- Alternate water sources (rain, well, grey water)

Common Plumbing Issues / Drainage Systems and Sewers

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- Specify materials for drain, waste, and vent piping
- Provide total drainage fixture units (Impact Fees)
- Sizing of drain and waste piping systems required
- Installation: cleanouts, grade, depth, ejectors
- Building sewer materials, sizing, installation
- Sewer and water pipe clearances
- Match building drains to sewer system

Common Plumbing Issues / Plumbing Vents

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- Vents or air admittance valves required
- Specify materials and sizing of vent piping
- Drain, waste and vent (DW&V) diagrams required
- Installation of plumbing vents
- Detail all special plumbing vent systems
  - Vertical and horizontal wet venting
  - Island fixtures
  - Combination waste and vent (CW&V) systems

Common Plumbing Issues / Indirect Waste Systems

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Food and beverage handling establishments

- Indirect waste piping
- Indirect waste receptors
- Appliances, condensate waste
- 3-compartment sinks
- Dishwashing machines
- Chemical wastes

Common Plumbing Issues / Plumbing Traps

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- Traps required to prevent sewer gas leakage
- Food waste disposal units to have separate trap
- Horizontal distance of trap arms
- Traps to be protected by plumbing vents
- Trap seals and protection
- Barrier type floor drain devices

Rainwater Removal System

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- Required for all roofs where ponding can occur
- Specify piping materials inside and outside building
- Primary and secondary roof drainage systems
  - Amendment from COP for rainfall rates (3”/hr)
  - Scupper sizing and separate overflow openings
- Detail sizing of roof drain piping and scuppers
- UPC sizing tables and IPC tables match

Common Plumbing Issues / Gas Piping Installations

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Design and Installation

- Use 2018 International Fuel Gas Code (IFGC)
- Gas diagrams and calcs are required for all projects
- All gas piping up to the gas meter is utility company, after the meter must be in compliance with code
- Sizing of gas piping based on system pressure, pressure drop, and total developed length of piping
- Specify gas piping materials, joints and fittings
- Pressure regulators to be vented to outdoors
- Gas piping installation

Interceptors and Separators

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- Hydro-mechanical Devices (indoor units)
  - four (4) fixtures or less
- Interceptors
  - Commercial cooking operations
  - Slaughterhouse, meat packing
  - Auto wash facilities
  - Commercial and industrial laundries
  - Computer chip manufacturers'
  - Radiator shops
  - Parking garages

Interceptors and Separators Continued

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- Vented flow controls required (indoor units)
  - *Access, access, access!!!*
- Flumes and other metering devices
  - Heavy Industrial users, 25,000 gallons of water/day

COP Technical Guidelines

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- Water Meter Sizing
  - Used for sizing of water meters
- Tracer Wires for Plastic Underground Pipe
  - Plastic underground water, sewer, and natural gas piping require tracer wire for future locating of lines per A.R.S. Section 40-360.22J
- Disinfection for Potable Water Systems
  - Acknowledges that typical flushing of new potable water systems is sufficient to clear piping of potential contaminants

Structural Plumbing Inspection and Observation

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- Required per IBC 1705.20 & 1704.8
- Certificates to be submitted prior to permit

➢ Medical Gas Systems

➢ Special Cases – work that, in the opinion of the Building Official, involves unusual hazards or conditions

Plumbing Plan Submittal

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Summary

- Minimum plumbing fixture calculations
- Plumbing fixture specifications, water conservation
- Water heater details
- Sizing of potable water systems
- Drain, waste and vent diagrams with sizing
- Indirect waste system design
- Rainwater removal systems, sizing calculations and diagram
- Gas piping systems diagram & calculation
- Site sewer, water and interceptor diagrams, plans and calculations

Submittal Requirements

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Summary

- Water and sewer service confirmed
- Water meter sizing worksheet completed
- Water Meter/Drainage Fixture Unit worksheet completed
- Code modifications approved
- Pollution Control issues resolved
- Special Inspection & Observation forms attached

Questions?

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