**ICC PLUMBING SECTION 604 DESIGN OF BUILDING WATER DISTRIBUTION SYSTEM

604.1 General.**
The design of the water distribution system shall conform to *accepted engineering practice.* Methods utilized to determine pipe sizes shall be *approved.*  **604.2 System interconnection.**
At the points of interconnection between the hot and cold water supply piping systems and the individual fixtures, appliances or devices, provisions shall be made to prevent flow between such piping systems.  **604.3 Water distribution system design criteria.**
The water distribution system shall be designed, and pipe sizes shall be selected such that under conditions of peak demand, the capacities at the fixture supply pipe outlets shall not be less than shown in Table 604.3. The minimum flow rate and flow pressure provided to fixtures and appliances not listed in Table 604.3 shall be in accordance with the manufacturer’s installation instructions.  **TABLE 604.3 WATER DISTRIBUTION SYSTEM DESIGN CRITERIA REQUIRED CAPACITY AT FIXTURE SUPPLY PIPE OUTLETS**

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| **FIXTURE SUPPLYOUTLET SERVING**  | **FLOWRATEa (gpm)**  | **FLOWPRESSURE(psi)**  |
| Bathtub, balanced-pressure, thermostatic or combination balanced-pressure/thermo-static mixing valve | 4 | 20 |
| Bidet, thermostatic mixing valve | 2 | 20 |
| Combination fixture | 4 | 8 |
| Dishwasher, residential | 2.75 | 8 |
| Drinking fountain | 0.75 | 8 |
| Laundry tray | 4 | 8 |
| Lavatory | 2 | 8 |
| Shower | 3 | 8 |
| Shower, balanced-pressure, thermostatic or combination balanced-pressure/thermo-static mixing valve | 3 | 20 |
| Sillcock, hose bibb | 5 | 8 |
| Sink, residential | 2.5 | 8 |
| Sink, service | 3 | 8 |
| Urinal, valve | 12 | 25 |
| Water closet, blow out, flushometer valve | 25 | 45 |
| Water closet, flushometer tank | 1.6 | 20 |
| Water closet, siphonic, flushometer valve | 25 | 35 |
| Water closet, tank, close coupled | 3 | 20 |
| Water closet, tank, one piece | 6 | 20 |

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| For SI: 1 pound per square inch = 6.895 kPa |
| 1 gallon per minute = 3.785 L/m.  |
| a. For additional requirements for flow rates and quantities, see Section 604.4. |

 **604.4 Maximum flow and water consumption.**
The maximum water consumption flow rates and quantities for all plumbing fixtures and fixture fittings shall be in accordance with Table 604.4.  **Exceptions:**

1. Blowout design water closets having a water consumption not greater than 31/2 gallons (13 L) per flushing cycle.

2. Vegetable sprays.

3. Clinical sinks having a water consumption not greater than 41/2 gallons (17 L) per flushing cycle.

4. Service sinks.

5. Emergency showers.  **TABLE 604.4 MAXIMUM FLOW RATES AND CONSUMPTION FOR PLUMBING FIXTURES AND FIXTURE FITTINGS**

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| **PLUMBING FIXTUREOR FIXTURE FITTING**  | **MAXIMUM FLOW RATEOR QUANTITYb**  |
| Lavatory, private | 2.2 gpm at 60 psi |
| Lavatory, public (metering) | 0.25 gallon per metering cycle |
| Lavatory, public  (other than metering) | 0.5 gpm at 60 psi |
| Shower heada | 2.5 gpm at 80 psi |
| Sink faucet | 2.2 gpm at 60 psi |
| Urinal | 1.0 gallon per flushing cycle |
| Water closet | 1.6 gallons per flushing cycle |

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| For SI: 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, |
| 1 pound per square inch = 6.895 kPa. |
| a. A hand-held shower spray is a shower head. |
| b. Consumption tolerances shall be determined from referenced standards. |

**604.5 Size of fixture supply.**
The minimum size of a fixture supply pipe shall be as shown in Table 604.5. The fixture supply pipe shall terminate not more than 30 inches (762 mm) from the point of connection to the fixture. A reduced-size flexible water connector installed between the supply pipe and the fixture shall be of an *approved* type. The supply pipe shall extend to the floor or wall adjacent to the fixture. The minimum size of individual distribution lines utilized in gridded or parallel water distribution systems shall be as shown in Table 604.5.  **TABLE 604.5 MINIMUM SIZES OF FIXTURE WATER SUPPLY PIPES**

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| **FIXTURE**  | **MINIMUM PIPE SIZE(inch)**  |
| Bathtubsa (60″ × 32″ and smaller) | 1/2  |
| Bathtubsa (larger than 60″ × 32″) | 1/2  |
| Bidet | 3/8  |
| Combination sink and tray | 1/2  |
| Dishwasher, domestica | 1/2  |
| Drinking fountain | 3/8  |
| Hose bibbs | 1/2  |
| Kitchen sinka | 1/2  |
| Laundry, 1, 2 or 3 compartmentsa | 1/2  |
| Lavatory | 3/8  |
| Shower, single heada | 1/2  |
| Sinks, flushing rim | 3/4  |
| Sinks, service | 1/2  |
| Urinal, flush tank | 1/2  |
| Urinal, flushometer valve | 3/4  |
| Wall hydrant | 1/2  |
| Water closet, flush tank | 3/8  |
| Water closet, flushometer valve | 1 |
| Water closet, flushometer tank | 3/8  |
| Water closet, one piecea | 1/2  |

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| For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, |
| 1 pound per square inch = 6.895 kPa. |
| a. Where the developed length of the distribution line is 60 feet or less, and the available pressure at the meter is 35 psi or greater, the minimum size of an individual distribution line supplied from a manifold and installed as part of a parallel water distribution system shall be one nominal tube size smaller than the sizes indicated. |

 **604.6 Variable street pressures.**
Where street water main pressures fluctuate, the building water distribution system shall be designed for the minimum pressure available.  **604.7 Inadequate water pressure.**
Wherever water pressure from the street main or other source of supply is insufficient to provide flow pressures at fixture outlets as required under Table 604.3, a water pressure booster system conforming to Section 606.5 shall be installed on the building water supply system.  **604.8 Water pressure reducing valve or regulator.**
Where water pressure within a building exceeds 80 psi (552 kPa) static, an *approved* water-pressure reducing valve conforming to ASSE 1003 or CSA B356 with strainer shall be installed to reduce the pressure in the building water distribution piping to not greater than 80 psi (552 kPa) static.  **Exception:** Service lines to sill cocks and outside hydrants, and main supply risers where pressure from the mains is reduced to 80 psi (552 kPa) or less at individual fixtures.

**604.8.1 Valve design.**
The pressure-reducing valve shall be designed to remain open to permit uninterrupted water flow in case of valve failure.

**604.8.2 Repair and removal.**
Water-pressure reducing valves, regulators and strainers shall be so constructed and installed as to permit repair or removal of parts without breaking a pipeline or removing the valve and strainer from the pipeline.

**604.9 Water hammer.**
The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water-hammer arrestor shall be installed where quick-closing valves are utilized. Water-hammer arrestors shall be installed in accordance with the manufacturer’s instructions. Water-hammer arrestors shall conform to ASSE 1010.  **604.10 Gridded and parallel water distribution system manifolds.**
Hot water and cold water manifolds installed with gridded or parallel connected individual distribution lines to each fixture or fixture fitting shall be designed in accordance with Sections 604.10.1 through 604.10.3.

**604.10.1 Manifold sizing.**
Hot water and cold water manifolds shall be sized in accordance with Table 604.10.1. The total gallons per minute is the demand of all outlets supplied.  **TABLE 604.10.1 MANIFOLD SIZING**

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| **NOMINAL SIZEINTERNAL DIAMETER (inches)**  | **MAXIMUM DEMAND (gpm)**  |
| **Velocity at 4 feetper second**  | **Velocity at 8 feetper second**  |
| 1/2  | 2 | 5 |
| 3/4  | 6 | 11 |
| 1 | 10 | 20 |
| 11/4  | 15 | 31 |
| 11/2  | 22 | 44 |

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| For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m, |
| 1 foot per second = 0.305 m/s. |

**604.10.2 Valves.**
Individual fixture shutoff valves installed at the manifold shall be identified as to the fixture being supplied.

**604.10.3 Access.**  *Access* shall be provided to manifolds with integral factory- or field-installed valves.

**604.11 Individual pressure balancing in-line valves for individual fixture fittings.**
Where individual pressure balancing in-line valves for individual fixture fittings are installed, such valves shall comply with ASSE 1066. Such valves shall be installed in an accessible location and shall not be utilized alone as a substitute for the balanced pressure, thermostatic or combination shower valves required in Section 424.3.