



VARIOUS FORMULAS FOR WATER HEATING CALCULATIONS

$$\% \text{ Efficiency} = \frac{\text{GPH} \times 8.25 \times \text{Temp. Rise} \times 1.0}{\text{Btu/Hr. Input}} \quad \text{Specific Heat}$$

$$\text{Btu/Output} = \text{GPH} \times 8.25 \text{ Lbs./Gal.} \times \text{Temp. Rise} \times 1.0$$

$$\text{Btu/Input} = \frac{\text{GPH} \times 8.25 \times \text{Temp. Rise} \times 1.0}{\% \text{ Efficiency}}$$

$$\text{Gal/Per/Hr.} = \frac{\text{Btu/Hr. Input} \times \% \text{ Efficiency}}{\text{Temp. Rise} \times 8.25}$$

$$\text{Rise (°F)} = \frac{\text{Btu/Hr. Input} \times \% \text{ Efficiency}}{\text{GPH} \times 8.25}$$

$$\text{KW} = \frac{\text{GPH} \times 8.25 \times \text{Temp. Rise} \times 1.0}{3413} \quad (\text{OR}) \quad \frac{\text{GPH} \times \text{Temp. Rise}}{414}$$

$$\text{Gal/Per/Hr.} = \frac{\text{KW} \times 3413}{\text{Temp. Rise} \times 8.25} \quad (\text{OR}) \quad \frac{\text{KW} \times 414}{\text{Temp. Rise}}$$

$$\text{Rise (°F)} = \frac{\text{KW} \times 3413}{\text{GPH} \times 8.25} \quad (\text{OR}) \quad \frac{\text{KW} \times 414}{\text{GPH}}$$

$$1 \text{ KW} = 3413 \text{ Btu} = 4.1 \text{ Gals. @ } 100^\circ\text{F Rise}$$

$$1 \text{ KW} = 1,000 \text{ Watts} \quad \text{Btu} \times 0.293 = \text{Watts}$$

Determine % of hot water portion of total mixed water requirements

$$\frac{\text{M-C}}{\text{H-C}} = \frac{140-40}{180-40} = \frac{100}{140} = 71.5\% \text{ of mixture is hot water}$$

% of cold water in mixture is:

$$\frac{\text{H-M}}{\text{H-C}} = \frac{180-140}{180-40} = \frac{40}{140} = 28.5\% \text{ of mixture is cold water.}$$

$$\frac{1 \text{ } \emptyset}{\text{Volts}} = \text{Amps} \\ \text{Volts} \times \text{Amps} = \text{Watts}$$

$$\frac{3 \text{ } \emptyset \text{ (Balanced Circuits)}}{\text{Volts}} = \text{Amps} \\ \frac{.577 \times \text{Watts}}{\text{Volts}} = \text{Amps} \\ \text{Volts} \times \text{Amps} \times 1.73 = \text{Watts}$$

PERCENTAGE OF 180°F PREHEATED WATER TO MIXING VALVE FOR SELECTED MIXED WATER TEMPERATURES

Desired Mixed Temperature °F	% of 180°F Water For Each Cold Supply Temperature						
	40°	50°	60°	70°	80°	90°	100°
180	—	—	—	—	—	—	—
170	92.8	92.3	91.7	90.9	90	88.8	87.5
160	86	85	83.3	82	80	78	75
150	78.5	76	75	73	70	67	68.5
140	71	69	67	64	60	55.5	50
130	65	61.5	58	54.5	50	44	37.5
120	57	54	50	45	40	33	25
110	50	46	41.5	36	30	21	12
100	43	38	33	27	20	11	—

Example: 1) Desired mixed outlet water temperature = 140°F 71% of hot water @ 180°F
 2) Hot water supply (stored water temp) = 180°F 29% of cold water @ 40°F
 3) Cold water supply = 40°F 100% mixed water @ 140°F

BIBLIOGRAPHY

BIBLIOGRAPHY FOR VARIOUS CHARTS AND TABLES IN TECHNICAL DATA SECTION

1. The Technical and Engineering Data Book Copyright 1961 by Domestic Engineering Company, Chicago, Illinois.

Page 19Circumferences and Areas of Circles
Page 24 Decimal Equivalents of Fractions
Page 69 Gas Burner Input Table
Page 71 Gas Venting Capacity Table
Page 120 Gas Pipe Size Selection Table

2. Gaseous Fuels, second edition prepared by Louis Shnidman, Editor, copyright 1954 by American Gas Association.

Page 138 Drill Size Designation and Diameters

3. Automatic Controls for Heating and Air Conditioning by Barber-Colman Company, Rockford, Illinois, Engineering Information Section Conversion Data.

Page F4252-1 Temperature Conversion Data

4. B & G Handbook, second edition, copyright 1949 by Bell & Gossett Company, Morton Grove, Illinois.

Page 133 Water Capacity per Foot of Pipe
Page 135 Capacities of Cylindrical Tank

5. ASHRAE Guide and Data Book, copyright 1964 by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Chapter 82 "Water Services."

Page 919 Proper Flow and Pressure Required for Fixtures
Page 920 Demand Weights of Fixtures and Estimate Curves

6. NFPA No. 54 ASA Z223.1 "Gas Appliances and Gas Piping", copyright 1974 by National Fire Protection Association, International, Boston, Mass.

7. Metalbestos Gas Vent and Chimney Sizing Handbook, copyright 1971 by William Wallace Division, Wallace-Murray Corporation, Belmont, California.

Pages 24 thru 27 "Section 10 - Capacities Through 48" Size"