

2021

BUSINESS DIRECTORY





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Windham
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2021

BUSINESS DIRECTORY

A Comprehensive Directory of the State of
Maine Plumbing-Heating-Cooling Contractors
and Related Businesses

www.maine-phcc.com

Presented by

Maine Association

Plumbing-Heating-Cooling Contractors

PO Box 6861

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Published April 2021

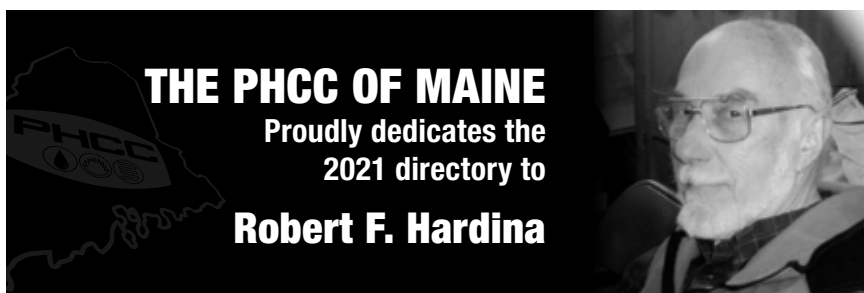
MISSION STATEMENT

“The PHCC-National Association, of which Maine PHCC is a member, is an Association of plumbing, heating, and cooling contractors dedicated to the promotion, advancement, education, and training of the industry for the protection of the health, safety, and comfort of society and the protection of the environment.”

CODE OF ETHICS

- To consider our trade worthy as affording us distinct opportunities to serve society
- To improve ourselves, increase our efficiency and enlarge our service, and by so doing attest our faith in the fundamental principles of life, that we profit most who serve best
- To realize that we are businesspersons and ambitious to succeed; but that we are first ethical persons, and wish no success that is not founded on the highest justice and morality
- To maintain the highest ethical standards of advertising, pricing, selling, installation and service guided by the principles of honesty and integrity
- To promote the latest technological advances in the design, types and methods of installation of plumbing-heating-cooling systems; using equipment and materials complying with the standards recognized by this industry
- To enter enthusiastically into the association work—to give as well as take—and do our part in elevating the industry
- To support all progressive moves that are being carried out along the lines of trade extension, standardization and sanitation
- To conduct our affairs that others in our business will find it wise, profitable and conducive to happiness to emulate our example
- To follow and execute our work in conformity with federal, state, county and city building, safety, energy and water conservation, fire and housing codes; and refusing to be a party to any action that violates these regulations
- To promote conservation of water and energy to the public we serve through improved, adequate, safe, modern installation of energy efficient equipment

PRIDE IN OUR PAST—FAITH IN OUR FUTURE



The Maine Association of proudly dedicates the 2021 Annual Business Directory to Robert Hardina for his dedication and commitment to this industry.

Bob came to Maine in the mid 1970's as an ordained minister teaching at Stone Hill College in Massachusetts. As a young minister he was involved in the Selma Alabama civil rights protest march, of which he was always proud. He purchased a small plumbing/heating/electrical business in Damariscotta, Maine in 1976. In the midst of the Arab oil embargo he named that company Mid-Coast Energy Systems. Early on he committed himself to learning the trades. Always a proponent of education, he acquired a Master's License in plumbing, oil burner, electrical, solid fuel, solar and later on propane. Bob spoke about the importance of the trades, the plumber protecting the health of the nation, employee education and to paying a fair wage with exceptional family benefits. This was his mantra for his entire career.

He spoke locally to educate the public on topics like energy efficiency, heat pump technology and aging in place. He is greatly missed by the crew that worked for him and beside him. Bob was always in attendance at the Maine PHCC expo up until the very end. He will be missed by all of us that knew and respected him for all that he accomplished in this industry and in his life.

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MEMBER BENEFITS

Plumbing-Heating-Cooling Contractors — National Association

Everything You Need to Strengthen Your Business — Now and in the Future

As a member of the PHCC community, you plug into a powerful network of valuable resources and contractors at the local, state and national level — plus our own PHCC Educational Foundation — offering the knowledge, tools, programs and services you need to succeed. PHCC means business, from protecting your interests with lawmakers and preventing over-regulation to providing huge savings when you take advantage of member discounts on products and services.

● BEST PRACTICES

- Crisis Management and Pandemic Action Plan Template
- Marketing & Advertising Resources
- Find a Contractor Online Directory
- Personalized Online Member Dashboard
- Access to Subject Matter Experts
- Safety & Risk Management Tools
- PHCC Water Supply Calculator App

● ADVOCACY

- Legislative & Regulatory Participation
- Representation on All Code Body & Industry Coalitions
- State Legislative & Regulatory Tracking Tool
- Fight Against Over-Regulation
- Reinforcement of Industry Standards that Protect Public Health & Safety
- Regular Alerts on Laws, Regulations & Code Changes
- Annual Legislative Conference in Washington, D.C.
- Grassroots Network to Engage Members When Needed to Take Action

WE MEAN BUSINESS

180 S. Washington Street, Suite 100
Falls Church, VA 22046
Phone: 703-237-8100 | 800-533-7694
Fax: 703-237-7442
Email: membership@naphcc.org
phccweb.org

● WORKFORCE DEVELOPMENT

- Plumbing & HVACR Apprentice & Journeyman Training
- Pre-Apprentice Courses
- Workforce Development Center and Resources
- Scholarships
- Assessment Tests
- Career & Job Fair Materials
- PHCC Career Center & Job Board

● EXPERT & AFFORDABLE TRAINING

- Fast Track to Service Plumbing
- Project Management & Foreman Training
- Plumbing & Mechanical Codes Training
- Business Management Programs
- Webinars & Other Training Opportunities

● SAVINGS & DISCOUNTS

- PHCC Industry Partners
- PHCC Labor Unit Database Subscription
- Online Buyers' Guide
- Discounts on Programs & Services
- Member Discounts on Conferences

● NETWORKING OPPORTUNITIES

- Access to Online Communities
- Join PHCC Enhanced Services Groups
- Online Business Interest Groups
- CONNECT Conference & Tradeshow
- Online & Print Member Directory
- State & Local Chapter Events and Online Resources

PHCC MEMBERSHIP PAYS FOR ITSELF

Free Resources for Members



Plumbing and HVACR Pre-Apprentice Course: Online program gives prospective apprentices an opportunity to learn about the p-h-c trade before beginning a longer-term apprentice program.



TechLine: Expert advice on code questions and clarifications.



Safety Program Builder: Available from Federated Insurance, allows contractors to customize efforts that illustrate your commitment to ensuring safety in your workplace.



Overhead and Profit Calculator: This simple software tool helps business owners calculate their real costs and find the right selling price for their company.



Labor Unit Database: Simplify your estimating process, prepare accurate bids, and increase efficiency and profitability using this tool, available through the PHCC Online Store.



PHCC Water Supply Calculator App: Offers a single resource to determine water supply fixture units and minimum fixture branch sizes for common plumbing fixtures, typical pressure drops in water meters, equivalent lengths of fittings, and more.



Multi-Employer 401(k) Retirement Program: PHCC members can choose among several 401(k) retirement program options offered by Lincoln Financial Group through Certified Financial Services.



Publications: Members receive Solutions Magazine, PHCC Online and the PHCC Advocate newsletter, chock full of valuable news and information to help run your business and stay current on industry legislation and regulations.

Member Savings and Discounts

- **Exxon/Mobil:** 5 cent savings per gallon of gas using Fleet National Card
- **Aramark:** 25% discount on uniforms
- **Market Hardware:** Free consultation and discount on web sites and marketing services
- **Time Communications:** Discounted monthly rate on call management systems
- **ConsensusDocs:** 20% discount on subscriptions to standard construction contracts
- **Labor Unit Database:** 30-day free trial and \$100 discount off subscription renewal
- **Monthly Webinars:** \$360 (\$30/ea. for non-members)
- **CONNECT Conference & Trade Show:** \$100 discount off each member registration
- **Who's Who Directory:** \$75
- **Solutions Magazine Subscription:** \$30
- **Plumbing and HVACR Apprentice eLearning Programs:** Discounts vary by chapter
- **Plumbing and HVACR Textbooks:** Up to 25% discount through your chapter
- **Code Books:** Discounts vary by chapter

Display Pride and Support Your Association

Purchase reflective decals and embroidered uniform patches with the PHCC logo from the PHCC Online Store. Members may put the PHCC logo on trucks, business cards, letterhead and marketing materials. Available "Hire a Professional" graphics can be printed on T-shirts and other items to showcase your commitment to using qualified workers.

Additional benefits and savings available through PHCC's state and local chapters.

800-533-7694 | membership@naphcc.org | phccweb.org



PLUMBING-HEATING-COOLING
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Introductory Membership Special

2021 Membership Application

Simply fill out and return this form to:

Maine PHCC 69 Rock Ridge Run, Cumberland, ME 04021

For more information please call (207) 829-5055 or visit

www.maine-phcc.com (Maine) or **www.phccweb.org** (National)

Name: _____

Company: _____

Address: _____ Zip Code: _____

Telephone: _____ Fax: _____ Email: _____

Mail Check Or charge to: ☐ American Express ☐ Visa ☐ Mastercard **Amount \$362.50**

Card Number: _____ Exp. Date: _____ CSV Code _____

Signature: _____ Date: _____

Please check the areas of most interest to you:

- | | |
|--|--|
| ☐ Industry Networking | ☐ Industry News |
| ☐ Workforce Development | ☐ Legislation |
| ☐ Education | ☐ Benefits |

I understand that by providing my mailing address, email address, telephone number and fax number, I consent to receive communication sent by or on behalf of the Plumbing-Heating-Cooling Contractors via regular mail, email, telephone or fax. I understand that the Plumbing-Heating-Cooling Contractors Association will not share my address, e-mail, telephone or fax numbers with other organizations.

Contractor Dues \$725

Associate Member Dues \$300

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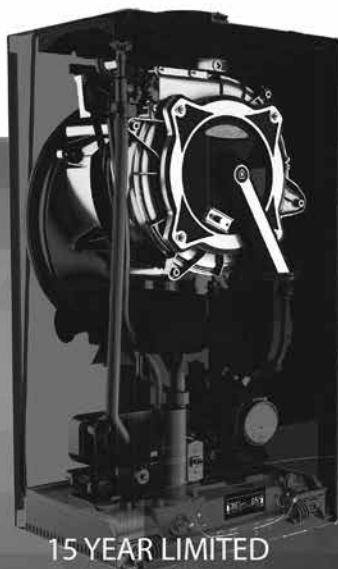
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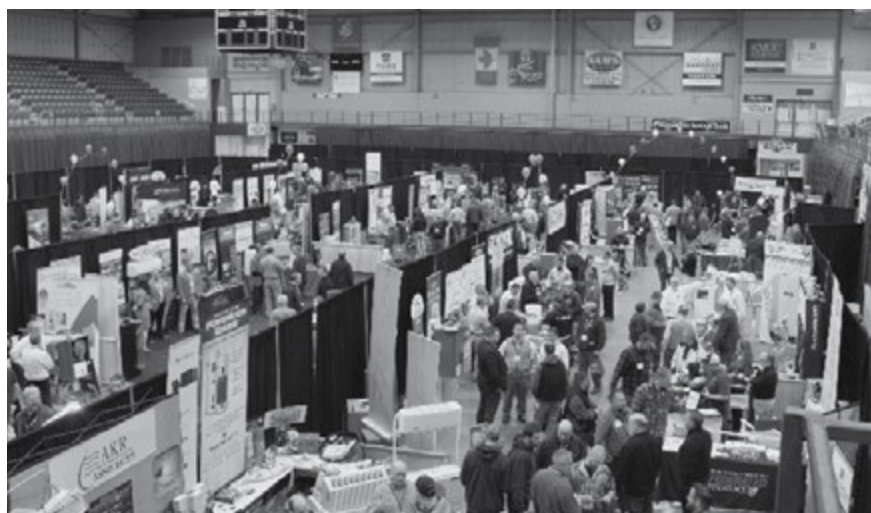
SAVE THE DATE

MARCH 25, 2022

MAINE PHCC EXPO

AUGUSTA CIVIC CENTER
MAINE'S LARGEST INDUSTRY TRADESHOW







GREETINGS FROM Hunter Botto

PHCC National Association President



Dear PHCC of Maine Members,

The challenges resulting from a global pandemic this past year reinforced something that those in our industry have always known... that we are better together. We adapted our businesses and continued to provide our essential services because we leaned on this association and on each other. We shared resources and recommendations, but most importantly, we shared a passion to help each other, strengthen our businesses, and elevate our industry, just as we've always done.

Together, we are a great team of member contractors, manufacturers and industry partners... and connecting the dots among all of us can be made easier through resources like this Annual Business Directory. The experts, the resources, the answers you need are right here. They are the people within these pages who will help you approach a pressing issue, evaluate your current process, discover a new supplier, adopt a new technology, recruit the best talent in your community, and more.

For more than 138 years, PHCC has positively influenced the success and advancement of our contractor members and our industry. And even during the challenging and uncertain times of this past year, one thing that we can be certain of is the importance of keeping your PHCC membership.

Because of your loyal membership, we are able to continue our good work of protecting members like you... and your employees, your families and your communities. With you, PHCC will continue to share best practices among our members, continue the momentum we've created on Capitol Hill to secure business-friendly legislation, train the next generation of workers, and safeguard the professionalism in this industry that you and I both love.

This past year is proof that we are stronger together. You are a part of a powerful and resilient association, a network of more than 3,100 contractors and state and local chapters who are here to help. I encourage you to get more involved in PHCC so that we can have even more power, more influence and more to offer each other.

It is a privilege to serve as your president for 2021. If you have any questions or concerns (or recommendations) about what is going on with the national association, please reach out to me!

Sincerely,

Hunter Botto
PHCC—National Association President
Botto Brothers
Hicksville, New York



**PLUMBING-HEATING-COOLING
CONTRACTORS ASSOCIATION**
Best People. Best Practices.



Dear PHCC of Maine Members and Fellow Tradesmen,

As we go through these unprecedented times in all lives with uncertainty, it is important to try and return to our routines and work towards establishing some normalcy. We have all been labeled as essential workers in our industry and have continued providing services to our customers. As we finally see a shift in this pandemic, signs show we may be headed for some sense of normalcy, which we have likely taken for granted in going through this pandemic. We hope we can now make plans to reunite and reminisce. We need to work with and for our association to reach common goals to better our industry.

We look forward to getting back to some meetings and workshops. We will review trends and impacts all this has had on our businesses and personal lives and adjust, now more than ever, with the changing times. We will need to be even more focused in bringing in new talent and training to develop our workforce. In the challenges coming to our industry, many of us have already been exposed to difficult times in finding and training new apprentices and trainees. We all need to work together in improving means and methods of attracting the right individuals to our industry's growth.

We are all in this together and hope we can energize and work with one another in the coming months. Hope this note finds you all safe, healthy, and we look forward to emerging stronger and more resilient as we try to bounce back from these global impacts.

Please consider joining us as we continue to fight the causes that are in your best interest as a plumbing, heating, cooling contractor.

Kevin Purnell
PHCC of Maine, President



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Front (left to right): Robert Miles, Sr., Richard Waltz, Sr., Elmer (Ted) Walker
Back (left to right): Kim Girard, Sal Raia, Roland (Beef) L'Heureux, David Walker



*John
Gerber*



*Anthony
LaMarre*



*Ralph (Fred)
Blake*



*Jim
Godbout*



*Frank
North*



*Jon
Harmer*



*Mark
Oliver*



*Charlie
Burnham*



*Kevin
Purnell*



Front (left to right): Don Dube and Executive Director Alice Ames
Back (left to right): Ron Dunsmoor, Jim Robinson, Robert Miles, Jr.

PAST PRESIDENTS OF THE MAINE ASSOCIATION SINCE 1930

1930	*George Noyes, Presque Isle	1975	*Ralph E. Clarke, Rumford
1931	*George Noyes, Presque Isle	1976	*Ralph E. Clarke, Rumford
1932	*Neils Knudsen, Falmouth	1977	*W. Franklin Blake, Portland
1933	*Neils Knudsen, Falmouth	1978	*W. Franklin Blake, Portland
1934	*John Kerrigan, Lewiston	1979	George Ray, Ellsworth
1935	*John Kerrigan, Lewiston	1980	George Ray, Ellsworth
1936	*Ernest R. Graham, Bar Harbor	1981	Thomas Kelley, Portland
1937	*Ernest R. Graham, Bar Harbor	1982	Thomas Kelley, Portland
1938	*Wilbur F. Blake, Portland	1983	Roland L'Heureux, Kennebunk
1939	*Wilbur F. Blake, Portland	1984	Roland L'Heureux, Kennebunk
1940	*Charles B. Davis, Waterville	1985	*Kim Girard, Old Orchard
1941	*Charles B. Davis, Waterville	1986	*Kim Girard, Old Orchard
1942	*Jerry A. Cyr, Fort Fairfield	1987	Salvatore Raia, Portland
1943	*Ralph L. Clarke, Rumford	1988	Salvatore Raia, Portland
1944	*Ralph L. Clarke, Rumford	1989	David Walker, Poland Springs
1945	*Ernest N. Cunningham, Portland	1990	David Walker, Poland Springs
1946	*Hilman A. Williams, Westbrook	1991	Robert Miles, Sr., Yarmouth
1947	*William A. Sparks, Brunswick	1992	Ralph F. Blake, Jr., Portland
1948	*Philip Reuben, Portland	1993	Ralph F. Blake, Jr., Portland
1949	*Arthur I. Knight, Westbrook	1994	Donald Dube, Biddeford
1950	*C. Merton Douglas, Brunswick	1995	Donald Dube, Biddeford
1951	*Andrew P. Iverson, Portland	1996	John H. Gerber, Portland
1952	*William P. Clapman, Waterville	1997	John H. Gerber, Portland
1953	*Bernard T. Young, Auburn	1998	James Robinson, Portland
1954	*Emil N. Iverson, Portland	1999	James Robinson, Portland
1955	*Frederick B. Chick, Westbrook	2000	Robert Miles, Jr., Yarmouth
1956	*Stuart W. Littlefield, Kennebunk	2001	Robert Miles, Jr., Yarmouth
1957	*Silas Fowler, Lincoln	2002	Ronald Dunsmoor, Biddeford
1958	*Harry B. Chase, Westbrook	2003	Ronald Dunsmoor, Biddeford
1959	*Richard P. Waltz, Portland	2004	Anthony Lamarre, Waterville
1960	*Arthur W. Ford, Auburn	2005	Anthony Lamarre, Waterville
1961	*Ernest W. Maxcy, Camden	2006	James Godbout, Biddeford
1962	*Ralph F. Blake, Portland	2007	James Godbout, Biddeford
1963	*Franklin E. Hannaford, Farmington	2008	Frank North, Naples
1964	*Richard J. Carvel, Portland	2009	Frank North, Naples
1965	*William J. Steeves, Millinocket	2010	Frank North, Naples
1966	Harry E. Nason, Jr., Auburn	2011	Ron Dunsmoor, Biddeford
1967	*Marlowe J. LeBarge, Kennebunk	2012	Jon Harmer, New Gloucester
1968	*Filmore O. Frye, Lincoln	2013	Jon Harmer, New Gloucester
1969	*Omer O. Oullette, Lewiston	2014	Jon Harmer, New Gloucester
1970	*Omer O. Oullette, Lewiston	2015	Mark Oliver, Kennebunk
1971	Elmer F. Walker, Jr., Poland Springs	2016	Mark Oliver, Kennebunk
1972	Elmer F. Walker, Jr., Poland Springs	2017	Charlie Burnham, Freeport
1973	*Martin Caron, South Portland	2018	Charlie Burnham, Freeport
1974	*Martin Caron, South Portland	2019	Kevin Purnell, Oakland
		2020	Kevin Purnell, Oakland

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Jordan Harmer, Harmer & Son Plg & Htg.....New Gloucester
Tony LaMarre, Houle's Plg & HtgWaterville
Keith Knowles, Knowles MechanicalSouth China
Robert Miles, III, Bob Miles & SonFreeport
Mark Oliver, Garrett Pillsbury Plg & HtgKennebunk

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1960		Ernest Cunningham
1962		E. W. Campbell
1964		Hilman O. Williams
1965		Joseph P. Welch
1966		George F. Scribner
1967		Harry B. Chase
1968		Neils M. Knudsen
1969		William Gower
1970		Richard Waltz, Sr.
1971		Ralph L. Clarke
1972		Arthur Ford
1973	Dick Carvel	Stanley Baker
1974	Arthur Ford	Omer Ouellette
1975		John Thornton
1977	Ralph Blake, Sr.	Andrew P. Iverson
1978	Ted Walker	Roger Ouelette
1979	Marty Caron	Fred Chick
1980	Lester Gross	Samuel Burokoff
1981	Donald McCubrey	Franklin Hannaford
1982	Bill & Bob Miles	William Steeves
1983	Sonny Blake	Ralph Blake, Sr.
1984	George Ray	Willis Johnson
1985	William Steeves	Marty Caron
1986	Thomas Kelley	Warren Charles
1987	Roland L'Heureux	William Miles, Sr.
1988	Lloyd Rainey	Lester F. Gross
1989	Dennis Steinert	John G. Morin
1990	Philip Lamoureux	Roland & Shirley L'Heureux
1991	John Gerber	Richard J. Carvel
1992	Salvatore Raia	Ted Walker
1993	David Walker	Richard and Jeanette Sylvester
1994	William Harmon	Richard R. Blais
1995	James Robinson	Donald McCubrey
1996	Donald Dube	Armand N. Houle
1997	Alice Ames	John H. Gerber
1998	Donald Dube	Ernie & Eleanor Goodwin
1999	Robert Miles, Sr.	Harland Hasey
2000	Shirley L'Heureux	Warren G. Lang
2001		Alan R. Urell
2002	James Robinson	Janey Miles
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2007	Ronald Dunsmoor	Sonny Blake
2008		Ronald Dunsmoor
2009		Phyllis Waltz
2010		Don Rutherford
2011		Kim Girard
2012		William E. Miles, Jr.
2013		Don Farnham
2014		Marlowe LeBarge
2015		James Robinson
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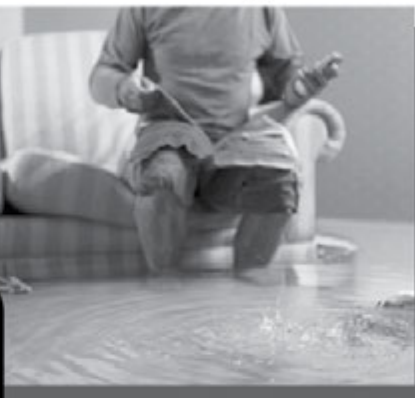


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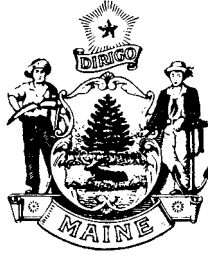
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5 Member Board

(Currently 3 members serving)

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SEAT QUALIFICATION DESCRIPTION

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VACANT

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Nicholas Adams

Master Plumber who has been engaged in plumbing inspections for at least 4 years and is employed by a municipality

Robert B. Hodgkin

Master Plumber

VACANT

Public Member

www.maine.gov/professionallicensing

PLUMBERS' EXAMINING BOARD BOARD STAFF

BOARD INSPECTORS GENERAL EMAIL ADDRESS: plumbers.code@maine.gov

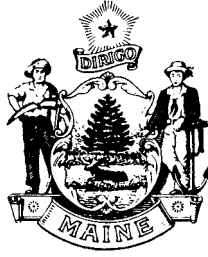
BOARD LICENSING STAFF EMAIL ADDRESS: plumbers.board@maine.gov

BOARD INSPECTORS GENERAL VOICEMAIL NUMBER: 207-624-8639

Vacant, Senior Plumbing Inspector

Mary A. Lord, Licensing Supervisor & Board Clerk (mary.a.lord@maine.gov) (207) 624-8627

Catherine M. Carroll, Administrator (catherine.m.carroll@maine.gov) (207) 624-8605



DEPARTMENT OF PROFESSIONAL AND FINANCIAL REGULATION
OFFICE OF LICENSING AND REGISTRATION

MAINE FUEL BOARD

9 Member Board

(Currently 5 members serving)

BOARD MEMBER NAME	SEAT QUALIFICATION DESCRIPTION
Mark Bossie , Board Chairperson	Propane and Natural Gas Technician and works in the natural gas industry
David Foster	Master Oil Burner Technician with the solid fuel authority
VACANT	Master Oil Burner Technician
Maynard W. Waltz, Jr.	Propane and Natural Gas Technician
VACANT	Propane and Natural Gas Technician
Paul F. McClay	Public Member
Richard McCarthy	Appointed by the Commissioner of Public Safety as the Commissioner's representative
VACANT	Master Oil Burner Technician and Propane and Natural Gas Technician
VACANT	Master Oil Burner Technician with the master solid fuel authority

MAINE FUEL BOARD BOARD STAFF

BOARD INSPECTORS GENERAL EMAIL ADDRESS: fuel.code@maine.gov

BOARD LICENSING STAFF GENERAL EMAIL ADDRESS: fuel.board@maine.gov

BOARD INSPECTORS GENRAL VOICEMAIL NUMBER: 207-624-8608

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Dale D. Hersey, Fuel Inspector (dale.d.hersey@maine.gov)	(207) 592-5864
Cecil B. Hafford, Fuel Inspector (cecil.b.hafford@maine.gov)	(207) 592-5043
Bruce Bristow, Inspector (bruce.bristow@maine.gov)	(207) 592-4516
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State Site Evaluator

Brent Lawson, State Plumbing Inspector
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Email: brent.lawson@maine.gov

Engineered Systems

James Jacobsen, Water Operator Licensing
Coordinator
Drinking Water Program, Engineering
Review Team
Tel: (207) 287-5695
Email: james.jacobsen@maine.gov

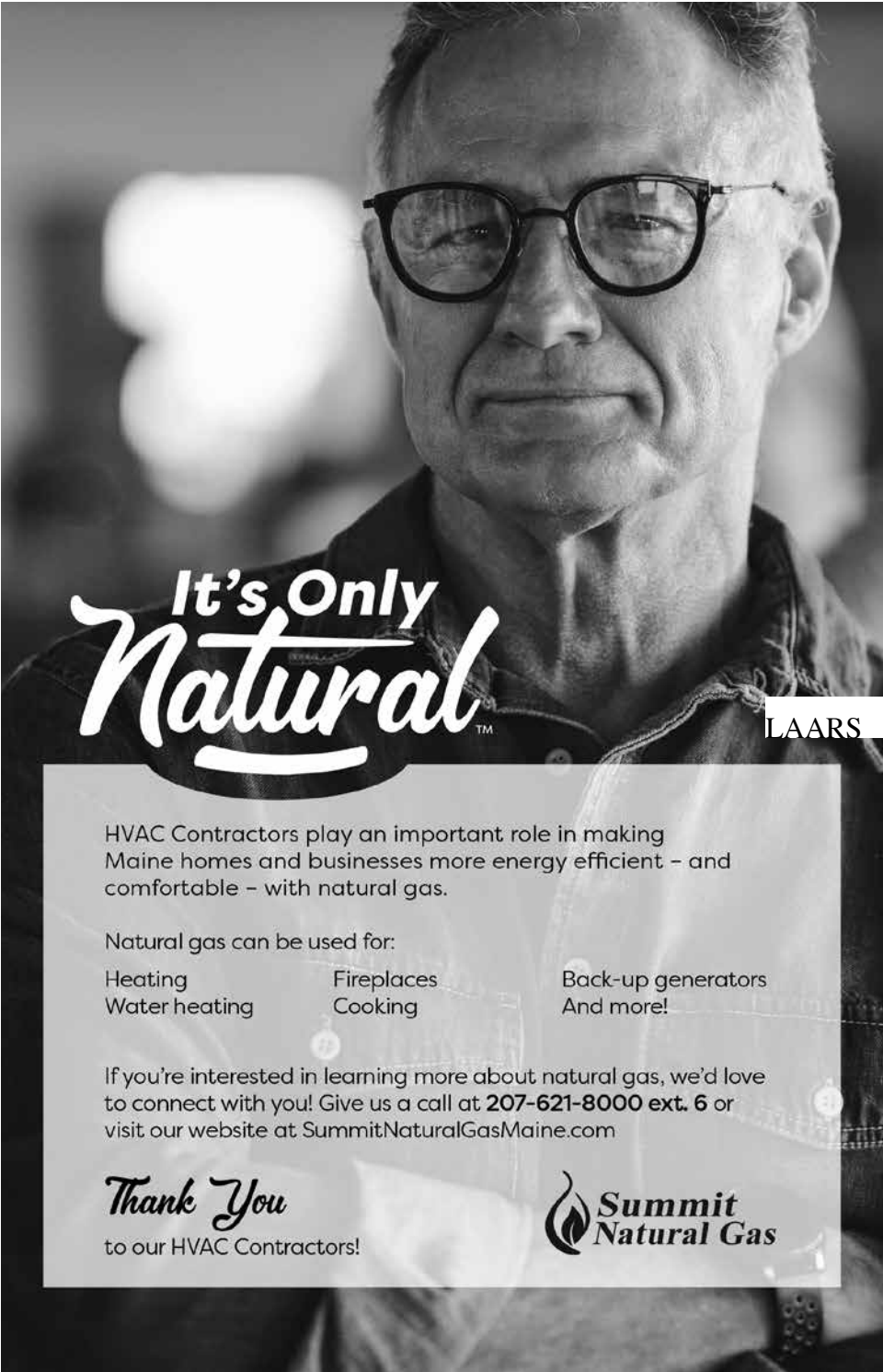
Private Well Coordinator

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Tel: (207) 592-3190
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This standard, one of a group which will ultimately replace the present American Standard Graphical Symbols for Use on Drawings and Mechanical Engineering, Z32.2.2-1949, replaces pages 4 through 9 of Z32.2-1949.

In preparing this list of Plumbing Symbols for Use on Drawings, Architects and Engineers were contacted in Boston, Chicago, New York, Philadelphia and Pittsburgh, as well as the resources of the two largest manufacturers of plumbing goods.

Based on the information made available to the committee, the symbols shown are a minimum requirement.

Following approval of the sectional committee and sponsor organizations, the proposal was presented to the American Standards Association for approval and designation as an American Standard. This was granted on October 11, 1955.

Autopsy Table  A T	Dental Unit 	Hot Water Tank  HWT	Sink  S-1 S-2, etc USE SPECIFICATION TO DESCRIBE
Bath  B-1, B-2, etc. USE SPECIFICATION TO DESCRIBE	Dish Washer  DW	Laundry Tray  L T	Wash Fountain Circular  WF
Bed Pan Washer  BPW	Drain  F D	Lavatories   L-1 L-2, etc USE SPECIFICATION TO DESCRIBE	Half Circular  WF
Bed Pan Sterilizer  BPS	Drinking Fountain  DF-1, DF-2, etc. USE SPECIFICATION TO DESCRIBE	Meter  M	Urinal  U-1, U-2, etc. USE SPECIFICATION TO DESCRIBE
Bidet  B	Gas Outlet  G	Roof Drain  R D	Vacuum Outlet 
Can Washer  CW	Range  R	Shower Head 	Water Closet  WC-1, WC-2, etc. USE SPECIFICATION TO DESCRIBE
Cleanout  CO	Grease Trap  GT	Stall 	Water Heater  WH
	Hose Bibb  H B		
	Hose Rack  H R		

FITTING & VALVE SYMBOLS

	Flanged	Screwed	Ball & Spout	Welded	Soldered		Flanged	Screwed	Ball & Spout	Welded	Soldered
Bushing						Crossover					
Cap						45° Elbow					
Reducing Cross						90° Elbow					
Straight Size Cross						Turned Down					
						Turned Up					

AIR CONDITIONING SYMBOLS

Immersion Cooling Unit



Low Side Float



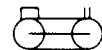
Motor-Compressor, Enclosed Crankcase, Reciprocating, Direct Connected



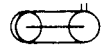
Motor-Compressor, Enclosed Crankcase, Rotary, Direct Connected



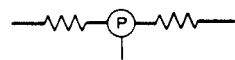
Motor-Compressor, Sealed Crankcase, Reciprocating



Motor-Compressor, Sealed Crankcase, Rotary



Pressurestat



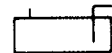
Pressure Switch



Pressure Switch with High Pressure Cut-Out



Receiver, Horizontal



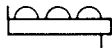
Receiver, Vertical



Scale Trap



Spray Pond



Thermal Bulb



Thermostat (Remote Bulb)



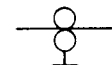
Valve, Automatic Expansion



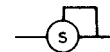
Valve, Compressor Suction Pressure Limiting, Throttling Type (Compressor Side)



Valve, Constant Pressure, Suction



Valve, Evaporator Pressure Regulating, Snap Action



Valve, Evaporator Pressure Regulating, Thermostatic Throttling Type



Valve, Evaporator Pressure Regulating, Throttling Type (Evaporator Side)



Valve, Hand Expansion



Valve, Magnetic Stop



Valve, Snap Action



Valve, Suction Vapor Regulating



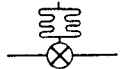
Valve, Thermo Suction



Valve, Thermostatic Expansion



Valve, Water



Vibration Absorber, Line



AIR CONDITIONING SYMBOLS

Capillary Tube



Compressor



Compressor, Enclosed, Crankcase, Rotary, Belted



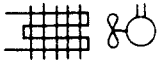
Compressor, Open Crankcase, Reciprocating, Belted



Compressor, Open Crankcase, Reciprocating, Direct Drive



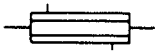
Condenser, Air Cooled, Finned, Forced Air



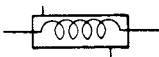
Condenser, Air Cooled, Finned, Static



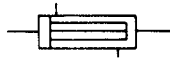
Condenser, Water Cooled, Concentric Tube in a Tube



Condenser, Water Cooled, Shell and Coil



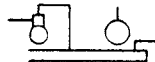
Condenser, Water Cooled, Shell and Tube



Condensing Unit, Air Cooled



Condensing Unit, Water Cooled



Cooling tower



Dryer



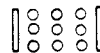
Evaporative Condenser



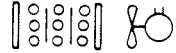
Evaporator, Circular, Ceiling Type, Finned



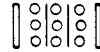
Evaporator, Manifolder, Bare Tube, Gravity Air



Evaporator, Manifolder, Finned, Forced Air



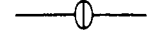
Evaporator, Manifolder, Finned, Gravity Air



Evaporator, Plate Coils, Headered or Manifold



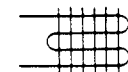
Filter, Line



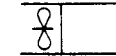
Filter & Strainer, Line



Finned Type Cooling Unit, Natural Convection



Forced Convection Cooling Unit



Gauge



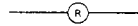
High Side Float



HEATING SYMBOLS



Lock and Shield Valve



Relief Valve (either pressure or vacuum)



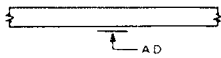
Reducing Pressure Valve



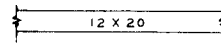
Vent Point

VENTILATING SYMBOLS

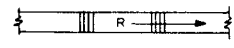
Access Door



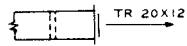
Duct (1st Figure, Side Shown;
2nd Side Not Shown)



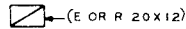
Inclined Rise in Respect
to Air Flow



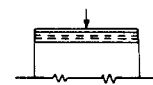
Adjustable Blank Off



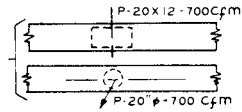
Duct Section
(Exhaust or Return)



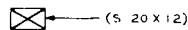
Intake Louvers on Screen



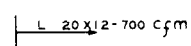
Adjustable Plaque



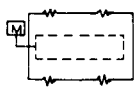
Duct Section (Supply)



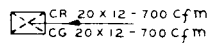
Louver Opening



Automatic Dampers



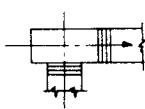
Exhaust Inlet Ceiling
(Indicate Type)



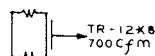
Supply Outlet Ceiling
(Indicate Type)



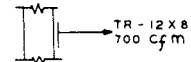
Canvas Connections



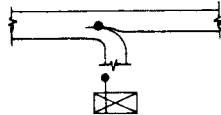
Exhaust Inlet Wall
(Indicate Type)



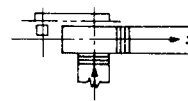
Supply Outlet Wall
(Indicate Type)



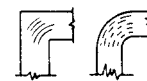
Deflecting Damper



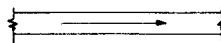
Fan and Motor with
Belt Guard



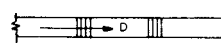
Vanes



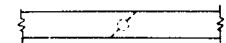
Direction of Flow



Inclined Drop in Respect
to Air Flow



Volume Damper

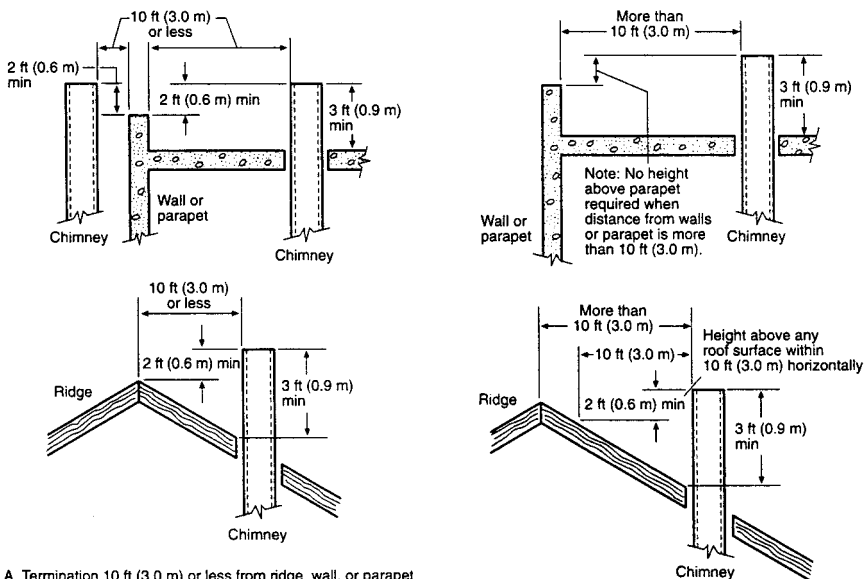


PIPING SYMBOLS

	AIR CONDITIONING		Low-Pressure Return
	Brine Return		Low-Pressure Steam
	Brine Supply		Make-Up Water
	Circulating Chilled or Hot-Water Flow		Medium Pressure Return
	Circulating Chilled or Hot-Water Return		Medium Pressure Steam
	Condenser Water Flow		PLUMBING
	Condenser Water Return		Acid Waste
	Drain		Cold Water
	Humidification Line		Compressed Air
	Make-Up Water		Drinking-Water Flow
	Refrigerant Discharge		Drinking-Water Return
	Refrigerant Liquid		Fire Line
	Refrigerant Suction		Gas
	HEATING		Hot Water
	Air-Relief Line		Hot-Water Return
	Boiler Blow Off		Soil, Waste or Leader (Above Grade)
	Compressed Air		Soil, Waste or Leader (Below Grade)
	Condensate or Vacuum Pump Discharge		Vacuum Cleaning
	Feedwater Pump Discharge		Vent
	Fuel-Oil Flow		PNEUMATIC TUBES
	Fuel-Oil Return		Tube Runs
	Fuel-Oil Tank Vent		SPRINKLERS
	High-Pressure Return		Branch and Head
	High-Pressure Steam		Drain
	Hot-Water Heating Return		Main Supplies

HEATING SYMBOLS

	Air Eliminator		Thermostat
	Anchor		Boiler Return Trap
	Hanger or Support		Blast Thermostatic Trap
	Heat Exchanger		Float Trap
	Heat Transfer Surface, Plan (Indicate type such as: convactor)		Float & Thermostatic Trap
	Pump (Indicate type such as: vacuum)		Thermostatic Trap
	Strainer		Unit Heater (Centrifugal Fan), Plan
	Tank (designate type)		Unit Heater (Propeller), Plan
	Thermometer		Unit Ventilator, Plan



A. Termination 10 ft (3.0 m) or less from ridge, wall, or parapet

B. Termination more than 10 ft (3.0 m) from ridge, wall, or parapet

Figure 12. Typical Termination Locations for Chimneys and Single-Wall Metal Pipes Serving Residential-Type and Low-Heat Equipment.

7.5.4 Inspection of Chimneys.

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

Exception: Where permitted by the authority having jurisdiction, existing chimneys shall be permitted to have their use continued when an appliance is replaced by an appliance of similar type, input rating, and efficiency.

(b) Cleanouts shall be examined to determine they will remain tightly closed when not in use.

(c) When inspection reveals that an existing chimney is not safe for the intended application, it shall be repaired, rebuilt, lined, relined, or replaced with a vent or chimney to conform to *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, NFPA 211, or local building codes, and shall be suitable for the equipment to be attached.

Table XIII Gas Input to Burner in Cubic Feet per Hour

Seconds for One Revolution	One-Half Cu Ft	Size of Test Meter Dial		Five Cu Ft
		One Cu Ft	Two Cu Ft	
		Cubic Ft per Hour		
10	180	360	720	1,800
11	164	327	655	1,636
12	150	300	600	1,500
13	138	277	555	1,385
14	129	257	514	1,286
15	120	240	480	1,200
16	112	225	450	1,125
17	106	212	424	1,059
18	100	200	400	1,000
19	95	189	379	947
20	90	180	360	900
21	86	171	343	857
22	82	164	327	818
23	78	157	313	783
24	75	150	300	750
25	72	144	288	720
26	69	138	277	692
27	67	133	267	667
28	64	129	257	643
29	62	124	248	621
30	60	120	240	600
31	58	116	232	581
32	56	113	225	563
33	55	109	218	545
34	53	106	212	529
35	51	103	206	514
36	50	100	200	500
37	49	97	195	486
38	47	95	189	474
39	46	92	185	462
40	45	90	180	450
41	44	88	176	440
42	43	86	172	430
43	42	84	167	420
44	41	82	164	410
45	40	80	160	400
46	39	78	157	391
47	38	77	153	383
48	37	75	150	375
49	37	73	147	367

NOTE: To convert to Btu per hour, multiply by the Btu heating value of the gas used.

What Is The **INTERNATIONAL CODE COUNCIL (ICC)**?

The International Code Council is the leading global source of model codes and standards and building safety solutions. Code Council codes, standards and solutions are used to ensure safe, affordable and sustainable communities and buildings worldwide.

- Dedicated to all aspects of building safety including fire prevention, plumbing and sanitation, property maintenance, energy efficiency and resilience.
- Mission: provide the codes, tools, and resources that members rely on, building safety professionals turn to, and manufacturers and the public trust.
- Administers the development and maintenance of 15 model codes and 8 standards used to construct residential and commercial buildings in the U.S. including schools and hospitals.
- Not for profit organization.
- 64,000 members.
- 394 state and local chapters throughout the United States.
- Founding members include the National Association of Home Builders (NAHB), the American Institute of Architects (AIA), the American Gas Association (AGA), the Building Owners and Managers Association (BOMA) and the National Multifamily Housing Council (NMHC).

The Importance of Strong, Updated Building Codes

- According to the U.S. Environmental Protection Agency, the average person spends nearly 90% of their life inside buildings.
- Model codes set minimum requirements for building design, construction and operation to protect public health, safety and the natural resources that sustain us.
- The process of updating model codes every three years is optimal to ensure new technologies, materials and methods can be incorporated into the next generation of buildings to help us build better, smarter buildings as cost effectively as possible.
- Research has shown that strong building codes are our first and best line of defense against natural disasters.
- A National Institute of Building Sciences (NIBS) study concluded, on average, every \$1 spent on mitigation at the federal level saves \$11 in disaster relief.

Where are the International Codes (I-Codes) Adopted?

Turn the page to find out more ►

Where are the International Codes (I-Codes) Adopted?

- The International Building Code (IBC) is adopted in all 50 states and the District of Columbia.
- The International Fire Code (IFC) is in use in 41 states and the District of Columbia.
- The International Residential Code (IRC) is in use in 49 states and the District of Columbia.
- The International Plumbing Code (IPC) is in use in 37 states and the District of Columbia.
- The International Mechanical Code (IMC) is in use in 46 states and the District of Columbia.
- The International Codes are in use in Puerto Rico, Guam, U.S. Virgin Islands, American Samoa and the Northern Mariana Islands.

The Importance of the Code Council

- Updated codes promote safe, resilient, efficient, and cost effective construction.
- Current codes protect the building owner's investment, enhance safety and foster innovation in the marketplace.
- For consumers, updated codes mean lower maintenance costs such as lower energy and water bills, less mechanical noise, and an overall higher quality of life.
- Current building codes spur innovation and are an incentive for American manufacturers to invest in product development.
- Current building codes also create a demand for new jobs including code enforcers, technical experts, tradesmen, construction workers, quality control assessors, and building and systems commissioning agents.

Code Council Solutions

- Codes & Standards
- Membership
- Product Evaluation & Testing
- Accreditation
- Professional Development & Training
- Software & Technology
- Consulting

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Table XIII continued

Seconds for One Revolution	One-Half Cu Ft	Size of Test Meter Dial		Five Cu Ft
		One Cu Ft	Two Cu Ft	
		Cubic Ft per Hour		
50	36	72	144	360
51	35	71	141	353
52	35	69	138	346
53	34	68	136	340
54	33	67	133	333
55	33	65	131	327
56	32	64	129	321
57	32	63	126	316
58	31	62	124	310
59	30	61	122	305
60	30	60	120	300
62	29	58	116	290
64	29	56	112	281
66	29	54	109	273
68	28	53	106	265
70	26	51	103	257
72	25	50	100	250
74	24	48	97	243
76	24	47	95	237
78	23	46	92	231
80	22	45	90	225
82	22	44	88	220
84	21	43	86	214
86	21	42	84	209
88	20	41	82	205
90	20	40	80	200
94	19	38	76	192
98	18	37	74	184
100	18	36	72	180
104	17	35	69	173
108	17	33	67	167
112	16	32	64	161
116	15	31	62	155
120	15	30	60	150
130	14	28	55	138
140	13	26	51	129
150	12	24	48	120
160	11	22	45	112
170	11	21	42	106
180	10	20	40	100

NOTE: To convert to Btu per hour, multiply by the Btu heating value of the gas used.

Appliance Category†	Vent Pressure	Temperature Above/Below Defined in Relevant ANSI Standard	Comment
I	Non-Positive*	Above	Natural draft venting
II	Non-Positive*	Below	Materials must be corrosion resistant. Condensate must be drained.
III	Positive**	Above	Vent must be gastight.
IV	Positive**	Below	Vent must be liquid and gastight. Condensate must be drained.

*Non-positive vent pressure means that even if fans or blowers are used in the appliance or vent systems, venting is accomplished by natural draft. (The vent pressure is lower than the atmospheric pressure.)

**Positive vent pressure means that fans, blowers, or other means are used to propel vent gases through the vent at above atmospheric pressure.

†The newer models of appliances will be identified as Category I, II, III, or IV on the nameplate on the appliance and will be stated as such in the manufacturers' installation instructions.

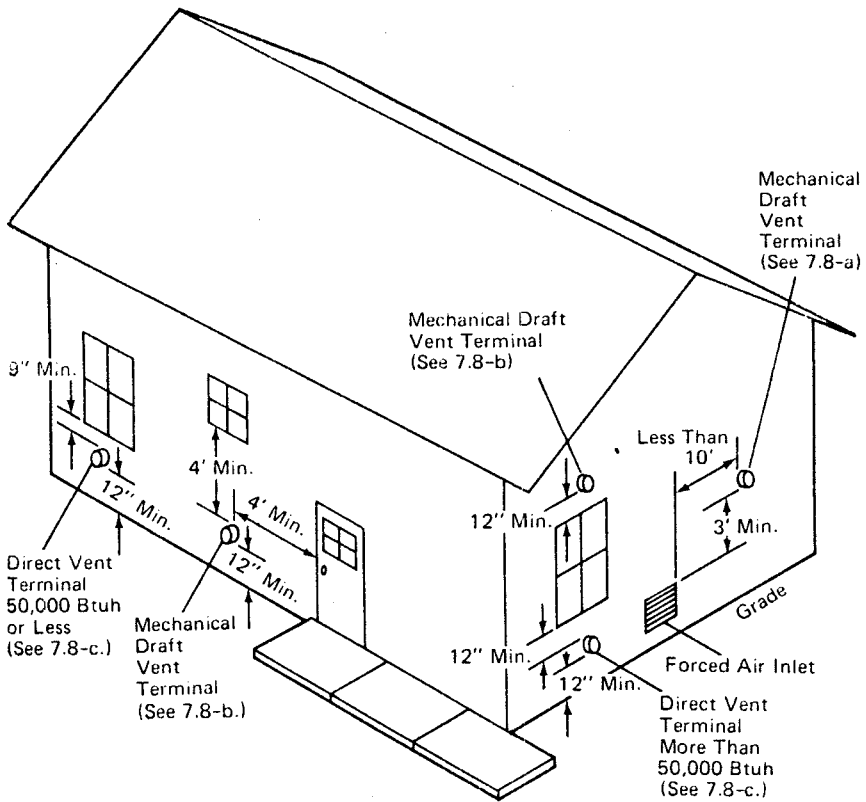
7.4.2 Plastic Piping. Approved plastic piping shall be permitted to be used for venting equipment listed for use with such venting materials.

Prior to the introduction of high efficiency gas utilization equipment, plastic was prohibited as a vent material. High efficiency appliances reduced vent temperatures resulting in condensate formation, and as accumulation of condensate became a problem, plastic became the preferred material. Note that plastic vent materials can be used for listed gas utilization equipment only when specified in the manufacturers' instructions.

7.4.3 Special Gas Vent. Special gas vent shall be listed and installed in accordance with the terms of the special gas vent listing and the manufacturers' instructions.

Special gas vents are listed in accordance with UL 1738, *Standard for Safe Venting Systems for Gas-Burning Appliances*. Special gas vents will include in their installation instructions limitations on operating temperature, categories of appliance to be used with, clearance to combustible materials, and requirements for a vent cap, if any. All special gas vents are listed.

Condensation Drain



For SI units: 1 foot = 0.305 m; 1 inch = 2.54 cm; 1 Btu per hour = 0.293 watts

Figure A.7.8. Exit Terminals of Mechanical Draft and Direct Vent Venting Systems.

from the NATIONAL FUEL GAS CODE HANDBOOK

**Maximum Capacity of Pipe in Cubic Feet of Natural Gas per Hour for Gas Pressures of 0.5 psig
or Less and a Pressure Drop of 0.5 Inch Water Column
(Based on a 0.60 Specific Gravity Gas)**

Nominal Iron Pipe Size, Inches	Internal Diameter, Inches	Length of Pipe, Feet															
		10	20	30	40	50	60	70	80	90	100	125	150	175	200	200	200
1/4	.364	43	29	24	20	18	16	15	14	13	12	11	10	9	8	8	8
3/8	.493	95	65	52	45	40	36	33	31	29	27	24	22	20	19	19	19
1/2	.622	175	120	97	82	73	66	61	57	53	50	44	40	37	35	35	35
3/4	.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72	72	72
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135	135	135
1 1/4	1.380	1,400	950	770	660	580	530	490	460	430	400	360	325	300	280	280	280
1 1/2	1.610	2,100	1,460	1,180	990	900	810	750	690	650	620	550	500	460	430	430	430
2	2.067	3,950	2,750	2,200	1,900	1,680	1,520	1,400	1,300	1,220	1,150	1,020	950	850	800	800	800
2 1/2	2.469	6,300	4,350	3,520	3,000	2,650	2,400	2,250	2,050	1,950	1,850	1,650	1,500	1,370	1,280	1,280	1,280
3	3.068	11,000	7,700	6,250	5,300	4,750	4,300	3,900	3,700	3,450	3,250	2,950	2,650	2,450	2,280	2,280	2,280
4	4.026	23,000	15,600	12,800	10,900	9,700	8,800	8,100	7,500	7,200	6,700	6,000	5,500	5,000	4,600	4,600	4,600

from the NATIONAL FUEL GAS CODE HANDBOOK

Table 10-26 Pipe Sizing
Sizing between Single or Second Stage (Low Pressure Regulator) and Appliance

Maximum undiluted propane capacities listed are based on 11 inch water column setting and a 0.5 inch water column pressure drop.

Capacities in 1000 Btu/hr

Pipe Length (Feet)	Nominal Pipe Size, Schedule 40								
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	3 1/2"	4"
	0.622	0.824	1.049	1.38	1.61	2.067	3.068	3.548	4.026
10	291	608	1146	2353	3525	6789	19130	28008	39018
20	200	418	788	1617	2423	4666	13148	19250	26817
30	161	336	632	1299	1946	3747	10558	15458	21535
40	137	287	541	1111	1665	3207	9036	13230	18431
50	122	255	480	985	1476	2842	8009	11726	16335
60	110	231	435	892	1337	2575	7256	10625	14801
80	94	198	372	764	1144	2204	6211	9095	12668
100	84	175	330	677	1014	1954	5504	8059	11227
125	74	155	292	600	899	1731	4878	7143	9950
150	67	141	265	544	815	1569	4420	6472	9016
200	58	120	227	465	697	1343	3783	5539	7716
250	51	107	201	412	618	1190	3353	4909	6839
300	46	97	182	374	560	1078	3038	4448	6196
350	43	89	167	344	515	992	2795	4092	5701
400	40	83	156	320	479	923	2600	3807	5303

Table 10-27 Copper Tube Sizing
Sizing between First Stage (High Pressure Regulator) and Second Stage (Low Pressure Regulator)

Maximum undiluted propane capacities listed are based on a 10 psi first stage setting and 1 psi drop.

Capacities in 1000 Btu/hr

Tubing Length (Feet)	Outside Diameter Copper Tubing, Type L				
	3/8"	1/2"	5/8"	3/4"	7/8"
	0.315	0.430	0.545	0.666	0.785
30	309	700	1303	2205	3394
40	265	599	1115	1887	2904
50	235	531	988	1672	2574
60	213	481	896	1515	2332
70	196	443	824	1394	2146
80	182	412	767	1297	1996
90	171	386	719	1217	1873
100	161	365	679	1149	1769
150	130	293	546	923	1421
200	111	251	467	790	1216
250	90	222	414	700	1078
300	89	201	375	634	976
350	82	185	345	584	898
400	76	172	321	543	836
450	71	162	301	509	784
500	68	153	284	481	741
600	61	138	258	436	671
700	56	127	237	401	617
800	52	118	221	373	574
900	49	111	207	350	539
1000	46	105	195	331	509
1500	37	84	157	266	409
2000	32	72	134	227	350

Table 10-28 Copper Tube Sizing
Sizing between Single or Second Stage (Low Pressure Regulator) and Appliance

Maximum undiluted propane capacities are based on 11 inch water column setting and a 0.5 inch water column pressure drop.

Capacities in 1000 Btu/hr

Tubing Length (Feet)	Outside Diameter Copper Tubing, Type L				
	3/8"	1/2"	5/8"	3/4"	7/8"
	0.315	0.430	0.545	0.666	0.785
10	49	110	206	348	536
20	34	76	141	239	368
30	27	61	114	192	296
40	23	52	97	164	253
50	20	46	86	146	224
60	19	42	78	132	203
80	16	36	67	113	174
100	14	32	59	100	154
125	12	28	52	89	137
150	11	26	48	80	124
200	10	22	41	69	106
250	9	19	36	61	94
300	8	18	33	55	85
350	7	16	30	51	78
400	7	15	28	47	73

Based on Propane Fuel NFPA #54, 1996 Edition

Information About LP-Gas *

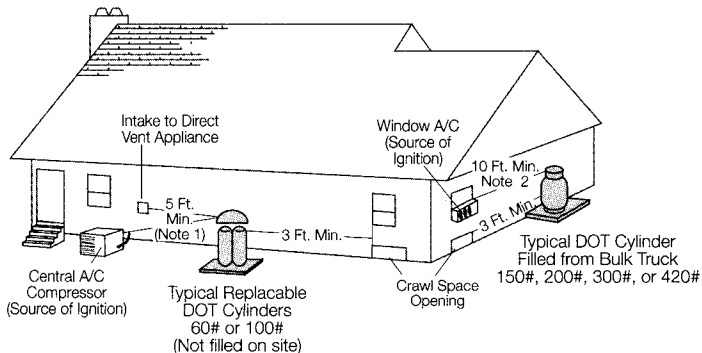
	Propane	Butane
Formula	C_3H_8	C_4H_{10}
Boiling Point, °F	-44	32
Specific Gravity of Gas (Air= 1.00)	1.53	2.00
Specific Gravity of Liquid (Water= 1.00)	0.51	0.58
Lbs. per Gallon of Liquid at 60 °F	4.24	4.81
BTU per Gallon of Gas at 60 °F	91690	102032
BTU per Lb. of Gas	21591	21221
BTU per Cu. Ft. of Gas at 60 °F	2516	3280
Cu. Ft. of Vapor at 60 °F/Gal. of Liquid at 60 °F	36.39	31.26
Cu. Ft. of Vapor at 60 °F/Lb. of Liquid at 60 °F	8.547	6.506
Latent Heat of Vaporization at Boiling Point BTU/Gal.	785.0	808.0
Combustion Data:		
Cu. Ft. Air Required to Burn 1 Cu. Ft. Gas	23.86	31.02
Flash Point, °F	-156	N.A.
Ignition Temperature in Air, °F	920-1020	900-1000
Maximum Flame Temperature in Air, °F	3595	3615
Limits of Flammability, Percentage of Gas in Air Mixture;		
At Lower Limit—%	2.4	1.9
At Upper Limit—%	9.6	8.6
Octane Number (ISO-Octane=100)	Over 100	92

* Commercial quality. Figures shown in this chart represent average values.

Location of DOT Cylinders

From NFPA 58, Appendix G

Federal, state, and local ordinances and regulations should be observed at all times.



Notes: 1) 5 foot minimum between relief valve discharge and external source of ignition (air conditioner), direct vent, or mechanical ventilation system (attic fan).

2) If the DOT cylinder is filled on-site from a bulk truck, the filling connection and vent valve must be at least 10 feet from any external source of ignition, direct vent, or mechanical ventilation system.

TANKS

HOT WATER STORAGE TANKS AND GENERATORS

Size Inches	Capacity Gallons	Weight Pounds	Size Inches	Capacity Gallons	Weight Pounds
20 × 46"	53	165	48 × 104"	840	1750
20 × 58"	80	205	48 × 140"	1125	2240
24 × 47"	92	230	48 × 164"	1315	2560
24 × 59"	115	280	48 × 188"	1505	2900
24 × 71"	140	325	48 × 212"	1690	3200
24 × 83"	160	380	48 × 260"	2065	3870
30 × 60"	190	495	54 × 120"	1220	2740
30 × 72"	220	590	54 × 144"	1460	3200
30 × 84"	270	670	54 × 168"	1700	3650
30 × 96"	305	770	54 × 216"	2080	4570
30 × 120"	340	945	60 × 124"	1580	3400
30 × 132"	415	1030	60 × 148"	1870	3970
36 × 72"	350	800	60 × 196"	2450	5100
36 × 88"	400	880	60 × 220"	2740	5680
36 × 96"	450	990	60 × 280"	3465	7100
36 × 112"	500	1090	72 × 223"	3940	7120
36 × 136"	600	1300	72 × 319"	5630	9500
42 × 90"	580	1310	72 × 415"	7325	11700
42 × 102"	650	1460	84 × 168"	4040	9100
42 × 114"	720	1600	84 × 192"	4630	10000
42 × 138"	865	1900	96 × 174"	5400	11900
42 × 162"	1005	2180	96 × 198"	6660	12800
42 × 186"	1050	2460	96 × 246"	7680	15000

FUEL OIL TANKS (UL-LABEL)

Size Inches	Capacity Gallons	Weight Pounds	Size Inches	Capacity Gallons	Weight Pounds
30 × 90"	275	240	90 × 18'-0"	5948	5400
42 × 94"	560	350	90 × 20'-0"	6600	6800
48 × 65"	510	320	90 × 24'-0"	7900	7200
48 × 128"	1004	930	90 × 28'-0"	9254	8300
64 × 72"	1016	950	90 × 32'-0"	10576	9000
64 × 143"	1990	2000	120 × 16'-0"	9450	7400
64 × 17'-10"	2980	2900	120 × 20'-0"	11750	8700
64 × 23'-8"	3950	4100	120 × 24'-0"	14100	10000
90 × 12'-0"	3966	4200	120 × 28'-0"	16500	11000
90 × 16'-0"	5288	5100	120 × 32'-0"	18750	13000

CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
Angstrom units	3.939×10^{-10}	Inches	Calories (large)	3.968	British thermal units
Angstrom units	.0001	Millimeters	Calories (large)	1.1619	Watt-hours
Atmospheres	760.0	Millimeters of mercury (at 32 F)	Calories (large) per hour	3.968	Btu per hour
Atmospheres	29.921	Inches of mercury (at 32 F)	Calories (small) per cm. per sq. cm. per hr. per C	.00156	Horsepower
Atmospheres	33.97	Feet of water (at 62 F)	Centimeters	.8064	Btu per inch per sq. ft. per hr. per F
Atmospheres	10,333.0	Kilograms per square meter	Centimeters of mercury	0.3937	Inches
Atmospheres	14,697	Pounds per square inch	Centimeters of mercury	0.01316	Atmospheres
Barrels (U.S. liquid)	4.211	Cubic feet	Centimeters of mercury	0.4461	Feet of water
Barrels (U.S. liquid)	31.5	Gallons	Centimeters of mercury	136.0	Kilograms per square meter
Barrels (oil)	42	Gallons	Centimeters of mercury	27.85	Pounds per square foot
Boiler horsepower	33,475	Btu per hour	Centimeters of mercury	0.1934	Pounds per square inch
Boiler horsepower	34.5	Pounds water evaporated from and at 212 F	Cubic centimeters	0.06102	Cubic inches
British tons of refrigeration (commercial)	1.1045	Tons of refrigeration (U.S.)	Cubic centimeters	0.0002642	Gallons
British tons of refrigeration (theoretical)	1.1905	Tons of refrigeration (U.S.)	Cubic feet	.028317	Cubic meters
Btu	.252	Calories (large)	Cubic feet	1,728.0	Cubic inches
Btu	778	Calories (small)	Cubic feet	7.48052	Gallons
Btu	.000393	Foot pounds	Cubic feet of water	28.32	Liters
Btu	.000293	Horsepower hour	Cubic feet of water	62.37	Pounds (at 60 F)
Btu	.0010307	Kilowatt hour	Cubic feet per minute	0.1247	Cubic centimeters per sec.
Btu per 24 hours	347×10^{-5}	Pounds water evaporated from and at 212 F	Cubic feet per minute	0.4720	Gallons per second
Btu per hour	2986×10^{-4}	Tons of refrigeration	Cubic inches	16.39	Liters per second
Btu per hour	.252	Boiler horsepower	Cubic meters	35.3145	Cubic centimeters
Btu per hour	.000393	Calories (large) per hour	Cubic meters	61,023.0	Cubic feet
Btu per hour	.000293	Calories (small) per hour	Cubic meters	264.2	Cubic inches
Btu per hour per square foot	.2712	Calories (small) per hour per square centimeter	Feet	30.48	Gallons
Btu per hour per square foot per F	.488	Calories (small) per hour per square centimeter per C	Feet	0.3048	Centimeters
Btu per pound	.5556	Calories (large) per kilogram	Feet of water	0.881	Meters
Btu per inch per square foot per hour per F	.0833	Btu per foot per sq. ft. per hour per F	Feet of water	304.8	Inches of mercury (at 32 F)
Btu per inch per square foot per hour per F	1.24	Calories (small) per centimeter per sq. cm. per hr. per C	Feet of water	62.37	Kilograms per square meter
			Feet of water	0.4335	Pounds per square foot
			Feet of water	0.5080	Pounds per square inch
			Feet of water	0.01667	Centimeters per second
			Feet of water	0.3048	Feet per second
			Feet of water	0.001286	Meters per minute
			Feet of water	30.48	Meters per minute
			Feet of water	18.29	British thermal units
			Feet of water	3,785.0	Centimeters per second
			Feet of water	0.1337	Meters per minute
			Feet of water	231.0	Cubic centimeters
			Feet of water	0.003785	Cubic foot
			Feet of water	3.7853	Cubic inches
			Feet of water		Cubic meters
			Feet of water		Liters

MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
Gallons of water	8.3453	Pounds of water (at 60°F)	Meters per minute	3.281	Feet per minute
Gallons per minute	0.06308	Liters per second	Meters per minute	0.05468	Feet per minute
Grams	15.432	Grains	Meters per second	196.8	Feet per second
Grains	.0648	Grams	Meters per second	3.281	Kilometers
Horsepower	33,000.0	Foot pounds per minute	Miles	1.60935	
Horsepower	2,546.0	British thermal units per hour	Pounds	7,000.0	Grains
Horsepower	42.42	British thermal units per minute	Pounds	0.45359	Kilograms
Horsepower	1.014	British thermal units per minute	Pounds of water (at 60°F)	0.01602	Cubic feet
Horsepower	0.7457	Horsepower (metric)	Pounds of water (at 60°F)	27.68	Cubic inches
Horsepower (boiler)	33,475	Kilowatts	Pounds of water (at 60°F)	0.1198	Gallons
		British thermal units per hour	Pounds of water evaporated from and at 212°F	0.284	Kilowatt-hours
Inches	2.540	Centimeters	Pounds of water evaporated from and at 212°F	0.381	Horsepower hours
Inches of mercury (at 62°F)	.03342	Atmospheres	Pounds of water evaporated from and at 212°F	970.4	British thermal units
Inches of mercury (at 62°F)	13.57	Inches of water (at 62°F)	Pounds of water evaporated from and at 212°F	4.883	Kilograms per square meter
Inches of mercury (at 62°F)	1.131	Feet of water (at 62°F)	Pounds per square foot	0.06804	Atmospheres
Inches of mercury (at 62°F)	345.3	Kilograms per square meter	Pounds per square inch	2.309	Feet of water (at 62°F)
Inches of mercury (at 62°F)	70.73	Pounds per square foot	Pounds per square inch	2.0416	Inches of mercury (at 62°F)
Inches of mercury (at 62°F)	.4912	Pounds per square inch	Pounds per square inch	.0703	Kilograms per square centimeter
Inches of water (at 62°F)	.002458	Atmospheres	Quarts	0.946	Liters
Inches of water (at 62°F)	.07355	Inches of mercury	Square centimeters	1.550	Square inches
Inches of water (at 62°F)	25.40	Kilograms per square meter	Square feet	.09290	Square centimeters
Inches of water (at 62°F)	.03613	Pounds per square inch	Square feet	6.452	Square centimeters
Inches of water (at 62°F)	5.202	Pounds per square foot	Square inches	10.765	Square feet
Kilograms	2.20462	Pounds	Square meters	1	Absolute temperature (C)
Kilogram-calories	3.968	British thermal units	Temperature (C) + 273	1.8	Temperature (F)
Kilograms per sq. cm.	14.220	Pounds per square inch	Temperature (C) + 17.78	1	Absolute temperature (F)
Kilograms per sq. meter	.2048	Pounds per square foot	Temperature (F) + 460	5-9	Temperature (C)
Kilometers	62137	Miles	Temperature (F) - 32	12,000.0	British thermal units per hour
Kilowatts	56.92	British thermal units per minute	Tons of refrigeration	200.0	British thermal units per minute
Kilowatts	1.341	Horsepower	Tons of refrigeration	50.40323	Calories per minute
Kilowatt-hours	3,415.0	British thermal units	Watts	3.415	British thermal units per hour
Kilowatt-hours	860.5	Kilogram-calories	Watts	0.05692	British thermal units per minute
Latent heat of ice	143.33	British thermal units per pound	Watts	0.01434	Kilogram-calories per min.
Liters	0.03531	Cubic feet	Watt-hours	3.415	British thermal units
Liters	61.02	Cubic inches	Watt-hours	0.8605	Kilogram-calories
Liters	0.2642	Gallons			
Meters	3.28083	Feet			
Meters	39.37	Inches			
Meters	1.094	Yards			

CIRCLES

Circumferences and Areas

Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area
1/32	.09818	.00077	8	25.133	50.265	21	65.973	346.36
1/16	.19635	.00307	1/8	25.525	51.849	1/4	66.759	354.66
1/8	.39270	.01227	1/4	25.918	53.456	1/2	67.544	363.05
3/16	.58905	.02761	3/8	26.311	55.088	3/4	68.330	371.54
1/4	.78540	.04909	1/2	26.704	56.745	22	69.115	380.13
5/16	.98175	.07670	5/8	27.096	58.426	1/4	69.900	388.82
3/8	1.1781	.11045	3/4	27.489	60.132	1/2	70.686	397.61
7/16	1.3744	.15033	7/8	27.882	61.862	3/4	71.471	406.49
1/2	1.5708	.19635	9	28.274	63.617	23	72.257	415.48
9/16	1.7671	.24850	1/8	28.667	65.397	1/4	73.042	424.56
5/8	1.9635	.30680	1/4	29.060	67.201	1/2	73.827	433.74
11/16	2.1598	.37122	3/8	29.452	69.029	3/4	74.613	443.01
3/4	2.3562	.44179	1/2	29.845	70.882	24	75.398	452.39
13/16	2.5525	.51849	5/8	30.238	72.760	1/4	76.184	461.86
7/8	2.7489	.60132	3/4	30.631	74.662	1/2	76.969	471.44
15/16	2.9452	.69029	7/8	31.023	76.589	3/4	77.754	481.11
1	3.1416	.7854	10	31.416	78.540	25	78.540	490.87
1/8	3.5343	.9940	1/8	31.809	80.516	1/2	80.111	510.71
1/4	3.9270	1.2272	1/4	32.201	82.516	26	81.681	530.93
3/8	4.3197	1.4849	3/8	32.594	84.541	1/2	83.252	551.55
1/2	4.7124	1.7671	1/2	32.987	86.590	27	84.823	572.56
5/8	5.1051	2.0739	5/8	33.379	88.664	1/2	86.394	593.96
3/4	5.4978	2.4053	3/4	33.772	90.763	28	87.965	615.75
7/8	5.8905	2.7612	7/8	34.165	92.886	1/2	89.535	637.94
2	6.2832	3.1416	11	34.558	95.033	29	91.106	660.52
1/8	6.6759	3.5466	1/8	34.950	97.205	1/2	92.677	683.49
1/4	7.0686	3.9761	1/4	35.343	99.402	30	94.248	706.86
3/8	7.4613	4.4301	3/8	35.736	101.62	1/2	95.819	730.62
1/2	7.8540	4.9087	1/2	36.128	103.87	31	97.389	754.77
5/8	8.2467	5.4119	5/8	36.521	106.14	1/2	98.960	779.31
3/4	8.6394	5.9396	3/4	36.914	108.43	32	100.531	804.25
7/8	9.0321	6.4918	7/8	37.306	110.75	1/2	102.102	829.58
3	9.4248	7.0686	12	37.699	113.10	33	103.673	855.30
1/8	9.8175	7.6699	1/8	38.092	115.47	1/2	105.243	881.41
1/4	10.210	8.2958	1/4	38.485	117.86	34	106.814	907.92
3/8	10.603	8.9462	3/8	38.877	120.28	1/2	108.385	934.82
1/2	10.996	9.6211	1/2	39.270	122.72	35	109.956	962.11
5/8	11.388	10.321	5/8	39.663	125.19	1/2	111.527	989.80
3/4	11.781	11.045	3/4	40.055	127.68	36	113.097	1017.9
7/8	12.174	11.793	7/8	40.448	130.19	1/2	114.668	1046.3
4	12.566	12.566	13	40.841	132.73	37	116.239	1075.2
1/8	12.959	13.364	1/4	41.234	135.29	1/2	117.810	1104.5
1/4	13.352	14.186	1/2	42.412	143.14	38	119.381	1134.1
3/8	13.744	15.033	3/4	43.197	148.49	1/2	120.951	1164.2
1/2	14.137	15.904	14	43.982	153.94	39	122.522	1194.6
5/8	14.530	16.800	1/4	44.768	159.46	1/2	124.093	1225.4
3/4	14.923	17.721	1/2	45.553	165.13	40	125.664	1256.6
7/8	15.315	18.665	3/4	46.338	170.87	1/2	127.235	1288.2
5	15.708	19.635	15	47.124	176.71	41	128.805	1320.3
1/8	16.101	20.629	1/4	47.909	182.65	1/2	130.376	1352.7
1/4	16.493	21.648	1/2	48.695	188.69	42	131.947	1385.2
3/8	16.886	22.691	3/4	49.480	194.83	43	133.518	1418.6
1/2	17.279	23.758	16	50.265	201.06	1/2	135.088	1452.2
5/8	17.671	24.850	1/4	51.051	207.39	44	136.659	1486.2
3/4	18.064	25.967	1/2	51.836	213.82	1/2	138.230	1520.5
7/8	18.457	27.109	3/4	52.622	220.35	45	139.801	1555.3
6	18.850	28.274	17	53.407	226.98	1/2	141.372	1590.4
1/8	19.242	29.465	1/4	54.192	233.71	46	142.942	1626.0
1/4	19.635	30.680	1/2	54.978	240.53	1/2	144.513	1661.9
3/8	20.028	31.919	3/4	55.763	247.45	47	146.084	1698.2
1/2	20.420	33.183	18	56.549	254.47	1/2	147.655	1734.9
5/8	20.813	34.472	1/4	57.334	261.59	48	149.226	1772.1
3/4	21.206	35.785	1/2	58.119	268.80	1/2	150.796	1809.6
7/8	21.598	37.122	3/4	58.905	276.12	49	152.367	1847.5
7	21.991	38.485	19	59.690	283.53	1/2	153.938	1885.7
1/8	22.384	39.871	1/4	60.476	291.04	50	155.509	1924.4
1/4	22.776	41.282	1/2	61.261	298.65		157.080	1963.5
3/8	23.169	42.718	3/4	62.046	306.35			
1/2	23.562	44.179	20	63.617	322.06			
5/8	23.955	45.664	1/4	63.617	322.06			
3/4	24.347	47.173	1/2	64.403	330.06			
7/8	24.740	48.707	3/4	65.188	338.16			

$$\text{Circumference} = 2\pi r = \pi d$$

$$\text{Area} = \pi r^2 = \frac{\pi d^2}{4}$$

CONTENTS IN CUBIC FEET U.S. GALLONS OF PIPES AND CYLINDERS

Diam. in Inches	For 1 Foot in Length		Diam. in Inches	For 1 Foot in Length		Diam. in Inches	For 1 Foot in Length	
	Cubic Feet	U.S. Gallons		Cubic Feet	U.S. Gallons		Cubic Feet	U.S. Gallons
1/4	0.0003	0.0025	6-3/4	0.2485	1.859	19	1.969	14.73
5/16	0.0005	0.0040	7	0.2673	1.999	19-1/2	2.074	15.51
3/8	0.0008	0.0057	7-1/4	0.2867	2.145	20	2.182	16.32
7/16	0.0010	0.0078	7-1/2	0.3068	2.295	20-1/2	2.292	17.15
1/2	0.0014	0.0102	7-3/4	0.3276	2.450	21	2.405	17.99
9/16	0.0017	0.0129	8	0.3491	2.611	21-1/2	2.521	18.86
5/8	0.0021	0.0159	8-1/4	0.3712	2.777	22	2.640	19.75
11/16	0.0026	0.0193	8-1/2	0.3941	2.948	22-1/2	2.761	20.66
3/4	0.0031	0.0230	8-3/4	0.4176	3.125	23	2.885	21.58
13/16	0.0036	0.0269	9	0.4418	3.305	23-1/2	3.012	22.53
7/8	0.0042	0.0312	9-1/4	0.4667	3.491	24	3.142	23.50
15/16	0.0048	0.0359	9-1/2	0.4922	3.682	25	3.409	25.50
1	0.0055	0.0408	9-3/4	0.5185	3.879	26	3.687	27.58
1-1/4	0.0085	0.0638	10	0.5454	4.080	27	3.976	29.74
1-1/2	0.0123	0.0918	10-1/4	0.5730	4.286	28	4.276	31.99
1-3/4	0.0167	0.1249	10-1/2	0.6013	4.498	29	4.587	34.31
2	0.0218	0.1632	10-3/4	0.6303	4.715	30	4.909	36.72
2-1/4	0.0276	0.2066	11	0.6600	4.937	31	5.241	39.21
2-1/2	0.0341	0.2550	11-1/4	0.6903	5.164	32	5.585	41.78
2-3/4	0.0412	0.3085	11-1/2	0.7213	5.396	33	5.940	44.43
3	0.0491	0.3672	11-3/4	0.7530	5.633	34	6.305	47.16
3-1/4	0.0576	0.4309	12	0.7854	5.875	35	6.681	49.98
3-1/2	0.0668	0.4998	12-1/2	0.8522	6.375	36	7.069	52.88
3-3/4	0.0767	0.5738	13	0.9218	6.895	37	7.467	55.86
4	0.0873	0.6528	13-1/2	0.9940	7.436	38	7.876	58.92
4-1/4	0.0985	0.7369	14	1.069	7.997	39	8.296	62.06
4-1/2	0.1104	0.8263	14-1/2	1.147	8.578	40	8.727	65.28
4-3/4	0.1231	0.9206	15	1.227	9.180	41	9.168	68.58
5	0.1364	1.020	15-1/2	1.310	9.801	42	9.621	71.97
5-1/4	0.1503	1.125	16	1.396	10.44	43	10.085	75.44
5-1/2	0.1650	1.234	16-1/2	1.485	11.11	44	10.559	78.99
5-3/4	0.1803	1.349	17	1.576	11.79	45	11.045	82.62
6	0.1963	1.469	17-1/2	1.670	12.49	46	11.541	86.33
6-1/4	0.2131	1.594	18	1.767	13.22	47	12.048	90.13
6-1/2	0.2304	1.724	18-1/2	1.867	13.96	48	12.566	94.00

One cubic foot of water at 39.1 degrees F. weighs 62.4245 pounds.

One cubic foot of air at 32 degrees F., atmospheric pressure, weighs 0.08073 pound.

One pound of water at 39.1 degrees F. has a volume of 0.01602 cubic foot.

One pound of air at 32 degrees F., atmospheric pressure, has a volume of 12.387 cubic feet.

One gallon of water at 62 degrees F. weighs 8.336 pounds.

One pound of water at 62 degrees F. has a volume of 0.1199 U.S. gallon.

ZONING MADE EASY

RULES OF THUMB

FLOW RATE

$$\frac{\text{Net Btuh Load}}{10,000} = \text{Flow Rate}$$

MAXIMUM FLOW RATE

Pipe Size (Copper)	Maximum Flow Rate
1/2"	1 1/2 gpm
3/4"	4 gpm
1"	8 gpm
1 1/4"	14 gpm

MAXIMUM FLOW RATE & HEAT CARRYING CAPACITY

Pipe Size (Copper)	Maximum Flow Rate	Heat Carrying Capacity
1/2"	1 1/2 gpm	15,000 Btuh
3/4"	4 gpm	40,000 Btuh
1"	8 gpm	80,000 Btuh
1 1/4"	14 gpm	140,000 Btuh

(Based on a 20-degree temperature drop across the system)

MAXIMUM LENGTH OF FIN-TUBE BASEBOARD LOOP

Baseboard Size Size (Copper)	Typical Btuh Per Linear Foot	Maximum Length of Baseboard Loop
1/2"	600	25 feet
3/4"	600	67 feet
1"	770	104 feet
1 1/4"	790	177 feet

(Based on 180-degree average water temperature and
a 20-degree temperature drop across the system)

"PUMP HEAD"

1. Measure the longest run in feet.
2. Add 50% to this.
3. Multiply that by .04, and
4. That's the pump head!

CHAPTER 4 - INSTALLED RADIATION: DETERMINING HEAT LOAD

HEAT LOSSES FROM BARE STEEL PIPE

Based On 70° Surrounding Air

Diameter of Pipe, Inches	Temperature of Pipe, Deg. F					
	100	120	150	180	210	240
	Heat Loss per Lineal Foot of Pipe, BTU per Hour					
1/2	13	22	40	60	82	106
3/4	15	27	50	74	100	131
1	19	34	61	90	123	160
1¼	23	42	75	111	152	198
1½	27	48	85	126	173	224
2	33	59	104	154	212	275
2½	39	70	123	184	252	327
3	46	84	148	221	303	393
3½	52	95	168	250	342	444
4	59	106	187	278	381	496
5	71	129	227	339	464	603
6	84	151	267	398	546	709
8	107	194	341	509	697	906
10	132	238	420	626	857	1114
12	154	279	491	732	1003	1305
14	181	326	575	856	1173	1527
16	203	366	644	960	1314	1711
18	214	385	678	1011	1385	1802
20	236	426	748	1115	1529	1990

HEAT LOSSES FROM BARE TARNISHED COPPER TUBE

Based On 70° Surrounding Air

Diameter of Pipe, Inches	Temperature of Pipe, Deg. F					
	100	120	150	180	210	240
	Heat Loss per Lineal Foot of Pipe, BTU per Hour					
1/4	4	8	14	21	29	37
3/8	6	10	18	28	37	48
1/2	7	13	22	33	45	59
5/8	8	15	26	39	53	68
3/4	9	17	30	45	61	79
1	11	21	37	55	75	97
1¼	14	25	45	66	90	117
1½	16	29	52	77	105	135
2	20	37	66	97	132	171
2½	24	44	78	117	160	206
3	28	51	92	136	186	240
3½	32	59	104	156	212	274
4	36	66	118	174	238	307
5	43	80	142	212	288	373
6	51	93	166	246	336	432
8	66	120	215	317	435	562
10	80	146	260	387	527	681
12	94	172	304	447	621	802

RADIATOR RATINGS

The output of a radiator is measured in square feet of direct radiation. To determine the number of square feet of direct radiation in a radiator

1. Identify the style of radiator—See Fig. 1 below.
2. Measure the height and width of the radiator.
3. Count the number of tubes in a section.
4. Count the number of sections.
5. Determine the square feet of radiation per section from the appropriate table and multiply by the number of sections.

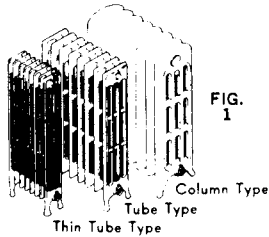


FIG. 1

Fig. 1 shows the relative sizes of radiator styles. All are four tube, eight section radiators but each rating is different.

EXAMPLE

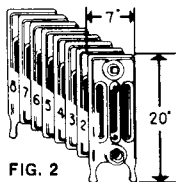


FIG. 2

Fig. 2 shows a tube type radiator, 20" high by 7" wide. There are four tubes per section and eight sections. The table on page four shows this size radiator has $2\frac{1}{4}$ square feet of radiation per section. $2\frac{1}{4}$ times 8 (the number of sections) equals 18 square feet of direct radiation in the radiator.

NOTE: All radiator dimensions and ratings in this booklet are approximate. Ratings should be used for checking the total radiation connected to an existing boiler.

OLD STYLE COLUMN RADIATORS SQ. FT. OF RADIATION PER SECTION

		NO. OF COLUMNS					
		1	2	3	4	5	6
Width→		4½"	7¾"	9"	11½"	12½"	12½"
Height In.							
45"		3½	5	6	10	—	—
38"		3	4	5	8	10	—
32"		2½	3½	4½	6½	8½	—
26"		2	2½	3¾	5	7	7
23"		1⅔	2⅓	3¼	4½	—	—
22"		1⅔	2¼	3	4	6	6
20"		1½	2	2¾	3½	5	5
18"		1⅓	1¾	2¼	3	5	4⅓
17"		—	—	—	—	—	4
16"		—	—	—	—	4	3¾
15"		—	1½	—	—	—	—
14"		—	—	—	—	4	3
13"		—	—	—	—	3	3

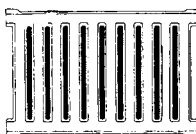
TUBE TYPE RADIATORS
SQ. FT. OF RADIATION PER SECTION

NO. OF TUBES					
Width→	3 	4 	5 	6 	7 
Height In.	5"	7"	8¾"	9¾"	12½"
38"	3½	4¼	5	6	—
36"	3½	4¼	5	6	7
32"	3	3½	4⅓	5	6
26"	2⅓	2¾	3½	4	5
23"	2	2½	3	3½	4½
22"	—	—	—	—	4½
20"	1¾	2¼	2⅔	3	3⅔
18"	—	—	—	—	3½
17"	—	—	—	—	3
16"	—	—	—	—	3
14"	—	—	—	—	2½

THIN TUBE RADIATORS
SQ. FT. OF RADIATION PER SECTION

NO. OF TUBES					
Width→	2 	3 	4 	5 	6 
Height In.	3½"	4"	4¾"	6"	7⅞"
38"	2.5	2.6	—	—	—
32"	2.0	2.4	—	—	3.7
26"	—	—	2.4	3.0	3.0
25"	1.6	1.6	2.0	—	3.0
23"	—	—	—	2.1	—
22"	1.3	1.4	1.8	—	—
20"	—	—	1.8	—	2.3
19"	1.1	1.2	1.6	—	2.3
17"	—	—	—	2.0	—

WALL TYPE RADIATORS



Size	Sq. Ft. Per Radiator
13½" x 17" x 3"	5
13½" x 21" x 3"	6
13½" x 22" x 3"	7
13½" x 29" x 3"	9

SECTIONAL WALL TYPE RADIATORS



Height	37"	26½"	21½"	15"	13⅞"
Sq. Ft. Radiation Per Section	2½	1¾	1½	1	¾

RADIATOR RATING STANDARDS

A SQUARE FOOT OF STEAM RADIATION is based on a heat emission of 240 BTU per hour per square foot, with standard 70° F. air temperature and 215° F. steam temperature in the radiator. A SQUARE FOOT OF WATER RADIATION is based on a heat emission of 150 BTU per hour per square foot, with standard 70° F. air temperature and an average water temperature in the radiator of 170° F.

A different rate of heat emission will be obtained when the average water temperature in the radiator is higher or lower than 170° F. See table below.

EXAMPLE: A structure has a calculated heat loss of 63,000 BTU and an average water temperature in the radiators of 200° F. As shown in the heat emission table, with 200° F. average water temperature, the heat emission is 210 BTU per square foot of radiation. Therefore the footage which must be used in selecting radiators is 300 sq. ft. (63,000 ÷ 210 = 300). Select the boiler on 63,000 BTU net rating.

HEAT EMISSION based on Room Temperature of 70° F.

AVERAGE WATER TEMP. IN RADIATORS °F							
150	160	170	180	190	200	210	215
HEAT EMISSION BTU PER HOUR SQ. FT.							
110	130	150	170	190	210	230	240

WEIL-McLAIN BASEBOARD RADIATION RATINGS

Capacities per Lineal Foot in BTU/Hr. with 65° F. Entering Air

CAST IRON BASEBOARD

MODEL	STEAM RATING SQ. FT. STEAM @ 215° F.	WATER FLOW RATE — 500 LBS./HR. OR 1 GPM						
		AVERAGE WATER TEMPERATURE BETWEEN INLET AND OUTLET — °F.						
		150	160	170	180	190	200	215
No. 9	3.35	390	450	510	570	640	700	800

CONVECTOR BASEBOARD

MODEL	WATER FLOW RATE — 500 LBS./HR. OR 1 GPM							
	AVERAGE WATER TEMPERATURE BETWEEN INLET AND OUTLET — °F.							
	170	180	190	200	210	220	230	240
Model 75 WL-3 (¾" Tube) THERMA TRIM	530	600	670	740	810	870	—	—
Model 75 H (¾" Tube) HIGH TRIM	680	760	850	940	1,030	1,110	1,200	1,290

CHAPTER 5 - WATER CONTENT

EXISTING RADIATION/PIPING

A. RADIATION:

Based on Sq. Ft. Rating	Water Content/Gal.	Weight/Lbs.
Slenderized Radiators	0.066	4.5
Large Tube Radiators	0.103	5.25
Column Radiators	0.188	7.0
Convectors (Non-Ferrous)	0.004	1.5
Convectors (Cast Iron)	0.04	3.4
Radiant Radiators	0.066	5.0
Base-Ray (Cast Iron Baseboard)	0.066	4.4

B. STEEL AND WROUGHT IRON PIPE (STD. WGT.)

Nominal Size: Inches	Based On Lineal Foot	
	Water Content/Gal.	Weight/Lbs.
1/2"	.016	.132
3/4"	.028	.231
1"	.045	.375
1 1/4"	.078	.648
1 1/2"	.106	.883
2"	.174	1.455
2 1/2"	.249	2.076
3"	.384	3.205
4"	.661	5.519
5"	1.039	8.662
6"	1.501	12.510

C. COPPER TUBING (TYPE L)

Nominal Size: Inches	Based on Lineal Foot	
	Water Content/Gal.	Weight/Lbs.
3/8"	.007	.063
1/2"	.012	.101
5/8"	.018	.151
3/4"	.025	.210
1"	.043	.357
1 1/4"	.065	.544
1 1/2"	.092	.770
2"	.161	1.340

D. WATER CONVERSION FACTORS

Lbs. of Water x 0.12 = Gallons

Gallons of Water x 8.33 = Lbs.

Lbs. of Water x 27.68 = Cubic Inches

Gallons of Water x 231 = Cubic Inches

Cubic Inches ÷ 1728 = Cubic Feet

CHAPTER 7 - FUEL CONSUMPTION AND ENERGY COST

There are several ways to calculate the operational cost of a specific boiler in a particular location. The accuracy of each will depend on the attention one gives the many variables.

Two popular methods are the "bin" and "degree-day". Though the "bin" method has the potential to be more accurate, it is more complicated and necessary weather data is not readily available. Discussion will be limited to the "Degree-Day" method.

The "Degree-Day" method is not without controversy. Historically, the reference temperature is 65°. This assumes that a building with average insulation and a thermostat set at 70° will cause a boiler to begin operation when outdoor temperature falls below 65°. Overlooked variables could be sunshine, wind, heavier insulation, different thermostat setting.

WHAT IS A DEGREE DAY?

When the outside temperature falls below 65°F, heat will be required to maintain the temperature within the building. The average outside temperature is estimated by adding the high and low temperature for a given day and dividing by two. (Example: A high of 40°F and a low of 20°F would be equivalent to a 30°F average temperature.) "Degree Days" are defined as the difference between the average temperature and the 65°F reference temperature. Therefore, 65°F minus 30°F equals 35 "Degree Days".

$$\text{Degree Days} = 65 - (\text{high} + \text{low}) \div 2$$

FUEL CONSUMPTION

In order to determine fuel usage the D.D. is used in the following equation:

$$\frac{F = HL \times 24 \times DD}{E \times P \times T.D.}$$

HL	=	Heating Load (Btuh)
DD	=	Degree Day
24	=	Hours in a day
E	=	Boiler Efficiency (AFUE)
P	=	Heating value of fuel (Btu)
T.D.	=	Design temperature difference (inside-outside)
F	=	Annual fuel consumption

TYPICAL DEGREE DAY FOR A FEW LOCATIONS:

	2010 heating degree days	2011 heating degree days	2012 heating degree days
Bangor 04401	8055	8825	8572
Portland 04112	7686	8040	7683
Presque Isle 04769	9565	10382	10083
Waterville 04901	8172	8662	8551
Wells 04090	7958	8293	7813

Source of Information: <http://www.weatherdatadepot.com/>

BTU PER GALLON HEATING #2 HEATING OIL 138,690 BTU/GALLON

BTU PER GALLON PROPANE 91,333 BTU/GALLON

OUTDOOR DESIGN TEMPERATURES 97.5%

Bangor -6, Portland -1, Waterville -4, Presque Isle -9, Wells 0

The Wind Chill Factor

Simple air temperature is not a reliable indicator of how we may feel outdoors. Other weather elements such as humidity, sunshine and wind speed all influence the “real” temperature. How do you measure wind speed without an instrument? Roughly, a wind speed up to 12 mph puts leaves in motion and can just be felt on the face . . . 13-24 mph moves small branches, raises dust, etc. . . . 25-30 mph makes wires whistle and moves large branches . . . 30-40 mph makes whole trees move and is difficult to walk against. This chart shows you must never underestimate the effect of the wind on outside temperatures. Obviously, winds also have relative effects on inside temperatures.

Wind Chill Chart

		Wind in Miles Per Hour									
		5	10	15	20	25	30	35	40	45	50
Current Temperature	35	33	21	16	12	7	5	3	1	1	0
	30	27	16	11	3	0	-2	-4	-4	-6	-7
	25	21	9	1	-4	-7	-11	-13	-15	-17	-17
	20	16	2	-6	-9	-15	-18	-20	-22	-24	-24
	15	12	-2	-11	-17	-22	-26	-27	-29	-31	-31
	10	7	-9	-18	-24	-29	-33	-35	-36	-38	-38
	5	1	-15	-25	-32	-37	-41	-43	-45	-46	-47
	0	-6	-22	-33	-40	-45	-49	-52	-54	-54	-56
	-5	-11	-27	-40	-46	-52	-56	-60	-62	-63	-63
	-10	-15	-31	-45	-52	-58	-63	-67	-69	-70	-70
	-15	-20	-38	-51	-60	-67	-70	-72	-76	-78	-79
	-20	-26	-45	-60	-68	-75	-78	-83	-87	-87	-88
	-25	-31	-52	-65	-76	-83	-87	-90	-94	-94	-96
	-30	-35	-58	-70	-81	-89	-94	-98	-101	-101	-103
	-35	-41	-64	-78	-88	-96	-101	-105	-107	-108	-110
	-40	-47	-70	-85	-96	-104	-109	-113	-116	-118	-120
	-45	-54	-77	-90	-103	-112	-117	-123	-128	-128	-128

**Radiant Panel Association
QUICK REFERENCE SHEET
to RPA Guidelines for Hydronic Radiant Floor Heating**

Special Insulation Considerations:

	Application	Min. R-Value	Coverage/Comment
Slab on Grade	Alternate #1	*(Ti-To) 0.125	perimeter to below frost line
	Alternate #2	R-10	4' horizontal or vertical at perimeter
	Conductive Soil	R-10	under entire slab
Suspended Floors Over Heated Space	Hard Surface	R-9	under entire floor w/ 2" air gap
	Carpeted Surface	R-13	under entire floor w/ 2" air gap
Over Unheated Space	Hard Surface	R-13	under entire floor w/ 2" air gap
	Carpeted Surface	R-19	under entire floor w/ 2" air gap
Walls With Panels	outside wall	R-13	entire wall
	inside wall	optional	
Ceiling With Panels	inside ceiling	R-11	entire ceiling above panel
	outside ceiling	R-30	entire ceiling above panel

*R-value = Inside Temperature - Outdoor Temperature x 0.125

Pressure Testing Embedded Tubing - 100 PSI for at least 30 minutes

Floor Surface Temperatures - 85°F max. in prolonged foot contact areas
90°F max. other than prolonged foot contact areas
85°F max. on solid or laminated hardwood flooring

Fluid Temperatures - 140° max. in gypsum based thermal mass
160° max. underside of wood subfloor
180° max. underside of wood subfloor when approved by
tubing manufacturer's design methods

Floor Covering - R-value not to exceed design requirement

Tube Placement -

Structural Slab 2" min. below surface, no tube joints in slab,
sleeved a min. of 4" either side of expansion joint
Non-structural 3/4" underlayment over highest point in tube
1/8" min. gap between butt ends of aluminum plates
no inaccessible tube joints
Joist Space 1/8" min. gap between butt ends of aluminum plates
2" air gap below tube except where aluminum plates are used

Tube Length -

<u>Tube Size</u>	<u>Recommended</u>		<u>Maximum</u>
1/4" I.D. tubing	100 ft.	125 ft.	
3/8" I.D. tubing	200 ft.	250 ft.	
1/2" I.D. tubing	250 ft.	350 ft.	
5/8" I.D. tubing	400 ft.	500 ft.	
3/4" I.D. tubing	500 ft.	600 ft.	
1" I.D. tubing	750 ft.	750 ft.	

Oxygen Permeation - Oxygen barrier tube, less than 0.1 gram/m³/day at 40°
Three options Heat Exchanger to isolate non-oxygen barrier tube
Water treatment to inhibit corrosion due to oxygen

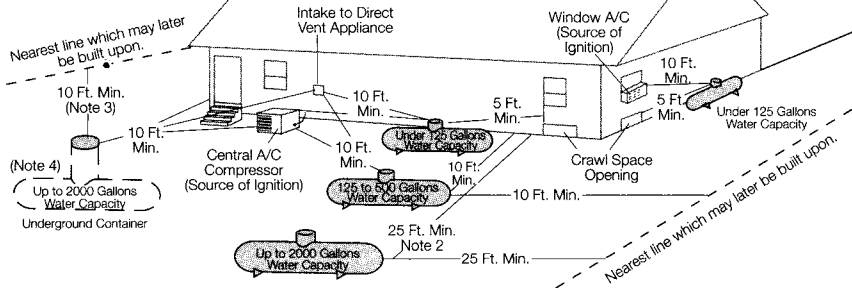
RPA Proposed Guideline

for review only

Location of ASME Containers

From NFPA 58, Appendix G

Federal, state, and local ordinances and regulations should be observed at all times.



Notes:

- Regardless of its size, any ASME tank filled on-site must be located so that the filling connection and fixed liquid level gauge are at least 10 feet from external source of ignition (i.e. open flame, window A/C, compressor, etc.), intake to direct vented gas appliance or intake to a mechanical ventilation system.
- May be reduced to 10 feet minimum for a single container of 1200 gallons water capacity or less if it is located at least 25 feet from any other LP-Gas container of more than 125 gallons water capacity.
- Minimum distances from underground containers shall be measured from the relief valve and filling or level gauge vent connection at the container, except that no part of an underground container shall be less than 10 feet from a building or line of adjoining property which may be built upon.
- Where the container may be subject to abrasive action or physical damage due to vehicular traffic or other causes, it must be either a) placed not less than 2 feet below grade; b) otherwise protected against such physical damage.

Table 4 — Second, Single, or Integral Twin Stage Pipe Sizing

11 Inches Water Column Inlet with a 1/2 Inch Water Column Drop

Maximum capacity of pipe or tubing in thousands of BTU/hr of LP-Gas

Size of Pipe or Copper Tubing, Inches	Length of Pipe or Tubing, Feet *									
	10	20	30	40	50	60	70	80	90	100
Copper	49	34	27	23	20	19	—	—	—	—
Tubing	110	76	61	52	46	42	38	36	33	32
(O.D.)	5/8	206	141	114	97	86	78	71	67	62
	3/4	348	239	192	164	146	132	120	113	105
	7/8	536	368	296	253	224	203	185	174	161
Pipe Size	1/2	291	200	161	137	122	110	102	94	87
	3/4	608	418	336	287	255	231	212	198	185
	1	1146	788	632	541	480	435	400	372	349
	1-1/4	2353	1617	1299	1111	985	892	821	764	717
	1-1/2	3525	2423	1946	1665	1476	1337	1230	1144	1074
	2	6789	4666	3747	3207	2842	2575	2369	2204	2068
		125	150	175	200	225	250	275	300	350
Copper	3/8	—	—	—	—	—	—	—	—	—
Tubing	1/2	—	—	—	—	—	—	—	—	—
(O.D.)	5/8	—	—	—	—	—	—	—	—	—
	3/4	—	—	—	—	—	—	—	—	—
	7/8	—	—	—	—	—	—	—	—	—
Pipe Size	1/2	74	67	62	58	54	51	48	46	43
	3/4	155	141	129	120	113	107	101	97	89
	1	292	265	244	227	213	201	191	182	167
	1-1/4	600	544	500	465	437	412	392	374	344
	1-1/2	899	815	749	697	654	618	587	560	515
	2	1731	1569	1443	1343	1260	1190	1130	1078	992

* Total length of piping from outlet of regulator to appliance furthest away.

Data Calculated per NFPA #54 & 58.

LIQUEFIED PETROLEUM GAS CODE

Table 12.14 Maximum Capacity of CSST in Thousands of Btu per Hour of Undiluted Liquefied Petroleum Gases at a Pressure of 11-in. Water Column and a Pressure Drop of 0.5-in. Water Column (based on a 1.52 specific gravity gas)

Size of Pipe or Copper Tubing, Inches	EHD* Flow Designation	Tubing Length, ft																	
		5	10	15	20	25	30	40	50	60	70	80	90	100	150	200	250	300	
3/8	13	72	50	39	34	30	28	23	20	19	17	15	15	14	11	9	8	8	
3/8	15	99	69	55	49	42	39	33	30	26	25	23	22	20	15	14	12	11	
3/8	18	181	129	104	91	82	74	64	58	53	49	45	44	41	31	28	25	23	
1/2	19	211	150	121	106	94	87	74	66	60	57	52	50	47	36	33	30	26	
1/2	23	355	254	208	183	164	151	131	118	107	99	94	90	85	66	60	53	50	
3/4	25	426	303	248	216	192	177	153	137	126	117	109	102	98	75	69	61	57	
1	30	744	521	422	365	325	297	256	227	207	191	178	169	159	123	112	99	90	
1	31	863	605	490	425	379	344	297	265	241	222	208	197	186	143	129	117	107	

Note: Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger numbers of bends or fittings shall be increased by an equivalent length of tubing to the following equation: $L = 1.3n$ where L is additional length (ft) of tubing and n is the number of additional fittings or bends.

*EHD — equivalent hydraulic diameter — a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

Source: NFPA 54, *National Fuel Gas Code*, 1999 edition, Table 9.29.

307.2 Cutting, notching or bored holes. A framing member shall not be cut, notched or bored in excess of limitations specified in the *International Building Code*.

✧ Cutting, notching or hole boring of structural members should be avoided whenever possible. The code recognizes that it is occasionally necessary to cut, notch or bore through studs, joists, beams, rafters or other structural members to install pipes, plumbing fixtures and appliances [see Figures 307.2(1) and 307.2(2)]. In order to maintain the integrity and load-carrying capacity of these structural members, the IBC is referenced to regulate the size and location of holes, notches, and other such modifications (see IBC Sections 2308.8.2 and 2308.9.10). If a structural member is to be modified beyond what is specifically permitted by the IBC, a structural analysis performed by a registered design professional and approved by the code official would be necessary to determine the effect that an alteration has had or will have on the load-carrying capacity of that structural member. Clearly, this should be considered before such alteration is made. Thoughtless cutting can result in an unnecessary hazard and expensive repair or replacement of improperly modified structural members.

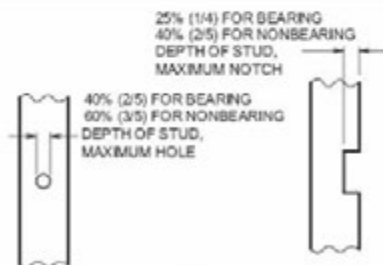
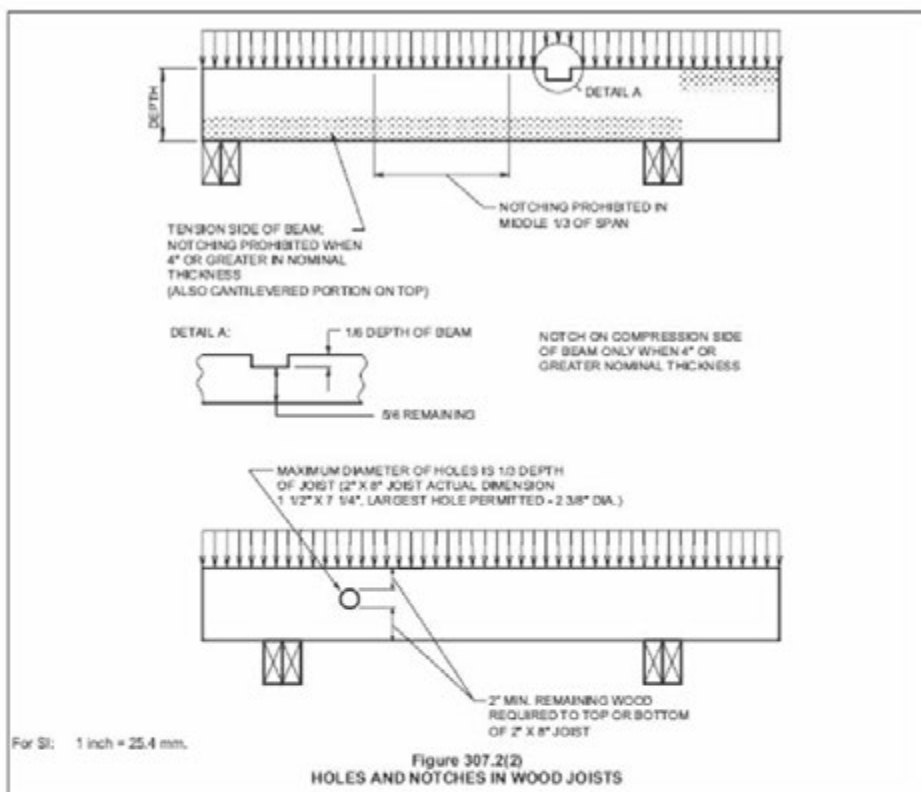


Figure 307.2(1)
NOTCHES OR HOLES IN WOOD STUDS



307.3 Penetrations of floor/ceiling assemblies and fire-resistance-rated assemblies. Penetrations of floor/ceiling assemblies and assemblies required to have a fire-resistance rating shall be protected in accordance with the *International Building Code*.

❖ This section provides the requirement for the protection of penetrations and openings necessary for plumbing pipe in building assemblies that are required to be fire-resistance rated. In addition to maintaining the structural integrity of walls, floors, ceilings and roofs when these elements are penetrated by the plumbing pipe, the penetrations must also be protected to prevent the passage of fire and other products of combustion through the fire-resistance-rated assembly because of the pipe penetrating the assembly. These penetrations must be protected in accordance with the IBC [see Sections 711 and 712 of the IBC and Figures 307.3(1) through 307.3(4)].

[E] 307.4 Alterations to trusses. Truss members and components shall not be cut, drilled, notched, spliced or otherwise altered in any way without written concurrence and approval of a registered design professional. Alterations resulting in the addition of loads to any member (e.g., HVAC equipment, water heater) shall not be permitted without verification that the truss is capable of supporting such additional loading.

❖ Trusses are engineered products, and any alteration to specific elements may prevent the truss from performing as intended. The code does not permit drilling and notching of truss members and components without documentation that the design has taken this possibility into account. Additionally, trusses are designed to resist specific loads; changing the loading on the truss or on any of its members should not be done without approval of a registered design professional.

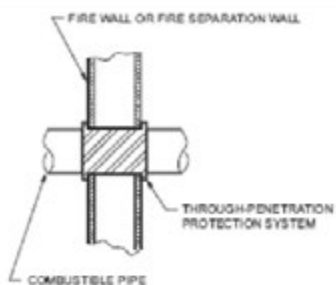


Figure 307.3(1)
COMBUSTIBLE PIPE PENETRATION OF FIRE WALL

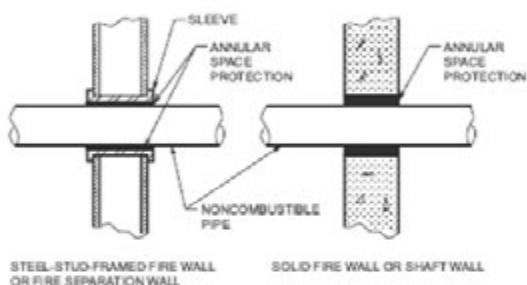


Figure 307.3(2)
ANNULAR SPACE PROTECTION

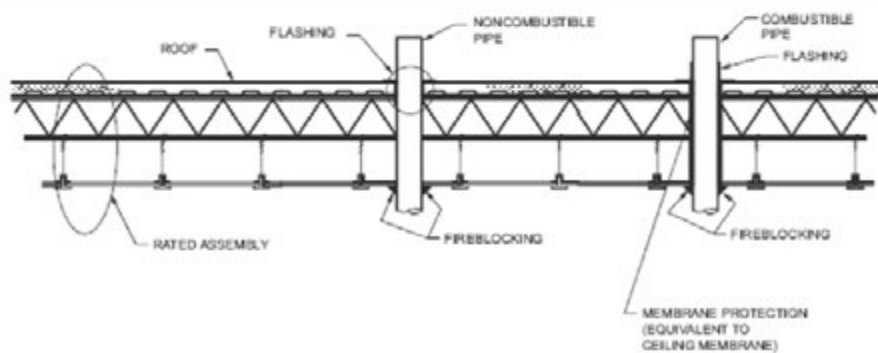


Figure 307.3(3)
PIPE PENETRATION OF FIRE-RESISTANCE-RATED ROOF/CEILING ASSEMBLY



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Boiler Output 1000's BTUH	Copper Baseboard & Radiant	Type of Radiation		
		Convectors & Unit Heaters	Cast Iron	
			Radiators	Baseboard
25	HTX 15	HTX 15	HTX 15	HTX 15
50	HTX 15	HTX 30	HTX 30	HTX 30
75	HTX 30	HTX 30	HTX 60	HTX 60
100	HTX 30	HTX 30	HTX 60	HTX 60
125	HTX 30	HTX 60	HTX 60	HTX 60
150	HTX 30	HTX 60	HTX 90	HTX 90
175	HTX 60	HTX 60	HTX 90	HTX 90
200	HTX 60	HTX 60	HTX 90	HTX 90
250	SXHT 30	SXHT 30	SXHT 40	SXHT 30
300	SXHT 30	SXHT 40	SXHT 40	SXHT 30
350	SXHT 30	SXHT 40	SXHT 60	SXHT 40
400	SXHT 30	SXHT 60	SXHT 90	SXHT 40
500	SXHT 40	SXHT 60	SXHT 90	SXHT 40
600	SXHT 40	SXHT 90	SXHT 90	SXHT 60
700	SXHT 60	SXHT 90	SXHT 90	SXHT 60
800	SXHT 60	SXHT 110	SXHT 110	SXHT 90
900	SXHT 60	SXHT 110	SXHT 110	SXHT 90
1000	SXHT 90	SXHT 110	SXHT 110	SXHT 90

Sizing recommendations based on average size systems.

Fill pressure 12 PSI. Relief valve 30 PSI.

Average system water temperature 200°F.

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HTX 30	VR30	30	ET-30	ET-5	XT-30	HXT-30
HTX 60	VR60	60	ET-60	ET-7	XT-60	HXT-60
HTX 90	VR90	90	ET-90	ET-14	XT-90	HXT-90
SXHT 30	SXVR30	SX30	N/A	ET-15	XTV-30	N/A
SXHT 40	SXVR40	SX40	N/A	ET-20	XTV-40	N/A
SXHT 60	SXVR60	SX60	N/A	ET-36	XTV-60	N/A
SXHT 90	SXVR90	SX90	N/A	ET-52	XTV-90	N/A
SXHT 110	SXVR110	SX110	N/A	N/A	XTV-110	N/A
SXHT 160	SXVR160	SX160	N/A	ET-96	XTV-160	N/A

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PH, WH & WHV Series Potable Water Thermal Expansion Tanks

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Water Heater Size/ Volume	Maximum Water Temperature			
	130°F	140°F	160°F	180°F
30 gal	PH-5 or WH-8	PH-5 or WH-8	PH-5 or WH-8	PH-5 or WH-8
40 gal	PH-5 or WH-8	PH-5 or WH-8	PH-5 or WH-8	PH-5 or WH-8
50 gal	PH-5 or WH-8	PH-5 or WH-8	PH-5 or WH-8	PH-12 or WH-18
60 gal	PH-5 or WH-8	PH-5 or WH-8	PH-5 or WH-8	PH-12 or WH-18
80 gal	PH-5 or WH-8	PH-12 or WH-18	PH-12 or WH-18	PH-12 or WH-18
100 gal	PH-12 or WH-18	PH-12 or WH-18	PH-12 or WH-18	WH-32
120 gal	PH-12 or WH-18	PH-12 or WH-18	PH-12 or WH-18	WH-32
150 gal	PH-12 or WH-18	PH-12 or WH-18	WH-32	WH-32
175 gal	PH-12 or WH-18	WH-32	WH-32	WHV-50
200 gal	WH-32	WH-32	WHV-50	WHV-50
240 gal	WH-32	WH-32	WHV-50	WHV-75
260 gal	WH-32	WHV-50	WHV-50	WHV-75
280 gal	WH-32	WHV-50	WHV-75	WHV-75
300 gal	WHV-50	WHV-50	WHV-75	WHV-120
350 gal	WHV-50	WHV-50	WHV-75	WHV-120
400 gal	WHV-50	WHV-75	WHV-120	WHV-120

Based on total water heater recovery from 40°F.

Based on water supply pressure of 60 PSIG.

Relief valve set at 150 PSIG.

Adjust tank precharge to equal incoming water pressure.

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PH-12 or WH-18	ST-12	PET or DET-12	ETC-5X	DXT-18	PT-12	WXTP-18 or XT-18
WH-32	ST-25V	PET or DET-25	ETC-7X	DXT-35	PT-25V	WXTP-32
WHV-50	ST-30V	PET or DET-30	ETC-14X	DXT-50	PT-30V	WXTP-50V
WHV-75	ST-42V	N/A	N/A	N/A	PT-42V	WXTP-75V
WHV-120	ST-60V	N/A	N/A	N/A	PT-60V	WXTP-120V
WHV-165	ST-80V	N/A	N/A	N/A	PT-80V	WXTP-165V
WHV-320	ST-210V	N/A	N/A	N/A	PT-210V	WXTP-320V

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CELSIUS TO FAHRENHEIT CONVERSION CHART

Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit
0.1	32.18	20	68	50	122	80	176
0.2	32.36	21	69.8	51	123.8	81	177.8
0.3	32.54	22	71.6	52	125.6	82	179.6
0.4	32.72	23	73.4	53	127.4	83	181.4
0.5	32.9	24	75.2	54	129.2	84	183.2
0.6	33.08	25	77	55	131	85	185
0.7	33.26	26	78.8	56	132.8	86	186.8
0.8	33.44	27	80.6	57	134.6	87	188.6
0.9	33.62	28	82.4	58	136.4	88	190.4
1	33.8	29	84.2	59	138.2	89	192.2
2	35.6	30	86	60	140	90	194
3	37.4	31	87.8	61	141.8	91	195.8
4	39.2	32	89.6	62	143.6	92	197.6
5	41	33	91.4	63	145.4	93	199.4
6	42.8	34	93.2	64	147.2	94	201.2
7	44.6	35	95	65	149	95	203
8	46.4	36	96.8	66	150.8	96	204.8
9	48.2	37	98.6	67	152.6	97	206.6
10	50	38	100.4	68	154.4	98	208.4
11	51.8	39	102.2	69	156.2	99	210.2
12	53.6	40	104	70	158	100	212
13	55.4	41	105.8	71	159.8	200	392
14	57.2	42	107.6	72	161.6	300	572
15	59	43	109.4	73	163.4	400	752
16	60.8	44	111.2	74	165.2	500	932
17	62.6	45	113	75	167	600	1112
18	64.4	46	114.8	76	168.8	700	1292
19	66.2	47	116.6	77	170.6	800	1472
		48	118.4	78	172.4	900	1652
		49	120.2	79	174.2	1000	1832

For greater accuracy use formula below:

To convert from Celsius to Fahrenheit:

$$°F = (9/5)°C + 32$$

To convert from Fahrenheit to Celsius:

$$°C = (5/9) \times (°F - 32)$$

°C = temperature in degrees Celsius

°F = temperature in degrees Fahrenheit

Maine Home Construction Contracts

The Maine Home Construction Contracts Act requires you use a written contract with specific provisions whenever the construction or repair contract is for more than \$3,000. For example, the contract must limit any down payment to no more than one third (1/3) of the total price and the contract must include an express warranty of good workmanship. **A sample contract can be found at www.maine.gov/ag at chapter 18.** **Another important feature of this statute is that you are now required to attach a copy of the AG's "consumer protection information on home construction and repair, which includes information on contractors successfully sued by the State" and the Statute also requires a clear and conspicuous notice on your contract strongly advising the consumer to visit the AG website at www.maine.gov/ag or telephone the AG at 1-800-436-2131.**

§ 1487. Home Construction Contracts Any home construction contract for more than \$3,000 in materials or labor must be in writing and must be signed by both the home construction contractor and the homeowner or lessee. Both the contractor and the homeowner or lessee shall receive a copy of the executed contract prior to any work performance. This basic contract must contain the entire agreement between the homeowner or lessee and the home construction contractor and must contain at least the following parts:

1. Names of parties. The name, address and phone number of both the home construction contractor and the homeowner or lessee;
2. Location. The location of the property upon which the construction work is to be done;
3. Work dates. Both the estimated date of commencement of work and the estimated date when the work will be substantially completed. The estimated date of commencement of work and the completion date may be changed if work cannot begin or end due to circumstances beyond the control of the contractor, including, but not limited to, the lack of readiness of the job site or the unavailability of building materials;
4. Contract price. The total contract price, including all costs to be incurred in the proper performance of the work, or, if the work is priced according to a "cost-plus" formula, the agreed-upon price and an estimate of the cost of labor and materials;
5. Payment. The method of payment, with the initial down payment being limited to no more than one-third of the total contract price;
6. Description of the work. A general description of the work and materials to be used;
7. Warranty. A warranty statement which reads: In addition to any additional warranties agreed to by the parties, the contractor warrants that the work will be free from faulty materials; constructed according to the standards of the building code applicable for this location; constructed in a skillful manner and fit for habitation or appropriate use. The warranty rights and remedies set forth in the Maine Uniform Commercial Code apply to this contract;
8. Resolution of disputes. A statement allowing the parties the option to adopt one of 3 methods of resolving contract disputes. At a minimum, this statement must provide the following information:

If a dispute arises concerning the provisions of this contract or the performance by the parties, then the parties agree to settle this dispute by jointly paying for one of the following (check only one):

Binding arbitration as regulated by the Maine Uniform Arbitration Act, with the parties agreeing to accept as final the arbitrator's decision (____);

1. Nonbinding arbitration, with the parties free to not accept the arbitrator's decision and to seek satisfaction through other means, including a lawsuit (____);
2. Mediation, with the parties agreeing to enter into good faith negotiations through a neutral mediator in order to attempt to resolve their differences (____);
9. Change orders. A change order statement which reads: Any alteration or deviation from the above contractual specifications that result in a revision of the contract price will be executed only upon the parties entering into a written change order;
10. Door-to-door sales. If the contract is being used for sales regulated by the consumer solicitation sales law, Title 32, chapter 69, subchapter V or the home solicitation sales law, Title 9-A, Part 5, a description of the consumer's rights to avoid the contract, as set forth in these laws;
11. Residential insulation. If the construction includes installation of insulation in an existing residence, any disclosures required by chapter 219, Insulation Contractors; and
12. Energy standards. A statement by the contractor that chapter 214 establishes minimum energy efficient building standards for new residential construction, and whether the new building or an addition to an existing building will meet or exceed those standards.

§ 1488. Change Orders Each change order to a home construction contract must be in writing and becomes a part of and is in conformance with the existing contract. All work shall be performed under the same terms and conditions as specified in the original contract unless otherwise stipulated. The change order must detail all changes to the original contract that result in a revision of the contract price. The previous contract price must be stated and the revised price shall also be stated. Both parties must sign the change order.

§ 1489. Exemption Parties to a home construction contract may exempt themselves from the requirements of this chapter only if the contractor specifically informs the homeowner or lessee of his rights under this chapter and the parties then mutually agree to a contract or change order that does not contain the parts set forth in sections 1487 and 1488

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On-the-job training must be coordinated with a participating employer.

Each course is equivalent to one year of classroom instruction.

For more information on enrollment or to enter the e-Learning Academy, please contact us at aames2@maine.rr.com or 829-5055

Maine PHCC Scholarships

Scholarships with Simple Application to bring new people into the trade.

Maine PHCC has updated their scholarship eligibility for all Members and Associate Members and their employees.

To build workforce and help to bring new people into the trade it was decided that the scholarships would be given to unlicensed applicants or apprentices. Anyone with a journeyman licensee or higher would not be eligible.

- Maine PHCC Scholarship - Up to \$500 per member per year.
- MEMA has generously offered to charge the membership rate for anyone receiving a scholarship.
- \$500 reimbursement from the State of Maine for apprentices completing Plumbing 101 of the PHCC Academy e-learning.

Courses or Programs for plumbing, oil, gas, hvac offered through PHCC, MEMA, Community Colleges or NTI.

More scholarship information is available on the next page.

National PHCC Scholarships

Access 56 scholarships worth up to \$150,000 - all with one application!

The PHCC Educational Foundation and its industry partners are teaming up to provide financial assistance to students pursuing a career in the p-h-c industry.

Contractors, be sure to have your apprentices apply! Even if your company pays for apprenticeship training, a scholarship win will help offset your training costs and build a sense of accomplishment for the apprentice who wins. Please limit applications to a **max of four per company** and tap your best set of apprentices to send in their applications.

<https://www.phccfoundation.org/wp-content/uploads/2020/12/2021-PHCC-Application-Details.pdf>

Under a separate program: National Auxiliary Scholarships:
include general and industry-related scholarships

<https://www.phccnationalauxiliary.org/scholarships> **Deadline: July 15, 2021

NEW CHANGES FOR 2021 PROGRAM YEAR

The Foundation Scholarship Committee approved these new adjustments to the scholarship program.

- Plumbing and HVAC apprentices may use scholarship funds toward their required apprenticeship program textbook expenses (does not apply to college or trade schools).
- Scholarships may be used toward the PHCC Educational Foundation's online apprenticeship training program or Fast Track to Service Plumbing course. The apprentice or technician must be employed by a PHCC–National Association contractor member company.

For the 2021 scholarship program only:

- An applicant who has previously won a Foundation scholarship may apply for another scholarship in 2021, as long as they continue to meet all other eligibility requirements. Past winners who have been awarded more than one past scholarship may apply, but a small deductive score modifier will be applied.

AND

- Apprentices working part-time (not just full-time) for a PHCC member company may also apply for the Foundation scholarships.

PHCC PREFERRED SERVICE PROVIDERS

We've partnered with companies across various industries to provide our members with substantial services and discounts. Questions or concerns?
Contact customercare@naphcc.org.

ARAMARK

Outfit your employees for comfort and style while you build your business with custom-embroidered clothing. Build relationships with your customers by displaying employee names and your company logo on work apparel. Add the PHCC logo to give your customers the confidence and security of using a contractor they can depend on.

ExxonMobil

Take your ExxonMobil Fleet Card to more than 14,000 ExxonMobil stations nationwide and save \$.05 per gallon on gasoline. Sign up for customized online reports to better manage your fleet costs. Extra bonus: The one-time enrollment fee of \$50 is waived for PHCC members. And when you purchase more than 1,200 gallons per month the \$10 accounting fee is also waived.

GreenSky

Helping its members close more sales and grow their businesses, the Plumbing-Heating-Cooling Contractors National Association (PHCC) has partnered with the GreenSky® Loan Program, a leader in home improvement financing. GreenSky gives PHCC members the opportunity to offer their customers flexible financing plans, such as no down payment/no interest promotions, as well as deferred interest, low interest and fixed payment options.

Hudson, Ink

Hudson, Ink is a leading provider of marketing services for contractors offering customer retention newsletters, lead-generating yellow page ads and turn-key marketing packages.

Market Hardware, Inc

Market Hardware is the preferred website and internet marketing provider for PHCC. As a member, you have access to free monthly Social Media Tips and discounts on websites, SEO, social media and more. Watch your inbox for monthly Web Marketing Best Practice Alerts, where you can download sample posts for your website, social media platforms and customer newsletters.

Time Communications

Don't miss your customers' calls! Time Communications answers your phones when you can't ... and treats your customers just like you would. Services include 24/7/365 call answering, paging and dispatch services, emergency response, appointment scheduling, on-call scheduling, and dedicated operators. Time Communications will develop a call management plan that works for your business – and deliver its award-winning customer service to your customers – all at a discounted monthly rate.

CALENDAR YEAR 2021

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2		1	2	3	4	5	6		1	2	3	4	5	6
3	4	5	6	7	8	9	7	8	9	10	11	12	13	7	8	9	10	11	12	13
10	11	12	13	14	15	16	14	15	16	17	18	19	20	14	15	16	17	18	19	20
17	18	19	20	21	22	23	21	22	23	24	25	26	27	21	22	23	24	25	26	27
24	25	26	27	28	29	30	28							28	29	30	31			
31																				
APRIL							MAY							JUNE						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3							1			1	2	3	4	5
4	5	6	7	8	9	10	2	3	4	5	6	7	8	6	7	8	9	10	11	12
11	12	13	14	15	16	17	9	10	11	12	13	14	15	13	14	15	16	17	18	19
18	19	20	21	22	23	24	16	17	18	19	20	21	22	20	21	22	23	24	25	26
25	26	27	28	29	30		23	24	25	26	27	28	29	27	28	29	30			
							30	31												
JULY							AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3	1	2	3	4	5	6	7				1	2	3	4
4	5	6	7	8	9	10	8	9	10	11	12	13	14	5	6	7	8	9	10	11
11	12	13	14	15	16	17	15	16	17	18	19	20	21	12	13	14	15	16	17	18
18	19	20	21	22	23	24	22	23	24	25	26	27	28	19	20	21	22	23	24	25
25	26	27	28	29	30	31	29	30	31					26	27	28	29	30		
OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
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3	4	5	6	7	8	9	7	8	9	10	11	12	13	5	6	7	8	9	10	11
10	11	12	13	14	15	16	14	15	16	17	18	19	20	12	13	14	15	16	17	18
17	18	19	20	21	22	23	21	22	23	24	25	26	27	19	20	21	22	23	24	25
24	25	26	27	28	29	30	28	29	30					26	27	28	29	30	31	
31																				

HOLIDAYS & OBSERVANCES

Jan 1	New Year's Day	Apr 5	Easter Monday	Sep 6	Labor Day
Jan 18	Martin Luther King Day	May 9	Mother's Day	Oct 11	Columbus Day
Feb 15	Presidents' Day	May 31	Memorial Day	Nov 11	Veterans Day
Apr 2	Good Friday	Jun 20	Father's Day	Nov 25	Thanksgiving Day
Apr 4	Easter Sunday	Jul 4	Independence Day	Dec 25	Christmas Day

CALENDAR YEAR 2022

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
						1			1	2	3	4	5			1	2	3	4	5
2	3	4	5	6	7	8	6	7	8	9	10	11	12	6	7	8	9	10	11	12
9	10	11	12	13	14	15	13	14	15	16	17	18	19	13	14	15	16	17	18	19
16	17	18	19	20	21	22	20	21	22	23	24	25	26	20	21	22	23	24	25	26
23	24	25	26	27	28	29	27	28						27	28	29	30	31		
30	31																			
APRIL							MAY							JUNE						
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						1 2	1	2	3	4	5	6	7				1	2	3	4
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30		
JULY							AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
						1 2		1	2	3	4	5	6					1	2	3
3	4	5	6	7	8	9	7	8	9	10	11	12	13	4	5	6	7	8	9	10
10	11	12	13	14	15	16	14	15	16	17	18	19	20	11	12	13	14	15	16	17
17	18	19	20	21	22	23	21	22	23	24	25	26	27	18	19	20	21	22	23	24
24	25	26	27	28	29	30	28	29	30	31				25	26	27	28	29	30	
31																				
OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
						1			1	2	3	4	5					1	2	3
2	3	4	5	6	7	8	6	7	8	9	10	11	12	4	5	6	7	8	9	10
9	10	11	12	13	14	15	13	14	15	16	17	18	19	11	12	13	14	15	16	17
16	17	18	19	20	21	22	20	21	22	23	24	25	26	18	19	20	21	22	23	24
23	24	25	26	27	28	29	27	28	29	30				25	26	27	28	29	30	31
30	31																			

HOLIDAYS & OBSERVANCES

Jan 1 New Year's Day	Apr 18 Easter Monday	Sep 5 Labor Day
Jan 17 Martin Luther King Day	May 8 Mother's Day	Oct 10 Columbus Day
Feb 21 Presidents' Day	May 30 Memorial Day	Nov 11 Veterans Day
Apr 15 Good Friday	Jun 19 Father's Day	Nov 24 Thanksgiving Day
Apr 17 Easter Sunday	Jul 4 Independence Day	Dec 25 Christmas Day

NOTES

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*The Automag Universal
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effective design that
can replace existing
zone valves from other
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Automag Zone Valves
normally open valve
allows gravity
circulation if power fails,
with slow closure to
eliminate water
hammer.

Powered with 24 VAC
Transformer Power Supply, and
available in ¾" or 1" sweat
connection or Press Fittings



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