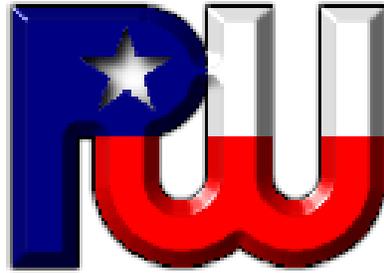


**2006 INTERNATIONAL ENERGY CONSERVATION CODE  
Amendments**

**For the Residential Portions of the Code**



**CITY OF HOUSTON  
PUBLIC WORKS AND ENGINEERING DEPT.**

**Effective Date: January 1, 2009**

Revision Date: September 30, 2009

2006 IECC Amendments, 2<sup>nd</sup> Printing  
Revised to incorporate changes passed by Ordinance 2009-905

# CHAPTER 1

## ADMINISTRATION

**101.1 Title.** This code shall be known as the ~~International~~ City of Houston Residential Energy Conservation Code of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as “this code.”

**101.2 Scope.** This code applies to residential ~~and commercial~~ buildings.

**101.2.1 Phased standards.** Provisions requiring increased energy efficiency shall be phased in as provided in Section 110.

**101.4.2 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, ~~are exempt from~~ shall comply with all of the provisions of this code.

**Exception:** Whenever a provision or provisions would invalidate or jeopardize the historical designation or listing, that provision or provisions may be exempted.

**101.4.5 Mixed occupancy.** Where a building includes both residential and commercial occupancies, each occupancy shall be separately considered and meet the applicable provisions of Chapter 4 for residential and ~~Chapter 5 for~~ the Houston Commercial Energy Conservation Code for commercial.

**101.5 Compliance.** Residential buildings shall meet the provisions of Chapter 4. ~~Commercial buildings shall meet the provisions of Chapter 5.~~

**TABLE 102.1.3(3)**  
**DEFAULT GLAZED FENESTRATION SHGC**

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
<del>0.8</del> .85	0.7	0.7	0.6	0.6

**102.2 Installation.** All materials, systems and equipment shall be installed in accordance with the manufacturer’s installation instructions and the ~~International Building~~ Houston Construction Code.

### **SECTION 108**

### **STOP WORK ORDER**

**108.1 Authority.** Whenever the code official finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the code official is authorized to issue a stop work order.

**108.2 Issuance.** The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

At the time such a stop order is issued, the person doing the work and the permit holder shall be given notice of a right to a hearing on the matter pursuant to Section 109. The notice shall be delivered to persons performing the work if present at the site or otherwise shall be conspicuously posted at the site. Upon request, such a hearing shall be held within three business days unless the permit holder or person who was doing the work requests an extension of time. Any stop order that has been issued shall remain in effect pending any hearing that has been requested unless the stop order is withdrawn by the code official.

**108.3 Unlawful continuance.** Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by law.

## **SECTION 109** **HEARING PROCEDURES**

**109.1 Hearing notice.** Whenever notice is to be given to any person concerning the right to a hearing, the notice may be given by personal delivery or by certified mail, return receipt requested.

If notice is being given to a building owner or to a tenant therein and the code official is unable to determine the name or address of such person after checking the building and the applicable records of the jurisdiction's Public Works and Engineering Department, the County Appraisal District, the electrical utility company, the gas utility company, and the water utility provider, notice shall be mailed to the billing addresses of the building as shown on the records of the electrical company and the gas company and shall be posted on or in view of each entrance to the building. Additionally, if any notice is mailed to a building owner or a building tenant and is returned without delivery, notice shall be effective if posted on or in view of each entrance to the building.

**109.2 Hearings.** Except where otherwise specifically provided, all hearings held pursuant to this code shall be conducted by the jurisdiction's Director of Public Works and Engineering or a representative, who shall hereinafter be referred to as the "hearing official". The director shall not designate any person to be a hearing official under this code who has taken any part in the investigation of the matter that is the subject of the hearing or any person who directly supervised the investigation. The hearing official shall consider only the evidence presented at the hearing in rendering a decision. The decision of the hearing official shall be set forth in writing and shall be served on each party in the same manner as a notice of a right to a hearing.

## **SECTION 110** **PHASED STANDARDS**

**110.1 General.** For any permit application filed on or after October 1, 2009, compliance with additional performance objectives for new construction shall be required to achieve a minimum fifteen percent improvement in efficiency above the minimum provisions of this code.

**110.2 Energy use.** New residences and apartments must use 15 percent less energy as shown by one of the methods indicated in Sections 110.2.1, 110.2.2, or 110.2.3.

**110.2.1 Above Code Programs.** The United States Environmental Protection Agency's ENERGY STAR Program certification of energy code equivalency, or other approved above code program; or

**110.2.2 Software and testing.** Energy code compliance modeling through Texas A&M Energy Systems Laboratory approved software or other approved simulation software program; along with testing of the building thermal envelope for infiltration and the duct system for leakage; or

**110.2.3 Option packages.** Prescriptive option packages approved by Texas A&M Energy Systems Laboratory and listed in Table 110(1) for One and Two Family Structures and Table 110 (2) and 110 (3) or for Multi-Family Structures. Additional option packages that are issued by Texas A&M Energy Systems Laboratory shall be permitted.

**TABLE 110(1)**  
**COMBINED ENERGY SAVINGS FOR ONE AND TWO FAMILY STRUCTURES**  
**WITH NATURAL GAS HEATING**

<u>Groups</u>	<u>Measures</u>	<u>Notes</u>
Group 1	Solar Domestic Hot Water System 64 sq. ft. collector area	<u>1</u>
Group 2	Photovoltaic Array for 6kW	<u>2</u>
Group 3	Photovoltaic Array for Partial Demand at 4kW	<u>3</u>
Group 4	Mechanical Systems within Conditioned Spaces 50% Energy Star CFL Indoor Lamps	<u>5</u> <u>6</u>
Group 5	Photovoltaic Array for Partial Demand at 2kW Decreased Duct Leakage (maximum 10%)	<u>4</u> <u>8</u>
Group 6	50% Energy Star CFL Indoor Lamps Tankless water heater (minimum .748 Energy Factor) Decreased Infiltration (maximum .35 ACHn)	<u>6</u> <u>9</u> <u>10</u>
Group 7	50% Energy Star CFL Indoor Lamps Decreased Duct Leakage (maximum 10%) Improved SEER (minimum 15)	<u>6</u> <u>8</u> <u>11</u>
Group 8	Decreased Duct Leakage (maximum 10%) Improved SEER (minimum 15) Decreased SHGC (maximum .35) & U-Value (maximum .35) Decreased Infiltration (maximum .35 ACHn)	<u>8</u> <u>11</u> <u>12</u> <u>10</u>
Group 9	Decreased Duct Leakage (maximum 6%) Decreased SHGC (maximum .35) & U-Value (maximum .35) Window Shading and Redistribution (minimum S= 45%)	<u>8</u> <u>12</u> <u>14</u>
Group 10	Improved Furnace Efficiency (minimum .93 AFUE) Decreased Infiltration (maximum .35 ACHn) Decreased Duct Leakage (maximum 10%) Improved SEER (minimum 15)	<u>15</u> <u>10</u> <u>8</u> <u>11</u>

**TABLE 110(2)**  
**COMBINED ENERGY SAVINGS FOR MULTI-FAMILY STRUCTURES**  
**WITH NATURAL GAS HEATING**

<u>Groups</u>	<u>Measures</u>	<u>Notes</u>
Group 1	Solar Domestic Hot Water System (21 sq. ft. collector area/unit)	<u>1</u>
Group 2	Photovoltaic Array for 2kW/unit	<u>4</u>
Group 3	50% Energy Star CFL Indoor Lamps Tankless water heater (minimum .748 Energy Factor) Decreased Infiltration (maximum .35 ACHn)	<u>6</u> <u>9</u> <u>10</u>
Group 4	Tankless water heater (minimum .748 Energy Factor) Decreased Duct Leakage (maximum 10%) <i>Upper Floor Only</i> Improved SEER (minimum 14)	<u>9</u> <u>8</u> <u>11</u>
Group 5	Mechanical Systems within Conditioned Spaces <i>Upper Floor Only</i> Decreased Infiltration (maximum .35 ACHn) Improved SEER (minimum 14) Improved Furnace Efficiency (minimum .93 AFUE) 50% Energy Star CFL Indoor Lamps	<u>5</u> <u>10</u> <u>11</u> <u>15</u> <u>6</u>
Group 6	Tankless water heater (minimum .748 Energy Factor) Decreased Duct Leakage (maximum 10%) <i>Upper Floor Only</i> 50% Energy Star CFL Indoor Lamps Decreased SHGC (Maximum .35) & U-Value (Maximum .35)	<u>9</u> <u>8</u> <u>6</u> <u>12</u>

**TABLE 110(3)**  
**COMBINED ENERGY SAVINGS FOR MULTI-FAMILY STRUCTURES**  
**WITH ELECTRIC RESISTANCE HEATING**

<u>Groups</u>	<u>Measures</u>	<u>Notes</u>
Group 1	PV Array for Partial Demand at 2kW/unit	4
Group 2	Solar DHW System (21 sq. ft. collector area/unit)	1
Group 3	50% Energy Star CFL Indoor Lamps	6
	Mechanical in Conditioned Space	5
	Improved SEER (minimum 14)	11
	Decreased SHGC (maximum .35) and U-Value (0.35 maximum)	12
	Decreased Infiltration (maximum .35 ACHn)	10
Group 4	Tankless water heater (minimum .748 Energy Factor)	9
	Decreased Duct Leakage (maximum 6%) Upper Floor Only	8
	Improved SEER (minimum 14)	11
	Reduced Infiltration (maximum .35 ACHn)	10
	25% Energy Star CFL Indoor Lamps	7
	Decreased SHGC (maximum .35) and U-Value (0.35 maximum)	12
Group 5	50% Energy Star CFL Indoor Lamps	6
	Decreased Duct Leakage (maximum 10%)	8
	Improved SEER (minimum 14)	11
	Decreased SHGC (maximum .35) and U-Value (0.35 maximum)	12
	Reduced Infiltration (maximum .35 ACHn)	10

**Notes:**

1. Solar Domestic Hot Water System: Storage tank type DHW heater with 64 square feet collector area for single-family homes and 21 square feet collector per unit area for multifamily structures.
2. Photovoltaic Array for 6kW: Installed according to DC Standard Test Criteria standard and manufacturer's instructions.
3. Photovoltaic Array for Partial Demand at 4kW per single family home or per unit for multi-family: Installed according to DC Standard Test Criteria standard and manufacturer's instructions.
4. Photovoltaic Array for Partial Demand at 2kW per single family home or per unit for multi-family: Installed according to DC Standard Test Criteria standard and manufacturer's instructions.
5. Mechanical Systems within Conditioned Spaces (upper floor only in multifamily): Ducts in ventilated attic moved to location within the thermal envelope of conditioned space including unventilated attic space.
6. 50% Energy Star CFL Indoor Lamps: Permanent Compact Florescent fixtures excluding closets.
7. 25% Energy Star CFL Indoor Lamps: Permanent Compact Florescent fixtures excluding closets.
8. Decreased Duct Leakage (maximum 10%), except Table 110(1) Group 9 and Table 110(3) Group 4 (maximum 6%) : Ducts tested with leakage to outside the building envelope.
9. Tankless water heater (minimum .748 Energy Factor for Electric/Gas house): Manufacturer's rating.
10. Decreased Infiltration (minimum .35 ACHn): Base case formula for ACHn is Normalized Leakage 0.57 x Weather Factor 0.8.

11. Improved SEER: (minimum 15 for Single Family homes and minimum 14 for multi-family units): *Manufacturer's nominal rating.*
12. Decreased SHGC (maximum .35) & U-factor (maximum .35): *NFRC 100 and 200.*
13. *RESERVED.*
14. Window Shading and Redistribution: *Maximum total window area of 18% window to floor ratio. Window orientation with 1.5 ft overhang (Projection Factor=.25) on all sides. A minimum of 45% of the total window area shall be on the south.*
15. Improved Furnace Efficiency (Minimum .93 AFUE): *Manufacturer's nominal rating.*

**110.3 Testing.** When required by Section 110.2.2 testing shall be performed according to Sections 110.3.1 and 110.3.2. Batch testing shall be permitted as approved by the Code Official.

**110.3.1 Testing of the Building Thermal Envelope for Infiltration.** Leakage of the building thermal envelope shall not exceed .35 Air Changes per Hour (ACHn) as measured by the blower door test. The testing procedure shall be based on ASTM E779, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization, ASHRAE 119 Air Leakage Performance for Detached Single Family Residential Buildings or ANSI/ASHRAE 136, A Method of Determining Air Change Rates in Detached Dwellings.

Testing shall be performed by an independent third-party technician approved by the building official. Documentation verifying thermal envelope air leakage equal to or less than .35 ACHn shall be submitted with the final mechanical code compliance package on the jobsite and include the following information:

- a. Address of residence
- b. Name and company of technician performing testing
- c. Date of final test
- d. Test results as percentage ACHn

**110.3.2 Testing of Duct Systems for Leakage.** Leakage of supply ducts and return plenum/ducts shall not exceed 10% of total design airflow. The testing procedure shall be based on ASTM E1554, Standard Test Methods for Determining External Air Leakage of Air Distribution Systems by Fan Pressurization, ASHRAE 111 Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems, ASHRAE 152, Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems, or a generally accepted equivalent method.

Testing shall be performed by an independent third-party technician approved by the building official. Documentation verifying duct leakage of less than 10% shall be submitted with the final mechanical code compliance package on the jobsite. Documentation shall include the following:

- a. Address of residence
- b. Date of final test
- c. Name and company of technician performing duct testing
- d. Type of test performed (duct pressurization method or blower door subtraction method)
- e. Test results in percentage of airflow CFM

## CHAPTER 2 DEFINITIONS

**201.3 Terms defined in other codes.** Terms that are not defined in this code but are defined in any volume of the International Building Code, ICC Electrical Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, International Plumbing Code, or the International Residential Code City of Houston Construction Code shall have the meanings ascribed to them in those codes

**201.5 International code reference.** When one of the International Codes is referenced in this document, the reference shall be construed to mean the corresponding City of Houston adopted code.

### SECTION 202\* GENERAL DEFINITIONS

**CODE OFFICIAL.** The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

**ABOVE GRADEWALL.** A wall more than 50 percent above grade and enclosing conditioned space and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and skylight shafts.

**DUCT.** ~~A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.~~ Any tube or conduit for transmission of air. This definition shall not include:

1. A vent, a vent connector or a chimney connector.
2. Any tube or conduit wherein the pressure of the air exceeds one (1) pound per square inch.
3. The air passages of listed self-contained systems.

**DUCT SYSTEM.** ~~A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air handling equipment and appliances.~~ All ducts, duct fittings, plenums and fans assembled to form a continuous passageway for the distribution of air.

**ENERGY SYSTEMS LABORATORY.** The Texas A & M Energy Systems Laboratory as referenced and defined in Chapter 388 of the Texas Health and Safety Code for the oversight of municipal energy codes.

**GLAZING AREA.** Total area of the glazed fenestration measured using the rough opening and including sash, curbing or other framing elements that enclose conditioned space. Glazing area includes the area of glazed fenestration assemblies in walls bounding conditioned basements. For doors where the daylight opening area is less than 50 percent of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the rough opening for the door including the door and frame.

**JURISDICTION.** The City of Houston, Texas.

\*NOTE: ALL OTHER PORTIONS OF SECTION 202 REMAIN AS SET FORTH IN THE 2006 INTERNATIONAL ENERGY CONSERVATION CODE.

## CHAPTER 3 CLIMATE ZONES

**301.1 General.** Climate zones from Figure 301.1 or Table 301.1 shall be used in determining the applicable requirements from Chapters 4 and 5. Locations not in Table 301.1 (outside the US) shall be assigned a climate zone based on Section 301.3. The climate zone designation for the jurisdiction is Zone 2.

**301.2 Warm humid counties.** Warm humid counties are listed in Table 301.2. The jurisdiction shall be considered warm-humid for the purposes of this code.

**302.2 Exterior Design Conditions.** When using the total building performance ~~Exterior design conditions shall be used in~~ compliance method, the criteria shall be as set forth in Table 302.2.

**TABLE 302.2  
EXTERIOR DESIGN CONDITIONS**

<b>CONDITION</b>	<b>VALUE</b>
<u>Winter, Design Dry-bulb (<math>E_f</math>)</u>	<u>28 F</u>
<u>Summer, Design Dry-bulb</u>	<u>96 F</u>
<u>Summer, Design Wet-bulb</u>	<u>80 F</u>
<u>Degree days heating</u>	<u>1365</u>
<u>Degree days cooling</u>	<u>3058</u>
<u>Climate Zone</u>	<u>2</u>

## CHAPTER 4 RESIDENTIAL ENERGY EFFICIENCY

**402.1.1 Insulation and fenestration criteria.** The building thermal envelopes shall meet the requirements of either Table 402.1.1(1) when the total percentage of glazing is less than or equal to 18% of the conditioned floor area or Table 402.1.1 (2) for window to wall area ratios based on the climate zone specified in Chapter 3.

When compliance using Table 402.1.1 is demonstrated with a ceiling R-value of R30 or less, no more than 33% of the total projected ceiling area may be of cathedral type construction (ceiling joist/roof rafter assembly) and the required insulation R-value may be reduced to a minimum of R22 insulation when the remaining ceiling area insulation is increased to R38.

**TABLE 402.1.1(1)  
 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT (BASED ON  
 WINDOW TO SQUARE FOOTAGE RATIO)<sup>a</sup>**

\*NOTE: NO OTHER CHANGE TO ABOVE TABLE.

**TABLE 402.1.1(2)  
 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT (BASED ON  
 WINDOW TO WALL RATIO)<sup>a</sup>**

Maximum Window to Wall Area Ratio	Fenestration U-Factor	Skylight U-Factor <sup>b</sup>	Glazed Fenestration SHGC	Ceiling R-Value <sup>c</sup>	Wood Frame Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value & Depth <sup>d</sup>	Crawl Space Wall R-Value
15	0.65	0.65	0.40	30	13	11	5	0	6
20	0.55	0.55	0.40	30	13	11	6	0	6
25	0.51	0.51	0.35	30	13	19	8	0	10
30	0.46	0.46	0.35	38	16	19	8	0	10

For SI: 1 foot = 304.8 mm.

- a. R-values are minimums. U-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 x 6 cavity.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies glazed fenestration.
- c. If a roof radiant barrier with an emittance of 0.05 or less as tested in accordance with ASTM C-1371 or ASTM E-408 is used, then the roof/ceiling minimum insulation value shall be R-19.
- d. R-5 shall be added to the required slab edge R-values for heated slabs.

~~**402.2.7 Reserved.** Slab on grade floors. Slab on grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table 402.1.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table 402.1.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Slab edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.~~

**402.4.1 Building thermal envelope.** The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be ~~caulked~~, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams and penetrations.

2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Other sources of infiltration.

**403.2.1 Insulation.** Supply and return ducts shall be insulated in accordance with Table 403.2.1. ~~to a minimum of R-8. Ducts in floor trusses shall be insulated to a minimum of R-6.~~

**Exception:** ~~Ducts or portions thereof located completely inside the building thermal envelope.~~

**TABLE 403.2.1 INSULATION OF DUCTS<sup>a, b, c</sup>**

<u>Duct Location</u>	<u>Insulation Types Mechanically Cooled and Outside Air</u>	<u>Insulation Types Heating Only</u>
1. On roof or exterior of building	R-8, V, W	R-8,W
2. Attics, garages, inside walls, floor-ceiling spaces and crawl spaces (located inside the building thermal envelope)	R-5,V	R-5
3. Attics, garages, outside walls, and crawl spaces (located outside the building thermal envelope)	R-8,V	R-8 W

1. ~~When the temperature difference between the interior and the exterior of the duct does not exceed 15°F (8°C) duct insulation is not required.~~
2. ~~Where ducts are used for both heating and cooling, the insulation requirements shall comply with the most restrictive condition.~~
3. ~~Exposed ductwork inside conditioned spaces need not be insulated.~~

**NOTES:**

- V. Vapor retarders: Material with a perm rating not exceeding 0.5 perm (29 ng/Pa•s•m<sup>2</sup>). Vapor retarders shall be installed on cooling supply ducts in spaces vented to the outside in geographic areas where the summer dew point temperature exceeds 60°F (16°C) at the 2 ½ percent summer design dry-bulb with mean coincident wet-bulb temperature. All joints to be sealed.
- W. ~~Approved weatherproof barrier.~~

**403.3 Mechanical system piping insulation.** Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated ~~to a minimum of R-2~~ in accordance with Table 403.3.

**TABLE 403.3  
 MINIMUM PIPE INSULATION  
 (thickness in inches)**

<u>PIPING SYSTEM TYPES</u>	<u>FLUID TEMPERATURE RANGE, °F</u>	<u>Pipe Sizes<sup>a, b</sup></u>					
		<u>Runouts up to 2"<sup>b</sup></u>	<u>1 and less</u>	<u>1.25" to 2"</u>	<u>2.5" to 4"</u>	<u>5" to 6"</u>	<u>8" and larger</u>
<b><u>HEATING SYSTEMS</u></b>							
<u>Steam and hot water:</u>							
<u>High pressure/temperature</u>	306-450	1 ½	2 ½	2 ½	3	3 ½	3 ½

Medium pressure/temperature	251-305	1 1/2	2	2 1/2	2 1/2	3	3
Low pressure/temperature	201-250	1	1 1/2	1 1/2	2	2	2
Low temperature	106-200	1/2	1	1	1 1/2	1 1/2	1 1/2
Steam condensate (for feed water)	Any	1	1	1 1/2	2	2	2
<b>COOLING SYSTEMS</b>							
Chilled water, refrigerant and brine:	40-55	1/2-3/4	1/2-3/4	3/4	1	1	1
	Below 40	1	1	1 1/2	1 1/2	1 1/2	1 1/2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F)-32]/1.8.

- a. Inside pipe diameter.
- b. Run outs not exceeding 12 feet in length to individual terminal units.

**403.4 Circulating hot water systems.** All circulating service hot water piping shall be insulated in accordance with Table 403.4 to at least R-2. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

**TABLE 403.4  
HOT WATER PIPING INSULATION**

SERVICE WATER- HEATING TEMPERATURES (°F)	PIPE SIZES <sup>a</sup>			
	Non-circulating run outs	Circulating mains and run outs		
	Up to 1"	Up to 1.25"	1.5" to 2"	Over 2"
170-180	0.5	1	1.5	2
140-169	0.5	0.5	1	1.5
100-139	0.5	0.5	0.5	1

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8

1 Btu/h/inch \* ft<sup>2</sup> \* °F = 0.144 W/(m \* K)

- a. Nominal iron pipe size and insulation thickness. Conductivity, k= 0.27

**403.6 Equipment sizing.** Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code* industry accepted engineering practices.

**404.6.1 Minimum capabilities.** Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

1. Computer generation of the standard reference design using only the input for the proposed design. The calculation procedure shall not allow the user to directly modify the building component characteristics of the standard reference design.
2. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence in accordance with Section M1401.3 of the *International Residential Code* industry accepted engineering practices.
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air conditioning equipment based on climate and equipment sizing.
4. Printed code official inspection checklist listing each of the proposed design component characteristics from Table 404.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g. R-Value, U-Factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

**404.6.2 Specific approval.** Performance analysis tools meeting the applicable sections of 404 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or



## **CHAPTER 5 RESERVED\***

\*NOTE: DELETE THIS CHAPTER IN ITS ENTIRETY AND RESERVE.

## CHAPTER 6

# REFERENCED STANDARDS

<b>ASHRAE</b>	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329-2305	Referenced in code section number
Standard Reference Number	Title	
119-88 (RA <del>1994</del> <u>2004</u> )	Air Leakage Performance for Detached Single-family Residential Buildings .....	110.3.1, Table 404.5.2(1)
146-1998	Testing and Rating Pool Heaters .....	Table 504.2
152-2004 (RA <u>2004</u> )	<u>Method of Test for Determining the Design and Seasonal efficiencies of Residential Thermal Distribution Systems .....</u>	<u>110.3.2</u>
13256-1 (2004)	Water-source Heat Pumps – Testing and Rating for Performance – Part 1: Water-to-air and Brine-to-air Heat Pumps (ANSI/ASHRAE/IESNA 90.1-2004) .....	Table 503.2.3(2)
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ASHRAE 111—08	<u>Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems .....</u>	<u>110.3.2</u>