Code: IECC –12/13

Code Sections/Tables/Figures Proposed for Revision (3.3.2);

R403.4.2

Proponent: Edward R. Osann, on behalf of Natural Resources Defense Council; Ryan Meres, on behalf of Institute for Market Transformation.

Revise the heading of section R403.4.2 as follows:

R403.4.2 Hot water pipe insulation (~~Prescriptive~~Mandatory).

Reason:

The 2012 edition of the IECC added this prescriptive section on hot water pipe insulation, containing a list of 9 factors or locations that require pipe to be insulated to R-3. However, because it is prescriptive and not mandatory, it is not required in any project that opts for the performance approach. Unfortunately, while the 2012 IECC performance approach allows credit for improving the efficiency of the hot water heat source, no credit is available for features of the hot water distribution system that might actually reduce the amount of hot water used, such as those listed in R403.4.2. (The HERS rating system is similarly drawn, offering no credit for hot water pipe insulation.) Thus, although hot water pipe insulation is known to save significant amounts of energy over the life of the building, the energy savings cannot be “scored” or accumulated within the performance framework of the code. Section R403.4.2 cannot contribute to compliance under the IECC performance approach, and is thus likely to be ignored. For these energy savings to be realized in all new residential buildings covered by the IECC, R403.4.2 should be mandatory instead of prescriptive. If and when Section R405 is modified to ensure that the performance path will account for the energy attributes of the hot water distribution system, consideration can be given to removing the mandatory designation from some or all portions of R403.4.2.

As was noted by the original proponents of Section R403.4.2, insulation of hot water piping reduces the waste of energy, water, and time during the delivery, use, and cool-down phases of a hot water event. During the delivery phase, when the piping runs in unconditioned spaces, in a slab, when it is buried or when the flow rate is very low (less than 1 gpm), pipe insulation significantly reduces the heat loss and helps to ensure that hot enough water gets to the outlets. During the cool-down phase, pipe insulation increases the time it takes for the temperature of the water to cool down, roughly doubling the cool-down time for ½ inch nominal pipe and tripling it for ¾ inch nominal pipe. This saves energy, water and time for all those hot water events that are clustered between 10 and 45 minutes apart, as when occupants are getting ready for work and school in the morning and during evening activities such as preparing and cleaning up from supper and getting ready for bed, as well as lunchtime when people are home during the day.

As hot water is being used, pipe insulation keeps the water hotter by reducing the temperature drop from the source of hot water to the outlet. This saves additional energy by making it possible to reduce the set point for storage temperature at the hot water heater. Every 1°F reduction in hot water storage temperature reduces standby heat losses by almost 2%.

Cost Impact:

This code change proposal will not increase the cost of construction for builders following the prescriptive approach, i.e., the majority of all builders. For those following the performance path, pipe insulation will be an added cost. A recent estimate[1] of the cost of insulating hot water piping with R-3 foam insulation is $1.10 to $1.50 per linear foot, including labor, materials, and profit for the plumbing subcontractor. The cost of insulating all hot water piping in a 2400 ft^2 home was estimated by the same study to be $135 to $325, depending on building configuration. It should be noted that these estimates are based on insulation of *all* hot water piping in the home, which is more than is required by Section R403.4.2. Thus the actual impact on the cost of construction should be somewhat less than this range in most cases.

[1] Klein, Gary, “Cost Estimation for Materials and Installation of Hot Water Piping Insulation,” prepared for Pacific Northwest National Laboratory, June 2012, accessible at <http://bc3.pnnl.gov/wiki/index.php/Downloads>.

Public Hearing: Committee:	AS	AM	D	
	Assembly:	ASF	AMF	DF

RE_____-13
R403.4.2

Proponent: Edward R. Osann, Natural Resources Defense Council, on behalf of self (eosann@nrdc.org)

Revise as follows:

R403.4.2 Hot water pipe insulation (Prescriptive). Insulation for hot water pipe with a minimum thermal resistance (*R*-value) of R-3 shall be applied to the following:

1. Piping larger than $^3/_4$ inch nominal diameter.
2. Piping serving more than one dwelling unit.
3. Piping from the water heater to kitchen outlets.
4. In occupancies with three or more bedrooms, piping from the water heater or recirculation system piping to the outlet for any shower or tub/shower combination.

~~4~~5. Piping located outside the conditioned space.
~~5~~6. Piping from the water heater to a distribution manifold.
~~6~~7. Piping located under a floor slab.
~~7~~8. Buried piping.
~~8~~9. Supply and return piping in recirculation systems other than demand recirculation systems.
~~9~~10. Piping with run lengths greater than the maximum run lengths for the nominal pipe diameter given in Table R403.4.2.

All remaining piping shall be insulated to at least R-3 or meet the run length requirements of Table R403.4.2.

Reason: Every adult in the United States has experienced the waiting time for water that is hot enough to step into the shower. Most do so on a regular basis, and often for a minute or more. While cold or tepid water in the initial draw from a hot water outlet serving a clothes washer, dishwasher, or lavatory sink may be usable for its intended purpose, cold or tepid water for showering is routinely purged, a waste of water, energy, and time. Pipe insulation significantly reduces heat loss and helps to ensure that hot water gets to the shower sooner. During showering, pipe insulation keeps the water hotter by reducing the temperature drop from the source of hot water to the shower outlet. This saves significant energy by making it possible to reduce the set point for the storage temperature at the hot water heater. Every 1°F reduction in hot water storage temperature reduces standby heat losses by almost 2%. During the cool-down phase, pipe insulation increases the time it takes for the temperature of the water to cool down, roughly doubling the cool-down time for ½ inch nominal pipe and tripling it for ¾ inch nominal pipe. This saves energy, water, and time for all those hot water events, including showers, that are clustered between 10 and 45 minutes apart, as when occupants are getting ready for work and school in the AM.

Cost Impact: This code change proposal will increase the cost of construction only to the extent that all or a portion of the pipe run to a shower would not already require insulation under the existing requirements of Section R403.4.2. For example, under the current language of this section, hot water pipe running in an unconditioned crawl space or attic is required to be insulated. Pipe running from a water heater to a distribution manifold is also required to be insulated, while up to 20 feet of ½ inch supply piping from a manifold to an end use such as a shower may be uninsulated. At an estimated cost of materials, labor, and profit of $1.10 to $1.50 per linear foot for installing foam insulation[2], the cost of insulating 20 feet of ½ inch supply piping would be $22 to $30.

[1] Klein, Gary, "Cost Estimation for Materials and Installation of Hot Water Piping Insulation," prepared for Pacific Northwest National Laboratory, June 2012, accessible at <http://bc3.pnnl.gov/wiki/index.php/Downloads>.

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Public Hearing: Committee:	AS	AM	D	
	Assembly:	ASF	AMF	DF

Code: <u>IECC</u> –12/13

Code Sections/Tables/Figures Proposed for Revision (3.3.2);

TABLE R403.4.2

Proponent: Edward R. Osann, Natural Resources Defense Council, on behalf of self.

Revise the TABLE R403.4.2 as follows:

TABLE R403.4.2 MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (inch)	3/8	1/2	3/4	~~≥ 3/4~~
Maximum Run Length	30	20	10	~~5~~

For SI: 1 inch = 25.4 mm, 1 foot 304.8 mm.

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

Reason:

Section R403.4.2 is intended to save energy, water, and time for future occupants by requiring domestic hot water piping to be insulated where savings are likely to be greatest. The text of Section R403.4.2 currently provides that *all* hot water piping larger than ¾ inch diameter must be insulated:

> "Insulation for hot water pipe with a minimum thermal resistance (*R*-value) of R-3 shall be applied to the following:
> 1. Piping larger than 3/4 inch nominal diameter.
>
> * * * * *
>
> 9. Piping with run lengths greater than the maximum run lengths for the nominal pipe diameter given in Table R403.4.2.
>
> All remaining piping shall be insulated to at least R-3 or meet the run length requirements of Table R403.4.2."

Table R403.4.2 is intended to identify lengths of pipe of various nominal diameters that may remain uninsulated when running from a distribution manifold or recirculation loop to a point of use. Although Table R403.4.2 is not set out as an exception to the text of this section, the last column of the table can be read to allow for pipe greater than ¾ inch to be uninsulated if it is part of a run of up to 5 feet from a manifold or recirculation loop. The last column of the table is at best ambiguous, at worst contradictory. This proposal will resolve this ambiguity by removing pipe greater than ¾ inch from the table, reaffirming that all hot water pipe of this dimension must be insulated as per item (1) of Section R403.4.2.

Cost Impact:

This code change proposal will not increase the cost of construction, except where the current language may be interpreted to allow for certain hot water pipe runs of up to 5 feet to remain uninsulated. At an estimated cost of materials, labor, and profit of $1.10 to $1.50 per linear foot of foam insulation installed, the additional cost for each such run would be in the range of five to seven dollars.

Public Hearing: Committee:	AS	AM	D	
	Assembly: ASF	AMF	DF	

Code: IECC –12/13

Code Sections/Tables/Figures Proposed for Revision (3.3.2);

TABLE R403.4.2

Proponent: Edward R. Osann, Natural Resources Defense Council, on behalf of self.

Revise the TABLE R403.4.2 as follows:

TABLE R403.4.2 MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (inch)	$^{3}/_{8}$	$^{1}/_{2}$	$^{5}/_{8}$	$^{3}/_{4}$	> $^{3}/_{4}$
Maximum Run Length	30	20	15	10	5

For SI: 1 inch = 25.4 mm, 1 foot 304.8 mm.

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

Reason:

This proposal adds ⅝ inch pipe to Table R403.4.2 to encourage plumbing system designers and installers to consider opportunities to use ⅝ inch pipe in hot water applications where the capacity provided by $^{1}/_{2}$ inch pipe is inadequate but $^{3}/_{4}$ inch pipe may not be necessary. The maximum uninsulated run length proposed is proportional to the length limits currently in the table for $^{1}/_{2}$ inch and $^{3}/_{4}$ inch pipe. Where system configurations allow ⅝ inch pipe to be used in lieu of ¾ inch pipe, both energy and water will be saved by reducing the volume of water standing in the pipe subject to cool-down between draws.

Cost Impact:

This code change proposal provides a design option and will not increase the cost of construction.

Public Hearing: Committee: AS AM D

Assembly: ASF AMF DF

RE___-13

R403.4 (IRC N1103.4). R403.4.3 (New) (IRC N1103.4.3 (New)), Table R403.4.3 (New) (IRC Table N1103.4.3 (New))

Proponent: Edward R. Osann, Natural Resources Defense Council, on behalf of self. (eosann@nrdc.org)

Revise as follows:

R403.4 (N1103.4) Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.4.1, ~~and~~ R403.4.2 and R403.4.3.

R403.4.3 (N1103.4.3) Hot water pipe volume (Mandatory). In a service hot water distribution system, the volume in the piping between the end of a hot water fixture supply and the piping connection to a hot water source shall not exceed 0.5 gallon (1.9 liters). The hot water source shall be a recirculating system pipe, a heat-traced pipe or a water heater. The volume in the piping shall be calculated using the values in Table R403.4.3.

TABLE R403.4.3 (N1103.4.3)
INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION PIPING

Underlining in table is omitted for clarity

	LIQUID OUNCES OF WATER PER FOOT LENGTH OF HOT WATER TUBING							
Nominal Size (Inches)	**Copper Type M**	**Copper Type L**	**Copper Type K**	**CPVC CTS SDR 11**	**CPVC SCH 40**	**PEX-AL-PEX ASTM F 1281**	**PE-AL-PE**	**PEX CTS SDR 9**
⅜	1.06	0.97	0.84	N/A	1.17	0.63	0.63	0.64
½	1.69	1.55	1.45	1.25	1.89	1.31	1.31	1.18
⅝	2.49	2.31	2.22	N/A	N/A	2.12	2.12	1.72
¾	3.43	3.22	2.90	2.67	3.38	3.39	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	5.56	5.56	3.91
1¼	8.70	8.36	8.09	6.61	9.66	8.49	8.49	5.81
1½	12.18	11.83	11.45	9.22	13.20	13.88	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	21.48	21.48	13.86

For SI: 1 inch = 25.4 mm, 1 liquid ounce = 0.0296 liters, 1.0 ounce = 0.00781 gallons,
0.5 gallon (1.9 liters) = 64.0 liquid ounces

Reason: Cold or tepid water in the initial draw from a hot water outlet is often unusable for its intended purpose, and is frequently purged, resulting in a waste of water, energy, and time for building occupants. Pipe insulation significantly reduces heat loss and helps to ensure that hot water gets to the shower sooner. However, a complementary strategy is to reduce the volume of water contained in the hot water distribution system in the first place.

This proposal, which is comparable to the criteria adopted by the US EPA WaterSense for New Homes specification in 2009, establishes a maximum volume of 0.5 gallons for water in a hot water supply line, based on internal volumes specific to the piping material. By allowing the volume limitation to be computed from runs from recirculation loops, this provision allows designers additional flexibility while effectively limiting the amount of water to be purged to ½ gallon per draw.

The proposal designates this provision as mandatory. The reason for this is that while the 2012 IECC performance approach allows credit for improving the efficiency of the hot water heat source, no credit is available for features of the hot water distribution system that might actually reduce the amount of hot water used, such as a limitation on hot water supply pipe volume Thus, even though this design criterion will save significant amounts of energy over the life of the building, its energy savings cannot be “scored” or accumulated within the performance framework of the code. If designated “prescriptive”, it is likely to be ignored by builders using the performance path since it cannot contribute to compliance under the IECC performance approach. Thus, “mandatory” is the better approach at this time. If and when Section R405 is modified to ensure that the performance path will account for the energy attributes of the hot water distribution system, consideration can be given to removing the mandatory designation from this proposed section.

Cost Impact: This code change proposal is a design requirement that will not increase the cost of construction.

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Public Hearing:	Committee:	AS	AM	D	
		Assembly:	ASF	AMF	DF

RE___-13
R403.9.3 (New)

Proponent: Edward R. Osann, Natural Resources Defense Council, on behalf of self. (eosann@nrdc.org)

Add new text as follows:

R403.9.3.1 Mechanical retraction mechanism required. Vapor retardant pool covers having a dry weight of 40 lbs (18.1 kg) or more for heated pools associated with one- or two-family homes shall be provided with a mechanical retraction mechanism. The mechanism shall be designed for the cover material, the cover weight and the dimensions of the cover.

Reason: Pool covers serve to retain heat in heated pool systems and reduce water loss due to evaporation – but only when used. Swimming pools at single-family residences are frequently not professionally managed or maintained, and such pools are most likely to go for several consecutive days without use. These characteristics support the use and value of a pool cover. However, the frequent deployment and retraction of a large pool cover by an individual swimmer in a single-family setting is problematic, contributing to widespread disuse of this valuable energy- and water-saving feature.

This proposal would require a pool cover to come with a means for mechanical retraction if it weighs 40 pounds or more. While the most common type of floating cover material is relatively light (0.1 lb per ft^2), the weight of a cover for a moderately sized back yard pool (18’ X 36’) can surpass 60 lbs. and be unwieldy for an individual to handle. The proposal is not specific as to the means or design of the device for mechanical retraction, and does *not* require a permanently affixed automatic retraction system. A hand operated device of suitable size would meet the requirements of this proposal.

Cost Impact: Hand operated mechanical equipment for the retraction of pool covers are marketed at around $200, and are available from several manufacturers. At least 5 manufacturers provide automatic pool cover equipment.

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Public Hearing: Committee:	AS	AM	D	
	Assembly:	ASF	AMF	DF