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Drain water heat recovery - Domestic Hot Water Measures

Additional submitted attachment is included below.

Docket 17-BSTD-01
2019 Residential Standards

Subject: Drain water heat recovery
Submitted by: David Velan, CEO, Ecodrain Inc. A manufacturer of drain water heat recovery systems (www.ecodrain.com).

Public Comments for California Energy Commission Staff Workshop High Performance Envelope and Domestic Hot Water Measures for the 2019 Residential Standards.

We would like to start by thanking the representatives of the California Energy Commission for allowing us to share our comments during the workshop and for meeting with us afterwards to address the comments in greater detail. We appreciate the work that has been done and the efforts to recognize drain water heat recovery in the 2019 Title 24 standards.

1. I want to clarify a key point in the testimony I provided at the workshop on June 1, 2017. EcoDrain wants to see drain water heat recovery (DWHR) devices included in the 2019 Title 24 standards. Our objection was that only vertical units were included in the original proposal. We want Title 24 to enable the use of DWHR installed at any slope.
2. The main issue that was cited to exclude sloped units was the lack of an official test procedure to rate the performance of sloped units. It is important that the everyone at the Commission understands that CSA B55.1 is a procedure for heat exchanger bench tests that provides a set of rules for how to test a heat exchanger so that different heat exchangers can be tested in the same way. CSA B55.1 does not provide any other information about these systems. It is not an endorsement of vertical systems. It is only a set of rules for how to conduct a performance test. A representative of IAPMO stated during the March 2017 CASE Stakeholder meeting, that IAPMO and other organizations could use the same CSA B55.1 test procedure to test heat exchangers at different slopes in order to rate their performance. The CASE Team said that they would follow up with IAPMO to learn more about how this could work, but to the best of my knowledge, never did.
3. On May 15, 2017, we received an email on behalf of the CASE Team that rejected using CSA B55.1 to test at other slopes. Although we still believe that rating the units using CSA B55.1 is a viable solution, we decided along with IAPMO to draft a new standard IAPMO IGC-346 for heat exchanger testing in order to move the process forward.
4. IAPMO IGC-346 references CSA B55.1, requiring the same testing conditions, but allowing for testing at different slopes. As CSA B55.1 is only a set of rules, IAPMO

IGC-346 is the same set of rules, except that it allows for testing at any slope from the minimum allowed in the code up to vertical.

5. IGC-346 will be presented at the next IAPMO standards review committee meeting on June 12, 2017. After that meeting, the standard will be open for public review and comment for 20 days. Depending on the extent of any comments, the standard will be published either in early July or August. At the CEC Staff Workshop, it was stated by a representative of PG&E that provided the IGC-346 is published before July 14th, it can be included in the CASE Report.
6. One issue that I want to address is the potential of clogging in DWHR devices. The plumbing code already has provisions to deal with drainage pipe systems that clog. First, the code specifies a minimum slope so that the drainage system is self-draining. No DWHR should ever be installed at a slope less than what is allowed by code. Second, while clogs often occur in the P-trap (installed before a DWHR) even large diameter round pipe with no heat exchanger on it can suffer from things getting stuck in the pipe and causing a backup in the plumbing. The plumbing code requires clean-outs so that it is possible to clear such clogs. These provisions apply to DWHR installed at any slope. Third, IAPMO PS-92 has a clogging test. Fourth, in order for a sloped DWHR to be installed in California, it must not only pass all of the tests and meet all the rules within the IAPMO product standard PS-92, but must also meet all of the rules within the plumbing code. IAPMO's process requires that its product certification committee, comprising of working plumbing inspectors from across North America, and who are not employed or remunerated by IAPMO, review all products and determine whether they meet the rules of the plumbing code in addition to the product standard prior to giving the product a listing. We have attached an example of the Uniform Plumbing Code listing issued by IAPMO.
7. We recommend the following changes to the draft T-24 language presented in the CASE Report.

SUBCHAPTER 8 LOW-RISE RESIDENTIAL BUILDINGS – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

SECTION 150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS
(c) Prescriptive Standards/Component Package.

8. A. ii.b. ~~All domestic hot water piping shall be insulated and field verified as specified in the Reference Appendix RA4.4.1, RA4.4.3 and RA4.4. 14 In multiple story dwellings, a~~ A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9 and that is compliant with the eligibility criteria in RA4.4.21. It shall have a minimum ~~CSA~~ rated effectiveness of 42 percent and shall recover heat from at least the master bathroom shower and must at least transfer that heat either back to all the respective showers or the water heater.

8. B. iii.a.
a. **EXCEPTION 1 to Section 150.1(c)8Biii**: A solar water-heating system and a drain water heat

recovery system. The solar water-heating system shall meet the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.15 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.30 in Climate Zones 10 through 16. The solar savings fraction shall be determined using a calculation method approved by the Commission. The drain water heat recovery system shall be field verified as specified in the Reference Appendix RA3.6.9 and shall be compliant with the eligibility criteria in RA4.4.21. It shall have a minimum ~~CSA~~ rated effectiveness of 42 percent. The drain water heat recovery system shall recover heat from at least half the showers ~~located above the first floor~~ and must at least transfer that heat either back to all the respective showers or the water heater.

Reasons:

1. Since we are proposing the inclusion of horizontal (low-slope) DWHR devices into the standard, then even 1-story buildings could have them installed.
2. Deleting CSA is appropriate because it will be possible to rate the effectiveness using either the CSA B55.1 or IAPMO IGC 346 criteria. The rated effectiveness under either method must be at least 42 percent for units to qualify for this credit.

7.2 Reference Appendices

The proposed changes consist of two new identical sub-sections: RA3.6.9 within "Appendix RA3 – Residential Field Verification and Diagnostic Test Protocols" and RA4.4.21 within "Appendix RA4 – Eligibility Criteria for Energy Efficiency Measures".

RA3.6.9: HERS-Verified Drain Water Heat Recovery System (DWHR-H)
A HERS inspection is required to obtain this credit. To meet the DWHR system requirement, the DWHR unit(s) shall ~~be~~have a representative sample of the same size tested in accordance with ~~compliant with~~ CSA B55.1 ~~and CSA B55.2~~ or IAPMO IGC 346. The make, model, and ~~CSA~~ rated effectiveness of the DWHR unit(s) shall match the construction documents. The installation configuration (e.g. equal flow, unequal flow to the water heater, or unequal flow to the showers) and the percent of served shower fixtures shall match the construction documents. The DWHR unit(s) shall be installed +/- 2 degrees of the rated slope. ~~vertically with no more than a 5% tilt.~~

Exception: The minimum slope shall be no less than the minimum allowed in Section 708 of the California Plumbing Code.

RA4.4.21 HERS-Verified Drain Water Heat Recovery System (DWHR-H)
A HERS inspection is required to obtain this credit. To meet the DWHR system requirement, the DWHR unit(s) shall ~~be~~ have a representative sample of the same size tested in accordance with ~~compliant with~~ CSA B55.1 ~~and CSA B55.2~~ or IAPMO IGC 346.. The make, model, and ~~CSA~~ rated effectiveness of the DWHR unit(s) shall match the construction documents. The installation configuration (e.g. equal flow, unequal flow to the water heater, or unequal flow to the showers) and the percent of served shower fixtures shall match the construction documents. The DWHR unit(s) shall be installed +/- 2 degrees of the rated slope. ~~vertically with no more than a 5% tilt.~~

Exception: The minimum slope shall be no less than the minimum allowed in Section 708 of the California Plumbing Code.

Reasons:

1. Deleting CSA B55.2 is appropriate because this is a product standard, not efficiency standard. It is similar to IAPMO PS 92. Heat exchangers are covered in Section 603.5.4 of the UPC as shown below. DWHR heat exchangers must be double wall because they exchange heat from a non-potable source to potable water.
2. Deleting CSA is appropriate because it will be possible to rate the effectiveness using either the CSA B55.1 or IAPMO IGC 346 criteria. The rated effectiveness under either method must be at least 42 percent for units to qualify for this credit.
3. Since we are proposing the inclusion of DWHR installed at any slope, we think they should all be installed very close to the slope at which the efficiency was rated. However, the plumbing code has a minimum slope for gravity drainage systems of 1/8" per foot or 1 percent and no DWHR should be installed at a slope less than this. The relevant section from the UPC is shown below.

~~3.~~4. All heat exchangers, whether they have been tested or not, can be compliant with a test procedure. What needs to be established is that a test of a representative unit of equivalent size has been conducted according to the test procedure. The performance of a unit can be verified when tested according to the test procedure.

603.5.4 Heat Exchangers. Heat exchangers used for heat transfer, heat recovery, or solar heating shall protect the potable water system from being contaminated by the heat-transfer medium. Single-wall heat exchangers used in indirect-fired water heaters shall meet the requirements of Section 505.4.1. Double-wall heat exchangers shall separate the potable water from the heat-transfer medium by providing a space between the two walls that are vented to the atmosphere.

708.0 Grade of Horizontal Drainage Piping.

708.1 General. Horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than ¼ inch per foot (20.8 mm/m) or 2 percent toward the point of disposal provided that, where it is impractical due to the depth of the street sewer, to the structural features, or to the arrangement of a building or structure to obtain a slope of ¼ inch per foot (20.8 mm/m) or 2 percent, such pipe or piping 4 inches (100 mm) or larger in diameter shall be permitted to have a slope of not less than ⅛ inch per foot (10.4 mm/m) or 1 percent, where first approved by the Authority Having Jurisdiction.

7.4 Residential Compliance Manual

5.4.1 Single Dwelling Units §150.1(c)8

Option 2: Install a natural gas or propane storage water heater with a rated storage volume 55 gallons or less and an input rating of 105,000 BTU per hour or less. The dwelling unit must meet all of the requirements for Quality Insulation Installation (QII), which requires that a HERS Rater verify QII has been designed and installed in accordance with Energy Standards. The user must also do one of the following:
1. Use a compact hot water distribution design, which requires a HERS Rater to verify that the system has been designed and installed in accordance with the Energy Standards (See Reference Appendix RA4.4.16.)
2. ~~Insulate all domestic hot water pipes which requires that a HERS Rater verify that the pipe insulation is designed and installed in accordance to the Energy Standards. In multiple story dwellings, a~~ A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9 and that is compliant with the eligibility criteria in RA4.4.21. It shall have a minimum ~~CSA~~ rated effectiveness of 42 percent and shall recover heat from at least the master bathroom shower and must at least transfer that heat either back to all the respective showers or the water heater.

Reasons: See above.

§150.1(c)8
As mentioned, there are threetwo options for users to comply prescriptively with the water heating requirements for newly constructed single dwelling units, including additions. All options must also comply with the applicable mandatory requirements in §110.3 and §150.0 (j and n).

2. A system with a single gas or propane storage water heater ~~with a rated storage volume of 55 gallons or less~~ must have:
a. A gas input rating of 105,000 BTU/h or less~~.~~, and either
~~b. The dwelling unit must meet all of the requirements for QII as specified in the Reference Appendix RA3.5, and either~~
i. Have HERS-verified insulation on all domestic hot water piping (see RA4.4.1, RA4.4.3 and RA4.4.14)
ii. Have a HERS-verified compact distribution system design (see RA4.4.16).
ii. ~~In multiple story dwellings, a~~ A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9 and that is compliant with the eligibility criteria in RA4.4.21. It shall have a minimum ~~CSA~~ rated effectiveness of 42 percent and shall recover heat from at least the master bathroom shower and must at least transfer that heat either back to all the respective showers or the water heater.
~~c~~b. If using a recirculation distribution system, only demand recirculation systems with manual control pumps are allowed

5.9.2.1 Multifamily, Motel/Hotels, and High-Rise Nonresidential §150.1(c)8Ciii
Solar water heating is prescriptively required for water heating systems serving multiple dwelling units, whether they are multifamily, motel/hotels, or high-rise nonresidential

buildings. The minimum solar fraction depends on the climate zone (CZ). For multifamily buildings only, it also depends on whether compliant DWHR is installed: ~~0.20 for CZ 1 through 9 and 0.35 for CZ 10 through 16.~~ See Tables 5-11 and 5-12 below. The drain water heat recovery system shall be field verified as specified in the Reference Appendix RA3.6.9 and shall be compliant with the eligibility criteria in RA4.4.21. It shall have a minimum ~~CSA~~ rated effectiveness of 42 percent. The drain water heat recovery system shall recover heat from at least half the showers in each apartment ~~building located above the first floor~~ and must at least transfer that heat either back to all the respective showers or the water heater.

7.5 Compliance Forms

Table 1: DWHR Table for CEC-CF2R-PLB-21-H (multifamily central hot water systems)

Unit ID	DWHR-1	DWHR-2
Make & Model		
Diameter & Length		
Rated Effectiveness in accordance with CSA B55.1 or IAPMO IGC 346		
Slope: (must match rated effectiveness)		
Configuration (Equal, Unequal-Shower, or Unequal-Water Heater)		
Quantity of residential units with DWHR		
Total quantity of shower fixtures receiving recovered heat		
Total quantity of shower fixtures amongst all served residential unit(s) (i.e. fully ignore residential units without any DWHR)		

Table 2: DWHR Table for CEC-CF2R-PLB-22-H (single dwelling unit hot water systems)

Unit ID	DWHR-1	DWHR-2
Make & Model		
Diameter & Length (or Width and Length)		
Rated Effectiveness in accordance with CSA B55.1 or IAPMO IGC 346		
Slope: (must match rated effectiveness)		
Configuration (Equal, Unequal-Shower, or Unequal-Water Heater)		
Quantity of shower fixtures receiving recovered heat		
Total quantity of shower fixtures		

The following instructions will also be added: "The DWHR unit(s) shall ~~be~~ have the performance of a representative sample of the same size verified in accordance with ~~compliant with~~ CSA B55.1or IAPMO IGC 346. ~~and CSA B55.2~~. The make, model, and ~~CSA~~ rated effectiveness of the DWHR unit(s) shall match the construction documents. The installation configuration (e.g. equal flow, unequal flow to the water heater, or unequal flow to the showers) and the percent of served shower fixtures shall match the construction documents. The DWHR unit(s) shall be installed +/- 2 degrees of the rated slope. ~~vertically with no more than a 5% tilt.~~
Exception: The minimum slope shall be no less than the minimum allowed in Section 708 of the California Plumbing Code."