**Draft PDS-02 MINHERS Addendum 77,**

**Integrated Heat Pump Water Heater (iHPWH)**

***Modify the MINHERS Chapter 3 as follows:***

*(Note: All text in blue print that are not hyperlinks are additions created by Addendum 76. Text deleted by Addendum 76 has been removed from this draft. All text in red print, shown with strike-through or underline, are changes proposed by PDS-02 and are open for comment. Text introduced in PDS-01 is shown in black underline and is not open for comment.)*

**301 General Provisions**

**301.1 Purpose**

The provisions of this Standard establish the RESNET HERS® residential energy rating and labeling standards, consistent with the provisions of the Energy Policy Act 1992. ~~that any provider of home energy ratings may follow to produce uniform energy ratings for Residential Buildings.~~

**301.2 Scope**

These Standards apply to existing or proposed, site-constructed or manufactured Dwelling Units and Sleeping Units in Residential and Commercial Buildings, excepting hotels and motels~~.~~

**301.3 Relationship to Other Standards.**

This Standard is a companion to Standard MINHERS [Chapter 1](https://resnet-standards.document360.io/docs/101-general-provisions), “National Accreditation Procedures for Home Energy Rating Systems”; Standard MINHERS [Chapter 2](https://standards.resnet.us/v1/docs/202-general-provisions), “National Rater Training and Certifying Standard; Standard MINHERS Chapter 6, “National Standard for Sampled Ratings”, and; Standard and; MINHERS [Chapter 9](https://standards.resnet.us/v1/docs/901-general-provisions) “RESNET National Standard for Quality Assurance”.

**302 Definitions**

The following terms of section 302.1 through 302.5 have specific meanings as used in this Standard. In the event that definitions given here differ from definitions given elsewhere, including those given in ANSI/RESNET/ICC 301, the definitions given here shall govern.

**302.1 Approved Rating Provider**

Shall mean a RESNET-accredited Quality Assurance Provider who is listed in good standing in the National RESNET Registry.

**302.2 Approved Software Rating Tool**

Shall mean a RESNET-accredited HERS® Rating Tool that has been tested and approved in accordance with RESNET Publication 002 and that is listed in the RESNET National Registry of Accredited Rating Software Programs <https://www.resnet.us/providers/accredited-providers/hers-software-tools/>

**302.3 Approved Tester**

Shall mean a RESNET Rater or Rating Field Inspector (RFI) who has been certified by a RESNET-accredited Quality Assurance Provider and who is listed in good standing in the National RESNET Registry.

**302.4 Certified Rater**

Shall mean a RESNET Rater who has become qualified to conduct home energy ratings through certification by a RESNET-accredited Quality Assurance Provider and who is listed in good standing in the National RESNET Registry.

**302.5 Approved IDR Review Authority**

Shall mean the RESNET Standards Development Committee 300 (SDC 300).

**303 Technical Requirements**

**303.1 Applicable Standards**

[All RESNET Home Energy Ratings conducted in accordance with this Standard shall comply with the provisions of ANSI/RESNET/ICC 301, Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index](https://codes.iccsafe.org/content/RESNET3012019P1) and its ~~MINHERS adopted~~ addenda adopted for the HERS.

**Exception 1:** RESNET Home Energy Ratings conducted in Puerto Rico and the US Virgin Islands shall comply with the provisions of ANSI/RESNET/ICC 301, except that Ratings of homes are permitted to use a default infiltration rate of 10 ACH50 in lieu of conducting an airtightness test in accordance with Standard ANSI/RESNET/ICC 380. In addition, for a home in the Tropical Climate Zone for which its Living Space is not serviced by a space heating mechanical system and not more than one-half of its Living Space is serviced by a space cooling mechanical system, the Conditioned Space Volume shall be defined as the volume of its Living Space and the Conditioned Floor Area shall be defined as the floor area of its Living Space.

**~~Exception 3:~~** ~~RESNET Home Energy Ratings shall be calculated using the modifications of ANSI/RESNET/ACCA/ICC 310-2020 established by Addendum 53f. (See Addendum 53f).~~

**Exception ~~4~~2:** Sampled Ratings for Townhouses and Detached Dwelling Units are not permitted. For Sampled Ratings of Attached Dwelling Units, the requirements of MINHERS Chapter 6 shall supersede the requirements of ANSI/RESNET 301-2022, Section 7.1.4.4.

**Exception ~~5~~3:** Home Energy Ratings shall be calculated using the rated HVAC equipment efficiency modifications to Standard ANSI/RESNET/ICC 301as follows:

*Heating Seasonal Performance Factor 2 (HSPF2)* – A standardized measure of Heat Pump efficiency, based on the total heating output of a Heat Pump in Btu and divided by the total electric energy input in watt-hours and under test conditions specified by the Air Conditioning and Refrigeration Institute Standard 210/240 2023.

*Seasonal Energy Efficiency Ratio 2 (SEER2)* – A standardized measure of Air Conditioner efficiency based on the total cooling output of an Air Conditioner in Btu/h, divided by the total electric energy input, in Watt-hours, under test conditions specified by the Air Conditioning and Refrigeration Institute Standard 210/240 2023.

4.4.4. Air Source Heat Pumps and Air Conditioners.

4.4.4.1. For Heat Pumps and Air Conditioners where a detailed, hourly HVAC simulation is used to separately model the compressor and evaporator energy (including part-load performance), the back-up heating energy, the distribution fan or blower energy and crank case heating energy, the Manufacturer’s Equipment Performance Rating (HSPF and SEER1) shall be modified to represent the performance of the compressor and evaporator components alone.2 The energy uses of all components, including compressor and distribution fan/blower and crank case heater, shall then be added together to obtain the total energy uses for heating and cooling.

For Heat Pumps and Air Conditioners with the more recent Manufacturer’s Equipment Performance Ratings (HSPF2 or SEER2) available, and HSPF or SEER are not available, these ratings shall be converted to HSPF and SEER values by dividing HSPF2 or SEER2 by the conversion factors in Table 4.4.4.1(1). If the type of equipment is not determined, the conversion shall default to the “Ducted Split System” factors. All calculations, including Equation 4.1-1a, shall use HSPF or SEER values as made available by the Manufacturer or converted as specified in this section.

**Table 4.4.4.1(1) SEER2 and HSPF2 Conversion Factors3**

| **Equipment Type** | **SEER2/SEER** | **EER2/EER4** | **HSPF2/HSPF** |
| --- | --- | --- | --- |
| Ductless Systems | 1.00 | 1.00 | 0.90 |
| Ducted Split System | 0.95 | 0.95 | 0.85 |
| Ducted Packaged System | 0.95 | 0.95 | 0.84 |
| Small Duct High Velocity System | 1.00 | Not Applicable | 0.85 |
| Ducted Space-Constrained Air Conditioner5 | 0.97 | Not Applicable | Not Applicable |
| Ducted Space-Constrained Heat Pump5 | 0.99 | Not Applicable | 0.85 |

1(Normative Note) For Commercial Variable Refrigerant Flow (VRF) Multi-Split Air Conditioning and Heat Pump Equipment, use IEER in place of SEER.
2 (Informative Note) Such approaches are described in Cutler et al. 2011 and Fairey et al. 2004.
3 (Informative Note) Conversion factors developed by AHRI, and adopted by RESNET.
4 EER and EER2 are not required in this Standard for equipment relevant to this table, but the values are shared here for informative purposes.
5(Normative Note) Space Constrained AC or Heat Pump – A space constrained unit is a product that has two overall exterior dimensions or an overall displacement that is substantially smaller than those of other units that are of similar heating and/or cooling capacity, and has rated cooling capacities no greater than 30,000 BTU/hr., and that if increased, would result in considerable increase in cost of installation or utility, and was available for purchase in the United States as of December 1, 2000. (Aligns with Title 20 and AHRI Standard 210/240 definitions.)

**Exception 4: RESNET Home Energy Ratings shall be calculated using the modifications of Standards ANSI/RESNET/ICC 301~~-2019~~ established by MINHERS addenda:**

* [**Addendum 66**](https://www.resnet.us/wp-content/uploads/FS_Adndm66f_v3.pdf)**, ~~and~~ CO2e Index**
* [**Addendum 79**](https://www.resnet.us/wp-content/uploads/FS_Adndm79f_InformNoteCrctn.pdf)~~.~~**, Table 5.1.2(1) Informative Note Correction**
* **Addendum 77, Integrated Heat Pump Water Heater (iHPWH)**

**303.2 Rating Registration**

All Confirmed, Threshold and Sampled HERS Ratings shall be registered with the National RESNET Registry in accordance with Sections [102.1.4.10](https://standards.resnet.us/v1/docs/102-accreditation-criteria-for-rating-quality-assurance-providers) and [102.1.4.12](https://standards.resnet.us/v1/docs/102-accreditation-criteria-for-rating-quality-assurance-providers).

**303.3 HERS Rating Tools**

All RESNET-accredited HERS Rating Tools shall prohibit printing of Confirmed, Threshold and Sampled HERS Ratings until such rating has been registered with the National RESNET Registry and a unique registration identification has been assigned. Said registration identification shall be prominently displayed on all printed HERS Rating reports.

**304 Normative References**

ANSI/RESNET/ICC 301-2022, “Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index.”, including normative appendices, Addendum A RECs and Addendum B CO2e and its other ~~MINHERS~~ Addenda adopted ~~addenda~~ for the HERS.

ANSI/RESNET/ICC 380-2022, "Standard for Testing Airtightness of Building, Dwelling Unit and Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems", including normative appendices, Addendum A and its other ~~MINHERS~~ Addenda adopted ~~addenda~~for the HERS.

ANSI/RESNET/ICC 310-2020, “Standard for Grading the Installation of HVAC Systems MINHERS- Mortgage Industry National Home Energy Rating Systems”, including normative appendices and ~~MINHERS~~its Addenda adopted ~~addenda~~for the HERS.

RESNET MINHERS Chapter 1, “National Accreditation Procedures for Home Energy Rating Systems” including addenda.

RESNET MINHERS Chapter 2, “National Rater Training and Certifying Standard” including addenda.

RESNET MINHERS Chapter 6, "RESNET National Standard for Sampled Ratings"

RESNET MINHERS Chapter 9, “RESNET National Standard for Quality Assurance” including addenda.

***Modify ANSI/RESNET/ICC 301 Chapter 3 as follows:***

1. ***Add definitions to Section 3.2 Definitions***

***Heat Pump Water Heater (HPWH)***- A water heater that transfers thermal energy from one temperature level to another temperature level for the purpose of heating water, including all ancillary equipment such as fans, storage tanks, or controls necessary for the device to perform its function.

***~~Hybrid~~ Integrated Heat Pump Water Heater (iHPWH)*** – An air-source Heat Pump Water Heater where the ~~air-source~~ heat pump is integrated into the unitary water heater~~, usually above the storage tank; there are electric resistance elements in the storage tank allowing hybrid water heating by the heat pump or electric resistance elements or both simultaneously~~.

1. ***Add acronyms to Section 3.3 Acronyms***

***HPWH –*** Heat pump water heater

***iHPWH –*** Integrated heat pump water heater

1. ***Add new footnote ‘v.2’ to ‘Service water heating systems’ section from Table 4.2.2(1)****:*

|  |  |  |
| --- | --- | --- |
| **Building Component** | **Energy Rating Reference Home** | **Rated Home** |
| Service water heating systems p, t, u, v.1, v.2, v.3 | Fuel type: same as Rated HomeEfficiency:Electric: EF = 0.97 - (0.00132 \* store gal)Fossil fuel: EF = 0.67 - (0.0019 \* store gal)Use (gal/day): Determined in accordance with Section 4.2.2.6.1.4Tank temperature: 125°FLocation:IECC Climate Zones 1-3: Attached garage if present, otherwise Conditioned Space VolumeIECC Climate Zones: 4-8: Unconditioned basement if present, otherwise Conditioned Space Volume | Same as Rated HometSame as Rated HomeacSame as Rated HomeDetermined in accordance with Section 4.2.2.6.2.11Same as Energy Rating Reference HomeSame as Rated Home |

***4. Modify the footnote ‘u’ in ‘Table 4.2.2(1)’ as follows:***

u. The Uniform Energy Factor (UEF) or Energy Factor (EF) shall be obtained for residential hot water equipment.~~, or~~ For commercial hot water equipment, UEF, COP or the Thermal Efficiency (TE) and Standby Loss (SL) shall be obtained ~~for commercial hot water equipment~~ from manufacturer’s literature or from AHRI directory for equipment being used where available. When UEF is obtained, the First Hour Rating (FHR) shall also be obtained. For commercial water heaters where EF or UEF is not available, an Approved commercial hot water system calculator shall be used to determine the EF or UEF.

Where a manufacturer provided or AHRI published EF or UEF is not available for the residential hot water equipment, the guidance provided in Item 1 below shall be used to determine the effective EF of the water heater. Where a manufacturer provided or AHRI published TE or SL is not available for commercial hot water equipment, the guidance provided in Item 2 below shall be used to determine the effective TE and SL of the water heater.

 1. For residential oil, gas and electric water heaters or Heat Pumps, default EF values provided in Table 4.5.2(3) for age-based efficiency or Table 4.5.2(4) for non-age-based efficiency shall be used.

 2. For commercial water heaters, values provided in Table C404.2 “Minimum Performance of Water-Heating Equipment” in the IECC shall be used.

***5. Modify the footnote ‘v’ in ‘Table 4.2.2(1)’ as follows and create a new table note:***

v.1. Where the heat balance of the space(s) connected to a Service Hot Water System is (are) explicitly modeled by software, t~~T~~he heat sources and sinks associated with the Service Hot Water System shall be included ~~in the energy balance for the space in which the Service Hot Water System is located~~. For a Service Hot Water System with a storage tank, the simulation shall include storage tank heat losses to the appropriate space.

v.2. For air-source HPWH, the simulation shall include the spaces where supply air intake is extracted and exhaust air is discharged. ~~In addition, the UEF shall be separated into the heat pump compressor COP, tank UA, and, if applicable, electric resistance elements (COP=1).~~ Where necessary, all air-source HPWH simulations shall include supplementary electric resistance elements to meet the hot water demand of the Dwelling Unit. The COP of an air-source HPWH shall ~~also~~ be adjusted for the temperature of its supply air intake and the tank heat transfer shall be adjusted for the temperature of the space.

v.3 For all HPWH, the UEF shall be separated into the heat pump compressor COP and the tank UA according to Tables X and Y.

Table X: HPWH Compressor COP Values

|  |  |
| --- | --- |
| **First Hour Rating[[1]](#footnote-1) (gal/hr)** | **COPcomp** |
| >= 18, < 51 | 1.0005 \* UEF - 0.0789 |
| >= 51, < 75 | 1.0909 \* UEF - 0.0868 |
| >= 75 | 1.1022 \* UEF - 0.0877 |

Table Y: HPWH Tank UA Values

|  |  |
| --- | --- |
| **Tank Volume (gal)** | **Tank UA (Btu/hr-F)** |
| <= 58 | 3.6 |
| > 58, <= 73 | 4.0 |
| > 73 | 4.7 |

***6. Add new footnote ‘ac’ language***

ac. Where an iHPWH ~~a Hybrid Integrated Heat Pump Water Heater~~ is installed, the rated UEF shall be used to determine the compressor COP if one of the following conditions is met for each water heater:

1. A ducted intake and ducted exhaust is installed and the incoming air is drawn from the same space as the space to which the exhaust is discharged.
2. The enclosed space containing the water heater is verified to have a total net free opening area to an adjacent heated or conditioned space of no less than ~~300 in~~~~2~~ 75 in2 per 100 watts of compressor power, using any combination of grilles, louvers, door undercuts, or a louvered door. Where the compressor power is not specified by the manufacturer, the total net free opening area shall be no less than 560 in2.
3. The ~~Hybrid~~ iHPWH is ~~with~~in an enclosed space ~~that has~~ having a volume equal to or greater than ~~700~~ 1,000 ft3 which is within the Conditioned Space Volume of the Dwelling Unit.

For all other ~~Hybrid~~ iHPWH installations, the maximum allowable COP (COPeff) shall be determined by the equation below.

COPeff = (COPcomp - 1.53) \* (1 - ( 1.009 \* exp(-5.492\*(RV) ) ) ) + 1.53

Where:

 COPcomp = Heat pump compressor COP at the rated UEF

RV = Relative Volume = MIN [(~~Hybrid~~ iHPWH containment volume, ft3)/1500 ft3), 1.0]

***7. Modify ‘Service Hot Water Equipment’ section from ‘Table 4.5.2(1)’ as follows:***

|  |
| --- |
| **Table 4.5.2(1) Minimum Rated Features** |
| **Building Element** | **Minimum Rated Feature** |
| 15. Service Hot Water Equipment  | For Residential Equipment - Equipment type, location, efficiency (Uniform Energy Factor and First Hour Rating; or Energy Factor), extra tank insulation R-Value, flow rates of showers and Bathroom sink faucets. For ~~Hybrid~~ Integrated Heat Pump Water Heaters – containment volume (ft3) and the net free opening area (in2) of the space containing the water heater. If ducted, the space to which the exhaust air is discharged and the space from which the intake air is supplied.For Commercial Equipment - Equipment type, location, Uniform Energy Factor, COP, or Thermal Efficiency and Standby Loss, extra tank insulation value, flow rates of showers and Bathroom sink faucets.Distribution Related:Distribution System Type (standard, recirculation), Recirculation System controls [none, timer, temperature, demand (manual) or demand (sensor)], pipe insulation R-Value, pipe length for standard distribution, branch length for recirculation, supply + return loop length, pump power (Watts, HP). |

***8. Modify ‘Building Element: Service Hot Water (SHW) Equipment’ table within Normative Appendix B as follows:***

|  |  |  |
| --- | --- | --- |
| Location | Determine and record location of service hot water equipment | Determine and record whether the water heater is in Conditioned or Unconditioned Space Volume, Unrated Heated Space or Unrated Conditioned Space.  |
| Efficiency  | Determine and record the Energy Factor, Uniform Energy Factor, COP, or thermal efficiency of the service hot water equipment | Look for the water heater's nameplate and product literature. Record the manufacturer, model number and if listed directly on the nameplate, the efficiency rating. Search for the model number in the manufacturer’s data sheets or appropriate efficiency rating directory to determine and record the EF, UEF, COP, or thermal efficiency rating. When UEF is recorded, also record the First Hour Rating. When thermal efficiency is recorded, also record the standby loss if available.When the efficiency rating cannot be determined, approximate the age of the unit and use a default efficiency.  |
| Extra tank insulation value  | Determine and record the insulation value of any exterior wrap  | Visually determine and record whether the water heater is or is not wrapped with exterior insulation. When insulation is present, look for the labeled/stamped R-value or measure the thickness of the wrap and determine and record the R-Value.  |
| Individual service hot water equipment type  | Determine and record type, capacity, and fuel source of standalone water heater serving single Dwelling Unit | Identify whether the equipment is storage or instantaneous, identify its fuel source and record storage tank capacity in gallons. Also record whether the SHW equipment is an ~~Hybrid~~ Integrated Heat Pump Water Heater, or supplemented by a desuperheater and/or if it is integrated with the space heating system.*~~Hybrid~~ Integrated Heat Pump Water Heater* – For ~~Hybrid~~ Integrated Heat Pump Water Heaters, record whether the system has a ducted intake and exhaust and record the spaces to and from which the air is ducted. If not ducted, for the space that contains the ~~Hybrid~~ iHPWH, measure dimensions of the room to calculate its volume (ft3) and record the total net free opening area (in2) of any grilles/louvers/door undercuts. Where the net free area of a grille or louvered opening is not specified by the manufacturer, the net free area shall be calculated as 35% of the area of the grille or louvered opening. |

1. (Informative Note) There are no HPWH products currently on the market with First Hour Rating < 18 gal/hr. [↑](#footnote-ref-1)