ANSI/RESNET/ICC 301-2019 Addendum A-2019
Clothes Washers and Dryers and Dishwashers

Note that the compliance dates correspond with those for ANSI/RESNET/ICC 301-2019
Voluntary Compliance (begins) Date October 1, 2019
Mandatory Compliance (required) Date January 1, 2021

Part A: Clothes Washer and Clothes Dryer Energy and Water Use

Modify Sections 4.2.2.5.1.1, 4.2.2.5.1.2, 4.2.2.5.2.8 and 4.2.2.5.2.10 of ANSI/RESNET/ICC 301-2019 as follows:

4.2.2.5.1.1. Electric Reference Homes. Where the Rated Home has electric appliances, the Energy Rating Reference Home lighting, appliance and Miscellaneous Energy Loads shall be determined in accordance with the values given in Table 4.2.2.5(1).

Table 4.2.2.5(1) Lighting, Appliance and Miscellaneous Energy Loads in electric Energy Rating Reference Homes

End Use Component	Units	Equation Coefficients		
		a	b	c
Residual MELs	kWh/y		0.91	
Interior lighting	kWh/y	455	0.80	
Exterior lighting	kWh/y	100	0.05	
Refrigerator	kWh/y	637		18
Televisions	kWh/y	413		69
Range/Oven	kWh/y	331		39
Clothes Dryer	kWh/y	~~529~~ 398		~~150~~ 113
Dishwasher	kWh/y	78		31
Clothes Washer	kWh/y	~~38~~ 53.53		~~10~~ 15.18

4.2.2.5.1.2. Reference Homes with Natural Gas Appliances. Where the Rated Home has gas appliances, those appliances in the Energy Rating Reference Home shall be determined in accordance with the natural gas and electric appliance loads provided below in Table 4.2.2.5(2), as applicable for each appliance.

Table 4.2.2.5(2) Natural Gas Appliance Loads for Energy Rating Reference Homes with Gas Appliances

End Use Component[a]	Units	Equation Coefficients		
		a	b	c
Range/Oven	Therms/y	22.6		2.7
Range/Oven	kWh/y	22.6		2.7
Clothes Dryer	Therms/y	~~18.8~~ 14.3		~~5.3~~ 4.05
Clothes Dryer	kWh/y	~~41~~ 31.5		~~11.7~~ 8.93
Notes: (a) Both the natural gas and the electric components shall be included in determining the Energy Rating Reference Home annual energy use for the above appliances.				

4.2.2.5.1.4. Service Hot Water Use. Service hot water system use in gallons per day for the Energy Rating Reference Home shall be determined in accordance with Equation 4.2-2:

$$\textbf{HWgpd = (refDWgpd+refCWgpd +F}_{\textbf{mix}}\textbf{*(refFgpd + refWgpd))} \qquad \textbf{(Eq. 4.2-2)}$$

where:
HWgpd = gallons per day of hot water use
refDWgpd = reference dishwasher gallons per day
= ~~((88.4+34.9*Nbr)*8.16)/365~~ 0.7801*Nbr + 1.976
refCWgpd = reference clothes washer gallons per day
= ~~(4.52*(164+46.5*Nbr))*((3*2.08+1.59)/(2.874*2.08+1.59))/365~~
= 0.6762*Nbr + 2.3847

4.2.2.5.2.8. Clothes Dryers. Clothes Dryer annual energy use for the Rated Home shall be determined in accordance with Equation 4.2-7 and shall be based on the clothes dryer located within the Rated Home. If no clothes dryer is located within the Rated Home, a clothes dryer in the nearest shared laundry room on the project site shall be used, if available for daily use by the occupants of the Rated Home. If the shared laundry room has multiple clothes dryers, the clothes dryer with the lowest EF or CEF shall be used.

~~kWh/y = 12.5*(164+46.5*Nbr)*FU/EFdry*(CAPw/MEF – LER/392)/(0.2184*(CAPw*4.08+0.24))~~
CDkWh/y = (((RMC-0.04)*100)/55.5)*(8.45/CEF)*ACY **(Eq 4.2-7)**
where:
RMC = Remaining Moisture Content = (0.97 * (CAPw / IMEF) – LER/312) / ((2.0104 * CAPw + 1.4242) * 0.455) + 0.04
ACY = Annual Cycles per Year = (164+46.5*Nbr) * ((3*2.08+1.59) / (CAPw*2.08+1.59))
Nbr = Number of Bedrooms in home

~~FU = Field Utilization factor = 1.18 for timer controls **or** 1.04 for moisture sensing~~

~~Efdry = Efficiency Factor of clothes dryer **or** the default value of 3.01 **or** calculated as 1.15*CEF.~~

CEF = Combined Energy Factor is the clothes dryer efficiency[1] (lbs dry clothes/kWh) based on current U.S. DOE clothes dryer testing procedures. (default = 3.73 for electric dryers or 3.30 for gas dryers)

CAP_w = Capacity of clothes washer (ft^3) from the manufacturer's data ~~**or** the CEC Appliance Efficiency Database **or** the EPA ENERGY STAR website[2] **or** the default value of 2.874 ft^3.~~

~~MEF = Modified Energy Factor of clothes washer from the Energy Guide label **or** the default value of 0.817 **or** calculated as 0.503+0.95*IMEF.~~

IMEF = Integrated Modified Energy Factor, which has replaced MEF as the U.S. DOE Energy Factor test metric for clothes washers. (default = 1.57 for top load clothes washers or 1.84 for front load clothes washers)

LER = Labeled Energy Rating of clothes washer (kWh/y) from the Energy Guide label ~~**or** the default value of 704.~~

For natural gas clothes dryers, annual energy use shall be determined in accordance with Equations 4.2-8a and 4.2-8b.

Therms/y = (result of Eq. 4.2-7)*3412*(1-0.07)
*(~~3.01/Efdry-g~~ 3.73/3.30)/100000   (Eq. 4.2-8a)
kWh/y = (result of Eq. 4.2-7)*0.07*(~~3.01/Efdry-g~~ 3.73/3.30)   (Eq. 4.2-8b)

~~where:~~

~~Efdry-g = Efficiency Factor for gas clothes dryers **or** the default value of 2.67 **or** calculated as 1.15*CEF.~~

~~CEF = Combined Energy Factor is the clothes dryer efficiency based on current U.S. DOE clothes dryer testing procedures.~~

For the purpose of adjusting the annual clothes dryer energy consumption for calculating the Rating, EUL_{LA} shall be adjusted by ΔEUL_{CD}, which shall be calculated as the annual clothes dryer energy use derived by the procedures in this section minus the annual clothes dryer energy use derived for the Energy Rating Reference Home in Section **Error! Reference source not found.**, converted to Mbtu/y, where Mbtu/y = (kWh/y) / 293 or (Therms/y) / 10, whichever is applicable.

When a Dwelling Unit has no in-unit clothes dryer, and no shared clothes dryers are available in the building or on the project site for daily use by the Rated Home occupants or they exist, but the ratio of Dwelling Units to shared clothes dryers is greater than 14, the clothes dryer values from Table 4.2.2.5(1) shall be assumed for both the Energy Rating Reference Home and Rated Home.

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[1] (Informative Reference) See the CEC Appliance Efficiency Database http://www.energy.ca.gov/appliances/, or the ENERGY STAR Appliance database https://www.energystar.gov/products/appliances/clothes_dryers.

~~[2] (Informative Reference) http://www.energystar.gov/index.cfm?c=clotheswash.pr_clothes_washers~~

For clothes dryer energy use, total Internal Gains in the Rated Home shall be modified by 15% of the clothes dryer ΔEUL_{CD} converted to Btu/day as follows: $\Delta EUL_{CD} * 10^6 / 365$. Of this total amount, 90% shall be apportioned to sensible Internal Gains and 10% to latent Internal Gains. Internal Gains shall not be modified for clothes dryers located in Unconditioned Space Volume, Unrated Heated Space, Unrated Conditioned Space, or outdoor environment.[3]

4.2.2.5.1.6. Clothes Washers. Clothes Washer annual energy use and daily hot water use for the Rated Home shall be determined as follows, and shall be based on the clothes washer located within the Rated Home. If no clothes washer is located within the Rated Home, a clothes washer in the nearest shared laundry room on the project site shall be used, if available for daily use by the occupants of the Rated Home. If the shared laundry room has multiple clothes washers, the clothes washer with the highest LER shall be used.

Annual energy use shall be calculated in accordance with Equation 4.2-10a.

kWh/y = [(LER/392)-[(LER*($/kWh)-AGC)/(21.9825*($/kWh) - ($/therm)]/392)*21.9825)]*ACY

$$CWkWh/y = Cwappl / LCY * ACY \qquad \text{(Eq. 4.2-10a)}$$
  where:
    Cwappl = (GHWC * gasH2O / gas$ - (LER*elec$) * elecH2O / elec$) / (elec$ * gasH2O / gas$ - elecH2O)
    GHWC = Gas Hot Water Costs from Energy Guide Label
    gasH2O = 0.3914 (gal/cyc) per (therm/y)
    elecH2O = 0.0178 (gal/cyc) per (kWh/y)
    LER = Label Energy Rating (kWh/y) from the Energy Guide label
    $/kWh elec$ = Electric Rate from Energy Guide Label (default = $0.12 per kWh)
    AGC = Annual Gas Cost from Energy Guide Label
    $/therm gas$ = Gas Rate from Energy Guide Label (default = $1.09 per therm)
    LCY = Label Cycles per Year from Energy Guide Label (default = 6 loads per week = 312)
    ACY = Adjusted Annual Cycles per Year
  and where:
    ACY = NCY SCY * [(3.0*2.08+1.59)/(CAPw*2.08+1.59)]
        where:
        NCY SCY = (3.0/2.874) * (164 + Nbr*46.5)
        CAPw = washer capacity in cubic feet from the Energy Guide Label manufacturer's data or the CEC Appliance Efficiency Database[4] or the EPA ENERGY STAR website[5] or the default value of 2.874 ft[3]

Daily hot water use shall be calculated in accordance with Equation 4.2-10b.

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[3] (Informative Note) For example, an unconditioned garage.
[4] (Informative Reference) http://www.energy.ca.gov/appliances
[5] (Informative Reference) http://www.energystar.gov/index.cfm?c=clotheswash.pr_clothes_washers

~~CWgpd = 60 * therms/cyc * ACY / 365~~

CWgpd = (LER – Cwappl) * elecH2O * ACY / 365   **(Eq. 4.2-10b)**

~~where:~~

~~therms/cyc = (LER * $/kWh – AGC) / (21.9825 * $/kWh - $/therm) / 392~~

For clothes washers where an Energy Guide label is not available, clothes washer inputs from Table 4.2.2.5(3) shall be used.

Table 4.2.2.5(3) Default Inputs for Clothes Washer Based on Year

Standard Clothes Washer Models						
	HERS Ref 2006	Std 2008-2017	EnergyStar 2006-2017	Std 2018-present	EnergyStar 2018-present	CEE Tier II 2018
Clothes Washer Inputs:						
LER [Label Energy Rating in kWh/y]=	400	380	260	284	152	125
GHWC [Cost with gas hot water in $/y]=	$27	$27	$18	$18	$12	$9
elec_price [$/kWh]=	$0.12	$0.12	$0.12	$0.12	$0.12	$0.12
gas_price [$/therm]=	$1.09	$1.09	$1.09	$1.09	$1.09	$1.09
IMEF [ft3/(kWh/cyc)]=	1	1.21	1.63	1.57	2.06	2.92
CAPw [ft3]=	3	3.2	3.5	4.2	4.2	5.2
IWF [(gal/cyc)/ft3]=	11.4	9.5	5.2	6.5	4.3	3.2
LCY [Label Cycles per Year] =	312	312	312	312	312	312

Footnotes
a: Used for standard clothes washers between 2006 – 2007
b: Used for standard clothes washers between 2008 – 2017
c: Used for ENERGY STAR clothes washers between 2006 and 2017
d: Consortium for Energy Efficiency Tier II efficiency minimum requirements

For the purpose of adjusting the annual clothes washer energy consumption for calculating the Rating, EUL_{LA} shall be adjusted by ΔEUL_{CW}, which shall be calculated as the annual clothes washer energy use derived by the procedures in this section minus the annual clothes washer energy use derived for the Energy Rating Reference Home in Section **Error! Reference source not found.**, converted to Mbtu/y, where Mbtu/y = (kWh/y) / 293 **or** (Therms/y) / 10, whichever is applicable.

For the purpose of adjusting the daily hot water use for calculating the Rating, the daily hot water use change shall be calculated as the daily hot water use derived by the procedures in this Section minus the gallons per day derived for the Energy Rating Reference Home clothes washer in Section 0.

When a Dwelling Unit has no in-unit clothes washer, and no shared clothes washers are available in the building or on the project site for daily use by the Rated Home occupants or they exist, but the ratio of Dwelling Units to shared clothes washers is greater than 14, the energy and hot water use of the Rated Home clothes washer shall be the same as the Energy Rating Reference Home, in accordance with Section **Error! Reference source not found.**.

For clothes washer energy use, total Internal Gains in the Rated Home shall be modified by 30% of the clothes washer ΔEUL_{CW} converted to Btu/day as follows: $\Delta EUL_{CW} * 10^6 / 365$. Of this total amount, 90% shall be apportioned to sensible Internal Gains and 10% to latent Internal Gains. Internal Gains shall not be modified for clothes washers located in Unconditioned Space Volume, Unrated Heated Space, Unrated Conditioned Space, or outdoor environment.[6]

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[6] (Informative Note) For example, an unconditioned garage.

Part B: Dishwasher Energy and Water Use

Modify Sections 4.2.2.5.1.1 and 4.2.2.5.2.9 of ANSI/RESNET/ICC 301-201x as follows

8.2.2.5.1.1. Electric Reference Homes. Where the Rated Home has electric appliances, the Energy Rating Reference Home lighting, appliance and Miscellaneous Energy Loads shall be determined in accordance with the values given in Table 4.2.2.5(1).

Table 4.2.2.5(1) Lighting, Appliance and Miscellaneous Energy Loads in electric Energy Rating Reference Homes

End Use Component	Units	Equation Coefficients		
		a	b	c
Residual MELs	kWh/y		0.91	
Interior lighting	kWh/y	455	0.80	
Exterior lighting	kWh/y	100	0.05	
Refrigerator	kWh/y	637		18
Televisions	kWh/y	413		69
Range/Oven	kWh/y	331		39
Clothes Dryer	kWh/y	529		150
Dishwasher	kWh/y	~~78~~ 60		~~31~~ 24
Clothes Washer	kWh/y	38		10

8.2.2.5.2.9. Dishwashers. Dishwasher annual energy use for the Rated Home shall be determined in accordance with Equation 4.2-9a and shall be based on the dishwasher located within the Rated Home, with the ~~lowest Energy Factor (~~highest kWh/y~~)~~. If no dishwasher is located within the Rated Home, a dishwasher in the nearest shared kitchen in the building shall be used, only if available for daily use by the occupants of the Rated Home.

dWkWh/y = ~~[(86.3 + 47.73/EF)/215]*dWepy~~ dWkWh/cyc * dWcpy   (Eq. 4.2-9a)
where:
  dWkWh/y = dishwasher annual electric use excluding water heater energy use
  dWkWh/cyc = [(GHWC * 0.5497/ Gas$ - LER * Elec$ * 0.02504 / Elec$) /
          (Elec$ * 0.5497 / Gas$ - 0.02504)] / 208
    GHWC = Labeled annual cost when used with a gas water heater
    Gas$ = Labeled price of gas in $/therm
    LER = Labeled dishwasher Energy Rating using electric water heater in kWh/y
    Elec$ = Labeled price of electricity in $/kWh
    dWcpy = dishwasher cycles per year = (88.4 + 34.9*Nbr)*12/dWcap
    Nbr = Number of bedrooms in Rated Home
    dWcap = Dishwasher capacity where Standard = 12 and Compact = 8
  ~~EF = Labeled dishwasher Energy Factor~~

    ~~or~~

~~EF = 215/(labeled kWh/y)~~
~~dWcpy = (88.4 + 34.9*Nbr)*12/dWcap~~
  ~~where:~~
    ~~Nbr = Number of bedrooms in Rated Home~~
    ~~dWcap = Dishwasher place setting capacity; Default = 12 settings for standard~~
      ~~sized dishwashers and 8 place settings for compact dishwashers~~

And the change (Δ) in daily hot water use (GPD – gallons per day) for dishwashers shall be calculated in accordance with Equation 4.2-9b.

ΔGPD$_{DW}$ = ~~[(88.4+34.9*Nbr)*8.16 – (88.4+34.9*Nbr)~~
        ~~*12/dWcap*(4.6415*(1/EF) - 1.9295)]/365~~
        refDWgpd - rateDWgpd   **(Eq. 4.2-9b)**

where:
  refDWgpd = [(88.4+34.9*Nbr)*8.16] / 365
  rateDWgpd = (LER - kWh/cyc*208) * 0.02504 * dWcpy / 365

For dishwashers where an Energy Guide label is not available, dishwasher inputs from Table 4.2.2.5(2) shall be used.

Table 4.2.2.5(2) Default Dishwasher Inputs

Default Dishwasher Energy Guide Label Data				
Energy Guide Label Information	ENERGY STAR Defaults		NAECA minimum	HERS Reference
Dishwasher Size	compact	standard	standard	standard
Annual Energy kWh/y (LER)	203	270	307	467
Annual Gas Hot Water Cost ($/y)	$14.20	$22.23	$22.32	$33.12
Electricity Price ($/kWh)	$0.12	$0.12	$0.12	$0.12
Gas Price ($/therm)	$1.09	$1.09	$1.09	$1.09
Label Cycles per Year (LCY)	208	208	208	208

For the purpose of adjusting the annual dishwasher energy consumption for calculating the rating, EUL$_{LA}$ shall be adjusted by ΔEUL$_{DW}$, which shall be calculated as the annual dishwasher energy use derived by the procedures in this section minus the annual dishwasher energy use derived for the Energy Rating Reference Home in Section **Error! Reference source not found.**, converted to MBtu/y, where MBtu/y = (kWh/y) / 293 or (therms/y) / 10, whichever is applicable.

For the purpose of adjusting the daily hot water use for calculating the rating, the daily hot water use change shall be 'ΔGPD$_{DW}$' as calculated above.

When a Dwelling Unit has no in-unit dishwasher, and no shared dishwashers are available in the building for daily use of the Rated Home occupants, the energy and hot water use of the Rated Home dishwasher shall be the same as the Energy Rating Reference Home, in accordance with Section **Error! Reference source not found.**.

For dishwasher energy use, total Internal Gains in the Rated Home shall be modified by 60% of the dishwasher ΔEUL$_{DW}$ converted to Btu/day as follows: ΔEUL$_{DW}$ * 10^6 / 365. Of this total amount, 50% shall be apportioned to sensible Internal Gains and 50% to latent Internal Gains.

Internal Gains shall not be modified for dishwashers located outside the Rated Home.