

ASHRAE Fundamentals 2021 – Chapter 18

Table 5C Recommended Rates of Radiant Heat Gain from Hooded Electric Appliances During Idle (Ready-to-Cook) Conditions

Appliance	Energy Rate, W		Rate of Heat Gain, W		Usage Factor F_U	Radiation Factor F_R
	Rated	Standby	Sensible Radiant			
Broiler: underfired 900 mm	10 814	9 056	3165		0.84	0.35
Cheesemelter ^a	3 605	3 488	1348		0.97	0.39
Fryer, kettle	29 014	528	147		0.02	0.28
Open deep-fat, 1-vat	14 008	821	293		0.06	0.36
Pressure	13 511	791	147		0.06	0.19
Griddle, double-sided 900 mm (clamshell down) ^a	21 218	2 022	410		0.10	0.20
(Clamshell up) ^a	21 218	3 370	1055		0.16	0.31
Flat 900 mm	17 115	3 370	1319		0.20	0.39
Small 900 mm ^a	8 997	1 788	791		0.20	0.44
Induction cooktop ^a	21 013	0	0		0.00	0.00
Induction wok ^a	3 488	0	0		0.00	0.00
Oven, combi: combi-mode ^a	16 411	1 612	234		0.10	0.15
Combi: convection mode	16 412	1 612	410		0.10	0.25
Oven, convection full-size	12 103	1 964	440		0.16	0.22
Convection half-size ^a	5 510	1 084	147		0.20	0.14
Pasta cooker ^a	22 010	2 491	0		0.11	0.00
Range top, top off/oven on ^a	4 865	1 172	293		0.24	0.25
3 elements on/oven off	15 005	4 513	1846		0.30	0.41
6 elements on/oven off	15 005	9 730	4074		0.65	0.42
6 elements on/oven on	19 870	10 668	4250		0.54	0.40
Range, hot-top	15 826	15 035	3458		0.95	0.23
Rotisserie ^a	11 107	4 044	1319		0.36	0.33
Salamander ^a	7 004	6 829	2051		0.97	0.30
Steam kettle, large (225 L), simmer lid down ^a	32 414	762	29		0.02	0.04
small (150 L), simmer lid down ^a	21 599	528	88		0.02	0.17
Steamer, compartment, atmospheric ^a	9 789	4 484	59		0.46	0.01
Tilting skillet/braising pan	9 642	1 553	0		0.16	0.00

^a Items with an asterisk appear only in Swierczyna et al. (2009); all others appear in both Swierczyna et al. (2008) and (2009).

Table 5F Recommended Rates of Sensible and Latent Heat Gain to Space from Warewashing Equipment

Equipment Type	Supply Water Flow Rate, L/s	Operating Water Temperature, C	Rate of Heat Gain to Space, W ^a				Usage Factor F_U^c
			Sensible Radiant ^b	Sensible Convective	Latent	Total	
Pre-Rinse Equipment							
Pre-rinse spray valve	0.04	49	0	59	2403	2462	1
Pre-rinse spray valve	0.08	49	0	88	3429	3517	1
Pre-rinse spray valve	0.25	49	0	322	4044	4367	1
3-Compartment sink, rinsing	NA	49	0	264	1436	1700	1
Idle	NA	NA	0	205	586	791	NA
Power wash sink, rinsing	NA	49	0	586	909	1495	1
Idle	NA	NA	0	440	469	909	NA
Scraper	1.14 ^d	49	0	352	3224	3575	1
Scraper with trough	4.42 ^d	49	0	821	4074	4894	1
Unhooded Dishwashers							
Under-counter dishwasher, low temperature	0.05	60	0	645	1436	2081	1
Under-counter dishwasher, high temperature	0.05	82	0	1172	1348	2520	1
Under-counter dishwasher, high temperature with heat recovery	0.04	82	0	645	322	967	1
Upright door type, low temperature dump and fill	0.06	49	0	938	1026	1964	1
Upright door type, low temperature with tank	0.04	60	0	1143	3869	5012	1
Upright door type, high temperature	0.06	82	0	2345	6272	8616	1
Upright door type, high temperature with heat recovery	0.06	82	0	1407	3810	5217	1
Pot and pan washer	0.15	82	0	1758	6887	8646	1
Pot and pan washer with heat recovery	0.15	82	0	1612	5568	7180	1
1120 mm Conveyor dishwasher, unvented	0.11	82	0	2931	17379	20310	1
1680 mm Conveyor dishwasher, unvented	0.11	82	0	4718	13188	17907	1
Hooded or Ducted High-Temperature Dishwashers							
Upright door type, high temperature under a 0.9 × 0.9 m hood at 142 L/s	NA	82	0	1026	3810	4836	1
Upright door type, high temperature under a 1.5 × 1.2 m hood at 236 L/s	NA	82	0	469	2315	2784	1
1120 mm conveyor, high temperature under a 0.9 m hood at 472 L/s	0.11	88	0	293	5861	6154	1
Ducted Conveyor Dishwashers							
Ducted 1680 mm conveyor dishwasher	0.11	82	0	3107	1846	4953	1
Ducted flight type conveyor dishwasher	0.06	88	0	3927	2608	6535	1
Ducted flight type conveyor dishwasher with heat recovery	0.06	88	0	3605	1055	4660	1
Ducted flight type conveyor dishwasher with blow dryer	0.06	88	0	6213	4601	10814	1

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Table 1.25: Metabolic Rates for Various Activities

Activity	Activity Level Schedule Value (W/Person)	Activity Level (W/m ²)	met*
<i>Resting</i>			
Sleeping	72	40	0.7
Reclining	81	45	0.8
Seated, quiet	108	60	1
Standing, relaxed	126	70	1.2
<i>Walking (on level surface)</i>			
3.2 km/h (0.9 m/s)	207	115	2
4.3 km/h (1.2 m/s)	270	150	2.6
6.4 km/h (1.8 m/s)	396	220	3.8
<i>Office Activities</i>			
Reading, seated	99	55	1
Writing	108	60	1
Typing	117	65	1.1
Filing, seated	126	70	1.2
Filing, standing	144	80	1.4
Walking about	180	100	1.7
Lifting/packing	216	120	2.1
<i>Miscellaneous Occupational Activities</i>			
Cooking	171 to 207	95 to 115	1.6 to 2.0
Housecleaning	207 to 360	115 to 200	2.0 to 3.4
Seated, heavy limb movement	234	130	2.2
Machine work	189	105	1.8
sawing (table saw)	207 to 252	115 to 140	2.0 to 2.4
light (electrical industry)	423	235	4
Handling 50 kg bags	423	235	4
Pick and shovel work	423 to 504	235 to 280	4.0 to 4.8
<i>Miscellaneous Leisure Activities</i>			

References

- ASHRAE. (2019). *ASHRAE Handbook: Fundamentals*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- U.S. Department of Energy. (2021). *EnergyPlus Version 9.6.0 Documentation: Input Output Reference*. NREL.