

Standardization of Home Laundry Test Conditions

Developed in 1984 by AATCC Committee RA88; revised 1986, 1992, 1995, 2003, 2005, 2010, 2011, 2012.

This monograph has been used by many AATCC test methods to assess performance of garments or fabrics after laundering in a home laundering machine. In the past, these methods have been developed independently of each other, with little consultation between test method committees. This led to a wide variation in test conditions between methods, and even when the same condition was specified in the two methods there might be differences in nomenclature or designation of the condition. The situation was further complicated by the fact that some of the test conditions; e.g., wash water temperature, did not adequately reflect actual consumer practice. This was in large part due to significant changes in consumer practices in the past several years as a result of energy conservation measures and changing lifestyles.

In order to establish a consistent set of test conditions for all test methods involving home laundering, an AATCC committee was established. Based on the input of a number of AATCC and ASTM committees and a survey of actual consumer practice, a set of guidelines was developed for the standardization of laundering, drying and restoration terminology in AATCC test methods. These guidelines have been approved by all AATCC committees involved in laundering test methods and are now presented in Tables I-VIII for the guidance of committees developing test methods utilizing laundry procedures. The standard settings for top loading washing machines in Table II and tumble dryers in Table VIII have been updated over the years as washing machines and dryers have become more energy efficient. Washing parameters for machines before 2000 are no longer included in Table II of this monograph but are available on the AATCC web site. In response to the growing trend of top loading High Efficiency washing machines in the United States, Table III has been added to provide standardized machine parameters based on the most commonly available model in U.S. homes. The front loading washing machine parameters in Table VI are also updated.

The prescribed models allow testing laboratories to keep AATCC test conditions nearly unchanged for longer periods of time or until a major change in platform occurs.

As U.S. government regulations on energy and water usage in washing machines have become even more stringent, we expect both top loading and front loading machine parameters will need to be updated more frequently to reflect the changing machine designs. Table IX provides the Federal Trade Commission (FTC) wash temperatures for information purposes only. FTC drying conditions are the same.

In order to avoid the inconvenience of frequently changing the washing machine parameters in the AATCC monograph, the committee investigated the possibility of introducing programmable machines. Based on that investigation, the committee has worked with the machine manufacturer to develop programmed wash cycles that are available on select models that will allow for the use for a prescribed "key-dance." A key-dance is a sequence of user interface options that enables programmed AATCC cycles with their defined fill-wash-drain-spin-drain sequence based on the 2013 monograph

cycles. The 2013 AATCC recommended models feature normal and delicate key-dance cycles. These cycles are based on consumer relevant cycle profiles. The key-dance feature will be available in selected top load, top load high efficiency and front load models. The detail of the key-dance sequence and the appropriate models will be available on the AATCC web site: www.aatcc.org.

It should be noted that the designated wash temperatures are the upper limit of each temperature range, as this is the critical area for appearance retention test methods. Under lab conditions, the tap cold water temperature for top loading machines is defined as $27 \pm 3^\circ\text{C}$ ($80 \pm 5^\circ\text{F}$), which can vary globally in customer homes. This variation can have a wide range between 5 to 49°C (40 to 120°F). It should be emphasized that it is not necessary that all test conditions be included in any test method. However, if these conditions are used, the numerical/alphabetic designations and terminology shown in the tables should be used.

Table I—Temperatures used in Top Loading Machines

Designation	Wash Temperature	Rinse
I	Cold $10 \pm 6^\circ\text{C}$ ($50 \pm 10^\circ\text{F}$)	Tap cold
II	Cool $22 \pm 6^\circ\text{C}$ ($71 \pm 10^\circ\text{F}$)	Tap cold
III	Warm $30 \pm 6^\circ\text{C}$ ($86 \pm 10^\circ\text{F}$)	Tap cold
IV	Hot $44 \pm 6^\circ\text{C}$ ($111 \pm 10^\circ\text{F}$)	Tap cold

Table IIA—Top Loading Washing Machine Parameters without Load 2013⁵

Cycle ¹	Normal ¹	Delicate ¹
Water Level Medium ²	19 ± 2 gal	19 ± 2 gal
Agitation Speed	86 ± 5 spm ³	27 ± 5 spm
Washing Time	16 ± 2 min total	8.5 min total (5 min integrated soak)
Number of Rinses	1	1
Final Spin Speed	660 ± 20 rpm ⁴	500 ± 20 rpm
Final Spin Time	5 -0/+ 5 min	5 -0/+ 5 min

Table IIB—Top Loading Washing Machine Parameters without Load 2011-2012⁵

Cycle ¹	Normal ¹	Permanent Press ¹	Delicate ¹
Water Level Medium ²	19 ± 1 gal	19 ± 1 gal	19 ± 1 gal
Agitation Speed	86 ± 2 spm ³	86 ± 2 spm	27 ± 2 spm
Washing Time	16 min total	12 min total	8.5 min
Final Spin Speed	660 ± 15 rpm ⁴	500 ± 15 rpm	500 ± 15 rpm
Final Spin Time	5 min	5 min	5 min

Table IIC—Top Loading Washing Machine Parameters without Load 2009-2010⁵

Cycle ¹	Normal ¹	Permanent Press ¹	Delicate ¹
Water Level Medium ²	18 ± 1 gal	18 ± 1 gal	18 ± 1 gal
Agitation Speed	$179/119 \pm 2$ spm ³	$179/119 \pm 2$ spm	119 ± 2 spm
Washing Time	12 min total (6 min at step down agitation)	9 min total (3 min at step down agitation)	6 min
Final Spin Speed	645 ± 15 rpm ⁴	430 ± 15 rpm	430 ± 15 rpm
Final Spin Time	6 min	4 min	3 min

Table IID—Top Loading Washing Machine Parameters without Load 2000-2008

Cycle ¹	Normal ¹	Permanent Press ¹	Delicate ¹
Water Level Medium ²	18 ± 1 gal	18 ± 1 gal	18 ± 1 gal
Agitation Speed	179 ± 2 spm ³	179 ± 2 spm	119 ± 2 spm
Washing Time	12 min	10 min	8 min
Final Spin Speed	645 ± 15 rpm ⁴	430 ± 15 rpm	430 ± 15 rpm
Final Spin Time	6 min	4 min	6 min

¹ Cycle names vary with machine brand and model. "Normal Cycle" generally corresponds to the cycle that has the highest agitation and spin speed and it is also frequently designated as "Heavy Duty" or "Ultra Clean." "Permanent Press Cycle" generally corresponds to the cycle with the shortest final spin time to minimize wrinkle formation and it is also frequently designated as "Easy Care." "Delicate Cycle" generally corresponds to the cycle with the shortest washing time and it is also frequently designated as "Gentle."

² This is the water volume designated for washing medium sized loads also referred to as a "medium water level." From 1989-2010, a water volume of 18 ± 1 gallons (68 ± 4 L) was designated for washing medium size loads. In 2011, the medium water level on top selling standard top loaders was 19 ± 1 gallons (72 ± 4 L). A volume of 21-22 gallons (equivalent to 79-83 L) is designated for washing large size loads and it is frequently referred as "high water level."

³ spm = strokes per minute. Around 2009-2010, many of the top selling vertical axis washing machines featured a step-down agitation that started at a higher agitation (e.g. 179 spm) and then changed to a lower agitation (e.g. 119 spm) during the cycle.

⁴ rpm = revolutions per minute.

⁵ These newer parameters supplement and are not meant to replace earlier machine parameters. The washers and dryers specifications listed are based upon models that are available in the U.S., specifically, the models at 60 Hz. Many models outside of the U.S., specifically models at 50 Hz, may have some variations in these conditions. In many models, the wash time is shorter than listed. If this is the case, report the actual time. These parameters are subject to change for machines sold after January 1, 2010; please refer to the AATCC web site (www.aatcc.org) for the most updated testing parameters.

Table III—Temperatures used in High Efficiency Top Loading Washing Machines

Designation	Wash	Rinse
I	Tap cold	Tap cold
II	Cold 10 ± 6°C (50 ± 5°F)	Tap cold
III	Cool 18 ± 6°C (65 ± 5°F)	Tap cold
IV	Warm 24 ± 6°C (75 ± 5°F)	Tap cold
V	Hot 35 ± 6°C (95 ± 5°F)	Tap cold

Table IV—High Efficiency Top Loading Washing Machine Parameters without Load 2013

Cycle	Normal	Delicate
Water Level Medium	8 ± 2 gal	15 ± 1 gal
Agitation Speed	60 ± 5 spm	75 ± 2 spm
Washing Time	11 ± 2 min total	9 ± 2 min total, with integrated soaks
Number of Rinses	1	1
Final Spin Speed	770 ± 20 rpm	500 ± 20 rpm
Final Spin Time	5 -0/+ 13 min	5 -0/+ 5 min

Table V—Temperatures used in Front Loading Washing Machines¹

Designation	Wash	Rinse
I	Tap cold	Tap cold
II	Cold 14 ± 6°C (57.2 ± 10°F)	Tap cold
III	Warm 25 ± 6°C (77 ± 10°F)	Tap cold
IV	Hot 31 ± 6°C (87.8 ± 10°F)	Tap cold
V	Very hot 40 ± 6°C (104 ± 10°F)	Tap cold

¹ High efficiency (HE) washing machines have ATC (Automatic Temperature Control) settings to regulate water temperature for most wash cycles. Tap cold is considered to be a non-ATC setting. In consumer households, Tap cold is equivalent to the water temperature entering the home which is dependent on geography and time of year. For testing procedures, the recommended temperatures are 10 ± 3°C (50 ± 5°F).

Table VIA—Front Loading Washing Machine Parameters without Load 2013

Cycle ¹	Normal ¹	Delicate ¹
Water Level Medium ²	4 ± 1.5 gal	4.5 ± 1.5 gal
Agitation Speed	45 ± 10 rpm	40 ± 10 rpm
Soil Level ³	Normal	Light
Washing Time	11 ± 1 min	11 ± 1 min
Number of Rinses ⁴	2	2
Final Spin Speed	1300 ± 150 rpm	400 ± 150 rpm
Final Spin Time	12 -0/+ 6 min	11 -0/+ 6 min