Standardization of Home Laundry Test Conditions

Developed in 1984 by AATCC Committee RA88; revised 1986, 1992, 1995, 2003, 2005, 2010, 2011, 2012, 2013.

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 IV 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.

Under lab conditions, the cold water temperature is defined as 16 ± 4.2°C (60 ± 7.5°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 16 ± 4.2°C (60 ± 7.5°F)	Tap cold[6]
II	Warm 30 ± 4.2°C (86 ± 7.5°F)	Tap cold[6]
III	Hot 44 ± 4.2°C (111 ± 7.5°F)	Tap cold[6]
IV	Extra Hot 54 ± 4.2°C (130 ± 7.5°F)	Tap cold[6]

Table IIA—Top Loading Washing Machine Parameters without Load 2013[5]

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 2011-2012[5]

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 2009-2010[5]

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 ± 2 spm[3]	179/119 ± 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.

[6] Tap cold temperature for Rinse is not meant to be controlled. Tap cold is equivalent to the water temperature entering the home which is dependent on geography and time of year. The tap water temperature can vary globally in customer homes. This variation can have a wide range between 5 to 49°C (40 to 120°F).

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

Designation	Wash	Rinse
I	Cold 16 ± 4.2°C (60 ± 7.5°F)	Tap cold
II	Warm 24 ± 4.2°C (75 ± 7.5°F)	Tap cold
III	Hot 35 ± 4.2°C (95 ± 7.5°F)	Tap cold
IV	Extra Hot 54 ± 4.2°C (130 ± 7.5°F)	Tap cold

Table IV—High Efficiency Top Loading Washing Machine Parameters with 8 lb 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 Machines[1]

Designation	Wash	Rinse
I	Cold 16 ± 2.9°C (60 ± 5°F)	Tap cold
II	Warm 25 ± 2.9°C (77 ± 5°F)	Tap cold
III	Hot 35 ± 2.9°C (95 ± 5°F)	Tap cold
IV	Extra Hot 54 ± 2.9°C (130 ± 5°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.

Table VIA—Front Loading Washing Machine Parameters with 8 lb 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

Table VIB—Front Loading Washing Machine Parameters Prior to 2013

Cycle[1]	Normal[1]	Permanent Press[1]	Delicate[1]
Water Level Medium (8 lb Load)[2]	5.75 ± 1 gal	5.75 ± 1 gal	5.75 ± 1 gal
Agitation Speed	40 rpm	30 rpm	30 rpm
Soil Level[3]	Normal	Normal	Light
Washing Time	18 min	16 min	14 min
Number of Rinses[4]	2	2	2
Final Spin Speed	1100 ± 100 rpm	800 ± 100 rpm	400 ± 100 rpm
Final Spin Time	9.5 min	6 min	3 min

[1] Cycle names vary with machine brand and model. "Normal" cycle generally corresponds to the cycle that has the high agitation and spin speed. "Permanent Press" cycle generally corresponds to medium agitation and spin speeds. "Delicates" or "Hand Wash" cycles generally combine lower tumbling and spin speeds for gentle fabric care. Other cycles that may be found on front loading machine include "Sanitary," "Whites," or "Heavy Duty" cycles which generally correspond to cycles with the longest wash time and highest spin speed. "Sanitary" cycles are typically found on machines equipped with on-board heaters to achieve water temperatures ≥ 160°F.

[2] Water volume in HE machines is determined by an automatic wash load detection system.

[3] Wash time is dependent on soil level selected. Selecting "Heavy" soil level will increase the wash time, whereas "Light" or "Extra Light" will decrease the wash time.

[4] Liquid fabric softener is generally dispensed in the final rinse. Most front loading machines have an option to include an extra rinse in addition to the standard machine setting.

Table VII—Drying Procedures

Designation	Drying Techniques
A	Tumble
B	Line
C	Drip
D	Screen
E	Flat Bed Press

Table VIII—Temperatures used in Tumble Dryers[1]

Cycle	Maximum Exhaust Stack Temperature with Loaded Dryer[1]	Cool Down Time
Normal or permanent press	68 ± 6°C (155 ± 10°F)	Up to 10 min
Delicate, synthetic	60 ± 6°C (140 ± 10°F)	Up to 10 min

[1] The temperature of dryer exhaust should be measured at the end of the drying cycle before any cool down.

Table IX—Federal Trade Commission—Wash Temperature

Warm	Initial warm temperature setting 32-43°C (90-110°F)
Hot	Water up to 66°C (150°F)

Note: It is recommended that **top loading** washing machines used for performing standard testing be calibrated before running a test or at minimum once a year to confirm they are performing as specified. This is particularly important for older models and machines that are three or more years old. No consumer calibration methods are currently available for top loading HE and front loading machines. Simple procedures can be used to calibrate the **top loading** washing machines as follows:

a) Water Level: Manually using a graduated metal pail, fill machine with room temperature water until it totals the specified volume (e.g., 18 gal). Vertically, submerge into the water (perpendicularly to its surface), an 18 inch or longer metal ruler until it touches the bottom of the machine drum. Using a permanent ink marker, draw a line on the ruler at the point of contact with the surface of the water. In the future, use the marked ruler to check the volume of water in taken by the machine (ruler needs to be submerged at exactly the same point where it was submerged during the initial calibration).

b) Agitation Speed (spm): To facilitate the counting of the spm during agitation in the wash cycle, tape (use duct tape) one end of a 6 inch metal ruler or rod to the center point on the top of the agitating post of the machine. Tape a small piece of the duct tape at the free end of the metal ruler. Start machine and count the number of strokes per minute in the wash cycle by focusing your eyes on the marked free end of the ruler.

c) Spin Speed (rpm): Use a tachometer to measure the speed (rpm) of the machine during the spinning process. Follow the operating instructions for the tachometer that is used.