

# Standardization of Home Laundry Test Conditions

Developed in 1984 by AATCC Committee RA88; revised 1986, 1992, 1995, 2003, 2005, 2010, 2011 (and numbered), 2012, 2013, 2016.

**A** AATCC Committee RA88, Home Laundering Technology, was established to develop a consistent set of test conditions for all test methods involving home laundering. 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 conditions 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 that specify laundry procedures.

Laundering temperatures and other parameters listed in Monograph (M) 6 may not be the same as those listed in various test methods. Parameters in M6 are updated periodically to reflect consumer experience, taking into account current technology and regulations regarding home water heater temperatures, particularly in the United States.

Typically, test method committees pursue a deliberate effort to maintain the same test method conditions over a long period of time in order to produce comparable results over time. Additionally, significant changes may invalidate precision data developed using the original conditions.

Temperatures listed in AATCC test methods were established at the time the methods were developed or revised, and closely mirror the temperature ranges specified in 16 CFR Part 423 for care labels. It should also be noted that AATCC test methods were developed using traditional top loading washing machines. Specified water level, detergent, and other details are not applicable to high efficiency top loading or front loading machines. New, commercially available home laundering machines may have to be modified by the user to meet the specifications in various test methods. All test reports should indicate the exact testing conditions, and any modification of the standard method, including use of M6 parameters. **Results of tests performed with different conditions may not be comparable.**

The standard settings for traditional top loading washing machines in Table II and

tumble dryers in Table VII 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 from AATCC. In response to the growing trend of high efficiency top loading washing machines in the United States, Table IV has been added to provide standardized machine parameters based on the most commonly available models in U.S. homes. The high efficiency 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 regulations on energy and water usage in washing machines have become even more stringent, both top loading and front loading machine parameters will

need to be updated more frequently to reflect the changing machine designs. The wash temperatures listed in Tables I, III, and V are those associated with common settings on current consumer washing machines. Table VIII provides the US Federal Trade Commission (FTC) wash temperatures, as published in 16 CFR Part 423, Appendix A, for information purposes only. FTC does not define drying temperatures. AATCC is actively working with FTC to align wash temperatures. Updates on FTC alignment, and revisions to this monograph, can be found at [www.aatcc.org](http://www.aatcc.org) as they become available.

RA88 worked with a machine manufacturer to develop programmed wash cycles on select models based on the 2013 monograph parameters. The details of the programmed cycle, and other washing machine and tumble dryer information are available at [www.aatcc.org](http://www.aatcc.org).

**Table I—Water Temperatures used in Traditional Top Loading Machines**

Machine Setting <sup>1</sup>	Wash	Rinse	US Care Label Term <sup>2</sup>
Cold	16 ± 4.2°C (60 ± 7.5°F)	Tap cold <sup>3</sup>	Not applicable
Warm	30 ± 4.2°C (86 ± 7.5°F)	Tap cold <sup>3</sup>	Cold
Hot	44 ± 4.2°C (111 ± 7.5°F)	Tap cold <sup>3</sup>	Warm
Extra Hot	54 ± 4.2°C (130 ± 7.5°F)	Tap cold <sup>3</sup>	Hot <sup>2</sup>

<sup>1</sup>Settings may vary for models other than those listed on the AATCC website ([www.aatcc.org](http://www.aatcc.org)). Some models may not include all setting options. It is important to use the prescribed wash water temperatures, regardless of setting names.

<sup>2</sup>Refer to Table VIII or 16 CFR Part 423, Appendix A for care label temperature ranges. Wash temperatures above the stated range for machine setting Extra Hot may require manual override of the standard washing machine fill procedure. This modification should be noted in the test report.

<sup>3</sup>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. In the extreme, water temperatures in consumer homes can vary from 4°C to 49°C (40°F to 120°F); however, on average, these temperatures will vary from 13°C to 24°C (55°F to 75°F).

**Table IIA—Traditional Top Loading Washing Machine Parameters without Load 2000-2008**

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

**Table IIB—Traditional Top Loading Washing Machine Parameters without Load 2009-2010<sup>5</sup>**

	Normal <sup>1</sup>	Permanent Press <sup>1</sup>	Delicate <sup>1</sup>
Water Level Medium <sup>2</sup>	18 ± 1 gal	18 ± 1 gal	18 ± 1 gal
Agitation Speed	179/119 ± 2 spm <sup>3</sup>	179/119 ± 2 spm	119 ± 2 spm
Washing Time	12 min total (6 min at stepdown agitation)	9 min total (3 min at stepdown agitation)	6 min
Final Spin Speed	645 ± 15 rpm <sup>4</sup>	430 ± 15 rpm	430 ± 15 rpm
Final Spin Time	6 min	4 min	3 min

**Table IIC—Traditional Top Loading Washing Machine Parameters without Load 2011-2012<sup>5</sup>**

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

**Table IID—Traditional Top Loading Washing Machine Parameters without Load 2013<sup>5</sup>**

	Normal <sup>1</sup>	Delicate <sup>1</sup>
Water Level Medium <sup>2</sup>	19 ± 2 gal	19 ± 2 gal
Agitation Speed	86 ± 5 spm <sup>3</sup>	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 <sup>4</sup>	500 ± 20 rpm
Final Spin Time	5 -0/+ 5 min	5 -0/+ 5 min

Notes for Tables IIA, IIB, IIC, and IID:

<sup>1</sup> 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."

<sup>2</sup> This is the water volume designated for washing medium sized loads, also referred to as a "medium water level." From 1989 to 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."

<sup>3</sup> 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.

<sup>4</sup> rpm = revolutions per minute.

<sup>5</sup> 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 website ([www.aatcc.org](http://www.aatcc.org)) for the most updated testing parameters.

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

Machine Setting <sup>1</sup>	Wash	Rinse	US Care Label Term <sup>2</sup>
Cold	16 ± 4.2°C (60 ± 7.5°F)	Tap cold <sup>3</sup>	Not Applicable
Warm	24 ± 4.2°C (75 ± 7.5°F)	Tap cold <sup>3</sup>	Cold
Hot	35 ± 4.2°C (95 ± 7.5°F)	Tap cold <sup>3</sup>	Warm
Extra Hot	54 ± 4.2°C (130 ± 7.5°F)	Tap cold <sup>3</sup>	Hot <sup>2</sup>

<sup>1</sup> Settings may vary for models other than those listed on the AATCC website ([www.aatcc.org](http://www.aatcc.org)). Some models may not include all setting options, It is important to use the prescribed wash water temperatures, regardless of setting names.

<sup>2</sup> Refer to Table VIII or 16 CFR Part 423, Appendix A for care label temperature ranges. For wash temperatures above the stated range for machine setting Extra Hot, it may be necessary to manually override the standard washing machine fill procedure. This modification should be noted in the test report.

<sup>3</sup> 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. In the extreme, water temperatures in consumer homes can vary from 4°C to 49°C (40°F to 120°F); however, on average, these temperatures will vary from 13°C to 24°C (55°F to 75°F).

**Table IV—High Efficiency Top Loading Washing Machine Parameters with 8-lb Load 2013**

	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—Water Temperatures used in High Efficiency Front Loading Washing Machines<sup>1</sup>**

Machine Setting <sup>2</sup>	Wash	Rinse	US Care Label Term <sup>3</sup>
Cold	16 ± 2.9°C (60 ± 5°F)	Tap cold <sup>4</sup>	Not Applicable
Warm	25 ± 2.9°C (77 ± 5°F)	Tap cold <sup>4</sup>	Cold
Hot	35 ± 2.9°C (95 ± 5°F)	Tap cold <sup>4</sup>	Warm
Extra Hot	54 ± 2.9°C (130 ± 5°F)	Tap cold <sup>4</sup>	Hot <sup>3</sup>

<sup>1</sup> 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.

<sup>2</sup> Settings may vary for models other than those listed on the AATCC website ([www.aatcc.org](http://www.aatcc.org)). Some models may not include all setting options, it is important to use the prescribed wash water temperatures, regardless of setting names.

<sup>3</sup> Refer to Table VIII or 16 CFR Part 423, Appendix A for care label temperature ranges. For wash temperatures above the stated range for machine setting Extra Hot, it may be necessary to manually override the standard washing machine fill procedure. This modification should be noted in the test report.

<sup>4</sup> 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. In the extreme, water temperatures in consumer homes can vary from 4°C to 49°C (40°F to 120°F); however, on average, these temperatures will vary from 13°C to 24°C (55°F to 75°F).

**Table VIA—High Efficiency Front Loading Washing Machine Parameters Prior to 2013**

	Normal <sup>1</sup>	Permanent Press <sup>1</sup>	Delicate <sup>1</sup>
Water Level Med. (8-lb load) <sup>2</sup>	5.75 ± 1 gal	5.75 ± 1 gal	5.75 ± 1 gal
Agitation Speed	40 rpm	30 rpm	30 rpm
Soil Level <sup>3</sup>	Normal	Normal	Light
Washing Time	18 min	16 min	14 min
Number of Rinses <sup>4</sup>	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

**Table VIB—High Efficiency Front Loading Washing Machine Parameters with 8-lb Load 2013<sup>5</sup>**

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

Notes for Tables VIA and VIB:

<sup>1</sup> 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.

<sup>2</sup> Water volume in HE machines is determined by an automatic wash load detection system.

<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> 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 website ([www.aatcc.org](http://www.aatcc.org)) for the most updated testing parameters.

**Table VII—Temperatures used in Tumble Dryers**

Cycle	Maximum Exhaust Temp <sup>1</sup>	Cool Down Time
Normal/Cotton Sturdy	68 ± 6°C (155 ± 10°F)	Up to 10 min
Delicate	60 ± 6°C (140 ± 10°F)	Up to 10 min
Permanent Press	68 ± 6°C (155 ± 10°F)	Up to 10 min

<sup>1</sup>The temperature of loaded dryer exhaust should be measured at the end of the drying cycle, before any cool down.

**Table VIII—Water Temperatures Published by US Federal Trade Commission<sup>1</sup>**

<b>Designation</b>	<b>Initial Wash</b>
Cold	Up to 30°C (86°F)
Warm	31-44°C (87-111°F)
Hot	45-63°C (112-145°F)

<sup>1</sup>Refer to 16 CFR Part 423, Appendix A for current care label temperature ranges.

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 HE top loading and front loading machines. Simple procedures can be used to calibrate the **top loading** washing ma-

chines as follows:

a) **Water Level:** Manually using a graduated 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.