

烫洗后至无尺寸的变化

经美国纺织品染化师协会 (AATCC) RA42 委员会在 1970 年开发;在 1973,2000 年进行重申;在 1978, 1987,1995,2001,2003 年进行修订(更改标题);并在 1982,1985,1989,1990,1991,1996,1997 年以编辑身份修订;1992 年以编辑身份修订和重申。内容涉及到 ISO 3759。

1. 目的与目标

在此测试方法是为了测定织物在经历若干次洗涤后其尺寸的变化。四种洗涤温度、三种搅拌周期、两种漂洗温度以及四种干燥工序包含了从普通家庭洗涤到现代化洗衣机洗涤的所有条件。

2. 原理 经过洗涤后织物尺寸的变化是通过对未进行洗涤的织物做一系列测试基准而测出的。

3. 术语

3.1 尺寸变化,名词——遭受特殊处理后试样长度或宽度变化的总称。此变化通常用处理后织物尺寸占织物原始尺寸的百分比来表示。

3.2 增长,名词——由于织物试样长度或宽度的增加而引起尺寸的改变。

3.3 烫洗,名词——在纺织物材料中这样定义:为了除去污物或/和污点而用水性洗涤液对织物进行的处理(洗涤)过程。通常包括漂洗,萃取及干燥。

3.4 收缩,名词——由于试样长度或宽度的减小而引起的织物尺寸的变化。

4. 安全措施

注意:这些安全说明的目的仅仅做为警告信息。这些预防措施在测试的程序中都是辅助性的,并不以为着都被包括在内。这个测试方法在处理材料过程中的使用安全以及正确的技术手法都要归使用者负责。生产者必须对诸如材料安全详细资料的特别信息以及别的生产者的建议进行咨询。所有的 OSHA 标准和规定都必须询问并且严格的遵守。

4.1 坚持优良的实验室操作。在所有的实验区域必须戴安全眼镜。

4.2 AATCC 于 1993 年推出的标准参照洗涤剂刺激性很大,一定要小心,防止将眼睛或皮肤暴露其中。

4.3 在实验室操作仪器时,应遵守生产商的安全建议。

5. 仪器与设备

5.1 自动洗衣机。(见 12.1)

5.2 自动翻转干燥机。(见 12.2)

5.3 带有筛孔或钻孔的处理/干燥架。(见 12.3)

5.4 滴干/晾干设备。

5.5 AATCC1993 年推出的标准参照洗涤剂。(见 12.9 与 12.10)

5.6 用重物压在面积为 920 × 920mm(36 × 36 英寸)的漂洗过的缝边棉条上(重压洗涤负载 1)或聚酯/棉为 50/50 的平织布(重压洗涤负载 3)。(见 12.4 及 12.10)

5.7 与合适的直尺、卷尺及标记模板或其他标记仪器一起使用的永不退色签名笔,也可用缝纫线作基准标记。

5.8 测量

5.8.1 标有毫米单位(1/8 或 1/10 英寸)的卷尺或模板。

- 5.8.2 用卷尺或模板直接量出织物的尺寸改变百分率,精确到0.5%或更小的增加量。(见12.6)
5.9 至少5.0Kg的负载能力(见12.6)

6. 测试试样

6.1 取样与制备

6.1 取样与制备

6.1.1 从将被用来进行尺寸改变的试样中选出的试样一定要能代表织物经历的处理过程,处理完成,实验室测试,批量或成品阶段。

6.1.2 当未经洗涤而已变形的织物进行洗涤后,可能会产生错误的尺寸变化结果。在这种情况下,建议不要选用已变形的试样。

6.1.3 应将圆形针织物撕裂并单层展开。只有在宽体机上制造的圆形针织物被允许在它们的圆形形状下测试。宽体机上生产的圆形针织物是那些被用来作无边外衣的产品。宽体机上生产的圆形外衣及无边外衣(针织物)应按照 AATCC 测试方法 150,外衣洗涤后尺寸改变的测试方法来测试。

6.1.4 如果在洗涤中试样有擦伤 见 12.7

6.1.5 标注测试基准点之前,对待测试样按 ASTM D 1176 织物的处理及测试标准对织物进行处理。将试样分开悬挂在带有筛孔或钻孔的架子上,在 $21 \pm 1^\circ\text{C}$ 或 $65 \pm 2\% \text{RH}$ 的条件下至少挂 4 小时。

6.1.6 将试样平铺在光滑的平面上。不要使试样的任何部分悬挂在工作台边缘。用一块选好尺寸的模板在平行于试样边缘或长度方向上标出测试基准。不要选择较于试样宽度 1/10 的地方。试样应选择带有不同横向线与纵向线的区域(见图1)。在样品上割下试样之前,应先将其长度方向标好。如果可能,每件样品上要用到 3 块试样。在在样品不足时,也可以只用 1 个或 2 个试样。

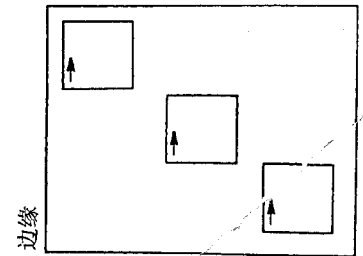


图1 割切织物试样的图

6.2 标记测量基准

6.2.1 选择 1:250mm(10.0 英寸)的测试基准。在面积为 $380 \times 380\text{mm}$ (15 × 15 英寸)的待测样品上标出 3 对平行于样品长度方向与宽度方向上都是 250mm(10.0 英寸)的测试基准,至少相距 120mm(5 英寸)。

6.2.2 选择 2:500mm(18.0 英寸)的测试基准。在面积为 $610 \times 610\text{mm}$ (24.0 × 24.0 英寸)的待测样品上标出 3 对平行于样品长度方向与宽度方向上都是 500mm(18.0 英寸)的测试基准,至少相距 240mm(10 英寸)。

6.2.3 对较窄的职务。

6.2.3.1 对宽度大于 125mm(5 英寸)而小于 380mm(15 英寸)的织物,用织物的宽度作为测试试样的宽,试样的长度规定为 380mm(15 英寸),只用两对平行于长度方向的基准。像 6.2.1 中描述的那样标出长度基准,宽度的测量是有选择的。

6.2.3.2 对宽度为 25 — 125mm(1 — 5 英寸)的织物,用织物的宽度作为测试试样的宽,试样的长度规定为 380mm(15 英寸),只用两对平行于长度方向的基准。像 6.2.1 中描述的那样标出长度基准,宽度的测量是有选择的。

6.2.3.3 对宽度小于 25mm(1 英寸)的织物,用织物的宽度作为测试试样的宽,试样的长度规定为 380mm(15 英寸),只用一对平行于长度方向的基准。像 6.2.1 中描述的那样标出长度基准,宽度的测量是有选择的。

6.3 试样的型号及原始尺寸

6.3.1 试样的型号及测量基准间的距离必须在报告中指明。

6.3.2 试样尺寸的变化可能会由于试样型号的不同,测试基准的长度及数目不同,因而不具有可比性。

6.3.3 在对织物用 6.2 中的测试基准时,为了提高尺寸变化结果的准确性与精度,需要将结果精确度毫米,即 1/8 或 1/10 英寸的直尺或卷尺来测量每对基准间的距离,并记录。这叫做 A 测量。为防止织物宽度小于 380mm(15 英寸)的情况,在要用到试样宽度时,测量织物的宽度。如果使用的是已经校准刻度的模板来标记并测量尺寸的变化百分比,则不需测量原始尺寸。

表 I 可供选择的洗涤及干燥条件(见 7.1)

机器工作周期	洗涤温度	干燥工序
(1)普通/硬棉	(II) $27 \pm 3^{\circ}\text{C}$ ($80 \pm 5^{\circ}\text{F}$)	(A) 翻转
(2)软棉	(III) $41 \pm 3^{\circ}\text{C}$ ($105 \pm 5^{\circ}\text{F}$)	i. 硬棉
(3)持久压力下	(IV) $49 \pm 3^{\circ}\text{C}$ ($120 \pm 5^{\circ}\text{F}$)	ii. 棉
	(V) $60 \pm 3^{\circ}\text{C}$ ($140 \pm 5^{\circ}\text{F}$)	iii. 持久压力下
		(B) 晾干
		(C) 滴干
		(D) 筛干

表 II 无负荷洗涤洗衣机的条件

	普通	精细	持久压力下
(A) 水位	$18 \pm 1\text{gal}$	$18 \pm 1\text{gal}$	$18 \pm 1\text{gal}$
(B) 搅拌速度	$179 \pm 2\text{spm}$	$119 \pm 2\text{spm}$	$179 \pm 2\text{spm}$
(C) 洗涤时间	12min	8min	10min
(D) 转速	$645 \pm 15\text{rpm}$	$430 \pm 15\text{rpm}$	$430 \pm 15\text{rpm}$
(E) 最终转动周期	6min	4min	4min

表 III 干燥器条件

	硬棉	软棉	持久压力下
排气温度	高	低	高
	$66 \pm 5^{\circ}\text{C}$ ($150 \pm 10^{\circ}\text{F}$)	$< 60^{\circ}\text{C}$ (140°F)	$66 \pm 5^{\circ}\text{C}$ ($150 \pm 10^{\circ}\text{F}$)
冷却时间	10min	10min	10min

7. 测试工序

7.1 表 I、II、III 概括了相应的冲洗、漂洗及干燥的条件和设备。关于设备和洗涤条件的一些附加信息,可以在此技术手册的其他部分关于家庭洗涤条件的测试标准中找到。

7.2 洗涤

7.2.1 称量织物及足够重的重物以能产生 $1.8 \pm 0.1\text{Kg}$ ($4.0 \pm 0.25\text{lb}$) 的负荷。 $3.6 \pm 0.1\text{Kg}$ ($8.0 \pm 0.25\text{lb}$) 的备用负荷可能会用到。用 1.8Kg (4lb) 重量的负荷产生的尺寸变化结果会与用 3.6Kg (8lb) 重量的负荷产生的尺寸变化结果不同,两者没有可比性。

7.2.2 选择特定的水平面,规定洗涤的水温以及不高于 29°C (85°F) 的漂洗温度。如果不能保证此温度,必须记录下所用的漂洗温度。在洗衣机中加入 $18 \pm 0.5\text{gal}$ 的水对于负荷重量变化的试验,应该加入 $22 \pm 0.5\text{gal}$ 的水。

7.2.3 向 $18 \pm 0.5\text{gal}$ 水中加入 $66 \pm 1\text{g}$ 的 1993 年的 AATCC 标准参照洗涤剂,对于负荷变化的试验,应该加入 $22 \pm 0.5\text{gal}$ 的水中加 $80 \pm 1\text{g}$ 1993 年的 AATCC 标准参照洗涤剂。快速搅拌,使洗涤剂溶解,停止搅拌。必须注意在水质较软的地区,洗涤剂的用量可以适当的减少,以避免产生过多的泡沫。

7.2.4 将试样及重物放进仪器,设定洗衣机为需要的洗涤时间(见表 I 和表 II)。

7.2.5 对于要进行 A、B、D 工序测试的试样,允许洗涤进行到最后的抽丝过程,试样经过最后的抽丝过程,立即变成缠结在一起的碎片,注意最小变形量,并用 A、B、D 工序干燥(见表 I 和表 II)。

7.2.6 对于要进行 C 工序测试的试样,允许洗涤进行到最后的抽丝过程,在最后一次漂洗的水开始排出之

前,从洗衣机中取出试样。

7.3 干燥

7.3.1 对于干燥工序 B、C 及 D,不能直接将空气吹到试样上,因为这样会引起织物的形变。

7.3.2 (A) 翻转干燥:将洗涤负荷(试样以及重物)放进转笼式干燥器中,按照表 III 中的规定,调到适当的温度。对热敏感的纤维,干燥温度应与生产商建议的温度一致,并温度的值记入报告中,直到试样完全干透再停止干燥,然后立即取出试样。

7.3.3 (B) 凉干。挂住试样两角,使织物按长度方向自然下垂。将试样挂在室温不超过 26℃(78 ℉)的无流动的空气中直到干透。

7.3.4 (C) 滴干。挂住试样两角,使织物按长度方向自然下垂。将试样挂在室温不超过 26℃(78 ℉)的无流动的空气中直到干透。

7.3.5 筛干。将织物平铺在一块有筛孔的平面上,除去褶皱,不要扭曲或用力拉伸试样。将试样放在室温不超过 26℃(78 ℉)的无流动的空气中直到干透。

7.3.6 重复选定的洗涤、干燥过程两次或达到规定数目的周期。

7.4 处理与恢复

7.4.1 在最后一道洗涤干燥循环完成以后,将每个试样分散的平铺在处理架的筛板上至少 4 小时,保持空气 $21 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$), $65 \pm 2\%$ RH。

7.4.2 对于要用作制备外衣的织物,通常在测定尺寸变化之前先进行一些处理。这种处理的方法尚无固定标准(一般用手在长度以及宽度方向上以某种不确定的力拉伸试样)。若在测试之前,对织物进行了这种处理,处理方法应该写入汇报之中,并在测试结果上标明织物在测试之前受过这种处理。

7.4.3 如果试样的褶皱程度太厉害,消费者通常会用熨斗熨烫织物,因此试样在基准重测之前也可以先进行熨烫。在织物熨烫过程中一定要选择安全的熨烫温度,见 AATCC 测试方法 - 133 热处理后的染色牢度中的安全熨烫温度指南。只有在要除去褶皱时才能对织物用力加压。

7.4.3.1 由于每个不同的操作者在进行手工熨烫时的不同(尚无对手工熨烫的测试标准),所以手工熨烫测试的尺寸变化结果再现性非常小。相应的,在比较不同操作者所汇报的织物尺度变化结果时一定要注意这一点。

7.4.3.2 手工熨烫主要是为了用在评价用作外衣的织物,因为这类织物在穿着以前通常要用熨烫来除去褶皱,相应的,在比较不同操作者所汇报的织物尺度变化结果时一定要注意这一点。

7.4.3.3 熨烫处理后,标注测试基准点之前,对待测试样按 ASTM D 1176 织物的处理及测试标准对织物进行处理。将试样分开悬挂在带有筛孔或钻孔的架子上,在 $21 \pm 1^\circ\text{C}$ 或 $65 \pm 2\%$ RH 的条件下至少挂 4 小时。

8. 测量

8.1 按照上面所述的处理后,将试样无张力的铺在一块光滑平整的平面上。测量并记录每对测量基准间的距离,准确到毫米,八分之一或者十分之一英寸。这叫作 B 测量。如果所用的测量尺是以尺寸变化 1% 为单位的,则测量时应精确到 0.5% 或者稍微大一点,并记下尺寸变化的百分比。

8.2 对大多数织物,在测量过程中织物的褶皱会因测量工具的压力而展平,所以不会带来册来年感偏差。

9. 计算与说明

9.1 计算

9.1.1 如果测量结果以尺寸变化的百分比来表示的,则取一次、三次或指定次数的各个方向的距离测量的平均值,分别求出长和宽的平均值,精确到 0.1%。

9.1.2 如果测量结果准确到毫米,八分之一或者十分之一英寸,则按照下式计算一次、三次或指定次数洗涤干燥后的尺寸变化。

$$\text{平均值 \% DC} = 100(B - A)/A$$

式中:DC 表示平均尺寸变化

A 表示原始尺寸测量的平均值

B 表示洗涤后的测量的平均值

对于原始尺寸以及最后尺寸的平均值都是对所有试样各个方向上测量的平均值,分别计算长与宽的平均值,准确到 0.1% (见 12.8)

9.1.3 最后测量结果小于原始测量结果的是负的尺寸变化,称作收缩。

最后测量结果大于原始测量结果的是正的尺寸变化,称作增长。

9.2 解释说明

9.2.1 如果是一次洗涤干燥并用手工熨烫的试样,并按照 9.1 所述的计算,所得到的测试结果符合先前的测试标准,则继续 7.2、7.3、7.4 中所述的测试,直到得到一组完整的循环数据。

9.2.2 如果是一次洗涤干燥并用手工熨烫的试样,并按照 9.1 所述的计算,所得到的测试结果超出了先前的测试标准,则停止测试。

10. 汇报

10.1 汇报每一个试样的如下测试数据:

(a)长与宽的尺寸变化;精确到 0.1%。如果是收缩则加上负号,如果是增长则加正号。

(b)洗涤工序(包括洗涤方式,周期及温度)和干燥工序(包括干燥方式,周期及温度)。

(c)测试试样及基准的大小。

(d)负荷的重量,例如:1.8Kg(4.0lb)或 3.6Kg(81lb)。

(e)完整的洗涤,干燥循环的次数。

(f)织物是否原来就有扭曲或褶皱。

(g)织物是否经过手工熨烫。

(h)织物是否受过处理及处理方法。

11. 精度与误差

11.1 精度。这种测试方法的精确性尚未确立。此法的使用者,在对同一实验室所得的平均值与其他实验室作比较时应当使用标准的统计技术。

11.2 偏差。在自动洗涤过程中织物尺寸的变化,只能用一些列的测试方法才能确定。没有一种方法可以独立而准确的测出变化值。由于估计方法的特性,所以每种测试方法都有不定的偏差。

12. 注意

12.1 要获得关于此测试中所用的洗衣机的规范参数以及信息,从美国纺织品染化师协会(AATCC)获取,汇票信箱 12215, Research Triangle Park 国家合格证号:27709;电话:919/549-8141;传真:919/549-8933;e-mail:orders@aatcc.org。其他类型提供的相应的数据的洗衣机也可以用。表 II 中列出的数据是此试、试验中所用洗衣机的真实速度及洗衣时间。其他洗衣机的参数可能会有一个或者多个的变化。

12.2 要获得关于此测试中所用的干燥机的规范参数以及信息,从美国纺织品染化师协会(AATCC)获取,汇票信箱 12215, Research Triangle Park 国家合格证号:27709;电话:919/549-8141;传真:919/549-8933;e-mail:orders@aatcc.org。其他类型提供的相应的数据的干燥机也可以用。表 III 中列出的数据是此试、试验中所用干燥机的真实速度及洗衣时间。其他干燥机的参数可能会有一个或者多个的变化。

12.3 筛孔或者钻洞处理/干燥架可以从 Somers Sheet Metal Inc., 5590N. Church St., Greensboro 国家合格证号:27405,电话:336/643-3477;传真:336/643-7443;衣架设计图从美国纺织品染化师协会(AATCC)获取,汇票信箱 12215, Research Triangle Park 国家合格证号:27709;电话:919/549-8141;传真:919/549-8933;e-mail:orders@aatcc.org。

12.4 负荷用重物可从 Testfabrics Inc. 获取,其汇票信箱:26415;电话:570/603-0432;传真:570/603-0433;e-mail:testfabric@aol.com。SDL Atlas L. L. C., 1813A Associate Lane, Charlotte, 处有效的获得;国家合格证号 28217;电话:704/329-0911;e-mail:info@sdlatlas.com。

12.5 不同笔尖的标记笔可以从 MARK - Tex Corp., Box681, Englewood NJ 07631 处获取 可以汇票到 AATCC 技术手册/2004

AATCC, P. O. Box 12215, Research Triangle Park NC 27709; 电话: 919/549 - 8141; 传真: 919 - 549 - 8933; 电子邮件: orders@aatcc.org.

12.6 有刻度的模板可以汇票到 AATCC, P. O. Box 12215, Research Triangle Park NC 27709; 电话: 919/549 - 8141; 传真: 919 - 549 - 8933; 电子邮件: orders@aatcc.org。百分比的机械标记仪器和标记测量尺可以从 The Sanforized Co., 3200 Highlands Plwy Suite 300, Smyrna GA 30082; tel: 770/8037662.

12.7 如果在干洗中出现过多的织物的碎屑, 样品的边缘可能被修剪。不建议用缝纫或修边的样品, 应为它们可能会影响尺寸改变的结果。然而, 使用 AATCC 测试方法 124 (多次洗涤后织物的外观的方法), 135 用于测试同一个试样。一些机织织物要求样品的缝制或修剪边缘, 在洗涤或干燥时以防止严重的缠结, 以至于影响到尺寸的变化和光滑度的评估。

12.8 如果需要同种试样或不同试样的尺寸变化信息, 计算尺寸的变化要根据每种试样测试数据的每对测试基准或根据不同试样测试数据间 3 对测试基准的平均值。

12.9 信息获取可以汇票到 AATCC, P. O. Box 12215, Research Triangle Park NC 27709; 电话: 919/549 - 8141; 传真: 919 - 549 - 8933; 电子邮件: orders@aatcc.org.

12.10 AATCC 技术中心进行了一项研究, 该研究是将 1993 AATCC 标准参考清洁剂, AATCC 标准参考清洁剂 124 和两种不同类型被用作负荷的纤维 (现在正在使用的或即将推出的)。在下述的测试条件下进行:

机械周期: 普通/硬棉

洗涤温度: $60 \pm 3^{\circ}\text{C}$ ($140 \pm 5^{\circ}\text{F}$)

干燥程序: 翻转干燥, 硬棉循环

纤维测试: 白斜纹布 (100% 棉)

米色斜纹布 (100% 棉)

灰色毛葛 (100% 棉)

蓝色斜纹布 (50/50 聚合物/棉)

使用清洁剂或负荷加载纤维的测试结果没有发现明显的差别。

Dimensional Changes of Fabrics after Home Laundering

Developed in 1970 by AATCC Committee RA42; reaffirmed 1973, 2000; revised 1978, 1987, 1995, 2001, 2003 (with title change); editorially revised 1982, 1985, 1989, 1990, 1991, 1996, 1997; editorially revised and reaffirmed 1992. Related to ISO 3759.

1. Purpose and Scope

1.1 This test method is intended for the determination of dimensional changes of fabrics when subjected to home laundering procedures used by consumers. Four washing temperatures, three agitation cycles, two rinse temperatures and four drying procedures cover the common home care options available to consumers using current laundering machines.

2. Principle

2.1 The dimensional changes of fabric specimens subjected to home laundering care are measured using pairs of benchmarks applied to the fabric before laundering.

3. Terminology

3.1 **dimensional change**, *n.*—a generic term for changes in length or width of a fabric specimen subjected to specified conditions. The change is usually expressed as a percentage of the initial dimension of the specimen.

3.2 **growth**, *n.*—a dimensional change resulting in an increase of length or width of a specimen.

3.3 **laundering**, *n.*—of textile materials, a process intended to remove soils and/or stains by treatment (washing) with an aqueous detergent solution and normally including rinsing, extraction and drying.

3.4 **shrinkage**, *n.*—a dimensional change resulting in a decrease in the length or width of a specimen.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules

must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

4.2 The 1993 AATCC Standard Reference Detergent may cause irritation. Care should be taken to prevent exposure to skin and eyes.

4.3 Manufacturer's safety recommendations should be followed when operating laboratory testing equipment.

5. Apparatus and Materials

5.1 Automatic washing machine (see 12.1).

5.2 Automatic tumble dryer (see 12.2).

5.3 Conditioning/drying racks with pull-out screens or perforated shelves (see 12.3).

5.4 Facilities for drip drying and line drying.

5.5 1993 AATCC Standard Reference Detergent (see 12.9 and 12.10).

5.6 Ballast of 920 × 920 mm (36 × 36 in.) hemmed pieces of bleached cotton sheeting (Wash load ballast type 1), or 50/ 50 polyester/cotton bleached plain weave (Wash load ballast type 3) (see 12.4 and 12.10).

5.7 Indelible ink marking pen (see 12.5) for use with suitable rule, tape, marking template or other marking device (see 12.6). Sewing thread may be used for making benchmarks.

5.8 Measuring devices.

5.8.1 Tape or rule marked in millimeters, eighths or tenths of an inch.

5.8.2 Tape or ruled template marked directly in percent dimensional change to 0.5% or smaller increment (see 12.6).

5.9 Scale with at least 5.0 kg (10.0 lb) capacity.

6. Test Specimens

6.1 Sampling and Preparation.

6.1.1 Samples from which dimensional change specimens are to be taken should be representative of the fabric processing stage, finishing treatment, research lab trial, pallet, lot or end-product stage.

6.1.2 Fabrics that are distorted in their unlaundered state may give deceptive dimensional change results when laundered by any procedure. In such cases, it is recommended that specimens not be taken from any distorted area of a fabric sample.

6.1.3 Tubular knitted samples should be slit and handled flat in a single layer. Only circular knitted fabrics produced on body-width machines are to be used as

specimens in their tubular form. Circular knitted fabrics made on body-width machines are ones to be used in garments with no side seams. Body-width tubular circular knitted garments and seamless garments (knit-to-wear) should be tested according to AATCC Method 150, Dimensional Changes of Garments after Home Laundering.

6.1.4 If fraying of specimens is expected in laundering, see 12.7.

6.1.5 Prior to marking, condition test specimens as directed in ASTM D 1776, Standard Practice for Conditioning and Testing Textiles. Condition each specimen for at least 4 h in an atmosphere of $21 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$) and $65 \pm 2\%$ RH by laying each test specimen separately on a screen or perforated shelf of a conditioning rack.

6.1.6 Lay the sample on a flat surface. Do not allow any section of the sample to hang over the edge of the work table. Using a template for the selected test size, mark specimens parallel to the selvege or fabric length direction. Avoid use of the sample area within ten percent of the sample width. Specimens should be taken from areas with different lengthwise and widthwise yarns (see Fig. 1). Identify the length direction of the specimens before cutting them out of the sample. When possible, three specimens from each fabric should be used. One or two specimens may be used when insufficient fabric sample is available.

6.2 Marking.

6.2.1 Option 1: 250 mm (10.0 in.) benchmarks. Mark each 380 × 380 mm (15 × 15 in.) test specimen with three 250 mm (10 in.) pairs of benchmarks parallel to the test specimen length and three 250 mm (10 in.) pairs of benchmarks parallel to the test specimen width. Each benchmark must be at least 50 mm (2 in.) from all test specimen edges. Pairs of bench-

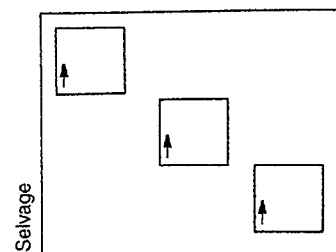


Fig. 1—Diagram for cutting fabric specimens.

marks in the same direction must be spaced approximately 120 mm (5 in.) apart.

6.2.2 Option 2: 500 mm (18.0 in.) benchmarks. Mark each 610 × 610 mm (24.0 × 24.0 in.) test specimen with three 500 mm (18.0 in.) pairs of benchmarks parallel to the test specimen length and three 500 mm (18.0 in.) pairs of benchmarks parallel to the test specimen width. Each benchmark must be at least 50 mm (2.0 in.) from all test specimen edges. Pairs of benchmarks in the same directions must be spaced approximately 240 mm (10 in.) apart.

6.2.3 Narrow Fabrics.

6.2.3.1 For test specimens greater than 125 mm (5 in.) and less than 380 mm (15 in.) wide, take full width of test fabrics and cut each specimen 380 mm (15 in.) long. Mark the length as in 6.2.1. Measurement of the width is optional.

6.2.3.2 For test specimens 25-125 mm (1-5 in.) wide, take full width of test fabrics and cut each specimen 380 mm (15 in.) long. Use only two pairs of benchmarks parallel to the length. Measurement of the width is optional.

6.2.3.3 For test specimens less than 25 mm (1 in.) in width, take full width of test fabrics and cut each specimen 380 mm (15 in.) long. Use only one pair of benchmarks parallel to the length. Measurement of the width is optional.

6.3 Original Measurements and Specimen Size.

6.3.1 Specimen size and benchmarks distances used must be indicated in the report.

6.3.2 Dimensional change results may not be comparable when different specimen sizes, different benchmark lengths, different number of specimens, or different number of benchmarks are used.

6.3.3 To improve the accuracy and precision of the dimensional change calculations based on the benchmarks applied to the fabrics as instructed in 6.2, measure and record the distance between each pair of benchmarks with suitable tape or rule to nearest millimeter, eight or tenth of an inch. This is measurement A. In case of narrow fabrics less than 380 mm (15 in.) wide, measure and record width if width measurement will be used. If using a calibrated template for marking and measuring in percent dimensional change directly, an initial measurement is not needed.

7. Test Procedure

7.1 Tables I, II and III summarize alternative washing, rinsing and drying conditions and settings. Additional information on the machine and laundering conditions may be found in the monograph, *Standardization of Home Laundry Test Conditions*, elsewhere in this TECHNICAL MANUAL.

7.2 Washing.

7.2.1 Weigh test specimens and enough ballast to make a 1.8 ± 0.1 kg (4.00 ± 0.25 lb) load. An alternative load size of 3.6 ± 0.1 kg (8.00 ± 0.25 lb) may be used. Dimensional change results obtained using a 1.8 kg (4 lb) load weight may not be equal to those obtained with a 3.6 kg (8

lb) load weight and should not be compared.

7.2.2 Select the specified water level, the desired water temperature for the washing cycle and a rinse temperature of less than 29°C (85°F). If this rinse temperature is not attainable, record available rinse temperature. Fill the washing machine to the 18 ± 0.5 gal water level. For alternate load size, fill washing machine to the 22.0 ± 0.5 gal water level.

7.2.3 Add 66.0 ± 1 g of 1993 AATCC Standard Reference Detergent to an 18 ± 0.5 gal wash load. For alternative load size of 22.0 ± 0.5 gal, add 80 ± 1 g of 1993 AATCC Standard Reference Detergent. Agitate water briefly to dissolve detergent. Stop the machine agitation. It should be noted that in soft water areas, the amount of detergent used may be reduced to avoid excessive sudsing.

7.2.4 Add test specimens and ballast to machine. Set the washer for the selected washing cycle and time (see Tables I and II).

7.2.5 For specimens to be dried by procedures A, B or D, allow washing to proceed through the final spin cycle. Remove the test specimens immediately after the final spin cycle, separate tangled pieces, taking care to minimize distortion, and dry by procedure A, B or D (see Tables I and III).

7.2.6 For specimens to be dried by procedure C, Drip Dry, allow washing to proceed through to the final rinse cycle. Remove the specimens from the washer just before the water begins to drain for the final rinse cycle. Remove specimens soaking wet.

7.3 Drying.

7.3.1 For drying procedures B, C and D, do not blow air directly on specimens as it may cause fabric distortion.

7.3.2 (A) Tumble Dry. Place the washed load (test specimens and ballast) in the tumble dryer, and set the temperature control to generate the correct exhaust temperatures as specified in Table III. For fibers that are heat sensitive, lower temperatures consistent with producer's care recommendations should be used and reported. Allow the dryer to operate until the total load is dry. Remove the load immediately after the dryer stops.

7.3.3 (B) Line Dry. Hang each specimen by two corners with the fabric length in the vertical direction. Allow the test specimen to hang in still air at room temperature not greater than 26°C (78°F) until dry.

7.3.4 (C) Drip Dry. Hang each dripping wet specimen by two corners, with the fabric length in the vertical direction. Allow the specimens to hang in still air at room temperature not greater than 26°C (78°F) until dry.

7.3.5 (D) Screen Dry. Spread each

Table I—Alternative Washing and Drying Conditions (see 7.1)

Machine Cycle	Washing Temperature	Drying Procedure
(1) Normal/Cotton Sturdy	(II) 27 ± 3°C (80 ± 5°F)	(A) Tumble
(2) Delicate	(III) 41 ± 3°C (105 ± 5°F)	i. Cotton Sturdy
(3) Permanent Press	(IV) 49 ± 3°C (120 ± 5°F)	ii. Delicate
	(V) 60 ± 3°C (140 ± 5°F)	iii. Permanent Press
		(B) Line
		(C) Drip
		(D) Screen

Table II—Washing Machine Conditions Without Load (see 7.1)

	Normal	Delicate	Permanent Press
(A) Water Level	18 ± 1 gal	18 ± 1 gal	18 ± 1 gal
(B) Agitator Speed	179 ± 2 spm	119 ± 2 spm	179 ± 2 spm
(C) Washing Time	12 min	8 min	10 min
(D) Spin Speed	645 ± 15 rpm	430 ± 15 rpm	430 ± 15 rpm
(E) Final Spin Time	6 min	4 min	4 min

Table III—Dryer Setting Conditions (see 7.1)

	Cotton Sturdy	Delicate	Permanent Press
Exhaust Temperature	High 66 ± 5°C (150 ± 10°F)	Low < 60°C (140°F)	High 66 ± 5°C (150 ± 10°F)
Cool Down Time	10 min	10 min	10 min

specimen on a horizontal screen or perforated surface removing wrinkles without distorting or stretching it. Allow the specimen to dry in still air at room temperature not greater than 26°C (78°F).

7.3.6 Repeat the selected washing and drying cycle two more times or to an agreed number of cycles.

7.4 Conditioning and Restoration.

7.4.1 After the final washing and drying cycle, condition the specimens for at least 4 h (see 6.1.5) by laying each specimen separately on the screen or perforated shelves of a conditioning rack in an atmosphere of $21 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$) and $65 \pm 2\%$ RH.

7.4.2 For fabrics that are intended to be used in a form fitting garment, restoration techniques are sometimes used prior to determining the dimensional change. Techniques for this type of restoration are not standardized (hand pulling specimens in the length and width directions at multiple locations using an unspecified force). If restoration techniques are used, a description of the technique should be reported and results should be reported as restored dimensional change.

7.4.3 If the specimens are extremely wrinkled and the consumer would ALWAYS expect to iron a garment made from the fabric, test specimens may be hand ironed prior to re-measurement of benchmarks. Use safe ironing temperatures appropriate to the fibers in the fabric being ironed. See Table I, Safe Ironing Temperature Guide, in AATCC Method 133, Colorfastness to Heat: Hot Pressing. Exert only that pressure during pressing which is necessary to remove wrinkles.

7.4.3.1 Due to the extremely high variability of hand ironing procedures performed by individual operators (no standard test method exists for hand ironing procedures), the reproducibility of dimensional change results after hand ironing has been found to be extremely poor. Consequently, caution is advised when comparing dimensional change results after laundering and hand ironing, reported by different operators.

7.4.3.2 Hand ironing is intended primarily for the evaluation of fabrics used in garments, which require ironing to remove wrinkles prior to wearing. Use safe ironing temperatures appropriate to the fibers in the fabric being ironed. See Table I, Safe Ironing Temperature Guide, in AATCC Method 133, Colorfastness to Heat: Hot Pressing. Exert only that pressure during pressing which is necessary to remove wrinkles.

7.4.3.3 After ironing, condition specimens for at least 4 h (see 6.1.5) by laying each specimen separately on the screen or perforated shelves of a conditioning rack in an atmosphere at $21 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$) and $65 \pm 2\%$ RH.

8. Measurement

8.1 After conditioning, lay each test specimen without tension on a flat smooth, horizontal surface. Measure and record the distance between each pair of benchmarks to the nearest millimeter, eighth or tenth of an inch. This is measurement B. If using a scale calibrated in percent dimensional change, measure each benchmark to nearest 0.5% or smallest increment on the scale and record the percent dimensional change directly.

8.2 The wrinkles in most fabrics flatten sufficiently under pressure of a measuring instrument at the time of measurement not to cause measurement bias.

9. Calculation and Interpretation

9.1 Calculation.

9.1.1 If measurements were made directly in percent dimensional change, average the measurements in each direction made on the specimens after the first, third, or other specified number of washing and drying cycles. Calculate length and width averages separately to the nearest 0.1%.

9.1.2 If measurements were made to the nearest millimeter or eighth or tenth of an inch, calculate the dimensional change after the first and third or other specified washing and drying cycle as follows:

$$\text{Average\% DC} = 100 (B - A)/A$$

where:

DC = Average dimensional change

A = Average original dimension

B = Average dimension after laundering

Both the average original and average final dimensions are the averages of the measurements in each direction made on all test specimens. Calculate length and width averages separately to the nearest 0.1% (see 12.8).

9.1.3 A final measurement smaller than the original measurement results in a negative dimensional change which is shrinkage. A final measurement larger than the original measurement results in a positive dimensional change which is growth.

9.2 Interpretation.

9.2.1 If the dimensional change after one washing, drying, and, if used, hand ironing cycle as calculated in 9.1, is within a specification previously agreed on, continue test procedures as directed in 7.2, 7.3 and 7.4 until an agreed upon number of cycles has been completed.

9.2.2 If the dimensional change after one washing, drying, and, if used, hand ironing cycle as calculated in 9.1 exceeds a specification previously agreed on, terminate the test.

10. Report

10.1 Report for each sample tested:

(a) Dimensional change of length and width, separately, to the nearest 0.1% with a minus sign (-) for shrinkage or a plus (+) sign for growth (see 9.1.3).

(b) Washing procedure (include type of washing, cycle and temperature) and drying procedure (include type of drying, cycle and temperature).

(c) Size of specimens and benchmarks

(d) Size of load; i.e., 1.8 kg (4 lb) or 3.6 kg (8 lb).

(e) Number of complete washing and drying cycles (see 9.2).

(f) If fabrics were distorted or wrinkled in their original state.

(g) If fabrics were hand ironed.

(h) If fabric was restored and a restoration technique.

11. Precision and Bias

11.1 *Precision.* Precision for this test method has not been established. Accordingly, it is recommended that any comparisons of results be performed by utilizing standard statistical techniques.

11.2 *Bias.* Dimensional changes in automatic home laundering of fabrics can be defined only in terms of a test method. There is no independent method for determining the true value. As a means of estimating this property, the method has no known bias.

12. Notes

12.1 Contact AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org, for model number(s) and source(s) of current approved washer(s). Any other washer, which is known to give comparable results, can be used. Washing machine conditions given in Table II represent the actual speeds and times available on the current specified model(s). Other washers can vary in one or more of these settings.

12.2 Contact AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org, for model number(s) and source(s) of current approved dryer(s). Any other dryer, which is known to give comparable results, can be used. Dryer machine conditions given in Table III represent the actual temperatures and cool-down times available on the current specified model(s). Other dryers can vary in one or more of these settings.

12.3 Screen or perforated conditioning/drying racks available from: Somers Sheet Metal Inc., 5590 N. Church St., Greensboro NC 27405; tel: 336/643-3477; fax: 336/643-7443. Rack drawings are available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org.

12.4 Ballast are available from Testfabrics Inc., P.O. Box 26, 415 Delaware St., W. Pittston PA 18643; tel: 570/603-0432; fax:

570/603-0433; e-mail: testfabric@aol.com; and SDL Atlas L.L.C., 1813A Associate Lane, Charlotte NC 28217; tel: 704/329-0911; fax: 704/329-0914; e-mail: info@sdlatlas.com.

12.5 Marking pens with different size tips are available from Mark-Tex Corp., Box 681, Englewood NJ 07631; and AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org.

12.6 A ruled template marked in percent dimensional change is available from AATCC, Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org. A mechanical marking device and measuring tape marked in percent dimensional change is available from The Sanforized Co., 3200 Highlands Pkwy., Suite 300, Smyrna GA 30082; tel: 770/803-7662.

12.7 If excessive fraying occurs in laundering, specimen edges may be pinked or slashed.

Sewing or over-edging a specimen is not recommended as it may influence actual dimensional change results. However, in the case where AATCC Methods 124 (Appearance of Fabrics after Repeated Home Laundering) and 135 are performed on the same specimens, some woven fabric constructions may require the specimen edges to be sewn or over-edged to prevent severe raveling that could cause entanglement in washing or drying, and therefore influence the assessment of both dimensional change and smoothness.

12.8 If information on the dimensional change variability within or between specimens is desired, calculate dimensional change based on the individual pairs of benchmarks for within specimen data or based on the average of the three pair of benchmarks for between specimen data.

12.9 Available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail:

orders@aatcc.org

12.10 The AATCC Technical Center conducted a study to compare the 1993 AATCC Standard Reference Detergent, AATCC Standard Reference Detergent 124 and two different types of fabrics (current and proposed) to be used as ballast, under the following test conditions:

Machine cycle: (1)—Normal/Cotton
Sturdy

Washing Temp: (V)— $60 \pm 3^\circ\text{C}$ ($140 \pm 5^\circ\text{F}$)

Drying Procedure: (A)_i—Tumble dry, cotton sturdy cycle

Fabrics tested: White Twill (100% cotton)
Beige Twill (100% cotton)
Grey Poplin (100% cotton)
Blue Twill (50/50 poly cotton)

No significant differences were found in the results using either detergent or ballast load fabrics.