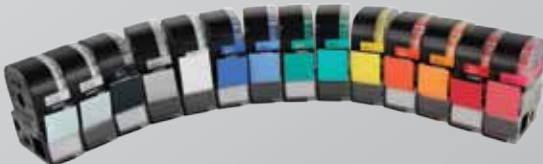


LABELWORKS PX

Technical Manual

for Tape Label Materials

Revision B



Features of Tapes

Create a variety of labels with a wide selection of tape widths

Tapes are available in a range of sizes – from 4mm up to 36mm – to help you create labels for a variety of different applications.

A variety of tape and text colors to choose from

Tapes are available in a wide range of colors, both ribbon (text) and tape, as well as materials, such as fluorescent, matte, metallic and clear.

Different labeling needs, different labeling materials

All standard tapes contain Polyethylene terephthalate (PET), due to its durability. In addition, tapes are available in a variety of shapes and finishes that are suitable for a wide range of jobs in and around the workplace.

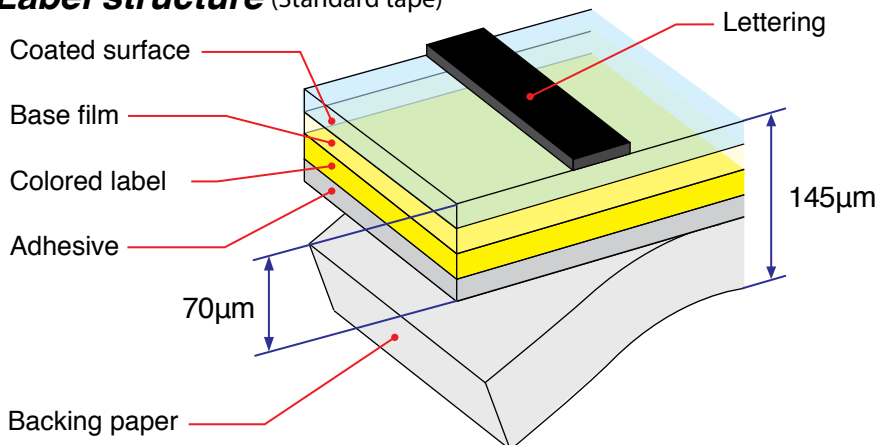
Tapes are designed to be as flexible and as durable as you need them to be, while also offering an environmentally friendly alternative to other labels. Every label printed with tape has a multi-layered structure for high durability, can be printed with reduced margins to help cut waste and is free from chlorine.

Structure of tapes

Because Epson labels can be used for a variety of needs, tapes need to be highly durable to ensure performance while at the same time offering great flexibility. Through research, Epson discovered that depending on traditional laminated finishes would make labels too thick and result in labels that would be unsuitable for many applications. With this in mind, Epson was able to develop a new label structure for its tape, which offers excellent durability and optimal thickness without relying on laminated finishes.



Label structure (Standard tape)



Thickness of tape label is 70µm.



Thickness may vary between tapes.

Testing LabelWorks Tapes

To ensure that Epson label materials are suitable for a variety of environments, they are put under rigorous evaluation tests, by both Epson and an independent third-party. In the next pages, you will find details of each test performed on Epson labels and the results.

Test results in this manual

Results shown in this manual are based on tests conducted by Epson and an independent third-party.

Test items in this manual	Conducted by	Reference page
High and low temperature resistance	Third-party	P.3
Adhesion property	Third-party	P.5
Curved surface adhesion property	Third-party	P.6
Water resistance	Third-party	P.7
Chemical resistance	Third-party	P.8
Abrasion resistance	Third-party	P.9
Weather resistance	Third-party	P.11
Flex resistance	Third-party	P.12
Iron-on: Fastness to washing	Third-party	P.13
Frequently Asked Questions		P.14



High and low temperature resistance

First temperature test

Tests were conducted to confirm the condition of each tape material when exposed to various temperatures. Tape materials were applied to a stainless-steel sheet or stainless-steel rod left in environments with high temperature, low temperature, and thermal-shocks. The results are shown in the table below.

First temperature test results

Tape	-70°C/72h	-30°C/72h	0°C/240h	50°C/240h	100°C/240h	150°C/2h	200°C/2h	225°C/2h	250°C/2h	-30°C/60°C each at 3h 20cycles
Standard	✓	✓	✓	✓	✓	✓	▲	▲	▲	✓
Strong adhesive	✓	✓	✓	✓	✓	✓	▲	▲	▲	✓
Heat resistant	✓	✓	✓	✓	✓	✓	✓	✓	▲	✓
Heat shrink tube (After shrinking)	✓	✓	✓	✓	✓	✓	▲	▲	▲	✓
Self-laminating cable wrap (After laminating)	✓	✓	✓	✓	✓	✓	▲	▲	▲	✓
Magnetic	✓	✓	✓	✓	✓	✓	×	×	×	✓

✓: No noticeable change

▲: Text is legible but there is some tape discoloration

×: Text become unreadable or serious tape discoloration

—: under evaluation

Before test

Labels: Standard

ABCDEFGG-1

Labels: Heat resistant

ABCDEFGG

Labels: Heat shrink tube

ABC

Labels: Magnetic

ABCDEF

After test

Temperature: 100°C

Duration: 240 hours

Labels: Standard

ABCDEFGG-1

Temperature: 100°C

Duration: 240 hours

Labels: Heat resistant

ABCDEFGG

Temperature: 100°C

Duration: 240 hours

Labels: Heat shrink tube

ABC

Temperature: 100°C

Duration: 240 hours

Labels: Magnetic

ABCDEF

Temperature: 200°C

Duration: 2 hours

Labels: Standard

ABCDEFGG-1

Temperature: 200°C

Duration: 2 hours

Labels: Heat resistant

ABCDEFGG

Temperature: 200°C

Duration: 2 hours

Labels: Heat shrink tube

ABC

Temperature: 200°C

Duration: 2 hours

Labels: Magnetic

ABCDEF

*The tests noted above were conducted by an independent third-party in Japan named Farstar Corporation.

<http://www.farstar.co.jp> (Japanese version only) Address: 6531-26 Sasaga, Matsumoto, Nagano, 399-0033 Japan

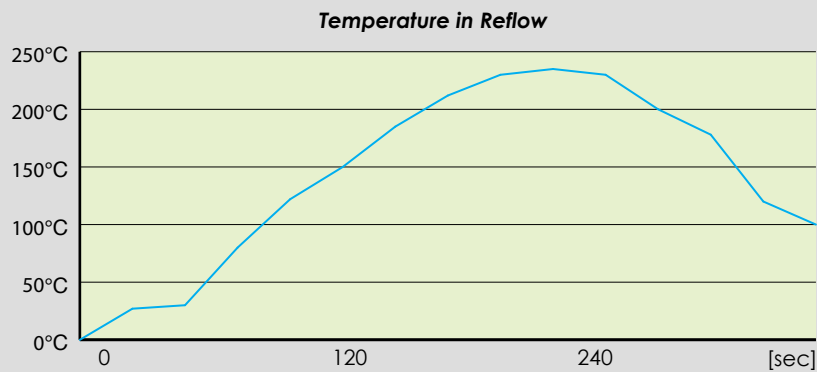
Telephone: +81-263-85-7855

High and low temperature resistance

Labels exposed to high temperatures for long periods can be prone to shrinkage, which can be a problem for important warning labels. Epson's heat-resistant tapes are designed not to shrink, even when exposed to temperatures of 200°C for up to 10 hours.

Second temperature test

Tests were conducted to confirm the shrinkage of each tape at high temperature. Tapes were mounted onto an electronic circuit board and then placed into a reflow oven. To ensure accurate results, the reflow oven temperature was adjusted for lead-free solder (Pb-free solder) and then slowly increased. The results below compare a standard tape to a heat resistant label.



Second temperature test results

Labels: Standard



Labels: Heat resistant



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Adhesion property

Adhesive test

First adhesive test – surface materials and texture

Tests were conducted to confirm the adhesive strength of a standard tape when applied to various materials. 12mm-wide adhesive tapes were applied to seven different materials. Each had a smooth surface and a textured surface. Labels were then left at room temperature (20°C to 25°C) for two weeks and evaluated for peeling. The results are shown in the table below.

Second adhesive test – strength

Tests were conducted to confirm the adhesive strength of a standard tape and a strong adhesive tape after application. This second test consisted of applying 12mm-wide adhesive tapes to six different materials at room temperature, and peeling at a 180° angle – first 20 minutes after application and then a second test 96 hours after application.

Adhesive test results

Test 1

	PE		PP		POM		PS		PA		PC		ABS	
	Smooth	Textured	Smooth	Textured	Smooth	Textured	Smooth	Textured	Smooth	Textured	Smooth	Textured	Smooth	Textured
Standard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓: No separation/peeling

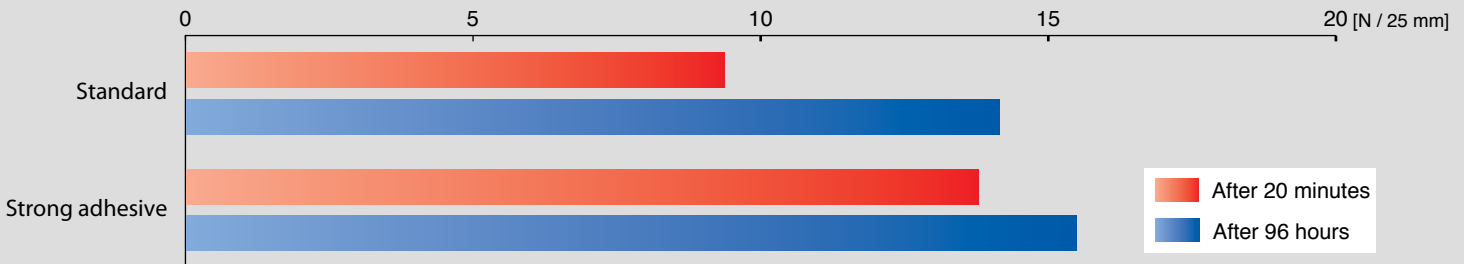
PE: Polyethylene
PP: Polypropylene
POM: Polyoxymethylene

PS: Polystyrene
PA: Polyamide
PC: Polycarbonate

ABS: Acrylonitrile butadiene styrene

Test 2

Comparison of adhesive power on stainless steel after 20 min. and 96 hours



Measurements 96 hours after application (Testing method conforms to JIS Z 0237, however, the duration of application is 96H)

	Stainless steel	Glass	Vinyl chloride	Acrylic	Polypropylene	Wood veneer with polyester-treated surface
Standard	14.14	18.68	20.02	13.00	0.78	0.55
Strong adhesive	15.48	17.69	21.27	17.21	2.11	0.54

Results in Newton (JIS norm)

For reference, the power to peel off the general cellophane tape attached on stainless plate is 9.83 N.

The above results do not represent guaranteed values.

Adhesive power varies between label products.

If label is removed and then reattached, label will lose some of its original adhesiveness.

*The tests noted above were conducted by an independent third-party in Japan named Farstar Corporation.

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Telephone: +81-263-85-7855

Curved surface adhesion property

Curved surface adhesive test

Tests were conducted to confirm the adhesive strength of a standard tape when applied to a curved surface. Adhesive tapes were applied to a stainless-steel bar (8mm in diameter) and a vinyl chloride bar (3mm in diameter). Labels were applied in three different ways (outlined below) and left at room temperature (20°C to 25°C) for two weeks and then evaluated for peeling. The results are shown in the table below.

Flag label:

label is completely wrapped around cable/pipe, with a 5mm overlap



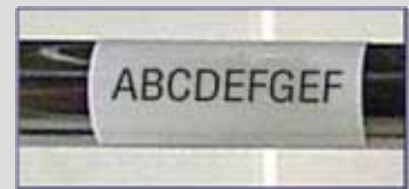
Wrapping label:

label is completely wrapped around cable/pipe, with a 5mm overlap



Straight label:

label is applied straight across stainless steel bar with no overlapping



Curved surface adhesive test results

	8mm diameter stainless-steel bar			3mm diameter vinyl chloride bar	
	Flag	Wrapping	Round bar	Flag	Wrapping
Standard	✓	✓	✓	✓	✓

✓ : No separation/peeling

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 Telephone: +81-263-85-7855

Water resistance

Water resistance test

Tests were conducted to confirm the durability of tape materials when exposed to water. Tape materials were applied to a stainless-steel sheet or actual cable and left in the following environments:

- Test A) Submerged in distilled water and left at 40°C for two hours
- Test B) Submerged in saltwater (5%) and left at 40°C for two hours
- Test C) Exposed to a humid atmosphere (80%) and left at 40°C for 96 hours



Water resistance test results

	Test A	Test B	Test C
Standard	✓	✓	✓
Strong adhesive	✓	✓	✓
Heat resistant	✓	✓	✓
Heat shrink tube (After shrinking)	✓	✓	✓
Self-laminating cable wrap (After laminating)	✓	✓	✓
Magnetic	✓	✓	✓

✓ : No abnormalities in text

Before test

Labels: Standard



Labels: Heat shrink tube



Labels: Self-laminating



Labels: Magnetic



After test

Test A

Labels: Standard



Test A

Labels: Heat shrink tube



Test A

Labels: Self-laminating



Test A

Labels: Magnetic



Test B

Labels: Standard



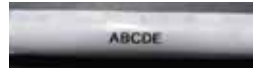
Test B

Labels: Heat shrink tube



Test B

Labels: Self-laminating



Test B

Labels: Magnetic



Test C

Labels: Standard



Test C

Labels: Heat shrink tube



Test C

Labels: Self-laminating



Test C

Labels: Magnetic



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Chemical resistance

Chemical immersion test

Tests were conducted to confirm the durability of tape materials when immersed in various chemicals and solvents. Tape materials were applied to a glass sheet or glass rod, and immersed in eight different chemicals and solvents for two hours.



Chemical immersion test results

	Toluene	Hexane	Ethanol	Acetone	Mineral spirits	0.1 N Hydrochloric acid	0.1 N Sodium hydroxide	Ethyl acetate	Engine oil
Standard	✓	✓	✓	✓	✓	✓	✓	✗	✓
Heat shrink tube (After shrinking)	▲	▲	✓	✓	▲	✓	✓	▲	✓
Self-laminating cable wrap (After laminating)	✗	✓	✓	✗	✓	✓	✓	✗	✓
Magnetic	✗	✓	✓	✗	✗	✓	✓	✗	✓

✓: No noticeable change in tape or tube

▲: Text is legible but the shrunk tube came away from the round glass rod

✗: Deformation/Peeling of tape or tube, erasure of text

Before test

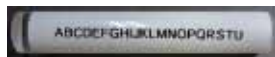
Labels: Standard



Labels: Heat shrink tube



Labels: Self-laminating cable wrap



Labels: Magnetic



After test

Chemical: Ethanol

Duration: 2 hours

Labels: Standard



Chemical: Ethanol

Duration: 2 hours

Labels: Heat shrink tube



Chemical: Ethanol

Duration: 2 hours

Labels: Self-laminating cable wrap



Chemical: Ethanol

Duration: 2 hours

Labels: Magnetic



Printed text on the tape may be affected if rubbed.

*The tests noted above were conducted by an independent third-party in Japan named Farstar Corporation.

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Abrasion resistance

Abrasion test

First abrasion test – plastic eraser

Tests were conducted to confirm the durability of tape materials when rubbed with a plastic eraser. Tape materials were rubbed 50 times with a 2kg weight attached to a machine, at a 90° angle.

Second abrasion test – copper coin

Tests were conducted to confirm the durability of tape materials when rubbed with a copper coin. Tape materials were rubbed 50 times with a 500g weight by hand, at a 45° angle.



	First abrasion test (Plastic eraser)	Second abrasion test (Copper coin)
Standard	✓	▲
Heat shrink tube (After shrinking)	✓	▲
Self-laminating (After laminating)	✓	✓
Magnetic	✓	✓

✓ : No abnormalities in text
▲ : Slight removal of text (still legible)

Abrasion test results

Before test

Labels: Standard



Labels: Heat shrink tube



Labels: Self-laminating



Labels: Magnetic



After test

First test

Labels: Standard



First test

Labels: Heat shrink tube



First test

Labels: Self-laminating



First test

Labels: Magnetic



Second test

Labels: Standard



Second test

Labels: Heat shrink tube



Second test

Labels: Self-laminating



Second test

Labels: Magnetic



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Abrasion resistance

Abrasion test

Third abrasion test – chemical and solvents

Tests were conducted to confirm the durability of tape materials when rubbed with various cloths soaked in different chemicals and solvents. Tape materials were rubbed 10 or 50 times with a cloth soaked with 4cc of a chosen chemical or solvent, attached to a machine with a 500g weight.


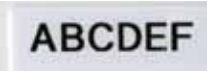










	Toluene	Hexane	Ethanol	Acetone	Mineral spirits	0.1 N Hydrochloric acid	0.1 N Sodium hydroxide	Ethyl acetate	Engine oil	Parts cleaner
Standard	×	✓	✓	×	✓	✓	✓	×	✓	✓
Self-laminating cable wrap (After laminating)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Magnetic	×	✓	✓	×	✓	✓	✓	×	✓	✓

✓ : No abnormalities in text after 50 rubbing times
 ✗ : Erasure of text less than 50 rubbing times

	Toluene	Hexane	Ethanol	Acetone	Mineral spirits	0.1 N Hydrochloric acid	0.1 N Sodium hydroxide	Ethyl acetate	Engine oil	Parts cleaner
Heat shrink tube (After shrinking)	×	✓	✓	×	×	✓	✓	×	✓	✓

✓ : No abnormalities in text after 10 rubbing times
 ✗ : Erasure of text less than 10 rubbing times

Abrasion test results

Before test		After test
Labels: Standard 	Third test Labels: Standard Chemical: Hexane 	Third test Labels: Standard Chemical: Ethanol 
Labels: Heat shrink tube 	Third test Labels: Heat shrink tube Chemical: Hexane 	Third test Labels: Heat shrink tube Chemical: Ethanol 
Labels: Self-laminating 	Third test Labels: Self-laminating Chemical: Hexane 	Third test Labels: Self-laminating Chemical: Ethanol 
Labels: Magnetic 	Third test Labels: Magnetic Chemical: Hexane 	Third test Labels: Magnetic Chemical: Ethanol 

*The tests noted above were conducted by an independent third-party in Japan named Farstar Corporation.
<http://www.farstar.co.jp> (Japanese version only) Address: 6531-26 Sasaga, Matsumoto, Nagano, 399-0033 Japan
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Weather resistance

Weather resistance test

Tests were conducted to confirm the durability of tape materials when exposed to outdoor conditions. Tape materials were applied to a stainless-steel sheet or stainless-steel rod left in weather resistance testing machine for acceleration weather resistance test.

55 hours acceleration weather resistance test by weather resistance testing machine is equivalent to outdoor weather resistance test in an average environment in Japan for 1 year.

110 hours acceleration weather resistance test by weather resistance testing machine is equivalent to outdoor weather resistance test in an average environment in Japan for 2 years.

Heat shrink tube: Shrunk on round stainless-steel rod

Self-laminating cable wrap: applied and laminated on round stainless-steel rod

	1 Y in outdoor	2 Y in outdoor
Standard	✓	✓
Heat shrink tube (After shrinking)	✓	✓
Self-laminating cable wrap (After laminating)	✓	▲
Magnetic	✓	✓

✓ :Text is legible but there is slight discoloration of tape or tube
▲ :Tape surface discoloration



Before test

Labels: Standard



Labels: Heat shrink tube



Labels: Self-laminating



Labels: Magnetic



After test

After 2Y

Labels: Standard



After 2Y

Labels: Heat shrink tube



After 2Y

Labels: Self-laminating



After 2Y

Labels: Magnetic



*The tests noted above were conducted by an independent third-party in Japan named Farstar Corporation.
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Flex resistance

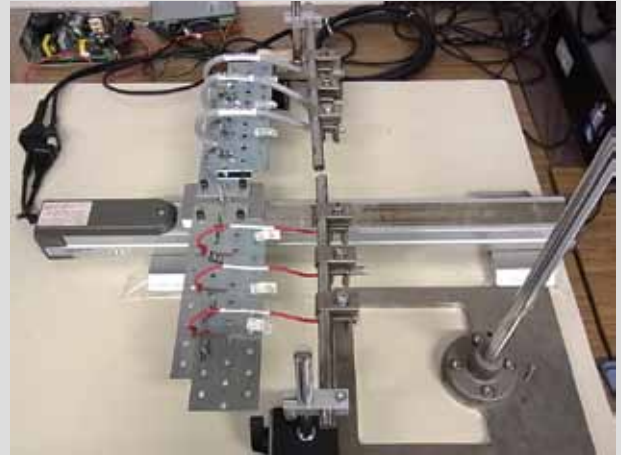
Flex resistance test

Tests were conducted to confirm the durability of tape materials when flexed.

Tape materials were applied to actual cable and flexed 10,000 times by flex resistance testing machine.

Heat shrink tube: Shrunk on $\phi 3\text{mm}$ and $\phi 8\text{mm}$ cable

Self-laminating cable wrap: Applied to $\phi 3\text{mm}$ and $\phi 8\text{mm}$ cable



	$\phi 3\text{mm}$ cable Flexed 10,000 times	$\phi 8\text{mm}$ cable Flexed 10,000 times
Heat shrink tube (After shrinking)	✓	✓
Self-laminating cable wrap (After laminating)	✓	✓

✓ : No noticeable change in tape and text

Before test

Labels: Heat shrink tube



Labels: Self-laminating cable wrap



After test

Flexing 10,000 times ($\phi 8$ cable)

Labels: Heat shrink tube



Flexing 10,000 times ($\phi 8$ cable)

Labels: Self-laminating cable wrap



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<http://www.farstar.co.jp> (Japanese version only) Address: 6531-26 Sasaga, Matsumoto, Nagano, 399-0033 Japan
 Telephone: +81-263-85-7855

Iron-on:Fastness to washing

1. Adhesiveness & printed text fastness to washing

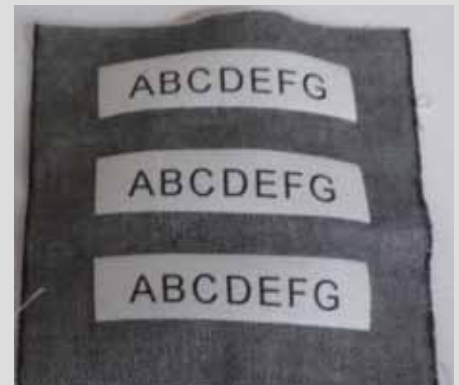
Tests were conducted to confirm the fastness of adhesiveness and printed text of Iron-on tape to washing.

Standard JIS-L-0217 method 103

- * JIS: Japanese Industrial Standards
- * Equivalent ISO standard: ISO 3758

Test method

- Placed Iron-on tape with text on a cloth, and washed by washing machine with detergent
- Checked text readability in every 10 cycles
- 1 washing cycle defined as:
 1. Washing for 5 minutes with 40°C water with detergent x 1 time
 2. Rinsing for 2 minutes with 30°C or below clear water with x 2 times
 3. Dewatering and hanging out to dry



Washing cycle	Adhesiveness of Iron-on tape	Printed text
10 cycles	✓	✓
50 cycles	✓	✓
100 cycles	✓	✓
150 cycles	✓	✓

✓: No noticeable change

2. Printed text fastness to washing

Tests were conducted to confirm the fastness of the printed text on Iron-on tape to washing.

Standard JIS-L-0844 method A-2

- * JIS: Japanese Industrial Standards
- * Equivalent ISO standard: ISO 105-C10

Test method

- Put Iron-on tape with text on a cloth, and washed by washing machine with detergent and white cotton cloth
- Check the change of color degradation of printed text and color contamination of cotton cloth every 10 cycles
- 1 washing cycle defined as:
 1. Washing for 30 minutes with 50°C water with detergent x 1 time
 2. Rinsing
 3. Dewatering and hanging out to dry

Washing cycle	Color degradation of printed text
10 cycles	✓
50 cycles	✓
100 cycles	✓
150 cycles	✓

✓: No noticeable change

Washing cycle	Color contamination of cotton cloth
10 cycles	✓
50 cycles	✓
100 cycles	✓
150 cycles	✓

✓: No noticeable change

* The tests (No. 1 & 2) noted above were conducted by an independent third-party in Japan named BOKEN QUALITY EVALUATION INSTITUTE. <http://www.boken.or.jp/languages/english.html>

Test No. 014718-1
Issue date of the test result 26-Mar-13

Frequently Asked Questions (1)

1 What printers use LABELWORKS PX Tape?

All previous K-Sun printers: 2001XL, 2001XLB, 2001XLST, 2010PC, 2011XLB, 2011XLB-PC, 2012XLST, 2012XLST-PC, BEE3, BEE3+, BEE3-EZ, BEE3-EZ+, 2020LSTB, 2020LSTB-PC, PEARLabel 270, PEARLabel 360

Epson LABELWORKS PX Printers: LW-PX900, LW-PX800, LW-PX700

For more detailed information visit www.ksun.com or call K-Sun Customer Support at 800-622-6312x210 or email info@ksun.com.

2 What is the difference between K-Sun LABELShop Tapes and PX Tapes?

PX Tapes have been engineered for tape re-winding and tape type/color detection.

3 How durable are K-Sun LABELShop tapes compared to PX tapes?

PX tapes and K-Sun LABELShop tapes use the same material and therefore the durability is the same.

4 How should I store PX Tapes?

PX tapes should be stored in a cool environment and avoid high temperatures, high humidity and direct sunlight.

The recommended storing environment is:

Temperature: -10° C (14°F) to 40°C (104°F)

Humidity: 80% RH or less

Avoid direct sunlight

5 Do PX Tapes have “expiration date” or “best used before date”?

There is no expiration date for these tapes. We do recommend you store them in a clean, indoor environment and use the tape immediately after opening the pack to ensure good quality and reliability during printing.

6 Will colored labels fade over time?

As with all color prints, colors may slightly fade over time. You may notice some colors may discolor faster in comparison to others, due to material and/or color. However, test results have shown that PX tapes are very durable, resisting water and chemicals and withstanding hot and cold conditions.

Frequently Asked Questions (2)

7 Will tapes give off harmful emissions if accidentally burned?

No. PX tapes are made from chlorine-free materials and so are free from harmful emissions if accidentally burned or recycled in an incinerator.

8 Do PX tapes contain silicone?

No. PX tapes do not contain silicone.

9 Do PX tapes contain chloroethene?

No. PX tapes do not contain chloroethene.

10 Do PX tapes contain natural rubber?

No. PX tapes do not contain natural rubber.

11 Are PX tapes resistant to alcohol?

Yes. Contact with alcohol will not cause significant change to the printed text or tape.

12 What are precautions when the tape is used for a circuit board?

If it is to be processed in a reflow oven, use a heat-resistant tape.

LABELWORKS PX Technical Manual

for Tape Label Materials

Better Products for a Better Future

At Epson, we know that planning for the future requires a strong commitment to the environment. That is why we strive to create innovative products that are reliable, recyclable, and energy efficient.

Better products that use fewer resources help ensure a better future for us all.

All features and specifications described are subject to change without notice. Other companies or product names used herein are also trademarks or registered trademarks of their respective owners.

For full details contact K-Sun Corporation, 370 SMC Drive PO Box 309
Somerset WI 54025 800-622-6312x210 www.ksun.com info@ksun.com

Note that the information about the characteristics, such as numeric values, described in this document are the evaluation results for information only, not for guarantees.