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EPSON

TM-L90 Roll Paper

Manufacturing Guide

STANDARD	
Rev. No.	A
Notes	

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REVISION SHEET

The table below indicates which pages in this manufacturing guide have been revised. Before reading this guide, be sure you have the correct version of each page.

Revisions		Design Section			Sheet Rev. No.							
Rev.	Document	WRT	CHK	APL	Sheet	Rev.	Sheet	Rev.	Sheet	Rev.		
A	Enactment	Tsukada	-	Takizawa	I	A						
					II	A						
					1	A						
					2	A						
					3	A						
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					12	A						
					13	A						
					14	A						
					15	A						
					16	A						
					17	A						
					18	A						
TITLE TM-L90 Roll Paper Manufacturing Guide					Front Part					Contents	Appendix	Total
					Cover	Rev. Sheet	Scope	General Descriptions	Table of Contents			
					1	1	--	1	1			
					18	--	22					

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EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT II	SHEET I

Table of Contents

- 1. REQUIREMENTS FOR ROLL PAPER 1
- 2. RECEIPT ROLL PAPER 2
 - 2.1 Receipt Paper 2
 - 2.2 Specified Original Receipt Paper 2
 - 2.3 Print Density Adjustment..... 2
 - 2.4 Paper to Use for High Speed 3
 - 2.5 Requirements for Black Mark Position for Receipt Paper 3
- 3. DIE-CUT LABEL ROLL PAPER 4
 - 3.1 Die-Cut Label Paper 4
 - 3.2 Specified Original Paper 4
 - 3.3 Print Density Adjustment..... 4
 - 3.4 Paper to Use For High Speed..... 4
 - 3.5 Requirements for Die-Cut Label Paper Thickness and Peeling Strength..... 4
 - 3.6 Requirements for Die-Cut Label Size 5
 - 3.7 Automatic Paper Layout Setup 6
 - 3.8 Manual Paper Layout Setup..... 8
 - 3.9 Requirements for Transparency of Die-Cut Label Paper..... 8
 - 3.10 Requirements for Black Mark Position for Die-Cut Label Paper..... 9
 - 3.11 Requirements for Black Mark Position I..... 10
 - 3.12 Requirements for Black Mark Position II..... 11
- 4. CONTINUOUS LABEL ROLL PAPER..... 12
 - 4.1 Continuous Label Paper 12
 - 4.2 Specified Original Paper 12
 - 4.3 Requirements for Thickness and Adhesive Agent..... 12
 - 4.4 Requirements for Size of Continuous Label Paper..... 13
- 5. RELIABILITY 14
- APPENDIX A. NOTES ON PAPER HANDLING 15
 - A.1 Notes on Thermal Paper Handling 15
 - A.2 Notes on Storage..... 15
 - A.3 Notes on Two-Color Paper Handling..... 15
- APPENDIX B. MAINTENANCE 16
 - B.1 Cleaning the Autocutter 16
 - B.2 Cleaning the Platen 17
- APPENDIX C. ROLL PAPER TYPE NO. 18

EPSON	TITLE	SHEET REVISION	NO.	
	TM-L90 Roll Paper Manufacturing Guide		A	NEXT 1

Confidential

1. REQUIREMENTS FOR ROLL PAPER

This printer can use receipt roll paper and label roll paper with the following roll paper specifications:

Paper type	Thermal paper <ul style="list-style-type: none">• Receipt paper• Die-cut label paper• Continuous label paper
Form	Roll paper
Paper width (backing paper width)	<ul style="list-style-type: none">• 79.5 ± 0.5 mm {3.13 ± 0.02"}• 37.5 ± 0.5 mm ~ 69.5 ± 0.5 mm {1.48 ± 0.02 ~ 2.74 ± 0.02"}
Take-up roll paper width	<ul style="list-style-type: none">• $80 +0.5/-1.0$ mm {$3.15 + 0.02/-0.04$"}• $38 \sim 70$ mm $+0.5/-1.0$ mm {$1.5 \sim 2.76 +0.02/-0.04$"}
Roll paper spool diameter (inside)	25.4 mm {1"} or more (*)
Roll direction	Printed side must face outside. Be sure that roll paper does not have any cuts or tears at any place in the roll.
Roll end position	Paper must not be pasted to the roll paper spool.
Outside diameter	Outside roll paper diameter: Maximum 90 mm {3.54"}

(*) Using roll paper with an inside diameter of 25.4 mm {1"} or less may decrease the detection accuracy of the roll paper near-end sensor.

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 2	SHEET 1

Confidential

2. RECEIPT ROLL PAPER

2.1 Receipt Paper

The printer can use the following receipt paper:

- Receipt paper with a thickness of 145 μm or less
- Receipt paper with a thickness of 62 ~ 75 μm

2.2 Specified Original Receipt Paper

The following original paper can be used:

- Single-color thermal roll paper type no.:
 - Receipt paper with a thickness of 145 μm
TF11KS-ET Nippon Paper Industries Co., Ltd.
 - Receipt paper
 - TF60KS-E (paper thickness: 75 μm) Nippon Paper Industries Co., Ltd.
 - PD160R (paper thickness: 75 μm) Oji Paper Mfg. Co., Ltd.
 - TF50KS-E (paper thickness: 65 μm) Nippon paper Industries Co., Ltd.
 - P350 (paper thickness: 62 μm) Kanzaki Specialty Paper (USA)
 - KF50 (paper thickness: 62 μm) KANZAN Spezialpapiere GmbH (Germany)
- Two-color thermal roll paper type no.:
 - PD750R (paper thickness: 75 μm) Oji Paper Mfg. Co., Ltd.

2.3 Print Density Adjustment

For best print quality and reliability, select the proper print density for the paper type used as described in the table below. If printing is performed with a density that exceeds the density described in the table below, the reliability is not guaranteed. Print density can be set with a software command.

Original paper no.	Density level
P350	90%
KF50	95%
TF60KS-E, TF50KS-E, PD750R	100%
PD160R, TF11KS-ET	105%

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 3	SHEET 2

2.4 Paper to Use for High Speed

If any of the following original paper types of receipt roll paper is used, the memory switch for the customized value setting can be used to set a maximum print speed up to 150 mm/s {5.91"/s} (level 9). The default is 120 mm/s {4.72"/s}:

- TF60KS-E
- PD160R
- TF50KS-E
- P350
- KF50

2.5 Requirements for Black Mark Position for Receipt Paper

When manufacturing receipt paper with black marks, be sure to make paper that meets the following requirements. (The ESC/POS commands expand the settable range, omitting the margin settings or the limitation on use (NOTE 2 of Section 3.6).)

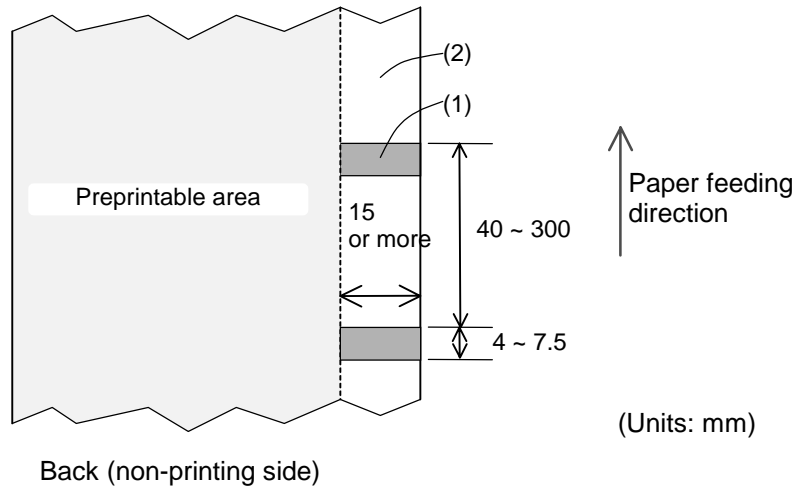
The reflecting rates of black mark portions (1) and non black mark portions (2) must meet the combinations shown in the table below (the reflecting rate is measured using the back of paper, the non-printing side):

- Black mark portions must be printed on black of paper (non-printing side).

Reflecting rate of black mark portion (1)	17%	16%	15%	14%	13%	Less
Reflecting rate of the portion where the black mark does not exist (2)	90%	85%	80%	75%	70%	More

NOTE: Reflecting rates are measured by the Macbeth PCM-II (Filter D) meter.

Paper without intervals between labels, such as continuous label paper, paper with perforated lines between labels, and paper with slits between labels, can also be used under the same requirements.



Black Mark Interval Requirement

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 4	SHEET 3

3. DIE-CUT LABEL ROLL PAPER

3.1 Die-Cut Label Paper

Die-cut label paper is label paper that has a predefined size of labels with an interval between labels.

3.2 Specified Original Paper

The following original paper types can be used for die-cut label roll paper:

- Single-color thermal label paper type no.:

HD-75	Nippon Paper Industries Co., Ltd.
KL470	NAKAGAWA MFG (USA). Inc. (Face stock is Kanzaki Specialty Paper (USA))
KL80GT	NAKAGAWA MFG (Germany). GmbH. (Face stock is KANZAN Spezialpapiere GmbH (Germany))
- Two-color thermal label paper type no.:

BR21	OJITAC Co., Ltd.
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3.3 Print Density Adjustment

For best print quality and reliability, select the proper print density for the paper type used as described in the table below. If printing is performed with a density that exceeds the density described in the table below, the reliability is not guaranteed. Print density can be set with a software command.

Original paper no.	Density level
HD-75, KL470, KL80GT, BR21	130%

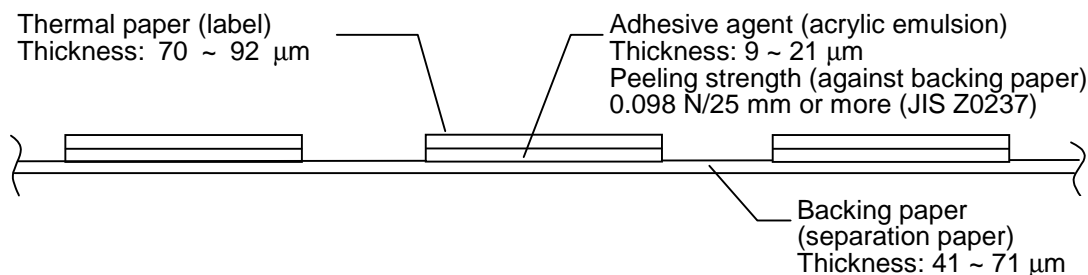
3.4 Paper to Use for High Speed

If any of the following original paper types of thermal paper are used, the memory switch for the customized value setting can be used to set the maximum print speed up to 150 mm/s {5.91"/s} (level 9). Default is 120 mm/s {4.72"/s}:

- HD-75, KL470, KL80GT

3.5 Requirements for Die-Cut Label Paper Thickness and Peeling Strength

Requirements for the thickness of the die-cut label paper, peeling strength against backing paper, and the adhesive agent that can be used with the printer are shown in the figure below:

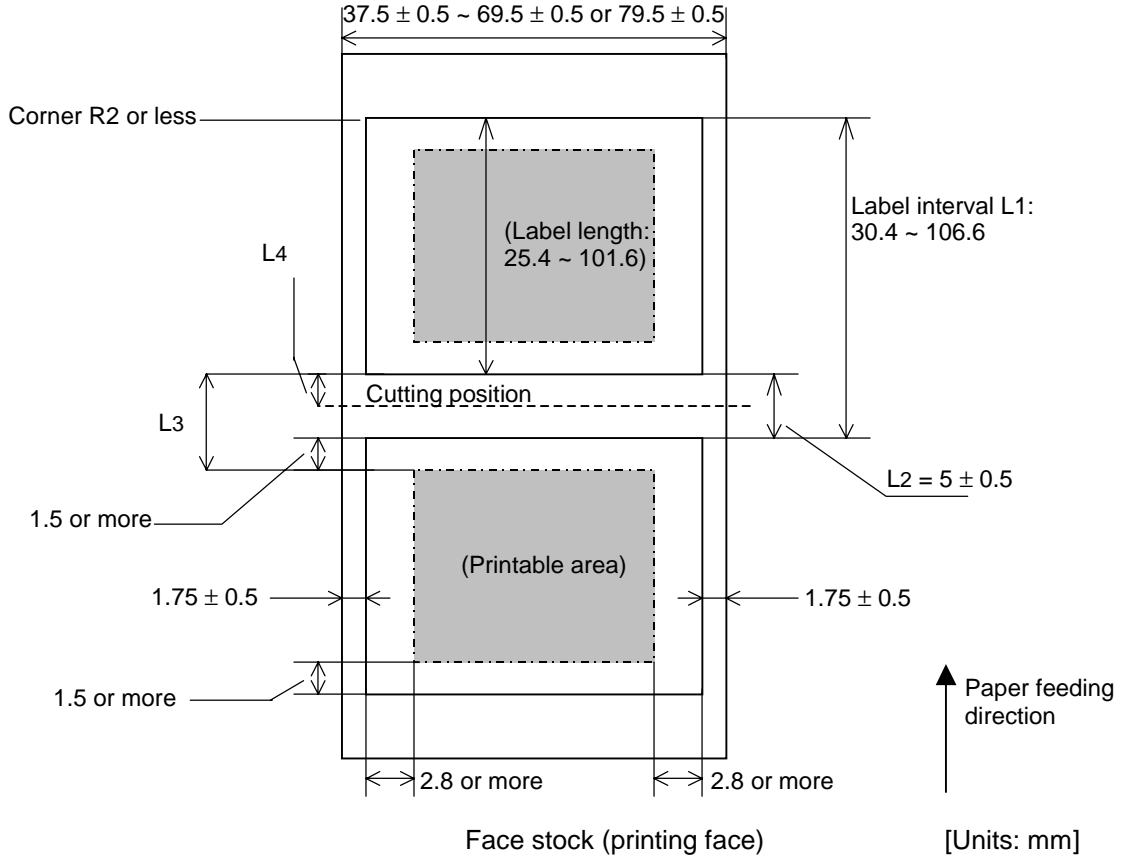


Die-Cut Label Paper Thickness Requirements

EPSON	TITLE	SHEET REVISION	NO.	
	TM-L90 Roll Paper Manufacturing Guide	A	NEXT 5	SHEET 4

3.6 Requirements for Die-Cut Label Size

When manufacturing die-cut label paper (with or without black marks), be sure that the paper meets the following requirements. (The ESC/POS commands expands the settable range, omitting the margin settings or the limitation on use (NOTE 2 of Section 3.6).)



Label Size Requirement

- NOTES:
1. Be sure to set the cutting position (L4) between labels.
 2. Since the position of the print head and the cutter is not contiguous, the printer operates as follows when the paper is cut:
 - ① Completes printing
 - ② Feeds the paper to the cutting position
 - ③ Cuts the paper
 - ④ Feeds the next label in reverse to the print starting position

Depending on the paper setting or the paper size, the tip of the next label may be fed over the print head in action ② above, or the paper may be fed incorrectly or jammed by catching the tip of the next label with the print head in ④.

To avoid this, be sure that the distance from the cutting position to the print starting position (=L3-L4) is 3.6 mm {0.14"} or more. And the minimum label length must be 25.4 mm {1"}.

If (L3-L4) is less than 3.6 mm or the label length is less than 25.4 mm, the paper may be fed wastefully because action ④ is not performed.

EPSON	TITLE	SHEET REVISION	NO.	
	TM-L90 Roll Paper Manufacturing Guide	A	NEXT 6	SHEET 5

3.7 Automatic Paper Layout Setup

The automatic paper layout setting is a function for the printer to measure the position of the black mark or the label and to execute the paper layout setting function.

This function can be used only for label paper, receipt paper, or receipt paper with black marks.

To enable the automatic paper layout setting, there are three methods, as follows:

- To select the automatic paper layout setting mode that is provided in the printer (Refer to the description below)
- To use the memory switch setting utility (Refer to the user's manual for the memory switch setting utility)
- To control the printer with ESC/POS commands (Refer to the ESC/POS Application Programming Guide)

If label paper with black marks is used, the paper layout setting must be set manually.

Execution procedure for the automatic paper layout setting mode:

- 1) Open the paper roll cover.
- 2) Load the paper roll.
- 3) Turn the power on while holding down the paper FEED button (located inside the printer), and continue holding down the paper FEED button until the ERROR LED comes on.
- 4) Release the paper FEED button once the ERROR LED comes on.
- 5) Press the paper FEED button (located inside the printer) six times, and then close the cover.
- 6) The printer measures the paper layout settings of the paper inserted automatically and stores them in the NV memory.
- 7) Once the automatic paper layout setting is performed, the automatic paper layout setting mode is ended.

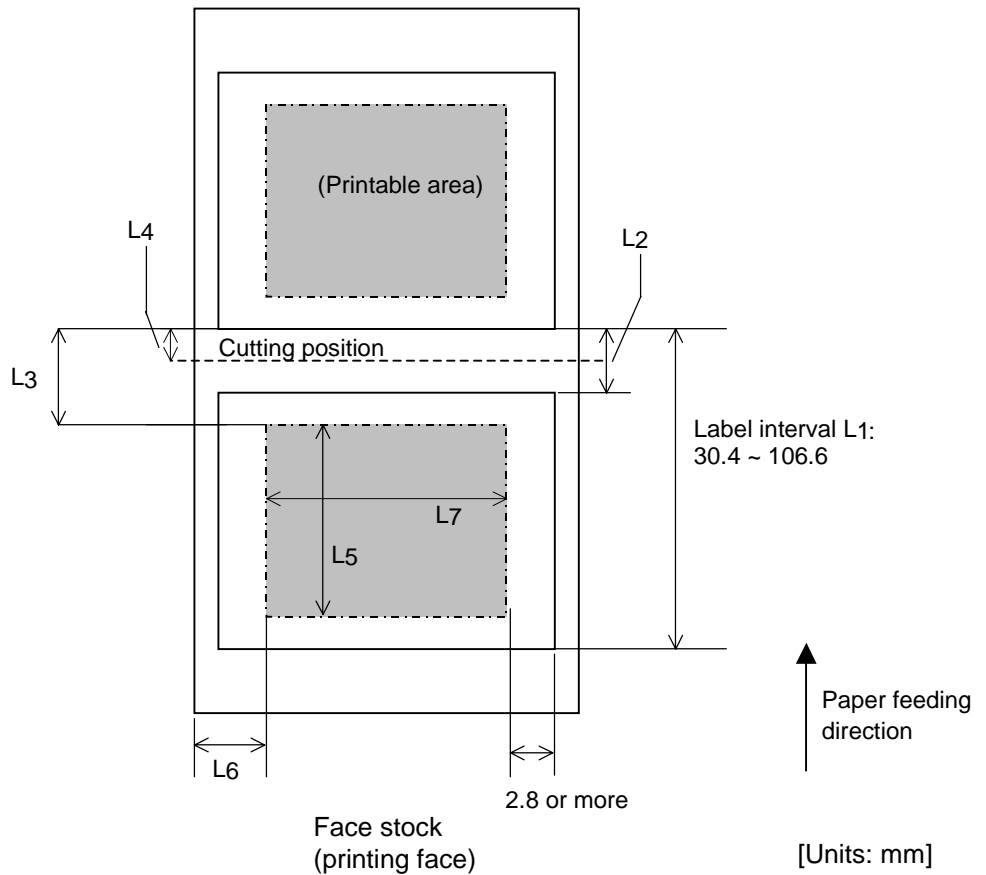
EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 7	SHEET 6

Confidential

Automatic setup values for paper layout are set based on the following formulas:

- L3: $(L2 + 1.5)$ mm
- L4: $(L2 \times 2/5)$ mm
- L5: $(L1 - L2 - 3)$ mm
- L6: 4.7 mm (fixed)
- L7:
 - When backing paper width is 78 mm or more: 70 mm
 - When backing paper width is below 78 mm: (backing paper width – 8) mm

NOTE: The printer measures L1 and L2. Lengths indicated by L1 ~ L7 are shown in the figure below:



Parameters for Setting up Automatic Paper Layout

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 8	SHEET 7

3.8 Manual Paper Layout Setup

The manual paper layout setup is used to execute the “Paper layout setup” function by entering paper data directly into the NV memory of the printer. This function enables adjusting the layout more precisely than with the automatic paper layout setup. It is possible to set a paper type, distance between marks, mark length, paper width, and items for printable area. After installing the paper, do the paper layout setup.

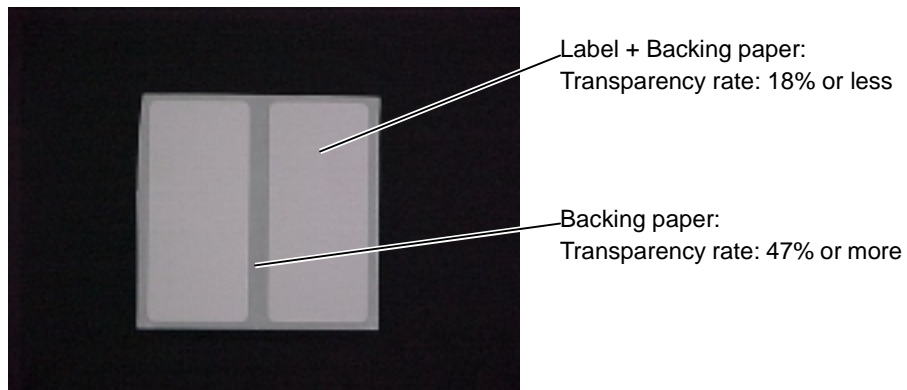
Even if the transparency rates (refer to Section 3.9) differ between papers whose paper size is the same (for example, when the backing paper changes from white glassine to blue), make sure to do the paper layout setup.

There are two ways to use the “Manual paper layout setup.” Refer to the appropriate instructions for details.

- Use a memory switch setting utility. (Refer to the utility and its user’s manual.)
- Control the printer directly with ESC/POS commands. (Refer to the ESC/POS Application Programming Guide.)

3.9 Requirements for Transparency Rate of Die-Cut Label Paper

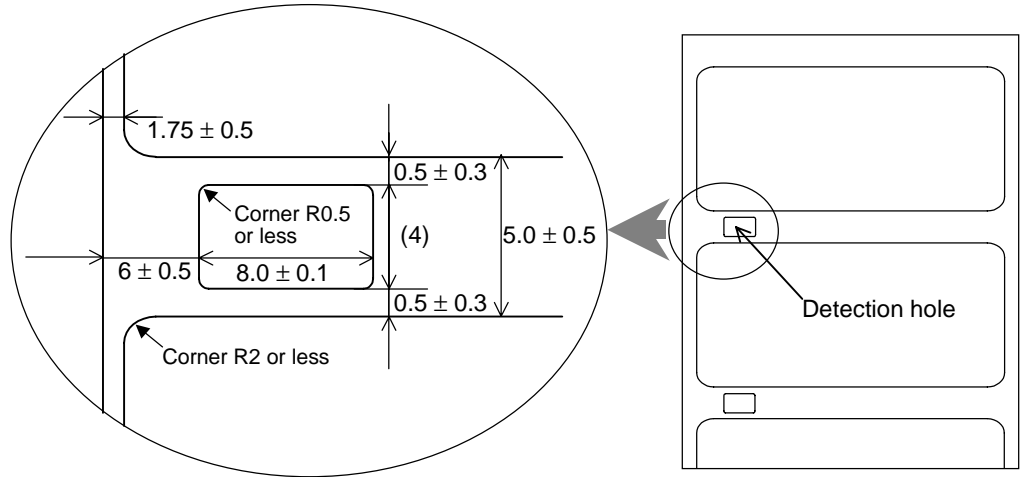
If die-cut label paper is used, the position of the label is determined by the difference between the transparency of the label backing paper and the transparency of the backing paper only. Therefore, it is recommended that you use label paper with a large difference of transparency. Be sure the label meets the following requirements so that the printer can recognize the position of the label.



NOTES: 1. Transparency rates are measured by the Macbeth TD-904 (with a filter for infrared) photometer. The transparency rates are calculated as follows:
 Use
 $Density = \text{Log}_{10} (\text{Amount of irradiation} / \text{Amount of transparency})$
 Then,
 $\text{Transparency rate (\%)} = (\text{Amount of transparency} / \text{Amount of irradiation}) \times 100$

EPSON	TITLE	SHEET REVISION	NO.	
	TM-L90 Roll Paper Manufacturing Guide	A	NEXT 9	SHEET 8

2. If the transparency rates are out of the specified range (label + backing paper: 18% or less, backing paper: 47% or more), the printer detects a layout error. However, paper identified with a layout error may be used when the detection hole is prepared as follows and the position to detect the label may be shifted by approximately 0.5 mm {0.02"}.



Face (printed side)

[Units: mm]

3.10 Requirements for Black Mark Position for Die-Cut Label Paper

For die-cut labels with black marks, there are two reflective rate requirements, depending on the size and position of black marks. Be sure to use label paper that meets either black mark position requirement I or II as follows:

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 10	SHEET 9

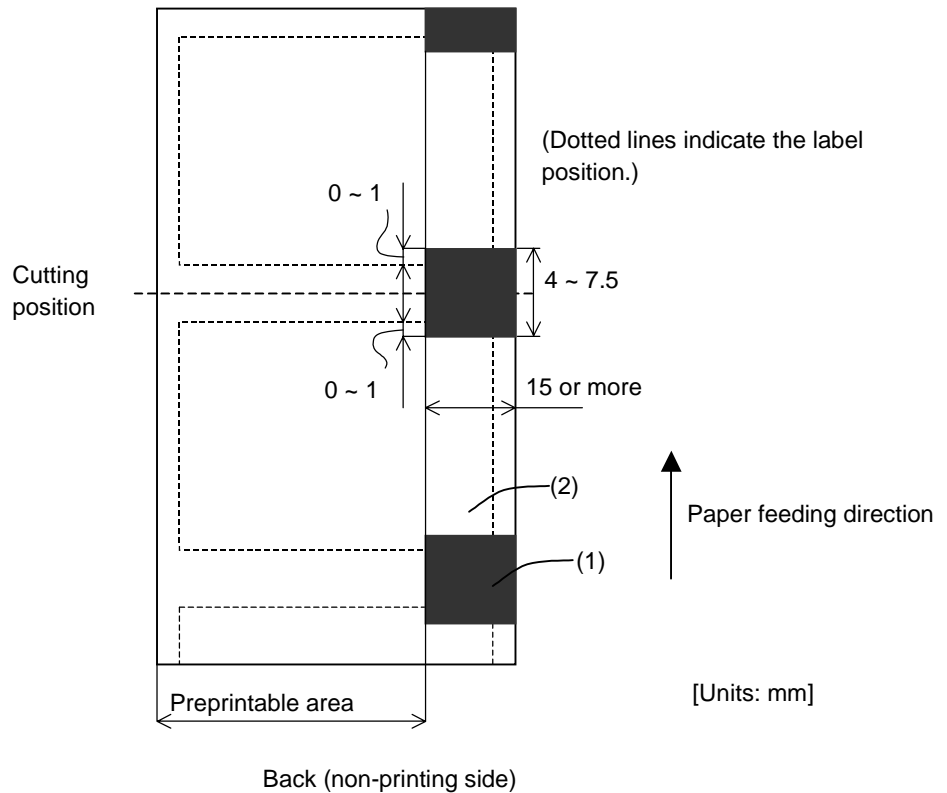
Confidential

3.11 Requirements for Black Mark Position I

The black mark positions on the paper to be manufactured must meet the requirements in the figure below. (The ESC/POS commands expand the settable range, omitting the margin settings or the limitation on use (NOTE 2 of Section 3.6).) The reflective rates of the black mark portions (1) and label portions (2) must meet the combinations shown in the table below (the reflective rate is measured using the back of the paper, the non-printing side):

- Black mark portions must be printed on the back of paper (non-printing side).
- The length of the black mark must cover the space between labels (backing paper between labels) completely (overlapping labels by 0 ~ 1 mm).

Reflecting rate for black mark portion (1)	17%	16%	15%	14%	13%	Less
Reflecting rate for label portion (2)	90%	85%	80%	75%	70%	More



NOTE: Reflective rates are measured by the Macbeth PCM-II (Filter D) meter.

EPSON	TITLE	SHEET REVISION	NO.	
	TM-L90 Roll Paper Manufacturing Guide	A	NEXT 11	SHEET 10

Confidential

3.12 Requirements for Black Mark Position II

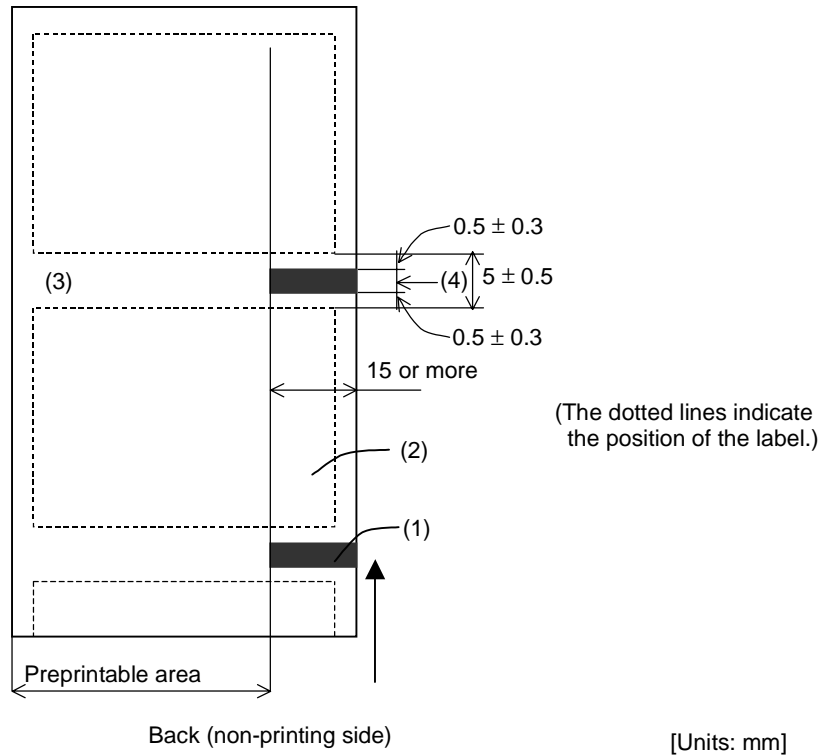
The black mark positions on the paper to be manufactured must meet the requirements in the figure below. (The ESC/POS commands expand the settable range, omitting the margin settings or the limitation on use (NOTE 2 of Section 3.6).) The reflective rates of each portion (1), (2), and (3) must meet the combinations shown in the table below (the reflective rate is measured using the back of the paper, the non-printing side):

- Black mark portions must be printed on the back of paper (non-printing side).

Reflective rate of black mark portion (1)	17%	16%	15%	14%	13%	Less
Reflective rate of the portion where the black mark does not exist (2) (3)	90%	85%	80%	75%	70%	More

NOTE: Reflective rates are measured by the Macbeth PCM-II (Filter D) meter.

If label paper meets Black Mark Position Requirement I, it is not necessary to consider Black Mark Position Requirement II.



The black mark is in the position between labels, but does not cover the entire interval.

EPSON	TITLE	SHEET REVISION	NO.	
	TM-L90 Roll Paper Manufacturing Guide	A	NEXT 12	SHEET 11

4. CONTINUOUS LABEL ROLL PAPER

4.1 Continuous Label Paper

Continuous label paper is label roll paper without labels die cut in predefined sizes.

Feature: Label size (length) is variable with an autocutter; therefore, it is possible to print labels of various sizes.

4.2 Specified Original Paper

The specified original paper is the same as that for die-cut label paper.

Print density adjustment and paper for high speed use are also the same as those for the die-cut label paper.

4.3 Requirements for Thickness and Adhesive Agent

Requirements are as follows:

- Total amount of thickness of the thermal paper and backing paper: 145 µm or less (without adhesive agent).
- Adhesive agent: Acrylic emulsion

NOTE: When cutting continuous label paper with an autocutter, the autocutter might not function correctly, depending on the adhesive agent used; therefore, be sure to use original label paper of the acrylic emulsion type.

Adhesive agents that must not be used are as follows:

- Acrylic solvent type
- Rubber type
- Silicon type
- Other special adhesive agents

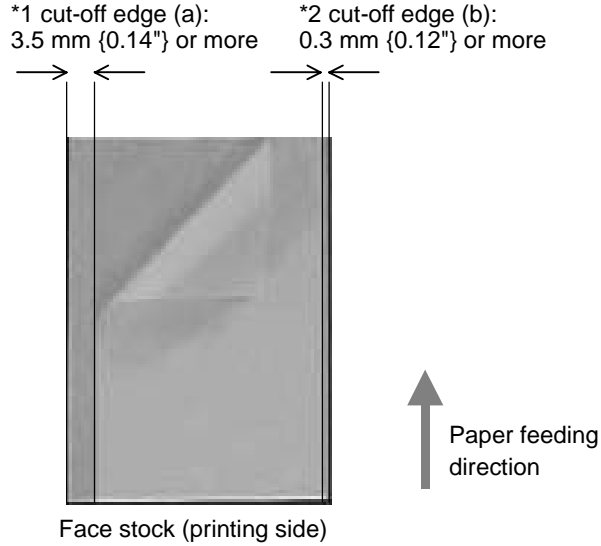
If an original paper other than that specified is used, be sure to confirm the specifications of the original paper.

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 13	SHEET 12

4.4 Requirements for Size of Continuous Label Paper

To make a cut-off edge, be sure to manufacture label paper that meets the requirements in the figure below:

Note: "cut-off edge" is a method of cutting and removing the edge of the label in advance so that the label can be peeled off easily from the backing paper.



Requirements for Size of Label Paper of the Cut-Off Edge Type

- NOTES: *1. When performing a full-cut, for the cut-off edge (a): 3.5 mm {0.14"} or more is not necessary; however, even though it is not necessary, it is recommended that cut-off edges with approximately 2 mm {0.79"} width be provided for (a) and (b) so that the label can be peeled off easily from the backing paper.
- *2. When using a label with 80 mm {3.15"} paper width, the cut-off edge (b) is not necessary. However, when labels with a width between 38 ~ 70 mm {1.5 ~ 2.76"} are used, be sure to make the cut-off edge (b): 0.3 mm {0.12"} or more to prevent the adhesive agent of the label roll paper from being attached to the platen.)

EPSON	TITLE	SHEET REVISION	NO.	
	TM-L90 Roll Paper Manufacturing Guide	A	NEXT 14	SHEET 13

Confidential

5. RELIABILITY

Life	Receipt (single-color)	20,000,000 lines printed (3.75 mm {0.15"} for one line) (The value above is calculated under the conditions of 15-line feeding and 10-line printing repeatedly with a paper thickness of 75 μ m or less, which corresponds to approximately 120 km {74.57 miles} of running length.)
	Receipt (two-color)	10,000,000 lines printed (3.75 mm {0.15"} for one line) (The value above is calculated under the conditions of 15-line feeding and 10-line printing repeatedly, which corresponds to approximately 60 km {37.28 miles} of running length.)
	Receipt (single-color, with a paper thickness of 145 μ m or less)	10,000,000 lines printed (3.75 mm {0.15"} for one line) (The value above is calculated under the conditions of 15-line feeding and 10-line printing repeatedly with a paper thickness of 145 μ m or less, which corresponds to approximately 60 km {37.28 miles} of running length.)
	Label (single-color)	1,000,000 labels issued (except for KL470) (When the length of the label in the paper feeding direction is 25.4 mm {1"} through 63.5 mm {2.5"}. The value above corresponds to approximately 30 km to 70 km {18.64 to 43.5 miles} of running length. When printing labels whose length exceeds 63.5 mm, the label-issuing life is 70 km {43.5 miles} of running length.) KL470: 700,000 labels issued (1,000,000 labels issued with platen cleaning.)
	Label (two-color)	500,000 labels issued (When the length of the label in the paper feeding direction is 25.4 mm {1"} through 63.5 mm {2.5"}.), which corresponds to approximately 15 km to 35 km {9.32 to 21.75 miles}.)
	Thermal head	150 million pulses
	Autocutter	When cutting receipt paper: 2,000,000 cuts (except for KF50, when the paper thickness is less than 75 μ m) 1,200,000 cuts (for KF50 (KANZAN)) 1,000,000 cuts (when the paper thickness is more than 75 μ m and less than 145 μ m) When cutting label paper: 1,000,000 cuts (for die-cut labels, baking paper is cut) When cutting continuous label paper: 500,000 cuts (1,000,000 cuts with cutter blade cleaning)

The values above are for when the specified paper is used.

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 15	SHEET 14

APPENDIX A. NOTES ON PAPER HANDLING**A.1 Notes on Thermal Paper Handling**

Substances such as chemicals on thermal paper may cause color development or faded printing; therefore, pay attention to the following:

- Use water paste, starch paste, polyvinyl paste, or CMC paste when gluing thermal paper.
- Volatile organic solvents such as alcohol, ester, and ketone can cause discoloration.
- Some discoloration may occur, depending on adhesive materials. Printing may be faded, depending on materials of tapes.
- If thermal paper touches anything that includes phthalic acid ester plasticizer for a long time, it can reduce the image-formation ability of the paper and can cause the printed image to fade. Therefore, when storing thermal paper in a card case or sample notebook, be sure to use only products made from polyethylene, polypropylene, or polyester.
- If thermal paper touches diazo copy paper immediately after copying, the printed surface may be discolored.
- Thermal paper must not be stored with the printed surfaces against each other because the printing may be transferred between surfaces.
- If the surface of thermal paper is scratched with a nail or hard metal object, the paper may become discolored.

A.2 Notes on Storage

Since discoloration begins at 70°C {158°F}, thermal paper should be protected from high temperatures, humidity, and light, both before and after printing.

- Store paper away from high temperatures and humidity.
Do not store thermal paper near a heater or in enclosed places exposed to direct sunlight.
- Avoid direct light.
Extended exposure to direct light (as with placement of the printer near windows) may cause discoloration or faded printing.
- When the printer is not used for one week or more, it is recommended not to leave the thermal paper between the platen and the print head.

A.3 Notes on Two-Color Paper Handling

- Two-color printing can be performed by selecting two-color paper with the memory switch (customized value) and using two-color paper as the print paper.
- In two-color printing, the hue might not be clear, depending on printing patterns.
- The reliability of two-color paper differs from that of single-color paper.

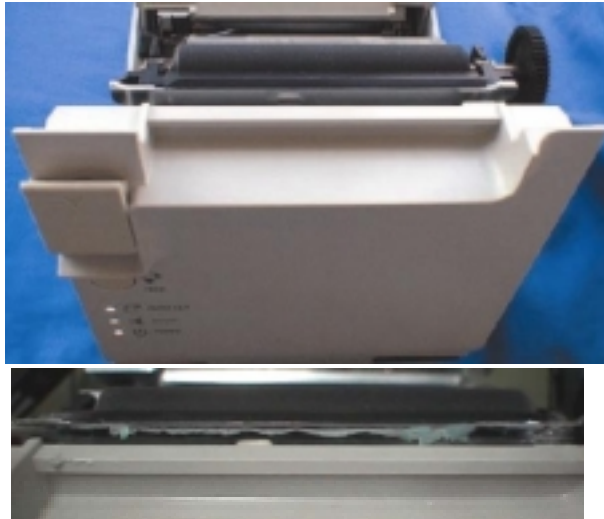
EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 16	SHEET 15

APPENDIX B. MAINTENANCE

B.1 Cleaning the Autocutter

If the adhesive agent on the labels sticks to the autocutter, it may dull the blade. In this case, clean the blade as described below:

Be sure that the printer is turned off. Collect and remove accumulated adhesive materials with a flathead screwdriver.



Adhesive Materials on the Blade



Removing Adhesive Materials with Flathead Screwdriver

Warning:

Be sure not to touch the edge of the autocutter directly with your fingers; otherwise, your fingers might be injured.

NOTE: Be sure to remove as much of the adhesive agent as possible from the cutter blade edge, but you do not need to polish the blade until it is absolutely clean. It is recommended not to use an alcohol solvent. If an alcohol solvent is used, the adhesive agent might begin to be dissolved, which can reduce the efficiency of the printer.

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 17	SHEET 16

B.2 Cleaning the Platen

Depending on the roll paper used, paper dust may stick to the platen roller and accuracy of paper feeding might be decreased. In this case, clean the platen roller as follows:

- 1) Turn off the printer and open the paper roll cover.
- 2) Clean the thermal element of the print head with a cotton swab moistened with water.
- 3) After moisture dries out completely, turn on the printer.

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT 18	SHEET 17

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APPENDIX C. ROLL PAPER TYPE NO.

The following roll paper types can be manufactured by NAKAGAWA Manufacturing Co., Ltd. (Japan).

Receipt	Paper width			Original paper type no.
	80 mm	60 mm	38 mm	
Single-color thermal Paper	ENTPD080090	---	---	TF60KS-E
Single-color thermal paper (paper thickness of 145 μm or less)	ENTPE080090	---	---	TF11KS-ET
Two-color thermal paper	ENTPC080090	---	---	PD750R

Die-cut label	Label length	Backing paper width (label width)				Original paper type no.
		80 mm (76 mm)	60 mm (56 mm)	38 mm (34 mm)	No labels/ Roll approx	
Single-color label paper	25 mm {1"}	ENTLA 080090025	ENTLA 060090025	ENTLA 038090025	1310	HD-75
	51 mm {2"}	ENTLA 080090051	ENTLA 060090051	---	710	HD-75
	76 mm {3"}	ENTLA 080090076	ENTLA 060090076	---	490	HD-75
	102 mm {4"}	ENTLA 080090102	ENTLA 060090102	---	370	HD-75
Two-color label paper	25 mm {1"}	ENTLB 080090025	ENTLB 060090025	ENTLB 038090025	1310	BR21
	51 mm {2"}	ENTLB 080090051	ENTLB 060090051	---	710	BR21
	76 mm {3"}	ENTLB 080090076	ENTLB 060090076	---	490	BR21
	102 mm {4"}	ENTLB 080090102	ENTLB 060090102	---	370	BR21

EPSON	TITLE TM-L90 Roll Paper Manufacturing Guide	SHEET REVISION A	NO.	
			NEXT END	SHEET 18