RICOH

RICOH Pro VC60000

Forms Design Guide

For information not in this manual, refer to the Help System in your product.

Read this manual carefully and keep it handy for future reference.

TABLE OF CONTENTS

Before you begin - READ THIS FIRST

The RICOH Pro VC60000 printer is a tractorless printing system and therefore **does not support** the following:

- Fanfold (box) forms
- Paper rolls with splices
- Fanfold (dishing) forms
- Perforation fold memory is not supported
- Labels
- Holograms
- Adhesives
- Glues
- Windows
- Action devices

Chemicals and paper treatments on things like labels can cause printer problems resulting in increased operator maintenance and chargeable service cost.

Note

A printer without the Undercoat Unit does not support offset coated paper.

Before attempting to use these papers, see Testing new paper and applications , p. 41.

Packaging, shipping, and storage of paper

Rolls should be shipped with core plugs and wrapped in a protective moisture barrier.

Keep paper rolls in sealed shipping containers until they are to be used. The sealed shipping container lessens moisture absorption during storage.

Store paper in an area where temperature and humidity are similar to the environment in which the paper will be used. Wrinkles and voids can occur during printing on paper that hasn't adapted moisture changes.

Avoid areas of extreme heat or humidity when storing paper. Extended exposure to these extremes can cause permanent damage. Exposure of paper to relative humidity greater than 65% can reduce print quality.

Optimal paper storage values are:

- Temperature: 13 to 27° C (55 to 80° F)
- Relative Humidity: 40% to 60%

Operating environment

The environment needs to be free of all airborne or paper fibers as it might cause printer reliability issues. While the release of some paper dust to the environment and into the printer is unavoidable, the amount of paper dust affects the frequency of operator cleaning and printer service. Make sure that paper is free of loose or hanging chads and dust, especially on the edges of the roll. Always use the web cleaner that is provided with the RICOH Pro VC60000 printer.

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1. Basic requirements for paper

• **Paper specifications**

The quality and performance of RICOH Pro VC60000 printers relates directly to the quality and consistency of the paper being used. To make sure that the paper purchased for RICOH Pro VC60000 printers is suitable for your applications, we strongly recommend that you:

- Request the assistance of your paper supplier and sales representative to select the proper paper.
- Test your application on a sample of a proposed paper before you order large quantities. See Testing new paper and applications , p. 41.

Paper specifications

RICOH Pro VC60000 paper specifications:

Paper width: 165 mm to 520 mm (6.5 to 20.5 in.)

Paper weights: 40 to 250 g/m² (15 to 170 lb. Text or 93 lb. Cover)
Test method: TAPPI T410 or ISO 536

Note

Offset coated papers above 200 gsm are supported for 30 m/min only.

Paper smoothness: Recommended range: 20 to 200 Sheffield units
Test method: TAPPI T538 or ISO 5636-4

Paper stiffness: Recommended range: less than 21.0 mN

Note

Papers with stiffness above 31 mN should not be run on this printer. These papers will damage the printer. With stiffness between 21 and 31 mN, degraded print quality is possible.

Test method: TAPPI T489 or ISO 5628

Other papers must be approved by RICOH Product Engineering. Please consult your RICOH Sales Representative.

Perforations:

- For cuts and ties across the web:
  - Cuts must be no longer than 3 mm (0.118 in.)
  - Ties must be no shorter than 1 mm (0.039 in.)
  - The perforation must have ties on the ends.
  - Perforations must stop 5.0 mm (0.20 in) from the edge of the sheet.
  - Tensile strength must be greater than 1.44 kg/cm (8 pounds/linear inch).
- For cuts and ties in the web feed direction:
  - Cuts must be no longer than 0.28 mm (0.011 in.)
  - Ties must be no shorter than 0.23 mm (0.009 in.)

Tractor Holes:

- Holes must be 4 mm (0.157 in.) in diameter with 12.7 mm (0.50 in.) pitch (space between the holes).
- Holes must be 6.35 mm (0.25 in.) centerline to paper edge

Preprinting:

- Printing with ink jet inks on top of preprinted areas is not recommended.
- Preprinted ink must be properly cured.

Paper rolls:

- Rolls must be wound tightly and evenly from side to side
- The sides of the roll must be straight. The accuracy of automated slitting systems is typically specified in reference to the width of a web (that is, between two cut positions). For example, an automated slitting system might specify ± 0.01 in. (0.254 mm) accuracy. This means that rolls produced are expected to be no more than 0.01 in. (0.254 mm) larger or smaller than the target width.
- Rolls must be free from defects, such as wrinkles and dents
- Rolls must contain no splices
- Rolls must be fitted with core plugs to prevent the core from being crushed during shipment
- Rolls must be shipped in a protective and moisture barrier wrap
- The shaft and roll diameter are dependent on the requirements of the pre- and postprocessing equipment manufacturers.

2. Selecting paper for RICOH Pro VC60000 Printer

•Tested papers

When selecting paper for digital color printing, be aware that the color or shade of the paper strongly influences how the eye perceives color on the page. When selecting a white paper, choose a paper that has good brightness as well as sufficient whiteness to provide good color reproduction. The closer to true white the paper is, the more accurately a given color will be rendered.

As digital color printing is predominantly graphics-based, image quality is more critical than with monochrome printing. Additionally, the increased ink application rates (four inks versus one for black-and-white printing) results in increased stress on the paper, which, in turn, results in the need for a slightly heavier and stiffer sheet of paper.

The following paper properties are very important to achieve the best possible print quality in RICOH Pro VC60000 printers:

- Basis Weight—see Paper weight (basis weight or grammage), p. 33
- Opacity—see Opacity, p. 32
- Brightness or Whiteness—see Brightness, p. 30 and Whiteness (shade), p. 37
- Porosity—see Porosity, p. 35
- Coated Paper—see Coated papers, p. 30
- Stiffness—see Stiffness, p. 36

Tested papers

This section lists the paper that has been tested with the RICOH Pro VC60000 printer. This list will continue to expand.

	Nippon Next-IJ70	Mitsubishi Sword Gloss	Lumiart Gloss
Paper Type	**Plain Paper**	**Inkjet Coated Paper**	**Offset Coated Paper**
Paper description	Setup paper	Setup paper	Density setup paper
Width	520 mm	520 mm	520 mm
Length	Depends on job	Depends on job	Depends on job
Thickness	95 microns	119 microns	96 microns
Weight	81 gsm	128 gsm	130 gsm
Coated	No – normal dot gain	Yes – medium dot gain	Yes – medium dot gain

Note

Offset coated papers above 200 gsm are not supported at 50 m/min.

3. General guidelines for forms

- **Clear zones**
- **Paper and image tolerances**
- **Edge accuracy**
- **Perforation and tractor hole accuracy**
- **Perforation embossing**
- **Perforation strength**

For best performance, use forms that meet the recommendations in this guide. Provide the form vendor with the form criteria outlined and request forms that meet these criteria.

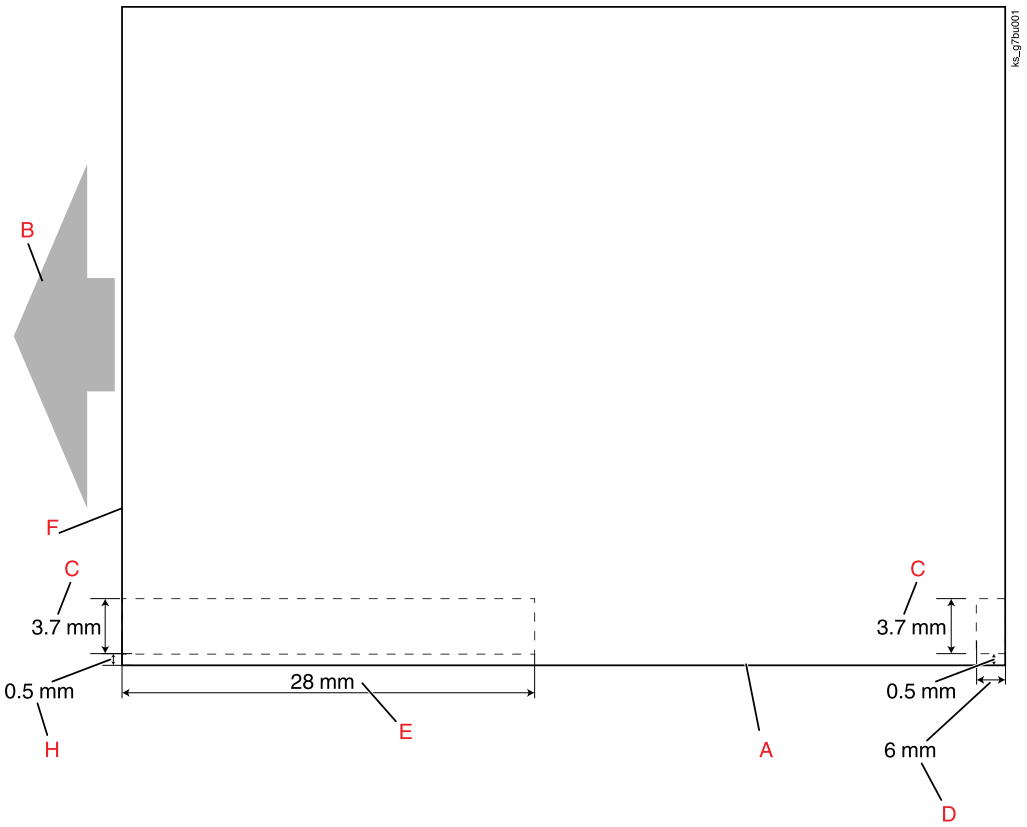
Clear zones

Clear zones are reserved areas that should contain no preprinting, backgrounds, colored/tinted paper, or customer data of any kind. This clear zone area must be maintained for printing marks which are used to ensure front-to-back or page-to-page registration.

Note

The location of the alignment mark clear zone can be moved anywhere across the page in the scan direction using a setting on the operator console.

Figure 1. Alignment mark clear zone



Clear zones for PostProcessor registration marks

PostProcessior Marks, also known as cutter marks, are a special mark to support cutters that require a continuous registration mark printed for the cutter to stay in sync, even in blank sheets (waste sheets created when the printer starts and stops printing).

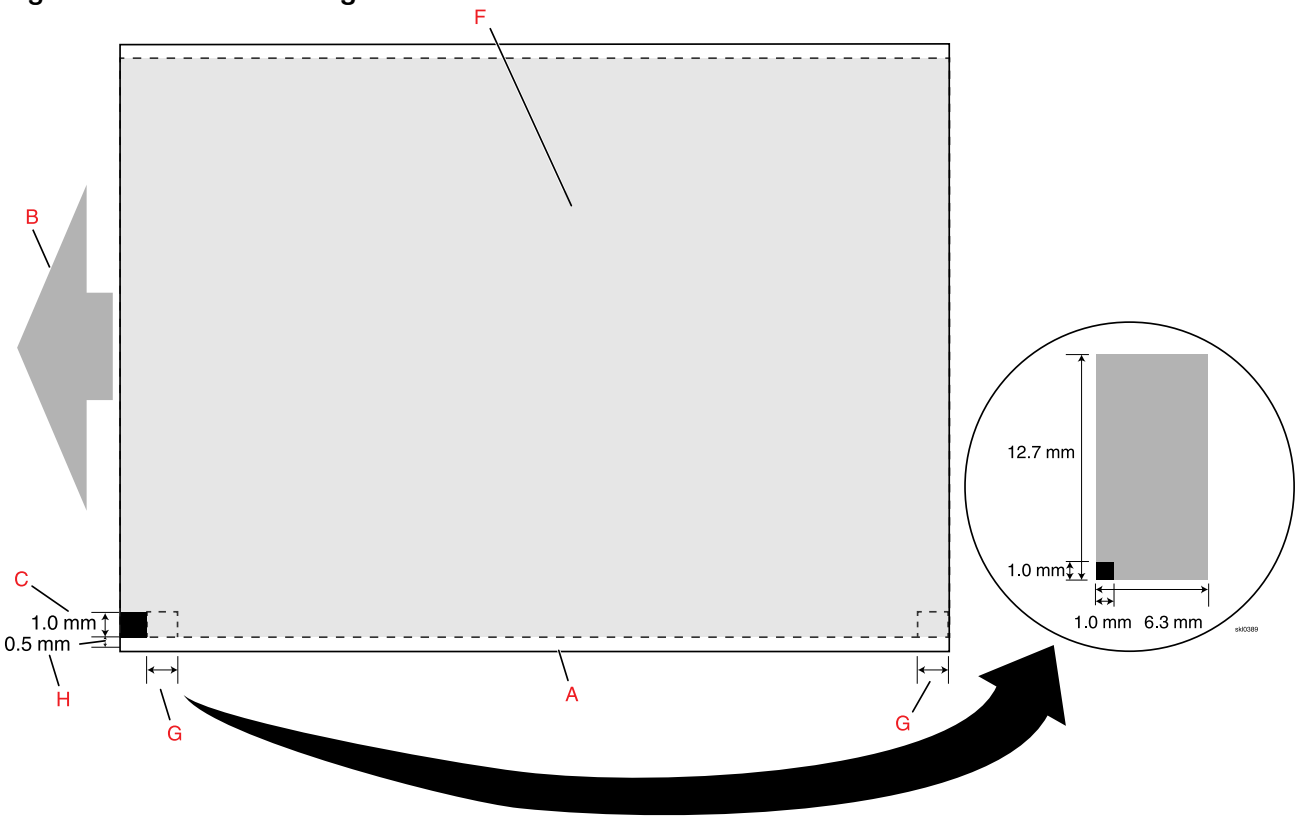
The clear zone for Postprocessor registration marks has these requirements:

- There can be up to 2 missing PostProcessing registration marks created when the web stops moving and starts moving again for the next print job. The equipment must be able to handle this.
- The registration mark:
  - Only prints on the front side of Printer 1.
  - Starts a minimum of 0.5 mm (0.02 in.) **(H)** from the front edge of the page **(A)** in the process direction **(B)**.

    Note

    The 0.5 mm space **(H)** represents the distance from the edge of the page **(A)** to the first printhead nozzle in the printer.
  - It always prints solid black. This cannot be changed.
  - Mark height **(H)** can be set from 1.0 mm (0.04 in.) to 6.3 mm (0.25 in.).
  - Mark width **(C)**can be set from 1.0 mm (0.04 in.) to 12.7 mm (0.5 in.).
  - Mark can be placed anywhere across the web in the imageable print area **(F).**
  - Mark can be placed along the web **(B)**(starting at the top of the sheet) from 0.0 mm (0.0 in.) to 609.6 mm (24 in.) or maximum sheet length.
  - There must be a clear zone **(G)** before and after the PostProcessor mark. For the length of the clear zones, refer to the documentation for your Pre and Post processing equipment.

Figure 2. PostProcessor registration marks



Clear zone for line flushing

The printer uses printhead line flushing to maintain the ink flow in the printhead.

The clear zone for line flushing has these requirements:

- The line flushing is always placed starting at the top of the sheet.
- The line flushing offset range is 0.0 to 3.0 mm (0.12 in.) starting at the top of the sheet.

Note

The 0.5 mm space **(H)** represents the distance from the edge of the page **(A)** to the first printhead nozzle in the printer.

Figure 3. Clear zone for line flushing

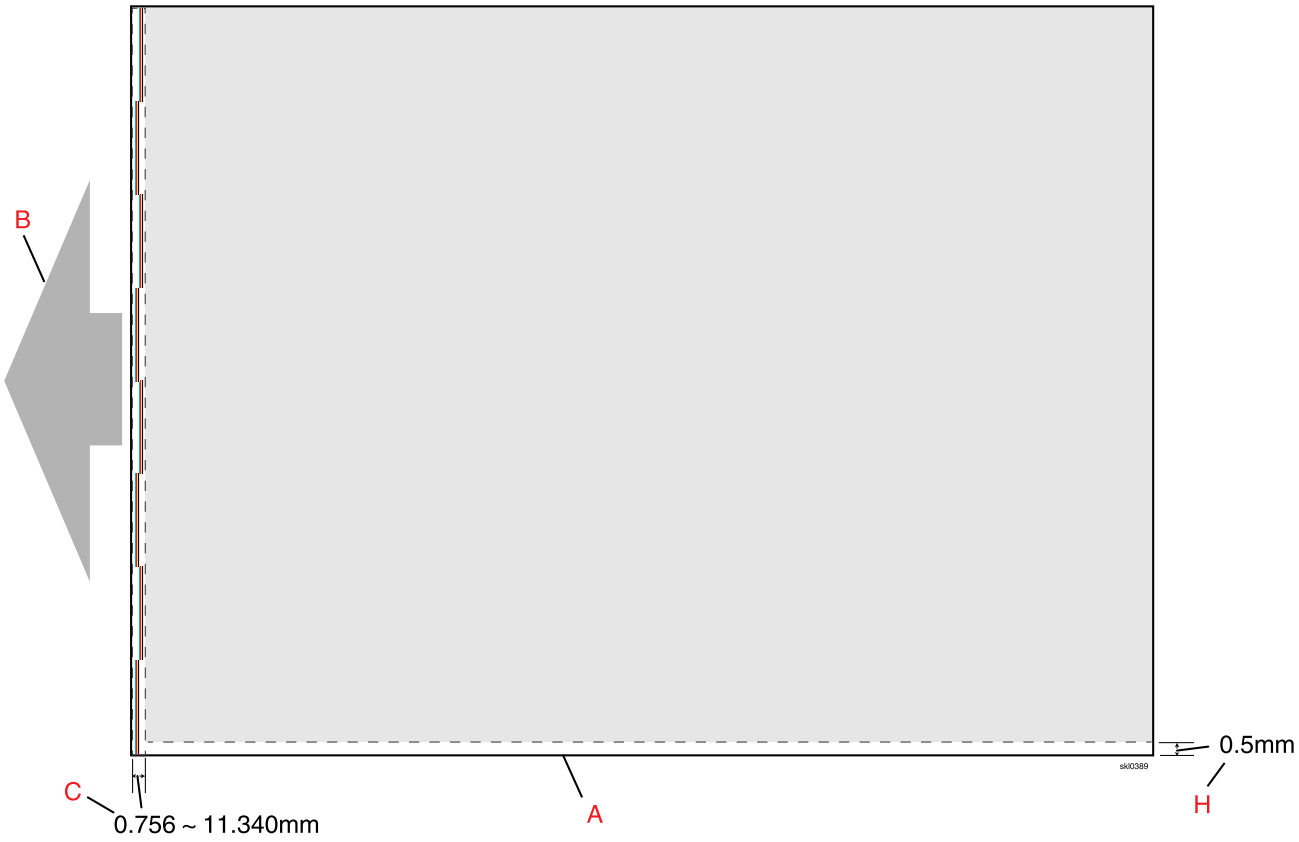


Table 1. Console Settings for Flush Lines in Clear Zones (C)

Console Setting	1200x1200	1200x600	600x600
Plain line 1	0.756 mm (0.03 in.)	0.924 mm (0.04 in.)	0.924 mm (0.04 in.)
Plain line 2	0.924 mm (0.04 in.)	1.260 mm (0.05 in.)	1.260 mm (0.05 in.)
Plain line 4	1.260 mm (0.05 in.)	1.932 mm (0.08 in.)	1.932 mm (0.08 in.)
Plain line 8	1.932 mm (0.08 in.)	3.276 mm (0.13 in.)	3.276 mm (0.13 in.)
Plain line 16	3.276 mm (0.13 in.)	5.964 mm (0.23 in.)	5.964 mm (0.23 in.)
Coated line 4	1.932 mm (0.08 in.)	3.276 mm (0.13 in.)	3.276 mm (0.13 in.)
Coated line 8	3.276 mm (0.13 in.)	5.964 mm (0.23 in.)	5.964 mm (0.23 in.)
Coated line 16	5.964 mm (0.23 in.)	11.340 mm (0.45 in.)	11.340 mm (0.45 in.)

Note

The values in this table are theoretical values, and these values might increase slightly from paper dot gain.

Clear zones for tractor hole sensors

This clear zone requirement is for the tractor hole sensors to read properly and is in addition to the clear zone requirements for particular forms outlined in this guide.

Figure 4. Clear Zones for Tractored Forms

Clear zones for alignment marks on tractored and tractorless forms with no preprinting

On forms with no preprinting, the alignment mark clear zone has the following requirements:

- Starts a minimum of 0.5 mm (0.02 in.) **(H)** from the front edge of the page **(A)** in the process direction **(B)**.

  Note

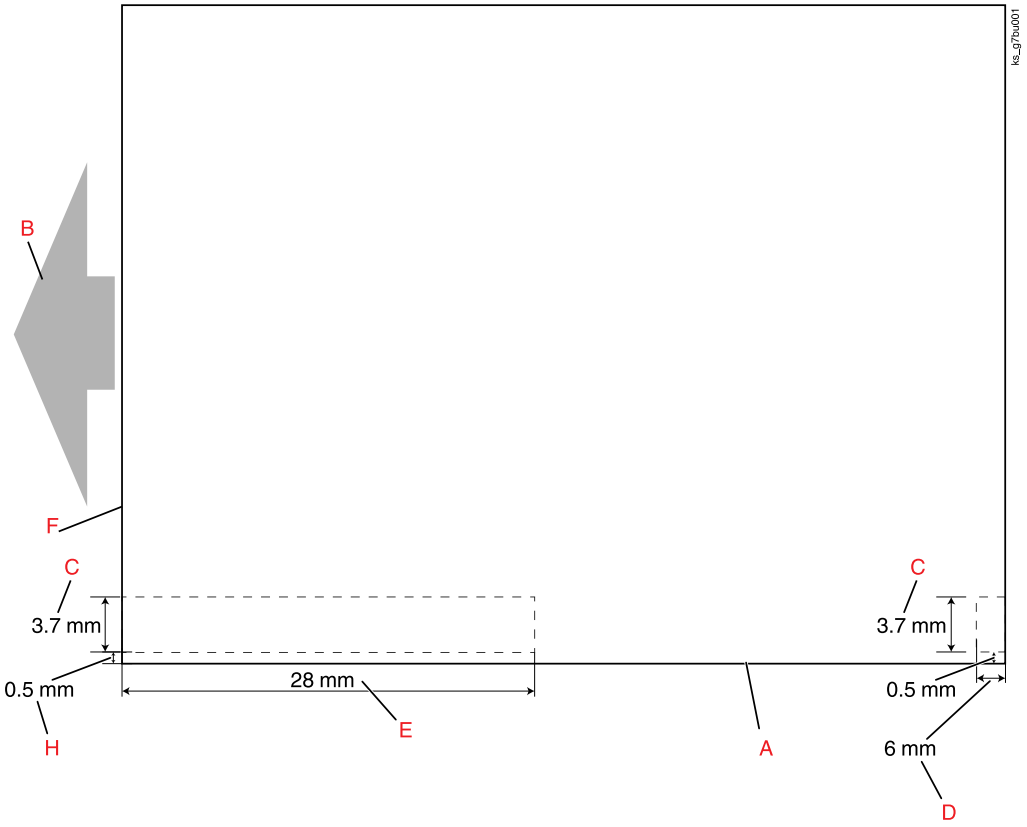
  The 0.5 mm space **(H)** represents the distance from the edge of the page **(A)** to the first printhead nozzle in the printer.
- Measures 3.7 mm (0.15 in.) in width **(C)**.
- Measures 6 mm (0.24 in.) in length **(D)** from the bottom of the page.

- Measures 28 mm (1.10 in.) in length **(E)** from the top of the page **(F)**.

Note

- The location of the alignment mark clear zone can be moved anywhere across the page in the scan direction using a setting on the operator console.
- See Clear zones for tractor hole sensors, p. 15 for information about preprinting in the area of the tractor holes on tractored forms.

Figure 5. Alignment mark clear zone



Clear zones on tractored and tractorless forms with a preprinted mark

Clear zones are reserved areas that should contain no preprinting, backgrounds, colored/tinted paper or customer data of any kind. This clear zone area must be maintained for printing marks which are used to ensure front-to-back or page-to-page registration.

Note

- The location of the alignment mark clear zone can be moved anywhere across the page in the scan direction using a setting on the operator console.
- See Clear zones for tractor hole sensors, p. 15 for information about preprinting in the area of the tractor holes on tractored forms.
- See Paper and image tolerances, p. 21 for more information about preprinted marks.

On forms with a preprinted mark **(G)**, the alignment mark clear zone has the following requirements:

- Starts a minimum of 0.5 mm (0.02 in.) **(H)** from the front edge of the page **(A)** in the process direction **(B)**.

  Note

  The 0.5 mm space **(H)** represents the distance from the edge of the page **(A)** to the first printhead nozzle in the printer.
- Measures 3.7 mm (0.15 in.) in width **(C)**.
- Measures 16 mm (0.63 in.) in length **(E)** from the top of the page **(F)**.
- Measures 6 mm (0.24 in.) in length **(D)** from the bottom of the page .
- There must be a 6 mm clear zone **(I)** before and after the preprinted mark.

The location of the alignment mark printed by printer one must be aligned with the preprinted mark in the process direction.

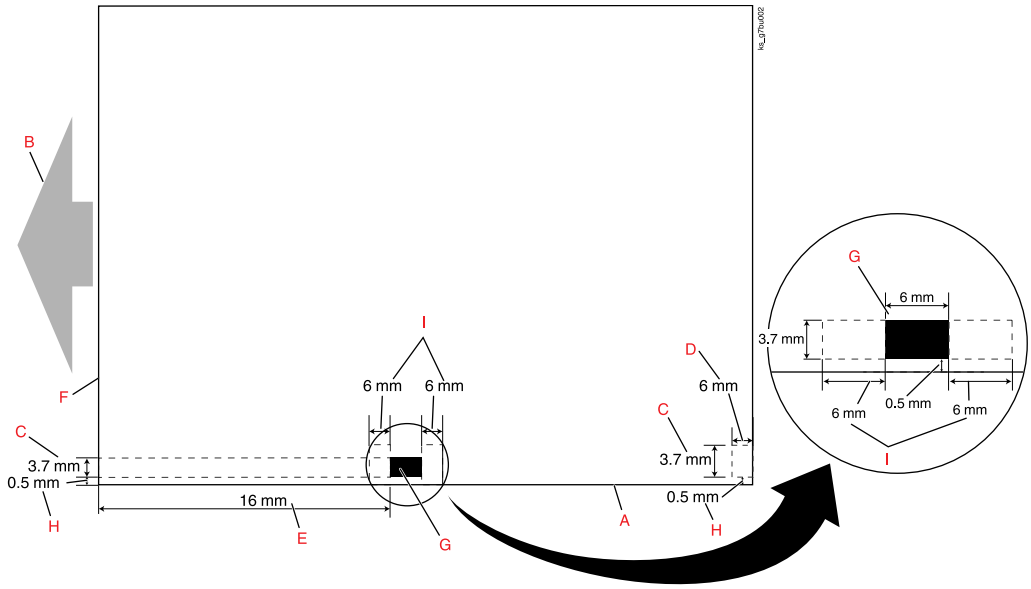
The preprinted mark has the following requirements:

- Measures 3.7 x 6 mm square, is black and has a minimum optical density of 0.8 measured with a densitometer set to Status T spectral response.
- The leading edge of the preprinted mark is printed 16 mm (0.63 in.) **(E)** from the top of page **(F)**.
- Is printed a minimum of 0.5 mm **(H)** from front edge of the page **(A)** so that alignment with the printer alignment mark can be maintained.

  Note

  The 0.5 mm space **(H)** represents the distance from the edge of the page **(A)** to the first printhead nozzle in the printer.

Figure 6. Preprinted mark clear zone



Clear zones for side verify marks on tractored and tractorless forms

Clear zones are reserved areas that should contain no preprinting, backgrounds, colored/tinted paper, or customer data of any kind. This clear zone area must be maintained for printing marks which are used to ensure front-to-back or page-to-page registration.

The location of the clear zone can be moved anywhere across the page in the scan direction using a setting on the operator console.
1

Note

See Clear zones for tractor hole sensors, p. 15 for information about preprinting in the area of the tractor holes on tractored forms.

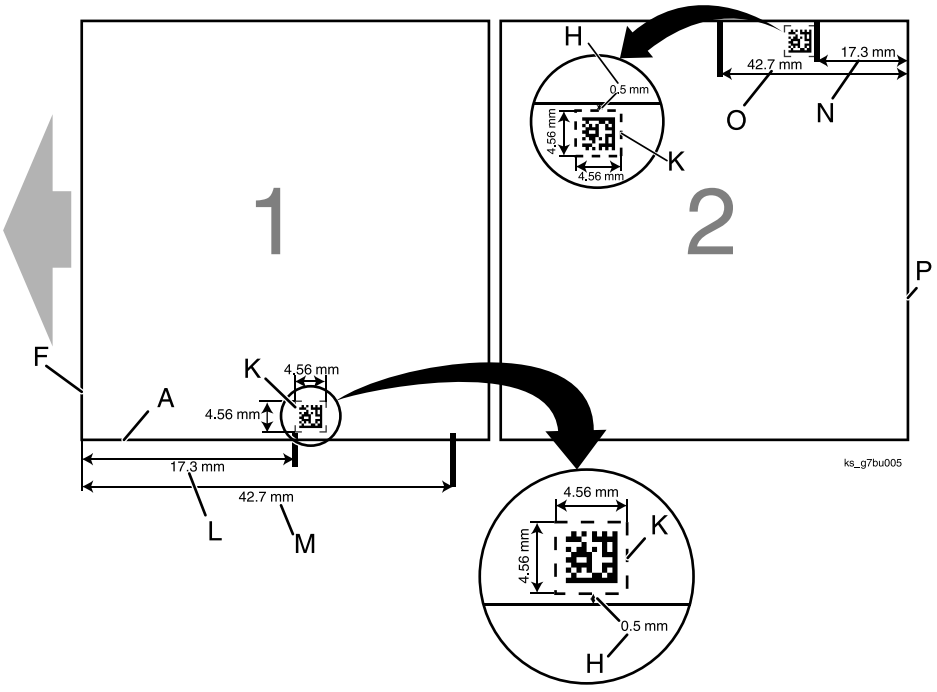
The clear zone for side verify marks has the following requirements:

- Measures 4.56 x 4.56 mm (.18 in.) square **(K)**.
- Starts a minimum of .5 mm (0.02 in.) **(H)** from the front edge of the page **(A)** and can be placed 17.3 mm (0.68 in.) **(L)** to 42.7 mm (1.68 in) **(M)** from the top of form **(F)** to the leading edge of the clear zone on the front side **(1)**.

  Note

  The .5 mm space **(H)** represents the distance from the edge of the page **(A)** to the first printhead nozzle in the printer.
- Can be placed 17.3 mm (0.68 in.) **(N)** to 42.7 mm (1.68 in.) **(O)** from the bottom of form **(P)** to the trailing edge of the clear zone on the back side **(2)**.

Figure 7. Clear Zones for Side Verify Marks



Clear zones for tractored and tractorless preprinted forms with no defined top of form

Clear zones are reserved areas that should contain no preprinting, backgrounds, colored/tinted paper or customer data of any kind. This clear zone area must be maintained for printing marks which are used to ensure front-to-back or page-to-page registration.

The location of the clear zone can be moved anywhere across the page in the scan direction using a setting on the operator console.

Note

See Clear zones for tractor hole sensors, p. 15 for information about preprinting in the area of the tractor holes on tractored forms.

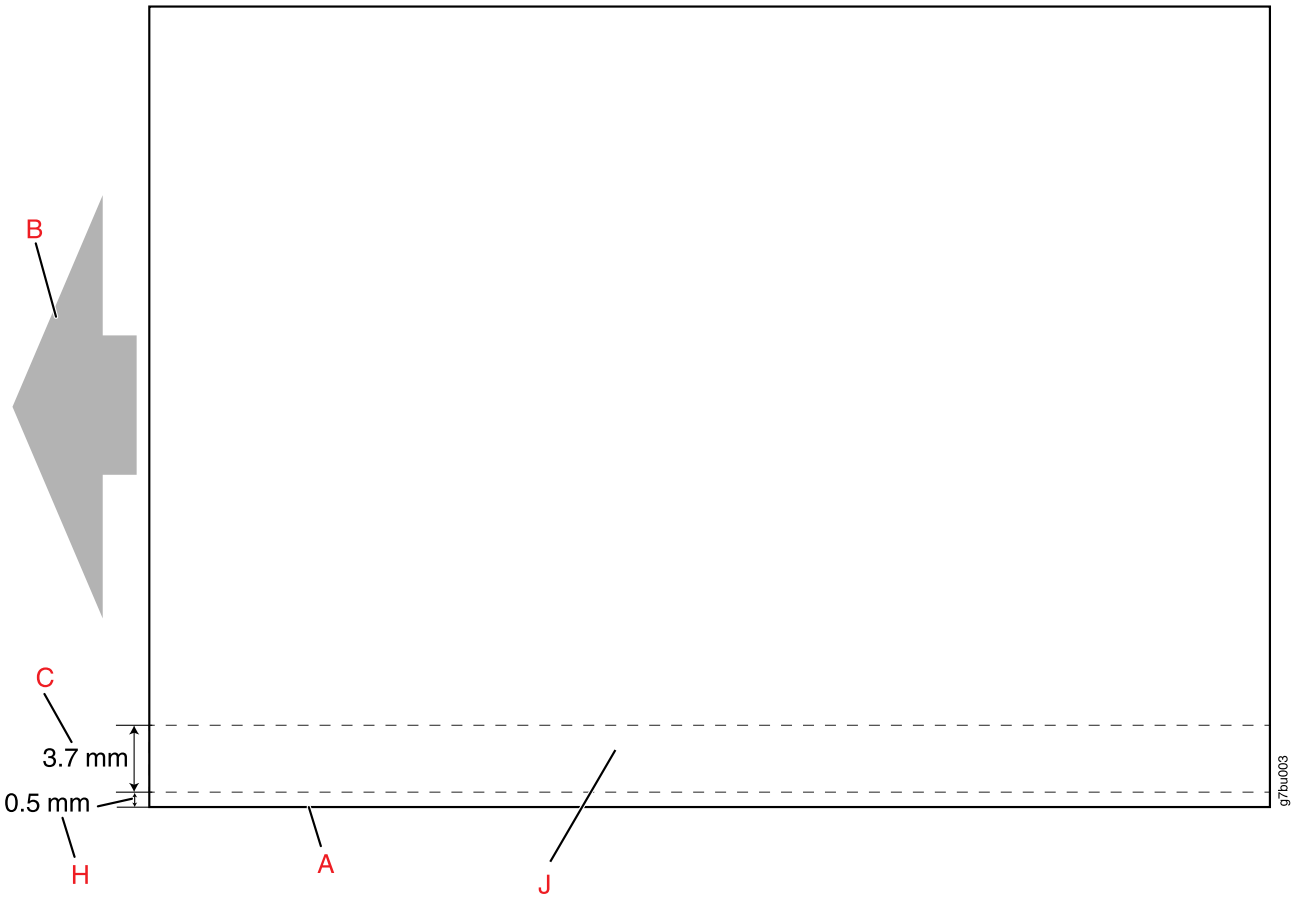
In this case the clear zone **(J)** has the following requirements:

- Starts a minimum of 0.5 mm (0.02 in.) **(H)** from the front edge of the page **(A)** in the process direction **(B)**.

  Note

  The 0.5 mm space **(H)** represents the distance from the edge of the page **(A)** to the first printhead nozzle in the printer.
- Measures 3.7 mm (0.15 in.) in width **(C)**.
- Continues for the entire length of the form.

Figure 8. Tractorless Preprinted Forms when no top of form mark is being used

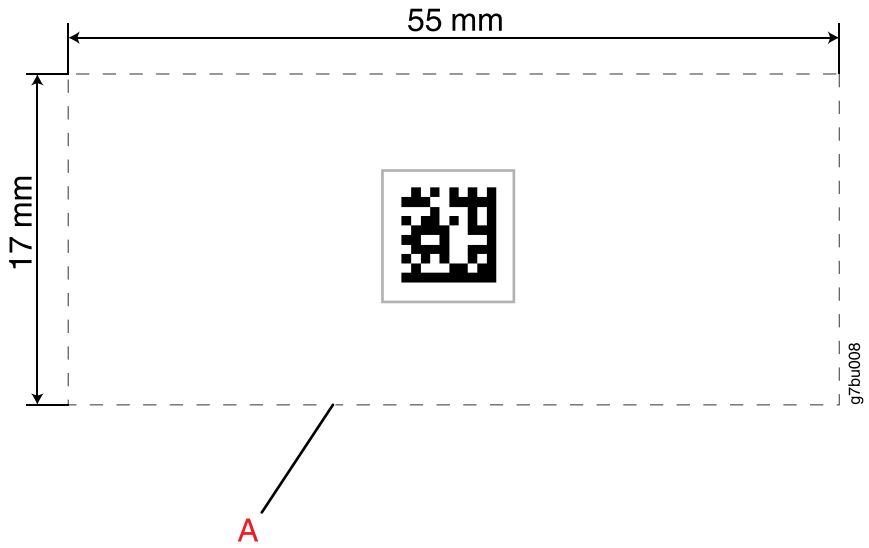


Clear zone for the barcode reader field of view

The barcode reader field of view **(A)** is 17 mm x 55 mm. No customer preprinted 2D barcodes, or customer data generated 2D barcodes can appear in the field of view. This area is reserved for the side verify 2D barcode.

The print position of the 2D barcode is determined by the operator using console settings. The reader is manually positioned by the operator so the barcode (including 7 mm quiet zone) is within the barcode reader field of view. The large field of view provides the operator adjustment flexibility. The barcode does not have to be centered in the field of view.

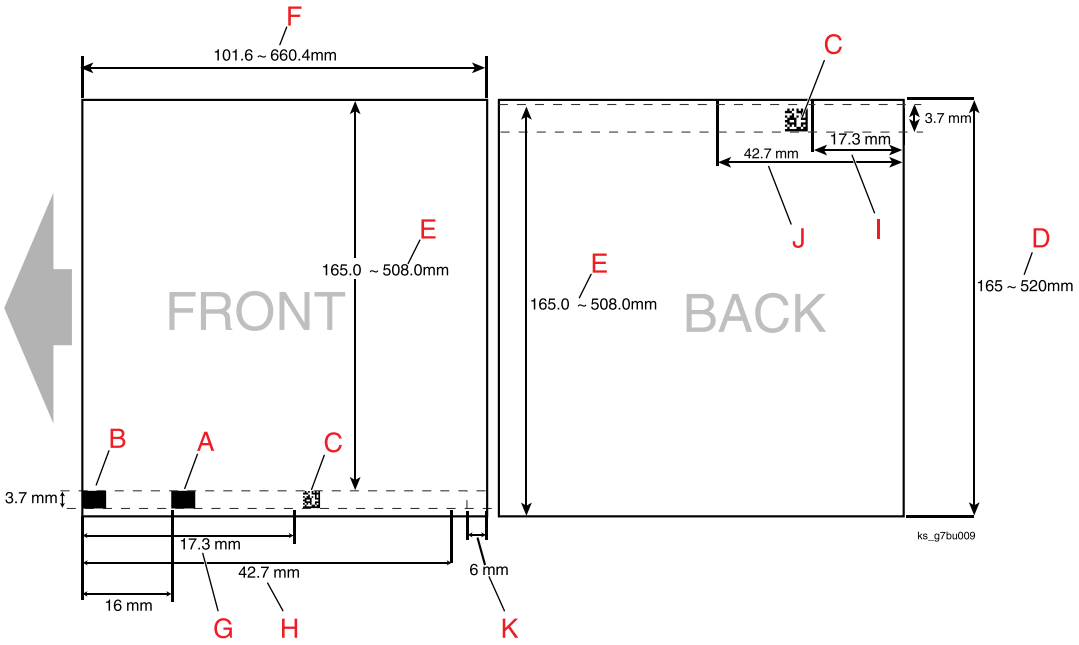
Figure 9. Clear Zones for barcode reader field of view



Paper and image tolerances

Tractorless forms that have any pre-printed text, preprinted background, horizontal perforations, or specific defined TOF require the form to have a 3.7 mm (0.15 in.) x 6 mm (0.24 in.) preprinted alignment mark **(A)** 16 mm below the desired TOF placed any where across the width of the form. This preprinted alignment mark is optional for tractor paper.

Figure 10. Marks



Other marks include the alignment mark **(B)**, and the side 2 verify mark **(C)** which must be located a minimum of 17.3 mm (0.68 in.) **(G)** to a maximum of 42.7 mm (1.68 in.) **(H)** from the top of form on the front side and a minimum of 17.3mm **(I)** to a maximum of 42.7 mm **(J)** from the bottom of form on the back side.

A clear zone of 6 mm (0.24 in.) **(K)** must be must be maintained at the bottom of the form. See Clear zones for alignment marks on tractored and tractorless forms with no preprinting , p. 15.

The paper width range is 165.0 mm to 520.0 mm **(D)**.

The page range is165.0 mm to 508.0 mm in width **(E)** and 101.6 mm to 660.4 mm in length **(F)**.

The image size range is 165.0 mm to 508.0 mm width **(E)** and 101.6 mm to 660.4 mm in length **(F)**.

Note

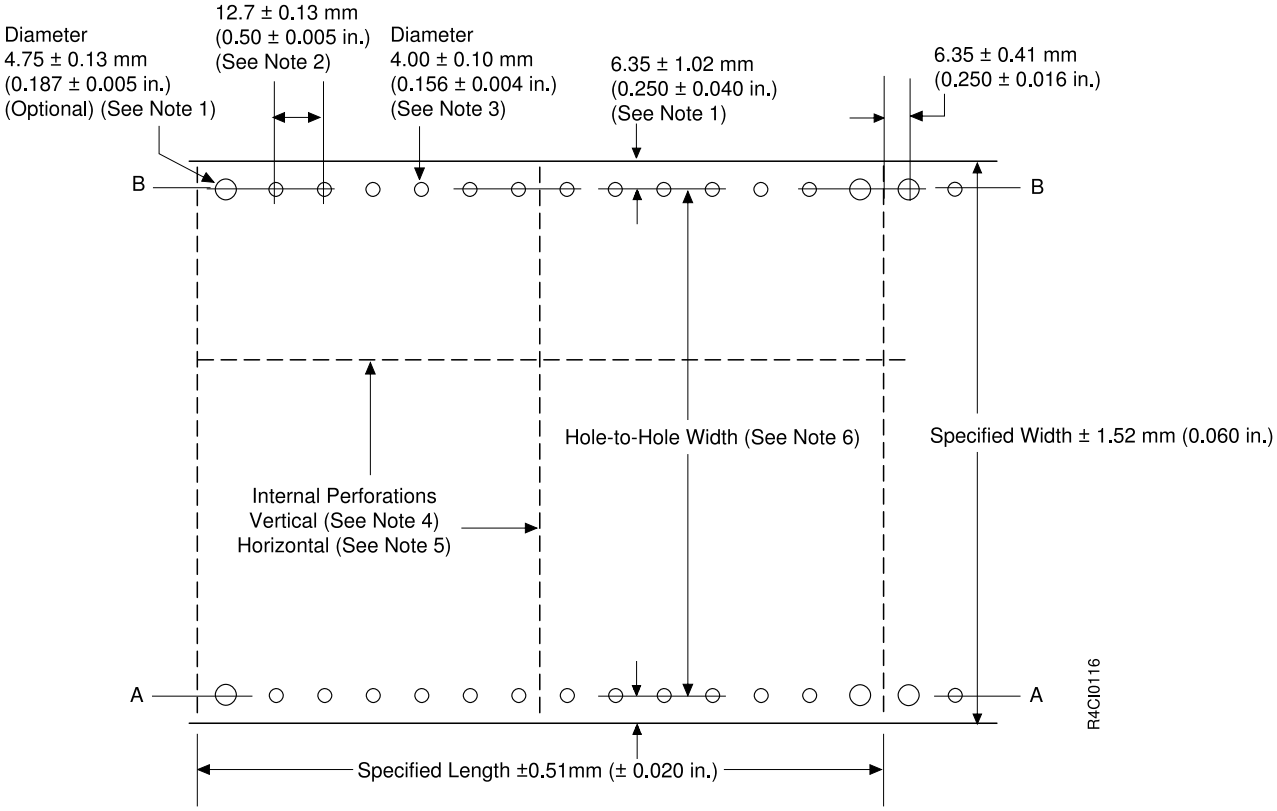
- With tractor paper, customer data will be clipped by 12.7 mm (0.5 in.) on each side. However, alignment marks, 2D barcodes, and user marks can still be printed in the tractor hole area.
- If the sheet lengths (perforation length) are not on 12.7 mm (0.5 in) boundaries, the printer does not support printing 2D barcodes between tractor holes.

3

Tractor hole tolerances

Forms pages must be within the tolerances shown in Tractor Hole Tolerances and hole tolerances shown in Hole Tolerances. To ensure correct printing and form feeding, the two vertical rows of tractor holes must be parallel. All measurements should be made at 22.8°C ± 2.8° (73°F ± 5°) and at 15% - 50% relative humidity.

Figure 11. Tractor Hole Tolerances



Note

1. The center of the tractor holes in the left margin should be lined up within 0.13 mm (0.005 in.) of the A axis. The center of the tractor holes in the right margin should be lined up within 0.13 mm (0.005 in.) of the B axis.
2. Spacing from any tractor hole to another should be the correct multiple of the adjacent hole space of 12.7 ±0.13 mm (0.50 ±0.005 in.).
3. Serrated feeding holes with a 3.86 mm (0.152 in.) inside diameter and a 4.37 mm (0.177 in.) maximum outside diameter are preferred. Continuous forms with a tractor-hole diameter of 4.0 ±0.10 mm (0.156 ±0.004 in.) in both right and left margins are acceptable.
4. Internal vertical perforations should not be closer than 25.4 mm (1.0 in.) to the edge of the form to avoid form breaks and jams.
5. For optimal form stacking, internal horizontal perforations should be at least 50.8 mm (2.0 in.) from the top or bottom of the form. To minimize premature folding in the stacker, any internal horizontal perforations should be stronger than the between-forms perforations.
6. Hole-to-hole widths and their tolerances are shown in Hole Tolerances, p. 23. The tolerances are based on a flat tolerance of 0.76mm ± 0.051mm (0.030 in. ± 0.002 in.).

Table 2. Hole Tolerances

Hole-to-Hole Widths (Width - 12.7 mm [0.5 in.])		Tolerances	
mm	in.	±mm	±in.
<203.2	<8.0	1.17	0.046
203.2 to 254.0	8.0 to 10.0	1.27	0.050
254.0 to 304.8	10.0 to 12.0	1.37	0.054
>304.8	>12.0	1.50	0.059

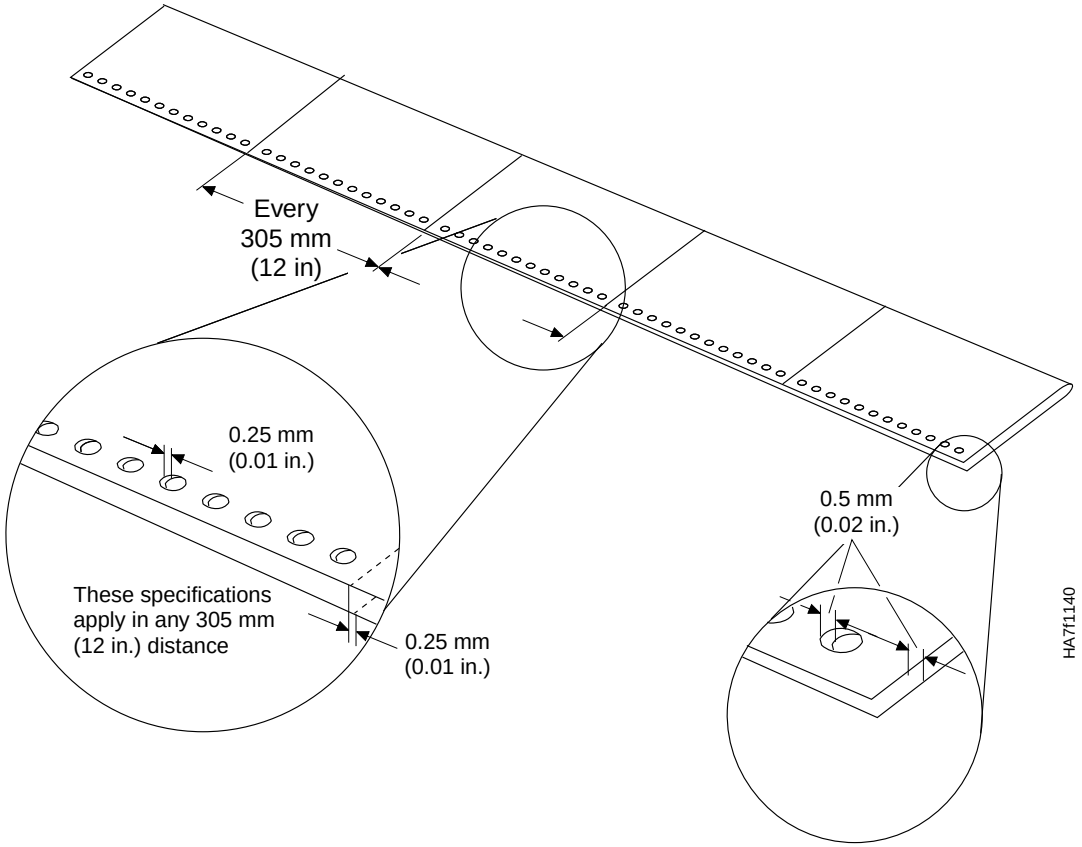
Edge accuracy

Edge accuracy refers to the accuracy with which tractor holes are drilled along the edges of the forms. Inaccurately drilled holes significantly reduce forms-feed performance through the printer.

To test edge accuracy:

1. Tear two lengths of forms, each about 2 meters (7 feet) long, from the stack.
2. Place the two lengths on top of each other on a flat surface. Match the tractor holes of both edges of the top sheet to the tractor holes of the bottom sheet at one end of the forms.
3. At the other end of the forms, measure the distance from the tractor holes of the top sheet to the tractor holes of the bottom sheet, as shown in the next figure. The distances must not be greater than shown.

Figure 12. Edge Accuracy



Perforation and tractor hole accuracy

Perforation and tractor hole accuracy refer to the accuracy with which page and fold perforations are cut perpendicular to the edge of the page. Inaccurately cut perforations affect form folding and may significantly reduce stacker performance. To check perforation and tractor hole accuracy, do the following:

1. Tear an even number of continuous sheets totaling about 2.8 meters (9 feet) from the stack or roll.
2. If the sheets are perforated, fold them at the middle page perforation and place the first sheet over the last sheet.

   If the sheets are not perforated, fold the sheets in half with the ends together and form a crease. The non-perforated, folded edge must be creased so that the folded edge is 6.35 mm (0.25 in.) from the tractor holes.
3. Measure the distance from either the edge or the tractor hole of the first sheet to the edge or the tractor hole on the last sheet, as shown in Perforation Accuracy, p. 25.

   1. The first tractor holes (top and bottom) after the fold should be aligned, with no offset.
   2. In **any** given 305 mm (12 in.), the distance between perforations or tractor hole edges must not exceed 0.25 mm (0.01 in.).
   3. The distances at the opposite end (the open end) must not exceed 0.5 mm (0.02 in.).
4. Refer to Perforation Accuracy, p. 25 and measure along each edge to verify that in **any** 305 mm (12 in.) of forms, the distance from either the edge of the tractor holes or the page perforations on

the top sheet to the edge of the holes or the page perforations on the bottom sheet does not exceed 0.25 mm (0.01 in.).

5. It is also necessary to ensure that the perforations and tractor holes on both edges of the forms are cut accurately and are not skewed.

    1. Unfold the sheets you folded in step 2.
    2. Refer to Perforation Accuracy — Edge to Edge, p. 26 and fold the sheets lengthwise. Measure the page perforations and tractor holes of the two edges as shown.
    3. The distances between the perforations or the tractor hole edges must not exceed 0.25 mm (0.01 in.) in **any** given 305 mm (12 in.) or 0.5 mm (0.02 in.) over the full length 2.8 meters (9 ft.).

Figure 13. Perforation Accuracy

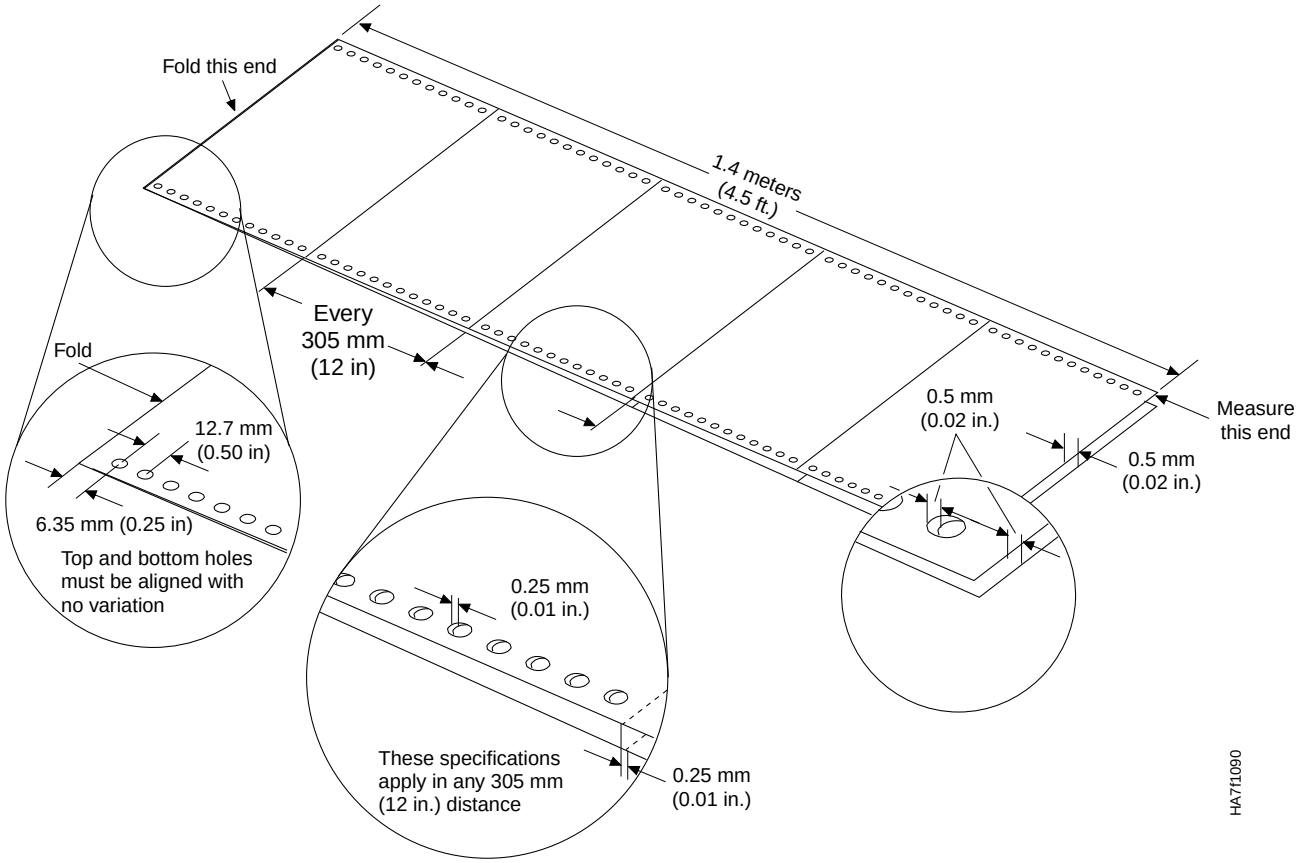
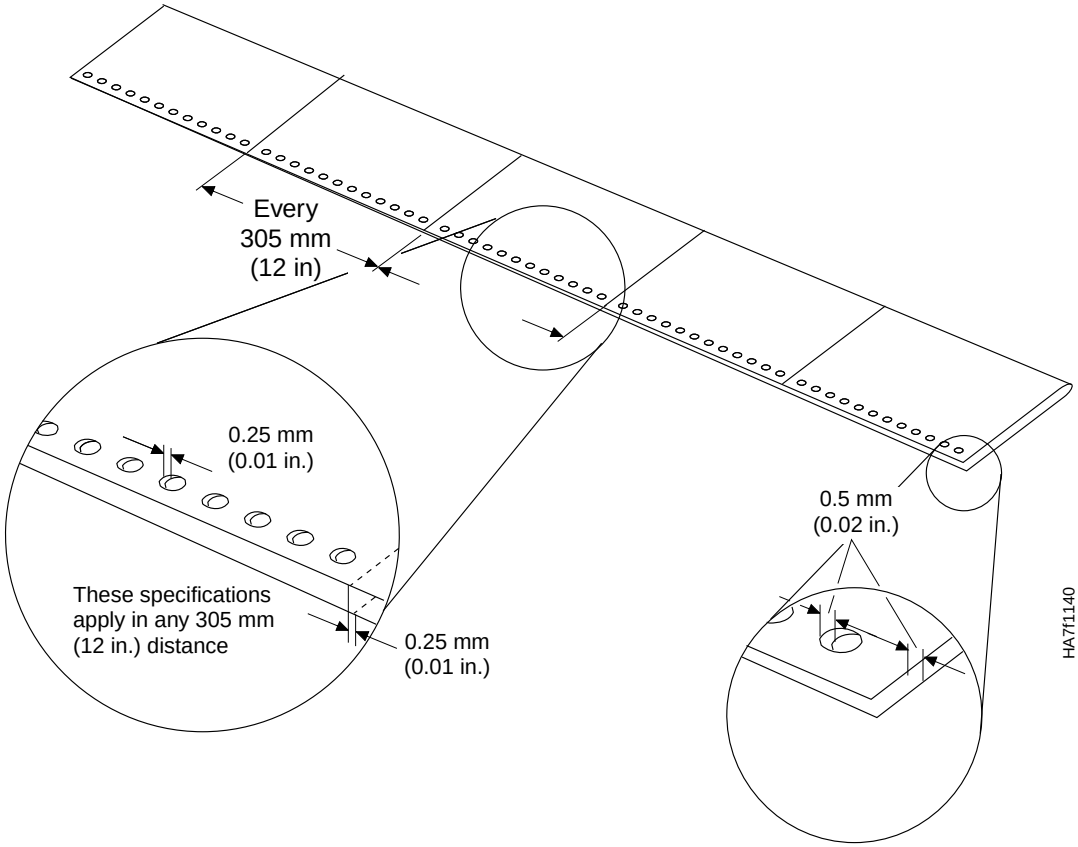


Figure 14. Perforation Accuracy — Edge to Edge



Perforation embossing

Perforation embossing around the cuts and ties of internal, non-folded perforations resulting from cutting and paper-handling equipment causes print quality to deteriorate near the embossing.

Generally, this is less noticeable when the embossed (raised) surface of the form is not the print side.

Note

Printing on the areas near the perforations is not recommended because print quality may not be acceptable.

Perforation strength

Perforation consists of cuts and ties. A cut occurs where the form is severed, and a tie is the small connection of form between cuts. The relative length of each determines the strength of the perforation. Weak perforations can break and cause feeding or refolding problems.

The following table describes the vertical and horizontal perforations strength values:

Table 3. Perforation Strength

Perforation Type	Tensile Strength	Tie Minimum	Cut Maximum
Page Perforation	>1.44 kN per linear meter (8 pounds/linear inch)	1 mm (0.039 in.)	3 x tie-length
Internal Perforation, Vertical1	>1.44 kN per linear meter (8 pounds/linear inch)	1 mm (0.039 in.)	3 x tie-length
Internal Perforation, Horizontal2	>1.44 kN per linear meter (8 pounds/linear inch)	1 mm (0.039 in.)	3 x tie-length

Note

1. Internal vertical perforations must be at least 50.8 mm (2.0 in.) form page perforations and at least 25.4 mm (1.0 in.) from edges to prevent forms breaks and jams.
2. Internal horizontal perforations must be at least 50.8 mm (2.0 in.) from the top and bottom page perforations to prevent errors.
3. Tie minimum's for end ties are 5.0 mm (.020 in).

4. Paper characteristics to consider when selecting paper

- **Abrasiveness**
- **Acid vs. alkaline paper**
- **Brightness**
- **Caliper (thickness)**
- **Coated papers**
- **Color or colored paper**
- **Cockling Paper and Smearing Ink**
- **Contamination**
- **Curl and moisture**
- **Curl-controlled papers**
- **Electrical conductivity/resistivity**
- **Formation**
- **Gloss level**
- **Moisture content**
- **Multipurpose papers**
- **Opacity**
- **Papers containing wax, stearate, or plasticizer**
- **Paper tests and test methods**
- **Paper weight (basis weight or grammage)**
- **Paper weight conversion**
- **Porosity**
- **Recycled paper**
- **Roll stock**
- **Smoothness**
- **Stiffness**
- **Tractor hole paper**
- **Treated papers**
- **Whiteness (shade)**

Abrasiveness

As a result of coatings and other additives, some papers can be highly abrasive. Such paper can cause damage. Abrasive papers (smoothness levels greater than 200 Sheffield units) are not recommended for use with the printer.

Acid vs. alkaline paper

The acidity or alkalinity of a paper is determined primarily by the internal sizing methodology used when the paper was manufactured. Paper produced using rosin/alum chemistry is often referred to as acid-sized or acid. Paper produced with calcium carbonate and a synthetic internal size is referred to as alkaline.

The major drawback of acid-sized paper is sheet life. Acid-sized papers age quicker than their alkaline counterparts, eventually becoming yellow and brittle.

Most paper manufactures have now converted to synthetic internal sizing and alkaline paper. Alkaline papers yield a higher quality color printed product.

In North America, the American Society for Testing and Materials (ASTM) has established standards of permanence for papers. Paper with a pH of 5.5 or lower lasts 50 to 100 years (ASTM type III). Paper with a pH of 7.5 to 9.5 lasts several hundred years (ASTM type I).

In Europe, the International Organization for Standardization (ISO) established ISO 9706: 1994 for paper permanence. Tearing resistance of papers above 70 g/m² must be at least 350 mN in any direction. Alkali reserve expressed as % calcium carbonated must be 2% minimum.

Brightness

In North America, brightness is how paper is commonly measured.

Brightness is measured at only one wavelength (457nm), where whiteness is measured with a different scale (L*, a*, b*). Brightness has no impact on sheet performance but brightness and whiteness do play an important role in the visual appeal of the sheet and printed product.

Caliper (thickness)

Caliper (thickness) of a sheet of paper depends mainly on its weight and the amount of calendaring (pressing) during manufacturing.

Thinner paper is usually smoother than a thicker sheet at a given basis weight (grammage). More calendaring makes the sheet thinner, smoother, less stiff, and less opaque. As a general rule, the higher the caliper, the stiffer and more opaque the sheet of paper.

Thickness is expressed in mils (thousandths of an inch) or microns (millionth of a meter).

Caliper is important because:

- Low-caliper papers can have low stiffness and opacity. Their relative lack of rigidity results in increased jam rates and wrinkling or bunching up in post-processing equipment.
- High-caliper papers, in heavier weights, have high stiffness. Their relative inflexibility can increase jam rates due to an inability to bend around printer rolls, inverters, and other portions of the post-processing equipment.

Coated papers

Coated papers are being used with increasing frequency in digital color printing.

The basic ingredients of a coating are mineral pigments, such as clay, calcium carbonate plus a binder. The binder is a synthetic copolymer, which not only binds the pigments together but also binds the coating mixture to the base paper. The main purpose of paper coating is to give a smooth, receptive area for printing inks and distinctive appearance.

Coated papers are commonly available in either Coated-two-side (C2S) or Coated-one-side (C1S) products.

Coated papers must be approved by RICOH Product Engineering. Please contact your RICOH Sales Representative.

Color or colored paper

Colored (tinted) papers are available in a wide range of shades.

The performance of tinted papers on the printer does not differ from untinted versions of the same paper from the same mill.

Cockling Paper and Smearing Ink

Paper that can hold lots of ink can be prone to cockling.

Possible fixes for cockling paper or smearing ink:

- Increase the dryer temperature
- Reduce ink loading
- Change the paper; thicker paper is usually less prone to cockling.

Contamination

Contamination is usually a direct result of adhesive residue or paper dust and fibers from paper that has poor cut quality.

Paper dust is a pervasive problem that causes a substantial number of service calls. The major drivers of paper dust are high filler content and poor finishing practices. Paper dust causes difficulty by accumulating in printing areas, which creates image quality issues and a variety of difficult-to diagnose problems.

For best performance, purchase only mill-cut and mill-sealed rolls obtained from a vendor whose quality assurance procedures provide for strict control of paper dust.

Curl and moisture

To help improve system productivity, select a low curl paper with the proper moisture content. In general, a higher paper moisture content increases the paper's tendency to curl.

The best performing papers exhibit a low amount of curl after being run through the printer. A trial run quickly demonstrates how much curl is likely with any particular paper, and this is the best curl test. When there is too much curl, paper jams can occur within the post-processing equipment.

All papers in the tested papers list have been tested for print quality and **not** how the papers perform in post processing equipment.

Curl-controlled papers

Some ink jet papers are manufactured with built-in curl control to counteract the tendency to curl when exposed to water-based inks used in the printer.

Electrical conductivity/resistivity

Electrical conductivity/resistivity is not a critical parameter for high quality images on the printer.

Formation

Formation describes the physical distribution and orientation of the fibers and other solid constituents in the sheet.

Good formation is essential in ink jet printing to ensure good color image quality and uniformity.

Gloss level

The gloss level of paper is measured as the ratio of reflected to incident light.

Surface reflectance of paper is responsible for its shiny or lustrous appearance. A higher gloss is achieved by making the surface more reflective through a combination of calendaring (pressing), coating choices, or both.

The range of gloss varies from a high gloss to a matte. Typical coated paper gloss levels per grade classification:

Table 4. Typical coated paper gloss levels per grade classification

	Coated Paper Classification	Gloss Range (75)
High Gloss	Cast Coated	80+
Gloss	Gloss, Enamels, Art	50 to 80
Semi-gloss	Dull, Silk	35 to 50
Satin	Satin or Velvet	25 to 35
Matte	Matte	10 to 25
None	Uncoated	

Moisture content

The moisture content must be consistent within the roll. To help ensure consistency, rolls must be shipped in a protective and moisture barrier wrap.

Multipurpose papers

Multipurpose papers are the most commonly used in digital monochrome printers. They have been designed for use in multiple devices, technologies (such as xerographic, offset, and inkjet) or for low cost printing.

The design specifications for these products perform satisfactorily in most instances. However, multipurpose papers typically do not provide the image quality required for high quality color ink jet image printing.

Opacity

Opacity is an important consideration in duplex (two-sided) printing. Good ink jet paper must be sufficiently opaque to prevent show-through from the reverse side of a duplexed page, or from the subsequent pages in a set.

Usually, the lighter in weight a paper is, the less opacity it has.

Opacity is especially important when printing color since multiple layers of water-based ink are placed on the paper.

Papers containing wax, stearate, or plasticizer

Wax, stearate, and plasticizer in paper can cause paper-handling problems due to their friction-lowering effects on paper and on pre- and post-processing equipment. These substances can also cause print quality defects due to ink smearing.

Stearates and plasticizers are found in a variety of papers (calendered, vellums, and coated papers). It is difficult to tell beforehand if these substances are present in paper; therefore, ask your paper supplier if the paper they supply contains wax, stearates, or plasticizers.

Paper tests and test methods

This section lists the paper tests and test methods used with paper for the RICOH Pro VC60000 printer.

Table 5. Paper tests and test methods

Parameter	Test Method	Range
Ash Content (900C)	T 413, ISO 2144	Depends on the application
Basis Weight (Grammage)	T 410, ISO 536	64 to 157 g/m² (17 to 40 lb. Bond)
Brightness (@ 457nm)	T-452, ISO 105	Customer preference
Caliper (Thickness)	T 411, ISO 534	86 to 185 um
Color (CIE)	T-560, T-562, ISO 11475, ISO 11476	Customer preference
Moisture Content (105C)	T-412, ISO 287	Customer preference
Opacity (d/0)	T-519, ISO 2471	Depends on the application
Porosity (Gurley)	T-536, ISO 5636-5	Less than 200 Gurley seconds
Porosity (Sheffield units)	T-547, ISO 5636-4	
Smoothness (Sheffield units)	T-538, ISO 8791-3	70 — 175 Sheffield
Stiffness (Taber type tester)	T 489, ISO 5628	< 16.0 mN

All tests were conducted per TAPPI T-400 or ISO 186 sampling procedures and T-402 or ISO 187 standard sample conditioning.

Test methods with a T-XXX are TAPPI methods and ISO XXX are International Organization for Standardization methods.

Paper weight (basis weight or grammage)

The most commonly mentioned characteristic about paper is the weight or grammage, expressed in pounds or grams per square meter, rounded to the nearest whole number.

When deciding on a paper to use in the printer, it is necessary to specify a particular weight. Internationally, the weight of paper is expressed in grams per square meter (g/m², grammage), which makes it possible to compare any two papers easily and determine which is heavier.

Printing on lighter-weight papers as opposed to heavier weight papers might increase the chance that printing on one side of the paper will show through on the other side.

The United States and Canada are the sole exception to this international standard. In the U.S. and Canada, paper weight is expressed in terms of basis weight, which is the weight of 500 sheets of a particular size. For bond/Ledger/office paper, the basis sheet size is 17 by 22 in., for Offset (text, book paper), it is 25 by 38 in.. Because each type of paper is expressed in terms of a different basis size, a 24-pound bond and a 24-pound offset paper are not the same weight.

Paper weight conversion

The Paper Weight Conversion Chart shows the weight, in grams per square meter and in basis weight.

By reading across the chart, it is possible to determine what the closest comparable weight is for two different categories of paper.

For example, a 20-pound bond paper weights 75 g/m² and falls between a 50- and 55-pound text/offset; the 50-pound offset weights 74 g/m², and is thus the closest commercially available weight of offset paper.

To convert any basis weight to grams per square meter:

1. Multiply the basis weight by 1406.13.
2. Divide by the number of square in. in the basis sheet.

For example, 20-pound bond has a basis size of 17 by 22 in. (374 square in.).

1. Multiply the basis weight by 1406.13. (20 x 1406.13 = 28,122.6)
2. Divide by the number of square in. in the basis sheet. (28,122.6 / 374 = 75 g/m².

Table 6. Paper Weight Conversion Table

Thickness in. (0.001)	Thickness microns (um)	Weight metric (g/m²)	Business paper	Book paper	Covers
			Bond - Ledger (#/500 sheets 17 X 22 in.)	Offset, Uncoated, Book coated, Text book (#/500 sheets 25 X 38 in.)	Coated, Uncoated, Opaque (#/500 sheets20 X 26 in.)
			Basis Weight (in pounds, lb.)		
3.20	81	60	16	44	22
3.60	91	67	18	45	24
3.80	96	75	20	50	28
4.30	109	80	22	55	30
4.80	121	90	24	60	33
5.80	147	105	28	70	39
6.15	156	118	32	80	48
6.20	159	135	35	90	50
7.30	185	150	40	100	54
7.60	193	165	43	110	60

Thickness in. (0.001)	Thickness microns (um)	Weight metric (g/m²)	Business paper	Book paper	Covers
			Bond - Ledger (#/500 sheets 17 X 22 in.)	Offset, Uncoated, Book coated, Text book (#/500 sheets 25 X 38 in.)	Coated, Uncoated, Opaque (#/500 sheets20 X 26 in.)
			Basis Weight (in pounds, lb.)		
7.80	198	177	47	120	65
9.00	229	190	54	137	75

Porosity

Porosity relates to the ability of fluids to pass through the paper sheet. It is measured in terms of the ease with which air passes through a sheet of paper.

Porosity is a significant consideration when using water-based inks. The porosity of the sheet influences the speed and volume of ink absorbed into the sheet, which affects the volume of pigment left on the surface of the sheet. The volume of pigment on the surface influences the density or vividness of the printed image.

Recycled paper

Environmental consciousness and a sense of public responsibility have resulted in the increased use of recycled papers. Recycled papers are manufactured using some percentage of post-consumer waste fiber instead of virgin fiber. With advances in wastepaper sorting and processing, recycled content can be found in many types of paper products, including multipurpose bonds and other ink jet papers.

There are two types of recycled fiber: post-consumer waste and pre-consumer/industrial waste. Post-consumer waste is the fiber recovered from papers that have been used for their intended end-use, for example a brochure or document that has been printed and discarded. Pre-consumer/industrial waste is the fiber recovered from papers that have been discarded during manufacturing process, for example, the waste such as hole punches or excess trim collected during paper converting operation.

Recycled paper should conform to the same paper quality recommendations for virgin fiber papers. In addition, recycled paper should be free of any contaminants. Some of these contaminants can interfere with print quality or paper handling reliability. Also, these contaminants can build up on various paper-path pre and post-processing components and cause premature failure of these components.

Roll stock

Roll width needs to be tightly controlled to ensure accurate sheet dimensions.

The roll edge must be cleanly cut to prevent equipment contamination. The rolls must also be free from defects such as wrinkles or dents and they cannot contain any splices.

The finished rolls should be fitted with a core plug to prevent core crushing during shipment and protected with a moisture barrier wrap to prevent moisture damage.

Great care must be taken in handling these rolls as they weigh as much as 1500 lb./740kg and lack stability due to their narrow width.

Smoothness

Smoothness is the evenness of the surface of the paper.

Rough paper tends to cause variable print quality. Paper that is too smooth can cause jams in the printer and post-processing.

Smoothness is a function of the type of material used to make the paper and the calendaring and processing of the paper.

For duplex printing applications, both sides of the paper must have similar smoothness.

Stiffness

Stiffness refers to the rigidity or bending resistance of the paper.

Paper thickness or stiffness has a direct impact on print quality performance.

Thicker papers are usually stiffer and are normally stiffer in the grain-short direction. In general, lightweight papers do not have the stiffness of heavier stock and are more likely to bunch up or wrinkle in the post-processing equipment causing jams.

These ranges of paper stiffness are supported for the printer:

Below 21mN

This paper meets best print quality performance.

Between 21mN to 31mN

Paper this thick might cause print quality to be degraded.

Above 31mN

Paper that is above 31mN in stiffness or thickness will not feed reliably through the printer.

Tractor hole paper

Tractor hole-punched paper has holes along the outside edges for use in post-processing equipment.

The main problems that can occur with tractor hole-punched paper are jams and poor print quality from paper dust or hanging chads.

Treated papers

Treated papers for ink jet printers feature a light, non-mineral coating.

This coating can provide the following advantages over traditional multipurpose or uncoated papers:

- Crisper and cleaner text
- Increased ink holdout
- Less ink usage at equal print density
- Improved opacity and water fastness
- More snap to print images

Whiteness (shade)

Whiteness is an important property of paper as it relates strongly to the color accuracy of the printed product.

Whiteness is a measure of the light reflectance of paper across the whole visible spectrum. Brightness, by contrast, is measured at only one wavelength (457nm). In this way whiteness more closely matches the viewer's perception of how white a sheet of paper is. Colors are measured using different scales. The L*, a*, b*" scale is the most common. Within this scale, L* measures degree of lightness, a* measures red/green, and b* measures blue/yellows. The terms blue-white and yellow-white comes from this scale. Whiteness has no impact on sheet performance but whiteness and brightness do play an important role in the visual appeal of the sheet and printed product.

5. Selecting preprinted forms

- **General recommendations**
- **Safety practices - vapor emissions from preprinted forms**
- **Forms for direct mail marketing**

This section describes important characteristics of inks and papers that you should consider when selecting preprinted forms

. A preprinted form is one on which ink has been applied before the RICOH Pro VC60000 prints on it. This includes mill and converter markings in the carrier strip area.

General recommendations

Important

Verify that preprinted forms do not emit unwanted vapors. See Safety practices - vapor emissions from preprinted forms, p. 39 for details.

The following requirements and recommendations can help you use preprinted forms more effectively and help maintain reliable printer performance:

- There must be a 6 mm black square synchronization mark located 16 mm below the intended top of form. The mark is black and has a minimum optical density of 0.8 measured with a densitometer set to Status T spectral response.
- Printing over offset preprinted documents is not recommended.
- Inks with phthalate esters in any concentration should not be used.
- Penetrating inks with high residual amounts of petroleum-based solvents should not be used.
- Adequate ventilation must be supplied, especially when using inks and papers that may emit hazardous materials during printing.
- The forms must allow water-based ink to adhere to the paper.
- The forms and preprinted information must not interfere with the normal function of paper path sensors.
- Clear zones are reserved areas that are used for side verify marks and forms identification bar codes on preprinted forms. If you use side-verify marks, you must maintain a clear for printing the marks; these marks ensure front-to-back registration and page-to-page registration. Another clear zone must be maintained when you use preprinted forms that contain forms identification bar codes.
- The final forms design should be tested on a roll-feed forms printer to verify that the layout is accurate and that the paper and ink are compatible with the printing process.
- Store forms within the environmental limits that are described in Packaging, shipping, and storage of paper, p. 3.

Safety practices - vapor emissions from preprinted forms

To verify that preprinted forms do not emit unwanted vapors, subject forms samples to a temperature of 90°C (194°F) for five minutes. Under those conditions the forms must not emit:

- Low-boiling aldehydes or halogen-containing compounds.
- Ketones (for example, benzophenone).
- Phthalate esters or triacetin.

- Penetrating inks with high residual amounts of petroleum-based solvents.
- Any vapor that causes discomfort to operator or service personnel.
- Any vapor that causes printer components to deteriorate.

Forms for direct mail marketing

Preprinted forms that are used in direct mail marketing often contain special paper and deep-hued, multicolored inks applied in larger amounts than is advisable for use in a roll-forms printer. Sometimes these forms create objectionable emissions and cause ink to transfer to printer components.

Multicolored, heavily inked forms sometimes give off a pungent odor at room temperature. The odor increases when the forms are processed in a roll-forms printer.

Note

Do not use forms that emit vapors that cause discomfort to operators and service personnel.

6. Testing new paper and applications

- **Questions and answers**
- **Paper testing process**
- **Print testing new paper**

This chapter contains information about testing forms and presents test procedures to be used with the RICOH Pro VC60000 printer. This information is intended to help you identify and avoid potential paper related problems. Discovering problems early can reduce paper and maintenance costs.

For best performance, use paper that meets the recommendations in this guide. Papers that do not meet these recommendations might be acceptable if they run well and do not cause damage to the printer. Ricoh may charge for time and materials of all required service and parts if the use of a paper causes printer damage, service calls, or parts replacement beyond that of normal wear.

Questions and answers

When should paper and applications be tested?

Test all new paper prior to committing to purchase large quantities of that paper. Testing will confirm that the expected result for a print job is achieved.

What are the basic requirements for paper on the RICOH Pro VC60000 printer?

The basic requirements for paper can be found in Paper specifications, p. 7. New papers should be similar.

Is the new paper equivalent to any of the tested papers for the RICOH Pro VC60000 printer?

Check with your RICOH Sales Representative to see if the paper has been tested for use on the RICOH Pro VC60000 printer. Contact your Field Technical Sales and Service engineer for the most recent list of tested papers.

Can recycled paper be used?

Recycled or mechanical paper must meet the same requirements as virgin fiber.

Are there any quick tests that can be performed on new paper to determine if it will work?

Perform the following basic tests on new paper. These tests only address a few of the potential problems with new paper and are not meant to replace proper testing procedures.

- *Dusting*

  Fold the paper in half and then press the fold into a crease. Unfold the paper and check for loose fibers in the creased area.

- *Web breaking*

  If the paper is perforated, check for "ties" on the ends of the perforated rows. There should be an uncut area on both edges of the paper at the perforation. Excessive breaking of the web in the printer will occur if there are no ties.

- *Paper curl*

  Check that the post processing equipment can handle the curl induced into the sheet from sitting on the printer when not moving paper.

What else should be considered when selecting a paper?

- Coated paper and paper with a waxy surface may reduce ink absorption into the sheet.
- Paper containing synthetic resins, synthetic sizing agents, or plastics may reduce ink absorption into the sheet and prematurely wear out printer components.
- Paper with poor surface stability and high amounts of sizing and filler can create paper dust, printer and postprocessing malfunctions, and reduced ink absorption.
- Certain coatings can soften or weaken the paper and give off vapors that cause discomfort to operators or service personnel. The additives should not be abrasive or have a tendency to come loose. Test these papers thoroughly before using large quantities.
- Fillers and other additives may increase paper abrasiveness and cause excessive machine wear, reduced print quality, increased operator interventions, or reduced ink absorption.
- Paper with calender cuts, grease spots, loose sizing particles, wrinkles, voids, cuts, and tears can cause misfeeds and illegible characters.

What concerns are there if an increased volume of ink is applied?

Paper is prone to cockling due to the increase ink loading or wetting of the paper.

Possible fixes for cockling paper:

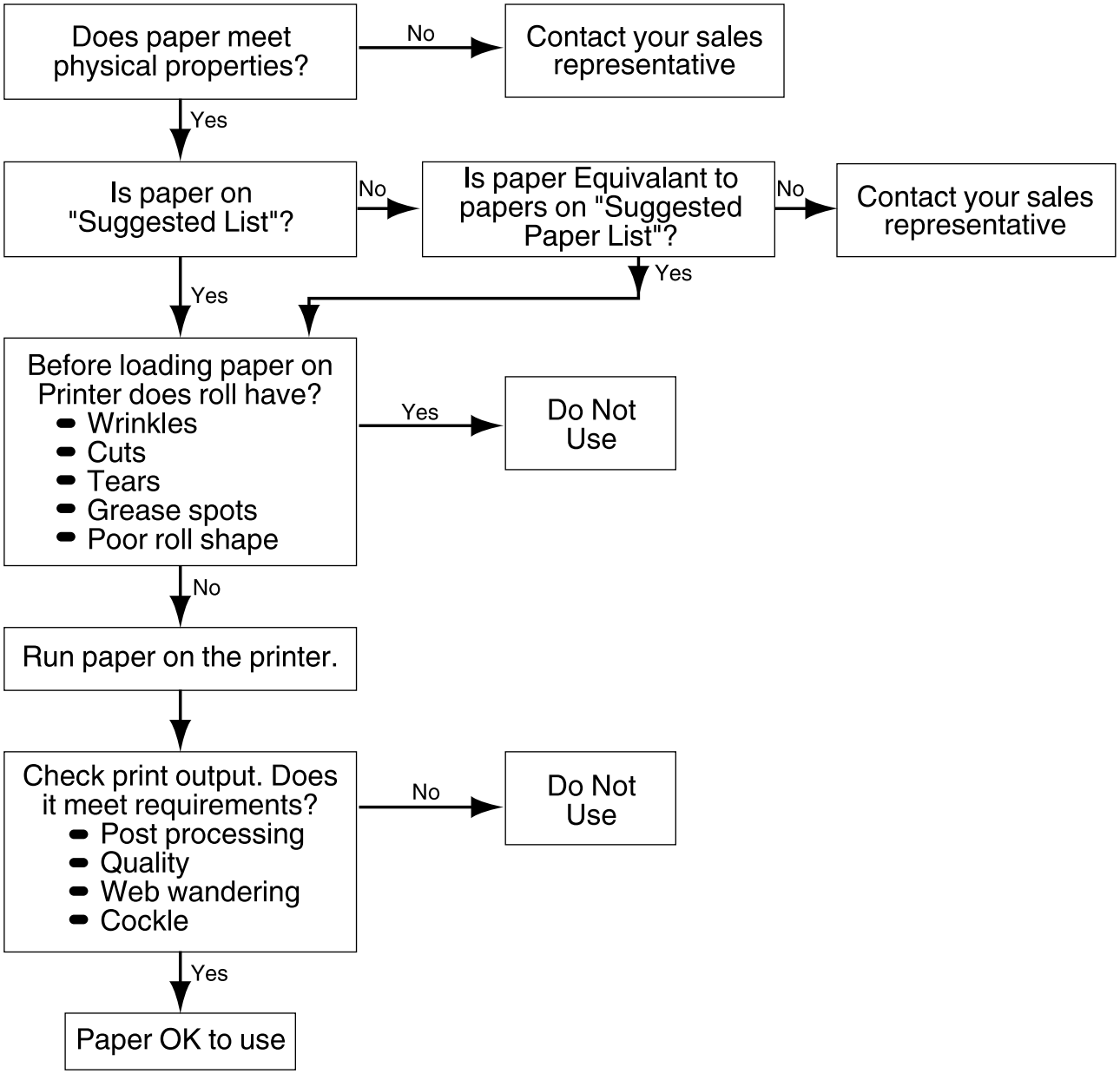
- Increase the dryer temperature
- Change the paper; thicker paper is usually less prone to cockling.

What concerns are there to using rolls which are not perfectly round?

- The out of roundness of the paper will pass all the way to the print heads and the paper might hit the print heads and damage the print heads.
- The out of roundness of the roll might cause registration issues.

Paper testing process

Procedures for testing new paper on the RICOH Pro VC60000 printer



Print testing new paper

Ricoh may charge for time and materials of all required service and parts if the use of a paper causes printer damage, service calls, or parts replacement beyond that of normal wear.

The following procedure describes how to properly print test new paper. Ricoh recommends running two to four rolls of the new paper to check for variations between the rolls.

1. Have a Ricoh technical person on site to monitor printer operation.
2. See the *RICOH Pro VC60000: User Guide* for details on adjusting paper thickness and paper tension.

3. Run the print job including any pre and postprocessing steps to make sure there are no cutting or stacking problems.
4. Review print quality. Check print quality for the following requirements:
   - Image sharpness
   - Character sharpness
   - Barcode performance
   - Color vividness
   - Show through
   - Uniformity
5. Review the physical quality. Check the printed output for the following:
   - Bleed through
   - Show through
   - Wrinkling
   - Ink smearing
   - Beading or mottling
6. Check for unacceptable paper cockling.
   - Cockling is indicated by unexpected ink streaks after solid print areas on side 2 of the paper.
   - Streaks are caused by the paper contacting the printheads.
7. Check for unacceptable dust levels.

   Monitor the dust and chad buildup on the inlet side of the printer. The new paper should create about the same or less paper dust as the paper you were previously using.
8. Check for web wandering.

   Web wandering is indicated by color registration problems that can be seen in colored text.
9. Work with your Ricoh technical person to determine any effect the paper might have on printer components.
10. Check that the paper curl induced in the paper from sitting in the idle printer can properly go through the post processing equipment.
11. Lot to lot changes might occur in paper rolls.

Evaluate the test results to determine what levels of quality and reliability are acceptable.

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