

Label Inspection Standard Mold In Graphic Systems® / Polyfuze® Graphics Corp.

POLYMER FUSION VS. TRADITIONAL LABELING:

Regardless of claims made by label suppliers or manufacturers asserting the similarity and durability of their labels as compared to Polymer Fusion labels from Mold In Graphics or Polyfuze specifically for products manufactured of low surface energy polyolefin thermoplastics, it is essential to recognize there are substantial differences between Polymer Fusion and traditional labeling methods (e.g., pressure-sensitive adhesive, hot stamp foil, heat transfer, and in-mold offerings for both injection and rotational molding.)

While each of these traditional methods are considered "finished labels," it is crucial to differentiate Polymer Fusion labels, which are provided in a "raw material" state before undergoing the application or molding cycle, at which stage they are deemed finished.

Construction Method:

- a. Traditional Labeling: Multi-layer construction commonly composed of coatings, inks, substrates, and adhesives that are not compatible with polyolefin thermoplastics.
- b. Polymer Fusion Labeling: Single-layer construction of pigmented fully polyolefin compatible "polymer ink" suspended on a removable clear carrier film.

Performance / Durability:

- a. Traditional Labeling: Efforts to attain linear adhesion to the product surface are challenged by the low surface energy, inconsistent expansion rates, and outgassing of polyolefin thermoplastics, impacting long-term adhesion and performance.
- b. Polymer Fusion Labeling: Accomplishes molecular fusion with polyolefin thermoplastics, seamlessly merging the two without the need for adhesives, tie-layers, or secondary treatments, ensuring a durable and lifelong polyolefin plastic component for the product's entire lifespan.

Sustainability/Recyclability:

- a. Traditional Labeling: Incompatible labels are non-recyclable with polyolefin thermoplastics, creating unclean recycle and generating waste when removed.
- b. Polymer Fusion Labeling: Compatible materials enable full recyclability with polyolefin thermoplastics.

PURPOSE:

This document establishes a common label inspection standard for the customers of Mold In Graphic Systems® (MIGS) and Polyfuze® Graphics Corporation (PGC).

A specific subset of these standards, tailored to MIGS and PGCs unique technology, is drawn from the National Association of Graphic and Product Identification Manufacturers, Inc. (GPI). These standards encompass a comprehensive set of guidelines for label inspection. They are designed to foster an objective versus subjective standard during the inspection process, offering customers unequivocal acceptance criteria. The provided inspection standard delivers a precise definition of what qualifies as acceptable, along with the exact conditions under which they apply.

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1.0 SCOPE:

This document is designed for use in the label receiving process (with exception to section 7.3.1 Color, where color verification is conducted from finished product) for labels produced by MIGS or PGC with label quality assessed through visual inspection. The ultimate determination of a labels acceptability depends on its visual appearance when viewed by the end user under specific guidelines. It's worth noting that minor imperfections may be inherent to the materials and printing processes involved and are deemed acceptable as an overall printing industry practice.

2.0 DEFINITIONS:

Apparent Color Variation – Any unintended variation in the perceived color that is visible under the defined viewing conditions. **NOTE:** Raw material polymer fusion labels are typically non-opaque and have been custom color-matched to match specific polyolefin substrate colors. As a result, color verification cannot occur until after the application or molding process on the finished product.

Blur – Printed defects such as shadowing, “ghosting” or static lines that cause the printed image to look undefined or out of focus.

Class A Label – Labels which are primarily of a decorative nature and aesthetically required to enhance the eye appeal of the product on which it is used. Acceptable Quality Level (AQL) to be used is 1.5 (1.5% of final order volume) per Mil-Std-105E.

Class B Label – Labels which are primarily for identification and/or instruction which are exposed on the outside and in full view when the product is on display or in use. Acceptable Quality Level (AQL) to be used is 2.5 (2.5% of final order volume) per Mil-Std-105E.

Class C Label – Labels which are not normally exposed when the product is displayed or in use. Acceptable Quality Level (AQL) to be used is 4.0 (4.0% of final order volume) per Mil-Std-105E.

Delamination – The condition when the label separates from the substrate prior to application.

Stray Spot - A tiny spot of polymer ink outside the printed label area.

Void – A tiny hole or void in the label that permits light to pass through the printed area.

Contamination – Foreign particles (usually caused by airborne materials such as dirt or lint that become lodged in the polymer ink during printing.

Printing Misregistration – Layers of polymer ink that are not aligned allowing the substrate to show through. This can typically be seen on the label itself or on the product after molding or application.

3.0 INSPECTOR QUALIFICATIONS:

3.1 Inspectors shall have been trained in the use of this inspection standard.

3.2 Inspectors shall have either unaided, or corrected, 20/20 vision.

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4.0 INSPECTION TOOLS:

4.1 Under this Label Inspection Standard, labels and/or parts are inspected under the prescribed viewing conditions (Section 5.0) with an unaided eye and without the use of backlighting. Once defects are noticed with the unaided eye per the outlined procedure, further inspection tools may be used to determine if a defect is large enough to be considered unacceptable.

4.2 Inspection tools that may be used are:

4.2.1 Digital Calipers

4.2.2 7X Loupe (see section 5.4)

4.2.3 Films with standard defect sizes

5.0 VIEWING CONDITIONS:

5.1 Lighting – Inspection shall be performed under overhead fluorescent lighting producing more than 70-foot candles. **NOTE:** The use of light tables or other forms of light from behind polymer fusion labels for quality inspection purposes is prohibited.

5.2 Viewing Distance - Visual inspection of all cosmetic-type defects will initially be performed without the use of any form of magnification. Inspection shall be performed at a distance of 18 inches. If a defect is considered suspect, magnification can be used to confirm size covered in section 7.0 and based on chart 1 shown on page 6.

5.3 Viewing Angle - During inspection, parts shall be held at approximately 45 degrees to the horizontal so the part's surface can be inspected without glare (from the overhead lighting) that may otherwise hide cosmetic defects from detection. The viewing line of sight shall be perpendicular to the part. Once the correct inspection angle is determined for the particular part, the viewing angle shall not change during the inspection process.

5.4 Magnification - Magnification shall only be used to confirm the size of defects.

6.0 VIEWING TIME:

6.1 Inspection viewing time will be based on the part size as follows:

Part Size (in ² = L x W)	Maximum Viewing Time
0 to 25 square inches	5 seconds
26 to 50 square inches	10 seconds
51+ square inches	15 seconds

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7.0 ALLOWABLE DEFECTS:

The following section outlines the acceptance criteria for parts inspected under this specification. Parts shall not be rejected for flaws that are not observed under the prescribed viewing conditions and allotted time. Please see section 2.0 for definitions.

7.1 Stray Spots / Voids / Contamination / Minor Printing Defects

7.1.1 These types of defects are generally round or irregular in shape and are typically defined by their total cumulative diameter.

7.1.2 See Chart 1 on page 6 for the size and number of allowable defects.

7.1.3 NOTE: Any group of extremely small spots that appear as one spot, without magnification, will be evaluated/counted as one defect (spot).

7.1.4 NOTE: The clear area in a void or fisheye-type defect will determine the size of the defect.

7.2 Scratches

7.2.1 Scratches are defects long in nature and are defined by their length and width.

NOTE: Any group of extremely small scratches that appear as one scratch, without magnification, will be evaluated/counted as one defect (scratch).

7.2.2 See Chart 1 on page 6 for the size and number of allowable defects.

7.3 Color Variation / Streaks

7.3.1 Color variation shall be held within the limits below (see a and b):

NOTE: Color verification is not to be conducted on raw material polymer fusion labels. It's important to first conclude the application or molding process. Raw material polymer fusion labels are semi-opaque polymer inks printed on a transparent carrier film that have been custom color-matched to a customer's specific polyolefin product color, not a standard white label substrate as used on many traditional labeling methods. While every effort is made to achieve an exact color match to customer specifications, the final color may exhibit slight variations when using color measurement equipment. Even official color formula guides, such as Pantone or RAL, utilize semi-translucent colors printed on a white substrate, allowing for acceptable ranges of variation. More information about color variation can be found at www.pantone.com/articles/technical/challenge-variations-in-print

a) Color limits initially set by the customer (color chips or color chart) with understanding about polymer fusion ink color variation. Color limits will be developed by label supplier and approved by the customer.

b) Color variation of polymer fusion color on finished product must pass a visual inspection by comparing production parts with approved customer samples, viewed over a fluorescent light source of 70 to 100 foot-candles by an inspector with normal color perception.

7.3.2 Streaks (lighter or darker than the surrounding printed areas of the same color) visible from 18 inches under the prescribed viewing conditions are not acceptable.

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7.4 Lettering / Characters / Borders

7.4.1 No defects (spots, smears, missing letters, etc.) that affect the meaning, intent or legibility of the part are allowable.

7.4.2 Imperfections in characters, lettering and borders shall be no greater than .020".

7.4.3 Color shadowing or "ghosting" shall not be visible at 18 inches under the prescribed viewing conditions.

NOTE: The label supplier bears no responsibility for uncorrected errors, whether graphical, textual, color-related, or other, in artwork provided by customer as approved and printed as a label.

7.5 Delamination

7.5.1 Minor delamination ($\leq 1.5\text{mm}$) of polymer ink from carrier film is normal and may be visible. Any major delamination apparent at 18 inches under the prescribed viewing conditions is cause for investigation.

7.6 Print Registration (color-to-color)

7.6.1 Minor color-to-color misregistration of printing visible from 18 inches under the prescribed viewing conditions is permitted as they generally disappear during the fusion process.

7.6.2 Edges of die-cut pieces will not show feathering (strings) visible at 18 inches.

NOTE: The purchase of die-cut tools, including replacements for worn-out tools, is the exclusive responsibility of the customer. Customers who opt not to replace these tools, even when strongly recommended by the label supplier, waive their right to inspection in this regard.

7.6.3 Edges of die-cut pieces may show minor delamination ($\leq 1.5\text{mm}$) of polymer ink from carrier film. Any major delamination apparent at 18 inches under the prescribed viewing conditions is cause for investigation.

7.7 **SPECIAL NOTE:**

Because of the subjective nature of aesthetic acceptability, some defects are difficult to discern even with the parameters defined within this specification. When these situations arise, the defect will be considered acceptable only if it cannot be detected by two different inspectors under the parameters prescribed in this specification without prior knowledge of the other inspector's results.

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8.0 DEFECT CHARTS AND PICTORIALS:

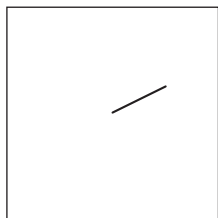
Chart 1 (Size and Number of Allowable Defects per Label)			
Label Class (see Section 2.0 Definitions)	Length x Width Or Total Cumulative Diameter	Maximum Number of Label Defects per Square Inch	Maximum Number of Label Defects per Three Square Inches
A	.25" Long x .003" Wide or .020" diameter	1	2
B	.50" Long x .003" Wide or .040" diameter	2	2
C	.50" Long x .003" Wide or .040" diameter	3	6

PLEASE NOTE: The total number of allowable label defects of either a single type (scratches or spots) or combination of the two types is not to exceed the limits specified per square inch.

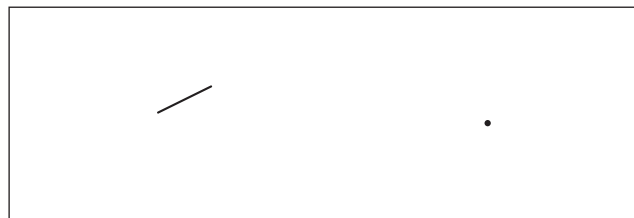
Pictorial A below shows examples of the allowable defects for a Class A Label based on Chart 1 above. The one-square-inch and the three-square-inch boxes show the approximate size of the areas used to determine the number of defects per prescribed area. As seen in the pictorials below, the allowable number and size of defects changes from Part Class A through Part Class C.

Pictorial A (Example of Allowable Defects for Class A Label based on Chart 1 above)

One Square Inch



Three Square Inches

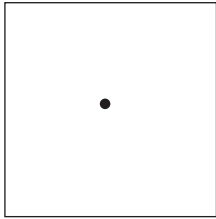


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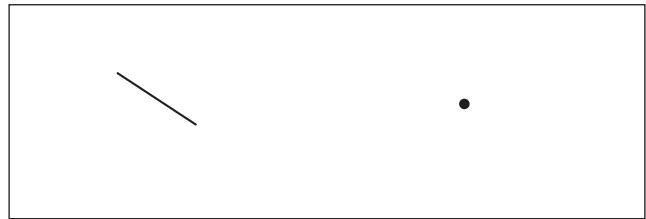
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Pictorial B (Example of Allowable Defects for Class B Label based on Chart 1 above)

One Square Inch

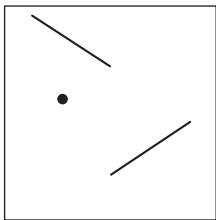


Three Square Inches

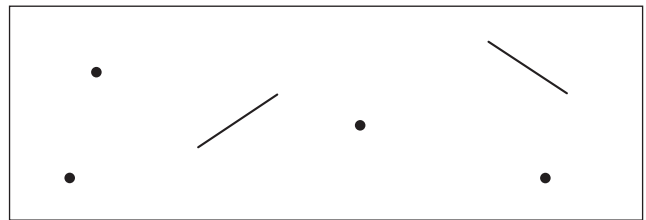


Pictorial C (Example of Allowable Defects for Class C Label based on Chart 1 above)

One Square Inch



Three Square Inches



9.0 REFERENCES:

National Association of Nameplate Manufacturers Inc. (NAME), Nameplate Industry Standards and Practices, 3rd ed., 1987