

DishDrawer Label Certification Polyfuze™ Polymer Fusion Label Technology

Performance Data

The Fisher & Paykel DishDrawer poses significant reliability demands. The following performance data is representative of polymer fusion label performance using standards performed by Fisher & Paykel for labeling to be used on dishdrawer appliances. Labels are tested until they all pass or fail one criteria.

All tests referenced are shown below.

Abrasion

Test Name	Test Specs	Surface	Result
Fisher & Paykel Internal	Jif Cream w/ Vilda Cloth	Production PP	<i>Passed performance criteria</i>

Crosshatch

Test Name	Test Specs	Surface	Result
ASTM D3359	Crosshatch Tape Test	Production PP	<i>Passed performance criteria</i>

Immersion

Test Name	Test Specs	Surface	Result
UL 749	168 hrs. @ 85°C	Production PP	<i>Passed performance criteria</i>

Scratch Resistance

Test Name	Test Specs	Surface	Result
ASTM D3363 / ASTM D7027	Pencil Hardness Scratch Test	Production PP	<i>Passed performance criteria</i>

Customer Interests

- ◆ Identify and quantify relevant customer interests.

Customer interest	Minimum acceptable value	Ideal value
Abrasion	ID graphics sizes remain	All graphics remain
Cross-hatch	3B	5B
Immersion	Pass UL749 s30.7.1 with legible remains	Zero deterioration after UL749 s30.7.1

Solution Sets

- ◆ Outline each discrete solution set or parameter range. Use photos and drawings

Customer interest	Minimum acceptable value	Ideal value
Abrasion	ID graphics sizes remain	All graphics remain
Cross-hatch	3B	5B
Immersion	Pass UL749 s30.7.1 with legible remains	Zero deterioration after UL749 s30.7.1

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External Referenced Standards:

ASTM D3359
UL 749
ASTM D3369 / ASTM D7027

Test Criteria:

Fisher & Paykel Abrasion:


An evaluative labels pattern is specifically designed to quantify abrasion evaluation results. This consists of a symmetrically balanced assortment of:

- Dots.
- Lines.
- Solid Squares

Abrasion material constituted Vileda "yellow" All Purpose Cloth and lemon scented Jif cream. Both are attached to a wet mop rig depicted below. Two 500g masses on mop provide normal loading against the two flanges during rubbing. Jif cream is considered abrasive and imposes wear/tear exceeding average kitchen cleaners. Note the wet zone in middle section – upon closer inspection cloth indeed skimmed across MDF but mop load rested on flanges.



Table 1: Controlled experimental parameters for graphics abrasion testing.

 <p>Vileda Yellow Cloth</p>	Wiping Materials	Vileda All Purpose Cloth (yellow).
	Load	0.5 kg.
	Solutions	Jif cream lemon scented.
	Cycles	Up to 10,000 cycles.
	Failure definition	When label feature intent cannot be distinguished e.g. >50% area lifted.

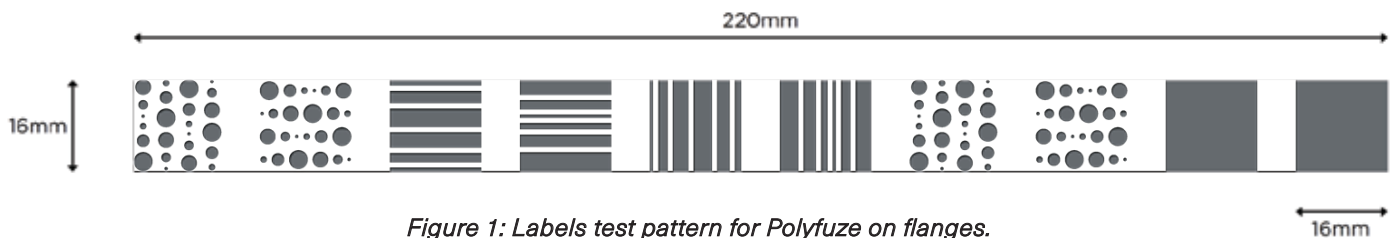
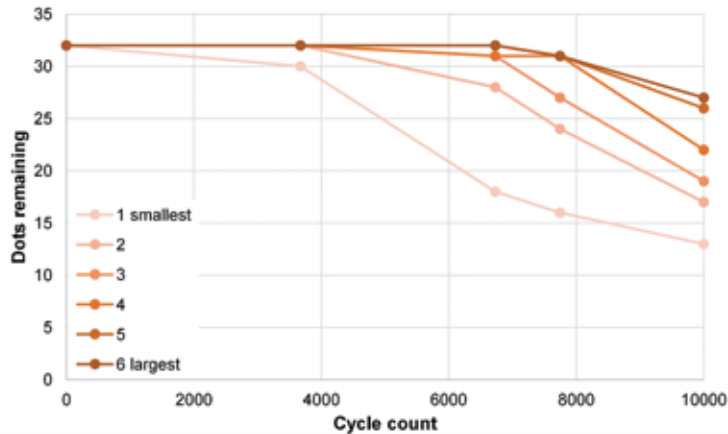


Figure 1: Labels test pattern for Polyfuzer on flanges.

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Some observations are quite subjective; whether to classify partially eroded dots as pass/fail is debatable. One cycle is one complete to and from mop movement. Abrasion test results can be summarized below.

**TEST PATTERN ABRASION (OVERALL DOTS)
POLYFUZE LABELS**



There are a variety of abrasion rates at different label sets on the two test flange pieces in rig. Therefore, a substantiated outcome requires accumulating abrasion results of all feasible positions. Overall, for EACH flange, there are:

- 6 dot sizes (in 0.54mm diameter increments).
- 16 dots per size.
- 6 line weights (in 0.54mm thickness increments).
- 4 lines per weight.

Inspect abrasion outcomes at regular intervals. Ensure sponge retains flexible conformity against substrate.

- Rejuvenate mop with Jif cream and water.

Now, define outcome significance based on collated knowledge.

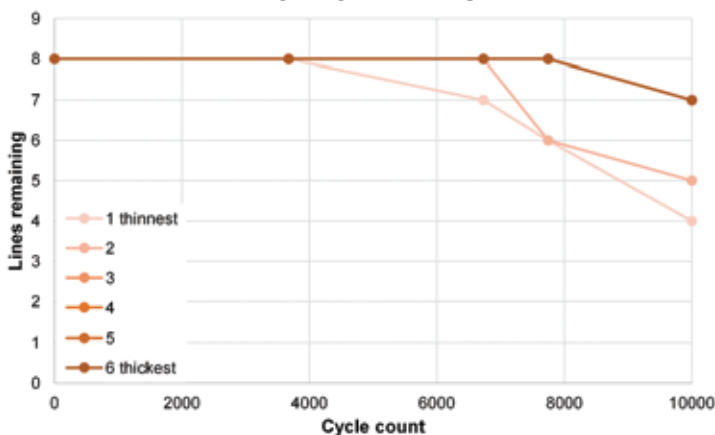
FPA should not utilize minute geometries (~0.5mm) with Polyfuz labels.

- Consider dots on 'i' characters → impacts minimum acceptable font size.
- Careful considerations during label selections when involving fine details or line thicknesses.

Based on one wipe daily over 10 years, the labels should withstand minimum 4000 cycles.

- Propose the smallest labels feature ≥ 1mm in size.

**TEST PATTERN ABRASION (OVERALL LINES)
POLYFUZE LABELS**



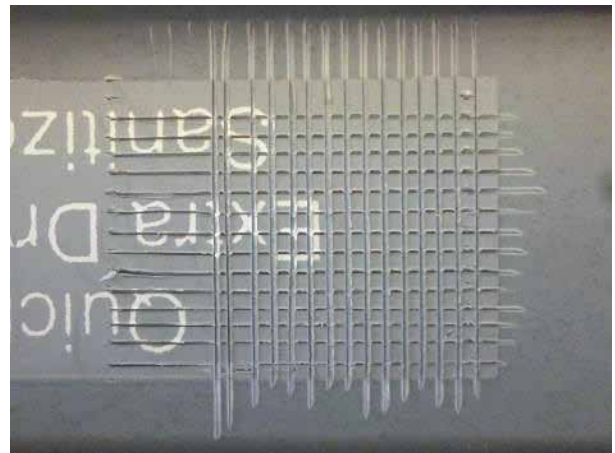
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Test Criteria Cont.:

ASTM D3359 Crosshatch:

Cross-hatch testing is a critical criteria for graphics longevity. As with DDC: Ph9 Designer Integrated: Flange WPS IML Tests, DANCO 130 pressure sensitive adhesive tape produced desirable outcomes. Standardized comparisons with current heat stamped FPA logo on flange can be useful.

- Performance classification 5B/4B.
- Arguably, some corner edges lifted off despite overall graphics structure remained intact.
- Results comply with Polyfuze internal ASTM D3359 test data report.



UL 749 Immersion:

After 168 hours immersion in concentrated detergent/rinse aid solution of 85°C:

- No obvious graphic degradation.
- All icons/text remain intact.

Observations confirm viability of Polyfuze's own test data report documentation. Polyfuze is indeed an advanced performer for long-term polypropylene label longevity.



Solid rectangular print

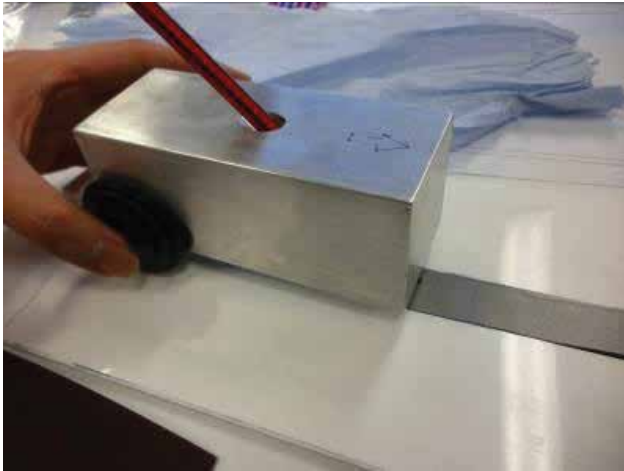
Text/icon only print

Standardised test pattern

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Test Criteria Cont.:

ASTM D3363 / ASTM D7027



Considering limitations imposed by Vileda cloths and Jif cream, the standardized methodology to evaluate scratch resistance are:

- ASTM D3363 Standard Test Method for Film Hardness by Pencil Test.
- ASTM D7027 Evaluation of Scratch Resistance of Polymeric Coatings and Plastics Using an Instrumented Scratch Machine.

Fisher & Paykel Appliances possess a professional pencil scratch resistance apparatus for ASTM D3363. Outcomes are tabulated on the next page in Table 3.

There are three types of scratch resistance:

Gouge hardness	The degree of hardness of the hardest pencil that will leave the film uncut for a stroke length of at least 3mm.
Scratch (pencil) hardness	The hardest pencil that will not rupture or scratch the film.
Wolff-Wilborn hardness	The degree of hardness of the softest pencil which damages the surface.

Table 2: Pencil degrees of hardness.

6B	5B	4B	3B	2B	B	HB	F	H	2H	3H	4H	5H	6H	7H	8H	9H
<i>softer</i>										<i>harder</i>						

Test procedures:

- Start testing with a hard pencil.
- Place instrument on the level test surface.
- Hold the instrument by the wheel hubs and push forward at a speed of 5-10cm/s for a distance of at least 7mm (cf. arrow).
- Examine the test surface with the naked eye for indentation or scratching.
- Repeat the process down the hardness scale until a pencil is found that will not cut the film to the substrate (either metal or a previous coat) for a distance of at least 3mm.

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Test Criteria Cont.:

- Continue the process until a pencil is found that will neither cut nor scratch the surface of the film (any defacement other than a cut or gouge is considered a scratch).

Table 3: Pencil hardness of various Polyfuzer graphics. Results are same for both UL749 immersed and non-immersed graphics.

	Graphics pattern	Gouge hardness	Scratch hardness	Wolff-Wilborn
A		4B	4B	3B
B		B	3B	2B
C		B	3B	2B

Summary

Polyfuzer labels meet or exceed reliability requirements.