

# Extreme Distribution Environment Certification

## Polyfuze™ Polymer Fusion Label Technology

### Performance Data

The following performance data is representative of polymer fusion label performance using several standards for labeling to be used in extreme distribution environments.

*All tests referenced are shown below.*

#### Water Jet:

Test Name	Test Specs	Surface	Result
Water Jet	Water Jet (122°F @ 1740psi)	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Part Washer:

Test Name	Test Specs	Surface	Result
Part Washer	250 Cycles @ 120°F	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### High Temperature:

Test Name	Test Specs	Surface	Result
High Temperature	95-120°F for 24hrs for 7 Days	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Low Temperature:

Test Name	Test Specs	Surface	Result
Low Temperature	-60°F for 72hrs	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Rainfall:

Test Name	Test Specs	Surface	Result
Rainfall	40MPH raindrops for 40min	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Salt Fog, Salt Spray:

Test Name	Test Specs	Surface	Result
Salt Fog, Salt Spray	5% salt solution at 95°F	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Blowing Dust:

Test Name	Test Specs	Surface	Result
Blowing Dust	Blown dust @ 2mph for 6hrs	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Humidity:

Test Name	Test Specs	Surface	Result
Humidity	80°F, 95-100% humidity 45 days	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>



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### Performance Data Cont.

#### Freeze / Thaw, Temperature Cycling:

Test Name	Test Specs	Surface	Result
Temperature Cycling	3 cycles 77°F, 95% RH to 18°F	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Accelerated Aging, Thermal Testing:

Test Name	Test Specs	Surface	Result
Aging, Thermal	150°F, 80% humidity, 96hrs	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Solar Radiation, Xenon Exposure:

Test Name	Test Specs	Surface	Result
Solar, Xenon	(56) 24 hour cycles	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Abrasion Resistance, Desert:

Test Name	Test Specs	Surface	Result
Abrasion, Desert	500g @ 60rpm at 60 °C ± 2	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Abrasion Resistance, Room Temperature:

Test Name	Test Specs	Surface	Result
Abrasion, Room Temp.	500g @ 60rpm at room temp.	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Abrasion Resistance, Cryogenic:

Test Name	Test Specs	Surface	Result
Abrasion, Cryogenic	500g @ 60rpm at -55 °C ± 3	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

#### Chemical Resistance Testing:

Test Name	Test Specs	Surface	Result
Deionized Water	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
5% Salt Water	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
Windex	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
Betco AF67 Bathroom Cleaner	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
99% Isopropyl Alcohol	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
Dot 3 Brake Fluid	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>



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**Performance Data Cont.**

**Chemical Resistance Testing Cont.:**

Test Name	Test Specs	Surface	Result
#2 Diesel Fuel	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
Nitric Acid - Ph 1.0±0.2	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
HCL - Ph 1.0 ± 0.2	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
Sodium Hydroxide - Ph 12±0.2@5.25%	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
Sodium Hypochlorite - 5%	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>
Quaternary Ammonium 200 ppm	8hr. exposure, max 24hr dry	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>

**FDA 510(k) Durability Requirement:**

Test Name	Test Specs	Surface	Result
600 Wash Cycles	250ppm ZEP FS Z-Chlor (#2443)	HDPE, PP Test Plaques	<i>Exceeded performance criteria</i>



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### External Referenced Standards:

Volvo STD 423-0015  
MIL-STD-810G  
ASTM D7932-14  
ASTM D3611  
ASTM D4332

### Test Criteria:

#### Water Jet:

Volvo STD 423-0015. Water at 122 °F sprayed 4 inches from the substrate at approximately 1740psi and 4 gallons/minute. Using a manual power washer wand for 30 seconds sweeping across the sample at a rate of 1 wand sweep per second.

#### Part Washer:

One cycle will consist of an ECOLAB cleaning solution at 120 °F sprayed 15 inches at a 45 degree angle from the substrate at line pressure of 45psi and flow rate of 5 gallons/minute for 45 seconds. Immediately followed by a 10 second fresh water rinse at 160 °F. The substrate will then cool to room temperature before the next cycle. Test will conclude after 250 cycles or part failure.

#### High Temperature:

ASTM D7932-14, Section 11.6, as described in MIL-STD-810G, Method 501.6, Procedure I, Storage, Table 501.5-III for seven (7)-24 hour cycles (168 hours). Cycling of sample occurred at 95-120°F for 24hrs for total of 7 Days.

#### Low Temperature:

ASTM D7932-14, Section 11.7, as described in MIL-STD-810G, Method 502.6, Procedure I, Storage, Design Type C3, -60° F for 72hrs.

#### Rainfall:

ASTM D7932-14, Section 11.8, as described in MIL-STD-810G, Method 506.6, Procedure II, Exaggerated Rain, Exposure duration will be 40mph for 40 minutes.

#### Salt Fog, Salt Spray:

ASTM D7932-14, Section 11.9, as described in MIL-STD-810, Method 5096, using a 5% ± 1% salt solution for four (4)-24 hour cycles, one cycle consists 24 hours salt spray, then 24 hours of drying time.

#### Blowing Dust:

ASTM D7932-14, Section 11.10, as described in MIL-STD-810G, Method 510.6, Procedure I. Dust particles were blown at 2mph for a total of 6hrs.



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#### Test Criteria Cont.:

**Humidity:**

ASTM D7932-14, Section 11.11, as described in MIL-STD-80G, Method 507.6, Cycle B1, exposure duration will be 45 days (1080hours) at 80°F cycling, 95-100% humidity.

**Freeze / Thaw, Temperature Cycling:**

ASTM D7932-14, Section 11.12, as described in MIL-STD-810G Method 524.1, Procedure III, Rapid Temperature Change, exposure duration will be 3 cycles at 77°F, 95% humidity for 1hr to 18°F for 1hr.

**Accelerated Aging, Thermal Testing:**

ASTM D7932-14, Section 11.13, as described in ASTM D3611, exposure to 150°F at 80% humidity for 96 hours.

**Solar Radiation, Xenon Exposure:**

ASTM D7932-14, Section 11.15, as described in MIL-STD-810G, Method 5056, Procedure II, duration will be (56) 24 hour cycles, (1344hours) each cycle will consist of 20 hours of light and 4 hours of darkness.

**Abrasion Resistance, Desert:**

ASTM D7932-14, Section 11.5.1, followed by abrasion testing to be performed as described in Table 1 of ASTM D4332, for 24 hours, Sample conditioned at 60 °C ± 2 (140 °F ± 4) RH 15% ± 2 with a 500g weight on a wheel moving at 60rpm.

**Abrasion Resistance, Room Temperature:**

ASTM D7932-14, Section 11.5, to be performed as described in ASTM G195. Sample conditioned at room temp with a 500g weight on a wheel moving at 60rpm.

**Abrasion Resistance, Cryogenic:**

ASTM D7932-14, Section 11.5.1 followed by abrasion testing to be performed as described in Table 1 of ASTM D4332, for 24 hours. Sample conditioned at -55 °C ± 3 (-67 °F ± 6) with a 500g weight on a wheel moving at 60rpm.

**Chemical Resistance Testing:**

ASTM D7932-14, Sections 11.14-11.14.3, as described in MIL-STD 810G, Method 504.2, P procedure II, eight (8) hour exposure and max 24hr drying time.

**FDA 510(k) Durability Requirement:**

600 Wash Cycles. Wash Temperature - 140°F-160°F for approximately 50 seconds, Rinse Temperature 180°F-195°F for approximately 36 seconds, Dry Temperature 180°F-200°F for approximately 80 seconds. Chemical in Wash Tank: 250ppm of free chlorine; using ZEP FS Z-Chlor (#2443)

