High Temperature Marker Tag

This specification is intended to outline the physical and chemical properties of *PANDUIT*'s GMNT material for identification purposes.

Printable Material Suffixes

FPT	
FQT	
FQT-B	

PRODUCT SPECIFICATIONS:

Description:	Material is RoHS compliant (European Union directive 2002/95/EC). GMNT is a crosslinked, thermal transfer printable polyolefin. When printed using RMR*BL, RMER4BL-A, and RMH*BL thermal transfer ribbons it will also meet MIL-M-81531. This product has been tested for use as an identification marker for use in (Class 1E) harsh environments in various high temperature power plants.
Recommended Ribbons:	RMR*BL, RMER4BL-A, RMH*BL (recommended for best print quality)
Standard Colors:	White
Thickness:	24 +/- 2 mils
Service Temperature Range:	Minus 67F to 275F (Minus 55C to 135C)
Storage Conditions:	Store at 70°F(21°C) and 50% Relative Humidity

PROPERTIES:	**PERFORMANCE:**
Tensile Strength:	1500 psi minimum (ASTM D638)
Elongation Ultimate:	200% minimum (ASTM D 638)
Dielectric Strength:	500 volts/mil minimum (ASTM D876)
Water Absorption:	0.5% maximum (ASTM D570)
Printability:	Product meets print performance as per MIL-M-81531
Flammability:	Product complies with the UL94-V2 flammability test
Specific Gravity:	1.35 max (ASTM 792)
QUV Outdoor Durability:	The samples were tested in a QUV weather tester as per test procedure ASTM G-154. Observations made at *3000 hours exposure showed no loss in legend or change in material.

*3000 hours equates to 5 years of assimilated outdoor UV exposure.

CHEMICAL/SOLVENT RESISTANCE:
The testing was conducted at room temperature. Samples were thermal transfer printed with Panduit Resin ribbon on Panduit printer.

Chemical/Solvent	7 DAY IMMERSION	DIP TEST	RUB TEST
30% Sulfuric acid	1	1	1
10% Sulfuric acid	1	1	1
30% Hydrochloric acid	1	1	1
10% Hydrochloric acid	1	1	1
50% Sodium Hydroxide	2	1	1
10% Sodium Hydroxide	3	1	1
Methyl Ethyl Ketone	3	3	3
Acetone	3	3	3
1:1:1 Trichloroethane	2	1	3
Isopropyl Alcohol	3	1	1
ASTM#3 Oil	1	1	1
SAE 30 Oil	1	1	1
Alconox	1	1	1
Toluene	2	1	3
Mineral Spirits	1	1	1
Glacial Acetic Acid	3	3	3
Diesel Fuel	1	1	1
10% Sodium Chloride	1	1	1
Water	1	1	1
Gasoline	1	1	1

1 = No change **2 = Slight failure in Legibility** **3 = Failure in Legibility**

7 Day Immersion – Immersed in reagent for 7 days
Dip Test - Five 10 minute dips in reagent followed by 30 minute recovery
Rub Test - Rubbed sample for 1 minute with swab soaked in reagent

Marking Performance:

MIL-M-81531: Print still legible after 20 eraser rubs with hard hand pressure.

CHEMICAL/SOLVENT RESISTANCE:
The testing was conducted at room temperature. Samples were thermal transfer printed with Panduit Hybrid ribbon on Panduit printer.

Chemical/Solvent	7 DAY IMMERSION	DIP TEST	RUB TEST
30% Sulfuric acid	1	1	1
10% Sulfuric acid	1	1	1
30% Hydrochloric acid	1	1	1
10% Hydrochloric acid	1	1	1
50% Sodium Hydroxide	2	1	1
10% Sodium Hydroxide	1	1	1
Methyl Ethyl Ketone	3	3	3
Acetone	3	3	3
1:1:1 Trichloroethane	3	1	3
Isopropyl Alcohol	3	1	3
ASTM#3 Oil	2	1	1
SAE 30 Oil	1	1	1
Alconox	1	1	1
Toluene	2	1	3
Mineral Spirits	3	1	2
Glacial Acetic Acid	3	3	3
Diesel Fuel	3	1	2
10% Sodium Chloride	1	1	1
Water	1	1	1
Gasoline	3	1	2

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7 Day Immersion – Immersed in reagent for 7 days
Dip Test - Five 10 minute dips in reagent followed by 30 minute recovery
Rub Test - Rubbed sample for 1 minute with swab soaked in reagent

Marking Performance:

MIL-M-81531: Print still legible after 20 eraser rubs with hard hand pressure.

High Temperature Plant (Class 1E) Harsh Environment Test Result Summary

GMNT marker tag has been tested for use as an identification marker for use in harsh environments in various high temperature power plants. Printed markers were subjected to radiation exposure, thermal aging and LOCA/MSLB environmental testing as shown in the three tables below. Test margins related to IEEE 323-2003 were used.

General Environmental Test Result Summary Table

Item	Normal	Accident
Service Life:	40 years	1 year
Temperature	140F (60C)	360F (182.2C) (peak)
Pressure	Atmospheric	57 psig (peak)
Relative Humidity	90%	100% (max)
Radiation	2.0E7 rads	2.0E8 rads (TID)
Halogen Content** ***Marker with (Print) (Thermal Print) (Thermal Print) (Thermal Print) (Thermal Print)	 Fluorine < 1.0 ppm Bromine < 1.0 ppm Chlorine < 7.0 ppm Iodine < 1.0 ppm	Not Applicable
Print Permanence	Print remained legible with no change in print density	Thermal Print -No significant change
Physical Integrity	No significant change	Some warping and splitting but remained attached on wire

Containment Spray Test Information Table

Item	Short Term (Injection Phase)	Long Term (Recirculation Phase)
Duration	4 hours	30 days
Temperature	60-360F (16-182C)	60-360F (16-182C)
Spray Density (gpm/ft^2.)	>0.62 (25.3 L/min/m^2)	>0.62 (25.3 L/min/m^2)
Chemical Composition Hydrazine (N_2H_4) Boric Acid (H_3BO_3) pH	 0-50 ppm 4,400 ppm 4.0 - 10.0	 0-50 ppm 4,400 ppm 7.0 - 8.5

LOCA /MSLB Combined Temperature/Pressure Test Information Table

TIME Seconds	Temperature Deg F (Deg C)	Pressure PSIG (kPa)
0	120 (49)	0 (0)
10	300 (149)	57 (393)
50	360 (182)	57 (393)
250	360 (182)	57 (393)
270	275.3 (135.2)	57 (393)
1 X 10^3	275.3 (135.2)	57 (393)
1 X 10^4	230 (110)	46 (317)
1 X 10^5	190 (88)	20 (138)
1 X 10^6	150 (66)	10 (69)
2.592 X 10^6 (30 days)	150 (66)	10 (69)
1.572 X 10^7 (182 days)	142 (61)	10 (69)
3.15 X 10^7 (365 days)	142 (61)	10 (69)

*The chemical analysis method SM4110B (De-ionized Water Soluble Method) was performed to identify concentration of halogen ions in this material that could potentially leach onto materials such as stainless steel and promote corrosion, This chemical analysis does not identify the concentration of toxic gaseous effluents released by burning this material.

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