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TDS: GMUHS31
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Technical Data Sheet

Heat Shrink Labels

This specification is intended to outline the physical and chemical properties of *PANDUIT*'s GMUHS31 tubing material for wire identification and insulation purposes and include the following part numbers and printable material identifiers:

Standard Roll Quantity with Liner

H050X025H*T H050X034H*T H050X044H*T H050X064H*T H050X084H*T H050X165H*T
H075X025H*T H075X034H*T H075X044H*T
H100X025H*T H100X034H*T H100X044H*T H100X064H*T H100X084H*T H100X165H*T
H150X025H*T H150X034H*T H150X044H*T
H200X025H*T H200X034H*T H200X044H*T H200X064H*T H200X084H*T H200X165H*T H200X240H*T

Bulk Roll Quantity with Liner

H050X025H*T-B H050X034H*T-B H050X044H*T-B H050X064H*T-B
H075X025H*T-B H075X034H*T-B H075X044H*T-B
H100X025H*T-B H100X034H*T-B H100X044H*T-B H100X064H*T-B
H150X025H*T-B H150X034H*T-B H150X044H*T-B
H200X025H*T-B H200X034H*T-B H200X044H*T-B H200X064H*T-B

Continuous Two-Sided

H000X025H*T-2 H000X034H*T-2 H000X044H*T-2 H000X064H*T-2
H000X084H*T-2 H000X122H*T-2 H000X165H*T-2 H000X240H*T-2

* - Color Code
1 = White
2 = Yellow
3 = Black
4 = Red

PRODUCT SPECIFICATIONS:

Description:	Material is RoHS compliant (European Union directive 2002/95/EC). GMUHS31 is a crosslinked, flexible, heat shrinkable thermal transfer and dot matrix printable polyolefin. This product meets the material requirements and physical properties of AS23053/5 (Class 1 and Class 3) and UL standard 224 with a VW-1 rating. When printed using Recommended Ribbons it will also meet SAE-AS5942, MIL-STD-883F Method 2015.13, Solutions A, B and D, and MIL-STD-202G Method 215K, Solutions A, C, and D. This product has been tested for use as an identification marker for use in (Class 1E) harsh environments in various nuclear power plants.
Recommended Ribbons:	RMH4BL, RMEH4BL, RHH4BL-S, RMR4BL, RMER4BL, RMR4WH, RMER4WH, RHR4BL-S, or RMR2BL
Standard Colors:	White, Yellow, Red, Black (per MIL-STD-104C)
Shrink Ratio:	3 to 1
Service Temperature Range:	Minus 67F to 275F (Minus 55C to 135C)
Storage Conditions:	Store at 70F (21C) and 50% Relative Humidity For cassette products do not exceed 95°F.

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Technical Data Sheet

PROPERTIES:	PERFORMANCE:
Tensile Strength:	1500 psi (10.3 MPa) minimum (ASTM D638)
Elongation Ultimate:	200% minimum (ASTM D 638)
Dielectric Strength:	500 volts/mil minimum (ASTM D2671, Sections 20-25)
Total Longitudinal Change:	Minus 15% to +5% (ASTM D2671, Sections 8-13)
Water Absorption:	0.5% maximum (ASTM D2671, Sections 79-80)
Low Temperature Flexibility:	No cracking (ASTM D2671, Section 36-43)
Printability:	Product meets print performance of 100 rubs (Taber abraser, CS-10 wheels, 100 cycles/250 gm wt)
Flammability:	Product passes UL 224 standard, VW-1 for flammability
Specific gravity:	1.35 max (ASTM D882, Sections 73-74)
Shrink Temperature:	194F to 248F(90C to 120C)
Corrosion:	Non-corrosive (ASTM D2671, Sections 93-95, Procedure A)
UV Resistance:	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.
Fluid Resistance:	Tubings tested in the following fluids per ASTM D2671 Sections 63-67

Hydraulic Fluid MIL-H-5606
JP8 - MIL-T-5624
OIL - MIL-L-7808
OIL - MIL-L-23699
5% NaCl - A-A-694
Deicing Fluids – MIL-A-8243

After immersion test:
Tensile Strength - 6.89 MPa (1000 psi) minimum per ASTM D2671 Sections 44-48
Ultimate Elongation - 100% minimum per ASTM D2671 Sections 44-4

PROPERTIES FOR SOLAR APPLICATION:	PERFORMANCE:
Short term temperature exposure:	30 days at -51C, no visible change observed
Short Term high temperature exposure:	30 days at 93C, no visible change observed
Relative Lightfastness and weatherability:	1000 hours, slight fade in color observed (ASTM D3424, Method 4)
Tensile Strength:	MD: 1158 PSI (ASTM D3759)
Elongation:	MD: 510% (ASTM D3759)
Marking Performance:	
SAE-AS5942:	Samples were tested heat shrunk. Print still legible after 20 eraser rubs with hard hand pressure.
MIL-STD-202G:	Method 215K, Solution A, C, and D: 3 cycles of 3-minute immersions in specified fluids followed by toothbrush rub after each immersion. Print still legible in all test fluids.
MIL-STD-883F:	Method 2015.13, Solution A, B and D: 3 cycles of 1 minute immersion in specified fluids followed by toothbrush rub after each immersion. Print still legible in all test fluids.

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Technical Data Sheet

Nuclear Plant (Class 1E) Harsh Environment Test Result Summary

GMUHS31 heat shrink tubing has been tested for use as an identification marker for use in harsh environments in various nuclear 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) (Dot Matrix Print) (Dot Matrix Print) (Dot Matrix Print) (Dot Matrix Print)	 Fluorine < 0.1 ppm Bromine < 0.1 ppm Chlorine < 0.1 ppm Iodine < 0.1 ppm Fluorine < 0.1 ppm Bromine < 0.1 ppm Chlorine < 0.7 ppm Iodine < 0.1 ppm	Not Applicable
Print Permanence	Print remained legible with no change in print density	Thermal Print -No significant change Dot Matrix – Some density loss
Physical Integrity	No significant change	Some warping and splitting but remained attached on wire.

*The chemical analysis method DM4110B (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 concentrations of toxic gaseous effluents released by burning this material.

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

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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)

CHEMICAL/SOLVENT RESISTANCE:

Samples were thermal transfer printed with RMR*BL/RMER*BL/RHR*BL-S/RMR*WH/RMER*WH and RMH*BL/RMEH*BL/RHH*BL-S ribbons. Test was conducted at room temperature. The samples were immersed in the specified chemical reagents for 5 immersions using the following cycle: a 10-minute immersion time followed by a 30-minute recovery time.

Chemical Reagent	Visual Observation
Distilled water	No effect
Mineral Spirits	No effect
ASTM #3 Oil	No effect
Isopropyl Alcohol	No effect
Methanol	No effect
3% Alconox Detergent	No effect
10% Sodium Hydroxide Solution	No effect
10% Sulfuric Acid Solution	No effect
5% Sodium Chloride Solution	No effect
Freon TF	No effect
Super Agitene	No effect
Jet A Fuel	No effect
Arco Truslide 68	No effect
SAE 30 Motor Oil	No effect

EUROPEAN REACH

This product contains Decabromodiphenylethane, which is designated as a substance of Very High concern by REACH. CAS registry number 84852-53-9 at 19%. Wash hands thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Avoid breathing dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area.

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Technical Data Sheet

APPROVALS:

UL Recognized: UL224 File Number: E492331
CSA Certified: C22.2 No. 198.1-06 File Number: 256205

LIMITED WARRANTY

All *PANDUIT* Identification Solution Products (except for Software programs) are warranted to be free from defects in material and workmanship at the time of sale but our obligation under this warranty is limited to replacement of the product proved to be defective within 6 months from the date of sale, or in the case of printers, within 90 days from the date of sale. This warranty is void if the products or printers are modified, altered or misused in any way. Use of *PANDUIT* printers with any product other than the specified *PANDUIT* products for which the printer was designed constitutes misuse. Before using, the user shall determine the suitability of the product for its intended use and user assumes all risk and liability whatsoever in connection therewith. The foregoing may not be altered except by an agreement signed by officers or seller and manufacturer.

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