Panduit Cable Tie Approvals

Logo (Symbol)	Agency	Spec/Approval	Requirement	Applicable Products
	Underwriters Laboratories, Inc.	File E56854 and MH29590	ZODZ(7), ZODZ(8), ALKW	Most miniature, intermediate, standard, light-heavy and heavy cross section ties are Recognized or Listed in the US and Canada
	Canadian Standards Association	File 031212	C22.2 No. 18.5-02 under the category “Fittings – Positioning Devices”	Most miniature, intermediate, standard, light-heavy and heavy cross section ties are Recognized or Listed in the US and Canada
	Conformity European	Low Voltage Directive 73/23/EEC (amended 93/68/EEC). *Pan-Ty* AND *Dome-Top* Barb Ty cable ties also meet the requirements from EN50146	CE Marking is required for products sold within the European Union. CE Marking Directives specify the minimum performance of these products. Applying the CE mark signifies compliance with essential requirements of specific directives.	All cable tie products
	ABS (American Bureau of Shipping)	05-HS463235-PDA	2005 Vessel Rules 1-1-4/7.7, 4-8/421.9.3 2001 MODU Rules 4-3-3/5.9.1	PLT Series, BT Series
	Bureau Veritas	Cert 05968/C0 BV1178B/BVN/04 File ACE 14/601/01	Bureau Veritas Rules for the Classification of Steel Ships	PLT Series, BT Series, PRT Series, CBR Series
	Det Norske Veritas	E-6405	Det Norske Veritas’ Rules for Classification of Ships and Mobile Offshore Units	PLT Series, PLC Series, PLM Series, PRT Series, PLWP Series, PRWP Series, PRST Series
	Germany (VG) Military	K17/97165	VG 95 387 – 100 MS 3367F	PLT Series, BT Series, SST Series
	Lloyd’s Register of Shipping	89/60111 (E3)	Lloyd’s Register Type Approval	PLT Series,BT Series, SST Series
	NRC (Nuclear Regulatory Commission)	NRC 10CFR50	Quality Assurance Criteria for Nuclear Plants and Reprocessing Plants	All cable tie products
	Plenum-Rated	Panduit logo	Panduit symbol indicates that the cable ties represented are suitable for use in plenum or air handling spaces in accordance with Sec. 300.22(C) and (D) of the National Electrical Code and Rules 12-010 (3), (4) and (5) and 12-020 of the Canadian Electrical Code, Part I.	Halar (702Y) and select Nylon 6.6 cable ties as noted throughout catalog
	US Military Aerospace Standard	QPL-AS23190-2	SAE spec AS23190	See Military Cross Reference Page B1.95
	AQA International	ISO/TS16949	AQA registration. Quality management system assessment certificate	Tinley Park, Illinois Manufacturing Operations (Cable Tie Division) Quality Management System.

Military Cross Reference

The Panduit cable ties and marker ties listed in the following tables meet all of the testing requirements of Aerospace Standard SAE-AS23190A (formerly MIL-S-23190E) and the dimensional requirements of Aerospace Standards SAE-AS33671 (formerly MS3367) and SAE-AS33681 (formerly MS3368).

		Cable Tie Cross Reference				
Mil. Std. Part Number	**Color**	**Pan-Ty®**	**Dome-Top® Barb Ty**	**Sta-Strap®**	**Belt-Ty™ In-Line**	**Contour-Ty®**
MS3367-1-0	Black*	PLT2S-C00, -M00	—	—	—	—
MS3367-1-1	Brown	PLT2S-C1, -M1	BT2S-M1	—	—	—
MS3367-1-2	Red	PLT2S-C2, -M2	BT2S-M2	—	—	—
MS3367-1-3	Orange	PLT2S-C3, -M3	BT2S-M3	—	—	—
MS3367-1-4	Yellow	PLT2S-C4Y, -M4Y	BT2S-M4Y	—	—	—
MS3367-1-5	Green	PLT2S-C5, -M5	BT2S-M5	—	—	—
MS3367-1-6	Blue	PLT2S-C6, -M6	BT2S-M6	—	—	—
MS3367-1-7	Purple	PLT2S-C7, -M7	BT2S-M7	—	—	—
MS3367-1-8	Gray	PLT2S-C8, -M8	BT2S-M8	—	—	—
MS3367-1-9	Natural	PLT2S-C, -M, -VMR	BT2S-C, -M	SST2S-C, -M	—	—
MS3367-2-0	Black*	PLT4S-C00, -M00	—	—	—	—
MS3367-2-1	Brown	PLT4S-M1	—	—	—	—
MS3367-2-2	Red	PLT4S-C2, -M2	BT4S-M2	SST4S-M2	—	—
MS3367-2-3	Orange	PLT4S-C3, -M3	BT4S-M3	—	—	—
MS3367-2-4	Yellow	PLT4S-C4Y, -M4Y	BT4S-M4Y	—	—	—
MS3367-2-5	Green	PLT4S-C5, -M5	BT4S-M5	—	—	—
MS3367-2-6	Blue	PLT4S-C6, -M6	BT4S-M6	—	—	—
MS3367-2-7	Purple	PLT4S-C7, -M7	BT4S-M7	—	—	—
MS3367-2-8	Gray	PLT4S-C8, -M8	BT4S-M8	—	—	—
MS3367-2-9	Natural	PLT4S-C, -M	BT4S-C, -M	SST4S-C, -M	—	—
MS3367-3-0	Black*	PLT4H-L00, -TL00	—	—	—	—
MS3367-3-1	Brown	PLT4H-TL1	—	—	—	—
MS3367-3-2	Red	PLT4H-TL2	—	—	—	—
MS3367-3-3	Orange	PLT4H-TL3	—	—	—	—
MS3367-3-4	Yellow	PLT4H-TL4Y	—	—	—	—
MS3367-3-5	Green	PLT4H-TL5	—	—	—	—
MS3367-3-6	Blue	PLT4H-TL6	—	—	—	—
MS3367-3-9	Natural	PLT4H-L, -C, -TL	BT4LH-L, -TL	SST4H-L, -D	—	—
MS3367-4-0	Black*	PLT1M-C00, -M00, -XMR00	—	—	—	—
MS3367-4-0	Black*	PLT1.5M-XMR00	—	—	—	—
MS3367-4-1	Brown	PLT1M-C1, -M1, -XMR1	BT1M-M1	—	—	—
MS3367-4-2	Red	PLT1M-C2, -M2, -XMR2	BT1M-M2	—	—	—
MS3367-4-3	Orange	PLT1M-C3, -M3, -XMR3	BT1M-M3	—	—	—
MS3367-4-4	Yellow	PLT1M-C4Y, -M4Y, -XMR4Y	BT1M-M4Y	—	—	—
MS3367-4-5	Green	PLT1M-C5, -M5, -XMR5	BT1M-M5	—	—	—
MS3367-4-6	Blue	PLT1M-C6, -M6, -XMR6	BT1M-M6	—	—	—
MS3367-4-7	Purple	PLT1M-C7, -M7, -XMR7	BT1M-M7	—	—	—
MS3367-4-8	Gray	PLT1M-C8, -M8, -XMR8	BT1M-M8	—	—	—
MS3367-4-9	Natural	PLT1M-C, -M, -XMR	BT1M-C, -M, -XMR	SST1M-C, -M	—	—
MS3367-4-9	Natural	PLT.7M-C, -M	—	—	—	—
MS3367-4-9	Natural	PLT1.5M-XMR	BT1.5M-XMR	—	—	—
MS3367-5-0	Black*	PLT1.5I-M00	—	—	—	—
MS3367-5-1	Brown	PLT1.5I-C1, -M1	BT1.5I-M1	—	—	—
MS3367-5-2	Red	PLT1.5I-C2, -M2	BT1.5I-M2	—	—	—
MS3367-5-3	Orange	PLT1.5I-C3, -M3	BT1.5I-M3	—	—	—
MS3367-5-4	Yellow	PLT1.5I-C4Y, -M4Y	BT1.5I-M4Y	—	—	—

Table continues on page B1.96

*Weather resistant per ASTM D 4066-94B.

Military Cross Reference (continued)

		Cable Tie Cross Reference				
Mil. Std. Part Number	Color	Pan-Ty®	Dome-Top® Barb Ty	Sta-Strap®	Belt-Ty™ In-Line	Contour-Ty®
MS3367-5-5	Green	PLT1.5I-C5, -M5	BT1.5I-M5	—	—	—
MS3367-5-6	Blue	PLT1.5I-C6, -M6	BT1.5I-M6	—	—	—
MS3367-5-7	Purple	PLT1.5I-C7, -M7	BT1.5I-M7	—	—	—
MS3367-5-8	Gray	PLT1.5I-C8, -M8	BT1.5I-M8	—	—	—
MS3367-5-9	Natural	PLT1.5I-C, -M	BT1.5I-C, -M	SST1.5I-C, -M	—	—
MS3367-6-9	Natural	PLT8LH-L, -C	BT8LH-L, -C	SST8H-L, -D	—	—
MS3367-6-9	Natural	—	BT9LH-L, -C	—	—	—
MS3367-7-0	Black*	PLT3S-C00, -M00	—	—	—	—
MS3367-7-1	Brown	PLT3S-M1	—	—	—	—
MS3367-7-2	Red	PLT3S-C2, -M2	BT3S-C2	—	—	—
MS3367-7-3	Orange	PLT3S-M3	—	—	—	—
MS3367-7-4	Yellow	PLT3S-M4Y	—	—	—	—
MS3367-7-5	Green	PLT3S-M5	—	—	—	—
MS3367-7-6	Blue	PLT3S-M6	—	—	—	—
MS3367-7-7	Purple	PLT3S-M7	—	—	—	—
MS3367-7-8	Gray	PLT3S-M8	—	—	—	—
MS3367-7-9	Natural	PLT3S-C, -M	BT3S-C, -M	SST3S-C, -M	—	—
MS3367-8-9	Natural	PLT5H-L, -C	—	—	—	—
MS3367-9-9	Natural	PLT6H-L, -C	—	—	—	—
MS3367-11-9	Natural	PLT8H-L, -C	—	—	—	—
MS3367-14-9	Natural	PLT13H-Q, -C	—	—	—	—
MS3367-20-9	Natural	PLT5EH-Q, -C	—	—	—	—
MS3367-21-9	Natural	PLT6EH-Q, -C	—	—	—	—
MS3367-22-9	Natural	PLT8EH-C	—	—	—	—
MS3367-23-9	Natural	—	—	—	ILT2S-C, -M	—
MS3367-24-9	Natural	—	—	—	ILT4S-C, -M	—
MS3367-25-9	Natural	—	—	—	ILT4LH-TL	—
MS3367-29-9	Natural	—	—	—	ILT3S-C, -M	—
MS3367-30-9	Natural	—	—	—	—	CBR1M-M
MS3367-31-9	Natural	—	—	—	—	CBR1.5M-M
MS3367-32-1	Brown	—	—	—	—	CBR2M-M1
MS3367-32-2	Red	—	—	—	—	CBR2M-M2
MS3367-32-3	Orange	—	—	—	—	CBR2M-M3
MS3367-32-4	Yellow	—	—	—	—	CBR2M-M4Y
MS3367-32-5	Green	—	—	—	—	CBR2M-M5
MS3367-32-6	Blue	—	—	—	—	CBR2M-M6
MS3367-32-7	Purple	—	—	—	—	CBR2M-M7
MS3367-32-9	Natural	—	—	—	—	CBR2M-M
MS3367-33-9	Natural	—	—	—	—	CBR1.5I-M
MS3367-34-1	Brown	—	—	—	—	CBR3I-M1
MS3367-34-2	Red	—	—	—	—	CBR3I-M2
MS3367-34-3	Orange	—	—	—	—	CBR3I-M3
MS3367-34-4	Yellow	—	—	—	—	CBR3I-M4Y
MS3367-34-5	Green	—	—	—	—	CBR3I-M5
MS3367-34-6	Blue	—	—	—	—	CBR3I-M6
MS3367-34-7	Purple	—	—	—	—	CBR3I-M7
MS3367-34-8	Gray	—	—	—	—	CBR3I-M8
MS3367-34-9	Natural	—	—	—	—	CBR3I-M
MS3367-35-9	Natural	—	—	—	—	CBR4I-M

*Weather resistant per ASTM D 4066-94B.

		Cable Tie Cross Reference				
Mil. Std. Part Number	Color	Pan-Ty®	Dome-Top® Barb Ty	Sta-Strap®	Belt-Ty™ In-Line	Contour-Ty®
MS3367-36-9	Natural	—	—	—	—	CBR2S-M
MS3367-37-9	Natural	—	—	—	—	CBR3S-M
MS3367-38-9	Natural	—	—	—	—	CBR4S-M
MS3367-39-9	Natural	—	—	—	—	CBR2HS-D
MS3367-40-9	Natural	—	—	—	—	CBR4LH-TL
MS3367-41-9	Natural	—	—	—	—	CBR6LH-C
MS3368-1-2A	Red	PLM2S-D2	—	—	—	—
MS3368-1-3A	Orange	PLM2S-D3	—	—	—	—
MS3368-1-4A	Yellow	PLM2S-C4Y, -D4Y	—	—	—	—
MS3368-1-5A	Green	PLM2S-D5	—	—	—	—
MS3368-1-6A	Blue	PLM2S-D6	—	—	—	—
MS3368-1-8A	Gray	PLM2S-D8	—	—	—	—
MS3368-1-9A	Natural	PLM2S-C, -D	BM2S-C, -D	—	—	—
MS3368-1-9B	Natural	—	—	SSM2S-C, -D	—	—
MS3368-2-2A	Red	PLM4S-D2	—	—	—	—
MS3368-2-4A	Yellow	PLM4S-D4Y	—	—	—	—
MS3368-2-6A	Blue	PLM4S-D6	—	—	—	—
MS3368-2-9A	Natural	PLM4S-C, -D	BM4S-C, -D	—	—	—
MS3368-2-9B	Natural	—	—	SSM4S-D	—	—
MS3368-3-4C	Yellow	PL2M2S-D4Y	—	—	—	—
MS3368-3-9C	Natural	PL2M2S-L, -D	B2M2S-D	—	—	—
MS3368-4-4D	Yellow	PL3M2S-D4Y	—	—	—	—
MS3368-4-9D	Natural	PL3M2S-L, -D	B3M2S-TL	—	—	—
MS3368-5-1E	Brown	PLM1M-M1	—	—	—	—
MS3368-5-2E	Red	PLM1M-M2	—	—	—	—
MS3368-5-3E	Orange	PLM1M-M3	—	—	—	—
MS3368-5-4E	Yellow	PLM1M-M4Y	—	—	—	—
MS3368-5-5E	Green	PLM1M-M5	—	—	—	—
MS3368-5-6E	Blue	PLM1M-M6	—	—	—	—
MS3368-5-7E	Purple	PLM1M-M7	—	—	—	—
MS3368-5-8E	Gray	PLM1M-M8	—	—	—	—
MS3368-5-9E	Natural	PLM1M-C, -M	BM1M-C, -M	—	—	—

Installation Tools

The Panduit installation tools listed in the table below meet all of the testing requirements of MIL-T-81306 and the dimensional requirements of MS90387.

Mil. Spec. Part Number	Panduit Part Number
MS90387-1	GTS, GS2B
MS90387-2	GS4H, GTH
MS90387-4	GS4EH
MS90387-5	GTSL

Cable Tie Selection and Specification Guidelines

Selecting the Proper Cable Tie Material for Your Application

By using the information on our material selection chart on pages B1.2 and B1.3 as a guide, the user will be better equipped to select the best cable tie and material suited to perform its intended function over a long period of time.

For long life and dependable service, there are many factors to consider when selecting the proper cable tie for each application. Since it is impossible for Panduit to provide data on all the various combinations of conditions which may arise, it is suggested that this data be used as a guide. Sample cable ties should be tested under actual end-use conditions to determine the correct cable tie for the application.

To select the optimum cable tie for a specific application, the chart on pages B1.2 and B1.3 can be used as a reference. First, determine the most critical design criteria and then read across the table to find which material is most suitable to meet this need. Next, review the other criteria by scanning in a vertical direction on the chart and then make your final selection.

Example No. 1

Application	Selection
The application requires high radiation (2 x 10^8 rads) resistance and excellent resistance to hydrocarbons.	The best choice is PEEK, TEFZEL■, or HALAR▲. The price is higher than other materials, but all have high ratings in resistance to radiation and hydrocarbons.

Example No. 2

Application	Selection
The application requires a low cost material, good ultraviolet resistance, and good resistance to acid rains.	The best choice is Weather Resistant Polypropylene. Price is medium, the UV rating is 6, and the acid resistance rating is 9.

■TEFZEL is a registered trademark of E.I. du Pont de Nemours and Company.
▲HALAR is a registered trademark of Ausimont USA, Inc.

Weathering

Over a period of time, ultraviolet light (a component of sunlight) attacks most plastic materials and reduces their properties by breaking the molecular chain. The material breakdown is accompanied by reductions in tensile strength and elongation, increased brittleness, color changes and loss of surface gloss.

Carbon black, which is used in Panduit nylon, polypropylene, and acetal cable ties, is one of the most effective stabilizers known today. A uniform dispersion of carbon black provides good ultraviolet light resistance without adversely affecting physical properties. The addition of carbon black, or any other ultraviolet light stabilizer, prolongs the useful outdoor life of plastic products, but it does not totally eliminate the destructive effects of the light. Some plastics, such as TEFZEL■ or HALAR▲, are intrinsically very resistant to ultraviolet light and do not require stabilizing additives.

Weathering Test Methods

In order to monitor the effects of ultraviolet light and the effectiveness of ultraviolet stabilizers, Panduit, in conformance with industry standards, adopted two methods of weatherability testing: Outdoor Aging and Accelerated Weather Aging.

Outdoor Aging

The Outdoor Aging method is probably the best and most realistic method of the two. It is conducted in accordance with ASTM D 1435 Standard Practice for Outdoor Weathering of Plastics, and allows the material to be affected by not only ultraviolet light, but by all other outdoor elements as well. Although this may more closely approximate an actual application, two drawbacks do exist. The period of time required to produce property decay and material failure may be quite long, and varying adverse chemical environments cannot be tested.

Accelerated Weather Aging

Accelerated weathering tests are conducted to estimate the rate of degradation due to a combination of ultraviolet light, temperature, and moisture. The methods used are in accordance with the following standards:

- ASTM D 1499, Operating Light and Water Exposure Apparatus (Carbon-Arc type) for exposure to plastics
- ASTM G 154-04, Operating Light and Water Exposure (Fluorescent UV Condensation type) for exposure of non-metallic materials

The condition specified in ASTM D 1499 utilizes a water spray and a carbon arc to simulate natural sunshine. The test chamber is operated 20 hrs./day with a two-hour cycle of 108 minutes of simulated sunshine and twelve minutes of sunshine and water spray. The temperature of a black body inside the chamber is approximately 63°C (145°F) during the “sunshine only” portion of the cycle. Humidity is not controlled inside the chamber.

The test chamber per ASTM G 154-04 uses fluorescent sun lamps to generate ultraviolet light only. A heated water pan produces condensation during a portion of the cycle. The daily cycle is composed of 20 hours of light followed by 4 hours of condensation. Black body temperatures during the light cycle are 50°C (122°F) and 40°C (104°F) during the condensation cycle.

Panduit has also designed a special chamber, which is used to simulate the effect of acid rain and ultraviolet light on cable tie materials. The effects of other common chemicals, such as road salt, are also evaluated in this chamber.

These methods are effective in quickly determining the ultraviolet light resistance of the various cable tie materials, but it must be emphasized that there are no exact correlations between accelerated aging and actual outdoor exposure.

■TEFZEL is a registered trademark of E.I. du Pont de Nemours and Company.
▲HALAR is a registered trademark of Ausimont USA, Inc.

Weathering (continued)

Material Failure Testing

Property decay can lead to three different modes of failure: loss of strength, loss of toughness, or change in appearance. The critical mode for any given application would depend upon the application and the requirements it places upon the material itself.

Loss of strength is monitored by tensile testing samples of the material before and after it has been weathered. This test will reveal the decreasing strength accompanied by extended weathering.

Loss of toughness can be monitored by measuring changes in elongation and impact strength. As ultraviolet light exposure time increases and the material becomes brittle, its elongation and impact strength are greatly reduced. It is important to note that brittle failures can occur even when the tensile strength shows no change.

Although change in appearance is normally not a failure mode for cable ties, the plastic does tend to discolor and lose its surface gloss as exposure increases. These changes can be measured by color difference using Adams units, which are similar to National Bureau of Standard units.

Panduit has its own weathering test program to determine estimated life of various cable tie materials. This includes examining many previously aged samples obtained throughout the world.

In all cases, the amount of property decay increased with increasing exposure to ultraviolet light. The principal signs of degradation were found to be brittleness, cracking, and loss of surface gloss. It was also determined that the time for failure to occur was shorter than indicated from industry tests performed on material samples. This discrepancy is in part due to the fact that cable ties were tested in an end use, stressed condition, while most plastic resin suppliers conduct weathering tests using unstressed test bars.

Five cable tie materials have superior ultraviolet light resistance: TEFZEL■, HALAR▲, Weather Resistant Acetal, Nylon 12 and Stainless Steel.

Determining the outdoor life expectancy of any material is difficult since there are other factors, besides ultraviolet light stability, which have to be considered. These factors are listed below and should be considered before specifying a cable tie material.

Table A – External Factors That Affect the Life of a Cable Tie

Factor	Effect on Cable Tie Life
Chemicals	Applications which have chemicals present can reduce the life of a tie. **This is the most detrimental factor to the life of a tie.**
Bundle diameter	As the bundle diameter is reduced, the tie has more bending stress. A thick strap on a small bundle diameter has more stress.
Loading	If the tie is under high loading, this will add additional stress on the tie body.
Thickness	A thinner tie will have a decreased life since surface cracks will penetrate the thickness of the tie faster.
Vibration	Applications with high vibrations will cause impact, which will propagate any surface cracks.
Degree of exposure	No shield or shade, southern exposure, higher altitudes and high temperatures, decrease the life of a cable tie.
Moisture	High humidity plus high temperature can result in degradation due to hydrolysis in nylon.
Galvanized metals	Acid rain and acid moisture acting on galvanized metals release chemicals known to attack Nylon 6.6.

Weathering Life Expectancy	
Material, Color (Part Number Suffix)	**Years***
Polypropylene, Green (109)	1
Nylon 6.6, Natural (No suffix)	1 – 2
Flame Retardant Nylon 6.6, Black (60)	1 – 2
Flame Retardant Nylon 6.6, Ivory (69)	1 – 2
Heat Stabilized Nylon 6.6, Natural (39)	1 – 2
PEEK, Polyetheretherketone, Translucent Brown (71)	1 – 2
Heat Stabilized Nylon 6.6, Black (30)	4 – 5
Weather Resistant Polypropylene, Black (100)	7 – 9
Weather Resistant Nylon 6.6, Black (0 and 00)	7 – 9
Heat Stabilized Weather Resistant Nylon 6.6, Black (300)	7 – 9
Weather Resistant Nylon 12, Black (120)	12 – 15
TEFZEL■, Aqua Blue (76)	>15
HALAR▲, Maroon (702Y)	>15
Weather Resistant Acetal, Black	>20
Stainless Steel	>30

*Based on the assumption of minimum loading, no chemical attack and impact-free conditions.

■TEFZEL is a registered trademark of E.I. du Pont de Nemours and Company.

▲HALAR is a registered trademark of Ausimont USA, Inc.

Flammability

Flammability

A number of test procedures have been developed which can be used for the evaluation and comparison of various materials to support combustion.

UL 94 Vertical Burning Test

Samples of a material, with dimensions 127mm by 12.7mm and the thickness of the intended end use product, are tested in an unaged “as manufactured” state and in an aged state (seven days at 158°F, 70°C). The test requires the placement of a precisely controlled flame under a vertically supported specimen for a ten second period. The controlled flame is removed and the duration of flaming combustion of the specimen is recorded. When the flaming combustion of the specimen extinguishes, it is immediately subjected to an additional controlled flame exposure. After the additional ten seconds of exposure, the controlled flame is removed, and the duration of flaming combustion of the specimen is recorded. A piece of surgical cotton is placed under the specimen. If drips ignite the cotton, this fact is also recorded.

Materials Classed 94V-0

Requirements:

- None of the specimens will burn with flaming combustion for more than ten seconds after either application of the controlled flame
- The total flaming combustion time will not exceed 50 seconds for the ten controlled flame applications (two controlled flame applications for each of the five specimens)
- None of the specimens will burn with flaming or glowing combustion up to the holding clamp
- None of the specimens will drip flaming particles that ignite the dry absorbent surgical cotton located 12 inches (305mm) below the test specimen
- None of the specimens will exhibit glowing combustion that persists for more than 30 seconds after the second removal of the controlled flame

Materials Classed 94V-1

Requirements:

- None of the specimens will burn with flaming combustion for more than 30 seconds after either application of the controlled flame
- The total flaming combustion time will not exceed 250 seconds for the ten controlled flame applications (two controlled flame applications for each of the five specimens)
- None of the specimens will burn with flaming or glowing combustion up to the holding clamp
- Specimens may drip flaming particles which burn only briefly, and may not ignite the dry absorbent surgical cotton located 12 inches (305mm) below the test specimen
- None of the specimens will exhibit glowing combustion that persists for more than 60 seconds after the second removal of the controlled flame

Materials Classed 94V-2

Requirements:

- None of the specimens will burn with flaming combustion for more than 30 seconds after either application of the controlled flame
- The total flaming combustion time will not exceed 250 seconds for the ten controlled flame applications (two controlled flame applications for each of the five specimens)
- None of the specimens will burn with flaming or glowing combustion up to the holding clamp
- Specimens may drip flaming particles which burn only briefly, and may ignite the dry absorbent surgical cotton placed 12 inches (305mm) below the test specimen
- None of the specimens will exhibit glowing combustion that persists for more than 60 seconds after the second removal of the controlled flame

Flammability (continued)

ASTM D 635

Samples of a material, with dimensions 125mm by 12.5mm and the thickness of the intended end use product, are tested in an unaged "as manufactured" state. A precisely controlled flame is applied to the specimen and a stopwatch is started. The flame is applied for 30 seconds. The stopwatch is stopped when burning or glowing combustion ceases or when the flame has proceeded to a mark 100mm from the free end. Ten specimens are tested. If any of the specimens burn to the 100mm mark, an additional ten specimens are tested.

Burning Rate

- If two or more specimens have burned to the 100mm mark then Average Burning Rate (cm/min.) shall be reported as the average of the burning rates of all specimens which have burned to the 100mm mark

Average Time of Burning and Average Extent of Burning

- Average time of burning and average extent of burning of the sample shall be reported if none of the ten samples or no more than one of the twenty specimens have burned to the 100mm mark

- Average Time of Burning (ATB):

$$ATB,\ s = \frac{\sum_0^N [time(sec) - 30(sec)]}{N}$$

N = Number of specimens tested
Rounded to the nearest 5 seconds

- Average Extent of Burning (AEB):

$$AEB,\ mm = \frac{\sum_0^N [10(mm) - unburned\ length(mm)]}{N}$$

N = Number of specimens tested
Rounded to the nearest 5mm

Table B – Flammability Ratings

Materials	Part Number Suffix	UL 94	ASTM D 635
Nylon 6.6, Natural	None	94V-2 @ .71mm	AEB = 20mm ATB = 5 seconds
Weather Resistant Nylon 6.6, Black (Meets Mil. Spec.)	00	94V-2 @ .71mm	AEB = 20mm ATB = 5 seconds
Weather Resistant Nylon 6.6, Black*	0	94V-2** @ .71mm	AEB = 20mm ATB = 5 seconds
Heat Stabilized Nylon 6.6, Black	30	94V-2 @ .71mm	AEB = 20mm ATB = 5 seconds
Heat Stabilized Nylon 6.6, Natural	39	94V-2 @ .71mm	AEB = 20mm ATB = 5 seconds
Heat Stabilized Weather Resistant Nylon 6.6, Black	300	94V-2 @ .71mm	AEB = 20mm ATB = 5 seconds
Flame Retardant Nylon 6.6, Black	60	94V-0 @ .81mm	AEB = 15mm ATB = < 5 seconds
Flame Retardant Nylon 6.6, Natural (Ivory)	69	94V-0 @ .81mm	AEB = 15mm ATB = < 5 seconds
PEEK, Polyetheretherketone, Translucent Brown	71	94V-0 @ 1.5mm	—
Metal Detectable Nylon 6.6, Blue	86	94 HB @ .71mm	AEB = 20mm ATB = 5 seconds
Weather Resistant Nylon 12, Black	120	94 HB @ 1.6mm	Avg. Burning Rate 1.6cm/min.
Polypropylene, Green	109	94 HB @ .94mm	Avg. Burning Rate 2cm/min.
Weather Resistant Polypropylene, Black	100	94 HB @ .94mm	Avg. Burning Rate 2cm/min.
TEFZEL■, Aqua Blue	76	94V-0 @ 1.5mm	AEB = 15mm ATB = < 5 seconds
HALAR▲, Maroon	702Y	94V-0 @ .18mm	AEB = 15mm ATB = < 5 seconds
Weather Resistant Acetal, Black	DT Prefix	94 HB @ 1.5mm	Avg. Burning Rate 2.8cm/min

*UL Recognized cable ties meet stated ratings. **UL Recognized -0 parts
■TEFZEL is a registered trademark of E.I. du Pont de Nemours and Company.
▲HALAR is a registered trademark of Ausimont USA, Inc.

Radiation/Moisture/Temperature/Tensile Strength

Radiation

Installed cable ties of various materials have been exposed to different amounts of radiation to determine the maximum acceptable limit. These tests were conducted by Panduit to determine the acceptability for use in various areas of nuclear power plants (for radiation exposure accumulated over a 40 year life). See Cable Tie Selection Chart (pages B1.2 and B1.3) for radiation resistance rating.

Moisture

Many plastics when exposed to high relative humidity absorb water and, as such, the tensile strength of the material can change dramatically. Nylon 6.6 when exposed to 100% relative humidity, will absorb as much as 8.5% water which will reduce tensile strength by 50% when compared to a dry cable tie. Polypropylene, HALAR▲, Type 12 Nylon, TEFZEL■, Acetal and PEEK are low water absorbing materials and, as such, the effect of water is minimal. See Cable Tie Selection Chart (pages B1.2 and B1.3) for moisture absorption.

Proper Storage

Nylon 6.6 is a hygroscopic material (affected by atmospheric moisture variations). The optimum storage requirement for Nylon 6.6 cable ties is 73°F (± 15°F) and 50% RH (relative humidity) in sealed containers. Improper storage, especially in cold/dry conditions can result in moisture loss, which impedes cable tie performance. Panduit packaging provides Nylon 6.6 cable ties conditioned to 2.5% moisture added by weight in heavy-wall, polyethylene heat-sealed bags.

Temperature

Plastic materials normally undergo property loss due to oxidation caused by exposure to high temperatures. The maximum continuous use temperature for cable tie materials depends upon the time at the elevated temperature as well as other environmental conditions. Initially, plastics become more flexible and weaker when exposed to high temperatures. After a period of time, oxidation may occur which will cause embrittlement, making plastic cable ties more susceptible to failure from impact and vibration.

The maximum continuous use temperature, is based on the UL Relative Thermal Index (mechanical without impact) as determined by UL per UL 746B. It is one indicator of a material's ability to retain a particular physical property when exposed to elevated temperatures over an extended period of time. It is based on the assumption that there is no loading, no chemical attack, and impact-free condition. The maximum continuous use temperatures for cable tie materials are listed in the Cable Tie Selection Chart (pages B1.2 and B1.3).

Low temperature exposure will also make most plastics more brittle during the exposure, but little property loss occurs when the material is returned to room temperatures. The minimum application use temperatures for cable tie materials are listed in the Cable Tie Selection Chart (pages B1.2 and B1.3).

Tensile Strength

Most cable ties are selected based on material, length, and minimum loop tensile strength. Minimum loop tensile strength was established under SAE Aerospace Standard AS23190. Each cable tie cross section (SM = Subminiature, M = Miniature, I = Intermediate, S = Standard, HS = Heavy-Standard, LH = Light-Heavy, H = Heavy and EH = Extra-Heavy) has a different loop tensile strength when tested per AS23190.

The cable tie is first conditioned at 49°C (120°F), 20% relative humidity for 24 hours, then the cable tie is installed on a split mandrel and the halves of the mandrel separated at a rate of 1 inch (25.4mm) per minute. The separating force required to unlock or break the cable tie is the loop tensile strength. Loop tensile strength is dependent both on the locking design and the tensile strength (psi) of the material. As an example, the tensile strength of polypropylene material is approximately 1/2 to 1/3 of Nylon 6.6; thus the loop tensile strength of a given cross section tie made of polypropylene would be much less than a tie made of Nylon 6.6. This is another property to be considered when selecting a cable tie. The various representative loop tensile strengths are listed in the Cable Tie Selection Chart (pages B1.2 and B1.3).

Halogen-Free

All Panduit cable ties (with the exception of TEFZEL■ and HALAR▲) are halogen-free per IEC Specification 61249-2-21.

▲HALAR is a registered trademark of Ausimont USA, Inc.
■TEFZEL is a registered trademark of E.I. du Pont de Nemours and Company.

Table C – Chemical Resistance Table

Many factors combine to determine the useful life of a cable tie material and none is as important as chemical exposure. Various chemicals will have different effects on plastics depending on such variables as chemical concentrations, temperature, stress and ultraviolet light. This table is an excellent guideline for the selection of the best cable tie material for various cable tie environments. It should be noted that the exposure for this chemical resistance chart is at 70°F (21°C).

Resistance of Panduit cable tie materials to chemical attack at 70°F (21°C)

A = Excellent
B = Satisfactory
C = Slight Attack
D = Attacked
— = Not Tested

[1] = Pitting occurs under some conditions
[2] = Attack may occur if sulfuric acid present
Aq. = Aqueous
C.S. = Cold Saturated

Agent	Percent Concentration	Nylon 6.6*	Nylon 12	Polypropylene	TEFZEL■	HALAR▲	PEEK	304 Stainless Steel	316 Stainless Steel
Acetaldehyde	90	B	—	C	A	A	A	—	—
Acetic Acid	97	D	D	A	A	A	A	A	A
Acetic Acid	10	C	B	A	A	A	—	A	A
Acetic Anhydride	90	—	B	A	A	A	—	A	A
Acetone	100	A	A	A	A	A	A	A	A
Acetophenone	100	—	—	B	A	A	—	A	A
Acetylene	100	—	—	A	A	A	A	A	A
Aluminum Chloride	10	B	A	A	A	A	A	D	C
Aluminum Fluoride	10	B	A	A	A	A	—	D	C
Aluminum Hydroxide	Aq. C.S.	—	A	A	A	A	—	A	A
Aluminum Potassium Sulfate	10	B	A	A	A	A	—	A[1]	A[1]
Ammonia	All	—	A	A	A	A	A	A	A
Ammonium Carbonate	1 to 5	—	A	—	A	A	—	A	A
Ammonium Chloride	10 to 25	D	A	A	A	A	A	A[1]	A
Ammonium Hydroxide	10	A	—	—	A	A	A	—	—
Ammonium Nitrate	100	—	A	A	A	A	A	A	A[1]
Ammonium Sulfate	10	—	A	A	A	A	A	E[1]	A
Amyl Acetate	100	—	—	C	A	A	A	A	A
Aniline	100	—	B	A	A	A	A	A	A
Antimony Trichloride	All	D	—	A	A	A	A	A	A
Arsenic Acid	1 to 80	—	—	A	A	A	—	A	A
Barium Carbonate	All	—	A	A	A	A	—	A	A
Barium Chloride	All	—	A	A	A	A	—	A[1]	A
Barium Sulfate	All	—	A	A	A	A	—	A	A
Barium Sulfide	All	—	A	A	A	A	—	A	A
Benzene	100	A	A	C	A	A	A	A	A
Benzoic Acid	100	D	A	A	A	A	A	A	A
Benzoyl Chloride	100	—	—	C	A	A	—	—	—
Benzyl Alcohol	100	—	—	A	A	A	A	—	—
Boric Acid	All	D	A	A	A	A	A	B	—
Bromine	100	D	D	D	A	A	D	D	D
Butadiene	100	—	—	C	A	A	—	A	A
Butane	100	—	A	A	A	A	A	A	A
Butanediol	100	—	—	A	A	A	—	—	—
Butyl Acetate	100	—	A	C	A	A	A	—	—
N. Butyl Alcohol	100	—	A	A	A	A	A	A	A
Butyl Phthalate	100	—	—	A	A	A	—	—	—
Butyraldehyde	100	—	—	A	A	A	—	—	—
Butyric Acid	10 to 100	D	—	A	A	A	—	A	A
Calcium Carbonate	Aq. C.S.	—	—	A	A	A	A	A	A
Calcium Chlorate	Aq. C.S.	—	—	A	A	A	—	A	A

*Includes all 6.6 Nylons (weather resistant, heat stabilized, and flame retardant).
■TEFZEL is a registered trademark of E.I. du Pont de Nemours and Company.
▲HALAR is a registered trademark of Ausimont USA, Inc.

Agent	Percent Concentration	Nylon 6.6*	Nylon 12	Polypropylene	TEFZEL■	HALAR▲	PEEK	304 Stainless Steel	316 Stainless Steel
Calcium Chloride	5	C	A	A	A	A	A	A[1]	A[1]
Calcium Hydroxide	50	—	—	A	A	A	A	A	A
Calcium Hypochlorite	2	D	—	A	A	A	A	A[1]	A[1]
Calcium Nitrate	50	—	A	A	A	A	A	—	—
Calcium Sulfate	2	C	—	A	A	A	A	A	A
Carbon Tetrachloride	100	A	A	D	A	A	A	A	A
Carbon Tetrachloride	Aq. 10	—	—	—	—	A	—	C[1]	A[1]
Chlorine	Dry	—	D	D	A	A	D	C	C
Chlorine	Wet	—	D	C	A	A	D	D	D
Chloroacetic Acid	10 to 50	D	—	A	A	A	A	D	C
Chlorobenzene	100	—	C	A	A	A	A	—	—
Chloroform	100	A	C	C	A	A	A	A	A
Chlorosulphonic Acid	10 to 100	D	D	D	B	A	D	D	D
Chromic Acid	10 to 50	D	D	A	A	A	A	C	C
Citric Acid	10 to 50	B	B	A	—	A	A	A	A
Copper Chloride	1 to 10	D	—	A	A	A	A	A[1]-D	A[1]-C[1]
Copper Cyanide	Aq. C.S.	—	—	A	A	A	A	A	A
Copper Nitrate	50	—	—	A	A	A	A	A	A
Cresol	100	D	D	—	A	A	—	A	A
Crotonaldehyde	100	—	—	A	A	A	—	—	—
Cyclohexane	100	—	A	C	A	A	A	A	—
Cyclohexanol	100	—	A	A	A	A	A	A	—
Cyclohexanone	100	—	A	C	A	A	A	A	—
Dibutyl Phthalate	100	—	—	A	A	A	A	—	—
Dichloroethane	100	—	—	A	—	A	A	A	A
Dichloroethylene	100	—	—	C	A	A	—	—	—
Diesel Fuel	100	—	A	C	A	A	A	A	A
Diethyl Ether	100	—	A	A	A	A	A	A	A
Diglycolic Acid	Aq. C.S.	—	—	A	A	A	—	—	—
Diisobytyl Ketone	100	—	—	A	A	A	—	—	—
Dimethyl Amine	100	—	—	A	A	A	—	—	—
Dimethyl Formamide	100	—	A	A	A	A	A	A	—
Dimethyl Sulfate	100	—	—	C	A	A	—	—	—
Dioctyl Phthalate	100	—	—	A	A	A	A	A	—
1.4-Dioxane	100	—	B	C	A	A	A	A	—
Ethyl Acetate	100	A	A	B	A	A	A	A	A
Ethyl Alcohol	100	A	A	A	A	A	A	A	A
Ethyl Chloride	100	—	—	C	A	A	—	A	A
Ethylene Chloride	100	A	C	C	A	A	—	A	A
Ethylene Glycol	100	A	A	A	A	A	A	A	A
Ethylene Oxide	100	—	—	C	A	A	A	—	—
Fatty Acids	100	—	—	A	A	A	—	—	—
Ferric Chloride	50	D	—	A	A	A	C	D	D
Ferric Hydroxide	All	—	—	A	A	A	—	A	A
Ferric Nitrate	All	—	—	A	A	A	A	A	A
Ferrous Chloride	Aq. C.S.	D	—	A	A	A	A	D	C
Ferrous Sulfate	10	—	—	A	A	A	A	A[1]	A
Fluorine (Dry)	100	—	—	D	A	—	D	D	D
Formaldehyde	40	A	B	A	A	A	A	A[1]	A
Formic Acid	All	D	D	A	A	A	C	A	A
Freons	100	A	—	—	A	A	A	—	—
Fuel Oil	100	—	A	—	A	A	A	A	A
Furfural	100	A	—	—	A	A	—	A	A
Gallic Acid	Aq. C.S.	—	—	—	A	A	—	A	A
Gasoline	100	A	—	C	A	A	A	A	A
Glycerin	100	—	A	A	—	A	—	A	A
Glycolic Acid	40	D	—	A	A	A	—	—	—
Heptane	100	—	A	A	A	A	A	A	A
Hexane	100	—	A	A	A	A	A	A	A
Hydrobromic Acid	All	D	D	A	A	A	D	D	D

*Includes all 6.6 Nylons (weather resistant, heat stabilized, and flame retardant).

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▲HALAR is a registered trademark of Ausimont USA, Inc.

Table continues on page B1.106

Table C – Chemical Resistance Table (continued)

Agent	Percent Concentration	Nylon 6.6*	Nylon 12	Polypropylene	TEFZEL■	HALAR▲	PEEK	304 Stainless Steel	316 Stainless Steel
Hydrochloric Acid	All	D	D	A	A	A	A	D	D
Hydrocyanic Acid	All	—	D	A	A	A	A	C	C
Hydrofluoric Acid	All	D	D	A	A	A	D	D	D
Hydrofluorosilicic Acid	30	—	D	A	A	A	—	D	D
Hydrogen Peroxide	30	D	B	B	A	A	A	B	A
Hydrogen Sulfide	Dry	—	—	A	A	A	A	A	A
Hydrogen Sulfide	Wet	D	—	A	A	A	—	C[2]	A[2]
Hydroquinone	100	—	—	A	A	A	—	—	—
Iodine	100	—	—	A	A	A	C	D	D
Iodoform	100	—	—	—	A	A	—	A	A
Isopropyl Alcohol	100	A	A	A	A	A	A	A	A
Jet Fuel	100	A	—	A	A	A	A	A	A
Lactic Acid	10	A	B	A	A	A	—	A	A
Lanolin	10	A	A	A	A	A	—	A	A
Lead Acetate	Aq. C.S.	—	—	A	A	A	A	A	A
Linseed Oil	100	A	A	A	A	A	—	A	A
Magnesium Carbonate	Aq. C. S.	—	A	A	A	A	—	A	A
Magnesium Chloride	Aq. C.S.	C	A	A	A	A	A	A[1]	A[1]
Magnesium Nitrate	Aq. C. S.	—	A	A	A	A	—	A	A
Maleic Acid	100	—	—	A	A	A	A	—	—
Malic Acid	Aq. C.S.	—	—	A	A	A	—	A	A
Mercuric Chloride	Dilute	—	A	A	A	A	A	D	D
Mercury	100	—	A	A	A	A	A	A	A
Methyl Alcohol	100	A	A	A	A	A	A	A	A
Methyl Bromide	100	—	—	D	A	A	—	—	—
Methyl Chloride	100	—	—	C	A	A	—	—	A
Methyl Chloroform	100	A	—	C	A	A	—	—	—
Methyl Ethyl Ketone	100	—	A	C	A	A	A	A	A
Methyl Isobutyl Ketone	100	A	—	C	A	A	—	A	A
Methylene Chloride	100	C	D	C	A	A	A	A	A
Naphtha	100	—	—	A	A	A	A	A	A
Naphthalene	100	—	B	A	A	A	A	A	A
Nickel Chloride	Aq. C.S.	—	A	A	A	A	A	A[1]	A[1]
Nickel Sulfate	Aq. C.S.	—	A	A	A	A	A	A[1]	A[1]
Nitric Acid	10 to 30	D	D	A	A	A	—	A	A
Nitric Acid	30 to 68	D	D	D	B	A	C	A	A
Nitro Benzene	100	—	C	C	A	A	A	A	A
Nitro Methane	100	A	—	—	A	A	—	—	—
Nitrous Acid	5	—	—	—	A	A	A	A	A
Oleic Acid	100	—	C	A	A	A	A	A	A
Oxalic Acid	10	—	C	A	A	A	A	A	A
Oxygen	All	—	—	A	A	A	A	—	—
Paraffin	100	A	A	A	A	A	—	A	A
Perchloroethylene	100	—	—	C	A	A	A	A	A
Petroleum Ether	100	—	A	A	A	A	A	A	A
Phenol	90	D	D	A	A	A	D	A	A
Phosphoric Acid	10	D	D	A	A	A	A	A	A
Phosphorous Pentoxide	100	—	D	A	A	A	A	—	—
Phosphorous Trichloride	100	—	D	C	A	A	—	A	A
Phthalic Acid	50	—	—	C	A	A	—	A	A
Picric Acid	1	—	—	A	A	A	A	A	A
Potassium Borate	1	—	—	A	A	A	—	—	—
Potassium Bromide	Aq. C.S.	—	—	A	A	A	A	A[1]	A[1]
Potassium Carbonate	Aq. C.S.	—	C	A	A	A	A	A	A
Potassium Chlorate	Aq. C. S.	—	B	A	A	A	A	A	A
Potassium Chloride	5	—	A	A	A	A	A	A[1]	A[1]
Potassium Dichromate	Aq. C.S.	—	D	A	A	A	A	A	A
Potassium Ferrocyanide	25	—	—	A	A	A	A	A	A
Potassium Hydroxide	30	C	—	A	A	A	A	C	C

*Includes all 6.6 Nylons (weather resistant, heat stabilized, and flame retardant).
■TEFZEL is a registered trademark of E.I. du Pont de Nemours and Company.
▲HALAR is a registered trademark of Ausimont USA, Inc.

Agent	Percent Concentration	Nylon 6.6*	Nylon 12	Polypropylene	TEFZEL■	HALAR▲	PEEK	304 Stainless Steel	316 Stainless Steel
Potassium Iodide	Aq. C.S.	—	A	A	—	A	—	A	A
Potassium Nitrate	Aq. C.S.	—	A	A	A	A	A	A	A
Potassium Perchlorate	1	—	—	A	A	A	—	—	—
Potassium Permanganate	5	D	D	A	A	A	A	A	A
Potassium Persulfate	All	—	—	A	A	A	—	—	—
Potassium Sulfate	Aq. C.S.	—	A	A	A	A	A	A	A
Potassium Sulfide	Aq. C.S.	—	—	A	A	A	A	A	A
Propionic Acid	50	—	—	A	A	A	—	—	—
Propyl Alcohol	100	A	—	A	A	A	A	A	A
Pyridine	100	—	A	C	A	A	A	C	C
Sea Water	100	—	A	A	A	A	—	A[1]	A[1]
Silver Chloride	Aq. C.S.	—	A	A	A	A	—	D	D
Silver Nitrate	10	—	A	A	A	A	A	A	A
Sodium Acetate	Aq. C.S.	A	—	A	A	A	A	A[1]	A
Sodium Benzoate	Aq. C.S.	—	—	A	A	A	—	—	—
Sodium Bicarbonate	Aq. C.S.	A	A	A	A	A	A	A	A
Sodium Bisulfate	10	—	—	A	A	A	—	A	A
Sodium Bisulfite	Aq. C.S.	—	B	A	A	A	—	A	A
Sodium Borate	Aq. C.S.	—	—	A	A	A	—	A	A
Sodium Carbonate	2	A	A	A	A	A	A	A	A
Sodium Chlorate	25	—	C	A	A	A	A	A	A
Sodium Chloride	10	A	A	A	A	A	A	A[1]	A[1]
Sodium Chromate	Aq. C.S.	D	—	A	A	A	—	A	A
Sodium Fluoride	5	—	—	A	A	A	—	A[1]	A[1]
Sodium Hydroxide	10	A	A	A	A	A	A	A	A
Sodium Hypochlorite	5	B	C	A	A	A	A	C[1]	A[1]
Sodium Hyposulfite	Aq.C.S.	—	—	—	A	A	—	A	A
Sodium Nitrate	5	A	A	A	A	A	A	A	A
Sodium Perborate	Aq. C.S.	—	B	A	A	A	—	—	C
Sodium Perchlorate	10	—	—	—	A	A	—	A	A
Sodium Phosphate	5	—	A	A	A	A	—	A	A
Sodium Sulfate	5	—	A	A	A	A	A	A	A
Sodium Sulfide	5	—	A	A	A	A	A	A[1]	A
Sodium Thiosulfate	25	—	A	A	A	A	—	A[2]	A[2]
Stannic Chloride	Aq. C.S.	D	—	A	A	A	A	D	C
Stannous Chloride	Aq. C.S.	—	A	A	A	A	A	C	B
Stearic Acid	100	—	C	A	A	A	—	A	A
Succinic Acid	100	—	B	A	A	A	—	—	—
Sulfur	100	—	A	A	A	A	A	B	C
Sulfur Dioxide	All	D	—	C	A	A	A	A	A
Sulfuric Acid	5	D	C	A	A	A	C	C	A
Sulfuric Acid	50	D	D	A	A	A	D	D	C
Sulfuric Acid	Concentrate	D	D	C	A	A	D	C	C
Sulfurous Acid	10	A	—	A	A	A	A	C[1]	A[1]
Tannic Acid	10	—	A	A	A	A	A	A	A
Tartaric Acid	50	—	B	A	A	A	A	A	A
Tetrahydrofuran	100	—	C	C	A	A	A	A	A
Toluene	100	A	A	C	A	A	A	A	A
Trichloroacetic Acid	10	D	—	B	A	A	—	D	D
Trichloroethylene	100	—	D	C	A	A	A	A[1]	A[1]
Turpentine	100	—	B	D	A	A	A	A	A
Urea	50	—	A	A	A	A	—	—	—
Vinyl Acetate	100	—	—	A	A	A	—	—	—
Xylene	100	A	—	D	A	A	A	A	A
Zinc Chloride	70	D	A	A	A	A	A	A	A
Zinc Nitrate	Aq. C.S.	—	A	A	A	A	—	A	A
Zinc Sulfate	Aq. C.S.	—	A	A	A	A	A	A	A

*Includes all 6.6 Nylons (weather resistant, heat stabilized, and flame retardant).
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