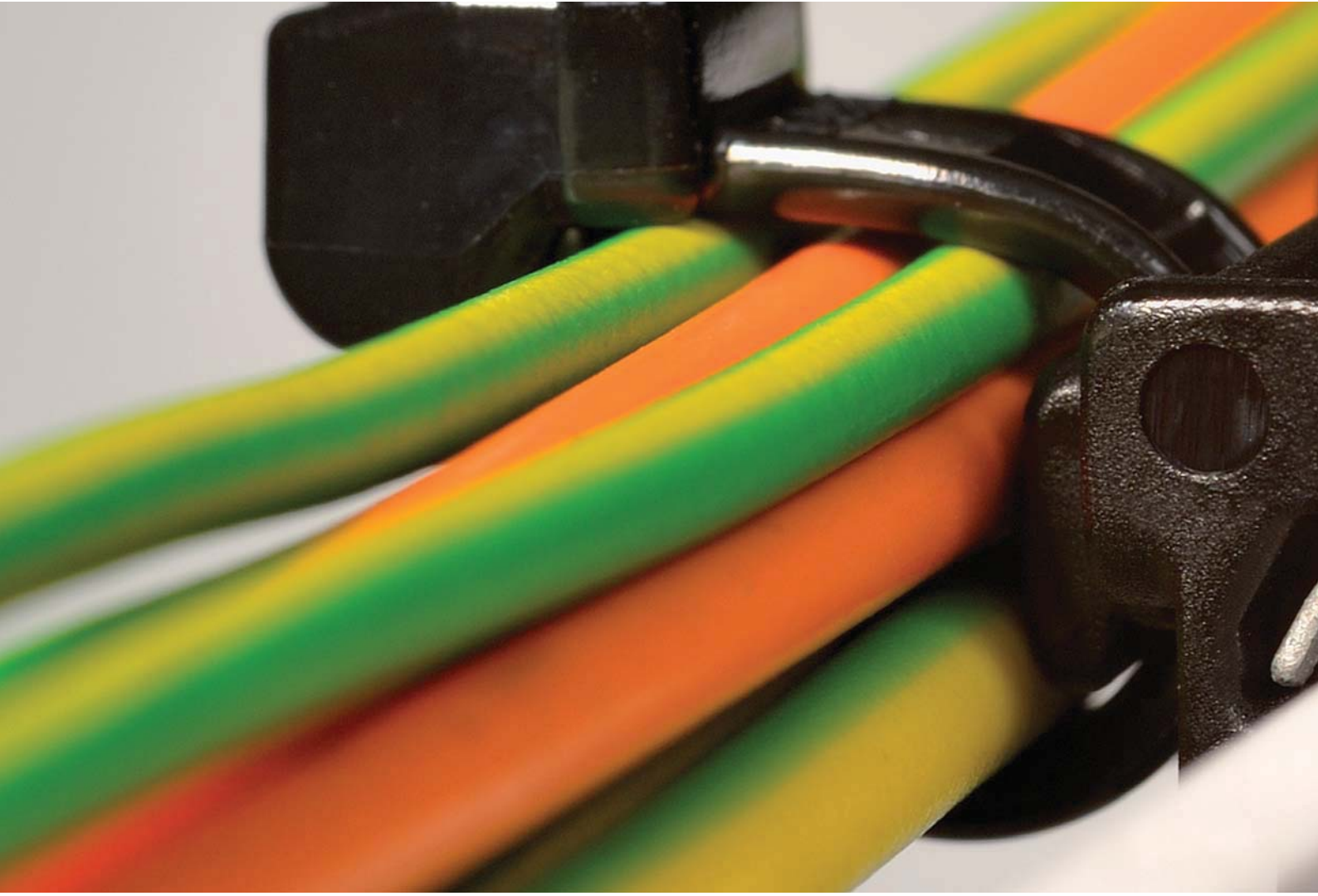


Cable ties and fixings 1

Date of issue: Juni 2012

HellermannTyton

Properties of polyamide PA66

Polyamides are among the most important thermoplastic synthetic materials. Thermoplastics can be reshaped by heating as often as required without undergoing chemical decomposition or other negative changes. This makes polyamide ideal for processing via injection moulding into high-quality products. About 90% of cable ties and fixings from **HellermannTyton** are made from this material. Polyamide is also known under the brand name of Nylon®, which was introduced by the Dupont company.

The inner structure of polyamide displays a partial order of polymer chains, i.e. polyamides are partially crystalline. Due to the tighter packing of the individual molecular chains polyamide only has limited transparency to light. The plastic is therefore described as translucent.

The molecular chains of PA66 are made from two base units:

[-NH(CH2)6NH-CO(CH2)4CO]

1st base unit with 6 C atoms	2nd base unit with 6 C atoms

Each base unit contains 6 carbon atoms (C). Hence the name PA66.

The polyamide PA66 has many properties which are highly advantageous for **HellermannTyton** cable ties and fixings, such as:

- High strength, rigidity and hardness
- High dimensional stability, even under the effect of heat
- High abrasion resistance

A wide-ranging selection of polyamides and additives allows for an optimum adaptation of the properties of the finished product to suit the respective requirements.

The following PA66 variants are used for **HellermannTyton** products:

- Polyamide 6.6 standard (PA66) for temperature conditions of up to +85°C
- Polyamide 6.6 heat-stabilised (PA66HS) for temperature conditions of up to +105°C
- Polyamide 6.6 UV-stabilised (PA66W) for exterior use
- Polyamide 6.6 heat-stabilised and UV-stabilised (PA66HSW) for exterior use up to +105°C
- Polyamide 6.6 impact-resistant (PA66HIR) for high elasticity requirements
- Polyamide 6.6 impact-resistant and heat-stabilised (PA66HIRHS) for high elasticity requirements and temperatures up to +105°C
- Polyamide 6.6 V0 for high standards of fire protection.

Water content in polyamide

Polyamide is a hygroscopic material - this means that it absorbs and releases water. The mechanical properties are significantly affected by the water content – especially flexibility and minimum tensile strength. In a standard atmosphere of 23°C and 50% relative humidity, the degree of water saturation of polyamide is around 2.5%. For optimal processing of cable ties it is therefore important that the polyamide has a water content of approximately 2.5% in a state of equilibrium.

The quality and functionality of the products are thus affected by the water content, therefore the correct storage of our products is crucial. Please read our separate instructions on storage.

Since humidity is so critical to the quality of the tie, the question arises: What happens if the tie is installed and the water content in the tie alters?

The water content determines the flexibility and strength of a tie. At a water content of approximately 2.5% the tie has the ideal flexibility for installation. When the strap is being threaded through the head of the tie, the pawl must be flexible enough to "see-saw" over the serration of the strap without breaking. On the other hand, there must also be adequate material rigidity for the serrations of the pawl to engage with the serrations of the strap during the tying process so that a 'positive locking' action is achieved. After achieving the positive locking action the tie is in a static condition. Changes in the mechanical properties of the tie as a function of water content are insignificant during this status.

For more details on the materials, see page 21.

Properties of UV-stabilised polyamide (PA66W)

The question constantly arises as to whether a black cable tie is suitable for use outside. This is dependant on the application of the tie, but in general the following statements can be made:

A black cable tie made of polyamide 6.6 standard (PA66) is only coloured black with a low proportion of carbon black. This is not sufficient to protect the material from damage caused by UV-radiation in the long term.

Products made from UV-stabilised polyamide PA66W are produced in accordance with ASTM standard D6779 with a higher carbon black percentage of approx. 2%. So they resist UV-radiation in the European area for a considerably longer period than standard PA66.

This is clearly illustarted by the comparison of the two images on the right:

After 500 hours of UV- radiation exposure

Polyamide 6.6 standard (PA66) dyed black:

The joint has been damaged throughout by UV-radiation.

Polyamide 6.6 UV-stabilised (PA66W) with approx. 2% carbon black:

The joint has only been altered at isolated points by the UV-radiation.

For outdoor use, therefore, we recommend our range of products made from UV-stabilised polyamide (PA66W).

A simple practical test: "the hammer test"

You can quickly determine whether or not a cable tie is UV stabilised. Strike with a hammer the tail of the strap on the tie. Hold up this flattened end to the light. Cable ties with a carbon black content of about 2% allow no light through and look black throughout. Standard black ties, however, are transparent on the flattened end.

Properties of polyamide PA12

Apart from PA66, there are polyamides which are less hygroscopic. These include PA12, which has a molecular chain made of a base unit with 12 carbon atoms:

[-NH(CH2)11CO-]

PA12 has the following advantages over PA66:

- Less hygroscopic - saturation at 23°C and 50% relative humidity is approximately 1%.
- Better impact performance.
- Good weather resistance, even without a special additive.

These three properties make PA12 ideal for use outdoors, in particularly when requirements may include impact resistance.

The water absorption of PA12 is not only less than that of PA66 but also slower. This is the requirement where the mechanical properties need to remain relatively unaffected by changing environmental conditions.

Properties of polyamide PA46

Polyamide PA66, despite the use of additives, is not suitable for long-term use in temperatures of +105°C. Due to considerably better heat resistance, polyamide PA46 is more suitable for temperatures of up to and exceeding 150°C (depending on the length of time of operation).

The molecular chain of PA46 is composed of two base units:

[NH-(CH2)4NH-CO-(CH2)4-CO-]

1st base unit	2nd base unit
with 4 C atoms	with 6 C atoms

Advantages of PA46 over PA66:

- Greater rigidity, even at higher temperatures.
- Higher operating temperature ranges of up to +150°C (5,000 hours).
- Greater form stability at higher temperatures.
- Excellent chemical resistance.

Properties of Polyetheretherketone PEEK

PEEK, a linear aromatic polymer is semi-crystalline and is widely regarded as the highest performance thermoplastic material currently available. A summary of key physical properties is as follows:

High temperature performance

- Melting temperature of 343 °C (649 °F).
- Continuous Use Temperature of 240 °C (464 °F) (UL 746B).

Wear resistance

- Outstanding wear resistance over wide ranges of pressure, velocity, temperature and counter facial roughness.

Chemical resistance

- Excellent resistance to a wide range of chemical environments, even at elevated temperatures.
- The only common environment that dissolves it is concentrated sulfuric acid.

Fire, smoke and toxicity

- Highly stable and requires no flame-retardant additives to achieve a V-0 rating at 1.45 mm thickness.
- The composition and inherent purity of the material results in extremely low smoke and toxic gas emission in fire situations.

Hydrolysis resistance

- PEEK is not attacked by water or pressurized steam.
- Components that are constructed from these materials retain a high level of mechanical properties when continuously conditioned in water at elevated temperatures and pressures.

Purity

- PEEK materials are inherently pure with exceptionally low levels of ionic extractables.
- Excellent out gassing characteristics.

This makes PEEK the right choice for any high performance application in any industry with a clearly outstanding continuous use temperature of 260 °C.

Radiation Resistance

- Excellent Radiation Resistance due to the energetically stable chemical structure of PEEK.

Properties of Ethylenterafluorine-ethylen (E/TFE)

E/TFE can be best described as a rugged thermoplastic with an outstanding balance of properties.
Mechanically, it is tough, has medium stiffness, impact and abrasion resistance.

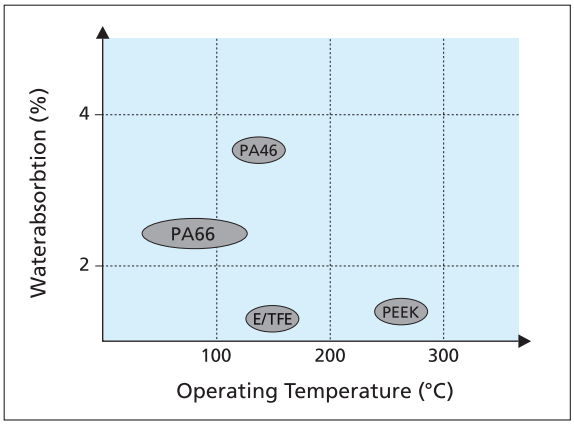
Summary of key properties:

- No load continuous use temperature of 150 °C.
- Weather resistant
- Inert to most solvents and chemicals
- Hydrolytically stable
- Substantially better resistance to radiation than other plastic materials.

E/TFE can perform successfully in applications where other materials are lacking in mechanical toughness, broad thermal capability, ability to meet severe environmental conditions.

General linguistic usage for cable ties made from raw material E/TFE is Tefzel®-Tie. In additon to Tefzel® from DuPont HellermannTyton is also using equivalent E/TFE raw material from other suppliers.

Tefzel® is a registered trademark of DuPont.

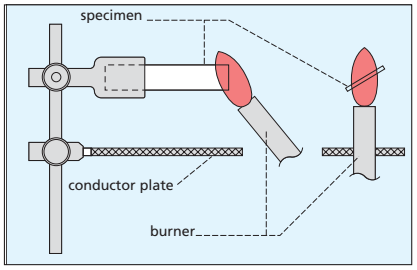


What does Flammability UL94 mean?

UL is the shortcut for Underwriters Laboratories. This is an independent organisation in the United States to control and certificate product safety.

Beside a lot of product standards UL also specified the flammability test UL94 for plastic materials. UL94 is a material burning test done on defined specimen of the raw material but not a test on final products.

UL94 differs between a horizontal burning test UL94 HB (picture 1) and a vertical burning test UL94 V (picture 2).
For the vertical test UL94 V there are three flame ratings defined: UL94 V0, UL94 V1 and UL94 V2.

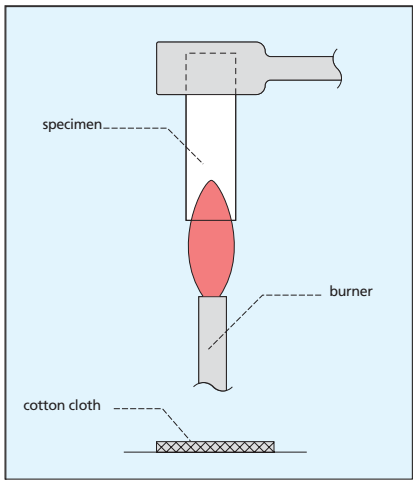


UL94 HB:

horizontal burning test

Test criteria:
• burning rate of specimen in mm/min.

Classification:
• according to HB



UL94 V:

Vertical burning test

Test criteria:
• afterflame time of specimen
• drip of flaming particles

Classification:
• according to V0, V1 or V2

In all these burning test s an open flame is applied for a certain time to the specimen. As the burning behaviour also depends on the thickness of the material it is important to classify the material not only according to HB, V0, V1 or V2 but also to mention the thickness of specimen.

Following table is a summary of test procedures and requirements of the above four UL94 classification.

	Horizontal Test UL94		Vertical Test UL94		
Classification	HB		V0	V1	V2
Number of specimen	3	3	5	5	5
Thickness of specimen	< 3 mm	3 to 13 mm		up to max. 13 mm	
1st flame application	30 sec.	30 sec.	10 sec.	10 sec.	10 sec.
2nd flame application	-	-	10 sec.	10 sec.	10 sec.
Burning rate	max. 75 mm/min	max. 40 mm/min	-	-	-
Afterflame time after 1st flame application for each individual specimen	-	-	max. 10 sec.	max. 30 sec.	max. 30 sec.
Afterflame time after 2nd flame application for each individual specimen	-	-	max. 30 sec.	max. 60 sec.	max. 60 sec.
Total afterflame time for all 5 specimen after 1st and 2nd flame application	-	-	max. 50 sec.	max. 250 sec.	max. 250 sec.
Afterflame or afterglow of any specimen up to its end allowed	yes	yes	no	no	no
Cotton indicator ignited by flaming particles or drops allowed	-	-	no	no	yes

Flammability behaviour on the following product pages are always related to the raw material burning rate according to UL94.
Most commonly used raw materials for cable ties and fixing elements are Polyamide 6.6 standard, Polyamide 6.6 weather resistant and Polyamide 6.6 heat stabilised. These materials normally fulfill UL94 V2 requirement.

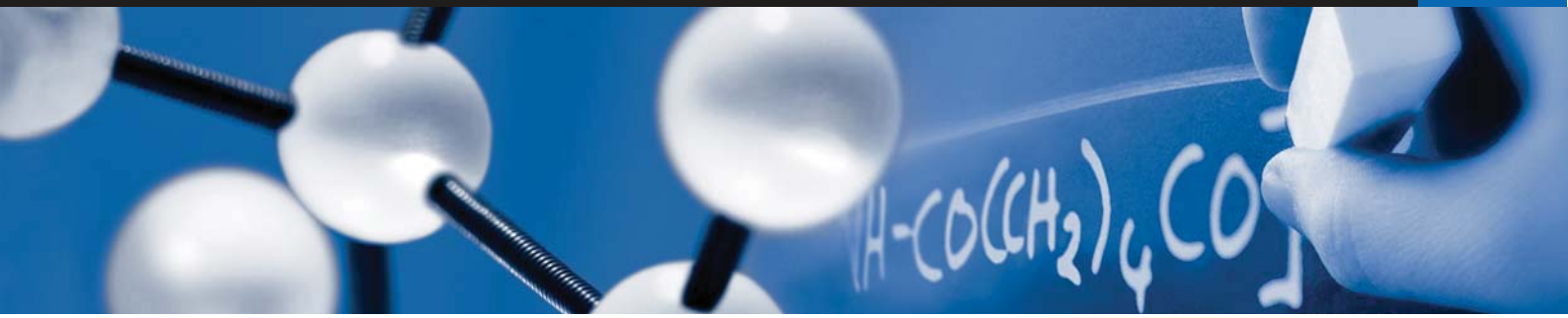
Chemical resistances of various plastics

+ = resistant
o = partly resistant
- = not resistant

These values are only rough guides. They should be regarded as a material specification and are no substitute for a suitability test. Please see our technical datasheets for further details.

Medium	Conc. [%]	Temp. [°C]	PA66	PA46	PA12	POM	PP	TPU	E/TFE (Tefzel®)	PEEK
Acetaldehyde, liquid	100	23	+	-		+	o	-	+	+
Acetone	100	23	+	+	+	+	+	-	+	+
Allyl chloride	100	23					+	-		
Formic acid	98	23	-		-	-	+	-	+	o
Aniline	100	23	+	o	o	o	+	-	+	+
Aromatic compounds						+	-		+	+
Benzaldehyde	any	23	+	o		+	+	-	+	+
Benzine/Benzol mix		23	+	+	+	+	o	o	+	+
Benzol	100	23	+		+	o	o	-	+	+
Bromine		23		-	-		-	-		
Chlorine, gaesous	100	23					-	o	+	
Chlorine, liquefied	100	23		-			-			
Chlorobenzene	100	23			-	o	+			
Chloroform	100	23		-	-	-	o			
Chromic acid	10	20	o	-		o	+		+	+
Chromic acid	20	23	-	-		-	+		+	+
Chromic acid	50	20	-	-		-	+		+	
CFC							o			
Cyclohexane	100	23	+			+	+	+	+	+
Cyclohexanone	100	23	+			+	+		+	+
Decahydronaphthlene	100	23	+			+	o		+	+
Diethyl ether	100	23	+			+	o		+	+
Di-isopropyl ether	100	23					o			
Dimethyl formamide	100	23	+	+		+	+		+	+
Dioctyl phthalate		23	+	+		+	+	-	+	+
Ethanonic acid	10	20	-	o	o	+	+		+	
Ethanonic acid	25	20	-			o	+		+	
Ethanonic acid	50	20	-			o	+		+	
Ethanonic acid	100	23	-	-		o	+		+	
Ethyl acetate	tech. pure	23		+	+	o	o			+
Freon		23					+			+
Heptane	100	23	+	+	+	+	+		+	+
Potass. Permanganate	<= 6	23	-	-	-	+	+		+	+
Ketone			+	+		+	+		+	+
Methylethylketone	100	23	+	+		o	+	-	+	+
Methyisobutylketone	100	23	+			+	+		+	+
Engine oil	100	23			+	+	+			+
Nitrobenzene	100	23	+	o		+	+	-	+	+
Ordinary petrol		23		+		+	+			+
Paraffin oil		23	+	+	+	+	+		+	+
Perchloroethylene		23	+		+	+	o	-	+	+
Petroleum		23	+	+	+	+	+		+	+
Phenol	approx. 70	23	-	-	-	-	+	-	+	
Nitric acid	10	20	-		-	-	+	-	+	+
Nitric acid	50	23	-		-	-	-	-	+	-
Carbon bisulphide	100	23	+	-	+	+	-	-	+	+
Sulphuric acid	10	20	-		o	-	+	+	+	o
Sulphuric acid	50	20	-			-	+	+	+	-
Sulphuric acid	96	23	-	-		-	-	+	+	-
Silicon oil		23	+	+	+	+	+	+	+	+
Salad oil		23		o			+			+
Carbon tetrachloride	100	23	+	+	o	+	o	-	+	+
Toluol	100	23	+		+	+	o	-	+	+
Trichlorethylene	100	23	+	o	o	o	o	-	+	+
Water, cold			+		+	+				+
Water, hot							+			+
Hydrogen peroxide	10	20	o			+	+		+	
Hydrogen peroxide	30	23	-	-		+	+	+	+	
Xylene	100	23	+	+	+	+	o	-	+	+

Tefzel® is a registered trademark of DuPont.
General linguistic usage for cable ties made from raw material E/TFE is Tefzel®-Tie. In additon to Tefzel® from DuPont HellermannTyton is also using equivalent E/TFE raw material from other suppliers.



Introduction to the main locking technologies used for cable ties

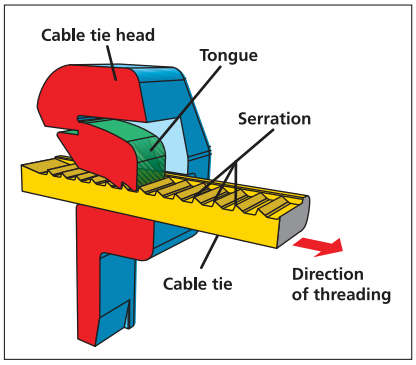
HellermannTyton offers a wide range of cable ties for use in different applications. By constantly refining our products and satisfying the ever-changing demands of the market, various locking technologies have been developed. Below you will find a brief overview of three most common locking technologies and their characteristics.

Cable ties with plastic pawls

This technology is used in 90% of all polyamide (PA) cable ties aupplied by HellermannTyton. In order to cover a variety of applications, there are different variants of this system, for example: releasable versions, in-line versions, open head versions. These are one-piece cable ties, that is the pawl is moulded as an integral part of the cable tie, thereby building in inherent strengths.

Locking technology

Positive locking is achieved by engaging the pawl with the strap serrations. This allows the cable tie to perform to the published minimum tensile strength, that is the loading that the cable tie can hold under application (see page 0000).

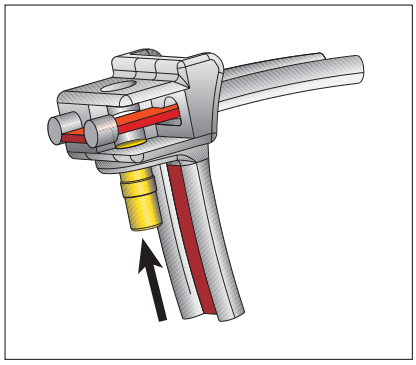


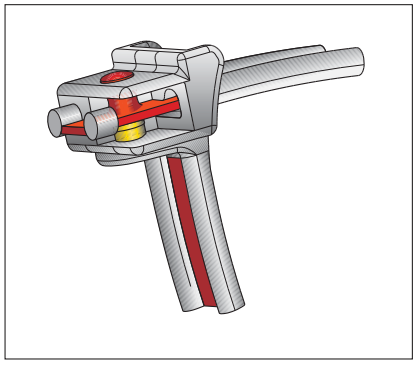
KR series cable ties

This cable tie is distinguished by its smooth strap and unique locking mechanism. With the KR series the chamfered head achieves an especially firm fit around the bundled material.

Locking technology

This patented lock technology takes advantage of the excellent deformation properties of polyamide (PA). Here, the glass fibre-reinforced (GRP) locking pin (yellow) is forced into the strap by the use of an application tool - either the KR6/8 or KR8PNSE (see page 0000). The strap is deformed into the head of the tie by the application of the pin, thereby locking the cable tie in position and allowing for the bundling heavy loads.





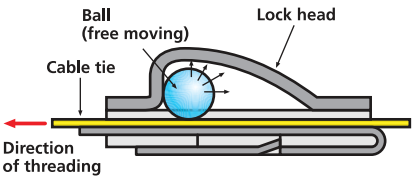
MBT series of cable ties

Made of stainless steel grades 304 or 316, the MBT range of cable ties have no serrations on the strap and are threaded parallel through the head, gliding under a metal ball-bearing locking mechansm. By using the MK9SST application tool the cable tie is tensioned and the strap cut to a flush finish.

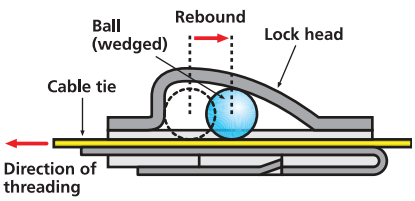
Locking technology

The strap is locked into the head by means of the small ball-bearing. The ball locks into the small end of the wedged shaped housing, forming a positive locking with the strap.
This cable tie is not suitable for rigid objects. Retraction of the ball-bearing (see drawing) is required into the small end of the wedged shaped housing to allow for a positive locking of the strap and also to make a flush cut of the end of the strap. Retraction, therefore, cannot take place with the bundling of inflexible materials. To bundle rigid objects LFPC channel should be laid as buffer between strap and bundled material to compensate for this retraction. This locking technology allows for minimum tensile strengths of up to 5400 Newton.

1. Initial position



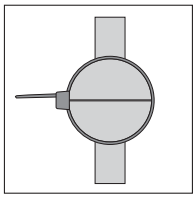
2. Ball locks cable tie by wedging.



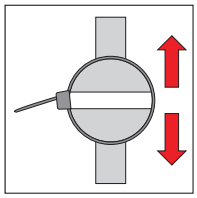
Determination of minimum tensile strength

The minimum tensile strength is a critical selection criterion for cable ties. It expresses how much loading a cable tie can bear. This minimum tensile strength is determined in accordance with the Military Specification and Standards of the USA. Test conditions being laid down precisely in MIL-S-23190E:
- Conditioning of the test pieces
- Construction of the test apparatus
- Application of the tie on a split test probe
- Test speed

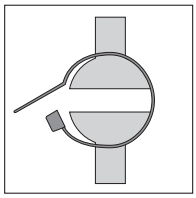
The test procedure to determine minimum tensile strength



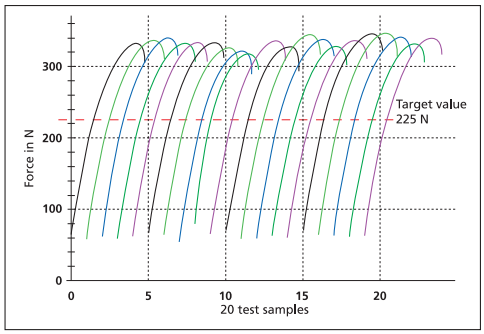
The cable tie is fixed onto a split mandril test probe with the suitable cable tie application tool.



The mandril is opened at a defined speed.



The loading at which the cable tie fails is determined. This value is stated in Newtons (N) and is recorded through a computer programme reading the tests. This programme produces graphs as outlined below.



Typical measurement protocol of a T50R made of PA66 with a minimum tensile strength of 225 N.

Explanation of minimum tensile strengths

What does a minimum tensile strength of 225 N (50LBS) mean?

To explain what this value means, the mass with which the tie can be loaded is calculated. The unit of measurement of the mass is stated in kg. To do so, the unit Newton (N) is shown in the following way:

[N] = [kg * m/s²]

The formula for calculating the mass is:

Mass = minimum tensile strength/ acceleration due to gravity

The acceleration due to gravity is 9.81 m/s²:

Mass = minimum tensile strength/ [kg * m/s²] /9.81 [m/s²]

At a minimum tensile strength of 225 N 50LBS) the mass is:

Mass = 225 [kg * m/s²] /9.81 [m/s²]

The units m/s² cancel each other out, leaving the unit [kg] for the mass. Thus:

Mass = 225/9.81 kg = 22.9 kg

Therefore, a T50R cable tie with a minimum tensile strength of 225 N (50LBS) can be loaded with 22.9 kg.
Conversely, with the required loading capacity the minimum tensile strength can be calculated by a mass:

Min. tensile strength = mass * 9.81[m/s²]

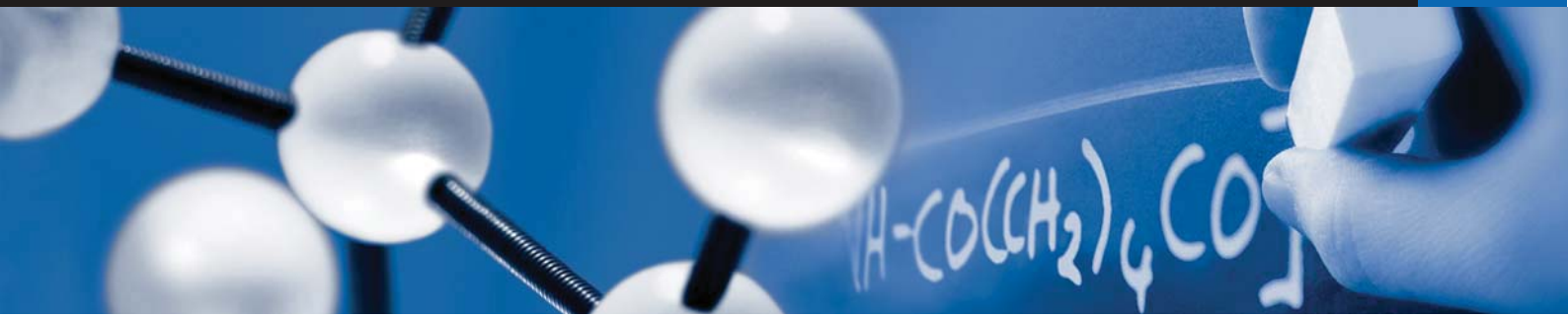
If the tie is to be loaded with, for example, 53 kg this produces:

Minimum tensile strength = [53 kg] * 9.81 [m/s²] = 520 N

In order to withstand a load of 53 kg, the tie must therefore have a minimum tensile strength of 520 N. In this case, select our T120R with a minimum tensile strength of 535 N (120LBS).

225 N/9,81 = 22,9 kg

53 kg * 9.81 = 520 N



Optimum storage conditions for cable ties made of polyamide (PA)

HellermannTyton cable ties, fastenings and fixings are manufactured from high-quality polyamide (PA). This industrial synthetic material is mainly processed using injection moulding, but can also be extruded.

Polyamide is a hygroscopic material. This means that the material absorbs and loses moisture. For optimum handling of cable ties it is important that the material is in a condition of equilibrium with a water content of approximately 2.5%.

The packaging used by **HellermannTyton** ensures that the water content in the material remains constant. Therefore, it is important to store the products in their original packaging to preserve the quality of the ties.

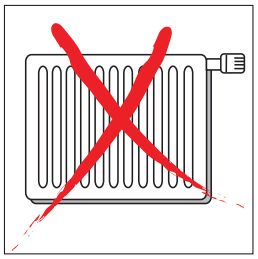
Always store ties in the sealed plastic bag made of polyethylene!

Once opened you should use the ties as quickly as possible.

Do not expose the product to direct sunlight

Do not store the product in sunlight; for example, on the windowsill.

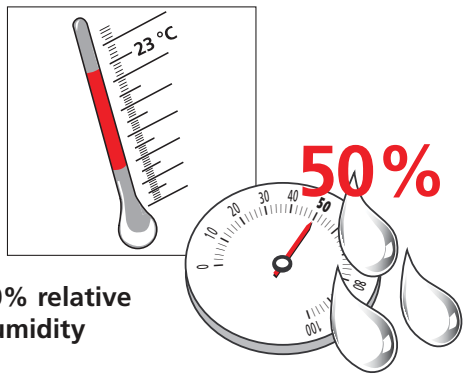
Store the product away from direct sources of heat



Avoid contact with heat: for example, do not place on the radiators.

The ideal storage conditions are those of the central European standard climate:

23 °C



50% relative humidity

HellermannTyton cable ties conform to DIN EN 50146 standard

HellermannTyton are a supplier of high-quality solutions for the routing, oganising and securing of cables, hoses and pipes. The level of quality has been inspected by the VDE (Verband der Elektrotechnik, Elektronik, Informationstechnik e.V) [German Association for Electrical, Electronic and Information Technologies].

Cable ties from the inside-serrated T-Series and the outside-serrated OS-Series have been tested in accordance to the cable tie standard DIN EN 50146 (VDE 0604 PART 201):2000-12; EN 50146:1999-08. The result of this independent testing is complete compliance:

These cable ties therefore qualify to bear the VDE symbol.

In addition to cable ties made of the standard material polyamide 6.6 (PA66), ties made from heat-stabilised (PA66H) and UV-stabilised polyamide 6.6 (PA66W) have been successfully tested and approved.
HellermannTyton is the only manufacturer to offer cable ties with inside and outside serration with DIN approval. So all current applications in the field of electrical installation are covered.

The standard includes the following tests:

- Test of minimum installation temperature
- Test of minimum application temperature
- Minimum tensile strength
  (in the standard this is described as the looping test)
- Load test and heat ageing test
- Temperature cycle test
- Contribution to spread of fire
- Corrosion resistance

The following HellermannTyton cable ties have been tested and certified:
T-Series inside-serrated cable ties
(see page 67-73) in the qualities:

Polyamide 6.6 (all colours) 38 types x 11 colours	=	418 cable ties
Polyamide 6.6 heat-stabilised (all colours) 38 types x 11 colours	=	418 cable ties
Polyamide 6.6 UV-stabilised (black) 38 types in black	=	38 cable ties
Total number of cable ties in T-Series to DIN standard		**874 cable ties**

OS-series outside-serrated cable ties
(see page 83-84)

Polyamide 6.6 heat-stabilised (all colours)7 types x 11 colours	=	77 cable ties
Total number of cable ties in OS series to DIN standard	=	77 cable ties
Total number of HellermannTyton cable ties to DIN standard		**951 cable ties**

For further information on materials, see page 21.

Material specifications				
Material	**Operating Temperature**	**Colour**	**Flammability**	**Material Properties***
Ethylene-Tetrafluorineethylene - E/TFE (Tefzel®)	-80 °C to +150 °C, continuous	Blue (BU)	UL94 V0	• Resistance to radioactivity • UV- resistant, not moisture sentitive • Good chemical resistance to: acids, bases, oxidizing agents
Polyamide 6.6 high impact modified (PA66HIR)	-40 °C to +80 °C, intermittent +105 °C (for 500 h)	Black (BK)	UL94 HB	• Limited brittlenes sensitivity • Good at low temperature
Polyamide 6.6 high impact modified, heatstabilised (PA66HIRHS)	-40 °C to +105 °C	Black (BK)	UL94 HB	• Limited brittlenes sensitivity • Good at low temperature • Modified elevated max. temperature
Polyacetal (POM)	-40 °C to +90 °C, intermittent +110 °C (for 500 h)	Natural (NA)	UL94 HB	• Limited brittlenes sensitivity • Flexible at low temperature • Not moisture sensitive • Robust on impacts

Material specifications, Halogen Free				
Material	**Operating Temperature**	**Colour**	**Flammability**	**Material Properties***
Polyamide 11 (PA11)	-40 °C to +85 °C, intermittent +105 °C (for 500 h)	Black (BK)	UL94 HB	• Bio-plastic which is derived from vegetable oil • Extreme temperature stability • Good chemical resistance • Strong impact resistance at low temperatures • Very low moister absorption • Weathering resistance
Polyamide 12 (PA12)	-40 °C to +85 °C, intermittent +105 °C (for 500 h)	Black (BK)	UL94 HB	• Good chemical resistance to: acids, bases, oxidizing agents • UV- resistant
Polyamide 6.6 (PA66)	-40 °C to +85 °C, intermittent +105 °C (for 500 h)	Natural (NA), Black (BK)**	UL94 V2	• High yield strength
Polyamide 6.6, heat stabilised (PA66HS)	-40 °C to +105 °C, intermittent +145 °C (for 500 h)	Natural (NA), Black (BK)**	UL94 V2	• High yield strength • Modified elevated max. temperature
Polyamide 6.6 UV-resistant (PA66W)	-40 °C to +85 °C, intermittent +105 °C (for 500 h)	Black (BK)	UL94 V2	• High yield strength, UV-resistant
Polypropylene (PP)	-40 °C to +85 °C, intermittent +105 °C (for 500 h)	Natural (NA), Black (BK)**	UL94 HB	• Good chemical resistance to: organic acids • Floats in water, moderate yield strength
Thermoplastic Polyurethane (TPU)	-40 °C to +85 °C	Black (BK)	UL94 HB	• High elastic, UV-resistant • Good chemical resistance to: acids, bases, oxidizing agents
Polyamide 6.6, Glassfibre reinforced (PA66GF13%)	-40 °C to +105 °C	Black (BK)	UL94 HB	• Good resistance to lubricants, vehicel fuel, salt water and a lot of solvents
Polyamide 6.6 with metal particles (PA66MP)	-40 °C to +85 °C, intermittent +105 °C (for 500 h)	Blue (BU)	UL94 HB	• High yield strength

Tefzel® is a registered trademark of DuPont.

* These details are only rough guide values. They should be regarded as a material specification and are no substitute for a suitability test. Please see our datasheets for further details.

** Other colours on request.

Material specifications, Limited Fire Hazard				
Material	**Operating Temperature**	**Colour**	**Flammability**	**Material Properties***
Polyamide 4.6 (PA46)	-40 °C to +150 °C for 5000 h, (+195 °C for 500 h)	Natural (NA), Grey (GY)**	UL94 V2	• Resistant to high temperatures • Very moisture sensitive, low smoke sensitive
Polyamide 6.6 V0 (PA66V0)	-40 °C to +85 °C	White (WH)	UL94 V0	• High yield strength, low smoke emissions
Polyamide 6.6 V0 High Oxygen Index (PA66V0-HOI)	-40 °C to +85 °C, intermittent +105 °C (for 500 h)	White (WH)	UL94 V0	• High yield strength, low smoke emissions
Polyolefin (PO)	-40 °C to +90 °C	Black (BK)	UL94 V0	• Low smoke emissions
Polyetheretherketone (PEEK)	-55 °C to +240 °C	Beige (BGE)	UL94 V0	• Resistance to radioactivity • UV- resistant • Good chemical resistance to: acids, bases, oxidizing agents • Not moisture sentitive
Stainless Steel Type SS304, Type SS316	-80 °C to +538 °C	Metal (ML)	–	• Corrosion resistant • Antimagnetic

* These details are only rough guide values. They should be regarded as a material specification and are no substitute for a suitability test. Please see our datasheets for further details.

** Other colours on request.