

Positioning Devices: Cable Ties for Cable Management of Electrical Installations – Application Guide

Introduction

The following information is derived from UL 62275 and intended to assist code authorities, designers, and installers in determining the suitability of cable ties in a particular installation and use. The purpose of this Guide is to provide you with the information that may be critical in determining if a product is certified and/or installed correctly. Refer to the specific guide information for the product category for additional information and marking.

What is Cable Management?

Positioning devices cover a wide variety of products, such as cable ties, fixing devices, bundling wraps, cable wraps, wiring ducts and similar types of related hardware. These devices provide mechanical means for bundling, securing, and positioning wires and cables for factory installation within equipment/devices and for field installation to meet national installation codes. They deliver neat and professional cable management installed within electrical equipment.

IEC, UL, and CSA

CSA C22.2 No. 62275 and UL 62275, the Standard for Cable Management Systems – Cable Ties for Electrical Installations, are based on the IEC 62275 standard. UL and CSA standards adopt the original IEC text and include additional national differences to address safety and regulatory situations.

UL Certification – Listed vs. Recognized

- Positioning devices that satisfy UL Solutions' evaluation requirements are certified under UL Category Control Number (CCN) ZODZ or ZODZ2, and manufacturers are authorized to apply one of the following UL Marks to the certified product. ZODZ7 and ZODZ8 apply in Canada.
- The traditional Listed UL Mark or the new Enhanced UL Certification Mark are intended for factory or field installation in accordance with ANSI/NFPA 70, National Electrical Code® (NEC). The backward "UR" Mark is for components intended for factory

installation in another device or product.

- For UL Mark information, see [Marks for North America: UL Marks and Labels](#).
- For category guide information:
 - United States
 - [ZODZ.GuideInfo – Positioning Devices](#)
 - [ZODZ2.GuideInfo – Positioning Devices – Component](#)
 - Canada
 - [ZODZ7.GuideInfo – Positioning Devices Certified for Canada](#)
 - [ZODZ8.GuideInfo – Positioning Devices Certified for Canada – Component](#)

Cable Ties and Fixing Devices

- Cable ties and fixing devices undergo evaluation in accordance with UL 62275 for specific functions.
- Cable ties are bands or lengths of material employing a locking device used for bundling or tying groups of cables together. Cable ties subjected to additional tests may be suitable for providing primary support of cable, flexible conduit or flexible tubing in accordance with the relevant national installation code (see "Support"). Cable ties may be designed with a releasable locking mechanism investigated for a single installation.
- Fixing devices, including edge clips, screw mounts, push mounts and devices that include features such as adhesives, are suitable for securing cable ties to mounting surfaces with parameters such as mounting surface, material, holes and slots.
- Applications that require both bundling and surface securement features may be achieved by installing an integral device produced as a single component incorporating a non-separable cable tie and fixing device.



Classifications

Cable ties and fixing devices are categorized based on performance ratings declared by the manufacturer. Each rating is identified by a Type designation based on the product's material, strength and applicable standard (geographical region).

Material	TYPE					
	1	11	2	21	2S	21S
Metallic	-	-	x	-	x	-
Nonmetallic	x	x	x	x	x	x
Composite	x	x	x	x	x	x
Strength						
Breaking	x	x	-	-	-	-
Withstand - 1 min.	-	-	x	x	-	-
Withstand - 5 min.	-	-	-	-	x	x
Standard (geographical region)						
IEC 62275	x	-	x	-	-	-
UL 62275	x	x	x	x	x	x
CSA 62275	x	x	x	x	x	x
UL certification						
Recognized	x	x	-	-	-	-
Listed	-	-	x	x	x	x

Material Characteristics

- **Metallic** – The construction is of entirely metallic material. Coatings applied to metallic devices are intended for appearance and do not aid the strength of the device. Metallic devices are classified as Type 2 or 2S (see “Type designation”).
- **Nonmetallic (polymeric)** – The construction is molded entirely of a polymeric material. Some applications in Canada and the United States require that polymeric materials be Recognized under UL Solutions’ Plastic Component program (QMFZ2/8).
- **Composite** – The strength of the construction relies on both metallic and nonmetallic materials, such as a metallic locking mechanism molded in a nonmetallic cable tie.

Material Temperature Rating

Products undergo investigation for a maximum operating temperature declared by the manufacturer and achieved through short-term property evaluation outlined in UL 62275. The addition of the “1” suffix indicates that the polymeric material has undergone further investigation regarding its thermal endurance of the mechanical

strength and structural integrity properties, commonly referred to as relative thermal index (RTI), in accordance with CSA-C22.2 No. 0.17 or UL 746B, the Standard for Polymeric Materials – Long Term Property Evaluations. The material was investigated as part of a long-term thermal aging program to establish a temperature for which the critical property is not compromised over the reasonable life of an electrical product.

Flammability

- Products undergo investigation for flame propagation determined through the contribution to fire test outlined in UL 62275 and in accordance with IEC 60695-11-5.
- The addition of the “1” suffix indicates that the polymeric material has undergone further investigation regarding the flammability of the polymeric materials with a minimum horizontal burn (HB) rating in accordance with CSA-C22.2 No. 0.17 or UL 94, the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

Strength

Products undergo evaluation using specific test methods based on the declared Type designation. Final design and installation dictate the appropriate Type designation based on the evaluation of strength (see “Type designation”).

- **Breaking** – Products undergo investigation to retain 50% of the declared loop tensile strength (cable ties) or mechanical strength (fixing devices) after environmental exposures. Applies to Types 1 and 11.
- **One-Minute Withstand** – Products undergo investigation to maintain the declared loop tensile strength (cable ties) or mechanical strength (fixing devices) after environmental exposures. Applies to Types 2 and 21.
- **Five-Minute Withstand** – Products undergo investigation to maintain the declared loop tensile strength (cable ties) or mechanical strength (fixing devices) after environmental exposures. Applies to Types 2S and 21S (see “Support”).

Type Designation

Products are categorized by Type designations pertaining to the manufacturer-declared material and strength classifications. Type designations offer the end user a quick and consistent understanding of the investigation for which the product has been identified. Type designation used in a given case shall be designed and constructed according to the intended uses of the installation. Final approval is dependent on the end-use application.



Bundling Diameter

Cable tie length correlates to the distance necessary to wrap around single or multiple wires and cables, also referred to as the bundle diameter. The manufacturer-recommended bundle diameter is verified for proper selection of cable ties.

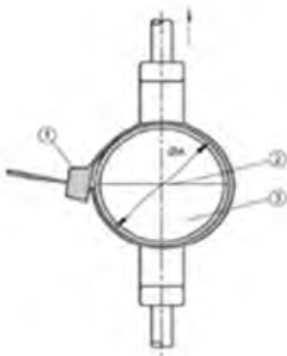
Minimum and maximum bundle diameters are specified to maintain proper operation as determined by the installer rather than the quantity of wires, cables, etc.

Additional length or diameter may be considered when a cable tie is secured to a surface using a fixing device, allowing for proper installation.

Declared bundle diameters are measured in a circular configuration around a mandrel. The shape of the bundle in the final installation, e.g., oval or triangle, may vary based on the quantity and size of the bundled wires.

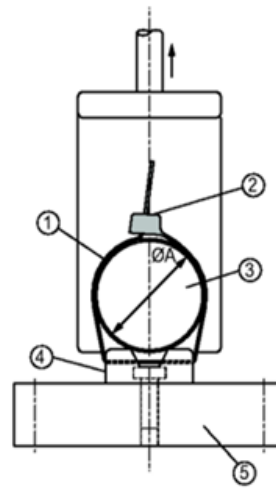
Loop Strength vs. Mechanical Strength

- Mechanical properties of cable ties and fixing devices are expressed in loop tensile strength and mechanical strength, respectively.
 - **Loop Tensile Strength** – This is a reference characteristic of a cable tie with its locking mechanism engaged. Stress is applied simultaneously on the locking mechanism and strap, representing the cable tie's ability to bundle a group of wires. Manufacturers may refer to loop tensile strength to represent various cable tie sizes. A rating does not indicate long-term static load-bearing capabilities. The loop tensile strength does not represent the strength of the material, a separate investigation is necessary.



- **Mechanical Strength** – This is a reference characteristic of a fixing device to secure a cable tie to a mounting surface. Mechanical strength is a

device's ability to maintain a connection between the cable tie and the fixing device and/or secure the fixing device to the surface. Stress is applied to the securement method of the fixing device.



mechanical strength test methods vary based on the declared Type designation.

- Declared mechanical strength should be considered along with the loop tensile strength when determining proper installation.
- Cable ties designed with an integral fixing device, referred to as an "integral device," declare a loop tensile strength and mechanical strength specific to each feature.
- Both loop tensile strength and

Mounting Hardware

Fixing devices may be secured to a surface through various methods such as screws, bolts, rivets and adhesives. Different strengths can be obtained based on the securement method and the manufacturer's instructions. Special applications with unique securement methods may require additional consideration.

Adhesives

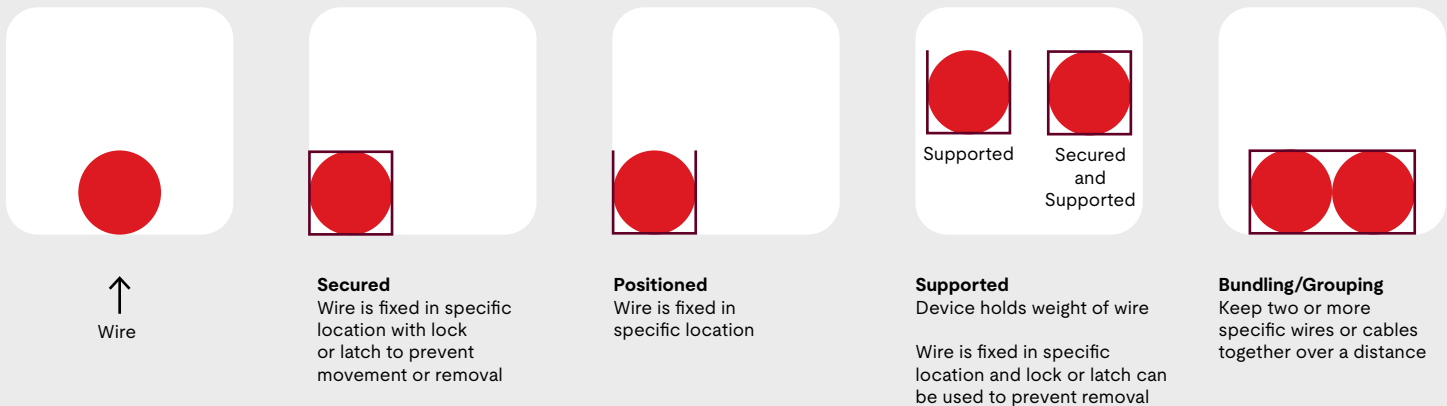
- Adhesives may accomplish two functions related to securing fixing devices. One: An adhesive can provide initial placement of a device while a secondary mechanical fastener like a screw or bolt is installed. Two: The adhesive may act as its main securement means. Certain adhesives may have lower or higher bond strength based on the attaching surface. Adhesives may be selected for specific surfaces related to particular applications.
- Fixing devices secured with adhesive undergo the mechanical strength test. Consideration may be given to adhesives Recognized under UL Solutions' Polymeric Adhesive System program (QOQW2) with respect to established bond strength values. Selection shall best represent the material of the fixing device and surfaces to which it is intended for installation.

Support

The performance of cable ties and fixing devices are defined by two key characteristics: securement and support.

- Securement of wire or cable means it is fixed or attached firmly in a particular place or specific location. Wire or cable is placed or arranged to maintain a single position or to follow a desired route. Referenced strength is the device's ability to operate properly.
- Support of wire or cable bears all or part of the weight. Referenced strength is commonly a result of gravitational force, but may also be applied in alternative directions.

- Electrical codes provide guidance on securing and supporting specific electrical installations and spacing intervals where primary support is required. These terms are not interchangeable and are not permitted to be installed around framing members. Example: Cable runs between boxes at specific intervals.
- All Type designations in UL 62275 are capable of securing. Products investigated for primary support, per the manufacturer, contain an "S" suffix to the Type designation (applies to Types 2S and 21S only). Support rating only applies when installing flexible conduit, flexible tubing or cable as indicated in the respective electrical code. Other installations shall be approved through further investigation. Rigid conduit is not covered.



- There is a different test method for securing compared to support (see "Strength"). Support products declare a minimum loop tensile strength and/or mechanical strength of 222 Newtons (50 lb-f).
- Flexible conduit and tubing is defined as a raceway that is easy to bend without tools.
- Consideration should be given to proper selection of cable tie and fixing devices with respect to the Type designation and installation surface. Support cable ties should be installed with an appropriate support fixing device, along with the hardware used when attaching cables to the support structure.

Vibration

- Cable management is frequently used in vibration applications.
- Nonmetallic and composite cable ties are considered resistant to the effects of vibration due to the design of the locking mechanism and materials.
- Metallic cable ties are designed with a locking

mechanism that could be susceptible to vibration and release of the wire or cable. Vibration exposure is conducted to determine the product's ability to maintain loop tensile strength following a vibration exposure in accordance with IEC 60068-2-6.

Suitable Environments

- Installers will be responsible for selecting the proper ratings for each application and the declared ratings on the product package.
- The minimum installation temperature is selected based on the temperature during which the products will be installed.
- The minimum and maximum operating temperatures are selected based on the temperature range for the environment of the final application. Additional temperature factors, such as heat generated from the electrical current of the conductor or surrounding heat sources, require additional consideration.
- "Resistant to ultraviolet light" is selected if the product is used outdoors or exposed to ultraviolet light.

Minimum Installation Temperature

- Cable ties installed in environments below 0°C are capable of proper installation in accordance with the manufacturer's instructions. A cable tie can wrap around the declared bundle diameter and engage the locking mechanism.
- Installers should consider the minimum operating temperature as products may experience an impact following installation.

Minimum Operating Temperature

Cable ties exposed to environments below 0°C after being installed in ambient temperature provide continuous operation and resist impact forces at lower temperatures. The wiring will remain secured in its intended position due to the material's ability to resist impacts from external forces.

Maximum Operating Temperature

- All products undergo investigation for a maximum operating temperature declared by the manufacturer and achieved through short-term property evaluation outlined in UL 62275. A product's maximum operating temperature is established based on the performance of unconditioned temperature cycling and heat aging exposures (see "Material temperature rating").
- Temperature cycling represents common environmental fluctuations during normal operation.
- Heat aging represents a short-term accelerated aging of the material's characteristics.

Resistant to Ultraviolet Light

- A product's strength undergoes investigation following ultraviolet light and water exposure in accordance with Method A, Cycle 1 of ISO 4892-2. Products may be suitable for exposure to ultraviolet light and/or outdoor use when marked on the package. Products are investigated to verify that the critical property is not compromised over the reasonable life of an electrical product.
- Polymer materials may be modified with UV stabilizers in a range of colors and may have undergone additional testing to verify material properties. Effects of long-term exposure to ultraviolet light have not been determined, and consideration should be given based on the final application and geographic region.

Corrosion — Chromium Content

Cable ties and related products are installed in a wide range of environments that may degrade the strength performance of the material over the lifetime of the equipment. Damp and wet regions are a concern for metallic materials and typically require additional corrosion protection. Products constructed with metallic materials are exposed to salt spray to be considered corrosion-resistant. Final approval is dependent on the specific environment of the end-use application.

- Additional corrosive protection of the metallic material may be acquired by applying a nonmetallic coating or employing a metallic material with a chromium content of 16% or greater. Examples include stainless steel grade 304 or 316.

Nonmetallic materials are inherently resistant to corrosion.

Air-Handling Spaces

- These include spaces where electrical wiring and equipment are installed in fabricated ducts specifically used for environmental air or spaces not primarily designed for but used as environmental air, including but not limited to spaces above hung ceilings or below raised floors. This does not include plenums used for removing dust, loose stock or vapor, or for ventilation of commercial-type cooking equipment. Electrical codes require metallic and nonmetallic devices installed in these areas to release a low quantity of smoke and heat if exposed to fire.
- Products used in these spaces are classified as Type 2, 21, 2S or 21S (see "Type designation").
 - AH-1 – Metallic products suitable for installation within air-handling ducts and other environmental air spaces without testing due to the metallic material's noncombustible properties. They are accordingly marked "AH-1" on the package.
 - AH-2 – These are nonmetallic products suitable for installation within spaces not primarily designed for but used as environmental air and not to be installed inside fabricated ducts. Nonmetallic materials are combustible and undergo investigation for low smoke (optical density) and heat release properties in accordance with UL 2043, the Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces. Applicable materials include nonmetallic (polymeric), composite and metallic products with a nonmetallic coating. Suitable products are accordingly marked "AH-2" on the package.

Moisture

- The performance of a polymeric material is known to vary depending on the moisture (water) content. The product's dimensions affect its ability to reach or maintain the declared strength rating. Locking mechanisms are designed and manufactured with strict tolerances that provide safer and more secure retention of the wire or cable. Variations in dimensions may result in slippage and release of the wire or cable.
- Products undergo investigation once the material reaches a state of equilibrium moisture content, at which moisture is no longer absorbed or released after exposure to a constant environment. This period of time depends on the product's thickness.
- Moisture affects different materials depending on their general composition. Some polymers, such as nylon 66, are known to have high hygroscopic properties for retaining more moisture per weight. Low-hygroscopic polymers, such as polypropylene or polyetheretherketone, retain a low percentage of moisture by weight.
- The environment of the final installation affects the moisture, and consideration should be given to the material's flexibility, brittleness and impact resistance.

Storage and Transport

With moisture content a point of concern for hygroscopic materials, products should be stored and transported properly to achieve an expected level of performance at the time of installation. Manufacturers recommend storage and transport parameters on the package or literature based on the design, polymeric material and packaging, usually a sealed plastic bag or container.

Electric Code

- Electrical codes are standards for the safe installation of electrical wiring and equipment; states or local governments focused on standardizing safer electrical practices adopt them regionally. Regions may alter or reject local governing bodies' regulations and identified amendments.
- Electrical codes refer to listed or labeled devices designed, manufactured, tested and marked according to the listing agency. UL 62275 and CSA C22.2 No. 62275 cover requirements for wiring systems in electrical installations in accordance with the NEC in the United States of America and Canadian Electrical Code (CE Code) Part I, CSA C22.1, in Canada.

- Code authority – This is an organization, office or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials and installation, or procedure. Code authorities are familiar with the parameters outlined in the NEC and may accept any device, appliance or piece of equipment with prior listed investigation, provided an end user or installer uses the product in accordance with the manufacturer's instructions and the limitations of the listing standard. Under the NEC's provisions, the code authority has the authority to deny approval for even listed and labeled products. Code authorities may provide written approval of an installation or product that does not meet either the NEC's or listing requirements after appropriate review of the specific conditions of a particular case or location.

Hand Tools

Manufacturers recommend a method of installation on the package or literature based on the design, polymeric material and ratings. Specific installation tools may be recommended to achieve the manufacturer's declared specifications. Installation tools are not certified according to UL 62275. Cable ties certified to UL 62275 have undergone investigation for installation by hand.

Marking — Package

- Marking a product is just as important as the established rating.
- The rating only applies when it's marked on the package.
- Manufacturer-declared ratings shall align with the certification information located directly on the packaging and/or literature.
- Performance parameters are to be clearly marked to allow the end user or installer to select the correct products for the application, such as but not limited to the bundle diameters, strength, temperature ranges, resistance to ultraviolet light, and mounting surfaces



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