Wind Turbine Components and Application Guide

Rayfast

Tyco Electronics

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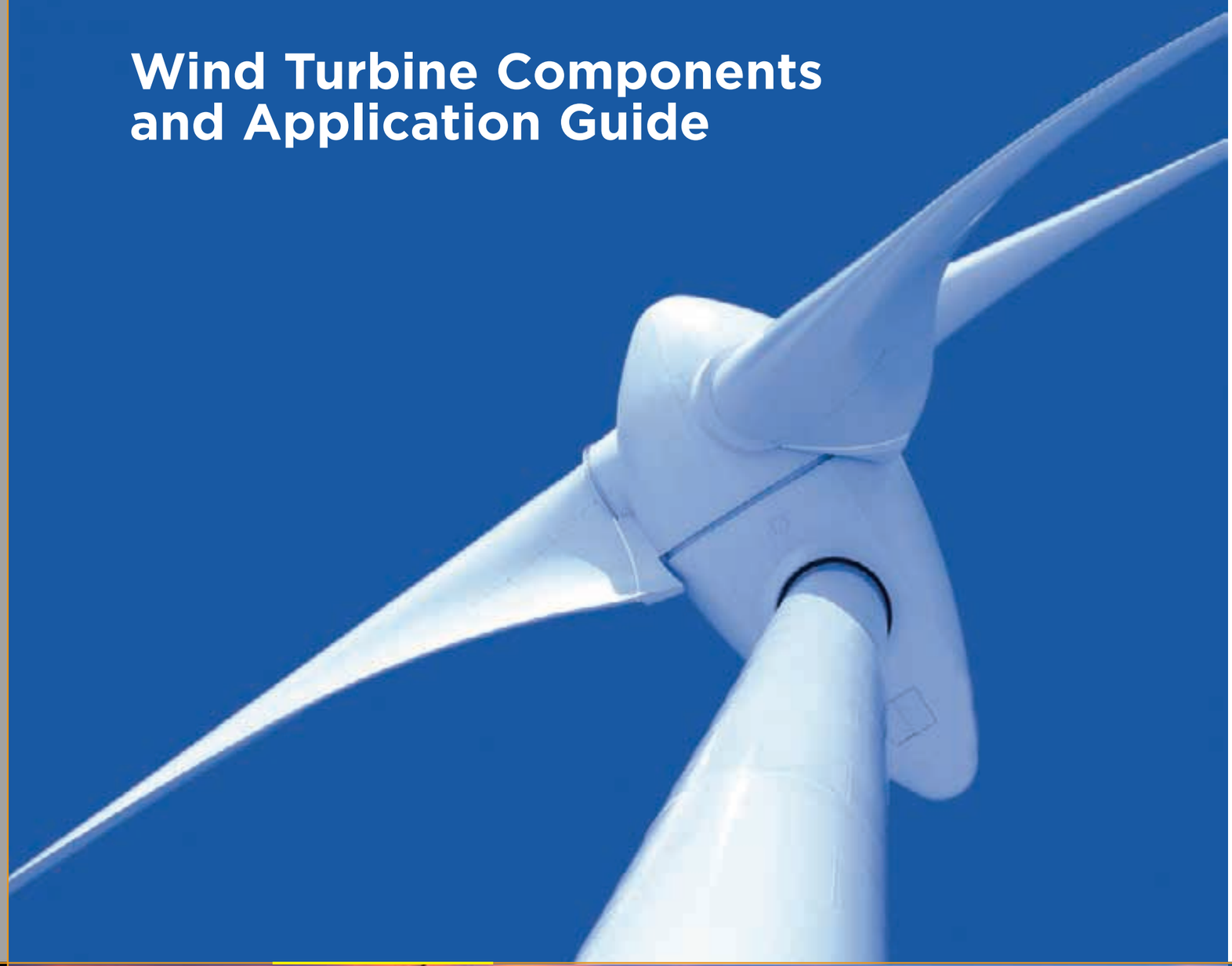
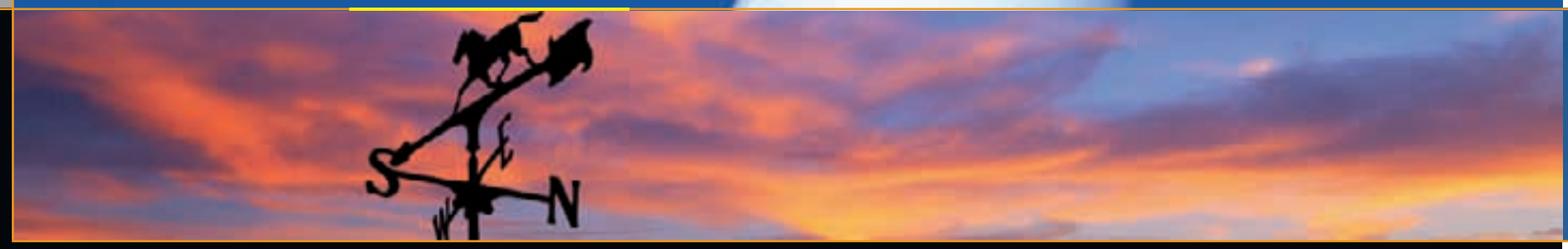
Wind Turbine Components and Application Guide





Tyco Electronics can help you to become a leading force in alternative energy with improved technical developments and higher power ratings, plus an ever-increasing pressure on quality, the alternative energy industry faces many challenges. Whether process control, motion control and drives, robotics, electrical or any other related areas, such as, designing a turbine, control systems, inverters, drives, the same challenges are being faced throughout this complex market.

For over 60 years, Tyco Electronics has worked with industry leaders to lower costs and develop systems to increase reliability, and to devise new and innovative ways to implement technically advanced products for the energy markets.

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Tyco Electronics is committed to bringing the promise of renewable energy to the world.

Early Involvement Pays Off in Competitive Advantage

With over 8,000 engineers and 12 design centers, plus manufacturing facilities in 25 countries globally, we put a premium on innovation when it comes to helping companies solve tough design problems. Talking to us early on in your design cycle will give you the full benefit of our expertise to help you:

- Shorten the design cycle
- Reduce costs
- Increase reliability
- Design for manufacturability

In short, we can help you achieve a sustainable competitive advantage.

Our commitment to advanced engineering and world-class manufacturing delivers innovation that can advance any project - from showing you the best existing products to offering a value-added solution, or even designing a new product.

Tyco Electronics is the world's largest supplier of passive electronic components, including connectors and interconnect systems, relays, switches, circuit protection devices, touch-screens, sensors, filters and wire and cable.

Tyco Electronics' ability to serve your present and future requirements is realized through the synergies of a strong R&D program and our expertise in materials science, product design and process engineering, all supported by our network of knowledgeable application engineers, sales representatives and customer service personnel.

Individual Support From Experts

Sales Support

Management, Engineering, Purchasing, R&D, Production, Maintenance, whatever your job is within a company, Tyco Electronics has an extensive team of customer service and sales engineers dedicated to supporting you. Sales engineers are available to visit your site to discuss the technical and commercial issues appropriate to your project or requirement. This support covers both existing products within our diverse portfolio and those that need to be tailored to your needs. Customer service can initiate new orders, change orders, request air shipments or drop shipments and generally support your business on a day to day basis.

Product Information Center

Our Product Information Center works closely with our sales support and sales engineer teams to ensure continuity of support. Whether you need an exact part or an alternative product, if you are looking for documentation or the right technical solution to resolve a problem, our experienced specialists are waiting to assist you across new and established products.

They are committed:

- To provide customers with dedicated technical support, product samples and literature across the Tyco Electronics product portfolio
- To assist in identifying the right solution for the customer's application
- To advise customers on the available sales channels
- To support customers using our internet based system
- To develop strong customer relationships by being professional, efficient and friendly

Distribution Network

We manufacture nearly 500,000 products, backed up by nearly 100,000 employees who all have a singular commitment to bringing performance advantage to every technology, product and service we provide. We serve customers in more than 150 countries, working closely with selected wholesalers, distributors and authorized dealers in order to improve our product availability and our service. Our global coverage places us near our customers and allows us to assist them in consolidating their supply base and lowering their production costs.

Leading Alternative Energy Solutions– Just a Simple Mouse-Click Away

Fast Access To Information 24/7

We make it quick and easy for you to find the information you need and to order samples and production parts, as well as to obtain documentation and CAD models.

Find Our Web Site

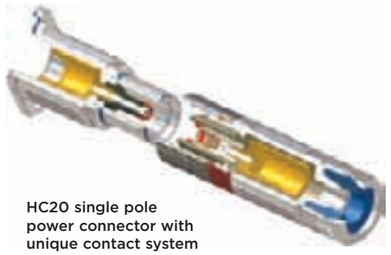
tycoelectronics.com is your single location for comprehensive product information, including CAD models, product and application specifications, drawings and competitive cross references. Our advanced parametric search engine allows you to find the exact part you need and all the documentation that goes with it. E-commerce gives you access to order tracking, distributor inventories, samples and much more.

Visit Our Alternative Energy Portal

To make things easy, we have created an industry-specific site that focuses exclusively on alternative energy. Here you can find our extensive line of products and solutions for wind turbines:

tycoelectronics.com/wind

Expertise in Alternative Energy



HC20 single pole power connector with unique contact system

Industrial hybrid connector with 8 power contacts and Fast Ethernet interface

Within our development teams, we have the knowledge and the skills that are required to meet all of your needs. Our global presence means we operate wherever you do, and we can support you worldwide through a single account management program, to simplify design and sourcing. Our focus on alternative energy gives you access to the widest selection of standard and semi-custom products, including:

- Connectors and terminal blocks
- Sensors and relays
- Switches and filters
- Wire and cable
- Identification
- Tooling

and many others from such well respected brands as AMP, HTS, OEG, Potter & Brumfield, Schrack, Corcom and Raychem.

Faster Front-End Design

With market dynamics forcing ever-shortening design cycles, our ability to quick-turn product concepts will keep your projects on schedule and shorten the time to market. Our capabilities include:

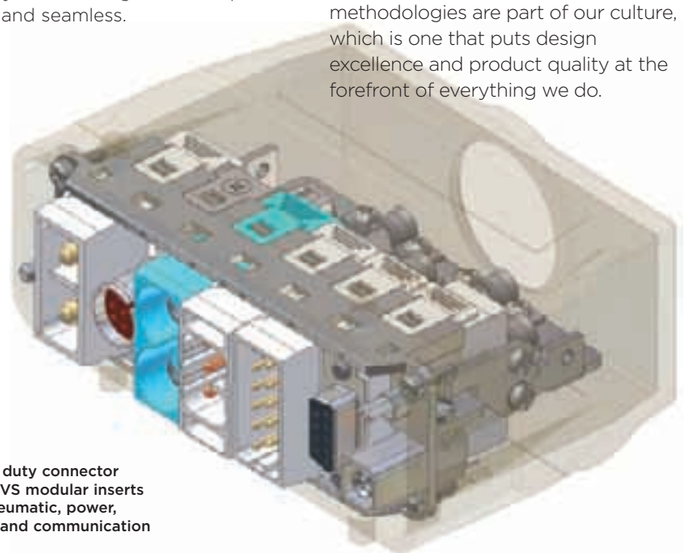
- **Computer-aided engineering -** giving some of the most sophisticated modeling and simulation capabilities in the industry to validate a design before prototyping.
- **Rapid prototyping -** from stereolithography for rough 'form and fit' evaluation in minutes, to model shops that turn prototypes in days, providing you with product samples quickly and conveniently.
- **CAD model interchange -** allowing us to import your CAD files into our system for custom application development. Alternately, we provide our CAD files in a wide range of formats for maximum compatibility, to ease integration of our products into yours. Sharing files is simple, fast and seamless.

Innovative Engineering For Mechanical, Electrical & Thermal Performance

From extensive research in materials, contact physics and signal transmission - to advanced tools that can model, simulate and validate a design, we understand the requirements of the wind sector. Every product we design considers the mechanical, electrical and thermal parameters – and their interactions.

Every design is subject to solid modelling, finite-element analysis (FEA), root-cause failure analysis (RCFA) and failure-mode and effects analysis (FMEA) – all supported by extensive design reviews and documentation, so that the design is optimized for its application.

As a company focusing on Six Sigma and Lean Manufacturing, we are continually improving our processes by reducing variation and eliminating waste. Six Sigma methodologies are part of our culture, which is one that puts design excellence and product quality at the forefront of everything we do.



Heavy duty connector with HVS modular inserts for pneumatic, power, signal and communication

Your Standards are Our Standards

Our engineering teams have a thorough knowledge of agency standards and regulations. We design and test our products to allow you to satisfy these requirements, through qualification testing, periodic retesting, labelling and marking. We comply with standards from ANSI/AAMI, IEC, UL/CSA, CE, VDE and other international agencies. We comply so you can comply.

Customer Confidentiality

All customer and project-related information will be handled securely and with extreme care. In order to guarantee complete confidentiality and peace of mind, Tyco Electronics provides secure data exchange services for all documentation and CAD models via IFX (Internet File Exchange) and Odette servers.

Product and Application Specifications

Tyco Electronics provides a full range of documentation which contains all of the product specifications you may require. Application Specifications are also available, in order to ensure that all components and products are professionally implemented.

Product Literature and Online Support

In addition to product and application specifications, Tyco Electronics offers a range of detailed product catalogs and brochures for reference. And in order to assist you even further, all documents are available online, so that you can access the information you require 24 hours a day, 7 days a week.

Our in-house test capabilities include mechanical, electrical, environmental testing and ANSYS analysis to qualify and validate that our products meet your specifications. Our test labs are approved by Underwriters Laboratories for testing Tyco Electronics' passive components, which is your sign that they meet stringent requirements for rigorous and reliable analysis. Routine capabilities include:

- **Environmental Testing**
  - Temperature and humidity
  - Temperature cycling
  - Thermal shock
  - Heat aging
- **Electrical**
  - Contact resistance
  - Dielectric withstanding voltage
  - Temperature rise versus current
  - EMI
- **Mechanical**
  - Vibration
  - Shock
  - Tension/compression
  - Mating cycles
  - Mating/unmating forces
  - Normal force
  - Flex life
  - Crush resistance
- **Product Simulation**

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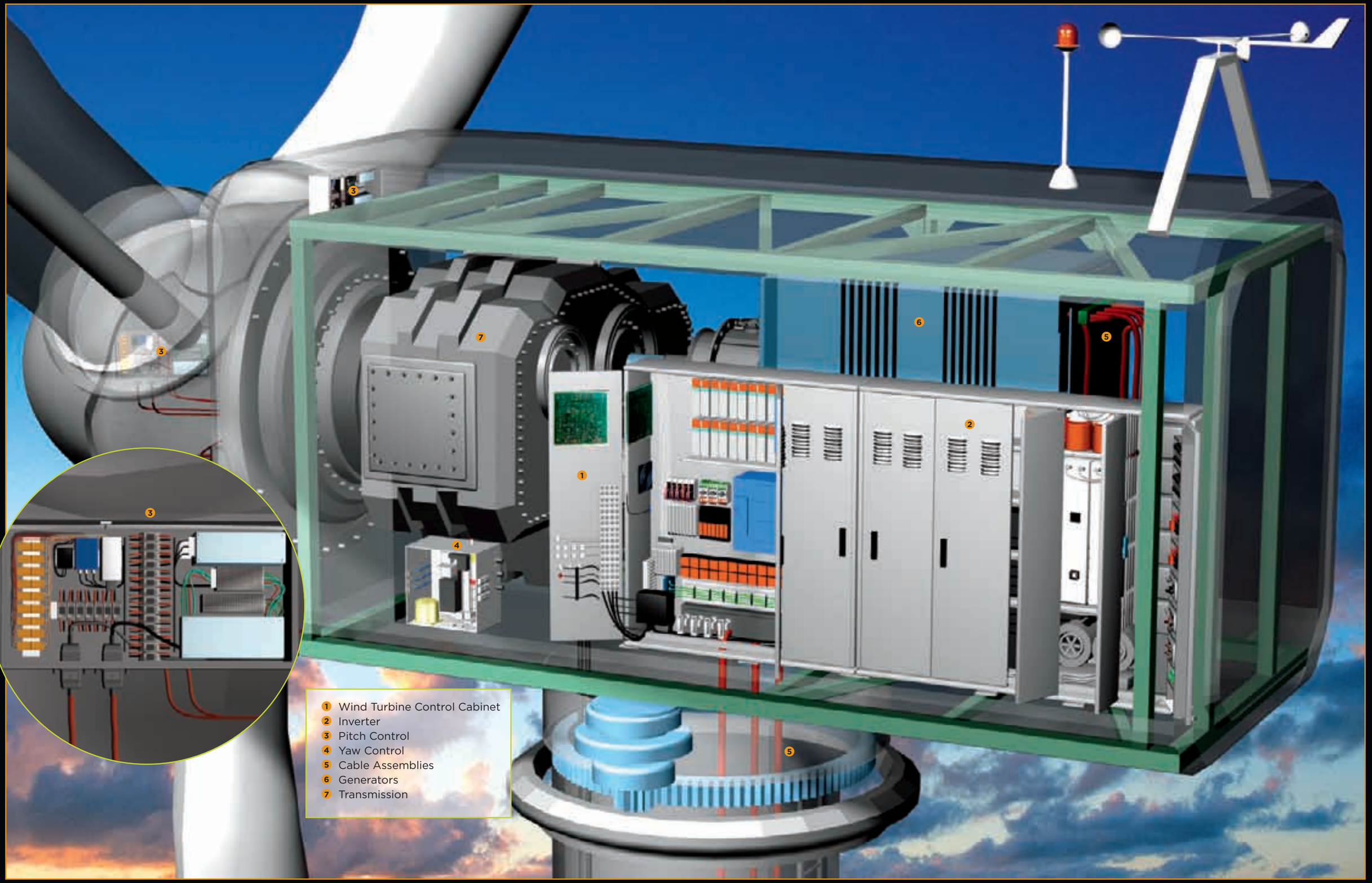
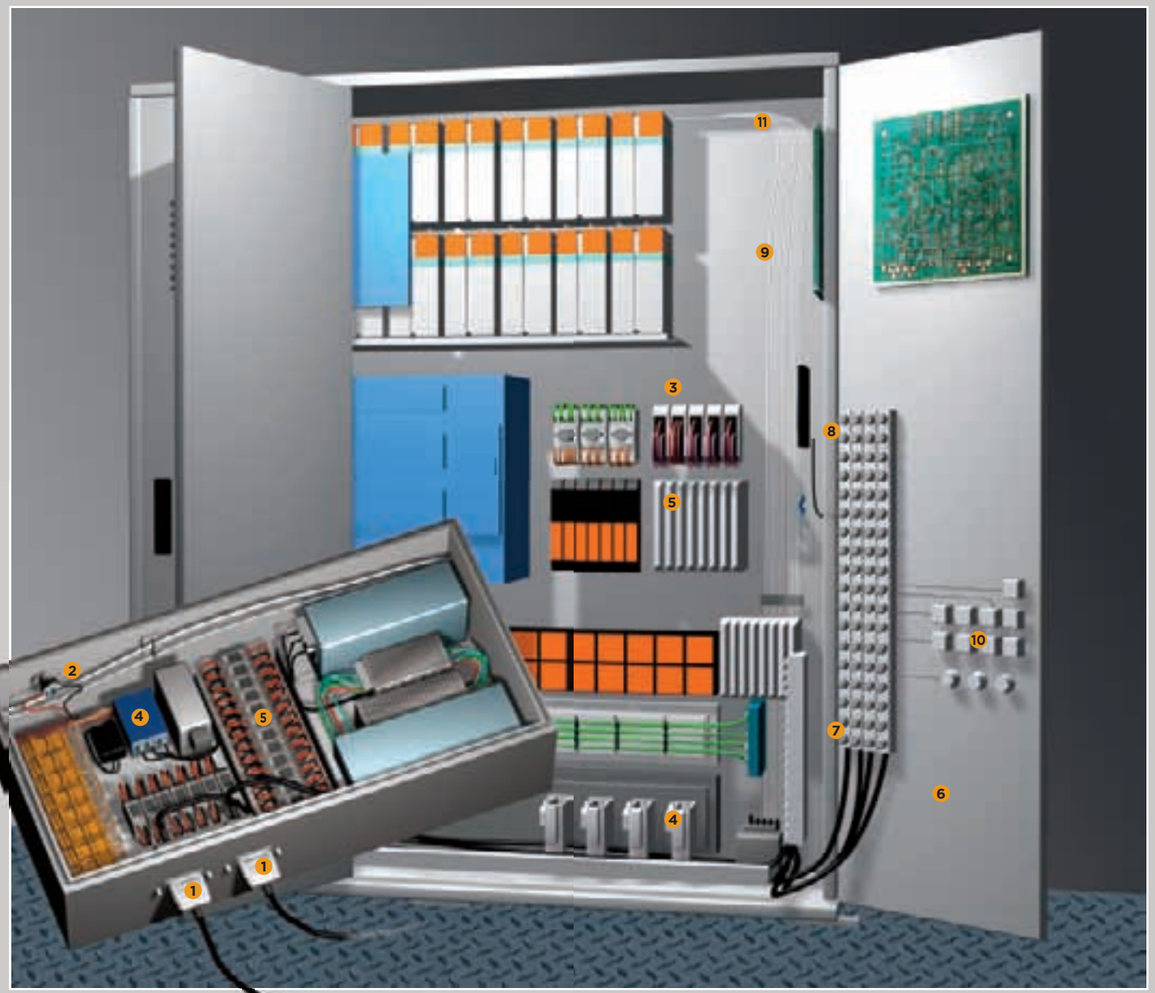

1 Wind Turbine Control Cabinet
2 Inverter
3 Pitch Control
4 Yaw Control
5 Cable Assemblies
6 Generators
7 Transmission



Control Cabinets: The control cabinets tend to be the heart of a wind turbine nacelle containing an array of numerous products which Tyco Electronics can contribute. With its vast capabilities, Tyco Electronics can provide components or a complete system.

1. Heavy Duty Connectors
2. Contactors
3. Resistor
4. Filters
5. Relays
6. Cable Assemblies
7. Industrial Ethernet
8. Connectors
9. Identification
10. Switches
11. Terminal Blocks

Inverters contain numerous Tyco Electronics technologies including braking resistors, current sense resistors, and a multitude of low to medium voltage interconnect systems.

1. Insulators
2. Resistors
3. High Voltage Connectors
4. Cable Assemblies
5. Fiber Optics
6. Bus Bars

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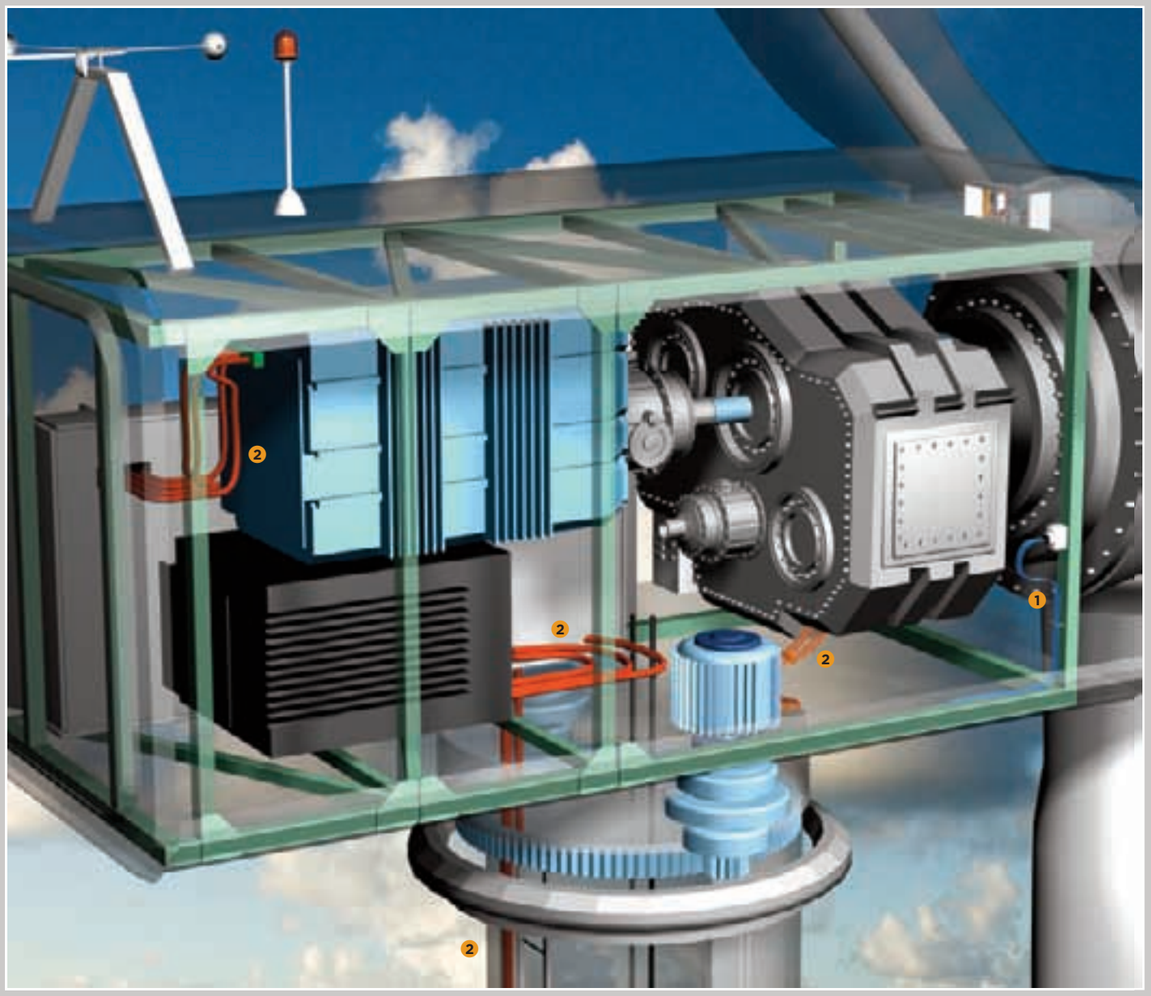
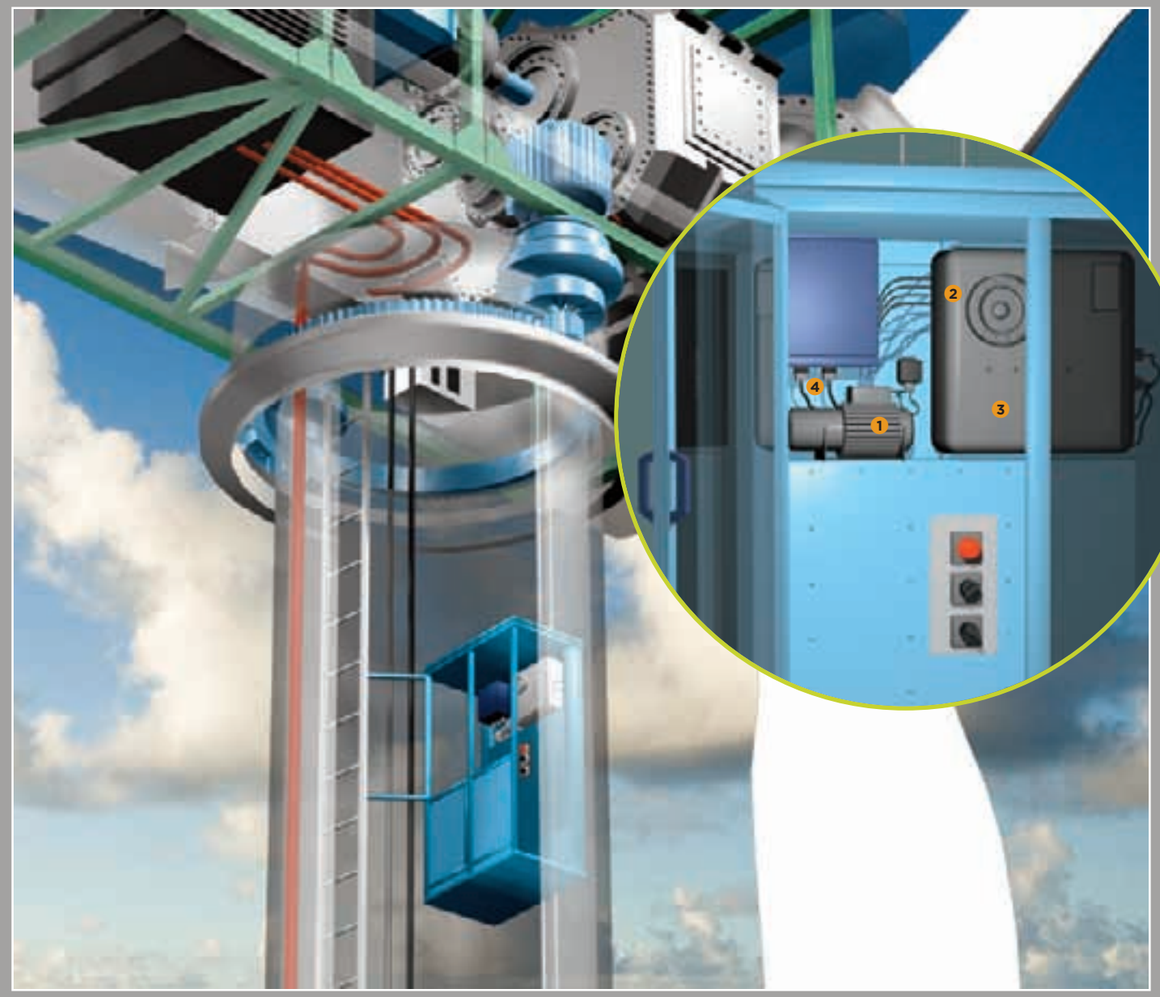


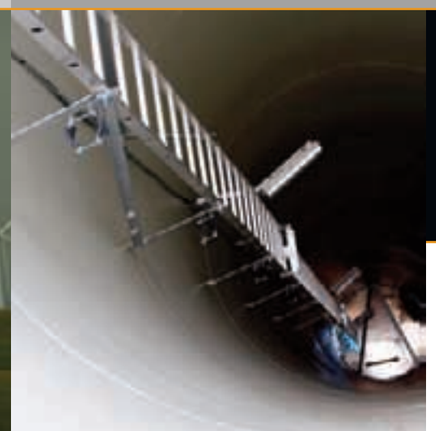
Tyco Electronics expertise in both connectors and cable assemblies provide our wind turbine manufacturing a complete “plug and play” system solution.

1. Fiber Optic & Industrial Ethernet Cable Assemblies
2. Medium & Low Voltage Cable Assemblies



Wind Turbine Elevators are a network of motors, drives, belt systems, controls and sensors all working together as one system. Tyco Electronics can supply component and system capabilities to the wind turbine elevators control and power systems.

1. Braking Resistors
2. Relays
3. Cable Gland
4. Heavy Duty Connectors



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Products

With a 60-year history of leadership, Tyco Electronics is a global provider of engineered electronic components for thousands of consumer and industrial products. We design and manufacture more than 500,000 precision-engineered products all backed by nearly 100,000 professionals with a singular commitment to bringing a performance advantage to every technology, product and service we provide.

Cable Assemblies

Identification & Labeling

Relays, Circuit Breakers and Contactors

Shrink Tubing

Switches

Terminal Blocks

Terminals & Splices

Wire & Cable

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HTS Heavy Duty Connectors

Tyco Electronics offers a range of heavy-duty connectors, which serve a wide range of applications within the wind turbine copology. This range includes inserts for signal and power applications.

Combination inserts for signal and power mounted in the same insert allows for a complete “plug and play solution”.

HTS connectors accommodate up to 5000V, 420A and up to 216 contacts. The inserts are available in RJ45, USB, FireWire, Fiber Optics, D-sub, Coax, Pneumatic, Power and Signal. The connector housings are made from die-cast aluminum and are classified IP65 to IP68. EMI/EMC and corrosion protection is also available.

Features

- Impact resistant die-cast aluminum
- Powder coated surface for corrosion resistance
- EMI protection
- IP68 classification for submersion in water
- Protection against shock and vibration
- Silver and gold plated contacts
- Crimp, screw and spring clamp style wire termination
- Laser-marked inserts for permanent product identification

Circular Plastic Connectors CPC

The CPC (Circular Plastic Connector) family consists of four sizes of pin and socket connectors arranged in six different series, which permit a wide range of different contact types. These connectors are used in wind turbine applications. Rapid connect and disconnect is achieved with the use of a coupling ring which is optional in the metal version. As an extension of the standard CPC ranges, splash-proof connectors classified as IP65 and IP67 are also available, as are connectors with metal housings.

Features

- Lightweight, all-plastic circular connectors with quick connect/disconnect coupling
- Six connector series comprising signal, power and combination signal/power configurations
- Overall position range of 3 to 63 with up to 50 amp current capacity
- Available in panel or chassis mount and free-hanging configurations
- Some versions sealable to IEC IP65 or IP67
- The metal-shell version (CMC – Circular Metal-Shell connector) has a thermoplastic insert in a nickel-plated, zinc alloy shell. Optional TETRASEALS provide splash-proof sealing between connector metal shells.

Terminal Block Connectors

Tyco Electronics offers an extremely wide range of terminal blocks for virtually all customer requirements in an industrial environment. The portfolio features the special rising cage clamp design. The modular design of Terminal Block connectors consists of one-piece board-mount terminal blocks and plug connectors, with mating straight and right angle shrouded headers. A special version - which can be mated either 90° or 180° - completes the product line.

Features

- IR reflow compatible
- Rising cage clamp with open screws to simplify handling in the field and to minimize installation
- Captive screws
- Non-magnetic metal parts
- Halogen-free Polyamide 6.6 housings according to UL 94V-0
- Operating temperature -40°C to +105°C
- End-to-end stackable without loss of centerline spacing

Dynamic Series Connectors

Dynamic Series Connectors are the solution for wire-to-wire, wire-to-panel and wire-to-board applications. The Dynamic Series family of products offers solutions for both signal and power, and is further segmented by current rating. The D-1000 series offers the smallest centerline spacing of 2mm (0.078”) and 3 to 5A per line while the D-5000 series offers the largest centerline spacing of 10.16mm (0.400”) and 12.5 to 48A per line.

The Dynamic Series family of products has a connector solution for almost all applications.

Features

- Audible click during mate cycle
- Polarized and latching housings
- Various keying options to help prevent mis-mating of connectors
- “Lance-less” contact design prevents back-out issues
- Visual markings identify housing cavities and contact size
- Accommodates 120VAC, 3A to 630VAC, 48A
- Wire range AWG 30 (0.5mm2) to AWG 8 (8mm2)
- PCB connectors in 90° and 180°

M8/M12 Connectors & Cords Sets

This connector system follows the established industry standards and consists of single-ended cable assemblies in lengths of two to ten meters. The cable assemblies are available with both PVC and PUR jacketed cables for indoor and outdoor use. They include options for straight or right angle over-molded connector ends, shielding and LEDs. Panel mount products are offered for both PCB mount or solder cup. Field terminable products are available in both screw-type or solder cup termination style. Y-adapters are available for splitting of control signals and double-ended cord-sets are available upon request.

Features

- IP67 rated product for cable assemblies and panel mount product
- IP68 rated product for field terminable products
- M8 product family – 3 and 4 position product
- M12 product family – 3, 4, 5, and 8 position product
- PVC and PUR jacketed cable available
- Single and double-ended cable assemblies
- Shielded and unshielded product
- Panel and PCB mount product
- Field terminable product

Industrial Ethernet Products

Tyco Electronics offers a variety of connectors and active products for Industrial Ethernet applications. These will accommodate virtually all of your connector needs, from ruggedized RJ45 connectors to Ethernet switches. Solutions for both IP20 and IP67 applications are available.

Passive Products

IP20 field-installable RJ45 plugs, IP67 plug and receptacle kits, IP20 and IP67 cable assemblies and Industrial Ethernet cable.

Active Products

- Industrial Ethernet switches, media converters and device servers.

Features

- Tool-less, field terminable, IP20 RJ45 plug - 4 and 8 position
- IP67 plug and receptacle connectors meet the Ethernet/IP and Open DeviceNet Vendor Association (ODVA)

Interoperability Interface Specification

- 10/100MB Ethernet switches
  - 4 port RJ45 with 1 port optic
  - 5 position RJ45
  - 8 position RJ45
- 10/100/1000MB Ethernet switch
  - 4 port with 1 port Small Form-Factor Pluggable transceiver
- Media converter
  - 1 port RJ45 to 1 port optic
- Device Server
  - 2 ports RJ45 to 1 port 9 pin D-Sub
- Cat 5e Industrial Ethernet cable
  - 2 twisted pair solid
  - 2 twisted pair stranded
  - 4 twisted pair stranded

Industrial Mini I/O Connector

Tyco Electronics Industrial Mini I/O connector is 1/4 the size of standard RJ45 connectors. At 1Gbit per second speed, it can be used in a variety of applications. Two points of contact and a metallic latch makes this ideal for high vibration industrial applications.

Features

- Two points of contact
- 0.5A per contact
- Latching
- Utilizes standard Cat 5e industrial cable
- Two keying options prevent mis-mating
- Cable assemblies available upon request

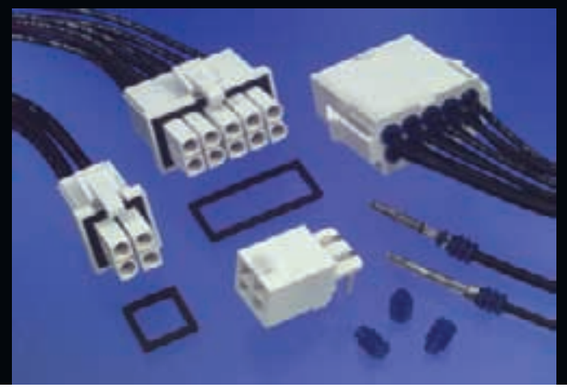
MATE-N-LOK Connectors

A reliable, versatile and environmentally friendly connector system with crimp contacts, available in strip or loose piece. Efficient polarization and connector latching are features of this economical connector range.

Features

- Standard density, wire-to-wire and wire-to-board connectors
- 5.08mm [0.200"] centerline
- 1-16 positions
- Panel mount or free hanging
- Ratings: 19A, 250VAC
- Hot side is egg-crated for safety
- Fully polarized nylon housings
- Easy cavity identification
- Locking devices are integral part of design. Connector halves will hold together under severe conditions of vibration and shock
- Wire-to-board capability using pin or socket headers

Mini-Universal MATE-N-LOK Connectors



The Mini-Universal MATE-N-LOK connector was developed for low voltage halogen lamp termination, offering ease of use and low assembly cost with high operating reliability. The compact design can be easily used for installation in narrow spaces. Integrated strain relief assures a reliable connection.

Features

- High density, 4.14mm [0.163"] centerline plus 1-24 and 2-24 positions respectively
- Wire-to-wire and wire-to-board capability
- Ratings: 600VAC or VDC, 9.5A and 10.5A respectively
- Contacts are protected in the housings
- Seals available for splash protection

Micro MATE-N-LOK Connectors

The Micro MATE-N-LOK 3mm connector system is a wire-to-wire and wire-to-board connector system with contacts on a 3mm [0.118"] centerline. Both single-row and dual-row configurations are available. Crimp, snap-in pin and receptacle contacts are used to terminate AWG 24-20 [0.2-0.6mm2] and AWG 30-26 [0.05-0.15mm2] wire. Plug and receptacle housings allow wire-to-wire and wire-to-panel configurations. Header assemblies for wire-to-board interconnections include vertical and right angle components. These IR reflow process compatible headers are available in through-hole and surface-mount configurations.

Features

- Wire-to-wire and wire-to-board pin and receptacle connector system
- Contacts are on 3mm [0.118"] centerline spacing
- 2 to 12 contact positions – single row
- 2 to 24 contact positions – dual row
- Panel mount or free-hanging wire-to-wire configurations
- Dual beam contact design for reliable interconnection
- Contacts accept AWG 24-20 and AWG 30-26 wire with an insulation diameter of 1.52mm [0.060"] maximum
- Contacts available in strip form or loose piece
- PCB-mount pin header assemblies in both vertical and right angle styles
- Surface-mount or through-hole PCB pin header attachment
- PCB headers are IR reflow process compatible

AMP Power Series Connectors

AMP Power Series Connectors provide a durable, quick connect/disconnect means of transmitting 'power' levels of current and voltage (15-275A, 600VAC/DC). This product family includes single-pole and two-pole (battery) connector housings, crimp snap-in contacts and accessories. Housings are offered in various colors and two-pole housings have different polarization configurations. With the exception of black housings, each color identifies a different keying configuration.

In general, only same-color housings will mate. Contacts are either cold-headed or stamped and formed, depending upon the connector series. AMP Power Series connectors are divided into eight series, based on approximate current-carrying capability.

Features

- Single-pole and 2-pole (battery) quick connect/disconnect connectors
- Eight series, based on approximate current–carrying capability
- Voltage rating: 600VAC/DC
- Color-coded housings: UL 94V-0
- Modular single-pole housings are stackable in four directions
- Stainless steel retaining springs secure contacts in housings
- Stamped and formed, open barrel contacts (AWG 6-20) on reels for automatic and semi-automatic machine termination
- Connectors are intermateable with similar connectors from other manufacturers

AMPOWER Terminals & Splices

The AMPOWER terminal and splice product line is available in a variety of styles to suit your individual design requirements. AMPOWER terminals and splices are ideally suited for power generation and distribution. This makes electrical systems in the wind turbine such as generators, motors, inverters and switch gears perfect applications for AMPOWER products.

Features

- Designed for large cables and leads
- Ideally suited for power generation and distribution
- Accepts a wide range of stranded copper wires (AWG 6 to 1,000 MCM [13-507mm2] for terminals and up to 1500 MCM [760mm2] for splices)
- Available in a variety of terminal and splice styles
- High-quality, seamless tubular copper for maximum conductivity

PRODUCTS

Mechanical Connectors

Mechanical connectors, lugs and repair sleeves are designed for use in low and medium voltage applications. All products consist of a tin-plated body, shear-head bolts and inserts for small conductor sizes and medium voltage applications.

Features

- Wide application range
- Only three sizes cover conductor cross-sections from 25 mm to 400 mm and can be used for almost every type of conductor and material.
- Connection between copper and aluminum conductors is possible.
- Bolts made of special aluminum alloy
- Compact design requires minimal installation space.
- Lubricated bolts reduces friction.
- Converts tightening torque into contact force for maximum effect.
- Chamfered edges suitable for up to 42 kV and adaptable to existing joint designs.
- Lengthwise seal for indoor and outdoor applications.

T-Connectors

RAYCHEM RSTI screened separable connectors are designed to connect single- and three-core polymeric cables to medium-voltage gas insulated switchgear and other equipment.

Made of a highly modified silicone rubber and protected by a thin walled outer conductive screen connected to earth, RSTI connectors are equally suited for indoor and outdoor installation.

Supporting a wide application range, the design incorporates one body and three stress cone adapters to cover all cross-sections from 400 to 630 mm2 and all voltage classes from 12 to 36 kV. The overall and cut back dimensions are designed to take up minimum space in the terminal box.

RSTI connectors are equipped with a capacitive test point for determining whether the circuit is energized.
A conductive cap protects this test point.

Kilovac Relays

KILOVAC contactors have been used to reliably switch high voltage DC loads. As pioneers in the development of lightweight, sealed contactors for 270 Volt dc operation, we have extensive capabilities in the design, manufacture and testing of these products for use in robust applications. While early contactor models were rated for only 25 amps, some of our latest designs are rated to make, break and carry 500 amps, with overload ratings up to 2,000 amps. We offer contactors with either electronic or mechanical economizers, or we can provide basic contactors to which you may apply your own economizer circuits.

Insulators

- Robust lightweight designs for inverter and switch gear applications
- Robust R polymer insulation systems
- Non-breaking housing material
- Low weight
- Suitable for AC and DC systems

Sensors

Tyco Electronics offers a wide range of sensors for the contactless detection of diverse mechanical parameters within the wind turbine such as switching, position, distance angle, blade speed and rotation. All these sensors operate based on the magnetic induction principle.

Thanks to their compact size and multiple control options, these electromagnetic sensors can be matched to almost all requirements. The selection and dimensioning of the magnetic circuit is oriented exactly to the relevant application.

A comprehensive service and a customized package is also offered in addition to standard elements. This covers the entire range from selection of the sensor technology via dimensioning, simulation, qualification and prototyping to the series manufacture of customized solutions.

A distinction is made between three types of binary sensors:

- Hall-effect proximity switches
- Pulse-wire sensors
- Position and compensation sensors

Features

- Contactless and no friction
- High level of innovation
- Wide range of proven sensor modules for position detection
- Selection of optimum sensor principle
- Customized solutions which consider specific applications needs
- In-house prototyping and mass production facilities

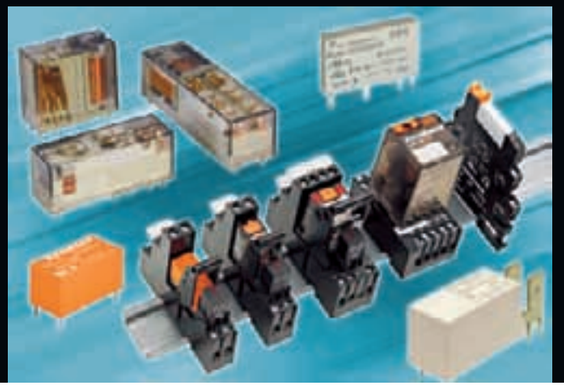
Switches

The Tyco Electronics range of switches is designed to be cost-effective, reliable and to enhance productivity. Delivering a broad range of switch products, the range covers rotary, panel mount power rocker, snap-action switches, toggle, DIP switches, slide switches. In addition, customized switching solutions for customer applications from the mA-range up to 25A is also offered. Rotary knobs, caps, boot seals and other accessories complete the extensive range.

Features

- Customized versions
- Process-sealed and environmentally-sealed versions
- Wide range of contact configurations, from 1 pole up to 30 poles
- Various mounting/terminal options - THT, SMT, wire lug, solder lug, quick connect and different bushing styles

Relays

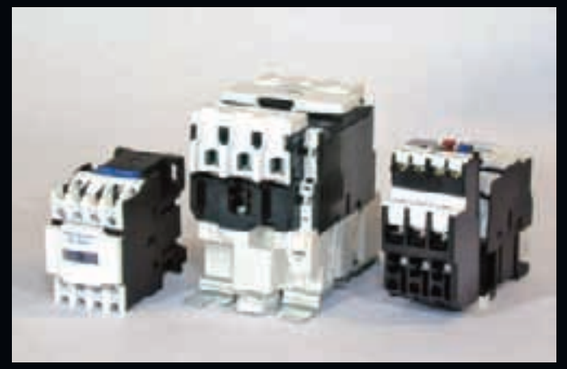


The Tyco Electronics range of Power Relays provides a cost effective solution for almost all main switching requirements. Incorporating the SCHRACK, POTTER & BRUMFIELD and OEG brands, these relays are for PCB, socket, surface or rail mounting with up to 30A capability. Products cover industrial, safety and many other applications - with solutions for high inrush, high temperature, energy saving and high reliability applications. All products meet the relevant international standards.

Features

- PCB, Plug-In, Solder/Faston, THR terminals
- DC-, AC-, bi-stable coils
- Up to 4 C/O contacts
- Up to 60A switching current
- Relays for high inrush currents
- Safety relays
- Relays for wind applications
- Relays for high ambient temperatures
- RoHS compliant

IEC–Type Contactors



Compact AC coil contactors in three frame widths offer ratings from 9A to 80A (AC-3 per IEC 947-4). Available accessories include auxiliary contact blocks for side or front mounting, thermal overload relays, timer blocks for front mounting, mechanical interlocks and more.

Features

- Contactors offer three pole switching (main contacts) plus integral auxiliary contacts
- Designed to snap onto DIN rail (35mm or 75mm) or mount directly to a panel with screws
- Efficient 50/60Hz coils (50 or 60 Hz coils optional) Finger-safe (IP20) terminals
- Modular design allows accessories and contactors to snap together
- Bimetallic thermal overload relay can be added to create a starter
- Coil termination permits either same side or diagonal wiring

Filters

Tyco Electronics CORCOM brand is one of the worldwide market leaders in the field of EMC filter technologies.

The range offers filter solutions based on more than

50 years experience. A large selection of off-the-shelf filters and already-proven special filters are available, in order to provide an optimal solution for noise reduction problems. Three main categories of filters are available:

1. IEC Plug Filters–Power Entry Modules (PEM) & IEC Plugs

The key ranges in this category are the P Series (PEM), EJ Series and the SRB Series. These filters cover a wide range of applications and connection/assembly requirements, making them suitable for a diverse range of electrical and electronic devices.

2. Single-Phase Filters For Wind Applications

The key ranges in this category are the EMC and B Series. These include an extensive selection of filter ranges for use in single-phase industrial applications, and include a wide range of connection and attenuation properties. Application examples include motors drives, inverters and switching power supplies.

3. Three-Phase Filters For Wind Applications

The key ranges in this category are the BCF and FCD series. The product spectrum comprises 3 and 4-wire filters for a range of 3 to 900A.

Passives

Key resistor technologies are thick film, thin film, and wire-wound and foil technology. These core processes can be adapted to achieve solutions both as standard components or specific to a customers design requirements. In addition Tyco Electronics is offering a market-leading range of inductors and capacitors to satisfy all customer requirements and to minimize their purchasing efforts.

Power Resistors

- Power ratings from 1W to > 1KW
- Wire-wound, thick and thin film, foil, carbon and ceramic composition
- Current-sensing capabilities
- Current sense resistors from 0.5 milliohm, TCRs and tolerances of 50ppm and 1%
- SMD series (TLR) offer power ratings to 3W

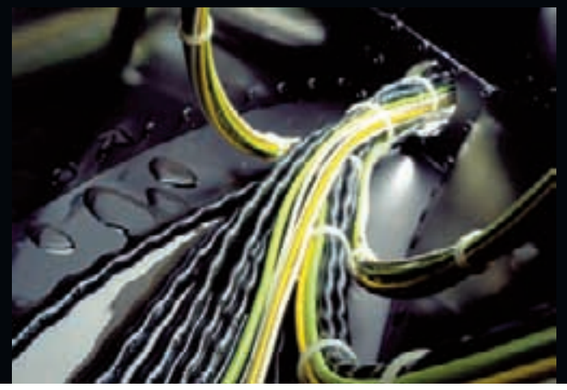
Customised Cables & Cable Assemblies

Value Added Cable Assemblies can be custom-designed to meet individual requirements. Global manufacturing capabilities are available for demand fulfillment based on customers needs.

Comprehensive Engineering Design and Support Teams can provide solutions for even the most demanding applications, including harsh environmental and wind applications. Solutions can be developed to meet individual needs and the entire project can be managed for the customer from concept through project launch - meeting quality, cost and timescale objectives.

Tyco Electronics value added products business development team can create comprehensive cost reduction roadmaps that provide a structured and systematic approach to achieving long-term cost targets. The overall aim is to create sustainable lowest-cost solutions using proven cost-reduction techniques, combined with comprehensive design and manufacturing capabilities.

Wire & Cable

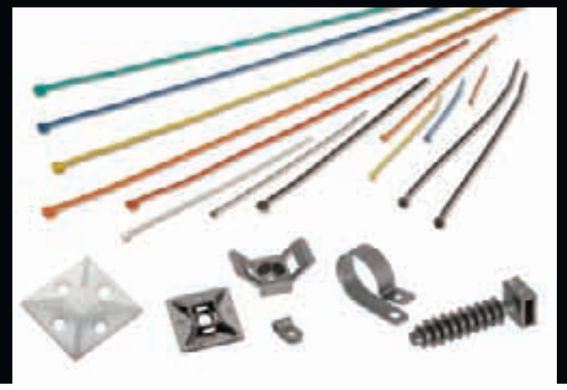


These products utilize Tyco Electronics knowledge of materials and radiation chemistry to maximize the performance of materials, which are used in exacting environments. By using precision extrusion, our wire and cable product range is smaller and lighter when compared to other wires and cables that have a similar electrical performance. This allows for a reduction in the size of cable accessories and connectors. The product range includes high performance insulated wires, coaxial and data bus cables, power cables, electronics wire and multi-core cables.

Features

- Small size
- Lightweight
- 600, 1000 and 2500V rating
- Good chemical resistance
- Available in both wire and multi-cable formats
- Low smoke and low corrosive gas generation
- Resists notch propagation

Cable Ties, Mounts & Accessories



There is a need for cable ties in order to bundle and fasten wires and cables quickly and economically, in various application areas. The range consists of the most commonly used sizes, materials and colors with customer-friendly packaging, and now offers an almost unlimited number of possibilities.

Features

- Self-locking head ensures stable binding power even under extreme conditions - e.g. temperature and vibration
- Interior serrations help to hold individual wires or bundles firmly in place through friction
- The tapered tip, often with a ‘bent tail’ facility for easy insertion, speeds up threading and reduces applied cost
- Tough, smooth polyamide may be used for indoor and outdoor applications
- The all-synthetic one-piece design eliminates metal parts
- Can be applied by hand or by using application tools

Heat Shrink Tubing

With today’s installation techniques, heat shrinkable products simply cannot be ignored. Due to easy processing and shrinking at relatively low temperatures, these products can be used in many applications. With a top performance at a low price, shrink products make it possible to accomplish lasting and safe mechanical and electrical protection of various parts. They also allow repairing of cables and cable connections. Can be used for the development of prototypes or small production runs.

Tyco Electronics offers kits with several different types of shrink tubing, or for other applications an extensive range of heat shrinkable tubing is also offered.

Features

- Flame retardant, standard-grade polyolefin
- Thin wall heat shrinks with a 2:1 shrink ratio
- Wide range of different colors
- Supplied in dispenser packs, multi packs and bulk reels
- Insulation – thermal and electrical
- Protection – chemical and mechanical abrasion
- Strain relief – connectors and splices
- Sealing – moisture, water and fuels
- Identification - earth/grounding color
- Cosmetic – improves appearance

Identification

Tyco Electronics offers a wide range of custom and pre-print adhesive-backed labels as well as dashboards

and membrane keyboards all of which are made from high quality materials and adhesives. We also offer a comprehensive after-sales and technical support service, including full hardware and software installation and training.

Features

- Custom and pre-print labels to meet specific customer application requirements, including custom designs and logos
- UL-certified label materials, marking and labeling systems (PGDQ2 and PGJI2)
- Printer, ribbon and label material solutions
- Custom-designed membrane keyboards and dashboards for industrial control and HMI
- Color-matching to customer specifications: PMS, RAL and BSI standards
- Scratch-resistant and anti-graffiti over-laminating technology
- Multiple types of adhesives to suit most surfaces

Cable Identification

Tyco Electronics is a world-class supplier of industrial identification products, which deliver the latest in wire and cable identification. We offer product lines in a wide range of materials and ink technologies, to suit a range of demanding environments.

Features

- Heat-shrinkable tubing sleeves provide permanent wire identification, strain relief and insulation
- Tie-on cable markers provide identification solutions for large cables and wire bundles
- Available in a multitude of sizes, materials and colors for diverse applications
- Outstanding print quality and mark permanence
- Meets industry and customer-specific standards
- Products will perform in harsh industrial environments and are abrasion resistant and fluid-resistant (oils, greases and fuels) as well as being suitable for high or low temperature applications
- Complete printing system available including software, printers and ribbons

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Reference

REFERENCE GUIDE

Glossary

Internet Glossary of Terms

A

abrasion-resistance A measure of the ability of a wire or wire covering to resist damage by mechanical means.

accelerated aging A test in which voltage, temperature, or other test parameters are increased above normal operating values to obtain observable deterioration in a relatively short time. The plotted results give service life within the context of the test.

adapter A device usually attached to the rear of connectors that provides for the attachment of harnessing components, such as strain-relief clamps, heat-shrinkable boots, and braid.

adhesive liner Lining that melts and flows inside a sleeve or molded part, filling any voids in between the substrate and the sleeve or molded part. DuraSeal has an adhesive liner.

alternating current An electrical current whose direction is reversed at regular intervals.

alternative energy The energy sources other than those derived from conventional fossil fuels. Typically used interchangeably for renewable energy. Examples include: biofuels, biomass, hydroelectric power, geothermal energy, solar energy, wind power, ocean thermal energy, wave power and tidal power

ampacity See current-carrying capacity.

amplitude The magnitude of variation in a changing quantity from its zero value. The word requires modification — as with adjectives such as peak, maximum, rms, etc. — to designate the specific amplitude in question.

arc voltage Voltage that continues to pass through a surge protector during activation of GDT (approx. 20 volts).

ASTM (American Society for Testing and Materials) A nonprofit industry-wide organisation that formulates test methods and material specifications, and publishes standards, testing methods, recommended practices, definitions and other materials.

AWG (American Wire Gauge) The recognised method (in the United States) of specifying conductor size. The higher the gauge number, the smaller the conductor size.

B

back mounted A connector attached to the inside of a panel or box with its mounting flanges inside the equipment.

bare conductor A conductor not covered with insulating material.

barrel ***1.) Connector barrel:*** The section of the terminal, splice, or contact that accommodates the stripped conductor. ***2.) Insulation barrel:*** The section of the terminal, splice, or contact that accommodates the conductor insulation. ***3.) Open barrel:*** The section of a cap that accommodates the conductor.

bayonet coupling A quick-coupling device for plug and receptacle connectors. Mating is accomplished by rotation of the two parts under pressure.

bellmouth Flared at the mouth. The rear of a properly crimped wire barrel will have a slight flare (bellmouth) to relieve the strain on the wire strands as they leave the area of high compression and take their natural "lay". A bellmouth condition may also be present in front of the wire barrel.

binder A spiral wrapping of a thread to hold together the members of a cable.

blade The part of a wind turbine that is pushed by the wind and propels the rotor.

blocking The sticking together of insulated wires; usually caused by heat.

body Main or largest portion of a connector to which other portions are attached.

bonding temperature Temperature above which adhesive melts and flows sufficiently to form an adhesive bond between substrates.

braid A weave of metal fibres used as a shield covering for an insulated conductor or group of insulated conductors. When flattened it may be used as a grounding strap.

braid angle The angle between the braid strands and the axis of the cable.

breakdown voltage The voltage at which an insulator or dielectric fails to maintain the applied voltage.

breakout A region in a harness assembly where a wire or a group of wires is detached to form a separate, terminated branch. Also known as a transition.

bulkhead A term used to define a mounting style of connectors. Bulkhead connectors are designed to be inserted into a panel cutout from the rear (component side) of the panel.

bunch stranding A method of twisting individual strands to form a finished stranded conductor. Specifically, a number of strands twisted together in a common direction and with a uniform pitch (or twist) per inch.

bus A communal circuit over which data or power is transmitted.

C

cable Two or more wires in a twisted or parallel configuration. Also, a shielded wire.

cable clamp A mechanical clamp attached to the cable side of a termination assembly to support the cable or wire bundle. It provides strain relief and absorbs vibration and shock that would otherwise be transmitted by the cable terminations.

cable clamp adapter A mechanical adapter that attaches to the rear of a termination assembly to allow the attachment of a cable clamp.

cable sealing clamp A device consisting of a gland nut designed to seal around the jacket of a cable.

cabler A machine that mechanically assembles a group of insulated wires.

cabling The act of twisting together two or more insulated components to form a cable.

capacitance The property of an electrical conductor (dielectric in a capacitor) that permits the storage of energy as a result of electrical displacement. The basic unit of capacitance is the farad, however, measurement is more commonly in microfarads or picofarads.

capacity factor The ratio of the actual output of a generating facility over a period of time (usually a year) over the theoretical energy output of the generating facility operated at its rated capacity over the same period of time.

carrier A group of strands or ends used to form a finished braid.

chemical resistance The ability of an insulation to withstand the presence of materials – such as acids, bases, water, salt water, and fuels – that can deteriorate the insulation, or that, if penetrable to the conductor, can cause dielectric loss of insulating qualities.

circuit The interconnection of a number of electrical elements or parts to accomplish a desired function.

Circular Mil Area (CMA) A unit of area equal to the area of a circle whose diameter is 1 mil (0.001 inch). Used chiefly in specifying cross-sectional areas of conductors. (See AMP Brochure No. 4402-8, Computing Circular Mil Area for AMP Terminals and Splices).

clocking The arrangement of connector inserts, jackscrews, polarising pins, sockets, keys/keyways, or housing configurations to prevent the mismating or cross-mating of connectors. See also polarisation.

closed entry contact A female contact designed to prevent the entry of a pin or probing device having a cross-sectional dimension (diameter) greater than the mating pin.

cold impact A test performed by subjecting a component to a specified impact during exposure to low temperature. It measures the brittleness of the material.

cold joint A soldered joint made with insufficient heat. (Solder hasn't completely flowed and wet the substrate).

colour code A means of identifying cable components using solid colours or stripes. Also, the scheme that assigns a number from 0 to 9 for each of 10 colours.

component A wire or cable that is combined with other wires or cables to make a multicomponent cable.

compound An insulating or jacketing material made by formulating polymeric materials and additives.

Compound Under Strands (CUS) A problem that occurs when loose stranding, or overheating during extrusion, allows compounds to get under individual strands of conductor.

concentric stranding A method of stranding conductor. Specifically, the final conductor is built up in layers so that the inner diameter of a succeeding layer is always equal to the outer diameter of the underlying layer.

conductivity The capability of a material to carry electrical current, usually expressed as a percentage of copper conductivity (copper being 100%). Specifically, the ratio of the current flow to the potential difference causing the flow. The reciprocal of resistance.

conductor The metallic strand or strands used to carry an electric current.

conductor resistance The resistance to flow of the electrical current along a conductor. Expressed in ohms/1,000 feet. (Usually referenced to 20°C).

conduit A tubular raceway for holding wires or cables.

configuration Arrangement of contacts in a multiple-contact connector.

connector A device used to physically and electrically connect two or more conductors.

connector classes Categories based on shape, function and smallest size contact in a series.

connector insert In connectors with metal shells, the part that holds contacts in proper arrangement while electrically insulating them from each other and from the shell.

contact The element in a connector that makes the actual electrical connection. Also the parts of a connector that actually carry the electrical current, and are touched together or separated to control the flow.

contact crimp A contact whose rear portion is a hollow cylinder that accepts the conductor. A crimping tool is applied to swage or form the contact metal firmly against the conductor. Sometimes referred to as a solderless contact.

contact durability The number of insertion and withdrawal cycles that a connector must be capable of withstanding while remaining within the performance levels of the applicable specification.

contact engaging and separating force Force required to either engage or separate contacts. Values are generally established for maximum and minimum forces.

contact inspection hole A hole, perpendicular to the cylindrical rear portion of screw machined contacts, used to check the depth to which wire has been inserted into the barrel.

contact resistance Measurement of electrical resistance of mated contacts when assembled in a connector under typical service use. Electrical resistance is determined by measuring from the rear of the electrical area of one contact to the rear of the contact area of the mating contact (excluding both crimps) while carrying a specified test current.

contact size The diameter of the engagement end of a pin contact; also related to the current-carrying capacity of a contact.

contact, two-piece A contact made of two separate parts joined by swedging, brazing or other means of fastening to form a single contact. While this provides the mechanical advantages of two metals, it also has the inherent electrical disadvantage of difference in conductivity.

continuity A continuous path for the flow of current in an electrical circuit.

continuous operating temperature Maximum temperature at which a component will maintain an acceptable lifetime performance, based on accelerated aging prediction.

core 1.) In cables, a component or assembly of components over which additional components, such as a shield or a sheath, are applied. 2.) Inner wall of dual-wall heat-shrinkable tubing.

coupling ring The portion of a plug that aids in the mating and demating of a plug and receptacle and holds the plug to the receptacle.

cover, electrical connector An item specifically designed to cover the mating end of a connector for mechanical and/or environmental protection. Also known as a dust cover.

coverage A calculated percentage that defines the completeness with which a braid or shield covers the surface of the underlying insulated conductor or conductors.

crimp The final configuration of a terminal barrel after the necessary compression forces have been applied to cause a functional union between the terminal barrel and the wire.

crimp height A top to bottom measurement of the crimped barrel, using a crimp height comparator in the prescribed manner. (Refer to AMP Instruction Sheet 7424).

crimping dies A term used to identify the shaping tools that, when moved toward each other, produce a certain desirable shape to the barrel of the terminal or contact that has been placed between them. Crimping dies are often referred to as die sets or as die inserts.

crimping head Tooling containing jaws and linkage for use in pneumatic or hydraulic powered units to crimp loose-piece contacts/terminals that may be too large for hand tool applications.

crimping tool A term commonly used to identify a hand held mechanical device that is used to crimp a contact, terminal or splice.

crosslinking The formation of bonds between molecular chains in a polymer by means of chemical catalysation or electron bombardment. The properties of the resulting thermosetting material are usually improved.

crosslinking by irradiation A method of crosslinking polymers that makes a nonflowing material. This generally improves the properties of the polymer.

CSA (Canadian Standards Association) An agency that has developed standard specifications for products with particular emphasis on safety in the end use.

current A movement or flow of electrons. Also, the measure of this flow, expressed in amperes.

current-carrying capacity The maximum current an insulated conductor is capable of carrying without exceeding its insulation- and/or jacket temperature limitations under specified ambient conditions. Also known as ampacity.

current rating The maximum continuous electrical flow of current recommended for a given situation. It is expressed in amperes.

cut-in wind speed The wind speed at which a wind turbine will begin producing electricity.

cutout The hole, usually round or rectangular, cut into a metal panel in order to mount a connector. The cutout may also include holes for mounting screws or bolts.

cut-out wind speed The wind speed at which a wind turbine stops producing power, thereby minimizing damage to the turbine.

cut-through resistance Resistance of solid material to penetration by an object (typically a closely controlled knife edge) under conditions of pressure, temperature, and other elements.

cycle One complete sequence of values of an alternating quantity, including a rise to maximum in one direction and return to zero; a rise to maximum in the opposite direction and return to zero. The number of cycles occurring in one second is called the frequency.

D

die closure Term used to designate a crimping area (crimping chamber) when the dies are fully closed or bottomed. Die closure is checked with go/no go plug gauge to insure that the crimp produced by the tooling satisfies the crimp height specification.

dielectric A material that serves as an insulator. The amount of resistance to voltage in a given insulation.

dielectric breakdown The voltage required to cause an electrical failure or breakthrough of the insulation. Determined by a destructive test. See also breakdown voltage.

dielectric constant (also K) The ratio of the capacitance between two electrodes with a solid, liquid, or gaseous dielectric, to the capacitance with air between the electrodes. Also called permittivity and specific inductive capacity. Generally low values are desirable for insulation.

dielectric strength The maximum voltage a dielectric can withstand without rupture. Usually expressed as volts per mil.

dielectric withstanding voltage The maximum potential gradient that a dielectric material can withstand without failure.

direct current A form of power transmission and distribution in which electricity flows in a single, unchanging direction.

Direct Current Resistance (DCR) The resistance offered by any circuit to the flow of direct current.

direction of lay The lateral direction in which the strands or elements of a cable run over the top of the cable as they recede from the observer. Expressed as right-hand or left-hand lay.

discontinuity Rated interconnection: a broken connection (open circuit) or the loss of a specified connection characteristic. Transient phenomena: Short term (temporary) interruption or unacceptable variation in current or voltage.

distributed generation The use of smaller power generation projects over a wider area as opposed to large power plants servicing a wide region.

distribution The dispersal of electricity from the transmission system to the customer.

drain wire In a cable, an un-insulated conductor laid over the component, or components, in a foil-shield cable. Used as a ground connection.

dust cover See cover, electrical connector.

E

elastic memory The ability of a crosslinked polymer to be deformed to some predetermined shape, hold that shape for a period, and then return to its original shape upon the application of heat.

elastomer A material that exhibits very low or zero crystallinity and a high degree of flexibility (rubber is a synonym).

electromagnetic compatibility (EMC) The ability of an electronic device to operate in its intended environment without its performance being affected by EMI and without generating EMI that will affect other equipment.

electromagnetic interference (EMI) Unwanted electrical or electromagnetic energy that causes undesirable responses, degrading performance or complete malfunctions in electronic equipment. See also: noise.

electromotive force (emf) See voltage.

elongation The ultimate elongation, or elongation at rupture. Expressed as a percentage of original length.

EMI Abbreviation for electromagnetic interference.

encapsulant Description related to the way dual-wall tubing products and precoated molded parts melt and flow when heated, filling any void in the area being covered. Unlike an adhesive, an encapsulant does not form a mechanical bond to the substrate.

Glossary

encapsulation Covering and sealing.

environmentally sealed A unit is provided with gaskets, seals, grommets, potting or other means to keep out moisture, dust, air or dirt which might reduce or impair its performance.

epoxy A family of thermosetting resins usually used as adhesives or encapsulants.

Expanded ID (EID) The specified minimum (as supplied) internal diameter of tubing.

expansion ratio An expression of how much larger the inside diameter of a tubing is before shrinking. Specifically, the relationship of the minimum (expanded) inside diameter of tubing to the maximum (recovered) inside diameter, expressed as a ratio. See also shrink ratio.

extraction tool A tool used for removing contacts from a connector body.

F

feedthrough A connector or terminal block, usually having double-ended terminals, which permits distribution and bussing of electrical circuits. Also used to describe a bushing in a wall or bulkhead, separating compartments at different pressure levels, with terminations on both sides.

ferrule A short tube used to make solderless connections to shielded or coaxial cable. Also molded into the plastic inserts of multiple contact connectors to provide strong, wear-resistant shoulders on which contact retaining springs can bear.

filler A material used in a cable construction to fill large interstices, thus providing a round construction; can be shaped, round, or in mastic forms. A nonfunctional member used in a cable to provide a more circular cross section.

flame-resistant A descriptor applied to a material that is inherently resistant to burning.

flame retardant A descriptor applied to a material that has been made or treated so as to resist burning.

flat braid A braided shield composed of flat strands.

flat cable A cable with each component in a single, flat plane.

flat conductor A conductor having a rectangular cross section, as opposed to a round or square cross section.

flex life A measure of the susceptibility of a conductor or other device to failure due to fatigue from repeated bending.

flux A liquid or solid that, when heated, exercises a cleaning and protective action upon surfaces. Used to promote or facilitate fusion during soldering or welding.

fretting corrosion A form of excellerated oxidation that appears at the interface of contacting materials undergoing slight cyclic relative motion. All non-nobel metals (tin) are susceptible to some degree of fretting corrosion and will suffer contact resistance increases.

front mounted A connector is said to be front mounted when it is attached to the outside of the mating side of a panel. A front mounted connector can only be installed or removed from the outside of the equipment.

front release contacts Connector contacts that are released from the front side of the connector and then removed from the back, wire side of the connector.

full recovery temperature, minimum See recovery temperature.

G

gauge A term used to denote the physical size of a wire. See also AWG.

gigawatt (GW) A unit of power equal to one billion watts, one million kilowatts or one thousand megawatts.

grid The transmission system used to deliver electricity to consumers from the source of generation.

ground A connection, intentional or accidental, between an electrical circuit and the earth or some conducting body (e.g. chassis) serving in place of earth.

grounding conductor A conductor that provides a current return path from an electrical device to ground.

H

hardness A general term that correlates with strength, rigidity, and resistance to abrasion or penetration. Measured on Shore or Rockwell scales. See also Shore.

harness A system providing electrical connection between two or more points.

heat aging A test that subjects components or materials to temperatures above normal operating values to evaluate changes in performance in order to predict service life. See also accelerated aging.

heat shock A test to determine the stability of a material by continuously exposing it to an extremely high temperature for a short period of time. The test was developed both to demonstrate that the material is crosslinked and to observe any problems in dripping, cracking or flowing.

heat-shrinkable A type of plastic material that has been cross-linked. A term describing tubes, sleeves, caps, boots, films or other forms of plastic which shrink to encapsulate, protect or insulate connections, splices, terminations and other configurations.

hermetic Airtight, impervious to external influence, as in a hermetic package. Often used to describe metal-to-metal solder or weld-sealed packages.

hermetic seal Hermetically sealed connectors are usually multiple contact connectors where the contacts are bonded to the connector by glass or other materials and permits maximum leakage rate of gas through the connector of 1.0 micron ft./hr. at one atmosphere pressure for special applications.

hertz (Hz) International standard term for cycles per second. Named after the German physicist Heinrich R. Hertz (e.g., 60 cycles per second is equal to 60 hertz or 60 Hz).

hookup wire and cable Wiring used to connect various points in electronic assemblies.

hot-melt adhesive An adhesive that becomes activated by heating. When heated, it melts, flows over the substrate surface, and forms an adhesive bond. Reheating causes the adhesive to remelt.

hub The center of a wind turbine rotor, which holds the blades in place and connects to the rotor shaft inside the nacelle.

I

ID (Internal Diameter) The inside or internal diameter of a tubing.

impulse test A high voltage test designed to locate pinholes in the insulation of a wire or cable by applying a voltage while the wire or cable is being drawn through an electrode.

inductance One cause of reactance. An electromagnetic phenomenon in which the expanding and collapsing of a magnetic field surrounding a conductor or device tends to impede changes in current. The effects of inductance become greater as frequencies increase. The basic unit for inductance is the henry.

insert Meltable thermoplastic ring placed within a SolderSleeve device. Aids in encapsulation and sealing.

insert (connector) Part that holds the contacts in their proper arrangement and electrically insulates them from each other and from the shell.

insert arrangement (connector) The number, spacing and arrangement of contacts in a termination assembly.

insert cavity (connector) A defined hole in the connector insert into which the contacts are inserted.

insertion tool (connector) A tool used to insert removable contacts into a connector.

inspection hole A hole placed at one end of a contact barrel to permit visual inspection, to ensure that the conductor has been inserted to the proper depth in the barrel prior to crimping or soldering.

installed capacity The maximum energy capacity of all equipment such as turbines, generators, condensers, etc., in a defined area.

insulated terminal A solderless terminal with an insulated sleeve over the barrel to prevent a short circuit in certain installations.

insulation crimp The area of a terminal splice or contact that has been formed around the insulation of a wire.

insulation, electrical A nonconductive material usually surrounding or separating two conductive materials. Often called the dielectric in cables designed for high-frequency use.

insulation grip The ability of certain crimped terminals to hold firmly in place both the conductor and a small portion of insulation. This prevents the conductor from being exposed due to insulation receding away from the terminal.

insulation resistance The electrical resistance between two conductors separated by an insulating material.

insulation, thermal A nonconductive material that prevents the passage of heat.

interconnection The joining of one individual device with another.

interface The two surfaces of a multiple-contact connector that face each other when the connector is assembled.

interference An electrical or electromagnetic disturbance that causes undesirable response in electronic equipment.

interstice In a cable construction, the space or void left between or around the cabled components.

inverter An appliance that converts direct current electricity into alternating current electricity in order to provide power to an electricity grid.

irradiation In insulations, the exposure of the material to high-energy emissions for the purpose of favorably altering the molecular structure via crosslinking.

J

jack A connecting device into which a plug can be inserted to make circuit connections. The jack may also have contacts which open or close to perform switching functions when the plug is inserted or removed. See also: receptacle.

jacket 1.) A material covering over a wire or cable assembly. 2.) Outer covering of a dual-wall heat-shrinkable tubing.

jackscrew A screw attached to one half of a two-piece, multiple-contact connector and used to draw both halves together and to separate them.

K

key (connector) A short pin or other projection that slides into a mating slot or groove to guide two parts being assembled.

keying (connector) Mechanical arrangement of guide pins and sockets, keying plugs, contacts, bosses, slots, keyways, inserts, or grooves in a connector housing, shell or insert that allows connectors of the same size and type to be lined up; used in situations where there is danger of making a wrong connection.

keyway The slot or groove in which a key slides.

kV (kilovolt) A unit equal to 1,000 volts.

kilowatt (KW) A unit of electrical power equal to 1,000 watts.

kilowatt-hour (KWH) A unit of electrical energy equal to the consumption of 1,000 watts over the period of one hour.

L

lacing cord or twine Used for lacing and tying cable forms, hookup wires, cable ends, cable bundles and wire harness assemblies. Available in various materials and impregnants.

lanyard A device, attached to certain quick-disconnect connectors, that permits uncoupling and separation of connector halves by a pull on a wire or cable.

lay Refers to direction or sometimes the ratio of lay length to core diameter.

lay length A term used in cable manufacturing to denote the distance of advance of one member, or a group of spirally twisted members in one turn, measured axially. The lay of any helical element of a cable or conductor is the axial length of a turn of the helix of that element.

life cycle A test to determine the length of time before failure in a controlled, usually accelerated environment.

liner See core.

load The demand required of an energy-producing system.

load factor The ratio of the average electric demand (load) to peak load over a period of time.

load profile A line graph showing changes in a customer's or system's energy demand over time (often 24 hours).

longitudinal change (shrink tubing) The change in length of tubing when recovered. Expressed in the percent of change from the original length.

lug A termination, usually crimped or soldered to a conductor, that allows connection to be made with a retaining screw.

M

marking A printed identification number or symbol applied to the surface of a wire or cable.

matched impedance The coupling of two circuits in such a way that the impedance of one circuit equals the impedance of the other.

mate To join two connectors in a normal engaging mode.

maximum discharge current defined as the peak current of an impulse which the device can withstand once without substantially affecting device performance.

mega (M) A prefix meaning one million (106).

megawatt (MW) A unit of power equal to one million watts.

megawatt-hour (MWH) One thousand kilowatt-hours.

melt/flow index Measurement of the flow of thermoplastic material under given conditions of temperature and pressure. Expressed as grams per unit of time.

melting point The temperature at which crystallinity disappears when crystalline material is heated.

microturbine Residential-sized wind turbine which may be mounted in groups to collect wind and convert it into electricity.

MIL A unit equal to one one-thousandth of an inch (.001"); used in measuring the diameter of a conductor or thickness of insulation over a conductor.

minimum full recovery temperature See recovery temperature.

multiconductor More than one component within a single-cable complex.

multiple-conductor cable A combination of two or more components cabled together.

N

nacelle The structure located at the top of the tower, behind the hub of the wind turbine rotor, housing the generator

nick A small cut or notch in conductor strands or insulation.

noise An extraneous signal in an electrical circuit, capable of interfering with the desired signal. Classes of noise include burst of popcorn noise, intermediate frequency noise at low audio frequencies, white (thermal) noise, etc. Signals from power supply or ground line coupled into an amplifier output may be considered noise.

nominal A descriptor applied to a dimension representing the centre of the range of tolerance or a value if no tolerance is applied.

O

"O" crimp An insulation support crimp for open barrel terminals and contacts. In its crimped form it resembles an "O" and conforms to the shape of the round wire insulation. "O" crimp is also used to describe the circumferential crimps used on COAXICON ferrules.

OFT (Optional Flame Test) Canadian Standards Association's test for flame-retardance. Tubing with an OFT rating is highly flame-retardant.

On peak The times of the year and of the day with greater power demands, typically occurring in predictable patterns.

operating temperature The maximum internal temperature at which a system, harness, or connector may operate in continuous service; generally expressed as a time and temperature.

operating temperature range The range between the maximum and the minimum internal temperature of insulation in a system, harness, or connector in continuous service. The lower limit is determined by low temperature flex test.

Optional Flame Test See OFT.

P

P-50 The minimum estimated amount of power that a given wind turbine will yield in a year 50% of the time

P-90 The minimum estimated amount of power that a given wind turbine will yield in a year 90% of the time.

packaging The process of physically locating, connecting, and protecting devices or components.

panel The side or front (usually metal) of a piece of equipment on which connectors are mounted.

panel mount A method of fixing a connector to a board, panel or frame. The mounted connector is usually the receptacle or female connector. The plug or male connector is usually the removable portion.

peripheral seal A seal provided around the periphery of connector inserts to prevent the ingress of fluids or contaminants at the perimeter of mated connectors.

pigtail A short conductor or wire extending from an electrical or electronic device to serve as a jumper or ground connection.

pin contact An electrical terminal, usually in a connector. Normally a smaller termination than a lug.

pitch control The control of a wind turbine's speed by altering blade orientation thereby altering rotor speed, aerodynamics and efficiency.

plastic deformation Change in dimensions under a load that does not recover when the load is removed.

plating The overlaying of a thin coating of metal on metallic components to improve conductivity, facilitate soldering, or prevent corrosion.

plug The part of a connector that is normally "removable" from the other, permanently mounted part; usually that half of a two-piece connector that contains the pin contacts.

plug connector An electrical connector that is intended to be attached to the free end of a conductor, wire, cable, or bundle, and that couples or mates to a receptacle connector.

Glossary

poke through A term describing stray wires in a solder joint that poke through the insulation.

polarisation (connectors) A mechanical arrangement of inserts or the shell configuration (referred to as clocking in some instances) that prohibits the mating of mismatched plugs and receptacles. See also clocking.

polyamide A polymer formed by the reaction of a diamine and a diacid. Nylons are commercial polyamides characterised by toughness, solvent resistance, and sharp melting point.

polymer A material of high molecular weight formed by the chemical union of monomers.

polyolefin A family of polymers (such as polyethylene and polypropylene) made from olefin monomers.

potting The permanent sealing of the cable end of a connector with a compound or material that thermosets into an elastomer, to exclude moisture and/or to provide strain relief.

power curve A graph outlining changes in the amount of electrical power output. For a wind turbine it shows power output at various wind speeds.

pretinned Description of an electrical component to which solder has been applied prior to soldering.

primary insulation The inner member of a dual-wall wire insulation. The insulation applied directly on the conductor. Also referred to as the core. See also core.

printed circuit board (pcb) An insulating board serving as a base for a printed circuit. When the printing process is completed, the board may include printed components, as well as printed wiring.

PVC (Polyvinyl chloride) A polymer compound used as wire insulation.

Q

quality assurance Systematic, planned, and documented activities designed to provide confidence that a product will meet specifications.

quality control Activities that monitor, measure, and control the characteristics of a material, component, or product to documented specifications.

quick disconnect A type of connector shell that permits rapid locking and unlocking of two connector halves.

R

radiation crosslinking The act of crosslinking a material with ionising radiation. (Most Raychem products are radiation crosslinked, with an electron beam as the form of ionising radiation.) See also crosslinking by irradiation.

rated temperature The maximum temperature at which a component can operate for extended periods with acceptable changes in its basic properties.

rated voltage The maximum voltage at which an electric component can operate for extended periods without undue degradation.

receptacle Usually the fixed or stationary half of a two-piece multiple contact connector. Also the connector half usually mounted on a panel and containing socket contacts.

removable contact A contact that can be mechanically joined to or removed from an insert. Usually special tools are required to lock the contact in place or remove it for repair or replacement.

renewable energy The energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include, biofuels, biomass, hydroelectric power, geothermal energy, solar energy, wind power, ocean thermal energy, wave power and tidal power. See also "alternative energy."

residual impulse Defined as the voltage that will pass through the device prior to activation of the GDT.

residual voltage Defined as the small amount of voltage left on the line after an impulse passes.

resistance A measure of the difficulty in moving electrical current through a conductor or insulation when a voltage is applied. It is measured in ohms.

resonance A frequency at which captive reactance and inductive reactance.

ribbon cable Flat cable with conductors that have been individually insulated together. Its structure is usually characterised by individual colours of insulation for each conductor, although a single colour may be used for all conductors.

root mean square (rms) The effective value of an alternating current, corresponding to the direct current value that will produce the same heating effect.

rope lay A type of conductor lay that uses stranded conductors as components to build a larger conductor.

rotor A multi-bladed assembly at the front of the wind turbine. Also called an armature.

RT and RW specifications Specification that describes standard product properties. Qualification and acceptance inspection criteria are incorporated into RT and RW specifications. RT and RW specifications are issued and controlled by the Specifications Group.

S

sealant Soft, tacky, pliable material that seals where mechanical strength is not required.

sealed Environmentally protected by the thermoplastic inserts or core of encapsulant/adhesive that has melted down around the substrate.

sealing plug A plug that is inserted to fill an unoccupied contact aperture in a termination assembly.

semi-rigid A cable containing a flexible inner core and a relatively inflexible sheathing.

shelf life Generally, the length of time a product or material may be stored without deterioration. Specifically, the length of time during which shrink tubing will retain its expanded ID and return to its recovered ID. Usually not a concern—except for some "amnesic" materials. See amnesia.

shell (connector) The outside case, usually metallic, into which the insert (body) and contacts are assembled. Shells of mating connector halves usually provide for proper alignment and polarisation as well as for protection of projecting contacts.

shock (mechanical) (1) An abrupt impact applied to a stationary object. (2) An abrupt or nonperiodic change in position, characterised by suddenness, and by the development of substantial internal forces.

shore A scale for comparing hardness. Higher Shore values represent harder materials. The hardness of a polymer, for example, is usually represented as Shore A or Shore D, with D being harder.

shrink ratio An expression of how much the inside diameter of shrink tubing will reduce in size when recovered. The inverse of the expansion ratio. See also expansion ratio.

shrink temperature, minimum The minimum temperature at which a product begins to recover.

SHV Abbreviation for standard high voltage.

signal cable A cable designed to carry current of less than 12 amperes per conductor.

skew Any out-of-squareness of the cut end of a piece of tubing after shrinking.

skin effect The tendency of alternating currents to flow near the surface of the conductor, thus being restricted to a small part of the total cross-sectional area. This effect increases the resistance and becomes more marked as the frequency rises.

sleeve The insulated or metallic covering over the barrel of a terminal.

solder An alloy that melts at relatively low temperatures and is used to join metals with higher melt points.

solder contact A contact or terminal having a cup, hollow cylinder, eyelet or hook to accept a wire for a conventional soldered termination.

solder cup A tubular end of a terminal into which a wire conductor is inserted prior to being soldered.

solderability The property of a metal surface that allows it to be readily wetted by molten solder. See also wetting.

soldering A process of joining metallic surfaces with solder without melting the base metal.

SolderSleeve device A device of flux-coated solder preform encapsulated in a heat-recoverable plastic sleeve. Upon the application of heat, the flux and solder will melt and flow as the sleeve recovers, forcing the solder around and onto the metallic parts being joined, thus forming an electrically insulated and strain-relieved joint.

solid conductor A conductor composed of one single strand.

solvent resistance The ability of a material to retain physical and electrical properties after being immersed in specific solvents.

SPC Silver-plated copper.

specific gravity The ratio of the density (mass per unit volume) of a material to that of water.

splice A joint connecting conductors with good mechanical strength and conductivity; a terminal that permanently joins two or more wires.

strain relief The technique for or act of removing or lessening the strain or stress on a joint, splice, or termination. SolderSleeve devices provide strain relief.

strain relief clamp See cable clamp.

strand A single unit of a conductor.

stranded conductor A conductor composed of more than one single strand. The strands in stranded conductors are usually twisted or braided together.

strip To remove insulation from a wire or cable.

stripe A continuous longitudinal or spiral colour strip applied on the surface of a wire, cable, or tubing for identification.

substrate The material – such as a wire, post, or tab – over which an interconnection device is used.

super high frequency (shf) The Federal Communications Commission designation for the band from 3,000 to 30,000 MHz in the radio spectrum.

surface resistance The ratio of the direct current applied to an insulation system to the current that passes across the surface of the system.

swept area The full circumference through which the blades of a wind turbine rotor spin, as seen when facing the rotor.

T

tape wrap A term denoting a spirally or longitudinally applied tape material wrapped around insulated or uninsulated wire and used as a mechanical barrier.

TC Tinned copper.

tear test A test to determine the tear strength of an insulating material. Usually includes exposure to given thermal conditions or a programmed series of conditions for prescribed periods of time.

temperature rating The maximum temperature at which the insulating material may be used in continuous operation without loss of its basic properties. Usually time dependent.

tensile The amount of axial load (longitudinal stress) required to break or pull the wire from the crimped barrel of the terminal, splice or contact.

tensile strength The greatest longitudinal stress that a substance or union can bear without tearing or pulling apart. In crimped terminations, it is the greatest longitudinal stress that a terminal can bear without the wire separating from the terminal.

thermal rating The effect of heat or cold applied at such a rate that nonuniform thermal expansion or contraction occurs within a given material or combination of materials. In electrical terminations, the effect can cause inserts and other insulation material to pull away from the metal parts.

thermal shock The effect of heat or cold applied at such a rate that nonuniform thermal expansion or contraction occurs within a given material or combination materials. The effect can cause inserts and other insulation materials to pull away from metal parts.

thermochromic indicator Special compound that changes colour when the proper wetting temperature has been reached in the solder joint.

thermoplastic A material that softens (melts and flows) when heated and becomes firm when cooled. A type of plastic that can be remelted a number of times without any important change in properties. Nylon, GE's Lexan, and PVC—examples of this type of plastic—are resilient after molding.

thermoset A material that hardens or sets when heated and, once set, cannot be resoftened by heating. This application of heat is called "curing."

thermosetting plastic A type of plastic in which an irreversible chemical reaction takes place while the plastic is being molded under heat and pressure.

thermosetting adhesive A curing adhesive that requires heat to promote curing. This type of plastic will not soften when reheated. See epoxy.

tolerance The total amount by which a quantity is allowed to vary from nominal; thus, the tolerance is half the algebraic difference between the maximum and minimum limits.

transmission The transportation of electrical energy over long distances, most often done at high voltages.

turbine A machine that converts an energy source (such as heat energy in steam, or kinetic energy in wind or water) into mechanical energy. By passing the energy source through blades attached to a central shaft and turning the blades like a fan, the mechanical energy that is generated can be used directly by the machine or converted into electricity.

U

UL (Underwriters' Laboratories) A nonprofit independent testing organisation that operates a listing service for electrical and electronic materials and equipment.

ultraviolet degradation The degradation caused by long-time exposure of a material to sunlight or other ultraviolet rays.

V

volt (V) The unit of measurement for electromotive force (emf). It is equivalent to the force required to produce 1 ampere through a resistance of 1 ohm.

voltage The difference of electrical potential between two points of an electrical circuit, expressed in volts.

voltage (E) The term most often used to designate electrical pressure that exists between two points and is capable of producing a flow of current when a closed circuit is connected between the two points. Voltage is measured in volts, millivolts, microvolts and kilovolts. The terms electromotive force (emf), potential, potential difference and voltage drop are often referred to as voltage.

voltage breakdown The voltage necessary to cause insulation failure.

voltage drop The voltage developed across a component or conductor by the flow of current through the resistance or impedance of that component or conductor.

voltage rating The voltage that may be continuously applied to wire.

volume resistivity Reciprocal of conductivity; the resistance of a material to the flow of electrical current, usually expressed in ohm-cm.

VW-1 A rating determined by the Underwriters' Laboratories' (UL) optional Vertical Wire Flame Test – the most difficult flame test for tubing. Tubings with a VW-1 rating are highly flame-retardant.

W

wall thickness The thickness of the applied insulation or jacket.

water absorption test A method to determine the water uptake of a material. It is time and temperature dependent.

water blocking The sticking together of insulated wires; usually caused by heat.

watt A standard unit of measurement for electrical power in the metric system.

wetting (solder) The formation of a relatively uniform, smooth, unbroken, and adherent film of solder to a base metal. Also, the free flow of solder alloy, with proper application of heat and flux, on a metallic surface to produce an adherent bond.

wicking The longitudinal flow of a liquid in a wire or cable construction due to capillary action. (This may also apply to solder.)

wind easement A written agreement ensuring access to an undisturbed flow of wind across real property, subject to the same state requirements as other easements respecting real property.

wind energy The energy created by the movement of wind via a wind turbine.

wind power density A measurement of watts per square meter at a measured site as a means to determine the amount of wind energy that will be available for conversion into electricity by a wind turbine.

wind resource The amount of energy available in a given area, typically used as a measure of projecting the performance of a wind turbine.

wind turbine A machine for converting wind energy into electricity.

wind turbine rated capacity The amount of power produced by a wind turbine at its rated speed.

wire A single conductor covered with insulation.

wire dress The orderly arrangement of wires and laced harnesses.

withstanding voltage The test voltage an electrical connector can withstand for one minute without showing evidence of electrical breakdown when the voltage is applied between conductors and grounding devices of the connectors in various combinations.

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