

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

---

Authors: Olga Rubio, Vince Hill, Clive Benning, Detlef Luksch

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

TE CONNECTIVITY (TE) IS ONE OF THE WORLD'S LEADING COMPANIES IN DEVELOPING, SUPPLYING AND MANUFACTURING HIGH QUALITY, TECHNOLOGICALLY ADVANCED, HEAT SHRINK PROTECTION PRODUCTS. OUR PRODUCT PROVIDES A PERFECT SOLUTION FOR TOUGH ENGINEERING PROBLEMS.

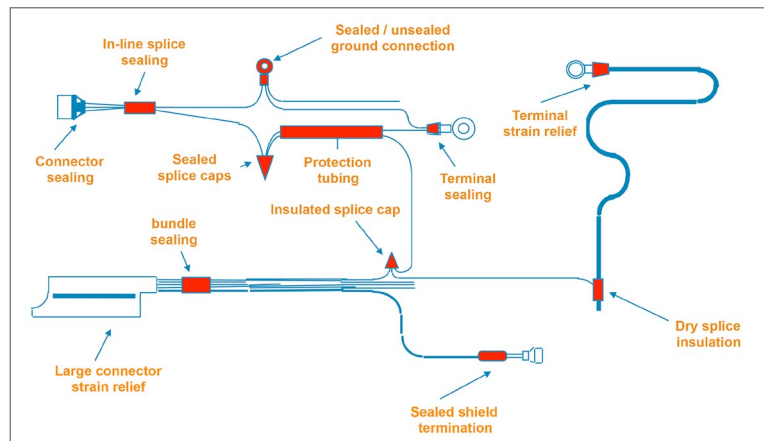
TE's Raychem heat-shrink products are in service throughout the world in automotive, telecommunications, power distribution, aerospace, defence, industrial and commercial applications.

Produced using Raychem state-of-the-art manufacturing facilities and processes, TE's Raychem tubing products are made from uniquely formulated materials that have been enhanced by radiation cross-linking, a technology that TE Connectivity under the brand of Raychem, famously pioneered.

These easy-to-use products provide cost effective, proven solutions in a wide range of automotive applications from sealing and protecting electrical splices to providing mechanical protection for fluid management systems in harsh environments.

The single wall tubing products have a wide range of characteristics. They can be used wherever reliable insulation, strain relief and protection from mechanical abrasion and chemical abuse is needed. They are an ideal way to identify or code components or simply use them to enhance aesthetics.

The adhesive-lined range shows its strength where sealing and encapsulation are critical requirements, as well as demonstrating many of the features of the single wall products. The inner adhesive can deliver a true seal against moisture and fluid ingress.



### Benefits | Features

- Complete solution provided. Tubing, installation equipment, application engineering support and training – available at AUT-WireTubing-TechSupport.
- Simple and fast installation supported by a wide range of TE Automotive application equipment.
- Renowned for their unrivalled performance and reliability in demanding environments.
- Durable, provide long-term protection against moisture ingress, corrosion, mechanical damage and extremes of temperature.
- Engineered to be cost-effective.
- Product design ensures a repeatable, reliable, shrink to fit installation compatible with present day manufacturing processes.
- Available in a wide range of materials, polyolefins, fluoropolymers and elastomers.
- Different degrees of flexibility, from highly flexible to semi-rigid tubings.
- Designed for operation in high or low temperature environments.
- Halogen free and flame retardant to meet a range of industry standards.
- Available in many sizes, constructions, lengths and colours.
- Available with shrink ratios of 2:1 up to 7:1.
- Customer specific sizes on request.
- RoHS/ELV compliant
- Fully certified production plants according to TS16494 and ISO 14001

### Technology

#### • Polymer formulation

TE Connectivity's Raychem formulations are blends of polymers and additives that are carefully designed to meet the stringent customer demands and internal specification requirements. They meet international standards and OEM approvals in many electronics markets.

The selection of polymers, flame-retardants, anti-oxidants, UV-stabilisers and other additives is of great importance for products to meet requirements of properties such as tensile strength, elongation at break, flame retardancy, continuous operating temperature, heat shock, heat ageing, flexibility, chemical and solvent resistance and shrink temperature.

TE Connectivity's Raychem hot melt adhesives are specifically formulated to be compatible with individual heat-shrink tubing compounds. These adhesives include a balance of polymers and additives that allow the adhesive to melt, flow, seal and adhere to a range of substrates at the shrink temperature of the overall tubing.

#### • Cross-linking

Radiation cross-linking enhances the polymer properties and provides heat-shrinkability or shape memory.

Polymeric tubing is extruded and in a separate process the chemical structure is modified to provide improved properties such as reduced deformation under load (creep), improved chemical and solvent resistance, increased abrasion resistance, improved impact properties and shape memory characteristics.

Due to the three dimensional cross-links which are formed during the cross-linking process, the tubing does not melt and obtains its perfect shape memory.

#### • Manufacturing technology

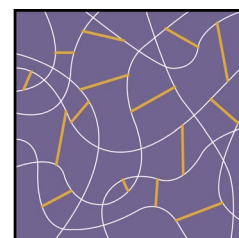
Based on many years of experience Raychem tubing by TE Connectivity is produced using optimised manufacturing processes by the following steps: compounding, extrusion, radiation cross-linking and expansion.

Compounding processes are used to mix selected polymers and additives. The resulting compounds are then extruded using optimised screw and die designs to produce homogeneous and consistent tubing. The tubing is then cross-linked using electron beam radiation.

In the expansion process the diameter of the tubing is increased by forces at high temperature. Immediately after the tubing reaches its required expanded size, it is cooled down and retains its expanded dimensions.



Unmodified  
Polymer

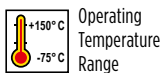


Cross-linked  
Polymer

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

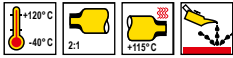
## Protection: Chemical / Mechanical Abrasion

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<p>Under bonnet cable protection</p> 	<p>Underbonnet higher temperatures and exposure to aggressive fluids place additional demands on the materials used to protect cables in these harsh environments. Products will require to offer long term heat resistance and withstand immersion in diesel fuels, hydraulic fluids and lubricating oils. Flexibility and abrasion resistance are ideal for the protection of electrical cables or similar components in these environments.</p>	<p><b>DR-25</b></p> <ul style="list-style-type: none"> <li>• Excellent resistance to fluids</li> </ul>  <p><b>FRAG</b></p> <ul style="list-style-type: none"> <li>• Good long term heat resistance</li> <li>• Flexible and abrasion resistant</li> </ul> 	 <p><b>Model 105</b></p> <ul style="list-style-type: none"> <li>• Closed-loop speed and temperature control</li> <li>• Continuous controlled process</li> <li>• Adaptable for different applications</li> <li>• CE approved</li> <li>• Heater operation and over-temperature alarm lights</li> </ul>
<p>Hoses</p> 	<p>Vehicle engine compartments are becoming ever more crowded and compact, often forcing cooling hoses to be routed in close proximity to high temperature engine components and under-bonnet parts. This makes hoses highly vulnerable to abrasion and chafing. This same space considerations may require hoses to be designed with sharp bends and other radical shapes, making difficult for manufacturers to fit protective sleeves where damage is likely to occur. An added complication is the effect that any over-protection may have on its surrounding components. Contacts between two hoses or a hose and a harness are hard to avoid. Where over-protection is used to alleviate this problem it needs to be non-abrasive itself and protect both components.</p>	<p><b>HFT 5000</b></p> <ul style="list-style-type: none"> <li>• Highly flexible woven fabric construction for easy installation onto bent hoses</li> <li>• Excellent mechanical and abrasion protection</li> <li>• Extremely tough meeting even demanding automotive abrasion specifications</li> <li>• Grips substrates without additional fixing</li> <li>• Resists harsh engine compartment environments</li> <li>• Safe installation with no hot knife cutting equipment required</li> <li>• Resists hose pulsing effects</li> <li>• Protect only where protection is needed - minimizing cost</li> <li>• Halogen free</li> </ul> 	
<p>Brake Pipes</p> 	<p>Metal brake and fuel lines, particularly those routed underneath vehicle floorpans and near suspension components, are exposed to substantial mechanical damage from flying stones and gravel. This damage can compromise the integrity of the pipe and abrade the protective coating surrounding the pipe allowing corrosion to set in. Auto manufacturers must find cost-effective ways of protecting these pipes to meet ever-increasing standards of vehicle reliability and safety.</p>	<p><b>AP-2000</b></p> <ul style="list-style-type: none"> <li>• Provides environmental and mechanical protection from corrosion</li> <li>• Designed to be positioned on straight pipe lengths before are bent and formed</li> <li>• Adds protection only where it is needed minimising costs compared to whole pipe coating</li> <li>• Simultaneous moisture proof sealing hot melt adhesive flows between tubing and pipe</li> <li>• Greater versatility, can be over expanded to allow over end fitting</li> </ul> 	




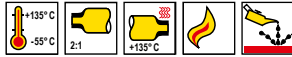
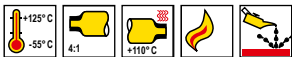


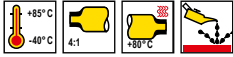



# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Protection: Chemical / Mechanical Abrasion

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<p>Air Conditioning</p> 	<p>Automotive aluminium air-conditioning lines must be thermally insulated to ensure maximum efficiency of the vehicle's air-conditioning system. These lines must also be protected from metal-to-metal contact with the vehicle's frame and other components to prevent noise and vibration from being transmitted into the vehicle interior. Corrosion can also be a problem particularly where lines are subject to road spray, and at the points where lines are clipped to the vehicle frame or other components.</p>	<p><b>RPT-120</b></p> <ul style="list-style-type: none"> <li>• Provides a tough resilient layer to protect the component beneath</li> <li>• Good surface finish giving a professional look to the final product</li> <li>• Easy to install with conventional heating equipment</li> <li>• Low shrink temperature for fast installation</li> </ul>  <p><b>AP-2000</b></p> <p>See page 6</p>	 <p><b>Model 105</b></p> <ul style="list-style-type: none"> <li>• Closed-loop speed and temperature control</li> <li>• Continuous controlled process</li> <li>• Adaptable for different applications</li> <li>• CE approved</li> <li>• Heater operation and over-temperature alarm lights</li> </ul>
<p>Diesel Injection Clusters</p> 	<p>Manufacturers are constantly searching for new ways to reduce engine noise, particularly in diesel vehicles where higher mechanical noise levels are perceived as a major disadvantage compared to petrol engines. Research has shown that high pressure diesel fuel injection clusters, which take fuel from the fuel pump to the injector can emit a significant "rushing" noise as fuel is transferred along the pipes.</p>	<p><b>ATUM</b></p> <ul style="list-style-type: none"> <li>• ATUM tubing provides excellent noise dampening performance</li> <li>• Reduced production times as tubes can be bent or formed on the pipe</li> <li>• Moisture proof sealing - adhesive melts and flows to provide permanent bond</li> <li>• High strength bonding to substrates</li> </ul>  <p>*(black and colours only)</p>	

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Strain Relief

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<p><b>Connectors</b></p> 	<p>Heavy gauge power distribution cables used in cars are typically long and heavy and can be difficult to work with. Many of these cables have to accommodate tight radius bends and other shapes to fit in crowded underbonnet areas. Products offering strain relief are required in these applications.</p> <p>For wet and high temperature areas such as engine compartments manufacturers need simple, versatile sealing systems with a minimum number of components.</p>	<p><b>CRN</b></p> <ul style="list-style-type: none"> <li>• Excellent abrasion resistance</li> <li>• Outstanding physical and electrical performance</li> <li>• Excellent chemical and solvent resistance</li> <li>• Good strain relief performance</li> </ul>  <p><b>HTAT</b></p> <ul style="list-style-type: none"> <li>• Low profile mechanical protection, strain relief and sealing</li> <li>• Semi-flexible, dual-wall moisture proof</li> <li>• High strength bonding</li> </ul> 	<p><b>IR-1891 Shuttle Machine</b></p> <ul style="list-style-type: none"> <li>• Automatic cycle start once heater is manually positioned over product, which gives improved process control (recommended for adhesive lined heat shrinkable tubing e.g. sealing applications)</li> <li>• Automatic heating head retraction at end of cycle prevents damage to components</li> <li>• Multiple product fixture assemblies give increased process rates</li> <li>• Cooling fan above each fixture assembly maintains holding fixture at an acceptable temperature</li> <li>• Compliant with latest CE and RoHS requirements</li> </ul> 
<p><b>In-line Splices</b></p> 	<p>All electrical splices in a wiring harness need to be insulated and protected from mechanical abuse. Effective protection is becoming even more critical as ultrasonic welding is increasingly being used to make the electrical connection. Ultrasonic welding, while providing a much better electrical connection than traditional crimping, is mechanically weak, especially in peel and tear, so additional mechanical protection and strain relief must be provided.</p>	<p><b>RPPM</b></p> <ul style="list-style-type: none"> <li>• Single component solution - to insulate and protect almost all dry area splices</li> <li>• Low profile protection - reducing diameter of conduit required</li> <li>• Flexible while providing superior strain relief than PVC tape</li> <li>• Rapid installation</li> <li>• Repeatable process</li> <li>• High shrink ratio - allow one size to cover a wide range of splice combinations</li> </ul> 	<p><b>RBK-ILS Processor MKIII</b></p> <ul style="list-style-type: none"> <li>• Long life heating elements</li> <li>• Installation parameters and product size information (individual selection)</li> <li>• Operator key lock / password protection levels</li> <li>• Automatic heater retraction on mains failure (updated safety feature)</li> <li>• Automatic calibration (single cycle)</li> <li>• RS232 interface to receive information for the next installation from an ultrasonic welding tool</li> <li>• Pre-installed connection for an optional air-cooling-device</li> <li>• Signal output "0" volt (n/c and n/o) which can be send to a server, local PC or customer intranet</li> <li>• Machine hours and installation cycle counters</li> <li>• Software upgradeable to support special applications</li> <li>• Integrated SW-safety-features to provide safeness during processing</li> <li>• Compliant with latest CE and RoHS requirements</li> </ul> 
<p><b>Miniature Splices</b></p> 	<p>Following the trend to reduce cost, weight and space, wire is being replaced by smaller cross-sections and the splices are particularly fragile requiring mechanical protection and strain relief.</p> <p>Given the very low profile of these splices, the use of conventional PVC tapes might become an increasingly unsatisfactory solution.</p>	<p><b>QSZH</b></p> <ul style="list-style-type: none"> <li>• Adhesive liner that melts to provide strong mechanical bond</li> <li>• Mechanical protection against flexing, abrasion and cut-through</li> <li>• Small cross-sectional profile</li> <li>• Quick installation</li> <li>• Zero halogen</li> </ul> 	

## Sealing

### Application

### Challenge facing manufacturers

### Products: Features + Benefits

### Application Tooling

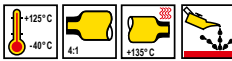
#### In-line Splice



An automotive wiring harness is only as strong as its weakest link. In many instances that weakest link is where wires are spliced together. Non-sealed splices exposed to water, salt spray and other fluids in wet areas of the vehicle can rapidly corrode, degrading both the electrical and mechanical properties of the harness. In addition, splice joints are mechanically weak. Welded splices, in particular, are highly susceptible to peel and tear loading, and must be provided with effective strain relief.

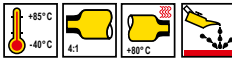
#### QSZH

- Excellent environmental sealing
- Inspectable after installation
- Mechanical protection against flexing, abrasion and cut-through
- Small cross-sectional profile
- Quick installation
- Zero halogen
- Applications versatility - one size covers a broad range of ground wire sizes and wire combinations



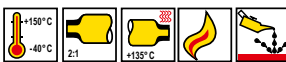
#### RPPM

- Single component solution - to insulate and protect almost all dry area splices
- Low profile protection - reducing diameter of conduit required
- Flexible while providing superior strain relief than PVC tape
- Rapid installation
- Repeatable process
- High shrink ratio - allow one size to cover a wide range of splice combinations



#### SCT

- Excellent environmental sealing
- Mechanical protection against flexing, abrasion and cut-through
- Small cross-sectional profile
- High shrink ratio allows a few sizes to cover a wide range of splices
- Strain relief



#### Model 19 Continuous Process Heater

- Process Control
- Closed-loop temperature control
  - Closed-loop belt speed control
  - Maxmin element temperature alarm bands
  - Lock-out on temperature belt speed controls to prevent unauthorized adjustment
  - Lock-out gate prevents loading of product if the element temperature is too low and if any of the alarms activate
- Diagnostic
- Heater failure alarm
  - Drive circuit fault alarm
- Safety
- Emergency stop switch
  - Cool down circuit



#### RBK-ILS Processor MKIII

- Long life heating elements
- Installation parameters and product size information (individual selection)
- Operator key lock / password protection levels
- Automatic heater retraction on mains failure (updated safety feature)
- Automatic calibration (single cycle)
- RS232 interface to receive information for the next installation from an ultrasonic welding tool
- Pre-installed connection for an optional air-cooling device
- Signal output "0" volt (n/c and n/o) which can be send to a server, local PC or customer intranet
- Machine hours and installation cycle counters
- Software upgradeable to support special applications
- Integrated SW-safety-features to provide safeness during processing
- Compliant with latest CE and RoHs requirements



#### CV-Obhat 1600 W Stub-System

- Capable of producing sealed stub and in-line splices on-board
- Wire support and cap holding fixtures integral part of pistol
- Small footprint on harness board
- Lightweight pistol connected to controller with 6 m umbilical
- Audible signal at end of installation cycle
- Control system incorporating audible and visual process safety alarms
- Programmable heat cycle start temperature
- Optional board locking capability





# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Sealing

### Application

### Challenge facing manufacturers

### Products: Features + Benefits

### Application Tooling

#### End Splice



Many automotive harness suppliers produce a basic harness after which the harness is modified to meet the requested specification of the vehicle. Sub harnesses are added which requires electrical connections being realised on the assembly line. Ultrasonic and crimped connections require sealing. ES Caps can provide an on-board solution to this requirement and they can be installed using especially designed equipment.

#### ES-CAP

- Mechanically tough jacket provides strain relief and abrasion protection
- Adhesive lined product to environmentally seal stub splices
- Highly resistant to automotive fluids and solvents
- High shrink ratio - three sizes cover a broad range of stub splices



\*(black only)

#### IR-1891 Shuttle Machine

- Automatic cycle start once heater is manually positioned over product, which gives improved process control (recommended for adhesive lined heat shrinkable tubing e.g. sealing applications)
- Automatic heating head retraction at end of cycle prevents damage to components
- Multiple product fixture assemblies give increased process rates
- Cooling fan above each fixture assembly maintains holding fixture at an acceptable temperature
- Compliant with latest CE and RoHS requirements



#### RBK-ILS Processor MKIII

- Long life heating elements
- Installation parameters and product size information (individual selection)
- Operator key lock / password protection levels
- Automatic heater retraction on mains failure (updated safety feature)
- Automatic calibration (single cycle)
- RS232 interface to receive information for the next installation from an ultrasonic welding tool
- Pre-installed connection for an optional air-cooling-device
- Signal output "0" volt (n/c and n/o) which can be send to a server, local PC or customer intranet
- Machine hours and installation cycle counters
- Software upgradeable to support special applications
- Integrated SW-safety-features to provide safeness during processing
- Compliant with latest CE and RoHS requirements



#### CV-Obhat 1600 W Stub-System

- Capable of producing sealed stub and in-line splices on-board
- Wire support and cap holding fixtures integral part of pistol
- Small footprint on harness board
- Lightweight pistol connected to controller with 6 m umbilical
- Audible signal at end of installation cycle
- Control system incorporating audible and visual process safety alarms
- Programmable heat cycle start temperature
- Optional board locking capability




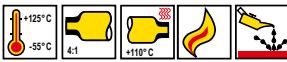
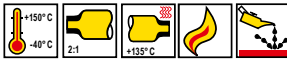




#### Model 105

- Closed-loop speed and temperature control
- Continuous controlled process
- Adaptable for different applications
- CE approved
- Heater operation and over-temperature alarm lights




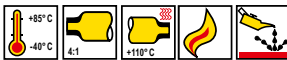
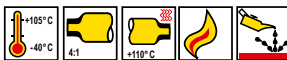

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Sealing

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<p><b>Connector</b></p> 	<p>2 to way 18 connectors are frequently used on cars, often in wet and high temperature areas such as engine compartments. Manufacturers need simple, versatile sealing systems with a minimum number of components that provide connector sealing even when not all of the contact cavities are in use.</p>	<p><b>HTAT</b></p> <ul style="list-style-type: none"> <li>• Low profile mechanical protection, strain relief and sealing</li> <li>• Seals a wide range or different number/gauge sizes of wires into the same connector housing</li> <li>• Semi-flexible, dual-wall moisture proof</li> <li>• Environmental sealing</li> <li>• Ideal for connector sealing covering large diameter differences</li> <li>• High strength bonding</li> </ul>  <p><b>SCT</b></p> <ul style="list-style-type: none"> <li>• Excellent environmental sealing</li> <li>• Mechanical protection against flexing, abrasion and cut-through</li> <li>• Small cross-sectional profile</li> <li>• High shrink ratio allows a few sizes to cover a wide range of splices</li> <li>• Strain relief</li> </ul> 	<p><b>Model 105</b></p> <ul style="list-style-type: none"> <li>• Closed-loop speed and temperature control</li> <li>• Continuous controlled process</li> <li>• Adaptable for different applications</li> <li>• CE approved</li> <li>• Heater operation and over-temperature alarm lights</li> </ul> 
<p><b>Ring Terminal</b></p> 	<p>Maintaining the electrical quality of ring terminal connections has always been critical. In today's cars it is even more important as manufacturers are increasingly using ring terminals to ground low current 'quiet' and 'logic' signal circuits. Any increase in resistance, usually caused by corrosion as a result of moisture entering the wire terminal connection, can critically impair these electrically sensitive circuits. Mechanical damage can also reduce electrical performance, so protection during handling is important, as well as effective strain relief when in use.</p>	<p><b>QSZH</b> See page 9</p> <p><b>SCT</b> See above</p> <p><b>RBK-RTP</b></p> <ul style="list-style-type: none"> <li>• Environmental protection</li> <li>• Mechanical protection against flexing, abrasion and cut-through</li> <li>• Small cross-sectional profile</li> </ul> 	<p><b>IR-1891 Shuttle Machine</b></p> <ul style="list-style-type: none"> <li>• Automatic cycle start once heater is manually positioned over product, which gives improved process control (recommended for adhesive lined heat shrinkable tubing e.g. sealing applications)</li> <li>• Automatic heating head retraction at end of cycle prevents damage to components</li> <li>• Multiple product fixture assemblies give increased process rates</li> <li>• Cooling fan above each fixture assembly maintains holding fixture at an acceptable temperature</li> <li>• Compliant with latest CE and RoHS requirements</li> </ul> 

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Sealing



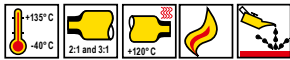



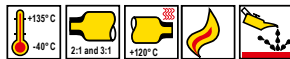

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<b>Wire Bundle</b> 	<p>Low cost, but reliable sealing of multi-wire bundles of up to 20 wires is becoming increasingly important as vehicle harnesses grow in size and complexity.</p> <p>Typically, sealing is needed to provide a water block where the wire bundle passes through a moulded rubber boot into the back of a connector, or at a grommet between a wet and dry area, such as the engine to passenger compartment.</p> <p>Ideally, this seal should not add significantly to the overall diameter of the bundle, allowing easy positioning of grommets and other components during the harness assembly.</p>	<p><b>RayBlock Sealing Kit</b></p> <ul style="list-style-type: none"> <li>• RayBlock sealing kit provides ultra low profile seals only marginally larger than the cable bundle itself</li> <li>• Excellent resistance to automotive fluids and solvents</li> <li>• Excellent electrical insulation</li> <li>• Outstanding vibration resistance</li> </ul> <p><b>RayBlock 85</b></p>  <p><b>RayBlock 105</b></p> 	<p><b>Model 19 Continous Process Heater</b></p> <p>Process Control</p> <ul style="list-style-type: none"> <li>• Closed-loop temperature control</li> <li>• Closed-loop belt speed control</li> <li>• Maxmin element temperature alarm bands</li> <li>• Lock-out on temperature belt speed controls to prevent unauthorized adjustment</li> <li>• Lock-out gate prevents loading of product if the element temperature is too low and if any of the alarms activate</li> </ul> <p>Diagnostic</p> <ul style="list-style-type: none"> <li>• Heater failure alarm</li> <li>• Drive circuit fault alarm</li> </ul> <p>Safety</p> <ul style="list-style-type: none"> <li>• Emergency stop switch</li> <li>• Cool down circuit</li> </ul> 

## Sealing Matrix

Application	Products								
	QSZH	RBK-ILS	RBK-VWS	ES-CAP	SCT	RBK-RTP	HTAT	RBK-105-KIT	RBK-85-KIT
Splice Sealing - Inline	✓	✓	✓		✓				
Splice Sealing - Stub				✓					
Ring Terminal Sealing	✓	✓	✓		✓	✓			
Connector Sealing					✓		✓		
Bundle Wire Sealing								✓	✓





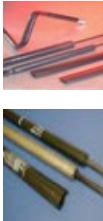
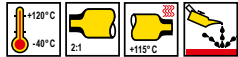

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Identification / Beautification

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<p>Gas Pipes</p> 	<p>Vehicle manufacturers need to improve on the environmental impact of materials. Replacing paint with heat shrink tubing is an effective way of reducing the use of solvents and chemicals.</p>	<p><b>LSTT</b></p> <ul style="list-style-type: none"> <li>• Rapid recovery at low temperatures</li> <li>• Can be used with temperature sensitive materials</li> <li>• Excellent physical and electrical performance</li> <li>• Flexible</li> </ul>  <p><b>CGPT</b></p> <ul style="list-style-type: none"> <li>• Very good chemical and solvent resistance</li> <li>• Wide range of colours</li> <li>• Flexible</li> <li>• Excellent physical and electrical performance</li> </ul> 	<p><b>Model 105</b></p> <ul style="list-style-type: none"> <li>• Closed-loop speed and temperature control</li> <li>• Continuous controlled process</li> <li>• Adaptable for different applications</li> <li>• CE approved</li> <li>• Heater operation and over-temperature alarm lights</li> </ul> 
<p>Ring Terminals</p> 	<p>Identification of voltage, ground and signal wires is increasingly required within automotive harnesses to prevent incorrect connections during the lifetime of the vehicle. More electrical apparatus results in an increased need to distinguish individual circuitry.</p>	<p><b>RBK-RTP</b></p> <ul style="list-style-type: none"> <li>• Mechanical protection against flexing, abrasion and cut-through</li> <li>• Environmental protection</li> <li>• Low profile</li> </ul>  <p><b>CGPT</b></p> <ul style="list-style-type: none"> <li>• Very good chemical and solvent resistance</li> <li>• Wide range of colours</li> <li>• Flexible</li> <li>• Excellent physical and electrical performance</li> </ul> 	<p><b>IR-1891 Shuttle Machine</b></p> <ul style="list-style-type: none"> <li>• Automatic cycle start once heater is manually positioned over product, which gives improved process control (recommended for adhesive lined heat shrinkable tubing e.g. sealing applications)</li> <li>• Automatic heating head retraction at end of cycle prevents damage to components</li> <li>• Multiple product fixture assemblies give increased process rates</li> <li>• Cooling fan above each fixture assembly maintains holding fixture at an acceptable temperature</li> <li>• Compliant with latest CE and RoHS requirements</li> </ul> 

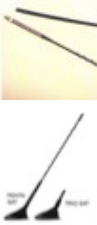
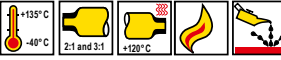
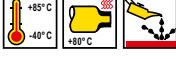

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Cosmetic: Appearance / Beautification

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<p>Seat Belt Stalks</p> 	<p>Metal fixtures within the vehicle require finishing which is both aesthetically pleasing and functional.</p>	<p><b>TUGA</b></p> <ul style="list-style-type: none"> <li>• Conforms uniformly with substrate</li> <li>• Less longitudinal change than most PVC materials</li> <li>• Halogen free</li> <li>• Operating temperature -55 to +125°C</li> <li>• Shrink ratio 2:1</li> </ul>  <p><b>LSTT</b></p> <ul style="list-style-type: none"> <li>• Rapid recovery at low temperatures</li> <li>• Can be used with temperature sensitive materials</li> <li>• Excellent physical and electrical performance</li> <li>• Flexible</li> </ul> 	<p><b>Model 19 Continuous Process Heater</b></p> <p>Process Control</p> <ul style="list-style-type: none"> <li>• Closed-loop temperature control</li> <li>• Closed-loop belt speed control</li> <li>• Max/min element temperature alarm bands</li> <li>• Lock-out on temperature belt speed controls to prevent unauthorized adjustment</li> <li>• Lock-out gate prevents loading of product if the element temperature is too low and if any of the alarms activate</li> </ul> <p>Diagnostic</p> <ul style="list-style-type: none"> <li>• Heater failure alarm</li> <li>• Drive circuit fault alarm</li> </ul> <p>Safety</p> <ul style="list-style-type: none"> <li>• Emergency stop switch</li> <li>• Cool down circuit</li> </ul> 
<p>Gas Springs</p> 	<p>Important functional components often need protection to maintain functionality but also to be pleasing to the eye. Components are often exposed to mechanical damage. Throughout the life of the vehicle this mechanical damage can often lead to excessive corrosion, or at least reduce the pleasing appearance of the component. Heat shrinkable tubing makes an interesting alternative to paint for some applications where the shape of the substrate allows tubing to be installed. Thin wall tubing when installed conforms to the shape of the component, encapsulating and protecting the surfaces beneath from mechanical and subsequent environmental damage. The surface finish of the tube is comparable with some paint finishes but more significantly the resilient surface gives the extra level of protection not exposing metal which could significantly reduce the appearance of the component.</p>	<p><b>RPT-120</b></p> <ul style="list-style-type: none"> <li>• Provides a tough resilient layer</li> <li>• Good surface finish</li> <li>• Particularly suitable for round substrates</li> <li>• Low cost installation equipment</li> </ul> 	<p><b>Model 105</b></p> <ul style="list-style-type: none"> <li>• Closed-loop speed and temperature control</li> <li>• Continuous controlled process</li> <li>• Adaptable for different applications</li> <li>• CE approved</li> <li>• Heater operation and over-temperature alarm lights</li> </ul> 

# HEAT SHRINK TUBING FOR AUTOMOTIVE APPLICATIONS

## Cosmetic: Appearance / Beautification

Application	Challenge facing manufacturers	Products: Features + Benefits	Application Tooling
<p><b>Antenna</b></p> 	<p>Car radio and cellular antennas need a protective coating to protect the antenna from mechanical abuse, abrasion and corrosion. The majority of antennas are straight and smooth and are typically painted or dip-coated. However, some antennas have a glass or fibre winding that extends around part or all of the antenna. In these cases a different protective covering is needed to hold the winding in place over the antenna base and provide abrasion protection to the entire assembly. Eliminating wind noise is also a critical factor in antenna design.</p>	<p><b>CGPT</b></p> <ul style="list-style-type: none"> <li>• Very good chemical and solvent resistance</li> <li>• Wide range of colours</li> <li>• Flexible</li> <li>• Excellent physical and electrical performance</li> </ul>  <p><b>RPPM-NR801</b></p> <ul style="list-style-type: none"> <li>• Excellent mechanical strength</li> <li>• Highly flexible</li> <li>• High abrasion resistance</li> <li>• Resistance against automotive fluids and solvents</li> <li>• Shrink ratio 6:1</li> </ul> 	<p><b>Model 105</b></p> <ul style="list-style-type: none"> <li>• Closed-loop speed and temperature control</li> <li>• Continuous controlled process</li> <li>• Adaptable for different applications</li> <li>• CE approved</li> <li>• Heater operation and over-temperature alarm lights</li> </ul> 

---

**Tyco Electronics AMP GmbH**  
**a TE Connectivity Ltd. company**

AMPèrestrasse 12-14  
D-64625 Bensheim  
Germany

[www.te.com](http://www.te.com)

© 2014 TE Connectivity Ltd. family of companies. All rights reserved.

ATUM, HFT, Raychem, RayBlock, TE, TE Connectivity, TE Connectivity (logo),  
and EVERY CONNECTION COUNTS are trademarks.

**DISCLAIMER** While TE has made every reasonable effort to ensure the accuracy of the information in this catalog, TE does not guarantee that it is error-free, nor does TE make any other representation, warranty or guarantee that the information is accurate, correct, reliable or current. TE reserves the right to make any adjustments to the information contained herein at any time without notice.

TE expressly disclaims all implied warranties regarding the information contained herein, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. The dimensions in this catalog are for reference purposes only and are subject to change without notice. Specifications are subject to change without notice. Consult TE for the latest dimensions and design specifications.