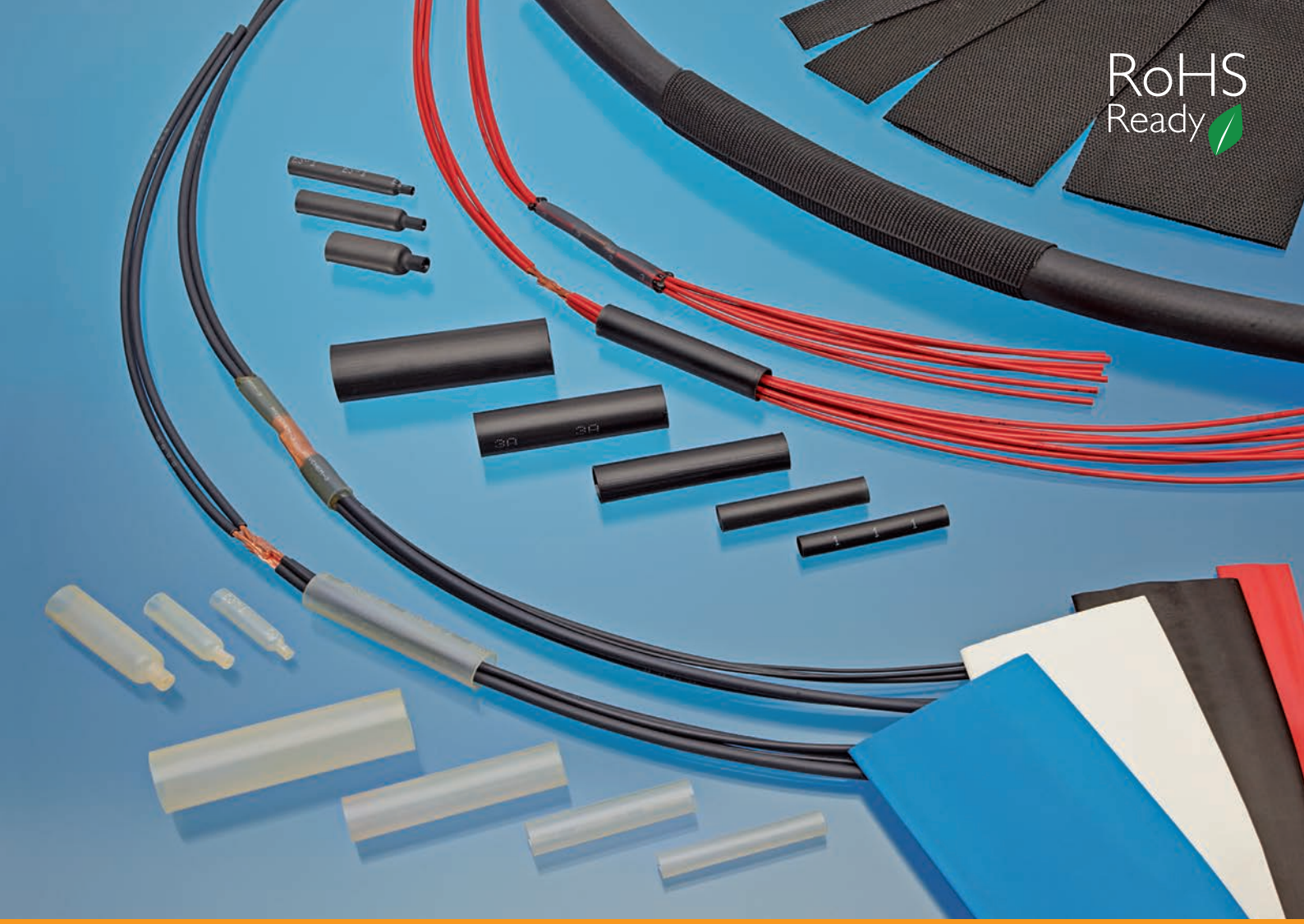
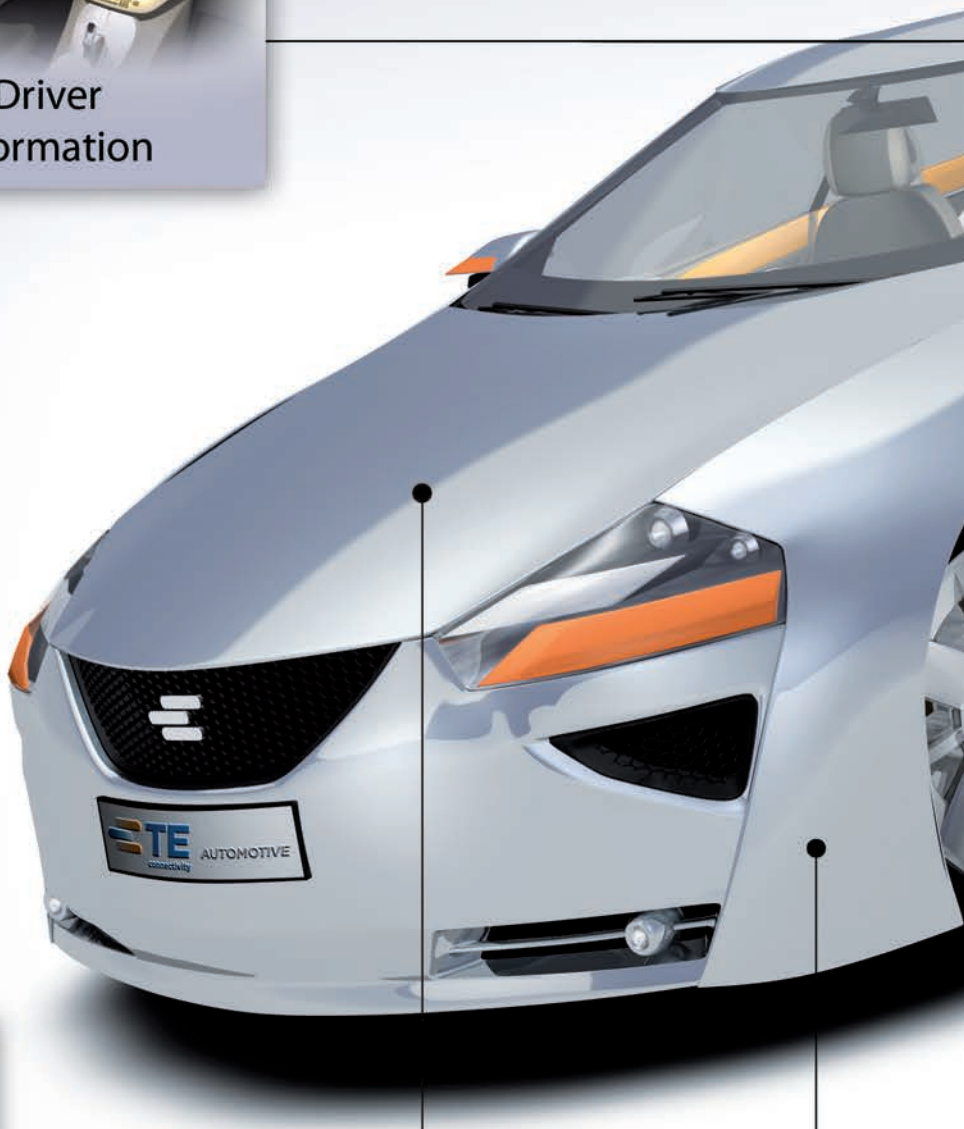


Protection Products
for the Automotive Industry

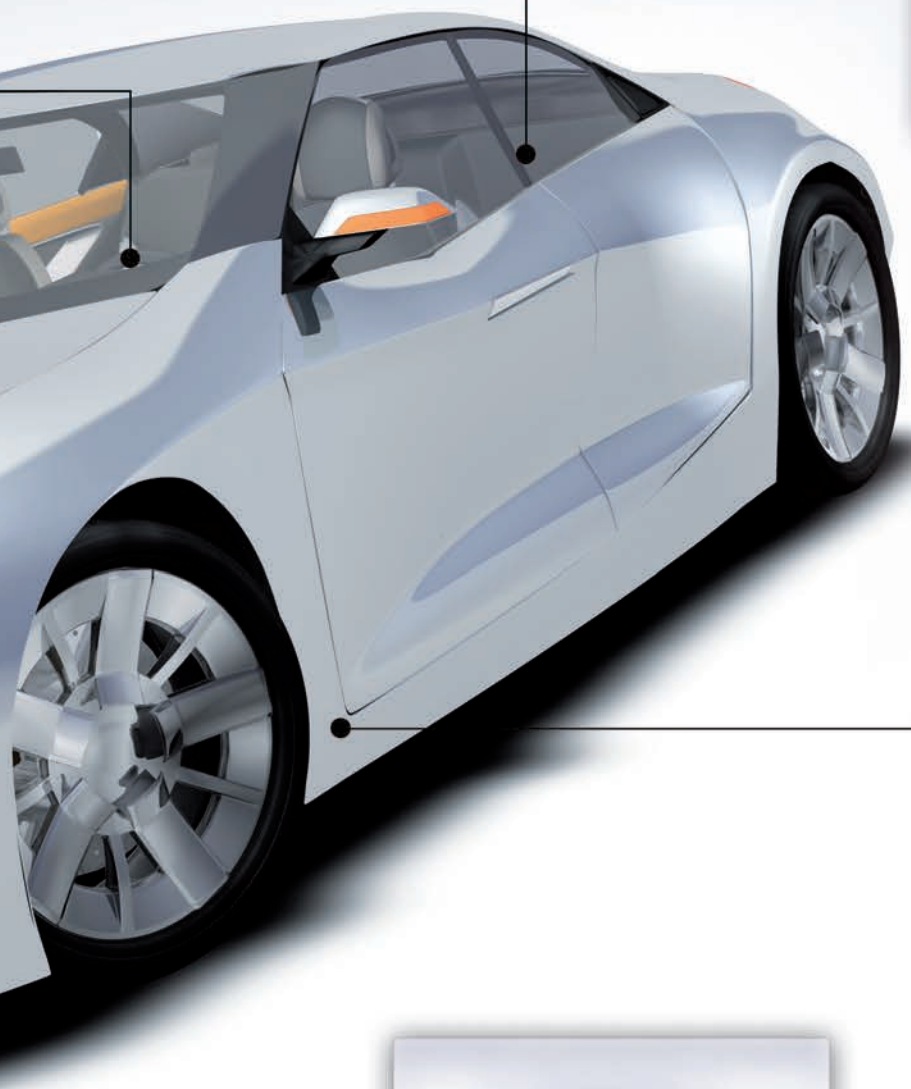
TE connectivity
AUTOMOTIVE

Driver Information



Powertrain Systems

THE 5 APPLICATION AREAS



Convenience

Safety & Security Systems

Body & Chassis Systems

INNOVATIVE TECHNOLOGIES

TE Automotive – a business segment of TE Connectivity – follows the globalization goals of our customers, speeds up the integration of new technologies and enables our customers access to our vast product portfolio and services.

TERMINALS & CONNECTORS

TE Automotive offers a broad range of high quality terminals and connectors. Our electrical/electronic interconnection products and solutions are used to electrically and mechanically join wires and cables, printed circuit boards, integrated circuit packages and batteries. TE Automotive expanding capabilities include new copper and fiber-optic connectors, wires, cables/cable management systems that are designed to meet automotive industry demands. Our brands encompass the broadest range of connectors in the world, including high-density, high-speed designs for leading-edge communications equipment.

HYBRID & ELECTRIC MOBILITY SOLUTIONS

Complete the connections you need to safely, and reliably make hybrid and electric mobility a reality for everyone, everyday. With over 50 years experience in automotive, industrial and energy connectivity, TE is an expert in pushing innovation from one industry to the next. Our portfolio of AMP+ high voltage relays, resistors, AMP+ headers, connectors, IPT/APT and cable assemblies and vehicle charging solutions are designed to connect and protect electric distribution inside and outside of the vehicle.

CABLE ASSEMBLY SYSTEMS

TE Automotive is your partner for special cable assemblies.
We offer research and development capabilities, prototyping, samples as well as manufacturing facilities for special cable assemblies. This includes overmold technology, semi/fully automatic manufacturing, testing equipment and appliances for handling of high volume production.

SENSORS

Contact-less measuring eliminates interference effects, wear and tear, and provides increased reliability. TE Automotive, one of the largest technology providers for the automobile industry, offers contact-less sensors for a variety of applications.

As sensor manufacturer and processing partner, TE Automotive also provides project planning support for new sensor applications, assistance in the selection of the appropriate sensor technology for the respective application, and assistance with defining the corresponding mechanical, electrical and magnetic interface.

TE Automotive has a broad electro-mechanical portfolio that includes robust housing technologies, connector systems, and temperature stable designs based on foil and cable networks. This combination of technologies and experience ensures that reliable and cost effective sensor solutions are available for all application types.

INFOTAINMENT

TE Automotive is focused on providing the best in class infotainment technology to support high speed data communication in the automotive industry. Data communication based optical, coaxial as well as shielded electrical physical layers are supported by a wide product portfolio of Automotive grade connector systems.

Through a deep understanding of the technical properties and requirements of signal integrity and combined with our application knowledge both in the vehicle as well as in the logistics chain, TE Automotive is well positioned to offer the right solution for all current and next generation Infotainment Systems.

INDUCTIVE COIL SYSTEMS

TE Automotive is your source for interconnection technologies for automotive, truck and off-highway OEMs and Tier 1 suppliers. With our global design center in Belgium and manufacturing sites in all regions, TE Automotive's Inductive Coil Systems (ICS) group is ready to design your next-generation coil modules and provide local production support.

The ICS group maintains a leading market position in braking modules and other automotive coil applications. Through early involvement with you on your next design, TE Automotive can offer the benefits of miniaturization, design-in of platform components and optimized process flow for your standard, hybrid and electric vehicle project needs.

TE Automotive Online

The TE Automotive website is an innovative and interactive source for application information, product updates and technical solutions.

Please contact us at:
www.te.com/automotive

TE Products

www.te.com/en/products/product-landing.html

Product and Machine Literature

TE Automotive offers a variety of product specific catalogs, brochures and high impact flyers to help better serve you!

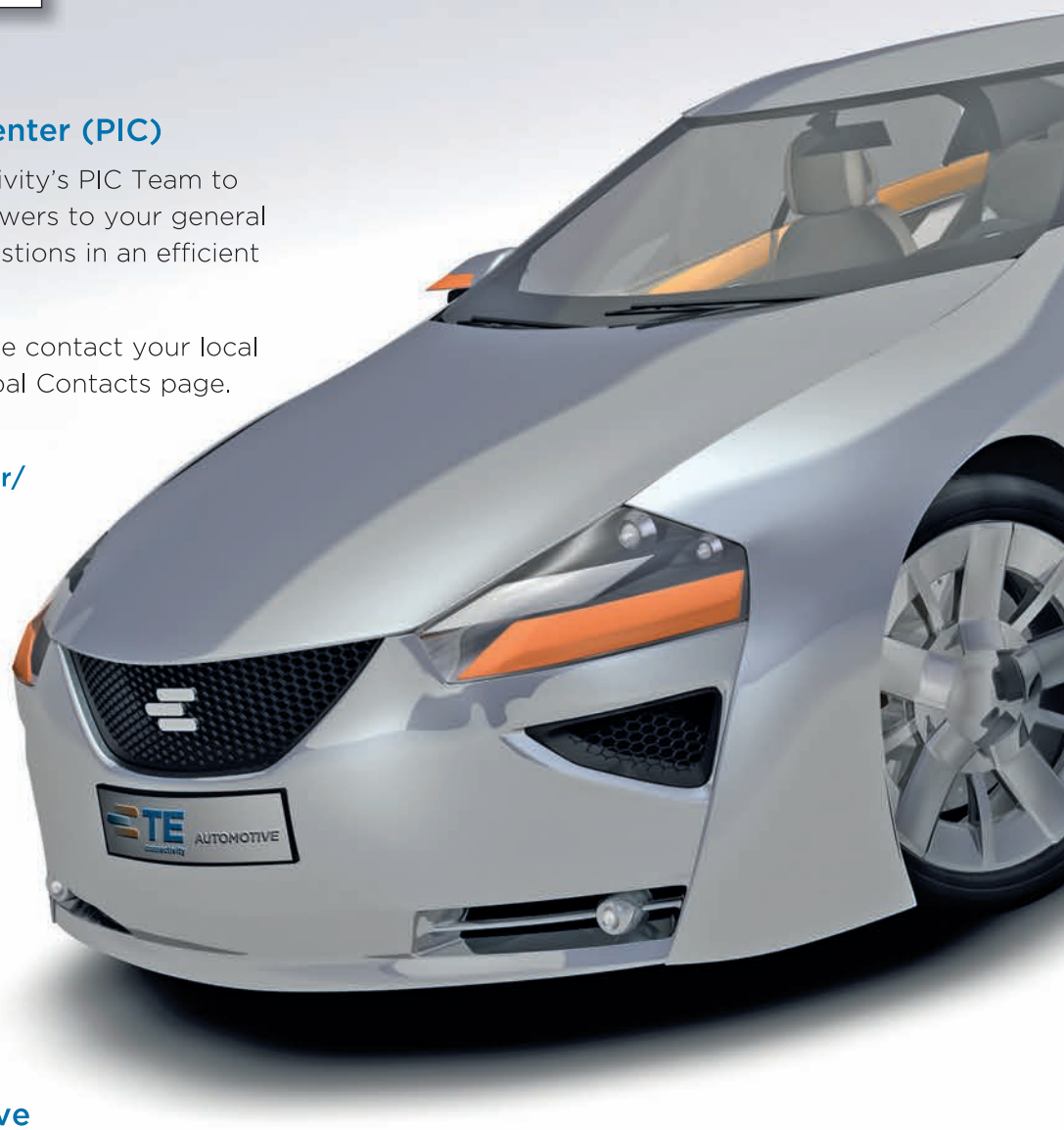
For more information on literature for TE Automotive, please contact your local organization or go to **www.te.com/automotive**

Product Information Center (PIC)

You can rely on TE Connectivity's PIC Team to provide you support for answers to your general information or technical questions in an efficient and effective manner.

To reach our PIC staff, please contact your local organization or see our Global Contacts page.

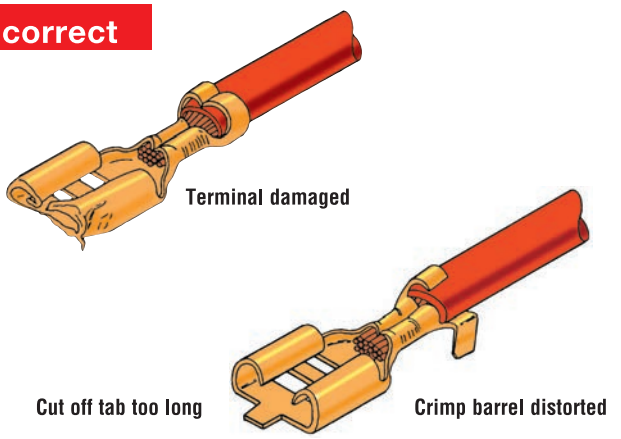
Please contact us at:
www.te.com/support-center/

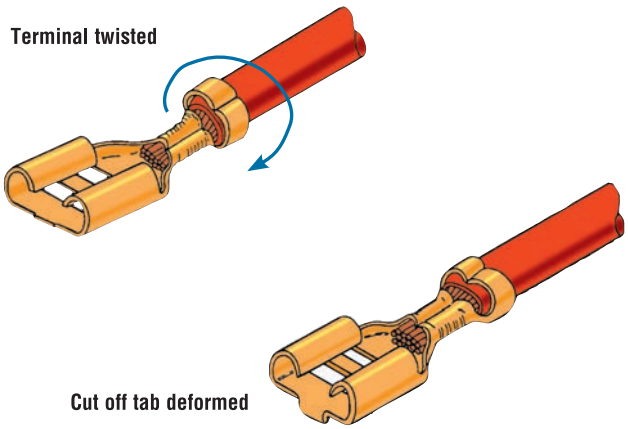


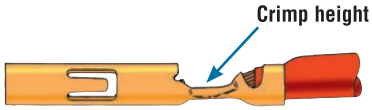
www.te.com
www.te.com/automotive
www.te.com/automotive/most

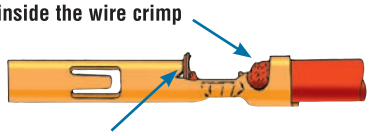
Quality Guidelines

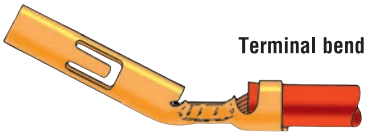
Incorrect

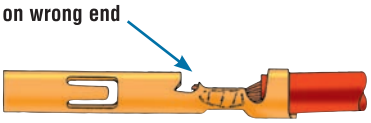










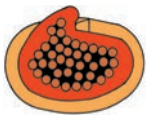


INSULATION CRIMP

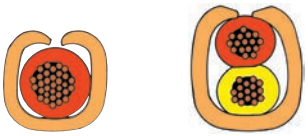
Insulation is pierced and could damage conductor

Insulation material is pierced

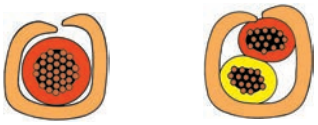
Insulation is not securely held



Insulation is over crimped



Insulation legs are not closed



Insulation is not securely held
Legs do not overlap

WIRE CRIMP

Incorrect applicator adjustment

Asymmetric crimp

Terminal feed incorrectly adjusted

Unacceptable formation excessive flash and/or cracks

Anvil and crimper not aligned or worn

Incorrect terminal/wire selection

Wire size too large

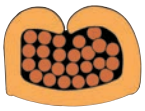
Crimp barrel does not close

Wire size too small

Legs too close to bottom of crimp. Insufficient deformation of strands, showing voids

Incorrect crimp height adjustment

Crimp height too loose



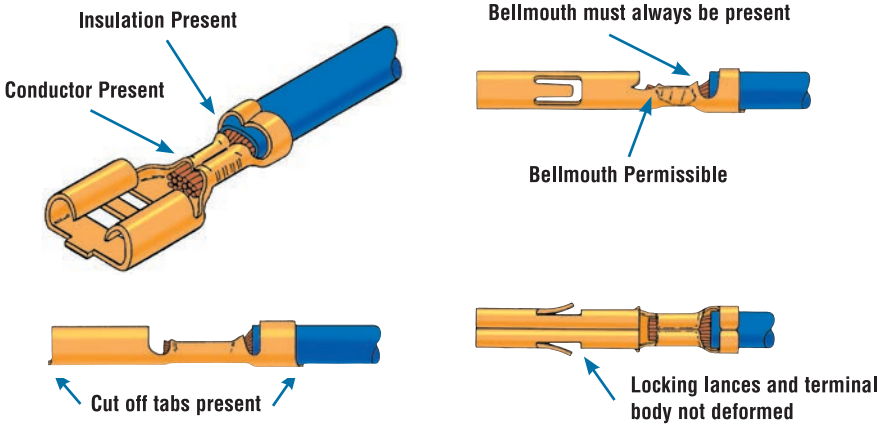
Insufficient deformation, showing voids

Crimp height too tight

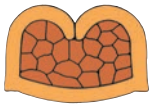
Flash at under side of crimp, due to over crimping

Correct

WIRE CRIMP



Correct selection of wire, terminal and applicator



Crimp barrel is closed, legs support each other

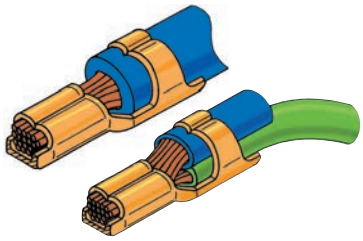
Sufficient gap between legs and bottom of crimp

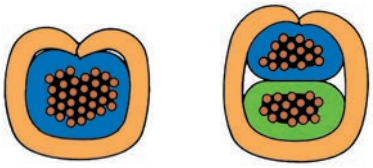
All strands are equally distributed and deformed

INSULATION CRIMP

Correct Insulation Diameter, Applicator and Terminal

F-CRIMP

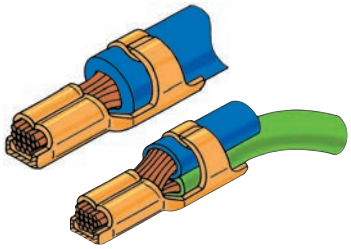


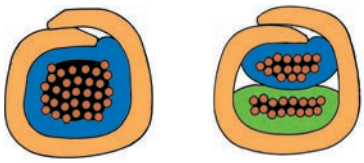


Insulation is securely held
Crimp barrel closed

For double wire applications with different size wires always place wire with smallest outer diameter in the bottom

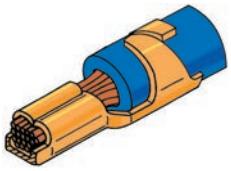
OVERLAP CRIMP

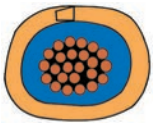




Insulation is securely held
Legs overlap

WRAP OVER CRIMP



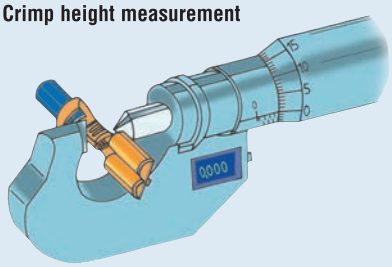


Insulation securely held
Legs must pass each other

Test

WIRE CRIMP

Crimp height measurement



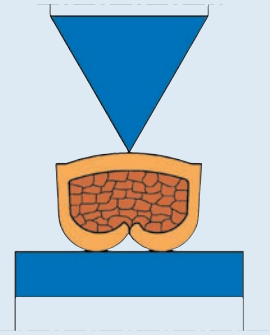
Crimp heights and tolerances

For crimp height tolerances for any given contact, please refer to the relevant application specification.

Examples:

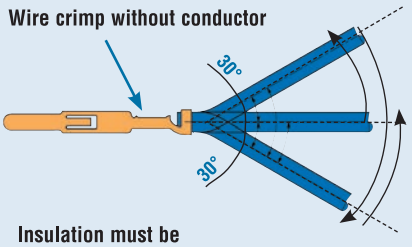
Contact	Part No.	Wire Range (mm^2)	Tolerance (mm)	Application Spec.
MQS	962885 962886	0.2–0.5	±0.03	114-18025
JPT	927775	0.5–1.0	±0.05	114-18050
JPT	927773	1.5–2.5	±0.05	114-18050

Digital Crimp Height Micrometer
(0.001 mm increments) acc. to DIN ISO 9001
Part No. 547203-1



INSULATION CRIMP

Wire crimp without conductor



Insulation must be securely held after bend test

Restriction on the use of Hazardous Substances (RoHS)

At TE Connectivity, we're ready to support your RoHS requirements. We've assessed more than 1.5 million end items/components for RoHS compliance, and issued new part numbers where any change was required to eliminate the restricted materials. Part numbers in this catalog are identified as:

RoHS Compliant

Part numbers in this catalog are RoHS Compliant, unless marked otherwise.

These products comply with European Union Directive 2002/95/EC as amended 1 January 2006 that restricts the use of lead, mercury, cadmium, hexavalent chromium, PBB, and PBDE in certain electrical and electronic products sold into the EU as of 1 July 2006.

Note: For purposes of this Catalog, included within the definition of RoHS Compliant are products that are clearly "Out of Scope" of the RoHS Directive such as hand tools and other non-electrical accessories.

Non-RoHS Compliant

These part numbers are identified with a "♦" symbol. These products do not comply with the material restrictions of the European Union Directive 2002/95/EC.

5 of 6 Compliant

A "●" symbol identifies these part numbers. These products do not fully comply with the European Union Directive 2002/95/EC because they contain lead in solderable interfaces (they do not contain any of the other five restricted substances above allowable limits). However, these products may be suitable for use in RoHS applications where there is an application-based exception for lead in solders, such as the server, storage, or networking infrastructure exemption.

Note: Information regarding RoHS compliance is provided based on reasonable inquiry of our suppliers and represents our current actual knowledge based on the information provided by our suppliers. This information is subject to change. For latest compliance status, refer to our website referenced below.

Getting the information you need

Our comprehensive on-line RoHS Customer Support Center provides a forum to answer your questions and support your RoHS needs. A RoHS FAQ (Frequently Asked Questions) is available with links to more detailed information. You can also submit RoHS questions and receive a response within 24 hours during a normal work week. The Support Center also provides:

- Cross-Reference from Non-compliant to Compliant Products
- Ability to browse RoHS Compliant Products in our on-line catalog: http://www.te.com/commerce/alt/RohsAltHome.do
- Downloadable Technical Data Customer Information Presentation
- More detailed information regarding the definitions used above

So whatever your questions when it comes to RoHS, we've got the answers at http://www.te.com/customersupport/rohssupportcenter/

RoHS Customer Support Center

AWG Conversion Table (Average Value)

Conversion Tables

Most of the wire size ranges are mentioned in mm^2, as well as the insulation diameters which are in many cases only in mm's.

We therefore included the conversion tables on page X and page XI.

Please note that wire and insulation sizes are for guidance only.

Consult the customer drawing for precise detail.

AWG Code	Diameter (Inch)	Diameter (mm)	F (mm^2)
000000	0.5800	14.733	170.0
00000	0.5165	13.13	135.0
0000	0.4600	11.684	103.8
000	0.4096	10.40	79.0
00	0.3648	9.27	67.5
0	0.3249	8.25	53.4
1	0.2893	7.34	42.2
2	0.2576	6.55	33.7
3	0.2294	5.82	26.6
4	0.2043	5.18	21.0
5	0.1819	4.62	16.9
6	0.1620	4.115	13.25
7	0.1443	3.66	10.25
8	0.1285	3.26	8.34
9	0.1144	2.90	6.6
10	0.1019	2.59	5.27
11	0.0907	2.30	4.15
12	0.0808	2.05	3.3
13	0.0720	1.83	2.63
14	0.0641	1.63	2.08
15	0.0571	1.45	1.65
16	0.0508	1.29	1.305
17	0.0453	1.14	1.01
18	0.0403	1.02	0.79
19	0.0359	0.91	0.65
20	0.0320	0.81	0.51
21	0.0285	0.72	0.407
22	0.0253	0.64	0.32
23	0.0226	0.57	0.255
24	0.0201	0.51	0.205
25	0.0179	0.455	0.162
26	0.0159	0.40	0.125
27	0.0142	0.36	0.102
28	0.0126	0.320	0.08
29	0.0113	0.287	0.0646
30	0.0100	0.254	0.0516
31	0.0089	0.226	0.04
32	0.0080	0.203	0.0324
33	0.0071	0.180	0.0255
34	0.0063	0.160	0.02
35	0.0056	0.142	0.0158
36	0.0050	0.127	0.0127
37	0.0045	0.114	0.01
38	0.0040	0.101	0.008
39	0.0035	0.089	0.0062
40	0.0031	0.079	0.0049
41	0.0028	0.071	0.00395
42	0.0025	0.064	0.00321
43	0.0022	0.056	0.00246
44	0.00198	0.050	0.00196
45	0.00176	0.045	
46	0.00157	0.040	
47	0.00140	0.036	
48	0.00124	0.031	
49	0.00110	0.028	
50	0.00099	0.025	

Remark: Starting from 0.03 mm^2 (AWG 32) a wire can be crimped.

FLK/FLR Cable

FLK and FLR stand for German DIN (72551) abbreviations.

FLK means:

In German:
- **F**ahrzeug **L**eitung **K**unststoff

In English:
- Vehicle Cable Plastic

FLR means:

In German:
- **F**ahrzeug **L**eitung **R**eduziert

In English:
- Thin Walled Cable (reduced insulation thickness)

Conversion Table – Inch/mm

Inch	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0	0	0.0254	0.0508	0.0762	0.1016	0.1270	0.1524	0.1778	0.2032	0.2286
0.010	0.2540	0.2794	0.3048	0.3302	0.3556	0.3810	0.4064	0.4318	0.4572	0.4826
0.020	0.5080	0.5334	0.5588	0.5842	0.6096	0.6350	0.6604	0.6858	0.7112	0.7366
0.030	0.7620	0.7874	0.8128	0.8382	0.8636	0.8890	0.9144	0.9398	0.9652	0.9906
0.040	1.0160	1.0414	1.0668	1.0922	1.1176	1.1430	1.1684	1.1938	1.2192	1.2446
0.050	1.2700	1.2954	1.3208	1.3462	1.3716	1.3970	1.4224	1.4478	1.4732	1.4986
0.060	1.5240	1.5494	1.5748	1.6002	1.6256	1.6510	1.6764	1.7018	1.7272	1.7526
0.070	1.7780	1.8034	1.8288	1.8542	1.8796	1.9050	1.9304	1.9558	1.9812	2.0066
0.080	2.0320	2.0574	2.0828	2.1062	2.1336	2.1590	2.1844	2.2098	2.2352	2.2606
0.090	2.2860	2.3114	2.3368	2.3622	2.3876	2.4130	2.4384	2.4638	2.4892	2.5146
0.100	2.5400	2.5654	2.5908	2.6162	2.6416	2.6670	2.6924	2.7178	2.7432	2.7686
0.110	2.7940	2.8194	2.8448	2.8702	2.8956	2.9210	2.9464	2.9718	2.9972	3.0226
0.120	3.0480	3.0734	3.0988	3.1242	3.1496	3.1750	3.2004	3.2258	3.2512	3.2766
0.130	3.3020	3.3274	3.3528	3.3782	3.4036	3.4290	3.4544	3.4798	3.5052	3.5306
0.140	3.5560	3.5814	3.6068	3.6322	3.6576	3.6830	3.7084	3.7338	3.7592	3.7846
0.150	3.8100	3.8354	3.8608	3.8862	3.9116	3.9370	3.9624	3.9878	4.0132	4.0386
0.160	4.0640	4.0894	4.1148	4.1402	4.1656	4.1910	4.2164	4.2418	4.2672	4.2926
0.170	4.3180	4.3434	4.3688	4.3942	4.4196	4.4450	4.4704	4.4958	4.5212	4.5466
0.180	4.5720	4.5974	4.6228	4.6482	4.6736	4.6990	4.7244	4.7498	4.7752	4.8006
0.190	4.8260	4.8514	4.8768	4.9022	4.9276	4.9530	4.9784	5.0038	5.0292	5.0546
0.200	5.0800	5.1054	5.1308	5.1562	5.1816	5.2070	5.2324	5.2578	5.2832	5.3086
0.210	5.3340	5.3594	5.3848	5.4102	5.4356	5.4610	5.4864	5.5118	5.5372	5.5626
0.220	5.5880	5.6134	5.6388	5.6642	5.6896	5.7150	5.7404	5.7658	5.7912	5.8166
0.230	5.8420	5.8674	5.8928	5.9182	5.9436	5.9690	5.9944	6.0198	6.0452	6.0706
0.240	6.0960	6.1214	6.1468	6.1722	6.1976	6.2230	6.2484	6.2738	6.2992	6.3246
0.250	6.3500	6.3754	6.4008	6.4262	6.4516	6.4770	6.5024	6.5278	6.5532	6.5786
0.260	6.6040	6.6294	6.6548	6.6802	6.7056	6.7310	6.7564	6.7818	6.8072	6.8326
0.270	6.8580	6.8834	6.9088	6.9342	6.9596	6.9850	7.0104	7.0358	7.0612	7.0866
0.280	7.1120	7.1374	7.1628	7.1882	7.2136	7.2390	7.2644	7.2898	7.3152	7.3406
0.290	7.3660	7.3914	7.4168	7.4422	7.4676	7.4930	7.5184	7.5438	7.5692	7.5946
0.300	7.6200	7.6454	7.6708	7.6962	7.7216	7.7470	7.7724	7.7978	7.8232	7.8486
0.310	7.8740	7.8994	7.9248	7.9502	7.9756	8.0010	8.0264	8.0518	8.0772	8.1026
0.320	8.1280	8.1534	8.1788	8.2042	8.2296	8.2550	8.2804	8.3058	8.3312	8.3566
0.330	8.3820	8.4074	8.4328	8.4582	8.4836	8.5090	8.5344	8.5598	8.5852	8.6106
0.340	8.6360	8.6614	8.6868	8.7122	8.7376	8.7630	8.7884	8.8138	8.8392	8.8646
0.350	8.8900	8.9154	8.9408	8.9662	8.9916	9.0170	9.0424	9.0678	9.0932	9.1186
0.360	9.1440	9.1694	9.1948	9.2202	9.2456	9.2710	9.2964	9.3218	9.3472	9.3726
0.370	9.3980	9.4234	9.4488	9.4742	9.4996	9.5250	9.5504	9.5758	9.6012	9.6266
0.380	9.6520	9.6774	9.7028	9.7282	9.7536	9.7790	9.8044	9.8298	9.8552	9.8806
0.390	9.9060	9.9314	9.9568	9.9822	10.0076	10.0330	10.0584	10.0838	10.1092	10.1346
0.400	10.1600	10.1854	10.2108	10.2362	10.2616	10.2870	10.3124	10.3378	10.3632	10.3886
0.410	10.4140	10.4394	10.4648	10.4902	10.5156	10.5410	10.5664	10.5918	10.6172	10.6426
0.420	10.6680	10.6934	10.7188	10.7442	10.7696	10.7950	10.8204	10.8458	10.8712	10.8966
0.430	10.9220	10.9474	10.9728	10.9982	11.0236	11.0490	11.0744	11.0998	11.1252	11.1506
0.440	11.1760	11.2014	11.2268	11.2522	11.2776	11.3030	11.3284	11.3538	11.3792	11.4046
0.450	11.4300	11.4554	11.4808	11.5062	11.5316	11.5510	11.5824	11.6078	11.6332	11.6586
0.460	11.6840	11.7094	11.7348	11.7602	11.7856	11.8110	11.8364	11.8618	11.8872	11.9126
0.470	11.9380	11.9634	11.9888	12.0142	12.0396	12.0650	12.0904	12.1158	12.1412	12.1666
0.480	12.1920	12.2174	12.2428	12.2682	12.2936	12.3190	12.3444	12.3698	12.3952	12.4206
0.490	12.4460	12.4714	12.4968	12.5222	12.5476	12.5730	12.5984	12.6238	12.6492	12.6746
0.500	12.7000									
Inch	**0**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**

Conversion Table – Inch/mm (continued)

Inch	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.500	12.7000	12.7254	12.7508	12.7762	12.8016	12.8270	12.8524	12.8778	12.9032	12.9286
0.510	12.9540	12.9794	13.0048	13.0302	13.0556	13.0810	13.1064	13.1318	13.1572	13.1826
0.520	13.2080	13.2334	13.2588	13.2842	13.3096	13.3350	13.3604	13.3858	13.4112	13.4366
0.530	13.4620	13.4874	13.5128	15.5382	13.5636	13.5890	13.6144	13.6398	13.6652	13.6906
0.540	13.7160	13.7414	13.7668	13.7922	13.8176	13.8430	13.8684	13.8938	13.9192	13.9446
0.550	13.9700	13.9954	14.0208	14.0462	14.0716	14.0970	14.1224	14.1478	14.1732	14.1986
0.560	14.2240	14.2494	14.2748	14.3002	14.3256	14.3510	14.3764	14.4018	14.4272	14.4526
0.570	14.4780	14.5034	14.5288	14.5542	14.5796	14.6050	14.6304	14.6558	14.6812	14.7066
0.580	14.7320	14.7574	14.7828	14.8082	14.8336	14.8590	14.8844	14.9098	14.9352	14.9606
0.590	14.9860	15.0114	15.0368	15.0622	15.0876	15.1130	15.1384	15.1638	15.1892	15.2146
0.600	15.2400	15.2654	15.2908	15.3162	15.3416	15.3670	15.3924	15.4178	15.4432	15.4686
0.610	15.4940	15.5194	15.5448	15.5702	15.5956	15.6210	15.6464	15.6718	15.6972	15.7226
0.620	15.7480	15.7734	15.7988	15.8242	15.8496	15.8750	15.9004	15.9258	15.9512	15.9766
0.630	16.0020	16.0274	16.0528	16.0782	16.1036	16.1290	16.1544	16.1798	16.2052	16.2306
0.640	16.2560	16.2814	16.3068	16.3322	16.3576	16.3830	16.4084	16.4338	16.4592	16.4846
0.650	16.5100	16.5354	16.5608	16.5862	16.6116	16.6370	16.6624	16.6878	16.7132	16.7386
0.660	16.7640	16.7894	16.8148	16.8402	16.8656	16.8910	16.9164	16.9418	16.9672	16.9926
0.670	17.0180	17.0434	17.0688	17.0942	17.1196	17.1450	17.1704	17.1958	17.2212	17.2466
0.680	17.2720	17.2974	17.3228	17.3482	17.3736	17.3990	17.4244	17.4498	17.4752	17.5006
0.690	17.5260	17.5514	17.5768	17.6022	17.6276	17.6530	17.6784	17.7038	17.7292	17.7546
0.700	17.7800	17.8054	17.8308	17.8562	17.8816	17.9070	17.9324	17.9528	17.9832	18.0086
0.710	18.0340	18.0594	18.0848	18.1102	18.1356	18.1610	18.1864	18.2118	18.2372	18.2626
0.720	18.2880	18.3134	18.3388	18.3642	18.3896	18.4150	18.4404	18.4658	18.4912	19.5166
0.730	18.5420	18.5674	18.5928	18.6182	18.6436	18.6690	18.6944	18.7198	18.7452	18.7706
0.740	18.7960	18.8214	18.8468	18.8722	18.8976	18.9230	18.9484	18.9738	18.9992	19.0246
0.750	19.0500	19.0754	19.1008	19.1262	19.1516	19.1170	19.2024	19.2278	19.2532	19.2786
0.760	19.3040	19.3294	19.3548	19.3802	19.4056	19.4310	19.4564	19.4818	19.5072	19.5326
0.770	19.5580	19.5834	19.6088	19.6342	19.6596	19.6850	19.7104	19.7358	19.7612	19.7886
0.780	19.8120	19.8374	19.8628	19.8882	19.9136	19.9390	19.9644	19.9898	20.0152	20.0406
0.790	20.0660	20.0914	20.1168	20.1422	20.1676	20.1930	20.2184	20.2438	20.2692	20.2946
0.800	20.3200	20.3454	20.3708	20.3962	20.4216	20.4470	20.4724	20.4978	20.5232	20.5486
0.810	20.5740	20.5994	20.6248	20.6502	20.6756	20.7010	20.7264	20.7518	20.7772	20.8026
0.820	20.8280	20.8534	20.8788	20.9042	20.9296	20.9550	20.9804	21.0058	21.0312	21.0566
0.830	21.0820	21.1074	21.1328	21.1582	21.1836	21.2090	21.2344	21.2598	21.2852	21.3106
0.840	21.3360	21.3614	21.3868	21.4122	21.4376	21.4630	21.4884	21.5138	21.5392	21.5646
0.850	21.5900	21.6154	21.6408	21.6662	21.6916	21.7170	21.7424	21.7678	21.7932	21.8186
0.860	21.8440	21.8694	21.8948	21.9202	21.9456	21.9710	21.9964	22.0218	22.0472	22.0726
0.870	22.0980	22.1234	22.1488	22.1742	22.1996	22.2250	22.2504	22.2758	22.3012	22.3266
0.880	22.3520	22.3774	22.4028	22.4282	22.4536	22.4790	22.5044	22.5298	22.5552	22.5806
0.890	22.6060	22.6314	22.6568	22.6822	22.7076	22.7330	22.7584	22.7838	22.8092	22.8346
0.900	22.8600	22.8854	22.9108	22.9362	22.9616	22.9870	23.0124	23.0378	23.0632	23.0886
0.910	23.1140	23.1394	23.1648	23.1902	23.2156	23.2410	23.2664	23.2918	23.3172	23.3426
0.920	23.3680	23.3934	23.4188	23.4442	23.4696	23.4950	23.5204	23.5458	23.5712	23.5966
0.930	23.6220	23.6474	23.6728	23.6982	23.7236	23.7490	23.7744	23.7998	23.8252	23.8506
0.940	23.8760	23.9014	23.9268	23.9522	23.9776	24.0030	24.0284	24.0538	24.0792	24.1046
0.950	24.1300	24.1554	24.1808	24.2062	24.2316	24.2570	24.2824	24.3078	24.3332	24.3586
0.960	24.3840	24.4094	24.4348	24.4602	24.4856	24.5110	24.5364	24.5618	24.5812	24.6126
0.970	24.6380	24.6634	24.6888	24.7142	24.7396	24.7650	24.7904	24.8158	24.8412	24.8666
0.980	24.8920	24.9174	24.9428	24.9682	24.9936	25.0190	25.0444	25.0698	25.0952	25.1206
0.990	25.1460	25.1714	25.1968	25.2222	25.2476	25.2730	25.2984	25.3228	25.3492	25.3746
1.000	25.4000									
Inch	**0**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**


Safety & Security Systems


Convenience


Driver Information


Body & Chassis Systems

✓	✓	✓	✓
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Safety & Security Systems


Convenience


Driver Information


Body & Chassis Systems

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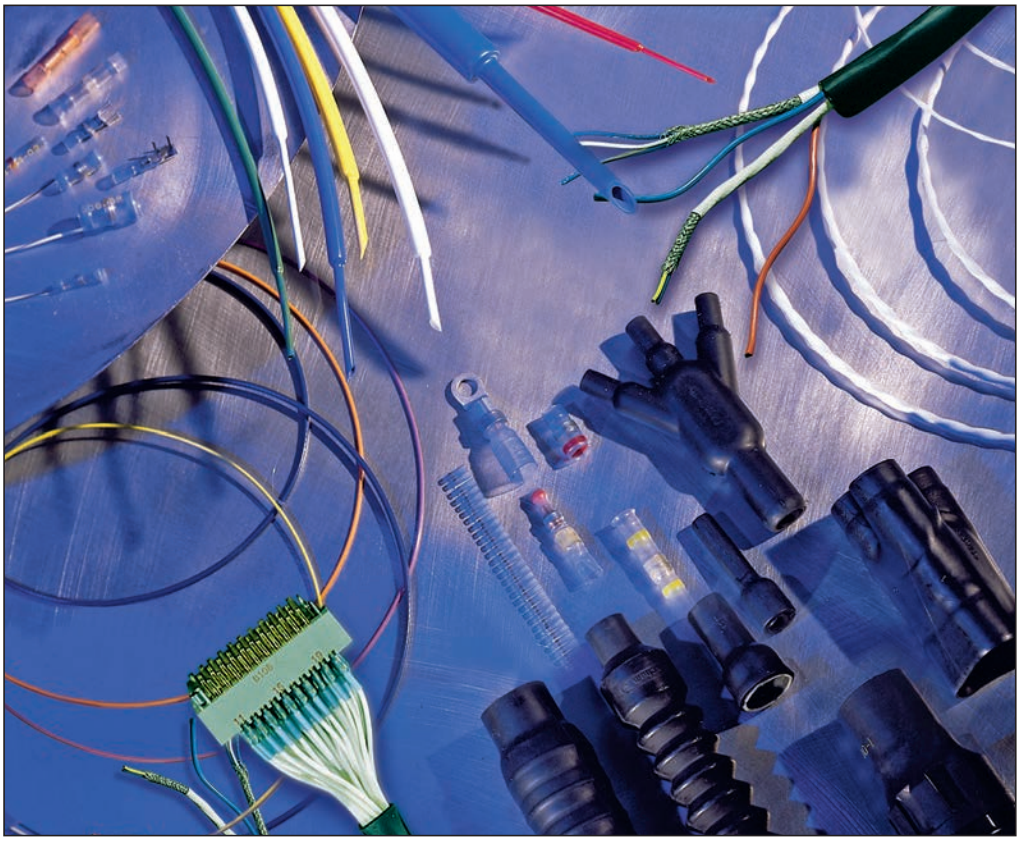
Engineering Notes

Introduction

Designed to be durable and engineered to be cost effective. The wide range of our tubing products is the way to provide effective electrical insulation, mechanical and environmental protection.



TE Connectivity (TE) is one of the world's leading companies in developing, supplying and manufacturing high quality, technologically advanced, heatshrink protection products. Our products provide a perfect solution for your toughest engineering problems.

TE's Raychem tubings are made from uniquely formulated materials that have been enhanced by radiation cross-linking, a technology that TE Automotive, 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.

Our single wall tubings have a wide range of characteristics. Choose them wherever you need reliable insulation, strain relief, protection from mechanical abrasion and chemical abuse or an ideal way to identify or code components, or simply use them to enhance aesthetics.

Our 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.

Product Facts

- Simple and fast installation supported by a wide range of TE Automotive application equipment.
- Available in a wide range of materials, such as polyolefins, fluoropolymers and elastomers.
- Choose from tubings that are highly flexible or semi-rigid, 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.

Core Technologies of TE Connectivity under the Raychem brand

Since its founding in the 1950s, and at that time known as “Raychem” material science expertise has pioneered many of the breakthrough technologies used to create today’s most advanced environmental sealing and protection systems.

TE’s Raychem heat-shrink products are in service throughout the world in automotive, telecommunications, power distribution, aerospace, defence, industrial and commercial applications. Renowned for their unrivalled performance and reliability in the most demanding of environments, they include a comprehensive range of automotive sealing and protection products.

Produced using Raychem state-of-the-art manufacturing facilities and processes, these products offer very cost-effective and robust solution to all your interconnection needs.

Automotive Sealing and Protection Products

Raychem heat-shrinkable products from TE Connectivity have been developed to provide robust and reliable protection of automotive electronic components and electrical systems. Based on a broad range of cross-linked, shape-memory, polymeric materials, these products provide long-term protection against moisture ingress, corrosion, mechanical damage and extremes of temperature.

TE Connectivity’s experience of Raychem product design ensures a repeatable, reliable, shrink to fit installation, compatible with present day manufacturing processes. Adhesive precoatings on heat-shrinkable sleevings and moulded shapes produce a positive watertight seal for wire-to-wire and wire-connector splices and terminations for both automotive and truck applications.

TE Connectivity’s Raychem brand of tubing was developed when our scientists pioneered the application of radiation cross-linking and the development of heat-shrinkable polymer products. Today, Raychem products from TE Connectivity are recognized worldwide for its expertise in these areas.

The Raychem brand of TE Connectivity tubings based on polyolefins, fluoropolymers and elastomers enhanced by radiation cross-linking and heat-shrinkability. When heated, the tubing shrinks to conform to almost any shape. Single wall tubings are available. Dual-wall tubings have an inner wall – either adhesive or an encapsulant – that melts and flows during installation heating to protect against environmental damage.

Heat-shrinkable products for the automotive industry may be used for a wide variety of applications including connector sealing, wire sealing and mechanical protection.

Core Technologies

• Polymer Formulation
TE Connectivity's Raychem formulations are blends of polymers and additives that are carefully designed to meet the stringent customer demands and international specification requirements.

The selection of polymers, flame-retardants, anti-oxidants, UV-stabilisers and other additives is of great importance for products to meet requirements on 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.

A wide range of Raychem compounds by TE Connectivity are available to manufacture a complete range of heat-shrinkable products. Heat-shrinkable tubing, manufactured with these compounds, will meet international standards & OEM approvals in many electronics markets.

TE Connectivity's Raychem hot melt adhesives are specially 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 was pioneered by TE Connectivity under the Raychem brand to enhance polymer properties and to provide heat-shrinkability or shape memory. Polymeric tubing is extruded and the chemical structure then modified in a separate process 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.

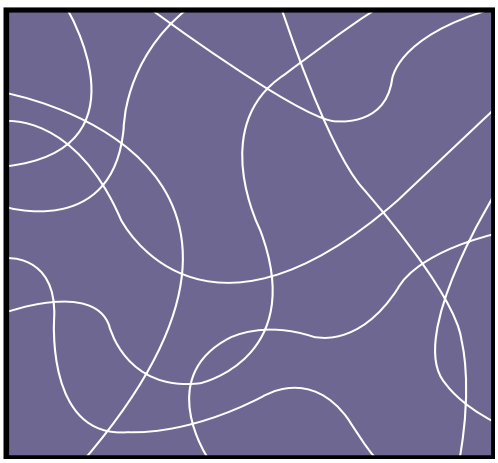
Due to the three dimensional cross-links which are formed during the cross-linking process, the tubing does not melt and obtains its perfect shape memory.

• 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.

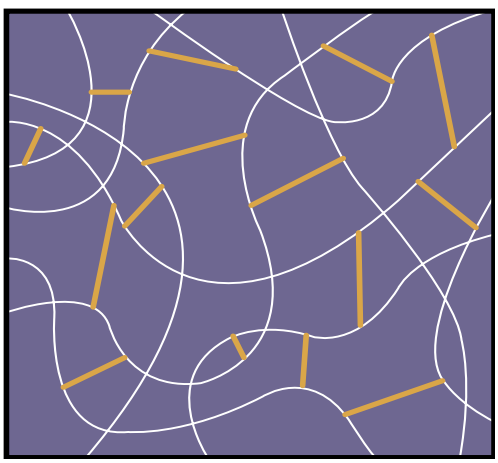
Firstly, compounding processes are used to mix selected polymers and additives. The resulting compounds are then extruded using optimised screw and die designs to produce homogeneous and consistent tubing. The tubing is then cross-linked using electron beam radiation.

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, the tubing is cooled down and retains its expanded dimensions. This stage is called the "expanded" state.



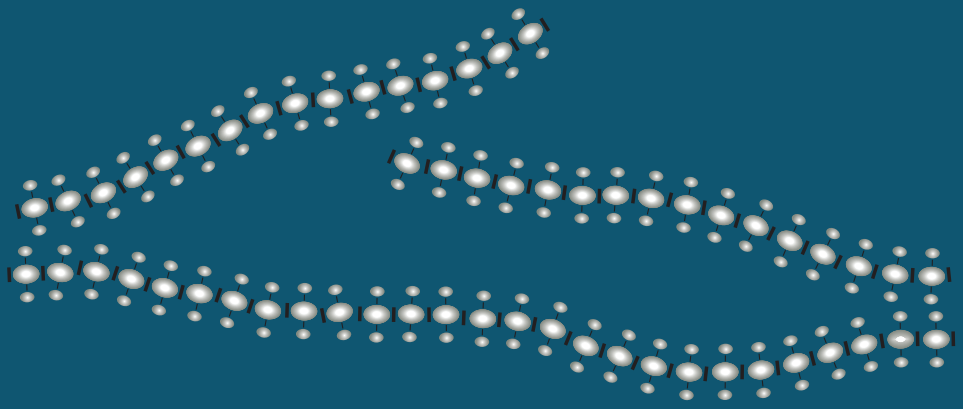
Unmodified Polymer



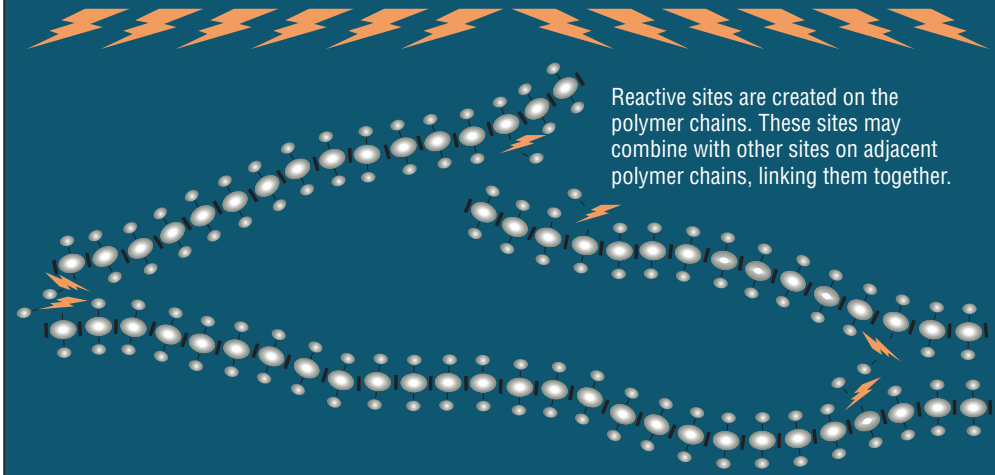
Cross-Linked Polymer

What is Radiation Cross-Linking?

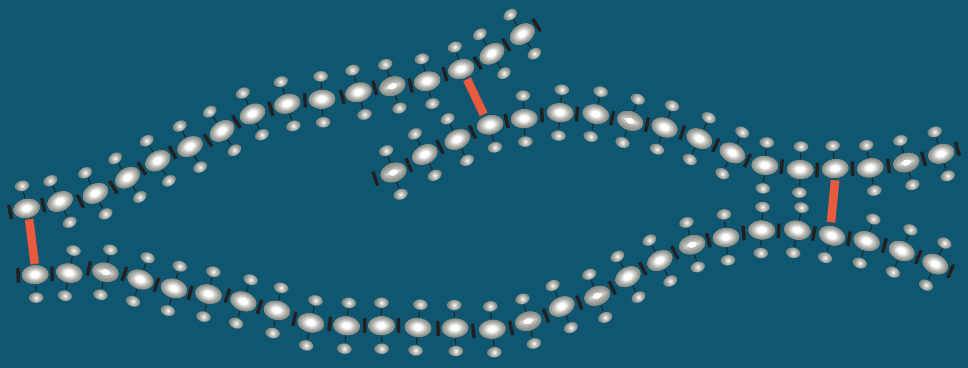
Uncross-linked polymer chains in insulation immediately after extrusion:
Long chain molecules are free to slide over each other – polymer can be melted.



To cross-link the insulation, high energy electrons are fired at it in a special chamber:



The resulting structure is a network of linked molecules:
This acts as a single giant molecule. Because the chains are no longer free to move over one another, the cross-linked molecules will not melt.



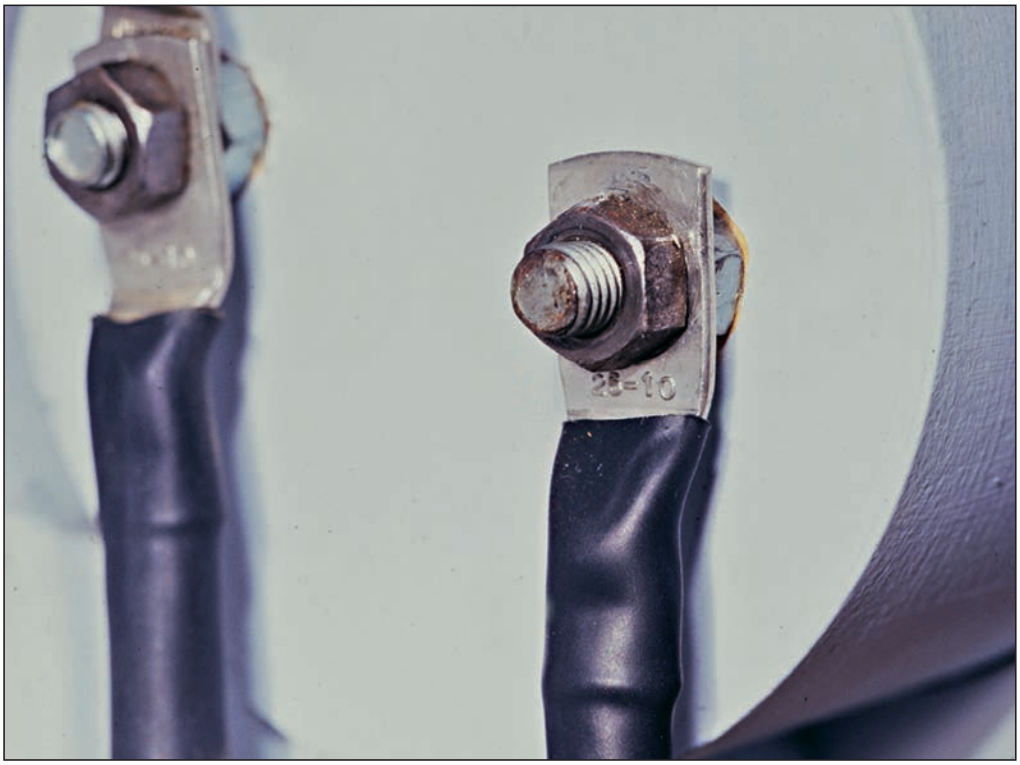
Harness Design

- Sealing and Protection for Wire Bundles, Connectors, Terminals and Splices
- Splice Sealing
- Connector Sealing
- Wire Bundle Sealing
- Feed-Throughs

Protection for Wire Bundles, Connectors, Terminals and Splices

CRN Tubing

Low cost forming for power cables.



CRN Tubing

semi-rigid, flame retarded, polyolefin based heat-shrinkable tubing displays excellent resistance to a wide range of chemicals and solvents combined with excellent electrical properties.

The tubing is tough and semi-rigid which makes it ideally suitable for applications requiring strain relief or abrasion resistance.

Widely used through-out industry for component protection and strain relief of sensitive areas such as solder and crimp joints.

Benefits

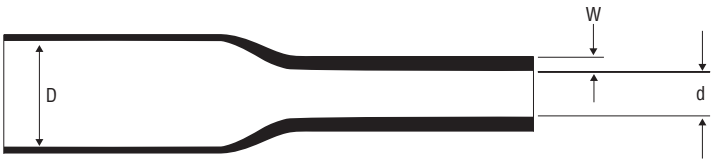
- Excellent abrasion resistance
- Good strain relief performance
- Outstanding physical and electrical performance
- Excellent chemical and solvent resistance
- Versatile process – can be carried out both on and off-board
- RoHS/ELV compliant

A Semi-Rigid, Flame-Retarded Polyolefin Heat-Shrinkable Tubing

Product Features

CRN Tubing

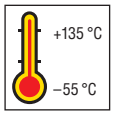
- Continuous operating temperature from –55°C up to +135°C (3000 hrs)
- Minimum shrink temperature: 110°C
- Minimum full recovery temperature: 135°C
- Flame retarded
- 2:1 shrink ratio



Product Dimensions

Size	Inside Diameter D (min) Expanded as Supplied mm	Inside Diameter d (max) Recovered after Heating mm	Wall Thickness W (nom) Recovered after Heating mm	Ordering Description
3/64	1.2	0.6	0.51	CRN-3/64-colour code
1/16	1.6	0.8	0.51	CRN-1/16-colour code
3/32	2.4	1.2	0.51	CRN-3/32-colour code
1/8	3.2	1.6	0.51	CRN-1/8-colour code
3/16	4.8	2.4	0.64	CRN-3/16-colour code
1/4	6.4	3.2	0.64	CRN-1/4-colour code
3/8	9.5	4.8	0.76	CRN-3/8-colour code
1/2	12.7	6.4	0.76	CRN-1/2-colour code
3/4	19.1	9.5	0.89	CRN-3/4-colour code

Other lenghts, colours and sizes are available subject to special order.



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded


Fluid Resistant


Canadian Standards Association


Underwriters Laboratories

Ordering Information

Standard Colour	Black (0)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example CRN-1/8-0)

Specifications/Approvals	Series	UL	CSA	TE
	CRN-black	E35586 600 V, 125°C	LR31929 600 V, 125°C	RT-360 Type 1 RK-6003

ES Caps

ES Caps are specially designed to provide mechanical and environmental protection of stub splices in electrical harnesses. Clear caps allow see-through inspection; black caps are flame-retarded.

ES Caps

Heat-shrinkable one-piece caps with a thick adhesive liner which provide complete environmental and moisture sealing for stub splices.

The cap, with a pre-crimped end, is placed over the splice and when it is heated the adhesive melts and is squeezed around and between the crimped or welded wires by the shrinking action of the tube.

The tough high density jackets also provide electrical insulation, excellent mechanical cut-through and abrasion protection as well as effective strain relief for the splice.

Benefits

- 4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters.
- Mechanically tough jacket provides strain relief and abrasion protection.
- Thick adhesive liner forms an effective barrier against fluids and moisture and performs well at an extended temperature range.
- RoHS/ELV compliant

High-Shrink-Ratio, Adhesive-Lined Semirigid Polyolefin Caps

Product Features

ES Caps

- Continuous operating temperatures from –40°C up to +125°C* (3000 hrs) (*with tape to help secure cap)
- Minimum shrink temperature: 100°C
- Minimum full recovery temperature: 135°C
- Flame retarded (black only)
- Black and clear cap options
- 2:1 shrink ratio

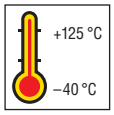
Product Dimensions

Inside diameter (including Core)				Recovered Wall Thickness**		
Standard Length* as Supplied mm	Maximum Expanded as Supplied mm	Maximum Recovered after Heating mm	Total Wall after Heating mm	Total Jacket Wall after Heating mm	Total Adhesive Wall after Heating mm	Ordering Description
30.35	5.72	1.27	1.20	0.64	0.56	ES-Cap-NO. 1
30.35	7.44	1.65	1.52	0.76	0.76	ES-Cap-NO. 2
40.50	10.85	2.41	1.91	0.89	1.37	ES-Cap-NO. 3

*) Other cap lengths available upon request.
**) The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.

Ordering Information

Standard Colours	Black (0)	Clear (X)	
Size Selection	Always order the largest size that will shrink snugly over the component to be covered.		
Standard Packaging	Cut pieces		
Marking	Caps will be marked with the number sizes (for example ES-1, ES-2, or ES-3).		
Ordering Description	Specify product name, size and colour (for example ES-CAP-NO. 1)		
Specifications/Approvals	**Series**	**UL**	**TE**
	ES-CAP	E85381, 600 V, 125°C	RW-3006



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

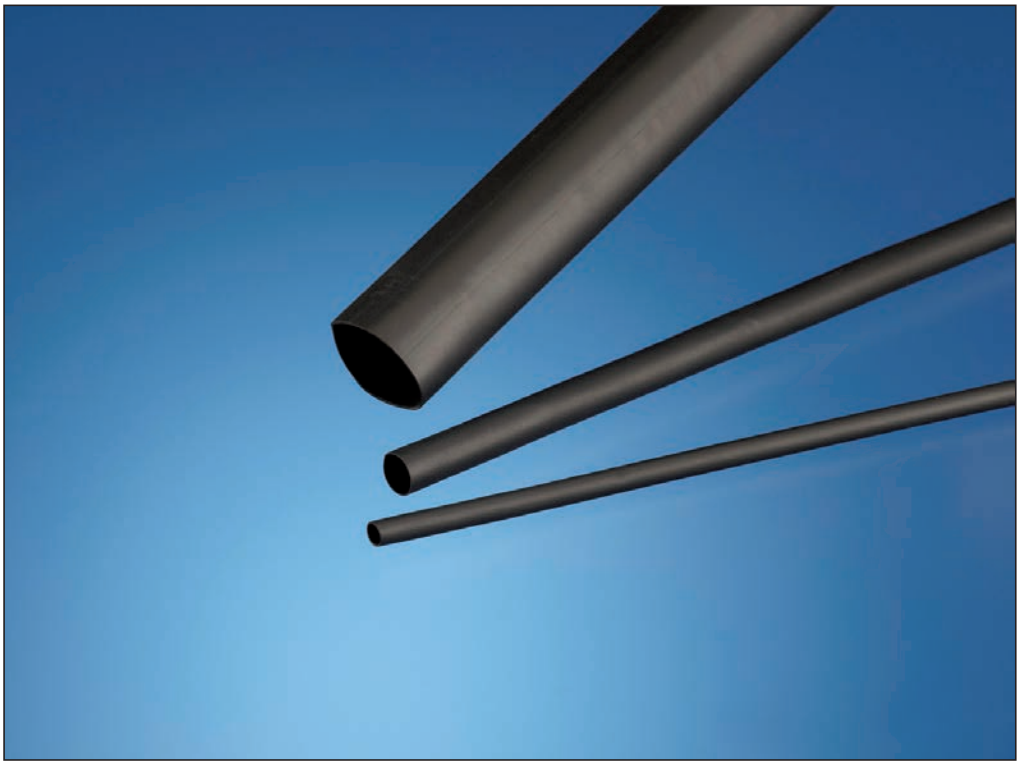
Flame Retarded (black only)

Fluid Resistant

Underwriters Laboratories

FRAG Tubing

Flexible, chemical and abrasion resistant tubing.



FRAG Tubing

Specially formulated for optimum high-temperature fluid resistance, and long term heat resistance. Resistant to diesel fuels, hydraulic fluids and lubricating oils. It is also well suited for the demands of motorsport cable harnesses.

Benefits

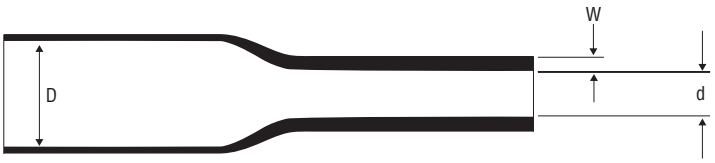
- FRAG is a heat-shrinkable, thick-wall tubing designed for harsh environments. It has excellent resistance to fluids at elevated temperatures and good long term heat resistance.
- FRAG is flexible as well as abrasion resistant. These properties make it ideal for the protection of electrical cables or similar components.
- RoHS/ELV compliant

Heat-Shrinkable, Flexible, Thick-Wall Tubing

Product Features

FRAG Tubing

- Continuous operating temperature from –75°C up to +150°C
- Minimum shrink temperature: 150°C
- Minimum full recovery temperature: 175°C
- Flame retarded
- 2:1 shrink ratio



Product Dimensions

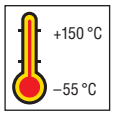
Size	Inside Diameter D (min) Expanded as Supplied mm	Inside Diameter d (max) Recovered after Heating mm	Wall Thickness W (nom) Recovered after Heating mm	Ordering Description
3.2/1.6	3.2	1.6	0.80	FRAG-3.2/1.6-0
4.8/2.4	4.8	2.4	0.80	FRAG-4.8/2.4-0
6.0/3.5	6.0	3.5	0.90	FRAG-6.0/3.5-0
9.0/5.0	9.0	5.0	1.00	FRAG-9.0/5.0-0
12.0/7.0	12.0	7.0	1.25	FRAG-12.0/7.0-0
18.0/10.0	18.0	10.0	1.45	FRAG-18.0/10.0-0
25.0/13.0	25.0	13.0	1.80	FRAG-25.0/13.0-0
38.0/19.0	38.0	19.0	2.40	FRAG-38.0/19.0-0
51.0/25.0	51.0	25.0	2.80	FRAG-51.0/25.0-0
76.0/38.0	76.0	38.0	3.20	FRAG-76/38-0

The largest size that will recover snugly over the component to be covered should be ordered.
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.
Other lenghts and sizes are available subject to special order.

Ordering Information

Standard Colour	Black (0)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example FRAG-3.2/1.6-0)

Specifications/Approvals	Series	TE
	FRAG	RK-6176



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Flame Retarded

Fluid Resistant

HTAT Tubing

Semi-flexible, dual wall and moisture resistant heat-shrinkable sealing.

HTAT Tubing

Semi-flexible, heat-shrinkable tubing with an integrally bonded meltable adhesive inner lining designed to provide moisture proof encapsulation for a range of substrates at elevated temperatures.

Manufactured from radiation cross-linked polyolefins, the inner wall melts when heated and is forced into interstices by the shrinking of the outer wall, so that when cooled, the substrate is encapsulated by a tough, protective, moisture proof barrier.

An operating temperature range from –55 °C up to +125 °C and a high shrink ratio as standard, means that the tubing offers superior environmental protection to a wide range of irregular shapes with varying dimensions. The jacket is flame retarded to reduce flame propagation.

Benefits

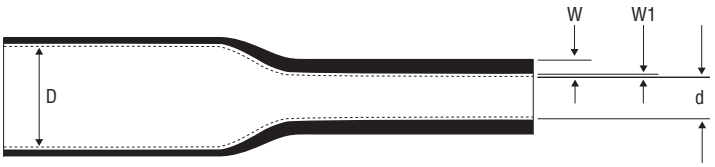
- Low profile mechanical protection, strain relief and sealing
- Seals a wide range of different number/gauge sizes of wires into the same connector housing
- Easy installation – using simple heat shrink process equipment
- Semi-flexible, dual-wall moisture proof, heat-shrinkable tubing
- Environmental sealing
- High strength bonding
- Ideal for connector sealing covering large diameter differences
- Shrink ratio 4:1
- Can be used in conjunction with adhesive profiles
- RoHS/ELV compliant

Semi-Flexible, Dual-Wall Moisture Proof, Heat-Shrinkable Tubing

Product Features

HTAT Tubing

- Continuous operating temperature from –55°C up to +125°C
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 110°C
- Flame retarded
- 4:1 shrink ratio



Product Dimensions

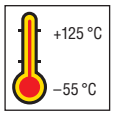
	Inside Diameter		Wall Thickness		
Size	**D (min) Expanded as Supplied mm**	**d (max) Recovered after Heating mm**	**W (nom) Recovered after Heating mm**	**W1 (nom) Meltable Wall Recovered after Heating mm**	**Ordering Description**
4/1	4.0	1.0	1.00	0.40	HTAT-4/1-0
8/2	8.0	2.0	1.00	0.50	HTAT-8/2-0
12/3	12.0	3.0	1.40	0.60	HTAT-12/3-0
16/4	16.0	4.0	1.75	0.75	HTAT-16/4-0
24/6	24.0	6.0	2.25	0.80	HTAT-24/6-0
32/8	32.0	8.0	2.50	1.00	HTAT-32/8-0
48/13	48.0	13.0	2.54	1.00	HTAT-48/13-0

The largest size that will recover snugly over the component to be covered should be ordered.
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.
Other lenghts, colours (colour codes by size) and sizes are available subject to special order.

Ordering Information

Standard Colour	Black (0)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example HTAT-12/3-colour)

Specifications/Approvals	**Series**	**TE**
	HTAT Tubing	RW-2052



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Flame Retarded

Fluid Resistant

LSTT Tubing

Low shrink temperature polyolefin heat-shrinkable tubing.

LSTT Tubing

Highly flexible, low shrink temperature heat-shrinkable tubing. Easy to handle and install, its low shrink temperature offers exceptionally fast recovery for maximum efficiency in high volume commercial applications and makes it suitable for use on or near delicate temperature sensitive materials e.g. PVC (80 °C) jacketed wire and cable.

The material contains no added halogens. Although not flame retarded, LSTT meets the automotive flame propagation standard MVSS 302.

LSTT gives good physical and electrical performance.

Typical applications are electrical termination insulation, colour coding, covering of heat sensitive devices, cosmetic coverings and mechanical protection.

Benefits

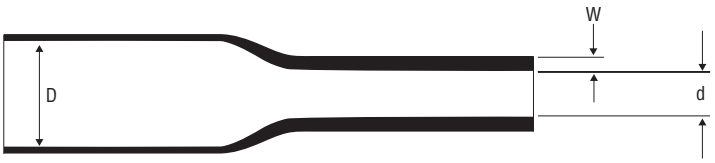
- Rapid recovery at low temperatures
- Can be used with temperature sensitive materials
- Excellent physical and electrical performance
- Flexible
- RoHS/ELV compliant

Low Shrink Temperature Polyolefin Heat-Shrinkable Tubing

Product Features

LSTT Tubing

- Continuous operating temperature from –40°C up to +125°C
- Minimum shrink temperature: 65°C
- Minimum full recovery temperature: 110°C
- 2:1 shrink ratio



Product Dimensions

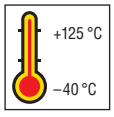
	Inside Diameter		Wall Thickness	
Size	**D (min) Expanded as Supplied mm**	**d (max) Recovered after Heating mm**	**W (nom) Recovered after Heating mm**	**Ordering Description**
1.6	1.6	0.8	0.50	LSTT-1.6-colour code
2.4	2.4	1.2	0.55	LSTT-2.4-colour code
3.2	3.2	1.6	0.55	LSTT-3.2-colour code
4.8	4.8	2.4	0.55	LSTT-4.8-colour code
6.4	6.4	3.2	0.65	LSTT-6.4-colour code
9.5	9.5	4.8	0.65	LSTT-9.5-colour code
12.7	12.7	6.4	0.65	LSTT-12.7-colour code
19.0	19.0	9.5	0.80	LSTT-19-colour code
25.4	25.4	12.7	0.95	LSTT-25.4-colour code
32.0	32.0	16.0	1.05	LSTT-32-colour code
38.0	38.0	19.0	1.05	LSTT-38-colour code
52.0	52.0	26.0	1.14	LSTT-52-available in black only

Ordering Information

Standard Colours	Black (0)	Red (2)	Yellow (4)	Blue (6)

Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example LSTT-32-colour)

Specifications/Approvals	**Series**	**TE**
	LSTT Tubing	RW-2051



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Sealing and Protection for Wire Bundles, Connectors, Terminals and Splices

QSZH-125 Tubing

Sealing and protection of inline wire splices and grounding ring terminals.

QSZH-125 Tubing

Zero halogen, dual wall heat-shrinkable tubing designed to provide environmental sealing, mechanical and electrical protection of in-line splices in an automotive environment.

The tubing is centred over the splice area and on heating the adhesive melts and is squeezed around where the wires are crimped or welded and between wire cores by the shrinking action of the sleeve. The installed QSZH-125 tube provides low profile mechanical protection against flexing, abrasion and cut-through as well as electrical insulation.

There are five QSZH-125 sizes to cover a wide range of typical automotive splice configurations having a maximum of seven wires on either side.

The sleeves are marked 1, 2, 3, 3A and 4 to denote the size.

Benefits

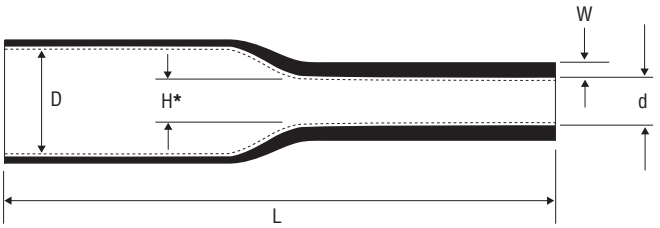
- Excellent Environmental Sealing (2 x 10^8 Ohms minimum after 24 hrs immersion in 5% NaCl)
- Quick installation
- Zero Halogen
- Inspectable after installation
- Mechanical Protection against flexing, abrasion and cut-through
- Applications versatility – one tubing size covers a broad range of ground wire sizes and wire combinations
- Small cross-sectional profile
- Temperature rated to 125°C
- RoHS/ELV compliant

Dual-Wall, Moisture Proof, Heat-Shrinkable Tubing to Protect Electrical Splices

Product Features

QSZH-125 Tubing

- Continuous operating temperatures from –40°C up to +125°C (3000 hrs)
- 4:1 shrink ratio



W = Jacket only
d = Inner diameter of jacket only
H* = Inner diameter of adhesive liner

Product Dimensions

	Inside Diameter			Wall Thickness (mm)			
Size	**D (min) Expanded as Supplied**	**H (max)* Recovered after Heating**	**d (max) Recovered Jacket after Heating**	**W (min) Recovered Jacket after Heating**	**W + Adhesive Liner (min)**	**Length** L (nom)**	**Ordering Description**
NR1	5.75	1.25	2.65	0.6	1.15	50	QSZH-125-NR1
NR2	7.50	1.65	3.45	0.7	1.4	50	QSZH-125-NR2
NR3	11.00	2.40	4.65	0.8	1.8	65	QSZH-125-NR3
NR3A	14.00	3.00	5.90	0.9	2.15	65	QSZH-125-NR3A
NR4	18.30	4.35	7.40	0.9	2.2	75	QSZH-125-NR4

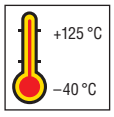
Refer to the Installation Guidelines document before selecting size (PIP-101).
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.

***) Nominal values for reference only.

****) Other lengths are available subject to special order.

Ordering Information

Standard Colour	Jacket	Adhesive
	Clear	Black
Installation	The product may be installed using a TE Automotive RBK-ILS Processor or other recommended application equipment. Consult your local TE Automotive office for more information.	
Size Selection	Refer to PIP-101	
Ordering Description	Specify product name, size and colour (for example QSZH-125-NR)	
Specifications/Approvals	**Series**	**TE**
	QSZH-125 Tubing	RK-6771



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Fluid Resistant

RayBlock 85 Sealing Kit

Easy-to-install grommet and wire bundle sealing for up to 20 wires.

RayBlock 85 Sealing Kit

Designed to provide consistent sealing for cable bundles and the back of connectors. The wires in the bundle are placed within the channels of a specially formulated hot-melt adhesive profile, and then covered by dual wall, heat-shrinkable tubing with a flame-retardant radiation-crosslinked outer wall and hot-melt-adhesive inner wall.

When the tubing is heated, the hot-melt adhesive melts and the tubing shrinks, forcing the molten adhesive to fill all the voids within the wire bundle and tubing. The result is a solid plug of adhesive molded around each wire in the bundle, creating a moisture-resistant seal.

Benefits

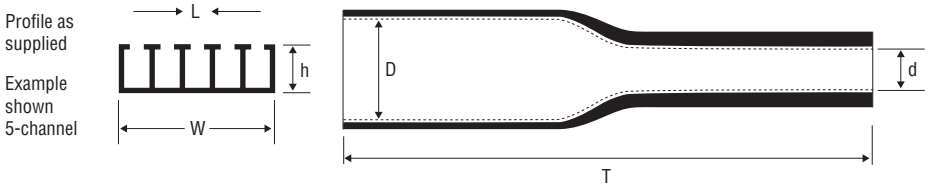
- Excellent resistance to all common solvents and acids
- Outstanding vibration resistance
- Excellent electrical insulation
- RoHS/ELV compliant

Heat-Shrinkable Water Blocking Systems for Cable Bundles and Multi-Wire Electrical Connectors

Product Features

RayBlock 85 Sealing Kit

- Continuous operating temperature from –40°C up to +85°C
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 110°C
- Flame retarded (ATUM tubing only)
- 4:1 shrink ratio



Product Dimensions

Profile				Tubing			
Number of Channels	h Outside height (nom) mm	L Length (nom) mm	W Width (nom) mm	D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	T (nom) mm	Ordering Description
2	8.5	2.75	8.50	12.00	3.00	34.00	RBK-85 Kit 0102-AX
3	8.5	2.75	12.25	16.00	4.00	33.00	RBK-85 Kit 0103-AX
4	8.5	2.75	16.00	16.00	4.00	44.00	RBK-85 Kit 0104-AX
5	8.5	2.75	21.00	24.00	6.00	34.00	RBK-85 Kit 0105-AX
5	8.5	2.75	21.00	24.00	6.00	23.00	RBK-85 Kit 0305-AX
7	8.5	2.75	27.25	24.00	6.00	65.00	RBK-85 Kit 0107-AO
7	8.5	2.75	27.25	24.00	6.00	23.00	RBK-85 Kit 0607-AX
8	8.5	2.75	31.00	24.00	6.00	47.00	RBK-85 Kit 0208-AX
10	8.5	2.75	38.50	32.00	8.00	55.00	RBK-85 Kit 0510-AO

The selection table is intended for guidance only and individual bundles may well differ in requirement.
Special designs may be possible on request to cater for large wires or larger cable bundles.
Please contact TE Automotive for further information.

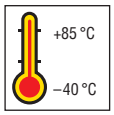
TE Automotive offers a variety of heating tools for the installation of RayBlock 85.
The range includes hot-air blowers, infra-red heaters and special automatic heating devices.

Ordering Information

Standard Colours	Black (0)	Clear (X)

Size Selection	Maximum two wires per channel, for wires with maximum outside diameter 2.8 mm. For wires with an outside diameter greater than 2.8 mm, please consult TE Automotive. Standard Packaging: 1000 pcs of profile plus 1000 pcs of tubing per box.
Ordering Description	Specify product name, size and colour (for example RBK-85-Kit-0102-AX)

Specifications/Approvals	**Series**	**TE**
	RayBlock 85 Sealing Kit	RW-2101



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded


Fluid Resistant

RayBlock 105 Sealing Kit

Easy-to-install grommet and wire bundle sealing for up to 20 wires.

RayBlock 105 Sealing Kit

Designed to provide consistent sealing for cable bundles and the back of connectors. The wires in the bundle are placed within the channels of a specially formulated hot-melt adhesive profile, and then covered by dual wall, heat-shrinkable tubing with a flame-retardant radiation-crosslinked outer wall and hot-melt-adhesive inner wall.

When the tubing is heated, the hot-melt adhesive melts and the tubing shrinks, forcing the molten adhesive to fill all the voids within the wire bundle and tubing. The result is a solid plug of adhesive molded around each wire in the bundle, creating a moisture-resistant seal.

Benefits

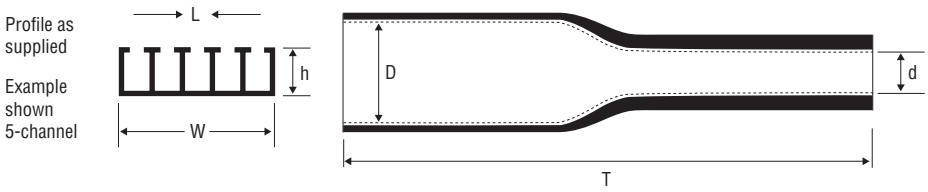
- Excellent resistance to all common solvents and acids
- Outstanding vibration resistance
- Excellent electrical insulation
- RoHS/ELV compliant

Heat-Shrinkable Water Blocking Systems for Cable Bundles and Multi-Wire Electrical Connectors

Product Features

RayBlock 105 Sealing Kit

- Continuous operating temperature from –40°C up to +105°C
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 110°C
- Flame retarded
- 4:1 shrink ratio



Product Dimensions

Profile				Tubing			
Number of Channels	h Outside height (nom) mm	L Length (nom) mm	W Width (nom) mm	D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	T (nom) mm	Ordering Description
2	8.5	2.75	8.50	12.00	3.00	55.00	RBK-105 Kit 0702-AO
2	8.5	2.75	8.50	19.00	4.00	50.00	RBK-105 Kit 1102-AO
3	8.5	2.75	12.25	16.00	4.00	40.00	RBK-105 Kit 0103-AO
3	8.5	2.75	12.25	16.00	4.00	50.00	RBK-105 Kit 1003-AO
4	8.5	2.75	16.00	16.00	4.00	33.00	RBK-105 Kit 0204-AO
5	8.5	2.75	19.75	24.00	6.00	45.00	RBK-105 Kit 0105-AO
7	8.5	2.75	27.25	24.00	6.00	65.00	RBK-105 Kit 0107-AO
8	8.5	2.75	31.00	24.00	6.00	47.00	RBK-105 Kit 0508-AO
10	8.5	2.75	38.50	32.00	8.00	65.00	RBK-105 Kit 0110-AO
10/7	8.5	2.75	38.50/28.60	32.00	8.00	60.00	RBK-105 Kit 0510-AO

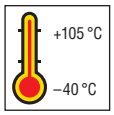
The selection table is intended for guidance only and individual bundles may well differ in requirement.
Special designs may be possible on request to cater for large wires or larger cable bundles.
Please contact TE Automotive for further information.

TE Automotive offers a variety of heating tools for the installation of RayBlock 105 Sealing Kit.
The range includes hot-air blowers, infra-red heaters and special automatic heating devices.

Ordering Information

Standard Colour	Black (0)
Size Selection	Maximum two wires per channel, for wires with maximum outside diameter 2.8 mm. For wires with an outside diameter greater than 2.8 mm, please consult TE Automotive. Standard Packaging: 1000 pcs of profile plus 1000 pcs of tubing per box.
Ordering Description	Specify product name, size and colour (for example RBK-105-Kit-0103-AO)

Specifications/Approvals	**Series**	**TE**
	RayBlock 105 Sealing Kit	RW-2102



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded


Fluid Resistant

RBK-ILS-125/ RBK-ILS-125-NR500 Tubing

Sealing and protection of inline wire splices and grounding ring terminals.

RBK-ILS-125 Tubing

Dual-wall, heat-shrinkable tubing designed to provide moisture proof encapsulation of an electrical splice in an automotive environment. Moisture may enter a splice area directly or indirectly via a capillary action between individual wires, thus causing corrosion.

The tubing is centered over the splice area and on heating the adhesive melts and is squeezed around where the wires are crimped or welded and between the conductors, by the shrinking action of the sleeve. The installed product provides low profile mechanical protection against flexing, abrasion and cut-through as well as electrical insulation. The jacket is flame-retarded.

There are five sizes to cover the range of splice profiles found, and up to seven wires may enter either end of the product. The sleeves are marked with size, eg. RBK-1 to aid selection. The compact size of RBK-ILS-125 suits process line harness assembly.

RBK-ILS-125-NR500 Tubing

Highly over-expanded product which allows the product to be positioned and installed after the ring terminal has been crimped or ultrasonically welded to the ground wires.

Benefits

- Excellent environmental seal
- Mechanical protection against flexing, abrasion and cut-through
- Small cross-sectional profile
- Simultaneous sealing, protection and insulation – in one process pass
- Rapid, simple installation – over-expanded sizes allow placement of tubing over ring terminal after ground wires have been terminated
- Applications versatility – one tubing size covers a broad range of ground wire sizes and wire combinations
- Superior strain relief and mechanical protection – provided by tough outer jacket, plus tubing and adhesive combination
- Established application and installation procedures – meeting most harness production processes
- RoHS/ELV compliant

Dual-Wall, Moisture Proof, Heat-Shrinkable Tubing to Protect Electrical Splices

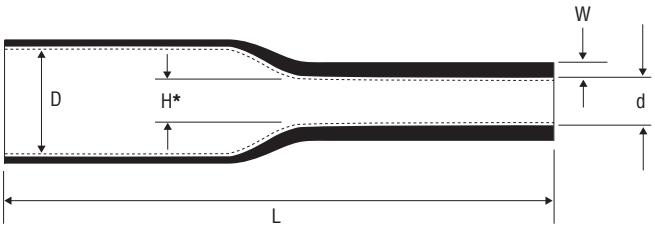
Product Features

RBK-ILS-125 Tubing

- Continuous operating temperature from -40°C up to +125°C (3000 hrs)
- Flame retarded
- 4:1 shrink ratio

RBK-ILS-125-NR500 Tubing

- 5:1 expansion ratio, allowing installation over terminal



W = Jacket only
d = Inner diameter of jacket only
H* = Inner diameter of adhesive liner

Product Dimensions

Size	Inside Diameter			Wall Thickness (mm)		Length**	Ordering Description
	D (min) Expanded as Supplied	H (max)* Recovered after Heating	d (max) Recovered Jacket after Heating	W (min) Recovered Jacket after Heating	W + Adhesive Liner (min)	L (nom)	
NR1	5.75	1.25	2.65	0.6	1.15	50	RBK-ILS-125-NR1
NR2	7.50	1.65	3.45	0.7	1.4	50	RBK-ILS-125-NR2
NR3	11.00	2.40	4.65	0.8	1.8	65	RBK-ILS-125-NR3
NR3A	14.00	3.00	5.90	0.9	2.15	65	RBK-ILS-125-NR3A
NR4	18.30	4.35	7.40	0.9	2.2	75	RBK-ILS-125-NR4

Refer to the Installation Guidelines document before selecting size (PIP-019).
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.

*) Nominal values for reference only.

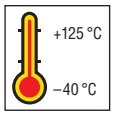
**) Other lengths are available subject to special order.

Ordering Information

Standard Colour	Black (0)
Installation	The product may be installed using a TE Automotive RBK-ILS Processor or other recommended application equipment. Consult your local TE Automotive office for more information.
Size Selection	Refer to PIP-019
Ordering Description	Specify product name, size and colour (for example RBK-ILS-125-NR)

Specifications/Approvals	Series	TE
	RBK-ILS-125	RK-6638

Note: This is a non-preferred product.
Please refer to QSZH datasheet on page 17.
Contact TE Automotive Sales representative.



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Flame Retarded

Fluid Resistant

RBK-RTP-125 Tubing

Dual wall, moisture resistant, heat shrinkabletubing for ring terminal applications.

RBK-RTP-125 Tubing

RBK-RTP-125 is a dual wall, heat-shrinkable tubing designed to provide environmental protection for ring terminal assemblies in an automotive environment.

The installed product provides low profile mechanical protection against flexing, abrasion and cut-through as well as electrical insulation.

Benefits

- Environmental Protection[1]
- Mechanical Protection against flexing, abrasion and cut-through
- Small cross-sectional profile
- Temperature rated to 125°C[2]
- RoHS/ELV compliant

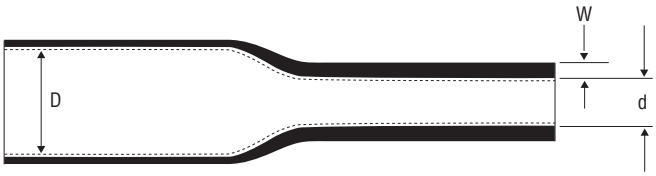
[1] Due to the variation in size and design of ring terminals no claim is made with respect to sealing performance.

[2] Depending on terminal shape. If surfaces are smooth or tapered there may be a tendency for the tube to move at elevated temperatures. Users should evaluate the suitability of this product at their required operating temperatures.

Product Features

RBK-RTP-125

- Continuous operating temperature from –55°C up to +125°C
- Minimum shrink temperature: 155°C
- Minimum full recovery temperature: 175°C
- Flame retarded



Product Dimensions

Inside Diameter		Wall Thickness		
D (min) Expanded as Supplied mm	d (max) Recovered Jacket after Heating mm	W (min) Recovered Jacket after Heating mm	W + Adhesive Liner (min)* mm	Ordering Description
11.00	3.45	0.70	1.40	RBK-RTP-125-NR500-Col
11.00	4.65	0.80	1.80	RBK-RTP-125-NR3-Col
20.20	11.40	1.25	2.31	RBK-RTP-125-NR5-Col

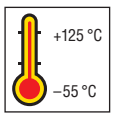
Supplied tube lenghts will be per customer order.
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.

***** Nominal values for reference only.

Ordering Information

Standard Colour	Check with Product Management on colour availability
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example RBK-RTP-125-NR)

Specifications/Approvals	Series	TE
	RBK-RTP-125	RW-6764



Operating Temperature Range

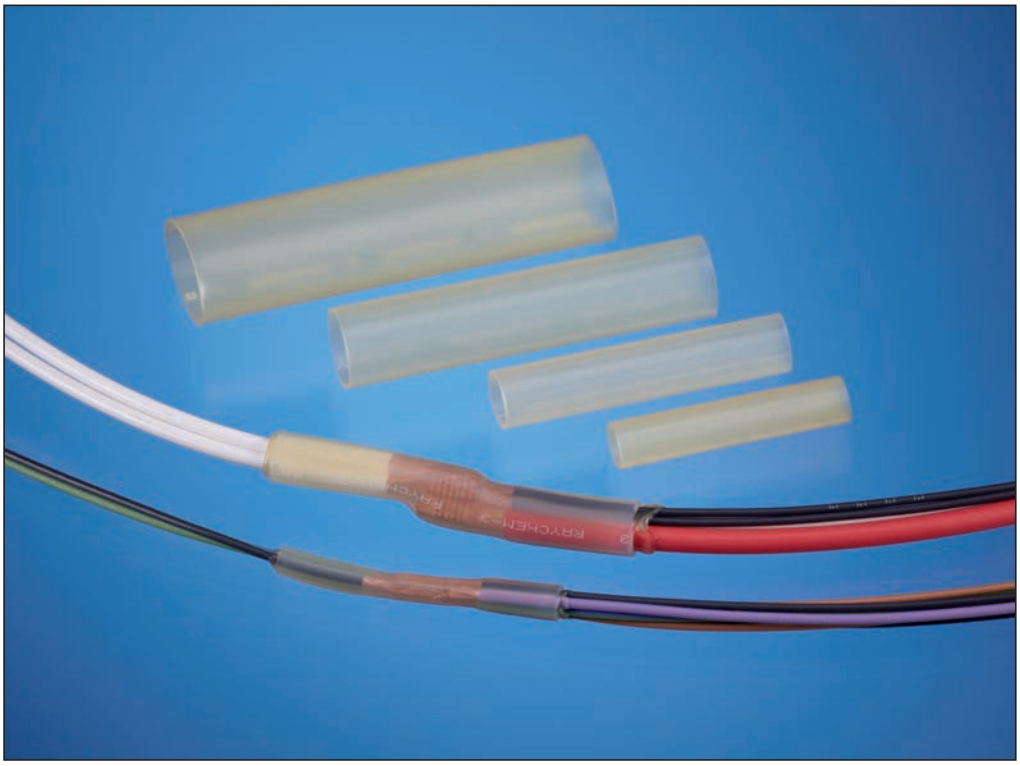
Shrink Temperature

Flame Retarded

Fluid Resistant

RBK-VWS-125 Tubing

Clear product for sealing and protection of inline wire splices.



RBK-VWS-125 Tubing

Dual-wall, heat-shrinkable tubing designed to provide environmental sealing of an electrical splice in an automotive environment.

Moisture may enter a splice directly or indirectly via capillary action between individual wires, thus causing corrosion. This effect is accelerated by variations in temperature.

The tubing is centred over the splice area and during heating the adhesive melts and is 'squeezed' around where the wires are crimped or welded and between the conductors by the shrinking action of the sleeve.

The installed product provides low profile mechanical protection against flexing, abrasion and cut-through as well as electrical insulation. There are four sizes to cover the range of splice profiles.

Benefits

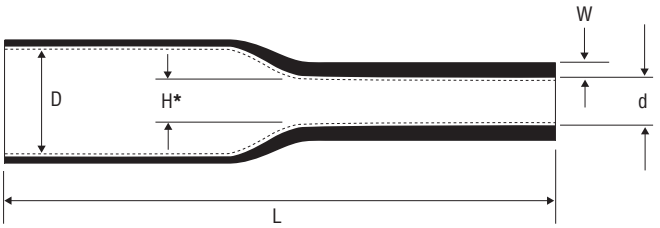
- Excellent environmental seal
- Mechanical protection against flexing, abrasion and cut-through
- Small cross-sectional profile
- Single component solution – to seal, protect and insulate most in-line and stub splices
- Complete environmental and moisture sealing – for up to seven wires per side
- Tubing and adhesive combination – for superior strain relief
- Clear tubing allowing inspection of wire splices
- Application equipment and installation procedures – to meet most harness production processes
- Meets most applicable worldwide automotive OEM splice sealing specifications
- RoHS/ELV compliant

Clear, Dual-Wall, Moisture Proof, Heat-Shrinkable Tubing to Protect Electrical Splices

Product Features

RBK-VWS-125 Tubing

- Continuous operating temperature from -40°C up to +125°C (3000 hrs)
- 4:1 shrink ratio



W = Jacket only
d = Inner diameter of jacket only
H* = Inner diameter of adhesive liner

Product Dimensions

	Inside Diameter			Wall Thickness (mm)			
Size	**D (min) Expanded as Supplied**	**H (max)*1 Recovered after Heating**	**d (max) Recovered Jacket after Heating**	**W (min) Recovered Jacket after Heating**	**W + Adhesive Liner (min)**	**Length*3) L (nom)**	**Ordering Description**
NR1	5.70	1.27	2.52	0.80	1.42	50	RBK-VWS-125-NR1-X
NR2	8.00	1.65	3.01	1.06	1.78	50	RBK-VWS-125-NR2-X
NR3	10.80	2.40	4.55	1.16	2.14	65	RBK-VWS-125-NR3-X
NR4	17.78	4.45	7.40*2	1.04	2.41	75	RBK-VWS-125-NR4-X

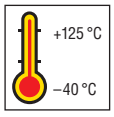
Refer to the Installation Guidelines document before selecting size (PIP-004).
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.

*1) Nominal values for reference only.
*2) Estimate.
*3) Other lengths are available subject to special order.

Ordering Information

Standard Colour	Clear (X)
Installation	The product may be installed using a TE Automotive RBK-ILS Processor or other recommended application equipment. Consult your local TE Automotive office for more information.
Size Selection	Refer to PIP-004
Ordering Description	Specify product name, size and colour (for example RBK-VWS-125-NR)

Specifications/Approvals	**Series**	**TE**
	RBK-VWS-125	
	Size 1–3	RK-6640
	Size 4	RT-1113



Operating Temperature Range

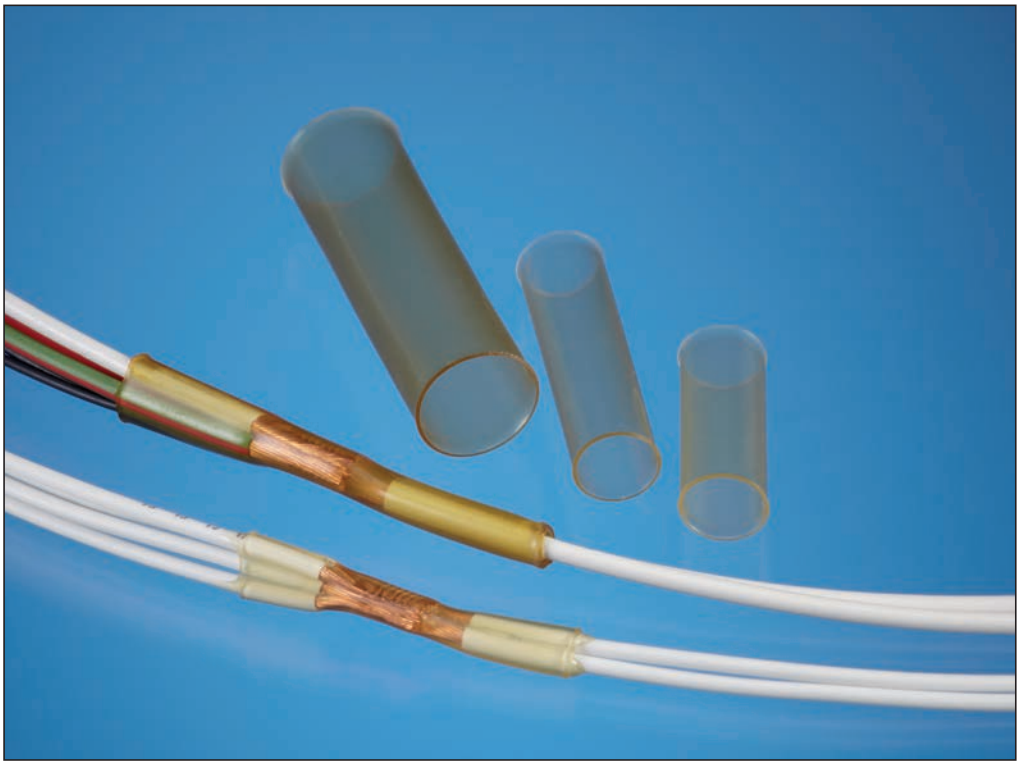
Shrinking Ratio

Shrink Temperature

Fluid Resistant

RPPM Tubing

Effective strain relief, protection and insulation for dry area splices.



RPPM Tubing

is a flexible, heat-shrinkable, dual-wall tubing with an integrally bonded meltable adhesive liner. Available in clear and black, the tough outer jacket with both types offers excellent mechanical strength.

RPPM is used for moisture proof encapsulation of a wide variety of components. In particular, it adheres well to PVC. The high shrink ratio allows RPPM to be used with a range of dimensions.

Clear RPPM offers excellent clarity for protection of substrates that may need to be inspected during service. Black RPPM has a high gloss finish suitable for cosmetic applications.

Benefits

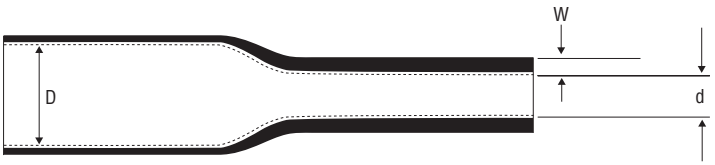
- Single component solution – to insulate and protect almost all dry area splices
- Repeatable process – not subject to operator variability
- Low cost, high throughput process equipment available – cost competitive with PVC tape
- Rapid installation – up to 2000+ splices per hour
- Low profile protection – reducing the diameter of conduit required
- Reduced total installed cost – less handling than PVC over-taping more than off-sets higher material cost
- Tubing and adhesive combination – for superior strain relief
- High shrink ratios – allow one size to cover a wide range of splice combinations
- RoHS/ELV compliant

Flexible, Dual-Wall, Moisture Proof, Heat-Shrinkable Tubing

Product Features

RPPM Tubing

- Continuous operating temperature from –40°C up to +85°C (3000 hrs)
- Minimum shrink temperature: 60°C
- Minimum full recovery temperature: 80°C
- 4:1 shrink ratio



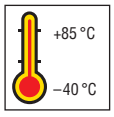
Product Dimensions

Size	Inside Diameter D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	Wall Thickness W (nom) Total Wall Recovered after Heating mm	Ordering Description
4/1	4.0	1.0	0.8	RPPM-4/1-colour code
8/2	8.0	2.0	0.9	RPPM-8/2-colour code
12/3	12.0	3.0	1.2	RPPM-12/3-colour code
16/4	16.0	4.0	1.5	RPPM-16/4-colour code
NR510	9.0	1.5	1.6	RPPM-NR510-X
NR801	6.4	1.0	0.8	RPPM-NR801-colour code

Order the largest size that will recover snugly over the component to be covered.
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.
Other lenghts and sizes are available subject to special order.

Ordering Information

Standard Colours	Clear (X)	Black (0)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.	
Ordering Description	Specify product name, size and colour (for example RPPM-8/2-X)	
Specifications/Approvals	**Series**	**TE**
	RPPM	RK-6214



Operating Temperature Range

Shrinking Ratio (up to 7:1)

Shrink Temperature

Fluid Resistant

RW-175 Tubing

High temperature tubing with excellent chemical and abrasion resistance. All round general protection and insulation.

RW-175 Tubing

An extremely tough, high temperature, thin-wall insulation tubing. This transparent, non-burning, semi-rigid tubing has superior resistance to most industrial fuels, solvents and chemicals.

Designed for applications requiring strain relief at temperatures up to 175°C, this product is unusally tough in its resistance to abrasion and cut through.

Typical applications include high temperature applications, protection, strain relief, chemical resistance, mechanical and abrasion protection.

The natural rigidity of this material makes it suitable for automated installation via pick and place stations.

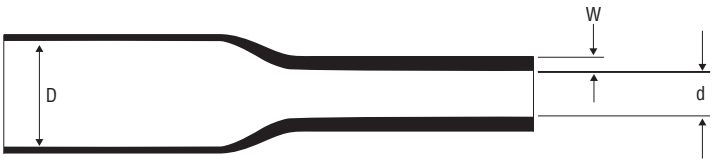
Benefits

- Tough, semi-rigid, very thin-wall insulation
- High flame-resistance meeting the requirements of UL and CSA VW-1 rating
- High temperature performance
- Protection from most industrial solvents
- RoHS/ELV compliant

Product Features

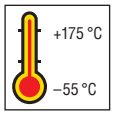
RW-175 Tubing

- Continuous operating temperature from –55°C up to +175°C
- Minimum shrink temperature: 155°C
- Minimum full recovery temperature: 175°C
- Flame retarded
- 2:1 shrink ratio



Product Dimensions

Size	Inside Diameter D (min) Expanded as Supplied mm	Inside Diameter d (max) Recovered after Heating mm	Wall Thickness W (nom) Recovered after Heating mm	Ordering Description
3/64	1.2	0.6	0.25	RW-175-3/64-X
1/16	1.6	0.8	0.25	RW-175-1/16-X
3/32	2.4	1.2	0.27	RW-175-3/32-X
1/8	3.2	1.6	0.27	RW-175-1/8-X
3/16	4.8	2.4	0.27	RW-175-3/16-X
1/4	6.4	3.2	0.33	RW-175-1/4-X
3/8	9.5	4.8	0.33	RW-175-3/8-X
1/2	12.7	6.4	0.33	RW-175-1/2-X
3/4	19.0	9.5	0.43	RW-175-3/4-X
1	25.4	12.7	0.48	RW-175-1-X
1 1/2	38.1	19.1	0.51	RW-175-1 1/2-X
2	50.8	25.4	0.51	RW-175-2-X



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Flame Retarded

Fluid Resistant

Canadian Standards Association

Underwriters Laboratories

Ordering Information

Colour	Standard Colour Non-Standard Colour	Clear (X) Black (0)		
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.			
Ordering Description	Specify product name, size and colour (for example RW-175-1/4-colour)			
Specifications/Approvals	**Series**	**UL**	**CSA**	**TE**
	RW-175	E35586VW-1 600 V, 150°C	LR31929VW-1 600 V, 150°C	RW-3029/1 RW-3029/2

RW-200/RW-200-E Tubing

Heat-shrinkable, chemical-resistant, high-temperature tubing.

RW-200/RW-200-E Tubing

Premium heat-shrinkable tubing fabricated from fluoro-elastomers – a crosslinked material designed for a wide range of applications.

It is available in two configurations. RW-200-E is the thickest wall version. RW-200 has the thinnest wall for lighter weight applications.

Offering fluid resistance, RW-200 tubing can be used in applications up to 200 °C [392 °F].

Benefits

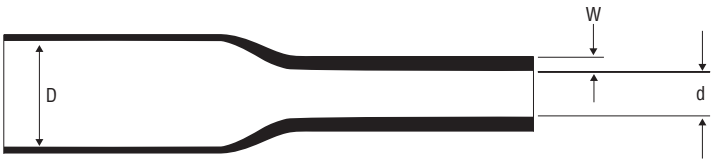
- High resistance to impact and abrasion
- Resistance to a wide variety of fuels, lubricants, acids, and solvents at elevated temperatures
- Flexibility at low temperatures without cracking
- RoHS/ELV compliant

RW-200/RW-200-E

Product Features

RW-200/RW-200-E Tubing

- **Operating Temperature Range**
  RW-200: –40°C to +200°C (–40°F to 392°F)
  RW-200-E: –55°C to +200°C (–67°F to 392°F)
- Minimum shrink temperature: 100°C (212°F)
- Minimum full recovery temperature: 175°C (347°F)
- Flame retarded
- 2:1 shrink ratio



Product Dimensions

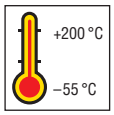
Size	Inside Diameter D (min) Expanded as Supplied	Inside Diameter d (max) Recovered after Heating	Wall Thickness* W (nom) Recovered after Heating RW-200-E	Wall Thickness* W (nom) Recovered after Heating RW-200
1/8	3.2 (0.125)	1.6 (0.062)	0.76 (0.030)	0.76 (0.030)
3/16	4.8 (0.187)	2.4 (0.093)	0.84 (0.033)	0.89 (0.035)
1/4	6.4 (0.250)	3.2 (0.125)	0.89 (0.035)	0.89 (0.035)
3/8	9.5 (0.375)	4.8 (0.187)	1.02 (0.040)	0.89 (0.035)
1/2	12.7 (0.500)	6.4 (0.250)	1.22 (0.048)	0.89 (0.035)
5/8	15.9 (0.625)	7.9 (0.312)	–	1.07 (0.042)
3/4	19.1 (0.750)	9.5 (0.375)	1.45 (0.057)	1.07 (0.042)
7/8	22.2 (0.875)	11.1 (0.437)	–	1.25 (0.049)
1	25.4 (1.000)	12.7 (0.500)	1.78 (0.070)	1.25 (0.049)
1 1/4	31.8 (1.250)	15.9 (0.625)	–	1.40 (0.055)
1 1/2	38.1 (1.500)	19.1 (0.750)	2.41 (0.095)	1.40 (0.055)
2	50.8 (2.000)	25.4 (1.000)	2.79 (0.110)	1.65 (0.065)

*) Wall thickness will be less if tubing recovery is restricted during shrinkage.

Ordering Information

Standard Colour	Black (0)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example RW-200-E-1/4-0, RW-200-1/2-0)

Specifications/Approvals	Series	TE
	RW-200	RW-3037
	RW-200-E	RW-3037



Operating Temperature Range (RW-200-E)

Shrinking Ratio

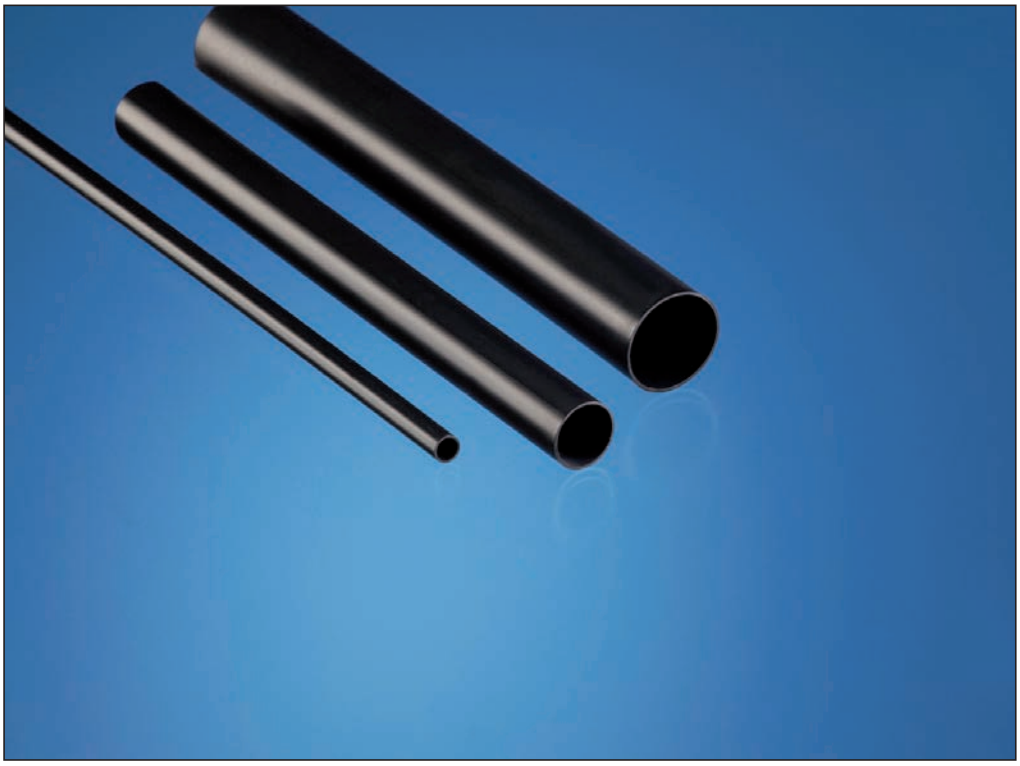
Shrink Temperature


Flame Retarded


Fluid Resistant

SCL Tubing

Semi-rigid cross-linked heat-shrinkable encapsulation tubing.



SCL Tubing

Encapsulates components, splices, and terminations where moisture resistance and mechanical protection are required. Encapsulant melts and flows to fill surface irregularities of the substrate. While still hot, the tubing can be blocked to form a wire breakout.

Benefits

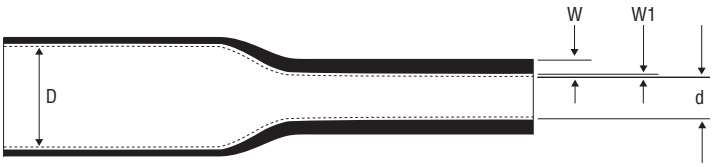
- UL approved construction is available
- One-step moisture proof encapsulation
- RoHS/ELV compliant

Semi-Rigid Selectively Crosslinked Heat-Shrinkable Encapsulation Tubing

Product Features

SCL Tubing

- Continuous operating temperature from –55°C up to +110°C
- Minimum shrink temperature: 125°C
- Minimum full recovery temperature: 135°C
- Flame retarded
- 2.5:1 and 3:1 shrink ratio



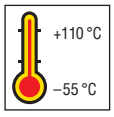
Product Dimensions

Inside Diameter		Wall Thickness		
D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	W (nom) Total Wall Recovered after Heating mm	W1 (nom) Meltable Wall Recovered after Heating mm	Ordering Description
3.2	0.6	0.96	0.51	SCL-⅛-0
4.8	1.5	1.09	0.64	SCL-3⁄16-0
6.4	2.0	1.19	0.69	SCL-¼-0
9.5	3.4	1.27	0.76	SCL-⅜-0
12.7	5.0	1.39	0.89	SCL-½-0
19.1	8.0	1.65	1.02	SCL-¾-0
25.4	10.2	1.90	1.02	SCL- 1-0

The largest size that will recover snugly over the component to be covered should be ordered.
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.
Other lenghts, colours (colour codes by size) and sizes are available subject to special order.
SCL is available in special UL approved constructions.

Ordering Information

Standard Colour	Black (0)		
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.		
Ordering Description	Specify product name, size and colour (for example SCL-⅛-0)		
Specifications/Approvals	**Series**	**UL**	**TE**
	SCL	E85381, 600 V, 125°C	RT-1301



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Underwriters Laboratories

Sealing and Protection for Wire Bundles, Connectors, Terminals and Splices

SCT Tubing

SCT Tubing is specially designed to insulate and seal automotive wire splices and components in an under-the-hood automotive environment.

SCT (150°C) Tubing

Dual-wall, heat-shrinkable tubing designed to provide environmental sealing of an electrical splice in an automotive environment.

Moisture may enter a splice directly or indirectly via capillary action between individual wires, thus causing corrosion. This effect is accelerated by variations in temperature.

The tubing is centred over the splice area and during heating the adhesive melts and is 'squeezed' around where the wires are crimped or welded and between the conductors by the shrinking action of the sleeve.

The installed product provides low profile mechanical protection against flexing, abrasion and cut-through as well as electrical insulation. There are four sizes to cover the range of splice profiles.

Benefits

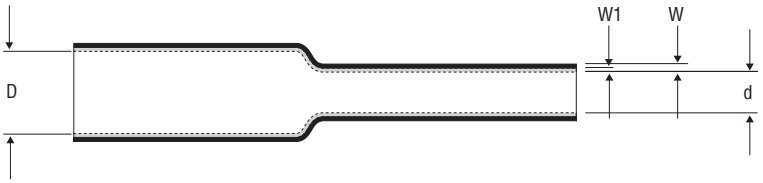
- Excellent environmental seal
- Mechanical protection against flexing, abrasion and cut-through
- Small cross-sectional profile
- 4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters
- Flame-retardant and mechanically tough, the tubing provides strain relief and abrasion protection of wire splices, terminals, and other components
- Thick adhesive liner forms an effective barrier against fluids and moisture and performs well at an extended temperature range
- RoHS/ELV compliant

Flame Retardant, Adhesive-Lined, Semi-Rigid Polyolefin, Heat-Shrinkable Tubing

Product Features

SCT (150°C) Tubing

- Continuous operating temperatures from –40°C up to +150°C (3000 hrs)
- Minimum shrink temperature: 110°C
- Minimum full recovery temperature: 135°C
- Flame retarded
- 4:1 shrink ratio



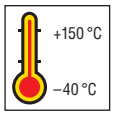
Product Dimensions

	Inside Diameter		Recovered Wall Thickness*	
Size	**D (min) Expanded as Supplied mm (Inch)**	**d (max) Recovered after Heating mm (Inch)**	**W (nom) Total Wall after Heating mm (Inch)**	**W1 Meltable Wall after Heating mm (Inch)**
SCT-NO. 1	7.6 (.300)	1.7 (.065)	1.52 $^{\pm.30}$ (.060 $^{\pm.012}$)	.76 (.030)
SCT-NO. 2	9.0 (.355)	2.3 (.090)	1.52 $^{\pm.30}$ (.060 $^{\pm.012}$)	.76 (.030)
SCT-NO. 3	11.6 (.455)	2.5 (.100)	2.29 $^{\pm.30}$ (.090 $^{\pm.012}$)	1.40 (.055)
SCT-NO. 4	17.8 (.700)	4.4 (.175)	2.54 $^{\pm.30}$ (.100 $^{\pm.012}$)	1.52 (.060)

***) Wall thickness will be less if tubing recovery is restricted during shrinkage.

Ordering Information

Standard Colour	Black (0)	
Size Selection	Always order the largest size that will shrink snugly over the component being covered. Special order sizes are available upon request.	
Standard Packaging	Cut pieces	
Marking	Tubing will be printed with its numbered size (such as SCT-1, SCT-2, SCT-3, SCT-4).	
Ordering Description	Specify product name, numbered size, colour and cut length (e.g. SCT-NO.3-0-1220mm).	
Specifications/Approvals	**Series**	**TE**
	SCT Tubing	SCT SCD



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Flame Retarded

Fluid Resistant

VERSAFIT Tubing

Highly flame-retarded, low shrink temperature polyolefin heat-shrinkable tubing.

VERSAFIT Tubing

VERSAFIT highly flame-retarded, very flexible polyolefin heat-shrinkable tubing has been designed to meet the stringent requirements of UL 224 VW-1 and CSA and is, therefore, recommended for use in applications requiring the highest level of flame retardance.

VERSAFIT tubing will electrically insulate and protect in-line components, terminals and splices, bundle wires for very flexible, light duty harnesses and provide electrical insulation, mechanical protection, cable bundling and strain relief.

Benefits

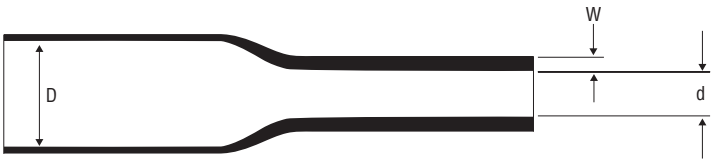
- Good chemical and solvent resistance
- Excellent physical and electrical properties
- Excellent flammability performance
- Low shrink temperature reduces installation time and the risk of damage to temperature-sensitive components
- Very flexible; doesn't easily wrinkle when bent
- RoHS/ELV compliant

Highly Flame-Retarded, Low Shrink Temperature Polyolefin Heat-Shrinkable Tubing

Product Features

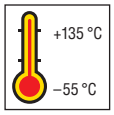
VERSAFIT Tubing

- Continuous operating temperature from –55°C up to +135°C
- Minimum shrink temperature: 70°C
- Minimum full recovery temperature: 90°C
- Flame retarded
- 2:1 shrink ratio



Product Dimensions

Size	Inside Diameter D (min) Expanded as Supplied mm	Inside Diameter d (max) Recovered after Heating mm	Wall Thickness W (nom) Recovered after Heating mm	Ordering Description
3/64	1.63	0.58	0.40	VERSAFIT-3/64-colour code
1/16	1.85	0.79	0.43	VERSAFIT-1/16-colour code
3/32	2.79	1.17	0.51	VERSAFIT-3/32-colour code
1/8	3.43	1.57	0.51	VERSAFIT-1/8-colour code
3/16	5.21	2.36	0.51	VERSAFIT-3/16-colour code
1/4	7.11	3.17	0.64	VERSAFIT-1/4-colour code
3/8	10.16	4.74	0.64	VERSAFIT-3/8-colour code-FSP
1/2	13.72	6.35	0.64	VERSAFIT-1/2-colour code-FSP
5/8	16.90	8.0	0.76	VERSAFIT-5/8-colour code-FSP
3/4	20.45	9.52	0.76	VERSAFIT-3/4-colour code-FSP
1	25.53	12.7	0.89	VERSAFIT-1-colour code-FSP
1 1/4	33.40	15.88	1.02	VERSAFIT-1-1/4-colour code
1 1/2	39.88	19.05	1.02	VERSAFIT-1-1/2-colour code
2	52.83	25.4	1.14	VERSAFIT-2-colour code
3	78.49	38.1	1.27	VERSAFIT-3-colour code
4	104.14	50.8	1.40	VERSAFIT-4-colour code



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded


Canadian Standards Association


Underwriters Laboratories

Ordering Information

Standard Colour	Black (0)	Red (2)	White (9)	Blue (6)	Yellow (4)	Green (5)
	Sizes 3/64 through 1-inch only					
	Suffix-FSP Flat Spool Product					

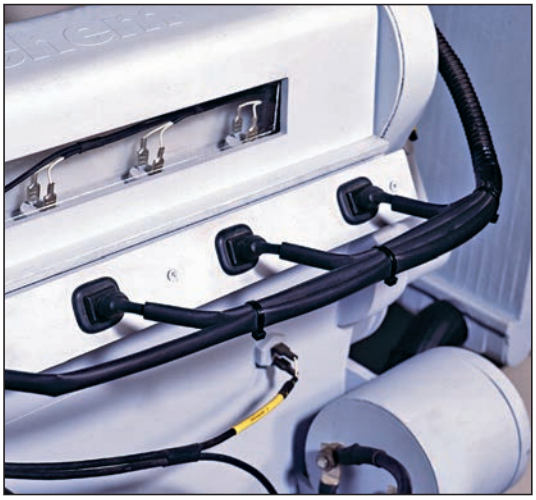
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example Versafit-1/2-colour)

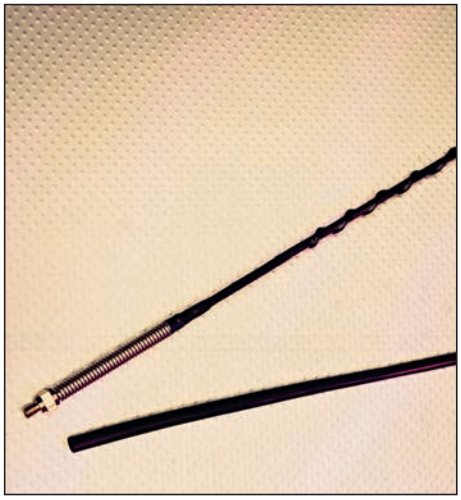
	Series	UL	CSA	TE
Specifications/Approvals	VERSAFIT	E35586VW1 600 V, 125°C	LR31929VW1 600 V, 125°C	RW-3009

Engineering Notes

Mechanical Protection

- Versatile Protective Coverings for Automotive Components
- Electric Motor Protection
- Wire Harness Protection
- Electronic Component Protection

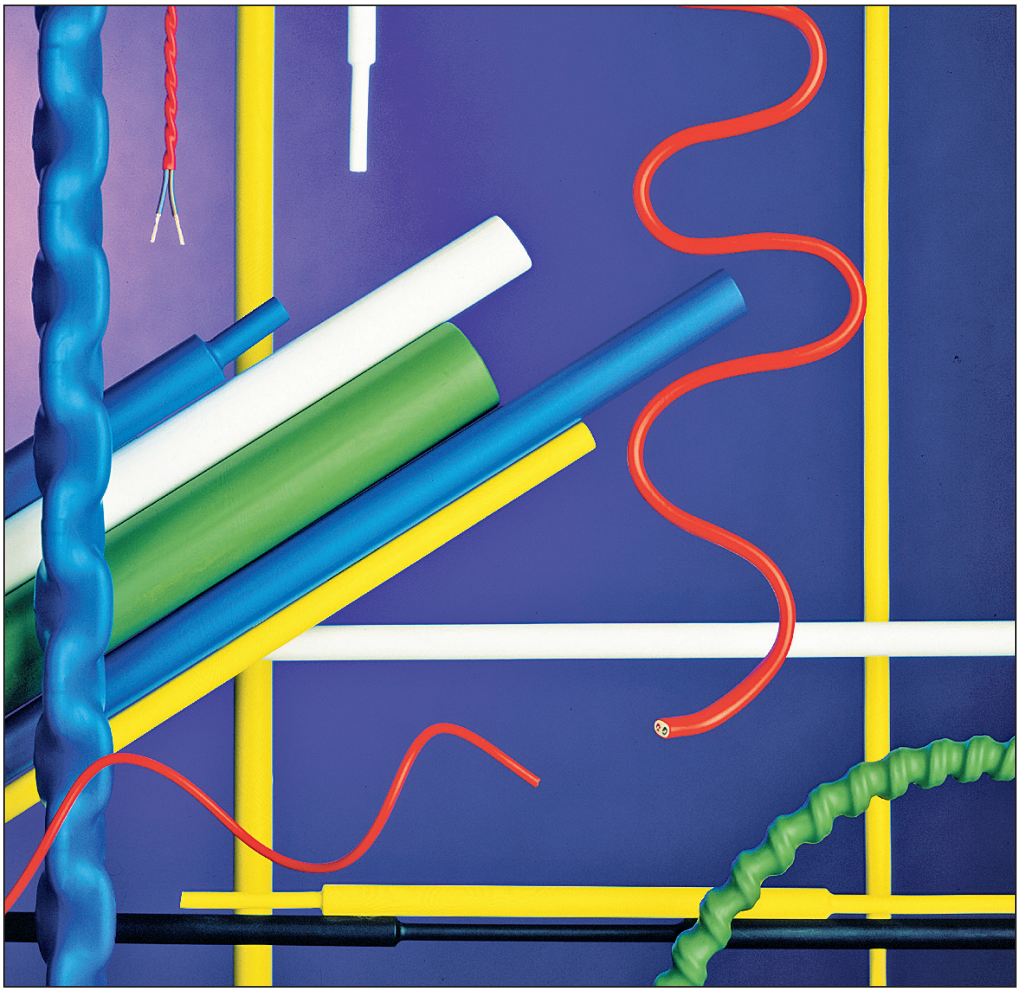




Versatile Protective Coverings for Automotive Components

CGPT Tubing

General purpose, flame-retardant* polyolefin tubing.



*) Clear product (X) is not flame-retardant.

CGPT Tubing

A tough, flexible, general purpose polyolefin tubing with good resistance to common fluids and solvents and a high dielectric strength. Its unique blend of chemical, electrical, and physical properties makes it suitable for a wide range of applications, including electrical insulation, strain relief, cable bundling, colour-coding and identification of wires, cables, pipes, and electrical and electronic components, and mechanical protection.

Benefits

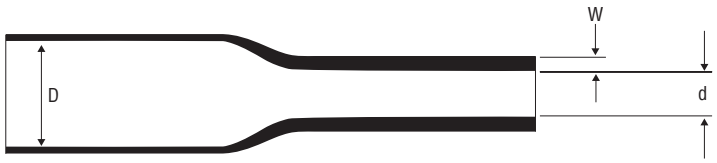
- Very good chemical and solvent resistance
- Flexible
- Excellent physical and electrical performance
- RoHS/ELV compliant

General Purpose, Flame Retarded, Polyolefin Heat-Shrinkable Tubing

Product Features

CGPT Tubing

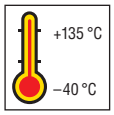
- Continuous operating temperature from –40°C up to +135°C
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 120°C
- Flame retarded
- 2:1 and 3:1 shrink ratio



Product Dimensions

Size	Inside Diameter D (min) Expanded as Supplied mm	Inside Diameter d (max) Recovered after Heating mm	Wall Thickness W (nom) Recovered after Heating mm	Ordering Description
2:1 Shrink Ratio				
1.2/0.6	1.2	0.6	0.45	CGPT-1.2/0.6-colour code
1.6/0.8	1.6	0.8	0.45	CGPT-1.6/0.8-colour code
2.4/1.2	2.4	1.2	0.50	CGPT-2.4/1.2-colour code
3.2/1.6	3.2	1.6	0.50	CGPT-3.2/1.6-colour code*
4.8/2.4	4.8	2.4	0.50	CGPT-4.8/2.4-colour code*
6.4/3.2	6.4	3.2	0.65	CGPT-6.4/3.2-colour code*
9.5/4.8	9.5	4.8	0.65	CGPT-9.5/4.8-colour code-FSP*
12.7/6.4	12.7	6.4	0.65	CGPT-12.7/6.4-colour code-FSP*
19/9.5	19.0	9.5	0.75	CGPT-19/9.5-colour code-FSP*
25.4/12.7	25.4	12.7	0.90	CGPT-25.4/12.7-colour code-FSP*
32/16	32.0	16.0	0.95	CGPT-32/16-colour code*
38/19	38.0	19.0	1.00	CGPT-38/19-colour code*
51/25.4	51.0	25.4	1.15	CGPT-51/25.4-colour code
76/38	76.0	38.0	1.25	CGPT-76/38-colour code
102/51	102.0	51.0	1.40	CGPT-102/51-colour code
3:1 Shrink Ratio				
1.5/0.5	1.5	0.5	0.45	CGPT-1.5/0.5-colour code
3/1	3.0	1.0	0.55	CGPT-3/1-colour code
6/2	6.0	2.0	0.65	CGPT-6/2-colour code
9/3	9.0	3.0	0.75	CGPT-9/3-colour code
12/4	12.0	4.0	0.75	CGPT-12/4-colour code
18/6	18.0	6.0	0.85	CGPT-18/6-colour code
24/8	24.0	8.0	1.00	CGPT-24/8-colour code
39/13	39.0	13.0	1.15	CGPT-39/13-colour code

*) Material supplied on Flat Spooled Packaging (FSP) as standard.



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded


Fluid Resistant


Canadian Standards Association


Underwriters Laboratories

Ordering Information

Standard Colours	Black (0) Red (2) Yellow (4) Green (5) Blue (6) White (9) Clear (X) Brown (1) Green/Yellow stripes
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example CGPT-3.2/1.6-colour)

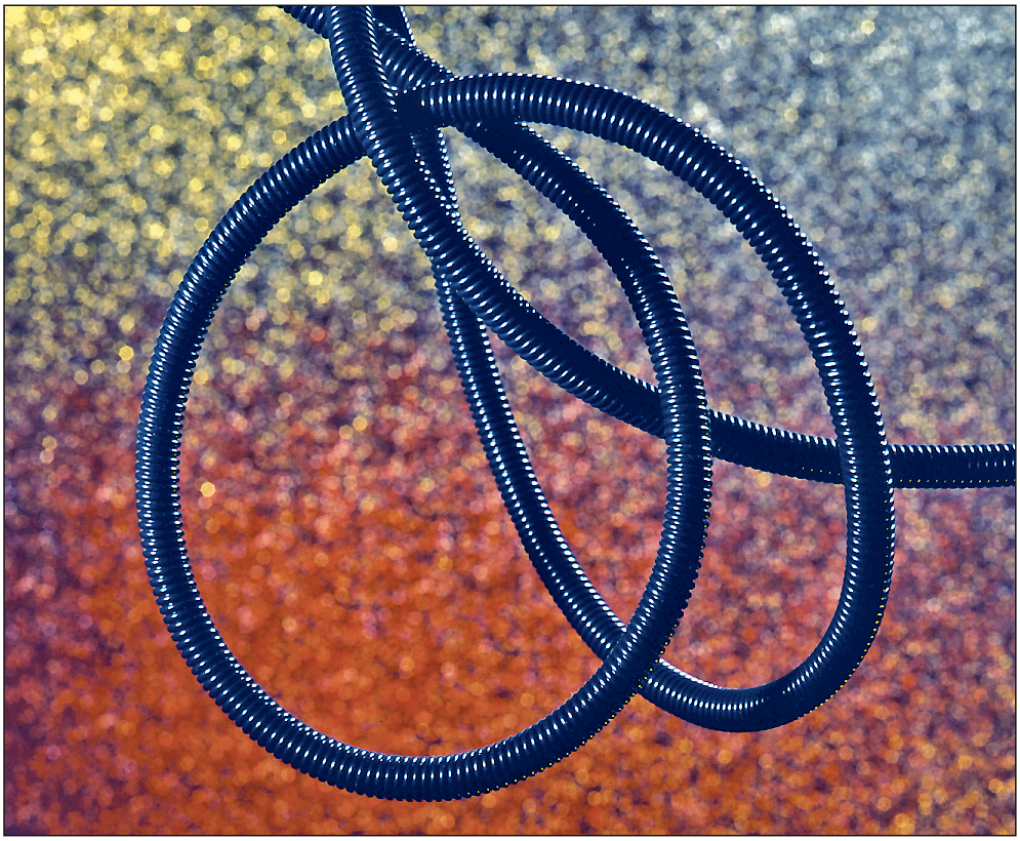
Specifications/Approvals	Series	UL	CSA	TE
	CGPT*	E35586 600 V, 125°C	LR31929 600 V, 125°C	RW-2059

*) clear product (x) is not flame retarded

Versatile Protective Coverings for Automotive Components

HCTE Tubing

Helical convolex tubing with a high crush resistance.



HCTE Tubing

Flexible convoluted conduit manufactured from radiation crosslinked, modified Ethylene Tetrafluoroethylene (ETFE). Its helical construction combines a high degree of flexibility with excellent crush resistance.

HCTE will operate continuously at temperatures up to 200 °C and up to 300 °C for limited periods.

Used as a conduit to provide mechanical protection for electrical wiring systems in applications requiring flexibility, high-temperature performance and good resistance to a variety of fluids. Widely used in the military and commercial aerospace industries.

Can be used in conjunction with other TE Connectivity's Raychem components to form an integrated harnessing system.

Installation

It is recommended that no more than 70 % of the internal area ("fill factor") of the HCTE conduit be occupied by wires in any application.

Benefits

- Highly flame-retardant
- Highly flexible and fluid resistant
- Not heat-shrinkable
- High crush resistance
- RoHS/ELV compliant

Versatile Protective Coverings for Automotive Components

Product Features

HCTE Tubing

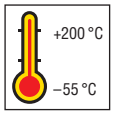
- Operating temperature Range –55°C up to +200°C
- Flame retarded
- 2:1 shrink ratio

Product Dimensions

Size	Inside Diameter Minimum mm	Outside Diameter Maximum mm	Maximum Wall Thickness mm
0187	4.60	8.10	0.46
0281	6.90	10.50	0.46
0312	7.70	11.80	0.46
0375	9.20	12.90	0.46
0437	10.80	14.50	0.46
0500	12.30	16.50	0.58
0625	15.40	19.50	0.58
0750	17.90	23.60	0.58
0875	21.80	27.20	0.58
1000	24.70	31.10	0.58
1250	30.70	35.30	0.58
1500	36.50	46.50	0.58
1625	39.60	50.17	0.58
1750	42.67	52.88	0.58
2000	49.20	59.23	0.58

Ordering Information

Standard Colour	Black (0)	
Size Selection	Always order a conduit size that will ensure that a “fill factor” of 70% is not exceeded.	
Ordering Description	Specify product name, size and colour (for example HCTE-0187-0)	
Specifications/Approvals	**Series**	**TE**
	HCTE	RT-1162



Operating Temperature Range

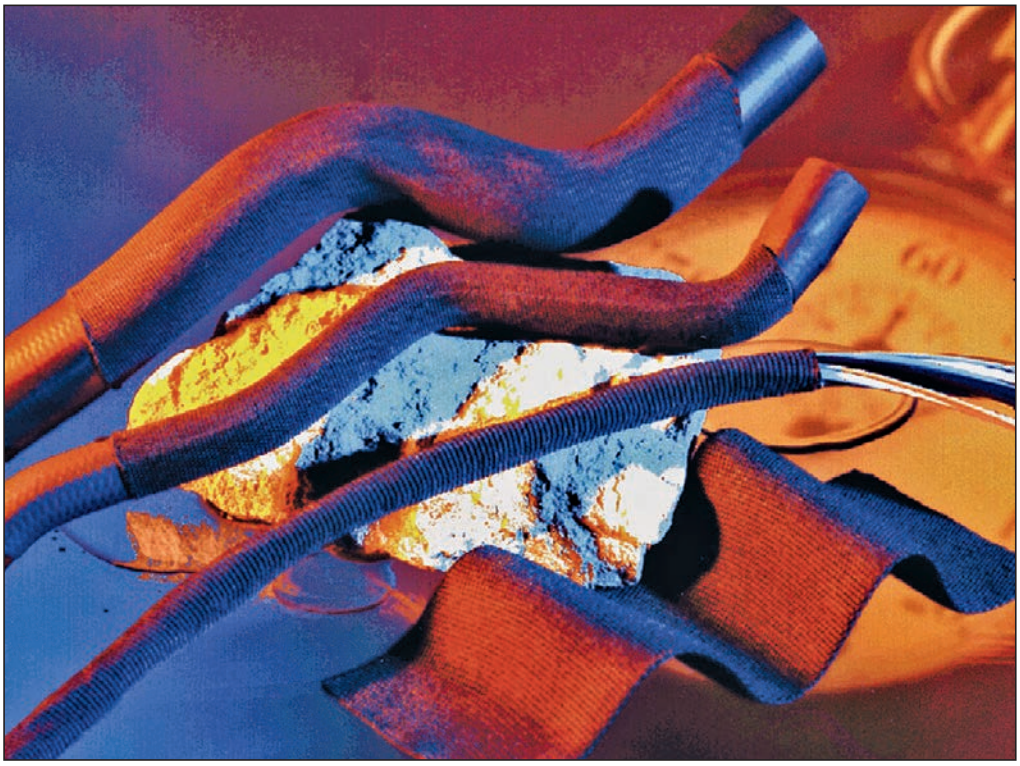
Shrinking Ratio

Flame Retarded

Versatile Protective Coverings for Automotive Components

HFT 5000 Tubing

Heat shrinkable abrasion resistant woven fabric tube.



HFT 5000 Tubing

HFT 5000 tubing products are made of very flexible heat-shrinkable fabric material, they shrink and fit snugly and securely around the underlying substrate.

Designed primarily to provide mechanical abrasion protection for components such as rubber hoses, plastic pipes, and harness wiring bundles, they are also suitable for other applications, such as noise and rattle suppression.

The woven construction makes HFT 5000 extremely flexible and resistant to trapping water, heat and humidity. It provides outstanding abrasion, chafing and cutting protection, even at high temperatures. HFT-5000 product is easy to install and can be cut with standard industrial cutting equipment.

Benefits

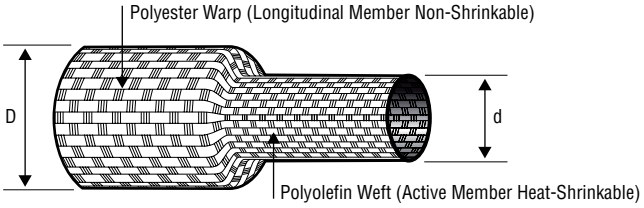
- Extremely tough – meeting even demanding automotive abrasion specifications
- Protect only where protection is needed – minimising cost
- Safe installation with no hot knife cutting equipment required – reduces investment
- Soft to handle so operators do not need to wear gloves – increases productivity
- Can be cut with conventional guillotines or even scissors
- Resists hose pulsing effects
- Halogen free
- Resistent to harsh environments such as engine compartments
- Grips substrates tightly without additional fixing
- Highly flexible woven fabric construction for easy installation onto awkward substrates such as tightly angled hoses
- RoHS/ELV compliant

Heat-Shrinkable Fabric Tubing

Product Features

HFT 5000 Tubing

- Continuous operating temperature from –40°C up to +125°C (3000 hrs) –40°C up to +150°C (1000 hrs)
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 110°C
- Low shrink temperature
- 2:1 shrink ratio



Product Dimensions

Standard Sizes

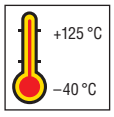
Inside Diameter

D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	Ordering Description
12	6	HFT-5000-12/6-0
20	10	HFT-5000-20/10-0
25	12	HFT-5000-25/12-0
30	15	HFT-5000-30/15-0
34	17	HFT-5000-34/17-0
40	20	HFT-5000-40/20-0
50	25	HFT-5000-50/25-0
60	30	HFT-5000-60/30-0
70	35	HFT-5000-70/35-0
80	40	HFT-5000-80/40-0
100	50	HFT-5000-100/50-0

Ordering Information

Standard Colour	Black (0)
	Note: Fully recoverable fabric wall thickness: Approximately 1 mm. Longitudinal change on full recovery is –10% to –20%; 0 = Black
	For full product performance details consult TE Automotive Specifications RW-2060.

Specifications/Approvals	**Series**	**TE**
	HFT 5000 Tubing	RW-2060
	Material Safety Data Sheet available on request.	
	Installation instructions available on request.	



Operating Temperature Range

Shrinking Ratio

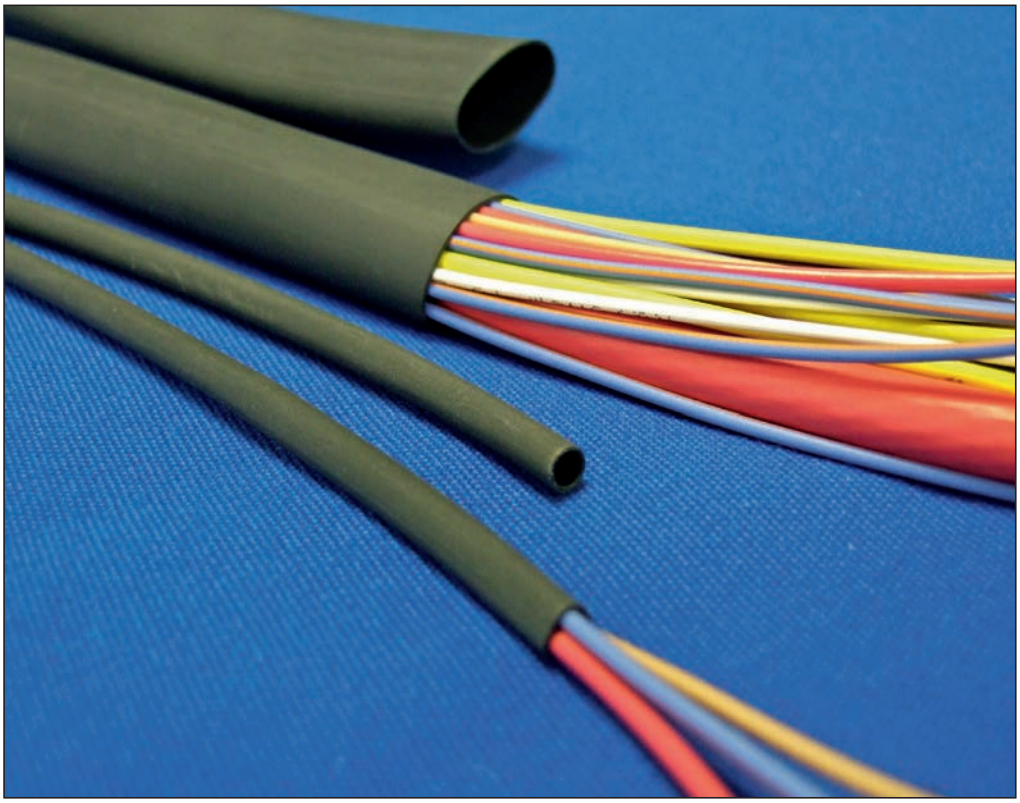
Shrink Temperature

Fluid Resistant

Versatile Protective Coverings for Automotive Components

NETM Tubing

Specially designed for use in electrical harnesses.



NETM Tubing

Non heat-shrink tubing designed for electrical harnessing needs. Particularly suitable for the agressive environment of car engines, NETM can withstand higher temperatures than traditional PVC materials whilst retaining its high level of performance.

NETM1000 is the more flexible product, enabling it to be easily routed through engine spaces. NETM2000 offers greater mechanical strength and excellent abrasion resistance.

NETM products are durable non-shrinking polyolefin tubings which remain heat resistant up to at least 130°C. Specifically designed for use in electrical harnesses, NETM tubings are flame retarded and offer excellent abrasion resistance.

NETM1000 is a more flexible 125 °C product allowing it to follow wiring bundles routed in tight bends around underbonnet components. NETM2000 is designed for higher temperature applications rated up to 150 °C.

Benefits

- Excellent heat resistance
- Flexible
- Good mechanical strength
- RoHS/ELV compliant

Non Heat-Shrink Harness Tubing

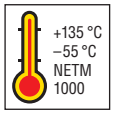
Product Features

NETM Tubing

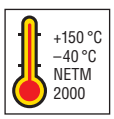
- Operating temperature from –55°C up to +135°C (NETM-1000) from –40°C up to +150°C (NETM-2000)

Product Dimensions and Ordering Information

	Inside Diameter D (nom) Supplied mm	Wall Thickness W (nom) mm	Product Description
NETM1000	3	0.5	NETM1000-3-0-SP
	4	0.5	NETM1000-4-0-SP
	5	0.5	NETM1000-5-0-SP
	6	0.5	NETM1000-6-0-SP
	8	0.5	NETM1000-8-0-SP
	10	0.5	NETM1000-10-0-SP
	12	0.5	NETM1000-12-0-SP
	14	0.5	NETM1000-14-0-SP
NETM2000	6	0.5	NETM2000-6-0-SP
	8	0.5	NETM2000-8-0-SP
	10	0.5	NETM2000-10-0-SP
	12	0.5	NETM2000-12-0-SP
Standard Colour	Black (0)		



Operating Temperature Range

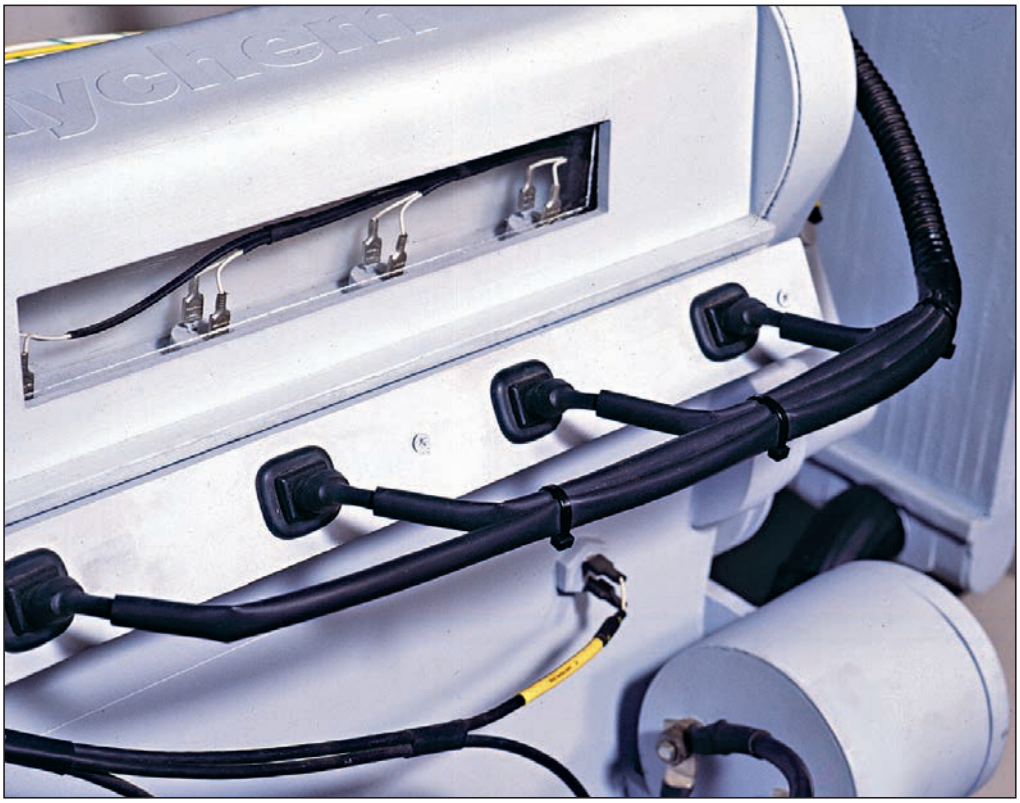


Operating Temperature Range

Versatile Protective Coverings for Automotive Components

RNF-100 Tubing

Cost-effective localized protection for wires and cables in high temperature environments.



RNF-100

Premium grade polyolefin based heat-shrinkable tubing with an outstanding overall balance of properties.

The product has a wide range of industrial approvals. RNF-100 tubing possesses a unique blend of physical, chemical and electrical properties and is suitable for a wide range of applications.

Used extensively for lightweight harness jackets, insulation, colour coding, identification, protection against fluids and provides mechanical strength.

Benefits

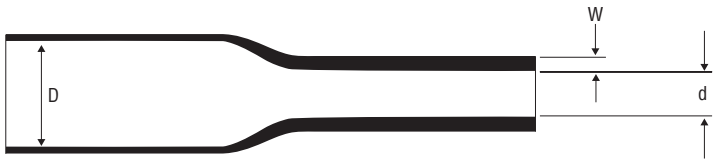
- Outstanding all round performance
- Excellent physical and electrical performance
- Good chemical and solvent resistance
- Flexible
- RoHS/ELV compliant

Versatile Protective Coverings for Automotive Components

Product Features

RNF-100 Tubing

- Continuous operating temperature from –55°C up to +135°C
- Minimum shrink temperature: 95°C
- Minimum full recovery temperature: 121°C
- Flame retarded (colours only)
- 2:1 shrink ratio



Product Dimensions

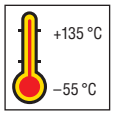
Size	Inside Diameter D (min) Expanded as Supplied mm	Inside Diameter d (max) Recovered after Heating mm	Wall Thickness W (nom) Recovered after Heating mm	Ordering Description
3/64	1.2	0.6	0.45	RNF-100-3/64-colour code
1/16	1.6	0.8	0.45	RNF-100-1/16-colour code
3/32	2.4	1.2	0.50	RNF-100-3/32-colour code
1/8	3.2	1.6	0.50	RNF-100-1/8-colour code
3/16	4.8	2.4	0.50	RNF-100-3/16-colour code
1/4	6.4	3.2	0.65	RNF-100-1/4-colour code
3/8	9.5	4.8	0.65	RNF-100-3/8-colour code-FSP*
1/2	12.7	6.4	0.65	RNF-100-1/2-colour code-FSP*
3/4	19.0	9.5	0.75	RNF-100-3/4-colour code-FSP*
1	25.4	12.7	0.90	RNF-100-1-colour code-FSP*
1 1/4	31.0	16.0	0.95	RNF-100-1-1/4-colour code
1 1/2	38.0	19.0	1.00	RNF-100-1-1/2-colour code
2	51.0	25.4	1.15	RNF-100-2-colour code
3	76.0	38.0	1.25	RNF-100-3-colour code
4	102.0	51.0	1.40	RNF-100-4-colour code
5	127.0	63.5	1.52	RNF-100-5-colour code

*) Material supplied on Flat Spooled Packaging (FSP) as standard.

Ordering Information

Standard Colours	Clear (X) Black (0) Red (2) Yellow (4) Green (5) Blue (6) White (9)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description	Specify product name, size and colour (for example RNF-100-1/8-0)

Specifications/Approvals	Series	UL	CSA	TE
	RNF-100 Type 1 (colours)	E35586 600 V, 125°C	LR31929 600 V, 125°C	RT-350 Type 1 RK-6001
	RNF-100 Type 2 (clear)	E35586 600 V, 125°C	LR31929 600 V, 125°C	RT-350 Type 2 RK-6001



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded


Fluid Resistant


Canadian Standards Association


Underwriters Laboratories

Versatile Protective Coverings for Automotive Components

RNF-150 Tubing

High-performance, flame-resistant, flexible, fluoropolymer tubing.

RNF-150 Tubing

Can be used for jacketing and bundling of wires to form light-duty harnesses, especially where a low profile, abrasion resistance, and flexibility are needed.

Can also be used to provide insulation and strain relief of electrical connections and wire terminations, identification of wires, and packaging of components.

Benefits

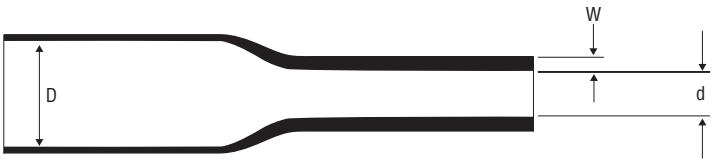
- Approximately 40 % thinner walls than most general purpose polyolefin tubings
- High flame-resistance
- Excellent physical and electrical properties after exposure to many chemicals and solvents at 50 °C (but not recommended for use in direct contact with ketones)
- Recommended maximum temperature for use as a primary insulator: 135 °C
- RoHS/ELV compliant

Versatile Protective Coverings for Automotive Components

Product Features

RNF-150 Tubing

- Continuous operating temperature from –55°C up to +150°C
- Minimum shrink temperature: 110°C (230°F)
- Minimum full recovery temperature: 150°C (302°F)
- Flame retarded
- 2:1 shrink ratio



Product Dimensions

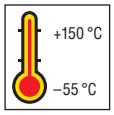
Size	Inside Diameter D (min) Expanded as Supplied mm/inch	d (max) Recovered after Heating mm/inch	Wall Thickness* W Recovered after Heating mm/inch	Ordering Description
3/64	1.2 (0.046)	0.6 (0.023)	0.25 ±0.05 (0.010 ±0.002)	RNF-150-3/64-colour code
1/16	1.6 (0.063)	0.8 (0.031)	0.25 ±0.05 (0.010 ±0.002)	RNF-150-1/16-colour code
3/32	2.4 (0.093)	1.2 (0.046)	0.25 ±0.05 (0.010 ±0.002)	RNF-150-3/32-colour code
1/8	3.2 (0.125)	1.6 (0.062)	0.25 ±0.05 (0.010 ±0.002)	RNF-150-1/8-colour code
3/16	4.8 (0.187)	2.4 (0.093)	0.25 ±0.05 (0.010 ±0.002)	RNF-150-3/16-colour code
1/4	6.4 (0.250)	3.2 (0.125)	0.30 ±0.08 (0.012 ±0.003)	RNF-150-1/4-colour code
3/8	9.5 (0.375)	4.8 (0.187)	0.30 ±0.08 (0.012 ±0.003)	RNF-150-3/8-colour code
1/2	12.7 (0.500)	6.4 (0.250)	0.30 ±0.08 (0.012 ±0.003)	RNF-150-1/2-colour code
3/4	19.0 (0.750)	9.5 (0.375)	0.43 ±0.08 (0.017 ±0.003)	RNF-150-3/4-colour code
1	25.4 (1.000)	12.7 (0.500)	0.48 ±0.08 (0.019 ±0.003)	RNF-150-1-colour code

*) Wall thickness will be less if tubing recovery is restricted during shrinkage.

Ordering Information

Standard Colour	Black (0)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.
Ordering Description**	Specify product name, size and colour (for example RNF-150-1/4-0)
	**) Europe only

Specifications/Approvals	Series	UL	TE
	RNF-150	E35586 VW-1, 600 V, 150°C	RT-370



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded

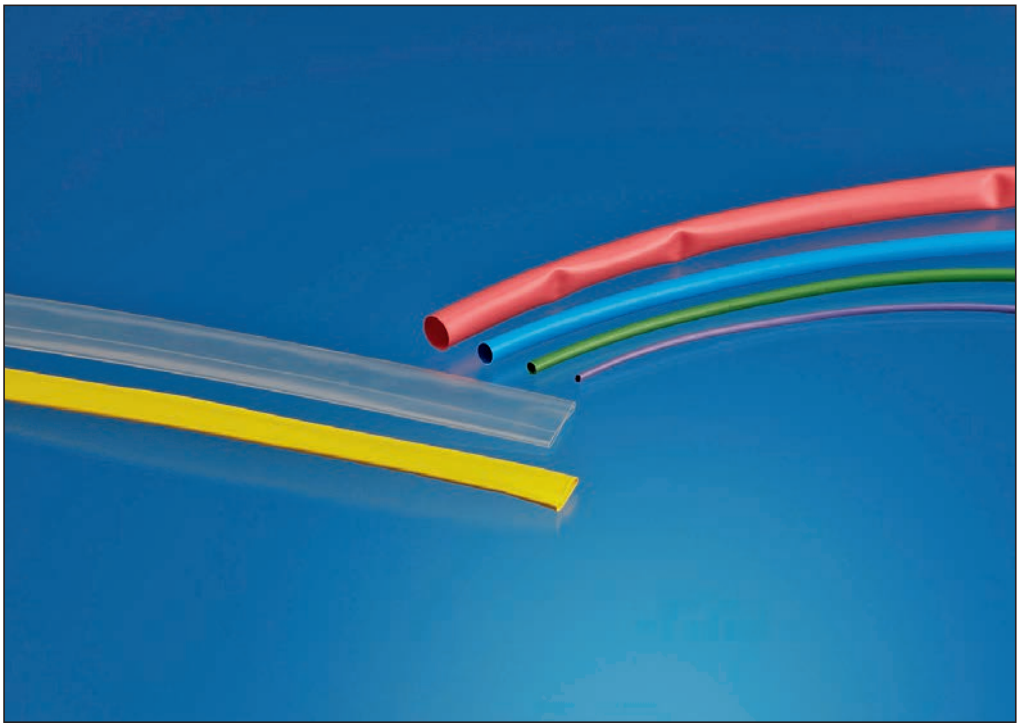

Fluid Resistant


Underwriters Laboratories

Versatile Protective Coverings for Automotive Components

RNF-3000 Tubing

Flexible, high-shrink-ratio, flame-retardant, general purpose, polyolefin tubing.



RNF-3000 Tubing

Used for insulation and strain relief of wire terminations and electrical connections. Also suitable for light-duty harnessing, jacketing, and identification of wires, cables, and electrical and electronic components.

Benefits

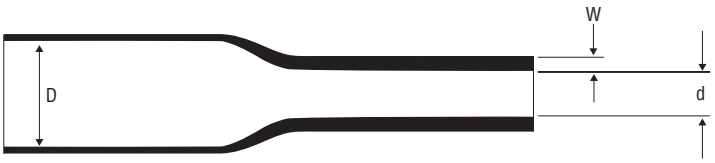
- 3:1 shrink ratio easily accommodates awkward, irregular shapes
- Few sizes cover a wide range of diameters, allowing reduced inventory
- Excellent physical, chemical, and electrical properties meet industry standards for highly reliable, general purpose tubing
- RoHS/ELV compliant

Versatile Protective Coverings for Automotive Components

Product Features

RNF-3000 Tubing

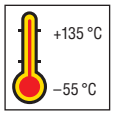
- Continuous operating temperature from –55°C up to +135°C
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 120°C
- Flame retarded
- 3:1 shrink ratio



Product Dimensions

Size	Inside Diameter D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	Wall Thickness* W Recovered after Heating mm	Ordering Description
1.5/0.5	1.5	0.5	0.45	RNF-3000-1.5/0.5-colour code
3/1	3.0	1.0	0.55	RNF-3000-3/1-colour code
4.5/1.5	4.5	1.5	0.55	RNF-3000-4.5/1.5-colour code
6/2	6.0	2.0	0.65	RNF-3000-6/2-colour code
9/3	9.0	3.0	0.75	RNF-3000-9/3-colour code
12/4	12.0	4.0	0.75	RNF-3000-12/4-colour code
18/6	18.0	6.0	0.85	RNF-3000-18/6-colour code
24/8	24.0	8.0	1.00	RNF-3000-24/8-colour code
39/13	39.0	13.0	1.15	RNF-3000-39/13-colour code

*) Wall thickness will be less if tubing recovery is restricted during shrinkage.



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded


Fluid Resistant


Canadian Standards Association


Underwriters Laboratories

Ordering Information

Standard Colours	Black (0)	White (9)	Red (2)	Blue (6)	Yellow (4) Clear (X)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.				
Ordering Description	Specify product name, size and colour (for example RNF-3000-6/2-0)				

Specifications/Approvals	Series	UL	CSA	TE
	RNF-3000	E35586 600 V, 125°C	LR31929 600 V, 125°C	RW-2053

RPPM Tubing

Flexible dual wall, moisture proof heat-shrinkable tubing.

RPPM Tubing

Flexible, heat-shrinkable dual-wall tubing with an integrally bonded meltable adhesive liner. The tough outer jacket offers excellent mechanical strength, yet is flexible enough to cater for a high degree of movement.

Available in clear and black, the tough outer jacket with both types offers excellent mechanical strength.

RPPM is used for moisture proof encapsulation of a wide variety of components. In particular, it adheres well to PVC. The high shrink ratio allows RPPM to be used with a range of dimensions.

Clear RPPM offers excellent clarity for protection of substrates that may need to be inspected during service. Black RPPM has a high gloss finish suitable for cosmetic applications.

Benefits

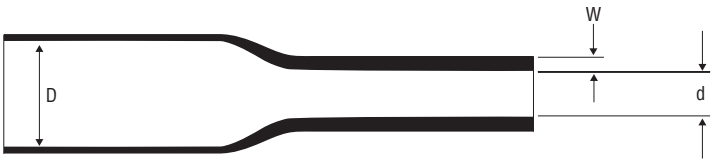
- Protects antenna and locates and protects antenna windings, in one simple process
- Adhesive lined – to fix winding and tubing permanently in position
- High shrink ratio (6:1) – providing a snug fit on both winding and bare antenna diameters
- Low wind noise – ultra thinwall tubing provides minimal wind shear
- Shiny black finish
- Minimal tooling and handling costs – simply cut what you need
- Versatile product – one tubing size shrinks to fit a range of antenna diameters
- Easy, low-cost installation process – using high volume hot air, convection or infrared equipment
- RoHS/ELV compliant

Flexible, Dual-Wall, Moisture Proof, Heat-Shrinkable Tubing

Product Features

RPPM Tubing

- Continuous operating temperature from –40°C up to +85°C (3000 hrs)
- Minimum shrink temperature: 60°C
- Minimum full recovery temperature: 80°C
- 4:1 shrink ratio



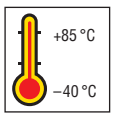
Product Dimensions

	Inside Diameter		Wall Thickness	
Size	**D (min) Expanded as Supplied mm**	**d (max) Recovered after Heating mm**	**W (nom) Total Wall Recovered after Heating mm**	**Ordering Description**
4/1	4.0	1.0	0.8	RPPM-4/1-colour code
8/2	8.0	2.0	0.9	RPPM-8/2-colour code
12/3	12.0	3.0	1.2	RPPM-12/3-colour code
16/4	16.0	4.0	1.5	RPPM-16/4-colour code
NR510	9.0	1.5	1.6	RPPM-NR510-X
NR801	6.4	1.0	0.8	RPPM-NR801-colour code

Order the largest size that will recover snugly over the component to be covered.
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.
Other lenghts and sizes are available subject to special order.

Ordering Information

Standard Colours	Black (0)	Clear (X)
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.	
Ordering Description	Specify product name, size and colour (for example RPPM-8/2-X)	
Specifications/Approvals	**Series**	**TE**
	RPPM	RK-6214



Operating Temperature Range

Shrinking Ratio (up to 7:1)

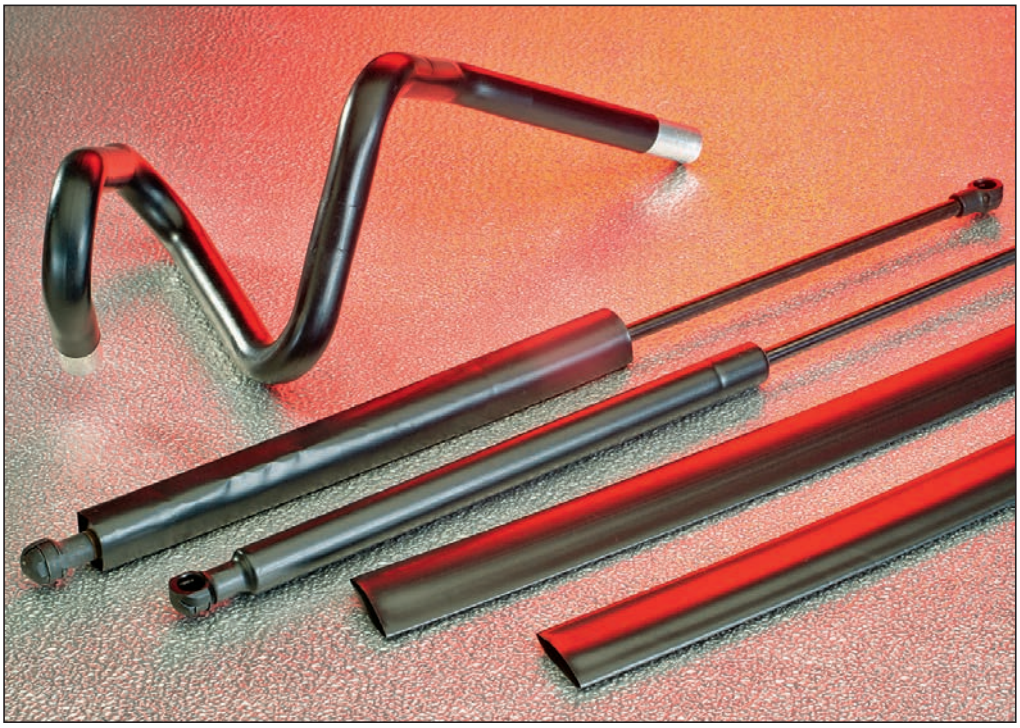
Shrink Temperature

Fluid Resistant

Versatile Protective Coverings for Automotive Components

RPT-120 Tubing

Thin-wall tubing, conforms and protects substrates as a cost-effective alternative solution to paint.



RPT-120 Tubing

This resilient tubing offers an alternative to paint, particularly suitable for round substrates. It provides excellent mechanical and corrosion protection compared to paint and the high quality surface creates a quality image for the component being protected.

Product Features

RPT-120 Tubing

- Provides a tough resilient layer to protect the component beneath
- Easy to install with conventional heating equipment
- Low cost of set up

Benefits

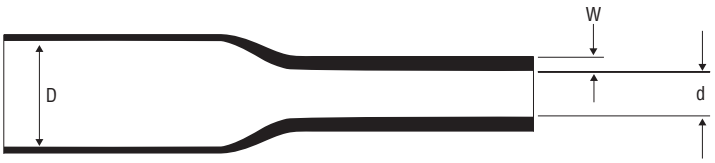
- Provides a resilient layer protecting the component beneath from damage and corrosion
- Good surface finish giving a professional look to the final product
- Less taxing Health and Safety considerations reducing the cost of process set up
- Low shrink temperature for fast installation
- Can be printed before installation to give component details
- RoHS/ELV compliant

Protection for Wire Bundles, Connectors, Terminals and Splices

Product Features

RPT-120 Tubing

- Operating temperature from –40°C up to +120°C
- Minimum full recovery temperature: 115°C
- 2:1 shrink ratio

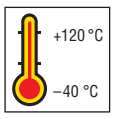


Product Dimensions

	Inside Diameter		Wall Thickness	
Size	**D (min) Expanded as Supplied mm**	**d (max) Recovered after Heating mm**	**W (nom) Wall Thickness mm**	**Ordering Description**
19/6	19.0	6.0	1.0	RPT-120-19/6-0
27/12.7	27.0	12.7	0.86	RPT-120-27/12.7-0

Ordering Information

Standard Colour	Black (0)	
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.	
Ordering Description	Specify product name, size and colour (for example RPT-120-19/6-0)	
Specifications/Approvals	**Series**	**TE**
	RPT-120	RK-6765



Operating Temperature Range

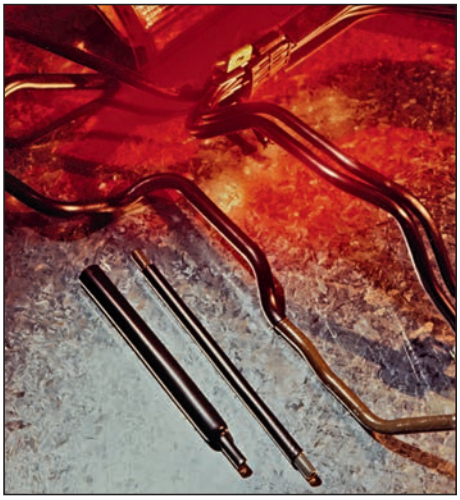
Shrinking Ratio

Shrink Temperature

Fluid Resistant

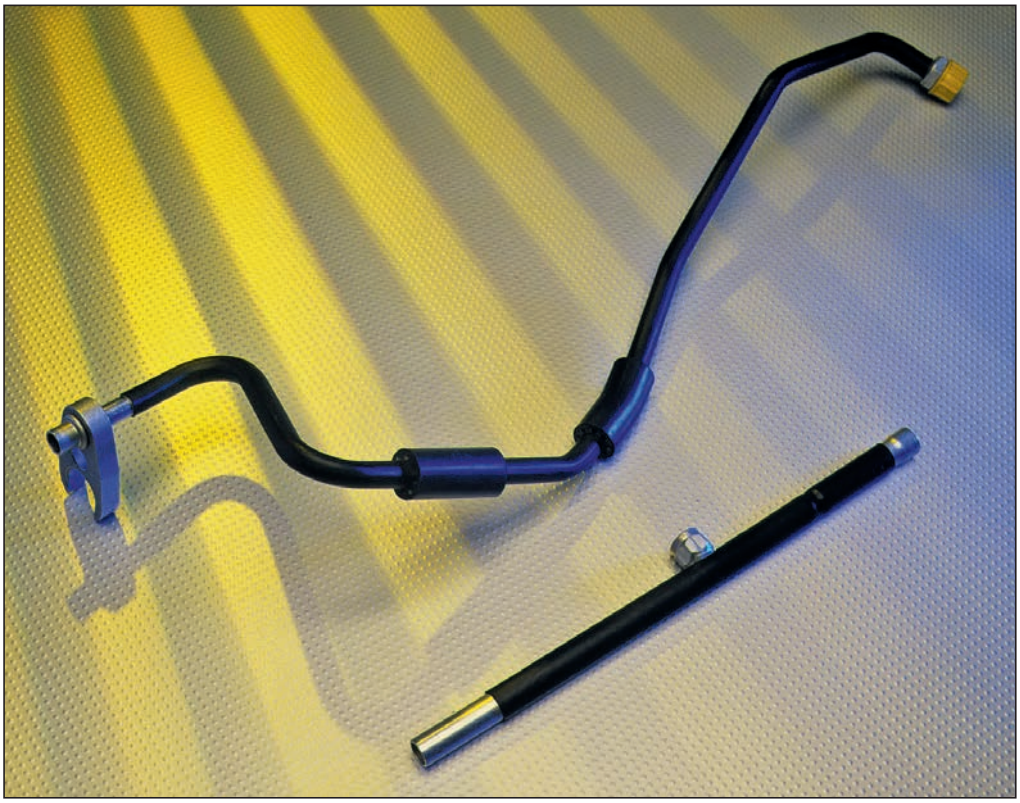
Fluid Management

- Automotive Hose and Pipe Protection
- Fluid Line Protection
- Hose Coupling
- Cooling Hose Protection



AP-2000 Tubing

Cost-effective anti-noise, abrasion and corrosion protection for automotive brake and air-conditioning lines.



AP-2000 Tubing

AP-2000 is designed for use on industry standard metal pipes to provide protection on automotive brake and fuel lines in areas exposed to mechanical abuse and moisture. The product is positioned on straight pipe lengths prior to the second end-nut fitting.

Each size of AP-2000 tubing has been designed for use on specific standard size of metal pipe. The product rapidly shrinks on application of heat above 115 °C and the adhesive melts and flows around the substrate, eliminating air gaps.

Once installed, the pipes are bent and formed.

Benefits

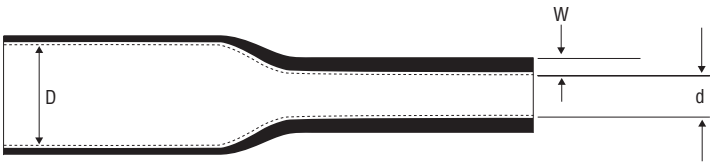
- Adds protection only where it is needed – minimising costs compared to whole pipe dip-coats.
- One size fits a range of pipes minimising inventory costs.
- Easier, lower cost installation compared to dip-coat processes – simple heat-shrink process using hot air, convection or infrared equipment.
- Reduced production times – as pipes can be formed after heat-shrink tubing is installed.
- Moistureproof sealing – hot-melt adhesive flows between tubing and pipe, preventing any moisture from coming into contact with the pipe.
- RoHS/ELV compliant

Dual-Wall Polyolefin Heat-Shrinkable Tubing to Protect Automotive Metal Pipework

Product Features

AP-2000 Tubing

- Continuous operating temperature from –40°C up to +80°C
- Minimum shrink temperature: 110°C
- Minimum full recovery temperature: 115°C



Product Dimensions

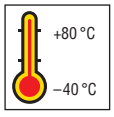
Size	Standard Pipe Diameter mm	Inside Diameter D (min) Expanded as Supplied mm	Wall Thickness W (nom) Recovered after Heating mm	Ordering Description
6	4.76	6.0	1.0	AP2000-6
8	6.35	8.0	1.0	AP2000-8
10	8.00	10.0	1.0	AP2000-10
15	10.00	15.0	1.0	AP2000-15
NR101	4.85	14.0	1.0	AP2000-NR101
NR102	3.50	5.0	1.0	AP2000-NR102

The size that corresponds to the pipe diameter shown in the table above should be ordered.
Contact TE Automotive for non-standard pipe diameters.

The product may be supplied in cut pieces and spools for long continuous lengths or high volumes.

Ordering Information

Standard Colour	Black (0)	
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.	
Ordering Description	Specify product name, size and colour (for example AP-2000-6-0)	
Specifications/Approvals	**Series**	**TE**
	AP-2000 Tubing	RW-1001



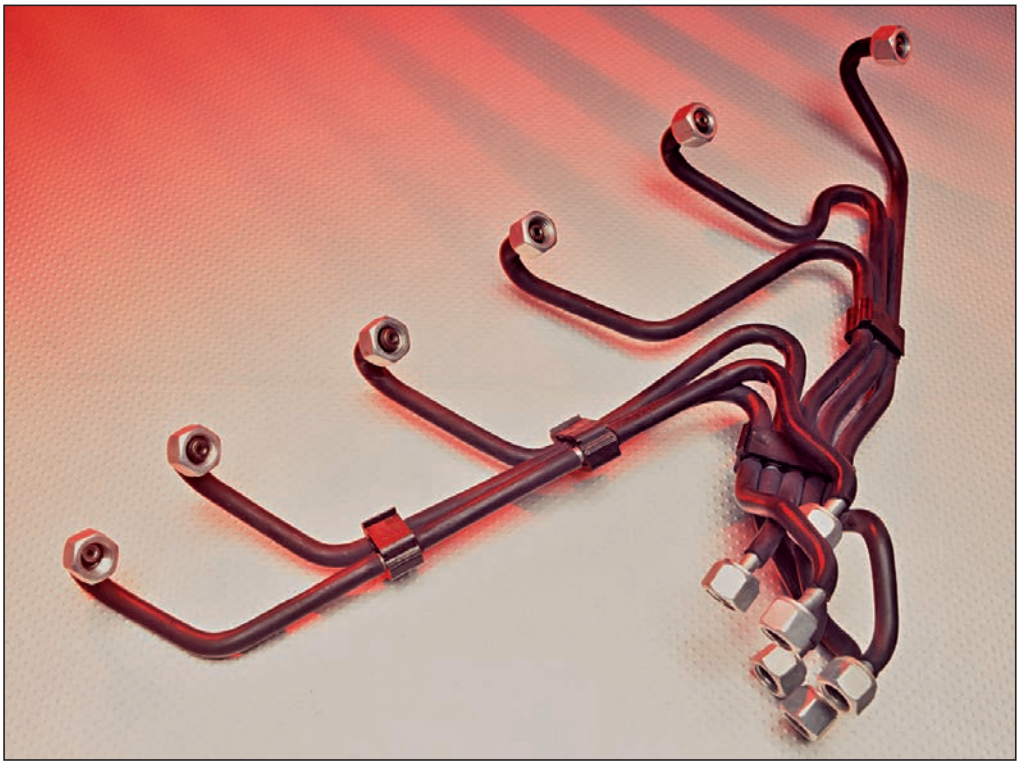
Operating Temperature Range

Shrink Temperature

Fluid Resistant

ATUM Tubing

High shrink ratio adhesive lined polyolefin tubing.



ATUM Tubing

Semi-flexible, heat-shrinkable tubing with a meltable adhesive inner lining designed to provide moisture proof sealing to a wide range of substrates such as electrical wire splices, cable jackets, wire breakouts and electrical components.

The high shrink ratios mean that only seven sizes are required to cover a wide range of substrate diameters. Typical applications are environmental sealing of electrical components including wire splices and harness breakouts as well as sealing cable ends against moisture ingress.

Benefits

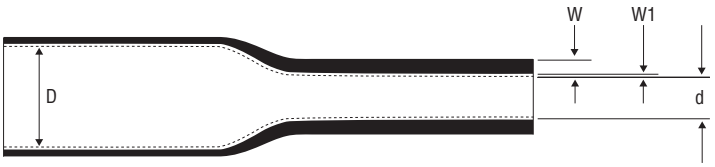
- Easier, lower cost installation compared to dip-coat processes – simply slide over substrate and shrink using hot air, convection or infrared equipment.
- Reduced production times – tubes can be bent or formed on the pipe.
- Moisture proof sealing – hot-melt adhesive flows between tubing and substrate to provide a permanent waterproof bond.
- Application versatility – one size of tubing fits a range of substrate diameters minimizing inventory costs.
- RoHS/ELV compliant

Automotive Hose and Pipe Protection

Product Features

ATUM Tubing

- Continuous operating temperature from –55°C up to +110°C
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 110°C
- 3:1 and 4:1 shrink ratio

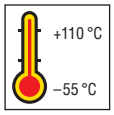


Product Dimensions

Inside Diameter				Wall Thickness					
D (min) Expanded as Supplied mm		d (max) Recovered after Heating mm		W (nom) Total Wall Recovered after Heating mm		W1 (nom) Meltable Wall Recovered after Heating mm		Ordering Description	
3:1	4:1	3:1	4:1	3:1	4:1	3:1	4:1	3:1	4:1
3	4	1	1	1.00	1.00	0.5	0.5	Atum-3/1-colour code	Atum-4/1-colour code
6	8	2	2	1.00	1.00	0.5	0.5	Atum-6/2-colour code	Atum-8/2-colour code
9	12	3	3	1.40	1.40	0.6	0.6	Atum-9/3-colour code	Atum-12/3-colour code
12	16	4	4	1.78	1.78	0.7	0.7	Atum-12/4-colour code	Atum-16/4-colour code
19	24	6	6	2.25	2.25	0.8	0.8	Atum-19/6-colour code	Atum-24/6-colour code
24	32	8	8	2.54	2.54	1.0	1.0	Atum-24/8-colour code	Atum-32/8-colour code
40	52	13	13	2.54	2.54	1.0	1.0	Atum-40/13-colour code	Atum-52/13-colour code

Ordering Information

Standard Colours	Black (0)	Clear (X)	
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.		
Ordering Description	Specify product name, size and colour (for example ATUM-12/3-colour)		
Specifications/Approvals	**Series**	**UL**	**TE**
	ATUM	E85381, 600 V, 110°C	RW-2063 (black) RK-6024 (colours and clear)



Operating Temperature Range

Shrinking Ratio

Shrink Temperature


Flame Retarded (black/colours only)


Fluid Resistant


Underwriters Laboratories

DWTC Tubing

Flexible, dual wall moisture proof heat shrinkable tubing.

DWTC Tubing

Flexible, heat-shrinkable, dual-wall tubing with an integrally bonded meltable adhesive inner liner designed to offer moisture proof encapsulation to a wide variety of substrates. Available in black and clear, clear version of DWTC offers excellent clarity for protection of substrates that may need to be inspected during service.

The tough outer jacket gives excellent mechanical strength with a high resistance to splitting. The high shrinkage ratio means that only four sizes are needed to give protection to a full range of irregular shapes with widely varying dimensions.

Benefits

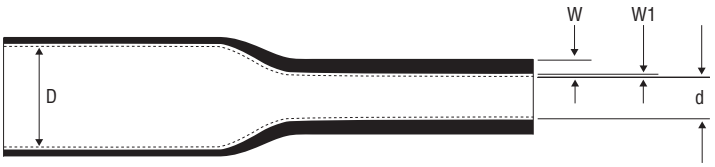
- Adds protection only where it is needed – minimizing costs compared to whole pipe coating.
- Greater versatility – can be over-expanded to allow over end fitting.
- Easier, lower cost installation compared to dip-coat processes – simple heat-shrink process using hot air, convection or infrared equipment.
- Reduced production times – heat-shrink tubing can be installed on a straight pipe before it is formed to make a cluster.
- Moisture proof sealing – hot-melt adhesive flows between tubing and pipe, preventing any moisture from coming into contact with the pipe.
- RoHS/ELV compliant

Automotive Hose and Pipe Protection

Product Features

DWTC Tubing

- Continuous operating temperature from –55°C up to +75°C
- Minimum shrink temperature: 60°C
- Minimum full recovery temperature: 100°C
- 4:1 shrink ratio



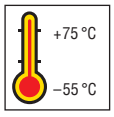
Product Dimensions

Size	Inside Diameter		Wall Thickness		Ordering Description
	D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	W (nom) Total Wall Recovered after Heating mm	W1 (nom) Meltable Wall Recovered after Heating mm	
4/1	4.0	1.0	0.8	0.25	DWTC-4/1-X
8/2	8.0	2.0	0.9	0.25	DWTC-8/2-X
12/3	12.0	3.0	1.2	0.40	DWTC-12/3-X
16/4	16.0	4.0	1.5	0.50	DWTC-16/4-X

The largest size that will recover snugly over the component to be covered should be ordered.
The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.
Other lengths and sizes are available subject to special order.

Ordering Information

Standard Colour	Clear (X)	
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.	
Ordering Description	Specify product name, size and colour (for example DWTC-4/1-X)	
Specifications/Approvals	**Series**	**TE**
	DWTC	RK-6204



Operating Temperature Range

Shrinking Ratio

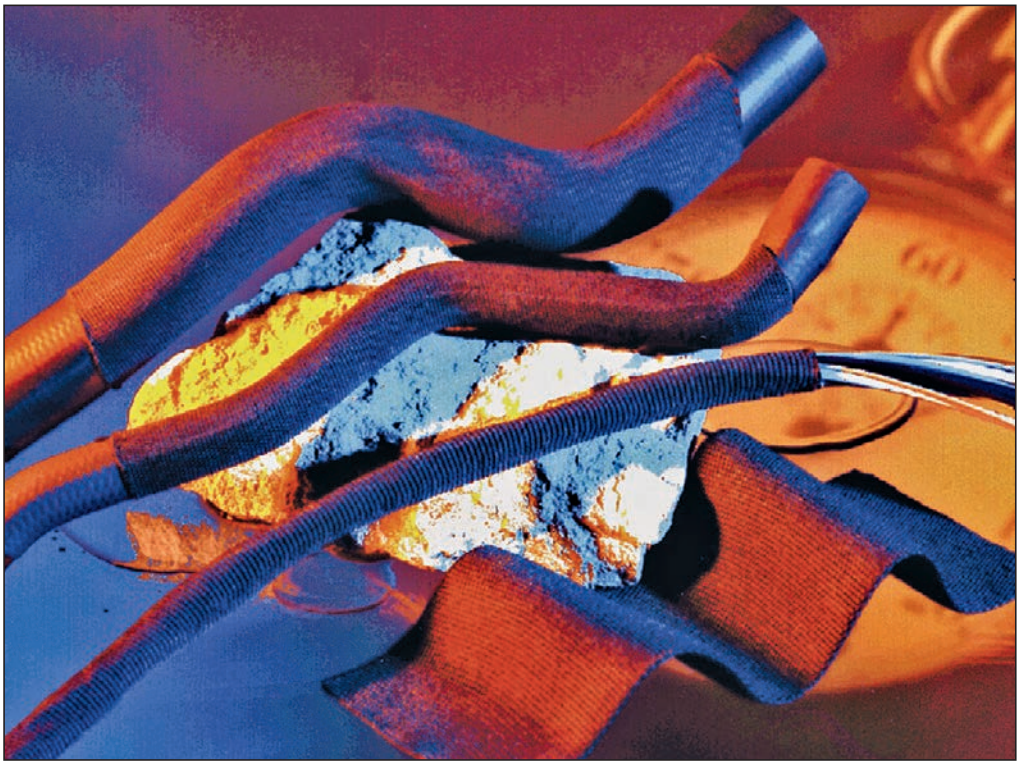
Shrink Temperature

Fluid Resistant

Veratile Protection Coverings for Automotive Components

HFT 5000 Tubing

Heat shrinkable abrasion resistant woven fabric tube.



HFT 5000 Tubing

HFT 5000 tubing products are made of very flexible heat-shrinkable fabric material, they shrink and fit snugly and securely around the underlying substrate.

Designed primarily to provide mechanical abrasion protection for components such as rubber hoses, plastic pipes, and harness wiring bundles, they are also suitable for other applications, such as noise and rattle suppression.

The woven construction makes HFT 5000 extremely flexible and resistant to trapping water, heat and humidity. It provides outstanding abrasion, chafing and cutting protection, even at high temperatures. HFT-5000 product is easy to install and can be cut with standard industrial cutting equipment.

Benefits

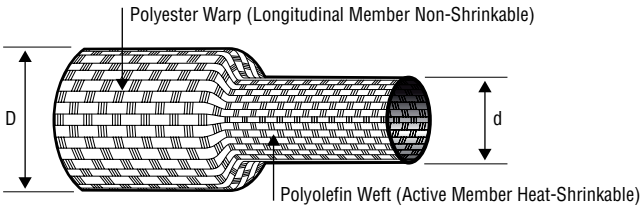
- Extremely tough – meeting even demanding automotive abrasion specifications
- Protect only where protection is needed – minimising cost
- Safe installation with no hot knife cutting equipment required – reduces investment
- Soft to handle so operators do not need to wear gloves – increases productivity
- Can be cut with conventional guillotines or even scissors
- Resists hose pulsing effects
- Halogen free
- Resistent to harsh environments such as engine compartments
- Grips substrates tightly without additional fixing
- Highly flexible woven fabric construction for easy installation onto awkward substrates such as tightly angled hoses
- RoHS/ELV compliant

Heat-Shrinkable Fabric Tubing

Product Features

HFT 5000 Tubing

- Continuous operating temperature from –40°C up to +125°C (3000 hrs) –40°C up to +150°C (1000 hrs)
- Minimum shrink temperature: 80°C
- Minimum full recovery temperature: 110°C
- Low shrink temperature
- 2:1 shrink ratio



Product Dimensions

Standard Sizes

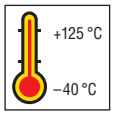
Inside Diameter

D (min) Expanded as Supplied mm	d (max) Recovered after Heating mm	Ordering Description
12	6	HFT-5000-12/6-0
20	10	HFT-5000-20/10-0
25	12	HFT-5000-25/12-0
30	15	HFT-5000-30/15-0
34	17	HFT-5000-34/17-0
40	20	HFT-5000-40/20-0
50	25	HFT-5000-50/25-0
60	30	HFT-5000-60/30-0
70	35	HFT-5000-70/35-0
80	40	HFT-5000-80/40-0
100	50	HFT-5000-100/50-0

Ordering Information

Standard Colour	Black (0)
	Note: Fully recoverable fabric wall thickness: Approximately 1 mm. Longitudinal change on full recovery is –10% to –20%; 0 = Black
	For full product performance details consult TE Automotive Specifications RW-2060.

Specifications/Approvals	**Series**	**TE**
	HFT 5000 Tubing	RW-2060
	Material Safety Data Sheet available on request.	
	Installation instructions available on request.	



Operating Temperature Range

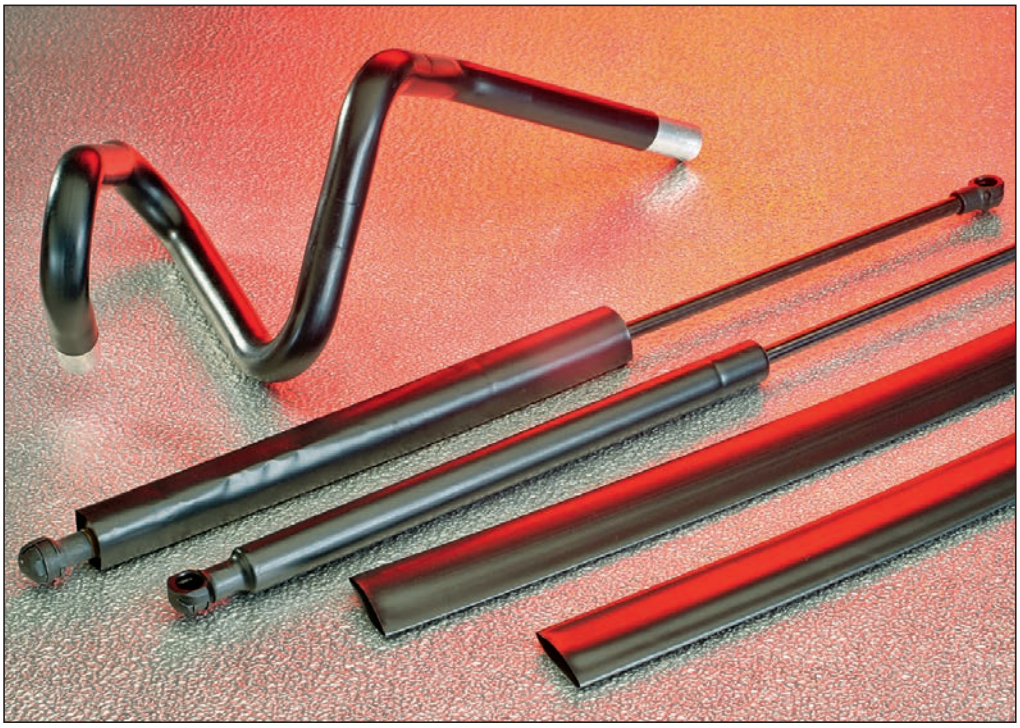
Shrinking Ratio

Shrink Temperature

Fluid Resistant

RPT-120 Tubing

Thin-wall tubing, conforms and protects substrates as a cost-effective alternative solution to paint.



RPT-120 Tubing

This resilient tubing offers an alternative to paint, particularly suitable for round substrates. It provides excellent mechanical and corrosion protection compared to paint and the high quality surface creates a quality image for the component being protected.

Product Features

RPT-120 Tubing

- Provides a tough resilient layer to protect the component beneath
- Easy to install with conventional heating equipment
- Low cost of set up

Benefits

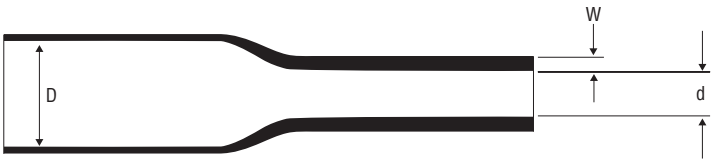
- Provides a resilient layer protecting the component beneath from damage and corrosion
- Good surface finish giving a professional look to the final product
- Less taxing Health and Safety considerations reducing the cost of process set up
- Low shrink temperature for fast installation
- Can be printed before installation to give component details

Protection for Wire Bundles, Connectors, Terminals and Splices

Product Features

RPT-120 Tubing

- Operating temperature from –40°C up to +120°C
- Minimum full recovery temperature: 115°C
- 2:1 shrink ratio

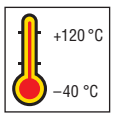


Product Dimensions

	Inside Diameter		Wall Thickness	
Size	**D (min) Expanded as Supplied mm**	**d (max) Recovered after Heating mm**	**W (nom) Wall Thickness mm**	**Ordering Description**
19/6	19.0	6.0	1.00	RPT-120-19/6-0
27/12.7	27.0	12.7	0.86	RPT-120-27/12.7-0

Ordering Information

Standard Colour	Black (0)	
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.	
Ordering Description	Specify product name, size and colour (for example RPT-120-19/6-0)	
Specifications/Approvals	**Series**	**TE**
	RPT-120	RK-6765



Operating Temperature Range

Shrinking Ratio

Shrink Temperature

Fluid Resistant

TECT Tubing

Semi-conductive, dual wall, moisture proof heat shrinkable tubing.

TECT Tubing

TECT is a dual wall semi-conductive heat shrinkable tubing designed to allow electrical groundling of coated fuel lines.

A portion of the protective coating on the fuel line is removed exposing the bare metal core. The TECT is recovered down over the exposed metal giving an electrical grounding point whilst resealing the coated fuel line from the environment.

Benefits

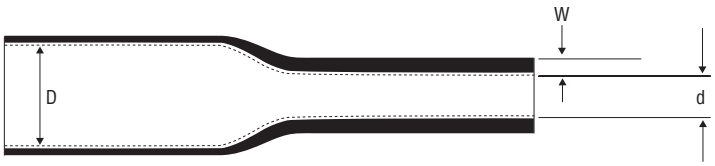
- Semi-conductive
- Environmentally sealed
- Simple to install
- RoHS/ELV compliant

Protection for Wire Bundles, Connectors, Terminals and Splices

Product Features

TECT Tubing

- Operating temperature from –40°C up to +120°C
- Minimum full recovery temperature: 120°C
- 2:1 shrink ratio (minimum)



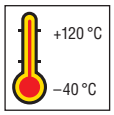
Product Dimensions

Inside Diameter		Wall Thickness			
D Diameter (min) mm	d Jacket Diameter (max) mm	W Jacket Wall (min) mm	Jacket and Liner L (min) mm	Cut Length (nom) mm	Ordering Description
13.5	5.0	1.0	1.25	30	TECT-13.5/4.5-0-XX
16.0	8.0	1.0	1.25	30	TECT-16/8-0-XX

The wall thickness of the tubing will be less than specified if recovery is restricted during shrinkage.
Dimension L (Jacket and Liner) value is for reference only.

Ordering Information

Standard Colour	Black (0)	
Size Selection	Always order the largest size that will shrink snugly over the component to be covered. Special order sizes are available upon request.	
Ordering Description	Specify product name, size and colour (for example TECT-13.5/4.5-0)	
Specifications/Approvals	**Series**	**TE**
	TECT	RW-2080



Operating Temperature Range

Shrinking Ratio (minimum)

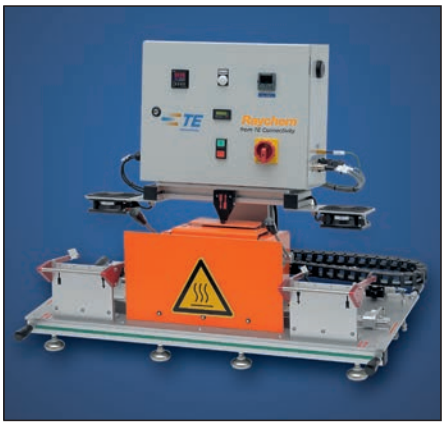
Shrink Temperature

Flame Retarded

Fluid Resistant

Application Equipment

- TE Application Tooling provides a comprehensive portfolio of tooling and equipment. Some of it is designed and engineered specifically for its installation of TE Connectivity's Raychem heat-shrinkable products.
- Designed for general Industry use or developed specifically in close collaboration with customers, using standard heater components.
- This equipment provides the optimal heating temperatures, performance, and control features for maximum production efficiency.



Splice Sealing and Connector Sealing Evaluation – Various Products

AD-3050-SEAL-TEST-EQUIP

Applications

The AD-3050-SEAL-TEST-EQUIP is a manually operated pneumatic device, intended for use as a convenient 'in-process' sampling technique for checking sealed splices. Different combinations of in-line or stub splices can be pressure tested in any of the combination of fixtures (8 in total). There is also a facility to allow leak testing of various connectors.

TE Raychem business line of TE Application Tooling has seen good correlation between results obtained with the AD-3050 and those obtained through water immersion testing. However, testing in accordance with the OEM specification is the only guaranteed way of confirming that the OEM spec is being met. The splice products are located in clamps which deliver the test pressure. The product is immersed in water and pressure is delivered down the wire(s) to the sealed area.The test result is determined visually by looking for bubbles in the area of the sealing product.

Use of this equipment is described in TE Connectivity Raychem procedure, reference No. PIP/017/95. This equipment does not check for poke through i.e. where individual wire strands poke through the installed heat-shrinkable sleeve. Poke through is eliminated by ensuring correct welding and subsequent handling conditions.

Features and Benefits

- Simple fixture design allows fast sealing test result assisting determination of installation conditions for splice sealing products.
- Connector fixture adapter allows connector sealing verification.
- Optional strong portable container allows use in various locations.
- Poke through indicator option available as an accessory.

Splice Sealing and Connector Sealing Evaluation – Various Products

Technical Specification	**AD-3050-SEAL-TEST-EQ-NC**	
	Pneumatic Supply	6 bar maximum, filtered supply. 2 bar test pressure maximum. (Test pressure typically 0.5 bar)
	Machine Cycle Times for Seal Testing:	Typically 1 minute.
	Total System Noise:	Negligible noise from air test
	Dimensions:	550 mm x 350 mm x 215 mm (Excludes packing case)
	Weight:	4 kg

Ordering Information	**Description**	**Part Number (PCN)**
Seal Test Equipment	AD-3050-SEAL-TEST-EQ-NC	C82893-000

Accessories	**Description**	**Part Number (PCN)**
Tool Case	AD-3050-SEAL-CASE-ONLY	F66989-000
Splice Poke-Through Indicator	AD-3050-SEAL-POKE-IND	E63259-000

Recommended Spares	**Description**	**Part Number (PCN)**
Set of 8 Seals**	AD-3050-SEAL-8-KIT	299155-000
Clamp Assembly including Seals	AD-3050-SEAL-CLAMP-ASSY	168927-000
Sealing Tape	EPDM foam, 6 mm x 9 mm, with acrylic adhesive backing	

**) Full set of seals.

As the equipment is designed to use readily available pneumatic components, these are listed on the parts list which is included with the equipment.

Heavy-Duty Hot-Air Heating Tools

CV-1981, CV-1983 Heating Tools

Applications

Used for installing dual or single-wall tubing up to three inches in diameter and for installing SolderSleeve devices. Closed loop version (PID) also available.

Features and Benefits

- Robust, double-insulated, heavy-duty unit
- Highest-wattage unit (1600–2260 watts)
- Integral stand that allows use as a bench tool
- Safe, quiet operation
- Variety of reflectors available
- Easy fixturing for dual opposing heating

Product Range

All dual-wall, single-wall tubing and moulded part products.
Various SolderSleeve devices products.
For other TE Connectivity's Raychem products discuss with Product Management.

Heavy-Duty Hot-Air Heating Tools

Technical Specification		CV-1981-MK2	CV-1983	CV-1981 PID
	Electrical Supply	120 V and 230 V	120 V and 230 V	120 V and 230 V
	Power Consumption	1600 W	2260 W/3060 W	1600 W
	Total System Noise	65dB	65dB	>70dB
	Length	340 mm (13”)	320 mm (13”)	350 mm (13”)
	Weight	1.3 kg (2.90 lb)	1.5 kg (3.30 lb)	1.4 kg (3.10 lb)
	Air Flow	Max 230 l/min	Max 500 l/min	230 l/min

Ordering Information

Equipment	Description	Part Number	Voltage	Hz
CV-1981-MK2	CV-1981-120V1600W-CANMK2	A42716-000	120 V	50/60 Hz
	CV-1981-120V1600W-UKMK2	E95798-000	120 V	50/60 Hz
	CV-1981-230V1600W-MK2	813914-000	230 V	50/60 Hz
	CV-1981-230V1600W-UKMK2	340970-000	230 V	50/60 Hz
CV-1983	CV-1983-110V-2260W-UK	441753-000	120 V	50/60 Hz
	CV-1983-220V-2260W	773898-000	230 V	50/60 Hz
	CV-1983-220V-2260W-UK	985426-000	230 V	50/60 Hz
	CV-1983-220V-3060W	538361-000	230 V	50/60 Hz
	CV-1983-220V-3060W-UK	231866-000	230 V	50/60 Hz
CV-1981-PID	CV-1981-AT-1600W-120V-US	CV1218-000	120 V	50/60 Hz
	CV-1981-AT-1600W-120V-UK	CV1219-000	120 V	50/60 Hz
	CV-1981-AT-1600W-230V-EU	CV1217-000	230 V	50/60 Hz
	CV-1981-AT-1600W-230V-UK	CV-1220-000	230 V	50/60 Hz
CV-1983 Barrel Adapter	AD-1962	989172-000		

Accessories	Description	Application	Part Number
	PR-12 reflector	Tubing: 6.3–25.4 mm (0.25”–1”)	991973-000
	PR-13 reflector	Tubing: Up to 6 mm (0.25”)	991963-000
	PR-13C reflector	Large SolderSleeve products	991974-000
	PR-21 reflector	Tubing: Up to 25.4 mm (1”)	991984-000
	PR-24 reflector	Tubing/moulded parts: 25.4 –34.93 mm (1”–1.38”)	991964-000
	PR-24A reflector	Tubing/moulded parts: 34.93–60.33 mm (1.38”–2.38”)	991989-000
	PR-25 reflector	SolderSleeve products: Up to 7 mm (0.28”)	991965-000
	PR-25D reflector	SolderSleeve products: 6.3–12.7 mm (0.25”–0.50”)	989523-000
	PR-26 reflector	Small SolderSleeve products:	991967-000
	PR-33 reflector	SolderSleeve products: 19.05–25.4 mm (0.75”–1”)	997768-000
	AD-1962 adapter	Adaptor for larger-barrel CV-1983	989172-000
	PR-34 reflector	SolderSleeve products: 12.0–20.0 mm (0.47”–0.79”)	989111-000
	PR-51	Special narrow reflector for moulded part transitions (21.5 x 3.5 mm nozzle)	113069-000

Users should independently evaluate the suitability of the product for their application.
Before ordering check with factory for most current data.

On-Board Stub- and Inline-Splice Sealing

CV-OBHAT-1600W System

Applications

The CV-OBHAT system is a lightweight, portable hot air tool, used to install TE Connectivity's Raychem ES-CAP Stub and Inline Splice Sealing products. The CV-OBHAT tool has been designed for use on-board with minimum board fixtures. Wire support and cap location fixtures are an integral part of the CV-OBHAT tool, hence only a simple board mounting/location post is required on the board. If suitably mounted the CV-OBHAT tool can be used off-board. The hot air pistol and control box are connected by a 6 m umbilical.
Loading and unloading product is made simple by the use of a hinged narrow reflector, which also minimizes air spillage and potential damage to wires during the heating cycle.

The CV-OBHAT tool utilises a closed loop temperature control system with a function, which disables the timing of the heat cycle until a pre-set temperature is achieved. By this method the effect of ambient temperatures and varying cycle duties can be minimised to ensure high quality, sealed installations.
The tool is designed to have a heating and cooling segment to each installation cycle. The cooling segment produces cooled product that is safe and easy to handle as well as being mechanically strong at the end of an installation cycle. For an In-line Splice Sealing variant contact Product Management.

Features and Benefits

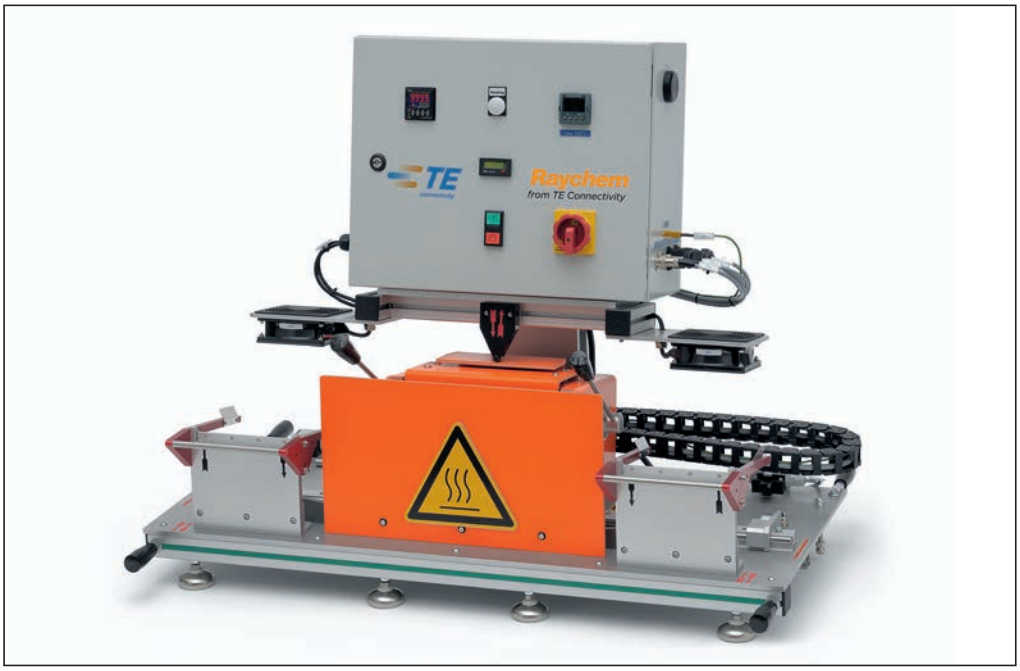
- Capable of producing sealed splices on-board
- Wire support and cap holding fixtures integral part of pistol
- Small footprint on harness board
- Lightweight pistol connected to controller with 6 m umbilical
- Audible signal at end of installation cycle
- Control system incorporating audible and visual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

On-Board Stub-Splice and Inline-Splice Sealing

Technical Specification	**CV-OBHAT**	
	Electrical supply	220/240 V – 50 Hz Single Phase
	Current maximum load	7 Amps
	Compressed air supply	400 kPa / 4 bar minimum
	Programable heat cycle timer	0–99.9 seconds
	Programable cool cycle timer	0–99.9 seconds from end of heat cycle
	Programable cap cooling fixture timer	0–99.9 seconds from end of heat cycle
	Programable board locking timer	0–99.9 seconds from end of heat cycle (board locking on during heat cycle)
	Operating temperature	Recommended 500 °C
	Dimensions	380 mm x 300 mm x 180 mm – Control box
	Weight	15 kg – complete system – (Control box + Pistol + Umbilical)
	Umbilical length	6 m
Product Range	TE Connectivity's Raychem ES Caps/ RBK-ILS tubes/RBK-VWS tubes/ QSZH tubes	Sizes 1 & 2 (Typical heat time 15 s + 30 s cooling) For size 3 contact Product Management
Ordering Information	**Stub-Splice Variant**	
	CV-OBHAT base unit:	CH3712-000
	CV-OBHAT-COOL-FIXASSY:	775072-000
	CV-OBHAT-SIL-ARM-GRIP:	CH3711-000
	Alternatively	
	CV-OBHAT-MECH-GRIPPER:	C58553-000
	Inline-Splice Variant:	
	CV-OBHAT base unit:	CH3712-000
	2 x CV-OBHAT-SIL-ARM-GRIP:	CH3711-000
	Alternatively	
	2 x CV-OBHAT-MECH-GRIPPER: C58553-000220/240 V – 50 Hz Single Phase	
	Users should independently evaluate the suitability of the product for their application. Before ordering check with your TE Application Tooling representative.	

Twin Workstation Heater for Multiple Installation of Short Length Tubing Products

IR-1891
Shuttle Machine



Applications

The IR-1891 is suitable for the installation of a range of TE Connectivity's Raychem heat-shrinkable tubing products onto a variety of small components, e.g. ring terminals, faston terminals and small connectors etc. The machine is provided with two work stations and a moveable heating head.

Each workstation is provided with supports for tooling fixtures (which must be specified and ordered separately). These support the workpieces and locate the tubing products. The operator loads the work-pieces into the fixtures at one of the workstations, ensures that the tubing product is correctly positioned and then slides the heat head into position before initiating the heating cycle. The operator then continues with loading / unloading the other work station whilst the heating cycle is taking place.

The IR-1891-220V-Shuttle-Retn is provided with closed loop temperature control and in addition the heat head is 'locked' into position by use of an electromagnet during the heating cycle.

Once the other workstation has been loaded and the first installation is complete the heat head is moved into position over the product and the next heating cycle initiated. Heating times vary typically from 3 to 30 seconds depending on the size and type of tubing product. Process rates up to 1200 pieces/hour can be achieved depending on the heating time and the time taken by the operator to load and unload the work-pieces. The installation temperature/power can be varied acc. to product type/size and required cycle times.

The heating elements, which are continuously energized, are of the infra-red medium wave length type and consist of a coiled resistance wire contained in quartz glass tubes. The closed loop temperature control uses similar elements but having integral thermocouple sensors.

Features and Benefits

- 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.

Twin Workstation Heater for Multiple Installation of Short Length Tubing Products

Technical Specification

IR-1891 Shuttle Machine	
Electrical Supply	230 V Single Phase
Power Consumption	1600 W
Operating Temperature	500 °C max
Process Rate	1200/hour maximum depending on application and operator
Heating Times	3 to 20 seconds depending on application
System Noise	<70 dB
Dimensions – 613148-000 / 289588-000	L1100 mm x H900 mm x D500mm (L43″ x H35″ x D20″)
Base Plate Dimensions 289588-000	L1040 mm x D450 mm (L41″ x D18″)
Base Plate Dimensions 613148-000	L1040 mm x D397 mm (L41″ x D16″)

Product Range

Wide range of TE Connectivity's Raychem tubing products such as all dual wall tubings, single wall tubings and ES-Caps

Maximum diameter 20 mm (0.8″) and maximum length 60 mm (2″)

Ordering Information

Description	Part Number
IR-1891-230V-Shuttle-Retn	528018-1
IR-1891-220V-Retn-Syl	

Note: The descriptions given here **do not** include the supply of the necessary tooling fixtures. These are designed for each individual application.

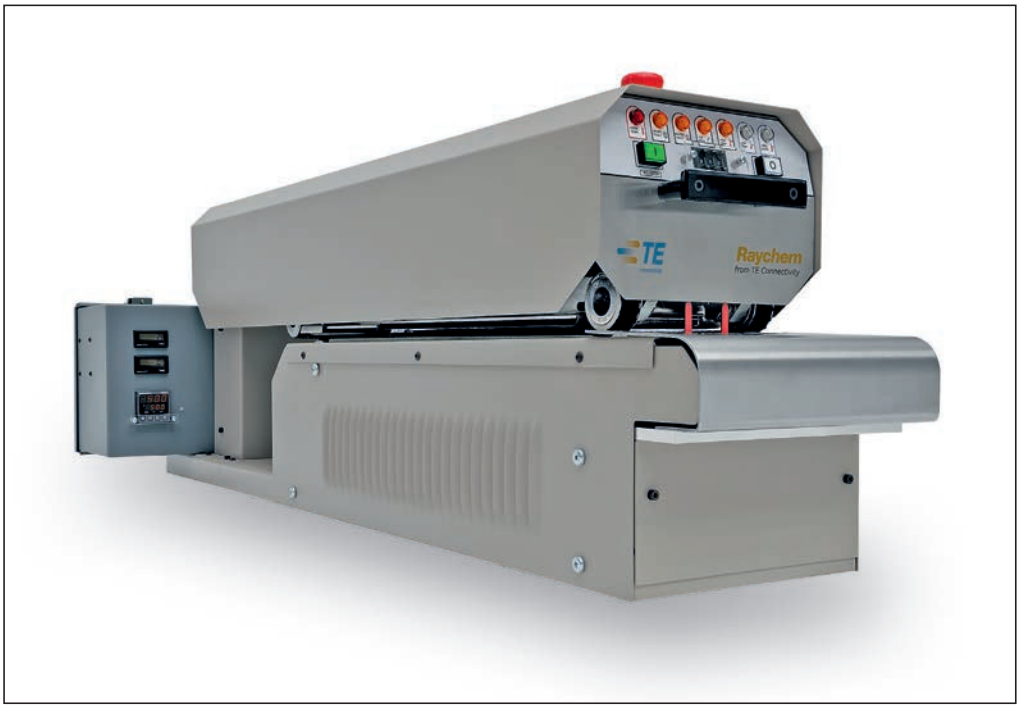
The IR-1891 Shuttle Machine is also available as an extra cooling and fixation version. Ordering information upon request.

A range of tooling fixtures designed for previous applications are available. Please contact your TE Application Tooling representative for details.

Users should independently evaluate the suitability of the product for their application. Before ordering check with factory for most current data.

Conveyor Heater for Processing Raychem Heat-Shrinkable Tubing and Terminating Devices

Model 19 Conveyor Heater



Applications

The Model 19 conveyor heater is the latest generation of reliable and versatile process heaters for a wide variety of heat-shrinkable products. Two sets of timing belts grip the individual assemblies and carry them through a closed-loop infrared heating zone, then through a cooling zone, and deposit the completed assemblies in a collection bin. The processor was designed to meet the requirements of the European Safety Directives and is CE approved, allowing for worldwide use. The processor is designed to operate on the following line voltages: 210 to 240 Vac, 20 A, 1 ∅, 50/60 Hz.

Options for this processor include:

- Powered or unpowered extension tables to support long or heavy harnesses.
- Kit for processing ring terminals and end terminations.
- Floor stand with wheels.
- Wider heating elements for tubing up to 178 mm (7″) long.
- Narrow heating elements for SolderSleeve devices up to 10 mm (0.4″) diameter and 45 mm (1.8″) long or short length tubing less than 50 mm (2″).

Features and Benefits

- Closed-loop speed and temperature control.
- CE approved for worldwide use.
- Adaptable for different applications.
- Continuous controlled process.

Conveyor Heater for Processing Raychem Heat-Shrinkable Tubing and Terminating Devices

Product Features

Controlled Heating Zone: The Model 19 has two etched-foil heating elements mounted under a quartz face. Consistent heating chamber temperatures are obtained with a closed-loop temperature controller. There is a lockout on the controller to prevent unauthorized changes.

Speed Control: Consistent speed is obtained with a closed-loop speed controller. The speed is adjusted using a 3-digit thumbwheel on the front control panel. There is a lockout on the thumbwheel to prevent unauthorized changes.

Minimal Skill Requirements: There are clearly marked guides for aligning the assembly as well as the tubing or device being processed. The operator only has to center the assembly; the grippers carry it through the heating and cooling zone and deposit it into the unloading bin.

Economical Production: The throughput rate is determined by the rate at which an operator can load the processor.

Versatility: The tool description CLTEQ-M19-BELT-HTR part number 714529-000 will handle tubing up to 25 mm (1″) diameter and 102 mm (4″) long. Tubing up to 178 mm (7″) long can be handled with the use of tool description CLTEQ-M19-BELT-HTR-6IN part number 075131-000. The tool description CLTEQ-M19-BELTHEATER-SS part number D43037-000 will handle SolderSleeve devices up to 10 mm (0.4″) diameter and 45 mm (1.8″) long or short length tubing (less than 50 mm (2″), where applications require a narrow heat width.

Self-Diagnostic Circuitry: There are several “self-diagnostic” circuits that alert the operator if any major component fails or if an unsafe processing condition occurs. A light will turn on and a lockout gate will lift in the entry zone, preventing the operator from loading assemblies until the situation has been corrected.

Other Features include:
- Emergency stop.
- Automatic cool-down circuit to extend the life of components.
- Lockout on temperature and speed controllers to prevent unauthorized changes.

Technical Specification

Model 19 Conveyor Heater	
Electrical	
Power requirements	210–240 Vac, 20 A, 1 ∅, 50/60 Hz
Heating elements	Std = 3160 W / Wide = 3320 W / Narrow = 1760 W

Mechanical

Conveyor belt system	Double-sided timing belts, 0.375″ pitch – 9.5 mm
Belt speed	Up to 152 cm/min (5.0 ft/min or 59.8″/min)
Processor dimensions	53 cm (21″) W, 135 cm (53″) L, 45 cm (18″) H
Shipping dimensions	66 cm (26″) W, 147 cm (58″) L, 58 cm (23″) H
Shipping weight with crate	86 kg (190 lb)

Tubing Sizes

Tubing diameter (max)	25 mm (1″)
Tubing length (max)	102 mm (4″)
	178 mm (7″) wide heating element tool
	50 mm (2″) narrow heating element tool
Work-piece length (min)	240 mm (9.5″)

Ordering Information

	Description	**Part Number**
Model 19 Standard	CLTEQ-M19-BELT-HTR	714529-000
Model 19 Wide	CLTEQ-M19-BELT-HTR-6IN	075131-000
Model 19 Narrow	CLTEQ-M19-BELT-HTR-SS	D43037-000

Users should independently evaluate the suitability of the product for their application. Before ordering check with factory for most current data.

Tunnel Oven

Model 105 Tunnel Oven

Applications

Table conveyor heater that provides a controlled process system suitable for installing a wide variety of heat-shrinkable tubing products up to 76 mm (3″) in diameter and unlimited in length. Ideally suited for efficient processing of fibre and fabric HFT and both single-wall and dual-wall tubing. Designed as an integrated modular unit. Assemblies are placed on the entry section of a mesh belt, transported through a heating chamber, across a bank of cooling fans then discharged from the rear of the conveyor.

Features and Benefits

- Closed-loop temperature control for a precise and repeatable thermal process.
- Conveyor speed precisely set by a 3-digit potentiometer.
- Operation that requires only minimal skill.
- Contains numerous safety features.
- Custom length conveyors for longer entry and/or exit sections available.
- Optional accessories to customize the tunnel oven.
- Ability to add additional heater chambers to extended customer length wire mesh conveyor.
- Custom floor stands.

Tunnel Oven

Technical Specification	Model 105 Tunnel Oven			
Electrical	Power requirements	208/240 VAC, 1 ∅, 50/60 Hz, 15 A		
	Heating elements	Two 1500 watt infrared stamped foil with black quartz face, one top and bottom.		
	Operating temperature	Ambient to 650 °C		
	Effective heating width	356 mm (14”)		
Dimensions	Control box	Length	515 mm	(20″)
		Width	210 mm	(8″)
		Height	178 mm	(7″)
		Control box weight	7.7 kg	(17 lb.)
	Heating conveyor	Length	990 mm	(39″)
		Width	685 mm	(27″)
		Height	417 mm	(17″)
		Heating conveyor weight	68 kg	(150 lb.)
	Shipping	Length	1346 mm	(53″)
		Width	1168 mm	(46″)
		Height	635 mm	(25″)
		Shipping weight	146 kg	(320 lb.)
Product Range	Inside diameter of tubing before heat	Up to 76.2mm	(3″)	
	Length	Perpendicular to belt travel	356 mm	(14″)
		Parallel to belt travel		Unlimited

Ordering Information	Description	Part Number
	CLTEQ-M105-Tunnel-oven	955018-000

Users should independently evaluate the suitability of the product for their application.
Before ordering check with factory for most current data.

Installation of Splice Sealing Products Adjacent to Ultrasonic Welder

RBK-ILS-Processor MkII

Applications

The RBK-ILS-Processor MkII is a semi-automatic unit designed specifically to install splice sealing products onto ultrasonically welded or crimped splice joints used in automotive harnesses.

The tool can operate in several modes:

- Stand-alone-operator sets time and temperature.
- Sequenced-preset times and temperature can be sequenced automatically (and can also be randomly selected from sequence stored).
- Automatic-communication with upstream ultrasonic welder can allow time and temperature to be automatically set without operator intervention.

The operator is able to efficiently load both machines and so minimise ‘dead time’.
Installing TE Connectivity’s Raychem splice sealing products immediately after welding gives reduced installation time and earliest possible mechanical protection for the welded joint. The operator positions the splice sealing product centrally over the splice joint and then locates the assembly into the gripper mechanism. The wire assembly is automatically ejected, with the splice sealing product installed and the joint area sealed, insulated and strain relieved. In-line or stub-type splices can be installed.

Features and Benefits

- Optimized heating element life.
- Installation times, temperatures and product size information storage (individual selection).
- Sequenced installations.
- Operator key lock/password protection levels.
- Automatic heater retraction on mains failure.
- Automatic calibration.
- RS-232 interface allows time, temperature and product sizes for the next installation to be transferred from a remote machine (e.g. an ultrasonic welding tool).
- Machine hours and installation cycle counters.
- Software upgradeable to support special applications.
- Air cooling can be provided to an optional stub splice fixture in the RBK-Proc-MK2-Aircool version.

Installation of Splice Sealing Products Adjacent to Ultrasonic Welder

Technical Specification

RBK-ILS-Processor MkII	
Electrical supply	220/240 V – 50 Hz
Power consumption	1.7 Amps (Max)
Operating temperature	550 °C (Max) (500 °C recommended)
Machine cycle times for splice sealing products used on typical range of automotive splices	6 to 20 seconds depending on wire size and the number or wires used
Total system noise	< 80 dB
Dimensions	390 mm x 365 mm x 225 mm (15″ x 14″ x 9″)
Weight	18 kg (40 lb)

Product Range

RBK-ILS-125 products	Sizes 1 to 3A
For other TE Connectivity's Raychem products (eg RBK-VWS, RBK-ESS …)	Discuss with Product Management

Ordering Information

	Description	Part Number
Equipment	RBK-Proc-Mk2-Processor	740331-000
Accessories	RBK-ILS-Proc-Stub-Sp-Fix Stub splice support fixture	981721-000
	RBK-ILS-Proc-Air-Cool-Kit Air cooling kit for use with stub splice support fixture – high process rates	843800-000
	RBK-ILS-Proc-Termfix-08mm 8 mm ring terminal fixture	049857-000
	Users should independently evaluate the suitability of the product for their application. Before ordering check with factory for most current data.	

Engineering Notes

Engineering Notes

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