Technical Information

Conductor and Insulation Materials

The technical information provided in this section has been expanded to include additional graphs and supplementary data as an aid in specifying the hook-up and lead wire best suited to the needs of a particular application. If you require additional technical information, contact Belden Technical Support at **1-800-BELDEN-1**.

The tables on the following pages are offered as a guide to assist users in selecting the correct lead wire for their application.

Conductors

Uni-Strand®

Uni-Strand tinned copper conductor. In this type of construction, the bare copper wires are stranded, then tinned to coat the strands and also to fill in the interstices between strands. This allows for easier wire stripping with no re-twisting operation.

Insulation Materials

PVC

Vinyl plastic insulation is fast stripping, resists oil, solvents, and ozone. The colors are bright and remain distinct after processing. Applications include motors, transformers, fluorescent ballasts and fixtures, switch-boards, panels, controls, rectifiers and electronic circuits. Meets VW-1 Vertical Wire Flame Test in many cases.

Teflon®

Teflon is a fluorinated thermoplastic with outstanding thermal, physical, and electrical properties. Teflon is generally restricted to applications requiring its special characteristics because its basic resin and processing costs are relatively high.

Belden Teflon wire products are highly recommended for miniature cable applications because of their superior thermal and electrical properties. Teflon is especially suitable for internal wiring-soldering applications where insulation melt back is a specific problem. Belden wiring products insulated with Teflon are outstanding in their resistance to oil, oxidation, heat, sunlight and flame; and also in their ability to remain flexible at low temperatures. They have excellent resistance to ozone, water, alcohol, gasoline, acids, alkalis, aromatic hydrocarbons and solvents.

EPDM

EPDM (ethylene-propylene diene elastomer) is a chemically cross-linked elastomer with excellent flexibility at high and low temperatures (+150°C to -60°C). It has good insulation and dielectric strength, as well as excellent abrasion resistance and mechanical properties. EPDM also has better cut-through resistance than Silicone rubber, which it replaces in some applications.

EPDM is compatible with most varnishes. After the dip and bake cycle, however, the varnish tends to adhere to the insulation because EPDM, unlike some rubber insulations, does not exude oils or waxes. As the lead wires are pulled apart for termination or flexed, the varnish cracks, sometimes tearing the insulation.

To help this problem, a stearic solution is applied to the lead wire during the manufacturing process. However, many varnishes may still bond to the insulation unless other special coatings are applied. (Other slip coats are available at additional cost.) **Because most cleaning processes will remove these coatings from the EPDM lead wire, cleaning EPDM lead wire before using in the process is not recommended.**

Due to the above, it is recommended that the compatibility between the individual lead wire size, the bake/varnish process and varnish used always be checked; and if possible, do not allow any varnish to extend beyond a point where the lead wire will be flexed or bent.

XL-Dur®

XL-Dur is a lead wire insulation utilizing thermoset, chemically cross-linked poly-ethylene. Because of its excellent physical and electrical properties, XL-Dur is highly desirable for a wide variety of applications.

Hypalon®

This insulation is chlorosulfonated polyethylene. Hypalon insulation has excellent heat resistance, color stability and electrical properties.

Neoprene

Neoprene insulation has good heat aging characteristics and is an excellent low-cost motor lead wire. It may be considered for use in hazardous locations and is being used in explosion-proof motors recognized by UL.

Silicone Rubber

Braidless Silicone lead wire features easy and clean stripping without the problems associated with glass braid lead wire. It has excellent physical and mechanical strength properties.

Recommended for high-temperature applications in motors, lighting fixtures, clothes dryers, stoves, therapeutic, and electronic devices. It is recommended that varnish compatibility be checked before production. Some rigid varnishes may cause cracking when the wire is severely bent.

Silicone Rubber — Glass Braid

The Silicone insulation strips clean and easy. The glass braid provides additional abrasion resistance and is treated to prevent fraying.

Recommended for high-temperature applications in motors, lighting fixtures, clothes dryers, stoves, therapeutic and electronic devices.

Hypalon and Teflon are DuPont trademarks.

Technical Information

Temperature Ranges and Classifications
Conductor Configurations

Table 6: Nominal Temperature Operating Ranges (°C)

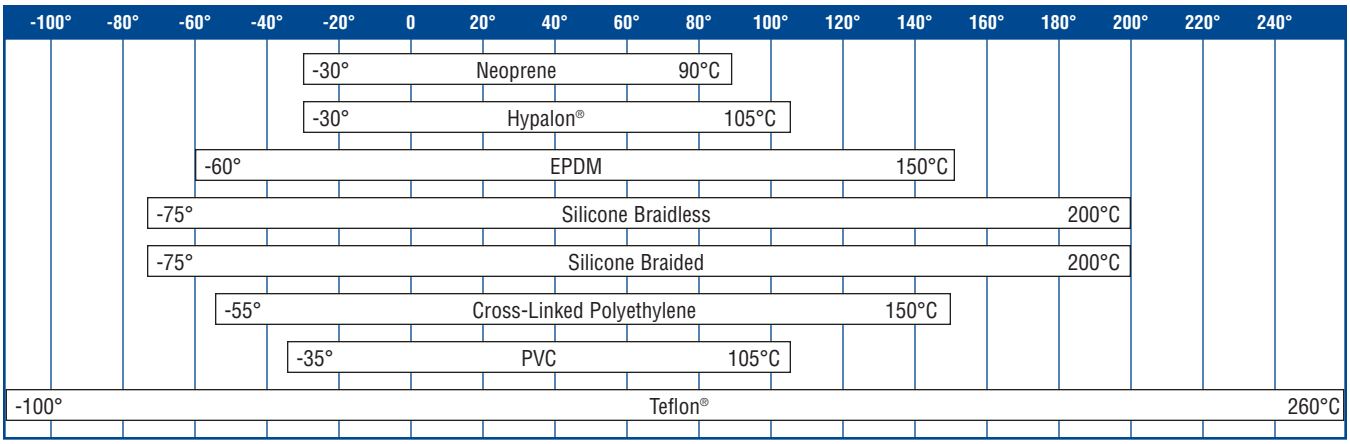

Table 7: Temperature Classification

Insulation System Class	Minimum Acceptable Lead Wire Temperature Rating	
	C°	F°
130(B)	90	194
155(F)	125	257
180(H)	150	302
220(R)	200	392

Systems of Insulating Materials — UL Standard 1446

This is a guide intended for UL approved insulation systems connected to branch circuits of 600V or less. Approval required by Underwriters Laboratories when using lead wire with a temperature rating more than 5°C under the system temperature rating.

Table 8: Conductor Configurations

Typical Application	American Wire Gage							
	12	14	16	18	20	22	24	26
Fixed Services Hook-Up Wire Cable in Raceway	19x25	solid or 19x27	solid or 19x29	solid or 7x26 or 16x30	solid or 7x28 or 10x30	solid or 7x30	solid or 7x32	solid or 7x34
Moderate Flexing Frequently Disturbed For Maintenance	65x30	19x27 or 41x30	19x29 or 26x30	16x30 or 41x34	7x28, 10x30, 19x32, or 26x34	7x30 or 19x34	7x34 or 10x34	7x34
Severe Flexing Microphone Test Prods	165x34	104x34	65x34 or 104x36	41x34 or 65x36	26x34 or 42x36	19x34 or 26x36	19x36 or 45x40	7x34 or 10x36
Most Severe Duty Mercury Switches	259x36 (7x37 Rope Lay)*	168x36 (7x24 Rope Lay)*	105x36 (7x15 Rope Lay)*	63x36 (7x9 Rope Lay)*	105x40 (3x35 Rope Lay)*	(Consider Braid or Tinsel)		

Note: For a given AWG wire size (based on equal cross-sectional area of conductor), limpness and flex life are increased by use of a large number of fine strands. The finer stranding does result in higher costs.

*Rope Lay is several stranded groups cabled together. For example: #12 AWG, 259x36 is 7 cords each consisting of 37 strands of #36 AWG

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