

# Cable Lore



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## LOW TEMPERATURE FLEXIBILITY

The seasonal temperature range in which a stock power cable might be installed or operated in the continental U.S.A. during the course of one year is fantastic. Winter temperatures in Minnesota will go as low as  $-46$  F. Sheath temperatures can reach  $140$  F during the summer in open pit mines in Arizona. This is a spread of over  $185$  F.

Most cable coverings are rated in the range of  $75-90$  C ( $167-194$  F). Generally little difficulty is experienced because of high natural ambient temperatures. Greater difficulty is experienced when cables are flexed during application or installation at very low temperatures. Low temperature, per se, does no great harm once a cable is installed.

All polymers have a tendency to become progressively stiffer as they are cooled. Cable difficulty at very low temperatures occurs when two conditions are reached:

- (1) Cable coverings become too stiff to be functional
- (2) Cable coverings become brittle or will shatter under impact

Many cables can be bent at very low temperature but will shatter under impact at a significantly higher temperature. PVC-covered building wire is a good example. It can be bent, depending on conductor size — from  $-22$  to  $-40$  F before it will crack. The same conductor in a coil dropped from a ladder onto a concrete floor during installation could shatter at  $+14$  F. The ability of a cable to withstand impact at low temperature is a prime factor to consider during application or cable installation.

Cable constructions over  $600$  volts are usually composites of two or three different compounds: (1) extruded strand shield; (2) insulation; (3) jacket. The low temperature flexibility of this composite will be no greater than that of the least resistant of the components. A polyethylene-insulated cable is a good example. Specs written before extruded strand shields were common practice required cold-bend requirement of  $-55$  C ( $-67$  F). With extruded strand shields this requirement has been removed and replaced with a  $-30$  C ( $-22$  F) requirement. The extruded strand shield was the limiting component.

Polyethylene, XLP, EP, SB-R, and Butyl rubber all have excellent low-temperature properties — flexibility without cracking at  $-50$  F. General-purpose Neoprene and PVC compounds have good low-temperature characteristics — these compounds pass cold-bend tests in the  $-22$  F to  $-40$  F range.

Since most power cables are protected with a PVC sheath low-temperature application must be geared to the properties of this sheath. Observation of a few general rules will be of great assistance in successfully installing cables at below normal temperatures:

- (1) Store cables in a warm warehouse prior to installation.
- (2) Avoid, if at all possible, installation of cables when temperature is lower than 14 F.
- (3) If necessary to install below 14 F, avoid all types of impact — for example: dropping cable on the concrete floor, sharp bending or kinking.
- (4) Avoid long pulls or those with an excessive number of bends.
- (5) When cable must be bent in a manhole or cable vault, do it carefully and slowly using a mandrel if space permits.

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