

Issue No. 43

January 2, 1976

THERMAL EXPANSION

The dimensions of most materials increase when the material is heated; the material expands. Design engineers and architects recognize the expansion of material with temperature and design accordingly. This is the reason that expansion joints are designed into concrete roads, bridges, etc.

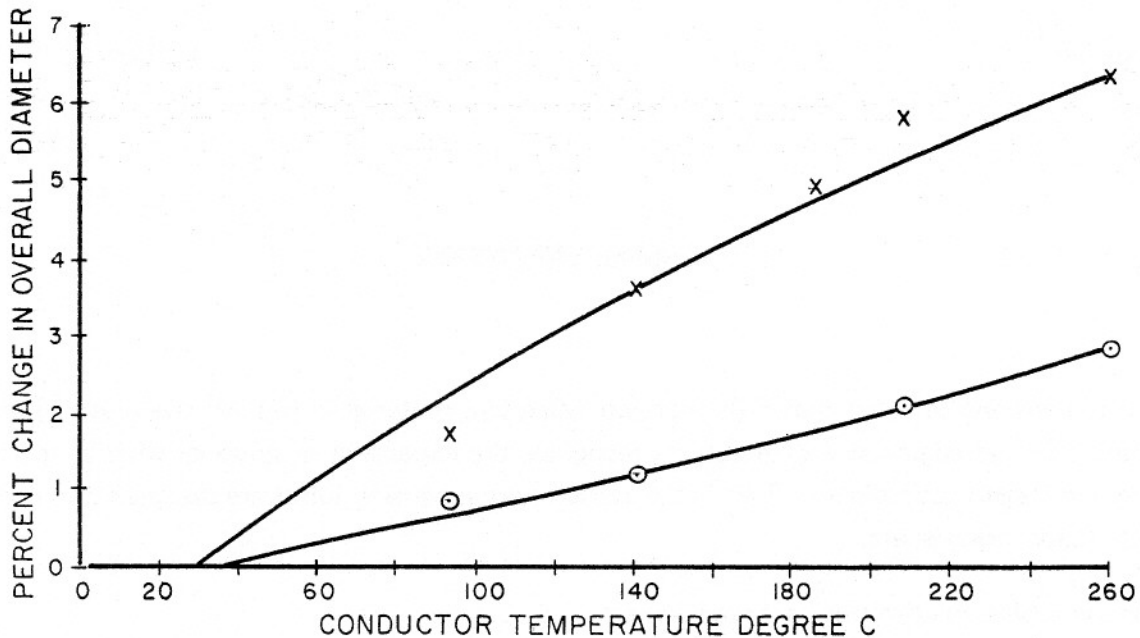
For the cables, the problem is more severe.

1. The temperature range is greater - from -40°C to 130°C compared to -40°C to 60°C for building materials.
2. Cables are made of materials with different properties. Some expand on heating but recover to approximately original dimensions on cooling, some expand but do not recover. Expansion rates differ. These differences can cause rupture or permanent deformation of components.
3. Should voids in stress relief systems or splices form or loose connections occur, corona and hot-spot or heat deterioration soon will lead to cable failure.

For a long-lived cable, components must be selected with their thermal expansion properties in mind.

The following graph shows how two different insulating materials can vary in expansion characteristics over a range of temperature. XLP and EP are used as examples. (For reference, copper expands 1.1% in volume, aluminum 1.6% from 25° to 250°C . The linear expansions are 0.4 and 0.53% for copper and aluminum.)

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Note: At normal 90° maximum operating temperature, XLP expands approximately twice as much as EP. At 130°C emergency temperature, XLP expands approximately three times as much as EP.

Excessive expansion of cable insulations can initiate problems that can lead to eventual cable failure, for example:

- (1) Shielding tapes can rupture.
- (2) Insulations can flow under tightly fitting prefabricated slip-on accessories.
- (3) Terminations can be damaged when thermal expansion increases length as well as diameter.
- (4) Expansion on heating and contraction on cooling could result in voids at the stress relief component and the insulation.

Relatively low expansion coefficient of EP is an important advantage of UniShield EP.