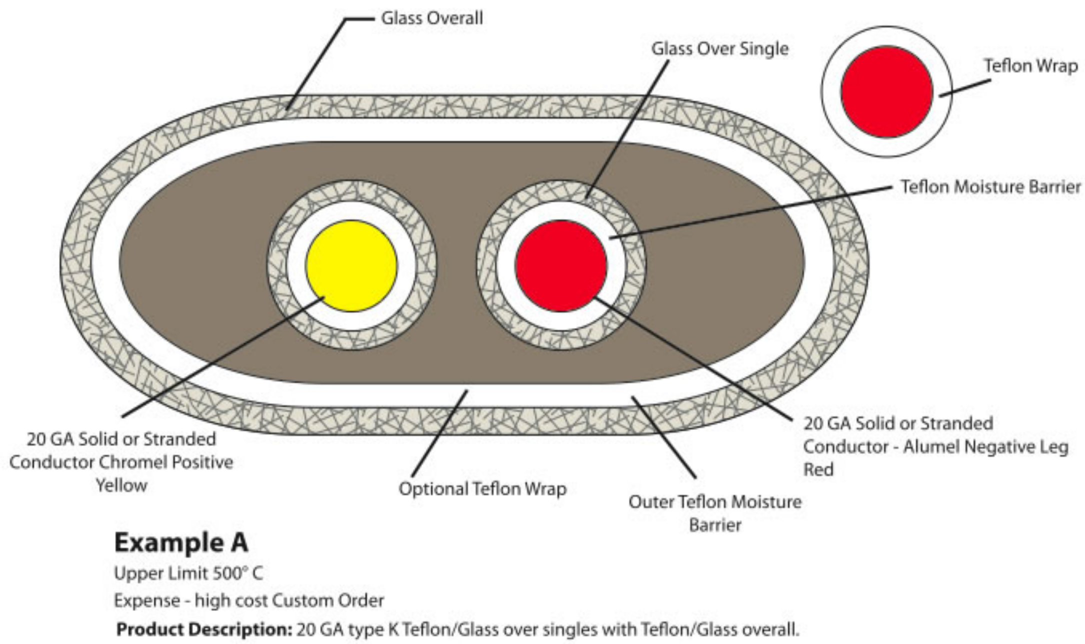
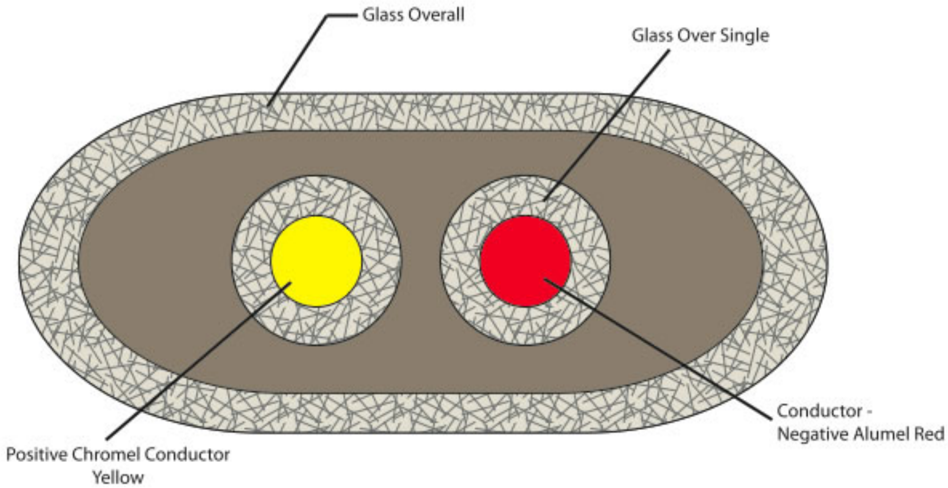
Wire information



Detail A

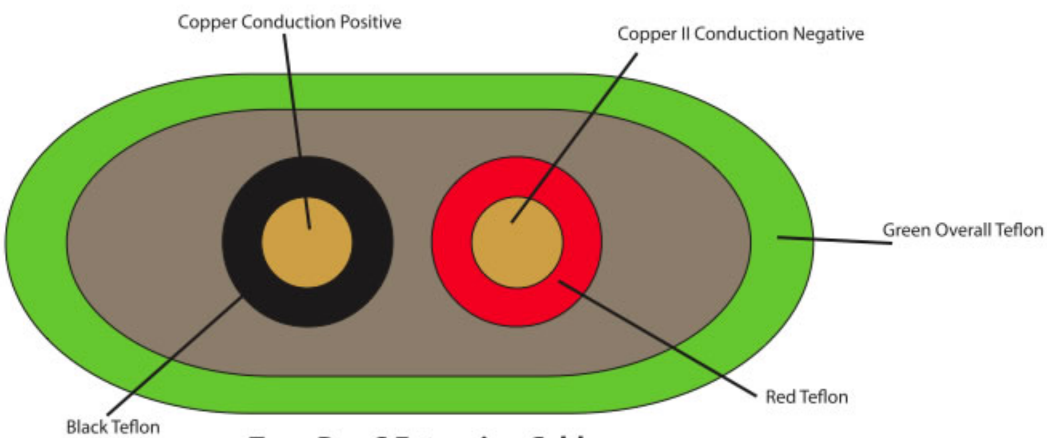
The wire example shown in detail A is for wire that will be exposed to moderate temperature and moisture or direct water situations. It is very expensive and less readily available than standard thermocouple wire. It is not required if conduit is used and it is not recommended where there is a potential for the wire to be exposed to temperatures beyond its maximum rated use temperature. Teflon will begin to decompose and out gas at about 680 ºF; this is well below the potential temperature within a burn building. It is expected that all of the wire is protected by insulating blocks and possibly conduit but this is difficult to guarantee without frequent inspections of the insulating tiles. It is also presumed that all personnel will be wearing SCBA at all times and that ventilation will be provided after the combustibles have been extinguished. The gases produced by degrading Teflon are very toxic and any exposure to these gases should be considered serious. See the list of toxins created by overheated degrading Teflon. The following link also discusses the risk of exposure to overheated Teflon http://www.ewg.org/node/8305.



Example B
Upper Limit 900° F
Expense - Low to Medium cost readily available
Product Description: Type K - 20 GA Glass/Glass

Detail B

The wire shown in example B is the most common type of extension wire used in high temperature applications. It is capable of operating at temperatures of 900 ºF without significant out gassing. It is a lower cost material and readily available in most standard thermocouple grades. Typically type K wire is used and so the extension wire conductors are Chromel and Alumel; both high nickel materials that resist oxidation in the presence of heat and moisture. This is the safest and most cost effective choice for burn buildings. However it should be protected from moisture or direct contact with water, preferably by running the wire inside a sealed conduit protector behind the fire brick.



Type R or S Extension Cable

Example C
Type K Teflon/Teflon will have a Chromel Conductor with a
yellow covering and an Alumel Conductor with a red covering. There is a Brown overall.
The Red is always Negative for thermocouple wires.

Detail C

The wire shown in example C is often used with type R or type S thermocouples. It is Teflon over Teflon parallel wire construction and it has an upper operating limit of 500 ºF. It is constructed of copper and copper 11 specifically intended for use with platinum type thermocouples. Although the type S and R sensors are well suited for high temperature the lead wire constructed of Teflon and copper is a very poor choice for hot or wet environments. Copper oxidizes rapidly in the presence of heat and moisture and therefore would not be a suitable choice for burn building. The Teflon insulation commonly used on type R and S extension cable is also a poor choice as explained in section A.

Appendix 1

Excerpts from The Toxicology of Perfluoroisobutene by Jiri Patocka and Jiri Bajgar.

Perfluoroisobutene ... is a fluoro-olefin produced by thermal decomposition of polytetrafluoroethylene (PTFE), e.g., Teflon [1].

Overheating of PTFE generates fumes of highly toxic PFIB and poses a serious health hazard to the human respiratory tract. PFIB is approximately ten times as toxic as phosgene [2]. Inhalation of this gas can cause pulmonary edema, which can lead to death. PFIB is included in Schedule 2 of the Chemical Weapons Convention (CWC), as a result of the prompting by one delegation to the Conference on Disarmament [3]. The aim of the inclusion of chemicals, such as PFIB was to cover those chemicals, which would pose a high risk to the CWC. Subsequently PFIB, specifically, was included in the final text of the CWC.

Chemistry. PFIB is a strong electrophile, which reacts with all nucleophiles [4]. The high electrophilicity of PFIB is a result of the strong electron-attracting effects of the fluorine atoms of the trifluoromethyl groups and the conjugation of the fluorine's p electrons with the double bond of the vinyl group. Several reactive intermediate species were identified in the reaction of PFIB with nitrone and nitroso spin trap agents, and, some of the expected reactive nucleophiles in vivo include amines, alcohols and especially thiols [5].

PFIB decomposes rapidly when dissolved in water, forming various reactive intermediates and fluorophosgene, which then decomposes into carbon dioxide, a radical anion and hydrogen fluoride [6]. PFIB is a gas with a boiling point of 7.0 ºC at one atmosphere and a gas density of 8.2 g/L [9]. The synthesis of PFIB from flourodichloromethane is given in Fig. 1.

Toxicology. The toxicity of PFIB may be correlated with its susceptibility to nucleophilic attack and the generation of reactive intermediates [1]. This is similar to the toxicity of other fluoro-olefins; their toxicity is directly proportional to the reactivity of that olefin with nucleophiles [7, 8].

Acute Toxicity. The median lethal concentration (LC50) in single exposures of rats was 0.5 ppm. The intoxicated rats either died with gross pathological signs of pulmonary congestion or recovered with no apparent residual effects. The 15-second LC50 was 361 ppm and the 10-minute LC50 was 17 ppm [9]. Similar high acute toxicity following inhalation was seen in other species with a two hour LC50 in mice reported to be either 1.6 ppm [9] or 0.98 ppm [10], in rabbits either 4.3 ppm [10] or 1.2 ppm [11], in guinea-pigs 1.05 ppm [10] and in cats 3.1 ppm [10]. In experiments in which rats were exposed to a concentration of 12.2 ppm for 10 min, an unusual postexposure latency period of approximately 8 hours was observed prior to the occurrence of pulmonary edema [12].

References

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Ref: Toxicology of Perfluoroisobutene by Jiri Patocka and Jiri Bajgar (Department of Toxicology, Military Medical Academy 500 01 Hradec, Czech Republic). The ASA Newsletter (Applied Science and Analysis, Inc.). 1998.

http://www.asanltr.com/ASANews-98/pfib.html