

**American Railway Engineering and Maintenance of Way Association
Letter Ballot 38 22-02**

1. Committee and Subcommittee:

AREMA C&S Committee 38

2. Letter Ballot Number: 38 22-02

3. Assignment:

New MP at Spring 2022 meeting.

4. Ballot Item:

Ballot 38 22-02: This ballot contains the MP approved at the Spring 2022 meeting:

10.3.30 - Application guideline for AREMA Signal Cable in transit tunnels

Rationale:

New Manual Part

Draft Not Yet Approved

**Application guideline for AREMA Signal Cable in transit tunnels
New 2023 (3 Pages)**

A. Purpose

This Manual Part is an application and design guide for signal cables in transit tunnels in USA and Canada. This guide will review the materials selection, thicknesses, and other considerations for underground and enclosed applications. This document increases awareness for Signal Design Engineers and Transit Authorities regarding the relevant Manual Parts (MP's) in AREMA "Communications and Signals Manual" that is published on a yearly basis.

B. General Recommendations

The AREMA Communications and Signals manual lists cable materials and construction parameters for Signal Cables that are installed in transit tunnels. The Signal Cables that are used in tunnels are single conductor, multi-conductors tray cable or multi-conductors armored cable rated 600V or 2000V.

AREMA MP 10.3.16 (Recommended Design Criteria for Signal Cable, non-Armored) and AREMA MP 10.3.17 (Recommended Design Criteria for Signal Cable, Armored) specifies the materials, thicknesses, and construction of the Signal cables.

The common **insulation** materials are listed under the following manual parts:

AREMA MP 10.3.19 (Recommended Design Criteria for Ethylene-Propylene Rubber Insulation for Wire and Cable). This material is also referred to as **EPR Type I** in AREMA MP 10.3.16 and AREMA MP 10.3.17.

AREMA MP 10.3.22 (Recommended Design Criteria for Cross-Linked Polyethylene Insulation and Jacketing for Wire and Cable). This material is also referred to as **XLPE Type IV** in AREMA MP 10.3.16 and AREMA MP 10.3.17

AREMA MP 10.3.26 (Recommended Design Criteria for Cross-Linked Polyolefin Low Smoke, Zero Halogen Insulation for Wire and Cable). This MP has two materials that are referred as **LSZH Type IV** and **LSZH Type V** in AREMA MP 10.3.16 and AREMA MP 10.3.17. The LSZH material is also referenced as LSZH XLPO, LSHF XLPO.

AREMA MP 10.3.28 (Recommended Design Criteria for Cross-Linked Ethylene-Propylene Rubber Low Smoke, Zero Halogen Insulation for Wire and Cable). This material is also referred to as **LSZH Type VII** in AREMA MP 10.3.16 and AREMA MP 10.3.17.

The common **jacket** materials are listed under the following manual part:

AREMA MP 10.3.13 (Recommended Design Criteria for Low-Smoke Halogen Free (LSHF) Polymeric Cable Jackets). The **thermoplastic LSZH** jacket is referred to as **Type III** in AREMA MP 10.3.16 and AREMA MP 10.3.17.

The **thermoset (cross-linked) LSZH** jacket is referred to as **Type IV** in AREMA MP 10.3.16 and AREMA MP 10.3.17.

How NFPA 130 addresses signal cables?

Most Transit Authorities in North America adopted NFPA 130 (Standard for fixed guideway Transit and Passenger Rail Systems), Chapter 12, as the performance standard for signal cables for tunnels.

The NFPA 130 requirements for signal cables are:

- 1) Cable shall be listed for being resistant to the spread of fire and shall have a reduced smoke emission when tested to UL 1685 FT4/IEEE 1202 or NFPA 262. (See NFPA 130-2020 section 12.2.1)
- 2) Cable insulation shall be of a moisture and heat resistant type with a temperature rating of 90°C. (See NFPA 130-2020 section 12.3.1.1)
- 3) Single and multi-conductor cables shall be listed for wet location. (See NFPA 130-2020 section 12.3.1.2)

A listed cable means that the cable carries Nationally Recognized Testing Lab (NRTL) mark and approval. (Example: Underwriter Laboratories UL).

Tunnels are considered a wet environment; this is the main reason for the 90°C wet rating for the cables. The UL 1685/ST1 flame test or NFPA 262 assures that the cable will have low flame propagation and low smoke emission during a fire event.

It is a common practice to install Signal Cables on a messenger wire along the tunnel walls branching out to the Signaling equipment. NFPA 130-2020 section 12.4.2 allows Signal Cable to be installed not enclosed in armor or conduit/raceway as all other wires.

Signal Cables are usually 14 AWG – 6 AWG, 600V, 2 to 37 conductors, with thermoset insulation and thermoplastic or thermoset jackets.

Why are AREMA Signal Cables thicker than UL Type TC Cables?

AREMA MP tends to have thicker insulation and jacket as compared to the UL 1277 Type TC rated 600 V cables. For example, AREMA 10.3.16 specifies insulation thickness for 14 AWG, 600 V EPR Type I, XLPE and LSZH (types VI and VII,

respectively) as 45 mils thick (per AREMA 10.3.16 Table 10316-1, Aerial). Common UL 1277 Tray Cables use XHHW-2 thermoset 600 V with 30 mils of insulation.

AREMA jacket thickness follow table 10316-4 in AREMA 10.3.16 and table 10317-3 in AREMA 10.3.17, which are thicker than UL's type TC (UL 1277 Table 12.3) for multiconductor cables.

Note: It is possible for AREMA Signal Cable Design to be UL listed per NFPA 130 requirements.

AREMA addresses Signal Cable performance and design for transit tunnels, which may be supplemental to the NFPA 130 2020 requirements for Signal Cables. The AREMA Manual Parts may be added by the Transit Authorities seeking to enhance cable performance and reliability for the environments where the cables will be permanently installed. For example, AREMA 10.3.26 and 10.3.28 have long-term water stability requirements, where two-year water absorption testing is done at 90°C; this test exceeds the UL 44 requirement for type XHHW-2, which is a minimum of 12 weeks at 90°C.

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