

## FLAME and SMOKE TESTS (IEEE, MSHA, NFPA, and UL) (Standard names appear alphabetically)

**IEEE 383** Vertical Flame Test is conducted on cables that are attached to a vertical metal ladder tray. The source of combustion is a 70,000BTU ribbon burner flame source. The flame is applied for 20 minutes. The rating requires the cable to self-extinguish before reaching the top of the tray. This test is very similar to the UL 1581-1160 Vertical Flame Test and the CSA FT-4 Vertical Flame Test.

**IEEE 1202** Vertical Flame Test is conducted on cables that are attached to a vertical metal ladder tray. The source of combustion is a 70,000BTU ribbon burner flame source. The IEEE 1202 test has its burner mounted at 20° from the horizontal with burner ports facing up. The flame is applied for 20 minutes. At the end of the 20 minute period, the burner flame shall be extinguished and the cable fire (if any) allowed to self-extinguish. The cable passes if the length of damage (charring or other affected portion) does not exceed 1.5meters (4.9ft). This test is almost the same as the CSA FT-4 Flame Test.

**MSHA** Horizontal Flame Test (per U.S. Code of Federal Regulations 30 CFR Part 7.407) is required by MSHA (Mine Safety and Health Administration) to assure adequate fire resistance for cables used in the mining industry. The cable conductors are connected to a current source to raise the conductor temperature to 400 Deg F (204.4 Deg C). The approximately 3000BTU flame source is applied to the cable for 60seconds. The flame source and the current is then removed. The cable passes if the burning does not exceed 4 minutes and the length of the burned (charred) area does not exceed 6 inches. The CSA FT-5 flame test is quite similar to the MSHA flame test.

**NFPA 262** Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces (Formerly UL 910) is a plenum cable test with a 300,000BTU flame source in a 25 foot tunnel chamber for 20minutes. To pass, a cable must have a flame spread of less than 5 feet with optical (smoke) density of 0.15 and maximum value of 0.50.

**UL VW1** (UL Standard 1581-1080) Vertical-Wire Flame Test which is a small scale test conducted on a single length of wire. A 1700BTU Tirrill burner flame source (like a Bunsen burner) is applied to a vertically clamped sample at a 20° angle so that the inner flame makes contact with the wire's surface. Below the sample is surgical cotton and near the top of the sample is a paper indicator flag. The flame is applied for 5 - 15second intervals, each time after the sample stops burning. To pass the test, the sample cannot burn longer than 60seconds after any flame application, or less than 25% of the paper indicator flag burns, or the cotton cannot ignite. This test is very similar to the CSA FT-1 flame test.

**UL Vertical Tray Flame Test** (UL Standard 1581-1160) is a large scale flame test in which cables are fastened to a 8 foot tall vertical metal ladder tray that is 1 foot wide. A 70,000BTU ribbon burner source is horizontally applied to vertically attached cables. In order to pass the test, the cable must self-extinguish before reaching to top of the tray. This test is similar to the CSA FT-4 Vertical Flame Test.

**UL 1685 Vertical Tray Test** evaluates flame spread and smoke generation from wire and cable exposed to a flame. The test is essentially the same as the UL 1581-1160 Vertical Flame Test with the addition of smoke requirements. The 70,000BTU flame source is mounted at a 20° angle from the horizontal and applied to cables on a 8foot metal ladder tray for 20minutes. The cables pass the test if the cable char height is less than 8 feet, the total smoke released is 95m<sup>2</sup> or less, and the peak smoke release rate is 0.25m<sup>2</sup>/sec. This test determines flame propagation and smoke characteristics of these cables to qualify for a limited smoke marking.

**UL 1666 Riser Flame Test** is required where cables are used in vertical runs in a shaft that may penetrate more than one floor. The tested cables are fastened vertically in a three story test chamber and a 527,500BTU flame source is applied for 30 minutes. To pass the test, the cables must have a maximum flame height of 12 feet and cable temperature must not exceed 850Deg F.