A Study of Smoke Release of Complete Cables and components of the cables

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ABSTRACT

In order to assess the smoke release of cables various assessment methods are available. Some standard suggests the smoke test method for the entire cable and some standards are for material assessment. Smoke tests are usually designed to measure the obscuration of light caused by the smoke since this reduces the visibility. Most smoke tests utilize the valuable inverse linear relationship between visibility and optical density of smoke.

The smoke chamber as per ASTM D 2843 is used to assess the smoke Density rating of polymeric materials and cable materials. Observations of absorbance within the cube are made by plotting smoke emission with time for 4 minutes of test duration.

The three metre test facility as per IEC 61034 has been standardized for measuring the smoke density of electric cables. Observations of transmittance within the cube are made by plotting transmittance with time for the test duration of 40 minutes. Minimum transmittance during the test is the parameter which is used to assess the Cable. This test is most appropriately used for assessing low smoke-emitting materials for use in potential high risk applications. Cables are classified based on the type of outer sheath used in the construction of the cable and the various types of cables are Fire Retardant (FR), Fire Retardant Low Smoke (FRLS) & Halogen Free Flame Retardant (HFFR) Cables.

The Low smoke properties are being concentrated only for the outer sheath of the Cable as the outer sheath is the protective covering of the cable and which is being exposed to the fire initially. Hence the other combustible components like inner sheath Fillers are not given much importance for the smoke emission by the manufacturers. Hence effort is put to compare the smoke results as a whole cable and individual components.

KEYWORDS

Smoke Density, Cables, Materials, Transmittance, Absorbance,

INTRODUCTION

The measurement of smoke density is an important aspect in the evaluation of the burning performance of cables as it is related to the evacuation of persons and accessibility for firefighting. Smoke density tests are used for the measurement of the amount of smoke obscuration produced in a simple, direct, and meaningful manner under the specified conditions. The degree of obscuration of vision by smoke generated by combustibles can be substantially affected by changes in quantity and form of material, humidity, draft, temperature and oxygen supply. The outer sheath of the cables is acting as a protective covering for the cables in case of sheathed cables and outer sheath is the main material which is exposed to fire first. Hence the special fire properties like Fire Retardancy, Low smoke emission & zero halogen emission are mainly concentrated only for the outer sheath of the Cable. The smoke density assessment of materials, outer sheath of cables is carried out as per ASTM D 2843 or IS 13370. This method serves to determine the extent to which plastic materials are likely to smoke under conditions of active burning and decomposition in the presence of flame. The “3 metre cube test ” measures the generation of smoke from electric cables during fire and this test is carried out as per IEC 61034. In this particular test not only the outer sheath, the other combustible components are also exposed to fire. The other combustible materials are inner sheath, insulation & filler materials. The smoke evolved by one or more burning cables is not necessarily reflected by the testing of individual components. In this paper FRLS inner sheathed and FRLS outer sheathed cable is considered.

3 M CUBE TEST FOR SMOKE DENSITY OF POWER CABLES

This test method is for determination of smoke density of the entire cable and the test apparatus is as shown in fig 1. The three meter smoke density chamber consists of a 3 meter cubicle made of aluminium sheets with a mild steel frame work [1]. A light beam emitted from a window is projected across the enclosure to a photo cell connected to a recorder at the opposite window. The recorder is adjusted to register from 0% for complete obscuration to 100% luminous transmission. The number of one metre length of the cable is selected according to the diameter of the cable. A 1 metre cable sample is placed in the centre of the enclosure and is applied with a fire. The flame source comprises of 1 litre alcohol which is located 70 mm below the cables positioned horizontally for a duration of 40 minutes or when there is no decrease in light transmittance for 5 min after the fire source has extinguished. The minimum light transmission is recorded. The result is expressed as percentage of light transmitted.

Fig 1. Three metre cube Smoke Test apparatus