

CABLE TRAY FLAME TESTS
- A Round-Robin Study -

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Report P-56-520
On
CABLE TRAY FLAME TESTS

—A Round Robin Fact-Finding Project—

By

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ROUND ROBIN FIRE TEST

ICEA **W6** 520

PARTICIPANT IDENTIFICATION

ANACONDA

BOSTON INSULATED WIRE

REYNOLDS

ROME

PIRELLI

TRIANGLE PWC

ESSEX

COLLYER

OKONITE

PHELPS DODGE

KERITE

GENERAL ELECTRIC

ITT SURPRENANT

UNDERWRITERS' LABORATORIES

ROCKBESTOS

JS2/1

Abstract

Testing was performed by members of the Insulated Cable Engineers Association, Inc. (ICEA) and guests to ascertain the degree of correlation among the various test sites in use to determine compliance with IEEE Std. 383-1974, para. 2.5. In all, three (3) separate test cycles or runs were included in the investigation.

The final test cycle, or Burn Run 3, included testing in the 8 x 8 x 8 test chamber with a controlled air flow. For comparison, similar testing was performed in the participants' existing test facilities.

All testing was performed in accordance with the test format outlined in para. 2.5 of IEEE Std. 383-1974 as modified to enhance conformance among the various test participants. The actual test procedures used for Burn Runs 1, 2 and 3 are attached to this report as appendices 1, 2 and 3, respectively.

Objective

The purpose of the formation of the Task Group was to determine whether tests conducted on the same test specimens in the various test facilities were correlatable or if results differed. If different, determine that which would be necessary to make the results uniform and implement such findings.

A second purpose given the group was to determine by test whether a standardized test facility (8x8x8 foot chamber) would provide greater uniformity among the results from the various test sites.

JS2/1

Conclusions

The conclusions that can be drawn from the data generated in this test series are:

- 1) IEEE Std. 383-1974, para. 2.5 does not provide for control of test procedures or environmental conditions to the extent necessary to produce satisfactorily consistent results among different laboratories. (Reference Data Burn Runs 1 and 2)
- 2)* Correlation of test results from several and varied test facilities is attainable by careful structuring of the test procedure. The test procedure must address such items as combustion air and gas flow, number of specimens, specimen spacing and method of position fixing, burner location, burner type, environmental condition limits and specimen temperatures. (Reference App. 3 and Data Burn Run 3)
- 3)* Within the range of test chamber sizes investigated in this report (Reference App. 4), the data indicate that there is no significant difference in results because of chamber dimensions or control of air flow.

Procedure

Burn Run #1 was conducted in each participant's test enclosure as it existed at that time. Further, no limitations were placed on any participant over and above the requirements that a specific cable sample be used by everyone involved and that the test be run according to each participant's understanding of the requirements of IEEE Std. 383-1974 para. 2.5. (See App. 1)

* Additional discussion of the test results will be found on pages 13 and 14.

JS2/1

Documents



Document Sharing Hub

Burn Run #2 was conducted in each participant's test enclosure as in Burn #1. The same cable was tested but the test format was modified slightly to be more specific than IEEE 383 above. (See App. 2)

Burn Run #3 was conducted with a significantly more stringent test format derived from the results of Burns 1 and 2. In addition, four (4) different cables were to be tested by each participant. Further, testing was to be performed in both the participants' test enclosure (as described in Discussion) and the 8x8x8 enclosure constructed according to plans submitted by Underwriters' Laboratories - one of the test participants. (App. 5)

Test Specimen Description

Burn Runs 1 and 2 used the same cable:

Seven conductor #14 AWG Copper, .020" wall polyethylene, .010" wall PVC, cabled and bound, .045" overall PVC jacket.

Burn Run 3 used four (4) different types of cable from three (3) sources. They were:

- Type 1) Four conductor #14 AWG Copper, .015" PVC, .004" Nylon, cabled and bound, .045" PVC overall jacket.
- Type 2) Nine conductor #14 AWG Copper, .015" PVC, .004" Nylon, cabled and bound, .045" PVC overall jacket.
- Type 3) Four conductor #12 AWG Copper, .030" FR XLPE, cabled and bound, .045" FR PVC overall jacket.
- Type 4) Nine conductor #14 AWG Copper, .030" FR XLPE, cabled and bound, .060" Neoprene overall jacket.

JS2/1

Discussion and Results

Burn Run #1

Burn 1 produced results that can best be described statistically.

The statistical analysis of test results gives:

Total Sample: 27 entries

Mean: 53.15 inches burned

Std. Deviation: 13.08

Range: 27 - 72 inches burned

Selected Sample*: 20 entries

Mean: 52.75 inches burned

Std. Deviation: 11.58

Range: 27 - 72 inches burned

*Selected Sample differs from the total sample by the elimination of test runs, which consumed too much or too little fuel (outside $70,000 \pm 5\%$ BTU/hr) and those runs made with more or less than six (6) specimens.

The Standard Deviations indicate less correlation among the test results than would normally be considered desirable.

JS2/1

Burn Run #2

The changes to the test format in Burn #2 did not produce a significant improvement in the correlation among test sites.

Total Sample: 21 entries

Mean: 51.81 inches burned

Std. Deviation: 15.46

Range: 20 - 72 inches burned

Selected Sample*: 18 entries

Mean: 51.33 inches burned

Std. Deviation: 16.56

Range: 20 - 72 inches burned

*Method of selecting the Selected Samples uses the same criteria employed in Burn Run #1.

These data show no practical difference in the results of Burn 1 and Burn 2.

Because of the lack of difference between Burn 1 and Burn 2 and the rather large variation in the test results among the test sites, it was decided to proceed with a third Burn Run. This third burn would be performed with tighter constraints on the test format, and would compare the results of tests performed in the participants' existing enclosures with those performed by the same participants in the special 8x8x8 foot enclosures constructed from a common plan.

JS2/1

Several test conditions believed by the participants to be contributing to the lack of correlation among the test sites were reviewed at working group meetings, revised as judged necessary by the participants and reissued by the working group as a test format for the third burn test. This revised format is attached to this report as Appendix 3 rather than repeat it in this discussion.

Burn Run 3

Burn 3 resulted in significantly better results than either 1 or 2 in that the data spread was much tighter and the overall results were considerably more correlatable than in the previous runs.

As stated in the Sample Description, four (4) different cable samples were tested by each participant. All participants tested all four sample types in their respective test enclosures and those who had constructed the 8x8x8 special enclosure tested the same samples in that enclosure.

Analysis of the test results follows and the data plots are included in the Data section of this report. Each participant performed two burns of each cable type in each type of available enclosure.