



Standard Guide for Assessment of Measurement Uncertainty in Fire Tests¹

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INTRODUCTION

The objective of a measurement is to determine the value of the measurand, that is, the physical quantity that needs to be measured. Every measurement is subject to error, no matter how carefully it is conducted. The (absolute) error of a measurement is defined in [Eq 1](#).

All terms in [Eq 1](#) have the units of the physical quantity that is measured. This equation cannot be used to determine the error of a measurement because the true value is unknown, otherwise a measurement would not be needed. In fact, the true value of a measurand is unknowable because it cannot be measured without error. However, it is possible to estimate, with some confidence, the expected limits of error. This estimate is referred to as the uncertainty of the measurement and provides a quantitative indication of its quality.

Errors of measurement have two components, a random component and a systematic component. The former is due to a number of sources that affect a measurement in a random and uncontrolled manner. Random errors cannot be eliminated, but their effect on uncertainty is reduced by increasing the number of repeat measurements and by applying a statistical analysis to the results. Systematic errors remain unchanged when a measurement is repeated under the same conditions. Their effect on uncertainty cannot be completely eliminated either, but is reduced by applying corrections to account for the error contribution due to recognized systematic effects. The residual systematic error is unknown and shall be treated as a random error for the purpose of this standard.

General principles for evaluating and reporting measurement uncertainties are described in the Guide on Uncertainty of Measurements (GUM). Application of the GUM to fire test data presents some unique challenges. This standard shows how these challenges can be overcome. An example to illustrate application of the guidelines provided in this standard can be found in [Appendix X1](#).

$$\epsilon = y - Y \quad (1)$$

where:

ϵ = measurement error;

y = measured value of the measurand; and

Y = true value of the measurand.

1. Scope

1.1 This guide covers the evaluation and expression of uncertainty of measurements of fire test methods developed and maintained by ASTM International, based on the approach

presented in the GUM. The use in this process of precision data obtained from a round robin is also discussed.

1.2 The guidelines presented in this standard can also be applied to evaluate and express the uncertainty associated with fire test results. However, it may not be possible to quantify the uncertainty of fire test results if some sources of uncertainty cannot be accounted for. This problem is discussed in more detail in [Appendix X2](#).

1.3 Application of this guide is limited to tests that provide quantitative results in engineering units. This includes, for

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