ISO DIS/PRF 6021:2023(E)

ISO/TC 92/WG14

Date: 2023-01-27

Secretariat: ANSIBSI

Date: 2024-01-10

Firebrand generator

PROOF

ISO ~~Copyright Office~~copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: + 41 22 749 01 11

~~Email: copyright@iso.org~~

E-mail: copyright@iso.org
Website: ~~www.iso.org~~www.iso.org

Published in Switzerland~~.~~

Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO ~~documents~~document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

~~Attention is drawn~~ISO draws attention to the possibility that ~~some of~~ the ~~elements~~implementation of this document may ~~be~~involve the ~~subject~~use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights~~.~~ in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights. ~~Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).~~

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see ~~www.iso.org/iso/foreword.html~~www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 92, *Fire safety*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at ~~www.iso.org/members.html~~www.iso.org/members.html.

Introduction

Large outdoor fires present a risk to the built environment. Wildfires that spread into communities, referred to as wildland-urban interface (WUI) fires, have destroyed communities throughout the world and are a growing problem in fire safety science. Other examples are large urban fires, including those that have occurred after earthquakes. Over the past several decades, fire safety science research has invested a great deal of effort into understanding fire dynamics within buildings. Research into large outdoor fires, and how to potentially mitigate the loss of structures in such fires, lags behind other areas of fire safety science research. Once a wildland fire reaches a community and ignites structures, structure-structure fire spread can occur under similar mechanisms as in urban fire spread. Firebrand showers are a main driver of fire spread in large outdoor fires but there is no accepted internationally harmonized device to generate firebrand showers. The purpose of this document is to provide a solution for such harmonization. Within this document, the firebrand generator described is a stand-alone device.

Firebrand generator

1 Scope

This document specifies rules and requirements concerning the construction and operation of a firebrand generator. This document is applicable to all firebrand generators.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13943,, *Fire safety — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 and the following terms and definitions apply.

ISO and IEC maintain terminologicalterminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obphttps://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
firebrand
airborne object capable of acting as an ignition source and carried for some distance in an airstream

For further information, please see [Firebrands and Embers | SpringerLink][SOURCE: Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) fires;

Note 1 to entry: For further information, see Reference [18].

3.2
forest fire
unwanted fire burning forests and wildlands

[SOURCE: Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) fires]

Note 1 to entry: This term is used primarily, but not exclusively, in Europe.

Note 2 to entry: This term is defined in France as a fire that has reached forests, heaths, underbrush vegetation or scrub with an area of at least 1 hectare, regardless of the area travelled.

[SOURCE: References [20] and [21], modified — original texts have been restructured to fit ISO format.]

3.3
informal ~~settlements~~settlement
unplanned ~~settlements~~settlement and ~~areas~~area where housing is not in compliance with current planning and building regulations (unauthorized housing~~)~~)[SOURCE: UN Glossary of Environment Statistics][19]

~~[SOURCE: Glossary of Environment Statistics, Studies in Methods, Series F, No. 67, United Nations, New York, 1997; ISO TR24188:2022]~~

3.4
spot fire
fire caused by flying firebrands at a distance from the original fire

[SOURCE: ISO/TR 24188:2022, 3.1.9]

3.5
urban fire
fire ~~occuring~~which occurs in an urbanized area

[SOURCE: ISO~~(~~/TR 24188:2022, 3.1.11]

3.6
wildland fire
fire occurring in peat, forests, scrublands, grasslands or rangelands, either of natural origin or caused by human intervention

Note 1 to entry: This term is used primarily, but not exclusively, in North America.

[SOURCE: ISO/TS 19677:2019, 3.3, modified — reference to "peat" added and Note 1 to entry added]

3.7
wildland-urban interface
WUI
area where structures and other human development adjoin or overlap with wildland

[SOURCE: ISO/TS 19677:2019~~(en),~~ 3.4]

3.8
wildland-urban interface ~~-~~fire
WUI fire
wildland fire that has spread into the wildland-urban interface (WUI)

Note 1 to entry: It is also possible for fires to start in the willdland-urban interface (WUI) and spread into the wildland.

[SOURCE: ISO/TR 24188:2022]

4 Importance of firebrand showers on ignition processes

Large outdoor fires involve the interaction of topography, weather, vegetation and structures. Large outdoor fires differ from enclosure fires in several ways; most notably the fire spread processes are not

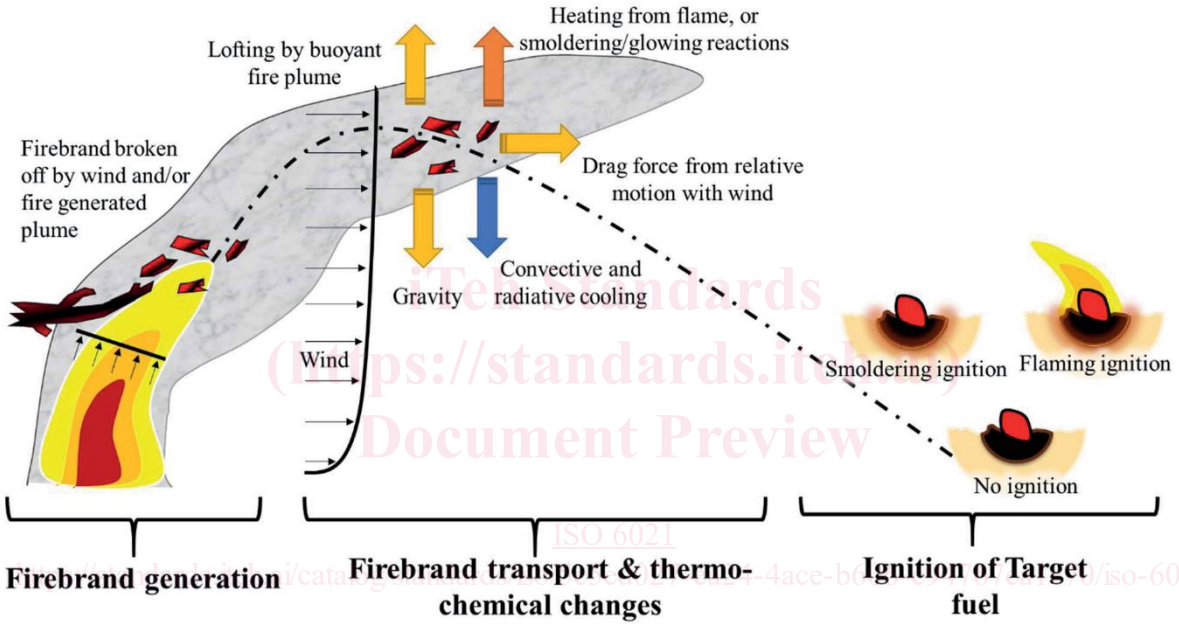
limited to well-defined boundaries, as is the case in traditional building or enclosure fires.[1-3],[1],[2],[3] Ignition couldcan occur in three ways[4].[4]

1) — directDirect flame contact.

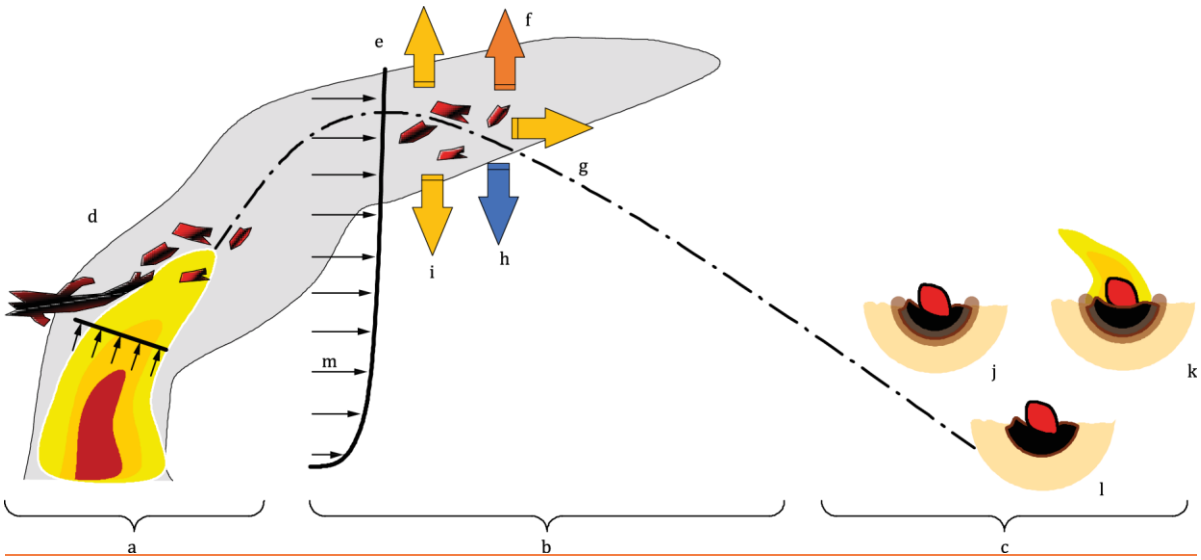
2) — thermalThermal radiation—: the probability of ignition is function of the distance and depends on the distance and on the time of exposure. This can occur at distances of tenths of metres. (dm).

3) — firebrands –Firebrands: the probability of ignition is function ofdepends on the accumulation. This can occur at long distances (several hundred metres).

Firebrand processes have been extensively reviewed.[1-4],[1],[2],[3],[4] Physical aspects of the firebrand processes are shown in Figure 1.Figure 1.



Key



a Firebrand generation.

b Firebrand transport and thermochemical changes.

c Ignition of target fuel.

d Firebrand broken off by wind and/or fire-generated plume.

e Lofting by buoyant fire plume.

f Heating from flame or smoldering/glowing reactions.

g Drag force from relative motion with wind.

h Convective and radiative cooling.

i Gravity.

~~i~~j ~~Gravity.~~Smoldering ignition.

~~j~~k ~~Smoldering~~Flaming ignition.

~~k~~l ~~Flaming~~No ignition.

~~l~~m ~~No ignition~~Wind.

~~m~~ ~~Wind.~~

Figure 1. — Firebrand processes in large outdoor fires~~, from 0.~~

5 Experimentally simulated firebrand showers

5.1 General

A major challenge in understanding firebrand transport and ignition is related to showers of firebrands that are generated in actual large outdoor fires. While studying the fundamental ignition processes of individual firebrands is important, these studies are not able to quantify the vulnerabilities of structures to ignition from firebrand showers or to elucidate the physics of firebrand transport. To accomplish this measurement, methods are required that are capable of replicating firebrand showers that occur in actual large outdoor fire events. In particular, well-controlled firebrand showers that can be produced in the laboratory are needed which can then be directed at various construction products as well as various vegetation types.

Alternative methods of firebrand generation are discussed in ~~Annex A.~~Annex A.