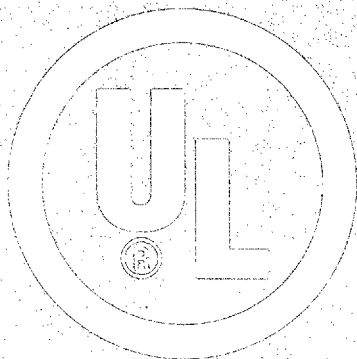


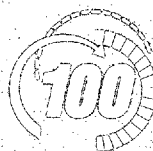


UL 910

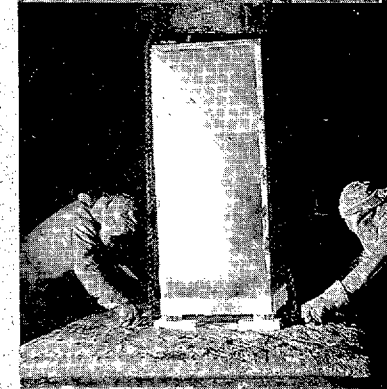
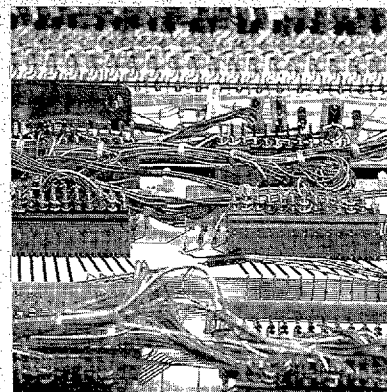
ISBN 0-7629-0370-8

Underwriters Laboratories Inc.
Standard for Safety

Test for Flame-Propagation and
Smoke-Density Values for
Electrical and Optical-Fiber
Cables Used in Spaces
Transporting Environmental Air



a century of public safety
established 1894



Documents

Document Sharing Hub

Northbrook, Illinois • (847) 272-8800
Melville, New York • (516) 271-6200
Santa Clara, California • (408) 985-2400
Research Triangle Park,
North Carolina • (919) 549-1400
Camas, Washington • (360) 817-5500



Underwriters Laboratories Inc., founded in 1894, is chartered as a not-for-profit organization without capital stock, under the laws of the State of Delaware, to establish, maintain, and operate laboratories for the examination and testing of devices, systems and materials to determine their relation to hazards to life and property, and to ascertain, define and publish standards, classifications and specifications for materials, devices, products, equipment, constructions, methods, and systems affecting such hazards.

UL Standards for Safety are developed under a procedure which provides for participation and comment from the affected public as well as industry. The procedure takes into consideration a survey of known existing standards and the needs and opinions of a wide variety of interests concerned with the subject matter of the standard. Thus manufacturers, consumers, individuals associated with consumer-oriented organizations, academicians, government officials, industrial and commercial users, inspection authorities, insurance interests and others provide input to UL in the formulating of UL Standards for Safety, to keep them consonant with social and technological advances.

Underwriters Laboratories Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety
for

Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air, UL 910

Fifth Edition, Dated November 23, 1998

The new and/or revised requirements are substantially in accordance with UL's Bulletin on this subject dated May 8, 1998. The bulletin is now obsolete and may be discarded.

The master for this Standard at UL's Northbrook Office is the official document insofar as it relates to a UL service and the compliance of a product with respect to the requirements for that product and service, or if there are questions regarding the accuracy of this Standard.

UL's Standards for Safety are copyrighted by UL. Neither a printed copy of a Standard, nor the distribution diskette for a Standard-on-Diskette and the file for the Standard on the distribution diskette should be altered in any way. All of UL's Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of UL.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of UL.

Revisions of UL Standards for Safety are issued from time to time. A UL Standard for Safety is current only if it incorporates the most recently adopted revisions.

UL provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will UL be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

UL will attempt to answer support requests concerning WordPerfect, Envoy, and Standards-on-Diskette. However, this support service is offered on a reasonable efforts basis only, and UL may not be able to resolve every support request. UL supports a Standards-on-Diskette only if it is used under the conditions and operating systems for which it is intended. UL's support policies may change from time-to-time without notification.

UL reserves the right to change the format, presentation, file types and formats, delivery methods and formats, and the like of both its printed and electronic Standards without prior notice.

Standards-on-Diskette purchasers agree to defend, indemnify, and hold UL harmless from and against any loss, expense, liability, damage, claim, or judgement (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing a Standard-on-Diskette on the purchaser's computer system.

If a single-user version Standards-on-Diskette was purchased, one copy of this Standard may be stored on the hard disk of a single personal computer, or on a single LAN file-server or the permanent storage device of a multiple-user computer in such a manner that this Standard may only be accessed by one user at a time and for which there is no possibility of multiple concurrent access. The original distribution diskette should be stored in a safe place.

If a multiple-user version Standards-on-Diskette was purchased, one copy of the Standard may be stored on a single LAN file-server, or on the permanent storage device of a multiple-user computer. The number of concurrent users shall not exceed the number of users authorized for the Standards-on-Diskette version. The original distribution diskette should be stored in a safe place.

Standards-on-Diskette are intended for on-line use, such as for viewing the requirements of a Standard, conducting a word search, and the like. Only one copy of the Standard may be printed from each single-user version of a Standards-on-Diskette. Only one copy of the Standard may be printed for each authorized user of a multiple-user version of a Standards-on-Diskette. An employee of an organization purchasing a Standard-on-Diskette can make a copy of the page or pages being viewed for their own fair and/or practical internal use. Because of differences in the computer/software/printer setup used by UL and those of Standards-on-Diskette purchasers, the printed copy obtained by a purchaser may not look exactly like the on-line screen view or the printed Standard.

The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

Copyright 1998 Underwriters Laboratories Inc.

NOVEMBER 23,1998

1

UL 910

Standard for

**Test for Flame-Propagation and Smoke-Density Values
for Electrical and Optical-Fiber Cables Used in
Spaces Transporting Environmental Air**

The First edition was titled Test Method for Fire and Smoke Characteristics of Cables Used in Air-Handling Spaces.

The Second edition was titled Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces.

First Edition – November, 1981
Second Edition – March, 1985
Third Edition – March, 1991
Fourth Edition – February, 1995

Fifth Edition

November 23, 1998

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

ISBN 0-7629-0370-8

COPYRIGHT © 1981, 1998 UNDERWRITERS LABORATORIES INC.

No Text on This Page

CONTENTS**FOREWORD****INTRODUCTION**

1 Scope	5
2 Units of Measurement	5

PERFORMANCE

3 Fire Test Room	5
4 Fire Test Apparatus	6
5 Test Specimens	18
6 Calibration of Test Equipment	18
7 Test Specimen Preparation	22
8 Test Procedure	23
9 Post-Test Clean-Up and Inspection	24
10 Calculation for Smoke Obscuration	24

REQUIREMENTS AND REPORT

11 Acceptance Criteria	25
12 Report	25

SUPPLEMENT SA – AIRFLOW, SMOKE AND HEAT RELEASE MEASUREMENTS AND DATA REPORTING**INTRODUCTION**

SA1 Scope	SA1
-----------------	-----

PERFORMANCE

SA2 Airflow Measurement	SA1
SA3 Smoke Release Rate Measurement	SA2
SA4 Heat Release Rate Measurement	SA3
SA5 Method for Determining Suitability of Oxygen Analyzers for Making Heat Release Measurements	SA8
SA6 Optional Data Report	SA9

FOREWORD

A. This Standard contains a description of the basic test method(s) for evaluating products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. This test method(s) is based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. It is subject to revision as further experience and investigation may show is necessary or desirable.

B. The consistent and uniform production of the product so that it will perform in the manner indicated by the coverage is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which performs in a specified manner will not necessarily be judged to be eligible for coverage if, when examined and tested, it is found to have other features which impair the significance associated with such performance.

D. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

E. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 This Standard covers the test method for determining values of flame-propagation distance and optical smoke density for electrical and optical-fiber cables that are intended to be installed in ducts, plenums, and other spaces used to transport environmental air without the cables being enclosed in raceways in those spaces.

1.2 The purpose of this test method is to determine whether the flame-propagation and smoke-generating characteristics of cables without raceways are within the limits specified in the National Electrical Code (NEC). Cables having adequate fire-resistant and low-smoke-producing characteristics need not comply with general wiring methods when the cables are installed (without raceways) in environmental-air ducts, concealed hollow building spaces used as ducts for environmental air, and other environmental-air-handling spaces not specifically excluded (areas involving grease and flammable dust, vapor, and the like). This test method is essentially the same as the test method described in the Standard Method of Test for Fire and Smoke Characteristics of Wires and Cables, NFPA 262.

1.3 This test method does not investigate the toxicity of the products of combustion or decomposition.

1.4 This test method does not cover the construction requirements for cables or the electrical, optical, or other performance requirements for cables.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Standard, and that involves a risk of fire or of electric shock or injury to persons, shall be evaluated using the appropriate additional component and end-product requirements to maintain the level of safety originally anticipated in the intent of this Standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions in this Standard cannot be judged to comply with this Standard. Where determined appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

2 Units of Measurement

2.1 If a value for measurement is followed by a value in other units in parentheses, the second value is approximate. The first stated value is the requirement.

PERFORMANCE

3 Fire Test Room

3.1 The fire test room in which the test chamber is located is to have provision for a free inflow of air to maintain the room at a controlled pressure of 0 – 0.05 inch (0 – 12 Pa) of water column with respect to barometric pressure and at a temperature of 73 ±5°F (23 ±3°C) and a relative humidity of 50 ±5 percent throughout each test.

4 Fire Test Apparatus

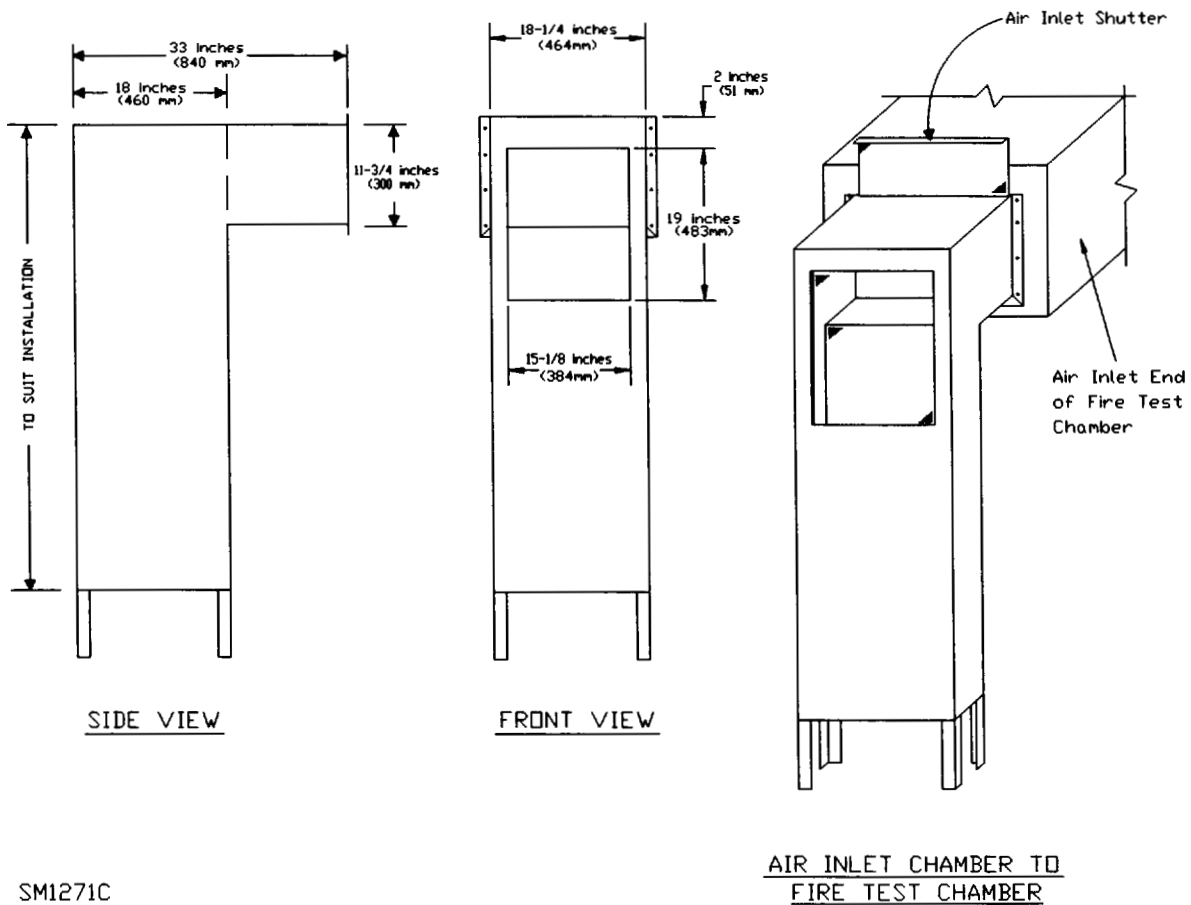
4.1 Air inlet chamber

4.1.1 The air inlet chamber prior to the inlet end of the fire test chamber consists of an L-shaped galvanized steel unit secured to the air inlet end of the fire test chamber. A schematic of the air inlet chamber is shown in Figure 4.1.

4.2 Air inlet shutter

4.2.1 A shutter extending the entire width of the test chamber is provided at the air inlet end of the fire test chamber. The shutter is positioned to provide an air inlet opening of $3 \pm 1/16$ inches (76 ± 2 mm) high measured from the floor level of the test chamber, as shown in Figure 4.2.

Figure 4.1
Schematic of the air inlet chamber



SM1271C

4.3 Fire test chamber

4.3.1 The fire test chamber consists of a horizontal duct having the shape and size shown in Figure 4.2 and Figure 4.3. The sides and base of the duct are lined with refractory firebrick¹, as illustrated in Figure 4.3. One side is provided with a row of two panes of 1/4 inch (6 mm) thick high temperature glass observation windows with the inside pane mounted flush with the inner wall of the firebrick (see Figure 4.3). The windows are pressure-tight [exposed area: $2\text{-}3/4 \pm 1/4$ inches by $11 \pm 1\text{-}1/2$ inches (70 ± 6 mm by 280 ± 38 mm)] and located so that the gas burner and the length of the specimens being tested, from the point at which the test fire ends, can be observed from outside the fire test chamber.

¹ The operation and calibration of this equipment is based on the use of refractory firebrick. The physical and thermal properties of the brick are:

Density = 51 lb/ft^3 (0.82 g/cm^3);
 Specific heat = $0.25 \text{ Btu/lb } ^\circ\text{F}$ ($1.05 \text{ kJ/kg-}^\circ\text{C}$).
 Thermal conductivity:
 $1.8 \text{ Btu in/ft}^2 \text{ hr } ^\circ\text{F}$ ($0.26 \text{ W/m-}^\circ\text{C}$) @ 400°F (205°C)
 $2.1 \text{ Btu in/ft}^2 \text{ hr } ^\circ\text{F}$ ($0.30 \text{ W/m-}^\circ\text{C}$) @ 800°F (425°C)
 $2.3 \text{ Btu in/ft}^2 \text{ hr } ^\circ\text{F}$ ($0.33 \text{ W/m-}^\circ\text{C}$) @ 1200°F (650°C)
 $2.5 \text{ Btu in/ft}^2 \text{ hr } ^\circ\text{F}$ ($0.36 \text{ W/m-}^\circ\text{C}$) @ 1600°F (870°C)
 $2.7 \text{ Btu in/ft}^2 \text{ hr } ^\circ\text{F}$ ($0.39 \text{ W/m-}^\circ\text{C}$) @ 2000°F (1095°C)

4.3.2 The top cover support ledges are to be fabricated of a structural material² capable of withstanding the abuse of continuous testing, level with respect to length and width of the chamber and each other.

² Water-cooled structural-steel tubing is suitable for this purpose; also high temperature furnace refractory such as Zicron have been found acceptable for this purpose.

4.3.3 To provide air turbulence for combustion, six 9 by 4-1/2 by 2-1/2 inch thick (230 by 115 by 65 mm) refractory firebricks (long dimension vertical and 4-1/2 inch dimension parallel to the wall) are positioned along the side walls of the chamber at distances of 6.5, 13, and 19 ± 0.5 ft (2.0 , 3.9 , and 5.8 ± 0.2 m, respectively) on the window side and 4.5, 9.5, 16 ± 0.5 ft (1.4 , 3.0 , and 4.9 ± 0.2 m), on the opposite side, as measured from the centerline of the gas burner to the centerline of the firebricks.

4.4 Gas burner

4.4.1 One end of the test chamber, designated as the "air inlet end" in Figure 4.2, is provided with a dual port gas burner delivering flames upward that engulf the test specimens. The burner is spaced $11\text{-}1/2 \pm 1/4$ inches (292 ± 6 mm) from the air inlet end of the fire test chamber and $7\text{-}1/2 \pm 1/4$ inches (191 ± 6 mm) below the removable top cover. The burner is located 52 ± 2 inches (1320 ± 51 mm) downstream of the air inlet shutter, as measured from the burner centerline to the outside surface of the shutter. Gas to the burner is provided through a single inlet pipe, distributed to each burner port through a tee-section. The outlet is a 3/4 inch (19 mm) elbow. The plane of the ports shall be parallel to the furnace floor, such that the gas is directed upward toward the specimen. Each port shall be positioned with its centerline $4 \pm 1/4$ inches (102 ± 6 mm) on each side of the centerline of the fire test chamber so that the ignition burner flame is evenly distributed (see Figure 4.3). Controls shall be used to maintain a constant flow of methane gas to the burner. A gas meter calibrated to read in increments of not more than 0.1 ft^3 (2.8 liters), shall be used to record gas consumption.

No Text on This Page

