

Entertainment Services and Technology Association



American National Standard
E1.29 -2009

Product Safety Standard for Theatrical Fog
Generators that Create Aerosols of Water,
Aqueous Solutions of Glycol or Glycerin, or
Aerosols of Highly Refined Alkane Mineral Oil

This is a preview of "ANSI E1.29 - 2009". [Click here to purchase the full version from the ANSI store.](#)

[inside front cover]

Entertainment Services and Technology Association



American National Standard E1.29 - 2009

Product Safety Standard for Theatrical Fog Generators That Create Aerosols of Water, Aqueous Solutions of Glycol or Glycerin, or Highly Refined Alkane Mineral Oil

F&S/2007-3004r5

This standard was approved as an American National Standard on 14 September 2009
by the American National Standards Institute's Board of Standards Review.

Copyright 2009 by ESTA, the Entertainment Services and Technology Association. All
rights reserved.

[This page is intentionally blank.]

Notice and Disclaimer

The Entertainment Services and Technology Association does not approve, inspect, or certify any installations, procedures, equipment or materials for compliance with codes, recommended practices or standards. Compliance with an ESTA standard or recommended practice, or an American National Standard developed by ESTA is the sole and exclusive responsibility of the manufacturer or provider and is entirely within their control and discretion. Any markings, identification or other claims of compliance do not constitute certification or approval of any type or nature whatsoever by ESTA.

ESTA neither guarantees nor warrants the accuracy or completeness of any information published herein and disclaim liability for any personal injury, property or other damage or injury of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document.

In issuing and distributing this document, ESTA does not either (a) undertake to render professional or other services for or on behalf of any person or entity, or (b) undertake any duty to any person or entity with respect to this document or its contents. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstance.

Published by:

Entertainment Services and Technology Association
875 Sixth Avenue, Suite 1005
New York, NY 10001 USA
Phone: 1-212-244-1505
Fax: 1-212-244-1502
standards@esta.org
<http://www.esta.org/>

For additional copies of this document contact:

ESTA Publications
The ESTA Foundation
875 Sixth Avenue, Suite 1005
New York, NY 10001 USA
Phone: 1-212-244-1505
Fax: 1-212-244-1502
<http://www.estafoundation.org>

The ESTA Technical Standards Program

The ESTA Technical Standards Program was created to serve the ESTA membership and the entertainment industry in technical standards related matters. The goal of the Program is to take a leading role regarding technology within the entertainment industry by creating recommended practices and standards, monitoring standards issues around the world on behalf of our members, and improving communications and safety within the industry. ESTA works closely with the technical standards efforts of other organizations within our industry, including USITT, PLASA, and VPLT, as well as representing the interests of ESTA members to ANSI, UL, and the NFPA. The Technical Standards Program is accredited by the American National Standards Institute.

The Technical Standards Committee (TSC) was established by ESTA's Board of Directors to oversee and coordinate the Technical Standards Program. Made up of individuals experienced in standards-making work from throughout our industry, the Committee approves all projects undertaken and assigns them to the appropriate working group. The Technical Standards Committee employs a Technical Standards Manager to coordinate the work of the Committee and its working groups as well as maintain a "Standards Watch" on behalf of members. Working groups include: Camera Cranes, Control Protocols, Electrical Power, Floors, Fog and Smoke, Followspot Position, Photometrics, and Rigging.

ESTA encourages active participation in the Technical Standards Program. There are several ways to become involved. If you would like to become a member of an existing working group, as have over two hundred people, you must complete an application which is available from the ESTA office. Your application is subject to approval by the working group and you will be required to actively participate in the work of the group. This includes responding to letter ballots and attending meetings. Membership in ESTA is not a requirement. You can also become involved by requesting that the TSC develop a standard or a recommended practice in an area of concern to you.

The Fog & Smoke Working Group, which authored this standard, consists of a cross section of entertainment industry professionals representing a diversity of interests related to fog and special effects for theatrical events. ESTA is committed to developing consensus-based standards in an open setting. Future Fog & Smoke Working Group projects will include updating this publication as changes in technology and experience warrant, as well as developing new standards and recommended practices for the benefit of the entertainment industry.

Contact Information

Entertainment Services and Technology Association

Karl G. Ruling
Technical Standards Manager
ESTA
875 Sixth Avenue, Suite 1005
New York, NY 10001
Phone: 1-212-244-1505
FAX: 1-212-244-1502
standards@esta.org

Technical Standards Committee Chairperson

Mike Garl
James Thomas Engineering, Inc.
10240 Caneel Drive
Knoxville, TN 37931
Phone: 1-865-692-3060
FAX: 1-865-692-9020
mikeg@jthomaseng.com

Fog & Smoke Working Group Chairpersons

Larry Schoeneman
Designlab Chicago, Inc.
328 N. Albany Avenue
Chicago, IL 60612
1-773-265-1100 x13
1-773-265-0800
Larry@dlabchicago.net

M. Brad Dittmer
Downhome Productions
1112 Eaglecrest Street
Nixa, MO 65714
1-417-724-8778
1-417-724-8777
bdittmer@downhomeproductions.com

Acknowledgments

The Fog & Smoke Working Group was the consensus body for the development of this Standard. The working group's membership and company affiliations at the time the working group approved this standard on 18 March 2009 are listed below:

Voting Members

Ron Bonner; PLASA [G]
Patrick Boyd; Jauchem & Meeh, Inc. [DR]
M. Brad Dittmer; Downhome Productions [U]
Ulrich Borup Hansen; Martin Professional A/S [MP]
Wendy Holt; Alliance of Motion Picture and Television Producers [U]
Edwin S. Kramer; I.A.T.S.E. Local 1 [U]
Greg Meeh; Jauchem & Meeh, Inc. [DR]
Martin Michaud; MDG Fog Generators Ltd. [MP]
Larry Schoeneman; Designlab Chicago, Inc. [DR]
Eric Tishman; Rosco Laboratories [MP]
Mike Wood; Mike Wood Consulting LLC [G]

Observer Members (Non-voting)

Robert Barbagallo; Solotech Inc. [U]
Marty Clausen; Safety & Health in Arts Production Entertainment [G]
Jim Cooper; Palomar College, representing USITT [U]
Gary Crawford; C I T C [MP]
Mark Elliott; Walt Disney Company [U]
Gary Fails; City Theatrical, Inc. [MP]
Lowell Fowler; High End Systems Inc. [MP]
Douglas Franz; QVC Network [U]
Reuben Goldberg; Technic Services [U]
Jerry Gorrell; Theatre Safety Programs [G]
Kent H. Jorgensen; IATSE Local 80 [G]
Nathan Kahn; Look Solutions USA Ltd. [MP]
Stephanie Kelly; Phoenix Stages/Convention Center, the City of Phoenix [G]
Thomas V. Korder; Krannert Center for the Performing Arts, the University of Illinois [U]
Peggy Lee Martindale; University of Texas, Austin [G]
Don Phillips; Le Maitre Special Effects [MP]
Julie Rogers; City of Phoenix Civic Plaza [G]
Monona Rossol; Arts, Crafts & Theater Safety [G]
Adrian Segeren; Le Maitre Special Effects [MP]
Marnie Styles; Le Maitre Special Effects [MP]
Stephen Vanciel [U]
Florian von Hofen; VPLT [G]
Colin Waters; TMB [G]
Norman Wright; Group One [DR]

[CP] Custom-market producer
[MP] Mass-market producer
[DR] Dealer or rental company
[U] User
[G] General interest

Contents

Notice and Disclaimer	i
Contact Information	iii
Acknowledgments	iv
Foreword (non-mandatory, informative only)	vi
1 Introduction	1
1.1 Scope	1
1.2 Definitions	1
1.3 Referenced publications	2
2 Requirements	2
2.1 General	2
2.2 Modifications	2
2.2.1 Flexible power cords	2
2.2.2 Conductor gauges	3
2.2.3 Screw fastener sizes	3
2.2.4 Consideration of the effects of fog fluid on components	3
2.2.5 Fans shall be guarded regardless of mass and rotational speed	4
2.2.6 Aerosol hygiene	4
2.2.6.1 Fog generators that use glycol, glycerin, or white mineral oil	4
2.2.6.2 Fog generators that use heated water and no glycol, glycerin, or mineral oil	5
2.2.6.3 Fog generators that use unheated water and no glycol, glycerin, or mineral oil	5
2.2.7 Markings and warnings	6
2.2.8 User operating instructions	6

Foreword (non-mandatory, informative only)

This Standard is intended to help guide product safety testing laboratory personnel in their evaluation of fog-making equipment for design or construction defects that might create unacceptable hazards to users of the equipment or the public. It is based on ANSI/UL 998 - 2006, Humidifiers, and adopts the requirements of that standard, but with modifications as noted in this Standard.

Many of the modifications listed in this Standard are to allow the use of components sized in SI units. ANSI/UL 998 - 2006 uses SI units as the primary units, but they are hard conversions from the US customary units used historically and describe few or no real components. It is in the interests of the industry and the end-users of the products covered by this Standard to advance the development of products for a global market, so this Standard attempts to correct the regional bias in the component descriptions of the UL document without compromising safety.

1 Introduction

1.1 Scope

The requirements of this Standard cover electrically powered theatrical fog generators rated 600 V or less, intended for use in professional live theatrical entertainment, professional film and video production, theme parks, and fire safety training, and to be used in accordance with the requirements of ANSI/NFPA 70, and the Canadian Electrical Code (CEC), Part 1, C22.1.

1.1.1 The theatrical fog generators that are the subject of this Standard use one or more of the following fluids.

Name	Chemical Abstracts Service (CAS) #
triethylene glycol	112-27-6
monopropylene glycol (propylene glycol; 1,2-propanediol)	57-55-6
diethylene glycol	111-46-6
dipropylene glycol	25265-71-8, 106-62-7, 110-98-5, 108-61-2
1,2-butylene glycol (1,2-butanediol)	584-03-2
1,3-butylene glycol (1,3-butanediol)	107-88-0
glycerin (glycerol; 1,2,3- propanetriol)	56-81-5
white mineral oil, medicinal or food grade	8042-47-5
water	07732-18-5
nitrogen, liquefied (LN2, L-N2))	7727-37-9
oxygen, liquefied (LOX)	80937-33-3
carbon dioxide, liquified (LCO2, L-CO2)	124-38-9

Fog generators that use fog fluids not on this list are outside the scope of this Standard.

1.1.2 The aerosols created by the theatrical fog generators within the scope of this Standard are injected directly into the environment or are carried out of the fog generating equipment on a stream of ambient air, or a stream of nitrogen, argon, carbon dioxide, or a mixture of nitrogen and oxygen that approximates the composition of normal air. The Chemical Abstracts Service registry numbers for the gases that are used as vehicles for the aerosols within the scope of this Standard are as follows:

Name	CAS #
oxygen	7782-44-7
nitrogen	7727-37-9
argon	7440-37-1
carbon dioxide	124-38-9

Fog generators that use gases not on this list are outside the scope of this Standard.

1.2 Definitions

The following definitions apply in this Standard:

1.2.1 Alkane mineral oil, highly refined: water-clear white mineral oil, consisting almost entirely of saturated hydrocarbons (alkanes), lacking significant amounts of aromatic hydrocarbons, and suitable for use in medicines or food.