



ANSI E1.29 – 2009 (R2014)

**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/2007-3004r5a

This document was approved as an American National Standard by the ANSI Board of Standards Review on 9 June 2014. It is a reaffirmation of the 2009 edition, F&S/2007-3004r5.

This standard was originally published when the Entertainment Services and Technology Association was operating under the name of PLASA North America.

ESTA has reverted to its original name, and this document has been rebranded with the current corporate name and logo. No changes have been made to the contents of the standard.

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## **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 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.

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The Fog & Smoke Working Group, which authored this Standard, consists of a cross section of entertainment industry professionals representing a diversity of interests. ESTA is committed to developing consensus-based standards and recommended practices in an open setting.

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### Interest category codes:

CP = Custom-market Producer  
DE = Designer  
DR = Dealer or Rental company  
G = General interest  
MP = Mass-market Producer  
U = User

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## **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.

**1.2.2 Class 2 Circuit:** The portion of the wiring system between the load side of a Class 2 power source and the connected equipment. A Class 2 power source is limited to 0 to 20 volts at 100 watts or 5 amps; 21 to 30 volts at 100 watts or 3.3 amps; and 31 to 150 volts at 0.5 watts or 5 milliamps.