



## **ANSI E1.46 — 2018**

### **STANDARD FOR THE PREVENTION OF FALLS FROM THEATRICAL STAGES AND RAISED PERFORMANCE PLATFORMS**

FL/2012-8002r8

Approved by the ANSI Board of Standards Review on 13 July 2018.

## NOTICE AND DISCLAIMER

ESTA does not approve, inspect, or certify any installations, procedures, equipment or materials for compliance with codes, recommended practices or standards. Compliance with a 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.

Note: Draft or proposed standards or recommended practices are subject to change. Conformance to a draft or proposed standard or recommended practice is no assurance that the product or service complies with the final approved standard or practice or any other version thereof.

### **Published by:**

The Entertainment Services and Technology Association  
630 Ninth Avenue, Suite 609  
New York, NY 10036  
USA  
Phone: 1-212-244-1505  
Fax: 1-212-244-1502  
[standards@esta.org](mailto:standards@esta.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 ESA, DTHG, 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.

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

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 four 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 Floors 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.

## Investors in Innovation

The Technical Standard Program (TSP) is financially supported by ESTA and by companies and individuals who make undirected donations to the TSP. Contributing companies and individuals who have helped fund the TSP are recognized as “Investors in Innovation.” The Investors in Innovation when this standard was approved by ANSI's Board of Standards Review include these companies and individuals:

### **VISIONARY LEADERS** (\$50,000 & up)

ETC

ProSight Specialty Insurance

### **VISIONARY** (\$10,000 & up; >100 employees/members)

Chauvet Professional

Martin by Harman

Cisco

Robe

Columbus McKinnon Entertainment Technology

Walt Disney Parks and Resorts

### **VISIONARY** (\$5,000 & up; 20–100 employees/members)

Altman Lighting, Inc.

Rose Brand

German Light Products

Stage Rigging

JR Clancy

TMB

McLaren Engineering Group

Tyler Truss Systems, Inc.

### **VISIONARY** (\$500 & up; <20 employees/members)

About the Stage

Mike Garl Consulting

B-Hive Industries, Inc.

Mike Wood Consulting

Scott Blair

Power Gems

Boston Illumination Group

Reed Rigging

Louis Bradfield

Reliable Design Services

Candela Controls Inc.

Alan Rowe

Clark Reder Engineering

David Saltiel

Tracey Cosgrove & Mark McKinney

Sapsis Rigging Inc.

Doug Fleenor Design

Stageworks

EGL Event Production Services

Dana Taylor

Entertainment Project Services

Steve Terry

Neil Huff

Theatre Projects

Hughston Engineering Inc.

Theatre Safety Programs

Interactive Technologies

Tobins Lake Sales Theatrical Supply

Lankey & Limey Ltd.

Vertigo

Jules Lauve

Steve A. Walker & Associates

Brian Lawlor

Westview Productions

Limelight Productions, Inc.

WNP Services

John T. McGraw

### **INVESTOR** (\$3,000–\$9,999; >100 employees/members)

Actors' Equity Association

Lex

Barbizon Lighting Company

NAMM

Golden Sea Professional Equipment Limited

Rosco Laboratories

IATSE Local 728

Texas Scenic Company

IATSE Local 891

**INVESTOR** (\$1,500–\$4,999; 20–100 employees/members)

American Society of Theatre Consultants  
Area Four Industries  
BMI Supply  
City Theatrical Inc.  
InterAmerica Stage, Inc.  
Lycian Stage Lighting

Morpheus Lights  
Niscon Inc.  
Syracuse Scenery and Stage Lighting  
Tomcat  
XSF Xtreme Structures and Fabrication

**INVESTOR** (\$200–\$499; <20 employees/members)

Benjamin Cohen  
Bright Ideas Custom Electronics Inc.  
Bruce Darden  
K5600, Inc.  
Indianapolis Stage Sales & Rentals, Inc.  
Jason Kyle

Eric Loader  
Moss LED  
Robert Scales  
Stephen Vanciel  
Suga Koubou Co., Ltd.

**SUPPORTER** (<\$3,000; >100 employees/members)

Ian Foulds, IATSE Local 873  
Harlequin Floors

PSAV  
Thern Stage Equipment  
USAI Lighting

**SUPPORTER** (<\$1,500; 20–100 employees/members)

Aerial Arts  
Blizzard Lighting, LLC  
Creative Stage Lighting  
Geiger Engineers  
H&H Specialties  
High Output  
InCord  
iWeiss  
Oasis Stage Werks

Serapid  
Stage Equipment & Lighting  
Stagemaker  
Thermotex Industries, Inc.  
Total Structures  
Ultratec Special Effects  
Vincent Lighting Systems  
Zhuhai Shengchang Electronics Co.

**SUPPORTER** (<\$200; <20 employees/members)

AC Power Distribution, Inc.  
Michael Cowger  
Peter Donovan  
Entertainment Project Services, LLC  
Tony Giovannetti  
Pat Grenfell  
Mitch Hefter  
Bill Hektner  
Alan Hendrickson  
Hoist Sales and Services  
John Huntington  
Beverly and Tom Inglesby  
Intensity Advisors  
JSAV  
Eddie Kramer  
J.P. Kyle

Michael Lay  
John Musarra  
Shawn Nolan  
Lizz Pittsley  
Phil Reilly  
Charles Scott  
Michael Skinner  
Skjonberg Controls Inc.  
Stage Labor of the Ozarks  
Studio T+L, LLC  
John Szewczuk  
Teclumen  
Theta Consulting  
Tracy Underhill  
Robert L. Williams

All donations to the TSP support the Technical Standards Program in general and are not directed to or for the benefit of any particular technical standard project or any Working Group working on any particular standard or project.

**Contact Information:**

**Technical Standards Manager**

Karl G. Ruling  
The Entertainment Services and Technology Association  
630 Ninth Avenue, Suite 609  
New York, NY 10036  
USA  
1-212-244-1505  
karl.ruling@esta.org

**Assistant Technical Standards Manager**

Richard Nix  
The Entertainment Services and Technology Association  
630 Ninth Avenue, Suite 609  
New York, NY 10036  
USA  
1-212-244-1505  
richard.nix@esta.org

**Technical Standards Council Chairpersons**

Mike Garl  
Mike Garl Consulting LLC  
836 Smoke Creek Rd.  
Knoxville, TN 37934  
USA  
1-865-389-4371  
mike@mikegarlconsulting.com

Mike Wood  
Mike Wood Consulting LLC  
3705 Ebony Hollow Pass  
Austin, TX 78739  
USA  
1-512-288-4916  
mike@mikewoodconsulting.com

**Floors Working Group Chairpersons**

Jerry Gorrell  
Theatre Safety Programs  
P. O. Box 17734  
Fountain Hills, AZ 85269  
USA  
1-480-837-9401  
jerryg@jgorrell.com

Tim Hansen  
Oasis Stage Werks  
249 S. Rio Grande Street  
Salt Lake City, UT 84101  
USA  
1-801-363-0364  
thansen@oasis-stage.com

## Acknowledgments

The Floors Working Group members when this document was approved by the working group on 31 May 2018 were.

### Voting members:

Patricia Basileo; American Harlequin Corp. (Harlequin Corporation); MP  
Bob Dagger; American Harlequin Corp. (Harlequin Corporation); MP  
William Gillett; Walt Disney Parks and Resorts (the Walt Disney Company); U  
Jerry Gorrell; Theatre Safety Programs; U  
Steve Gough; American Harlequin Corp. (Harlequin Corporation); MP  
Tim Hansen; Oasis Stage Werks; MP  
Pete Happe; G  
Gary Justesen; Oasis Stage Werks; MP  
Fred Kosiewski; Walt Disney Parks & Creative Entertainment (the Walt Disney Company); U  
Dave LaPage; Productions Unlimited, Inc.; DR  
Kasper Nyboe; American Harlequin Corp. (Harlequin Corporation); MP  
Karl G. Ruling; Unit 12 Productions; DE  
Robert R. Scales; U  
Steven Serafin; Chubb Group of Insurance Companies; G  
Keith Sklar; Actors' Equity Association; G  
Stephen Spendiff; Rosco Canada (Rosco Laboratories); MP

### Observer (non-voting) members:

Robert Barbagallo; Solotech Inc.; DR  
K.J. Bartosh; U  
Mark Elliott; the Walt Disney Company; U  
Robert Haycock; Cal Performances (UC Berkeley); U  
Nevin Kleege; Kleege Industries; G  
Jeong Sik Yoo; Ghost LX; DE

### Interest category codes:

CP = custom-market producer  
DE = designer  
DR = dealer rental company  
G = general interest  
MP = mass-market producer  
U = user

## Table of Contents

NOTICE AND DISCLAIMER.....	ii
Investors in Innovation.....	iv
Contact Information.....	vi
Acknowledgments.....	vii
1 Scope (mandatory).....	1
2 Problem (informative).....	1
2.1 Fall protection is needed.....	1
2.2 Adequate fall protection often is not provided.....	1
3 Solution.....	1
3.1 Purpose of this Standard (informative).....	1
3.2 Language used in this Standard (mandatory).....	1
3.3 Definitions (mandatory).....	1
3.4 Requirements (mandatory).....	2
3.4.1 Stages and raised performance platforms shall have a fall protection plan.....	2
3.4.2 The fall protection plan shall be implemented.....	2
3.4.3 The fall protection plan shall be evaluated on a regular schedule.....	3
3.4.4 The fall protection plan shall be revised for improvement.....	3
3.4.5 The fall protection plan shall be documented.....	3
4 General guidance (informative).....	3
4.1 Use risk assessment.....	3
4.1.1 General.....	3
4.1.2 Identify the affected parties.....	3
4.1.3 Identify the hazards.....	3
4.1.4 Assess and rank the risk.....	4
4.1.5 Record the risk assessment.....	5
4.2 Design a fall protection plan to control the risk.....	5
4.2.1 Consider the hierarchy of controls in developing the plan.....	5
4.2.2 The fall protection plan should be reasonable.....	6
4.2.3 Share the plan with others and revise as necessary.....	6
4.3 Implement the fall protection plan.....	6
4.3.1 Buy and install needed equipment.....	6
4.3.2 Train the people needing to be trained.....	6
4.3.3 Train and retrain people as needed.....	6
4.3.4 Enforce the use of the plan.....	6
4.4 Review and revise the plan to improve it.....	6
4.4.1 Review and revise the plan on a regular basis.....	6
4.4.2 Review and revise the plan if the venue or the people using it change significantly.....	6
4.4.3 Review and revise the plan whenever a fall occurs or almost occurs.....	7
5 Specific guidance (informative).....	7
5.1 The front edge of the stage.....	7
5.1.1 Elimination or substitution of the fall hazard.....	7
5.1.2 Engineering controls to isolate the hazard.....	8
5.1.2.1 Standard guardrails.....	8
5.1.2.2 Other barriers.....	8
5.1.2.3 Fire safety curtains.....	9
5.1.3 Administration: implementation of safe work practices, procedures, and policies.....	9
5.1.3.1 Performer Blocking as protection.....	9
5.1.3.2 Stage edge marking.....	9
5.1.3.3 Safe passage marking.....	10
5.1.3.4 Escorts.....	10



5.1.3.5 Verbal warnings and signage.....	10
5.1.4 Personal protective equipment.....	10
5.2 Raised performance platforms.....	10
5.3 Orchestra Pit Bridges and Passerelles.....	10
5.4 Traps and holes in the stage floor.....	11
5.5 Stage lifts.....	11
5.6 Choral and orchestra risers.....	11
Annex A (Informative) – Federal OSHA Regulations.....	12
29 CFR 1910.28, Duty to have fall protection and falling object protection. (general industry).....	12
29 CFR 1926.501, Duty to have fall protection. (construction industry).....	14
29 CFR 1926.502 Fall protection systems criteria and practices. (construction industry).....	14
29 CFR 1926.503 Training requirements. (construction industry).....	23
Annex B (Informative) – Example Of An Orchestra Lift Safety Program.....	25
Annex C (Informative) – Example of a Plan for Installing an Apron Extension.....	26
Annex D (Informative) – Selected Building Code Requirements.....	28

## 1 Scope (mandatory)

This Standard offers guidance to people working in the entertainment industry on preventing falls by performers, technicians, and members of the public from theatrical stages and raised performance platforms into orchestra pits, into audience areas, into stage traps, and from raised surfaces to surfaces that are lower. Its guidance is intended to be applied to stages and raised platforms used for performance of a show or event to an audience. It is not intended to offer guidance for fall protection in off-stage areas or audience spaces, such as theatre lobbies, although the recommendations in this Standard may be used in those areas at the discretion of the reader. The guidance offered in this Standard may be applied on a per show basis or to a performance venue.

## 2 Problem (informative)

### 2.1 Fall protection is needed

Management, supervisors, and workers have a responsibility to ensure that all persons are kept safe from fall hazards. Workplace health and safety regulations in virtually all industrialized nations require this, but it is also good management. Falls and the injuries that result are expensive in money and time. Even when there is no significant injury, a fall stops a show, stops work, and generally wastes time and damages morale.

### 2.2 Adequate fall protection often is not provided

Because a standard guardrail historically has not been installed across the front of a stage, and because a guardrail would be visibly obtrusive in most stage shows, there is the common perception that stages and raised performance platforms are special places where fall protection is not needed. The expectation is that people understand that the edge of a stage or raised platform, or an open trap in a stage floor, is a danger and will take appropriate action to protect themselves. This expectation is often proven to be unfounded, with expensive results.

## 3 Solution

### 3.1 Purpose of this Standard (informative)

The purpose of this Standard is to encourage people in safety management positions to accept their responsibility to provide fall protection against falls from stages and raised performance platforms for all the people whom they might need to protect in an entertainment venue. The purpose of this Standard also is to help them successfully fulfill that responsibility. It lays out what is required to provide this protection, and offers suggestions on some of the methods that might be used.

This Standard is not written as a compliance or enforcement document.

### 3.2 Language used in this Standard (mandatory)

**3.2.1** "Shall," "shall not," and "shall not be" indicate mandatory requirements.

**3.2.2** "Should" indicates something that is recommended but not mandatory. "Should not" indicates something that is not recommended but that is not prohibited.

### 3.3 Definitions (mandatory)

**Competent Person:** a person who is capable of identifying existing and predictable hazards in the workplace, and who is authorized to take prompt corrective measures to eliminate hazards.

**Orchestra pit bridge:** in a theatre, a narrow walkway that extends over the orchestra pit from the stage.

**Passerelle:** in a theatre, a narrow walkway that extends from the stage and that encircles the orchestra pit, separating the pit from the auditorium.

**Performer Blocking:** how the performers are placed and move around on the stage during rehearsals or performances of a play, dance, or other entertainment event.