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
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:

<table>
<thead>
<tr>
<th>Visionary Leaders ($50,000 &amp; up)</th>
<th>ProSight Specialty Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ETC</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Visionary ($10,000 &amp; up; &gt;100 employees/members)</strong></td>
<td></td>
</tr>
<tr>
<td>Chauvet Professional</td>
<td>Martin by Harman</td>
</tr>
<tr>
<td>Cisco</td>
<td>Robe</td>
</tr>
<tr>
<td>Columbus McKinnon Entertainment Technology</td>
<td>Walt Disney Parks and Resorts</td>
</tr>
<tr>
<td><strong>Visionary ($5,000 &amp; up; 20-100 employees/members)</strong></td>
<td></td>
</tr>
<tr>
<td>Altman Lighting, Inc.</td>
<td>Rose Brand</td>
</tr>
<tr>
<td>German Light Products</td>
<td>Stage Rigging</td>
</tr>
<tr>
<td>JR Clancy</td>
<td>TMB</td>
</tr>
<tr>
<td>McLaren Engineering Group</td>
<td>Tyler Truss Systems, Inc.</td>
</tr>
<tr>
<td><strong>Visionary ($500 &amp; up; &lt;20 employees/members)</strong></td>
<td></td>
</tr>
<tr>
<td>About the Stage</td>
<td>Mike Garl Consulting</td>
</tr>
<tr>
<td>B-Hive Industries, Inc.</td>
<td>Mike Wood Consulting</td>
</tr>
<tr>
<td>Scott Blair</td>
<td>Power Gems</td>
</tr>
<tr>
<td>Boston Illumination Group</td>
<td>Reed Rigging</td>
</tr>
<tr>
<td>Louis Bradfield</td>
<td>Reliable Design Services</td>
</tr>
<tr>
<td>Candela Controls Inc.</td>
<td>Alan Rowe</td>
</tr>
<tr>
<td>Clark Reder Engineering</td>
<td>David Saitiel</td>
</tr>
<tr>
<td>Tracey Cosgrove &amp; Mark McKinney</td>
<td>Sapsis Rigging Inc.</td>
</tr>
<tr>
<td>Doug Fleenor Design</td>
<td>Stageworks</td>
</tr>
<tr>
<td>EGI Event Production Services</td>
<td>Dana Taylor</td>
</tr>
<tr>
<td>Entertainment Project Services</td>
<td>Steve Terry</td>
</tr>
<tr>
<td>Neil Huff</td>
<td>Theatre Projects</td>
</tr>
<tr>
<td>Hughston Engineering Inc.</td>
<td>Theatre Safety Programs</td>
</tr>
<tr>
<td>Interactive Technologies</td>
<td>Tobins Lake Sales Theatrical Supply</td>
</tr>
<tr>
<td>Lankey &amp; Limey Ltd.</td>
<td>Vertigo</td>
</tr>
<tr>
<td>Jules Lauve</td>
<td>Steve A. Walker &amp; Associates</td>
</tr>
<tr>
<td>Brian Lawlor</td>
<td>Westview Productions</td>
</tr>
<tr>
<td>Limelight Productions, Inc.</td>
<td>WNP Services</td>
</tr>
<tr>
<td>John T. McGraw</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investor ($3,000–$9,999; &gt;100 employees/members)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors' Equity Association</td>
<td>Lex</td>
</tr>
<tr>
<td>Barbizon Lighting Company</td>
<td>NAMM</td>
</tr>
<tr>
<td>Golden Sea Professional Equipment Limited</td>
<td>Rosco Laboratories</td>
</tr>
<tr>
<td>IATSE Local 728</td>
<td>Texas Scenic Company</td>
</tr>
<tr>
<td>IATSE Local 891</td>
<td></td>
</tr>
</tbody>
</table>
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

INVESTOR ($200–$499; <20 employees/members)
Benjamin Cohen
Bright Ideas Custom Electronics Inc.
Bruce Darden
K5600, Inc.
Indianapolis Stage Sales & Rentals, Inc.
Jason Kyle

SUPPORTER (<$3,000; >100 employees/members)
Ian Foulds, IATSE Local 873
Harlequin Floors

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

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

Morpheus Lights
Niscon Inc.
Syracuse Scenery and Stage Lighting
Tomcat
XSF Xtreme Structures and Fabrication
Eric Loader
Moss LED
Robert Scales
Stephen Vanciel
Suga Koubou Co., Ltd.
PSAV
Them Stage Equipment
USAI Lighting
Serapid
Stage Equipment & Lighting
Stagemaker
Thermetex Industries, Inc.
Total Structures
Ultrace Special Effects
Vincent Lighting Systems
Zhuhai Shengchang Electronics Co.
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@jjgorrell.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 Daggar; 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

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