



# **ANSI E1.47 - 2017, Entertainment Technology—Recommended Guidelines for Entertainment Rigging System Inspections**

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**Interest category codes:**

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

## ANSI E1.47 - 2017, Entertainment Technology—Recommended Guidelines for Entertainment Rigging System Inspections

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## 1 Introduction

Entertainment rigging systems are systems used to move, lift or support scenery, luminaires, and other equipment in entertainment venues, such as theatres, video/film studios, amphitheatres, and arenas used for live performances or special events. Routine inspection of entertainment rigging systems is required in order to provide a safe working environment and to comply with ANSI rigging standards. This document offers guidance to inform owners, users and inspectors about the process of inspecting entertainment rigging systems. ESTA has written this recommended practice to promote proper inspection of entertainment rigging systems, to enhance safety of system users and audiences, to enhance the longevity and performance of systems and identification of potential equipment problems, to assist in regulatory compliance, and to reduce liability associated with the operation of entertainment rigging systems.

The purpose of an entertainment rigging inspection is to provide information about the condition of the systems and components at the time of the inspection. Nothing should be inferred regarding the future performance of the system as a result of this inspection.

## 2 Scope of this document

### 2.1 General

These guidelines include recommended inspector qualifications and responsibilities, scope and frequency of inspections, content of the rigging inspection report, and related information concerning the inspection process.

### 2.2 Exclusions

These guidelines do not pertain to the process of inspecting:

**2.2.1** Temporary entertainment rigging systems.

**2.2.2** Performer flying rigging systems.

**2.2.3** The building structure.

**2.2.4** The building electrical infrastructure.

## 3 Definitions

Definitions contained in this section apply to this guideline. Where terms are not defined in this section, they should be defined using their ordinarily accepted dictionary meanings within the specific context of their use.

**3.1 inspector:** The person engaging in the examination of entertainment rigging systems.

**3.2 lifting media:** The load carrying element that is attached from a batten through blocks to the counterweight carriage or is driven by the hoist to move the load (e.g. wire rope, roller chain).

**3.3 limits of use:** The parameters under which the system is designed to operate (e.g. working load limit, speed of movement, duty cycle, environmental conditions, user skill level, availability of maintenance).

**3.4 lineset:** A system of multiple lift lines, operated together to raise, lower, or suspend a load.

**3.5 owner:** the legal entity which exercises control over management and recordkeeping functions relating to a building and/or facility in which activities covered by this document take place.

**3.6 qualified person:** A person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

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**3.7 user:** Any person who operates the installed rigging equipment.

**3.8 working load limit:** The maximum load the user may apply under normal operating conditions.

#### **4 Reference information**

The following are codes, regulations and standards typically used in the entertainment industry. This listing is provided as a basis of knowledge for the inspector and as background information for owners and users. Rigging inspections should be performed referencing the edition current at the time of the inspection and the edition referenced should be noted in the inspection report.

Occupational Safety and Health Act of 1970 Section 5 – Duties

American National Standard E1.2 - Entertainment Technology Design, Manufacture and Use of Aluminum Trusses and Towers

American National Standard E1.22 - Entertainment Technology Fire Safety Curtain Systems

American National Standard E1.4 - Entertainment Technology, Manual Counterweight Rigging Systems

American National Standard E1.6-1 - Entertainment Technology, Powered Hoist Systems

American National Standard E1.6-2 - Entertainment Technology — Design, Inspection, and Maintenance of Electric Chain Hoists for the Entertainment Industry

American National Standard E1.6-4 - Portable Control of Fixed-Speed Electric Chain Hoists in the Entertainment Industry

American National Standard Z359 - Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

NFPA 80: Standard for Fire Doors and Other Opening Protectives

NFPA 70: National Electrical Code

#### **5 Qualifications of the inspector**

##### **5.1 Work experience**

**5.1.1** The inspector should have a minimum of 5 years or 10,000 hours of experience including a combination of entertainment rigging systems design, engineering, inspection, installation, maintenance, service, repair, modification, and functional testing. Typically, experience only in system operation will not provide suitable experience to inspect entertainment rigging systems.

**5.1.2** This experience should provide a working knowledge of how to identify deficiencies in mechanical, structural, and electrical systems, and components of entertainment rigging systems.

**5.1.3** This experience should provide familiarity with prevailing regulations and standards related to entertainment rigging systems.

**5.1.4** This experience should provide a working knowledge of how to identify deficiencies in the specific type of rigging system to be inspected (e.g. counterweight, package hoist, motorized hoist and drum, line shaft hoist).

**5.1.5** This experience should include manufacturer's training, if available, in the specific rigging system to be inspected. If the manufacturer offers certification, the inspector should have received manufacturer certification for the specific system.

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**5.1.6** This experience should include third-party certification in the applicable discipline.

## 5.2 Physical qualifications

**5.2.1** The inspector should have sufficient strength, endurance, agility, coordination, manual dexterity and speed of reaction to meet the demands of the work.

**5.2.2** The inspector should be capable of working at heights in a safe manner.

## 6 Ethics and responsibilities

**6.1** The inspector should be honest and impartial.

**6.2** The inspector should avoid misrepresentation or overstatement of qualifications or credentials, and should issue reports in an objective and truthful manner, both with regard to the findings, and the extent of inspections conducted.

**6.3** The inspector should act in the interest of the safety, health, and welfare of the owners and users of the facilities inspected.

**6.4** The inspector should perform services only in the areas of the inspector's competence.

**6.5** The inspector should comply with all regulations and requirements of the jurisdiction where the inspector conducts business.

**6.6** The inspector should continue professional development throughout the inspector's career.

**6.7** Where appropriate, the inspector should avoid conflicts of interest or the appearance of conflicts of interest.

**6.8** The inspector should not accept or offer any undisclosed commissions, rebates, profits, or other benefit from any parties having an interest in the venue being inspected.

## 7 Frequency and scope of inspections

### 7.1 General

The frequency and scope of inspections should be as determined by the applicable standards, regulations and manufacturer's recommendations.

### 7.2 Frequency of inspections

Unless applicable standards, regulations and manufacturer's recommendations require greater frequency, the following chart provides recommended types and frequency of inspection for various types of equipment. Category levels are defined in the section following the chart.

Equipment Type	Level One Inspection Frequency	Level Two Inspection Frequency
<b>Manually Operated Equipment</b>	Annual	No less than every 5 years or as determined by a qualified person
		Immediately after equipment or components have been newly installed, altered, or repaired
		When the last date of inspection is unknown

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<b>Fire Safety Curtain (manually operated)</b>	Annual	No less than every 5 years or as determined by a qualified person
		Immediately after equipment or components have been newly installed, altered, or repaired
		When the last date of inspection is unknown
<b>Motorized Equipment (including motorized Fire Safety Curtain)</b>	Annual as part of Level Two	Annual
		Immediately after equipment or components have been newly installed, altered, or repaired
		When the last date of inspection is unknown

### 7.3 Scope of inspections

#### 7.3.1 Level one inspection

Level one inspection is performed from accessible positions (rigging galleries, catwalks, facility ladders and gridirons) or the stage floor where no accessible positions exist. Unless otherwise noted below, all accessible components of all sets, including lifting media, are to be inspected.

##### 7.3.1.1 General level one requirements

The following requirements apply to all level one inspections:

**7.3.1.1.1** Verify that operations manuals are available and accessible to system users.

**7.3.1.1.2** Verify that operational and warning signage is in place.

**7.3.1.1.3** Inspect components for damage, loose or missing hardware visible from accessible positions.

**7.3.1.1.4** Inspect samples of lifting media termination hardware, no less than 20% per set, for the correct type and installation.

**7.3.1.1.5** Inspect the lifting media at all terminations for excessive wear and damage.

**7.3.1.1.6** Verify that shackles, turnbuckles, and other rigging hardware are of the appropriate material and grade, and are secured to resist loosening.

**7.3.1.1.7** Observe and document any loose loft blocks or head blocks.

**7.3.1.1.8** Verify that sheave material does not show signs of excessive wear, cracks or chips.

**7.3.1.1.9** Verify that all equipment operates smoothly throughout the available range of travel and without unusual friction, noise, or motions.

**7.3.1.1.10** Verify that fleet angles are suitable and lifting media does not contact any obstructions.

**7.3.1.1.11** Verify that the working load limits of the rigging systems are known and visible to the operators.

**7.3.1.1.12** Verify that guards, if required, are existing and in good condition..

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**7.3.1.1.13** Verify that documentation exists for identification of trained users and training dates.

**7.3.1.1.14** Verify that a maintenance log is in use and up to date.

**7.3.1.2 Additional requirements for inspection of manually operated equipment:**

**7.3.1.2.1** Verify that counterweight linesets are properly balanced and pipe weight is indicated.

**7.3.1.2.2** Verify that rope locks are functional and properly adjusted and rope lock jaws are not excessively worn.

**7.3.1.2.3** Verify that operating lines are appropriate material, properly terminated, and not excessively worn.

**7.3.1.2.4** Verify that floor blocks are properly adjusted and attached to the guide system.

**7.3.1.2.5** Verify that arbor rod spreader plates and locking collars are used properly, spreader plates are properly located in weight stack, and spreader plate location labels/markings are present.

**7.3.1.2.6** Verify that counterweight is appropriately located and stored and does not constitute a hazard.

**7.3.1.2.7** Inspect condition and attachment of the locking rail and arbor stops for signs of damage.

**7.3.1.3 Additional requirements for inspection of fire safety curtain system**

**7.3.1.3.1** Perform all types and methods of manual and emergency release operation.

**7.3.1.3.2** Verify that the rate of curtain descent is within the time allowed by applicable regulations or standards.

**7.3.1.3.3** Inspect fire safety curtain rigging per 7.3.2.1 and 7.3.2.2 as applicable to system.

**7.3.1.3.4** Inspect condition of the dashpot or other deceleration device for leaking fluid or other signs of wear or damage.

**7.3.1.3.5** Inspect the condition of all manual and automatic release lines, release mechanisms, thermal link attachments and related hardware for wear or damage.

**7.3.1.3.6** Verify that signage, tags, and certificates are present and properly located.

**7.3.1.3.7** Retrain the owner and staff in the operation of the fire safety curtain system.

**7.3.2 Level two inspection**

Level two inspection is performed by gaining access, typically using ladders, scaffolding, or personnel lifts, to all rigging components. All components of all sets, including lifting media, are to be inspected.

**7.3.2.1 General**

The following requirements apply to all level two inspections:

**7.3.2.1.1** Items listed under section 7.3.1 level one inspection

**7.3.2.1.2** Inspect all components per 7.3.2 including those requiring use of temporary equipment to gain access.

**7.3.2.2 Additional requirements for level two inspection of motorized systems**

**7.3.2.2.1** Verify that the direction of movement is correctly labeled on the controls.

**7.3.2.2.2** Test the emergency stop(s). Verify that the emergency stop(s) disconnect power to the motor and not to the control circuit.

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**7.3.2.2.3** Visually inspect the condition of controller cables, strain reliefs and junction boxes adjacent to rigging equipment.

**7.3.2.2.4** Verify that all indicator lamps are functional.

**7.3.2.2.5** Verify that all fuses and disconnects are the correct size and type for the applications and for the machines.

**7.3.2.2.6** Verify that indicators show the correct position of the load.

**7.3.2.2.7** Verify that the brake(s) stop the machinery when the operator control device is released. Full load testing is not required.

**7.3.2.2.8** Verify that the upper and lower normal travel limit switches are functional and set to avoid collision with surrounding objects.

**7.3.2.2.9** Verify that moving elements are lubricated to comply with the manufacturers limits of use or as determined by a qualified person. Covers and guards, designed to be removed, should be removed to inspect components within. The condition and suitability of lubricants should be determined, based on the manufacturer's recommendations.

**7.3.2.2.10** Visually observe welds for the presence of cracks and porosity.

**7.3.2.2.11** At the completion of the inspection reset any inspection reminder indicators according to the manufacturer's recommendations.

#### **7.4 Inspection service variations**

Concurrent with the inspection inspectors may provide any additional services for which they are qualified. Additional services should be included in the documented scope of work. Examples of additional services include lubrication, inspection of tracks and curtains, and adjustment of limit switches.

### **8 Arrangements prior to the inspection**

#### **8.1 General arrangements**

**8.1.1** The process of an inspection should include acceptance of written documentation that specifies the scope of the inspection. It is important the parties involved in the inspection are aware of and agree to the extent of the work to be performed. This is important from the time the inspection is arranged to the time that the final report is issued.

**8.1.2** The person to receive the rigging inspection report, and the designated person to receive notification of any imminent hazard(s) identified during the inspection should be determined.

**8.1.3** The inspector should request and obtain any available documentation relating to the installed rigging systems for review before the time of on-site inspection. Documentation that would assist the inspector includes:

**8.1.3.1** As-built drawings.

**8.1.3.2** Operation manuals.

**8.1.3.3** Technical information typically provided to potential users of the venue.

**8.1.3.4** Known modifications to the installed systems.

**8.1.3.5** Reports of any known issues or incidents.

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**8.1.3.6** Maintenance logs.

**8.1.3.7** Previous rigging inspection reports.

**8.1.3.8** Records of user training.

**8.1.3.9** List of authorized system users.

**8.1.4** A schedule including specific inspection date(s) and times should be arranged.

**8.1.5** Since the inspector may require access to all areas where rigging equipment is located depending upon the level of inspection, no performances, rehearsals, sound checks, load-ins, load-outs, classes, or similar activities should be scheduled in the venue during the rigging inspection.

**8.1.6** Arrangement should be made for access to equipment and work areas (e.g. backstage support spaces, electrical rooms, ladders, staircases, catwalks, galleries, gridirons, arbor pits, etc).

**8.1.7** Arrangements should be made for turning on lights and any mechanical systems that may be required to allow the inspector to work in the spaces to be inspected.

**8.1.8** Arrangements should be made to ensure that the noise level is suitable for performing the inspection.

**8.1.9** Arrangements should be made for unlocking or providing required keys for rigging system operation (e.g motorized system control panels, rope lock padlocks).

**8.1.10** Arrangements should be made for the work areas to be clear of unnecessary items of scenery, furnishings, and equipment.

## **8.2 Considerations for level two access**

**8.2.1** For equipment that cannot be inspected from safely accessible positions as is required for a level two inspection, arrangements should be made or coordinated to provide required access. The access equipment may include aerial work platforms, man-lifts, articulating boom lifts, or scaffolding.

**8.2.2** Arrangements for access equipment should ensure that there is a clear path of travel to maneuver equipment from the parking lot or loading dock to the working locations.

**8.2.3** Arrangements for access equipment should ensure that the floor surfaces have the structural capacity to support the loads (e.g. wheel bearing pressure) of the equipment.

**8.2.4** Fall protection safety and rescue plan, if required.

## **9 Site conditions during inspection**

**9.1** Any deficiency observed during the inspection determined by the inspector to be an immediate hazard to persons should be tagged or “locked-out” by the owner to prevent use of the equipment or system associated with the deficiency. The inspector should immediately inform the designated person of the deficiency and instruct the person that the equipment associated with the deficiency should not be operated.

**9.2** Any condition observed during the inspection that alters the original scope of the inspection should be noted by the inspector in the rigging inspection report.

## **10 Rigging inspection report**

**10.1** A written rigging inspection report should be issued following the inspection.

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**10.2** At a minimum the rigging inspection report should include the following: name of the venue inspected; date(s) of the inspection; name and signature of the inspector or inspectors; name of the affiliated company or firm providing inspection services, if applicable; scope of work of the inspection performed. Any exclusions identified prior to the inspection, or discovered during the on-site inspection should be noted specifically.

**10.3** The rigging inspection report could also include: description of the systems inspected, and if known, or identifiable; age of the venue; system installation dates; manufacturer of major system components; identification of the installing company; major or minor renovations to the systems; and modifications to the installed systems by the owner or system users.

**10.4** Fire safety curtain testing and training should be included in the rigging report as required by applicable regulations and standards.

**10.5** At a minimum the rigging inspection report should identify the standards and other guidelines used by the inspector as the basis for evaluation of the installed rigging systems. These may include relevant American National Standards, NFPA standards, OSHA laws, manufacturers recommended practices, operation and maintenance manuals, prevailing building codes, standard industry practices, and common sense.

**10.6** The nature and location of observed deficiencies should be included in the report. The deficiencies should be prioritized into at least three categories. Prioritization categories should be defined in the rigging inspection report. Additional categories as determined by the inspector to address specific deficiencies could be included. Suggested categories include:

**10.6.1** Deficiencies representing an immediate hazard.

**10.6.2** Deficiencies representing a potential hazard resulting from abnormal wear and tear, or misuse that will cause foreseeable failure.

**10.6.3** Deficiencies representing normal wear and tear, or misuse that have not yet caused foreseeable failure.

**10.7** The report should include a recommendation for possible remedy of each deficiency. The report should recommend qualifications for the personnel that may be required to perform the recommendation, (e.g. professional engineer, rigging equipment contractor, or venue staff).

**10.8** The report might include recommendations for one-time or routine testing of components or systems.

**10.9** The report should include suggested timing for future inspections and might include recommendations for more in-depth inspection.

**10.10** Other supplementary information and documentation that could be included in the report includes:

**10.10.1** Generic or specific system illustration(s).

**10.10.2** Glossary of terms used to describe the system(s) and operation.

**10.10.3** Digital images for clarification.

**10.10.4** Sample maintenance log.

**10.10.5** Educational resources such as books, trusted websites, and training programs.