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Event Safety - Material Handling

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The Event Safety 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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Voting members:**Observer (non-voting) members:****Interest category codes:**

DE = designer

EQP = Equipment provider

EW = Event worker

INS = Insurance company

DR = Equipment dealer or rental company

EVP = Event producer

G = general interest

PA = Performing Artist

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Foreword

The Event Safety Guide was first published by the Event Safety Alliance in 2014, as a guideline for discourse regarding the many aspects of special event safety. It originated in the UK Health and Safety Executive's HSG195 "The event safety guide (Second edition) A guide to health, safety and welfare at music and similar events." where its purple cover subsequently led to its reference as, simply, "The Purple Guide". In 2016 the Event Safety Working Group was established within ESTA's Technical Standards Program for the purpose of converting the Event Safety Guide chapters into formally recognized, consensus-based standards that could be universally referenced across special events organizers, producers, enforcement agencies and user-groups. This document is one of many such chapters, intended to be used in conjunction with each other, as a collection of standards, which are used to establish minimum standards for care and public safety for special events. Because event technology and requirements constantly evolve, so too will this collection of standards change and evolve to accommodate industry needs.

It has been assumed in the drafting of this standard that the execution of any design provision is entrusted to appropriately qualified and experienced people, and that any fabrication and use provision is carried out by qualified and suitably experienced people and organizations.

This standard presents a coordinated set of rules that may serve as a guide to government and other regulatory bodies and municipal authorities responsible for the guarding and inspection of the equipment within its scope. The suggestions leading to accident prevention are given both as mandatory and advisory provisions; compliance with both types may be required by employers of their employees.

Compliance with this Standard does not of itself confer immunity from legal obligations.

This document uses annex notes to provide additional reference information about certain specific section requirements, concepts, or intent. Subject matter with a corresponding annex note reference is identified by the asterisk (*) symbol, and the associated reference text is found in Appendix A, Commentary, identified with the referring text section number – e.g. an annex note to section 3.2 will be identified in Appendix A, Commentary as A.3.2. The annex notes are informational only, and do not add or subtract from the mandatory requirements of this standard.

Introduction

Material handling and the related field of ergonomics are some of the most common and potentially life changing injury hazards that people in the event and entertainment industry face. Many might reasonably point out that several material handling standards and regulations already exist, yet despite their existence the rate of life changing injury and death in the event and entertainment industry remain unacceptably high.

The goal of this standard is to build on the foundation of existing standards and regulation. This standard will provide context for the material handling challenges that can exist in the event and entertainment industry. It will identify the types of situations that event personnel may face that present significant material handling hazards.

This includes identifying the role and responsibilities of the event organizer and the personnel they authorize to ensure that appropriate material handling equipment, policies, procedures, and training, are available to mitigate the material handling hazards that affected event personnel may reasonably be exposed to.

1 Scope, purpose, and application

This standard shall apply to the safe provision, availability and use of appropriate material handling procedures, equipment, training & planning at events. Events include, but is not limited to, musical productions, festivals, concerts, theatre and film production, video productions, special events, corporate events, trade shows, sporting events, broadcast production, and events related to them.

This shall include the identification and assessment of specific material handling hazards related to life safety risks, and how lack of planning, appropriate equipment and training can negatively impact life safety at an event.

1.1 Purpose

The purpose of this document is to address and describe steps necessary to minimize the potential material handling hazards caused by the lack of provision of appropriate material handling planning, appropriate equipment, and training at an event.

1.2 Intent

This document is intended for use by both users and enforcement officials in order to help establish and maintain minimum standards for material handling at events.

1.3 Equivalency

The provisions of this standard are not intended to prevent the use of any materials or to prohibit any design, method of fabrication, or services not specifically prescribed by this standard, provided that they comply with applicable regulation and with the intent of this standard with the goal of improving safety.

1.4 Application

This document is one part of a larger collection of standards relating to special event safety. The requirements of the complete collection shall be considered in relation to applicable regulation and to the application of this standard.

1.5 Normative references

The following documents contain requirements relating to the scope of this standard. They are provided for guidance only, unless otherwise referenced specifically elsewhere within this standard. Where no year is listed the most current version should apply.

[List any relevant standards that should or shall be referenced by this standard]

2 Definitions

2.1 Affected (event) personnel: Event personnel at risk from a hazard due to their proximity to or potential interaction with the potential hazard.

2.2 Authority Having Jurisdiction (AHJ): An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

2.3 Authorized personnel: Individuals or groups of event personnel authorized by the event organizer to undertake tasks assigned by the event organizer for the event.

2.4 Competent person: One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, volunteers, patrons, or the public; and who has authorization to take prompt corrective measures to eliminate them. (OSHA 29 CFR 1926.32(f))

2.5 Control measure: Any action that can be taken to reduce or eliminate exposure to the hazard.

2.6 Event: Any assembly, public or private, indoor, or outdoor, including the planning for, preparation for and dismantling of (load in, load out) the event

2.7 Event organizer: The individual, group, or organization (or their authorized representatives) that originates, organizes, promotes, and manages an event.

2.8 Event personnel: Anyone working the event, including the production team, vendors, contractors, subcontractors, laborers, volunteers, etc.

2.9 Event site: The physical or virtual location where the event occurs, regardless of the original use or designation of the location (includes venues).

2.10 Hazard: Any source of **potential** damage, harm or adverse health effects on something or someone.

2.11 Must: Denotes a mandatory action; equivalent to the term "shall".

2.12 Personal protective equipment (PPE): Personal protective equipment is the safety equipment worn by a user to prevent bodily harm. It is only to be used to mitigate the remaining risk of injury after all technical and organizational means have been implemented. (e.g., safety shoes or boots, high visibility vests, hard hats, and safety (fall arrest) harnesses).

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

2.14 Shall: Denotes a mandatory action; equivalent to the term "must".

2.15 Venue: See Event Site.

3 General

3.1 Every event must be constructed, designed, equipped, maintained, and operated in accordance with this standard and all national, regional, and local regulation to provide a reasonable level of life safety, property protection, free from recognized hazards created by material handling for events.

3.2 Regulation.

Every event must comply with all applicable national, regional, and local material handling standards and regulations.

3.3 Equipment.

All equipment, devices & materials must be used in accordance with the manufacturer's instructions and where required display all necessary labels and limitations.

3.4 Documentation.

All documentation and signage required by applicable regulation, this standard, and the AHJ, shall be maintained onsite throughout the duration of the event. The documents should be easily identifiable and readily accessible.

3.5 Modifications.

No modifications to material handling equipment or modified use of material handling equipment shall be permitted without the express written authorization of the manufacturer or when allowed by applicable regulation by the written authorization of a qualified, licensed, registered professional engineer with applicable experience.

3.6 Operators.

Operators of material handling equipment must be trained and competent. Where required by applicable regulations they must be qualified, certified, and licensed.

3.7 Roles & Responsibilities.

The load-in, load-out and operation of events in the entertainment industry typically involves several companies hired by the event organizer to facilitate the event. While the event organizer or their authorized representative is ultimately responsible for compliance with this standard, each contractor, subcontractor, competent person, department lead, and event manager also have a responsibility to ensure a safe working environment for event personnel as it relates to their roles and responsibilities.

4 Planning & Hazard Communication

4.1 The event organizer or authorized personnel must ensure that there is a plan for the safe handling of all materials that will be used for the event.

4.2 The event organizer or authorized personnel must ensure that the following factors are evaluated and mitigated when planning the installation of materials at the event:

- The roles and responsibilities required for event personnel to safely handle materials that will be used for the event.
- The number of event personnel required, and time allotted to safely handle the material that will be used for the event and reduce the potential for injury.
- The correct tools and assistive equipment with the required capacity to handle materials safely and reduce potential for injury.
- The location and environmental conditions where materials will be handled, transported, installed, or used.
- The pathway through the venue including any restrictions or obstacles that the materials being handled will have to traverse.
- The potential hazards for materials that require special handling.
- The handling of hazardous materials as defined by national, regional, and local regulation
- Reasonably foreseeable hazards created by the equipment used to handle the materials.
- The loading of materials for transportation.
- The number of hours that material handling equipment operators can reasonably be expected to operate equipment safely when not already prescribed by national, regional, and local regulation.

4.3 Performers and material handling.

The event organizer must ensure the evaluation of the prevailing environmental conditions when performers will be required to handle materials. The evaluation should include potential hazards and impacts that the performer will be exposed to. The hazards identified must be communicated to the performer and reasonably mitigated (e.g., Weather conditions etc.).

5 Material Handling Risk Assessment

5.1 The event organizer or authorized personnel must ensure that a risk assessment is conducted for all of the materials and material handling equipment being used at the event.

The material handling risk assessment for the event is a subset of the overall event risk assessment. It is a key tool for mitigating risks at the event.

5.2 Method.

Any method or model should contain the following but other things may apply in your circumstances:

- A physical examination of the event site or space & event production elements to determine the material handling risks present. Each project, job site or event is going to have material handling hazards and risks that are unique to those circumstances.
- Identification of potential impacts of any material handling risk or hazard.
- Steps should be taken to reduce likelihood and severity of the risks identified.
- The control measure should reduce the likelihood & severity to an acceptable level in the given circumstances.
- It should be a written document and relevant sections must be provided to all affected event personnel.
- It must be provided in a language and vocabulary that the affected event personnel understand.
- It should be revised regularly and updates should be provided to all affected event personnel as necessary throughout the production process.

5.3 Risk Factors.

Some examples of the different types of risk factors and hazards that event organizers or authorized personnel may reasonably need to evaluate for material handling hazards are given in the relevant sections of this standard. This is done to provide additional context and when necessary, advice.

6 Documentation

6.1 Purpose:

6.1.1 All event material handling documentation must communicate information in a clear, simple, and legible fashion. Pictographs and illustrations should be used to supplement written language where possible.

6.1.2 Where abbreviations, colloquialisms, graphical elements, or technical language is used, a key must be provided with meanings translated into clear language to ensure the user understands. The key shall be part of the document it refers to.

6.2 Accessibility:

All event material handling documentation must be provided to all affected event personnel that require access to it as part of their roles and responsibilities at the event.

6.3 Required Information:

As a minimum, the following material handling information must be documented:

- Operators' manuals, user manuals, and manufacturer's instructions.
- Locations that materials will be handled and stored.
- Hazardous materials as defined by applicable regulation.
- The size and weight of materials to be handled or moved.
- Incident, accident and near miss reports.
- Emergency response protocols and procedures for the event

7 Common Injury Hazards and the Role of Fatigue

7.1 The event organizer or authorized personnel must ensure that policies and procedures are put in place to mitigate circumstances that may cause injuries by material handling.

Common causes for injuries in material handling:

- Misuse of materials & equipment
- Being struck by materials & equipment
- Being caught between objects
- Falling objects
- Being distracted
- Repetitive motion & strain
- Mishandling of chemical components,
- Exposure to environmental hazards
- Not wearing necessary PPE for the materials being handled

Injuries can include, crushing, amputations, fractures, punctures, chemical burns, sprains & strains, tears, bruises, and contusions slips trips & falls, respiratory injuries, eye injuries, hearing injuries, heat injuries, dehydration.

Material handling hazards common to events can cause life changing injuries, severe trauma and death.

7.2 Treatment of Injuries:

The event organizer or authorized personnel must ensure that there is prompt access to first aid and medical treatment at or near the event site for event personnel who suffer injuries. Information where the first aid and medical treatment is located, and how the medical personnel can be reached must be provided to all event personnel in clear language, pictograms, maps or signs.

8 Venue

The venue can present material handling hazards that are unique to that event site. Events that travel to more than one venue may encounter unique risks at each site and many that may be common across many venues. A risk assessment that evaluates each site for material handling risks is a crucial tool in mitigating those risks.

8.1 The event organizer or authorized personnel must ensure that the material handling hazards that may reasonably exist at each venue the event will be using are evaluated and mitigated to reduce the risks to event personnel and attendees. Communication with the venue when determining compliance with the event planning guide is a necessary step in confirming if specific hazards exist and must be mitigated.

Material handling hazards & risks that may need to be mitigated include, but are not limited to:

- Slopes, inclines, levels, and stairs
- Surface materials and transitions
- Lack of sufficient space
- Pathway for material entry and exit
- Height restrictions
- Width restrictions
- Structural integrity of the venue and its structures
- Venue equipment that will be used for the event
- Venue access (street, courtyard, dock, etc.)
- Heating and cooling equipment
- Weather and temperature
- Use by other users not related to the event
- Illumination during setup, operations, and removal
- The appropriate amount of personnel for the specific task(s)

9 Material Handling Techniques & Training

9.1 The event organizer or authorized personnel must ensure that all affected event personnel are trained in safer lifting techniques and procedures.

E9.1 This section provides information on safer material handling for event organizers and event personnel including techniques that can help reduce the likelihood and possible severity of injury. It also includes requirements for training.

9.1.1 Techniques for safer manual lifting:

- Before lifting, evaluate the hazards in the location you will be lifting
- Before lifting, evaluate the hazards of the path and location you will be carrying the items to
- Before lifting, evaluate the PPE (e.g., safety toe shoes, gloves etc.), and assistive devices (e.g., blocking, straps, handles etc.) required to mitigate the hazards present.
- Before lifting, evaluate your own fitness and ability to conduct the lift and know when to say no or ask for help.
- Before lifting, evaluate if the load can be moved more safely without lifting it manually
- Before lifting, arch your back and keep your chest facing forward
- Before lifting, test the weight of the object
- At the start of the lift, tighten your abdominal muscles
- While lifting, keep the load as close to your body as possible
- While lifting, grasp the load in a position that keeps the load as stable as possible
- Where possible, reduce the distance, you need to lift or carry the object
- While lifting use your legs, bend at the knees, do not bend at the waist or lift with your back
- While lifting, maintain the natural curve of your lumbar(lower) spine
- While lifting, avoid twisting your spine and maintain your balance
- When lowering the load bend at the knees and do not overreach and put yourself off balance
- Control the load at all times, avoid sudden, jerky movements.

9.1.2 Safer manual lifting with others:

- Discuss the lift with others taking part in the lift
- Determine what and how each person will be lifting
- Determine roles and responsibilities for coordinating the lift
- Determine how problems will be communicated during the lift
- Evaluate the hazards caused by the way people will be traversing the space with the load (e.g., walking backwards)
- Evaluate the need for spotters and supervisors to manage the lift and avoid hazards that may be present along the travel path
- Determine how the load will be safely lowered
- Evaluate the need for pads or other devices that the load will be lifted from or lowered onto to mitigate the risk of injury to hands, feet, and other body parts

9.2 Planning techniques for safer material handling:

- Clear labeling and marking of materials to be moved
- Identification of safe lifting points for the materials to be moved (e.g., points re-enforced for forklifts etc.)
- Planning which containers and equipment are best for the safer movement of materials at the event site
- Determining roles and responsibility for the safety of the materials be handled.
- How the hazards of the materials being handled will be communicated to affected event personnel
- What training is required for event personnel to safely handle materials being used at the event.
- Visually identifying the weights of materials to be moved in more than one location improving hazard identification
- Planning how material handling equipment will be inspected prior to use, to ensure safe function of that equipment

- Designating areas or “depots” for materials to minimize congestion and other hazards at the event site or venue
- Maintaining egress pathways during all stages that materials for the event are being handled, used, or stored.
- Maintaining reasonable clearances for first responders
- Maintaining minimum clearances around electrical boxes and hazards as determined by the AHJ.
- The clear identification of materials defined as hazardous by applicable regulation.

9.3 Training.

9.3.1 The event organizer or authorized personnel must ensure that all event personnel are trained to identify and mitigate the reasonably foreseeable hazards of the materials they will be handling and the requirements of any applicable regulation.

9.3.2 The event organizer or authorized personnel must ensure that all event personnel handling materials at the event are supervised by event personnel that are trained to be competent personnel as defined in 2.4 of this standard.

9.3.3 The event organizer or authorized personnel must ensure that all event personnel are trained in the proper use of all PPE and equipment they will be using to mitigate the hazards of the materials they will be handling.

10 Heavy Equipment

The use of heavy equipment such as forklifts, mobile elevated work platforms (MEWP's), material handling lifts, hoists (other than those used specifically for entertainment and event rigging) can reduce the risks to effectively trained event personnel when handling materials. However, the use of this equipment can create additional hazards specific the equipment being used.

10.1 The event organizer or authorized personnel must ensure that all heavy equipment is used, operated, inspected, and maintained in accordance with all applicable national, regional, and local regulation, applicable national consensus standards and the manufacturer's instructions

10.2 The event organizer or authorized personnel must ensure that all heavy equipment is operated by event personnel who have met all applicable national, regional, and local requirements for training, certification, and competent personnel.

E10.2 According to estimates from safety bodies around the world the percentage of accidents that can be attributed to a lack of effective training ranges from 20%-70% depending on the source you choose to cite. Lack of effective training is the single largest contributory factor to injuries, incidents and accidents caused using heavy equipment. Heavy equipment can go a long way to mitigating the material handling hazards that event personnel can be exposed to when handling materials manually at the event. But the use of such equipment comes with additional responsibilities to mitigate the potential risks from the use of the equipment in question. <https://www.cdc.gov/niosh/docs/2001-109/default.html> (Preventing Injuries and Deaths of Workers Who Operate or Work Near Forklifts: DHHS (NIOSH) PUBLICATION NUMBER 2001-109)

10.3 The event organizer or authorized personnel must ensure that they or their contractors for the event provide and supervise the use of all required safety equipment for the safe operation of heavy equipment at the event.

10.4 The event organizer or authorized personnel must ensure that the risks and hazards that are reasonably foreseeable from the use of heavy equipment in material handling at the event are evaluated and mitigated.

Hazards and risks from the use of heavy equipment can include hazards from the specific equipment being used and the materials it is handling or providing access to.

Examples of possible hazards that can exist when using heavy equipment may include:

- Crushing and struck by hazards from objects and equipment (e.g., vehicles, equipment, barricades road cases, machinery, carts, rigging, scenic materials, platforms and many more.)

- Equipment tipping or overturning
- Release of potentially hazardous energy (e.g., hydraulic, pneumatic, thermal, chemical, electrical and gravity.)
- Falling materials
- Reduced situational awareness & ineffective communication
- Operator Fatigue and impairment
- Unsecured materials
- Faulty equipment (e.g., damaged, or missing guards, safety equipment, covers and signage)
- Explosions
- Hazardous chemicals
- Overloading structures and surfaces
- Vehicle collisions
- Overloading of the equipment leading to its structural failure
- Unstable & uneven surfaces

E10.4 Many of these hazards can be successfully mitigated by following the manufacturer's instructions for use and maintenance including following required pre-use and periodic inspection procedures.

11 Truck Loading & Unloading

When materials are transported to an event or event site via trucks, it can significantly increase the risks and hazards of material handling at the event.

The area where trucks deliver their cargo at an event can range from a purpose-built dock, to driving vehicles directly into the venue, to a flat open space near the venue, to unloading on a busy street with lots of pedestrians, dense traffic, and very little room to safely maneuver.

Each location where trucks are marshaled, loaded and unloaded can present unique risks and hazards that need to be mitigated to protect event personnel.

Risks and hazards associated with the use of trucks can be influenced by their size, weight, cargo and internal logistics (e.g., ramp, lift gate, e-track, load bars etc.)

How a truck is loaded directly impacts safety during transit and the hazards that event personnel are exposed to when unloading materials at the event site. Careful planning and thought should be given to specific conditions that will be present at the event site, so that trucks can be safely unloaded.

11.1 The event organizer or authorized personnel must ensure that the reasonably foreseeable material handling hazards of loading and unloading trucks at the event are evaluated and mitigated.

Hazards and risks from the loading and unloading of trucks at the event may include but are not limited to:

- Failure to Plan for truck packs for both shop and the event site
- Failure to identify and assign who is responsible for the safety of the load and when that responsibility begins and ends.
- Failure to document and communicate how the truck is loaded to other affected parties.
- Failure to Identify hazards within the truck using labels and signage
- Failure to distribute the load within the truck according to the requirements of the vehicle and applicable regulation
- Failure to plan for the environment where materials will be delivered (e.g., street level, vs dock level, illumination, traffic, pedestrian and public access within the loading zone, terrain, etc.)
- Failure to plan for the extreme weather conditions and their potential impact.
- Failure to secure loads.

12 Boxes, Wheels & Other Assistive Equipment

The equipment we use to store, move, and assist with material handling at events comes in countless shapes, sizes, and weights. This type of equipment can be present in significant quantities and therefore can present a significant risk to event personnel.

Often the most common types of material handling injuries found at event sites come from the improper use of this equipment. Careful planning and clear communication when using this equipment can significantly reduce the risk of material handling injuries at your event site.

The equipment used to move or assist with moving materials goes by many names for the purposes of this section:

Road cases will refer to any rigid box with wheels, with or without lids.

Dollies will refer to any device with a frame and wheels used to place items on top of the that does not have a handle to steer it with.

Carts will refer to any platform on which objects can be placed that has wheels and uses a handle to steer it.

Hampers refer to any soft sided container with an external frame to support it and wheels (often used to move draper etc.)

Other devices will be explained if needed where they are cited below.

12.1 Hazard Identification & Mitigation

The event organizer or authorized personnel must ensure that the hazards common to using the types of material handling equipment discussed in section 12 are identified and mitigated, common hazards can include:

- Crushing injuries
- Pinch points
- Puncture wounds
- Lacerations & abrasions
- Fractures

12.2 Equipment Handling and Storage

The event organizer or authorized personnel must ensure that event personnel are protected from hazards by ensuring the following:

- The equipment used is appropriate for the materials being moved.
- The equipment is appropriate for the surfaces and terrain over which the materials will be moved.
- That equipment is properly stored in a manner that prevents it from toppling over, moving unintentionally, or creating a hazard due to the location it is being stored.

12.3 Training, Techniques and Procedures

Training techniques and procedures must include:

- Safer lifting techniques to reduce strain and injuries
- Ensuring that the equipment is in good working condition prior to moving
- Ensuring the pathway is clear and free from hazards and obstructions
- Ensuring that equipment is pushed rather than pulled in such a way that the equipment could run over or injure the person pulling it
- Selection of the appropriate equipment for the task assigned
- Ensuring the use of spotters where vision is obstructed
- Ensuring that other affected event personnel are clear of the materials being moved
- The proper use of the equipment and examples of prohibited uses

- The weight of the equipment and the number of people required to safely move it
- The proper use of PPE required by the materials and equipment being moved
- The dangers of loose equipment and materials riding on top of other equipment
- The instability of the materials and equipment being moved
- The proper operation of locking wheels and when to use them

12.4 Inspection, Maintenance

The event organizer or authorized personnel must ensure that the equipment is regularly inspected and maintained to ensure the safe operation of that equipment.

When inspected if a piece of equipment is found to be unsafe it must be removed from service until it has been repaired.

13 Material Handling by Department

13.1 Rigging.

Equipment used for overhead rigging in the entertainment industry is typically large, heavy, and requires careful handling. This section aims to provide clear guidelines for safely managing and transporting these items throughout various stages:

- **Preparing for delivery:** Ensure proper preparation before delivery.
- **Loading and unloading:** Safely load and unload from ground surfaces and loading docks.
- **Manual transportation:** Handle manual transportation to the event site cautiously.
- **On-site procedures:** Unpack, position, or unstrap the equipment on-site.

Refer to Section 12 for specific guidance on rigging items stored in cases or boxes. These measures are crucial for maintaining safety and preventing incidents during the handling and transportation of overhead rigging equipment in the entertainment industry.

13.1.1 Truss bundles.

Truss is typically transported in bundles on carts or dollies, where ratchet straps secure the individual pieces together. These bundles are large, have a tendency to tip over, and can weigh thousands of pounds. To ensure the safety of the event personnel handling them, truss bundles must be prepared with careful consideration:

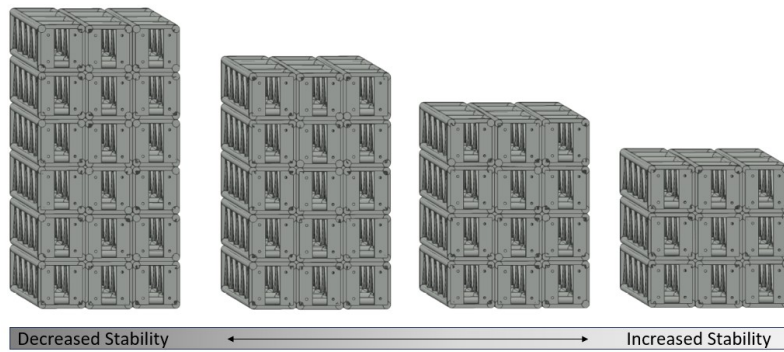
- Modules, trusses, and towers should be adequately secured and supported during transportation.
- When stacking truss bundles, sufficient spacers should be used between successive heights and adjacent stacks. This prevents abrasion and enhances the overall stability of the bundle. (ANSI E1.2-2021)

These measures aim to minimize the risk of accidents and ensure that truss bundles are safely transported and handled at all times.

13.1.1.2 Truss bundle tipping hazards.

Efforts to mitigate tipping hazards should be prioritized when preparing truss bundles, as depicted in Figure 1.

Figure 1



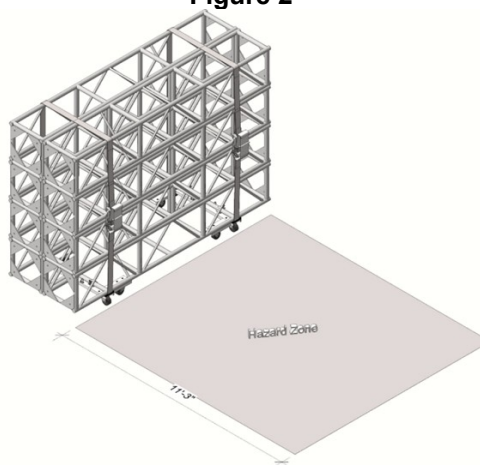
13.1.1.3 Truss strapping and un-strapping.

To minimize risks during the strapping and unstrapping process, the following procedures must be followed:

- Use a minimum of two appropriately rated ratchet straps with a minimum working load limit of 900 pounds each. These are typically 2-inch rated ratchet straps.
- Place these straps no more than 24 inches from the ends of the truss modules.
- This positioning allows personnel to stay outside of the hazard zone while handling the strapping and unstrapping tasks. Refer to figure 2 for visual guidance.

Adhering to these guidelines ensures that personnel can safely secure and release the truss bundles without placing themselves in danger. This approach helps maintain a safe environment during these critical operations.

Figure 2



13.1.1.4 Unstrapping and down stacking.

Once truss stacks have been moved to the designated event site location, with event personnel positioned at each end of the stack, at a minimum, the following procedures shall be followed:

- Unstrap the truss stack immediately upon arrival.
- Down stack the truss to a safe height, not exceeding 3 feet, while ensuring that personnel are clear of the hazard zone.
- Truss stacks must never be left unstrapped and unattended at any time.

By promptly unstrapping and down stacking the truss stacks to a manageable height, and ensuring that all safety measures are observed, the risk of accidents or injuries can be minimized effectively. It is crucial to adhere to these guidelines to maintain a safe working environment for event personnel.

13.1.1.5 Loading and unloading using liftgates for ground delivery.

Loading and unloading truss stacks at ground level using a liftgate should be avoided whenever possible, favoring methods like dock delivery or forklift unloading. However, if a liftgate operation is unavoidable, thorough pre-planning is crucial for the safety of the event personnel involved.

If a liftgate operation is the only option, the following precautions are essential to minimize risks and ensure the safe handling of truss stacks during loading and unloading operations:

- Truss dollies must be securely attached and positioned on the stack so that all wheels are in contact with the liftgate surface.
- Determine a safe stacking height and width based on the liftgate and the type of truss being handled.
- Assign specific tasks to individuals, such as the liftgate operator, Handler 1, and Handler 2.
- Event personnel should stay clear of the hazard zone during liftgate operations.
- If conditions at the event site pose safety risks, truss stacks should be down-stacked and modules offloaded individually.
- Ensure that dolly placement and the dimensions of the stack are suitable for a liftgate operation to prevent accidents.

13.1.1.6 Manually transporting.

Transportation routes to the event site should be carefully planned to ensure the safest and most efficient pathway. It is important to avoid routes with debris or other hazards that could destabilize the truss stack. When moving truss stacks, always push from the back. An additional person at the front is responsible for steering and guiding the load. Horizontal movement of the truss stack should be minimized to prevent tipping hazards.

Event personnel should refrain from entering the hazard zone when transporting truss. Enough clearance shall be provided so that hazard zone remains clear when passing other event personnel.

13.1.2 Rigging pipe.

Rigging pipe is typically transported individually, or in bundles on carts, with ratchet straps used to secure the individual pieces together.

- It is essential to always secure pipes during transportation.
- The quantity of pipes will determine the best method of transport, which may include carts, handles, or other containment devices.
- Typical risks to mitigate include strain injuries, potential pinch points, crush hazards, sharp edges, or protruding hardware that may puncture must be identified and communicated to event personnel undertaking the task.
- Moving bundles of pipe should only be done when they are strapped to an appropriate containment device.
- When manually transporting long pipes through the venue, spotters must be assigned to ensure the safety of event personnel, and make sure there is sufficient clearance.

13.1.4 Base plates.

Base plates vary in size and shape and can be transported in carts or stacked individually. Base plate sizes range from small for pipe and drape, to large for ground support truss applications.

The following precautions are essential to minimize risks and ensure the safe handling of base plates.

- Refer to section 9. *Material Handling Techniques & Training* for safely lifting base plates, both individually or team lifting.
- Refer to section 9. *Material Handling Techniques & Training* for guidance on the appropriate PPE for handling base plates.
- Base plates should be transported in an appropriate cart determined by the size and quantity of base plates in use.
- Base plates shall always be used following manufacturer recommendations.
- Base plates should never be used in an unsupported, elevated position due to risks of tips, drops, and falls.

13.1.5 Ballast.

Ballast for temporary structures is available in diverse sizes, shapes, and weights tailored for specific uses. Typically, heavy and challenging to move, these materials often necessitate handling with a forklift or crane. Examples include portable water tanks, sandbags, arbor weights, jersey barriers, concrete cubes, ballast blocks, steel plates, or 55-gallon drums filled with water or concrete.

The following precautions are essential to minimize risks and ensure the safe handling of ballast.

- The center of gravity must remain below the forks if there are no fork pockets incorporated into the ballast.
- Use guy-lines (or rope) to position and avoid handling the ballast by hand.
- While in the process of moving ballast, clear communication is essential.

13.2 Scenery & Staging

The entertainment and event industry uses stock and custom scenery and staging. Whether it is stock or custom it is often designed to be modular so that it can be transported more easily and navigate any physical restrictions at the venue. Items can weigh a couple of pounds (>1kg) up to many thousands of pounds or kilos. Often the staging and scenery needs to be assembled and disassembled rapidly. It may move as part of the “show” using automation or human power, often in low light conditions.

This can present unique hazards to event personnel tasked with handling, assembling, disassembling, and operating scenic and staging elements.

13.2.1 The event organizer or authorized personnel must ensure that each scenic and staging piece used for the event is labeled with the weight of the piece in pounds, kilograms, or both.

13.2.2 The event organizer or authorized personnel must ensure that material handling equipment is available when necessary to reduce the hazards that event personnel are exposed to while moving scenery and staging pieces.

13.2.3 If a scenic or staging piece is to be moved by human power alone, the event organizer or authorized personnel must ensure that there is enough space around the piece for the number of event personnel required to safely complete the move.

Performers handling scenery and staging should receive training for the materials they will be expected to move as part of the performance. This should include information and techniques on how to reduce potential injuries, including repetitive strain injuries.

E13.2.3 Scenic and staging pieces can be awkward and heavy. As an example, some pieces may be heavy enough to require 8 people to move them safely but not physically large enough so that 8 people can fit around them and assist with the move or lift. During load-in and load-out the same 8 people may be able to fit around the piece in question until it must pass a restriction such as doorway. While transiting the doorway the number of people that can fit may go from 8 to 4, doubling the effort required of the 4 remaining individuals and putting them at a much higher risk of injury. The point of 13.2.3 is to say if you are going to move something relying on human power, you must make sure this is accomplished safely along the entire length of the intended path the piece will be moved.

13.2.4 Scenery and staging are often assembled from smaller modular pieces. During assembly and disassembly those pieces are not at full strength and are more likely to fail or collapse. The event organizer or their representative(s) must ensure that steps are taken to mitigate the hazards that event personnel will be foreseeably exposed to during the assembly and disassembly process.

13.2.5 During the assembly, use and disassembly of scenic and staging pieces, potential pinch points, crush hazards, sharp edges, or protruding hardware that may puncture must be identified and communicated to event personnel undertaking the task. During assembly and disassembly if these hazards can reasonably be mitigated, they must be. During use of the assembled pieces the hazards must be mitigated.

13.2.6 When scenery above 8ft (2.44m) in height (e.g., a flat) is moved in the vertical position, it creates a potential tipping hazard. The event organizer or authorized personnel must ensure that steps are taken to mitigate this hazard to protect event personnel from injury.

13.2.7 Only authorized event personnel must be allowed to work underneath scenery and staging that is being assembled, disassembled, or operated. Any event personnel working underneath the scenery or staging must be trained for those hazards and must be supervised by a competent person.

13.2.8 Hazardous materials and coatings: Scenery that contains hazardous materials must be provided with the applicable SDS sheets and training must be provided for the safe handling of the materials.

E13.2.8 Scenery and staging pieces should be free from hazardous or toxic substances that could be ingested, inhaled, or absorbed including potential exposures to performers due to them handling the pieces as part of the show.

13.2.9 All scenery and staging must comply with all national, regional, and local regulation related to the flame resistance of any of the materials used or the finished product.

13.3 Audio, Lighting and Video

Audio, lighting, and video share many common hazards related to material handling. Often the process involves choosing individual pieces of equipment and installing them as part of a larger system. Sometimes those systems will be physically connected, in other circumstances they will have overlapping functions.

A key part of mitigating the material handling hazards is considering how they are designed to be used and installed as part of the system.

13.3.1 The design of the audio, lighting and video systems used for the event should evaluate and where reasonable mitigate the material handling hazards it creates.

13.3.2 The event organizer or authorized personnel must ensure that audio, lighting, or video equipment weighing over 5lbs (2.2kg) being used for the event is labeled with the weight in pounds, kilograms, or both.

13.3.3 The event organizer or authorized personnel must ensure that material handling equipment is available when necessary to reduce the hazards that event personnel are exposed to while moving audio, lighting and video equipment.

13.3.4 If audio, lighting, or video equipment is to be moved by human power alone, the event organizer or authorized personnel must ensure that there is enough space around the piece for the number of event personnel required to safely complete the move.

13.3.5 Any surfaces that audio, lighting or video equipment will be placed onto must be capable of resisting the weight of the equipment without collapsing or subsiding.

13.3.6 The event organizer or authorized personnel must ensure that event personnel are protected from the hazards caused by the by the equipment they will be handling. Some examples of hazards specific to audio, lighting and video equipment includes but is not limited to:

- Heat produced during operation of the equipment
- Cuts & abrasions
- Electrical hazards
- Explosive hazard from pressurized lamps
- Laser light
- Release of stored energy (e.g., capacitors)
- Falling objects during assembly and disassembly
- UV radiation
- Acoustic energy
- Crushing and impacts
- Rigging hazards

- Access hazards

13.4 Wardrobe, Makeup and Wigs

13.4.1 All materials used for wardrobe, makeup and wigs must be provided with the applicable SDS sheets and training must be given on how to mitigate the hazards from the materials used.

13.4.2.1 All costumes and wigs must comply with all national, regional, and local regulation related to the flame resistance of any of the materials used or the finished product.

13.4.2.2 Where no applicable regulation exists, performers must be protected from flammable materials that are used or worn near open flames or other ignition sources.

13.4.3 All costumes and wigs must be methodically checked for pins, and they must be removed prior to the performer wearing the costume or wig when not involved in a fitting.

13.4.4 Event personnel must be informed of any pins remaining in costumes or wigs that they will be responsible for handling. Steps must also be taken to minimize the risks from potential exposure to blood borne pathogens, (e.g. due to puncture wounds).

E13.4.4 It is recommended that any costumes and wigs containing pins should be identified with a label or tag that clearly identifies the hazards.

13.4.5 Hazards caused by costumes, materials or wigs worn or used by performers that could become caught in the moving parts of automated scenery, lifts or flying pieces must be mitigated.

13.4.6 Materials used for makeup must be designated safe for use on human skin and must only be used according to the manufacturer's instructions.

13.4.7 Makeup must not be shared where the shared use would be unsanitary and risk passing a disease from one user to another.

E13.4.7 The event organizer or authorized personnel should ensure that event personnel are sufficient trained to mitigate the hazards from blood borne pathogens and other potentially infectious materials that they would reasonably be exposed to in the course of their work.

13.4.8 All ingredients and materials used in makeup and applicators that can cause allergic reactions must be clearly labeled and the potential allergens must be prominently posted near to where the materials will be stored or used. Original packaging and documentation must be available to the user.

13.4.9 The event organizer or authorized personnel must ensure that event personnel are trained for the hazards caused by the tools and materials they will be using. The training must include the mitigation of the hazards that may be present during preparation, use and safe disposal of the materials.

13.4.10. Aerosols regardless of source used for wardrobe, wigs and makeup, should not be used in enclosed spaces without sufficient ventilation. Any mitigation must include methods that are designed to reduce the inhalation and ingestion of the aerosolized products.

Aerosols can include both pressurized containers with a propellant and "pump action" sprays. Aerosols should not be used around open flames, or other ignition sources.

The use of such productions must be in accordance with the manufacturer's instructions.

13.5 Automation

Automation used within the entertainment and events industry is often customized for the project at hand. It may use off the shelf components that are assembled into unique systems or used differently than their original manufactured purpose. This can make “following the manufacturers instructions” very difficult.

People and materials are handled by automation in close physical proximity, often “live” in front of an audience.

This section aims to address the unique hazards caused by using automated scenery, props and rigging in the handling of materials and people.

13.5.1 The event organizer or authorized personnel must ensure that all affected event personnel are trained for automation they will be, operating, using, near to, or riding on.

Training must include the identification of the applicable hazards and how to mitigate those hazards.

13.5.2 The event organizer or authorized personnel must ensure that only trained and authorized event personnel are in the active hazard zone when automation is being used.

13.5.3 The event organizer or authorized personnel must ensure that any rehearsals of automated equipment include the operation of the piece in the same way as it will be used during the event.

At the start of their first rehearsal the equipment must be demonstrated to the affected event personnel without any personnel riding on or standing near the equipment being operated.

Rehearsals should then include a progression in terms of speed and height so that the pieces are not initially moving at full speed and to their full height until event personnel have become familiar and comfortable with the operation of the pieces at slower speeds and lower heights.

13.5.4 The event organizer or authorized personnel must ensure that all pinch points, nip points and crush points have guards to prevent access. Where such guards are impractical then other methods of mitigation must provide the same level of protection from injury.

13.5.5 The event organizer, supervisors and affected event personnel must identify and mitigate the hazards created by the potential for costumes, footwear, props, and other items from becoming entangled in automated pieces or their mechanisms.

13.5.6 The event organizer, supervisors and affected event personnel must ensure that automated materials and equipment are safely stored when not in use.

13.5.7 During the event the event organizer, supervisors and affected event personnel must ensure that the cueing of automated equipment and materials maintains a safe separation between all event personnel, the automated materials and any materials being handled under human power alone.

13.5.8 The event organizer or authorized personnel must ensure that additional training is given to all affected event personnel involved with flying of materials and people. Training should focus on the interaction of people and equipment in three-dimensional space, maintaining safe clearances, as well as the additional hazards from personnel working at height.

13.5.9 When automated materials and equipment are used outdoors and exposed to the elements, the event organizer must ensure that there is a weather safety plan for the safe operation of the materials. The plan must be communicated and available to all affected event personnel.

13.5.10 The event organizer or authorized personnel must ensure that there are policies and procedures in place for regular inspection and maintenance of all automated materials and equipment.

Inspection and maintenance procedures must be sufficient to address the specific hazards for the type of automation used, (e.g., pneumatics, hydraulics, electrical, etc.)

13.5.11 The event organizer or authorized personnel must ensure that any hazards specific to the sudden loss of electrical power when using automated materials and equipment are mitigated.

13.5.12 The event organizer or authorized personnel must ensure that the location and number of emergency-stop devices are sufficient to safely stop any automated materials and equipment during use promptly.

Planning for the location and number of the devices should include the time required to activate the devices in an emergency.

All affected event personnel must be trained and authorized in their use.

13.5.13 Supervisors and affected event personnel must test the operation of all emergency-stop devices prior to each rehearsal and show.

13.6 Special & Other Effects

This section discusses hazards related to special and other effects used in the entertainment and event industry. The term “special effects” can have multiple meanings and is not clearly defined in many areas of the industry.

The range of effects used in the industry is too large to create a comprehensive list in a standard, especially when effects can be created specifically for the project at hand.

The authors have tried to focus on a few more common categories and address hazards that would be common to a broad range of contexts in which these effects might be used.

For this section the phrase “special and other effects”, is being used to describe equipment and materials used to create an effect outside of the ones commonly used by departments encountered on most events; (e.g., lighting, audio, scenery, props, rigging, video, automation, wardrobe, wigs, and makeup). Or, where the authors wished to highlight a particular hazard commonly associated with an effect used by those departments.

13.7 Compressed Gas Effects

Non-Flammable compressed gases such as Carbon Dioxide, Nitrogen, Helium, and compressed air are often used on events to create various effects.

13.7.1 The event organizer or authorized personnel must ensure that all compressed gasses are, handled, stored, and used in accordance with the applicable regulation and the manufacturer’s instructions.

13.7.2 The event organizer or authorized personnel must ensure that all event personnel working with compressed gasses or who may be reasonably affected by the use of those gases are trained for the hazards they will be exposed to, or they may reasonably expose others to.

13.7.3 The event organizer or authorized personnel must ensure that all event personnel working with compressed gases are provided with the PPE necessary to protect them from the potential hazards.

13.7.4 The event organizer or authorized personnel must ensure that there is a plan to mitigate the hazards caused by repeated exposure to the use of compressed gases, (e.g., hearing damage).

13.7.5 The event organizer or authorized personnel must ensure that event personnel affected by the hazards of the specific gas used are informed of the use of that gas and protected from the potential hazards caused by using that gas.

E13.7.5 The use of Carbon Dioxide and Nitrogen in a confined space can displace the oxygen and cause suffocation and death.

13.8 Flammable Materials and Flame Effects

Many devices and materials are used to create flame effects & sparks, this can include materials like wax candles, flaming torches and machines deigned to project flame several feet using flammable gases, solid fuels or liquids.

13.8.1 The event organizer or authorized personnel must ensure that all flammable materials and flame effects are handled, stored, and used in accordance with the applicable regulation and the manufacturer's instructions.

13.8.2 The event organizer or authorized personnel must ensure that all event personnel working with all flammable materials and flame effects or who may be reasonably affected using those materials are trained for the hazards they will be exposed to, or they may reasonably expose others to

E13.8.2 Some of the more severe injuries related the handling of flammable materials and flame effects can include the inhalation of superheated or toxic gases (inhalation trauma).

13.8.3 The material handling hazards can include, by-products of combustion, heat, toxic gases, or fumes, burns and potential ignition of any surrounding materials.

The event organizer or authorized personnel must ensure that all materials used to create flame effects and spark, comply with all applicable regulation and any permit requirements.

13.8.4 The event organizer or authorized personnel must ensure that steps are taken to mitigate the hazards of surrounding materials being ignited and that sufficient firefighting measures are in place to address incipient stage fires caused using such effects.

13.8.5 The event organizer or authorized personnel should ensure the provision of PPE necessary to protect event personnel when handling, using, or firing flammable materials or flame effects.

13.9 Pyrotechnics, Cryogenic, Atmospheric, Laser effects & Performers (Specialty Effects)

13.9.1 Prior to performers committing to a production, or as soon as possible thereafter, the event organizer should ensure that notice is provided to performers to inform if they will be touching and/or operating specialty effect devices.

13.9.2 Prior to the first day when the performers will be introduced to the specialty effects, a qualified individual(s) (e.g., safety supervisor, licensed pyro technician etc.) must conduct an evaluation of all areas and the work planned between the performers and the pyrotechnics. A plan should be developed to mitigate the risks for the performers. The plan should include anything required by the AHJ in the jurisdiction in which they will be used.

13.9.3 At the start of the first day prior to when the performers will be introduced to the specialty effects, the qualified individual(s) must give an orientation to the performers explaining the results of the production assessment, provide demonstrations and instructions and copies of the safety plan that is in place.

This should include but is not limited to, the type of specialty effects, introduction of the operator(s) and fire guard(s), safety measures and hazard awareness

E13.9.3 Examples of mitigations may include fireproofing, including maintenance, extinguishers, blankets, first aid, fire curtain, etc. Examples of hazards may include the use of or exposure to the specialty effects, locations of the specialty effects, fallout area, etc.

13.9.4 The same orientation, demonstrations, instructions, and documentation must be provided to all replacement performers at the start of the first day prior to when those performers and will be first introduced to the specialty effects.

13.9.5 Performers and qualified individuals must be notified immediately if any conditions change the established practices and use of specialty effects in the production. At that time, the specialty effects plan should be updated, and the new version provided to the performers and affected event personnel.

13.9.6 An inspection by the local authority having jurisdiction (e.g., fire department, emergency services, etc.) should take place prior to the use of the specialty effects with the performers.

13.9.7 The type of material that will be used must have a Safety Data Sheet (SDS) and should be posted in a prominent position backstage (e.g., the performer's callboard and in the stage manager's office).

13.9.8 Performers & event personnel staged in the fallout area should be directed to avoid looking at the specialty effects (e.g., exposing their face to the fallout from the effect). Eye and face protection should be provided when necessary to mitigate the hazard.

13.9.9 For each performer that will be staged working in the fallout area, all costume and prop pieces the performer is wearing, handling or in proximity should be flame resistant. Soft goods (e.g., curtains, borders, tabs, scrims, etc.) should be routinely flameproofed. It is recommended to flame proof items outside of the fallout area for an extra level of safety.

13.9.10 For specialty effects placed on or in contact with a performer's body, shielding and appropriate PPE should be provided, or any alternate mitigation should be adequate to prevent injury.

13.9.11 When cueing a specialty effect there should be a separate cue for each pyrotechnic that will take place and a specific identification for the name of the cue.

13.9.12 Emergency stops should be in place for all specialty effects when required and located where they can be easily accessed.

13.10 Fluids Effects

Fluids are often used at events to create effects, the most common fluids are water, oils, detergents, glycol, and food grade products used to create blood effects. Common hazards can include inhalation, ingestion, aspiration, drowning, allergic reactions, and biohazards.