



**BSR ES1.18 – 201x,
Event Safety – Rigging**

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Entertainment Services and Technology Association
271 Cadman Plaza
PO Box 23200
Brooklyn, NY 11202-3200
USA
Phone: 1-212-244-1505
standards@esta.org

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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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Contact Information**Technical Standards Manager**

Karl G. Ruling
ESTA
271 Cadman Plaza PO Box 23200
New York, NY 11202-3200
USA
+1-212-244-1505
karl.ruling@esta.org

Assistant Technical Standards Manager

Richard J. Nix
ESTA
271 Cadman Plaza PO Box 23200
New York, NY 11202-3200
USA
+1-212-244-1505
richard.nix@esta.org

Technical Standards Council Chairpersons

Mike Garl
Mike Garl Consulting LLC
+1-865-389-4371
mike@mikegarlconsulting.com

Mike Wood
Mike Wood Consulting LLC
+1-512-288-4916
mike@mikewoodconsulting.com

Working Group Chairperson

Dr. Donald Cooper
Event Safety Alliance
+1-330-414-8938
dcc1@neo.rr.com

Acknowledgments

The Event Safety Working Group members when this document was approved by the working group on DD MONTH YEAR were as follows:

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

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

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1 Scope

Rigging creates life safety hazards that affect every person associated with an event.

This standard provides minimum requirements and general guidelines for the suspension of equipment and materials that are utilized in the technical production of organized events.

This standard addresses the general requirements for design, planning, installation, set-up, removal and operation of rigging activities. These activities may be conducted using permanent or temporary structures, either in or out of doors.

This is not a tutorial or list of specifications.

Installation of permanent rigging systems are not discussed here.

A typical event has multiple stakeholders that may have substantial authority and responsibility for the event's execution. The responsibility of the stakeholders must be mutually agreed upon prior to the event. It is imperative to have clear lines of authority and responsibility between each of the affected parties.

E1

Written Contracts Prevent Disputes. The days immediately before an event can be very hectic; this is no time to be making spontaneous, important agreements. Instead, to the extent possible, lines of authority and responsibility should be memorialized in advance in written contracts that the agreeing parties sign and date which, may also be signed in counter-parts. Memories often differ after an event, but recorded communications always remember. While a signed contract is always preferred, use whatever means of recording an agreement you can to clearly document your agreements for posterity.

1.1 References

All relevant standards must be complied with in the safe planning and execution of a rigging event. These must include, but are not limited to, the following:

ANSI E1.56, Rigging Support Points

ANSI E1.50, Requirements for the Structural Support of Temporary LED, Video & Display Systems

ANSI E1.47, Recommended Guidelines for Entertainment Rigging System Inspections

ANSI E1.44, Common Show File Exchange Format For Entertainment Industry Automation Control Systems – Stage Machinery

ANSI E1.43, Performer Flying Systems

ANSI E1.39, Selection and Use of Personal Fall Arrest Systems on Portable Structures Used in the Entertainment Industry

ANSI E1.22, Fire Safety Curtain Systems

ANSI E1.21, Temporary Ground-Supported Overhead Structures Used To Cover Stage Areas and Support Equipment in the Production of Outdoor Entertainment Events

ANSI E1.15, Recommended Practices and Guidelines for the Assembly and Use of Theatrical Boom & Base Assemblies

ANSI E1.8, Loudspeaker Enclosures Intended for Overhead Suspension--Classification, Manufacture and Structural Testing

ANSI E1.6-4, Portable Control of Fixed-Speed Electric Chain Hoists in the Entertainment Industry

ANSI E1.6-3, Selection and Use of Chain Hoists in the Entertainment Industry

ANSI E1.6-2, Design, Inspection, and Maintenance of Electric Chain Hoists for the Entertainment Industry

ANSI E1.6-1, Powered Hoist Systems

ANSI E1.4, Manual Counterweight Rigging Systems

ANSI E1.2, Design, Manufacture and Use of Aluminum Trusses and Towers

ANSI E1.1, Construction and Use of Wire Rope Ladders

CFR - 1926.501 – Duty to Have Fall Protection

CFR - 1926.251 – Rigging Equipment for Material Handling

CFR - 1926.251 – OSHA Requirements Addressing Fall Protection Equipment

CFR - 1926.753 – Hoisting and Rigging

CFR - 1910.132 – Personal Protective Equipment

CFR - 1910.184 – Slings

ANSI/ASSP Z359.1-2016 The Fall Protection Code

ANSI/ASSP Z359.2-2017 Minimum Requirements for a Comprehensive Managed Fall Protection Program

ANSI/ASSP Z359.3-2017 Safety Requirements for Lanyards and Positioning Lanyards

ANSI/ASSP Z359.4-2013 Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components

ANSI/ASME P30.1 – 2019, Planning for Load Handling Activities

2 Definitions

2.1 Competent Person: A person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

2.2 Dynamic Loading: Forces caused by the acceleration or deceleration of an object.

2.3 Flying: Any movement of a person or other suspended load caused by the operation of a rigging system.

2.4 Live event: Any assembly, indoor or outdoor, presented to a live audience. As used herein, this includes the preparation for and dismantling (load in, load out) of the event.

2.5 Load Hazard Zone (LHZ): The area underneath the load system where death or serious injury may occur as the result of a load system or a rigging failure.

2.6 Must: Denotes a mandatory requirement.

2.7 Production Rigger: The person designated by the production supervisor to ensure the proper installation of the rigging system and hoists.

2.8 Production Supervisor: The person or entity who either by ownership, sub-contract or other arrangement oversees the installation, operation and dismantle of production elements.

2.9 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.

2.10 Rigger: A person who assembles, attaches or detaches rigging equipment to loads, structure or lifting devices. Rigging work often requires riggers to work at height and on the ground simultaneously.

2.11 Registered Design Professional: An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

2.12 Secondary Suspension: Additional rigging used to support the load in case of primary suspension failure.

2.13 Should: Denotes a recommendation.

2.14 System, Flown: Describes all the systems and components that must be considered when using a hoist system. See figure 1 & 4, section 8.

2.15 System, Lifting: The group of hoists used to raise and lower the load system. See figure 1, section 8.

2.16 System, Load: The objects attached to the hoist(s), either directly or indirectly, causing a load to be applied to the hoist(s). See figure 1-3, section 8.

2.17 System, Rigging: The system of wire rope, shackles and any other equipment used to connect hoist(s) to a support structure. See figure 1, section 8.

3 Responsibility & Roles

3.1 Responsibility

Authority Must Match Responsibility. Any person with authority must be, at a minimum, competent in the relevant discipline regarding rigging and/or overhead suspension.

Persons performing the rigging planning and operations must be qualified and competent, as determined by the employer or employer's representative, to perform the assigned tasks.

All personnel involved in the rigging planning and operations must meet the qualifying criteria established in applicable consensus standard(s), site-specific requirements, or regulations.

All Event Rigging Personnel and Affected Event Personnel must be empowered to and informed that they can make a Life Safety Call (e.g. stopping work) for any reason at any time for any action or situation they deem to present a hazard to Life Safety without fear of discrimination or retaliation.

E3.1 There is no universally established amount of responsibility that any one entity must have. For example, some rigging service providers will use all their own equipment and personnel, providing supervision from load-in through load-out, ensuring all aspects of worker safety in between. Some venues or producers may seek to insert their own supervisors, workers, or equipment. The key is that however much responsibility one entity has for its work and safety, the entity **MUST** have the corresponding authority to bear that responsibility. The worst possible scenario is to be responsible for conditions at an event that you are powerless to change.

3.2 Roles

Roles may include, but are not limited to those duties outlined below. In some cases an individual or entity may perform multiple, non-conflicting roles.

3.2.1 Production Supervisor

- Overseeing the installation, operation and dismantle of production elements
- Supplying the Production Rigger in advance with a plot indicating all rigged production elements and their desired locations
- Integration and communication relative to production elements, coordination of production vendors and suppliers
- The management of information and obtaining documents that apply to the event's rigging in conjunction with the event's production rigger and/or the registered design professional, described above.

3.2.2 Production Rigger

- A production rigger must meet the definition of both a competent and a qualified person for the reasonably foreseeable role and responsibilities they have for the event
- Participating in the development or, review of a rigging risk assessment & JHA (Job Hazard Analysis for working at height)
- Ensuring that a fall protection plan and rigging rescue plan are in place for the reasonably foreseeable fall hazards at the event
- Should be involved in the applicable parts of any event emergency response plan
- Reviewing the event safety policy with all rigging workers immediately prior to starting work; Toolbox talk
- Ensuring the event related rigging system meets all current applicable codes, standards and regulations.
- Supervising rigging teams and rigging service suppliers during the installation, operation and removal of the event related equipment
- Ensure the proper usage of event related rigging equipment
- Monitoring the event related rigging installation to ensure the rigging plan is properly executed per the agreed upon documents and drawings

- Maintaining applicable documentation including relevant engineering information and an accurate as-built rigging plan
- Verification of actual conditions against agreed upon documents
- Inspection of event related production elements for integrity before the equipment is raised, rigged overhead or suspended and again once those elements have been parked and secured
- Oversight of event rigging operations and event rigging crew for all rigged show elements
- Monitoring rigging crew for compliance with commonly accepted rigging practices for the event
- In the event the agreed upon documents do not match actual conditions, appropriate action must be taken that includes, but not limited to
 - Take appropriate action to clear the obstruction and update current rigging plan to reflect any changes and inform the Production Supervisor
 - Ensure the new conditions do not exceed allowable loading criteria
 - When a registered design professional is involved, obtain written approval from the registered design professional for any variations and/or discrepancies from the approved engineering documents and drawings.

3.2.3 Rigger(s)

- Rigger(s) must meet the definition of a competent person in order to install and operate the rigging components
- Rigger(s) must be familiar and comply with the applicable event safety policies and procedures, regulations, industry standards and reasonable practices, and be trained in the proper use of the applicable safety procedures personal protection equipment (PPE) for the hazards present at a rigged event
- All riggers are expected to observe and monitor the event's rigging environment for life safety hazards in support of the production rigger and to report any life safety hazards to the production rigger and/or the production supervisor.

In addition to the safe installation, operation and dismantling of the rigging equipment, all riggers are expected to observe and monitor the event's environment for event rigging related life safety hazards in support of the production rigger and their duties as described above in 3.2.2 and to report those issues to the production rigger.

E3.2.3 All members of the rigging crew need to inspect their respective elements of the rigging and should vigilantly look for damaged, worn, compromised rigging equipment.

3.2.4 Registered design professional

- Responsible for providing any required engineering support and documentation for the load handling activity
- The registered design professional must be competent in structural analysis.

E3.2.4 It is recommended that the registered design professional be familiar with temporary entertainment structures, equipment, systems and components.

3.2.5 Event Organizer or Producer

As the general contractor for the event, this person or entity is responsible for:

- Ensuring a qualified and competent event personnel are authorized to mitigate the hazards from live event rigging at the event including a final evaluation of the live event rigging system(s) prior to commencing operations
- Verifying that suppliers and event personnel involved with rigging are competent to do so and have appropriate training, experience and, insurance appropriate for the size and complexity of the event and the reasonably foreseeable live event rigging hazards.
- Ensuring that appropriate method statements, policies, procedures, documentation, contracts and insurance are in place before work begins onsite

- Must ensure appropriate PPE is used in accordance with all applicable local and national codes, standards and regulations.

4 Venue Considerations

4.1 Suitability

Facilities for events requiring rigging must be evaluated for suitability. Consideration must be given, but not limited to the following:

- overall rigging capacity
- point load capacity
- physical interference of other objects
- access for rigging personnel
- lifting distance
- support structure height
- wind/air currents
- available work lighting
- fall protection or, fall arrest system if required.

E4.1 While very specific details will be identified in the planning stages of an event involving rigging, it is important that this question is answered broadly in the beginning. For example, it would be typically unfeasible for a concert with over 100,000 lbs. of equipment to be installed in a venue that only seats 1,000 people. Similarly, temporary structures, including tents, can have very specific and narrowly defined loading capacities.

4.2 Point of contact

Confirm communication with authorized venue's official point of contact who should be a person with authority.

4.3 Approval requirements

Establish contact with the appropriate Authority Having Jurisdiction (AHJ) if required.

Provide to the venue a rigging plan as well as a fall protection & rescue plan.

E4.3 When applicable, accurate drawings depicting the rigging design may need to be submitted to and approved by the enforcing authority and the venue prior to the commencement of any site work.

5 Rigging Design & Planning

5.1 General

The intent of this section is to provide guidance for event organizers and promoters rather than for the actual rigger. The questions and considerations outlined within this section are broad and encompass a global perspective of an event. The answers to these topics will have major impact on much of the content that follows.

The planner must know the weight of all the rigging and equipment to be flown.

The capacity of the structure supporting the rigging must be known and accounted for in all calculations.

Dynamic forces caused by the rigging system shall be accounted for in the design.

Calculations need to be documented and available for review at any time.

E5.1 Planning a rigging system for a temporary installation requires careful consideration to minimize the hazards to event personnel and attendees.

In order to plan the system, information is required. The planner needs to know the weight of all the equipment to be flown. In addition, the purpose of the flown items need to be taken into account. Things like moving lights may

impose stresses that need to be accounted for in the design. If the flown elements are to move during the show, additional precautions need to be taken.

Co-ordination with the other affected event personnel is necessary, especially with the electricians. Power is required for many elements, and close co-operation is necessary.

A logistical plan to schedule the events needed to install the system should be developed. It will make for a more efficient day if the elements are scheduled in a logical order.

5.2 Rigging plan

All temporary rigging installations must be preplanned by a competent person and should include a rigging plan developed by a qualified person.

E5.2 Standard rigging plan can vary from a simple verbal plan to a complex documented rigging plan. Written documentation of a rigging plan is recommended.

5.3 Compliance

Rigging operations must comply with applicable regulations and standards.

5.4 Origin of plans

Rigging plans and documents must include sufficient information to convey the location of the agreed upon origin, benchmark or, datum.

E5.4 When planning an event that utilizes rigging equipment it's not uncommon for the various departments to generate drawings specific to their department for use on the job site. The origin is often unique to the specific department plans and do not always correspond to the other departments involved. It is usually the production rigger that will collect the various department's drawings and generate a comprehensive rigging drawing. In some cases, there may a person designated by the production supervisor to collect the various departments drawing information. When a person or, entity other than the production rigger is tasked with drawing collection it is highly recommended that all parties agree on the origin, benchmark or, datum location.

5.5 Load distribution

When a rigging plan is written the distribution of loads to supporting members and attachment points shall be shown. When the plan is only verbal the loads should be identified verbally in conversation between all affected event personnel.

5.6 Anticipated point loads

The maximum reasonably foreseeable point loads must be included on the rigging plan or supporting documents.

Caution notice must be placed at the control point of a lifting system when statically hung secondary suspensions are used.

E5.6 Secondary suspensions should be avoided if possible and the rigging design should favor redundancy.

In many cases a secondary suspension is constructed using rigging hardware that is considered statically (dead-hung) hung in that the hardware used is non-moving.

5.7 Risk assessment & management

Risk assessment and management must comply with all applicable state and federal regulations or, standards such as OSHA regulations & published guidelines such as the Event Safety Guide, Chapter 2 – *Planning & Management*, and Chapter 3 - *Major Incident*, {or comply with ANSI ES1.2 – 202x, Event Safety – Planning, Management, and Major Incident at such time as it is finally approved by ANSI's BSR}.

E5.7 Risk assessment & management rigging considerations

Event Rigging Personnel

- Qualifications & Training Level
- Assignments & Roles
- Work Hours & Staffing Levels
- Availability of first aid
- Fall rescue personnel

Rigging/Suspension

- Structural/ System/ Component/Hardware Failure
- Heavy Equipment
- Working at Height
- Fall Protection
- Falling from Height
- Fall Rescue
- Electrical Safety
- Proper Bonding & Grounding of equipment & Material
- Equipment Damage
- Lifting & Lowering Operations
- Assembly & Disassembly
- Non-rigging event personnel

5.8 Fall hazards

Riggers must be protected from fall hazards.

5.9 Fall protection methods

Fall protection methods must be determined and agreed upon by all stakeholders during the planning process. Where possible the focus of any fall protection system should first focus on elimination of the fall hazard, fall prevention, fall restraint with fall arrest being the least preferable.

5.10 Fall arrest system

Fall arrest systems used on portable entertainment structures must at a minimum comply with ANSI E1.39.

E5.10 There are many other potential fall hazards associated with installing an event production. Other regulations such as OSHA 1910 & 1926 and standards such as ANSI Z359 & A92 address fall protection planning, including rescue planning, in more detail.

5.11 Fall arrest system rescue plan

A fall arrest system rescue plan must be developed and documented.

5.12 Rigging rescue plan

Rigging rescue plan must at a minimum comply with all applicable local, state and federal standards.

5.12.1 The rescue plan must be updated to reflect any on site changes.

5.13 Rest periods & breaks

When scheduling rigging calls, the production must plan to incorporate appropriate rest periods or breaks.

E5.13 It is imperative for supervisors to be cognizant of the physical and mental condition of their crew during the course of any rigging operation.

5.14 Rigging work at height

Rigging work at height must not be performed alone at any time.

In addition, the rescue personnel and equipment detailed in the rescue plan must be at the ready.

E5.14 When performing rigging work at height there needs to always be another person available to assist the person working at height.

5.15 Staffing levels

Production Rigger and Production Supervisor must determine the appropriate staffing levels for the event.

6 Equipment Considerations

6.1 Selection

Selection of rigging equipment at a minimum must be determined by a competent person.

E6.1 Chain hoists, winches and a variety of other devices can be utilized to support equipment overhead.

6.2 Compliance

All equipment must comply with applicable regulations and/or standards.

6.3 Traceability

All equipment must be identifiable and traceable to the manufacturer.

6.4 Records

Maintenance, inspection and/or testing records for equipment must be made available upon request.

E6.4 Many standards address record requirements. The two most common in entertainment rigging are:
ANSI E1.6-2 Design, Inspection, and Maintenance of Chain Hoist
ANSI E1.2 Truss

6.5 Custom built hardware

Custom built lifting clamps/hardware must be proof tested to 2 times the rated capacity in the direction of the lift or, be designed by a qualified person.

6.6 Load considerations

Equipment selected for use in each rigging system must have a rated load capacity greater than the highest anticipated calculated load or combination of loads that are reasonably foreseeable in the circumstance, including dynamic loading.

6.7 Electrical considerations

Verify the power supply is appropriate for the equipment being used.

6.7.1 Check all electrical connections for proper functioning and direction of motor rotation

7 Lifting Operations

7.1 Installation

All event workers must be informed and aware at all times of when event rigging personnel are working overhead. They should avoid the area where the hazards exist unless they are focused solely on the rigging work overhead and are trained for the hazards exposure that is reasonably foreseeable.

7.1.1 The Hazards from overhead work should be communicated using visual and audible methods, signage and where possible barriers should clearly identify the load hazard zone (LHZ) and access controlled to authorized Event personnel only.

7.2 Prior to lifting

The operator must alert all persons in the LHZ of the intended action. Prior to each lift or adjustment. All persons not authorized, directly involved or sufficiently trained for the hazard exposure in the LHZ should move to a designated position outside the LHZ.

7.2.1 The integrity of the system & visible components must be visually checked prior to every lift and/or series of lifting operations.

7.2.2 Authorized and Designated event personnel must be positioned to observe and monitor the lifting operation.

The number of persons must be based on the specifications of the lifting operations.

The number of Event Personnel must be sufficient for the reasonably foreseeable hazards of the lifting operations.

E7.2.2 When moving multiple hoists simultaneously it is extremely hazardous for one individual to monitor all the hoists from a fixed position. Having additional event personnel monitor the movement will create more visibility allowing for a quicker reaction to a potential hazard.

7.2.3 All available competent event personnel should be designated to closely monitor the lifting operation and be ready to alert the operator to any potential hazards by using the established communication method and term(s.)

7.2.4 Lifting operations using chain hoists must comply with ANSI E1-6.3

E7.2.4 The use of load verification equipment (e.g. load cells) is highly recommended.

7.3 Post Lifting Operation

Once the rig is parked at its desired location the rigging team must ensure the loading of the rig is distributed properly using an appropriate method. A visual inspection of the rigging must be performed by the production rigger or, designated competent rigging personnel to ensure items in the lifting plan have been followed.

Once overhead rigging work has been completed and the rig has been evaluated to be secure the LHZ may be released to other Event Personnel.

7.4 Flying scenery during a performance

Flying scenic elements add potential hazards that require hazard mitigation.

7.4.1 Any rigged scenery must be weighed before being lifted.

7.4.2 The location of adjustment hardware should be accessible.

E7.4.2 When possible, adjustable rigging hardware should be located at the bottom of the element.

7.4.3 Rigging people/performers and people/performer flying systems are outside of the scope of this document.

E7.4.3 ANSI E1-43 Performer flying standard

This standard addresses performer flying

7.4.2 Rigging methods and construction of flying scenic elements are outside of the scope of this document.

7.4.3 Prior to flying any elements, all event personnel who will be in areas where the flying of any object will occur, must be given advance notice.

7.4.4 Under the leadership of the person in charge of performer integration, an event organizer, promoter, or stage manager, all affected event personnel should attend a rehearsal where:

- Under full work lights with minimal noise levels, flying units should be demonstrated, in the exact sequence in which they will be executed during the performance
- Under full work lights with minimal noise levels, all flown units are then run with affected event personnel in the same places where they will be during the performance, and all affected event personnel are given the time to ask questions, express concerns, and receive training in the process to STOP the motion of any flown unit at any time—including during the performance.

- Under show conditions rehearsal of the flying unit(s) must repeat until affected event personnel are trained & familiar with the process.

E7.4.4 Rehearsal should be first at half speed (if possible) and then in real time.

It is recommended that rehearsal utilize all show elements used in actual show conditions (i.e., show lighting, other moving units such as scenery actually moving, full audio, full effects, etc.)

7.5 Dismantle or Load Out

All event personnel must be informed at all times when event rigging personnel are working overhead and should avoid the area where the hazards exist unless they are focused solely on the rigging work overhead and are trained for the hazards exposure that is reasonably foreseeable.

7.5.1 Prior to dismantle or load out, the Event Organizer or Producer must coordinate with the venue any potential logistical conflicts during the changeover that may create additional reasonably foreseeable event rigging hazards during rigging removal.

E7.5.1 It is not uncommon for a venue to have tight timelines for turning around events. Careful planning may reduce any potential logistical conflicts for example, floor cleaning machines, basketball court installation etc. during rigging operations and removal.

7.5.2 Prior to moving the rig, competent rigging personnel must verify that any secondary suspensions are removed.

7.5.3 Competent event rigging personnel must verify that suspended equipment can be lowered safely and equipment is operating correctly.

7.5.4 The Hazards from overhead work should be communicated using visual and audible methods. Signage and where possible barrier should clearly identify the LHZ and access controlled to authorized Event personnel only.

7.5.5 The operator must alert all event personnel in the load hazard zone (LHZ) of the intended action prior to each lift or adjustment. All persons not authorized, directly involved and sufficiently trained for the hazard exposure in the LHZ should move to a designated position outside the LHZ.

7.5.5 Once the rigging work has been completed, the LHZ must be released to the production supervisor.

8 FIGURES

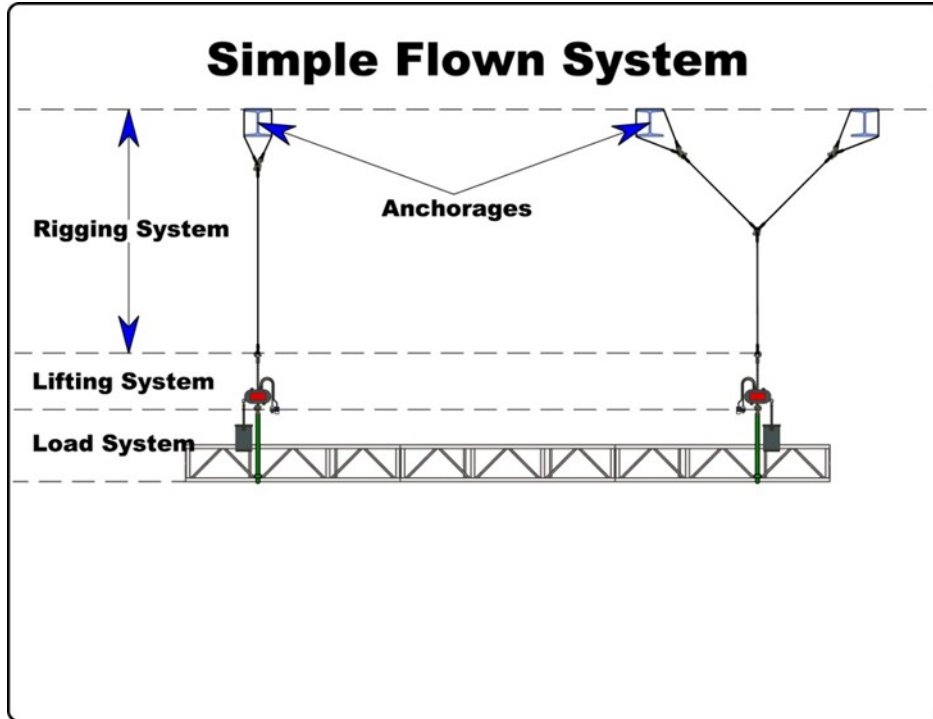


Figure 1

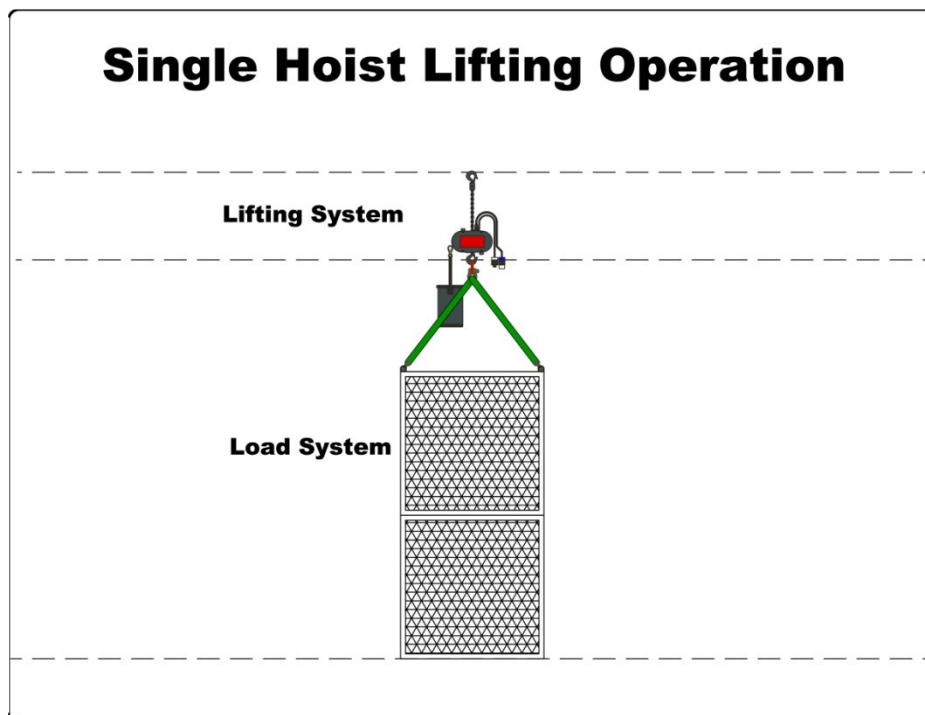


Figure 2

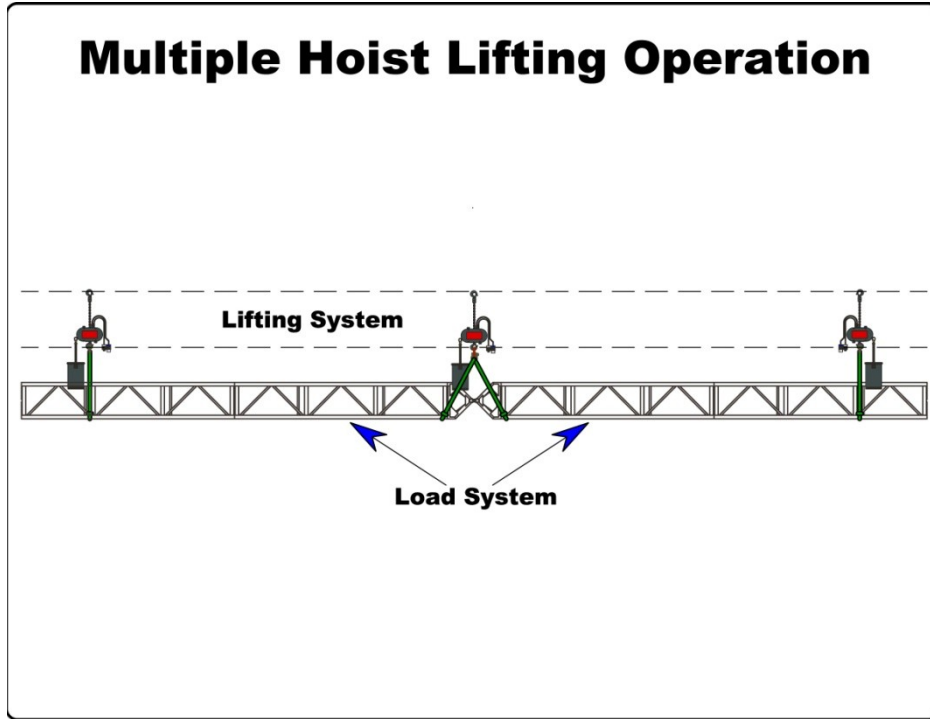


Figure 3

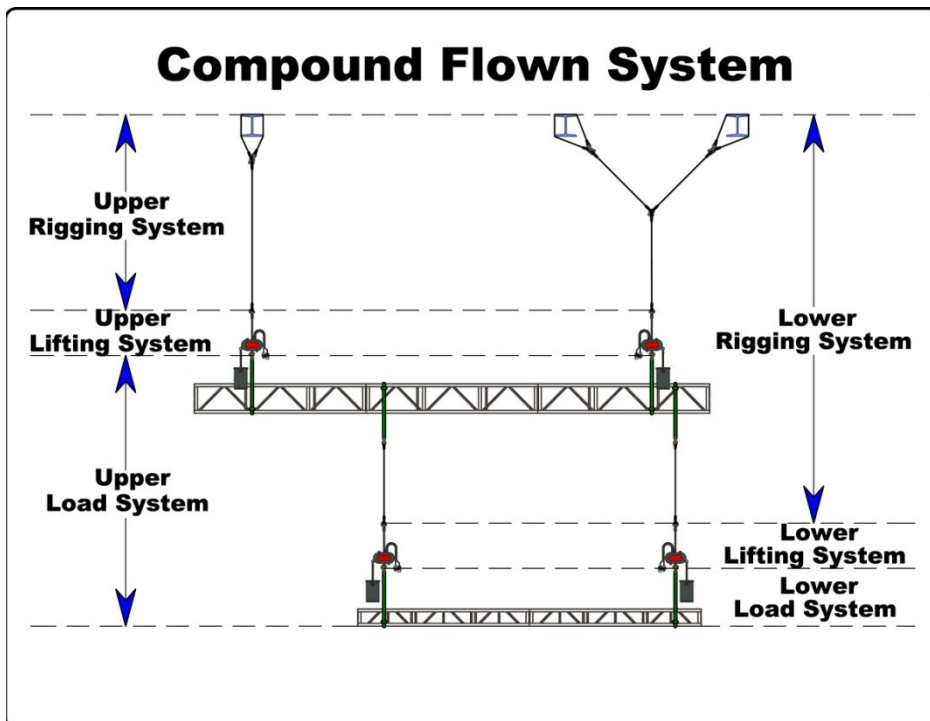


Figure 4