VERSION 2.0

RIGGING GUIDE

FOR PERFORMANCE SPACES

AN EDUCATION RESOURCE FOR THEATRE RIGGING TECHNOLOGY

Wenger® | JR CLANCY

INTRODUCTION

RECOMMENDATIONS/PRECAUTIONS

Much of the functionality and safety of an installed rigging system is dependent upon the proper selection and integration of equipment and on its correct installation and operation. It's also critical that structural members supporting the equipment have adequate load-bearing capacity, that all equipment is tested and maintained, and that rigging system operators be properly trained. Failure to do any one of these may lead to equipment malfunction, which can cause serious injury or death. For these reasons, J.R. Clancy does not warrant the suitability of any product in this document for any application unless J.R. Clancy specifically designed and engineered the specifications and drawings of the rigging system and the products are installed in accordance with those documents. Should you have any questions regarding the selection of the proper equipment, installation, maintenance or training requirements, please contact Wenger Corporation's Syracuse Service Department.

TABLE OF CONTENTS

This Planning Guide is intended for theatre educators and other planning team members, offering information that is easily accessible and organized to help create a rigging system that supports great performances safely, efficiently and cost-effectively.

Wenger works with the American Institute of Architects Continuing Education Systems a registered AIA/CES provider.

USING THIS GUIDE

HOW TO BENEFIT MOST FROM THIS GUIDE

This guide provides concise explanations of theatrical rigging equipment and its operation, from simple to complex. By understanding the basics of rigging, applying this information to your needs and using the reference material included, you will be able to participate more effectively in your new construction or renovation project. Your proactive, informed communication will help ensure the best rigging solution for your facility, your students, your employees and your budget.

To benefit most from this guide, we recommend you do the following:

- Read the guide thoroughly.
- Use the information to understand rigging needs of your facility.
- Begin the dialogue with your project team and consultants about project specifics.
- Most importantly, start now. The most critical decisions are often made years before construction begins. And, as the project progresses, changes become difficult and expensive. Investing planning time now can save money and avoid problems later.

TIP:

Engage with a theatre design specialist, like a theatre consultant, as early in the design/ renovation process as possible.

THE CONSTRUCTION PROCESS

GET INVOLVED

Proper planning and continued engagement are key to realizing the theatre that meets your producing and audience expectations. Use this guide to become actively involved from the onset, ensuring the project stays on course to achieve its desired outcomes.

Build Your Team

Building a team that communicates regularly is a great way to ensure you get the best facility possible. Make sure to include not just the individuals who will be using the finished spaces regularly, but also outside experts like architects, acousticians and theatrical consultants who bring years of experience to the table. Wenger's Planning Guides will also help you focus on complex issues you may have otherwise overlooked.

END USER
Uses or supervises the theatre and related equipment once installation is complete.

ADMINISTRATOR
The person or team making budgetary decisions and monitoring finances.

THEATRE MANAGER
Maintains and oversees theatre activity, ensures end users are trained, maintenance is performed and inspections are completed.

ACOUSTICAL & THEATRICAL CONSULTANT
Advises on sound, lighting and/or other performance aspects, ensuring optimal acoustics and functionality in the theatre's design and equipment choices.

ARCHITECT
Plans the design of the theatre and related building spaces.

GENERAL CONTRACTOR
Manages the various subcontractors and tradespeople.

MANUFACTURER/ DEALER
Produces or procures the specified equipment; facilitates installation.

PROJECT TIMELINE

The following phases are the basic steps in a new construction or renovation project:

Phase 1

Pre-Planning

Establish Team & Objectives

- Define project goals.
- Form planning committee with theatre managers, administrators and end users (include theatre and music teachers for schools).
- Research by contacting manufacturers, attending trade shows and visiting other theatres.
- Explore funding options, including federal/state arts grants.

Phase 2

Programming

Develop Detailed Vision

- Gather input for creating a "big picture" plan.
- Define theatre's goals and anticipate future needs.
- Present ideas from this guide to architect/theatre consultant.
- Explain needs, space requirements and unique factors.
- Communicate research/usage requirements to the design team.

Phase 3

Schematic Design

Create Initial Concepts

- Architect and theatre consultant diagram facility and allocate square footage.
- Committee reviews multiple concepts to understand direction.
- Agree upon basic design; future changes are costly.

Phase 4

Design Development

Finalize Design

- Confirm dimensions of performance area and support spaces.
- Detail electrical/lighting, audio/visual, rigging and other mechanical systems.
- Consultants create plan and section drawings.
- Review and scrutinize all details, even minor elements.

TIP:

Concentrate most of your involvement during Phases 1-3, when the theatre design takes shape. Attempting modifications later in the process is more difficult and expensive.

Phase 5

Construction Documents

Complete Plans for Bidding

- Design team details everything for bidding and construction.
- Finalize general contractor selection and all cost estimates.
- Potential value engineering to fit budget; advocate for key needs.

Phase 6

Bidding

Initiate Selection Process

- Issue invitations to bid (ITBs) to contractors and subcontractors including electrical, plumbing, HVAC, mechanical and specialties like theatrical.
- Review bids and award contracts.

Phase 7

Construction

Oversee Building Activity

- Last opportunity to ensure theatre adheres to specifications.
- Visit site often and discuss concerns with general contractor, consultants and administration.
- Be part of the solution for problems encountered.

Phase 8

Equipment Purchasing & Installation

Ensure Timely Procurement

- Theatre consultant reviews and approves submittal drawings from equipment subcontractors.
- Approved subcontractors procure materials, manufacture equipment and install as scheduled.
- Order products like storage cabinets, staging/risers, music chairs, stands and portable acoustical shells.

Phase 9

Theatre Opening!

Learn, Train & Prepare

- Familiarize with new equipment operation and maintenance.
- Plan for the first annual rigging inspection.

TIP:

Advocate for today's needs – and tomorrow's. Strive to future-proof your theatre, planning for program growth and technology innovations. No one knows what your theatre needs better than you do. You won't get what you don't ask for.

TYPES OF THEATRES

RIGGING FOR EACH TYPE OF THEATRE SPACE

Theatre architecture and design, including rigging equipment, has adapted to cultural changes, artistic trends and technological advancements over the years. To determine a specific theatre's rigging needs, first consider the programming intended for that space, such as: band/orchestra, choir, amplified music, drama, musicals, assembly, graduation and/or rentals/tours.

The following six common theatre types each feature unique elements and functionality:

PROSCENIUM

Characterized by the "picture frame" effect of the proscenium arch bordering the stage, separating performers and audience; the most common theatre type. Enables flexible array of elaborate stage settings with multiple scenery backdrops and lighting; a full-stage acoustical shell helps blend and project sound.

Rigging may include:

- Counterweight sets
- Motorized utility sets (fixed speed) for shells and electrics
- Motorized performance sets (variable speed) for scene changes
- Front of House lighting positions, either motorized or catwalk-accessible
- Drapery track
- Speaker hoists
- Acoustic banners
- Other options include:
  - Performer flying hoists
  - LED walls
  - Projection screens

THRUST

Described as a proscenium theatre with a large portion of the stage extending into the audience space. Allows a more intimate, dynamic and participatory space; ideal for drama.

Rigging may include:

- Dead hung rigging over the thrust/audience
- Tension wire grid
- Counterweight sets
- Motorized utility sets (fixed speed) for electrics
- Motorized performance sets (variable speed) for scene changes
- Drapery track

BLACK BOX

Identified by black walls, flat floor and minimal sets/architectural details. Provides flexible configuration options for both stage and audience.

Rigging may include:

- Dead hung rigging/Pipe grids
- Tension wire grid
- Drapery track
- Motorized pipe grid

FLEX SPACE AND CAFETORIUM

Designed for versatile use, this adaptable theatre setup is commonly found inside a gymnasium, cafetorium or other multipurpose area. Accommodates a wide range of activities beyond performing arts.

Rigging may include:

- Dead hung rigging/Pipe grids
- Drapery track
- Motorized rigging

TYPES OF THEATRES (CONTINUED)

CONCERT HALL/ RECITAL HALL

Designed primarily to create superior acoustics for music, often with sound-reflecting panels and absorptive materials to fine-tune the auditory experience. Hosts a range of music and often non-music programming.

Rigging may include:

- Counterweight sets
- Motorized utility sets (fixed speed) for shells and electrics
- Motorized performance sets (variable speed) for scene changes
- Front of House lighting positions, either motorized or catwalk-accessible
- Drapery track
- Speaker hoists
- Acoustic banners
- Other options include:
  - LED walls
  - Projection screens

ARENA/THEATRE IN THE ROUND

Surrounded by audience seating on all sides, this immersive theatre style places the stage in the center to provide 360-degree engagement. Encourages close interactions between performers and audience, suitable for diverse events from concerts to drama.

Rigging may include:

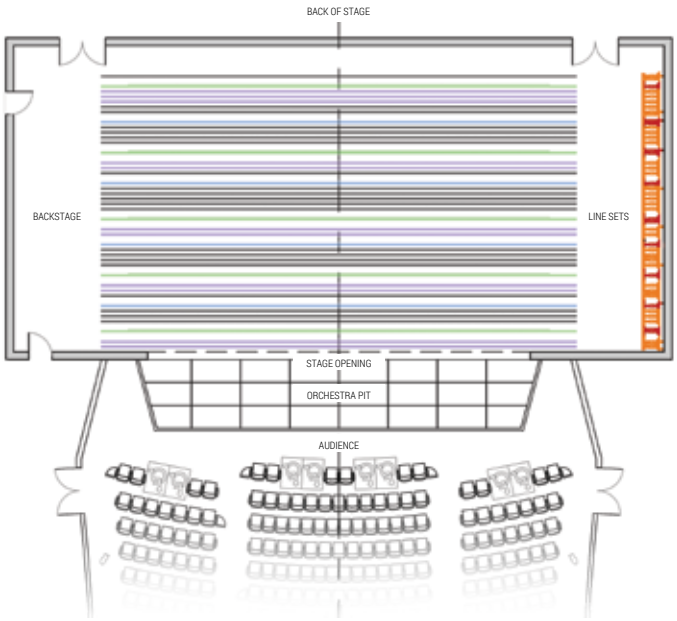
- Dead hung rigging/Pipe grids
- Chain hoists
- Tension wire grid
- Motorized rigging

TYPICAL LINE SET BREAKOUT - TOP VIEW

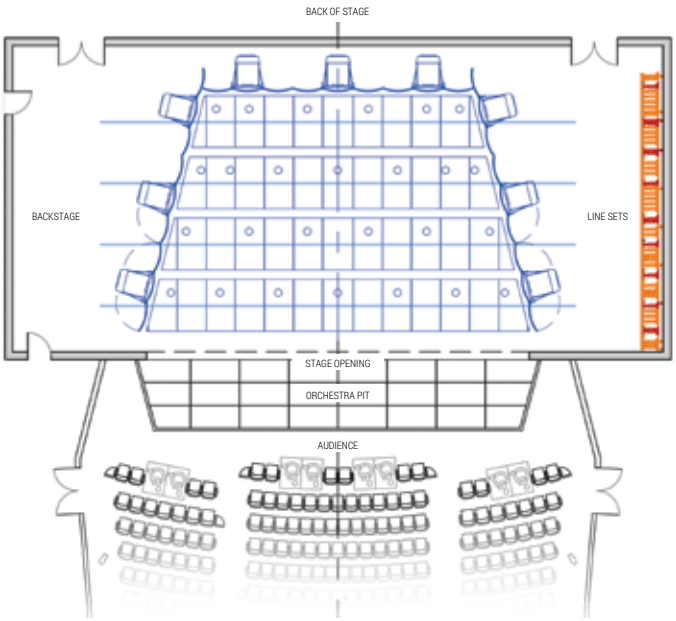
This is a typical allocation of line sets in a medium-sized 500-650 seat proscenium theatre.

Battens
Curtains
Lighting
Acoustical Shell & Ceiling Sets
Scenery
Counterweight Rigging
Motorized Rigging

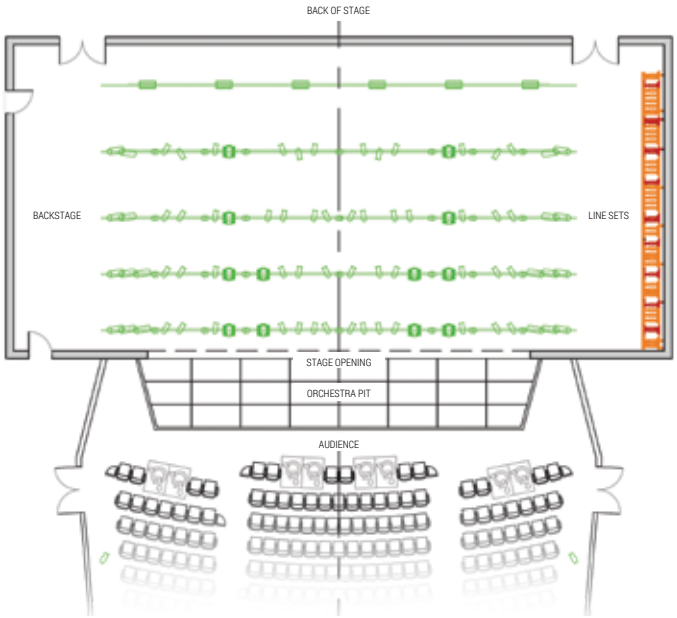
BATTENS



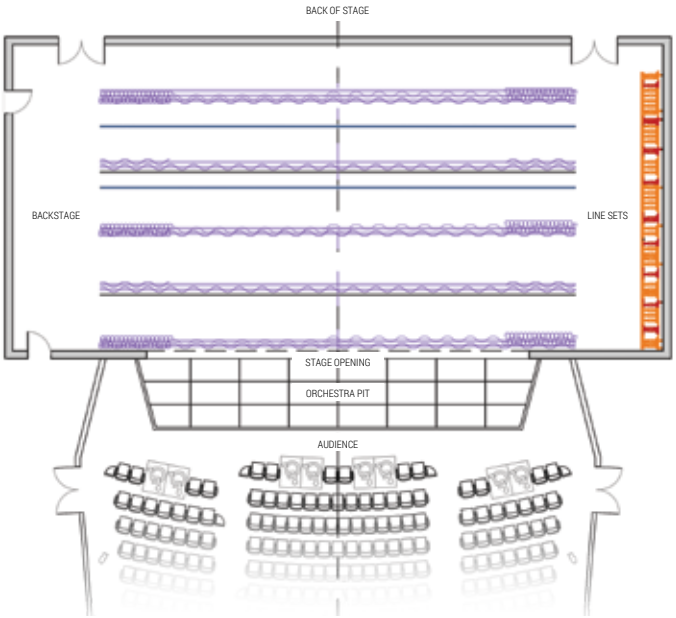
FULL-STAGE ACOUSTICAL SHELL



LIGHTING



CURTAINS & SCENERY



WHAT IS RIGGING USED FOR?

THEATRICAL RIGGING DEFINED:

Theatrical rigging refers to the system of ropes, cables, pulleys and other mechanical devices used in the theatre to manipulate and control the movement of scenery, lighting, acoustical shells and other elements.

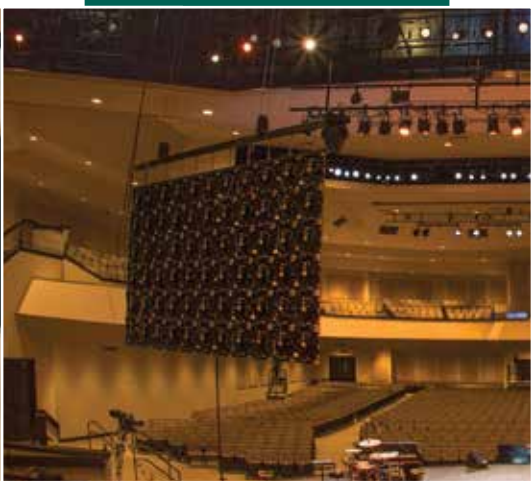
Theatrical rigging plays a crucial role in creating dynamic and visually captivating stage productions. With the use of rigging, stage crews can lift, lower, or shift large set pieces, creating smooth transitions between scenes and enhancing the overall flow of the performance.

Additionally, rigging is employed for the safe and controlled deployment of special effects, such as flying actors or scenery, adding an extra layer of spectacle to theatrical productions. The precise and coordinated use of theatrical rigging contributes to the immersive experience of the audience, allowing for dynamic andvisually stunning performances that go beyond the limitations of static stage designs.

LIGHTING

ACOUSTICAL CEILINGS

A/V EQUIPMENT



THE FOUR MAIN USES OF RIGGING:

Rigging systems in theatre integrate technical precision with creative flair, crucial for enhancing stage functionality and artistic expression. Rigging combines safety and functionality with the art of dramatic presentation, making it an indispensable element of theatrical productions.

STREAMLINING STAGE OPERATIONS

One of the essentials of rigging design is making sure stage lighting and other on stage equipment can be easily raised and lowered so that work isn't performed on high ladders. Altering lighting schemes, adjusting equipment, replacing lamps and gels and performing general maintenance are all easier and safer when you bring battens to floor level.

AMPLIFYING DRAMATIC EFFECT

Essential for dynamic scenery movement, rigging systems add dramatic impact to productions. They enable seamless scene changes and contribute significantly to visual storytelling, enriching the audience's experience.

ENHANCING ACOUSTICS AND VISUALS

Rigging is key in positioning acoustical shells, ceiling panels and audio-visual equipment, optimizing sound quality and visual effects. This aspect is critical for achieving the desired acoustic environment for both performers and audience, and creating engaging visual environments.

FACILITATING SCENE TRANSITIONS

Through the movement of curtains, rigging systems play a vital role in stage framing and transitioning between scenes, adapting quickly to the requirements of various production setups.

PERFORMER FLYING

SCENERY

CURTAINS

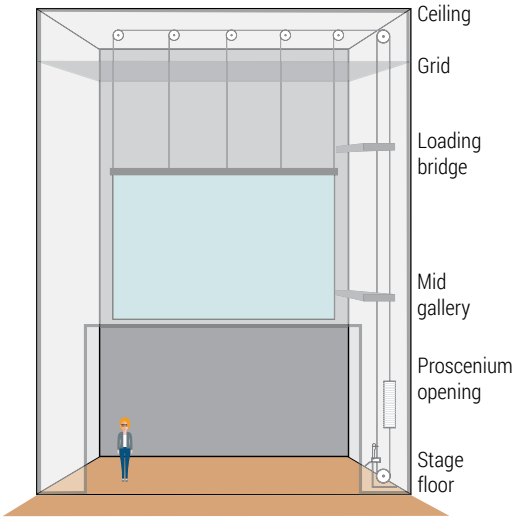
TYPES OF RIGGING

THE FOUR BASIC TYPES OF RIGGING

There are four basic types of rigging: **dead hung**, **counterweight**, **counterweight assist** and **motorized**. These methods may be mixed within a stage to meet production and budget requirements.

Though rigging can be designed to fit almost any space, straight walls and square corners will provide a better fit and improved economy. Here are several rules-of-thumb:

- Theatres used for dramatic performances with set changes require a stagehouse height 2½ times the height of the proscenium, providing a walking grid, and allowing softgoods, scenery and lights to be hidden when flown.
- Rigging sets should be installed with spacing of 6"or 8" (152-203 mm) on center.
- The layout of the rigging needs to accommodate the moving curtains (main curtain, midstage curtain and rear curtain), masking curtains (borders and legs), sets for lighting equipment and general-purpose battens for scenery.
- The rigging system extends from the proscenium wall to within 3'-5' (914-1524 mm) of the back wall of the stagehouse, providing maximum versatility in providing an on-stage crossover.



The stagehouse height must be 2-1/2 times the height of the proscenium opening.

AMOUNT OF RIGGING

The intended uses of the stage determine how much rigging is required. A middle school or gymnasium may only have a few lighting sets while a school with an active drama program could have 20 to 40 rigging sets and an active professional theatre 60 sets or more. For new construction, anticipating future needs can provide considerable cost savings compared to retrofitting a rigging system in the future.

TIP:

Your rigging requirements should be based on the type of programming as well as the skill set of those utilizing the equipment in your space.

RATINGS

The following ratings apply to most installations:

- Scenery sets are typically rated to carry 25 lb per foot (37 kg/m) of batten length.
- Lighting sets and acoustic ceilings are rated at 25-40 lb per foot (37-60 kg/m) for schools and performing arts centers, and higher for opera houses.

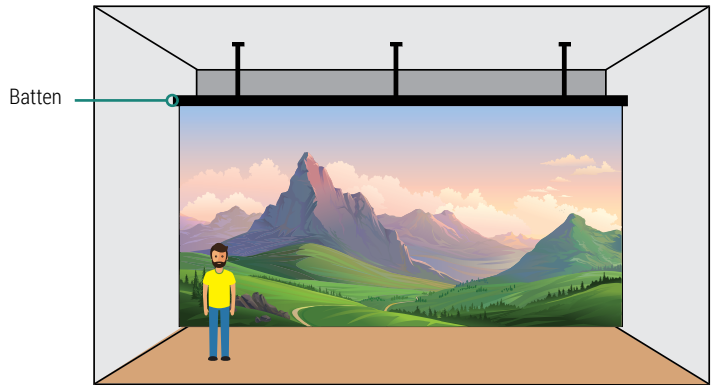
RIGGING COMPARISON CHART

	Dead Hung Rigging	Manually Operated Counterweight Rigging	Counterweight Assisted	Motorized Rigging
Cost	Least expensive	Lowest capital cost for movable rigging	Most cost-effective way to add motorization to a counterweight system	Most expensive
Appropriate for	Low ceiling heights or venues with limited funds that prohibit other options	All types of staging Versatile performance capabilities	Fixed speed applications: shells and electrics Existing counterweight systems	Venues that cannot support a counterweight system or venues without dedicated trained staff
Not appropriate for	Electrics or scenery sets	Performance venues with limited space	Performance cueing	Spaces that don't require advanced motorized operation
Pros	Best for small theatres without suitable fly space that rarely need to move the location of curtains or lighting	Best for venues with suitable fly space Most bang for your buck – effective with excellent functionality	Simple and intuitive control Safer than counterweight (no loading required)	More robust control system that utilizes show programming for cueing Often safer than counterweight Fewer operators needed Very quiet
Cons	Maintenance requires the use of a ladder, which is an inconvenience and possibly hazardous Any equipment changes must be done at batten level, and cannot be used for stage effects	Requires multiple skilled operators Not ideal for untrained students Requires dedicated space for guide system, locking rail and loading bridge for safe operation Considerations need to be made with regards to stored counterweight on loading bridge	Limited speed capabilities Requires counterweight system Can be louder than manual counterweight use Requires operator training	Number of machines may be limited by structural or power capabilities of the building Requires operator training
Possible upgrades	Integrate motorized electrics/utility battens for easier maintenance	Integrate with motorized sets for more versatility	Integrate variable speed machines and a more robust control system	N/A

FOUR TYPES OF RIGGING

1 DEAD HUNG RIGGING

The most economical and simplest rigging method of hanging equipment, dead hung consists of pipes, called battens, fixed to the ceiling to support curtains, lights or scenery. Tracks are sometimes used in place of battens. Dead hung rigging is typically used where low ceiling heights or limited funds prohibit other options.



PIPE GRID

Pipe grids are often associated with Black Box theatres. Installing a pipe grid is an efficient and cost-effective way to provide flexible rigging to a multi-use space. A pipe grid is a series of dead hung pipes arranged in 4-foot or 5-foot squares. As with dead hung rigging, a pipe grid must be accessed by ladders or man lifts unless the space is also equipped with a tension wire grid.

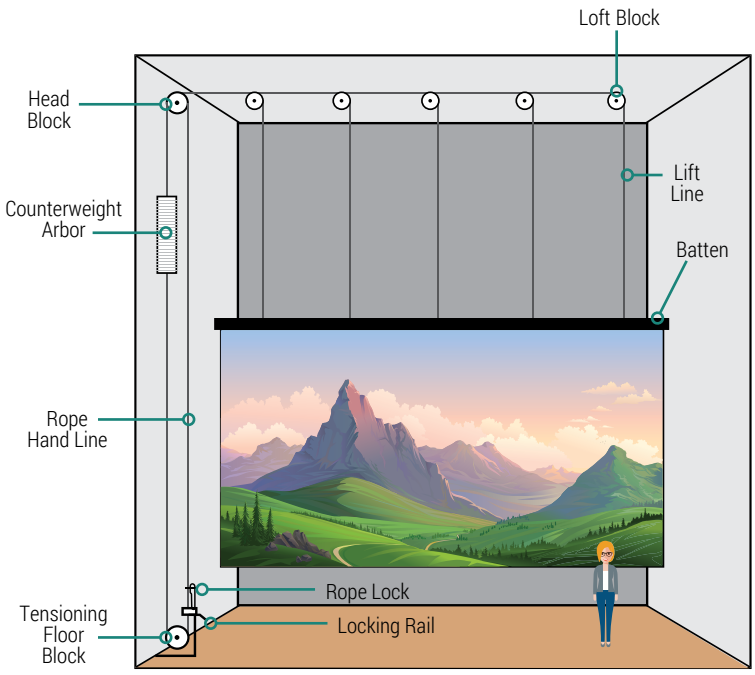
TENSION WIRE GRID

A tension wire grid is commonly paired with a pipe grid to provide a secure and convenient method for accessing the entire rigging grid. It's typically built modularly, with a heavy steel perimeter and an interior walking surface made of cables arranged in 2-inch squares. This cable surface serves as an access platform and allows light to pass through without creating shadows on the floor.

2 MANUALLY OPERATED COUNTERWEIGHT RIGGING

Manually operated counterweight systems have been used in theatres since the 1930s. The load being raised or lowered — scenery, curtains or lights — is counterbalanced by an arbor loaded with the correct amount of steel weights.

A properly balanced system is inherently safe, as neither the load nor the counterbalancing weight will move without an external force. The load can be moved by pulling on the hand line with moderate effort.



SINGLE PURCHASE LINE SET

In a single purchase line set, the weight and travel distance of the loaded batten equals the weight and travel distance of the properly loaded arbor.

DOUBLE PURCHASE LINE SET

In buildings where limited vertical space prohibits a single purchase set, the counterweight side of the system can be double purchased. By doubling the lift cables around a pulley on the arbor, the batten will travel twice as far as the arbor, reducing the travel distance needed by arbors so they can be located well above the stage floor on fly galleries, providing space for doors or scenery storage below the arbors and locking rail.

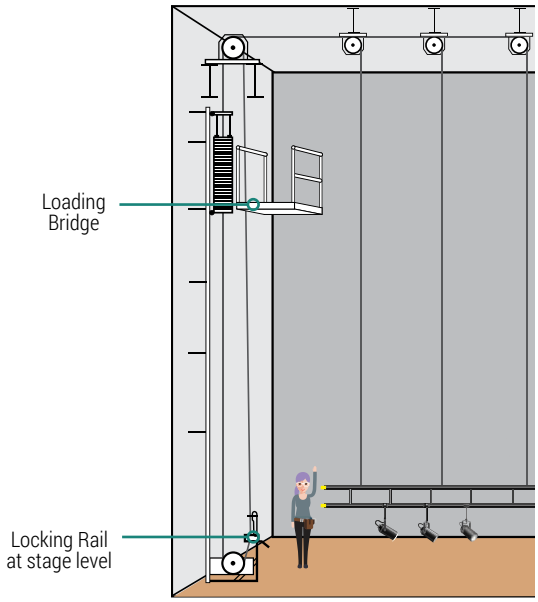
- Requires twice the amount of weight in the arbor as is supported by the batten.
- Only 1' (305 mm) of arbor travel is required for each 2' (610 mm) of batten travel.
- More expensive and more difficult to install and operate.
- Requires loading and unloading twice as much weight compared to single purchase sets.
- Additional mass and sheaves add friction and inertia to the system, making it harder to operate.
- Additional structural steel is required to support the additional weight.

ARBOR GUIDE SYSTEMS

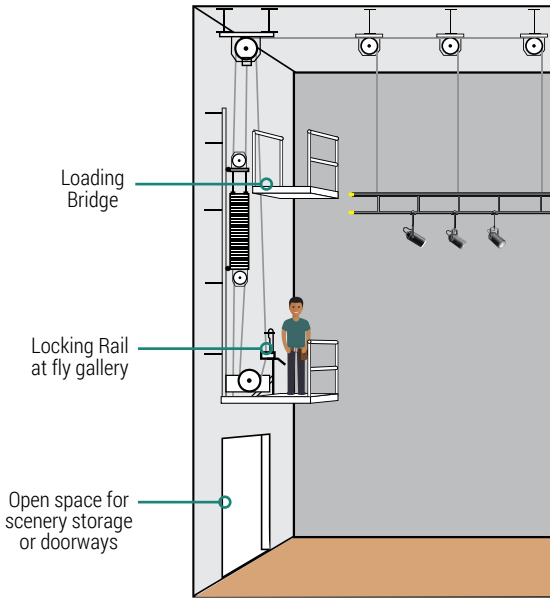
Slotted guides, called shoes, are mounted at the rear of arbors and ride between equally spaced pairs of adjoining "J" or "T" shaped guide rails.

- Rigid guides are preferred for new installations; wire guide systems are considered to be more dangerous than rigid guide systems.
- Aluminum J-guides are recommended as they have fewer parts than the older, heavier steel T-Bar Guides and are easier to align and install.
- Areas subject to seismic events should upgrade to seismic arbors and A-guide systems which have been specifically engineered for the additional loads.
- Front-loading arbors eliminate the rods and spreader plates of the conventional rod arbor. It also eliminates the awkward bending to load bricks. The shelves allow for neat, easy and safe stacking of bricks from the loading gallery.

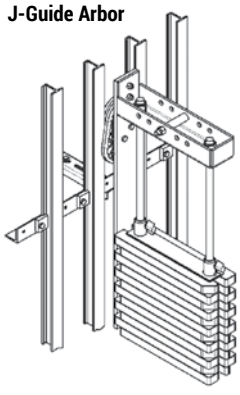
Single Purchase Line Set



Double Purchase Line Set



J-Guide Arbor



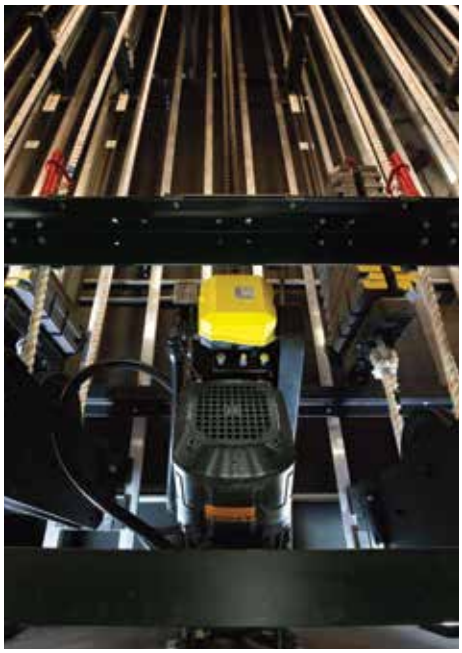
Front-Loading Arbor

4 TYPES OF RIGGING (CONTINUED)

3 COUNTERWEIGHT-ASSISTED RIGGING

Counterweight sets can be retrofitted with counterweight-assist motors. These utilize the counterweight to keep the motor size to a minimum.

- The combination of a fixed weight in the arbor and a hoist allows the set to work with loads from 0 - 2,000 lb (0 - 907 kg) without the need to adjust or handle counterweights.

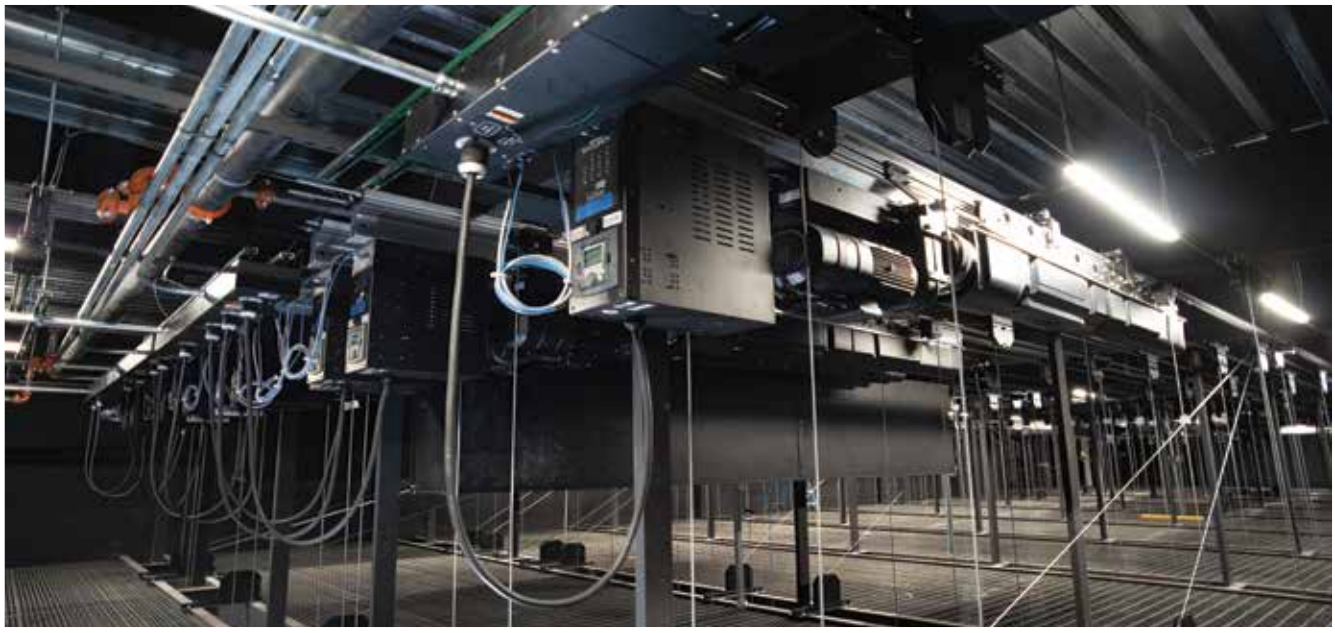


4 MOTORIZED RIGGING

In this system a hoist lifts the entire weight of the equipment without the use of counterweights. Although a higher initial capital cost than manual or motorized counterweight sets, this system offers many advantages.

PACKAGED MOTORIZED RIGGING

Packaged hoists are constructed as a unified package or unit within a single device compliant with ANSI E1.6-1 standard. They should include options to add additional safety features, such as load cell, encoder, etc. They offer straightforward installation (in contrast to custom units) and are engineered to enhance or replace manual rigging systems.



Rigging hoists are typically designed and built to meet specific requirements. This section provides an overview of the major choices, types of hoists, features and options.

ZERO-FLEET

In the Zero-fleet design, the cable drum travels horizontally as fast as the cable unwinds which keeps the cable spooling off the drum at a zero degree fleet angle.

- Can be mounted from roof steel, on top of a walking grid, below a walking grid and vertically on a side wall.
- Typically located 10" on center (254 mm); can be installed 7" (178 mm) on center by alternating the hoists on the left and right sides of the stage.
- Self-contained to reduce installation time and costs.
- Requires less space and support steel than traditional counterweight rigging, reducing construction and installation costs.

FIXED-SPEED

Fixed-speed hoists are generally used for heavy loads — lighting battens, speaker clusters, orchestra shell ceilings — which do not have to move dynamically in front of an audience.

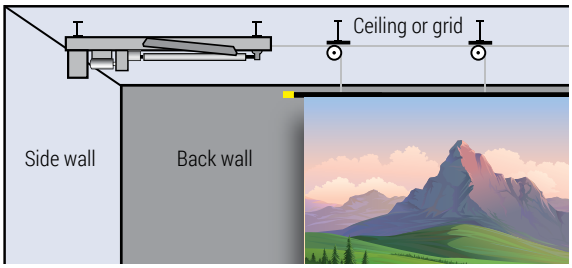
- Hoist speeds vary widely with the application.
- Orchestra shell ceilings or lighting bridges may fly out at speeds as low as 3 fpm (.9 mpm).
- Lighting sets typically fly at 20 - 30 fpm (6 - 9 mpm).
- Fixed-speed curtain hoists can operate at 60 fpm (18 mpm).
- Moving too quickly with a fixed-speed hoist will result in stops and starts that may be too abrupt for conventional lighting fixtures and building structure.

VARIABLE-SPEED

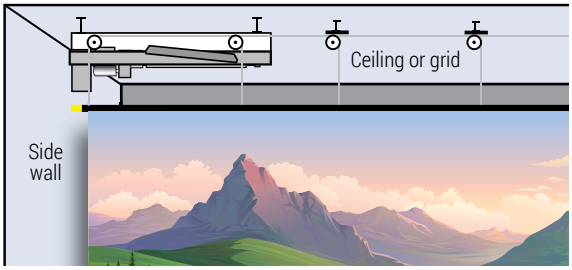
Offering a tremendous range of speed, variable-speed hoists are ideal for use with scenery that must move in front of the audience. The right hoist can perform a subtle move at less than 1 fpm (.3 mpm) and then move over 100 fpm (30 mpm) in the next cue.

- Top speeds are dictated primarily by the user's requirements and the height of the proscenium opening.
- Scenery sets in theatres with a proscenium height of 40' (12,192 mm) or less typically run at up to 120 or 180 fpm (37 or 55 mpm).
- Venues with higher proscenium openings may have speeds exceeding 360 fpm (110 mpm).
- Main curtain hoists have been built to operate at even higher speeds.

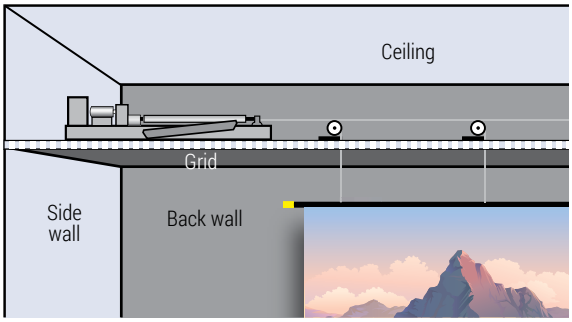
Zero-fleet – Horizontally mounted underside of rigging steel



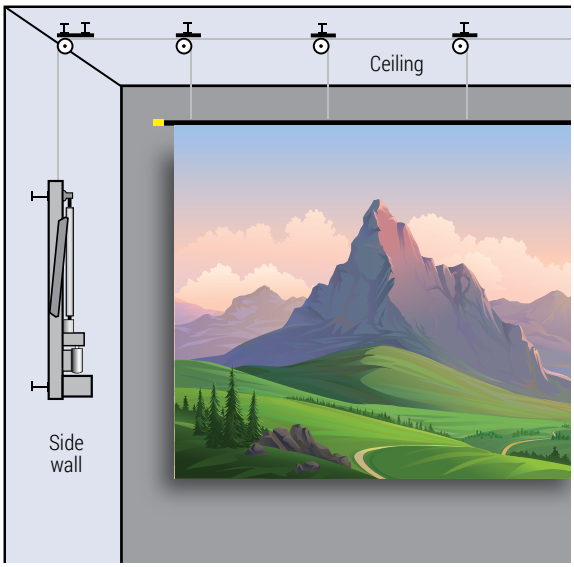
Zero-fleet – Underhung onstage with lines directly off hoist



Zero-fleet – Upright mounted on grid



Zero-fleet – Vertically mounted to stagehouse wall



MOTORIZED RIGGING (CONTINUED)

CUSTOM HOISTS

Unique or unusual applications sometimes require custom hoists to meet specific needs.

- Solutions are as varied as the applications.
- Custom low-capacity hoists handle acoustic banners and other simpler needs.
- Custom high-capacity hoists can move ceilings and structures in excess of 100,000 lb (45,359 kg).

DRUM HOISTS

Drum hoists are the most traditional hoist design. There is no standard drum hoist design so it is infinitely customizable and suitable for many applications. Because there is no standard design, each hoist is custom and can carry a higher price tag than a packaged hoist. The drum is long enough to accommodate all lift lines required for the line set. As with other drums, it is helically grooved to allow for a single layer of cables wrapped around the drum.

- Drum hoists can be located on the grid or galleries, or in a separate motor room.
- Head and loft blocks may be used to route the lift lines to the batten.
- The traditional drum hoist (below) typically requires consideration for fleet angle between the drum and head blocks.

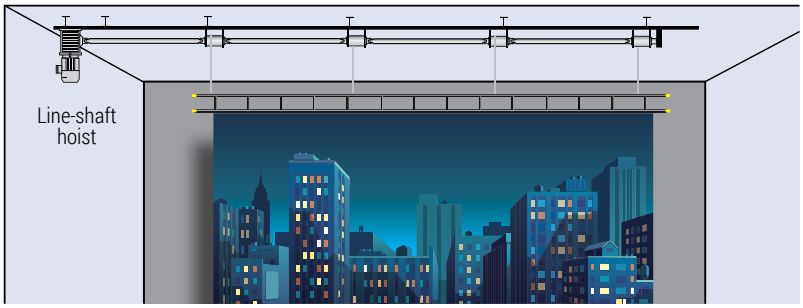
Drum Hoist

LINE-SHAFT HOISTS

Line-shaft hoists are self-contained units with a separate drum for each lift line. No wall or floor space is required for the hoist, nor are head, loft or mule blocks required.

- Load placed on the building structure is a vertical load only, without the resultant and compression loads normally associated with conventional rigging.
- Ideal for renovations and in locations with limited space or limited structure.
- More expensive than drum hoists, but offering more convenience and simplicity.

Line Shaft Hoist



CONTROL SYSTEMS

Rigging control systems vary widely in their scope of performance. The simplest are manually operated push-button controllers that allow positioning by eye or tape measure. Advanced control systems can manage multiple elements like curtains, scenery hoists and acoustic banners simultaneously, with targeting and preset programming options, variable speed adjustment and in some systems the ability to create elaborate cues.

LOCATION CONSIDERATIONS

It is vital to carefully consider the location of all controllers. Always ensure unrestricted line-of-sight visibility from the operators to any moving rigging components. Relying on closed-circuit TV cameras/monitors is insufficient in most cases. Realize that other, secondary control points might also be warranted, including extra consoles, plug-in locations or emergency stops.

CONTROL SYSTEM CAPABILITIES TO CONSIDER

- **Interlocks** specifying parameters/safeties to prevent potential collisions.
- **Cues** that allow precision movement during performances.
- **Performer flight** for controlling performer elevation.
- **"Hold-to-run"** toggles providing extra security by requiring operator to be present and engaged during movement. This is required on every system to comply with standards.
- **Password protection** and tailored access based on user.
- **Positioning accuracy and repeatability**.
- **Load monitoring** protecting rigging equipment and structure from overburdening.
- **Emergency stop** (E-Stop) capabilities providing compliance up to and including SIL3 ("SIL" is a safety integrity level as defined by the IEC 61508 standard). This is required on every system to comply with standards.

RIGGING SAFETY

Safety in theatrical rigging is paramount due to the inherent potential dangers of overhead equipment that can fall and harm individuals and/or cause structural damage. Improper handling or malfunctioning of rigging systems can lead to accidents, possibly causing severe injuries or even fatalities.

MOTORIZED VS. MANUAL SYSTEMS

Enhanced safety is a key advantage of motorized systems. In school settings, where students may not have extensive training, such systems minimize the expertise required and offer more integrated safety features. Motorized systems also offer greater precision, repeatability and ease of use. For a particular facility, they require less architectural modifications and structural upgrades than manual systems, which rely on heavy elements like head block beams, counterweights and a loading bridge.

TIP:

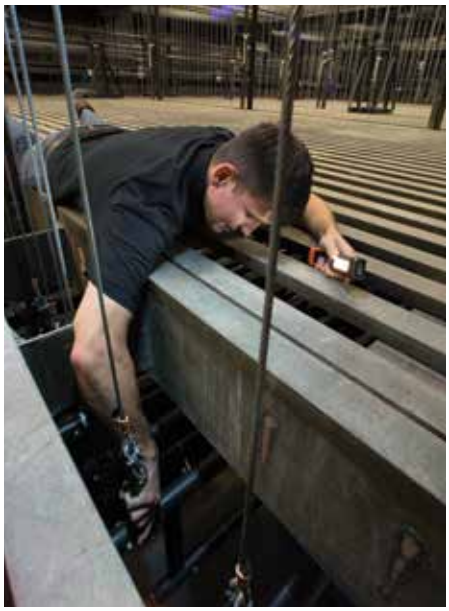
Educational facilities often install a hybrid system utilizing both manual and motorized systems to better expose students to a variety of rigging applications.

TRAINING, MAINTENANCE AND INSPECTIONS ARE VITAL

To help mitigate risks with any rigging system, establish comprehensive, systematic training of all operators, coupled with regular, thorough maintenance and inspections. Level 1 inspections focus on easily accessible parts, visually checking rigging components, logbooks and safety signage. Level 2 inspections take it a step further by also examining and putting hands on harder-to-reach elements, often requiring extra equipment for accessibility. (See chart on next page.)

FREQUENCY OF INSPECTIONS

Regular inspections help ensure the safety and functionality of these systems, plus compliance with relevant industry and ANSI standards.
The chart on the next page gives general guidelines; consult local codes, standards and Authority Having Jurisdiction (AHJ) for exact requirements.



Click here or scan the QR code for important safety manuals, signs and sheets.

EQUIPMENT TYPE	LEVEL ONE INSPECTION FREQUENCY	LEVEL TWO INSPECTION FREQUENCY
Manually Operated Equipment	Annually	Immediately after equipment or components have been newly installed, altered or repaired.
		No less than every 5 years or as determined by a qualified person.
		When the last day of inspection is unknown.
Fire Safety Curtain (Manually Operated)	Annually	Immediately after equipment or components have been newly installed, altered or repaired.
		No less than every 5 years or as determined by a qualified person.
		When the last day of inspection is unknown.
Motorized Equipment (Including Motorized Fire Safety Curtain)	Not Applicable	Immediately after equipment or components have been newly installed, altered or repaired.
		Annually
		When the last day of inspection is unknown.
Statically Suspended Rigging Equipment	Not Applicable	Immediately after equipment or components have been newly installed, altered or repaired, and one year after installation.
		No less frequently than every 5 years or more frequently as determined by a qualified person.
		When the last day of inspection is unknown.

BEST PRACTICES FOR SCHOOLS

For school facilities, safety is particularly crucial during rigging operations because students lack daily, hands-on familiarity with these complicated systems. Here are some best practices to consider:

- **Training and Awareness:** Ensure all students and staff are trained on rigging safety and are fully aware of ongoing rigging operations. This is particularly crucial with manual systems.
- **Emergency Protocols:** Have well-defined emergency procedures and ensure everyone is familiar with them.
- **Supervised Operation:** Have at least two people supervising the movement of equipment, always keeping line-of-sight clear.
- **Loading Bridge Safety:** When adding counterweights on the loading bridge with a manual system, follow protocols to prevent accidents.

TIP:
Developing a detailed safety plan with students is critical to avoid injury or equipment damage.

CONSISTENT LANGUAGE IMPROVES SAFETY

Any rigging crew, whether student volunteer or professional, should use consistent terminology when describing onstage movements, such as loading/unloading procedures. This helps minimize misunderstandings that could compromise safety. Here are a few examples of safe usage terms, also known as "Rail Calls":

"Coming In"
Used when moving a pipe on a line set in the down direction.

"Going Out"
Used when moving a pipe on a line set in the up direction.

"Moving"
Used when continuing a move after a brief pause.

"Heads!"
Used in a loud, clear voice to alert everyone onstage when something is dropped from above.

For more safe usage terms and examples, click here or scan the QR code.

FIRE SAFETY CURTAIN SYSTEMS

A CRUCIAL BARRIER BETWEEN THE STAGE AND THE AUDIENCE

Fire safety curtains serve a dual purpose in theatres: they act as a crucial barrier between the stage and auditorium during a fire, and they help prevent unauthorized access to backstage areas. In line with U.S. building codes and standards, specifically NFPA 80 chapter 20 and ANSI E1.22, such curtains are required to have a 20-minute fire rating. This ensures that the audience has sufficient time exit the theatre safely during a fire. Curtain fabric must be approved by the AHJ (Authority Having Jurisdiction), confirming both its suitability and durability over time. Codes also emphasize regular maintenance and inspection to ensure reliable operation.

- Vertical guide pockets protect the edges of the curtains, support the curtain guides and transfer large air pressure loads from the curtain into the building structure during a fire.
- Curtain-release systems permit automatic closing; simple systems consist of a tensioned release line located around the three sides of the proscenium arch with two manual release stations; all systems include rate-of-rise heat detectors on the upstage side of the proscenium.
- Some older release systems require resetting each time the curtain is closed, while all current systems mandate that the curtain to be operated in non-emergency situations without affecting emergency operation.
- Fire safety curtains close by gravity and are not dependent on electrical power when deploying in an emergency.

TIP:

Remember to close your fire curtain anytime the facility is not in use.

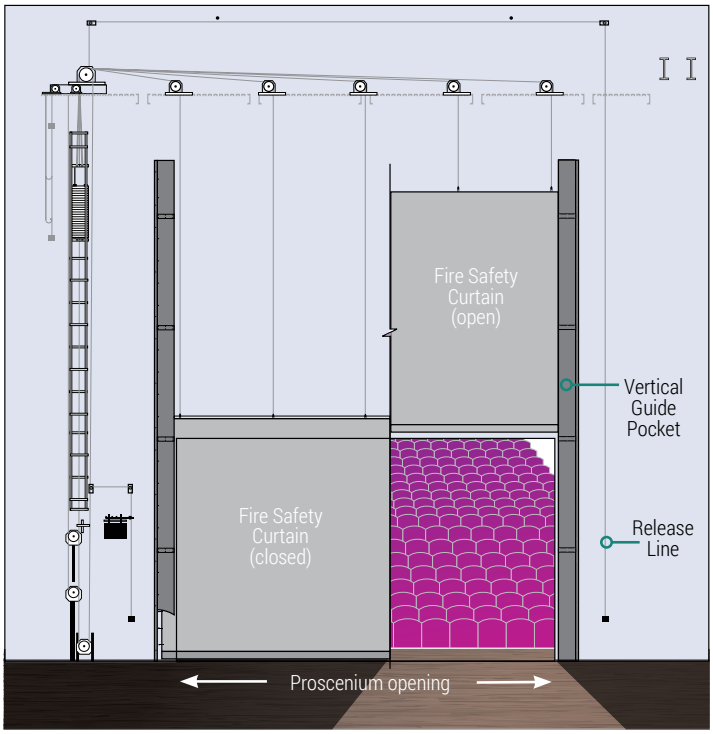
- NFPA 80, Chapter 20, Section 7.1.1

STRAIGHT-LIFT FIRE SAFETY CURTAIN

Straight-lift curtains consist of a single panel that is lowered to close off the proscenium opening. The weight of the curtain is often counterbalanced to close in a controlled manner.

- Dashpots or hydraulic speed governors are required to control the rate of closure and slow down the curtain near the end of its travel-per-code requirements.
- Must overlap the proscenium a minimum of 18" (457 mm) at each side and 24" (610 mm) at the top.
- Curtain storage space above the proscenium should be equal to the height of the proscenium arch, plus a minimum of 3' (914 mm) (additional height is recommended).
- Distance between lift lines should not exceed 10' (3,048 mm).
- Note: per NFPA 80 20.6.2 "Fire safety curtain assemblies other than straight lift unframed fire safety curtains for proscenium openings less than 850 square feet shall be power operated."
- For large proscenium openings of a certain size, a metal frame may be required to support the straight-lift fire curtain, to ensure compliance with NFPA/ANSI standards. The theatre equipment designer and/or structural engineer will make that determination.

Straight-Lift Fire Safety Curtain



Split illustration shows curtain in deployed and undeployed positions.

TIP:

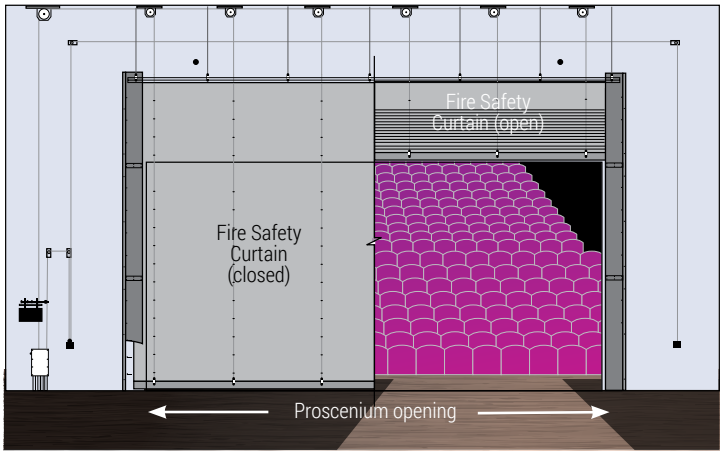
Fire curtain standards are updated every three to five years, underscoring the importance of annual inspections to ensure safety and compliance with NFPA/ANSI standards.

BRAIL-TYPE FIRE SAFETY CURTAIN

Brail-type fire curtains are used when the space above the proscenium is insufficient for a straight lift curtain. These curtains fold like a Roman shade and fit in a space half the height or less of the proscenium opening.

- Operated by a brail hoist with a speed governor.
- Hoist is attached to an emergency release line system similar to the straight-lift curtain.
- Industry best practices recommend that the distance between lift lines not exceed 8' (2,438 mm).

Brail-Type Fire Safety Curtain



Split illustration shows curtain in deployed and undeployed positions.

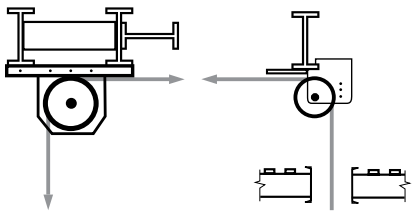
APPENDIX

BLOCK – BASICS

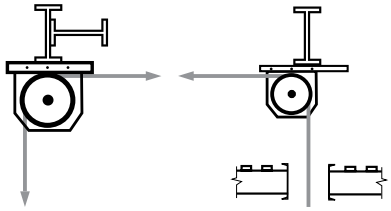
A block is a set of pulleys, or sheaves, mounted on a single axle. Structural designs, existing conditions and operational preferences determine the type of block used. Basic block styles are often combined in practice.

BLOCK – UNDERHUNG

Underhung components attach to the bottom flanges of structural steel or other supporting members. The diagrams below show preferred examples. The grid is optional in these configurations and, if present, is available for rigging spot lines, side masking, wraparound cycloramas and other special effects. This configuration also provides the best access for maintenance and inspection and for making changes to the rigging layout.



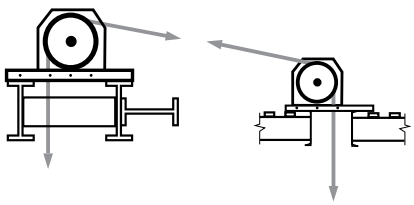
Underhung Head Block and Underhung Loft Block



Underhung Head Block and Universal Loft Block

BLOCK – UPRIGHT

Upright rigging components are mounted on top of structural supports that are usually steel, but may also be concrete or other materials. The diagram below shows grid-mounted loft blocks. When the lift lines are located on the grid, walking is difficult.



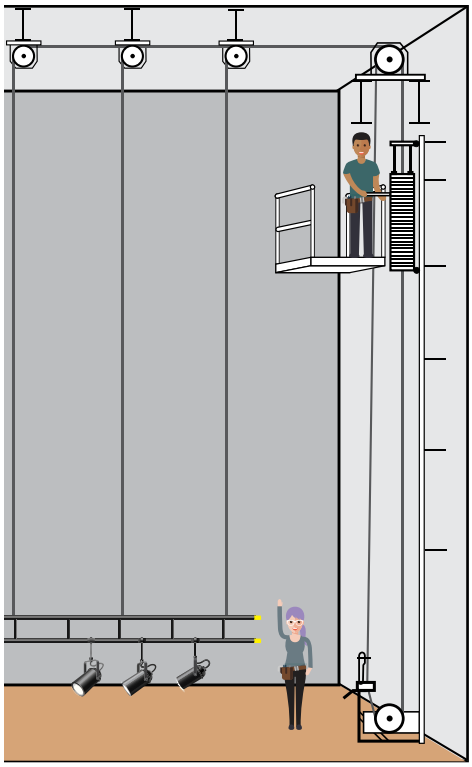
Upright Head Block and Universal Loft Block

COUNTERWEIGHT LOADING GALLERY

A loading gallery is a necessity for any counterweight rigging system. In order to properly balance, or counterweight, the load on the batten, it is necessary to add or remove weight from the counterweight arbor. This must be done at the same time the weight is being changed on the batten, so the system is always in balance. When the batten is at floor level, the counterweight arbor is at its highest level. It is therefore essential to have a loading bridge for access to the counterweight arbors to add or remove weights to balance the load.

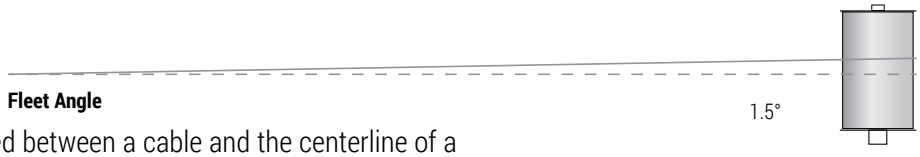
Shown with front-loading arbor

It is not recommend installing counterweight equipment without a loading bridge in the building. While there are procedures and equipment that can help in this situation, working with out-of-balance sets can be extremely dangerous. If a loading bridge cannot be provided, we recommend the use of motorized equipment in place of manual rigging. Note that people working on a loading bridge should use fall-protection equipment.



Counterweight Loading

FLEET ANGLES

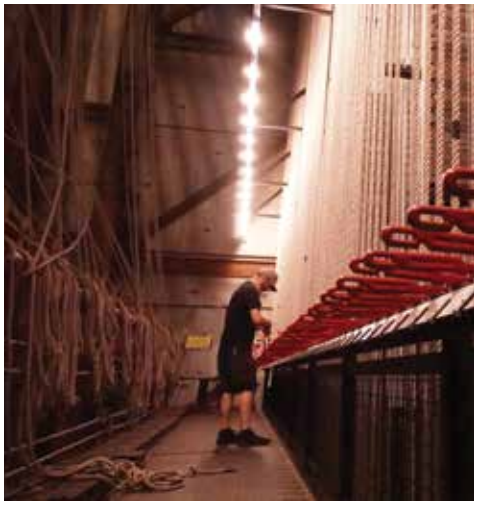


Fleet Angle

Fleet angles refer to the angle formed between a cable and the centerline of a pulley or hoist cable drum, or between two pulleys. Fleet angles beyond 1½ degrees result in additional friction and wear in the rigging. This condition causes more strain on the operators and reduces the safe working load and equipment lifespan.

GRIDS AND GALLERIES

Access to moving equipment is important for inspection and maintenance. If the rigging system cannot be reached from a conventional man lift, then a grid or gallery, or both, will be required. A grid offers great convenience by allowing access to all rigging equipment and by providing a location for rigging spot lines and other special rigging requirements. It should be noted grids do add height to the fly tower. For professional theatres a grid is a necessity. For other theatres, a grid is suggested if usage includes productions with extensive rigging requirements. Tops of loft block well channels in grids should have a 10" (254 mm) opening and be flush with the top of the surrounding grid floor channels or bar grating to reduce tripping hazards.



Gallery rope locks are shown here in the open position during stage level operation.

IDLERS

Idler pulleys may be added to underhung loft blocks to carry the weight of the wire rope, reduce sag and prevent rubbing against adjacent blocks — but idlers cannot carry line loads or act as deflectors or mule blocks. The idler pulley assembly is mounted to the side of the block housing. When the first loft block in a system is situated at a higher elevation than the head block, employing idler pulleys is not advised. Instead, a multi-line loft block with grooves for all lift lines should be utilized to support the added stress of the load.

SHEAVE MATERIALS

Sheaves, more commonly known as pulleys, are available in steel, cast iron or nylon. The majority of new installations use nylon sheaves, due to their lighter weight, longevity and low cost. Loft blocks with nylon sheaves cost approximately 20 percent less than those with cast iron sheaves. Nylon sheaves' low inertia also makes them easier to operate and the lighter weight can reduce installation time.

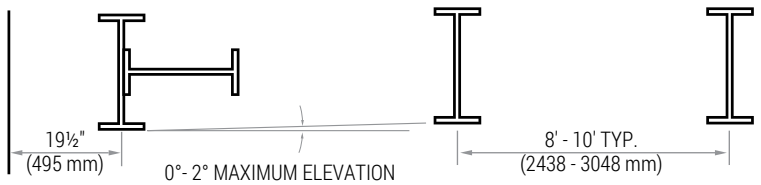
SUPPORT STEEL

Head block beams may absorb several times the live load of the system. Horizontal bracing is often required on rigging steel. If cross-bracing or structural diaphragms are used inside the head block beams, careful consideration must be given to their placement in order not to obstruct the installation of the head blocks.

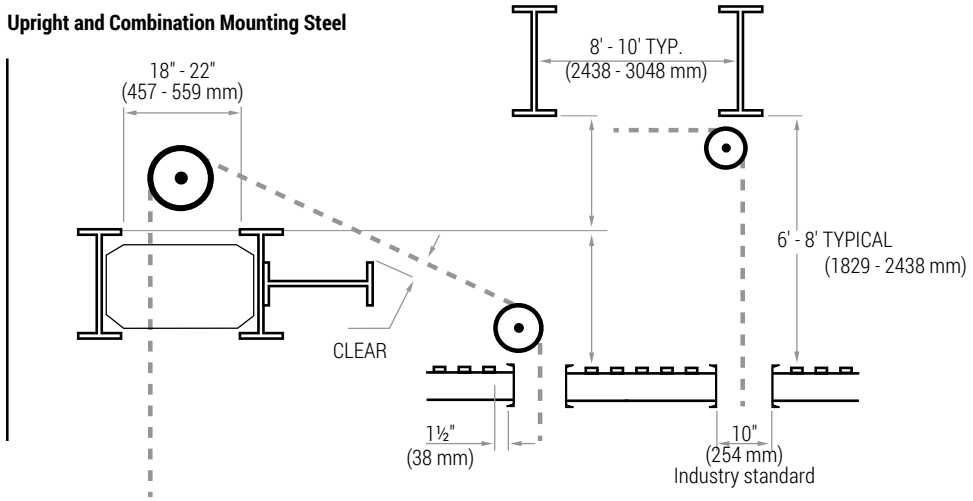
Bar joists are not recommended for the support of rigging systems without considerable lateral bracing.

When head blocks mount on top of head block beams, the block should be located so the rope and cable are at least 2" - 3" (51 - 76 mm) away from the beam flanges to prevent rubbing when the rope moves. The figures below show commonly used rigging steel configurations.

Recommended Underhung Steel Detail



Upright and Combination Mounting Steel



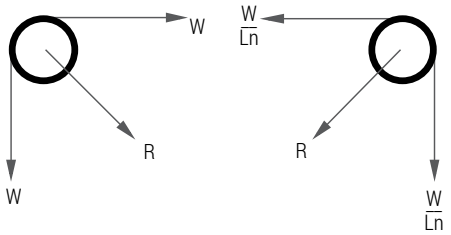
SYSTEM LOADS

Rigging systems impose both vertical and horizontal loads on the supporting structures, as illustrated by the figures below. On average, scenery batten live loads are a maximum of 25 lb/ft. (37 kg/m) and electric batten loads as much as 25-40 lb/ft. (37-60 kg/m). Rigging line sets for house curtains, fire curtains and orchestra shells must be calculated carefully and their live loads included in the total design of the system. For example, when a traveler curtain is open, all of the weight is concentrated on the extreme offstage ends of the track. The self-weight of all equipment must also be included in the structural design criteria. The possibility of future expansion of the rigging system should also be considered.

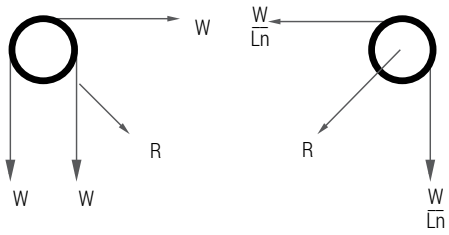
W= Total weight (load) on batten

R = Resultant load on block (and supporting structure)

Ln = Number of pickup lines in each set



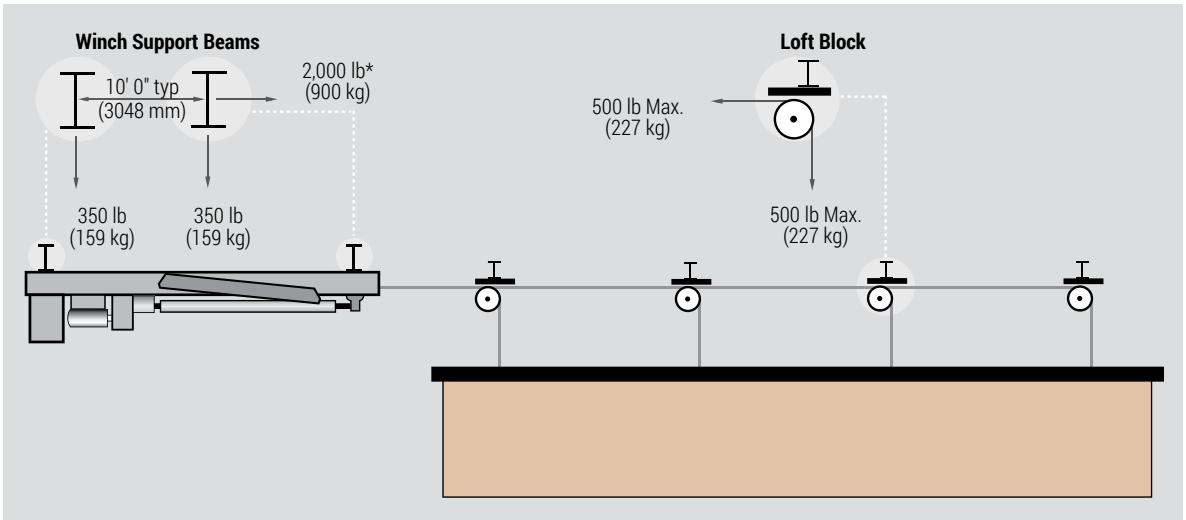
Single Purchase Line Set Loading Condition



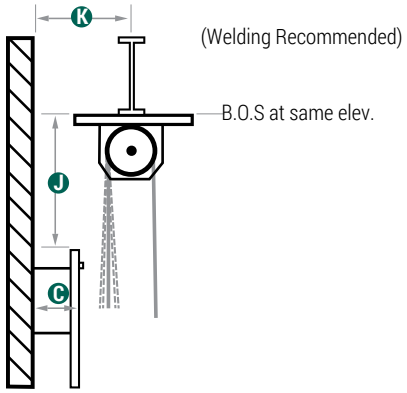
Double Purchase Line Set Loading Condition

The horizontal load shown below may be shared with the off stage beam. Worst case is shown. Bottoms of the two beams must be at the same elevation. The combined load on the loft blocks associated with a single Zero-Fleet hoist will not exceed the winch capacity. Loads in theatres may be unevenly distributed with a maximum load of 500 lb (227 kg) on any individual loft block.

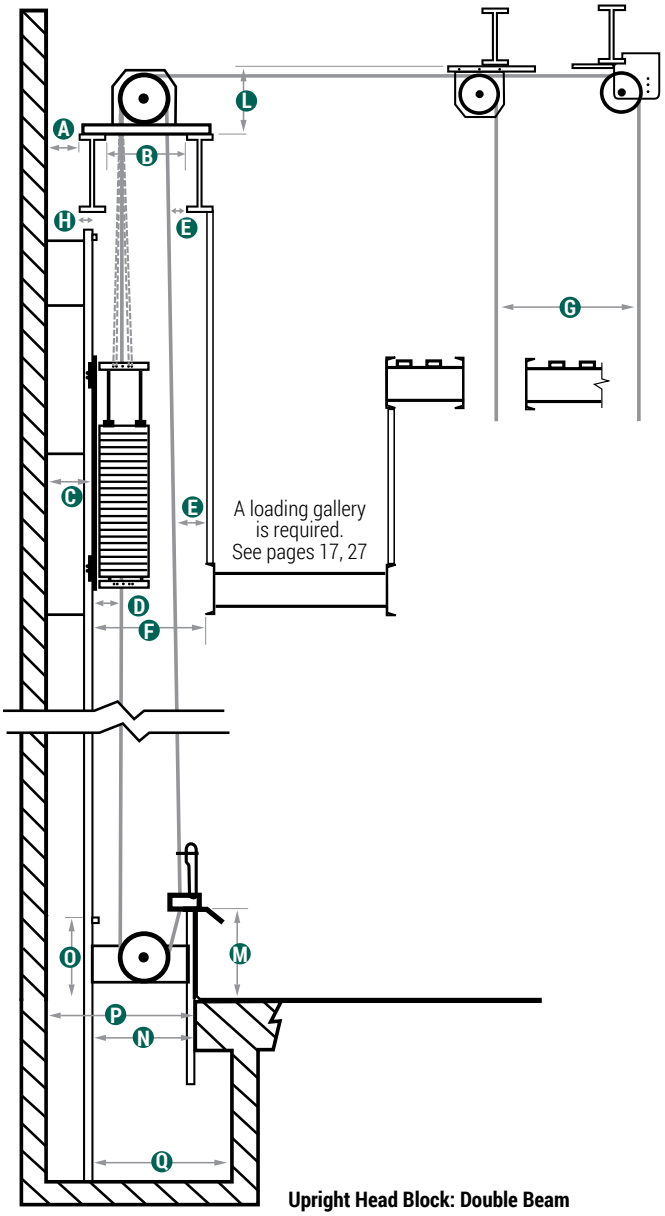
Horizontal Loads



RECOMMENDED MOUNTING DIMENSIONS



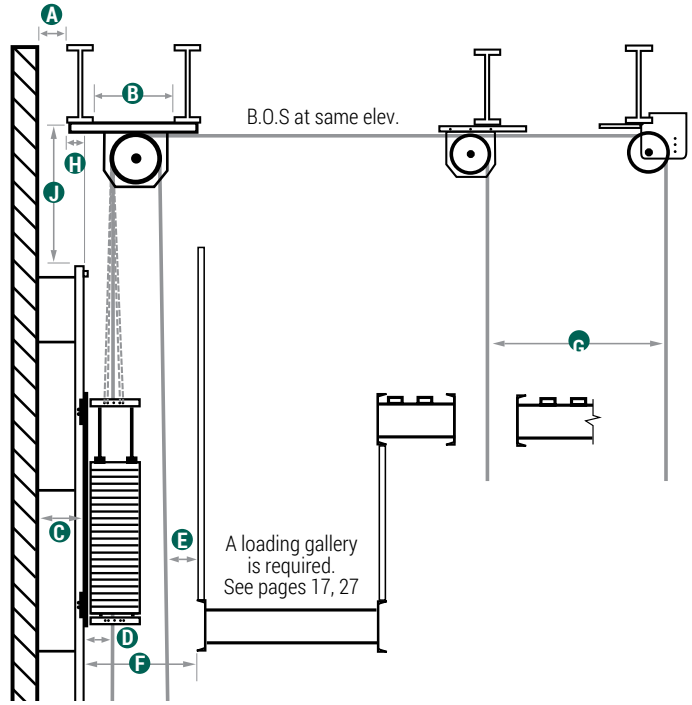
Underhung Head Block: Single Beam



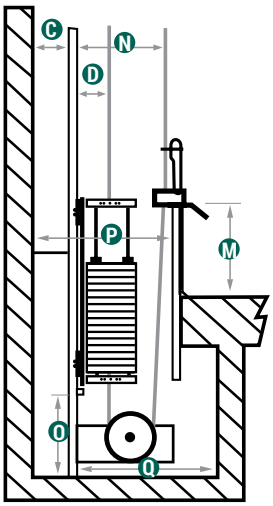
Upright Head Block: Double Beam

Dim	Description	Value
A	Wall Clearance	3" (76 mm) Min
B	Beam Spacing	18" - 22" (457 - 559 mm)
C	Wall to Face of T or J Guide	8" - 20" (203 - 508 mm)
D	Face of T or J Guide to Center of Arbor	7⅞" (200 mm)
E	Clearance of Handlines to Adjacent Structures	3" - 5" (76 - 127 mm)
F	Face of T or J Guide to Edge of Loading Gallery	22" - 25" (559 - 635 mm)
G	Liftline/Loft Block Beam Spacing	10' (3048 mm) Max
H	Face of T or J to Edge of Beam Flange of Offstage Head Beam	5" Max (127 mm)
J	B.O.S. Head Block Beam to Top of Guide	18" (457 mm) Min
K	Wall to Center of Single Head Block Beam	19 ½" (495 mm) Min
L	T.O.S. Head Block Beam to Blocks B.O.S. Loft Block Beams	16" for 12" Head Blocks (406 mm for 305 mm) 12" for 8" Loft Blocks (305 mm for 203 mm)
M	Floor to Top of Lockrail	24" (610 mm)
N	Face of T or J Guide to onstage side of Lockrail	24" (610 mm)
O	Floor to Top of the Bottom Arbor Stop	24" Min (610 mm)
P	Wall to Edge of Arbor Pit Opening	= N + C
Q	Face of T or J Guide to Arbor Pit Wall	36" Min (914 mm)

RECOMMENDED MOUNTING DIMENSIONS



Underhung Head Block: Double Beam



Arbor Pit Mounted Lock Rail

Dim	Description	Value
A	Wall Clearance	3" (76 mm) Min
B	Beam Spacing	18" - 22" (457 - 559 mm)
C	Wall to Face of T or J Guide	8" - 20" (203 - 508 mm)
D	Face of T or J Guide to Center of Arbor	7⅛" (181 mm)
E	Clearance of Handlines to Adjacent Structures	3" - 5" (76 - 127 mm)
F	Face of T or J Guide to Edge of Loading Gallery	22" - 25" (559 - 635 mm)
G	Liftline/Loft Block Beam Spacing	10' (3048 mm) Max
H	Face of T or J to Edge of Beam Flange of Offstage Head Beam	5" Max (127 mm)
J	B.O.S. Head Block Beam to Top of Guide	18" (457 mm) Min
K	Wall to Center of Single Head Block Beam	19 ½" (495 mm) Min
L	T.O.S. Head Block Beam to Blocks B.O.S. Loft Block Beams	16" for 12" Head Blocks (406 mm for 305 mm) 12" for 8" Loft Blocks (305 mm for 203 mm)
M	Floor to Top of Lockrail	24" (610 mm)
N	Face of T or J Guide to Back of Lockrail	24" (610 mm)
O	Floor to Top of the Bottom Arbor Stop	24" Min (610 mm)
P	Wall to Edge of Arbor Pit Opening	= N + C
Q	Face of T or J Guide to Arbor Pit Wall	36" Min (914 mm)

RIGGING GUIDE

FOR PERFORMANCE SPACES

Since its founding in 1885 by stagehand-turned-innovator John Clancy, J.R. Clancy has been at the forefront of theatrical rigging innovation addressing the need for safer, sturdier rigging systems. Clancy invented advanced pulleys, sheaves, and a self-closing fire curtain, revolutionizing theatre rigging and establishing a leadership position that continues today. Wenger Corporation purchased J.R. Clancy in 2011, expanding its own distinguished portfolio of solutions for performing arts and music education.

With over a century of commitment to innovation, safety and quality, J.R. Clancy stands as a leading authority on theatre rigging, exceptionally qualified to publish authoritative resources on the topic.

Leverage our expertise. If you have questions, a Wenger representative is just a phone call or email away.

Wenger® CORPORATION

© 2024 Wenger Corporation
USA/9-24/1500/W/LT0370D

Minnesota Location Wenger Phone 800.4WENGER (493-6437) Wenger Worldwide +1.507.455.4100 | Parts & Service 800.887.7145 | wengercorp.com
GearBoss Phone 800.493.6437 | gearboss.com
555 Park Drive, PO Box 448 | Owatonna | MN 55060

New York Location JR Clancy Phone 800.836.1885 JR Clancy Worldwide +1.315.451.3440 | jrclancy.com | 7041 Interstate Island Road | Syracuse | NY 13209

Brands of Wenger Corporation

Wenger® JRCLANCY GEARBOSS®

Follow us on Social Media

Music Education *Performing Arts* *Athletics*