

Theatrical Rigging System Design Guide



REVISED 2010

THEATRICAL RIGGING SYSTEM DESIGN GUIDE

THIS DESIGN GUIDE is intended to assist in the planning of rigging systems. The concepts covered are applicable to theatres of all sizes. For more in-depth assistance please feel free to contact J.R. Clancy directly. We are dedicated to helping you design the safest, most complete and economical rigging systems possible.

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Much of the functionality and safety of an installed rigging system is dependent upon the proper selection and integration of equipment and on its proper installation and operation. For this reason, 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.

The information in the document is current as of the printing date, and every effort has been made to ensure its accuracy. However, no guarantee of accuracy is made or implied. J.R. Clancy reserves the right to update its equipment designs at anytime.

■ WHY DO WE NEED RIGGING?

Rigging is essential to safely move equipment overhead on the stage and serves the following functions:

Access to Equipment

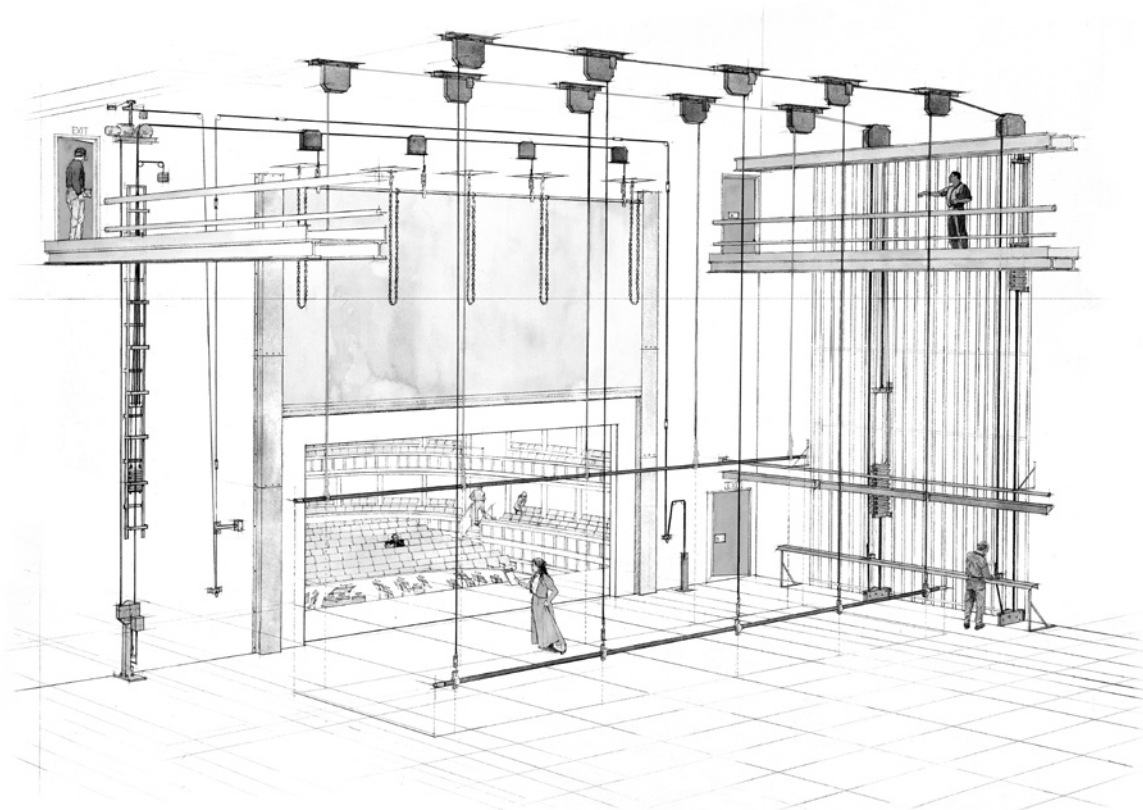
Rigging allows you to raise and lower the stage lighting and other onstage equipment for adjustment, replacement of lamps and gels, and to perform essential routine maintenance. Lighting equipment is frequently moved to meet the requirements of individual productions. All of these functions are most easily (and safely) performed when the battens are brought to the floor level, rather than working off of ladders.

Dramatic Effect

For many theatres, the primary use of the rigging equipment is to move scenery for dramatic effect. A well-designed rigging system makes simple, easy scene changes possible. Many shows use scenery moving in view of the audience, adding impact that becomes a key part of the production.

Masking of Equipment

Curtains are used to frame the visual picture as well as masking equipment from audience view. This “frame” can change to meet the requirements of specific productions, requirements that can be achieved quickly and easily with a properly designed rigging system.

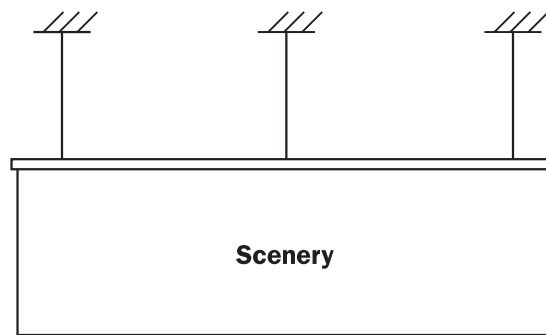


■ TYPES OF RIGGING

Rigging can be dead hung, manually operated, or motorized (automated). These methods may be mixed within a stage to meet production and budget requirements.

DEAD HUNG RIGGING

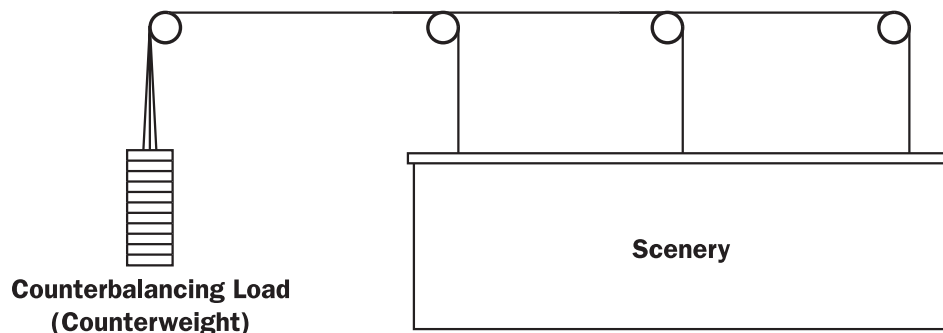
The simplest rigging is dead hung, consisting of pipes (called battens) or tracks that are hung from the ceiling. These may support curtains, lights, or scenery. Dead hung rigging is typically used where low ceiling heights or limited funds prohibit the use of anything else. All maintenance and changes require the use of a ladder, which is inconvenient and can be hazardous.



Dead Hung Rigging

MANUALLY OPERATED COUNTERWEIGHT RIGGING

Manually operated counterweight systems have been used on stages for over 100 years. The load being raised or lowered (scenery, curtains, or lights) is counterbalanced by an arbor loaded with the correct amount of steel weights as shown below.



Manual Counterweight Rigging

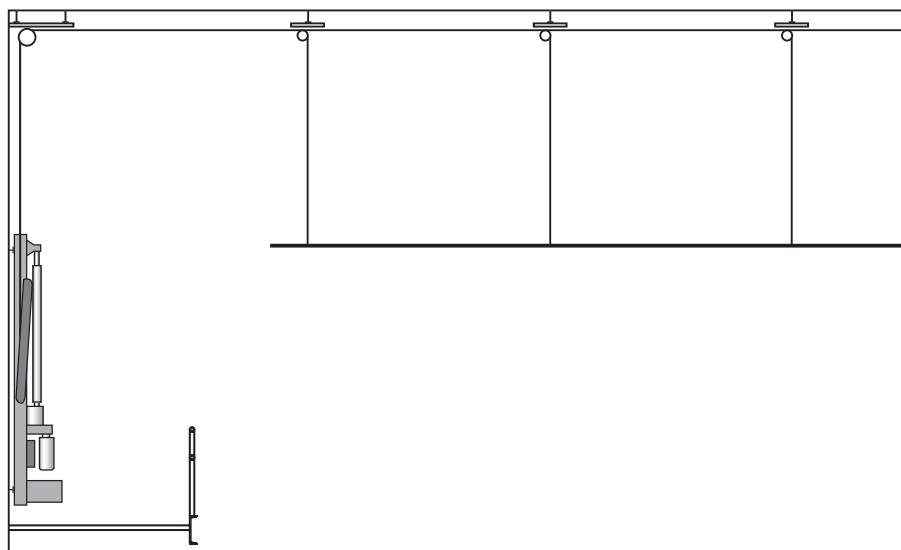
Manually operated counterweighted sets are economical to purchase. They also offer versatile performance capabilities. The operator can produce speeds that range from the subtle to the dramatic to meet the needs of the performance onstage. A trained operator can feel any change in the load or contact with an obstruction and take corrective action. Experienced operators can produce effects that go beyond technology, putting “art” into the performance. The downside is that the weights must be adjusted every time the load changes on the batten pipe.

Operation of these sets depends on correctly balancing the load with steel weights. This requires that people using the equipment be trained in the correct procedures for operating the equipment. The loads on sets will change as the suspended scenery and equipment are changed, requiring the user to adjust the counterweight.

MOTORIZED RIGGING

There has been a shift from manual to motorized rigging (also known as *automated rigging*) in the past few years. Motorized rigging enhances the impact of your productions. Dramatic scenery moves can be programmed effortlessly using simple, instinctive controls. You’ll have the assurance of predictable, consistent scenery movements at every performance.

The movement to motorized rigging has affected theatres at all levels – from middle schools to opera houses. Safety and efficiency are key factors in this change. Motorized sets are easier to use and do not require the handling of counterweights. The ease of use, however, does not reduce the need for operator training.



Motorized Hoist

The motorized rigging sets used onstage are generally “dead haul” sets, where the motor lifts the entire weight of the equipment without the use of counterweights. This eliminates the safety concerns that come with improperly balanced sets and the need to handle heavy weights. Operators use control systems ranging from simple push button panels to computerized control systems with the ability to record and play back cues.

Although motorized rigging sets have a higher initial cost than manually operated counterweight sets, there are offsetting savings:

- the use of motorized rigging equipment requires less stage space and less structural steel than equivalent manual counterweight sets
- personnel costs for operations can be lower
- removing counterweights eliminates a potential cause of repetitive stress injury

Another approach to motorized rigging is to upgrade manually operated counterweighted sets with the PowerAssist® hoist. This hoist uses the existing rigging hardware (which must be in good condition and rated for the load) and motorizes the operation of the rigging set. Many theatres motorize their lighting sets, as they are typically the most used sets, and the ones with the greatest changes in loads.

HOW MUCH RIGGING DO I NEED?

The intended uses of the stage will help determine how much rigging is required. At minimum a few sets allow the lighting equipment to be raised and lowered for safe and easy maintenance. On the other hand professional theaters may have 100 or more rigging sets to maximize flexibility in their productions.

While curtains may be dead hung (hung at a fixed height) on simple stages, this limits their utility, as they cannot be raised or lowered to meet the needs of specific productions, or even to allow the stage floor to be swept.

Any stage where presentations are made needs a few sets to raise and lower banners, signs, support hanging microphones, etc. If plays will be produced, additional rigging will be required to allow the movement of scenery and other dramatic effects. Rigging is all about technology aiding art, so it’s hard to have too many sets.

FRONT OF HOUSE LIGHTING POSITIONS

The front of house lights are the most used lights, requiring frequent access for adjustment and lamp replacement. These key lighting positions are generally located above the audience seating, making access difficult and possibly hazardous unless there are fixed, structural catwalks.

If these are not possible, front of house hoists can be used to raise and lower equipment. Unless robotic lighting fixtures are provided, it will be necessary to provide a man lift that will allow students and staff to adjust the theatrical lighting.

■ RIGGING SAFETY

As with any type of machinery, there are dangers if the system is not used correctly. All users must be trained in the proper and safe operation of the equipment.

Operators must be particularly vigilant in watching the moving equipment. Counterweight equipment must be properly balanced, or the side with the heavier load will descend. The greater the imbalance between the loads the more rapid the descent which will be increasingly difficult to control.

When operating a manual set there is a great deal of tactile feedback that allows the operator to “feel” the load and its performance. With motorized hoists load monitoring can perform similar functions.

Training

Proper training and a policy of allowing only trained and authorized personnel to use rigging equipment are essential components of your safety program. People who are using moving equipment must understand the equipment, the proper methods of operating equipment, and the hazards involved. A formal training program must be completed before users are authorized to operate the rigging equipment.

Operation manuals should be provided by your rigging supplier. Our operation manuals are also available at www.jrclancy.com. Other sources of rigging safety and operation information include: *Stage Rigging Handbook* by Jay Glerum, and *Stagecraft 1 - A Complete Guide to Backstage Work* by William H. Lord.

Maintenance and Inspection

Rigging systems must be inspected regularly by a competent theatrical rigging specialist. OSHA requires annual inspection (29 CFR 1926.550(a)(6)), as does the ANSI/ASME hoist standard (B30.16). Inspections should be made by the rigging manufacturer’s authorized technician.

Users should also be aware of how their system performs. Any changes in the “feel” of the system or any unusual noises should be investigated.

Access to the hoists for inspection and maintenance is essential, and must be incorporated into the building design. In many cases the use of personnel lifts will not be practical due to the height required or equipment and obstructions on stage.

Access

When not in use, access to any rigging system should be restricted. All J.R. Clancy control stations have key operated On/Off switches and our rope locks allow the use of a user-supplied padlock to restrict the use of the set.

Signage

Warning and operation signage are an important part of any safety program. Signage should be in conformance with ANSI-Z535, which clearly identifies the hazard, how to avoid the hazard, and the probable consequences of not avoiding the hazard (*ANSI compliant signage is available from J.R. Clancy*).

■ MOTORIZED RIGGING

We produce affordable motorized hoists specifically to meet the needs of schools, colleges, and performing arts centers.

SELECTING A HOIST

Motorized hoists are available in a tremendous range of speeds, capacities, types, and costs. Our hoists are designed and built to meet our customer's specific requirements. This section provides an overview of the major choices, types of hoists, features, and options. Please contact us if you need additional information or assistance in selecting the equipment that will best meet your needs.

Fixed Speed

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

Hoist speeds vary widely with the application. An orchestra shell ceiling or lighting bridge may fly out at speeds as low as 3 fpm (feet per minute). Lighting sets typically fly at 20 fpm. Moving sets any faster with a fixed speed hoist will result in stops and starts that may be too abrupt for lighting fixtures and may damage the rigging.

Variable Speed

The range of speeds possible with variable speed hoists makes them ideal for use with scenery that must move in front of the audience. A hoist that performs a subtle move at a rate of less than 1 fpm can suddenly travel at over 100 fpm in the next cue.

Top speeds are dictated by three main considerations:

1. The heights of the proscenium and fly loft tower. The speed of the hoist determines how quickly scenery can be moved into or out of the audience's view.
2. The user's requirements. A venue with a wide variety of users or production types may want to provide the maximum versatility given by higher speed hoists.
3. Cost – higher maximum speeds generally come at an increased price.

As a guide, scenery sets in college or regional theatres typically run at up to 120 or 180 fpm. Major performing arts centers and opera houses may have speeds of up to 240 fpm, while some of the newest international opera houses are using hoists with speeds of up to 360 fpm. Main curtain hoists have been built to operate at even higher speeds.

Variable speed hoists require solid state vector drives rated for hoisting duty, with the reliability and safety features necessary for use in a theatrical environment. Dynamic braking systems are also generally required on high-speed units. These factors make variable speed hoists more costly than fixed speed hoists.

Capacity

Scenery sets are typically anticipated to carry 15-25 lbs. per foot of batten length, while lighting sets are anticipated to carry 25-30 lbs. per foot for schools and performing arts centers, and higher for opera houses or showrooms.

Brakes

Theatrical hoists should have dual brakes for added safety. The primary brake is on the motor, for stopping and holding the load. The secondary brake is on the drum, providing redundant protection.

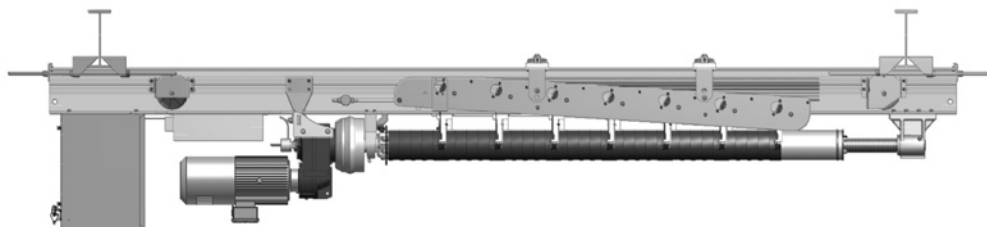
Configuration

Most sets are dead haul, where the hoist lifts the entire weight of the set. This is preferred for most scenery and general purpose applications. For sets with fixed loads over a few thousand pounds (such as large acoustical shells) counterweight assisted hoists may be used to reduce motor size and costs.

HOIST TYPES

PowerLift®

PowerLift hoists are mass produced compact, self-contained hoists, substantially reducing the cost of motorized rigging systems. The hoists use “moving drum” technology, so that the point where the wire rope leaves the drum is always aligned with the head block. This is the key to building compact hoists — a technology pioneered by J.R. Clancy in the 1960’s.



PowerLift

PowerLifts are manufactured in standard speeds and capacities, selected to fulfill the needs of school, college and regional theatres.

High capacity low-speed hoists (0-20 fpm) are used for lighting, shell ceilings, and other utility sets which do not move during a performance. Control options range from push button controls to several models of position controllers.

Variable speed sets are used for moving scenery, curtains, and other elements for dramatic effect during a performance. 0-120 fpm units are generally used in middle and high schools, and community theatres where the fly tower is typically less than 50' high. 0-180 fpm units are available to provide additional versatility for performing arts high schools, colleges, universities, and regional theatres.

Variable speed units must be controlled using a computerized console. This allows them to be moved precisely and safely with complete location and speed control.

PowerLift Hoists have two, independent braking systems for added security. The traditional failsafe brake on the motor is supplemented by a load brake on the drum. The load brake is triggered by an overspeed condition.

Location

All hoisting systems (manual or motorized) require inspection and maintenance. OSHA requires annual inspection. In addition various state laws, codes, and standards also require regular inspection and maintenance by a competent person. Access to the equipment is essential, and is an important consideration during the design process.

Mounting the hoists vertically on the stage house walls has several advantages.

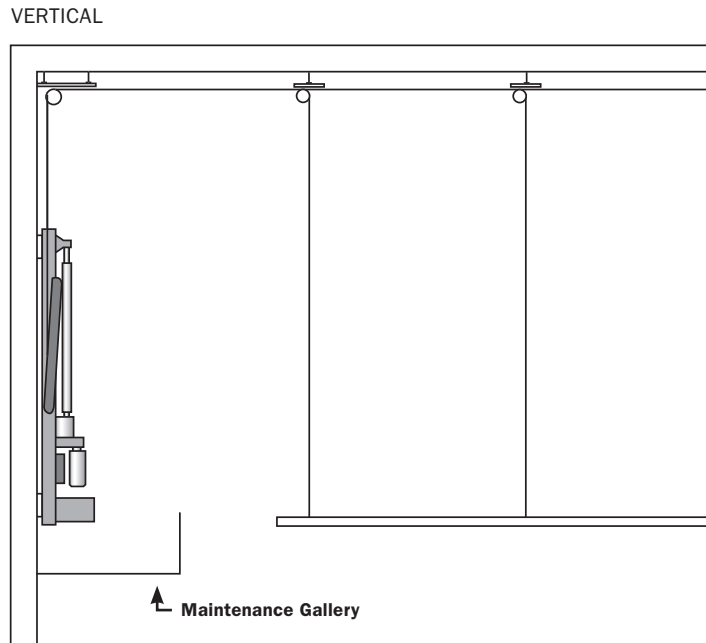
- Easy access for inspection and maintenance
- Lowest installation costs in many cases
- May eliminate the need for a full grid

Other mounting configurations are possible. Planning for access to the hoists is essential, as they may be out of the range of a personnel lift, or may impractical to reach due to equipment on a stage.

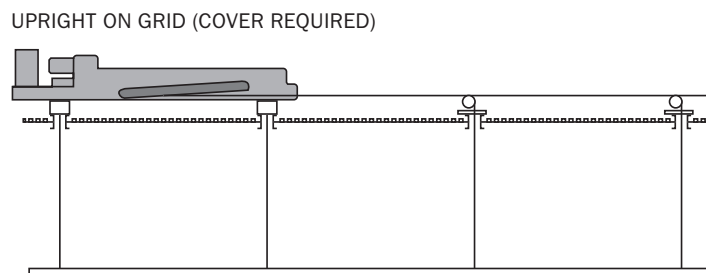
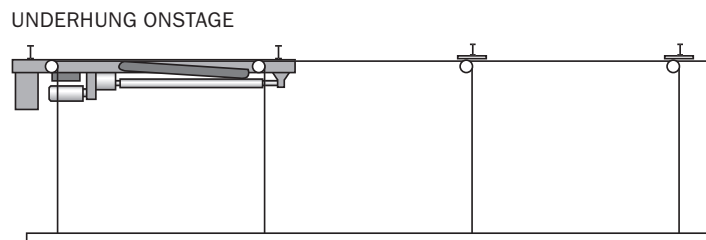
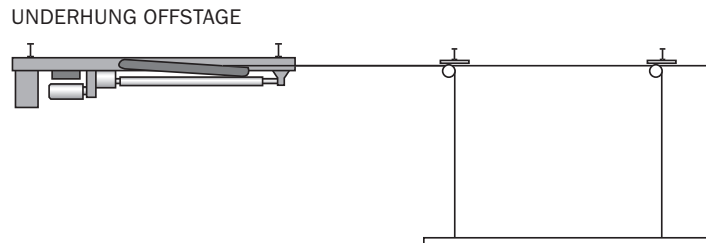
PowerLift hoists can be located on 10" centers or even 7" by alternating the hoists on the left and right sides of the stage. They require less space and support steel than traditional counterweight rigging, reducing construction costs.

More information and product specifications are available at www.jrclancy.com.

PowerLift Installations — Preferred Mounting Approach



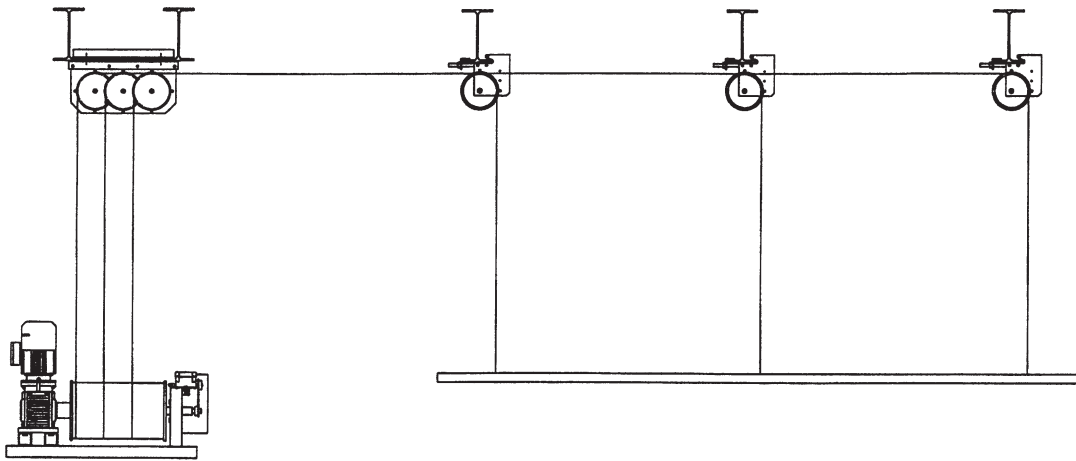
PowerLift Installations — Other Mounting Approaches



Drum Hoists

Most traditional hoists use a single drum, long enough to accommodate all of the lift lines required for the set. The drum is helically grooved so that the lift lines wrap neatly in a single layer, to avoid damage to the wire rope and to keep all lines lifting evenly.

Hoists can be located on the grid, galleries, or in a separate motor room. Head and loft blocks are used to route the lift lines to the batten. The traditional drum hoist shown below typically requires at least 10' between the drum and head blocks to maintain the proper fleet angle(s).



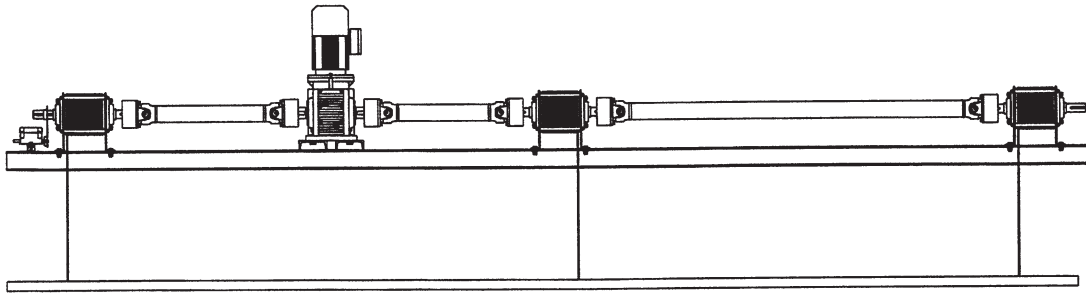
Traditional Drum Hoist

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. Due to its design, the load placed on the building structure is a vertical load only, without the resultant and compression loads normally associated with conventional rigging. Line shaft hoists are particularly useful for renovations and in locations with limited space or limited structure.

In order to compensate for movements in the structural steel as loads change, line shaft hoists should include universal joints in the shafting between the drums. This provides increased reliability, easier installation, and prevents the accumulation of destructive stresses within the shafting.

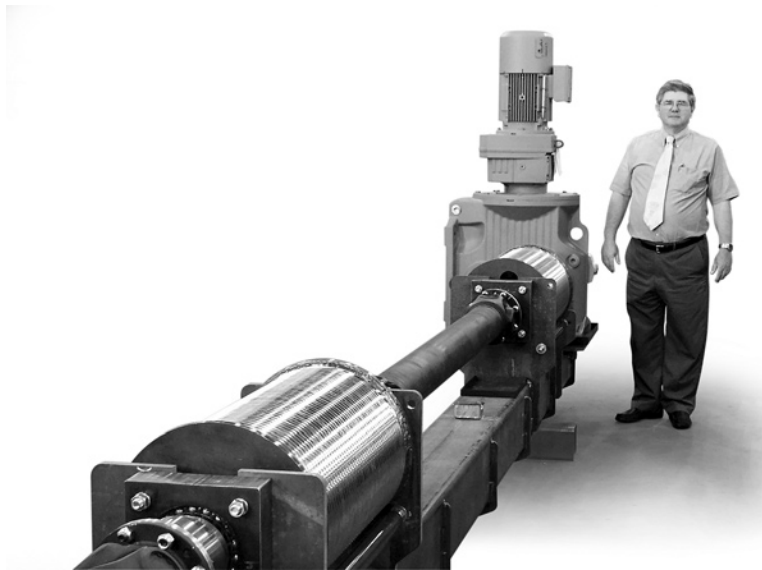
Line shaft hoists offer convenience and simplicity, but can be more expensive than drum hoists.



Line Shaft Hoist

Custom Hoists

For unusual applications we can provide custom hoists to meet your specific needs. These range from low capacity hoists for acoustic banners up to hoists with capacities in excess of 100,000 lbs. for moving ceilings and other structures.



Custom Line Shaft Hoist with 34,000 lb. Capacity

CONTROL SYSTEMS

The control system is the key to the creating great performances. J.R. Clancy offers a range of consoles to meet your performance requirements. All of these systems provide accurate, repeatable positioning,

- **SceneControl 500:** The SceneControl 500 uses clear graphics to show your facility in a familiar manner. The displays are easily understood, giving the operator the ability to work confidently. Users can make simple manual moves for setup, or create cues with multiple items moving at different speeds and targets for dramatic effects. A touch screen makes operation simple and easy.

This console can be mounted on an adjustable pedestal or wall mounted and both styles are ADA compliant. Options include a hand held remote and offline editing software.

- **Altus:** is perfect for high schools with backstage rigging systems with up to 36 hoists. Its touch screen programmable capabilities allow you to create up to 200 cues with different speeds and targets for each hoist.

This gives you the flexibility you need to stage impressive set changes and dramatic visuals for dramas, musicals, and concerts. During the production, movements are played back reliably, yet can be modified as needed to match the flow of each performance.

Desk, wall, and adjustable height pedestal models are available.

- **SureTarget 10:** Simple, accurate speed and position control for up to 10 sets, with eight presets for each hoist.
- **SureTarget:** Position control for a single fixed speed hoist, with four user defined preset positions. These are used on lighting sets, orchestra shell ceilings and other sets that need to be positioned accurately and repeatedly.
- The simplest control systems are manually operated Up/Down push buttons that allow positioning “by eye”. This is a low cost option, but does not allow the most accurate positioning.

Safety

J.R. Clancy control systems use only industrial grade computers and components, providing the reliability necessary for overhead lifting. For added security, “hold-to-operate” buttons are used so that an operator must be at the console during movement. All controllers have a key operated On/Off key switch to restrict usage; higher level systems also require passwords. Hoists can be equipped with load monitoring and other sensing components to enhance the safety of operations.

Load monitoring is provided on all PowerLift hoists. Load cells on each hoist measure the load 20 times a second. The monitoring program was developed specifically for theatrical hoists and will stop motion if an overload is detected. Additionally, this system monitors the load during acceleration and deceleration and speed changes without false tripping. Simpler systems do not allow speed changes, or require the system be de-sensitized to the point where they are ineffective to avoid false tripping.

Control Systems Comparison

	SceneControl® 500	Altus™	SureTarget™ 10	SureTarget™
Maximum number of channels	999	48	10	1
Maximum numbers of cues / presets per show	999	200	8	4
Color display size	15"	12"	6"	
Reliable industrial grade components	•	•	•	•
Simple, accurate position control	•	•	•	•
User programmed soft end-of-travel limits	•	•	•	•
Direct UP / DOWN push button control	•	•	•	•
Speed control / time control*	•	•	•	
User programmed acceleration, deceleration, and default velocity*	•	•	•	
Joystick for speed adjustment "on the-fly"*	2	1	1	
User naming of presets / cues	•	•	•	
Status page showing current position, limit switch status, amperage*, and drive fault status*	•	•	•	
Load monitoring for hoists with load sensors	•	•	•	
Position displayed in US or metric units	•	•	•	
Optional hand held remote	•	•	•	
Custom 3D display of your performance space	•			
Group winches for synchronized operation*	•			
Adjustable height for operator convenience and ADA compliance	•	•		
Twin playbacks for simple execution of complex moves	•			
UL Listed as meeting UL 508A Standard for Industrial Control Panels	•	•	•	•
3 year warranty	•	•	•	•

*Variable speed hoists required.

Specifications subject to change.



SceneControl® 500



Push Button Control Station



Hand Held Remote



Altus™



SureTarget™10

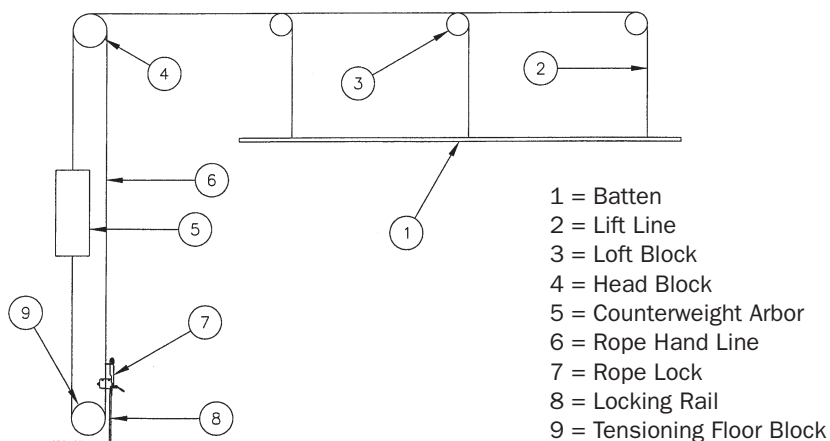


SureTarget™

MANUAL COUNTERWEIGHT RIGGING

Manually operated, counterweighted sets are economical and versatile. An operator can produce speeds ranging from subtle to dramatic as required by the needs of the performance. Experienced operators can feel any change in the load or contact with an obstruction and take corrective action.

A simple, manual counterweight set consists of a balanced system of weights and pulleys so that loads such as scenery, curtains, or lighting equipment can be raised and lowered. Each set is comprised of a batten (1) suspended from lift lines (2) which pass over loft block sheaves (3) then over a head block (4) at one side of the stage, and finally down to a counterweight arbor (5). The arbor holds weights that are adjusted by the user to balance (or counterweight) the load. Movement of the set is controlled by a rope hand line (6) that passes from the top of the arbor, over the head block, down through a rope lock (7) mounted on the locking rail (8) around a tensioning floor block (9) and back to the bottom of the arbor.



Manual Counterweight Set

Balance is the Key

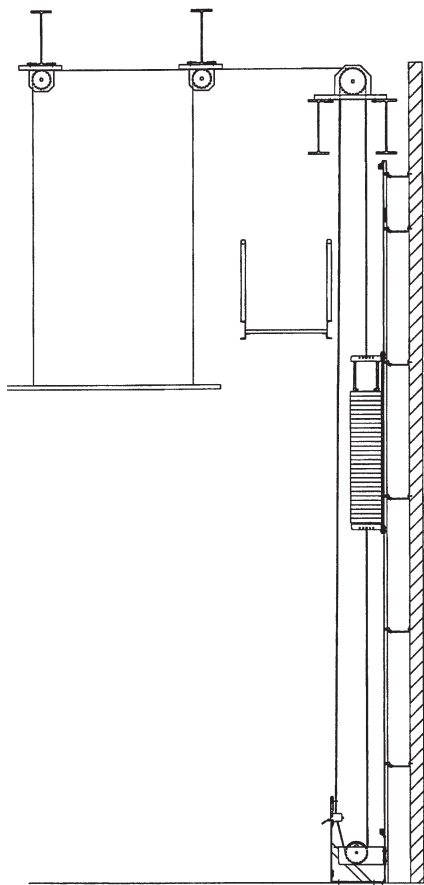
The key to the system is to counterbalance the load (scenery, lights, curtains) with steel counterweights. A properly balanced system is inherently safe, as neither the load nor the counterbalancing weight will move without an external force. The load can be moved with moderate effort by pulling on the hand line. For many years this was the most popular type of rigging system. This requires handling of counterweights, and a loading gallery is required just below the head blocks in order to adjust the counterweights. It is essential that the operators be trained to fully understand the proper operation of the rigging equipment. The same requirements for training apply to motorized rigging equipment, and many other types of equipment used in schools or theatres.

There are several different ways counterweight rigging sets can be built. These depend on the manner in which the sets will be operated, how they are attached to the building, available space and stage height, and even whether they are to be powered by the operators or by some form of motorized assistance. Some of the decisions needed to make the best selections are discussed on the following pages.

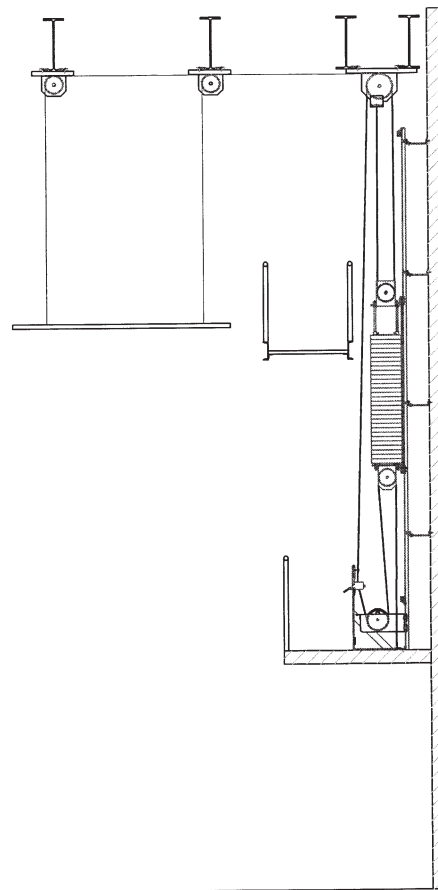
SINGLE OR DOUBLE PURCHASE

In a *single purchase* counterweight set the weight and travel distance of the loaded batten equals the weight and travel distance of the properly loaded arbor. These sets are simple to install and operate, and are very efficient.

A *double purchase* system is installed in buildings where space for vertical travel of the counterweight arbor is not sufficient for single purchase sets to operate. By doubling the lift cables around a pulley on the arbor, the batten will travel twice as far as the arbor. This reduces 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. This creates a condition that requires twice the amount of weight in the arbor as is supported by the batten. However, only 1' of arbor travel is required for each 2' of batten travel. Double purchase systems are very useful in some situations, but they are more expensive and more difficult to install and operate. Further, you also have to load and unload twice as much weight when scenery is changed. The additional mass and additional sheaves add both friction and inertia to the system making it harder to operate.



Single Purchase Set



Double Purchase Set

ROPE LOCK TYPES

The rope lock holds the hand line so that a properly balanced set will not move. Rope locks should provide for the use of a padlock to restrict operation by unauthorized personnel.

It is possible to have an imbalance between the load and counterbalancing weight if a set is improperly loaded. If a rope lock is opened on an out-of-balance set, the heavier load will move down. The greater the imbalance, the faster the movement. A runaway set can be dangerous. This is why it is essential that users are properly trained, and that untrained people must not use rigging equipment.

There are two types of rope locks, as shown below:



Standard Rope Lock



SureLock®

The standard rope lock is widely used in theatres of all types, and is also the preferred choice of professional theatres.

The SureLock has a load detection mechanism that will not allow the lock to be opened if there is an out-of-balance condition of more than 50 lbs. This lock can help prevent the inadvertent release of an unbalanced set and reduce the possibility of runaways. Many schools utilize load-sensing rope locks in order to provide an additional level of security beyond that provided by their training program.

More information and product specifications are available at www.surelock.info.

ARBOR GUIDE SYSTEMS

Counterweight arbors require a guide system. Rigid guides are preferred for new installations. 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. Aluminum J-Guides have fewer parts than the older T-Bar system, are easier to align and install, are equally strong, and are quieter in operation.

Wire guide systems remain in use and are a solution for short arbor travel or where a rigid system cannot be installed. Lattice track guides are used only for special applications, such as fire curtains, due to the additional cost and the space required for each set.

■ MOTORIZING MANUAL RIGGING

New or existing counterweight sets may be motorized using the PowerAssist® hoist. This eliminates the need to handle and balance counterweights. This is a much easier way to operate sets, without the need to replace the entire set.

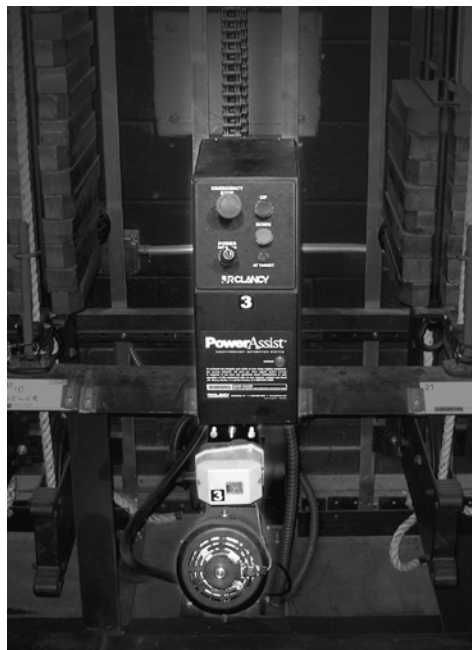
This hoist replaces the floor block and the rope lock. A double leaf roller chain positively drives the arbor, and a proprietary steel/urethane rope allows use of a standard head block. The combination of a fixed weight in the arbor and a hoist allow the set to work with loads from 0-2,000 lbs. without the need to adjust or handle counterweights.

These are widely used for motorizing lighting sets for several reasons:

- Lighting sets are typically heavier and harder to move manually
- The loads on lighting sets are changed as the number of cables and instruments are frequently modified
- Lighting sets are moved frequently to facilitate replacement of gel and lamps and the sets must then be returned to their “trim” positions accurately. This is difficult to do by “eye”.

Other frequent applications are for acoustic ceilings, shell walls, and large curtains.

Push button controls or the SureTarget position controller are used with the PowerAssist. The controller may be wall mounted, or can be mounted on the locking rail, replacing the rope lock.



PowerAssist

■ FIRE SAFETY CURTAINS

Fire safety curtains have been installed in theatres for over 100 years. They provide a barrier between the stage and auditorium in the event of a fire. Building codes require automatic, self closing fire safety curtains for many theatres. The curtains have a 20-30 minute fire rating to allow the audience to exit the theatre safely.

Fabric

Zetex Plus 1210 ZP curtains are listed by the California State Fire Marshal and New York City Department of Buildings for use as Proscenium Fire Protection. Zetex fabric meets the code strength requirements without the need for expensive wire reinforcement.

Activation

Current codes require the use of rate-of-rise detectors to activate the fire curtain. J.R. Clancy's SureGuard II is a UL Listed device that monitors the rate of rise detectors, and activates the fire curtain.

Fire safety curtains are also frequently used to provide a security barrier between the stage and auditorium in schools. This can be an effective method for keeping unauthorized personnel from the backstage area.

Current building codes recognize two types of curtains. The diagrams on the following pages show typical fire safety curtains and their rigging. Be sure to verify the standards and codes applicable to your facility.

Guide Pockets

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.

Fire Safety Curtain Release Systems

In order to provide automatic closing, a release system is required. It typically consists of a tensioned release line located around the three sides of the proscenium arch. It also contains the required number of fusible links, two manual release stations, and may include a SureGuard® interface for smoke and rate-of-rise detectors.

Manual vs. Powered Curtains

Straight lift curtains are normally counterweighted so that the curtain is somewhat heavier than the balancing weight. This allows them to close by gravity when released. More than one operator may be required to reopen the curtain. Larger curtains and steel-framed fire safety curtains should be motorized for ease of operation.

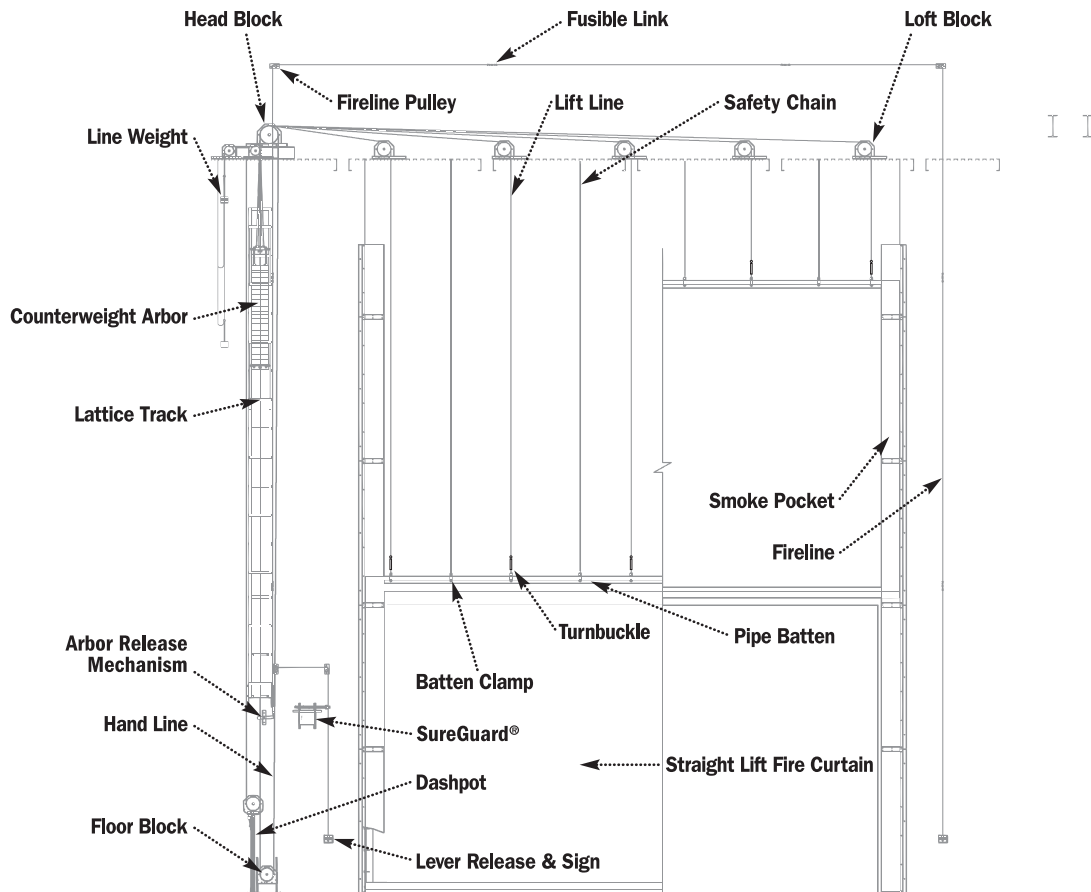
Brail fire safety curtains may be raised using a hand cranked brail hoist; however, a motorized brail hoist is recommended. Operating a manual brail hoist is a strenuous activity! In facilities where the fire curtain is closed daily for safety and security, a motorized hoist will be appreciated by the entire staff.

STRAIGHT LIFT FIRE SAFETY CURTAIN

Straight lift curtains consist of a single panel that is lowered to close off the proscenium opening. The curtains usually consist of a fabric panel with a 30 minute fire rating, a pipe at the top and bottom, and guides at the sides. Other required specifications for installation include:

- Overlap of proscenium a minimum of 18" at the sides and 24" at the top
- Curtain storage space above the proscenium equal to the height of the proscenium arch plus a minimum of 3' (additional height is recommended)
- Distance between lift lines should not exceed 10'

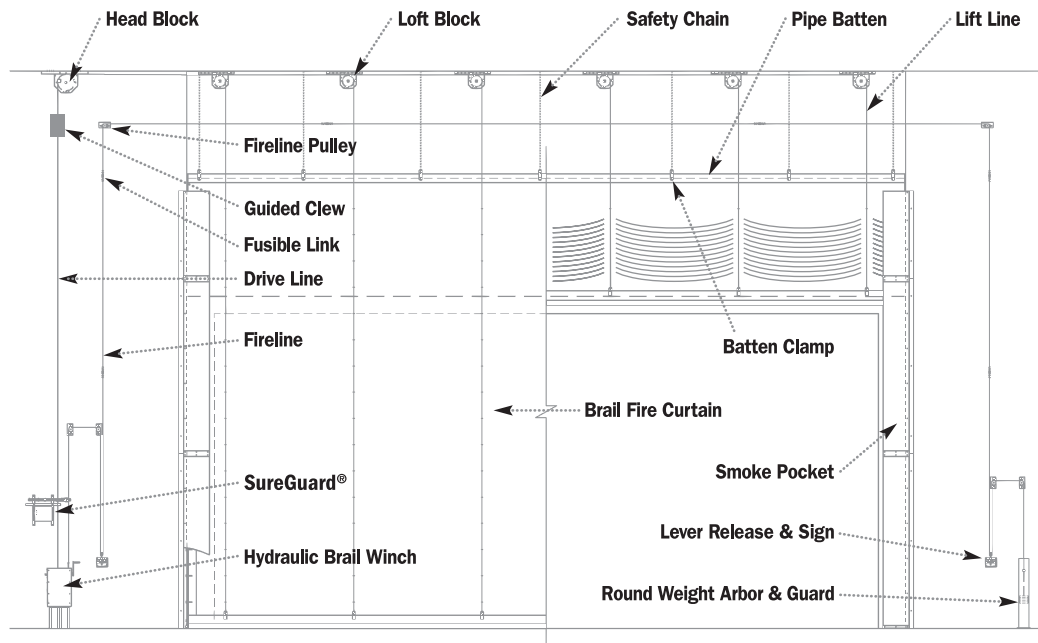
Fire curtains are imbalanced so they will close by gravity. A release system with fusible links will automatically release the curtain in case of fire. Manual releases are also provided. Local codes may also require rate of rise or other detectors. The speed of descent of the curtain may be controlled by chain weights, dashpots, or speed regulators. These additional systems slow down the curtain near the end of its travel.



Straight Lift Fire Curtain

BRAIL TYPE FIRE CURTAIN

Brail Type fire curtains are used when the space above the proscenium is insufficient for storage of a straight lift curtain. They fold like a Roman Shade and fit in a space half the height (or even less) of the proscenium opening. This type of curtain is operated by a brail hoist with a speed governor. The hoist is attached to an emergency release line system similar to the straight lift curtain. The distance between lift lines must not exceed 8'. Motorized operation is required by current standards.



Brail Type Fire Curtain

■ STAGE & RIGGING LAYOUT

Backstage

The stage area of a theatre is a busy, crowded space. In addition to being used for many types of performances, it's frequently used as teaching space, a scenery construction area, and for other activities. Stages may also be used for storage of scenery, costumes, musical instruments, and other large objects. Planning for storage and access is important.

Wing space is needed on either side of the proscenium, for floor-supported scenery, actors awaiting their cues, and the technical crew. Manual counterweight systems are normally operated from stage level, requiring additional wing space for the locking rail and operators. During performances the backstage area is in a near-dark condition. It's essential that there be clear space for access and emergency evacuation.

Doors are needed by actors to access the stage area from all sides and to facilitate the movement of scenery from storage areas. Hallways that surround the stage help by providing easier access.

Rigging

The shape of the stage house needs to accommodate the scenery and rigging. Rigging can be designed to fit just about any space, but it fits best and most economically in spaces with straight walls and square corners. For theatres that will be used for dramatic performances with set changes, the stage house height should be 2½ times the height of the proscenium. This allows the scenery and lights to be hidden from the audience when flown.

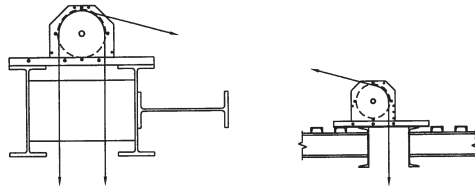
Rigging sets should be installed on centers that are multiples of 6" or 8". The rigging system extends from the proscenium wall to within 3-4' of the back wall of the stage house for maximum versatility. Depending on the program for the facility it may not be necessary to provide sets at every possible point, but keeping sets on multiples of 6" or 8" is desirable.

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 (typically on 10' centers), and battens for scenery.

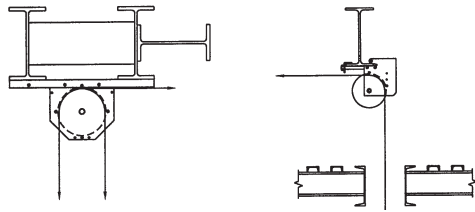
UPRIGHT OR UNDERHUNG BLOCKS

Structural designs, existing conditions, and operational preferences determine the choice of the block types. Upright rigging components are mounted on top of structural supports that are usually steel but may also be concrete or other materials. Underhung components attach to the bottom flanges of structural steel or other supporting members. Typical structural designs are shown on the following page.

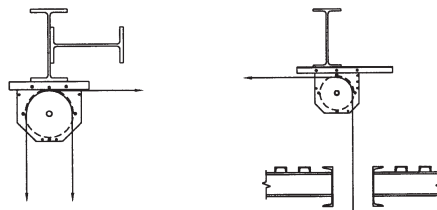
These basic styles are often combined in practice. The first example shows grid mounted loft blocks. The lift lines are located so that walking on the grid is difficult, which is not desirable. The other examples are preferred. The grid is optional in these configurations and, if present, is available for rigging spot lines, side masking, wrap around cycloramas, and other special effects. This configuration also provides the best access for maintenance and inspection and for making changes to the rigging layout.



Upright Head Block (Series 55) and Universal Loft Block



Underhung Head Block (Series 59) and Underhung Loft Block



Underhung Head Block (Series 59) and Universal Loft Block

Sheave Materials

Head block sheaves are available in cast iron or nylon. J.R. Clancy nylon sheaves are filled with molybdenum disulfate which makes them stronger and more self-lubricating than standard nylon. Nylon sheaves are lighter in weight than cast iron, which reduces inertia and makes sets easier to operate. The lighter weight can reduce installation time and cost, as well as providing lubrication to the lift lines. The load capacity and service life of the head blocks are the same with either sheave material.

Single line sheaves may be either cast iron or nylon. The majority of new installations use nylon sheaves, due to their light weight, significantly lower cost compared to cast iron, and low inertia. Two, four, and eight line sheaves are also available.

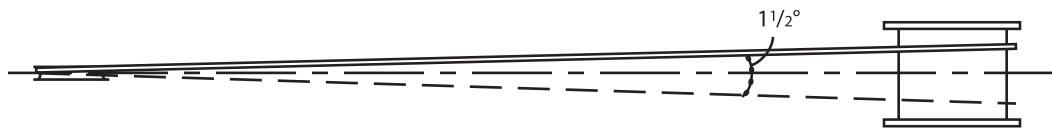
Idlers

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. Assemblies contain three or six 3 1/2" diameter grooved nylon sheaves. The idler pulley assembly is mounted to the side of the block housing.

Idler pulleys cannot carry line loads or act as deflectors or mule blocks. When using idler pulleys, the loft block closest to the head block should be a multi-line block with grooves for all of the lift lines. This ensures that fleet angle (see Fleet Angles below) and other alignment stresses are not transferred to the idler pulleys.

Fleet Angles

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 1 1/2° result in additional friction and wear in the rigging. This condition also causes more strain on the operators and reduces the safe working load and the life of the equipment.



Fleet Angle Diagram

GRIDS & 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 and/or galleries will be required.

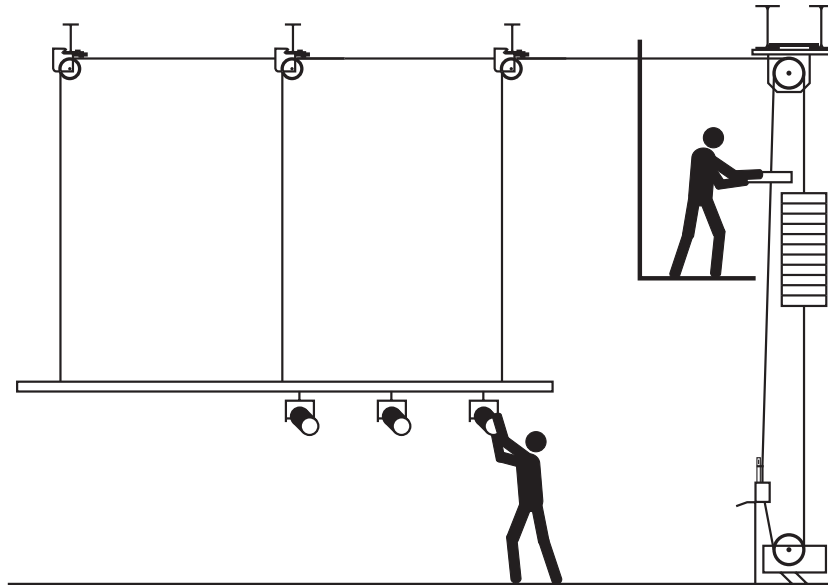
A grid is a real convenience, as it allows access to all of the rigging equipment. It also provides a location for rigging spot lines, and other special rigging requirements. However, a grid adds height to the fly tower. For professional theatres a grid is a necessity. For other theatres, a grid is suggested if the theatre is being heavily used for productions with extensive rigging requirements.

Tops of loft block well channels in grids should have a 10" opening, and be flush with the top of the surrounding grid floor channels or bar grating to reduce tripping hazards.

COUNTERWEIGHT LOADING GALLERY

An Essential Component

A loading gallery is a necessity for any counterweight rigging system. In order to properly balance (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 that the system is always in balance.



After a load is added to the batten at the ground, weights are added to counterbalance the load.

Loads are added to or removed from the batten when it is at floor level. When the batten is at floor level, the counterweight arbor is at its highest level. Therefore, it is essential to have a loading bridge so that there is access to the counterweight arbors to add or remove weights to balance the load. It may be necessary for people working on a loading bridge to use fall protection equipment.

Without a loading bridge it is necessary to raise and lower the battens in an out-of-balance condition. While there are procedures and equipment which can help in this situation, working with out-of-balance sets is extremely dangerous, and should be discouraged. We do not recommend the provision of a counterweight rigging system without a loading bridge. If a loading bridge cannot be provided, we recommend the use of motorized equipment in place of manual rigging.

⚠ WARNING

The safe and efficient use of rigging equipment requires that the structural members supporting the equipment have adequate load-bearing capacity, that the equipment be properly selected, installed, tested and maintained, and that rigging system operators be properly trained. Failure to do any one of the foregoing may lead to equipment malfunction, which can cause serious injury or death. Should you have any questions regarding the selection of the proper equipment, or installation or maintenance requirements, contact J.R. Clancy, Inc.

FOR MORE INFORMATION:

Visit our website www.jrclancy.com

- Our complete product catalog is available online for review and download.
- The “Design” section of the website provides more design information, as well as drawings, white papers, and articles.

Or, call us — **1-800-836-1885**

- Applications engineers are available to help you plan and lay out theatrical rigging systems, assist with specifications, electrical risers, etc.
- We can also introduce you to our local authorized dealers. These firms can install complete rigging systems using our equipment. They’ll also be there for support after the sale.

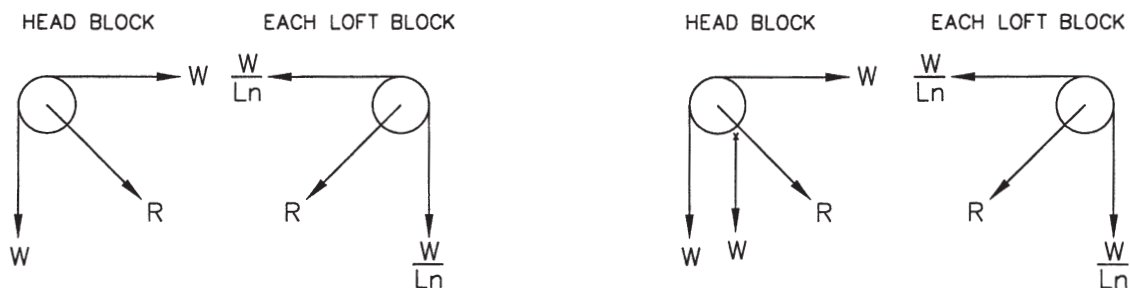
TECHNICAL INFORMATION SYSTEM LOADS

Rigging systems impose both vertical and horizontal loads on the supporting structures. The accompanying reaction diagrams use “W” to describe the maximum load capacity per batten, including the dead weight of the system, and “Ln” to designate the number of pickup lines in each set. Lift lines should be typically spaced at intervals of not more than 10' along the length of the batten. Greater spacing reduces the load carrying capacity of the batten or requires the use of reinforced battens such as two pipe trusses. On average, scenery batten live loads are a maximum of 25 lbs. per foot with electric batten loads being as much as 25 to 40 lbs. per foot.

Rigging sets for house curtains, fire curtains, orchestra shells, etc. must be calculated carefully and their live loads included in the total design of the system. For example, when a traveller curtain is open all of the weight is concentrated on the extreme ends of the track.

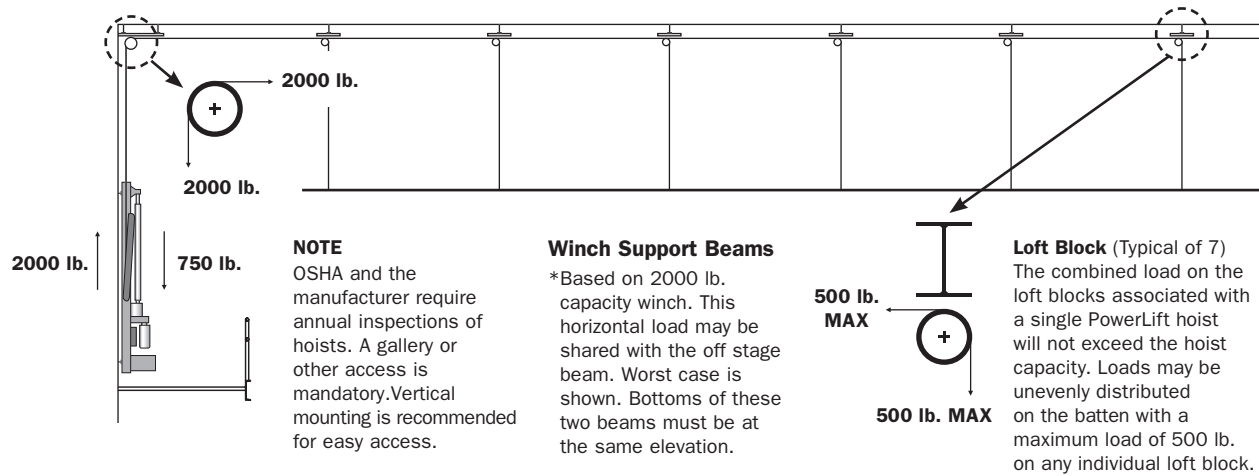
The dead weight of all equipment must also be included in the structural design criteria. The possibility of future expansion of the rigging system should also be considered.

W = Total Weight (Load) on Batten
R = Resultant Load on Block (and Supporting Structure)
Ln = Number of Lift Lines



Single Purchase Loading Condition Double Purchase Loading Condition

Structural Loading for PowerLift®



Load Diagram for PowerLift Hoist

SUPPORT STEEL FOR COUNTERWEIGHTS

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 diaphragms are used inside the head block beams, careful consideration must be given to their installation in order not to obstruct the cables that pass between the beams to the equally spaced head blocks above.

Bar joists are not recommended for the support of loft blocks without alteration for bracing.

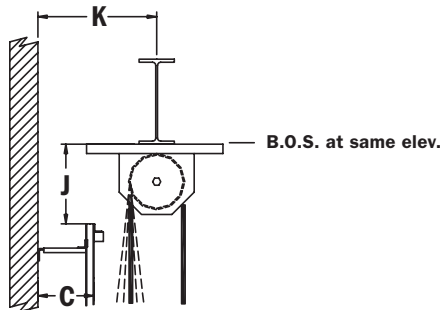
When head blocks mount on top of head block beams the block should be located so the rope and cable are at least 2-3" away from the beam flanges to prevent rubbing when the rope is operated. This is especially important when there is a mix of different sized head blocks in the system.

The following two pages provide details of rigging equipment locations and required dimensions.

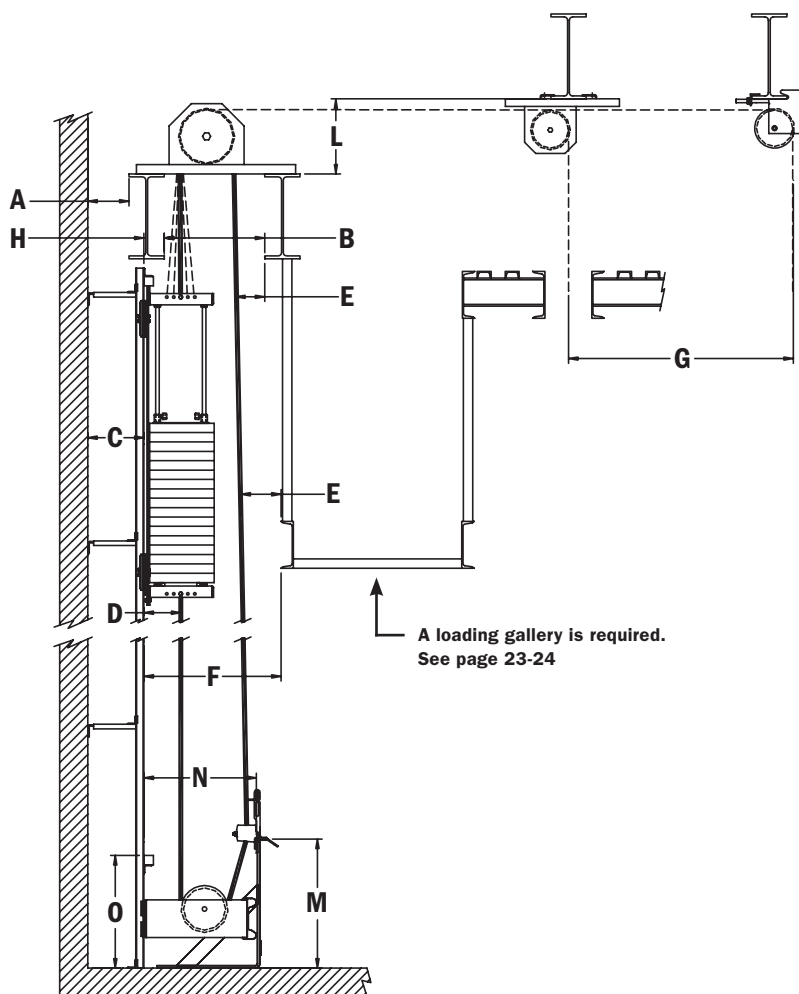
RECOMMENDED MOUNTING DIMENSIONS

▼ Underhung Head Block: Single Beam

(Welding Recommended)



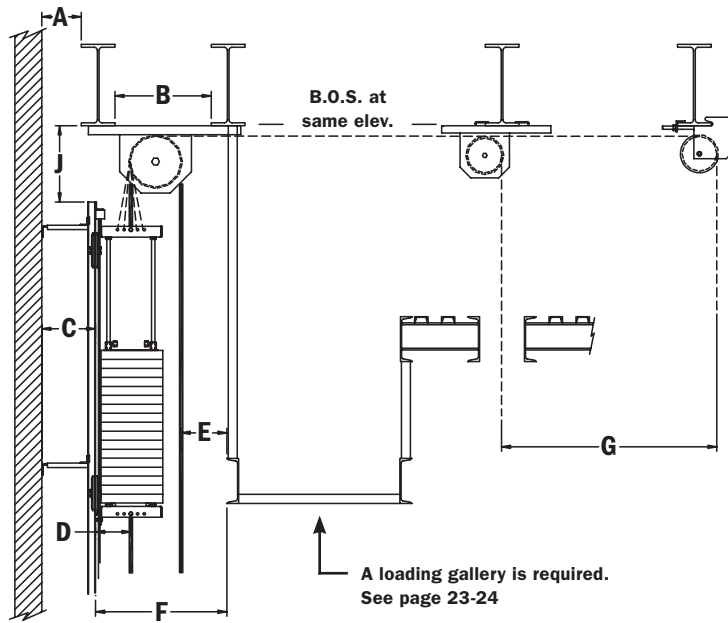
▼ Upright Head Block: Double Beam



Dim	Description	Value
A	Wall Clearance	3" MIN
B	Beam Spacing	18-22"
C	Wall to Face of T or J Guide	8-20"
D	Face of T or J Guide to Center of Arbor	7 7/8"
E	Clearance of Handlines to Adjacent Structures	3-5"
F	Face of T or J Guide to Edge of Loading Gallery	22-25"
G	Liftline/Loft Block Beam Spacing	10' MAX
H	Face of T or J to Edge of Beam Flange of Offstage Head Beam	5" MAX
J	B.O.S. Head Block Beam to Top of Guide	18" MIN
K	Wall to Center of Single Head Block Beam	19 1/2" MIN
L	T.O.S. Head Block Beam to Blocks B.O.S. Loft Block Beams	16" for 12" Head Blocks 12" for 8" Loft Blocks
M	Floor to Top of Lockrail	27 1/2"
N	Face of T or J Guide to Back of Lockrail	24"
O	Floor to Top of the Bottom Arbor Stop	24" MIN
P	Wall to Edge of Arbor Pit Opening	= N + C
Q	Face of T or J Guide to Arbor Pit Wall	36" MIN

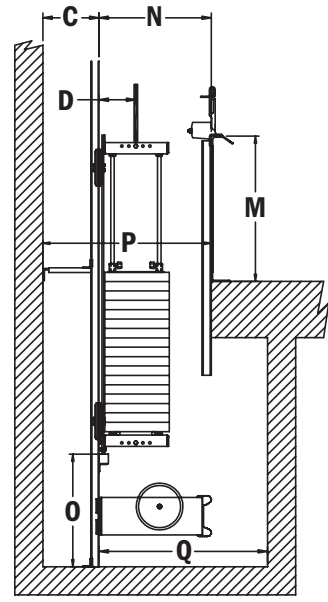
▲ Floor Mounted Lock Rail

▼ Underhung Head Block: Double Beam



Dim	Description	Value
A	Wall Clearance	3" MIN
B	Beam Spacing	18-22"
C	Wall to Face of T or J Guide	8-20"
D	Face of T or J Guide to Center of Arbor	7 7/8"
E	Clearance of Handlines to Adjacent Structures	3-5"
F	Face of T or J Guide to Edge of Loading Gallery	22-25"
G	Liftline/Loft Block Beam Spacing	10' MAX
H	Face of T or J to Edge of Beam Flange of Offstage Head Beam	5" MAX
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O	Floor to Top of the Bottom Arbor Stop	24" MIN
P	Wall to Edge of Arbor Pit Opening	= N + C
Q	Face of T or J Guide to Arbor Pit Wall	36" MIN

▼ Arbor Pit Mounted Lock Rail



TIM TRAIN INSPECT MAINTAIN

The Keys to a Safer Backstage

► Train

No one should be allowed to handle any rigging equipment unless they are properly trained. Anyone who is going to use moving equipment of any type backstage must be trained to understand the purpose of the equipment and the proper methods of operation. Operations manuals and signs on the proper use of stage rigging equipment are available from www.jrclancy.com (Operation & Safety).

The Theatrical Services and Technology Association (www.esta.org) has an Entertainment Technician Certification Program (ETCP). Your lead technicians should be trained by an ETCP certified rigger.

► Inspect

OSHA requires that rigging systems be inspected annually by a competent person [29 CFR 1926.550 (a)(6)]. This work should be done by the rigging manufacturer's authorized service technician.

► Maintain

Rigging systems involve overhead lifting. Just like any other mechanical system, periodic maintenance is essential. The rigging equipment manufacturer or the person who conducts your annual inspection can provide maintenance services.

For more information about stage rigging safety and the name of an Authorized J.R. Clancy dealer near you, contact us at 800-836-1885 or visit us at www.jrclancy.com.