VERSION 1.0

rigging guide

FOR PERFORMANCE SPACES

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PERFORMANCE SPACES ▶ *rigging*

Rigging equipment is an essential part of any stage. This guide is intended to assist architects and consultants in planning rigging systems that are functional, durable, and safe. How well the system works within its environment directly effects its productivity and value.

EASY ACCESS

One of the essentials of rigging design is making sure stage lighting and other onstage 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.

DRAMATIC EFFECT

For many theatres, the primary use of the rigging equipment is to move scenery for dramatic effect. A well-designed rigging system simplifies the process and can even be an enhancement. For productions where scenery moves in front of the audience, for example, a streamlined system adds drama and can be a key part of the production.

ENHANCED ACOUSTICS

Rigging systems are typically required for acoustical ceilings and clouds. Rigging allows easier and more accurate adjustments in ceiling height and angles of deployment and makes it easier to modify the effect for performing groups of varying sizes. Multiple configurations can be programmed and motorized for repeat use.

EQUIPMENT MASKING

Curtains mask equipment from audience view. Ideally they are easily raised and lowered, a feature that is especially important when the height of the masking curtains needs to change to meet the requirements of specific productions.

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, or installation or maintenance requirements, please contact J.R. Clancy, Inc.

RECOMMENDATIONS - SPACE

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, allowing scenery and lights to be hidden when flown.

- Rigging sets should be installed 6" - 8" (152 - 203 mm) on center.

- The rigging system extends from the proscenium wall to within 3' - 4' (914 - 1219 mm) of the back wall of the stagehouse, providing maximum versatility and allowing equipment and scenery to be hung virtually anywhere required for a production.

- 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-foot (3048 mm) centers), and battens for scenery.

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 100 sets or more. For new construction, anticipating future use can provide considerable cost savings compared to retrofitting a rigging system sometime down the line.

RATINGS

The following ratings apply to most installations:
- Scenery sets are typically rated to carry 25 lb per foot (11 kg per 305 mm) of batten length.
- Lighting sets and acoustic ceilings are rated at 25 - 40 lb per foot (11 - 18 kg per 305 mm) for schools and performing arts centers, and higher for opera houses.

RIGGING TYPES

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

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.

- Typically used where low ceiling heights or limited funds prohibit other options.
- Maintenance requires the use of a ladder, which is inconvenient and potentially hazardous.
- Unmovable once installed; any equipment changes must be done at ceiling level, and cannot be used for stage effects.

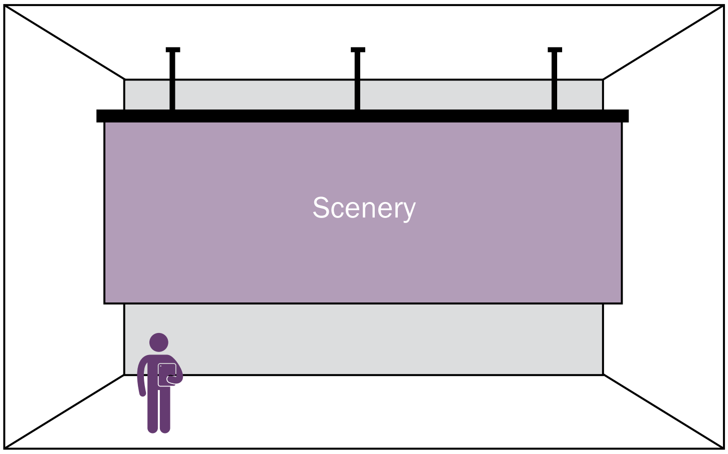


Figure JR 1

MANUALLY OPERATED COUNTERWEIGHT RIGGING

Manually operated counterweight systems have been used in theaters 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, as shown in figure JR2.

- On a per set basis the lowest initial capital cost for moveable rigging.
- Versatile performance capabilities.
- Requires trained operators and weight changing for safe operation.
- Requires a loading bridge (additional steel structure) for safe operation.
- Adds the complexity of a counterweight guide system.
- Adds the additional counterweight load to the building's total weight.

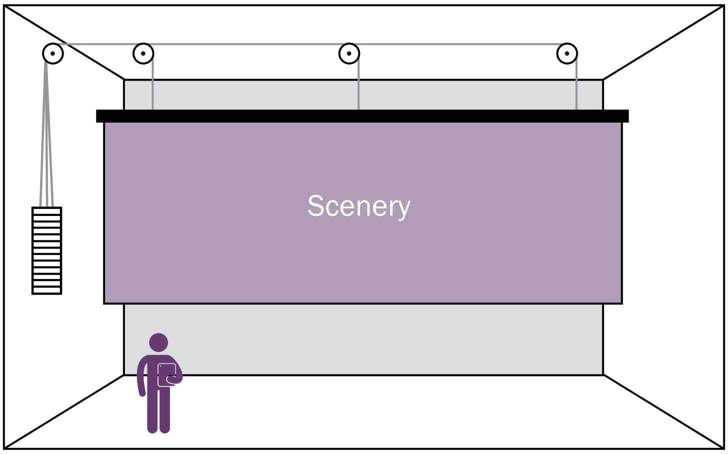


Figure JR 2

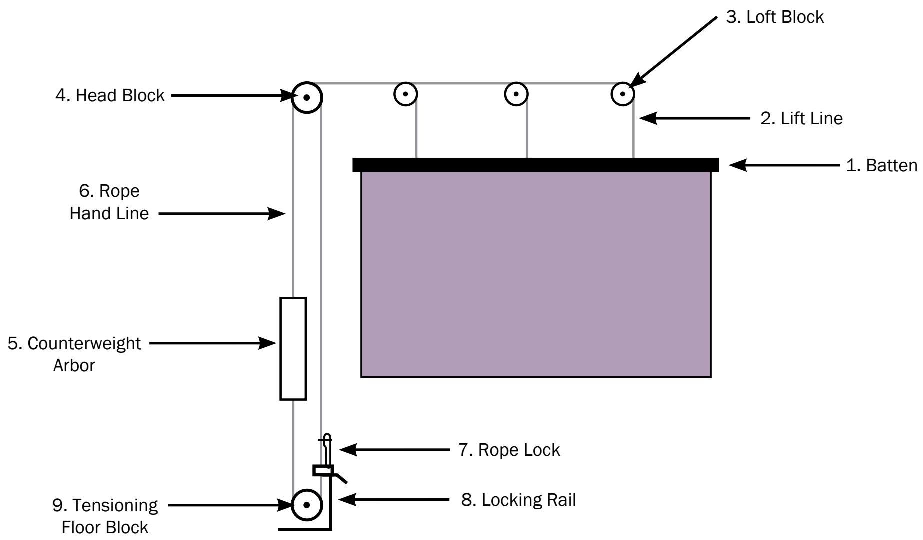
MANUALLY OPERATED COUNTERWEIGHT RIGGING (CONT.)

OPERATION

Proper operation requires that the load is correctly balanced with steel weights every time it changes. Properly trained, an operator can alter speeds — from the subtle to the dramatic — to meet performance needs and can take corrective action if she or he senses a change in the load. Experienced operators can produce effects that enhance and even define the performance.

A counterweight set consists of a balanced system of weights and pulleys designed to raise and lower scenery, curtains, and lighting equipment. 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 operator 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.

Figure JR 3 – Manual Counterweight Set



MANUALLY OPERATED COUNTERWEIGHT RIGGING (CONT.)

PROPER BALANCE

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 SET

In a single purchase set, the weight and travel distance of the loaded batten equals the weight and travel distance of the properly loaded arbor. (See figure JR 4)

- Simple to install and operate.
- Very efficient.

DOUBLE PURCHASE 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. (See figure JR 5)

- 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.

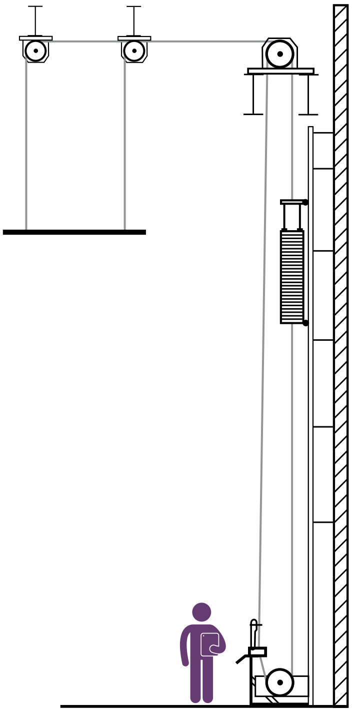


Figure JR 4 – Single Purchase Set

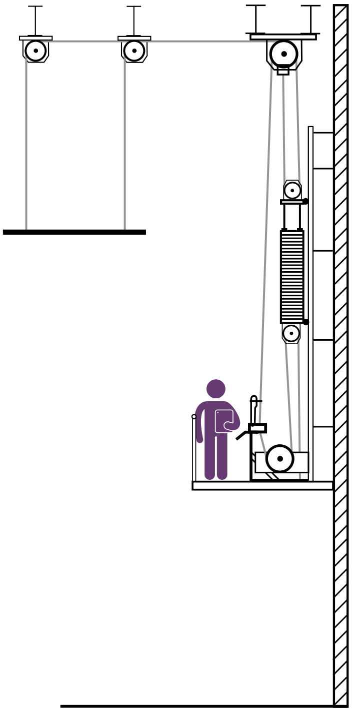


Figure JR 5 – Double Purchase Set

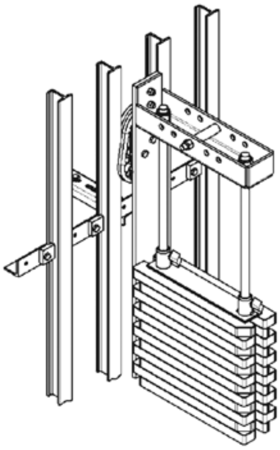
MANUALLY OPERATED COUNTERWEIGHT RIGGING (CONT.)

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 not.
- Aluminum J-guides are recommended as they have fewer parts than the older T-Bar system and are easier to align and install, equally strong, and quieter.
- Areas subject to seismic events should upgrade to seismic arbors and guide systems which have been specifically engineered for the additional loads.

Figure JR 6 – J-Guide



COUNTERWEIGHT WITH POWERASSIST® RIGGING

Counterweight sets can be retrofitted with PowerAssist® units. The PowerAssist system utilizes 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 - 900 kg) without the need to adjust or handle counterweights.
- Allows computer control of the sets.
- Speeds setups and load outs.
- Does not eliminate need for a counterweight guide system with counterweighted arbors.
- Can be noisier than manual counterweight sets or fully motorized sets.
- Limited speed capabilities.
- Requires operator training.

FULLY MOTORIZED RIGGING

In this system the motor 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:

- Very quiet.
- Typically reduces the structural steel needed.
- Reduces operational costs for setups/shows/load outs.
- System can be locked to prevent unauthorized use.
- Can be operated with control systems ranging from simple push button panels to controllers with the ability to record and play back cues.

HOIST TYPES

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.

FIXED SPEED HOIST

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 (feet per minute) (.9 mpm (meters per minute)).
- 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 lighting fixtures.

VARIABLE SPEED HOIST

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 theaters with a proscenium height of 40' (12192 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.
- Preferred hoists have a solid state vector drive rated for hoisting duty and a dual braking system with the quiet actuation necessary for a theatrical environment.

ZEROFLEET HOIST

In the Zerofleet design, the drum travels horizontally as fast as the cable unwinds which helps keep the cable on the same 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 costs.

Figure JR 7 - Zerofleet Underhung Offstage

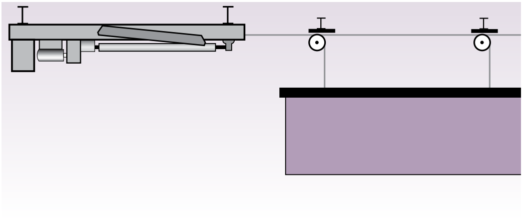


Figure JR 8 - Zerofleet Upright on Grid

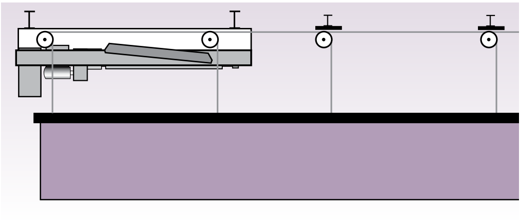
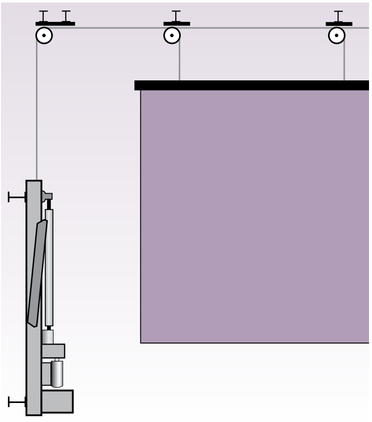


Figure JR 9 – Zerofleet Vertical Onstage



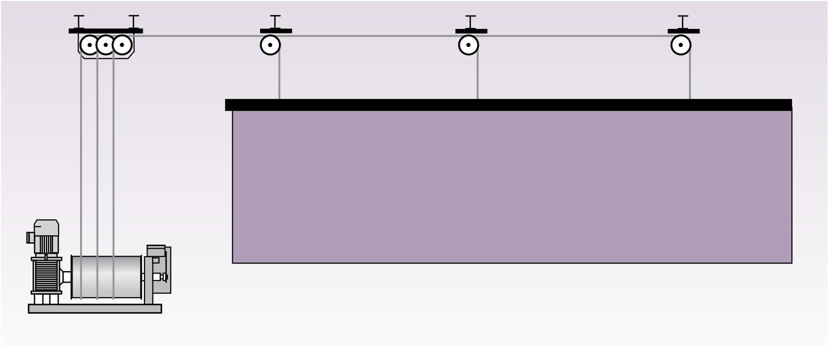
HOIST TYPES (CONT.)

DRUM HOIST

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.

- 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 shown below (Figure JR 10) typically requires at least 10' (3048 mm) between the drum and head blocks.

Figure JR 10 - Drum Hoist

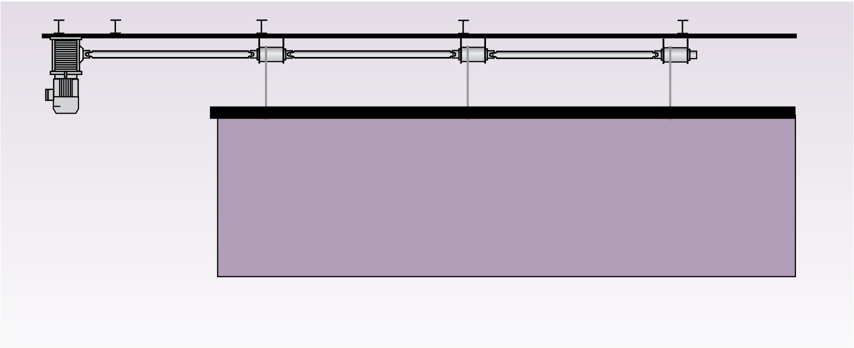


POWERLINE HOIST

PowerLine 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.

Figure JR 11 - Powerline Hoist



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 (45,000 kg).

CONTROL SYSTEMS

Rigging control systems vary widely in their scope of performance. The simplest are manually operated pushbutton models that allow positioning by eye. The most advanced permit programming of elaborate cues with multiple hoists moving at once.

As an example of control system choices, SceneControl offers different models for different needs. All models use the same software to make it easy for operators to move from one theater to another.

- Options for adjusting graphics and cueing.
- Options for establishing definable alarms and safeties to alert for potential collisions.
- Security options include "hold-to-operate" buttons that require the operator to be at the console during movement.
- All controllers are password protected to restrict usage and access.
- Computerized console models provide accurate, repeatable positioning, and sophisticated programming functions.
- Can be a fully compliant part of a SIL3 system.
- Integrated emergency stop system.

FIRE SAFETY CURTAIN SYSTEMS

Fire safety curtains provide a barrier between the stage and auditorium in the event of a fire and can also be an effective method for keeping unauthorized personnel from the backstage area. U.S. Codes typically require fire safety curtains to have a 20 to 30 minute fire rating to allow the audience to exit the theatre safely. The curtain fabric should be listed by the California State Fire Marshal for use as a Proscenium Fire Protection Curtain per code.

- Smoke 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 six fusible links and two manual release stations; more advanced systems include smoke detectors and rate-of-rise detectors in the upstage side of the proscenium and overstage areas for faster response.
- Some release systems require resetting each time the curtain is closed, while others permit the curtain to be operated in a non-emergency situations without affecting emergency operation.
- Fire Safety Curtains close by gravity and are not dependent on electrical power.

FIRE SAFETY CURTAIN SYSTEMS (CONT.)

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 counterbalanced to close in a controlled manner.

- Weight chains, dashpots, and hydraulic speed governors can be added 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 the sides 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' (3048 mm).

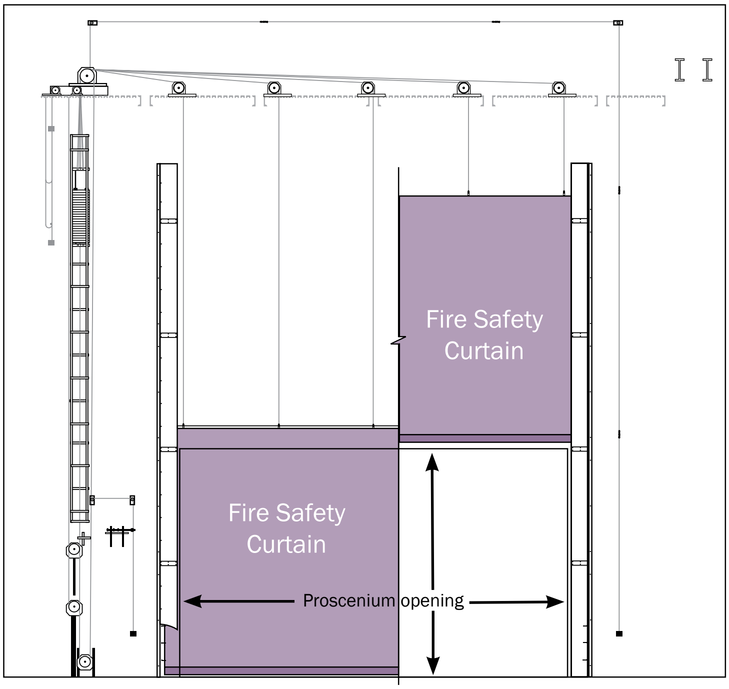


Figure JR 12 - Straight Lift Fire Safety Curtain

Split illustration shows curtain in deployed and undeployed positions.

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.
- The distance between lift lines must not exceed 8' (2438 mm).

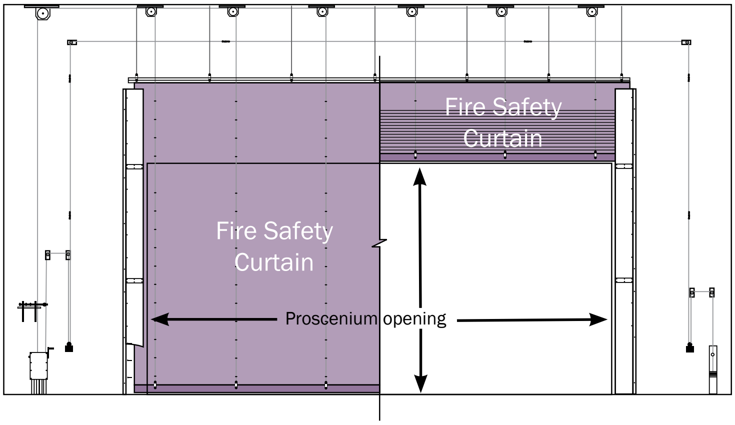


Figure JR 13 - Brail Type Fire Safety Curtain

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. Figures JR14 and JR15 show preferred examples. 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.

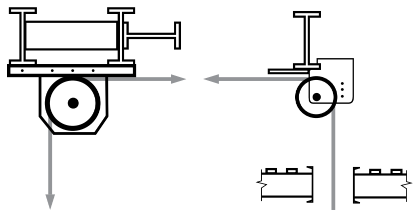


Figure JR 14 - Underhung Head Block (Series 59) and Underhung Loft Block

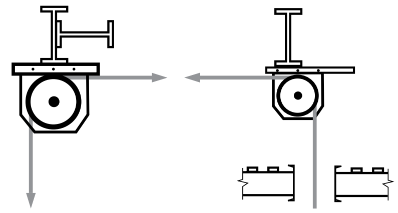


Figure JR 15 - Underhung Head Block (Series 59) and Universal Loft Block

BLOCK – UPRIGHT

Upright rigging components are mounted on top of structural supports that are usually steel, but may also be concrete or other materials. Figure JR16 shows grid-mounted loft blocks. When the lift lines are located on the grid, walking is difficult.

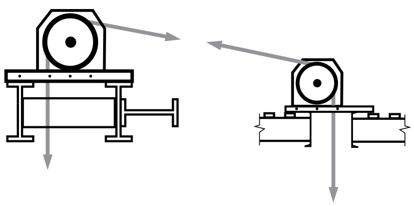


Figure JR 16 - Upright Head Block (Series 55) and Universal Loft Block

COUNTERWEIGHT LOADING GALLERY AND LOADING BRIDGE

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 that the system is always in balance. After a load is added to the batten — at floor level — weights are added to counterbalance the load.

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. 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 that can help in this situation, working with out-of-balance sets can be extremely dangerous and should not be permitted. 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. Note that people working on a loading bridge may use fall protection equipment.

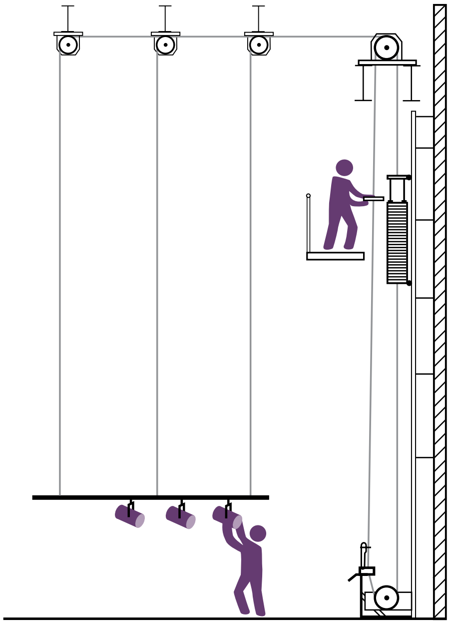


Figure JR 17 - Counterweight Loading

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 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, as well as the life of the equipment.

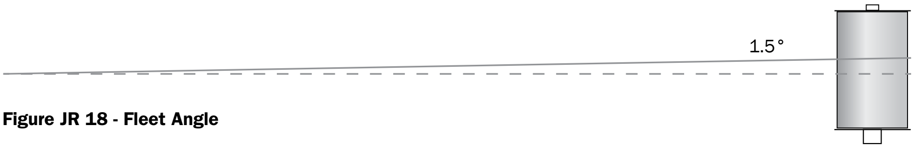


Figure JR 18 - Fleet Angle

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 galleries, 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.

APPENDIX (CONT.)

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. Assemblies contain 3 or 6 nylon sheaves, each of them 3½" (89 mm) in diameter. The idler pulley assembly is mounted to the side of the block housing. 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, ensuring that fleet angle and other alignment stresses are not transferred to the idler pulleys.

SHEAVE MATERIALS

Head block and line sheaves are available in cast iron or nylon. The load capacity of the head blocks are the same with either material. The majority of new installations use nylon sheaves, due to their lighter weight 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. One, two, four, and eight line sheaves are available.

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 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 considerable 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" (51 - 76 mm) 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. Figures JR19 and JR20 show commonly used rigging steel configurations.

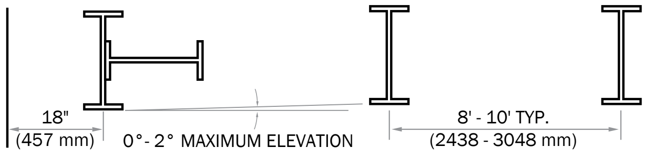


Figure JR 19 - Recommended Underhung Steel Detail

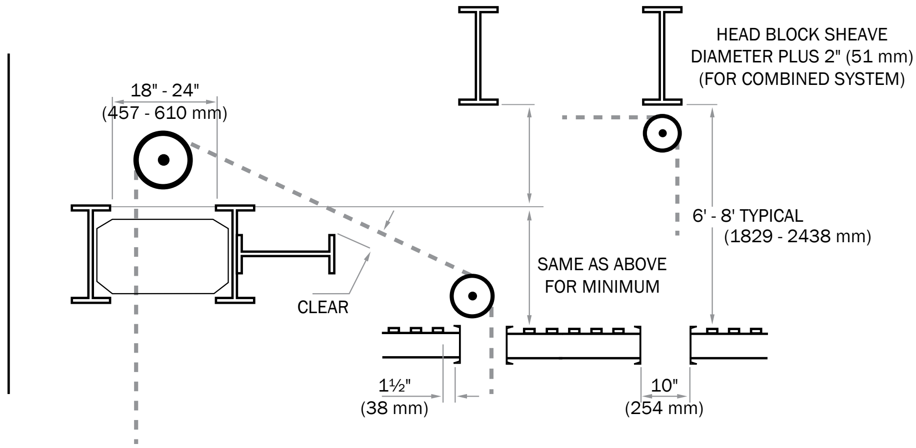


Figure JR 20 - Upright and Combination Mounting Steel

SYSTEM LOADS

Rigging systems impose both vertical and horizontal loads on the supporting structures, as illustrated by Figures JR21 and JR22. Note that lift lines should be typically spaced at intervals of not more than 10' (3048 mm) along the length of the batten. Greater spacing reduces the load carrying capacity of the batten or reinforced battens, such as two pipe trusses. On average, scenery batten live loads are a maximum of 25 lb (11 kg) per foot and electric batten loads as much as 25-40 lb per foot (11 - 18 kg per 305 mm). Rigging 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 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 pickup lines in each set

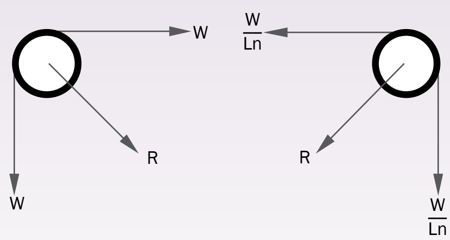


Figure JR 21 - Single Purchase Loading Condition

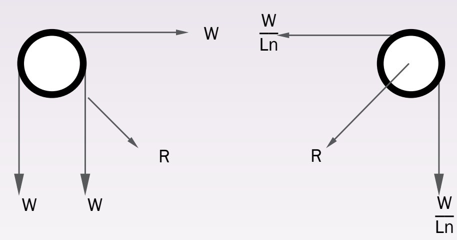
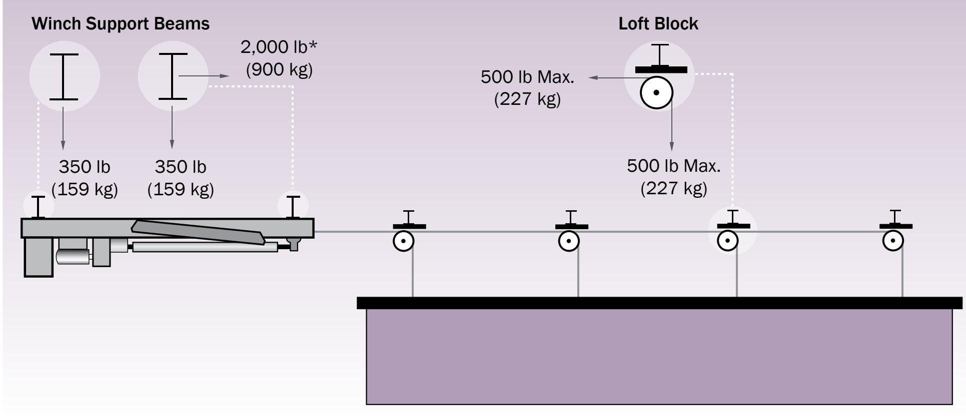


Figure JR 22 - Double Purchase Loading Condition

The horizontal load shown in Figure JR23 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 PowerLift winch will not exceed the winch capacity. Loads in theatres may be unevenly distributed with a maximum load of 400 lb (181 kg) on any individual loft block.

Figure JR 23 - Horizontal Loads



Winch Support Beams
*Based on 2,000 lb (907 kg) capacity winch. This horizontal load may be shared with the offstage beam. Worst case is shown. Bottoms of these two beams must be at same elevation.

Loft Block (Typical of 7)
The combined load of the loft blocks associated with a single PowerLift winch 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.

RECOMMENDED MOUNTING DIMENSIONS

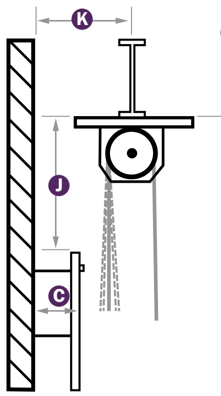


Figure JR 24 - Underhung Head Block: Single Beam

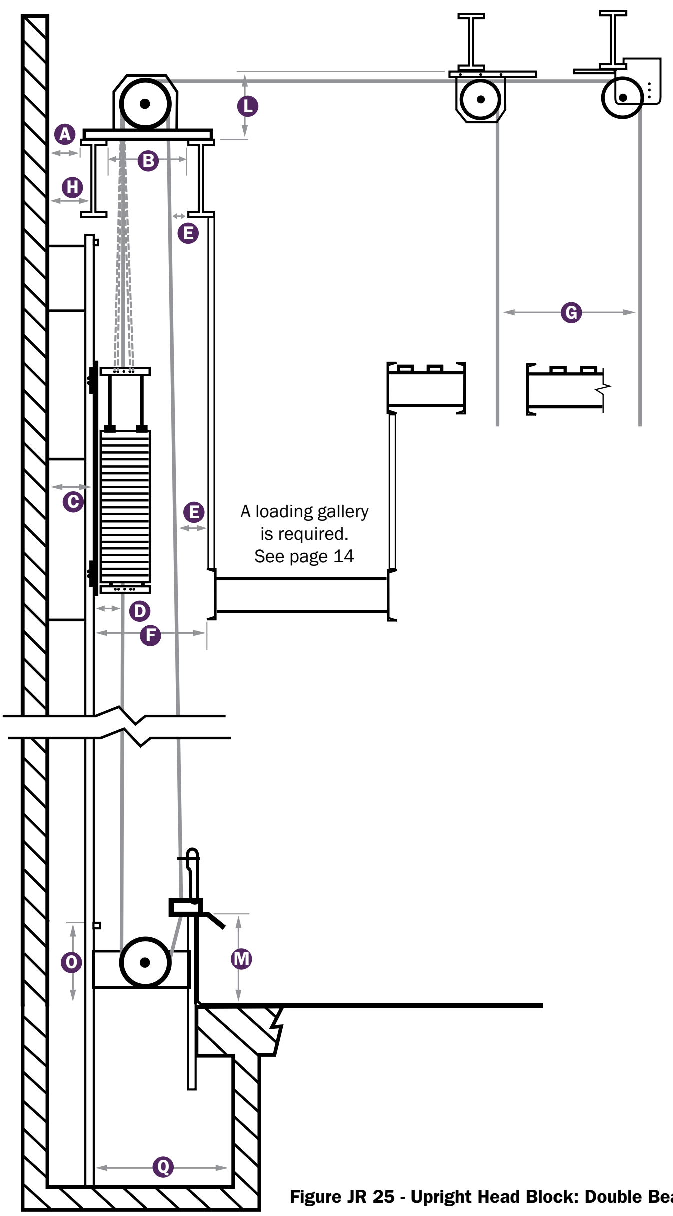


Figure JR 25 - Upright Head Block: Double Beam

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	7 7⁄8" (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 1⁄2" (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)

RECOMMENDED MOUNTING DIMENSIONS

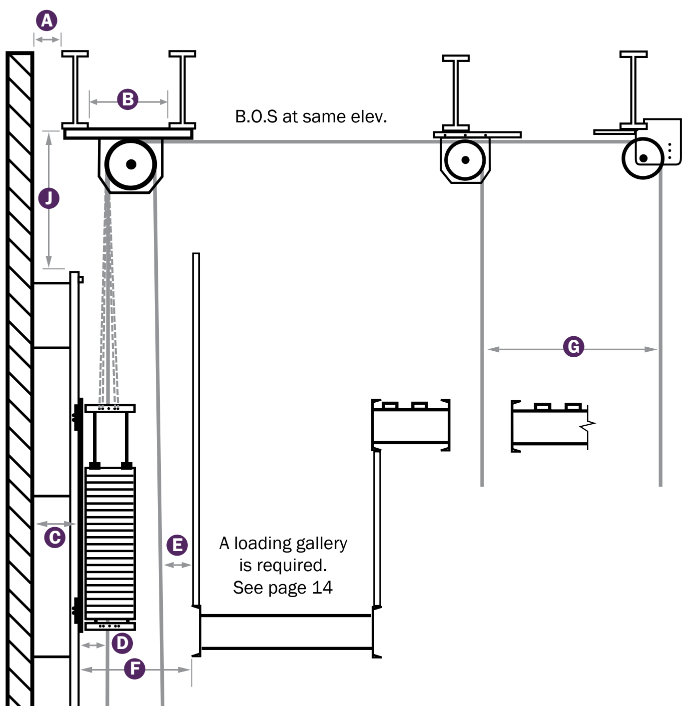


Figure JR 26 - Underhung Head Block: Double Beam

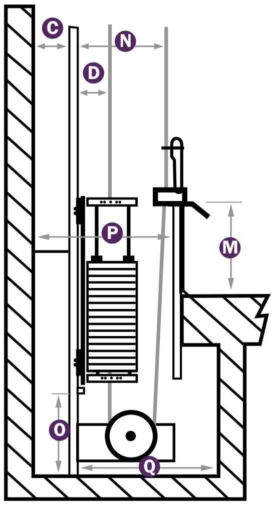


Figure JR 27 - Arbor Pit Mounted Lock Rail

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	7 ⅞" (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)

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