



# Manual Counterweight Rigging Systems

## Operation and Maintenance Manual



P.O. Box 9327  
South El Monte, CA 91733  
626-575-0776 | 800-221-9995  
[www.hhspecialties.com](http://www.hhspecialties.com)

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## NOTICE

H & H Specialties Inc. manufactures products for lifting stage curtains, scenery, lighting and other equipment typical of performing arts facilities. Our products are not intended to lift or transport people or any other living entity such as animals.

The information contained herein is general in nature and not venue specific. All theaters have unique operational characteristics due to the differing designs of backstage areas. This manual is intended to provide a guide to safe operational practices and maintenance of the counterweight rigging equipment manufactured by H & H Specialties Inc. It is the facility director's duty to implement a training program to ensure that the crew can operate the facility's stage rigging system in a safe and efficient manner.

H & H Specialties Inc. shall not be held responsible for any damage that is caused by failure to follow the information contained within this manual.

## WARNING

Failure to follow the instructions contained in this instruction and operation manual may result in property damage, serious injury or death.

# INTRODUCTION

Counterweight rigging equipment is a background tool in the theatre. A counterweight rigging system operates so that it is not normally seen by the audience; however, the elements supported by the rigging are integral to the function of the performance. If the rigging performs its function, the operators do not think about it. If the rigging does not perform its function properly, the results can be catastrophic.

Operators of any counterweight rigging system shall be given appropriate training prior to operating any rigging system and shall always be supervised by qualified personnel. If you are operating a rigging system you shall:

- ◆ Understand the various rigging systems that you are using.
- ◆ Learn the location of all components and system capacities.
- ◆ Understand how to use each of the rigging systems installed in your theatre.
- ◆ Make sure that you have been properly trained on the specific equipment you are expected to operate.
- ◆ Be aware of the current condition of the rigging system and immediately report anything that may affect safety or proper operation of the system to your supervisor.
- ◆ Always keep the rigging equipment in safe working order. Learn good work habits.
- ◆ Don't let distractions keep you from your job. Maintain your concentration during operation of the system.

A counterweight rigging system is a machine. It is a system of parts that together perform a task. Like any other machine, a counterweight rigging system requires regular inspection and maintenance. General inspection and maintenance intervals are detailed in the appendix of this document. H & H Specialties also recommends that periodic inspections be performed by qualified outside rigging contractors to assess your rigging system and identify and recommend correction of any hazards noted.

## DEFINITIONS

**Authorized Person:** A person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the job site.

**Batten:** A pipe, tube, or other structural shape that is used to support scenery, curtains, lighting, and other scenic elements in the theatre.

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

**Counterweight:** A weight used to balance the load on a line that is being raised, lowered, or held in position.

**Counterweight Arbor:** A weight carriage designed so that the amount of counterbalance can be varied proportional to the load imposed on the pipe batten. The purchase line ties off to the top and bottom of the arbor.

**Counterweight Carriage:** See Counterweight arbor.

**Double Purchase Counterweight System:** One foot of arbor travel equals two feet of batten travel. Balancing the batten load requires two pounds of counterweight on the arbor to counterbalance one pound of weight on the pipe batten.

**Fleet Angle:** The angle between the centerline through a sheave and the centerline of the wire rope leading to a second sheave.

**Grid:** A grid is an open framework of steel located under the roof for the support of stage rigging equipment. The grid provides a position to access the rigging for inspection and maintenance. It is also an area for the placement of specialty rigging sets or spotline rigging required for specific theatrical productions.

**Head Block:** A multi-groove sheave assembly whose purpose is to gather all of the lift lines from the loft blocks and reeve them toward the counterweight arbor.

**Lift Lines:** 3/16", 1/4" or 3/8", 7x19 galvanized specialty cord used to support the batten at intervals approximately ten feet on center. This spacing varies by venue dependent on the structural system of the building.

**Loft Block:** A single groove sheave assembly used in groups for the support of a pipe batten. Loft blocks are placed between the batten and head block.

**Pipe Weight:** The weights left on the arbor or carriage to balance the batten. Often the ends of these weights are painted yellow.

**Purchase (Operating) Line:** Typically a 3/4" diameter manila or synthetic rope that is reeved in an endless loop and tied off at the top and bottom of the counterweight arbor.

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

**Rope Lock:** A device used to position a balanced counterweight set at the required location in the fly loft. These devices are designed to hold an out-of-balance load of up to 50 pounds.

**Run-Away:** A line set that becomes so far out of balance with load in the air and either the batten or the counterweight arbor become so heavy that the rope lock or snubbing system cannot hold it in position and the load and/or arbor moves uncontrollably.

**Shall:** Indicates a mandatory requirement.

**Should:** Indicates a recommendation or that which is advised, but not required.

**Single Purchase Counterweight System:** One foot of arbor travel equals one foot of batten travel. Balancing the batten load requires one pound of counterweight on the arbor to counterbalance one pound of weight on the pipe batten.

**Spot Block:** Special placement of a loft block on the gridiron for an additional, single or special running line.

**Spreader Plates:** Plates that are installed between counterweight arbor rods to inhibit the rods from spreading during rapid travel or impact in order to prevent the counterweights from falling out of the arbor.

**Tension Block:** A single groove assembly mounted under the counterweight arbor used to reeve the purchase line from the arbor bottom toward the head block.

**Trailer:** An arbor attached below the rigging system's existing arbor to allow for the use (installation) of more weight (additional counterweights).

**Upright (Grid Mounted) Rigging System:** Upright counterweight rigging systems have a steel grid for the attachment of loft blocks and a separate raised head block beam assembly. From the position of the head block the lift lines array downward toward the loft blocks. On a fully rigged stage, accessibility across the grid becomes limited.

**Underhung (Roof Mounted) Rigging System:** Underhung counterweight rigging systems have the same structural members that support the roof also support the loft and head blocks. From the position of the head block the lift lines travel horizontally toward the loft blocks. For functionality, these systems should also have a grid for the attachment of spotline rigging and inspection and maintenance of the rigging system.

**Wire Rope Clip:** A device used for forming eye terminations on wire rope.

**Working Load Limit:** The maximum recommended capacity of a system or component during normal operating conditions.

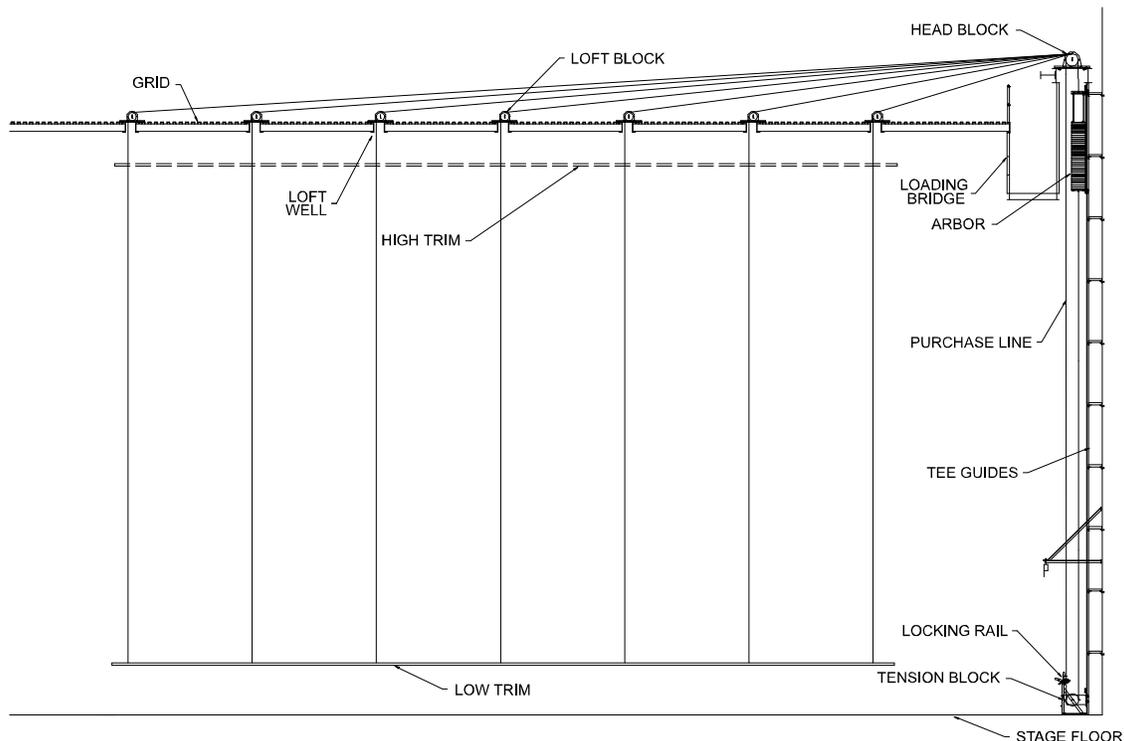
# DESCRIPTION OF COUNTERWEIGHT RIGGING SYSTEM

A theatrical counterweight system provides a simple mechanical method of raising and lowering various balanced loads by a system of pulleys and weight carriages. As the scenery and equipment loads are varied, the amount of counterbalance is adjusted on the weight carriage so that the system can be raised and lowered with a minimum amount of effort. If the load on the batten is greater than the load on the counterweight arbor, this condition is known as "batten heavy." If the load on the batten is less than the load on the counterweight arbor, this condition is known as "arbor heavy." A counterweight system is meant to be operated in a near balanced condition. When a near balanced condition occurs, the effort required to fly a set in or out equals the amount of system friction plus the inertia to move the load.

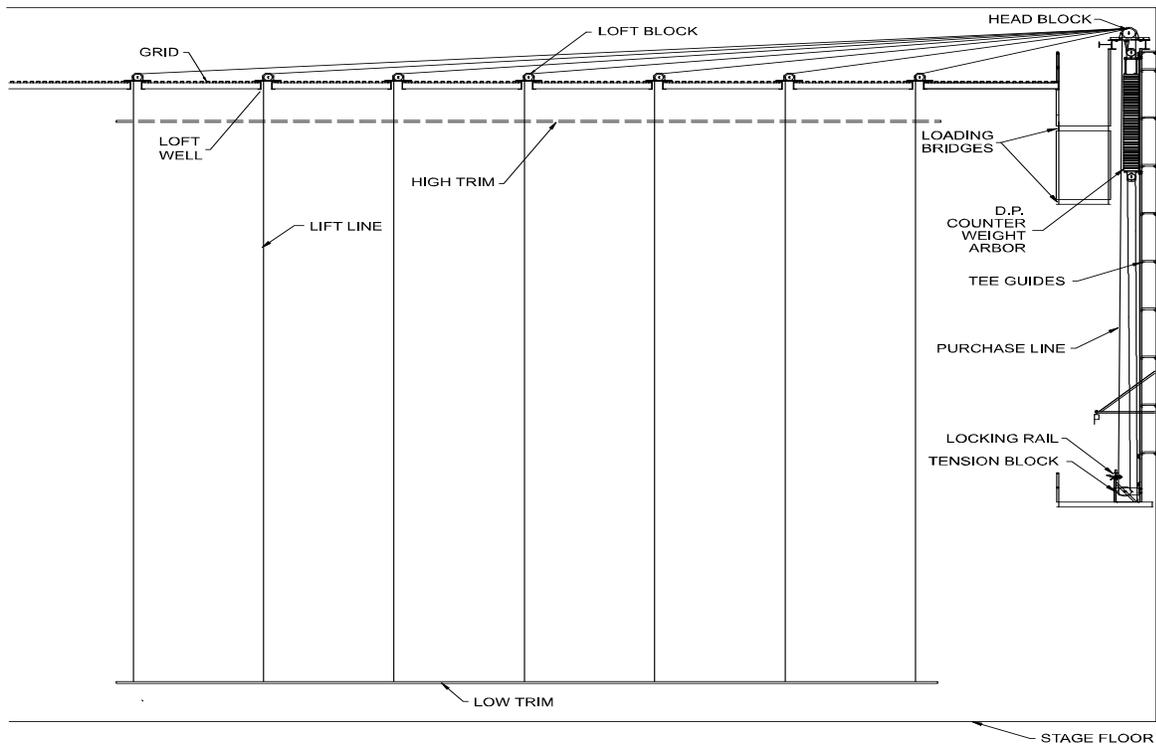
The only time that a counterweight rigging system is in balance is when the batten and counterweight arbor are at the same elevation (midpoint of batten travel). At other points of travel, the lifting cables add weight to either the arbor or batten sides of the system. In theatres with very tall grids, the differential between high and low trim can be substantial. In such cases, cable compensation systems may be installed to equalize the lift cable differential between high and low trims of the batten. Double purchase counterweight systems do not normally have compensating systems because the relatively short counterweight arbor travel distance.

In a double purchase rigging system the lift and purchase line are compound rigged. One foot of arbor travel results in two feet of batten travel. A double purchase rigging system requires two pounds of counterweight on the arbor for every pound of load on the batten.

Rigging systems are composed of basic components. The major components include the following items as indicated on the drawings below:



**TYPICAL SINGLE PURCHASE RIGGING SYSTEM  
UPRIGHT BLOCKS  
ARBORS ARE STEEL "T" BAR or ALUMINUM "J" BAR GUIDED**



**TYPICAL DOUBLE PURCHASE RIGGING SYSTEM  
 UPRIGHT BLOCKS  
 ARBORS ARE STEEL "T" BAR or ALUMINUM "J" BAR GUIDED**

Other possible rigging system configurations can be found in Appendix D

## OPERATING INSTRUCTIONS

Counterweight rigging equipment shall be operated only by trained, qualified and authorized persons.

The rigging system shall be kept in balance during normal operations. The operators shall be trained in the methods for keeping the system in balance.

Operating personnel shall be familiar with the system installed and the operation and suggested maintenance intervals of the system. To prevent potential damage to equipment and/or injury to personnel, the instructions below shall be understood and followed. If any doubt exists as to the correct operation or maintenance of this equipment, questions should be directed to the stage equipment contractor who installed the system or to a qualified stage rigging contractor.

Training, experience and common sense are integral parts of operating a theatrical rigging system. The rigging crew shall be trained in the safe operation and maintenance of theatrical rigging systems prior to operating the rigging system.


When removing equipment from a batten, <b>NEVER</b> remove the load from a batten before removing the counterweights from the counterweight arbor.
When loading a batten, <b>NEVER</b> add counterweights to the counterweight arbor before attaching the load to the batten


Rigging systems and equipment shall be operated only by trained, qualified and authorized personnel
The rigging system shall be kept in balance during normal operations and the operators trained in the methods for keeping the system in balance
A double purchase rigging systems requires the balancing weight on the counterweight arbor be double the weight of the load on the batten
Failure to follow the instructions contained in this manual may result in property damage, serious injury or death

## GENERAL SAFETY RULES

- ◆ Equipment shall be operated only by trained, qualified and authorized personnel.
- ◆ All tools carried by personnel in the overhead area shall be tethered at all times.
- ◆ The system shall be kept in balance during normal operations. The operators shall be trained to understand the methods for balancing the system and keeping the system in balance.

### NOTICE

Double purchase rigging systems require the balancing weight in the counterweight arbor to be double the weight of the load on the batten.

- ◆ Never assume a set is balanced. Check for signs of imbalance:
  - Arbor creeping with rope lock secured.
  - Strain or slack condition in the purchase line.
    - Slack in the purchase line above the rope lock indicates that the system is batten heavy.
    - Slack in the purchase line under the arbor bottom indicates that the system is arbor heavy.
- ◆ Never operate a counterweight set when stage personnel are under or near a batten to be flown.
- ◆ Wear appropriate hand protection when adding or removing counterweights.
- ◆ Store counterweights in a safe location. Personnel shall make sure that the counterweights are stored neatly and do not impose a trip hazard.

### ! WARNING

**Falling counterweights may cause serious injury.**

- ◆ Most stage rigging accidents are caused as a result of human error. Keep a clear mind and think before acting. Overconfidence and complacency can cause accidents.
- ◆ The use of "trailers", sandbags and the substitution of the steel counterweights with counterweights of any other material are not permitted.

### ! WARNING

**The use of sandbags, "trailers" and the substitution of the steel counterweights with counterweights of any other heavier material may overload the system and cause a failure of the system.**

### NOTICE

When operating rigging systems using wires to guide the counterweight arbor, care must be taken to avoid moving the arbor at speeds that cause the arbor or carriage to swing. Swinging of the counterweight arbor may cause the arbor to strike part of the building structure, other counterweight arbors or kink, deform or cause other damage to the guide wires.

### NOTICE

Unused spreader plates shall be stored at the top of the counterweight stack at all times.

## OPERATION OF A THEATRICAL RIGGING SYSTEM

- ◆ Know your system. Become familiar with the look, feel, sound and smell of the system and its components. Use all of your senses. Become aware of your equipment and the surroundings.
- ◆ Know the capacity of the system. Become familiar with the capabilities and limitations of all components and the system in general.
- ◆ Use common sense during the operation of the system. A noisy or hard pulling set may indicate a problem. If something doesn't look or feel right, it probably isn't.
- ◆ If the flyman cannot maintain visual contact through the entire travel distance, a designated spotter shall be assigned to maintain visual contact with any moving piece of scenery or batten. The spotter shall immediately communicate any problems to the flyman operating the line set being moved. The spotter is required to have complete control of the situation and shall maintain that control at all times.
- ◆ Follow appropriate and safe practices when operating any of the rigging systems installed in the theatre. Don't become overconfident.
- ◆ Load and unload counterweight in a safe manner. Keep all counterweight arbors in a balanced condition at all times.
- ◆ Unused spreader plates shall be stored at the top of the counterweight stack at all times.
- ◆ Clear the deck of all unnecessary items prior to moving a rigging set.
- ◆ During load-in and load-out, warn all persons in the stage house prior to moving a batten or other rigging item.
- ◆ Perform regularly scheduled inspection and maintenance procedures on the system. A rigging system is a machine and shall be treated as such.
- ◆ Before operating the fly system or any line set, make sure the arbor, pipe batten and load are in balance.
- ◆ Make absolutely sure that no personnel are under or near the pipe batten that will be flown.
- ◆ Flyman shall announce the movement of batten by saying in a loud voice, "Set No .xxx coming in." Stage personnel in the area during set-up shall acknowledge that they heard the flyman by saying "*thank you, clear*", or some other appropriate response to indicate that the batten may be flown.
- ◆ Before releasing rope lock, check for signs of an imbalance in the system. If the set appears balanced, release rope lock and begin moving batten slowly while making sure that personnel are out of the way. If the set is in an unbalanced condition, take corrective action immediately.
- ◆ Listen for unusual noise caused by rubbing cables or other moving parts. If unusual noises are heard, immediately engage rope lock with handle and secure with ring. Investigate source of noise. Correct the problem immediately.
- ◆ If system binds, engage rope lock with handle and secure with ring. Investigate the source of the binding. Immediately correct the problem.
- ◆ Once a batten is flown in, engage rope lock with handle and secure with ring.
- ◆ To fly a batten in, pull down on the onstage purchase line.
- ◆ To fly a batten out, pull down on offstage purchase line.

- ◆ During show rehearsals and productions, check your cue sheet to verify which set is to be operated and when. Timing is everything during a production.
- ◆ During a performance, the flyman cannot speak out loud. During a performance, the flyman shall be especially careful when operating equipment to ensure all personnel are at a safe distance.



**When removing equipment from a batten, NEVER remove the load from a batten before removing the counterweights from the arbor.**

**When loading a batten, NEVER add counterweights to the arbor before attaching the load to the batten.**

## BALANCING A LINE SET

- ◆ A counterweight system enables the theatre technician to raise and lower theatrical lighting and scenic elements with minimum effort. When the arbor is in balance, a minimal amount of force exerted on the purchase line will fly the batten in or out.
- ◆ The system shall be kept in balance during normal operations. The operators shall be trained in the methods for keeping the system in balance.
- ◆ The load on a pipe batten and arbor shall be balanced. Strain or slack on the purchase line indicates an imbalance. Immediate adjustments shall be made.
- ◆ Make sure that the rope lock is secured and the ring is in place so that the handle will not accidentally unlock.
- ◆ Tie a safety line from the arbor bottom to the locking rail or a suitable anchorage on the building structure.

### NOTICE

Double purchase rigging systems require the balancing weight in the counterweight arbor or carriage be double the weight of the load on the batten.

- ◆ Estimate load to be added to or taken from pipe batten.
- ◆ Loosen tri-knob screw on arbor locking collars to raise collar on 3/4" arbor rod.
- ◆ Raise spreader plates to allow addition or removal of counterweight(s). One spreader plate shall be placed every two feet while stacking counterweights on a counterweight arbor.
- ◆ Add or remove counterweights as necessary to balance the load keeping unused spreader plates on the top of the counterweight stack. Never add or remove more than 150 pounds on pipe batten at any one time without adding or removing a corresponding amount to or from the counterweight arbor.
- ◆ Secure tri-knob screw on locking collars so that collars are snug against top spreader plate.
- ◆ Check to see if batten and arbor are balanced. Strain or slack in the control line indicates an imbalance. Adjustments shall be made prior to operation of system.

### WARNING

**Failure to balance a line set properly creates a hazardous condition.**

### NOTICE

Unused spreader plates shall be stored at the top of the counterweight stack at all times.

## LOADING AND UNLOADING OF COUNTERWEIGHTS WITHOUT LOADING BRIDGE(S)


This theatre has no counterweight loading bridge(s). Loading counterweights without a loading bridge is hazardous. Only personnel trained in the proper procedures for loading counterweight arbors without a loading bridge shall be permitted to load or unload counterweight arbors in this facility
When removing equipment from a batten, <b>NEVER</b> remove the load from a batten before removing the counterweights from the counterweight arbor
When loading a batten, <b>NEVER</b> add counterweights to the counterweight arbor before attaching the load to the batten

The loading of counterweight arbors without loading bridge(s) requires the use of a capstan winch, block and fall or similar device to support the load and manage out of balance conditions.

The capstan winch, block and fall or other device shall be rated for the maximum anticipated load.

The winch, block and fall or other device is attached to the bottom of the arbor or counterweight carriage using the attachment point provided on the arbor.



**Always follow the manufacturer's directions for the installation and operation of the winch, block and fall or other device used pursuant to these instructions for the loading and unloading of counterweight arbors without a loading bridge.**

### **To load the line set:**

1. The counterweight arbor is brought to its lowest position.
2. The winch, block and fall or other device is attached to the counterweight arbor and the batten is brought to low trim.
3. The load is placed on the batten.
4. The winch, block and fall or other device is used to bring the counterweight arbor to a position where the required weight can be added to the counterweight arbor.
5. The winch, block and fall or other device is disconnected from the counterweight arbor.

### **To unload the line set:**

1. The counterweight arbor is brought to its lowest position.
2. The winch, block and fall or other device is attached to the counterweight arbor.

3. The counterweight is unloaded from the counterweight arbor. The winch, block and fall or other device is used to support the load.
4. The winch, block and fall or other device is used to control the out of balance condition while the batten is brought to low trim.
5. Remove the load from the batten.
6. The counterweight arbor is brought to a location where the winch, block and fall or other device can be disconnected from the counterweight arbor.

## RUN-AWAY LINE SET



Failure to follow the emergency procedure below may result in serious injury or death.

### EMERGENCY PROCEDURE FOR RUN-AWAY LINE SETS

- ◆ Do Not Attempt To Stop The Run-Away Line set.
- ◆ Shout A Warning To All Persons On The Stage.
- ◆ Exit stage or take cover. The possibility of flying counterweights and objects falling from the grid is great.



Falling counterweights may cause serious injury.

# MAINTENANCE AND INSPECTION OF RIGGING SYSTEMS

## General

All counterweight rigging systems require periodic inspection and maintenance to keep them in good working order and to maximize their life expectancy. The information contained herein is suggested for normal operating conditions. It is the duty of the facility manager to schedule the inspection and maintenance at regular intervals depending on how the equipment is used and the environment of the venue in which the equipment is installed.

## Inspection

High humidity, dust, extreme temperature changes, and frequency of use will affect the operation and life of a counterweight rigging system. Inspection should include, but is not limited to, the following:

### Pipe Battens

- ◆ Bent battens
- ◆ Battens are level
- ◆ Batten splice connections are correct. Fasteners, if used, are not deformed, missing, loose, or have components missing

### Wire Rope

- ◆ Broken strands in wire rope
- ◆ Corrosion on wire rope
- ◆ Kinked or deformed wire rope
- ◆ Wire rope rubbing against equipment or building structure
- ◆ Fleet angle exceeding 1.5 degrees

### Wire Rope Terminations

- ◆ Wire rope clips, if used, are drop forged and manufacturer is identifiable
- ◆ Wire rope clips are installed per manufacturer's printed instructions.
- ◆ Wire rope thimbles provided
- ◆ Manufacturer of turnbuckle or shackle is identifiable on product
- ◆ Turnbuckle or shackle is deformed or bent
- ◆ Turnbuckles are moused with wire to prevent unloosening
- ◆ Manufacturer of batten clamp is identifiable on product with load rating
- ◆ Welded chain used with grade mark identifiable
- ◆ Swaged fittings are correctly made on wire rope

### Loft Blocks

- ◆ Clips are bent or do not have sufficient engagement on structure
- ◆ Fasteners are deformed, missing, loose, or have components missing
- ◆ Housing is deformed or damaged
- ◆ Sheave rubs against side plates
- ◆ Sheave groove(s) is corrugated due to excessive loads
- ◆ Grooving for wire rope and purchase lines is not correct
- ◆ Bearings make noise during operation

### Head Blocks

- ◆ Clips are bent or do not have sufficient engagement on structure
- ◆ Fasteners are deformed, missing, loose, or have components missing

- ◆ Housing is deformed or damaged
- ◆ Sheave rubs against side plates
- ◆ Sheave grooves are corrugated due to excessive loads
- ◆ Grooving for wire rope and purchase lines is not correct
- ◆ Bearings make noise during operation

### **Mule Blocks**

- ◆ Clips are bent or do not have sufficient engagement on structure
- ◆ Fasteners are deformed, missing, loose, or have components missing
- ◆ Housing is deformed or damaged
- ◆ Sheave rubs against side plates
- ◆ Sheave grooves are corrugated due to excessive loads
- ◆ Grooving for wire rope is not correct
- ◆ Bearings make noise during operation

### **Counterweight Arbors**

- ◆ Arbor top or bottom is made of cast components
- ◆ Arbor rods are straight and not deformed or bent
- ◆ Counterweights rest squarely on arbor bottom
- ◆ Onstage ends of pipe weight painted for identification
- ◆ Spreader plates are provided for spacing 2'-0" on center
- ◆ Locking collars are installed with set screws tightened to prevent movement
- ◆ Fasteners are deformed, missing, loose, or have components missing
- ◆ Guides shows move freely on tee or jay guides
- ◆ Backing plates are deformed or missing

### **Counterweights**

- ◆ Counterweights have sharp corners
- ◆ Counterweights are stored properly on stage and loading bridge

### **Tension Blocks**

- ◆ Fasteners are deformed, missing, loose, or have components missing
- ◆ Guides shows move freely on tee or jay guides
- ◆ Backing plates are deformed or missing
- ◆ Housing is deformed or damaged
- ◆ Sheave rubs against side plates
- ◆ Grooving for purchase lines is not correct
- ◆ Bearings make noise during operation

### **Rope Locks**

- ◆ Rope locks are adjusted correctly for 50 pound maximum imbalance
- ◆ Fasteners are deformed, missing, loose, or have components missing
- ◆ Jaws are worn
- ◆ Handle cam is worn
- ◆ Retaining ring missing or damaged

### **Purchase Lines**

- ◆ Excessive slack in manila purchase lines
- ◆ Manila purchase line shows signs of dry rot
- ◆ Synthetic or manila purchase lines show wear
- ◆ Purchase lines are kinked
- ◆ Knots are tied correctly and ends secured

### **Locking Rail**

- ◆ Fasteners are deformed, missing, loose, or have components missing
- ◆ Uprights are in good order
- ◆ Upright bolts from the stage floor are secure
- ◆ Index card holders are installed
- ◆ Index cards are provided and function/set numbers are identified

### **Guide System (Steel Tee or Aluminum Jay Bar)**

- ◆ Tee or jay guides are bent or deformed
- ◆ Tee or jay guides are not plumb
- ◆ Fasteners are deformed, missing, loose, or have components missing
- ◆ Tee or jay guides are clean
- ◆ Knee braces are bent
- ◆ Arbor stops are bent or deformed
- ◆ Wood on arbor stops is damaged or splintered

### **Arbor Wire Guides (In Absence of Tee or Jay Guides)**

- ◆ Guide wires are loose
- ◆ Guide wires are deformed or kinked
- ◆ Guide wires are installed plumb
- ◆ Wire rope clips are drop forged and manufacturer is identifiable
- ◆ Wire rope clips installed correctly
- ◆ Wire rope thimbles provided
- ◆ Manufacturer of turnbuckle or shackle is identifiable on product
- ◆ Turnbuckle or shackle is deformed or bent
- ◆ Turnbuckles are moused with wire to prevent unloosening
- ◆ Verify proper clearance to adjacent walls, other structure, and obstructions

## MAINTENANCE INSTRUCTIONS

Periodic, regularly scheduled maintenance inspections are necessary for any mechanical system. A theatrical rigging system is a machine like an automobile. It has components that must be regularly inspected, adjusted, maintained and replaced. In order to keep your system safe and in good working order, a regular inspection and maintenance program must be implemented.

The best way to maintain your theatrical rigging system is through regular use. Each mechanical device should be cycled a minimum of once each week. This will keep the grease properly distributed in the bearings and allow the inspector to regularly check for unusual noise or drag in the system. Plan a few minutes each week during a quiet period to operate each device. Listen for unusual noise. Determine the source if one appears. Do not allow any item to be operated or used if there is any question as to its safety or integrity. Accidents and injuries can result. Most accidents are the result of complacency, overconfidence and lack of training. Do not assume anything.

### **NOTICE**

Whenever your theatrical rigging system receives any type of shock or impact load, all components in that set *must* be inspected thoroughly before that set is put back into use. At an absolute minimum, a shock load is equal to twice the static value. This value can be much greater depending on the mass of the object and velocity at impact. The inspection shall be performed by a qualified person. Any component must be replaced if its integrity is in question.

Follow the schedules outlined below as a minimum maintenance program. Once the house crew has had an opportunity to work with the system during the first year, additional procedures may be added or adjusted as is necessary. If you are not sure about the proper maintenance procedures, questions should be directed to the stage equipment contractor, or the equipment manufacturer, H & H Specialties Inc., South El Monte, CA 1-800-221-9995.

# MANUAL COUNTERWEIGHT RIGGING SYSTEM

## MAINTENANCE SCHEDULE INTERVALS:

Item	weekly	monthly	6 months	12 months
Operate each set	X			
Level battens			X	
Inspect & tighten wire rope clips				X
Inspect cables for rubbing against objects/structure				X
Inspect & adjust fleet angles of cables				X
Inspect wire rope				X
Inspect fittings (turnbuckles, shackles, etc.)				X
Inspect & tighten all attachment bolts				X
Inspect electric batten feeder cable rigging				X
Inspect & remove slack in control lines <sup>1</sup>		X		
Inspect & adjust rope locks			X	
Inspect & adjust arbor guides (tees or jays)				X
Inspect arbor guide assemblies				X
Inspect tension block guide assemblies				X
Inspect all block assemblies for wear & noise				X
Inspect locking rail & attachments				X
Inspect index strip light & outrigger brackets				X
Verify proper storage of counterweight on bridge	X			
Inspect sets for out of balance condition	X			
Inspect tension of guide wires <sup>2</sup>				X
Inspect guide wires for kinking or deformation			X	
Inspect guide wires turnbuckle mousing			X	

1 - If synthetic ropes are used, inspect at 6 or 12 month intervals.

2 - Do not over tighten guide wires. Over tightening the guide wires may cause damage to or failure of the guide wires, terminating hardware and/or support structure.

The above maintenance schedule is suggested for normal operating conditions. Above average use or location in an environment of high humidity, dust, extreme temperature changes, etc. may require shorter intervals.

# **INSPECTION MEASURING, RECORDING, AND SAFETY EQUIPMENT**

A thorough rigging inspection requires the proper equipment for measuring, recording, and safety of the personnel involved. The following list is not intended to be complete. There may be certain applications where not all items listed will be used to conduct the inspection.

## **Measuring Equipment**

- ◆ Micrometer
- ◆ Tape Measures
  - 25 foot
  - 100 foot
- ◆ Groove Gauge
- ◆ Torque Wrench
- ◆ Adjustable Wrench
- ◆ Binoculars

## **Recording Equipment**

- ◆ Camera with Flash Attachment
- ◆ Tape Recorder
- ◆ Video Recorder
- ◆ Note Pads
- ◆ Inspection Forms
- ◆ Sample Bag
- ◆ Yellow Hazard Tags
- ◆ Adhesive Tape
- ◆ Cell Phone or Two-Way Radios (Portable, Hand Held)

## **Safety Equipment**

- ◆ Hard Hat
- ◆ Jumpsuit with Zippered Pockets
- ◆ Tethers for All Tools
- ◆ Flashlight
- ◆ Fall Protection Equipment
- ◆ Safety Glasses
- ◆ Gloves
- ◆ Hard Shoes

# OUTLINE FOR THE TRAINING OF PERSONNEL IN THE INSPECTION OF ENTERTAINMENT RIGGING SYSTEMS

## Support Materials

- ◆ Codes, Standards, Ordinances
- ◆ Manufacturers/Vendors Catalogs of Equipment and Related Hardware
- ◆ Periodicals
- ◆ Manuals and Handbooks
- ◆ Measuring Devices
- ◆ Recording Devices
- ◆ Safety Devices

## Identification of Hazards

- ◆ Toxic Substances
- ◆ Attachments
- ◆ Electrical Apparatus
- ◆ Worn-out Equipment
- ◆ Damaged Equipment
- ◆ Misalignment of Equipment
- ◆ Non-functioning Equipment
- ◆ Improper Installation of Equipment
- ◆ Overstress of Equipment
- ◆ Misuse of Equipment
- ◆ Incorrect Product Selection
- ◆ Fire
- ◆ Lubrication
- ◆ Corrosion

## The Inspection Process

- ◆ Determine Procedure
- ◆ Determine the Sequence of Inspection
- ◆ Identify Hazards
- ◆ Begin Systematic Inspection of Equipment

## Methods of Documentation

- ◆ During Actual Inspection
- ◆ Tape Recorder
- ◆ Photographs
- ◆ Video Recorder
- ◆ Handwritten Notes
- ◆ Physical Examples
- ◆ Testing Lab Data
- ◆ Written Report
  - Description of Procedure
  - Results of Inspection
    - ▶ Written Results
    - ▶ Pictorial
    - ▶ Spoken
    - ▶ Test Data

## Recommendations

- Code Requirements
- Life threatening corrections that must be made before additional use by owner
- Corrections or adjustments to be made within a reasonable period of time
- Documentation of Items That Appear to be in Proper Working Order

# APPENDIX A

## SAMPLE FLYMAN WEIGHT LOADER DIALOGUE

### EXAMPLE #1 SAMPLE LOADER DIALOGUE DURING LOADING OF BATTEN

After the line set is secure:

**FLYMAN:** "Put 10 weights on line set number five."

**LOADER:** "10 weights going onto line set number five."

Loader installs 10 weights on line set number five placing spreader plates every 2' or as marked on the arbor or carriage and secures the hold down plate or locking collars.

**LOADER:** "10 weights on line set number five - complete."

### EXAMPLE #2 SAMPLE LOADER DIALOGUE DURING WEIGHT ADJUSTMENTS

After the line set is secure:

**FLYMAN:** "Remove 2 weights from line set number five."

**LOADER:** "Remove 2 weights from line set number five."

Loader removes 2 weights from line set number five and secures the locking collars.

**LOADER:** "2 weights off line set number five - complete."

### EXAMPLE #3 SAMPLE LOADER DIALOGUE DURING WEIGHT ADJUSTMENTS

After the line set is secure:

**FLYMAN:** "Add 2 weights to line set number five."

**LOADER:** "Add 2 weights to line set number five."

Loader adds 2 weights to line set number five, placing spreader plates every 2' or as marked on the arbor or carriage (If required) and secures the locking collars.

**LOADER:** "2 weights on line set number five - complete."



When removing equipment from a batten, **NEVER** remove the load from a batten before removing the counterweights from the counterweight arbor. When loading a batten, **NEVER** add counterweights to the counterweight arbor before attaching the load to the batten.



Double purchase counterweight rigging systems require the balancing weight in the counterweight arbor carriage be double the weight of the load on the batten.

### EXAMPLE #4 SAMPLE LOADER DIALOGUE DURING UNLOADING OF BATTEN

After the line set is secure:

**FLYMAN:** "Line set number five to pipe weight."

**LOADER:** "Line set number five to pipe weight."

Loader removes all weights except the pipe weight from line set number five and secures the locking collars.

**LOADER:** "Line set number five is at pipe weight."



Unused spreader plates shall be stored at the top of the counterweight stack at all times.

## APPENDIX B

### COUNTERWEIGHT RIGGING EQUIPMENT INSPECTION & REPAIR/MAINTENANCE RECORDS

The following forms will allow the facility manager to keep accurate records for the inspection, repair and maintenance of all line sets and associated equipment within a facility. The first page is an inspection record that keeps track of all inspections in chronological order. The second page is a historical record of all repairs or maintenance procedures that have been performed on the stage rigging equipment.

**INSPECTION RECORD:** This document shall be an accurate record of all inspections performed on the stage rigging equipment in a facility. As the list is filled out, a chronological history is kept of the inspections which are beneficial for future reference. In case of an accident or other occurrence with the rigging equipment, a history of the previous inspections and repairs/maintenance performed during the life of the system will be helpful.

Whenever the theatrical rigging system receives any type of shock or impact load, all components in that set **shall** be thoroughly inspected by a qualified person before that portion of the rigging system is put back into use.

At a minimum, a shock load is equal to twice the static value. This value can be much greater depending on the mass of the object and velocity at impact. The inspection should be performed by qualified personnel and any component replaced if the integrity of the component is in question.



**If you know there is a potential problem with a line set it shall be taken out of service **immediately** and not used until a thorough inspection is performed.**



**Do not use a line set where there is a known or potential problem. Damage to equipment or injury to personnel or performers may result. A qualified person shall perform a thorough inspection immediately and determine course of action required.**

**REPAIR AND MAINTENANCE RECORD:** This record keeps an accurate list of all of the procedures that have been performed on the stage rigging system in a facility. These procedures include rope lock adjustment, leveling of battens, purchase line replacement, lift line replacement, etc.

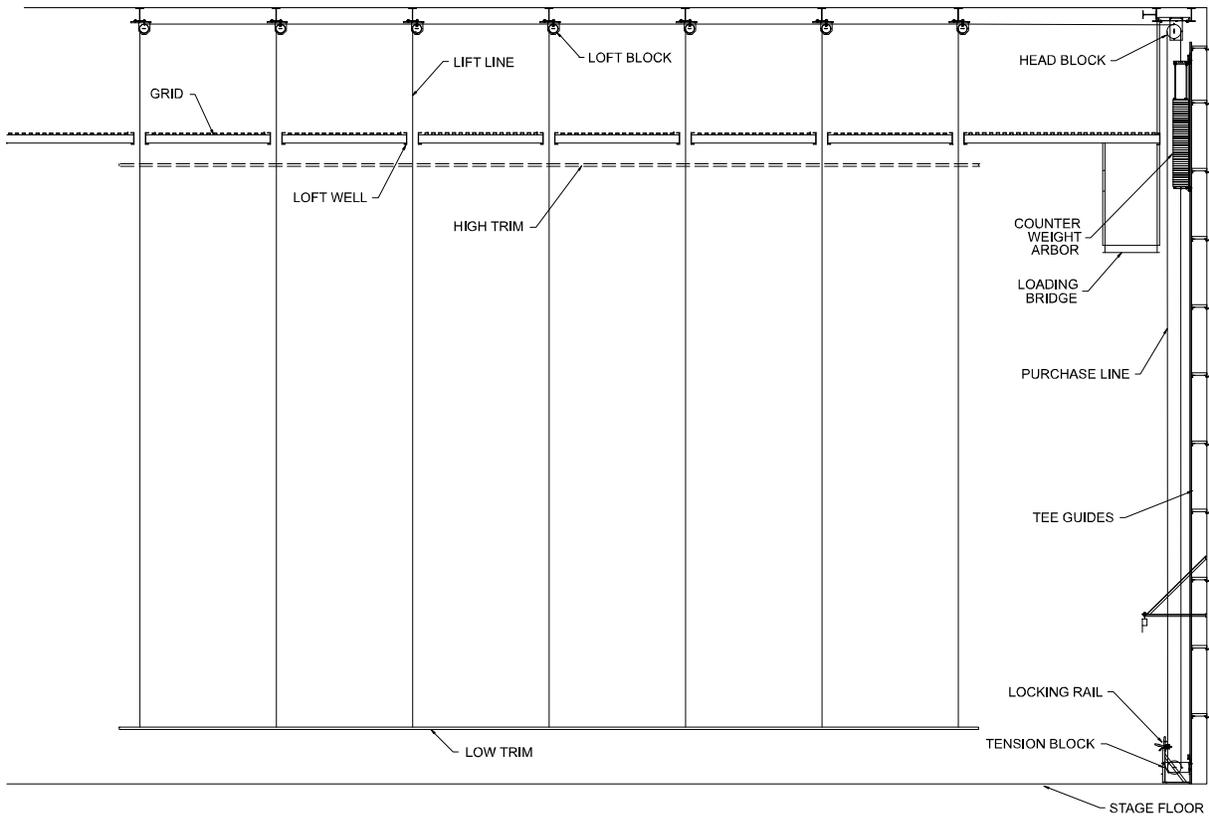
**KEEPING RECORDS UP-TO-DATE:** Record keeping is a valuable asset to any facility. During the life of a facility there are always management and personnel changes. Accurate long term record keeping on your stage rigging system will provide the history required so that any new personnel will know what has been done in the past and what should be done in the future.



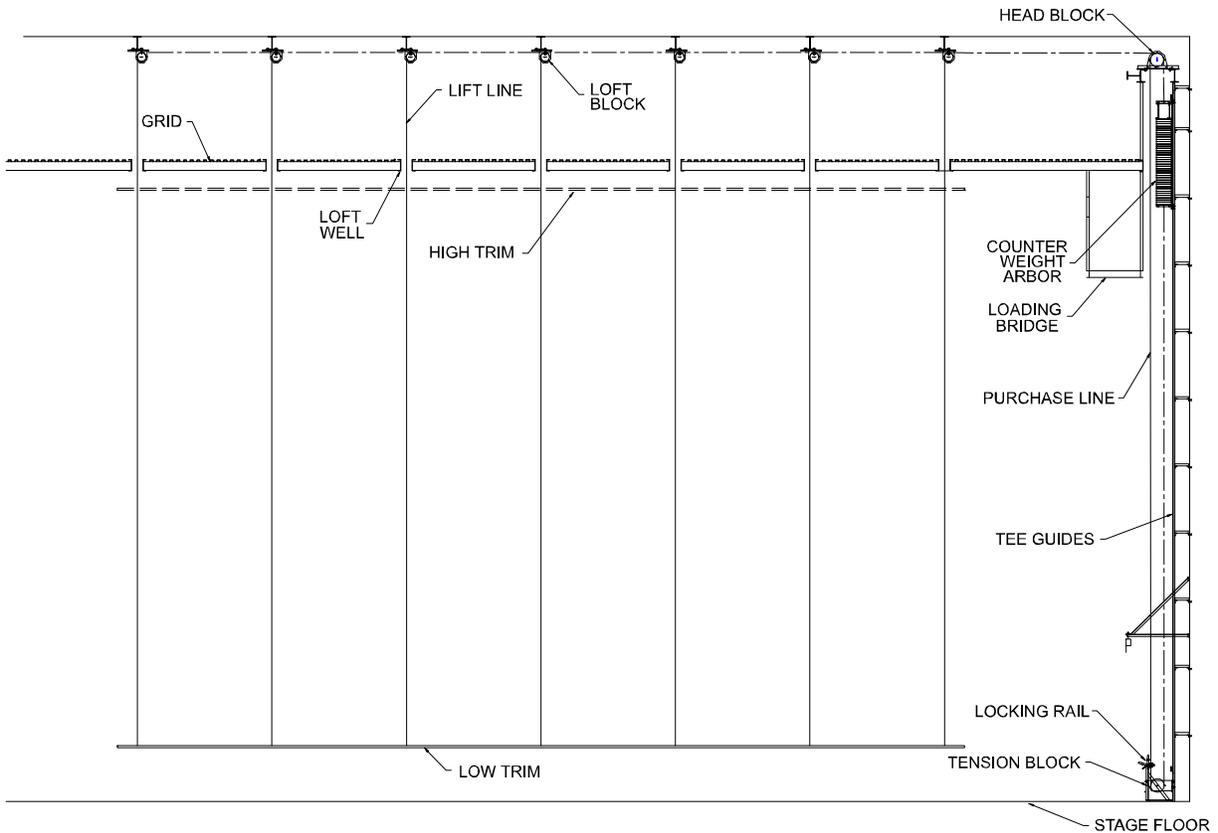




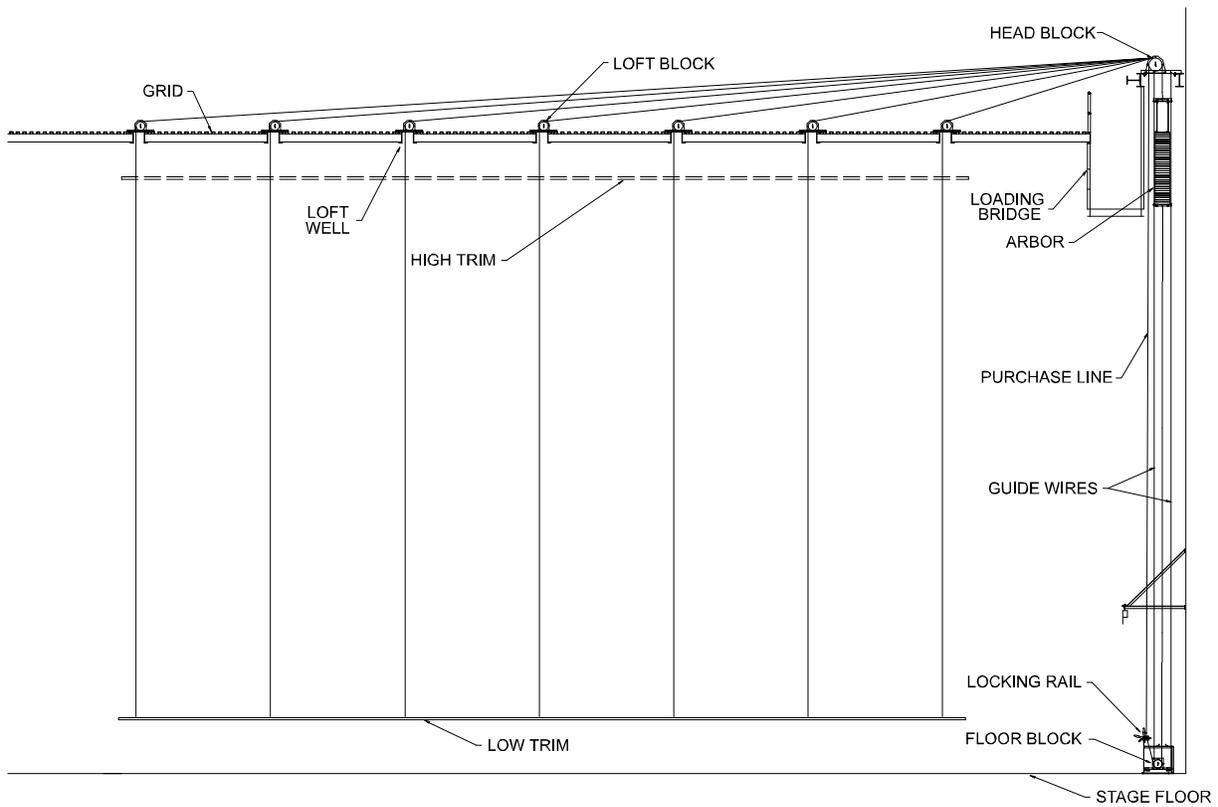
# APPENDIX D



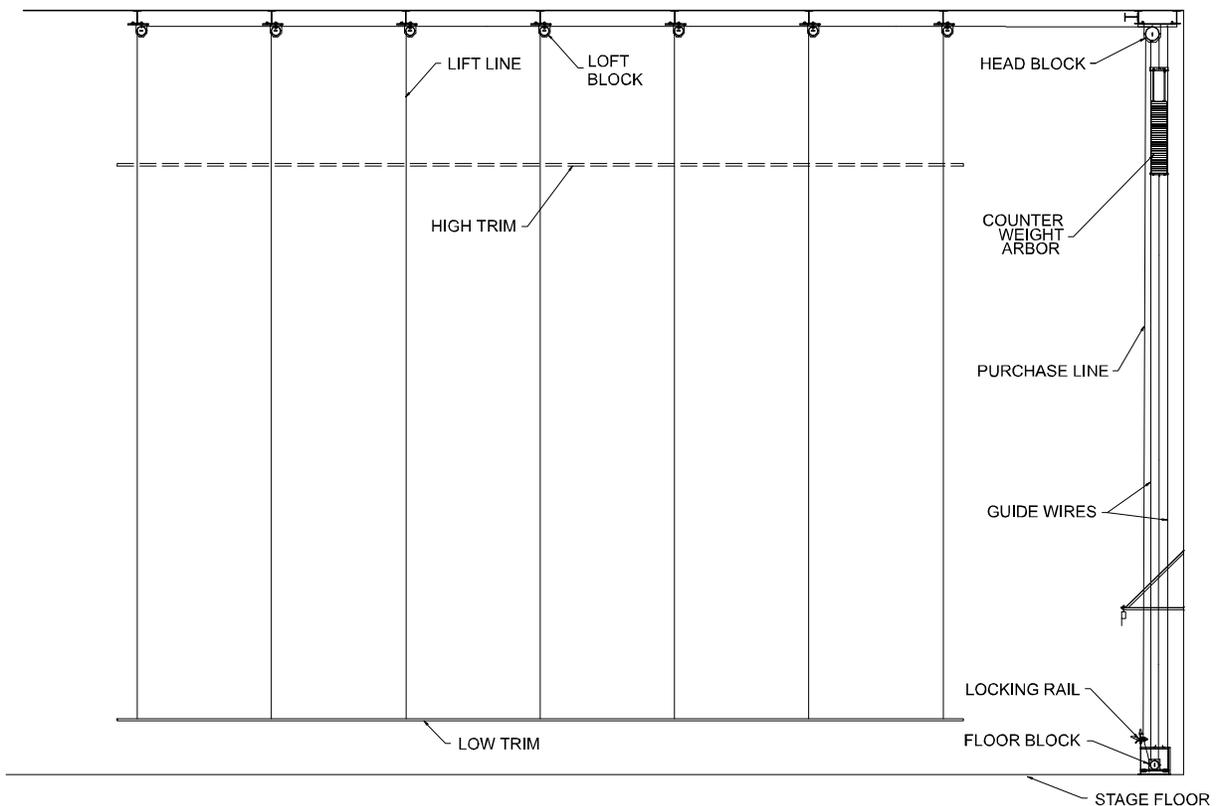
**TYPICAL SINGLE PURCHASE RIGGING SYSTEM  
UNDERHUNG BLOCKS  
ARBORS ARE STEEL "T" BAR or ALUMINUM "J" BAR GUIDED**



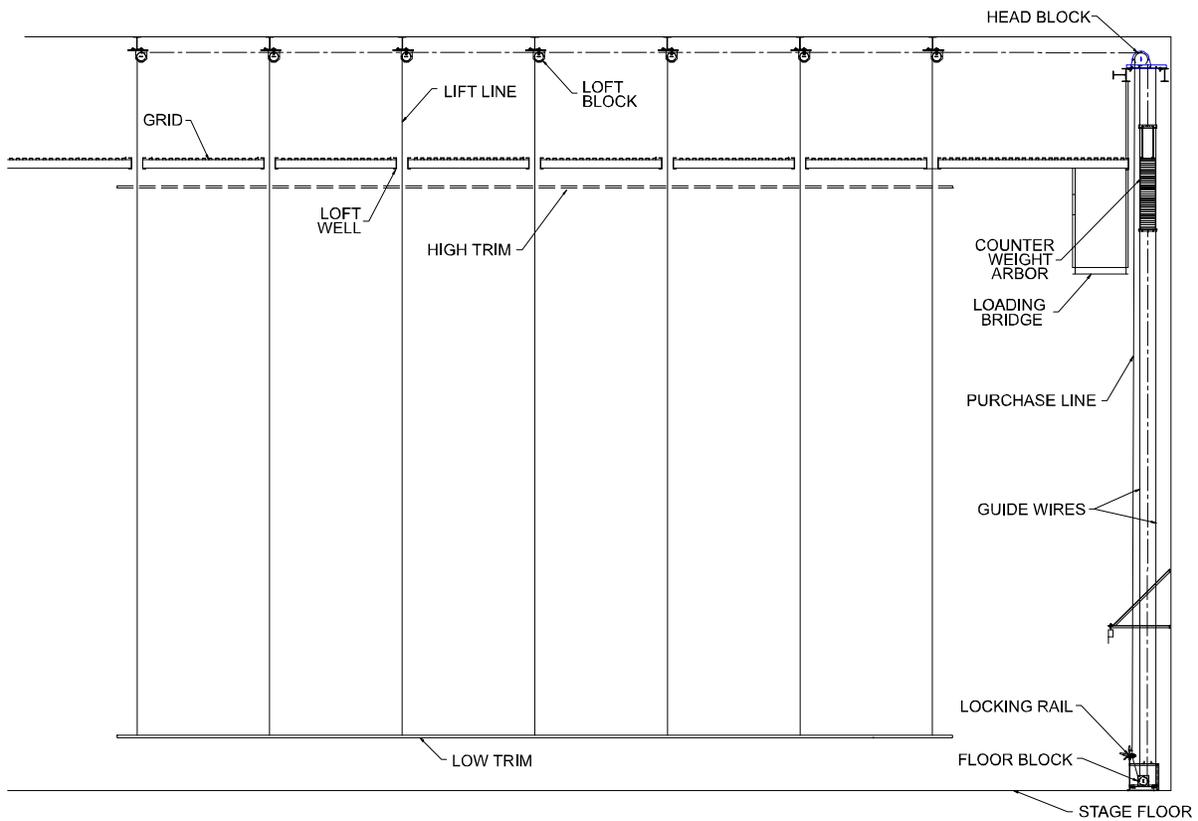
**TYPICAL SINGLE PURCHASE RIGGING SYSTEM  
UPRIGHT HEAD BLOCKS - UNDERHUNG LOFT BLOCKS  
ARBORS ARE STEEL "T" BAR or ALUMINUM "J" BAR GUIDED**



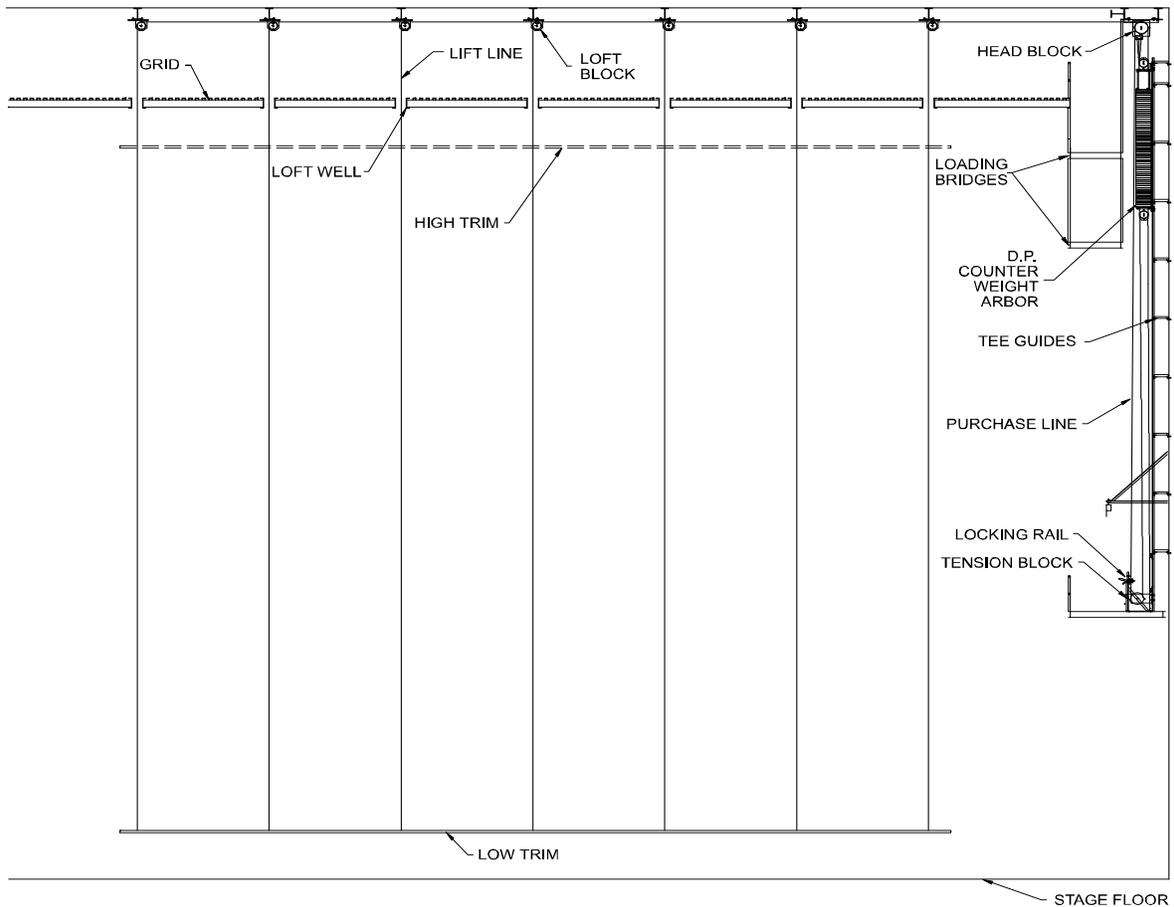
**TYPICAL SINGLE PURCHASE RIGGING SYSTEM  
UPRIGHT BLOCKS  
ARBORS ARE WIRE GUIDED**



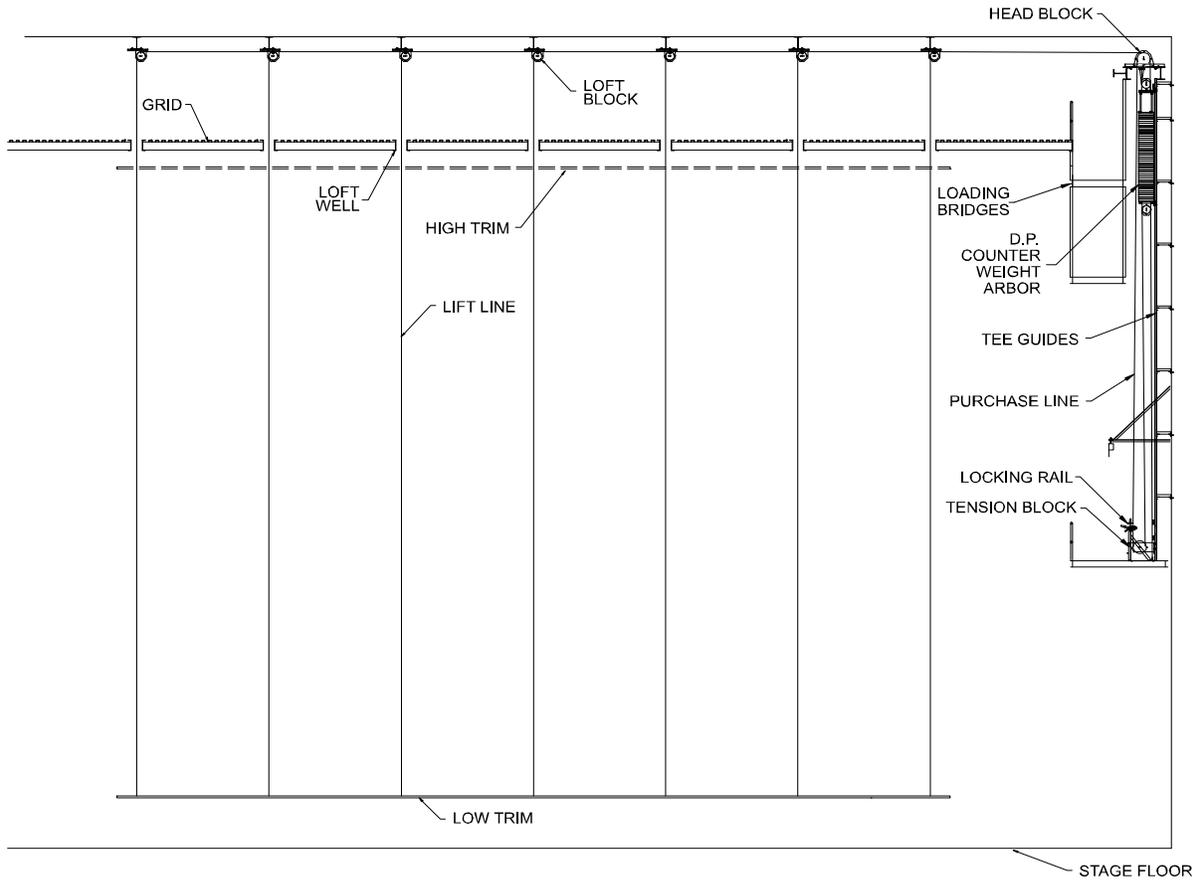
**TYPICAL SINGLE PURCHASE RIGGING SYSTEM - NO LOADING BRIDGE  
UNDERHUNG BLOCKS  
ARBORS ARE WIRE GUIDED**



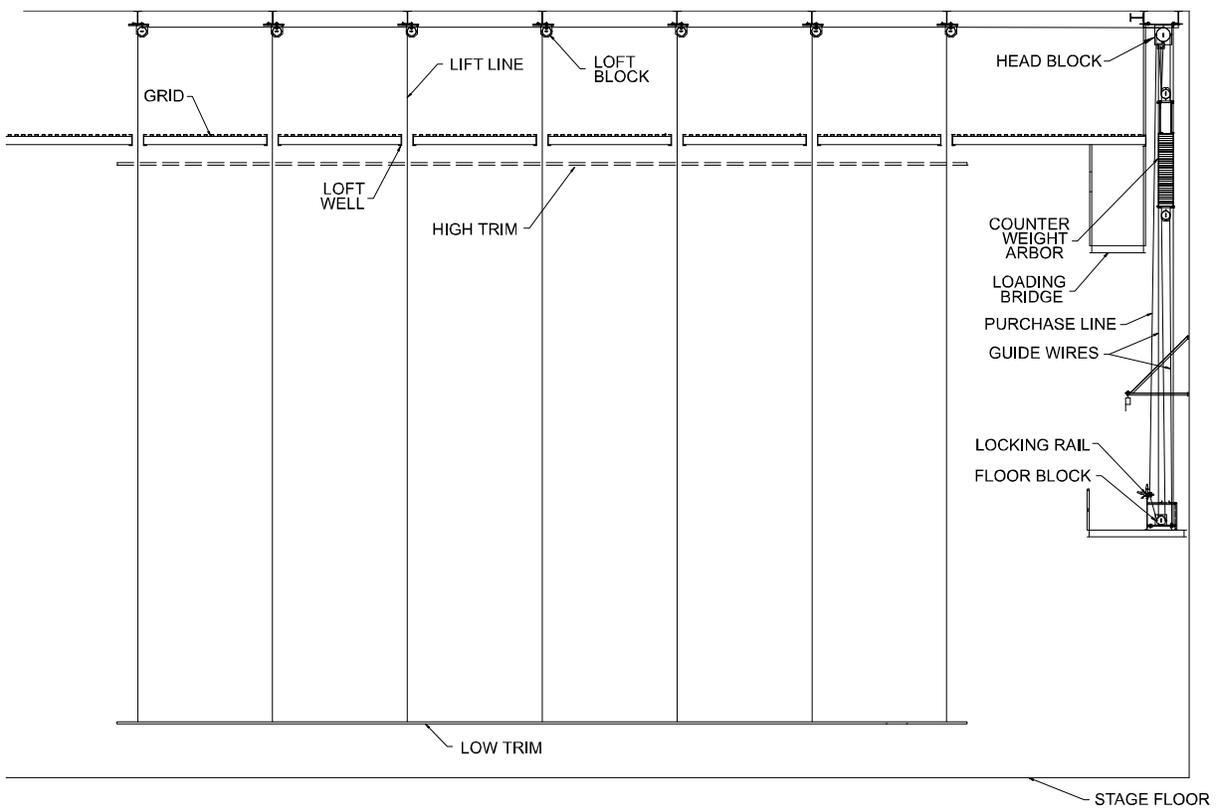
**TYPICAL SINGLE PURCHASE RIGGING SYSTEM  
UPRIGHT HEAD BLOCKS - UNDERHUNG LOFT BLOCKS  
ARBORS ARE WIRE GUIDED**



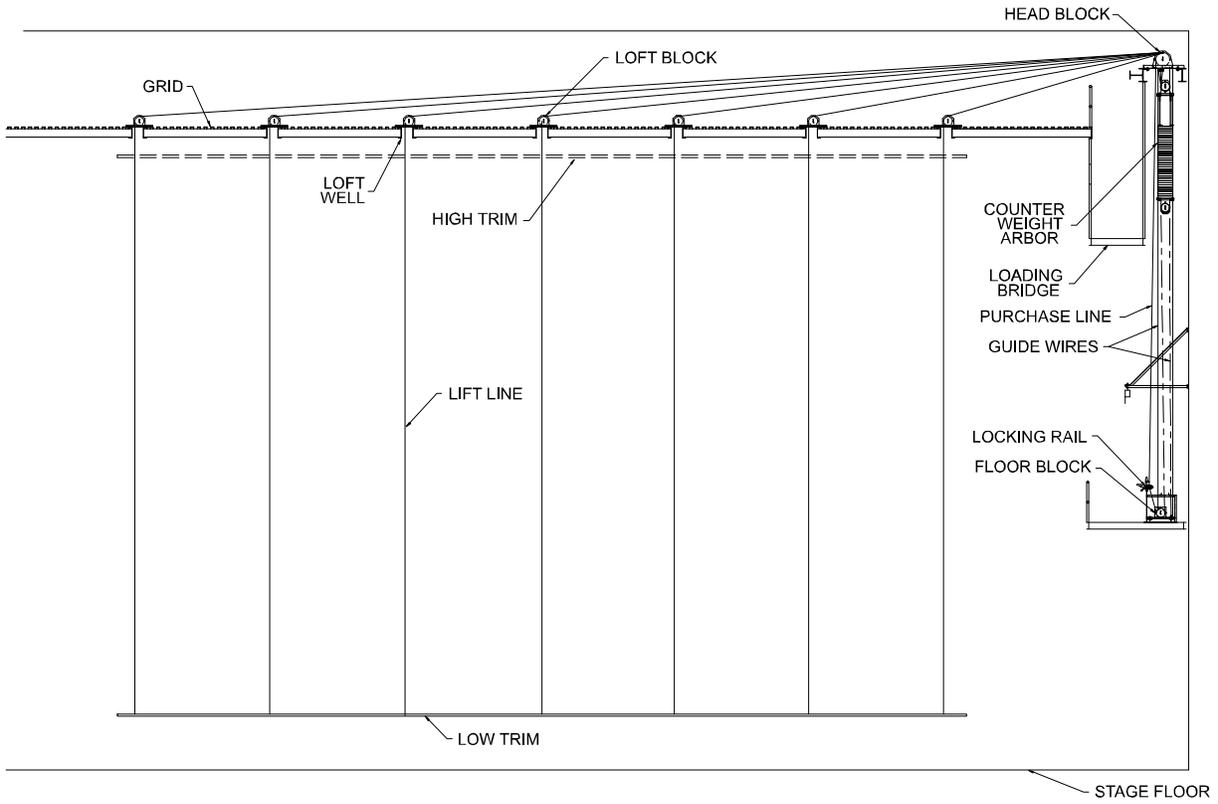
**TYPICAL DOUBLE PURCHASE RIGGING SYSTEM  
UNDERHUNG BLOCKS  
ARBORS ARE STEEL "T" BAR or ALUMINUM "J" BAR GUIDED**



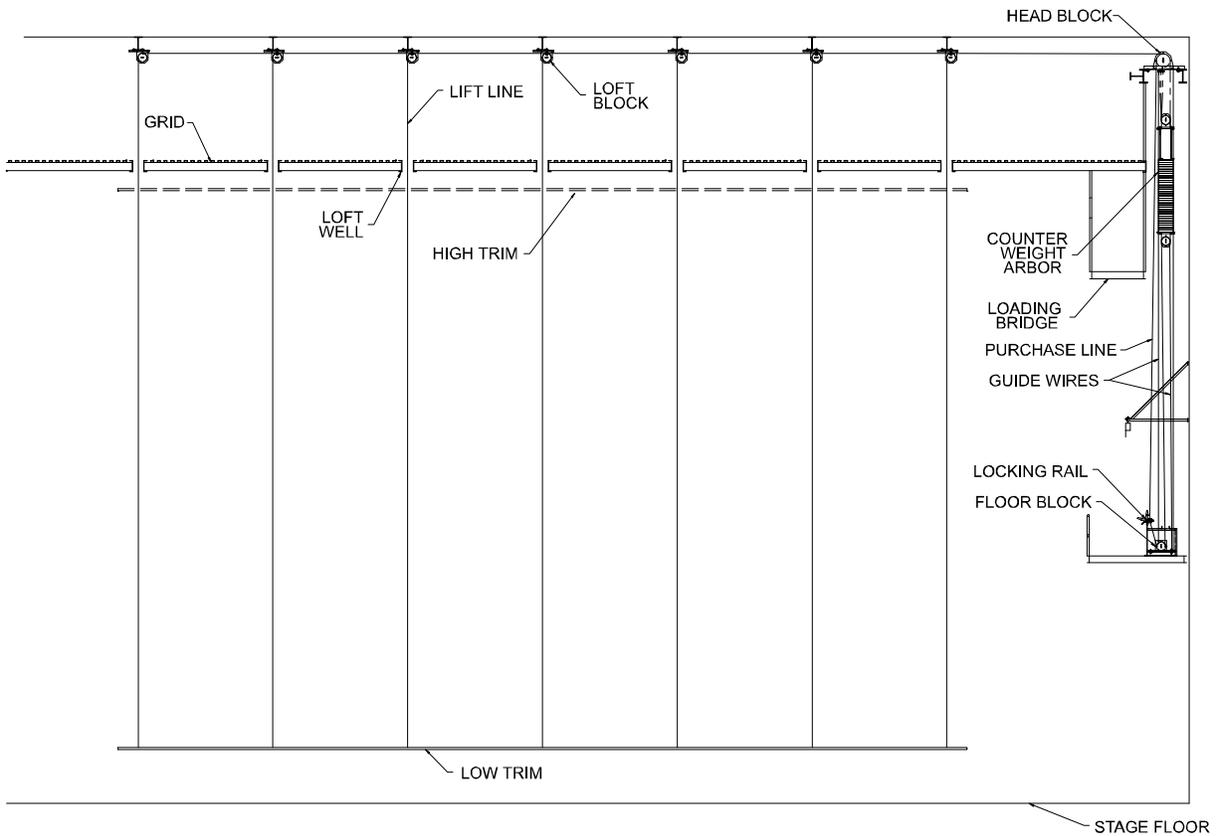
**TYPICAL DOUBLE PURCHASE RIGGING SYSTEM  
 UPRIGHT HEAD BLOCKS - UNDERHUNG LOFT BLOCKS  
 ARBORS ARE STEEL "T" BAR or ALUMINUM "J" BAR GUIDED**



**TYPICAL DOUBLE PURCHASE RIGGING SYSTEM  
 UNDERHUNG BLOCKS  
 ARBORS ARE WIRE GUIDED**



**TYPICAL DOUBLE PURCHASE RIGGING SYSTEM  
UPRIGHT BLOCKS  
ARBORS ARE WIRE GUIDED**



**TYPICAL DOUBLE PURCHASE RIGGING SYSTEM  
UPRIGHT HEAD BLOCKS - UNDERHUNG LOFT BLOCKS  
ARBORS ARE WIRE GUIDED**

## APPENDIX E

- ◆ Stage Rigging Hand Book Third Edition; by Jay O. Glerum
- ◆ ANSI E1.4 - 2009 *Entertainment Technology - Manual Counterweight Rigging Systems*; PLASA North America
- ◆ *Wire Rope Users Manual Fourth Edition*; Wire Rope Technical Board