

101 Rigging

Knowing and operating your counterweight rigging system

by Tom Young

Do you need stage rigging in a house of worship? It's not as odd an idea as it may sound. With all of the new technology in use to make the worship service more interesting and accessible to congregations of all kinds, theatrical technology has become part of the "new norm" for worship and productions.

Rigging is the hoisting system used to raise and lower equipment and decorative elements. Your requirements may include the movement of banners and lighting fixtures to change the appearance of your worship space, or scenery for your annual holiday play or pageant. The rigging in your church could be as complex as a full stage house with a fly tower, or as simple as moving drapery to reveal your choir. Perhaps you need lighting hoists for chandeliers, to lower them to a safe level for changing bulbs, cleaning and maintenance; or you may have permanently installed hoists for theatrical effects.

Whatever rigging you may have in your house of worship—or whatever you may be considering as part of a renovation or a new facility—it's critical that the people who use your rigging know exactly how to operate it, and that the equipment be maintained in top working order. "Train, Inspect, Maintain" are the watchwords for rigging, whether you work with manually operated counterweight sets or technologically advanced automation.

Your rigging system can be as simple as a few hoists to raise and lower drapes, lighting and speakers, or as complex as the rigging used in a performing arts center. The most important thing is having the right rigging for your facility and your production needs, and to make certain that the people who operate your system can do so safely.

Manual vs. Automated

For more than 100 years, most theatrical rigging used systems of ropes and steel weights to counterbalance the equipment being moved. These fairly low-cost systems remain popular, and they are found in most performance spaces built before 2003. If your operators have experience and training, counterweight rigging is relatively easy to use—but the operators must be trained to use the system correctly. We'll talk more about this in a moment.

The other option is automated (motorized) rigging systems, with programmable control systems. Automated systems designed specifically for overhead lifting allow you to preplan and record rigging movements so that they can be played back accurately. A properly designed system of permanently installed hoists and a control system is easy to use, and is a lower risk approach than a counterweight system. The technology that makes spectacular performance effects happen in



PowerLifts automated rigging system by J.R. Clancy.



theaters and performing arts centers is available in standard designs and formats for smaller spaces—and many churches have chosen automated rigging. This makes automation cost-effective for many facilities that could not have considered it just a few years ago.

If you are considering automated rigging for your house of worship, be sure to choose a firm that understands the risks of moving loads

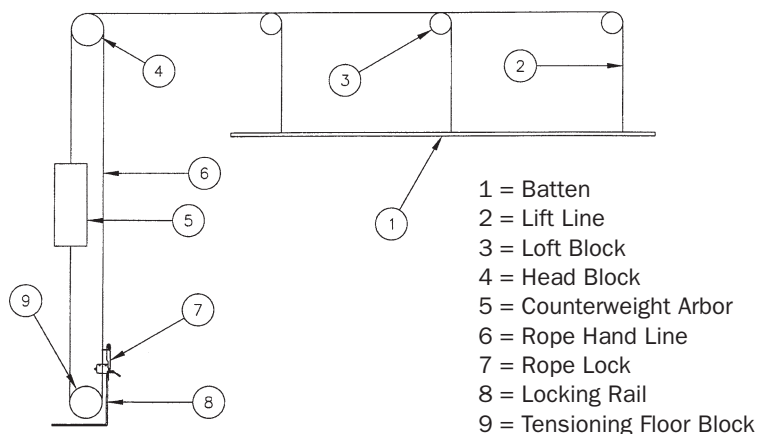
over people's heads. Many hoists are not rated for overhead lifting, which means that they place your celebrant, choir or performers in danger. The hoists you choose must be designed for theatrical use, and the control system must be fail-safe. At the minimum, ask the supplier if the system meets NFPA-79, the Electrical Standards for Industrial machinery regulation. Enlist the assistance of a theatre consultant—someone who works with performance spaces on a regular basis, who can bring his or her expertise to your facility. Above all, *do not* attempt to cobble together a system with hardware store components—nothing you'll find at the DIY store is appropriate for hanging heavy weight over people's heads. Remember that the liability rests with your church if someone gets hurt.

As most houses of worship have counterweight rigging, perhaps installed many years ago, let's look at the manually operated system to fully understand its use and to move toward its safe operation.

What is counterweight rigging?

Counterweight rigging operates on simple principles of physics: The load over the stage is counter balanced by an equal amount of steel weights called "counterweights" backstage. When properly counterweighted, this manual rigging is easy to operate—but when the set is out of balance, the system has the potential to be very dangerous. That's why it's so important to understand your system, and to be properly trained to run counterweight sets.

The information provided here will familiarize you with the parts of the system and its basic operation, but every system is installed and configured differently, to fit the space in which it is used. To fully understand your system and its operation, bring a professional trainer with Entertainment Technician Certification Program (ETCP) training to your facility, both to train your operators and to inspect your system to be sure it is in perfect working order.



Everyone working backstage at your house of worship should use the same vocabulary when talking about your rigging system. The diagram will help you define the parts of your system, and the purpose of each piece of equipment.

- 1. Batten:** The pipe or truss to which the scenery, curtains or lights are attached over the stage
- 2. Lift lines:** The wire ropes that suspend the batten from the loft blocks
- 3. Loft block:** A pulley mounted to the gridiron of a performance space or to the building's support steel, to support the lift lines and change their direction between the load (on the batten) and the head block. There are several loft blocks for each batten, and each supports a portion of the total load.
- 4. Head block:** The pulley, or block, mounted to the building's support steel, that guides the wire rope between the arbor (see below) and the loft blocks. The head block bears the full load of the set, and changes the direction of the lift lines.
- 5. Arbor:** The carriage that holds the weights that counterbalance the load on the batten.
- 6. Hand line (also called Operating Line):** The rope that allows the operator to control the movement of the set.
- 7. Rope lock:** This lever holds the batten in position when the load is balanced. A rope lock is not intended to hold a load that is heavily out of balance while you load or unload the arbor. It is also not intended as a brake, or to slow the speed of a set.
- 8. Locking rail:** A horizontal metal rail, with a row of rope locks—one for each counterweight set.
- 9. Tension floor block:** The return pulley for the hand line, which is weighted to keep tension in the hand line.

Rigging Safety Basics

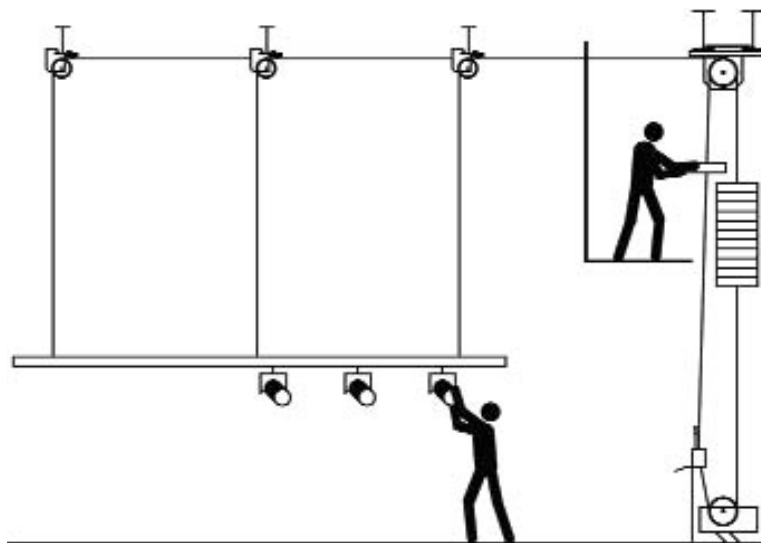
Using counterweight rigging is a process of understanding some basic laws of physics—especially the ones involving gravity—and taking every precaution to ensure that the load is in balance, so it won't come crashing down when you least expect it. Remember that you are hanging heavy weight over people's heads, both onstage and backstage. In houses of worship, it's common to have children involved with services, pageants and holiday celebrations, so treat the rigging as if your own children were standing beneath it.

The key is to *counterbalance the load with*

the counterweights. Think back to your high school physics: When the load is in proper balance, it is relatively easy to move the load by pulling on the hand line. If you have to struggle to move the load, the set is out of balance. By the same token, if the set moves by itself or takes virtually no effort to move, it is also out of balance. Either of these situations is potentially dangerous.

Here's where gravity comes in: The heavier side of the system will always move downward, while bringing the lighter side up—and the more the system is out of balance, the faster it will do this.

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.



The loading gallery must be designed by a structural engineer who understands theatrical rigging systems. Most of your extra weights will be stored on the bridge, so must be designed properly.

How can you determine what the load on the batten actually weighs? As you load or unload counterweights, feel the system by seeing which side of the hand line is in tension. When a set is in balance, both lines have the same amount of tension, and they move fairly easily. Once you have balanced the load, you can count the counterweights to get a rough weight.

Keep these basic issues in mind as you work with your counterweight rigging system:

1. **Know your load limits.** Each line set has a specific load capacity; make sure these are written on the batten end caps and on the index cards under each rope lock at the lock rail. Do not exceed these limits, as they can affect the structure of your building.
2. **Train and authorize the operators.** Keep a log that details which of your staff members and volunteers have had official training on use of the rigging. Choose one of these people to supervise rigging operation during productions.

3. **Determine the permanent counterweight.** Identify the empty trim (pipe) weight for each batten, so the trim weight will not be mistakenly removed. Every set will have permanent counterweight on the arbor to balance the empty batten. Consider painting these permanent weights red or yellow, to signal that they should not be removed from the arbor. Strapping them in place with flat metal bands or cable ties is also a good idea.
4. **Keep weights in neat stacks at the side of the loading gallery**—but no higher than the toe boards at the bottom of the gallery. This will keep operators from accidentally kicking them off the bridge.
5. **Don't overload the gallery.** There should be a sign on the gallery to tell you how much load the bridge will carry.
6. **Keep your mind on the job.** Make sure a responsible adult is in charge of the counterweight system, and keep distractions to a minimum backstage.
7. **Wear heavy-duty work gloves and closed, hard shoes.** Fingers and toes can be in peril during any production.

Rigging Operation: Attaching Loads to Battens and Loading Arbors

These steps are listed in J. R. Clancy's Operation & Maintenance Manual for Single Purchase Counterweight Rigging System with Loading Bridge. You can download the entire manual at www.rigging-safety.com. If you believe your system is double-purchase, or if your system does not have a loading bridge, you'll find manuals for these systems at this Web site as well.

1. Attach the load to the batten.

- Bring the empty batten to the FULL IN (or Low Trim) position just above the stage floor.
- Engage the rope lock and set the oval safety ring.
- In the loading gallery, remove all the weight from the arbor except for the permanent "pipe weight." Now the batten is the same weight or heavier than the arbor, so that the system is in a stable condition.
- Securely attach the scenery, drapery, track, lights, etc., to the batten. Be sure that the



This video screen at Lakewood Church in Houston is raised and lowered by a rigging system.

hanging devices (chains, clamps, etc) are strong enough to hold the load, securely fastened, and in good condition.

2. Once the load is safely secured, load the arbor at the loading gallery level.

- Yell “Clear the rail!” or another command on which you and your fellow stagehands have agreed. Make sure that all persons are clear of the areas on the stage below the arbors and loading gallery.
- Raise the spreader plates and stop collars and hold them. A spring-loaded “pony” clamp may be used to hold them out of the way during loading.
- Load each counterweight into the carriage individually, by setting the weight on the stack vertically, using both hands. Ease the top back until the top slot fits around the rear rod. Then ease the bottom forward. Grasp the bottom of the weight between the heels of your hands, and bring it forward so that it slides around the front rod.
- Keep your fingers out from under the weights. Always maintain complete control over the weights.

- Insert spreader plates every two feet as you build the weight stack.
- Fill the arbor with counterweight to equal the weight of the batten plus the scenery, lights, or other items on the batten.
- Remove any clamps, securing the spreader plates, and slide the spreader plates down to the top of the weight stack. Extra spreader plates may be secured under the top plate.
- Hand-tighten the setscrews on both stop collars to secure the spreader plates and weights.

3. The set should always be in balance or under operator control before releasing the rope lock. “In balance” means that the weight of the batten and load equals the weight of the arbor and counterweight. Once you have determined that the set is close to balanced, open the rope lock while an assistant holds the hand line. Close the rope lock again and make any needed adjustment to the counterweight.

- Any excessive tension in the hand line above or below the rope lock means that the set is significantly out of balance.
- If there’s tension in the hand line above the rope lock and the hand line under the arbor is slack, the arbor is too heavy.
- If there’s tension below the rope lock, and the hand line above the rope lock is slack, the batten is too heavy.
- If any of these conditions exist, add or remove weight accordingly while the arbor is still in the loading gallery.

4. Remember that rope locks are intended to lock arbors and loads that are balanced.

- A properly adjusted rope lock should hold about 50 pounds.
- Adjusting the rope lock to hold additional loads only wears out hand lines faster, increasing the potential for an accident.

5. To unload the arbor and remove the load from the batten, reverse the process.

Counterweight Set Operation

1. Do a visual check. Identify the arbor and look at the locking rail’s index cards. These identify the set number, its contents, and its function. (If there are no index cards, start this

system in your facility by checking and recording the information with the help of an experienced person.)

- Look for obstructions that might prevent safe operation. Is the batten hung up on a neighboring pipe or a curtain track? Is anything in the way of the arbor's smooth running?
 - Look at the front and back purchase lines to determine the condition of the balance.
 - If the set is out of balance and you have NO CHOICE but to operate it as is, GET HELP from a competent person.
2. **Warn your coworkers.** Before moving the batten or arbor, shout, "Batten number X coming in (or going out)!" Look to be sure that people and objects are clear of any moving battens. If you don't have a clear view of the moving batten, ask another person to "spot" for you.
 3. **Cautiously release the line.** Release the oval metal safety ring that prevents the lock from opening accidentally. Then release the rope lock handle slowly until you know the condition of the balance.
 - If it takes excessive force to move the set, or if the pull feels different from normal, STOP immediately. Put the rope lock and safety ring back on, and find out what's wrong.
 - If all is well and the line moves normally, move the batten to the desired position. Then engage the rope lock and the safety ring.
 - To always bring this batten to the same position, "spike" the rope by "stabbing" it with a string through the hand line. Don't use adhesive tape to spike the line, as it will leave a sticky residue that may inhibit smooth functioning later.

Other Resources

- www.churchrigging.com for information that will help you choose and operate your rigging safely.
- Glerum, Jay O. *Stage Rigging Handbook*, Third Edition. Carbondale, Southern Illinois University Press, 2007.
- www.rigging-safety.com for manuals and maintenance info.
- www.sapsis-rigging.com/technotes.html for technical terms, safe rigging practices and more.❖

Tom Young is the vice president of marketing for J.R. Clancy, Inc., a designer, manufacturer and installer of stage and studio rigging equipment. For more information visit the company's Web site at www.jrclancy.com.