



COUNTERWEIGHT RIGGING MANUAL

Texas Scenic Company, Inc. recommends that only trained personnel be allowed to operate the Stage Equipment. As part of training a thorough review of the manual should be required by all trained personnel. A safety program for your stage area must include regular inspections and maintenance of the stage rigging hardware. Periodically a professional consultant or qualified stage equipment installer should do safety inspections and repairs.

OPERATION OF THE COUNTERWEIGHT SYSTEM

The “flyman” is the person responsible for hanging scenic and lighting units on the counterweight system and supervising its operation during a production.

The “flyman” has responsibility for the safety of personnel and equipment associated with a production. Lack of skill and care on his part is liable to lead to a serious accident. Therefore, he must always keep in mind the considerable loads he is manipulating.

A typical counterweight set is balanced when set up with a load of scenery, draperies or lights. A pull of 30 to 40 pounds on hand line is sufficient to move or stop the set, which may easily involve a thousand pounds of scenery and counterweights.

When a load is being added to, or removed from a set, an imbalance is created until the set is re-weighed. Large quantities of scenery or counterweight may be suspended high above the stage and must be carefully controlled.

Sometimes, a careless stagehand will lower a balanced batten to the stage floor, close the rope lock and proceed to remove several hundred pounds of equipment from the batten. The counterweights remaining on the arbor places a strain on the hand line greater than the holding capability of the rope lock, against the grid, often resulting in damage to the cables and/or pipe. This is the most common type of runaway accident.

Conversely, the scenery may be left on the batten while the arbor is unloaded at the rail. Now, the weight of the scenery overcomes the lock. The arbor, with its few remaining weights, is thrown against the head beams. This type of “runaway” will often spill counterweights down on the rail crew.

To add scenery or lights, lower the batten to the floor, placing the arbor at the height of the loading bridge. The scenery is fastened to the batten, while weights are placed in the arbor. When both are complete, the set is in balance and ready to use.

Close estimates of the weight of a particular unit are rarely available, so an estimated quantity of weight is loaded. The man at the rail brings the arbor to the rail and as needed, and adjusts the load by adding or removing weight.

Frequently, in the case of a drop or set of flats, most of the weight of the load is not placed on the system until the batten is raised. Therefore, the set may tend to “creep” as the weight on the arbor exceeds the load on the batten. For this reason, the man at the rail should keep hold of the lines or tie-off the set during this process.

UNBALANCED METHODS

Small loads can easily be balanced without sending personnel to the loading bridge. The batten is lowered, scenery attached and the batten raised by pulling the arbor down with the hand line. When the arbor may be reached from the floor, it is loaded.

Sometimes it is desirable to pre-load the arbor at the floor before raising it.

Then, with the batten down, the scenery is attached. However, the rope lock should not be trusted to hold the arbor up while the scenery is being attached. The hand line should be held or tied off or stagehands should be told to hold the batten down until the scenery is attached and the balance checked.



Clearly, these methods require more efforts than the loading bridge method. They are used when the amount of scenery to be loaded is insufficient to warrant the long climb to the loading bridge.

It is useful to combine the two methods, when the effort required to lift the load or its equivalent counterweight is too great. By preloading the arbor with half the estimated weight, the effort required is cut in half.

UNLOADING

ALL THE ABOVE DESCRIBED METHODS MAY BE USED IN REVERSE FOR REMOVING THE SCENERY AND COUNTERWEIGHT FROM A SET.

TYING OFF

A rope lock is not intended for securing substantial imbalance, which may occur during loading and unloading. To allow for imperfect adjustment and wear on the rope, we do not rely on a rope lock to hold an imbalance of greater than *40 pounds*.

Where it is necessary to hold an imbalance greater than 40 pounds, there is a method which may be employed.

A short piece of rope is tied to the hand line and the other end secured around the rail. If the imbalance is in excess of 200 pound, two (2) or more such ropes should be used.

A suitable knot for tying the short rope to the hand line is a clove hitch with 2 half hitches on top. In case of a $\frac{3}{4}$ inch hand line, the tie-off rope should not be greater than $\frac{1}{2}$ inch nominal diameter, to insure that the knot will "grab."

TWISTING THE HAND LINE TO OBTAIN GREATER CONTROL

Sometimes, the flyman will wish to control (as opposed to tie-off) a greater imbalance than his weight and strength would normally permit. For example, he may wish to lower a loaded arbor or a loaded batten whose counterbalancing load has been removed.

Some slack is taken in the hand line and the two (2) sides twisted about each other. The side which is attempting to run down is pulling away from the rail, creating a substantial friction in the rope. By allowing the rope to slide through his hank, the flyman can control a far greater imbalance than he could otherwise handle. If he allows the rope to pass freely, the sides of the hand line slip by each other with little friction. If he holds fast on the line the twists bind slightly, holding the imbalance.

FUNCTION AND OPERATION OF THE TENSION BLOCK

The rope hand lines may change length with changes in humidity. If the tension block were simply fixed to the floor, the hand lines would sometimes be excessively taut, and other times, too slack.

The tension block is designed to drop as hand line increases in length. However, if it were designed to raise to accommodate shrinkage of the rope, it would also rise whenever a lock was closed on a down-running set. Therefore, it is designed to drop freely, but to jam whenever the rope attempts to raise it.

The protruding toe-plate at the operator's end of the block assembly is designed to release the locking function of the guide shoes. To release the tension block, either to relieve excess tension in the band lines or to obtain slack off tie-off or controlling twists, the operator pulls on the hand line while stepping on the toe-plate.



THE LOADER

The flyman's responsibility is the loading gallery. He must see that the stock of weights is distributed on the gallery in a manner to avoid concentrated structural loads and stacked so they may not be accidentally kicked over the side. A counterweight dropped from that height becomes deadly.

Before loading or unloading an arbor, the loader must call out: "CLEAR THE RAIL!" This call is a warning that everyone must clear the area of the stage adjacent to the locking rail. When this area is clear, the railman must call out: "RAIL CLEAR!" Only after this has been done should the loader commence a loading or unloading operation. It is the responsibility of the railman who gives the "RAIL CLEAR" call to keep the rail area vacant.

When loading or unloading is complete, the loader will call out "RAIL IS SAFE." This call should be acknowledged from the sage.

THE COUNTERWEIGHT ARBOR

The arbor consists of a head and base fabricated of heavy steel plate joined by two (2) steel rods and a steel backing bar and equipped with two (2) fiber J-Bar guide assemblies to engage the track. Depending on the arbor length, two (2) or more spreader bars two (2) locking collars are supplied.

As initially installed, a group of weights are placed on the arbor. These weights balance the pipe batten and cables and are referred to as the "dead" or pipe load. *NEVER* remove these weights. The balance weights are painted red.

As practical matter, if your loader will scribe lines on the front arbor bar above the dead load 5-5/8 inches on center and call it 100 pounds each, it will makes his job a bit easier.

The spreader plates on the arbor serve a definite safety function. In the event of a "runaway" the arbor may be subjected to forces sufficient to deform the rod, allowing weights to fall out. The spreaders resist the tendency of the rods to spread and help retain the weights. As weights are stacked on the arbor rods, a spreader plate should be placed approximately every 24 inches.

The spreader plates can also get in the way when you are loading. A loader will supply himself with a squeeze clamp or a short length of shock cord with hooks in each end and use it to hold the plates up out of the way.

Finally, one (1) spreader is placed at the top of the load and locked in place with the stop collars. This serves to prevent the top weight from being thrown off in case of runaway or careless operation.

WIRE ROPE

The wire rope lift lines installed on this project are 1/4"x 7 x 19 galvanized aircraft cable. This cable has a breaking strength of 7,000 pounds. The working strength of a cable is taken at a ratio of 8:1 thus 875 pounds.

As initially installed, the wire rope operating lines are clear of all possible abrasion points. As long as these lines are not shifted into contact with structure and are running free, forty or more years of life may be expected. These ropes are lubricated at the time of spinning and no other treatment is required. During the first few months of operation, the cables tend to stretch slightly. The stretch is uniform, but due to the difference in length of the various cables, it will eventually result in the battens becoming slightly out of horizontal trim (relative to the stage floor). It may become necessary to re-trim chains that attach the cables to the battens.



ROPE LOCKS

Rope locks are designed to position a balanced batten in a required location in the fly loft. While the device is designed to hold a modest imbalance, it should not be used as a holding device for out-of-balance sets.

The rope lock grasps the rope by an internal clamping action. Since, in the course of normal stretching, the diameter of the hand line diminishes slightly, some adjustment of this action will be required. To adjust, release the lock nut (9/16-inch open-end wrench required) and turn the thumb-screw in to tighten the jaw action. After the adjustment is made, retightening the lock nut.

The rope locks are equipped with a steel “keeper” ring that should be placed over the hand line and lock handle when the line is not being run.

It prevents accidental opening of the locking case its handle is inadvertently struck while working on an adjacent set. Further, as the cams on rope lock handles become worn, over the years, the lock loses its tendency to stay closed positively. The ring insures that the lock will not pop open under any conditions of strain on the rope.

PREVENTATIVE MAINTENANCE RECOMMENDATIONS FOR STAGE RIGGING

In order to maintain a safe and efficient stage rigging system, it is necessary to implement a regular and continual preventative maintenance program. We list below some of the critical areas of stage rigging that need consistent review, inspection and/or correction. This list is a guideline to assist you in establishing a maintenance program, but can not replace ongoing inspection by operating personnel. All irregularities should be checked out and corrected immediately.

Accidents, injuries, and sometimes deaths can be caused by the human factors of ignorance, misuse, and poor judgment. Any suggested program to maintain special equipment and to prevent accidents, injuries, or death must have an occasional professional appraisal, and professional corrective care. Texas Scenic Company, Inc. recommends professional inspection at least annually.

Remember that counterweight sets should be kept in a balanced condition at all times, and should be operated only by well-trained, experienced personnel.

TYPICAL ITEMS TO CHECK BUT NOT NECESSARILY A COMPLETE INVENTORY

Cable Clips - Look for apparent wire rope damage. Check for loose nut. Do not over-torque nuts. Tighten only to manufacturer’s specifications.

Nico-Press Sleeves – All swage fittings are installed and checked on installation and require no further maintenance.

Turnbuckles - Maintain proper tension on wire rope. Tighten jam nuts when proper tension is achieved. Check safety wire if present.

Counterweight Carriages - Never allow sets to be out of balance. Top and bottom should be parallel. Spacers should be dispersed throughout weights. Top spacer should be locked on weights by locking sleeves on carriage rods.

Loft Blocks - Check alignment (cable wear). Check clip bolts - tighten if required.

Head Blocks - Check alignment (cable wear). Check clip bolts - tighten if required.

Wire Rope - Check for wear, kinking or any deformation. Determine source of any wear and correct. Replace all damaged wore rope immediately.

Battens - When necessary trim level to compensate for initial cable stretch.

Hand Lines –

Stage-Set X - New England Rope’s Stage-Set X has been developed specifically for the Theatre industry. It is designed to provide the strongest, most environmentally stable product available.



The design consists of a parallel core of polyester fiber contained within a helically wrapped polyester tape and covered by a braided polyester jacket. Stage-Set X requires very little maintenance. It shows very little degradation from Ultra Violet rays, is resistant to most mineral and organic chemicals, weak acids and alkalis, solvents, bleaches and other oxidizing agents. Periodically the rope should be inspected for cuts or wear to the outer jacket. It is not recommended that tape or ribbons be woven into the outer jacket.

Manilla - Inspect for dry rot (indicated by excessive splintering and/or internal deterioration) and fraying. Cause of any fraying should be corrected. Replace only damaged rope immediately. Otherwise, all hand lines should be replaced at the same time. Excessive stretch can be expected upon installation. This slack may need to be taken up one or more times after the installation period. To do so, secure the arbor to prevent travel, untie the bottom knot, draw out the slack and re-tie the knot. Remember to raise the floor block to its highest point of travel. Trim off the tail and tape it to the standing part of the line.

Rope Lock - Adjust regularly to compensate for decreased diameter of stretching rope. Always retighten lock nut on thumbscrew after adjusting.

Counterweight - Store in safe location. Maintain stock to balance all anticipated loads.

Curtains - Cleanliness: Always keep draperies as clean as possible to assure their longest possible life. Sweep, vacuum, and/or lightly beat dust and dry surface soil off at least annually. **Storage:** When not in use, make it a practice to fly your drapes. You can save your drapes from much wear simply by keeping them out of reach. **Rust:** Never use pins in a stage curtain. The flameproofing, being a chloride process, tends to attract moisture and will rust the pins. Rust will weaken the fabric and holes will develop. **Tears and Snags:** The nap of velour fabrics is not tightly locked into the mesh of the backing. When a tear or snag occurs the nap will loosen and fall out at that point. For that reason, it is wise to repair tears immediately. We recommend that serious repairs be made by a professional drapery studio. **Flameproofing:** Your stage drapery is treated with a chemical flame retardant. Do not allow stage lighting instruments to come into direct contact or shine directly on the curtain close to the instrument. Charred spots are extremely difficult and expensive to repair. **Removal, Packing, and Storing:** It is sometimes necessary to remove and store drapes. To do so, lower the batten, lock it off and unload the counterweight. Untie the curtain and lay it on its back fully spread out. Fold the curtain face-to-face, hem-to-crown. Repeat until you have a workable fold (three or four feet). Then fold each end to end to the center. Repeat these folds until you have a workable bundle. Store curtain in a dry place. To rehang, lay the bundle under the batten with the ties facing upstage. Open the bundle across the stage.

Note that the center of the heading is marked with a color blaze or cloth tag. Tie this point on the center mark of the batten, then tie successive ties from center to end, (the knot is a simple bow). Load the counterweight arbor with weight equal to the curtain and fly. **Spot Cleaning:** Should a curtain accidentally be spotted or soiled, clean as soon as possible. If left for any time, soil spots tend to set. Acetone, chlorethene, or prechlourethylene make excellent solvents for cleaning cotton drapes. Test for color fastness on a concealed portion of the curtain. Be very careful in cleaning water-based spots, (soft drinks, coffee, etc.). Attack the stain with a slightly damp cloth. Do not saturate the curtain. Immediately dry the spot area with dry cloths.

Fire Curtain - The fire curtain and associated rigging should be periodically inspected and maintained in accordance with the principles outlined for all other counterweight equipment.

General - Check operation off all counterweight sets frequently to determine if all lines are free of fouling or rubbing. All sheave bearings are packed on assembly with heavy duty lubricants, formulated to withstand the high temperature encountered in grid lofts. We do not make provision for relubrication, nor do we recommend that you attempt to relubricate.