Counterweight Rigging
Dana W. Taylor

Rigging Procedures

Bringing In (or Taking Out) a Batten

1. Make sure stage area is clear
2. Check hand lines below and above the arbor for excess tension
3. Make call "heads up on deck, _____coming in"
4. Wait for response "Thank you"
5. Open rope lock and bring set in.

Loading an Arbor (with a Loading Gallery)

1. Make sure stage area is clear below loading bridge
2. Clarify how much weight is to be added or removed "add 80 lbs. over pipe weight" 3. Loader: "Clear the rail, loading weight" Operator: "Rail is clear, load weight" Loader: "Finished loading, check for balance" Operator: "Checking balance. Thank you."

If you do not have a loading gallery:

1. Put a small amount of weight on the arbor- enough so the operator can safely raise the arbor to a height where the batten can be reached.

2. Add part of the load to the batten, overloading the batten slightly.

3. Lower the arbor so more weight can be added. This procedure is followed back and forth until both the arbor and the batten are fully loaded and balanced. The rail operator needs to be strong and in good physical condition for this work. (Glerum, *Stage Rigging Handbook*)

4. For unloading, the procedure is reversed. Do not remove all of the load or counterweight at one time. This could result in a runaway set. (Glerum, *Stage Rigging Handbook*)

What Things Weigh

1-1/2" Schedule 40 Pipe: 2.72 lbs./Ft
Source 4 PAR: 7.5 lbs.
Source 4 ERS: 14 lbs.
Selecon Rama Fresnel: 12 lbs.
Drapes: depends on the fabric, fullness and size. Ask your draper
1x4: .64 lbs./ft.
2x4: 1.28 lbs./ft.
Luaun: ¼" x 4' x 8': 17.5 lbs.

(wood and drapes are also influenced by the amount of moisture absorbed by the material)

Types of Loads

Point Load: A load exerting force at a single connection point (chain hoist, lights)

Uniformly Distributed Load: A load spread evenly across a pipe or truss (drops)

Static Load: A load that remains constant over time (a hanging scenic element)

Dynamic Load: A load that changes over time (aerial effects)

Shock Load: An instant load (run away)

Design Factors

Commonly called "safety factor" are the ratios of line capacity and what is being supported.

Static Load: 5:1

Running 8:1

Dynamic/Live Load 10:1

Termination Efficiency

Swaged Fittings 95-100%

Wire Rope Clips 80%

Clove Hitch: 75%

Bowline 60%

Design Factors/Termination Computation

All rope, wire or other material has an Ultimate Breaking Strength, which is the force that causes the material to fail. Once we determine what it will be used for, we need to apply the appropriate design factor and a termination efficiency percentage.

For example: 1/8" Galvanized Aircraft Cable (GAC) has an Ultimate Breaking Strength of 2000 lbs.

Using wire rope clips (with 80% efficiency) the derated ultimate load is 1600 lbs.

2000 x 0.8 = 1600 lbs.

Applying a 5:1 design factor (static load), gives us a Working Load Limit (WLL) of 320 lbs.

1600/5 = 320 lbs.

If it were to be a running load with a design factor of 8:1, it would give us a WLL of 200 lbs.

1600/8 = 200 lbs.

Rigging Inspections

ANSI E1.47 (Recommended Guidelines for Entertainment Rigging System Inspections)

According to the standard, rigging inspections are to be performed annually.

Inspections come in two forms:

Level 1 (performed annually) is a basic inspection looking at system components, functionality and looking for any obvious issues.

Level 2 (performed every five years) is a thorough inspection of all system components. If your rigging includes motorized components, they should receive a level 2 inspection annually. If you don't know the date of you last inspection, you should have a level 2.

<u>The inspector will not perform repairs</u>

Resources

Standards

ANSI E1.4 (2016) Entertainment Technology—
Manual Counterweight Rigging Systems
https://tsp.esta.org/tsp/index.html

ANSI E1.47 Entertainment Technology —
Recommended Guidelines for Entertainment Rigging System Inspections
https://tsp.esta.org/tsp/index.html

Books

The Stage Rigging Handbook (Third Edition)
Jay O. Glerum

The Theatre Riggers' Handbook (2016)
Delbert Hall and Brian Sickles

Safety Signage, Operations Manuals and Rigging Articles

http://www.jrclancy.com/operations-manuals.php

http://www.jrclancy.com/downloads/JRC_Cntrwt_Rigging.pdf

https://www.hhspecialties.com/Counterweight%20Rigging%20Manual.pdf

Documentation

Rigging Log Book: a record of all rigging issues, inspections, etc. Also, keep hard copies of all communication with administrators.

Student training with written documentation of proficiency. Typically both written and practical exams will be used.

Teacher training with written documentation of proficiency.

Training

Dana W. Taylor Consulting, LLC
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Glerum Master Classes
https://www.usitt.org/glerummasterclass