THEATRE ROYAL
WHAKATŪ NELSON

Theatre Royal Whakatū Nelson
Fly Operators Handbook

www.theatreroyalnelson.co.nz

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VenueTech

System & Overview

Our fly tower system provides us with incredible flexibility for rigging elements over stage. As backstage crew, we most regularly use this system for rigging our lighting bars masking (drapery). We can also use the fly rigging system for hanging suitably built set or scenic objects, backdrops, or other elements which can fly in or out as the show progresses, complimenting the stage design and re-enforcing scene changes or story-lines.

Our system consists of 44 line-sets.
42 run width-ways and 2 are panoramic bars that run up/downstage.
Each line-set is its own complete system. Each consists of a batten to hang the load on and a cradle to provide counterweight suspended over pulleys with steel ropes. This forms the primary load-bearing component of the system, which a closed loop of rope fixed to top and bottom of the cradle provide us with the means to raise and lower the cradle, and in doing so, the baten and object suspended off of it.

When weight (i.e. a 50kg Curtain) is hung off a batten, a corresponding weight (n this case, 50kg) is applied to the cradle. When perfectly balanced, a single operator can ascend or descend the load, no matter how great, with very little effort.

The theory behind this is relatively simple, though much like felling a tree, the practice can be extremely hazardous; hence persons operating the rigging systems must be duly trained and authorised by The Theatre Royal Nelson. The Theatre keeps a register of all persons who have attended our training courses and have been deemed competent by the trainer for future reference.

Fly Tower Specifications

Batten in-dead	1300 mm (top of batten)
Batten out-dead	10450 mm (top of batten)
Maximum drift	9150 mm
Stage floor to grid	10670 mm (underside)
Battens Dimensions	75 x 50 mm RHS
Batten length	10600 mm
Suspension wires	4x 6mm wire rope, 1600mm & 4800mm from the centre

Max distributed load per batten is 400 Kg
Max point load is 200 Kg

Fly-Tower Communication

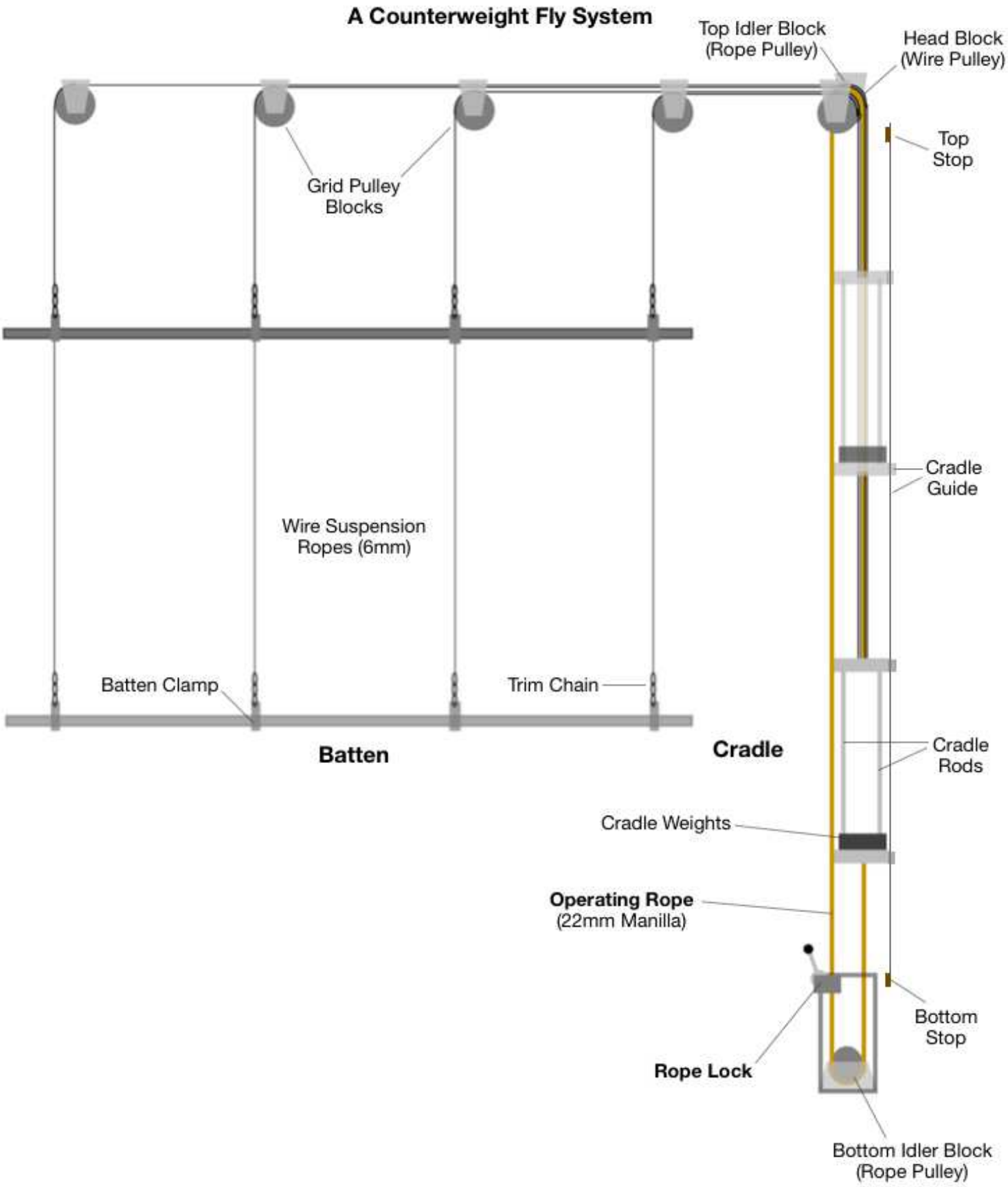
Clear communication when working with the fly rigging systems is vital to maintaining a safe working environment for all crew.

Moving Bars

If you hear any of the following calls : '*bar moving!', 'line-set coming in!',* or, '*heads up onstage!'*.

- Stop what you are doing and sight the moving bar
- Call 'OK' or 'Thank-you' so the fly operator knows you heard their warning.
- Inform others in the area if you believe they are not aware of the hazard.
- Get out of the way of incoming bars and prevent others from entering the space.

Any crew member may call for a fly bar to stop moving if they believe there is reason to do so.


A Counterweight Fly System
Top Idler Block
(Rope Pulley)
Head Block
(Wire Pulley)
Top
Stop
Grid Pulley
Blocks
Cradle
Guide
Wire Suspension
Ropes (6mm)
Batten Clamp
Trim Chain
Batten
Cradle
Cradle
Rods
Cradle Weights
Operating Rope
(22mm Manilla)
Bottom
Stop
Rope Lock
Bottom Idler Block
(Rope Pulley)

System Roles

Fly-Operator (Fly op)

A ticketed member of crew who has been identified as an operator for the season.
They may operate balanced lines. They may also be selected to work alongside the fly tower manager (venue staff or professional) during the rigging process.

Loader

One of the most responsible roles during rigging. The loader applies/removes weight on/from cradle at gallery orfly floor level, as instructed by the fly tower manager.
The risk of injury to the person loading/unloading and to the personnel below is very real, so the loader must be suitably trained, fit and responsible.

Fly HOD

The Fly HOD is the head of department for the production. After the fly tower manager has handed the balanced system over to the HOD, they then hold over-arching responsibility for the fly tower, the objects suspended from it, and all crew who operate the system during the season.

Fly HOD's responsibilties include:

- Actively communicating with the venue during preproduction.
- Creating a show specific hanging plot (Note: Consider lateral placement too!)
- Coordinating rigging needs - Whether sourced from the venue or elsewhere.
- Ensuring objects to be flown are completed on arrival the the venue, are sound in construction, have approrate rigging points installed, and are flame treated if applicable.
- During pack-in; work with the fly tower manager to lay out each object and it's relevant rigging for fixing to battens.
- To actively oversee the quality of work undertaken by fly crew, to the standard of the Theatre Royal

HOD's are identified and approved during preproduction planning. They enter into an agreement with The Theatre Royal and the producing company that they will hold responsibility for delivering the technical design, manage the system and its crew to the standards expected by the venue in the absence of a Venue Technician.

Fly Tower Manager

The Fly Tower Manager is the Venue Technician, but may also be a duly appointed professional. The Fly Tower Manager is responsible for overseeing the system during weight adaptations and signing off all items fixed to the system including:

- Lamps or other technical equipment.
- Hanging flown scenic elements, rigid or soft.
- Re-configuring masking.

Professional Rigger

A certified professional who is trained in advanced rigging techniques.
A professional rigger may be required for situations where complex, large loads, or humans are to be suspended. Individuals wishing to work in this domain should attend an Entertainment Technology NZ working at heights course to gain further understanding of this industry sector.

System Permissions

Being a ticketed operator does not grant an automatic right of use.
Respect needs to be shown the venue, system and the staff responsible for both.

Regardless of your role, *always ask your VT for permission* as to whether you may operate a line set. Once the system is balanced, the Fly HOD will be handed the system, and themselves may grant permission for other trained crew to operate balanced lines on their behalf.

System Guidelines

General

- Confirm the stage and area above is clear of moving battens before walking onstage.
- Never place any loose object, even momentarily onto any batten or cradle.
- Remove loose items and empty your pockets when accessing fly floor or gallery levels.
- Inform all crew if you are to access the grid. (See 'grid access' section)

Appraising the balance of a line-set

- Prior to the operation of any line-set, appraise the balance of the system by checking the relative tension of the front and rear operating ropes.
- When either is more taut than the other, there is an imbalance in the system.
- If the front operating rope is loose, the cradle is under-weighted.
- If the front rope is tight the cradle is overweighted.
- The rope lock must never be opened if either rope has a lot of tension on it.
- Twist the two ropes and slowly release the rope lock to identify the severity of imbalance.
- If the weight imbalance is unmanageable, i.e. the ropes start moving immediately, close the rope lock and notify the VTM or Fly HOD the line-set needs to be balanced.
- Out of weight-lines should be identified with an 'unbalanced line-set' tag and should be returned to balanced at first opportunity.

Rope Lock

- The rope lock is rated for an out of balance load of 100 kg, although it is strongly recommended that the system should not be out of balance by more than 60 kg.
- The rope lock should never be used as a break to slow the cradle - unless in emergency
- Using the rope lock as a break will cause premature wear of the operating rope.
- It is recommended that rope locks are left in the 'open' position when a line-set is not in use. Be sure the cradle is overweighted and rests positively on the bottom stop.
- Secondary rope locks are available for out of balance weights that needs to be managed.

Calling Moves

- All fly movements are to be called in a loud, clear voice to inform crew onstage and at various levels of the fly tower as to what line is moving and in which direction.
- Calls may differ from person to person, but should contain the following information:
    - A warning, prior to a move
    - The number line-set to be moved
    - Whether the movement is in (down) or out (up)
    - When an object enters the stage space call 'heads up!' and location i.e.US or DS
    - When bars are being 'floated' to confirm their balance.
- All onstage crew should verbally respond to all calls
  If not, repeat as many times as necessary to get their attention before affecting the move.

Operating a line

- Lines should only be moved when there is no risk of individuals being caught in the system.
- The operator should maintain a visual sight of the moving element, while also considering the position of the batten it hangs from.
- Items hung on battens must be secured and safetied before being lifted overhead.
- During rigging, all elements should be flown at a pace that allows them to be stopped quickly if required.
- If a show cue calls for a fast-paced move, rehearse with an empty stage and increase the speed in increments to gain a true understanding of how the object will react to the additional forces.
- Battens should hang still before being flown out.
- Have stage-hands assist by watching or paging back curtains etc to avoid collisions.
- When flying panorama bars, take extra care as they intersect with lighting looms, leg returns and cables dropped from the gallery.
- Cradles must never be allowed to slam into the top or bottom stop as this may cause deformation of the cradle and/or damage to the top/bottom hardwood stops.

Stopping a Move

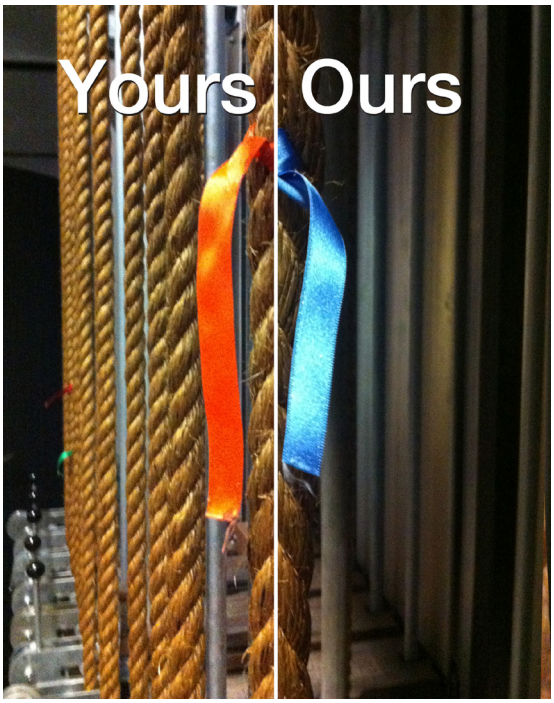
- A fly operator should respond to any crew member calling “Woah!” or “STOP” if they have ANY reason to believe it is not safe to continue the move.

Runaways

A runaway is a severe event and one which we work diligently to avoid at all costs. It is a line set that is traveling at speed and not able to be brought under control. In the case of a runaway set, the stop is designed to shear off, thereby taking some of the inertia out of the runaway line set. If this occurs, ensure the safety of all cast and crew, secure the line-set from additional movement, cease all activities in the area and inform the Venue Technical Manager immediately. This line-set will be taken out of commission and the systems manufacturer will be contacted so that the extent of damage may be ascertained. This will likely affect the ability for performances or rehearsals to continue.

Marking Positions / Dead’s

- The position of a batten can be marked on the operating rope with a coloured cloth ribbon fed between strands of the manila rope using a fid (riggers splicing tool).
- The ribbon can be moved up or down and tied in-place when required dead is achieved
- Several dead’s may be marked using different coloured ribbons.
- Do not use tapes as the sticky residue on the rope promotes wear.



House Deads

- To aid venue resets, we have a system of house and user dead’s.
- House dead’s are blue and mark the positions of our standard configuration.
- Users may mark their own dead’s in any colour they wish. We supply a range of ribbons and ask that our blue dead remain in place where possible and noted if not.

Battens

- Suspension battens are 75×50×3.0mm RHS steel section,10.6 m, butt welded at centre.
- Battens are marked at 0.5 m intervals from centre on the upstage face.
- Batten line-set numbers are indicated on both offstage edges.
- Battens are rated for a point load of 200 kg anywhere along its length, a point load of 400 kg directly underneath a suspension wire and a max distributed load of 400 kg.

Rigging to Battens

- All rigging equipment used must undergo an annual load certification process.
- The Theatre Royal can provide certificates of load test results on request.
- The Theatre Royal has a variety of rated rigging including batten and pipe clamps, chain, suspension wires, bow shackles, turnbuckles and soft slings.
- We recommend Hampidjan and Nelrig as a reliable local source of rigging equipment or custom wire fabrication.
- All flown objects must be fixed to the rigging system with bolts. Screws, nails or other items subject to wear or working loose are not acceptable.
- Limited batten clamps are provided.
- Under no circumstances can a wire rope be wrapped around a batten to attach a load.
- Wires should never be bent beyond their specifed bend radius.
- Deformation of a wire renders its load capacity void.
- If an item weighing more than 400 kg is to be flown (such as a heavily loaded lighting bar or structural scene wall) this may be done by connecting two line sets together.
  Please discuss this requirement with the Venue Technical Manager.
- All rigid items must be suspended from the rigging system with rated steel components.
- Synthetic string or ropes must never be used to suspend rigid loads.
- When the risk of ignition is present (i.e naked flame, pyrotechnics or close proximity lighting elements) soft slings must be backed up with a wire rope safety strop.
- All components, including wire rope (and terminations), shackles, chains and turnbuckles must be suitably rated items.
- Turnbuckles and shackles should be moused (safetied with cable ties) once rigging is complete.
- Both the in & out height of the rigged object plus the wire length and visibility of the batten must be considered when planning to fly objects.
- Objects flown in to the floor, and out to disappear must be 5m in total height, from batten to base.
- Use the correct wire rope drifts for the load to be suspended
  Weight limits or Safe Working Loads (WL or SWL) listed at a Safety Factor (SF) 5 : 1
  - 3 mm 100 kg
  - 4 mm 180 kg
  - 5 mm 300 kg
  - 6 mm 400 kg

Counterweights & Loading

Items are rigged to battens at stage level. This places the cradle at the top of its track, so the relative counterweight is loaded from the upper fly-floor. Occasionally, additional weight adjustments may take place from the gallery or on-stage levels.

- Two sizes of counterweights have been supplied 15 kg 'Bricks' and 5 kg 'trim weights'.
- Two white painted bricks on each cradle are batten weights, to balance the empty batten.
- Batten weights should never be removed (unless temporarily while trapping trims)
- The 15 kg weights are used to approximately balance the load on suspension batten.
- Trim weights are for exact balance as required.
- If more than 2 trim weights are required, remove, and replace with a single 15.
- Trim weights should only be used towards the top of the counterweights in the cradle and must always be placed under a 15kg brick (trapped). This prevents a trim 'leaping' if the cradle hits the top stop - either as a simple accident, or in the severe event of a runaway.
- Weights should only be loaded/unloaded when instructed by the one person in charge of the rigging system (Fly Tower Manager).
- Loading/unloading weights is one of the most responsible jobs on stage.
- When handling the weights during loading, be very careful not to be in a position where a weight could be dropped by rushing or being off balance.
- Always take your time
- Both hands should maintain a firm grip of the weight throughout loading/unloading.
- Let the weight clunk when releasing into the cradle or stack. This allows the Fly Tower Manager to audibly register the rate of loading and instruct the stage crew to pace their batten un/loading appropriately.
- The Fly Tower Manager and loader may question the qty of weight to be/being shifted.
- At the time of loading weights, there should be no person directly below the cradle.
- All persons on stage must be made aware that loading progress so in the case of a weight being dropped, personnel know where to evacuate to.
- A dropped weight can hit any item on the way down, which may change its direction. This possibility should be discussed prior, allowing personnel to move away from immediate danger.

Storing Weights

- When stacking the weights on the loading galleries the height of each stack must not exceed the height of the kick rail and should not exceed the height of the wooden paneling
- Weight must be stacked in a uniform manner as not to risk the chance of toppling.
- Trim weights should be kept together at various points along the floor.

Balancing Pointers

- If the cradle is hard up against the top stop and/or the front operating rope is loose, the cradle is under-weighted.
- If the front rope is tight and the cradle has moved down from the top stop the cradle is overweighted.

Accessing the Grid

If a member of crew is to access the grid to carry out work, the following methodology applies.

- All crew on site must be informed the grid is being accessed
- Identify the practice on the H&S board
- The stage area below must be made out-of bounds.
- Install the OP wing barrier and signage at the US scene dock and US prompt doors.
- Any crew providing ground assistance must wear a hard-hat and maintain verbal contact.
- All tools taken onto the grid must be secured via lanyard.
- All rigging equipment must be contained (i.e. in a bucket)
- Use of loose items must be verbally called from the grid. i.e. 'working with loose objects!'

Working with an LX crew.

The way in which the lighting crew approach the rigging process will depend on the state of the lighting system upon arrival. It will be one of the following:

Strip and re-rig

This gives you a clean slate to work from and is the best option when what your given, looks nothing like what you want.

- Reset lamps on the bar and have their safeties and hook clamps loosened.
- The fly-tower manager will instruct the loader to remove the relevant weight, and the LX crew to remove lamps until each bar is empty.
- Lay out lights on the floor below each bar with placement as indicated in the design.
- The fly-tower manager will call for the fixtures to rough hung on the bar, and then weights on the cradle added to achieve a balance.
- The bar can then be raised to a comfortable working height while lamps are secured and patched etc.

Option B: Shuffle & Substitute

This is the best option when the rig is there or thereabouts.
Circumstantially, this option can be quicker in appearance than fact.

- Shuffle fixtures on the same bar to match their intended positions in the design.
- Swap-out fixtures for those required while maintaining the same weight on the bar.
- Make one final adjustment of weight and fixtures.

Clear Communication

Clear communication between crew working with the fly rigging system is critical its safe operation. Particularly at times of loading this will require a quiet working environment

Loading Example

What follows is an example of a safe and well-communicated work flow when making weight changes to a line-set. Every instruction should be responded to with a repeat of instruction to confirm the message was received correctly

Fly Manager	>>	Loader	" 3x 15's (kg) onto line-set 14"
Loader	>>	Fly Manager	" Three 15's onto line 14"
Fly Manager	>>	Loader	"Yes Please"
Loader	>>	ALL	"Loading on line set 14!"
Loading Occurs	3x clunks are audible		
Loader	>>	Fly Manager	"3x 15's are on 14"
Fly Manager	>>	Loader	"Thank-you, I'll float that"
Checks Balance			
Fly Manager	>>	Loader	"That's good, Thank-you"

Flown Object Weights

House Masking

Older leg sets without returns (Legs 1)	10kg
Older Leg Sets with Returns (Legs 2-4)	15 kg
New Wool-surge Legs (Legs5)	20 kg
Borders	5 kg
Tabs	30 kg
Tab Track	45 kg
House Rag	60 kg

House Screens

Cinema w/ Tail Batten	40 kg
Cyc w/ Tail Batten	55 kg

House Rigging

Electric Sets + Weilands	60 kg
Ladder + 6way Loom	12 kg

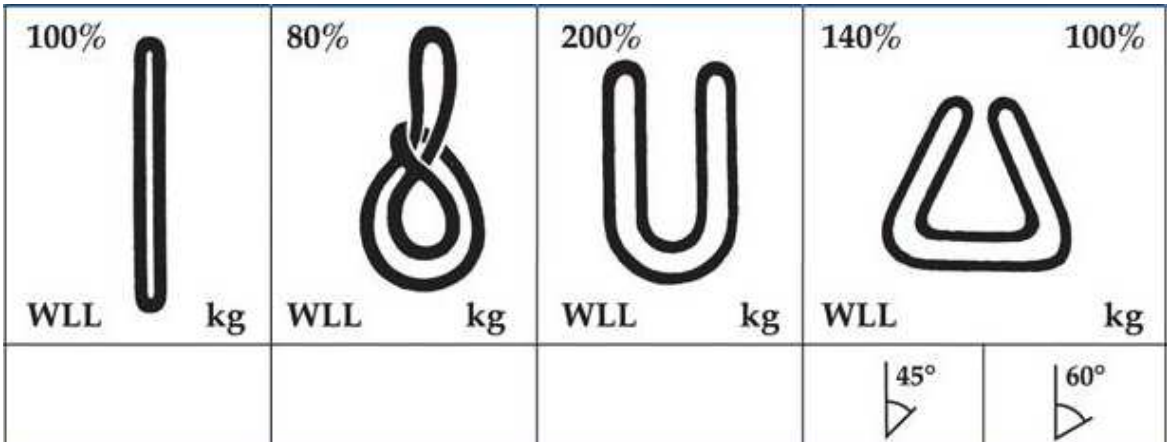
House Fixtures w/ accessories

Par 64	3.5 kg
LED QUAD	7 kg
Rama 1200 Fresnel	7.3 kg
Rama 1200 PC	8.6 kg
Acclaim 650 PC	4.3 kg
Pacific 14/35	10.5 kg
Pacific 23/50	9.2 kg
Lui 4 Bay Cyc	14.2 kg

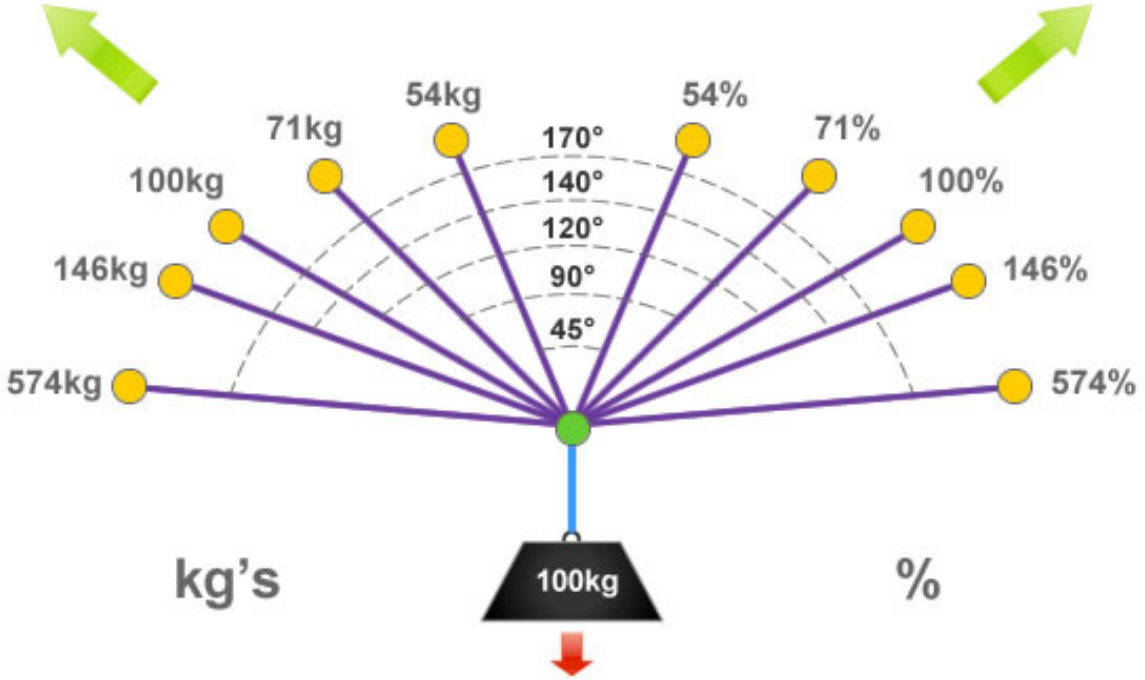
Other Local Fixtures

NSOM 2k Fresnel	7.3 kg
Old 1200 PC	7.9 kg
Old 1k Fres	6.2 kg
Single Cyc	2.8 kg
Lui 3 Bay Cyc	11.2 kg

How sling rigging techniques affect the rated load capacity



How rigging angles affect the load generated



Theatre Royal Nelson - Standard House Hanging Plot

Setting line is upstage edge of proscenium arch.
Heights are house standard trims to the underside of the flown object.

Line	mm to setine	Item	Trim Height	Weight	Notes
1	100	House Curtain	4.3m	Bat + 60kg	Red Velvet, overlapped split, 5.5m Drop
2	280	Black Legs #1	6m	Bat + 5kg	
3	460				
4	640	**LX 1**	5.3m	Bat + 125 kg	20 Pre-Wired Circuits
5	820				
6	1000				
7	1180				
8	1360				
9	1540	Black Border # 1	4.5m	Bat + 5kg	6m Drop
10	1720	Black Legs # 2	6m	Bat + 15kg	3m Drop
11	1900				
12	2080				
13	2260	**LX 2**	5.3m	Bat + 125 kg	20 Pre-Wired Circuits
14	2440				
15	2620				
16	2800				
17	2980				
18	3160				
19	3340				
20	3520	Black Border # 2	4.6m	Bat + 5kg	6m Drop
21	3700	Black Legs # 3	6m	Bat + 15kg	3m Drop
22	3880				
- STRUCTURAL BEAM -					
23	4290	**LX 3**	5.3m	Bat + 140 kg	20 Pre-Wired Circuits
24	4470				
25	4650				
26	4830	Tab Rail		Rail 45, Tabs 30	Tabs 6m Drop, rail centre opening
27	5010				
28	5190				
29	5370	Black Border # 3	4.7m	Bat + 5kg	6m Drop
30	5550	Black Legs # 4	6m	Bat + 15kg	3m Drop
31	5730				
32	5910	**LX 4**	5.5	Bat + 160 kg	20 Pre-Wired Circuits
33	6090				
34	6270				
35	6450				
36	6630				
37	6810				
38	6990				
39	7170	Black Border # 4	5m	Bat + 5kg	6m Drop
40	7350	Black Legs # 5	6m	Bat + 20kg	3m Drop
OP pan		3 x LX Ladders		Bat + 80kg	Ladders in wing bays 1, 2 & 3
42	7710	Cinema Screen	5m	Bat + 40kg	5.2m High, White, Front Proj (90%Gain)
PS pan		3 x LX Ladders PS		Bat + 80kg	Ladders in wing bays 1, 2 & 3
44	8070	Cyc	5.5 m	Bat + 55kg	5.5m High, Black Fr/Rr Proj (50% Gain)

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