Addendum to XLC Touring Rigging Manual

Includes the following XLC Loudspeaker Models and Rigging Accessories -

- XLC127 (updated structural model only)
- XLC127+ (updated structural model only)
- XLC118 (updated structural model only)
- XLC127DVX (new loudspeaker system)
- XLC907DVX (new loudspeaker system)
- A1 Grid (updated rigging accessory)
- B1 Grid (new rigging accessory)
- XLC-EB Extender Beam (new rigging accessory)

October 2009

Live For Sound
www.electrovoice.com

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0. Introduction

Purpose of this Addendum

This document is an addendum to the XLC Rigging Manual and describes several additional loudspeaker system models and several rigging accessories for use with the XLC loudspeaker systems. In addition, some updated information is presented for some items.

This addendum only provides additional information not found in the XLC Rigging Manual. Thus, the user must consult the XLC Rigging Manual for all details concerning the structural ratings of the XLC loudspeakers and for general rigging instructions to safely suspend an XLC loudspeaker system overhead.

Unless otherwise noted in the text in this addendum, all references to figures are for those contained in this addendum. When figures are referenced from the XLC Rigging Manual, they are specifically referenced as such.

New Loudspeaker Models

Several new loudspeaker models have been added to the XLC product line and are shown in Figures 1 and 2.

XLC127DVX: Three-way, LF/MB/HF loudspeaker system with a 120°H x 7.0°V coverage pattern. The system includes one DVX3121 12-inch (305-mm) LF driver, two DN2065 6.5-inch (165-mm) MB drivers and two ND6-16 3-inch (76-mm) HF drivers. An optional passive crossover may be purchased from Electro-Voice that allows either biamp or triamp operation. The XLC127DVX utilizes the same 8° trapezoidal enclosure as the XLC127, XLC127+ and XLC907DVX, and has the same standard XLC 8° rigging frame secured to the left and right enclosure sides.

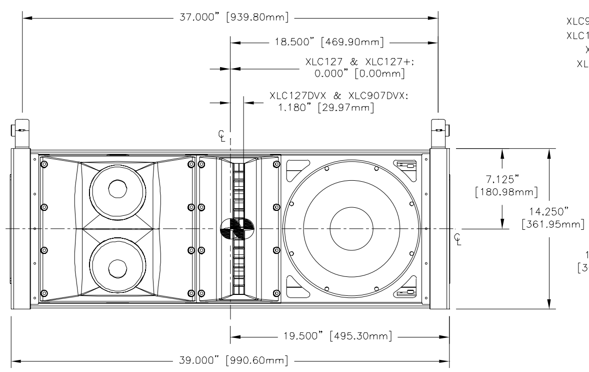
XLC907DVX: Three-way, LF/MB/HF loudspeaker system with a 90°H x 7.0°V coverage pattern. The system includes one DVX3121 12-inch (305-mm) LF driver, two DN2065 6.5-inch (165-mm) MB drivers and two ND6-16 3-inch (76-mm) HF drivers. An optional passive crossover may be purchased from Electro-Voice that allows either biamp or triamp operation. The XLC127DVX utilizes the same 8° trapezoidal enclosure as the XLC127, XLC127+ and XLC127DVX, and has the same standard XLC 8° rigging frame secured to the left and right enclosure sides.

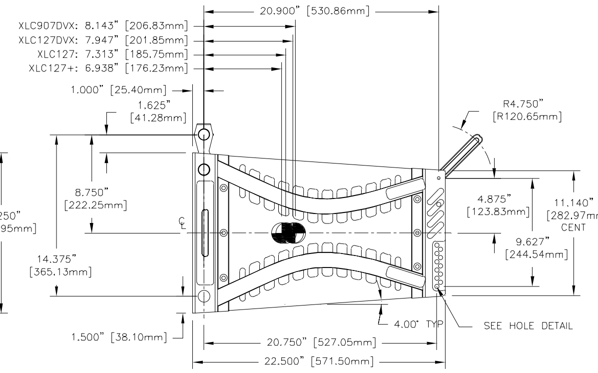
XLC215: Subwoofer loudspeaker system with two DVX3150 15-inch (380-mm) woofer. The XLC215 utilizes the same 12° trapezoidal enclosure as the XLC118 and has the standard XLC 12° rigging frame secured to the left and right enclosure sides.

Several new XLC loudspeakers have been added to the product line since the original printing of the XLC Rigging manual, as well as several new rigging accessories have been added. This addendum presents those new items.

0. Introduction

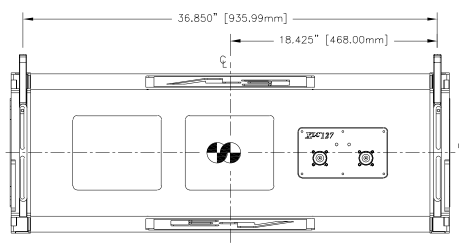
Front View

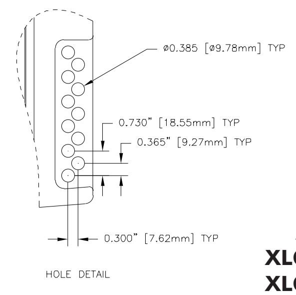




Side View

Rear View

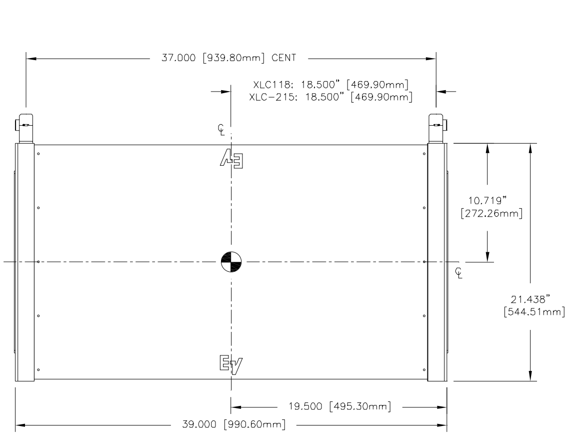


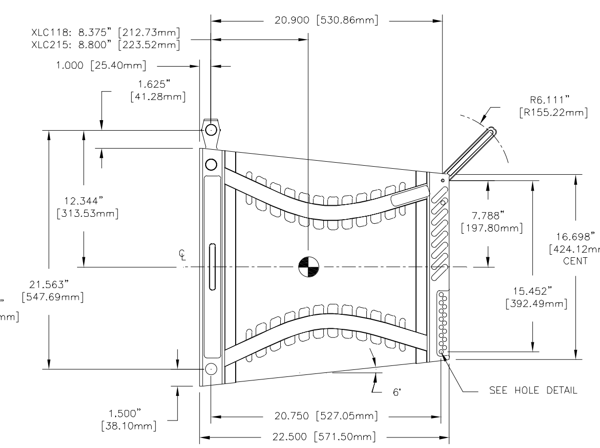


System Weights -
XLC127: 116 lb (52.6 kg)
XLC127+: 111 lb (50.3 kg)
XLC127DVX: 114 lb (51.7 kg)
XLC907DVX: 114 lb (51.7 kg)

Figure 1:
XLC127, XLC127+, XLC127DVX and XLC907DVX dimensions and weights

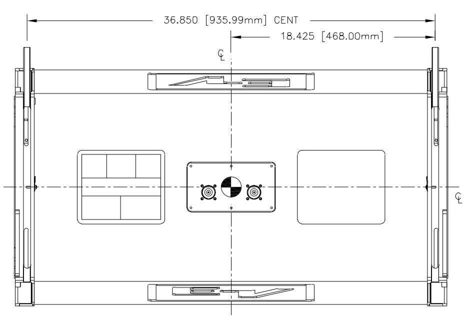
Front View

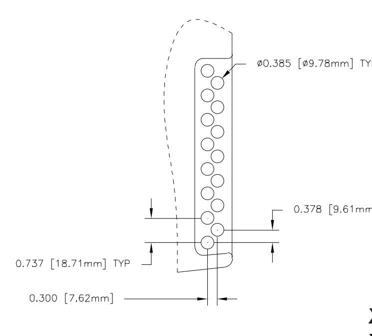




Side View

Rear View





System Weights -
XLC118: 120 lb (54.4 kg)
XLC215: 140 lb (63.5 kg)

Figure 2:
XLC118 and XLC215 dimensions and weights

1. XLC Rigging System

1.1 XLC Enclosure Rigging Hardware Details

The XLC127DVX, XLC907DVX and XLC215 loudspeaker systems have been added to the product line. These share the same enclosure shells and rigging as existing models. Consult the XLC Rigging Manual for rigging hardware details, rigging attachment details and flying techniques.

All enclosure, rigging hardware dimensions and centers of gravity are shown in Figure 1 for the XLC127, XLC127+, XLC127DVX and XLC907DVX loudspeaker systems, and in Figure 2 for the XLC118 and XLC215 systems.

1.2 XLC Rigging Accessory Details

XLC A1 and B1 Grids

The XLC B1 grids are used for suspending a column of XLC full-range or subwoofer loudspeaker systems overhead and is shown in Figure 3a. The grid consists of two sidearm assemblies and two spreader bar assemblies. The front of the sidearm has a rectangular tube identical to that on the loudspeaker systems. The hinge bar from the top loudspeaker system is inserted into the grid tube and pinned into place using the same quick-release pins from the loudspeaker. The rear of the sidearm has channel with a vertical slot that is similar to that on the loudspeaker systems. The swing arm from the top loudspeaker system is inserted into the grid tube and pinned into place using the same quick-release pins from the loudspeaker.

The grid sidearms are then attached to either one or two spreader bars. Two spreader bars are used when two front-to-back pickup points are required. One spreader bar is used when two side-to-side pickup points are required or one center pickup point is required.

Quick-release pins are used to secure the sidearms to the spreader bar. The width of the assembly matches the width of all of the XLC full-range and subwoofer loudspeaker enclosure rigging.

The older A1 grid, shown in Figure 3b, was replaced by the newer B1 grid. The A1 grids only have one middle hole in the spreader bar, while the B1 grid has three holes. The B1 grid is compatible with all XLC loudspeaker systems, while the A1 is not compatible in some configurations with the XLC-DVX loudspeaker systems.

XLC-EB Extender Beam

The XLC-EB, shown in Figure 3c, is an extender beam that may be used with the XLC grids to hang a single column of XLC loudspeakers overhead. The extender beam enables greater tilt angles than can be achieved by the grid alone. Two yoke assemblies on the XLC-EB are used to attach to the front and back spreader bars of the XLC grid using quick-release pins. The extender beam may be oriented so it sticks out behind the grid for a greater downward tilt or in front of the grid for a greater upward tilt.

When a single pick point is used, the tilt of the array is determined by the selection of the attachment position of a single pickup ring along a series of holes in the extender beam.

When two pickup points are used, one pickup ring is attached to the front of the extender beam and one pickup ring is attached at the back. The tilt angle of the array is then adjusted by raising or lowering the pickup points.

The XLC-EB extender beam is compatible with the older A1 grid and the newer B1 grid.

1. XLC Rigging System

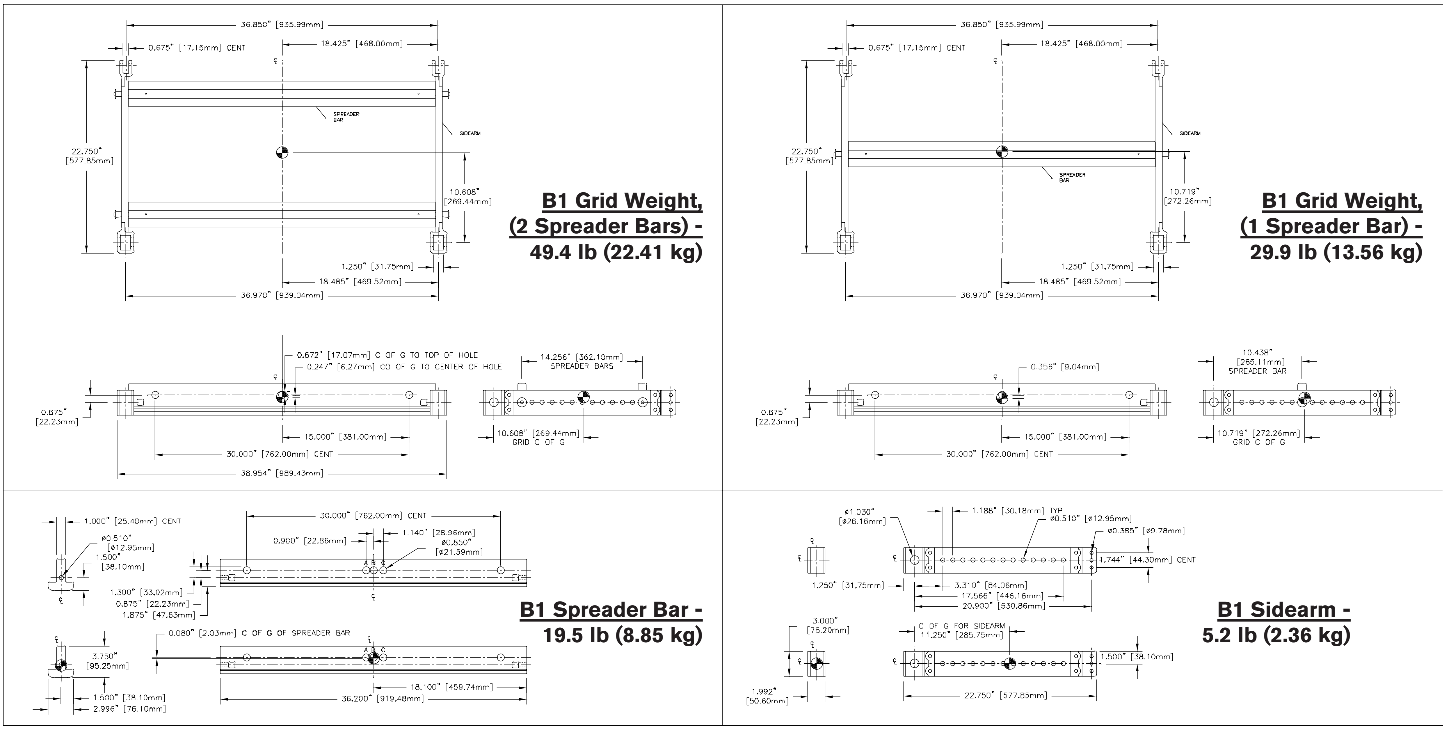


Figure 3a:

XLC B1 Grid rigging dimensions and weight

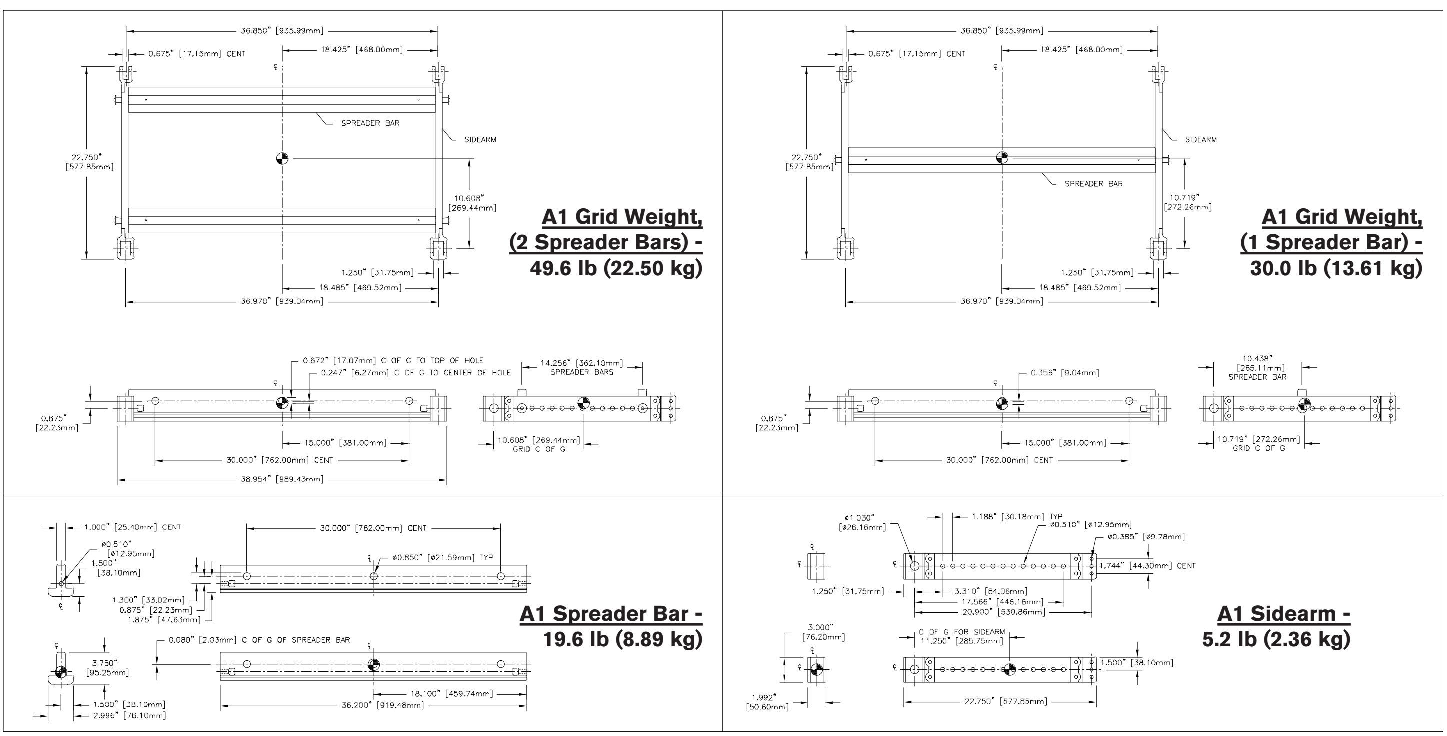
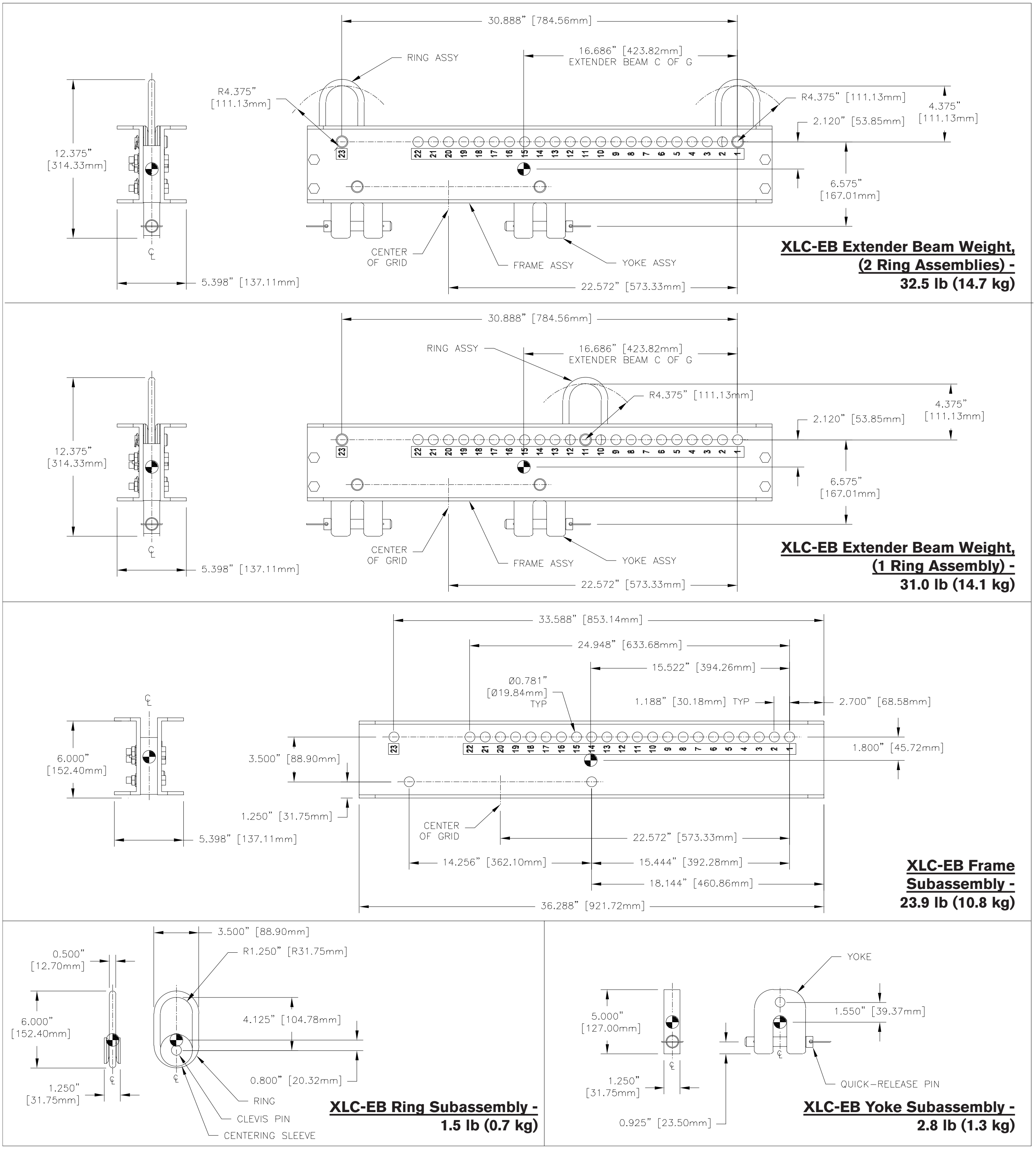


Figure 3b:

XLC A1 Grid rigging dimensions and weight



XLC-EB Extender Beam Weight, (2 Ring Assemblies) - 32.5 lb (14.7 kg)

XLC-EB Extender Beam Weight, (1 Ring Assembly) - 31.0 lb (14.1 kg)

XLC-EB Frame Subassembly - 23.9 lb (10.8 kg)

XLC-EB Ring Subassembly - 1.5 lb (0.7 kg)

XLC-EB Yoke Subassembly - 2.8 lb (1.3 kg)

Figure 3c:

XLC-EB rigging dimensions and weight

2. Rigging and Flying Techniques

2.1 Rigging the XLC Loudspeaker Systems and XLC Grids

Attach the top enclosure in the array to the grid, as shown in Figure 4a. (Only an XLC compatible grid can be used with an XLC array.) The grid has front rigging tubes similar to the enclosures. Slide the front hinge bar of the top enclosure into the front tube of the grid using the same technique that was used to link two enclosures.

⚠ ALWAYS MAKE SURE THAT THE QUICK-RELEASE BUTTONS ON THE HINGE BARS FULLY LOCK INTO THE ROUND HOLES IN THE FRONT RIGGING TUBES ON BOTH THE ENCLOSURE AND THE GRID.

The grid also has a rear rigging channel similar to the enclosures, except that the grid only has three attachment holes available. Unlock the rear swing arm from the top enclosure by removing the quick-release pin from the rear rigging channel on the enclosure. Pivot the rear swing arm on the enclosure up into the rear rigging channel on the grid. Insert the quick-release pin from the grid through one of the three holes in the rear rigging channel on the grid (top hole is 0°, middle hole is 2° up, and bottom hole is 4° up) and through the hole in the swing arm. Repeat the process for the other side of the enclosure and grid.

⚠ ALWAYS MAKE SURE THAT THE LEFT AND RIGHT SWING ARMS ON THE ENCLOSURE ARE LOCKED INTO THE SAME HOLES FOR THE SAME VERTICAL SPLAY ANGLE ON THE GRID.

⚠ ALWAYS MAKE SURE THAT THE QUICK-RELEASE PINS FOR EVERY SWING ARM PASS THROUGH THE HOLE IN THE SWING ARM AND ARE FULLY LOCKED IN THE RIGGING CHANNELS IN THE GRID.

The grid sidearms are attached to either one or two spreader bars.

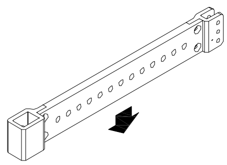
When two spreader bars are used, one is attached to the sidearms at the (one at the front and one at the rear), the spreader bars are attached to the front and rear of the sidearms and two hoist motors are used to lift the array. In this case, the hoist motors are used to adjust the vertical angle of the entire column of loudspeakers. When one spreader bar is used, the vertical angle of the entire column of loudspeakers is determined by the front-to-back position at which the spreader bar is attached to the sidearms. There are a series of holes in the sidearms the user may select to adjust the vertical array angle.

Large quick-release pins that are tethered to the spreader bars are used to secure the side arms to the spreader bars.

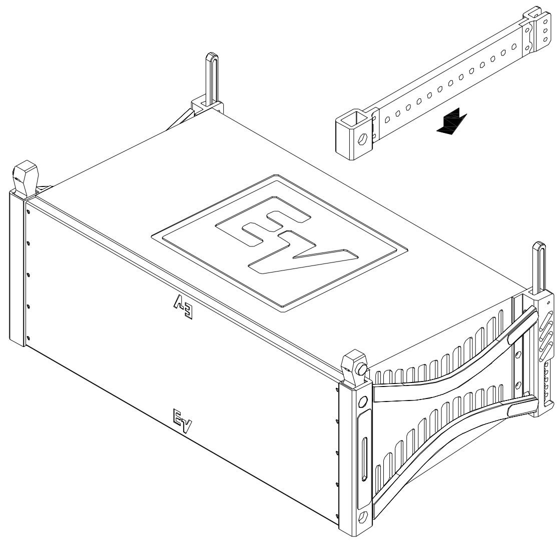
⚠ MAKE SURE THAT THE QUICK-RELEASE PINS ATTACHED TO THE GRID SIDEARMS FULLY LOCK INTO THE HOLES IN THE ENDS OF THE SPREADER BARS. ALWAYS MAKE SURE THAT EACH SPREADER BAR IS ATTACHED TO THE SAME HOLE ON THE LEFT AND RIGHT SIDEARMS.

The center of gravity of all current subwoofer systems (XLC118 and XLC215) and all older full-range loudspeaker systems (XLC127 and XLC127+) is centered left to right. The older XLC A1 grids had one hole in the center of the spreader bar when using a center pick point on the grid.

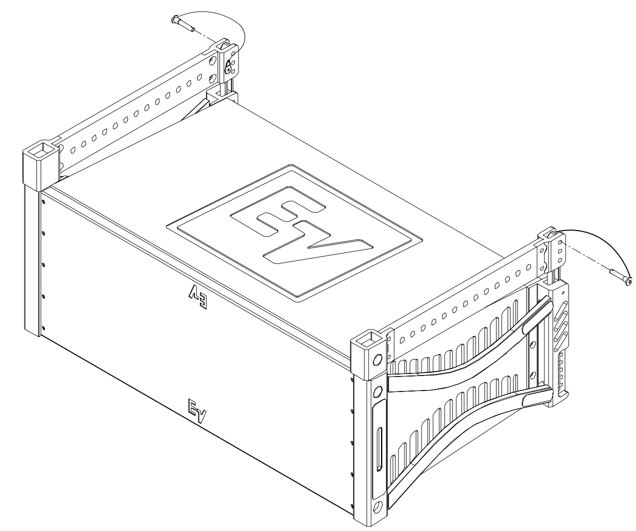
2. Rigging and Flying Techniques



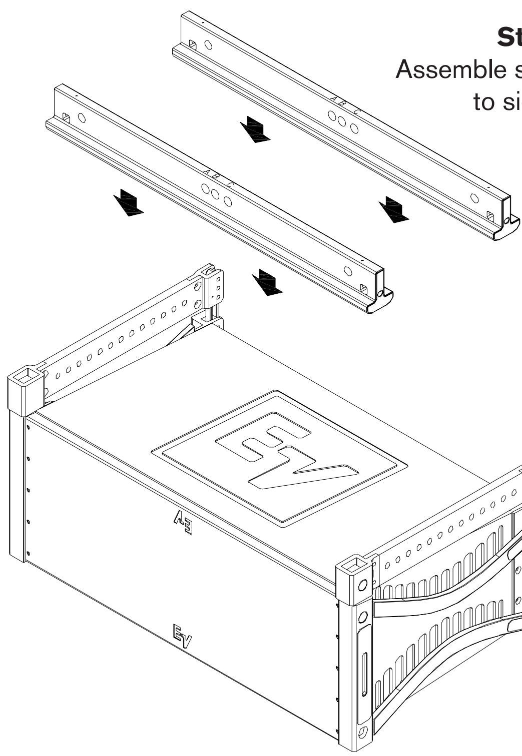
Step 1:
Assemble sidearms to rigging at top of the enclosure. Ensure front hinge-bar button fully engages into front tube of sidearm and rotate rear swing arm into rear channel of sidearm.



Step 2:
Insert quick-release pins through swing arm and sidearm holes. Ensure quick-release pins are fully engaged and locked into position.



Step 3:
Assemble spreader bar(s) to sidearms.



Step 4:
Insert quick-release pins through sidearms and spreader bar(s) using the hole locations from LAPS.

See Figures 4b - 4g for fully assembled configurations.

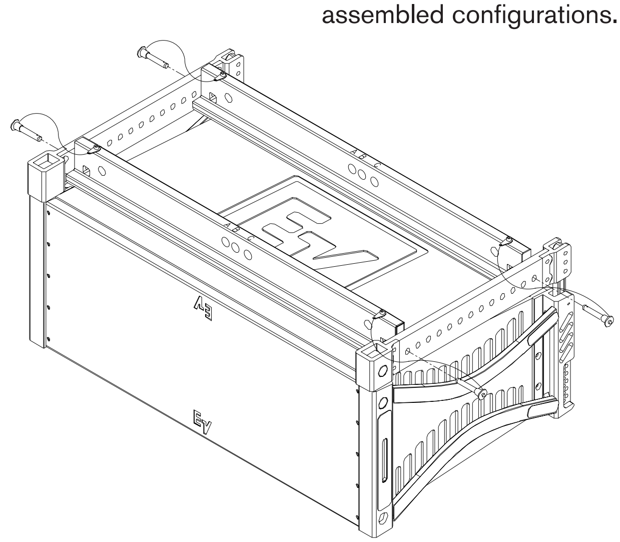


Figure 4a:
Grid rigging assembly

However, the center of gravity of the newer DVX full-range versions (XLC127DVX and XLC907DVX) is shifted off center towards the low-frequency side. The B1 grids were developed specifically to accommodate the different centers of gravity by having three holes in the spreader bars labeled A, B and C. Configurations for rigging the various XLC loudspeaker systems are shown in Figure 4b.

When the left and right pick points on the spreader bars are used on the B1 grid, the center of gravity of the enclosures is not a concern, and any of the XLC loudspeaker systems may be suspended as shown in figure 4b.

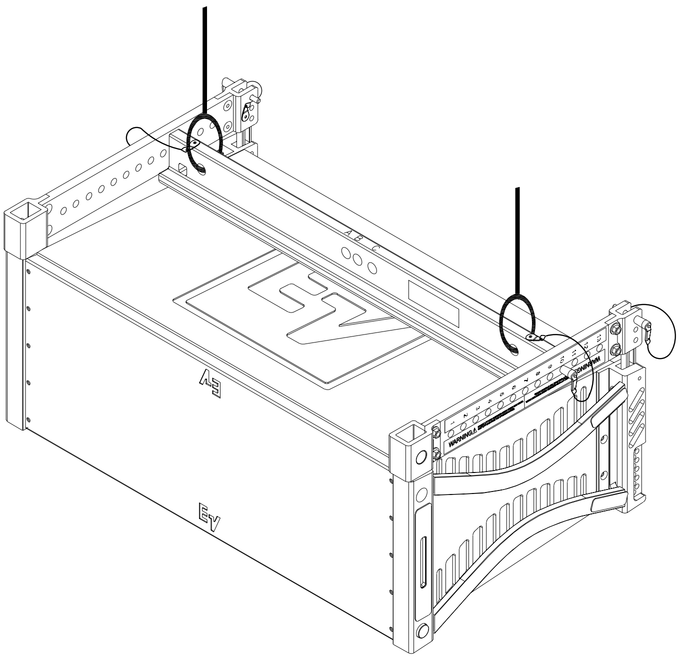
The center of gravity of the enclosures is only a concern when using a single pick point on the spreader bar(s). When lifting XLC127, XLC127+, XLC118 or XLC215 loudspeaker systems, use the middle hole labeled “B” as shown in Figure 4c. When lifting XLC127DVX or XLC907DVX loudspeaker systems, use the hole labeled “C” as shown in Figure 4d. When lifting XLC127DVX or XLC907DVX loudspeaker systems, use the hole labeled “A”. When XLC127DVX or XLC907DVX systems are mixed in the same column with XLC118 or XLC215 systems, use the hole labeled “C” as shown in Figure 4e.

The older A1 grids only had one hole that was equivalent to the hole labeled “B” on the B1 grid This means that the A1 grids are not compatible with the XLC127DVX and XLC907DVX loudspeaker systems in some configurations.

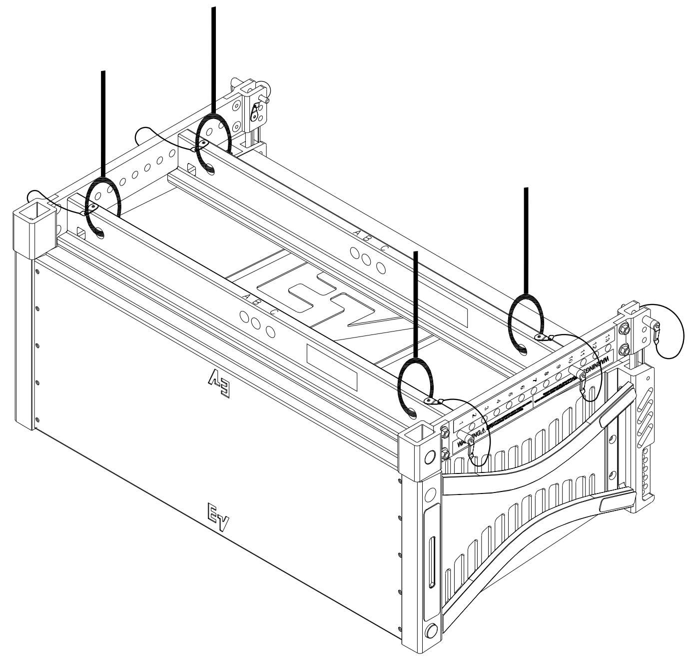
When the left and right pick points on the spreader bars are used on the A1 grid, the center of gravity of the enclosures is not a concern, and any of the XLC loudspeaker systems may be suspended as shown in figure 4f.

The center of gravity of the enclosures is only a concern when using a single pick point on the spreader bar(s). The A1 grid may be used for lifting XLC127, XLC127+, XLC118 or XLC215 loudspeaker systems, as shown in Figure 4g. However, the A1 grid is not compatible with the XLC127DVXand XLC907DVX loudspeaker systems when using a single pick point on the spreader bar(s)

The A1 grids may be modified to become B1 grids. Consult the Electro-Voice service department for details.

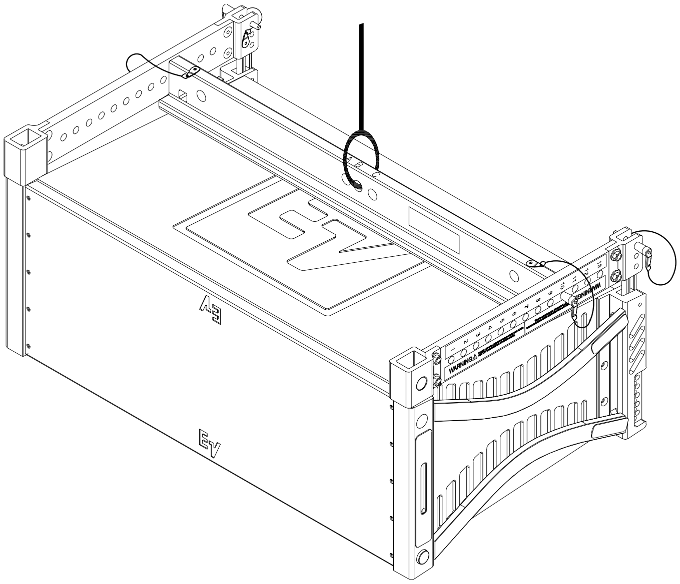


Single Bar/Dual Pull = Use Outer Holes

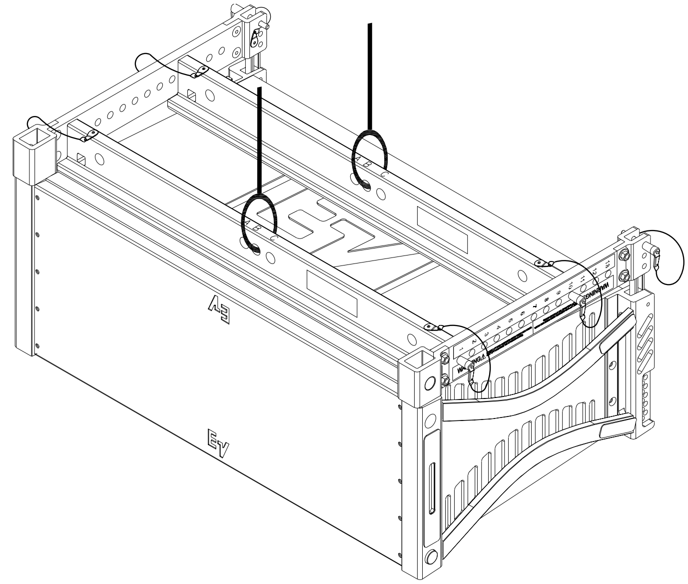


Dual Bar/Dual Pull = Use Outer Holes

Figure 4b:
XLC B1 Grid configurations for any XLC Array



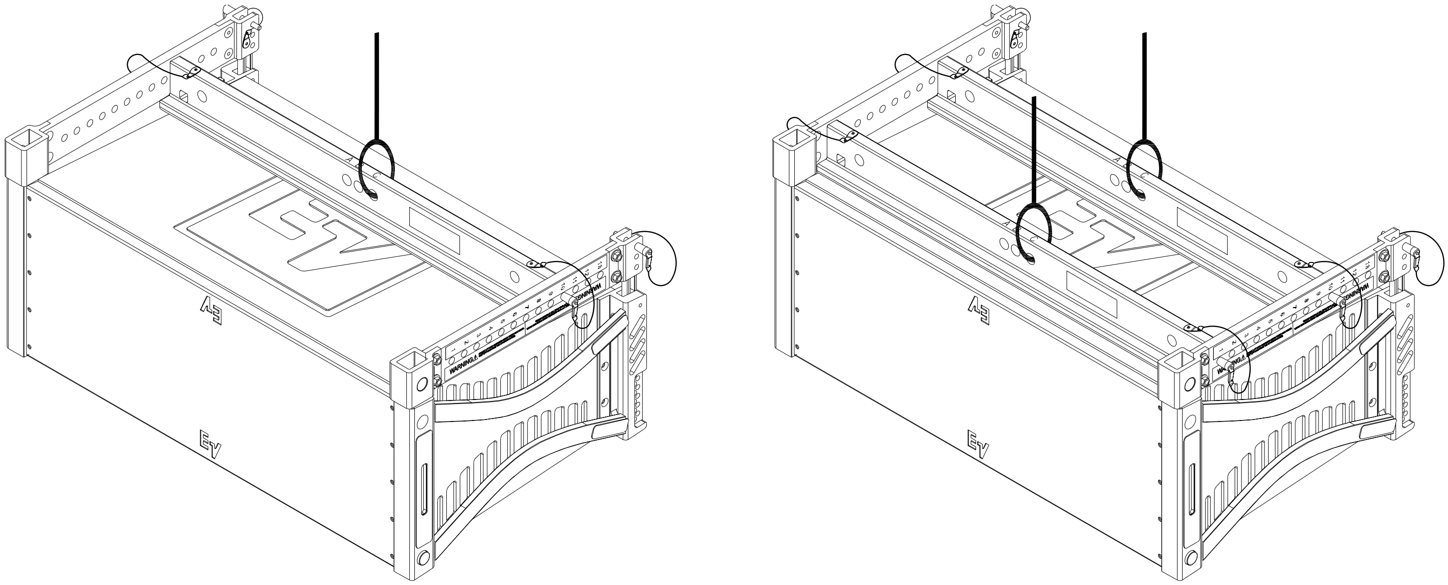
Single Bar/Single Pull = Use Hole "B"



Dual Bar/Single Pull = Use Hole "B"

Figure 4c:
XLC B1 Grid configurations for XLC127, XLC127+, XLC118 or XLC215 Arrays

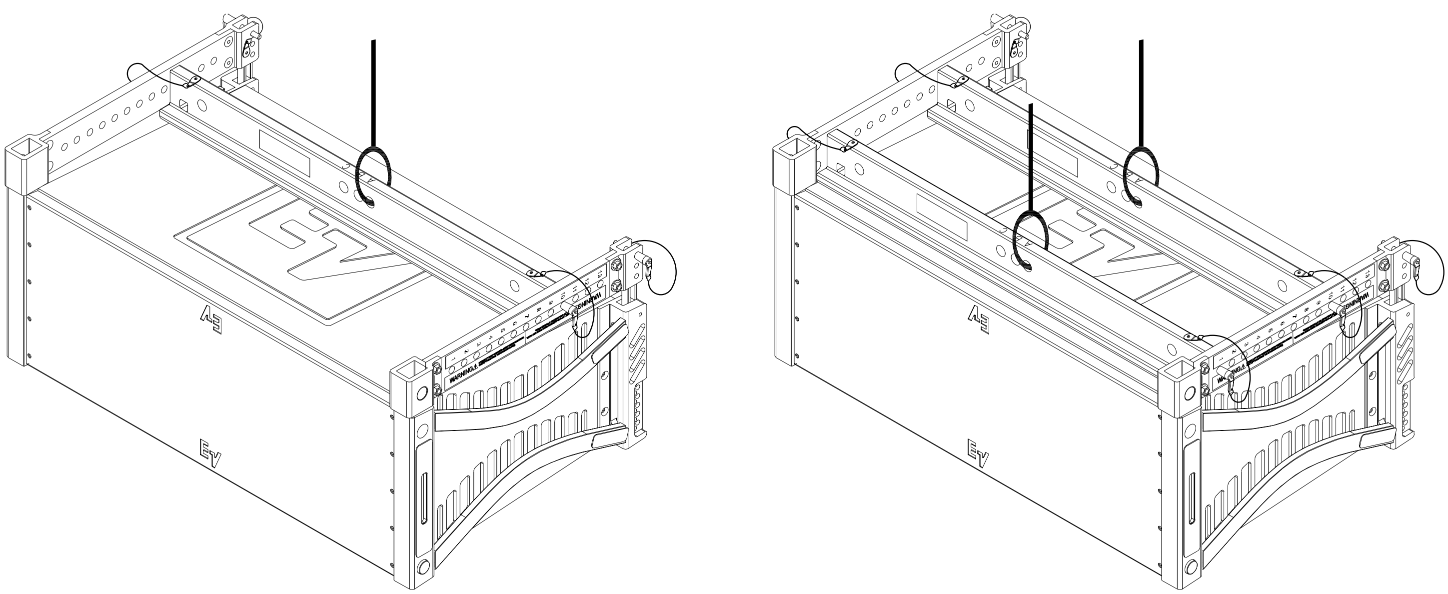
2. Rigging and Flying Techniques



Single Bar/Dual Pull = Use Hole "C"

Dual Bar/Dual Pull = Use Hole "C"

Figure 4d:
XLC B1 Grid configurations for XLC127DVX or XLC907DVX Arrays

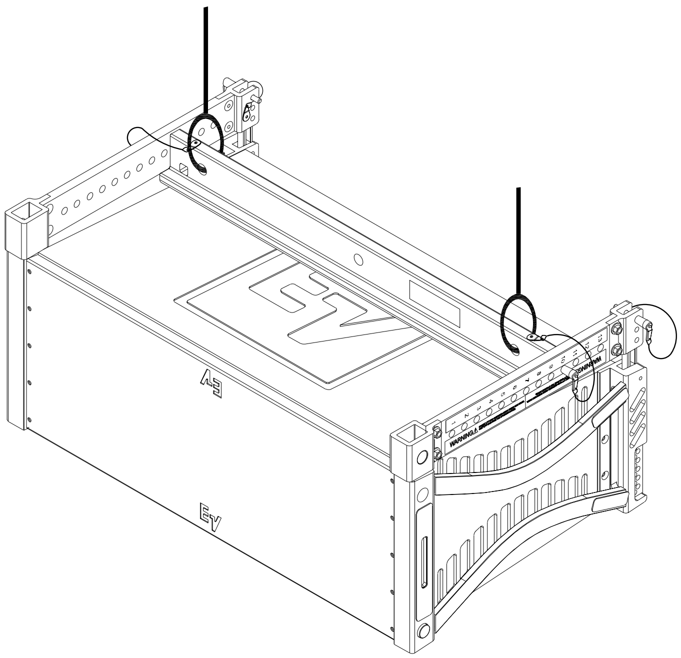


Single Bar/Single Pull = Use Hole "A"
(Note that the bar is reversed)

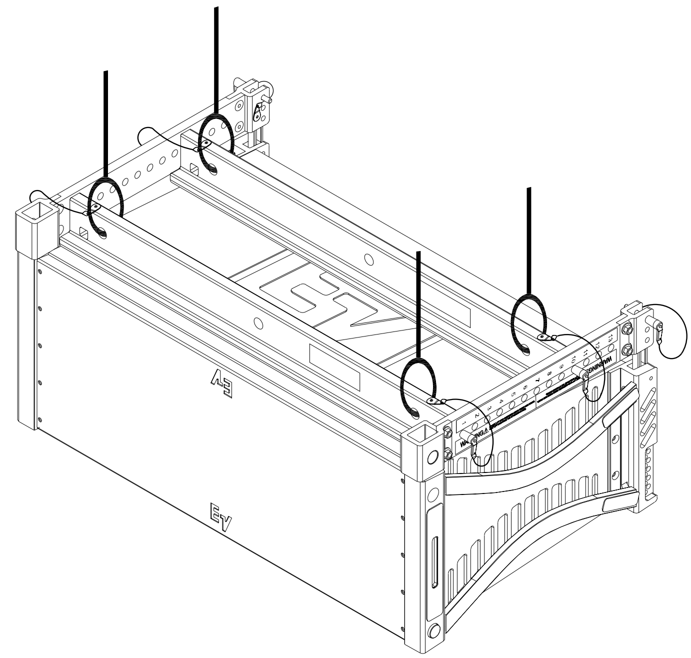
Dual Bar/Single Pull = Use Hole "A"
(Note that the bar is reversed)

Figure 4e:
XLC B1 Grid configurations for XLC127DVX or XLC907DVX with XLC118 or XLC215 in the same array

2. Rigging and Flying Techniques



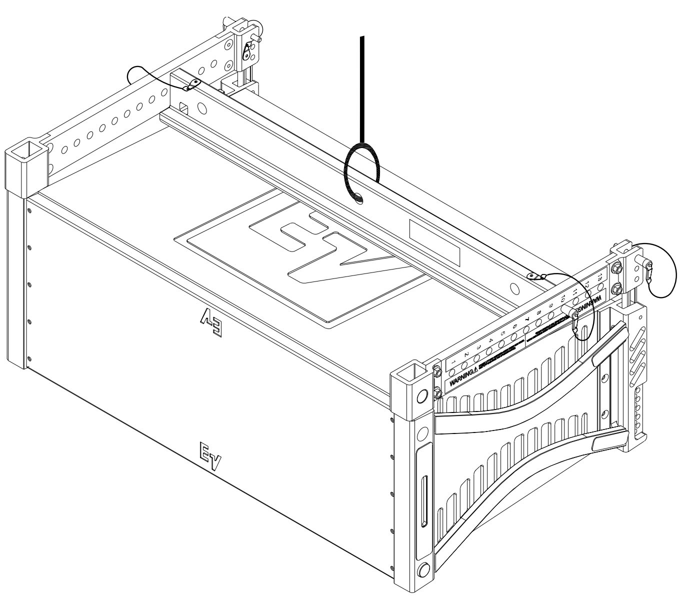
Single Bar/Dual Pull = Use Outer Holes



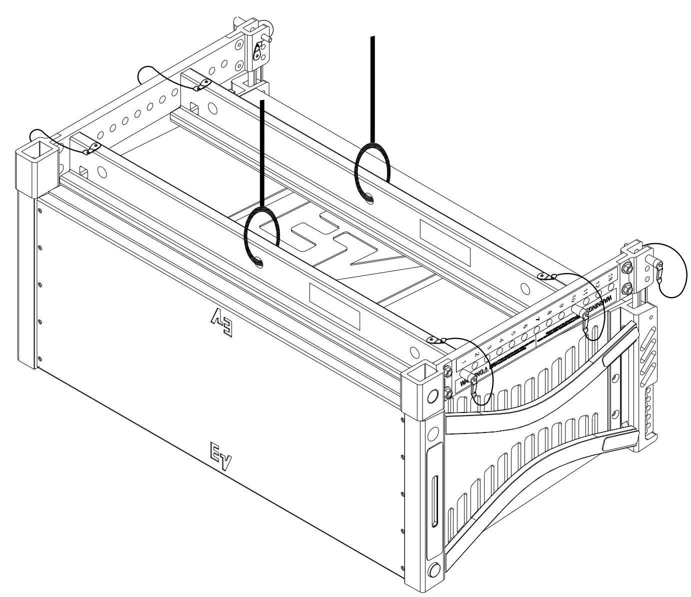
Dual Bar/Dual Pull = Use Outer Holes

Figure 4f:

XLC A1 Grid configurations for any XLC Array



Single Bar/Single Pull = Use Center Hole



Dual Bar/Single Pull = Use Center Hole

Figure 4g:

XLC A1 Grid configurations for XLC127, XLC127+, XLC118 or XLC215 Arrays

2.2 Rigging the XLC Grids and the XLC-EB

The XLC-EB extender beam is used to hang a single column of loudspeaker systems where more vertical tilt angle is required than could be achieved from only a grid. The XLC grid is attached to an XLC-EB as shown in Figure 5a. Note that the orientation of the XLC-EB will change depending on whether the entire array needs to tilt up or down. If the entire array needs to be tilted down, Hole #1 in the XLC-EB must be pointed away from the audience (upstage). If the entire array needs to be tilted up, Hole #1 in the XLC-EB must be pointed towards the audience (downstage). Because the XLC-EB extends beyond the end of the grid, greater tilt angles for the array (either up or down) can be achieved than would be possible with just a grid alone. In fact, for most applications, the XLC-EB eliminates the need for a pull back for severe downward angles.

An XLC grid must always be attached to the XLC-EB using two spreader bars, as shown in Figure 4a. One spreader bar must be attached to the grid side arms at the first hole at the front and the other at the last hole at the rear. The grid spreader bars are then secured to the XLC-EB yoke assemblies.

To attach a grid to the XLC-EB, remove the quick-release pins from the two yoke assemblies that will support the grid. Position the grid underneath the XLC-EB and slide the two yokes over the two spreader bars. Insert the quick-release pins through each yoke and spreader bar. To make sure that the quick-release pins are fully locked into the yoke, always push the pins in all the way in so that spring-loaded balls are visible at the opposite side of the yoke.

The XLC-EB is compatible with both the A1 and B1 grids. Note that the B1 grids have three holes to chose from in the middle of the spreader bar, while the A1 only has one hole. See the previous section that describes which holes to use for the B1 grid and which loudspeaker configurations are compatible with the A1 grid.

⚠ ALWAYS MAKE SURE THAT EACH QUICK-RELEASE PIN SECURING EACH GRID SPREADER BAR IS FULLY LOCKED IN EACH YOKE.

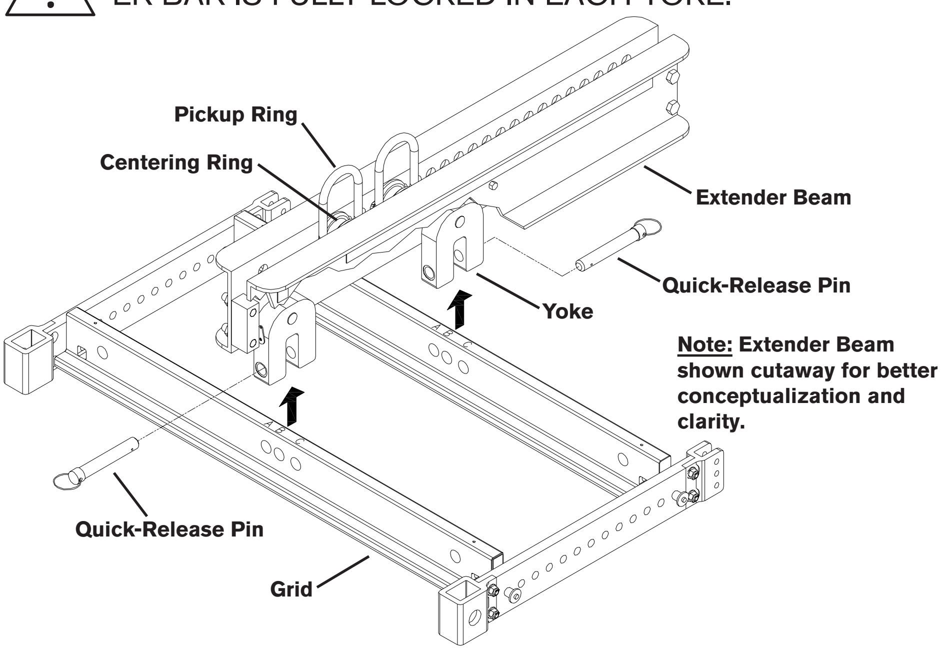


Figure 5a:
XLC-EB rigging assembly

2. Rigging and Flying Techniques

As shown in Figure 5b, the XLC-EB may be picked up using one pickup point or two pickup points. The two pick up points may be raised and lowered as necessary to adjust the vertical tilt angle. When using two pick up points, the pickup rings are usually installed in Holes #1 and #23 at the extreme ends of the XLC-EB for maximum front-to-back stability. However, the pickup rings may be relocated to redistribute the load between the front and back points. Holes #1 and #23 can only accommodate tilt angles of up to 30° before the rings will contact the spacer bars in the beam assembly. When greater tilt angles are required, the pickup points should be moved towards the center of the XLC-EB.

When using one pickup point, the vertical tilt of the array can be adjusted by changing the hole in which the pickup ring is installed in the XLC-EB. The LAPS program can be used to determine which hole to use to achieve the desired vertical angle.

Each pickup ring has a centering ring. The centering ring positions the pickup ring in the center of the XLC-EB slot so that array will hang straight and not tilt sideways. To relocate the pickup ring, remove the cotter pin from the clevis pin and remove the clevis pin from the beam assembly. Move the pickup ring and centering ring to the desired hole and reinstall the clevis pin in the beam assembly holes, then secure the clevis pin with the cotter pin.

⚠ MAKE SURE THAT THE EACH CLEVIS PIN SECURING EACH PICKUP RING TO THE BEAM IS LOCKED IN POSITION BY THE COTTER PIN. DO NOT LIFT ANY ASSEMBLY OVERHEAD WITHOUT A COTTER PIN TO LOCK EACH CLEVIS PIN.

For Shipping/Transport, the yoke and ring assemblies may be rotated into the beam assembly, as shown in Figure 5c, so that all moving parts are recessed.

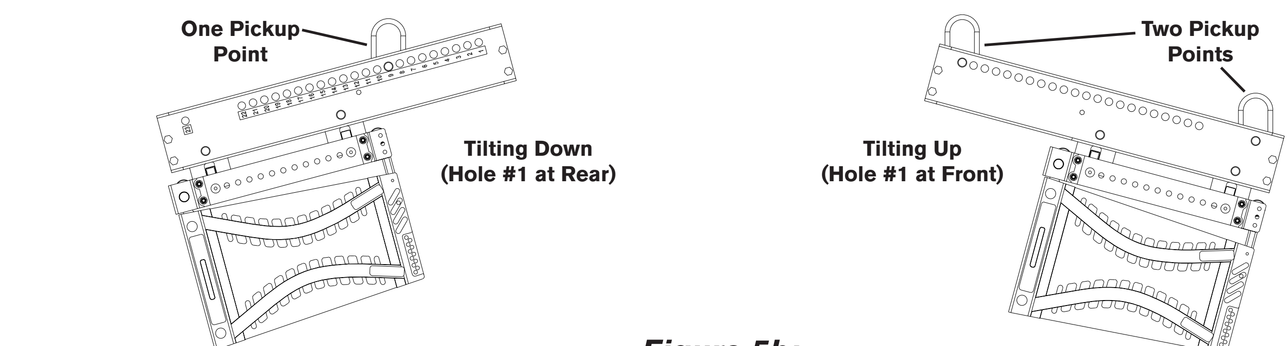


Figure 5b:
XLC-EB array configurations

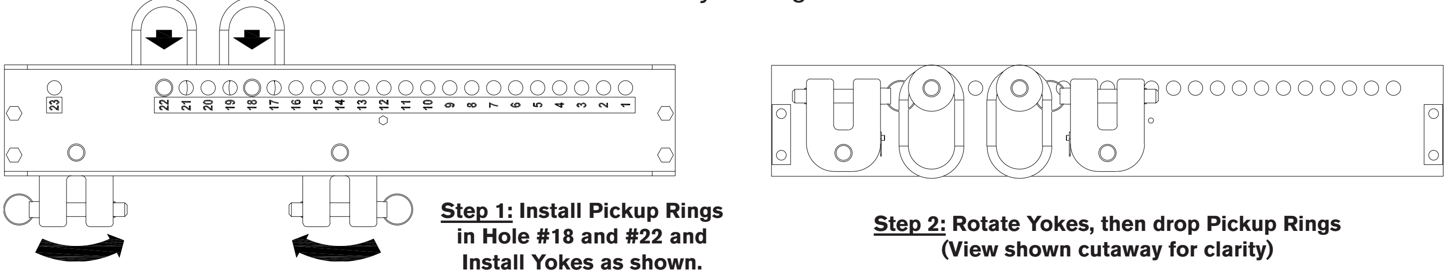


Figure 5c:
XLC-EB shipping/transport configuration

3. Rigging Strength Ratings/Safety Factors/Special Considerations

3.1 Working-Load Limit and Safety Factor Definitions

The structural ratings for all of the XLC rigging components and complete loudspeaker systems are based on test results in which parts were stressed to failure. Manufacturers typically present the structural-strength ratings of mechanical components or systems as either the working-load limit (WLL) or the ultimate-break strength. Electro-Voice chooses to present the structural-load ratings of the XLC loudspeaker systems as the working-load limit. The working-load-limit rating represents the maximum load that should ever be applied to a mechanical component or system.

⚠ THE USER SHOULD NEVER APPLY A LOAD THAT EXCEEDS THE WORKING-LOAD LIMITS OF ANY OF THE RIGGING COMPONENTS OR COMPLETE LOUDSPEAKER SYSTEMS DESCRIBED IN THIS MANUAL.

The working-load limits for the XLC rigging components and complete loudspeaker systems described in this manual are based on a minimum of an 8:1 safety factor. The safety factor is defined as the ratio of the ultimate-break strength divided by the working-load limit, where the ultimate-break strength represents the force at which a part will structurally fail. For example, if a part has working-load limit of 1,000 lb (454 kg), it would not structurally fail until a force of at least 8,000 lb (3,629 kg) was applied, based on a 8:1 safety factor. However, the user should never apply a load to that part that exceeds 1,000 lb (454 kg). The safety factor provides a margin of safety above the working-load limit to accommodate normal dynamic loading and normal wear.

CAUTIONS for Working-Load Limits and Safety Factors

The working-load limits defined by the manufacturer of any rigging component should never be exceeded. Electro-Voice bases the working-load limits of its XLC products on a minimum of an 8:1 safety factor. Other manufacturers of rigging components may base their working-load limits on safety factors other than 8:1. For example, 5:1 safety factors are fairly common amongst rigging manufacturers because many regulatory agencies call for a minimum safety factor of 5:1.

When an XLC loudspeaker system is installed where local regulations only require a safety factor of 5:1, Electro-Voice insists that the working-load limits of the XLC rigging never be exceeded and that an 8:1 safety factor be maintained for the XLC loudspeakers.

The user is cautioned that some local regulations may require safety factors higher than 8:1. In that circumstance, Electro-Voice insists that the user maintain the higher safety factor as required by the local regulations throughout the entire XLC installation. It is the responsibility of the user to make sure that any XLC installation meets any applicable local, state or federal safety regulations.

3. Rigging Strength Ratings/Safety Factors/Special Considerations

3.2 Structural Rating Overview

For the XLC loudspeaker enclosures there are two independent strength ratings that, together, give a complete description of the overall structural capabilities of any loudspeaker system; which are:

1. **The strength of each individual enclosure rigging point;** which is the combined strength of the rigging tube and channel, hinge bars, swing arms, bolts and enclosure.
2. **The total strength of the overall grid;** which is a function of the combined forces from all of the rigging points acting on the rigging components and the grid as a whole.

For the XLC grids, there are also two independent strength ratings that, together, give a complete description of the overall structural capabilities of the grid; which are:

1. **The strength of each individual grid rigging point;** which is the combined strength of the rigging tube and channel, hinge bars, swing arms, quick-release pins, bolts, sidearms and spreader bars.
2. **The total strength of the overall grid;** which is a function of the combined forces from all of the rigging points acting on the rigging components and the grid as a whole.

For the XLC-EB extender beam, there are also two independent strength ratings that, together, give a complete description of the overall structural capabilities of the beam; which are:

1. **The strength of each individual beam rigging point;** which is the combined strength of the U channels, yokes, quick-release pins, bolts and chain-link rings.
2. **The total strength of the overall beam;** which is a function of the combined forces from all of the rigging points acting on the rigging components and the beam as a whole.

⚠ WHEN SUSPENDING ANY XLC LOUDSPEAKER ARRAY OVERHEAD, THE WORKING-LOAD LIMIT MUST NEVER BE EXCEEDED FOR THE INDIVIDUAL ENCLOSURE RIGGING POINT, FOR THE OVERALL ENCLOSURE, OR FOR ANY OF THE RIGGING ACCESSORIES.

In an XLC system, the forces acting on each loudspeaker system (on each individual rigging point and on the overall enclosure) and the forces acting on each rigging accessory (grid, coupler beam, extender beam, etc.) will vary with each array configuration. Determining the forces throughout an array requires complex mathematical calculations. Electro-Voice engineers have, however, defined a set of simplified structural-rating guidelines that eliminate the need for the complex calculations for most array configurations. The interaction of the complex forces throughout arrays were analyzed to develop this set of conservative guide-lines, presented below, to enable a rigger to immediately determine on site whether or not an array is safe without having to make weight-distribution calculations. The structural-strength ratings of the individual rigging points and the overall XLC enclosures are also presented below so that a complex structural analysis can be made for any array configuration. The reader should consult an experienced structural engineer to perform the complex structural analysis.

3.3 Simplified Structural-Rating Guidelines

Electro-Voice engineers have defined a set of simplified structural-rating guidelines that will enable a rigger to immediately evaluate the safety of an XLC system on site without having to make complex force-distribution calculations. A combination of destructive testing and computer modeling were used to analyze the complex forces throughout arrays. Conservative working-load ratings were utilized to simplify the guidelines. Therefore, array configurations other than those illustrated in these simplified guidelines may be permissible. For those applications, consult section 3.4, Complex Structural-Rating Analysis for a detailed structural analysis.

1. The simplified structural-rating guidelines for the XLC loudspeakers are shown in Figure 7 of the XLC Rigging Manual. These guidelines provide a simplified rating for typical arrays based on the:
2. Vertical elevation angle of each enclosure.
3. Total weight of that enclosure plus all the enclosures and rigging hung below it.
4. Angled forces on rigging frames, rigging components and enclosures.

The XLC127, XLC127+, XLC127DVX, XLC907DVX, XLC118 and XLC215 loudspeaker systems have identical simplified structural rating guidelines.

Figure 7 includes a graph of the working-load weight-versus-angle limit rating for the XLC enclosures. This working-load weight limit is applicable to every enclosure in an array, and includes the weight of that enclosure plus the total weight of all enclosures, rigging hardware and cabling suspended below it. The enclosure elevation angle is the vertical angle of that enclosure, where 0° represents an upright enclosure facing straight ahead (0° elevation angle). These working-load-versus-angle limits take into account the complex forces generated in the front hinge bars, the rear swing arms, the quick-release pins, the rigging tubes and channels, the enclosures and the (optional) pull-up line, as a result of the complex weight distribution throughout the array.

Also included in the simplified structural-rating guidelines in each Figure 7 are side-to-side and front-to-back angle limits for the front hinge bars and rear swing arms on the top enclosure.

3. Rigging Strength Ratings/Safety Factors/Special Considerations

WHEN APPLYING THE SIMPLIFIED STRUCTURAL RATING GUIDELINES TO ANY XLC LOUDSPEAKER SYSTEM SUSPENDED OVERHEAD, THE USER MUST OBEY THE FOLLOWING RULES:

1. Never exceed the working-load-versus-angle limit for any loudspeaker enclosure in the array.
2. Never exceed the side-to-side angle limits for the front hinge button bar on any loudspeaker enclosure in the array.
3. Never exceed the side-to-side angle limits for the rear swing arm bar on any loudspeaker enclosure in the array.
4. Always make sure that two buttons on every front hinge bar at the side of the enclosures and grids and that those pins are fully locked in the rigging tubes on every enclosure and grid.
5. Always make sure that the quick-release pins for every swing arm pass through the hole in the swing arm and are fully locked in the rigging channels on all enclosures and grids.
6. If a pull-up grid is used at the bottom of the array, never exceed the side-to-side angle limits for the pull-up grid.

Discussion of Array Examples: For example, if the top enclosure in a column was angled down 30°, the enclosure working-load-versus-angle limit from the simplified structural-rating guidelines shown in Figure 7 of the XLC Rigging Manual would indicate that a total of 1950 pounds (885 kg) could be safely suspended. This would include the weight of the top enclosure plus all of the enclosures and rigging suspended below.

If, however, the top enclosure in a column was angled up 30°, the total allowable weight would then only be 1863 lb (845 kg) - including the weight of the top enclosure plus all of the enclosures and rigging suspended below. The enclosure working-load-versus-angle limit shown in Figure 7 not only applies to the top enclosure in an array column, but also applies to every enclosure in an array column. In arrays where a pull-up grid is not used, the top enclosure is always the limiting factor because it supports the most weight. However, in arrays where a pull-up grid is used to achieve substantial downward angles, it is possible that a lower enclosure could be the limiting factor.

3.4 Complex Structural-Rating Analysis

For a complete structural-rating analysis, the forces in each individual piece of attachment hardware throughout the XLC system must be determined, as well as the forces on each enclosure. Determining these forces requires complex mathematical calculations. All of these forces must then be compared to the working-load limits detailed below for each of the rigging points and the overall enclosures.

The reader should consult an experienced structural engineer to perform the complex structural analysis.

WHEN SUSPENDING ANY XLC LOUDSPEAKER SYSTEM OVERHEAD, THE WORKING-LOAD LIMITS MUST NEVER BE EXCEEDED FOR EACH INDIVIDUAL RIGGING POINT, AND THE OVERALL ENCLOSURE.

3. Rigging Strength Ratings/Safety Factors/Special Considerations

3.5 XLC127, XLC127+, XLC127DVX, XLC907DVX, XLC118 and XLC215 Structural-Strength Ratings

There are two independent strength ratings that, together, give a complete description of the overall structural capabilities of the XLC loudspeaker system - the working-load limits of the individual rigging points (the two front button-bar assemblies and the two rear swing-arm assemblies) and the working-load limit for the overall enclosure assembly.

XLC Front Rigging Hinge Bar Structural Ratings

The working-load limit of each of the front rigging points on the XLC enclosures is dependent upon the button bar assembly, the rigging tube, the enclosure and the angle of pull. Each enclosure has two hinge-bar rigging points - left and right. The front rigging point structural-strength ratings are identical for the XLC127, XLC127+, XLC127DVX, XLC907DVX, XLC118 and XLC215 loudspeaker systems, and are shown in Figure 8 of the XLC Rigging Manual. The enclosures have two rigging points at the front. The structural ratings shown in Figure 8 are for a single rigging attachment point. That is to say, the left and right front hinge-bar rigging points each have the rating shown in the figure.

The front-to-back structural ratings for the front rigging points cover a full 360° of rotation. Although it is not possible to put the front hinge bars into tension over 360°, it is possible for the hinge bars to go into compression with some array configurations. Therefore, the 360° rating is necessary to accommodate both tension and compression. It should also be noted from Figure 8 that the front hinge bars are only rated for side-to-side pull angles of a maximum of ±5°.

XLC Rear Rigging Swing Arm Structural Ratings

The working-load limit of each of the rear swing-arm rigging points on the XLC enclosures is dependent on the swing arm, the rigging channel, the enclosure and the angle of pull. Each enclosure has two swing-arm rigging points - left and right. The rear rigging point structural-strength ratings are identical for the XLC127, XLC127+, XLC127DVX and XLC907DVX loudspeaker systems, and are shown in Figure 9 of the XLC Rigging Manual. The rear rigging point structural-strength ratings are identical for the XLC118 and XLC215, and are shown in Figure 10 of the XLC Rigging Manual. The structural ratings shown in Figures 9 and 10 are for a single rigging attachment point. That is to say, the left and right rear swing-arm, rigging points each have the rating shown in the figures.

The front-to-back-angle range shown in Figure 9 for the XLC127, XLC127+, XLC127DVX and XLC907DVX consists of two 8° arc segments, while the front-to-back-angle range shown in Figure 10 for the XLC-118 and XLC215 consists of two 12° arc segments. When both the front and rear rigging are installed, the front button bar always prevents the rear swing arm from having any kind of front-to-back force. Thus, the rear swing arm will always be axially loaded. For the XLC127, XLC127+, XLC127DVX and XLC907DVX, a tensile force can only be applied over an angle range of negative 0°-8°, while the XLC-118 and XLC215 can only have a tensile over a range of negative 0°-12°. The angles are negative because the boxes can only be angled downward. (Imagine two boxes facing straight ahead. The bottom enclosure can only be tilted downward because the rear rigging can only be adjusted to bring the rear corners of the enclosures together.) Under compression, the forces would be from positive 172°-180° for the XLC127, XLC127+, XLC127DVX and XLC907DVX, and positive 168°-180° for the XLC-118 and XLC215. It also should be noted that the XLC rear rigging is only rated for use over side-to-side pull angles of a maximum of ±5°.

3. Rigging Strength Ratings/Safety Factors/Special Considerations

XLC Overall Enclosure Structural Ratings

The actual strength of the XLC enclosures will depend on the complex total of the combined forces from each of the rigging points acting on the enclosure as a whole and will vary with the array configuration. However, for the sake of simplicity, Electro-Voice chooses to define the working-load limit of the overall enclosures as the sum total of the weight of that enclosure plus the weight of all of the enclosures and rigging hardware suspended below. This simplified working-load weight rating of the overall enclosures is defined as being independent of the angles of pull on the individual rigging points. The Electro-Voice engineers have chosen to define the working-load limits of the individual rigging points as a function of pull angle so that they take into account any variations in enclosure strength that might occur as a function of pull angle. This approach allows the enclosure working-load limit to be defined as independent of pull angles, making the complex structural rating analysis easier. The overall enclosure strength ratings are identical for the XLC127, XLC127+, XLC127DVX, XLC907DVX, XLC118 and XLC215 loudspeaker enclosures, and are shown in Figure 11 of the XLC Rigging Manual.

CAUTIONS for Enclosure Complex Structural Rating Analysis

⚠ WHEN APPLYING A COMPLEX STRUCTURAL RATING ANALYSIS TO ANY XLC LOUDSPEAKER SYSTEM SUSPENDED OVERHEAD, THE USER MUST OBEY THE FOLLOWING RULES:

1. Never exceed the front-to-back angle limits for the front button-bar assemblies on any enclosure.
2. Never exceed the side-to-side angle limits for the front button-bar assemblies on any enclosure.
3. Never exceed the front-to-back angle limits for the rear swing-arm assemblies on any enclosure. Never exceed the side-to-side angle limits for the front swing-arm assemblies on any enclosure.
4. Always make sure that every front button bar is securely locked in the front rigging tube on every enclosure and grid, when applicable.
5. Always make sure that every rear swing arm is securely locked in the rigging frame with the quick-release pins on every enclosure and grid.

3. Rigging Strength Ratings/Safety Factors/Special Considerations

3.6 A1, B1 and XLC-EB Complex Structural-Strength Ratings

XLC A1 and B1 Grid Complex Structural-Strength Ratings

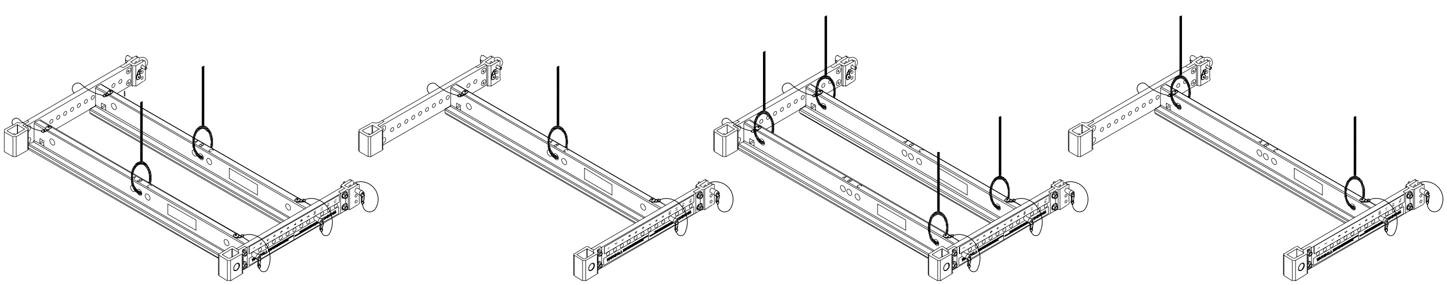
The newer B1 grid can be used to suspend a column of any XLC loudspeaker systems. The older A1 can be used to suspend most of the XLC loudspeakers, but has some compatibility issues in some configurations for the some of the XLC systems. (See the XLC Rigging and Flying Techniques section above for a detailed explanation of the implementation of both the A1 and B1 grids.) The construction of the A1 and B1 grids is identical, with the only difference being that the B1 spreader bar has three middle holes while the A1 grid has only one. Thus, the A1 and B1 grids have identical structural ratings.

The structural strength of a column of loudspeakers suspended from a grid is a function of the strength of the grid spreader bar assemblies, the grid sidearm assemblies, the front and back rigging attachment to the XLC enclosures, the strength of all of the quick-release attachment pins, the loudspeaker array configuration and the vertical tilt angle of the grid. This is a complex mechanical system, where the strength of the overall system is determined by the strength of the weakest component in the system.

The Electro-Voice engineers have designed the XLC A1 and B1 grids to be stronger than the XLC loudspeaker systems over the entire mechanical operating range of the loudspeaker systems. This makes the structural analysis of the overall system (grids and loudspeaker enclosures) much easier because the structural rating of the entire mechanical system will be determined solely by the structural strength of the loudspeaker systems.

Specifically, this means that, when an XLC grid is used in any of the configurations shown in Figure 6, the structural rating of the grid will always exceed the structural ratings of the XLC127, XLC127+, XLC127DVX, XLC907DVX, XLC118 and XLC215 loudspeaker systems. Thus, if the structural rating is not exceeded for any loudspeaker in the column, the structural rating of the grid will not be exceeded.

When two side-to-side pickup points, or two front-to-back pickup points are used to suspend an A1 or B1 grid, the maximum included angle between the pickup points shown in Figure 6 must not be exceeded.



When using the grid in any of the configurations shown to support a column of loudspeaker systems, the structural rating of the grid will always exceed the structural rating of any of the loudspeaker systems for any vertical tilt angle. Thus, if the structural rating is not exceeded for any loudspeaker in the column, the structural rating of the grid will not be exceeded. When using two pickup points to suspend a grid, do not exceed the angles shown.

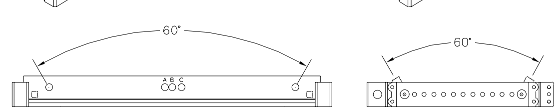


Figure 6:

XLC A1 and B1 Grid complex structural ratings

3. Rigging Strength Ratings/Safety Factors/Special Considerations

XLC-EB Complex Structural-Strength Ratings

The XLC-EB is used as an extender beam with a single column of XLC127, XLC127+, XLC127DVX, XL-C907DVX, XLC118 and XLC215 loudspeaker systems to enable greater vertical angle tilt of the column than that which could be achieved with a grid alone.

The structural strength of the of a column of loudspeakers suspended from a XLC-EB is a function of the strength of the beam frame assembly, the beam yoke assemblies, the beam ring assemblies, the grid spreader bar assemblies, the grid sidearm assemblies, the front and back rigging attachment to the XLC enclosures, the strength of all of the quick-release attachment pins, the loudspeaker array configuration and the vertical tilt angle of the beam. This is a complex mechanical system, where the strength of the overall system is determined by the strength of the weakest component in the system.

The Electro-Voice engineers have designed the XLC-EB to be stronger than the XLC A1 and B1 grids, which are in turn stronger than the XLC loudspeaker systems over the entire mechanical operating range of the loudspeaker systems. This makes the structural analysis of the overall system (beam, grids and loudspeaker enclosures) much easier because the structural rating of the entire mechanical system will be determined solely by the structural strength of the loudspeaker systems.

Specifically, this means that, when the XLC-EB is used in any of the configurations shown in Figure 7, the structural rating of the beam will always exceed the structural ratings of either the XLC loudspeaker systems. Thus, if the structural rating is not exceeded for any loudspeaker in the column, the structural rating of the beam will not be exceeded.

When suspending a XLC-EB, the maximum included angle of the pickup points relative to the beam shown in Figure 7 must not be exceeded. Note that the maximum angle for the pickup rings is less for holes 1 and 23 because the pickup rings will contact the spacer bars at greater angles.

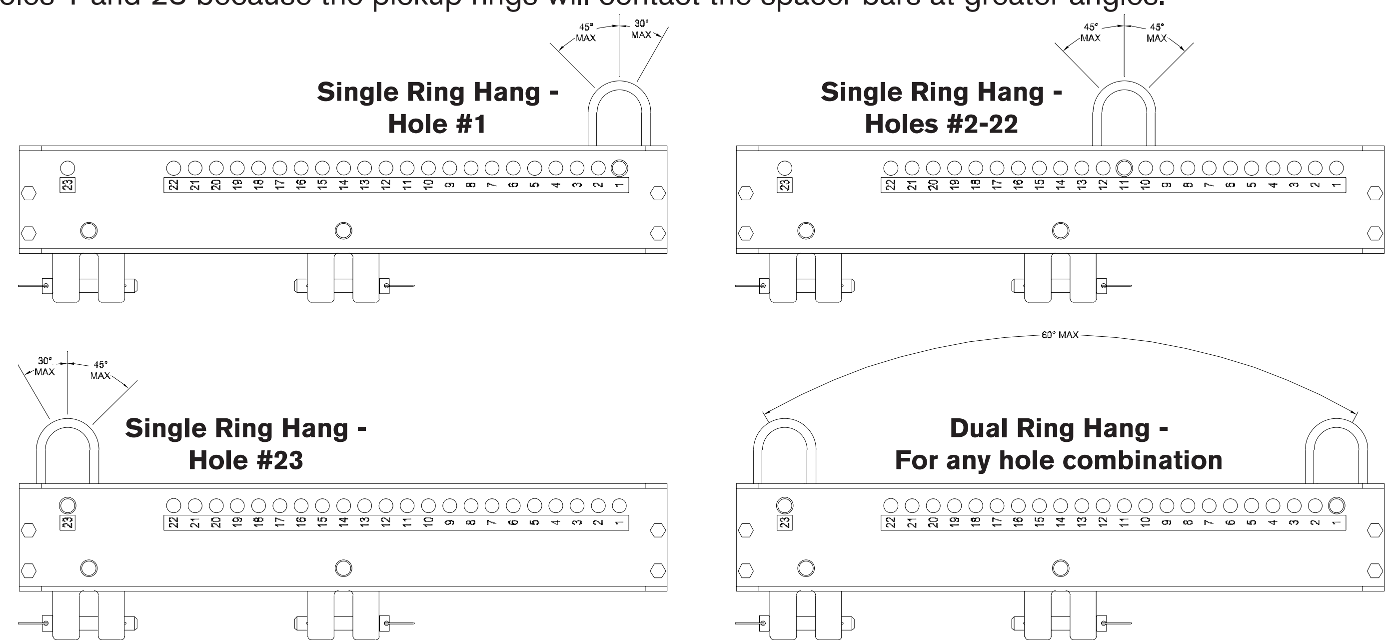


Figure 7:

XLC-EB Extender Beam complex structural ratings

4. Rigging Inspection and Precautions

Electro-Voice XLC Loudspeaker Systems: Prior to each use, inspect the loudspeaker enclosures for any cracks, deformations, missing or damaged components that could reduce enclosure strength. Inspect the rigging tube and channel assemblies on the enclosures for any cracks, deformations, corrosion, missing or loose screws which could reduce the flying hardware strength. Replace any loudspeaker systems that are damaged or missing hardware. Never exceed the limitations or maximum recommended load for the XLC loudspeaker systems.

Electro-Voice XLC Front Rigging Hinge Bar Assemblies: Prior to each use, inspect the front rigging hinge bars and the front rigging tubes for any cracks, burrs, deformations, corrosion or missing or damaged components that could reduce hinge bar assembly strength. Always check to make sure that the hinge bar can move freely in the front rigging tube. Replace any hinge bars that are damaged or missing hardware. Always double check that each button on each hinge bar is securely locked into position in the front rigging tubes on the XLC enclosures and grids before lifting. Never exceed the limitations or maximum recommended load for the XLC rigging hardware.

Electro-Voice XLC Rear Swing Arm Assemblies: Prior to each use, inspect the rear rigging swing arms, the rear rigging channels and rear rigging holes for any cracks, burrs, deformations, corrosion or missing or damaged components that could reduce swing arm assembly strength. Always check to make sure that the swing arm bar can move freely in the rear rigging slots and that the quick-release locking pins can be easily inserted in the swing arm holes and rigging holes to lock the arm. Replace any swing arms that are damaged or missing hardware. Always double check that each swing arm is securely locked in the rear rigging holes with a quick-release pin. Never exceed the limitations or maximum recommended load for the XLC rigging hardware.

Electro-Voice Quick-Release Pins: Prior to each use, inspect the quick-release pins on the rigging frame assemblies any for cracks, burrs, deformations, corrosion or missing or damaged components that could reduce the pin strength. Replace any quick-release pins that are damaged. Always double check that each quick-release pin is securely locked to the front hinge bar and rear swing arm assemblies on the XLC enclosures before lifting. Never exceed the limitations or maximum recommended load for the XLC rigging hardware.

Grid Assemblies: Prior to each use, inspect each grid assembly any for cracks, burrs, deformations, corrosion or missing or damaged components that could reduce the grid assembly strength. Replace any grids that are damaged or missing hardware. Always double check that each grid is securely locked to the front hinge bar assemblies and the rear swing arm assemblies on the XLC enclosures before lifting. Always double check that that each quick-release pin attaching the sidearms to the spreader bar(s) are securely locked into place. Never exceed the limitations or maximum recommended load for the grids.

4. Rigging Inspection and Precautions

Extender Beam Assembly: Prior to each use, inspect the XLC-EB assemblies for any cracks, burrs, deformations, corrosion or missing or damaged components that could reduce the XLC-EB assembly strength. Replace any XLC-EB assemblies that are damaged or missing hardware. Always double check that each XLC-EB assembly is securely locked to the spreader bar(s) on the grids below. Always double check that that each quick-release pin in the frame and yoke assemblies are securely locked into place. Never exceed the limitations or maximum recommended load for the XLC-EB assemblies.

Chain Hoists: Prior to each use, inspect the chain hoist and associated hardware (including motor, if applicable) for any cracks, deformation, broken welds, corrosion, missing or damaged components that could reduce the hoist strength. Replace any damaged chain hoists. Never exceed the limitations or maximum recommended load specified by the hoist manufacturer. Always follow manufacturers' recommendations for operation, inspection, and certification. Always raise and lower the load slowly and evenly, avoiding any rapid changes in speed or shifting loads that could result in a sudden jolt to the suspended system.

Building, Tower or Scaffold Supports: Prior to each use, the strength and load-bearing capabilities of the building, tower or scaffold structural supports should be evaluated and certified by a professional engineer as being adequate for supporting the intended rigging system (including the loudspeakers, grids, chain hoists and all associated hardware). Prior to each use, inspect the building, tower or scaffold structural supports for any cracks, deformation, broken welds, corrosion, missing or damaged components that could reduce the structural strength. Damaged structural supports should be replaced or repaired and recertified by a professional engineer. Never exceed the limitations or maximum recommended load for the supports.

Miscellaneous Mechanical Components: Prior to each use, inspect all mechanical components (chain, wire ropes, slings, shackles, hooks, fittings, ratchet straps, etc.) for any cracks, deformation, broken welds, slipping crimps, fraying, abrasion, knots, corrosion, chemical damage, loose screws, missing or damaged components that could reduce the maximum strength specified by the component manufacturer. Replace any damaged mechanical components. Never exceed the limitations or maximum recommended load for the mechanical components.

5. Notes

5. Notes

Electro-Voice®

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