



Rigging Guide
for
YAMAHA Installation Series Loudspeakers

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Installation and use of Installation Series speakers should only be performed by a qualified certified rigger in accordance with the recommendations contained within the Rigging Guide and Owner's Manual. These products are for use only by certified and qualified professionals and individual consumer use is not recommended or intended. Please consult an appropriate professional about installation or use of Installation Series speakers.

1. Introduction

The process of rigging and mounting speakers is not always straight-forward. This rigging guide has been created to assist the user during the design phase and to promote **safe** rigging and mounting practices during the installation phase to ensure a successful project.

A successful installation should satisfy the sonic and aesthetic requirements of the design while adhering to building codes and rigging safety standards. The installer should have a thorough understanding of the intent of the design and the proper methods required to execute that design.

Understanding safe rigging and mounting practices will provide the following benefits:

- Proper coverage of listening area through accurate speaker placement.
- Suitable selection of proper installation methods will be chosen with regard to safety, performance, aesthetics and cost.
- minimizing any extra time or costs during installation

While many applications require the use of wall or ceiling mounted loudspeakers, there are many instances where a well designed and suspended solution will provide superior coverage, minimize reflections, and possibly utilize fewer speakers, than a wall or ceiling mounted equivalent.

The careful selection of Yamaha Installation Series hardware and load rated rigging products designed for overhead suspension will ensure a **safe** and successful installation.

2. Safety recommendations

The following recommendations are intended to serve as general guidance.

1. Always ensure that the intended structure the loudspeaker is to be mounted to or suspended from is rated to hold a weight that exceeds the weight of the complete loudspeaker system (i.e. all flown components including loudspeaker(s), rigging, cabling etc). If in doubt, always consult a qualified structural engineer.

2. Do not allow inexperienced persons to carry out installation. Installation personnel should be trained in loudspeaker mounting / flying techniques in accordance with the level of skill required for the job.
3. Always inspect all components - the cabinets, supplied eyebolts and any third party accessories - for damage before assembly. If you suspect any component to be sub-standard DO NOT use the affected part, but contact the manufacturer immediately and arrange alternative parts.
4. Appropriate Personal Protective Equipment (PPE), such as protective headwear, footwear and eyewear should be worn at all times during the installation process.
5. Ensure that all relevant health & safety regulations are understood and adhered to. Information on applicable legislation can often be obtained from local government offices.
6. Mounting loudspeakers often necessitates working at height. Ensure that all personnel involved are suitably trained and equipped for working at height and also to use any access equipment (scaffolding tower, moving work platform, fly grid etc).
7. Ensure that all lifting equipment (rigging components, wire rope, slings, brackets, motor hoists and control systems etc.) are certified as safe and that they pass a visual inspection prior to use.
8. Carefully read all included instructions shipped with the loudspeakers and any rigging parts. If you don't fully understand them, seek advice.
9. Ensure that public and personnel are not allowed to pass beneath the loudspeaker system during the installation process. The work area should be isolated from public access until installation is complete and has been inspected.
10. Never leave the system unattended during the installation process.
11. Do not place any object (e.g. a tool or rigging item) on top of a loudspeaker during installation. The object may fall and cause injury.
12. Secondary steels must be fitted even if not required by the local safety standards applicable to the territory. They must be installed once the system has been suspended to operating height, and before access is granted to public and personnel.
13. Ensure that the system is designed to avoid any form of dynamic or shock loading. If in doubt, always consult a suitably qualified structural engineer.
14. Do not rig any other components from the loudspeaker system.
15. Installation activities must be either completed by or at a minimum supervised by a certified rigger. .
16. Follow local safety regulations when working with speakers.

<p>Yamaha cannot be held responsible for damage or injury caused by insufficient strength of the support structure or improper installation. Illustrations herein are for explanatory purposes</p>
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only, and may not match actual appearances during operation.

Some fittings may deteriorate due to wear and/or corrosion. Rigging systems and rigging accessories, including all eyebolts and speaker brackets provided by Yamaha, need to be checked thoroughly for fatigue at regular intervals to ensure maximum safety. (Intervals may vary, please contact your rigging expert for more information.) All other third-party accessories also need inspection, please refer to the hardware manufacturer's safety and inspection guidelines. All components must be inspected following exposure to impact, shock, fire, water or other hazard to detect cracks, corrosion, damages or any other signs of decrease in strength of all components.

3. Ascertaining the data

In order to plan loudspeaker rigging effectively, one needs to be in possession of all the facts. Typical data required includes:

- Floor plan
- Cross-section
- Roof / wall construction detail
- Weight loadings of structural members to mount or fly from

A site survey is a good idea even for simple jobs. Bring a digital camera if possible so that intended mounting positions can be shared with others not in attendance at the site survey.

4. Designing the system

Once the loudspeaker system has been designed (see other information such as the Installation Series application guide), the desired loudspeaker positions will be determined.

The types of system, from a rigging point of view can be broadly categorized as:

- single loudspeaker mounting
- single loudspeaker suspension
- array suspension
- ground stacked systems

5. Single loudspeaker mounting

Single loudspeakers can be mounted in many ways. The most common methods include:

- Wall or ceiling mounting using Yamaha U-brackets
These allows convenient 'portrait' or 'landscape' mounting, but note that the cabinet can be rotated in one direction only
- Wall or ceiling mounting using third-party supplied tilt and swivel brackets

e.g. Omnimount / Multimount / Powerdrive / Ohashi / König & Meyer etc.

These allow mounting at many different angles and orientations.

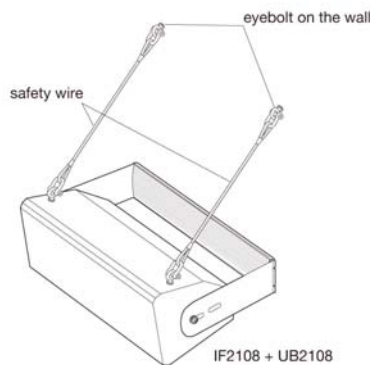
- From truss / scaffolding bars

For applications requiring occasional or frequent moving of loudspeakers, “fly frames” offer a convenient solution. They can also be used in permanent situations when a loudspeaker requires a great degree of tilt, or where steel wires would be unsightly.

- Mounting inside furniture

For applications such as corporate audio visual, often the loudspeaker installation is required to be completely invisible, which is achieved by mounting the speaker flush with a surface, and covering the aperture with an acoustically transparent grille cloth. In most instances, brackets are not required, as the speaker is held by the surrounding material of the aperture. If the aperture is significantly larger than the cabinet, any gaps should be lined with heavy duty absorption material (e.g. rockwool), to prevent any undesirable acoustic affects of the cavity.

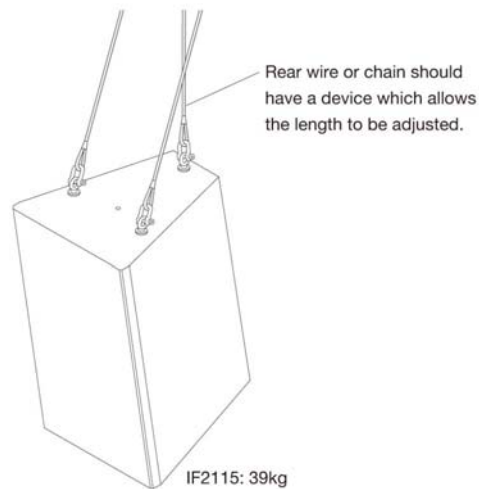
All the above applications require a secondary safety wire. All the components of the system must be rated with a Safe Working Load (SWL) that exceeds the weight of the speaker and bracket in order to ensure that it can support the speaker should the primary mounting method fail.



When more eyebolts are needed, contact your Yamaha dealer for additional part #AAY03100.

6 Single loudspeaker suspension

In order to fly a single loudspeaker, a minimum of three points must be used, both for safety reasons, and to ensure the cabinet can be angled correctly.



The front two wires provide the primary support, whilst the rear point enables the cabinet to be tilted, or 'kelped'. In most instances of the configuration, the cabinet can be flown with fixed length steels or chains for the front two points. Aside from safety reasons, a minimum of three points are practically needed to provide the degree of positioning required, and prevent rotation. The rear point should have a device which allows the length to be adjusted, *while in the air*, to enable accurate aiming. Tools such as a laser pointer and an inclinometer are very useful to align the speaker accurately and consistently.

If possible, select two front flying points anchored to independent mounting surfaces, to ensure that one can act as a secondary safety in the event of the other failing.

Ensure there are sufficient steel cables and sufficient adjustment designed into the rigging system to enable angling in all required directions (i.e. pan, tilt and yaw, or X,Y,Z)

Before suspending the speaker, make sure you understand how to use eye bolts correctly. See section 11

7. Array loudspeaker suspension

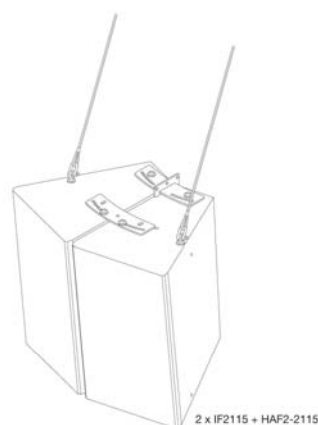
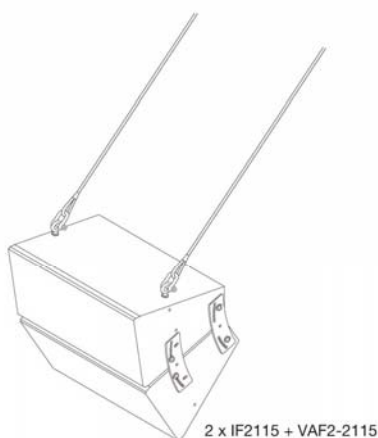
The principles of flying arrays are the same as for single loudspeakers.

After determining the correct loudspeaker configuration, location, array orientation and cabinet splay angles, the cabinets comprising the array must be physically arranged to become a single assembly ready for flying. This can be achieved using the Yamaha array frames. The safe working loads (SWL) are shown below for different array configurations:

Minimum of three or four rigging points are required when using an array frame.

Array frame model	Speaker model	Total weight	Number of rigging points required
HAF3-S18	IF3115*2 + IS1218*1	233kg (512 lbs)	4
HAF3-3115	IF3115*3	206kg (453 lbs)	4
HAF3-2115	IF2115*3	127kg (275 lbs)	4
HAF3-2112	IF2112*3	102kg (224 lbs)	4
HAF2-3115	IF3115*2	134kg (294 lbs)	4
HAF2-2115	IF2115*2	83kg (182 lbs)	3
HAF2-2112	IF2112*2	66kg (145 lbs)	3
VAF2-2112	IF2112*2	66kg (145 lbs)	3
VAF2-2115	IF2115*2	83kg (182 lbs)	3
VAF2-3115	IF3115*2	134kg (284 lbs)	3

See the included instructions for more details.



8. Rotating the horn

Refer to the manual for instructions on rotating the horn to the correct orientation required for the application.

9. Check the system prior to mounting

Check the cabinets for any physical damage (e.g. during transit to the job site).
 Plug-in and perform a listening test on the loudspeakers prior to mounting/flying

10. Check the structure prior to mounting

Check the structure to be mounted from (ceiling, roof beam etc). If in any doubt whatsoever, consult a suitably qualified structural engineer.

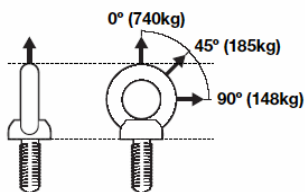
11. Use of Eye bolts

The eye bolts supplied with your Yamaha Installation Series speakers are not common eye bolts that you would find at your local hardware store. The supplied eye bolts are actually hardened, load-rated lifting eyes and are much stronger than common eye bolts. Do not substitute. Use only M10 x 38mm hardened lifting eyes.

Keep in mind that the strength of an eye bolt differs depending on the angle of the steel attached to it, and the suspension angle of the speaker. The safe working limits (SWL) of Yamaha eye bolt supplied with the Installation Series are shown in the illustration below:

CAUTION

When using the eye bolts, make sure that the suspension angle is within the range of 0 to 45 degrees, as shown below.



Use only the supplied eye bolts

Always use three or more eye bolts per cabinet for suspended applications, except when using the optional array frames. Please refer to section 14 for proper number of eye bolts per array. Install the eye bolts on multiple surfaces of the speaker (e.g. top and rear), never on just a single surface (e.g. top only).

12. Selecting the correct size of wire rope

After calculating the total load required of each cable, choose the appropriate steel wire rope as recommended by the manufacturer. We recommend a safety factor of 10:1. Requirements in different territories may differ from this.

Assuming we choose 10:1 ratio for wire rope, the total flown weight (speaker/speaker array plus hardware, cable etc) must be less than $\frac{\text{Maximum load of the wire rope}}{10}$

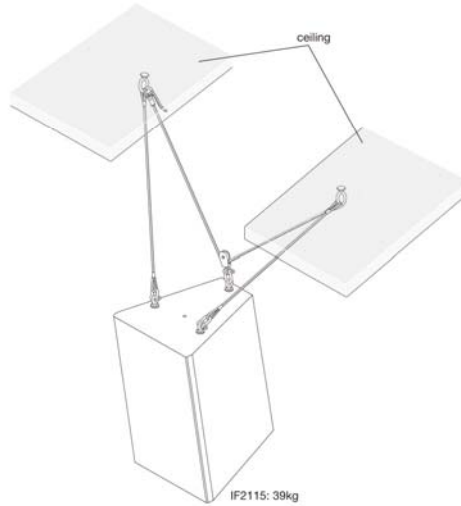
Rigging item	Qty	Weight each	Weight total
IF2115/64 Speakers	3	39kg (85 lbs)	117 kg (257 lbs)
HAF array frame *	1	10 kg (22 lbs)	10 kg (22 lbs)
Cabling(8 core x 4.0mm ²)	25	0.5 kg (1.1 lbs)	12.5 kg (27 lbs)
Eye bolts, steels etc	4	0.25 kg (0.55 lbs)	1 kg (2.2 lbs)
		TOTAL	143.5 kg (315 lbs)

Cabling and lifting accessory weights are shown as examples and should be calculated for each system.

MODEL	WEIGHT
HAF3-2112	9 kg (19.8 lbs)
HAF3-2115	10 kg (22 lbs)
HAF3-3115	14 kg (30 lbs)
HAF3-S18	29 kg (63 lbs)
HAF2-2112	4 kg (8.8 lbs)
HAF2-2115	5 kg (11 lbs)
HAF2-3115	6 kg (13 lbs)
VAF2-2112	4 kg (8.8 lbs)
VAF2-2115	5 kg (11 lbs)
VAF2-3115	6 kg (13 lbs)
UB2112	4 kg (8.8lbs)
UB2115	9 kg (19.8 lbs)
UB2000	9 kg (19.8 lbs)
UB2208	3 kg (6.6 lbs)
UB2108	2 kg (4.4 lbs)
UB2205	1 kg (2.2 lbs)

13. Suspending using bridles

In many applications it is possible to find a suitable mounting point on the building, directly above the desired speaker location, and provide a “dead hang” (i.e. supporting wires are vertical). However, in some applications this is not possible, so a bridle arrangement becomes necessary.



Bridle installation should only be installed by a certified rigger or installed after consultation and with supervision by a certified rigger.

14. Enclosures capability

IF2112, IF2115 and IS series subwoofer enclosures are capable of a maximum load of 60Kg , or 132 lbs per single rigging point. (10:1 safety ratio. That means they passed 600Kg, or 1320 lbs weight test)

**At 7:1 ratio, maximum load is 85Kg, or 188 lbs. (600kg / 7)*

**At 5:1 ratio, maximum load is 120Kg or 264 lbs. (600kg / 5)*

3 point rigging and the total load weight is below (10:1 ratio).

NOTE: Load equally to each rigging point. These figures represent maximum load when suspension angle are all at 0 degrees.

3 points rigging: Total weight (Speaker boxes and wires) $\leq 3 \times 60 \text{kg} = 180 \text{kg}$, or 396 lbs.

4 points rigging: Total weight (Speaker boxes and wires) $\leq 4 \times 60 \text{kg} = 240 \text{kg}$ or 528 lbs.

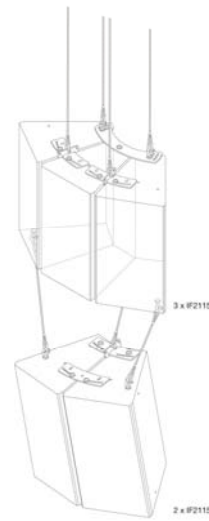
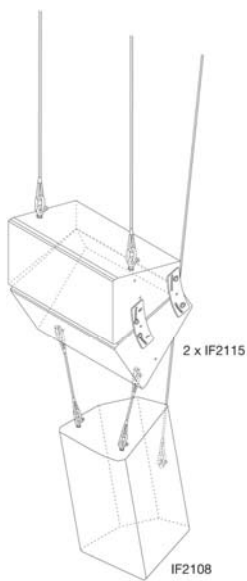
So the number of cabinets which can be flown safely is:

Model	1Box weight	2Boxes weight	3Boxes weight	4Boxes weight
IF2112	31kg (68.2 lbs)	62 kg (136 lbs)	93 kg (204 lbs)	124 kg (272 lbs)
IF2115	39 kg (85.8 lbs)	78 kg (171 lbs)	117 kg (257 lbs)	156 kg (343 lbs)
IS1118	44 kg (96.8 lbs)	88 kg (193 lbs)	132 kg (290 lbs)	176 kg (387 lbs)
IS1215	63 kg (138 lbs)	126 kg (277 lbs)	189 kg (415 lbs)	252 kg (554 lbs)
IS1218	76 kg (167 lbs)	152 kg (334 lbs)	228 kg (501 lbs)	304 kg (668 lbs)

3 or 4 point rigging

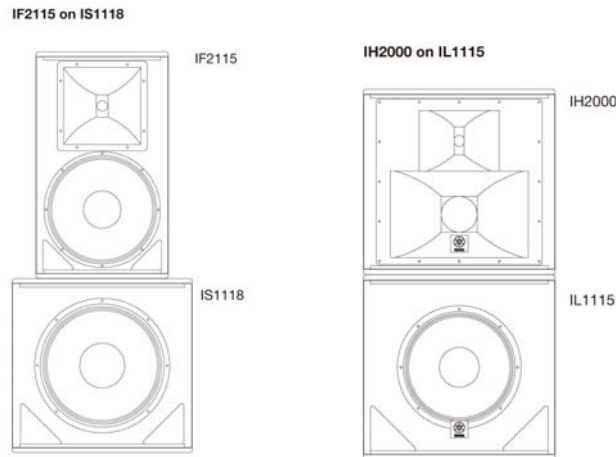
4 point rigging only (3 point rigging is NOT allowed)

Unsafe to rig



For larger clusters, it may be necessary to arrange multiple arrays together.

15. Ground stacked systems



Loudspeakers that need to be portable or re-configured on a regular basis for a venue like a performing arts center or multi-purpose facility can be ground stacked for convenience.

All ground stacked speakers, especially in locations where public may gain access to the systems (e.g. stages in music venues), even if unauthorized, should have the system permanently anchored down (e.g. by load straps).

Always check the supporting surface (e.g. floor, stage etc) that the speaker system is to be placed upon, to ensure that the floor is even and level. If necessary, survey the underside of any temporary structure such as staging to ensure that it sufficiently stable and supported. Sloping stage surfaces (e.g. in theatres), may require blocks to make the surface level. If it is not, have a carpenter provide a suitable platform.

Rubber blocks or mats may be placed between cabinets as necessary to prevent upper cabinets from “walking” – i.e. movement due to the speaker’s vibration.

Follow proper manual handling procedures when stacking and unstacking systems to reduce risk of injury, and always ensure sufficient personnel and equipment are available.

The Installation Series products are designed for indoor use only.

16. Loudspeakers on tripod stands

When using tripod floor stands, consult the stand manufacturer’s instructions for proper use.

General advice includes:

- Ensure the stand is not placed where it will be a trip hazard
- Ensure the stand is rated to take the weight of the speaker comfortably
- Ensure the legs are splayed out sufficiently to prevent toppling

17. Loudspeaker cables

From a rigging perspective, there are a number of points to consider regarding loudspeaker cables:

1. The “self” weight of the cable must be factored in to the total load to be flown.

Some typical cable weights are listed below for illustration:

Cable type	Connector type	Typical weight per metre (grams)
2 x 2.5mm ² (14AWG)	NL4	122 (0.269 lbs)
2 x 4.0mm ² (12 AWG)	NL4	162 (0.357 lbs)
4 x 2.5mm ² (14AWG)	NL4	160 (0.353 lbs)
4 x 4.0mm ² (12AWG)	NL4	260 (0.573 lbs)
8 x 2.5mm ² (14AWG)	NL8	350 (0.772 lbs)
8 x 4.0mm ² (12 AWG)	NL8	500 (1.102 lbs)

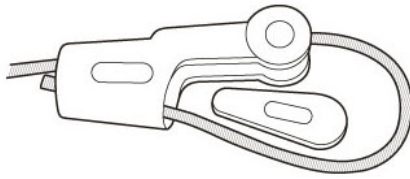
E.g. For a system comprising an IF3115, 10 metres of 8 x 4.0mm² cable would add an additional 5kg of weight per speaker.

2. Cable management is necessary to ensure the cabling is held securely, and neatly in place, and that the cable is not under any strain, which may cause damage to the connections, undesired positioning or movement of the system.
3. Never use a loudspeaker cable for “tying off” – the purposes of preventing the system from rotating.

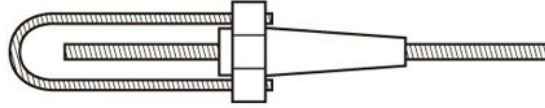
18. Commonly used rigging accessories

Here are some examples of rigging accessories which may prove useful in providing solutions to common problems encountered in rigging the Installation Series speakers in a variety of environments:

- Wedge sockets
- Bullets
- Rigging screws
- Hanging clamp
- STAC chain
- RUD Adjustable chain sling
- Bridles
- Master links / O links
- Shackles
- Wire rope slings
- Girder clamps
- Load Rated Karibiner
- Custom brackets



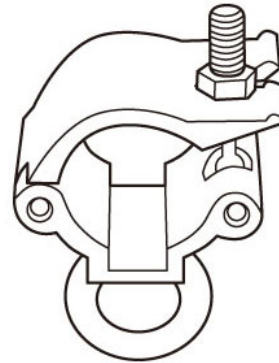
WEDGE SOCKETS



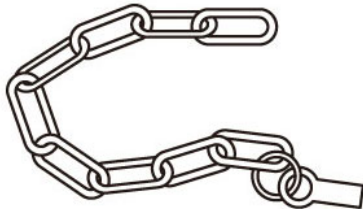
BULLETS



RIGGING SCREWS



HANGING CLAMP



STAC CHAIN



RUD ADJUSTABLE
CHAIN SLING



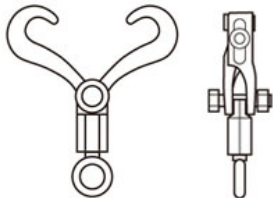
MASTER LINK



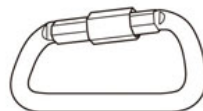
SHACKLES



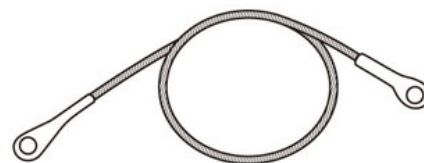
BRIDLES



GIRDER CLAMPS



LOAD RATED
KARIBINER



WIRE ROPE SLING

19. Specialist rigging tools

While many of the tools needed for rigging are common, there are some specialized tools that can greatly facilitate installation, such as:

- Inclinometer (digital or conventional for measuring angles)
- Laser tape measure (to measure distances, particularly height)
- Laser pointer (for loudspeaker alignment)