5. RIGGING THE SYSTEM

GENERAL RIGGING WARNINGS AND SAFETY PRECAUTIONS

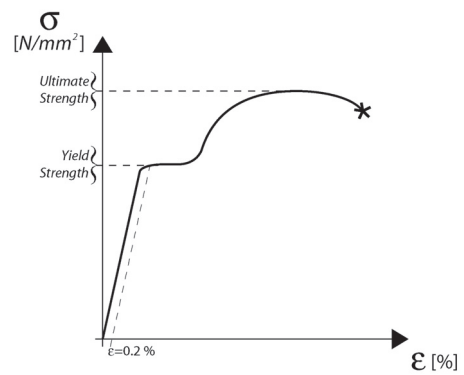
- *Suspending loads should be done with extreme caution.*
- *When deploying a system always wear protective helmets and footwear.*
- *Never allow people to pass under the system during the installation process.*
- *Never leave the system unattended during the installation process.*
- *Never install the system over areas of public access.*
- *Never attach other loads to the array system.*
- *Never climb the system during or after the installation.*
- *Never expose the system to extra loads created from the wind or snow.*

⚠ WARNING

- The system must be rigged in accordance with the laws and regulations of the Country where the system is used. It is responsibility of the owner or rigger to make sure that the system is properly rigged in accordance with Country and local laws and regulations.
- Always check that all the parts of the rigging system that are not provided from RCF are:
  -appropriate for the application
  -approved, certified and marked
  -properly rated
  -in perfect condition
- Each cabinet support the full load of the part of the system below. It is very important that each single cabinet of the system is properly checked.

"RCF SHAPE DESIGNER" SOFTWARE AND SAFETY FACTOR

The suspension system is designed to have a proper **safety factor** (configuration dependent). Using the "RCF Shape Designer" software it is very easy to understand safety factors and limits for each specific configuration. To better comprehend in which safety range the mechanics are working a simple introduction is needed: TTL33/ TTL31-A mechanics are built with certified **UNI EN 10025-95 S 235** JR Steel. RCF prediction software calculates forces on every single stressed part of the assembly and shows the minimum safety factor for every link. S 235 JR is a structural steel and has a stress-strain (or equivalent Force-Deformation) curve like the following:



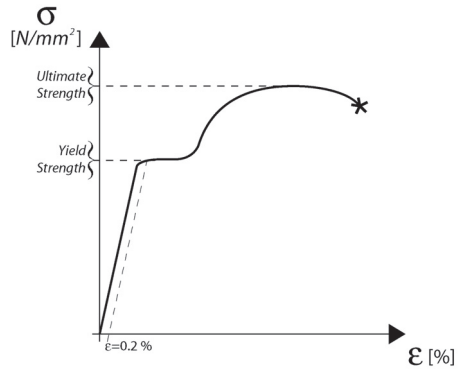
The curve is characterized by two critical points: the **Break Point** and the **Yield Point.** The tensile ultimate stress is simply the maximum stress attained. Ultimate tensile stress is commonly used as a criterion of the strength of the material for structural design, but it should be recognized that other strength properties may often be more important. One of these is for sure the Yield Strength. Stress-strain diagram of S 235 JR exhibit a sharp break at a stress below the ultimate strength. At this critical stress, the material elongates considerably with no apparent change in stress. The stress at which this occurs is referred to as the yield point. Permanent deformation may be detrimental, and the industry adopted 0.2% plastic strain as an arbitrary limit that is considered acceptable by all regulatory agencies. For tension and compression, the corresponding stress at this offset strain is defined as the yield.

S 235 JR characteristic values are R=360 [N/mm2] for Ultimate Strength and Rp0.2=360 [N/mm2] for **Yield Strength.**

In our prediction software the **Safety Factors** are calculated considering the **Maximum Stress Limit** equal to the **Yield Strength,** according with many international standards and rules.

The resulting Safety Factor is the minimum of all the calculated safety factors, for each link or pin.

This is where you are working with **a SF=7**



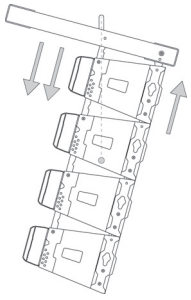
Depending on local safety regulation and on situation the required safety factor can vary. It is responsibility of the owner or rigger to make sure that the system is properly rigged in accordance with Country and local laws and regulations.

The "RCF Shape Designer" software gives detailed information of the safety factor for each specific configuration.
The results are classified in 4 classes:

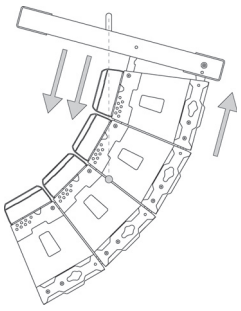
-GREEN:		**SAFETY FACTOR**	**> 7**	**SUGGESTED**
-YELLOW	**4 >**	**SAFETY FACTOR**	**> 7**	
-ORANGE	**1.5 >**	**SAFETY FACTOR**	**> 4**	
-RED		**SAFETY FACTOR**	**< 1.5**	**NEVER ADMITTED**

WARNING

- The safety factor is the result of the forces acting on fly bar's and system's front and rear links and pins and depends on many variables:
  - number of cabinets
  - fly bar angles
  - angles from cabinets to cabinets. If one of the cited variables change the safety factor **MUST BE** recalculated using the software before rigging the system.
- In case the fly bar is picked up from 2 motors make sure that the fly bar angle is correct. An angle different from the angle used in the prediction software can be potentially dangerous. Never allow persons to stay or pass under the system during the installation process.
- When the fly bar is **particularly tilted** or the array is **very curved** the centre of gravity can move out from the rear links. In this case the front links are in compression and the rear links are supporting the total weight of the system plus the front compression. Always check very carefully with the "RCF Shape Designer" software all this kind of situations (even with a small number of cabinets).

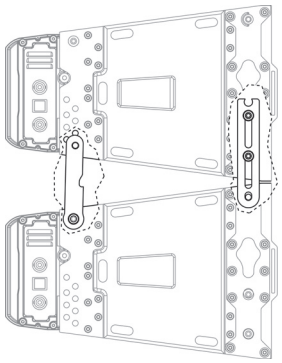


System particularly tilted



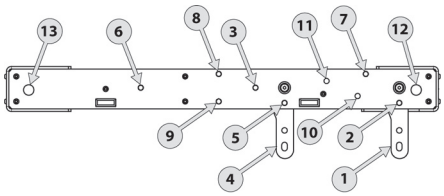
System very curved

RIGGING SYSTEM

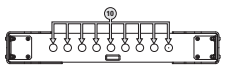


The TTL33-A/TTL31-A module is provided with 4 rigging bars, 2 in the front and 2 in the rear corners. The rigging bars are securely connected
to front and rear metal corners. Front and rear metal corners are securely connected to the cabinet. The rigging system is made of rigging bars and metal corners in sequence. Rigging bars and metal corners are securely connected by:
- M10 rectified bolts
- Quick lock pins The wooden cabinet is not a primary part of the rigging system.

THE TTL33-A FLY BAR

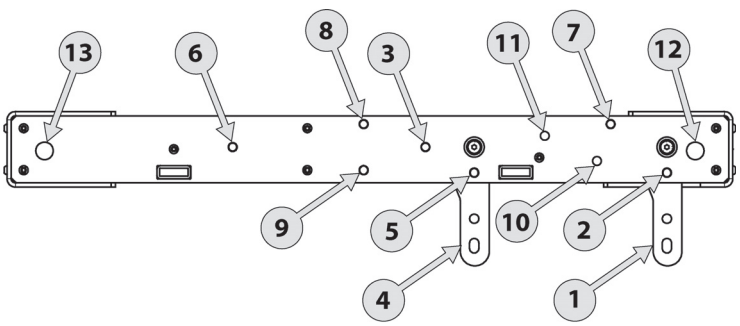


The TTL33-A system must be suspended using the RCF TTL33-A fly bar

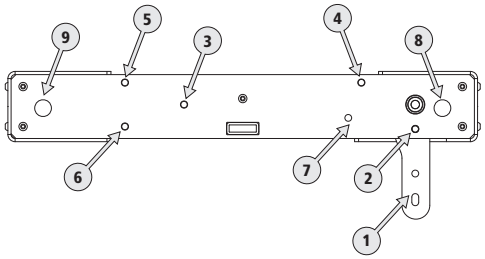


THE TTL33-A FLY BAR FEATURES:

1. FRONT FLYING BRACKET - Front mounting
2. QUICK LOCK PIN HOLE - Front mounting (to be used to lock the front bracket before installation)
3. REAR BAR HOLE - Front mounting
4. FRONT FLYING BRACKET - Rear mounting
5. QUICK LOCK PIN HOLE - Rear mounting (to be used to lock the front bracket before installation)
6. REAR BAR HOLE - REAR MOUNTING.
7. FRONT STACKING POINT.
8. REAR STACKING POINT - UPPER POSITION.
9. REAR STACKING POINT - LOWER POSITION.
10. FRONT BRACKET - TRANSPORT POSITION HOLE.
11. REAR BRACKET - TRANSPORT POSITION HOLE.
12. CORNER DOUBLE-MOTOR PICK-UP POINT.
13. CORNER DOUBLE-MOTOR PICK-UP POINT.
14. 12 CENTRAL PICK-UP POINTS.



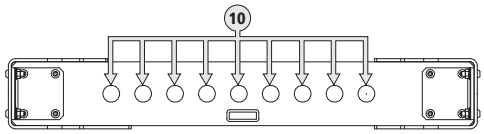
THE TTL31-A FLY BAR

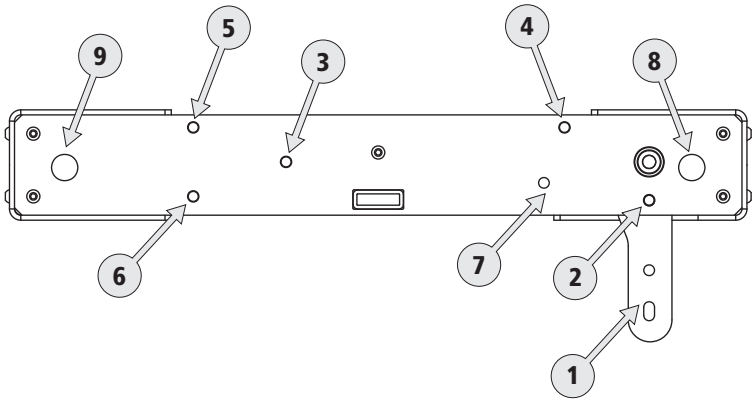


The TTL31-A system must be suspended using the RCF TTL31-A fly bar

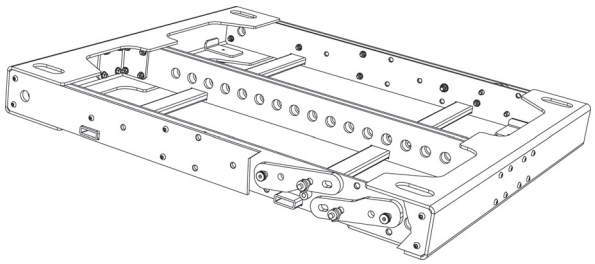
THE TTL31-A FLY BAR FEATURES:

1. FRONT FLYING BRACKET - Front mounting
2. QUICK LOCK PIN HOLE - Front mounting (to be used to lock the front bracket before installation)
3. REAR BAR HOLE - Front mounting
4. FRONT STACKING POINT.
5. REAR STACKING POINT - UPPER POSITION.
6. REAR STACKING POINT - LOWER POSITION.
7. FRONT BRACKET - TRANSPORT POSITION HOLE.
8. CORNER DOUBLE-MOTOR PICK-UP POINT.
9. CORNER DOUBLE-MOTOR PICK-UP POINT.
10. 9 CENTRAL PICK-UP POINTS.

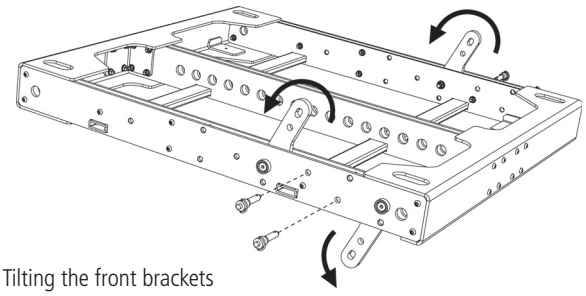




FRONT BRACKETS, FRONT AND REAR MOUNTING:

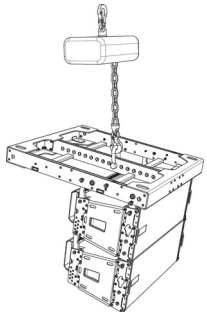


Front brackets in transport position

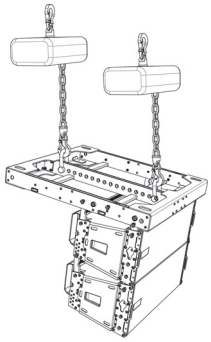


Tilting the front brackets

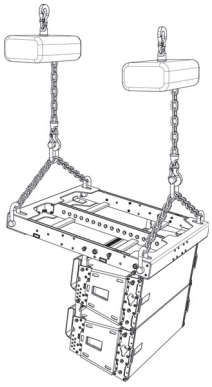
THE 3 POSSIBLE PICK-UP SYSTEMS FOR THE TTL33-A/TTL31-A FLY BAR ARE THE FOLLOWING:



SINGLE MOTOR - CENTRAL PICK-UP



DOUBLE MOTOR - CENTRAL FRONT-BACK PICK-UP



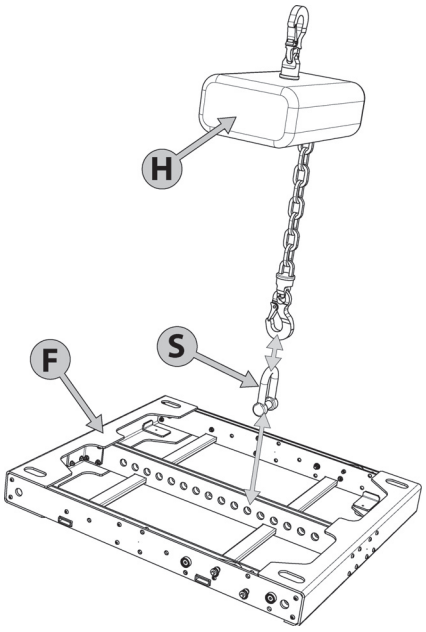
DOUBLE MOTOR - 4 CORNERS PICK-UP

WARNING

- Always check that the rigging motors rating exceed the total load to be suspended.
- Always check that the connection hoist rating exceed the total load to be suspended. The connection hoist must be connected using the flat part in contact to the bar and the round part connected to the motor hoist.

RIGGING PROCEDURE

RIGGING THE SYSTEM FOLLOW THE PROCEDURE:

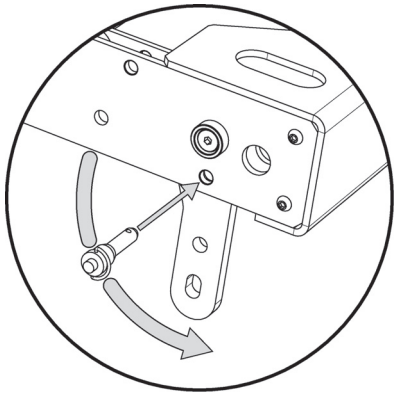


H RIGGING CHAIN HOIST

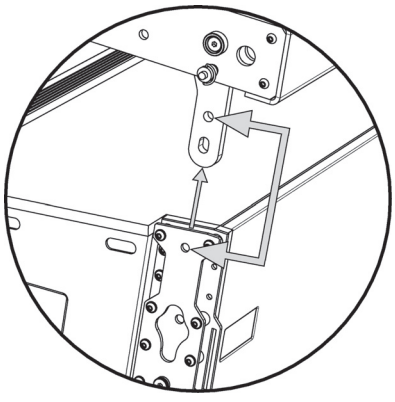
S CERTIFIED SHACKLE

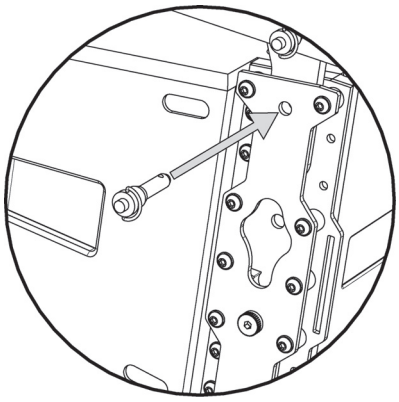
F FLY BAR

1 Connect the fly-bar F to the chain hoist H (o motors) using a certified shackle. Secure the shackle to prevent un-screwing (following the shackle supplier instructions
and warnings)

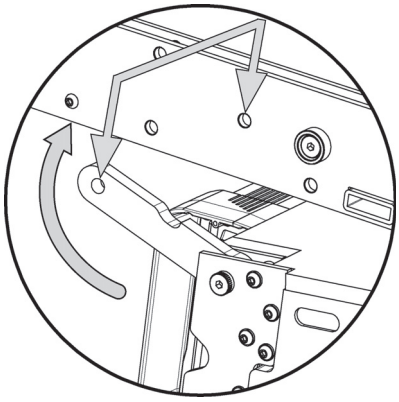


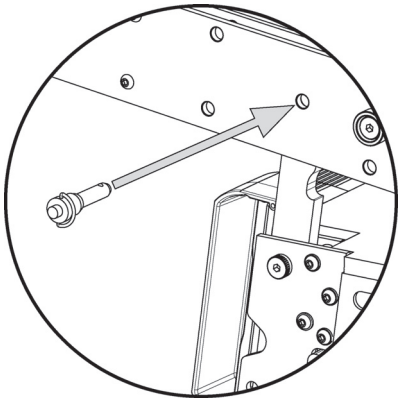
2 Connect the second pin on the front bracket to make sure that the connecting bracket is vertical



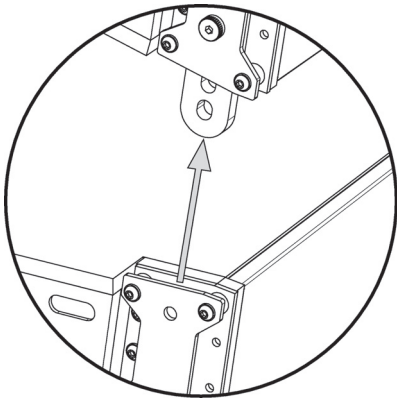


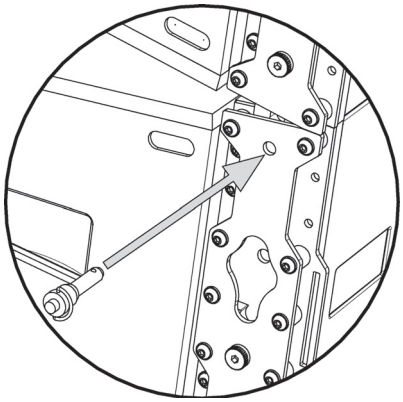
3 Connect the front bracket to the first TTL33-A/TTL31-A cabinet using 2 quick lock pins



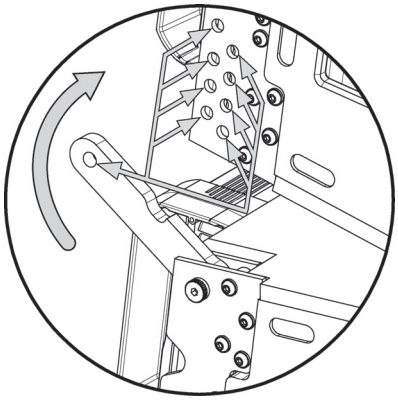


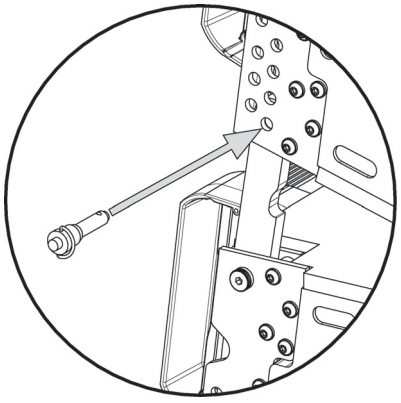
4 Reverse and connect the 2 rear bracket to the fly-bar using 2 quick lock pins





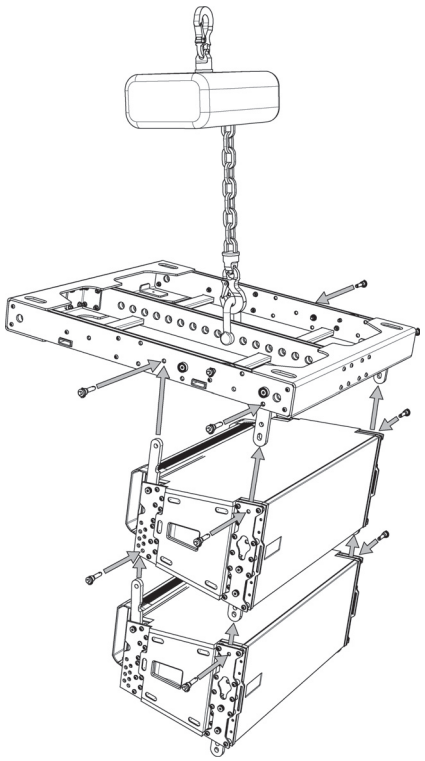
5 Connect the second cabinet to the first always starting from the 2 front brackets



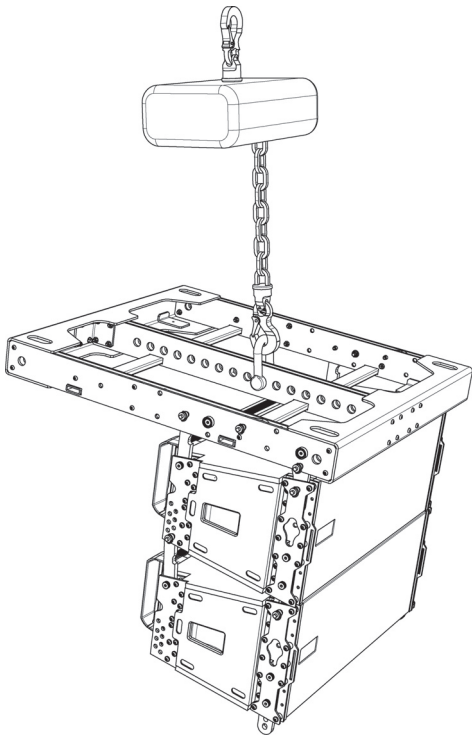


6 Reverse and connect the rear brackets of the second cabinet using the hole for the proper angle.

7 Connect all the other cabinets following the same procedure and connecting a single cabinet each time.



TTL33-A/TTL31-A RIGGING SYSTEM



TTL33-A/TTL31-A FLOWN SYSTEM

WARNING

- Always make sure that each quick locking pin is properly entered in the right position and securely locked.
- Always make sure that rear left and right angle set-up are the same.
- Rigging the array, in any case, always lock the 2 front pins at first, then the 2 rear pins. Un-rigging the array, in any case, always un-lock the 2 rear pins at first, than the 2 front pins.

UN-RIGGING THE SYSTEM

Un-rigging the system follow this instructions:

- remove the last cabinet un-locking the 2 rear pins at first, than the 2 front pins.
- remove all the other cabinets following the same procedure and removing a single cabinet each time.
- remove the fly-bar from the motor (o motors).

RIGGING OR UN-RIGGING MULTIPLE CABINETS

If the array is made of a small group of cabinet it is possible to rig or un-rig more than one cabinet a time. For example an array made of six cabinets can be rigged in two group of three cabinets, each group directly from the kart.

WARNING

This procedure is generally more dangerous and it is very important to respect the following limits of application:

- NEVER CONNECT A GROUP OF CABINETS BIGGER THAN 4
- NEVER CONNECT CABINETS IN GROUPS IF THE ARRAY IS BIGGER THAN 8
- NEVER CONNECT CABINETS IN GROUPS IF THE ARRAY IS VERY CURVED
- NEVER FLY THE SYSTEM AT TEMPERATURES LESS THAN -5° C

Use the same general strategy un-rigging the system.