Arena Deck - Operating & Maintenance Manual - V1

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1 Introduction

1.1 Operating & Maintenance Manual for Arena Deck Rolling Stage designed and manufactured by Total Solutions Group. *Fig. 1 - Complete System Front* & *Fig. 2 - Complete System Rear*

1.2 This document provides the guidelines and recommendations for the use, handling, care and future inspection of the system for the benefit of the user. Some general matters of safety are also discussed, but these should not be considered as an exhaustive list and users shall satisfy themselves that all reasonable steps are taken to ensure the safety of the personnel who are erecting and dismantling the system.

1.3 The system is to be made from aluminium to be light weight, easily movable, and generally to have an easy and quick method of fixing.

1.4 The system consists of modular decks nominally 8' x 4' typically. These are supported by a series of Gates and Beams that are linked via adjustable height Node Posts. The Gates are arranged in a set pattern for structural rigidity. Typically, the Gates and Beams are 8' or 4' in length. *Fig. 3 - Exploded View*

1.5 There are two scenarios for use:

1.5.1 Rolling. The Stage would be supplied with Castors, assembled FOH whilst Lighting Rigs or other flown items are installed and then the Stage rolled into final position.

1.5.2 Static. The Stage is supplied with Scaffold Jacks to level. Fixed position once assembled.

1.6 Achievable Stage Heights:

1.6.1 Rolling. 1397mm to 1955mm. *Fig. 4 - Rolling Stage Heights*

1.6.2 Static. 1120mm to 1480mm. *Fig. 5 - Static Stage Heights*

1.7 Modular handrails can be fitted to create a safe working area around the perimeter of the Stage.

1.8 Variable height steps and ramps can be added once the Stage is in its final position. These are fully demountable for storage.

1.9 The deck surface is typically hi-grip Phenolic Ply. This can be substituted for a range of finishes. Eg. Birch Ply with black hi-Shine Marley.

1.10 A dolly storage system can also be supplied if required.

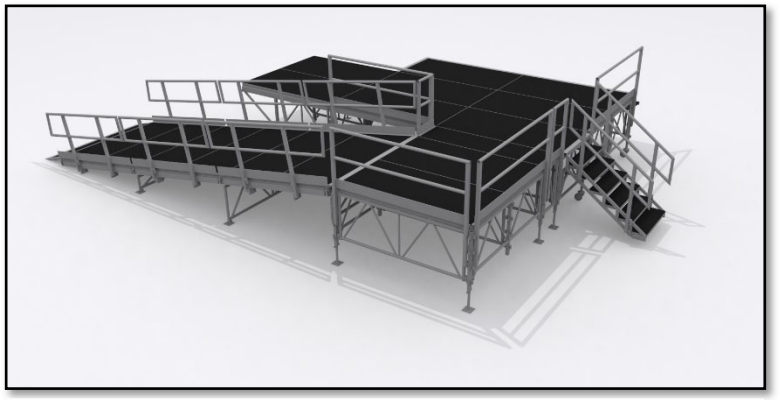

Fig. 1 - Complete System Front

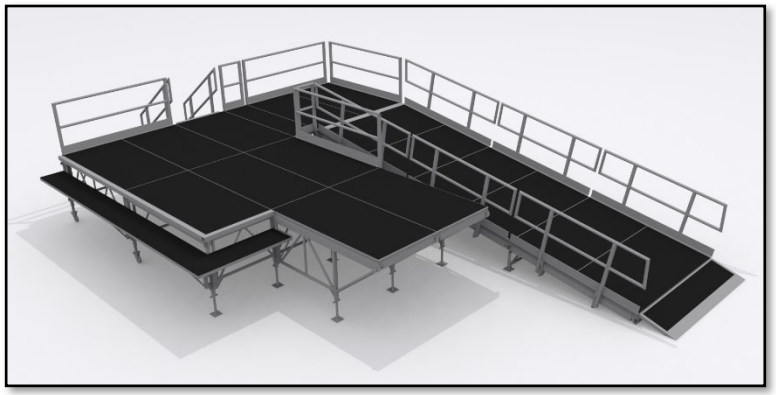

Fig. 2 - Complete System Rear

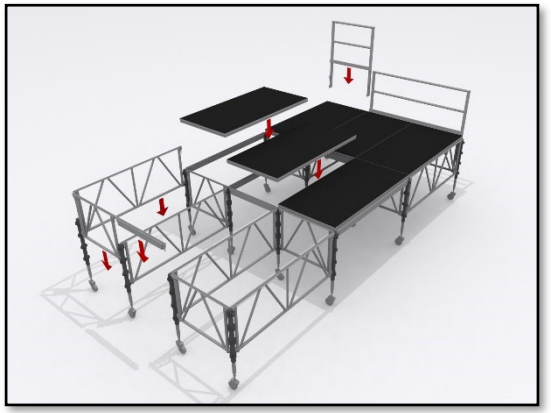

Fig. 3 - Exploded View

2 Version

Version: 1

Date: 29th October 2024

2.1 Other Operating Manuals

2.1.1 The User shall read and fully understand this manual and all other relevant Operating Manuals which are available from TSG before attempting to set up a structure without a consultant from TSG being present.

2.1.2 The User should also refer to:

2.1.2.1 The Event Safety Guide- Guidance to Health, Safety and Welfare at Music and Similar Events- HSG195 Health and Safety Commission.

2.1.2.2 Temporary Demountable Structures - The Institution of Structural Engineers

2.1.3 If Users are unclear about any aspect of the operation, then they shall seek advice from TSG before proceeding.

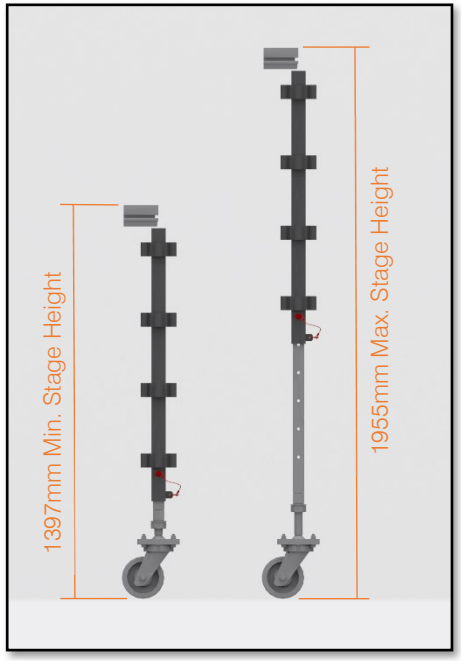

Fig. 4 - Rolling Stage Heights

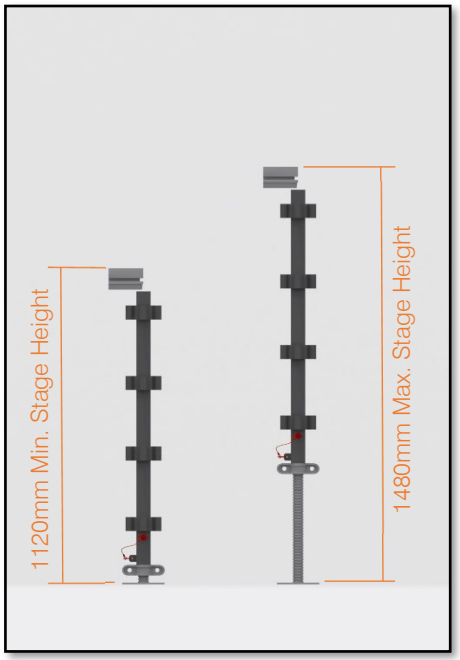

Fig. 5 - Static Stage Heights

3 Important

3.1 Read Carefully Before Use.

3.2 Keep for Future Reference.

3.3 This manual is specific to TSG Arena Deck Rolling Stage.

3.4 **Danger:** For intended use only.

3.5 **Danger:** Do not apply other manufacturers instructions to TSG products.

3.6 **Danger:** Do not climb structure to gain Stage access.

3.7 **Danger.** Do not Load Stage before rolling into position.

3.8 **Danger:** Do not modify components.

3.9 **Danger:** Holes should never be drilled in components.

3.10 **Warning:** Aluminium and steel conduct electricity.

3.11 **Warning:** Do not use in a severe marine environment without surface protection.

3.12 **Warning:** Do not store in freezing conditions.

3.13 **Warning:** This product shall only be used by a competent person.

3.14 **Warning:** This product shall not be used by children.

3.15 **Warning:** Always inspect product prior to use.

3.16 **Warning:** Appropriate PPE should be used where necessary .

3.17 **Warning;** Wear hearing protection when hammering pins.

3.18 **Warning:** Never undertake repairs or welding to components.

3.19 **Warning**: Decks and storage Dollies can potentially be heavy. Ensure Manual Handling is adequately considered and implemented.

3.20 **Caution:** Do not consume.

3.21 Any of the above items can lead to the following consequences:

- Invalidation of warranty
- refusal of support services
- structural failure
- damage to property
- injury or death

4 Users

4.1 This product is to be used only by competent persons.

4.2 This product shall not be used by children.

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6 Terms and Definitions

Beam

Manufactured Box Section with integrated connection to connect to a Node Post.

Competent Person

A person who has the necessary knowledge, skill and experience to carry out the task at hand.

Connection

Connectors or connection elements needed to connect components and associated structural components.

Connection element

Loose parts for assembling truss modules and associated structural components.

Dead load

The self-weight of the component.

Deck

Manufactured frame fitted with cladding to act as the Stage floor.

Dolly or Dollies

Manufactured cart designed for safe storage and handling of components when not in use.

Dynamic load

A structurally significant magnification of design load due to movement.

Frequent use factor

Reduction factor used when calculating allowable loads.

Gate

Manufactured frame with integrated connection to connect to a Node Post.

Imposed Load

The load imposed by fixtures (including cabling) or other equipment carried by or attached to a component.

Monotonic

For which the variation is always in the same direction.

Node Post

Manufactured post to accept incoming connection.

Permanent Action

Action that is likely to act throughout a given reference period and for which the variation in magnitude with time is negligible, or for which the variation is always in the same direction (monotonic) until the action attains a certain limit value.

Scaffold Jack

Proprietary off the shelf leveling component. Consists of a coarse external threaded upright and rotatable collar. Usually rated at either 4t or 6t.

Snug-tight

'A condition achievable by the effort of one person using a spanner without an extension arm' for tightening bolts.

Telescopic Leg

Manufactured steel leg that slides inside Node Post. Fitted with Castor and variable holes. Threaded boss to give Stage height adjustments and movement.

TFL

Total Fabrications Ltd (part of the Total Solutions Group).

TSG

Total Solutions Group.

Variable Action

Action for which the variation in magnitude with time is neither negligible nor monotonic.

7 General Notes

7.1 The components are designed to be used under normal operating conditions and not in extremes of temperature or other particularly adverse conditions.

7.2 **Important:** The use of lifting equipment is outside of the scope of this manual. The user should seek advice from the manufacturer as required.

7.3 Materials:

7.3.1 The material generally used in the manufacture of the components is 6082 - T6 aluminium alloy.

7.3.2 Surface protection is only needed where the components are used in severe urban, industrial environments.

7.4 Certification, testing and inspection:

7.4.1 Persons supplying work equipment are responsible for ensuring that the components are inspected at the appropriate frequency.

7.4.2 The inspection schedule is dependent on such things as frequency of use, typical and maximum imposed loads and this is discussed later. *See 14 Inspection and Maintenance*

7.4.3 Components must be visually checked by the user for damage before and during assembly.

7.4.4 Components shall not be used if damaged beyond TSG guidelines. *See 14 Inspection and Maintenance*

7.5 Load Tables:

7.5.1 **Warning:** Do not consult generic load charts. *See 10 Loading*

7.6 Supervision of erection, rigging and dismantling of the Structure:

7.6.1 **Warning:** The erection, any modification and the subsequent dismantling of the structure shall be planned and supervised by a competent person

7.6.2 **Warning:** A competent person shall be responsible for the safe erection or rigging of the structure and check that all components and fasteners are in place and functioning satisfactorily.

7.6.3 **Warning:** The structure must be checked for damage during and on completion of the erection or dismantling of the structure.

7.7 Existing Structures

⚠ 7.7.1 **Warning:** It is the responsibility of the user to check that the existing supporting structure for the Stage is adequate for the purpose.

8 Tools and Equipment

8.1 Rolling of Stage:

8.1.1 Bespoke Node Turner. Used to ensure all wheels are pointing in the same direction prior to movement. *Fig. 6 – Node Turner*

8.2 Setup of Node Post Height:

8.2.1 Use a Tape Measure to initially set the height of all Node Posts.

8.3 Removal of incoming connection from Node Post:

8.3.1 Raw Hide Hammer of suitable weight (No.4) *Fig. 9 – Raw Hide Hammer*

⚠ 8.3.2 **Warning:** Do not strike the face of box or tubular sections. Irreversible damage may occur to the component.

8.4 Locating Deck to substructure:

8.4.1 Paving Maul or Slab Hammer. Used to finely adjust the position of a deck to drop into place. *Fig. 8 – Pavers Maul*

8.4.2 Can also be used to adjust the substructure in the eventuality that it has become a parallelogram and is out of square.

⚠ 8.4.3 **Warning:** Do not strike the face of box or tubular sections. Irreversible damage may occur to the component.

8.5 Additional equipment a user may find useful to provide when assembling components to form a Stage could include:

8.5.1 2.4m Spirit Level. *Fig. 7 – 2.4m Spirit Level*

8.5.2 Large Set Square.

8.5.3 Laser level and staff. *Fig. 10 – Laser Level*

9 Assembly and connection of components

9.1 Assembly of Stage:

9.1.1 Telescopic Leg to Node Post (Rolling Configuration):

9.1.1.1 Remove R-clip followed by the pin from the hole in the Node Post. Pin is captive on a steel wire rope.

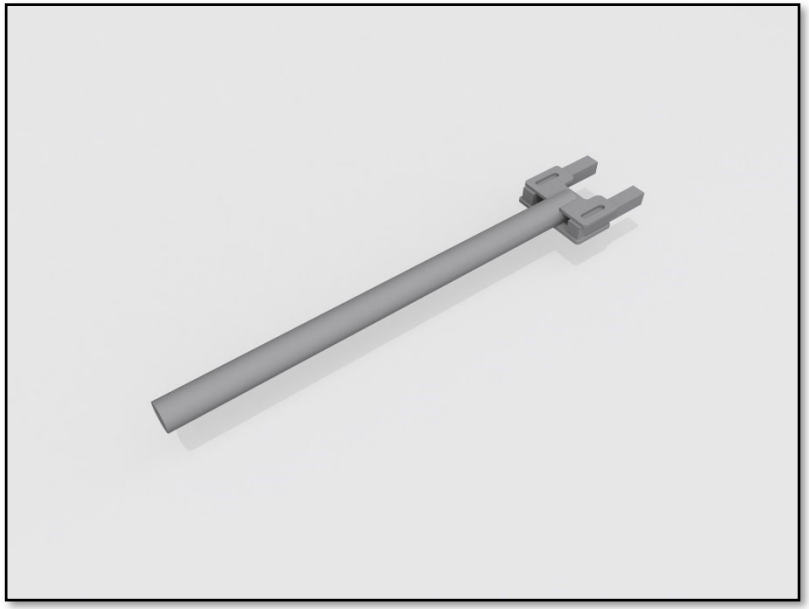


Fig. 6 – Node Turner

Fig. 8 – Pavers Maul

Fig. 7 – 2.4m Spirit Level

Fig. 9 – Raw Hide Hammer

Fig. 10 – Laser Level

9.1.1.2 Insert Telescopic Leg inside Node Post. Ensure holes in Leg and Node Post are in the same direction.

9.1.1.3 Slide the Telescopic Leg all the way in until the required pin hole is aligned to the Node Post hole depending on the Stage height required.

9.1.1.4 Refit the pin through the Node Post hole and keep in place with the R-clip. Failure to do so could cause the pin to work loose and fall out. *Fig. 13 – Pin Telescopic Leg to Node Post*

9.1.1.5 **Warning:** Only use the R clips supplied.

9.1.1.6 **Warning:** PVC tape is not an appropriate substitute for R clips which prevent the pin from being drawn into the connection under load.

9.1.1.7 For fine adjustments to level the Stage, undo the M20 plain nut and rotate the castor plate mounted to the threaded bar. Once set, tighten the plain nut until snug. *Fig. 12 – Adjusting Height rotating castor*

9.1.1.8 **Danger:** The top pin hole is not to be used (Hole 7). This would result in the Telescopic Leg lacking lateral support. Risking buckling of the Leg and potential collapse of the deck once loaded. *Fig. 11 – Pin Hole References*

9.1.2 Node Post Height (Rolling Configuration):

9.1.2.1 Use a Tape Measure to initially set the height of all Node Posts. Subtract 82mm from the required height. Measure from the underside of the castor to the top of the Node Post. *Fig. 15 – Measuring Node Post Height*

9.1.2.2 The Telescopic Leg has 6 useable pin positions. These give a working range of 1397mm to 1955mm. Achieved in the below increments: *Fig. 11 – Pin Hole References*

- Pin hole 1 (Lowest Hole). 1397mm to 1497mm.
- Pin hole 2. 1497mm to 1597mm.
- Pin hole 3. 1597mm to 1697mm.
- Pin hole 4. 1697mm to 1797mm.
- Pin hole 5. 1797mm to 1897mm.
- Pin hole 6. 1897mm to 1955mm.

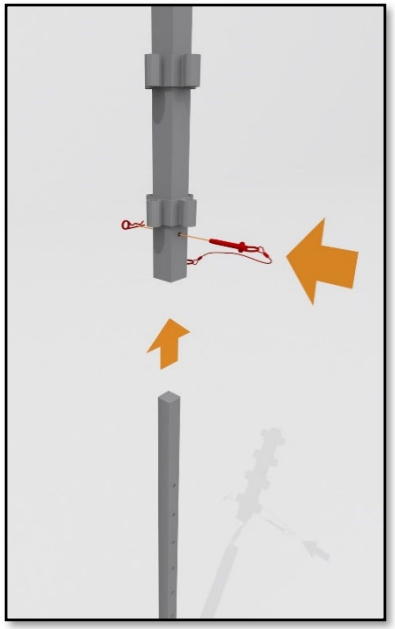


Fig. 13 – Pin Telescopic Leg to Node Post

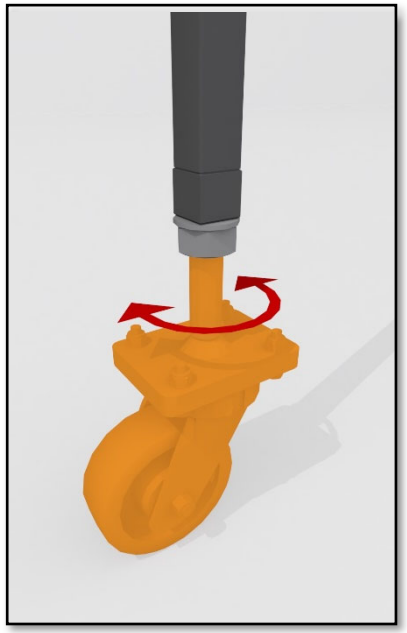


Fig. 12 – Adjusting Height rotating castor

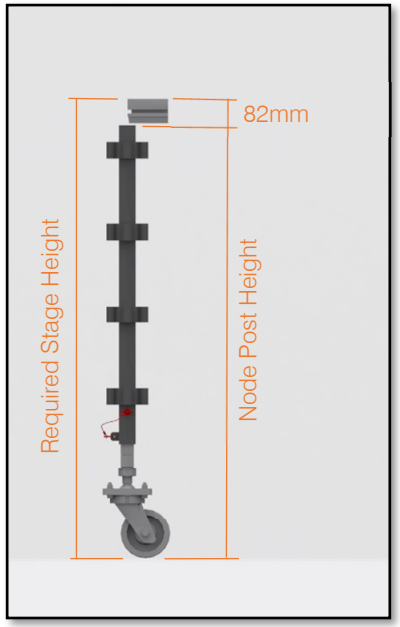


Fig. 15 – Measuring Node Post Height

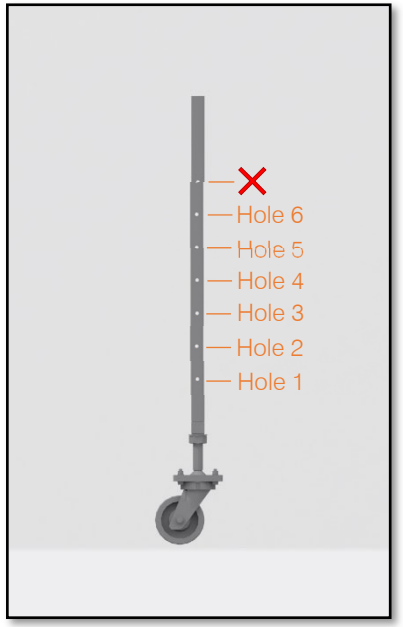


Fig. 14 – Pin Hole References

9.1.3 Scaffold Jack to Node Post (Static Configuration):

9.1.3.1 Slide the threaded Scaffold Jack into the bottom of the Node Post. *Fig. 17 – Scaffold Jack to Node Post*

9.1.3.2 Use the threaded collar to level and set the stage height.

⚠ 9.1.3.3 **Warning:** 225mm of thread minimum must be inside the Node Post. Use timber packers if more adjustment is required. *Fig. 16 – Min. Insertion*

9.1.4 Gate to Node Post:

9.1.4.1 Stand two Node Posts upright and engage the two top connections of the Gate into the top holes of the Node Post. *Fig. 18 – Gate onto Node Post*

9.1.4.2 As the Gate is lowered into position ensure the lower connections also engage in the bottom holes of the Node Post.

9.1.4.3 Once fully seated fit R-clips through the holes in the top connections.

⚠ 9.1.4.4 **Warning:** Only use the R clips supplied.

⚠ 9.1.4.5 **Warning:** PVC tape is not an appropriate substitute for R clips which prevent the pin from being drawn into the connection under load.

⚠ 9.1.4.6 **Danger:** Failure to fit the R-clips could allow the gate to become detached from the Node Post causing potential deck collapse.

9.1.5 Beam to Node Post:

9.1.5.1 Stand two Node Posts upright and engage the two connection each end of the Beam into the top holes of the Node Post. *Fig. 19 – Beam onto Node Post*

9.1.5.2 Once fully seated fit R-clips through the holes in the top connections.

⚠ 9.1.5.3 **Warning:** Only use the R clips supplied.

⚠ 9.1.5.4 **Warning:** PVC tape is not an appropriate substitute for R clips which prevent the pin from being drawn into the connection under load.

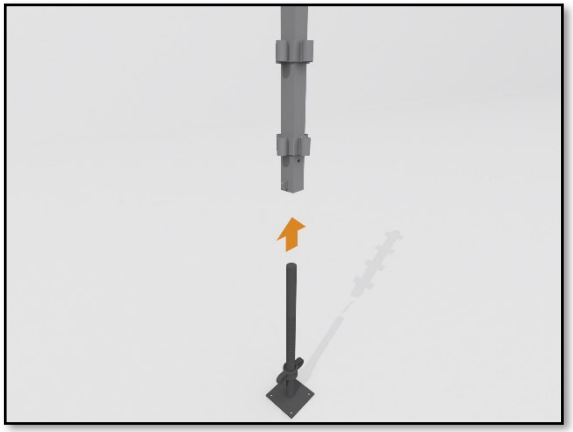


Fig. 17 – Scaffold Jack to Node Post

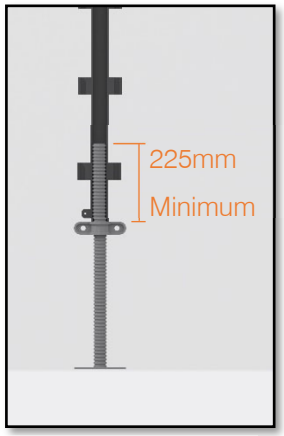


Fig. 16 – Min. Insertion

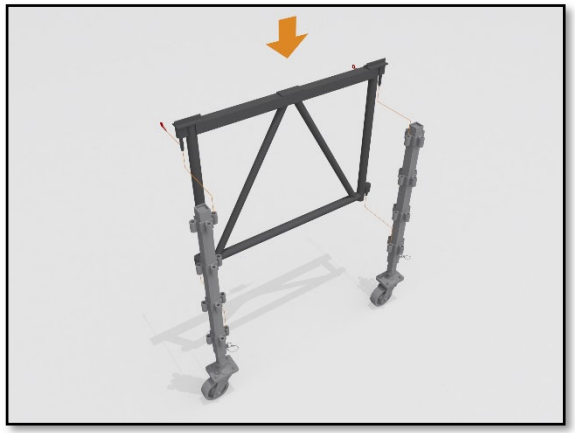


Fig. 18 – Gate onto Node Post

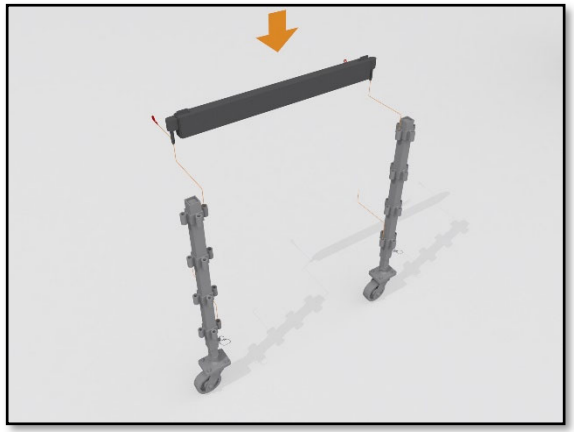


Fig. 19 – Beam onto Node Post

9.1.5.5 **Danger:** Failure to fit the R-clips could allow the gate to become detached from the Node Post causing potential deck collapse.

9.1.6 Assembly of 1st bay:

9.1.6.1 Typically the 1st bay would be consist of:

- 4 off Node Posts.
- 2 off 4' Gates.
- 2 off 8' Gates.

9.1.6.2 Assemble Gates to Node Posts as described above to form a rectangle with a Node Post in each corner. The gates fit into the adjacent holes in the Node Post at 90 Deg. *Fig. 20 – Typical Bay of Gates*

9.1.6.3 Carefully lift the first deck off the dolly. The outside edge of the deck fits onto the top face of the Gates between the T-Sections.

9.1.6.4 Engage one corner of the deck first, the other three corners then align due to the profile of the deck extrusion. If not rotate the opposing Node Post to ensure the gates are at 90 Deg. to each other and the Node Post. *Fig. 21 – Fitting of Deck*

9.1.6.5 **Danger:** Ensure fingers are not underneath the deck edge when being lowered. Failure to do so could cause injury against the Gate.

9.1.6.6 Using a long spirit level or Laser Level ensure the deck is level. Failure to do this can cause tolerance issues when fitting adjacent decks.

9.1.6.7 TSG recommends levelling each deck as the install progresses.

9.1.7 Assembly of bays 2 and 3 (Working across Stage):

9.1.7.1 Assemble another rectangle of Gates separate to the first bay but close by. *Fig. 22 – Assembling Cross Stage*

9.1.7.2 Using 2 off 4' Beams link the bays of gates together.

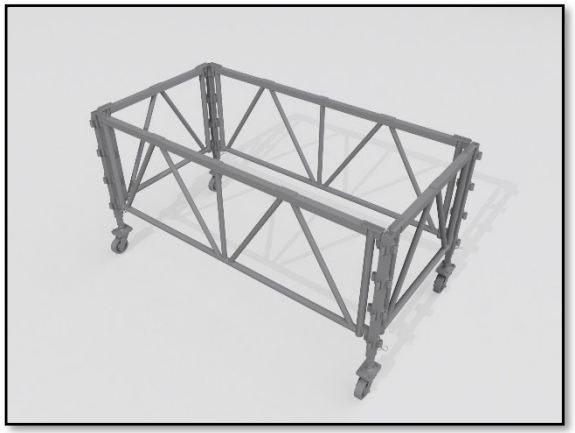


Fig. 20 – Typical Bay of Gates

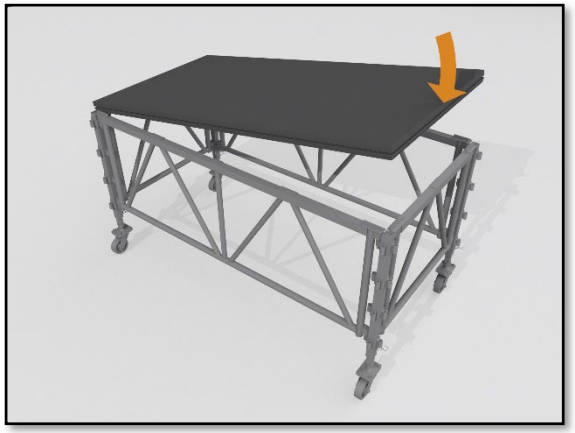


Fig. 21 – Fitting of Deck

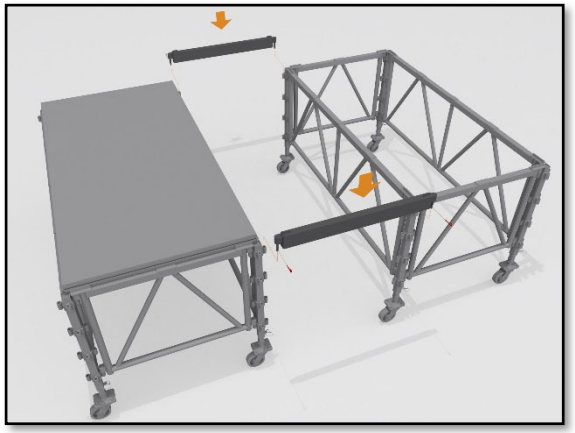


Fig. 22 – Assembling Cross Stage

9.1.7.3 **Danger:** There must always be 2 off gates at 90 Deg, connected to each Node Post. Failure to do so shall result in the Node Post not having vertical stability and could cause the Deck to collapse. *Fig. 23- Gates NOT at 90 Deg.* & *Fig. 24 - Gates at 90 Deg.*

9.1.7.4 Carefully fit the deck into the 2nd bay. This bay should be made up of 2 off 8' gates and 2 off 4' beams. *Fig. 26 – Fitting Decks to bays 2 & 3*

9.1.7.5 Level the 2nd bay to match the 1st bay.

9.1.7.6 Carefully fit the deck into the 3rd bay. This bay should be made up of 2 off 8' gates and 2 off 4' Gates. *Fig. 26 – Fitting Decks to bays 2 & 3*

9.1.7.7 Level the 3rd bay to match the 2nd bay.

9.1.7.8 **Important:** Ensure that the deck edges are inline. Use the Paving maul to manipulate the substructure and decks. Failure to do this shall result in tolerance difficulties later on. *Fig. 25 – Decks NOT inline* & *Fig. 27 – Decks inline*

9.1.7.9 Continue the pattern repeating beams followed by gates until the desired width of Stage is created.

9.1.7.10 **Important**: If the last bay ends up as 4' Beams then they must be switched out to 4' gates to correctly support the Node Post. *Fig 29 – End bay of Beams* & *Fig. 28 – End bay of Gates*

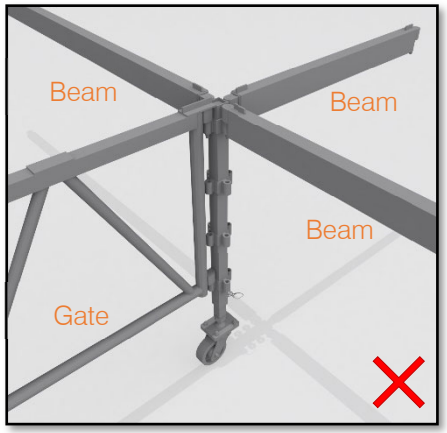


Fig. 23- Gates NOT at 90 Deg.

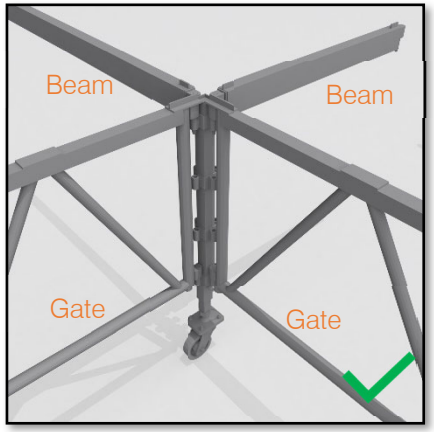


Fig. 24 - Gates at 90 Deg.

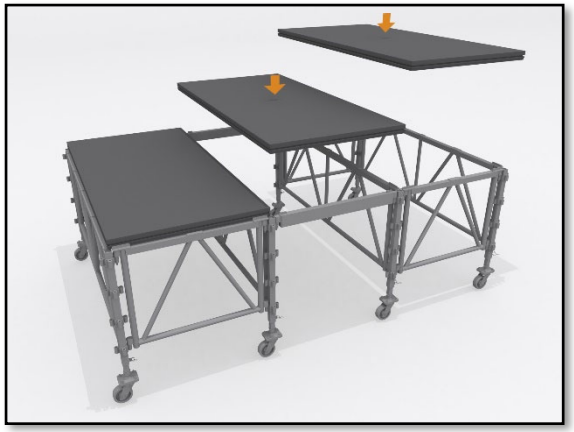


Fig. 26 – Fitting Decks to bays 2 & 3

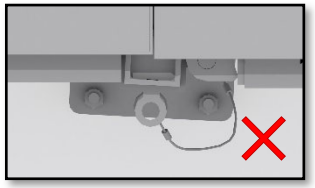


Fig. 25 – Decks NOT inline

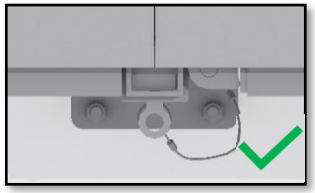


Fig. 27 – Decks inline

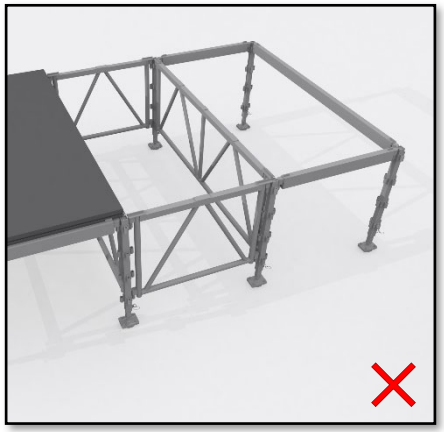


Fig 29 – End bay of Beams

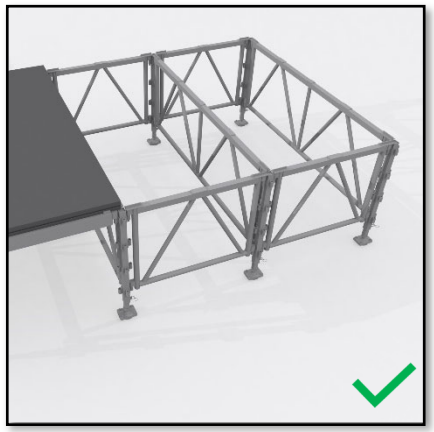


Fig. 28 – End bay of Gates

9.1.8 Assembly Up and Down Stage:

9.1.8.1 Assemble another rectangle of Gates separate to the first bays in close proximity. *Fig. 30 – Assemble additional substructure*

9.1.8.2 Using 2 off 8' Beams link the bays of gates together.

9.1.8.3 **Danger:** There must always be 2 off gates at 90 Deg, connected to each Node Post. Failure to do so shall result in the Node Post not having vertical stability and could cause the Deck to collapse. *Fig. 23- Gates NOT at 90 Deg.* & *Fig. 24 - Gates at 90 Deg.*

9.1.8.4 Carefully fit the deck into the Downstage bay. This bay should be made up of 2 off 4' gates and 2 off 8' beams. *Fig. 31 – Fit additional decks*

9.1.8.5 Level this deck to the original cross stage run of decks.

9.1.8.6 Carefully fit the next Downstage deck into the last empty bay. This bay should be made up of 2 off 8' gates and 2 off 4' Gates. *Fig. 31 – Fit additional decks*

9.1.8.7 Level this deck to the Upstage Decks.

9.1.8.8 **Important:** Ensure that the deck edges are inline. Use the Paving maul to manipulate the substructure and decks. Failure to do this shall result in tolerance difficulties later on. *Fig. 25 – Decks NOT inline* & *Fig. 27 – Decks inline*

9.1.8.9 Continue the pattern repeating beams followed by gates until the desired depth and width of Stage is created. Create bays of substructure before fitting Decks and levelling

9.1.8.10 **Important**: If the last bay ends up as 8' Beams then they must be switched out to 8' gates to correctly support the Node Post. *Fig 29 – End bay of Beams* & *Fig. 28 – End bay of Gates*

9.1.9 Rolling the Stage:

9.1.9.1 Using the Node turner, rotate all Telescopic Leg Castors to face the same direction. It shall not be possible to push a large Stage unless this step is carried due to the swivel radius of the castor. *Fig. 32 – Node Turner on Rolling Castor*

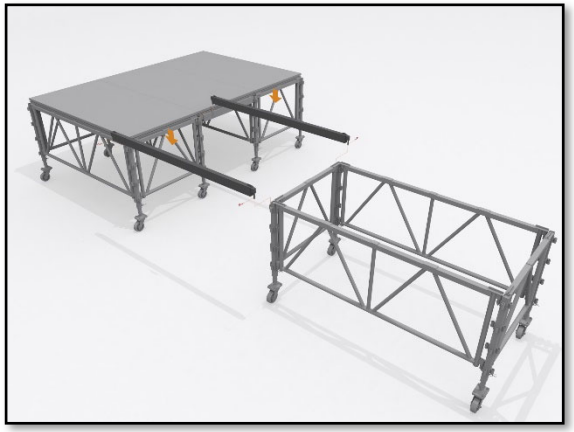


Fig. 30 – Assemble additional substructure

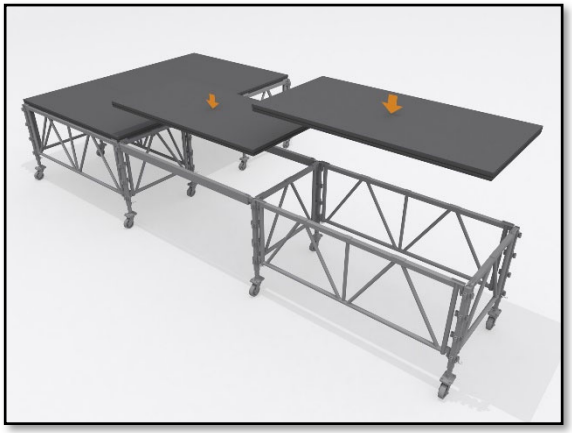


Fig. 31 – Fit additional decks

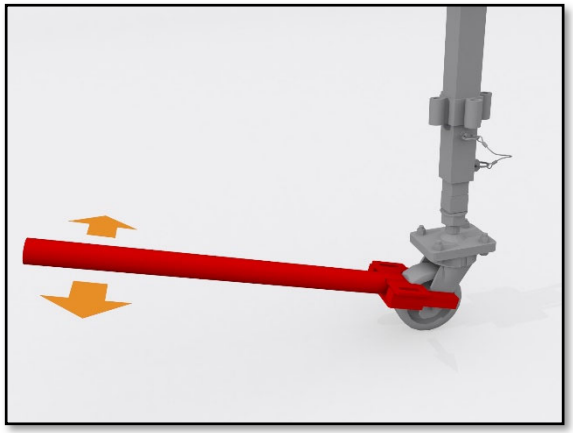


Fig. 32 – Node Turner on Rolling Castor

9.1.9.2 Using a suitable amount of personnel for the Stage Configuration, push against each of the Node Posts. Ensure the manoeuvre is controlled and that everyone pushes equally, else the Stage won't track straight. *Fig. 33 – Push Point*

9.1.9.3 If a small direction adjustment is required, rotate all of the castors before attempting to roll.

9.1.9.4 **Danger:** Do not use Mechanical means (Forklift) to roll the stage. This could result in localised forces being centred around the contact points. Leading to damage and/ or injury.

9.2 Handrail Installation:

9.2.1 The Node Post has 4 off vertical sets of connection holes. The top and bottom positions are for Gates and Beams. Handrails locate on to the mid positions (Holes 2 & 3). *Fig. 34 – Handrail Installation*

9.2.2 Engage the two top connections of the Handrail into the holes of two adjacent Node Posts.

9.2.3 As the Handrail is lowered into position, ensure the lower connections also engage in the holes of the Node Post.

9.2.4 Once fully seated fit R-clips through the holes in the top connections.

9.2.5 **Warning:** Only use the R clips supplied.

9.2.6 **Warning:** PVC tape is not an appropriate substitute for R clips which prevent the pin from being drawn into the connection under load.

9.2.7 **Danger:** Failure to fit the R-clips could allow the handrail to become detached from the Node Post causing a potential fall from the Stage.

9.3 Fascia Installation:

9.3.1 The Fascias have connections on the underside at each end. These locate into the top outer hole of the node post. *Fig. 35 – Fascia Installation*

9.3.2 Underside of the Fascia rests on the top face of the Gate or Beam.

9.3.3 Where two Fascias require the same hole of the Node Post, install, the small Node Bracket first. This creates additional holes for the connections to locate into. *Fig. 36 – Node Bracket*

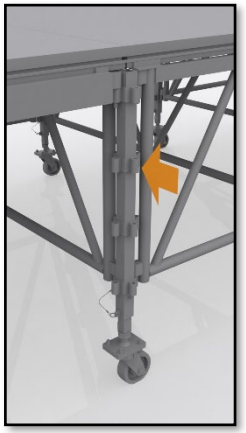


Fig. 33 – Push Point

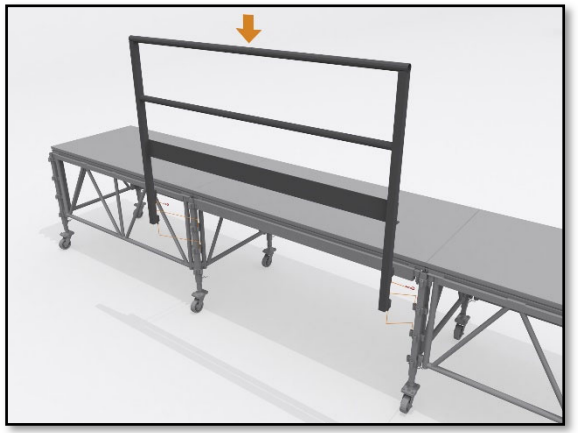


Fig. 34 – Handrail Installation

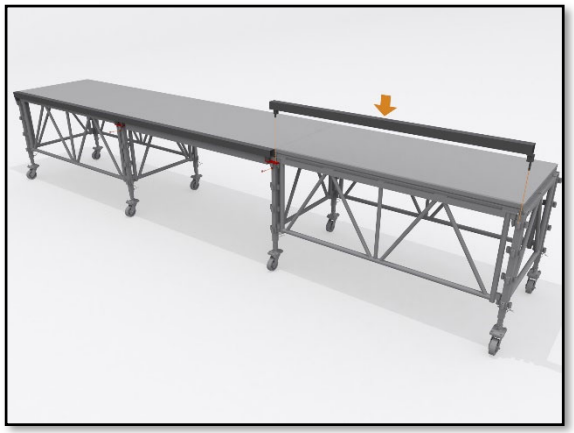


Fig. 35 – Fascia Installation

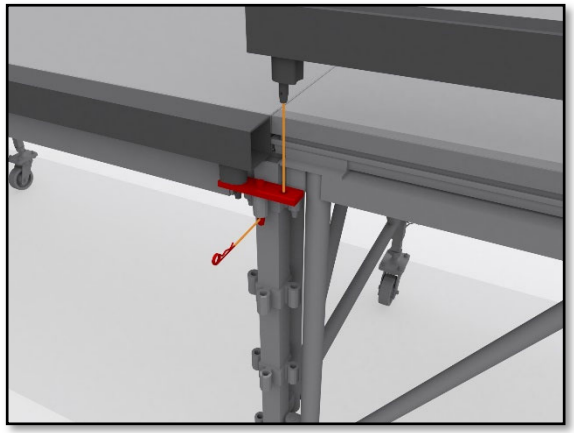


Fig. 36 – Node Bracket

9.3.4 Secure the small Node bracket using an R-clip.

9.3.5 **Important:** If the Stage is not levelled, due to the design and tolerances, the Fascias may not locate correctly.

9.4 Varistair Assembly:

9.4.1 **Danger:** The Stringers of the Varistairs pivot on the treads to accommodate any height of Stage required. Ensure Fingers are not between the stringers as injury could occur.

9.4.2 **Warning:** Only use the R clips supplied.

9.4.3 **Warning:** PVC tape is not an appropriate substitute for R clips which prevent the pin from being drawn into the connection under load.

9.4.4 **Danger:** Failure to fit the R-clips could allow the handrail to become detached from the Node Post causing a potential fall from the Stage.

9.4.5 Refer to drawing TFL04-VARISTAIRS-09.

9.4.6 The Sub Frame locates on to the mid positions of the Node Post. (Holes 2 & 3). *Fig. 37 – Step Subframe*

9.4.7 The Sub Frame is designed to fit onto a 4' bay (Gate or Beam) or an 8' Gate with Integral node position.

9.4.8 Engage the two top connections of the Sub Frame into the holes of two adjacent Node Posts.

9.4.9 Once fully seated secure using an R-clip.

9.4.10 The top tread of the Varistairs has connections to the underside. Align and insert these into the Holes in the Sub Frame. *Fig. 38 – Step Installation*

9.4.11 Once fully seated secure using an R-clip.

9.4.12 Align the handrail vertical posts to the sockets on the treads and fully insert. *Fig. 39 – Step Handrail Installation*

9.4.13 Once fully seated secure each post using the pin and an R-clip.

9.4.14 **Warning:** Do not use the steps as access until the associated handrails have been fitted and secured.

9.5 Ramp Assembly:

9.5.1 **Warning:** Only use the R clips supplied.

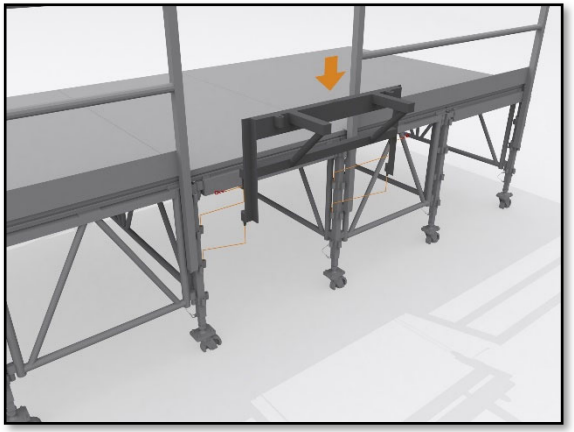


Fig. 37 – Step Subframe

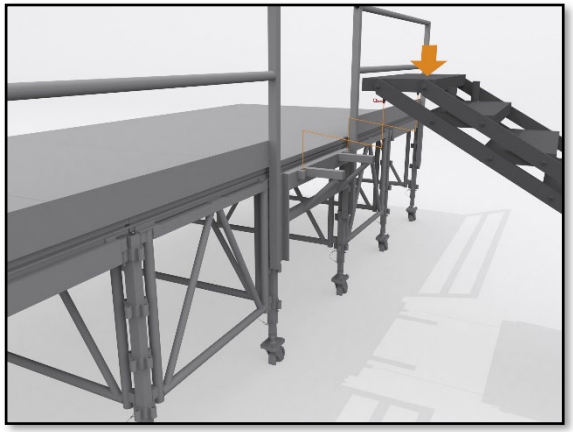


Fig. 38 – Step Installation

Fig. 39 – Step Handrail Installation

9.5.2 **Warning:** PVC tape is not an appropriate substitute for R clips which prevent the pin from being drawn into the connection under load.

9.5.3 **Danger:** Failure to fit the R-clips could allow the handrail to become Stage.

9.5.4 Refer to drawing ASR-195-15.

9.5.5 The Interface Bracket locates on to the outer mid positions of the Node Post. (Holes 2 & 3). *Fig. 40 – Interface Bracket*

9.5.6 The Interface Bracket is designed to fit onto an 8' bay (Gate or Beam). It can span 2 bays of 4'.

9.5.7 Insert the connections of Primary Beam Type One into the Interface Bracket holes. *Fig. 41 – Primary Beam Type One*

9.5.8 Once fully inserted secure using an R-clip.

9.5.9 Place the 2 off long Scaffold Jack into Support Frame Type One.

9.5.10 Locate 1 off Primary Beam Type Two. Insert the connections into the holes in the top of Support Frame Type One. *Fig, 42 – Primary Beam Type Two*

9.5.11 Once fully inserted secure using an R-clip.

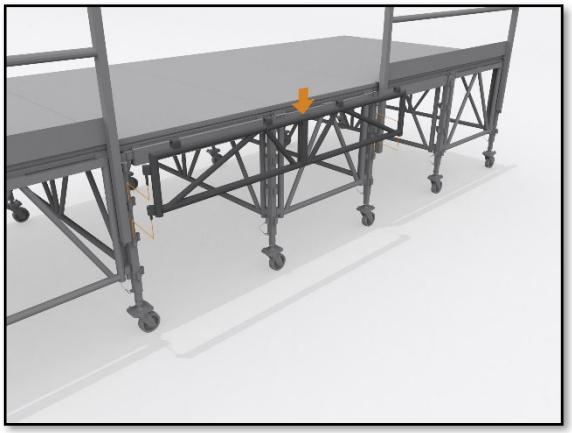


Fig. 40 – Interface Bracket

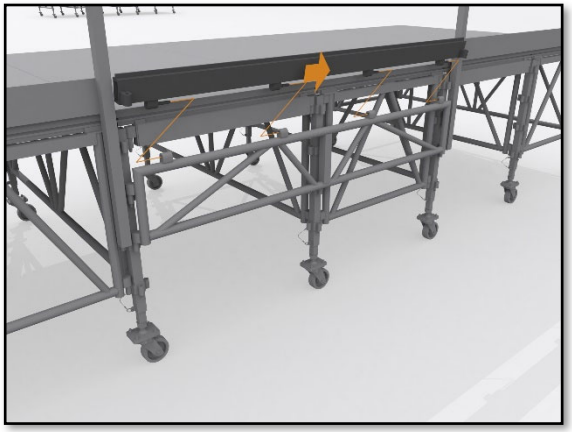
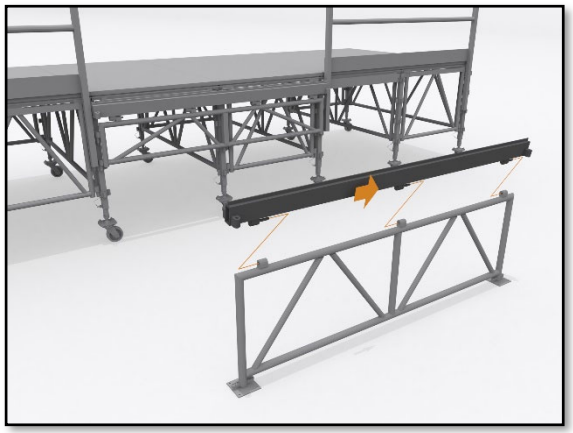


Fig. 41 – Primary Beam Type One



Fig, 42 – Primary Beam Type Two

9.5.12 Locate 2 off Secondary Beam Type Ones's. Insert the connections at one end, into the Primary Beam Type One holes. Fit the other end into the Support Frame Type One holes. Ensure the handrail mounting points are facing the outside. *Fig. 43 – Secondary Beam Type One's*

9.5.13 Once fully inserted secure using an R-clip.

9.5.14 Place the 2 off short Scaffold Jack into Support Frame Type Two.

9.5.15 Locate 1 off Primary Beam Type Two. Insert the connections into the top hole of the Support Frame Type Two. *Fig. 44 – Primary Beam Type Two*

9.5.16 Once fully inserted secure using an R-clip.

9.5.17 Between the 2 off Primary Beam Type Two's fit 2 off Secondary Beam Type One's using the connections at each end. Ensure the handrail mounting points are facing the outside. *Fig. 45 - Secondary Beam Type One's*

9.5.18 Once fully inserted secure using an R-clip.

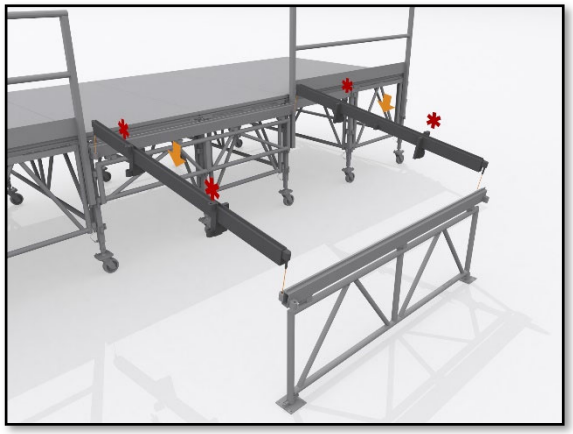


Fig. 43 – Secondary Beam Type One's

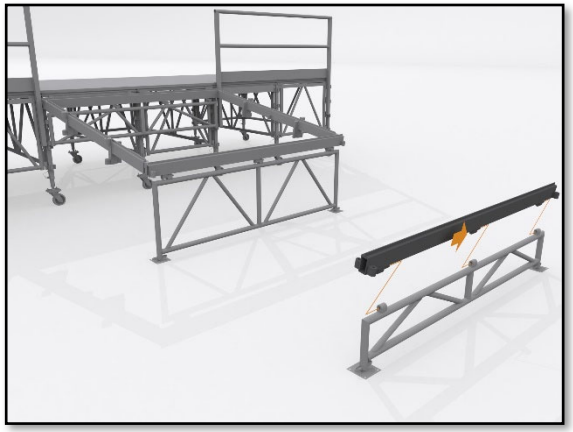


Fig. 44 – Primary Beam Type Two

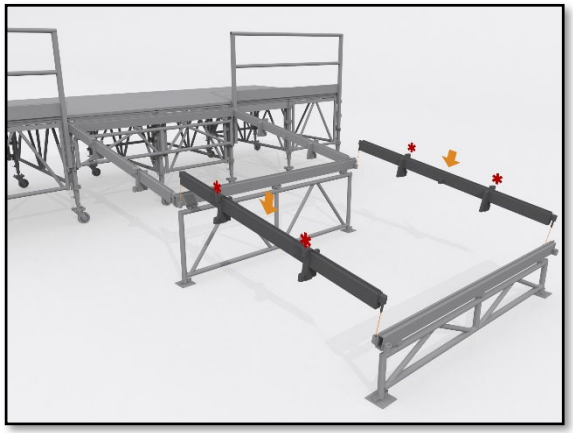


Fig. 45 - Secondary Beam Type One's

9.5.19 Locate 2 off Secondary Beam Type One's. Insert the connections at one end, into the holes in the top of Primary Beam Type Three. Ensure the handrail mounting points are facing the outside. *Fig. 46 – Secondary Beam Type One's into Primary Beam Type One*

9.5.20 Once fully inserted secure using an R-clip.

9.5.21 Lift the ends of the Secondary Beam Type One's and insert the unused connections at one end into the holes of Support Frame Two. *Fig. 47 – Connecting Secondary Beam One's*

9.5.22 Once fully inserted secure using an R-clip.

9.5.23 Between all of the Secondary Beam Type One's, insert the connections each end of Secondary Beam Type Two. 3 off positions. This beam supports the deck edge. *Fig. 48 – Secondary Beam Type Two's*

9.5.24 Once fully inserted secure using an R-clip.

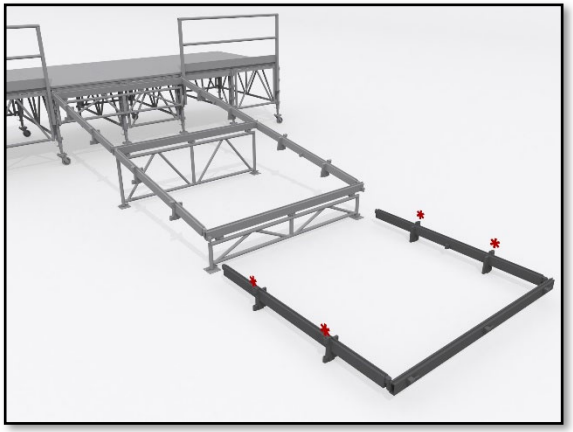


Fig. 46 – Secondary Beam Type One's into Primary Beam Type One

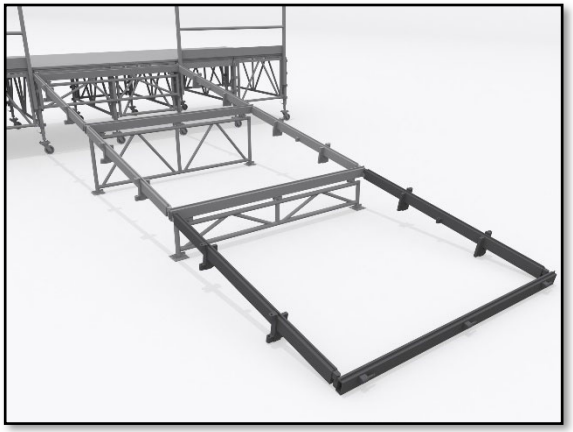


Fig. 47 – Connecting Secondary Beam One's

Fig. 48 – Secondary Beam Type Two's

9.5.25 At this point using a spirit level adjust the Scaffold Jacks of the Support Frames so the Secondary Beam Type Ones are all inline. *Fig. 49 – Level the Ramp*

9.5.26 Fit the Top Special Deck into the top bay. The lip should be orientated towards the Stage. *Fig. 50 – Fit the Special Top Deck*

9.5.27 **Danger:** Ensure fingers are not underneath the deck edge when being lowered. Failure to do so could cause injury against the Beam.

9.5.28 Working down the Ramp continue to fit 5 off 8' x 4' decks. *Fig. 51 – Fit remaining Decks*

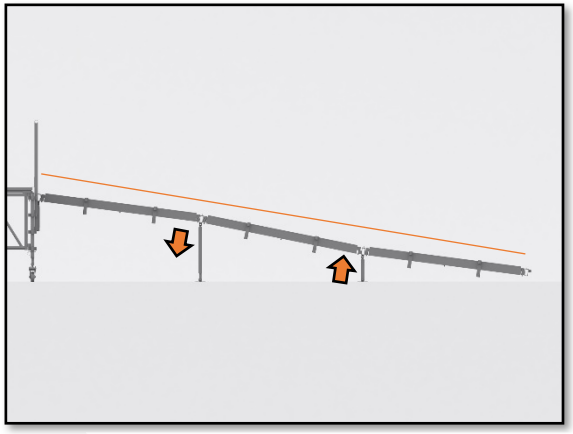


Fig. 49 – Level the Ramp

Fig. 50 – Fit the Special Top Deck

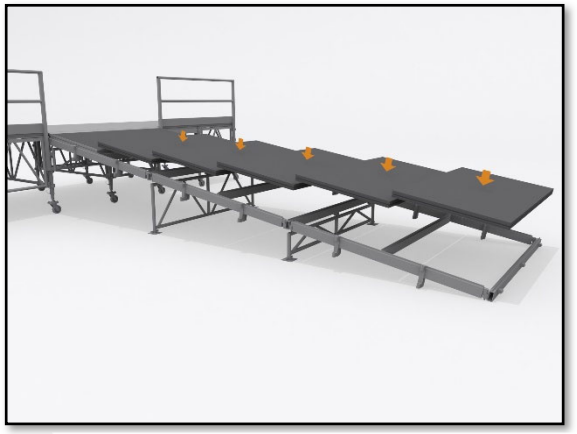


Fig. 51 – Fit remaining Decks

9.5.29 Fit the front lip by sliding the connections into the holes of Primary Beam Three. *Fig. 52 – Fit Front Lip*

9.5.30 Once fully inserted secure using an R-clip.

9.5.31 Engage the two top connections of the Handrails into the holes on the outside of Secondary Beam Type One's. *Fig. 53 – Fit Handrails*

9.5.32 As the Handrail is lowered into position, ensure the lower connections also engage into the next set of holes.

9.5.33 Once fully seated fit R-clips through the holes in the top connection elements.

⚠ 9.5.34 **Danger:** Failure to fit the R-clips could allow the handrail to become detached from the Secondary Beam causing a potential fall from the Stage.

10 Loading

10.1 Design Loads

10.2 Static Loading (When on Scaffold Jacks):

10.2.1 The deck has been designed for a maximum vertical imposed load of 7.8kN/m^2.

10.2.2 A 10% Notional Horizontal has been included in the Calculations for static configuration.

10.2.3 The deck has been designed for Wind Speed gusts up to 25m/s.

10.3 Rolling Loading (When on Telescopic Leg with Castors):

10.3.1 The deck has been designed for a maximum vertical imposed load of 5kN/m^2 in a static position.

10.3.2 The deck has been designed for its own self weight only when being rolled.

⚠ 10.3.3 **Danger:** The Stage must never be loaded when rolling.

10.3.4 A 10% Notional Horizontal has been included in the Calculations for rolling configuration.

10.3.5 The deck has been designed for Wind Speed gusts up to 25m/s.

10.4 Stage handrail Loading:

10.4.1 The handrail has been designed for a barrier load of 0.74kN/m.

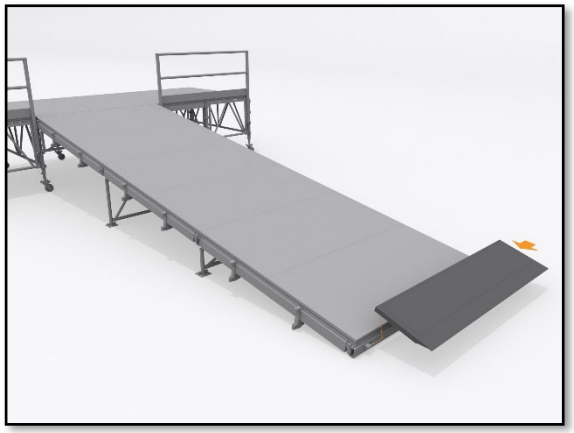


Fig. 52 – Fit Front Lip

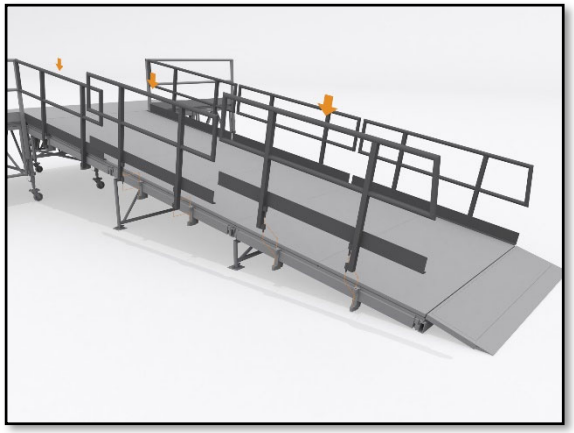


Fig. 53 – Fit Handrails

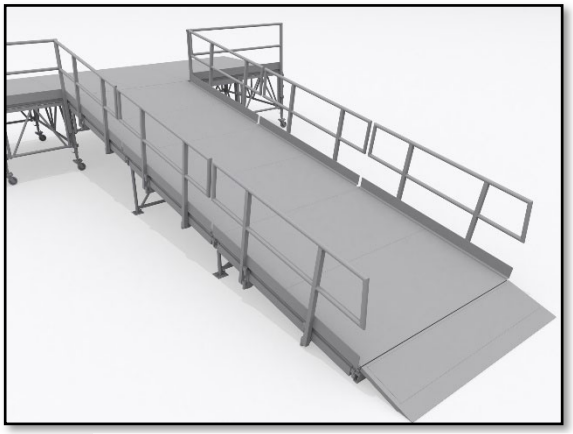


Fig. 54 – Completed Ramp

10.4.2 **Warning:** No other load is to be applied to the handrail. (This includes rigging equipment.)

10.5 Ramp Loading:

10.5.1 The ramp has been designed for a maximum vertical imposed load of 4kN/m^2.

10.5.2 The ramp handrail has been designed for a barrier load of 0.74kN/m.

10.5.3 A 5% Notional Horizontal has been included in the Calculations.

10.6 Varistair Loading:

10.6.1 The ramp has been designed for a maximum vertical imposed load of 5kN/m^2 and a point load of 3.6kN on the middle of the step. *Fig. 55 – Step Point Load Location*

10.6.2 The ramp handrail has been designed for a barrier load of 0.36kN/m.

10.6.3 A 2.5% Notional Horizontal has been included in the Calculations.

10.7 Additional Loads:

10.7.1 **Warning.** Do not impose any additional load or overload the components without consulting TSG or a qualified Structural Engineer.

10.8 Self-weight:

10.8.1 The Structural Report accounts for the self-weight of the TSG supplied components only.

10.9 Frequent Use Factor according to EN17115:

10.9.1 The structural report takes into consideration the potential for damage or excessive wear by including a multiplication of 0.85 for calculated capacities.

11 Identification and Serial Numbers

11.1 Each component has a separate identification and Serial Label unique to TSG. *Fig. 56 – Typical Serial Label* & *Fig. 57 – Typical Identification Label*

11.2 These labels are easily recognisable, durable and should not be obscured or removed. Take care to ensure the label cannot be worn away by slings or other equipment in contact with component chords.

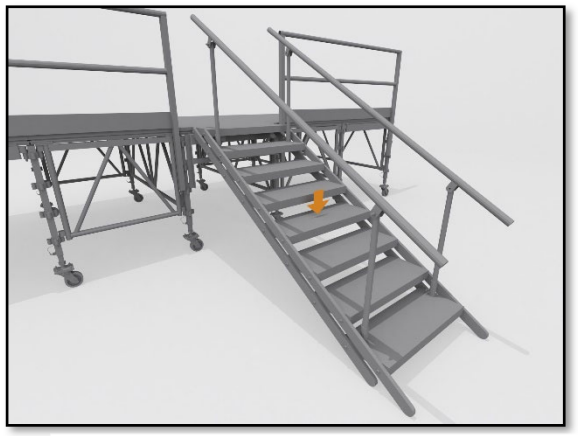


Fig. 55 – Step Point Load Location

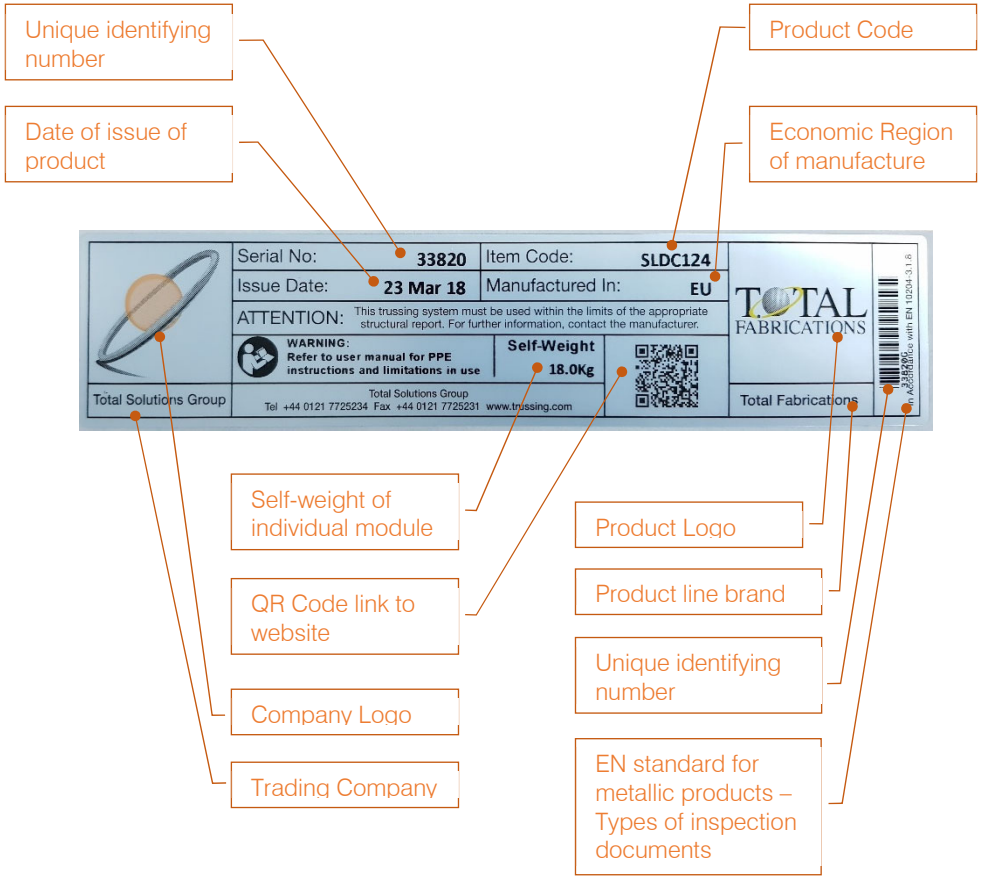


Fig. 56 – Typical Serial Label

11.3 The label includes the TSG name, type of component, month and year of manufacture, self-weight and the unique serial number and barcode. *Fig. 56 – Typical Serial Label*

11.4 Identification Prefix:

11.4.1 G = Gate

11.4.2 B = Beam

11.4.3 H = Handrail

11.4.4 D = Deck

11.4.5 N = Node

11.4.6 ASF = Fascia

11.4.7 R = Ramp

12 Wind and loads created by air pressure

12.1 **Important:** Stability of structures can be affected indoors and outdoors by changes in wind speed, direction and pressure. *Fig. 58 – Potential for Instability due to Wind Load*

12.2 Stability calculations must be carried by a competent person.

12.3 The appropriate structural report will contain instructions that must be followed by the user.

12.4 If required, a wind management plan must be created by the User and the conditions monitored via a device such as Anemometer. This must be mounted as per Manufacturer recommendations to minimise false readings.

12.5 **Important:** Reference should be made to 'Temporary Demountable Structures'

13 Earthing (Equipotential bonding)

13.1 Appropriate earth bonding shall be determined by a Competent Person.

13.2 The surface of the aluminium or steel shall be cleaned with wire wool to remove the oxidisation on the surface before the earth clamps are fitted.

13.3 **Caution:** The User should note that in a rolling format there is not a proper connection between the Stage and ground due to the castors having rubber coated wheels.

Fig. 57 – Typical Identification Label

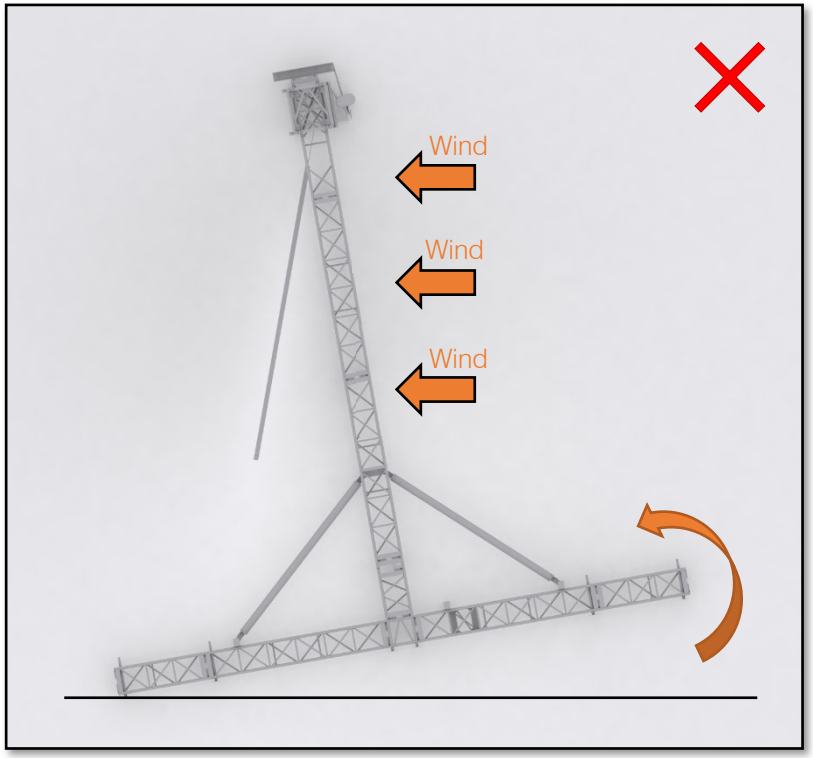


Fig. 58 – Potential for Instability due to Wind Load

14 Inspection and Maintenance

14.1 **Important:** These inspection criteria relate only to TSG manufactured components.

14.2 Discard or Quarantine criteria; General

14.2.1 Bent or deformed without load applied

14.2.2 Welds are incomplete or shows signs of cracking. Certain cracks are associated with the manufacturing process. If in doubt, consult TSG.

14.2.3 Wear on welds and/or welded areas.

14.2.4 Repairs made without written approval from TSG.

14.3 Discard or Quarantine criteria; Main members

14.3.1 Reduction of the total cross–sectional surface area by more than 15%, *Fig. 59 – Local Area Reduction* ; or any local area reduction transverse to the tube axis of more than 15%, *Fig. 60 – Multiple Area Reduction*

14.3.2 Localised bending of one or more of the main tubes viewed from the end of a section.

14.3.3 Damaged, partly missing or broken tubes.

14.3.4 Cracks or holes in the main tubes including drilled holes.

14.3.5 Holes from the manufacturing process should not be considered as damage

14.3.6 Lasting deformation through dents, lateral compression etc. that results in a change of diameter (D) by more than 10%. e.g. Lite Beam tube dia. = 48mm; 44mm minimum and 52mm maximum. *Fig. 61 - Dents*

14.4 Discard or Quarantine criteria; Lattice members

14.4.1 Reduction of the total cross–sectional surface area by more than 15%, *Fig. 59 – Local Area Reduction* ; or any local area reduction transverse to the tube axis of more than 15%, *Fig. 60 – Multiple Area Reduction*

14.4.2 Localised bending of one or more of the lattice tubes.

14.4.3 Damaged, missing, or broken lattice tubes.

14.4.4 Cracks or holes in the lattice tubes.

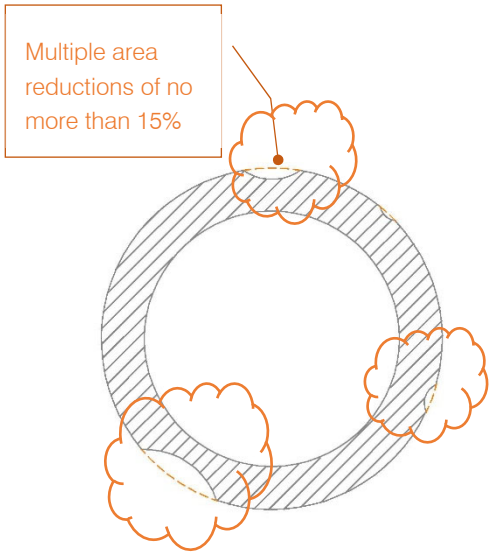


Fig. 60 – Multiple Area Reduction

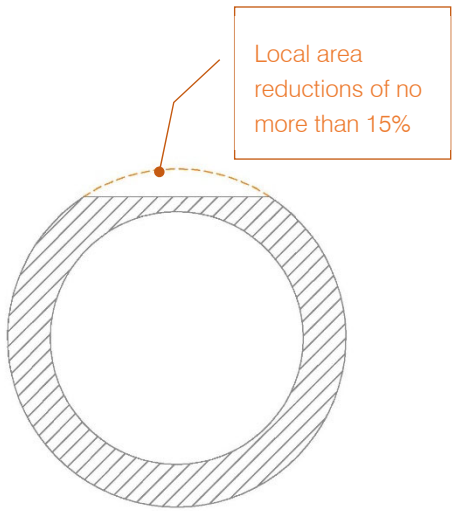


Fig. 59 – Local Area Reduction

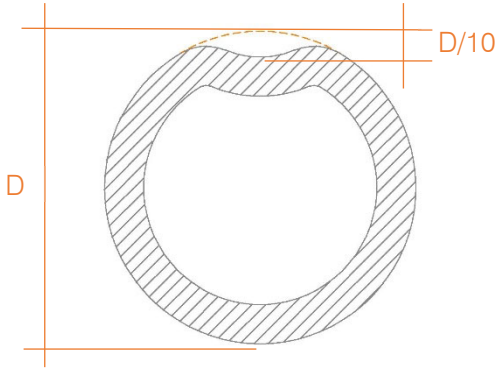


Fig. 61 - Dents

14.4.5 Holes from the manufacturing process should not be considered as damage.

14.4.6 Lasting deformation through dents, lateral compression etc. that results in a change of diameter by more than 10%. *Fig. 61 - Dents*

14.5 Discard or Quarantine criteria; Connectors and connecting elements

14.5.1 Deformation or elongation of connection holes (rivets, roll pins, holes) in the fittings or the main tubes by more than 10%. E.g. Node Post hole is 17mm dia + 1.7mm = 18.7mm dia. Bending or deformation of any fitting part by more than 10 degrees from the axis of the main tubes. *Fig. 62 - Hole Elongation*

14.5.2 Reduction of the cross-sectional area of the connector (male or female) surface by more than 10%. *Fig. 63 - Connector Reduction*

14.5.3 Damaged connecting element or parts of the connecting element missing.

14.5.4 Damaged or missing roll pins or fixing rivets.

14.5.5 Fixing rivet should completely fill holes and have close contact with the riveted surfaces

14.5.6 Diameter reduction of connector elements (truss pins or fixing bolt) by more than 10%. *Fig. 64 - Connecting Element Reduction (Pin)*

14.5.7 No damage to the threads on fixing bolts

14.5.8 Clear (galvanic) corrosion on rivets or roll pins in the connectors.

14.6 Painting

14.6.1 Inspecting painted modules is difficult because paint can obscure surface defects and cracked welds.

14.6.2 If a component is painted repeatedly, defects may exist indefinitely.

14.6.3 Components should always have previous layers of paint removed before any new painting occurs. Media blasting preferred.

14.6.4 Components should be re-inspected before new paint is applied.

14.6.5 Paint removal must not reduce the dimensions of any materials.

14.6.6 **Warning:** Chemical treatments damage aluminium. Do not use chemical baths for paint-stripping.

14.7 Saline environment

14.7.1 If trusses are subjected to a salty atmosphere, then they should be rinsed on a regular basis.

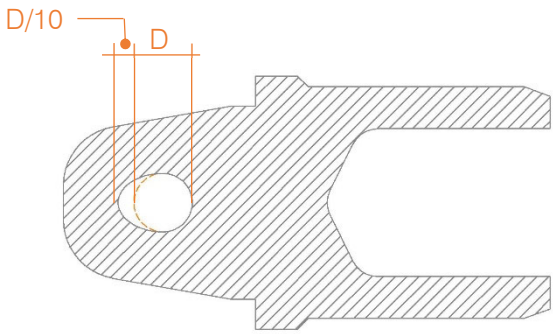


Fig. 62 - Hole Elongation

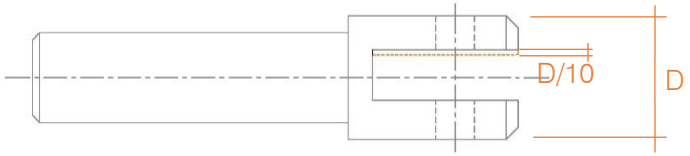


Fig. 63 - Connector Reduction

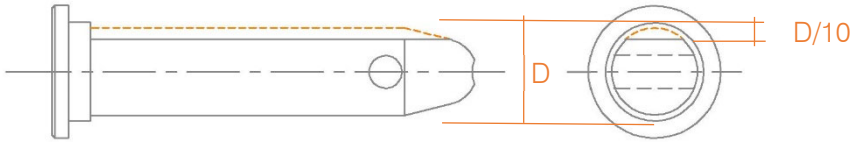


Fig. 64 - Connecting Element Reduction (Pin)

14.8 Corrosion

14.8.1 The contact surfaces of different metals should be checked for corrosion, for example the bolts and their bearing surfaces.

14.9 Attention

14.9.1 **Danger:** Neglecting any of the above factors may result in property damage, injury to people or death.

14.9.2 **Important:** Damaged modules should be clearly marked as such and shall not be used under any circumstance. Any repair must be undertaken by an authorized agent of TSG.

14.9.3 **Important:** If 3rd party inspections are checking welds then they should only inspect TSG products if they are fully conversant with the following:

- Execution class
- Consequence class
- Weld quality level

14.9.4 **Important:** Aluminium Trusses should be inspected by, and in line with an Examination Scheme drawn up by, a competent person based on a Risk Analysis of usage.

15 Transportation, handling and storage

15.1 The components shall be loaded in such a way that they are not put under undue or significant stress during transportation.

15.2 Take care to ensure that components are not subjected to abrasion which could result in loss of metal or other damage.

15.3 Do not allow load restraints to damage components.

15.4 On no account shall components be dragged across the floor as this could lead to abrasion of the chords, which would result in loss of metal, or significant cuts, gouges or other damage which could result in stress concentrations and ultimately to stress fracturing.

15.5 Take care where forklifts are used to move components.

15.6 Position the forks to avoid damage to the Components, particularly the diagonals. *Fig. 65 – Using a Forklift to handle components*

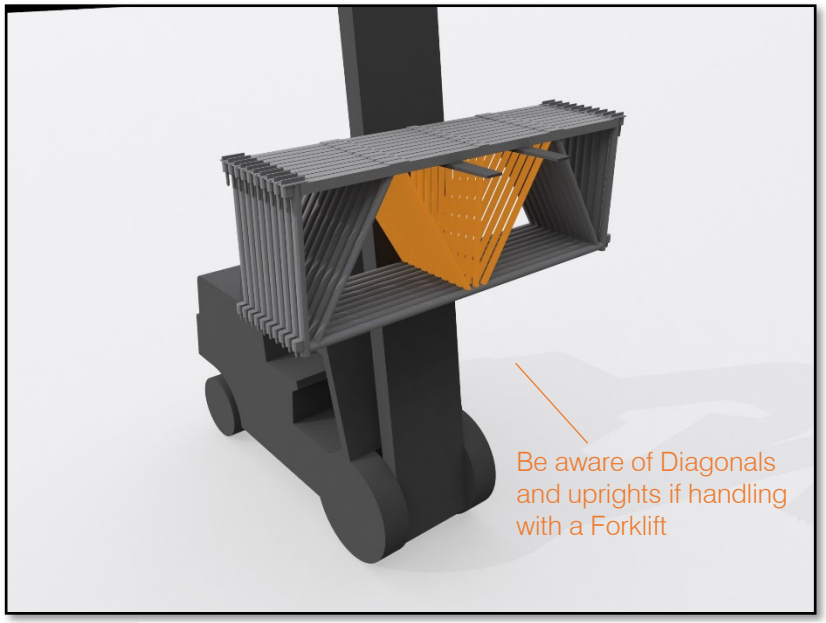


Fig. 65 – Using a Forklift to handle components

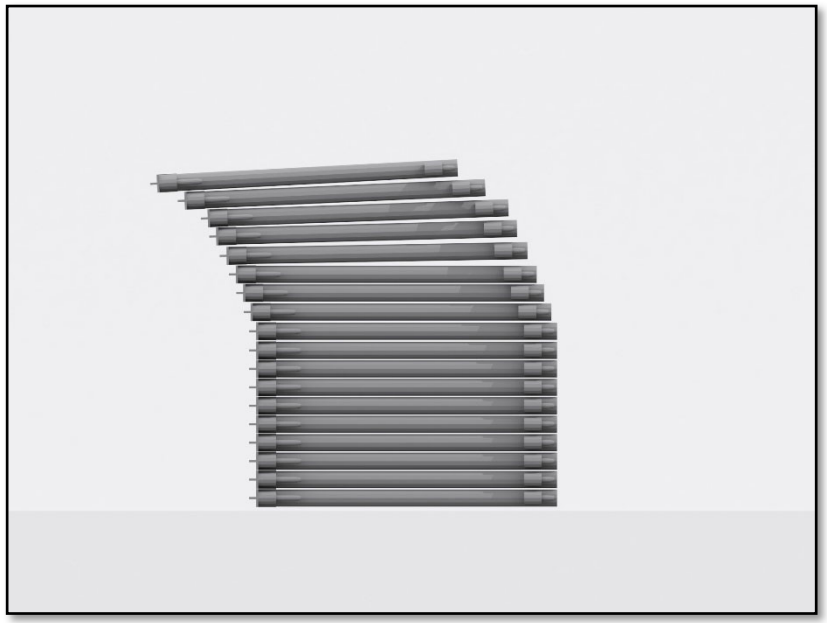


Fig. 66 – Unstable stacking of Components

15.7 When lifting components with forklifts ensure that forks are positioned as close to node points as possible.

15.8 Stacks of components should be supported off the ground at node points.

15.9 Take care to ensure stacks of modules remain stable. *Fig. 66 – Unstable stacking of Components*

15.10 **Warning:** Components may be heavy enough to prevent safe manual handling. Mechanical means are preferred.

15.11 The components shall not be stored outside unless they are adequately protected from the elements.

15.12 **Warning:** Do not allow water ingress where there is a possibility of freezing conditions

15.13 The User shall use adequate care when storing the components so that they are not overstressed. For example, the trusses should not be stacked so that the members or connections are bent or damaged.

15.14 If dollies have been supplied care must be taken when:

15.14.1 Lifting with a forklift. The Operator must be aware of the weight they are lifting and the potential for overturning if the load isn't balanced. Each dolly should be marked with it's gross weight. *Fig. 67 – Balanced Load to stop overturning during handling*

15.14.2 Moving with a forklift. The Operator must aware of uneven ground and potential potholes and/or changes in surface.

15.14.3 Moving manually. Deploy the correct number of personnel to safely carry out the manoeuvre. Where possible use powered equipment to assist.

15.14.4 **Warning:** Do not climb dollies for access.

15.14.5 **Warning:** Heavy items stored in dollies should always be strapped after each item is removed. Never leave an unstrapped dolly unattended. Risk of injury and damage if an item were to fall over. *Fig. 68 – Injury/damage risk if items left unstrapped*

16 Spares and Replacement parts

16.1 There are few parts on this system that are replaceable by the user.

16.2 Any items or spares that are replaceable must be supplied by TSG.

16.3 Any replaceable parts must be fitted in accordance with TSG instructions.

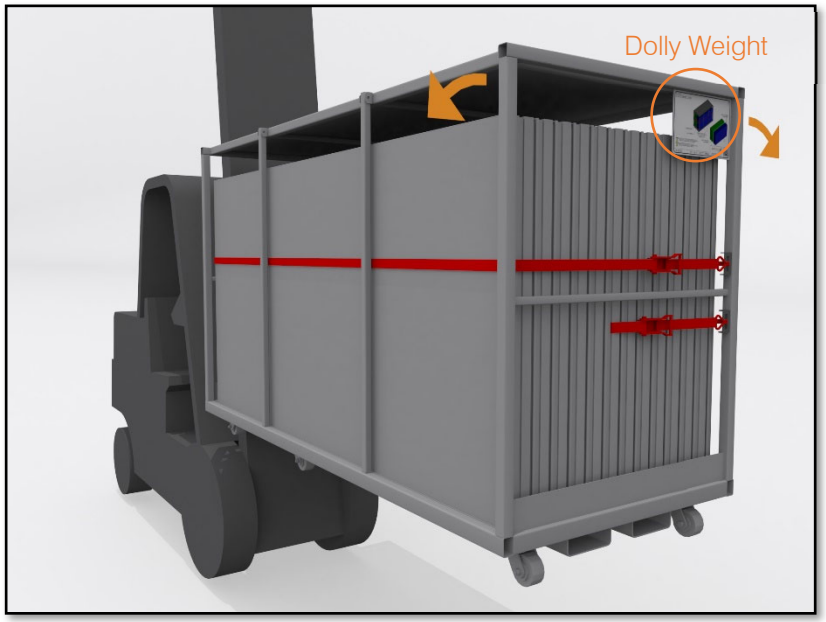


Fig. 67 – Balanced Load to stop overturning during handling

Fig. 68 – Injury/damage risk if items left unstrapped

17 Disposal and Recycling

17.1 All aluminium, steel and timber items are 100% recyclable unless otherwise stated.

17.2 Rubber tread on castor is not recyclable.

17.3 If Hi-Shine Marley has been applied to Decks this is not recyclable.

18 List of Significant Hazards

18.1 Mechanical hazards due to:

- 18.1.1 Inadequate mechanical strength
- 18.1.2 Instability
- 18.1.3 Gravity and stability
- 18.1.4 Height from the ground
- 18.1.5 Approach of moving elements to fixed parts
- 18.1.6 Slippery surface
- 18.1.7 Surface geometry
- 18.1.8 Potential energy
- 18.1.9 Sharp edges

18.2 Additional hazards and hazardous event due to lifting procedures, falling loads, collisions due to:

- 18.2.1 Gravity and stability
- 18.2.2 Incorrect loading
- 18.2.3 Unsuitable connection elements and accessories
- 18.2.4 Unsuitable selection of lifting devices, equipment and incorrect integration
- 18.2.5 Incorrect installation, testing, use and maintenance
- 18.2.6 Incorrect integration of machinery parts
- 18.2.7 Unintentional movement due to mechanical failure

18.3 Electrical hazards:

- 18.3.1 Contact of persons with parts which have become live under faulty conditions

18.4 Thermal hazards:

18.4.1 Objects or materials with a high or low temperature

18.5 Noise hazards:

18.5.1 Mechanical noise

18.6 Vibration hazards:

18.6.1 Loosening of components due to dynamic actions

18.7 Ergonomic hazards:

18.7.1 Poor body mechanics, posture or excessive effort

18.7.2 Inadequate working light

18.8 Hazards associated with the environment in which the product is used:

18.8.1 Weather conditions (temperature, wind, ice, lightning etc.)

18.8.2 Internal wind pressures

18.8.3 Seismic activity

18.8.4 Corrosion

19 References

19.1 The structures and this manual have been designed using the latest editions of all appropriate European Standards and British Standard Codes of Practice as reference. The principal codes are: -

19.2 BS EN 1991; Actions on Structures Part 1-1; General actions – Densities, Self-weights, imposed loads.

19.3 BS EN 1999; Design of Aluminium Structures Part 1-1; General structural rules.

19.4 BS EN 1993; Design of Steel Structures Part 1-8; Design of joints.

19.5 BS 8118: Structural Use of Aluminium, Part 2; Specification for materials, workmanship and protection (in older reports).

19.6 EN 17115 Entertainment Technology – Specification for design and manufacture of aluminium and steel trusses.

19.7 Temporary Demountable Structures; Institute of Structural Engineers, UK.

19.8 BS EN 82079-1 2012 Preparation of instructions for use structuring, content and presentation Part 1: General principles and detailed requirements.

20 General Arrangement Drawings

20.1 Project Specific, Available on request.