

# FLI structures

## INSTALLATION & MAINTENANCE MANUAL: ATS1301 TOWERS

FLI Document Reference: 2023/44

Revision	Modification	Date	Prepared By	Checked By	Status
01	FIRST ISSUE - New document to update the ATS1300 IMM in line with the changes for the ATS1301 tower.  Rooftop stub guidance will feature in a separate document.	24/04/2024	G M JONES	T C BURDEN	APPROVED
02	General rewording and restructure. Guidance updated, images added and replaced, helicopter lift section updated.  Annexes have been removed and are now listed as recommended reading.	22/07/2025	J STROUD	T C BURDEN	APPROVED

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## **1 INTRODUCTION**

FLI Structures (FLI) design and supply a range of products, including towers, steel grillages and frames, monopoles & screw piles. These products provide a safe foundation and support for antennas and other services.

This document contains general information required for the safe installation, operation, and maintenance of the ATS1301. This document includes a summary of the designer's residual hazards, a maintenance statement and general installation guidance.

Furthermore, this document is intended only to provide **general guidance** and is **not a method statement**. It is essential that FLI's products are installed using proven techniques by competent Contractors. Installers should always produce a method statement outlining the proposed safe install method prior to commencing any works. The statement of Designers Residual Hazards addresses general issues regarding the installation, maintenance and dismantling of structures, however **all projects will require task and site specific risk assessments**.

### **1.1 Description**

The ATS1301 are available both as a range of 15m-50m towers for 'Greenfield' sites and as 5m-10m parallel 'Rooftop Stub' structures.

The ATS1301 are lattice towers fabricated from galvanized steel angle sections. Square on plan, the towers taper from bottom to top and can incorporate parallel modules at the top. The bracing layout is warren style. The tower is modular, with each module being typically 5m in length.

An internal ladder complete with fall arrest system provides access along the height of the tower. Feeder brackets mounted onto the tower legs support the feeder cables. This can either be on 2 legs (standard) or 4 legs. A horizontal climbing deterrent frame and steel ladder cover-plate deter unauthorised climbing of the structure.

The tower will be delivered to site either pre-assembled, piece small for the modules to be assembled on site, or a combination of the two. The headframe, fall arrest, climb deterrent and all other fixings (e.g. ladders, feeder brackets, antenna/dish poles) are supplied with the tower for assembly on site.

The tower is installed onto one of the following foundation systems:

- Either via the protruding stubs of a base grillage set into a mass concrete foundation pad
- **OR** onto stubs/holding down bolts supplied as part of a pile frame or roof grillage.

For information regarding the ATS1301 base-grillage foundations, refer to the foundations section of this document.

Headframes can be attached to the tower in order to increase physical antenna capacity – or simply provide a more accessible antenna-mounting area. For information regarding the installation and maintenance of any headframe provided with the tower, please refer to the relevant sections in this document and assembly drawings provided.

## 2 GENERAL INSTALLATION GUIDANCE

Refer to the relevant General Arrangement (GA) drawings for details of the tower layout, components and fixings used on the structure.

It is essential that the tower is installed using proven techniques by competent persons. Refer to Residual Risks and site surveys prior to determining the preferred installation method for each site.

The ATS1301 should normally be installed using a suitable crane to lift the assembled tower in one or more pieces. These notes provide a suggested sequence for the installation of the tower.

### 2.1 Assembly and Erection

The assembly and lifting method and sequence will vary between structure types, equipment availability and site constraints.

When planning the structure assembly and erection the installer must consider the health and safety of the workforce as their first priority. Good practice in this regard is to follow the Working at Height Hierarchy of control:

- 1) Avoid working at height, e.g. pre-assemble as much as possible at ground level.
- 2) Prevent falls using appropriate access equipment such as Mobile Elevated Work Platforms (Cherry pickers) or rope access techniques.
- 3) Reduce the distance and consequences of a fall should one occur, e.g. use fall arrest systems or catch nets.

Only soft slings should be used to lift modules; chains will damage the galvanised finish. When lifting the modules, the slings should be fitted around the top of each leg. It is recommended that the slings are attached to each leg at the connection between the brace and the leg.

Dragging and scraping the structure along the ground must be avoided to prevent damage to the galvanised finish.

Practicality and efficiency should also be considered. Where structurally possible, lifting structures in one piece is preferable to multiple lifts or, as a last resort, derrick build method. However, crane availability and site constraints can also determine the assembly and erection methods.

Prior to lifting structures onto the foundation or grillage, the position of the base stubs/holding down bolts should be checked against the layout of the structure legs. Any discrepancy should be noted and clarity sought.

### 2.2 Transportation of modules pre-assembled before dispatch

Smaller modules (from Module D to Module //A) can be pre-assembled at FLI before dispatch to site. Larger modules (from Module E to Module H) need to be delivered piece small due as they are too wide for transport. Pre-assembled modules are usually dispatched with feeder brackets and ladders fitted.

Modules //A and A should both be assembled with the lowest braces bolted to a temporary position on the leg to avoid them working loose during transport. **These temporary fixings must be removed before installation.** Photo 1 shows a brace installed in the transport position, the red ringed bolt is the one to be removed.

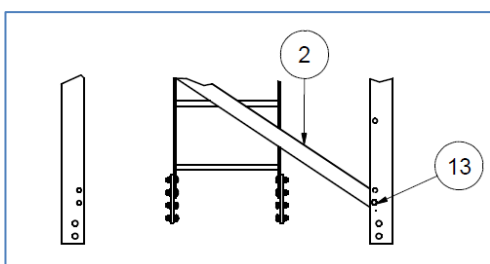


Figure 1. Module //A – Lower bracing position for transport/lifting

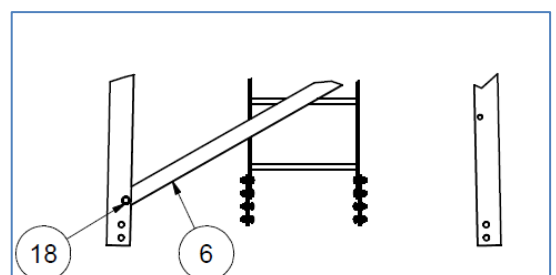


Figure 2. Module A – Lower bracing position for transport/lifting

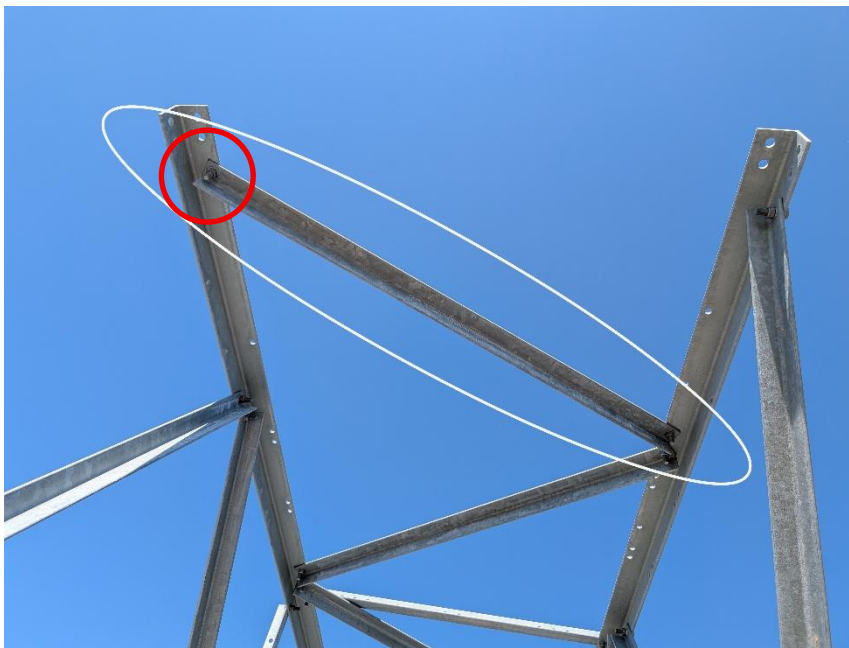


Photo 1. Brace installed in the transport position.

### 2.3 Bolt Configuration

Bolt assemblies supplied by FLI Structures are typically Grade 8.8 spun galvanised to BS EN ISO 10684:2004 and usually comprise a Bolt, Nut and Flat Washer. Flat washers are placed under the part to be rotated, typically the nut. Bolts in slotted holes are typically supplied with an oversize washer, which must always be placed on the slot side. **Spring washers are not supplied**, nor desired, any that are found must be discarded.

U-Bolts and N-Bolts are typically Grade 4.6. and comprise the shaft, and one washer and 2 nuts per threaded end, the second nut being used as a lock nut.

Special bolts, fixings and configurations are occasionally utilised for bespoke towers, as detailed on the structure specific General Arrangement Drawing. Where special fixings are supplied, appropriate tightening methods must be used.

It is important that the correct bolts are used in each connection. FLI's assembly drawings give details of which nuts and bolts are to be used and the quantities of each size required are supplied in individual labelled bags with the tower.

Wherever possible, all splice bolts should preferably be fitted with their heads on the inside.

The orientation of bolts in holes is generally shown on the drawings and should be followed. On occasion it may be necessary to fit a bolt left to right (rather than right to left). This is usually acceptable, as the vast majority of connections act in shear, and the orientation of the bolt is not important. However, check that no other unintended consequences arise, such as clashes. If in doubt, ask.

### 2.4 Bolt Tightening – modules delivered to site pre-assembled

Modules that arrive at site pre-assembled are subject to vibration in transit and, therefore, bolts can loosen thus should be considered as loose on site. **All bolts on pre-assembled modules must be fully tightened on site.**

### 2.5 Bolt Tightening – Ordinary Bolts (non-preloaded)

Torque settings for tightening standard nuts and bolts are not given. For guidance, refer to 'Guidance Notes for Tightening Non-Preloaded (Ordinary) Bolts' Document No. MD030 (Appendix A).

### 2.6 Bolt Tightening – Preloaded Bolts

Preloaded / High Strength Friction Grip (HSFG) bolts such as TCBs or holding down bolts shall be tightened in accordance with a specific method appropriate to the bolt assembly type.

**2.7 Bolt Tightness Checks**

After waiting a minimum period of one hour from initial bolt tightening (the longer the wait the better, preferably days), a 100% tower bolt tightness check should be completed, starting from the top and working downwards. Refer to the 'Guidance Notes for Tightening Non-Preloaded (Ordinary) Bolts', Document No. MD030.

### 3 FOUNDATIONS

ATS1301 towers are designed to be installed onto 2 general foundation types dependant on ground conditions, site layout and other factors such as project timelines, access for plant and existing infrastructure.

#### 3.1 Base grillage set into a concrete pad with protruding fixing stubs.

In most cases, for new sites, a Base Grillage is supplied by FLI and cast into a concrete pad. The tower is then attached to the protruding stubs with the relevant splice plates.

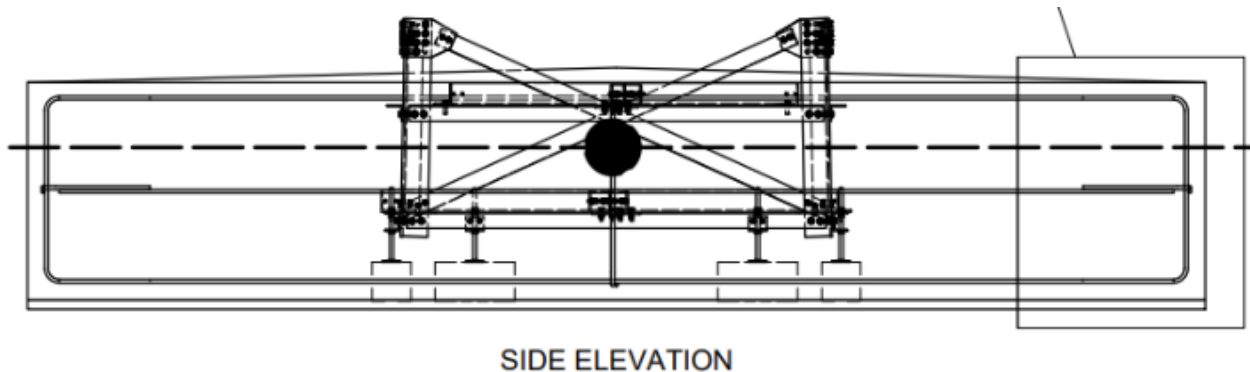


Figure 3. Extract from typical foundation drawing showing elevation of Base Grillage in concrete.

For additional details and guidance on base grillages and concrete foundations, please refer to the latest revision of the FLI document “Installation & Maintenance Manual Tower & Monopole Concrete Pad Foundations” Document Ref. FLI IMM Foundations 2019-66.

#### 3.2 Stubs/holding down bolts supplied as part of a steel substructure.

In some cases, a pile frame similar to the one below may be provided, this can be fixed to a range of pile types, and may have 4 or 8 piles. Other types of frame are also available that include overlay platforms and points for mounting cabinets, gantry poles and handrail/fencing if required.

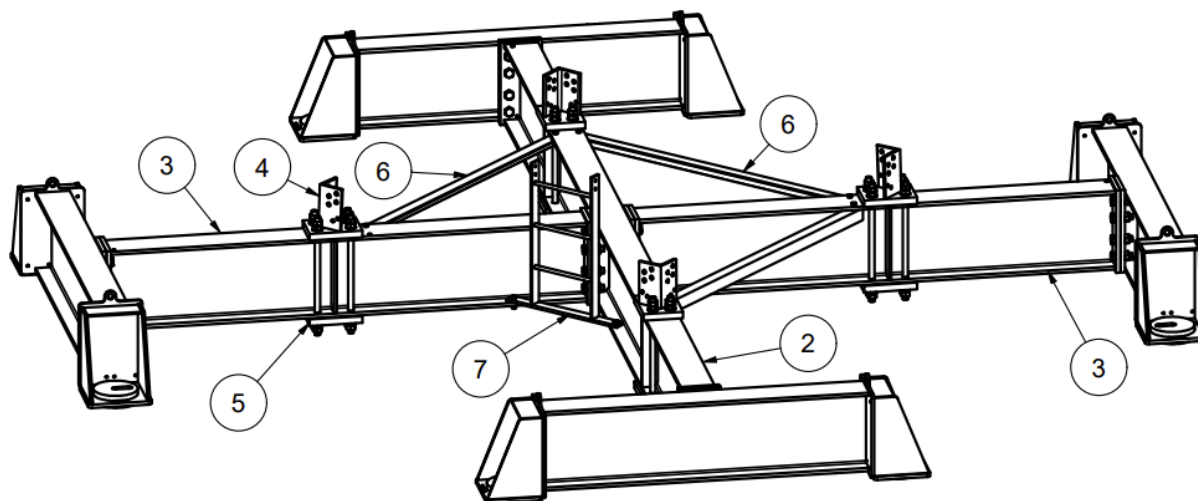


Figure 4. Typical 8-Pile Frame with ATS1301 Stubs

For additional details and guidance, please refer to the latest revision of the FLI document “Installation & Maintenance Manual – FLI Piled Base Grillages”.

## 4 GUIDANCE ON TOWER BUILDING

### 4.1 Typical (Crane) Installation

The ATS1301 should normally be installed using a suitable crane to lift the assembled tower either in single modules or combined modules depending on available space, crane capacity and reach.

Assembled ATS1301 towers consisting of modules up to and including parallel A (//A) to C (i.e. 4 Modules up to a combined length of 20m) can be lifted without any additional bracing across the bottom legs for up to 1 fully equipped headframe – to a maximum mass of 3000kg. If more than 1 headframe is to be installed (whether with no equipment or fully equipped), or for ATS1301 towers consisting of modules //A-D (5 modules = 25m) are to be lifted, then temporary bracing is required. Details of the required bracing will be shown on drawings. No more than 5 modules should be lifted as one.

These notes provide a suggested sequence for the installation of the tower. This document is not a method statement and the installers erecting the tower should provide a method statement outlining the proposed method of work, and the relevant Lift Plan.

Prior to the commencement of structure assembly, stubs/hold-down bolts projecting from the base should be checked for level and plan dimensions against the dimension noted on the foundation drawing. The tolerances are shown on the drawings, but as guidance these are generally as follows: on stub/HDB projection +/-5mm globally, but no more than 2mm between different legs. The tolerance on plan dimensions is +/- 2mm. If level and/or plan dimensions are not within tolerances given, please contact FLI for guidance.

Check also that Stubs/HD Bolts match the tower base module dimensions.

The tower modules will be delivered either pre-assembled or piece small. If piece small, ATS1301 sections should be assembled in the following sequence – **note that bolts should only be installed hand tight at the assembly stage:**

- 1) Using timbers to support the steel off the ground, one face of the module should be assembled on the ground with the leg angle facing up. Ideally this should be the face that the ladder will attach to. The ladder can be also be fitted at this time. Refer to the module assembly drawing to check part numbers for bracing positions. Ensure the legs are the right way up and orientated correctly noting the marking on these items.
- 2) The second, opposite, face should be assembled adjacent to the first, but with the leg angle facing down. Then it can be slung from the crane or other lifting plant (Telehandler/Hiab etc.) above the completed face and the two remaining sides filled with the remaining bracing members.
- 3) Ladders and feeder brackets can then be attached if not already in place.
- 4) If sufficient clearance is available, attach the climb deterrent system. Otherwise fit this system once the tower is installed.

If combined modules are to be installed, then the individual modules should be assembled on the ground and are then bolted together **hand tight**.

- 5) NOTE: where temporary braces are required for the lift, the lowest braces of the top and bottom faces of the tower (with the tower laid down) should be removed and temporarily attached to the side faces perpendicular to the legs as shown in red in Figure 5.

The side braces (in blue) should be attached to the outside of the legs, using the relevant holes as detailed on Sheet 2 of the relevant module drawing.

*This is a temporary solution to prevent the legs from buckling during the process of lifting the horizontally-assembled, tower sections into the vertical position (i.e. prior to being lifted and added to any sections or mounted to the grillage).*

- 6) Once the section(s) to be lifted are vertical and stably suspended by the crane no more than 5-10cm above ground level, these four bottom braces are to be relocated into their final position – with the lower end in free-space so that it can later be fixed to the splice plates at the top of the receiving module (Figure 6).



Figure 5. Tower section in horizontal position with braces installed in temporary location for lifting.



Figure 6. Tower section in vertical position with braces installed in the permanent location ready for landing.

- 7) Splice plates should be fitted to the top of the receiving module, NOT to the underside of the module to be lifted.
- 8) The upright tower section(s) should then be raised and positioned over the base stubs/receiving module and the splice plates bolted. The bottom braces can then be bolted in position on the Base Grillage (Figure 7) or receiving module (Figure 8). Care should be taken to ensure that upper bolts of the lowest brace are fully tightened, as they can come loose during transportation and installation.

The relevant Lift Plan should be followed throughout.

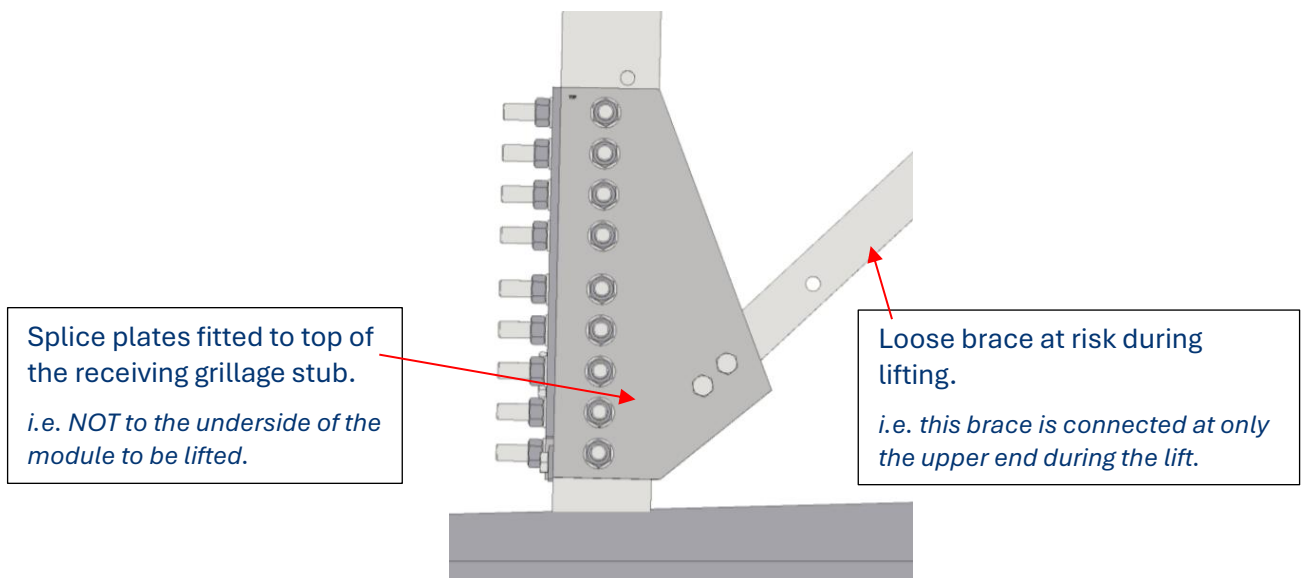


Figure 7. Configuration of module landed on Base Grillage

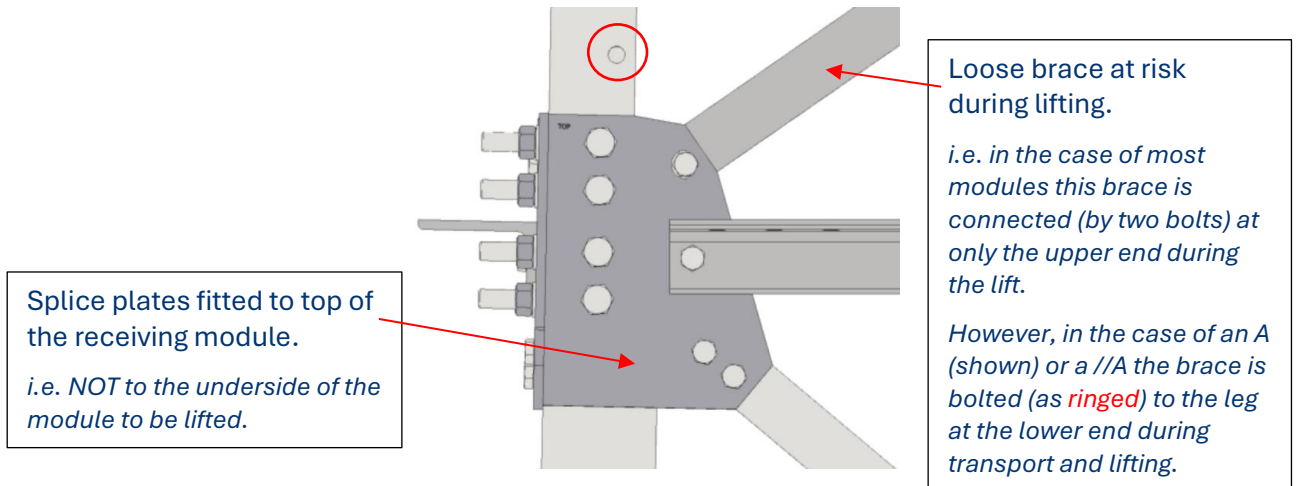


Figure 8. Configuration of module landed on another module

**4.2 Helicopter Lift of ATS1301H Tower sections**

**4.2.1 Introduction**

The helicopter variant of the ATS1301 is denoted as ATS1301H.

ATS1301H towers have special welded flanges, rather than splice plates for most modules, to simplify helicopter installation (except for the base module, which retains splice plates).

This section provides guidance for how to complete the helicopter lift of an ATS1301H lattice tower. This is based upon advice that a helicopter has a maximum lift limit of limit of 1000kg.

Some of the FLI ATS1301H tower modules, specifically those below module C, are greater than 1000kg when fully assembled. Currently three ATS1301H modules (F, E & D) have been considered for lifting into place partially assembled.

The weights of the modules have been reduced for lifting by considering which items can be removed from the section assemblies whilst still retaining rigidity.

Excluding the base module, all modules should be lifted into place with the flange bolts located in bags tied to each leg. This is to enable the installers to bolt the modules together swiftly after each upper module is landed on top of the module below.

One or more pallets of loose parts will need to be delivered to site ahead of the first lift containing items such as braces, bolts and feeder brackets which cannot be installed to the modules prior to lifting. It may be possible to combine items from multiple modules into one lift.

A general installation sequence for landing modules is illustrated below and is described in more detail in the sections which follow. Unless specified, the sequence and method is the same as for a non-helicopter lift tower.

**4.2.2 Typical module landing**

To assist with drawing the modules together and landing them with minimised manual handling, tower uprights are connected using welded flanges that allow the sections to be landed easily atop each other.

- 1) Prior to lifting, a ‘draw together’ rope should be run through the inner hole on each of the flanges on the section about to be landed, this should be knotted to prevent it pulling through.
- 2) As the module is brought into position, the bottom of the rope should then be passed through the corresponding hole on the already installed module and pulled tight to align the sections (Figure 9).
- 3) Once the first set of bolts are fitted, the ropes can then be removed and the remaining bolts fitted (Figure 10)



Figure 9. Draw together rope passed through holes to align flanges.

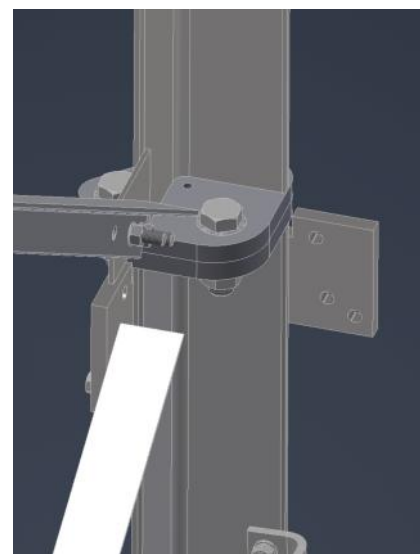


Figure 10. Flanges bolted together in final position.

### 4.2.3 Module F – TS1183 (fully assembled 1445kg)

Module F will need to be partially pre-assembled then lifted as 2 opposing faces. The ladder can be mounted to one of these faces prior to lifting. The remaining braces can then be lifted and bolted into place by the install team. Please refer to drawing TS1183 for full details.

- 1) Lift 1 (Approx. **230kg**) – A pallet containing the braces which do not form part of the pre-assembled faces, along with all the bolts and ancillaries required for the module will need to be taken to site prior to any modules.
- 2) Lift 2 (Approx. **680kg**) – The pre-assembled face with the ladder attached can then be lifted and bolted into position.
- 3) The lower diagonal brace (D1585 – 27.5kg) shown in red below should then be installed to further stabilise the face (Figure 11).
- 4) Lift 3 (Approx. **540kg**) – The opposite face can then be lifted into position and bolted into position.
- 5) The lower diagonal brace (D1585 – 27.5kg) shown in yellow below should then be installed to stabilise the face (Figure 12).



Figure 11. Ladder face with lower diagonal fitted (red) to stabilise the face.



Figure 12. Opposite face with lower diagonal (yellow) fitted to stabilise the face.

- 6) The remaining braces (max. 28.3kg) shown in blue can then be installed to complete the module.



Figure 13. Remaining braces in blue to be hand installed

**4.2.4 Module E – TS1182 (fully assembled 1190kg)**

Module E can be almost fully assembled. The lowest level of braces and the ladder will need to be installed after the helicopter lift, see TS1182.

- 1) Lift 1 (approx. **200kg**) – A Pallet containing the lowest brace for each face, the ladder assembly and fixings will need to be taken to site
- 2) Lift 2 (**990kg**) – The pre-assembled module E (less ladder and lowest braces) (figure 14) can then be installed onto the module below.
- 3) The lower braces (22.5kg each) can then be installed by hand.
- 4) The ladder (75kg) can then be installed either by helicopter lift, or by rigging a suitable lifting system on the tower.

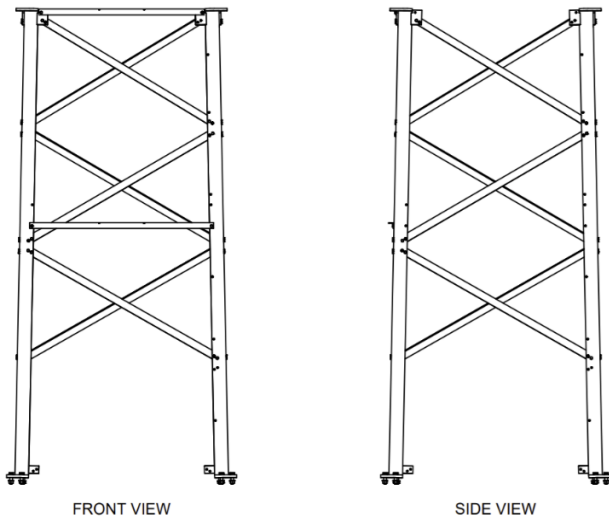


Figure 14. Elevations of pre-assembled section to be lifted.



Figure 15. Completed section showing braces and ladder assembly in red to be fitted once module is landed.

#### 4.2.5 Module D – TS1181 (fully assembled 1079kg)

Module D can be almost fully assembled. The lowest level of braces will need to be installed after the helicopter lift, see **TS1181**.

- 1) Lift 1 (approx. **80kg**) – A pallet containing the lowest brace for each face and various fixings will need to be taken to site.
- 2) Lift 2 (**999kg**) – The pre-assembled module D (less lowest braces) (figure 16) can then be installed onto the module below.
- 3) The lower braces (19.2kg each) can then be installed by hand.

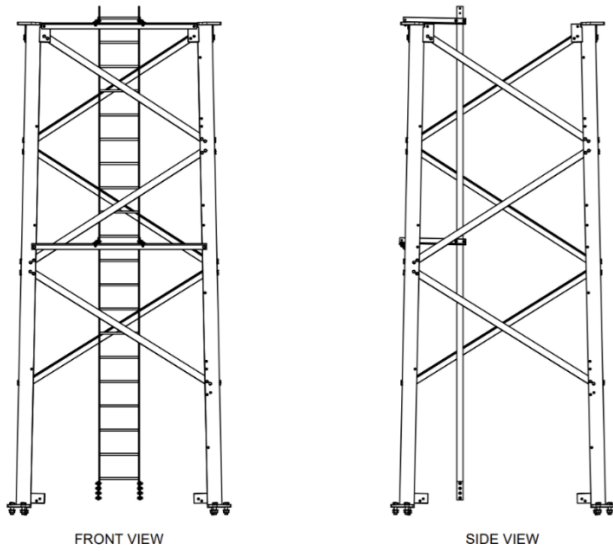


Figure 16. Elevations of pre-assembled section to be lifted

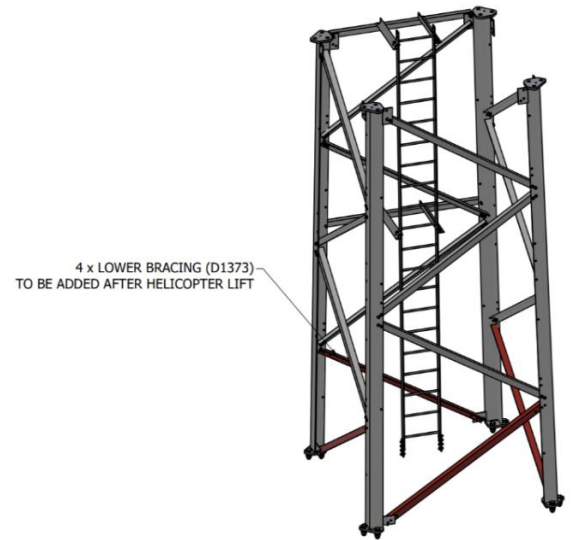


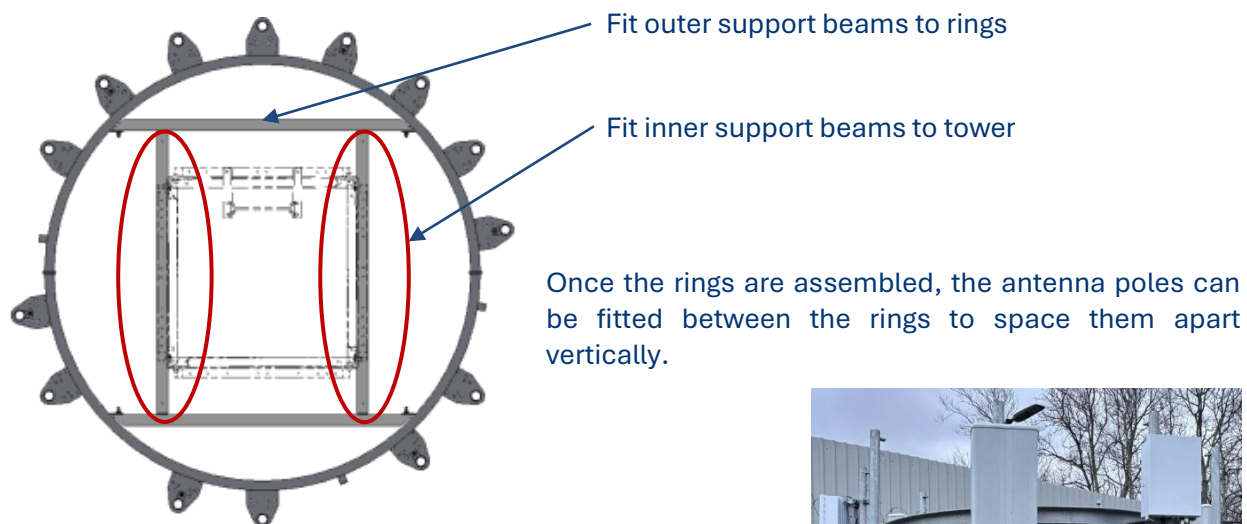
Figure 17. Completed section showing braces to be installed once module is landed.

## 5 HEADFRAME INSTALLATION

### 5.1 Typical Headframe Assembly

Headframes are best pre-assembled and pre-rigged at ground level to reduce working at height.

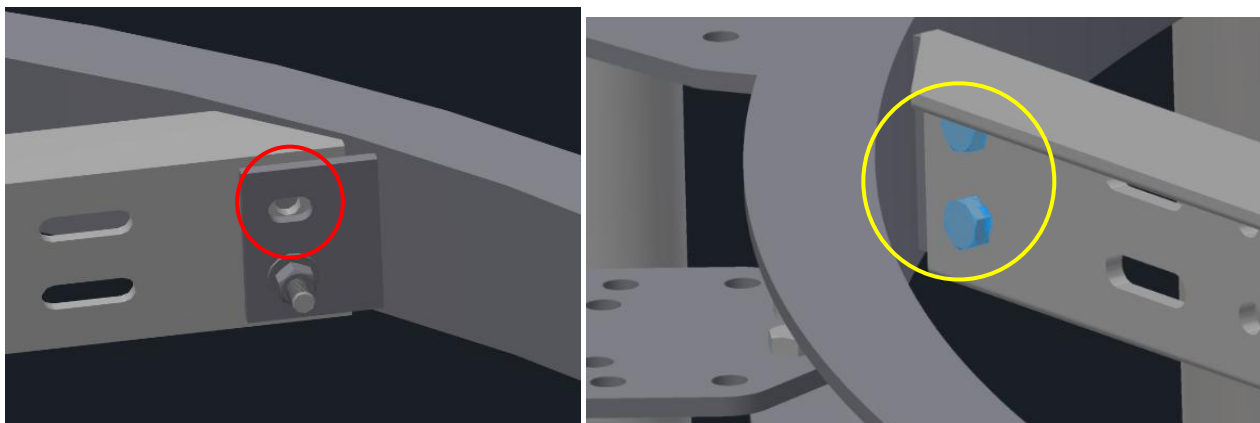
Typically, the rings are assembled on the ground as complete components in the horizontal plane, including their outer horizontal support beams. **The inner horizontal support beams must be fitted to the tower and not the headframe.** Otherwise, these will clash with braces when attempting to lower the assembled headframe over the tower.



Then antenna, ancillary equipment and jumpers can be fitted as appropriate, and as shown in the photo adjacent (outer support beams still to be fitted).



The bolts connecting the outer beam to the ring should be installed as shown below with the oversized washer (Form F) over the slot.

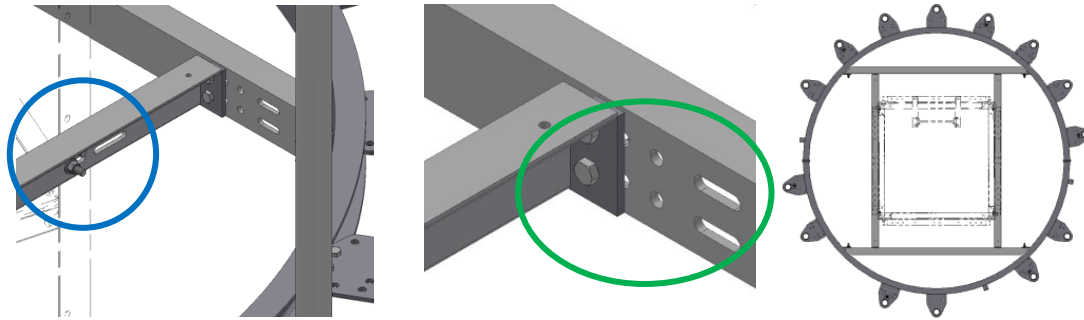


NOTE a bolt is omitted from the left-hand image to show the slots – bolts need to be installed in both positions (as per the yellow circle, seen from the opposite side).

The inner and outer support beams are configured to suit the varying tower face widths, by utilising the different holes and slots in the beams, as shown circled blue and green in the image below.

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The inner support beams are typically directly bolted onto the tower legs (circled in blue). Occasionally N-bolts are used to vary the height of the headframe, but the principles remain unchanged. Ensure the support beams are located at the correct heights and project equally each side of the tower.



5.1.1 Method 1a: Installation of the pre-assembled and pre-rigged headframe onto the tower



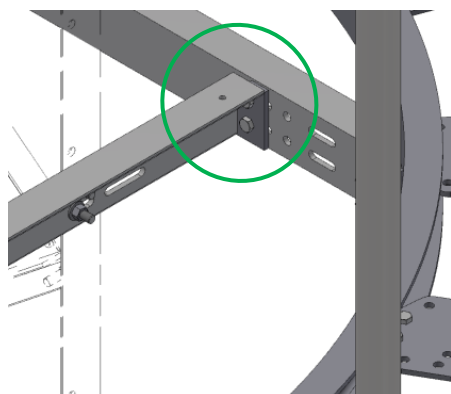
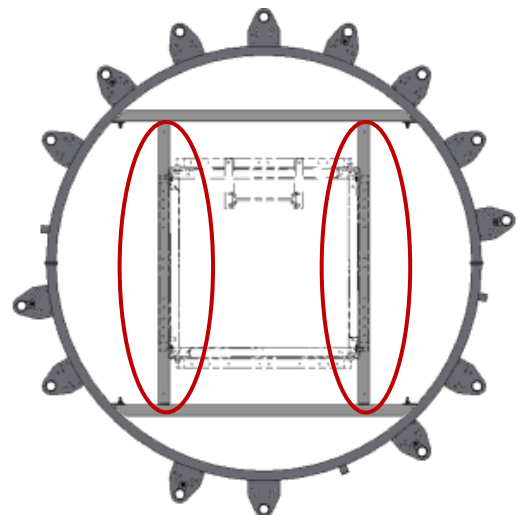
Ideally the headframe will be pre-rigged to limit work at height. However, this methodology could equally be applied to a bare pre-assembled headframe.

The tower is first assembled and installed on the foundation. If rings are to be installed at low positions on the tower, it may be necessary to fit those rings before completing the full tower height. Ensure that there are no protruding elements on the tower above the headframe locations that could snag the headframe assemblies as they are lowered into position.

At each location where a headframe is to be mounted and in advance of the headframe, fit the two support members (shown fitted in the photo above and circled red adjacent). These mount directly to the tower face.

The pre-assembled (and pre-rigged) headframe is then slung and lifted over the tower and lowered into position.

Suitable length slings are to be used to ensure the crane block clears the top of the tower.



All climbers should remain positioned safely within the confines of the tower whilst the pre-assembled headframe is lowered to the required mounting level on the tower. The tower-mounted headframe members will then need to be connected to the internal angle members of the headframe (circled green adjacent) by the rigging team at all ring locations (four per ring level). Once the headframe members are bolted together securely in all positions, any flooring that is not yet in place, can be installed.

**5.1.2 Method 1b: Installation of the headframe in parts onto the pre-installed tower**

This method should only be used where assembly at ground level is not practical as it requires more work at height. It assumes the tower (with ladder) is installed first, and the headframe is fitted piece small or in part-assemblies from the side. This is usually needed when pre-existing steelwork is mounted above the required platform level. This method works best if half platforms (in plan) are assembled, lifted and brought side-on, to the tower. The image below shows two halves of a headframe assembled with antenna poles (internal members not yet fitted)



If lifting individual rings, start with the lowest ring. Else lift the pre-assembled ½ headframe set. Lift each headframe ½ ring to the desired height and bring sideways onto the tower face before bolting to the mounting steel. Ensure the vertical dimension between mounting steel and ring sets is correct so that the antenna poles will fit.

Suitable length slings are to be used to ensure the crane block clears the top of the tower.

If not already fitted, once the rings are secure, the flooring and mounting poles can be fitted, followed by the equipment.

The image to the right shows a pre-assembled and pre-rigged ½ headframe being lifted in from the side between 2 existing headframes.



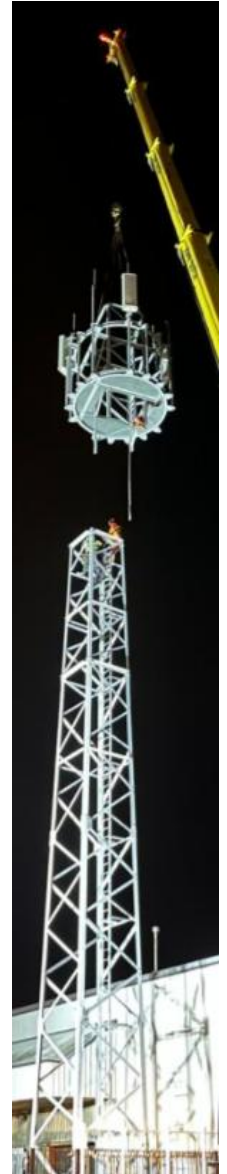
**5.1.3 Method 2: Vertical Installation of the headframe onto the top module before lifting**

In this method, the tower module that houses the headframe is held vertically, typically by the crane or on a bespoke ground frame, to prevent it toppling whilst being worked on. The headframe and equipment can then be installed and part rigged onto the module before lifting.

Ensure suitable lifting equipment & techniques are used along with working at height mitigation as appropriate.

The adjacent images show a ATS1301 //A module, with headframe flooring, antenna poles and antenna being pre-assembled and pre-rigged at ground level before being lifted as a unit onto the tower.

Note the tower section is supported by the crane to stop it from being at risk of toppling whilst it is being worked on.



**5.1.4 Method 3: Horizontal Installation of the headframe onto the tower/modules before lifting**

This is an alternate to minimise work at height. This method assumes suitable space and equipment are available. The tower sections are preassembled horizontally on trestles lifting them clear of the ground. The headframe(s) are fitted on to the pre-assembled tower module(s). The entire module, complete with headframe(s) is then lifted into the vertical and installed onto the base or lower modules.



The tower will need to be supported by trestles, rather than standing on the ground (as shown in this photo). Trestles can be provided by FLI upon request.

This method requires suitable trestles/supports to hold the tower clear of the ground (missing from image above) while the headframe(s) are fitted onto the tower. Mobile Elevated Working Platforms (MEWP/Cherry picker) are likely to be required to gain access to the elevated connections as the rings are typically 3m in diameter, meaning that the top of the ring will be at least 3m above ground level. If ancillary items such as antenna poles, feeder brackets and the Latchways kit can be fitted without interfering with the lifting then these too can be installed prior to lifting. Please note that the above photograph shows a 6m tall 3-ring headframe – FLI now typically supply a 4m tall 2-ring headframe.

**5.2 Flooring – Guidance for the Installation of panels onto the headframe**

Flooring panels should be fitted at ground level wherever possible to avoid work at height, larger panels are susceptible to wind and can be difficult to install at height in even moderate winds.

Flooring panels can be made of either Solid Top GRP, or Durbar plate. All panels are designed to be hand-carriable by one or 2 people. Typically, if Durbar panels are supplied, they will be split into more smaller panels rather than fewer, larger GRP panels. Please refer to the drawings supplied with any specific tower for weights and panel layouts.

Most panels include hand holds that can be used for carrying the panels, but also for slinging should this be required. Typically, the panels can be slung either through the handhold or a bolt hole with a suitably rated shackle/carabiner/lifting eye.

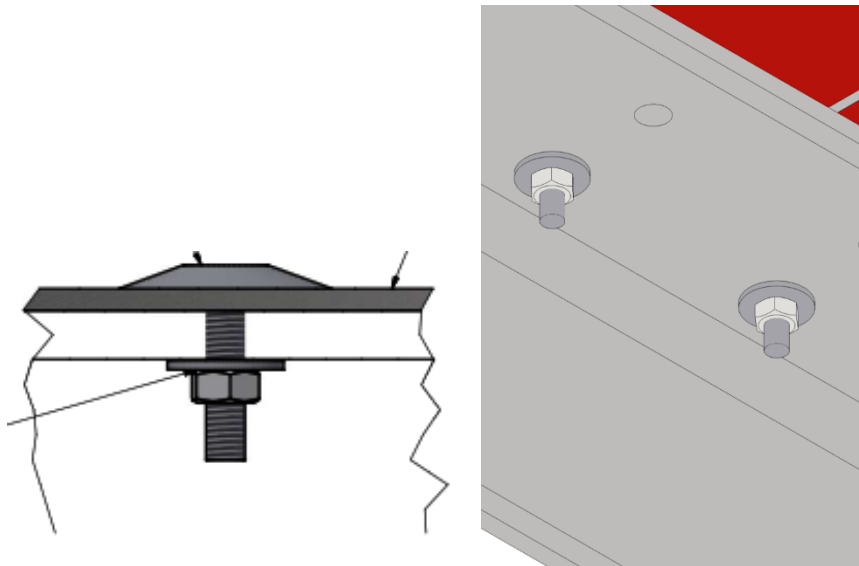
There are 4 types of fixing used on the flooring panels, the layout and composition of which may vary dependant on the practice at the time of construction, or any retrofit work completed on a site. All clip type fixings include a dome washer and countersunk bolt with a hex-head which sits inside to minimise trip hazards, solid fixings may include a domed washer, or a dome-head bolt.

Fixings may require 2 operatives to install, one from above and one from underneath in order to fit the nut.

If any additional holes are required, to reposition a clip to account for cable mounting for instance, it is generally easier to drill from below. The abrasive nature of non-slip coating applied to the top of the GRP panels means there can be significant wear to drill bits should the panels be drilled from above. Refer to the relevant COSHH sheet for detailed information, typically dust masks, eye protection and gloves must be worn when cutting GRP.

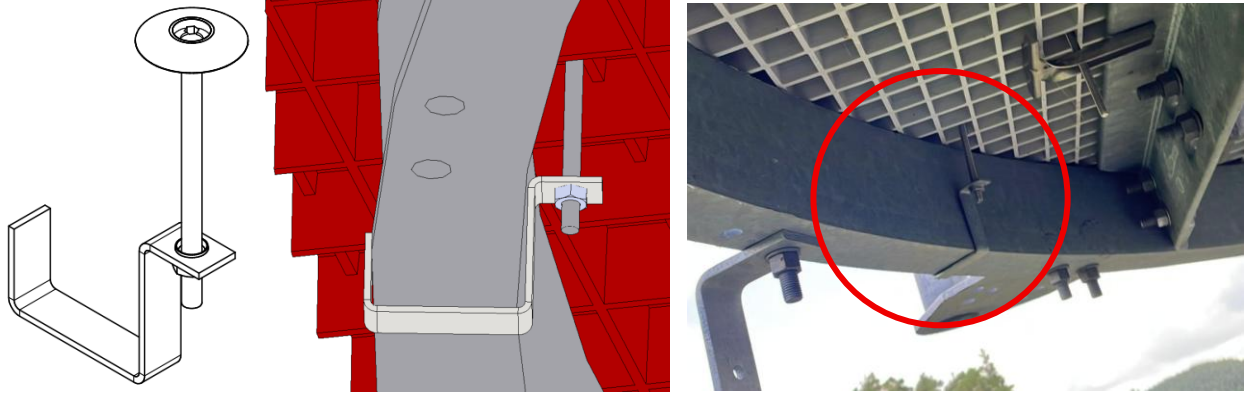
**5.2.1 Solid fixing with bolt/nut assembly**

The preferred method of fixing is to use a bolt and nut to provide a positive fix to the steelwork. The flooring and steelwork usually are pre-drilled in the required hole locations.



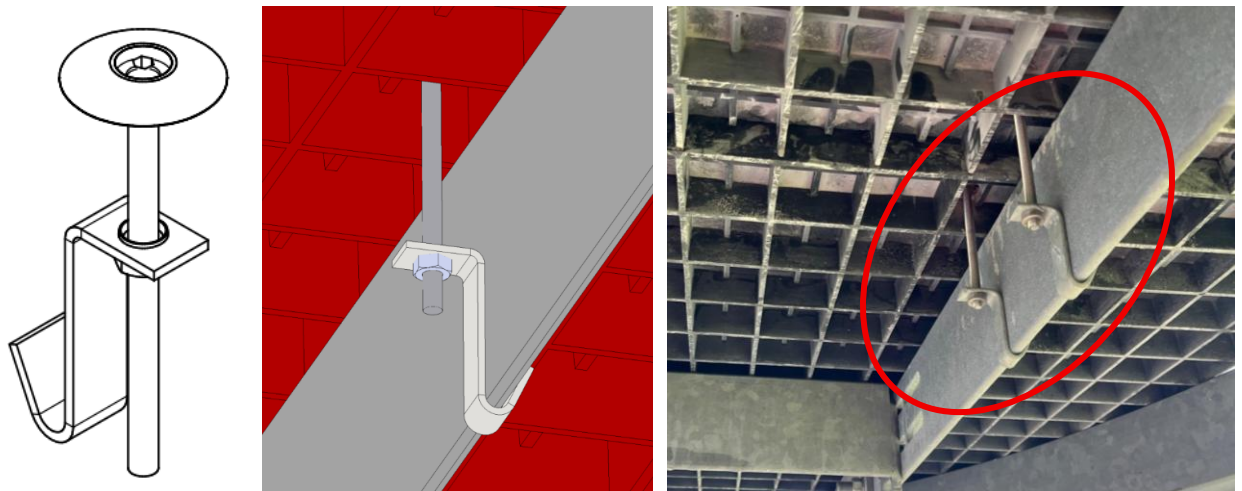
**5.2.2 Channel-Clips (CLA43)**

This type of clip is used when connecting to a channel, as the bottom of the clip can go around the channel, clamping the flooring in place as shown in the images below. These should be fitted inside the ring where possible to prevent the ring sliding outward should anything work loose.



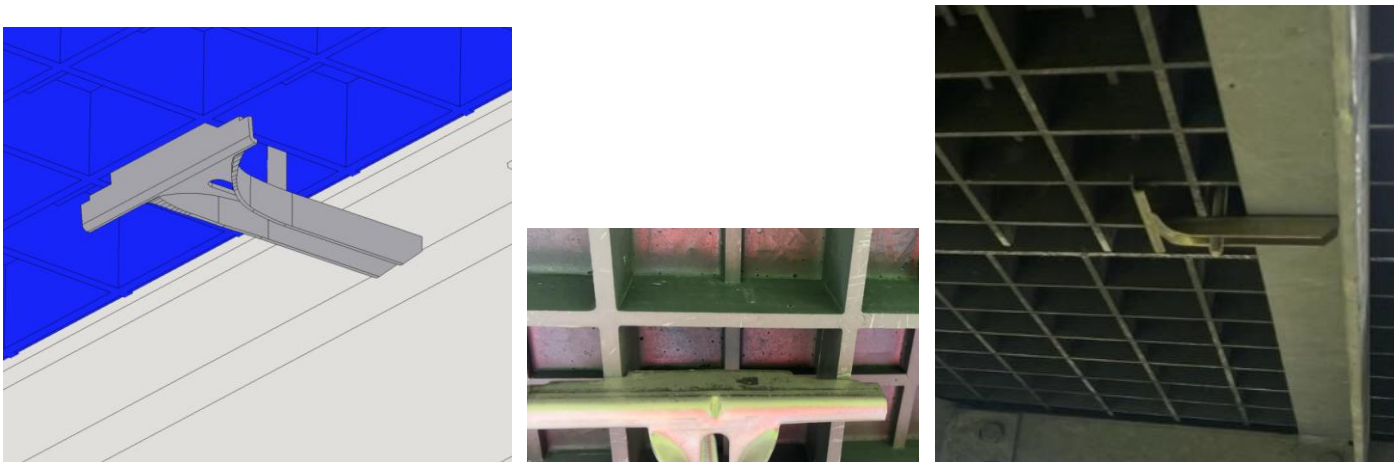
### 5.2.3 Angle-Clips (CLA46)

This type of clip is used to clamp to Angle (RSA). The bottom of the clip can hook around the bottom of the vertical face of the angle as shown in the images below.



### 5.2.4 GRP 'J-Clips'

This type of fixing is used where it is not possible to use channel or angle clips, typically where the fixing is adjacent to the horizontal face of an angle. It is critical that these are installed in the correct orientation. The ridges on the wide part of the clip must be sat into the grid of the flooring to maintain the orientation as in the middle photo below, and the longer part then clamps to the horizontal face of the angle as shown in the right hand image.



## 6 MSA LATCHWAY

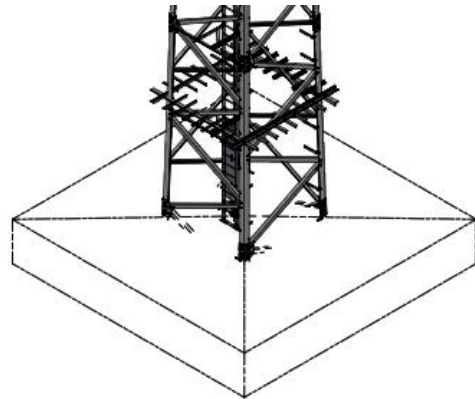
The Fall Arrest system should only be installed by competent operatives who have been trained by MSA. The fall arrest system is not guaranteed unless installed by trained operatives. FLI's fall arrest assembly drawing shows the fall arrest system that runs between the top ladder rung and the bottom. Installation should start at the top rung, with the fixing of the top anchor bracket and strengthening plate (**do not install the strengthening plate at the bottom**), taking care to install the split pin above the nut on the shock absorber. The wire guide assemblies should be fixed at a maximum of 3 metre pitches in the centre of the rungs and the wire should form a straight vertical line from top to bottom. The bottom anchor bracket and tensioning device should be fixed as per the drawings and MSA guidance, the clamping plate below the bottom anchor should be gradually tightened, working around the bolts in once direction to ensure an even clamping force. When installed the wire tensioner should not be over tensioned. The indicator disc on the tensioning device must be free to move by hand. Once everything is in place and tensioned, all fixings should be checked and torqued to the values specified in the MSA documentation provided.

## 7 CLIMB DETERRENT & ASSET TAG

The climb deterrent comprises a set of angles around the tower perimeter to impede trespassers progress and make it clear that climbing is not permitted, but without endangering authorised persons.

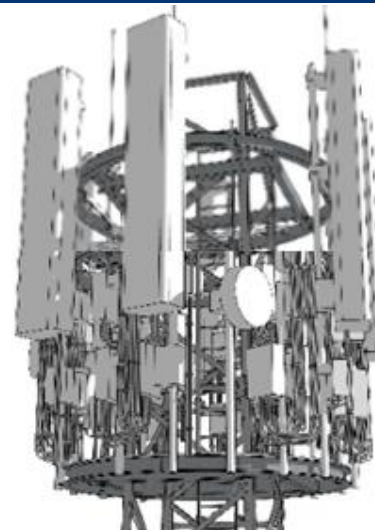
The ladder is protected by a close-fitting lift-off lockable cover plate.

The asset tag will be secured to the ladder cover plate using 3mm rivets prior to dispatch and stamped with the FLI Job No. for the site.



**8 RIGGING**

The antennas are typically arranged in 3 sectors at 120° orientations for 2 operators, one aperture per operator in each sector. Each antenna aperture is a maximum of 3.3m tall. The antenna feeder ports, feeders, RRU, MHA, BoB and dishes should all be accessible from the lower headframe ring, which is typically decked. The upper headframe ring usually has no flooring as only skilled riggers are expected to access this area.



**8.1 Sector Orientation Flexibility**

Gross 20° flexibility is provided by the primary holes around the perimeter of the headframe ring and any apertures on yokes can be orientated individually on the mounting poles. It is preferable to arrange the equipment so that only poles directly bolted to the rings are required and avoid the need for yoke arms. Should Yokes be deployed, additional functionality in 10 degree increments is built into the antenna mounting steelwork. The red marks indicate the bolt positions utilised for these example increments at 10°, 0° and -30° respectively (Patent No GB2587411). Where equipment mounted on yokes is of significant weight and/or wind area, or the yokes are particularly long, the yokes may need bracing.



3-user Large Separation Headframe

**9 MAINTENANCE STATEMENT**

Towers are Class A structures (towers, monopoles, grillages, etc.) and as such inspection and maintenance to be completed at intervals no greater than 2 years. Fall Arrest systems should be inspected at least once a year.

As a minimum, the following items are to be examined:

<b>Design Residual Hazard</b>	<b>Description</b>	<b>Activity</b>
<b>Ground Works and Foundation</b>	Any concrete foundation shall be checked for general deterioration. This may include cracking, spalling and discolouration. The ground around the foundation shall be checked to ensure there is no visible movement, erosion or subsidence. Any drainage or surface water problems in the vicinity of the foundation should be noted as these can affect the stability of the foundations. The interface between towers and their foundations should be checked to ensure the drainage paths for the uprights are clear. Ensure any detritus that may have collected under base flanges and around Hold Down bolts or tower stubs is cleared away and the area left neat clean. Any obstructions to drainage or items that encourage detritus collection must be dealt with.	Installation Maintenance
<b>Earthing</b>	The earthing system must be checked for electrical resistance in accordance with the original customer specification.	Installation Maintenance Dismantling
<b>Tower Structure and ladder</b>	An ascent of towers shall be made to inspect all members and connections for corrosion and any form of distress, e.g. bent or fractured members.	Installation Maintenance
<b>General Bolt Tightness</b>	A 5% representative sample of all bolts shall be tested for tightness. This should be split over all modules and the headframe. Tightness checks need to be appropriate to the type of bolt. If there are any problems, check another 5%. If further problems are encountered all bolts in similar locations must be checked and tightened.	Installation Maintenance
<b>Fall Arrest Systems</b>	The fall arrest system should be checked in accordance with the OEM installation and maintenance statement.	Installation Maintenance Dismantling
<b>Galvanising and Painting</b>	Members shall also be checked for signs of any damage to the galvanised surface. Any damaged surface shall be identified and remedial measures proposed. Refer to the following for guidance. Stubs must be cleaned and inspected at the point of entry into the concrete where detritus often collects. Bolts, and in particular Hold Down Bolts, must be checked for corrosion, as these receive a lower thickness of galvanising than standard steel.	Installation Maintenance
<b>Antennas and feeders</b>	Equipment and power or other feed cable mountings should be checked for any loose fittings. Any obvious damage to equipment should be reported.	Installation Maintenance Dismantling
<b>Flooring</b>	All flooring fixings should be checked for orientation and tightness and the panels checked for lateral movement.	Installation Maintenance

**A full risk assessment for each of the relevant identified hazards above and any other hazards that present themselves needs to be completed by the inspector and/or maintainer.**

**This list is not exhaustive and site-specific risks should always be considered.**

## **9.1 Galvanised Coating Repair**

These notes are an example only and the relevant manufacturer's product details and BS EN ISO 1461 should be referenced.

Repair Materials:

- Zinc rich paint.
- Zinc sheen aerosol spray.
- Paint brushes.
- Protective gloves.
- Wire brushes.
- Sheets of emery paper.
- PPE as identified by task Risk Assessments shall also be used.

Repair Procedure:

1. Visually inspect all galvanising components to identify areas of coating damage.
2. Wire brush any damaged areas to remove loose coating material, signs of staining and corrosion products.
3. Exposed steel and the edges of any mechanically damaged areas are to be abraded with emery paper and the edges 'feathered' to provide a keying surface.
4. Clean area of damage with a clean cloth removing all dust/dirt from damaged area.
5. Observe good painting practice and do not apply paint in wet or damp conditions, or when the air temperature is below 5°C.
6. Apply 2 coats of zinc rich paint to the repair area (Touch dry approximately 1 hour). The total Dry Film Thickness (DFT) shall be no less than 100µm. (as per Clause 6.3 of BS EN ISO 1461:2009)
7. When dry, the painted area should be over sprayed with a zinc sheen spray to give a similar appearance to the galvanise coating. Note that when first applied, zinc sheen spray may appear bright but will fade quite quickly to match the galvanised surface.

Notes:

- a) Superficial marks such as band staining and footmarks should be wiped clean and sprayed with zinc sheen.
- b) Wet storage stain (white rust) rarely progresses past the superficial stage and will generally wear off in normal weather. No remedial treatment is required for light white rusting.
- c) Wet storage stain which has progressed past the superficial stage is characterised by a noticeable darkening and apparent etching of the galvanised coating. In such cases less than 5% of the galvanised coating has been removed and repair may be limited to removal of the white rust by wire brushing and over spray of the affected area with zinc sheen.
- d) Severe wet storage stain is characterised by heavy oxide deposits, with the area underneath almost black and showing signs of red rust.

## **9.2 Removal/Decommissioning**

To remove the structure and decommission the site, typically, the reverse of erection procedures should be followed. A new Method Statement must be produced (by an appropriate authority) that takes into consideration any changes to the site and to the structure since the original design and construction (as this may impact on plant that can be used, space within which the decommissioning team can operate and the types of risk present on site).

Care should be taken to identify primary, secondary, tertiary (etc.) structural members so as to ensure that the dismantling process is safe and does not lead to instability, partial or total collapse of the structure. If in doubt, professional advice must be sought.

## 10 RECOMMENDED READING

The following FLI documents are recommended for reading alongside this document, the latest copies of which can be found on the FLI website at:

<https://www.fli.co.uk/resources/installation-maintenance-manuals/>



- [FLI Guidance Notes for Tightening Non-Preloaded \(Ordinary Bolts\) – Document No. MD030](#)



- [FLI Installation and Maintenance Manual – Tower & Monopole Concrete Pad Foundations – Document No. 2019-66](#)



- [FLI Installation & Maintenance Manual – FLI Piled Grillages – Document No. 2018-65](#)



- [MSA Latchways Installation Guidance](#)

