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Installation & Maintenance Manual

ATS Tower Foundations

Job Ref: General
Prepared for: General Guidance

DOCUMENT No 2019/66

Revision	Date	Prepared By	Checked By	Authorised By
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1.0 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.

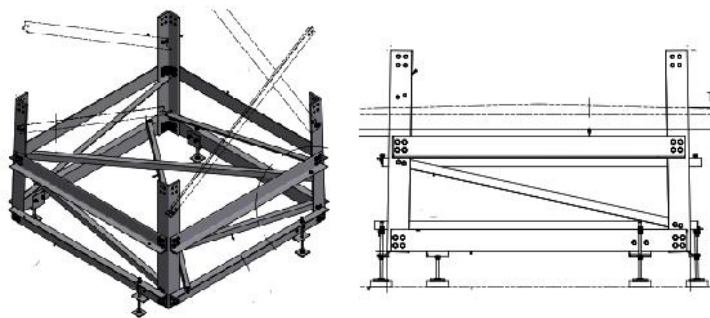
This document contains general information required for the safe operation and maintenance of ATS Tower Foundations. This document includes a summary of the designer’s residual hazards, a maintenance statement and general installation guidance.

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. The installers should provide a method statement outlining the proposed 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 specific risk assessments.

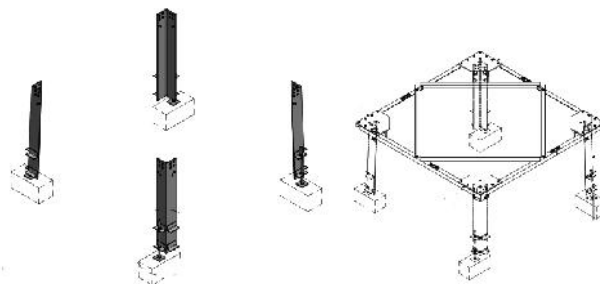
1.1 DESCRIPTION

ATS towers are designed to be installed onto 3 general foundation types:

A- Base grillage set into a concrete pad with protruding fixing stubs.



B- Stubs set-into a concrete pad (no grillage set-up).



C- Hold down bolts in steel substructure.



This document covers all three foundation types.

2.0 DESIGNERS STATEMENT OF RESIDUAL HAZARDS

Design Residual Hazard	Description	Activity
Tripping	It is likely there will be trip hazards in the form of uneven ground, and other encumbrances protruding from the surface. (In some cases piles and grillages).	Installation Maintenance Dismantling
Falling into excavations	The foundation excavation will be in excess of 1m deep and measures should be taken to avoid falls into the hole.	Installation
Collapse of excavations	Appropriate shoring or battering of excavations shall be used to prevent collapse of the sides of the foundations.	Installation
Contaminated Land	During excavation arisings will occur. Though exposure is minimal measures should be taken to prevent contact with known contaminated soil.	Installation Dismantling
Underground Services	Underground services may be struck during excavation. Underground services should be identified prior to commencing excavation works.	Installation Dismantling
Breaking out or removing of base	During removal of the base, heavy plant with hydraulic breaking equipment will be necessary. Personnel carrying out the removal of the base should be appropriately trained and be aware of the hazards in addition to those stated above that may occur during this process.	Dismantling
Injury from Plant Movements	During installation, plant may need to be relocated. Hydraulic attachments will also be in operation. For each operation measures need to be taken to prevent injury.	Installation Dismantling
Falling objects from height	Items can be dropped from the grillage assembly when being positioned or lifted, (crane install). This can include tools or bolts. For each operation measures need to be taken to prevent items being dropped.	Installation
Use of inappropriate lifting techniques or equipment / handling heavy individual pieces	Injury or product damage can result from employing inappropriate lifting techniques or equipment. The weights of individual elements and assemblies are shown on the relevant general assembly drawings.	Installation
Entrapment by hinged or rotating parts	During assembly of hinged or rotating items, body parts (fingers, arms, legs) can become trapped between the parts as they hinge into position.	Installation
Separation of hinged or rotating parts during lifting	During installation, hinged or rotating items may separate during lifting. It is important that the hinged items are secured using an appropriate method. Refer to installation guidance in the relevant FLI document.	Installation
Use of hazardous material: touch-up paint and zinc rich paint	Damage to the galvanised coating can be repaired using zinc rich paint. Painted products are similarly repaired using touch-up paint. Inappropriate use of these materials can cause harm to operatives or the environment.	Installation Maintenance
Use of inappropriate foundation designs	It is the responsibility of the foundation designer to ensure that appropriate base sizes have been designed for above-ground structures. Refer to the relevant drawings for more information on the unfactored base forces and foundation connections.	Installation

A full risk assessment of 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.

3.0 **INSTALLATION GUIDANCE**

Refer to the relevant General Arrangement drawings for details of the structure layout, elements and fixings used on the specific structure.

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

General guidance notes for the 4 Foundation types may be found below.

3.1 **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 his first priority. Good practice in this regard is to follow the Working at Height Hierarchy of control:

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

Practicality and efficiency should also be considered. Where structurally possible, lifting structures in one piece is preferable to multiple lifts. However the cranes available and the site constraints will also influence the assembly and erection methods.

3.2 **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 for use under the nut. Spring washers are not supplied, nor desired.

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 utilised from time to time, as detailed on the structure specific General Arrangement Drawing. Where special fixings are supplied, appropriate tightening methods must be used.

3.3 **Bolt Tightening – Ordinary Bolts (non-preloaded)**

Refer to 'Guidance Notes for Tightening Non-Preloaded (Ordinary) Bolts' Document No. FLI-GN-0007.

3.4 **Bolt Tightening – Pre-loaded Bolts**

Pre-loaded bolts shall be tightened in accordance with a specific method appropriate to the bolt assembly type.

4.0 FOUNDATION TYPE-SPECIFIC GUIDANCE NOTES

After delivery, an inventory check should be carried out on all items including a check for the correct size and quantity of bolts and studding. FLI should be informed immediately if there are any delivery errors.

A) Base grillage set into a concrete pad with protruding fixing stubs.

The following method assumes that the base-grillage assembly will be assembled piece small, by hand, in the prepared foundation excavation. The method has been developed by a trial erection at our works. The assembly must not be erected out of the excavation and lifted into position.

INSTALLATION GUIDANCE FOR ATS BASE-GRILLAGES

1. An assembly drawing will be supplied with the base stub assembly. This drawing will show part numbers and their positions. It gives the lift weights of each part.
2. The assembly of the base stubs is assumed to be carried out in the bottom of the foundation excavation once the blinding has been cast and the bottom level of rebar fixed. 4No. concrete construction blocks should be placed on the blinding in positions corresponding with the corners of the grillage. These blocks are to facilitate levelling of the grillage, additional blocks may be required to achieve the tolerances set out on the drawings.
3. Assemble two opposite faces of the grillage assembly, making reference to the drawings for part numbers and bolt sizes. At this stage leave the bolts hand tight.
4. Whilst holding the faces upright, infill the remaining faces of the grillage with the appropriate bracing members.
5. Install the plan braces to make the grillage fully triangulated.
6. With all bolts hand tight, check that the tops of the leg stubs are all level to the dimensions shown on the foundation drawing. Also check that the centres of the leg stubs are equal and to the lengths shown on the drawings. This should be done across the faces and diagonal of the assembly. If there is a discrepancy, adjust the assembly as necessary by loosening off some bolts of the affected pieces, re-setting them to the required position and then retighten bolts. Once measurements and dimensions are correct fully tighten the bolts.
7. If after adjustment the levels or dimensions are outside of the tolerances specified on the drawings, the FLI Project Manager should be informed. If no tolerances are shown, the diagonal measurements should be within $\pm 2\text{mm}$.
8. Place the remaining reinforcement.

9. Tie the assembly to the reinforcement cage and ensure that the template is at the correct level to produce the required final stub projection from the completed foundation level. The projection should be as stated on the drawing and the tolerance is $\pm 5\text{mm}$, unless stated otherwise.
10. Recheck levels, heights of stubs above concrete and centres of stubs. If outside tolerances report this to FLI.
11. Pour the concrete.
12. Check dimensions and levels after pouring/curing. If tolerances are exceeded, report this to FLI.

B) Stubs set-into a concrete pad (no grillage set-up).

The following method assumes that the base-grillage assembly will be assembled piece small, by hand, in the prepared foundation excavation. The method has been developed by a trial erection at our works. Note well that any steelwork provided, that connects the leg-stubs, is intended for setting out purposes only – and therefore, **the assembly cannot be erected out of the excavation and lifted into position with lifting apparatus.**

Note that the template is a guide to setting the base stubs into required positions. At times, additional efforts, tools or materials may be necessary.

INSTALLATION GUIDANCE FOR ATS BASE-STUBS

1. An assembly drawing will be supplied with the base stub assembly. This drawing will show part numbers and their positions. It gives the lift weights of each part.
2. The assembly of the base stubs is to be carried out in the bottom of the foundation excavation once the blinding has been cast and the bottom level of rebar fixed. 4No. concrete construction blocks should be placed on the blinding in positions corresponding with the corners of the tower feet (and thus, of the stubs). These blocks are to facilitate levelling of the stub assembly; additional blocks may be required to achieve the tolerances set out on the drawings.
3. The base setting template is to be assembled out of the hole and craned into position allowing the legs to be bolted-on in-situ. At this stage leave the bolts hand tight.

6. With all bolts hand tight, check that the tops of the leg stubs are all level to the dimensions shown on the foundation drawing. Also check that the centres of the leg stubs are equal and to the lengths shown on the drawings. This should be done across the faces and diagonal of the assembly (Note that the base-setting-template corner-plates include inspection holes that allow accurate readings of corner-to-corner dimensions). If there is a discrepancy, adjust the assembly as necessary by loosening off some bolts of the affected pieces, re-setting them to the required position and then retighten bolts. Once measurements and dimensions are correct fully tighten the bolts.

Note the use of shims or washers in some connection areas on the template is permitted, should these be useful in adjusting dimensions to achieve the required measurements. Rebar and surrounding shuttering can also be utilised along with the template, to assist with positioning the stubs and holding secure during pour.

7. If after adjustment the levels or dimensions are outside of the tolerances specified on the drawings, the FLI Project Manager should be informed. If no tolerances are shown, the diagonal measurements should be within $\pm 2\text{mm}$.
8. Place the remaining reinforcement.
9. Tie the assembly to the reinforcement cage and ensure that the template is at the correct level to produce the required final stub projection from the completed foundation level. The projection should be as stated on the drawing and the tolerance is $\pm 5\text{mm}$, unless stated otherwise.
10. Recheck levels, heights of stubs above concrete and centres of stubs. If outside tolerances report this to FLI.
11. Pour the concrete.
12. Check dimensions and levels after pouring/curing. If tolerances are exceeded, report this to FLI.
13. The template will be removed from the stubs once concrete has cured, and collection will be coordinated with FLI.

C) Hold down bolts into steel substructure.

Rooftop ATS towers are designed with steel base-plates for fixing with hold down bolts onto a steelwork supporting structure (by others).

Note that the supporting structure must be level and that any additional levelling must be carried out using shims (and **NOT** levelling bolts).

5.0 MAINTENANCE STATEMENT

BS8100 recommends that inspections for Class A structures (towers, monopoles, grillages, etc.) be completed at intervals no greater than 2 years.

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

Item	Description
Ground Works and Foundation	<p>Any concrete foundation shall be checked for general deterioration. This may include cracking, spalling and discolouration.</p> <p>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.</p> <p>The interface between towers and their foundations should be checked to ensure the drainage paths for the uprights are clear.</p>
Earthing	<p>The earthing system must be checked for electrical resistance in accordance with the original customer specification.</p>
General Bolt Tightness	<p>A 5% representative sample of all bolts shall be tested for tightness. Tightness checks need to be appropriate to the type of bolt.</p> <p>If there are any problems, check another 5%. If further problems are encountered all bolts in similar locations must be checked and tightened.</p>
Galvanising and Painting	<p>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 section 5.1 for guidance.</p>

5.1 Removal/Decommissioning

To remove the structure and decommission the site, typically - in elements not cast in concrete - the reverse of erection procedures should be followed. Care should be taken 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.

Where elements have been cast into concrete, heavy plant with hydraulic breaking equipment will be necessary. Personnel carrying out the removal of the base should be appropriately trained and be aware of the hazards that may occur during this process.

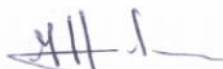
A new Method Statement must be produced (by an appropriate authority) that takes into consideration any changes to the site and to the structure since the original design and construction (as this may impact on plant that can be used, space within which the decommissioning team can operate and the types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

ANNEX A: COSHH DATA SHEETS

The Following Data sheet has been included as an example. Other touch-up products are available and other hazardous products may be required on-site. All hazardous materials used on site will require a COSHH data sheet.

FRANCIS & LEWIS INTERNATIONAL

Substance Identification Record (COSHH) and Assessment Record

<u>Substance:</u> Paint-Zinc Rich Primer (Manor Product)		<u>Record No:</u> 54
<u>Manufacture:</u> Shipley Paint Limited		<u>Manufactures Health & Safety Identification Number:</u> UN 1263
<u>Process:</u> Repair/ touch-up of damaged hot dip galvanised steel.		<u>Process Location:</u> Workshop and Site.
<u>Ingredients</u>	<u>Occupation Exposure Limit</u>	<u>Date</u>
Xylene (mixed isomers) Ethylbenzene	100ppm 8hr TWA 100ppm 8hr TWA	02/02/04 02/02/04
<u>Physical Properties</u>	<u>Suppliers</u>	
Liquid Aromatic Odour Boiling Point 138-185°C Vapour heavier than air Auto-flammability 490°C	Shipley Paint Ltd Otley Road Shipley West Yorkshire BD17 7DP Tel No: 01274 587351	
<u>Frequency & Duration of Exposure</u>	<u>Hazard Identification</u>	
Intermittent, (as required for repairs), Maximum duration 3 hours.	<ul style="list-style-type: none"> - Highly Flammable - Harmful by inhalation - Harmful in contact with skin - Irritating to skin 	
<u>Assessment of Exposure:</u> The level of exposure is considered acceptable providing this Product is applied in a well-ventilated area.		
<u>Exposure Controls:</u> -Use only in well-ventilated areas. -Keep container sealed when not in use. -Store in cool dry place	<u>Personal Protection:</u> -Wear eye protection, gloves and overalls. -Do not smoke when using this product. -If insufficient ventilation wear suitable respiratory protection.	
<u>Approved for Use:</u> Providing controls and personal protection requirements are followed.		
Safety Officers Signature :  Date : 18/01/06		

**ANNEX B: GUIDANCE NOTES FOR
TIGHTENING NON-PRE-LOADED
BOLTS**

(Normal Bolts)