



*Supporting Renewable Energy*

# **Tm24**

# **Modular Low Level Support Structure**

*Installation Manual*



**Manufactured in the UK**

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Recommended tightening torques on the fasteners used on Tm24 structures.

M6 module fixings	7.6Nm
or	
M8 module fixings	15.4Nm
Grubscrews & M10 Fasteners	39Nm
M10 Anchor bolts	30Nm

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## INTRODUCTION

This manual provides a basic guide to the assembly of the Tm24 low level support structure, it is recommended that you read through the manual before attempting to assemble the structure taking note of the health & safety issues. The structures are supplied as kits to provide a 2.4m long array, each kit can then be joined to the next using the pole joiners provided. Module fixing kits are supplied separately from the kits as solar modules are of different widths, so the number of modules on each array will depend upon the size of the modules. There are also two options when it comes to ground mounting, either a set of four feet and anchor bolts for fixing onto concrete foundations or a set of four ground poles and fixings for when concrete foundations are not desired.

When purchasing the kits, the stockist would have supplied you with the correct number of 2.4m array kits, module fixing kits and either sets of feet or ground poles to suit your required application. The details shown in this manual shows the preferred distances between the legs of the structures, but it is advised to work out how your modules will be placed on the structure, the normal rule is to allow around 15mm of array tube to protrude beyond the first module then allow a 10mm gap between modules. By working this out before attempting to assemble the kits or placing the foundations this will prevent issues of the leg sets clashing with the frames of the modules and also help you work out how many module fixings are required between each leg set.

When joining the 2.4m frames together, we recommend that a maximum of four frames are joined, then a gap to the next frame should require more than this in one row. This helps prevent issues with the structure legs clashing with the module frames and also help allow for un-even ground. The drawings shown near the back of this manual provide you with a view of the basic assembly.



*Typical structure layout using ground poles*

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## HEALTH & SAFETY

### Structure Assembly

Construction must not be attempted in high winds. Care must be taken in lifting large solar panels.

Some of the structural components may have sharp edges, take extra care when handling.

When using ground poles, please ensure that the area of installation is free from underground pipework and cabling.

**WARNING- DO NOT PUT YOUR FINGERS IN THE ENDS OF THE STEEL TUBES, SHARP EDGES**

### Electrical Interconnection

Potentially lethal voltages can be developed from arrays. Take the following precautions:

Electrically isolate the array from the rest of the system.

The modules should be shaded from the sun by opaque sheeting before any electrical connections are made to the sub-array junction boxes or at the control unit.

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## INSTALLATION SEQUENCE

### Part Identification

Refer to the drawings, photographs and parts list within this manual to familiarise yourself with the components of this structure prior to attempting assembly.

### What's Involved?

Concrete foundations may be required for this structure, a basic guide to foundations is shown in this manual, but it is suggested that you consult a local civil engineer to establish local ground conditions. Foundations (supplied by others) are to be left to settle for a period of 28 days prior to the installation of the structures.

Preparation of tools, and checking that all components are present.

Assembly of the first 2.4m structure

Fitting additional extensions to the structure to establish the required array size.

Compass	To ensure correct orientation
Tape measure (5 metres long)	Measure out mounting points etc.
Post hammer	To insert the ground tubes (if required)
Electric screwdriver/impact driver with 10mm socket	To fit the self-drilling screws for pole joining
Hammer drill	To drill the footings
10mm masonry bits	To drill the footings
Hammer	To tap in the ground anchor bolts
Allen key (1/4") <b>(SUPPLIED)</b>	General structure assembly
Chalk/felt marking pen	Mark out correct mounting positions
10mm / 13mm A/F spanners	Module mounting bolts
Zinc touch up paint and brush (Galvafruid)	For touching up transit damage
17mm A/F spanners	M10 fasteners and ground anchor bolts
Sponge, cloth and clean water	For cleaning the modules
Opaque sheeting	To shade the modules as required
Inclinometer (angle setter)	To ensure the correct tilt angle is set

*Minimum recommended tools for structure assembly.*



Corner clamp



End cap



Ground anchor bolt



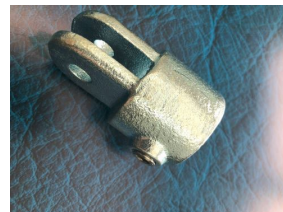
Short tee clamp



Foot



Swivel Male



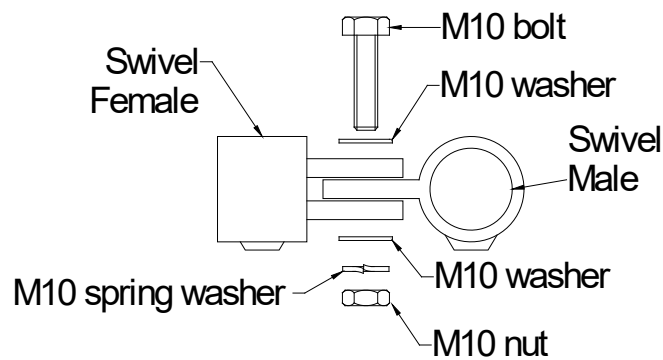
Swivel Female



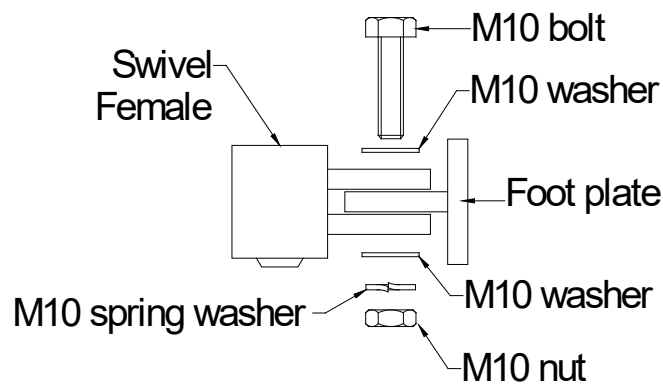
Module clamp



250mm pole joiner



Assemble of Swivel slide male & female



Assemble of Swivel slide female and foot plate

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## ASSEMBLY OF SUB ARRAYS

### Assembly of the first TM24 structure

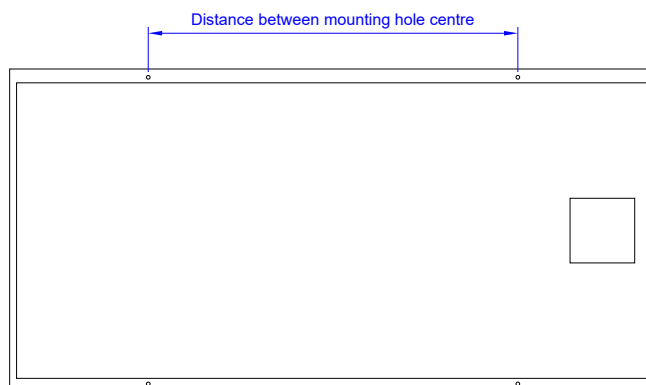
The first stage is to assemble the first Tm24 structure kit, the following describes a suggested method for assembly, for the first 2.4m kit it is easier to assemble this with the modules face down then turn the whole assembly over once complete. We will assume that the structure required is for more than 2 solar modules and that the first kit is for the 2 modules on the left when facing the front of the array. For the sake of this manual it is assumed that only 2 modules will fit onto this first 2.4m section, additional module clamps can be slid into place ready for the placement of the next solar module

### Module Preparation

Lay the solar modules face down on a smooth flat surface that will not damage the glass, leaving a 10mm gap (approx.) between the two panels. Ensure all the module junction boxes are grouped together on one side. Note - it is important to protect the back of the modules during assembly, use sheets of cardboard so that any smaller components dropped on the back of the module do not damage the module backing material.

### Sub Array Tube Preparation

Locate the sub-array tubes. They can be identified by measuring their length and comparing them with the values in the parts list at the back of this manual. To ensure that you are able to obtain a full tilt angle range, it is important to fit the module clamps onto the sub-array rails correctly. First measure the distance between centres of the mounting holes on the rear of the solar panels as shown below:



If the distance between the mounting hole centres is 100cm or less then the module clamps must be fitted so that they point outwards towards the ends of the modules, I.E. the fasteners are nearer the ends of the modules than the tubes.

If the distance between the mounting hole centres is more than 100cm then the module clamps must be fitted so that they point inwards towards the centre of the modules, I.E. the fasteners will be nearer the centre of the module than the tubes.

For the purpose of this manual we will assume that the hole centres is greater than 100cm

**Upper Sub array Tube** - Slide the Tee clamps and module clamps onto one length of tube. The upper tube is fitted to the junction box end of the modules. Position the clamps so as to line up with the mounting holes on the modules taking note of the above with regard to orientation of the module clamps.

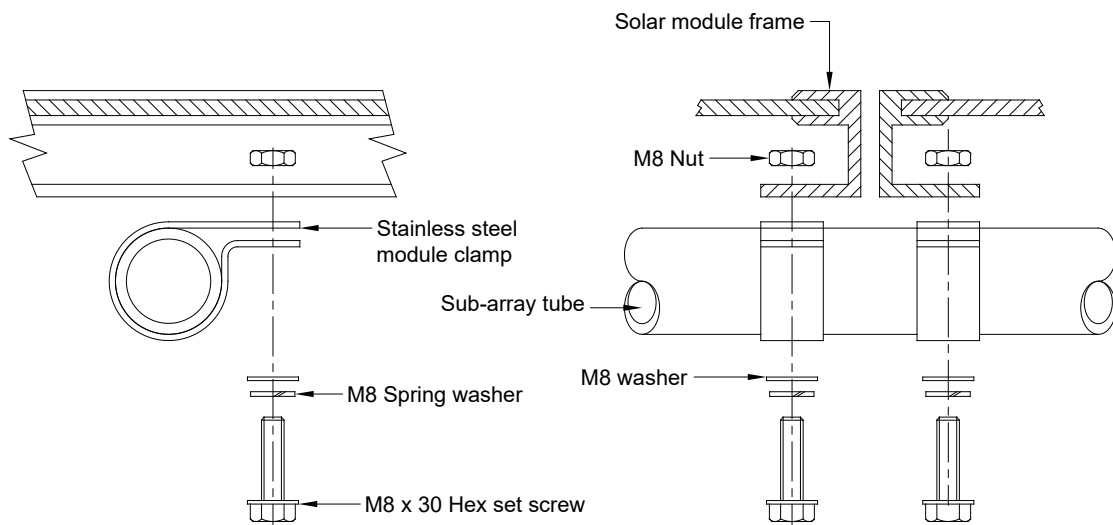
**Lower Sub Array Tube** - Slide the right angle clamps and module clamps onto one length of tube. The upper tube is fitted to the junction box end of the modules. Position the clamps so as to line up with the mounting holes on the modules taking note of the above with regard to orientation of the module clamps.

**Note** - Only tighten the clamps sufficiently to stop them sliding on the tube, they will need to be adjusted when the support legs are fitted later.

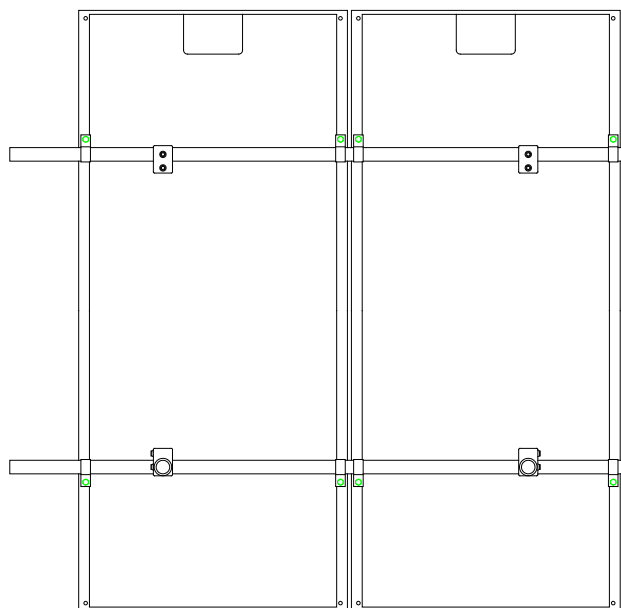
**Sub Array Assembly**

Lay the tube assemblies on to the back of the solar modules as shown and position the module clamps so as to line up with the module mounting holes.

Using the M6/M8 fastener kits, bolt the module clamps onto the modules as shown below (we have assumed M8 in the drawing).



*Module fixing details (Alternative M6 fasteners supplied for some modules).*



*Typical layout of array tubes on top of the solar modules (hole centre greater than 100cm)*

## 1. ASSEMBLY OF THE SUPPORT LEGS TO THE SUB-ARRAY

Ensure that the Tee clamps on the back of the array are in the correct position as shown in the detailed drawing at the back of this manual. Their separation must correspond to the separation of the foundation points for the structure. The position of the clamps are easily adjusted by loosening the grub screw using the Allen key supplied, moving the clamp and then re-tightening the grub screw.

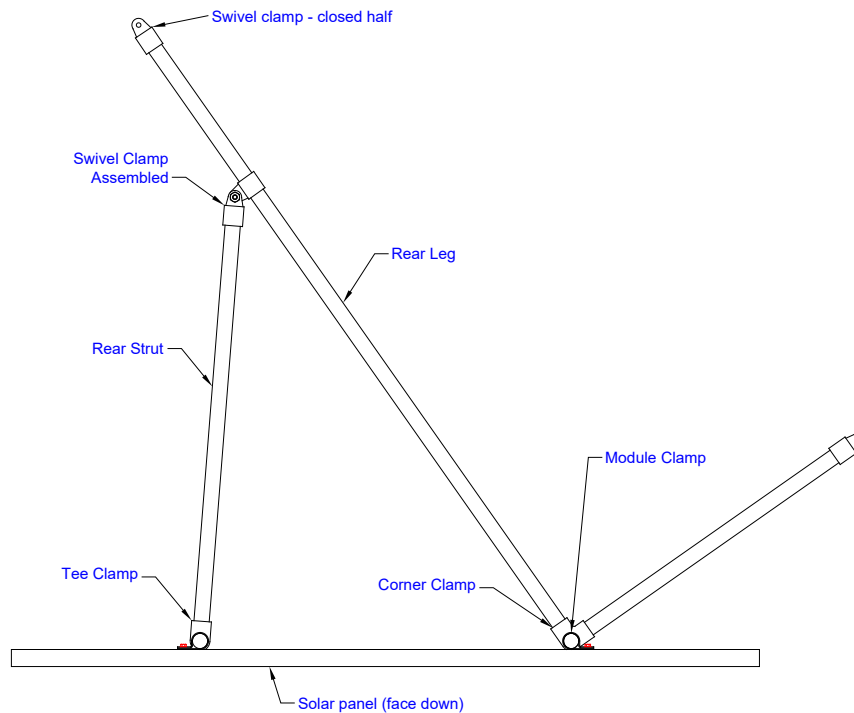


Figure 6.1 : T structure final assembly.

### Front legs – 720mm

Fit the front legs into each of the right angle clamps on the lower sub array tube. Tighten the grub screws using the Allen key to secure the tubes.

### Rear legs – 1630mm

Fit the rear legs into the right angle clamps on the lower sub array tube. Tighten the grub screws using the Allen key to secure the tubes.

### Slide Clamps

Now add the slide clamps to the rear legs and set to approximate tilt angle required, the tilt angle must be checked when in position. Note this clamp is supplied in 2 parts and needs to be bolted together using the M10 galvanised steel fasteners provided.

### Rear Struts – 1200mm

Insert each rear strut between the slide clamp and the corresponding tee clamp on the upper sub array tube. Tighten the grub screws using the Allen key to secure the tubes.

### Swivel male

On the end of each leg fit the male swivel clamp and tighten into place.



### Structure placement

The assembled array can now be turned over and placed carefully on its feet. If the structure is to be used with concrete foundation then attach a footplate to swivel clamp halves on the bottom of each leg prior to turning the structure over. With the Non-foundation version the open half of the swivel clamp will be pre-fitted onto the ground anchor tubes that have been positioned into the ground as shown later in the manual.

### Installation of the Array onto a Bolted Foundation. (Foundation type only)

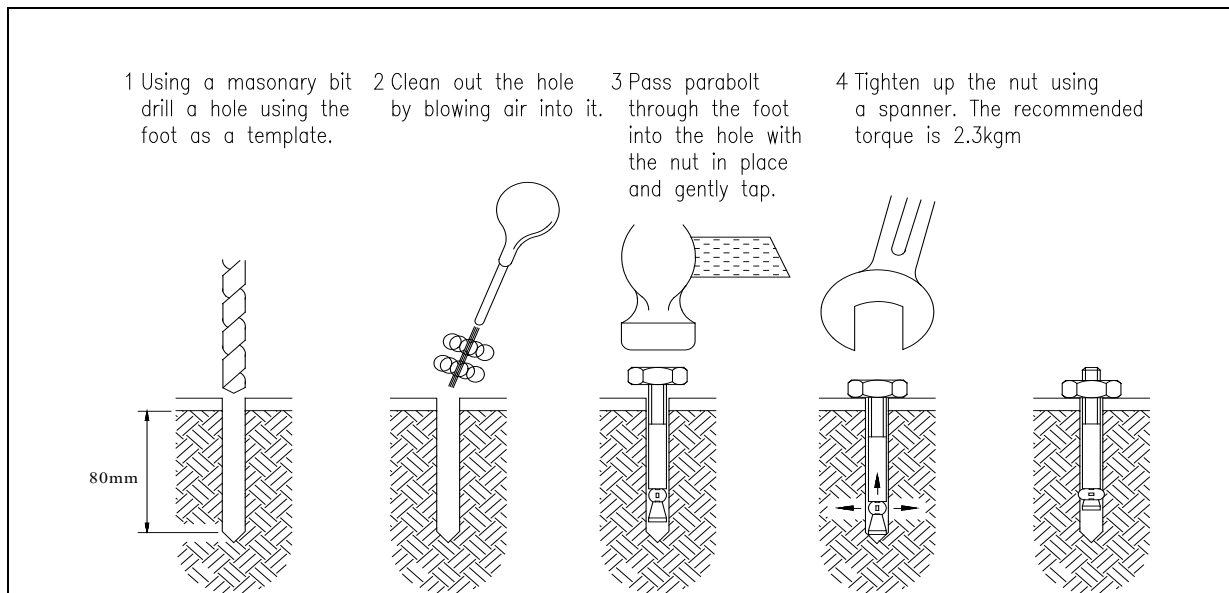
The array must be secured to foundations.

Anchor bolts (expanding) are fitted as illustrated below. It is best to drill and fit only one anchor bolt in each foot (preferably the one that will be difficult to get at when the assembly is finally positioned). Drill the holes 95mm deep with a 10mm masonry bit.

Place the sub array in position and mark out the other holes.

Remove the sub array, drill the remaining holes and fit the anchor bolts.

Replace the sub array over the anchor bolts and fix down.

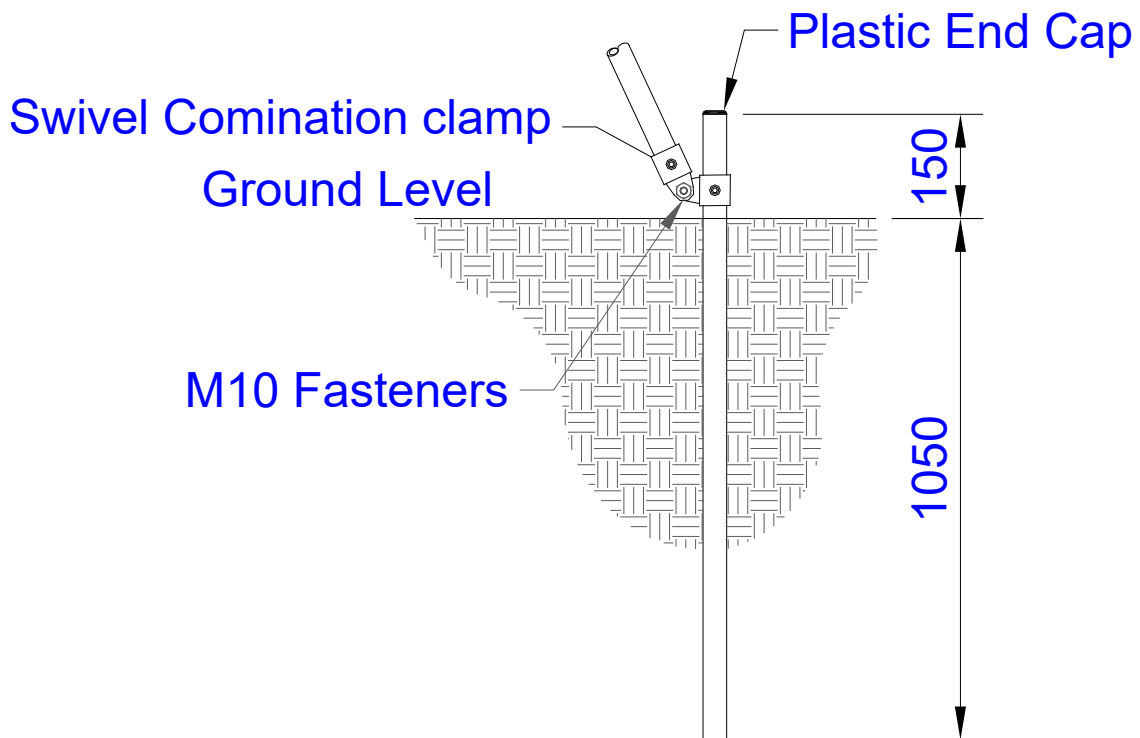


*Fixing of Anchor bolts.*

**Installation of the Array onto ground poles.**

If your structure is supplied with ground anchor poles, you will need to follow these instructions for the final placement of the structure.

1. Your kit will consist of 2 part swivel combination clamps c/w M10 fasteners to secure, these are to be fitted onto the ends of each leg so that the clamps swivel front to back.
2. Install the 4 ground poles as shown on the structure drawing, making sure that they are positioned correctly, the distance front to back (north/south) is more critical than the distance sideways (east/West). The installation of the ground tubes will depend upon the ground conditions, a mechanical post knocker is recommended for this.
3. If the top of the tube is damaged during installation, cut the top off with an angle grinder or Hacksaw and paint end with zinc rich paint.
4. Making sure the grub screws in the swivel combination clamps allow the tubes to pass through the clamps, position the structure onto the four ground poles.
5. Lift the structure to just above the ground level and tighten the grub screws.
6. Fit a plastic end cap onto the top of each ground tube.



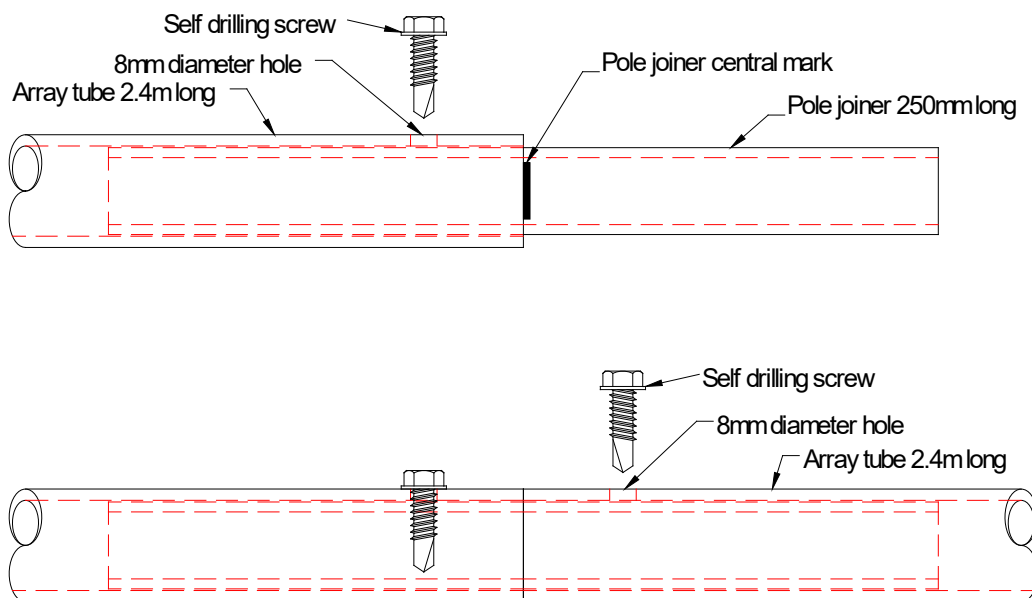
### Adding additional Tm24 2.4m kits

The modular Tm24 structure allows you to add additional modules up to a maximum of four 2.4m (9.6m) per structure, should you require a longer array then it is advised to start a new array either alongside the original one or behind making sure you allow enough distance to prevent shadowing. Additional Tm24 module sub-arrays can be easily fitted to the end of the off-set array tubes using the pole joiners as shown below:-

For this stage, you will require an electric drill or impact driver with a 10mm A/F socket to fit the Self drilling screws into place. Slide the joiner into the end of the array poles up to the central line on the joiner tube and using the self-drilling screws, secure into place through the 8mm diameter hole provided in the end of the array tubes.

Fit the clamps and module clamps onto the next set of array poles and partially assemble the kit, slide the array tubes onto the fitted joiner poles inserted into the original array tubes making sure that this is pushed fully up to the existing array tube, this can now be secured into place using the self-drilling screws as before.

The top array tube will need to be held in place until the next set of solar modules are fitted. This process can then be repeated for any additional Tm24's.



*Pole joint details*

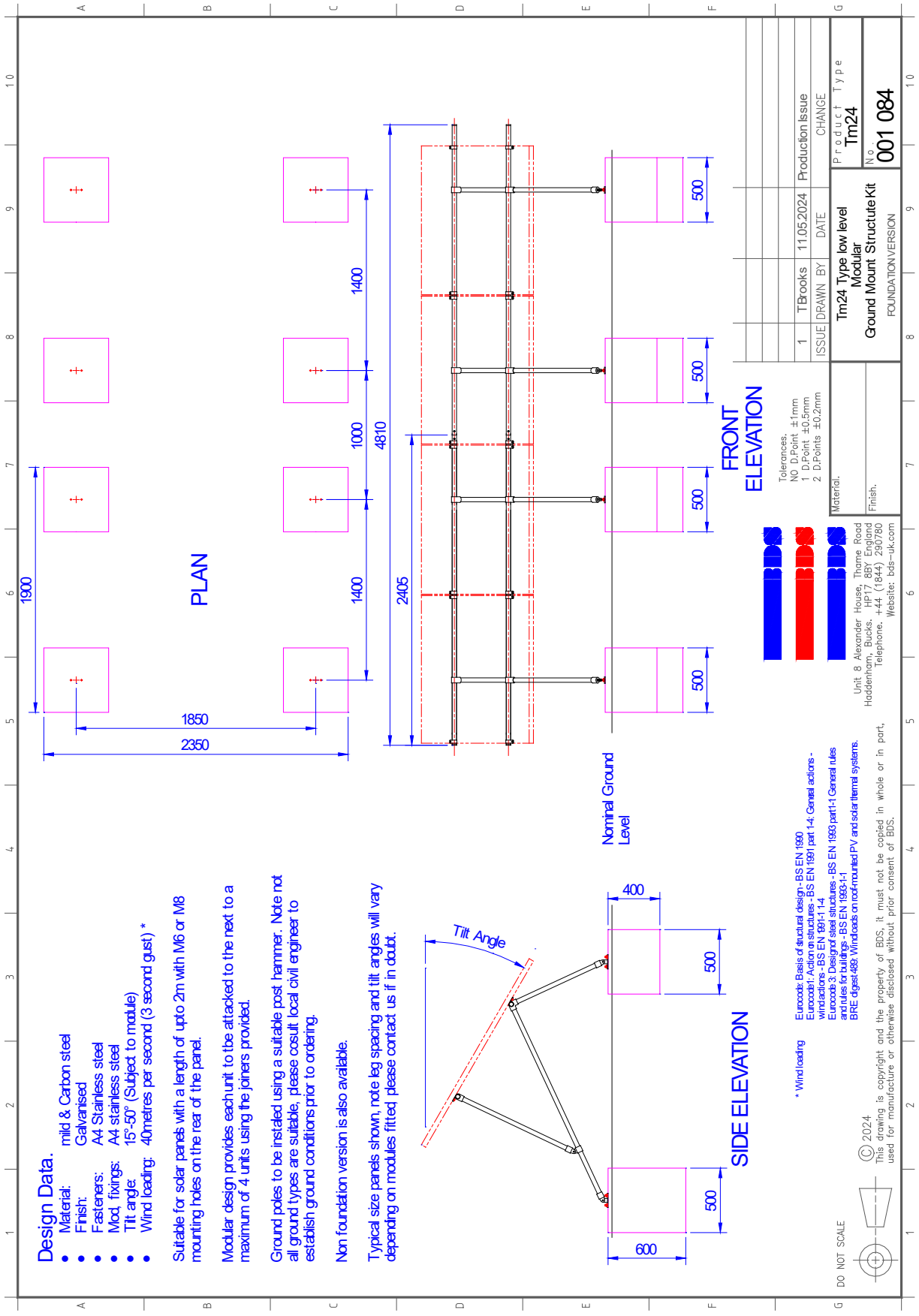
### Earthing

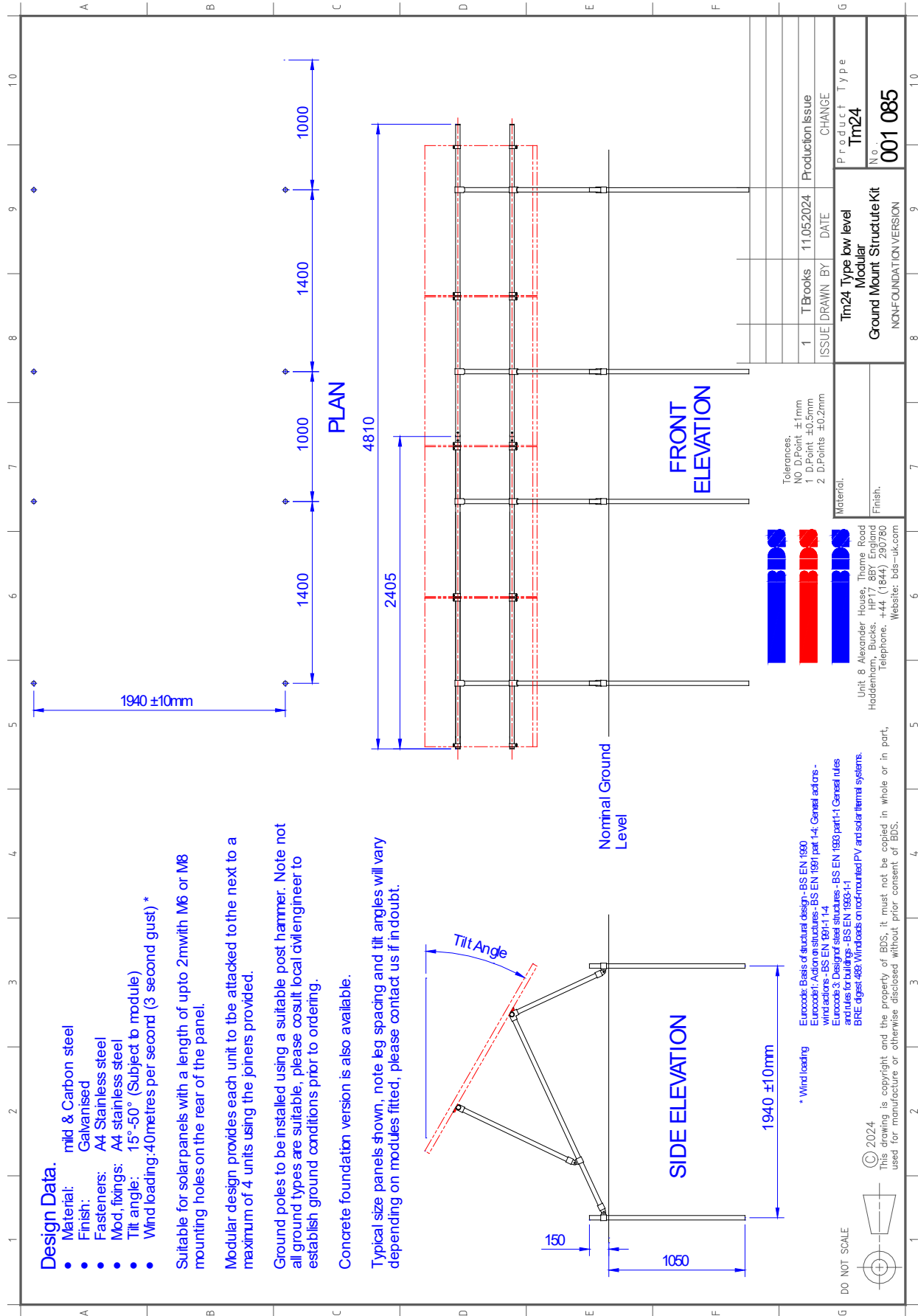
The module frames are earthed to one another through the stainless steel module clamps and the structure tubes.

When the structure assembly is completed the array structure should be earthed to ground using a suitable earth. Use earth rods as required.

## Parts list

Modular T type structures		2.4m Array	Solar panel fixing kit	Leg set foundation kit	Leg set ground poles
Components	Length	001 080	001 081	001 082	001 083
	mm	QTY	QTY	QTY	QTY
Front leg	720	2			
Rear strut/Ground pole/1m	1200	2			4
Rear leg	1630	2			
2.4m array poles	2400	2			
Joiner 20NB tube	250	2			
101-2 Short tee		2			
116-2 Corner		2			
173F-2 Swivel female		6			
173M-2 Swivel male		2			4
169M-2 foot				4	
Plastic end cap		4			4
Allen key		1			
6.3 x 25mm Self drilling screw		6			
Module clamp			4		
M6 x 25 hex set screw			4		
M6 Form C washer			8		
M6 Nyloc Nut			4		
M8 x 25 hex set screw			4		
M8 washer			8		
M8 Nyloc Nut			4		
M10x40 hex set screw Galv		6			
M10 washer Galv		12			
M10 spring washer galv		6			
M10 Nut galv		6			
M10 x 90 through bolt				10	





**Design Data.**

- Material: mild & Carbon steel
- Finish: Galvanised
- Fasteners: A4 Stainless steel
- Mod, fixings: A4 stainless steel
- Tilt angle: 15°-50° (Subject to module)
- Wind loading: 40metres per second (3 second gust) \*

Suitable for solar panels with a length of upto 2m with M6 or M8 mounting holes on the rear of the panel.

Modular design provides each unit to be attached to the next to a maximum of 4 units using the joiners provided.

Ground poles to be installed using a suitable post hammer. Note not all ground types are suitable, please consult local civil engineer to establish ground conditions prior to ordering.

Concrete foundation version is also available.

Typical size panels shown, note leg spacing and tilt angles will vary depending on modules fitted, please contact us if in doubt.

\* Wind loading  
 Eurocode: Basis of structural design - BS EN 1990  
 Eurocode: Action on structures - BS EN 1991 part 1-4: General actions - wind actions - BS EN 1991-1-4  
 Eurocode 3: Design of steel structures - BS EN 1993 part 1-1: General rules and rules for buildings - BS EN 1993-1-1  
 BRE digest 468: Windloads on roof-mounted PV and solar thermal systems.

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**Tolerances.**  
 NO D.Point ±1mm  
 1 D.Point ±0.5mm  
 2 D.Points ±0.2mm

**Material.**  
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 Telephone: +44 (1844) 290780  
 Website: bds-uk.com

1	T Brooks	11.05.2024	Production Issue
ISSUE	DRAWN BY	DATE	CHANGE
Tm24 Type low level Modular Ground Mount Structure Kit			Product Type
NON-FOUNDATION VERSION			N <sup>o</sup> Tm24
			001 085

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## COMMISSIONING TESTS

In order to ensure that the system has been properly installed and will function correctly, the following tests should be performed immediately after installation.

### Support Structure

Check module fasteners are tight.

Check all structure fasteners are tight.

Check tilt angle is correct to within  $\pm 2^\circ$

Ensure array is within  $\pm 5^\circ$  of the azimuth specified.

Inspect for any damage to the galvanised steel work; touch up with Galvafruid (or similar) zinc paint as required.

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## MAINTENANCE

The following maintenance schedule should be followed at 12 monthly intervals. However, in some areas prone to excessive dust or bird deposits, module cleaning could be necessary more frequently and can only be determined taking local conditions into account.

### Solar Modules

Check that modules are clean; wash down glass and frames with water. Do not use detergents or solvents.

Inspect modules for damage; ensure glass is undamaged, and that there are no tears in plastic on back of modules.

Inspect module junction boxes; check seal is in place.

### Array Structure

Inspect for rusting; brush off any rust. Paint affected area with zinc paint.

Ensure all nuts and bolts are tight.

### Site

Ensure that arrays are not shadowed by growing vegetation; trim vegetation as necessary.

All Tm24 structures are available through UK distributors and are manufactured by.

**BDS**

**Unit 8 Alexander House, Thame road  
Haddenham, Buckinghamshire. HP17 8BY UK**