



TOWER SHIELD NORWEGIAN PATENT NUMBER 344511

TOWER SHIELD INSTALLATION MANUAL

FOR
CLIENT X

A PRODUCT BY

**GSM TOWERS
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About the supplier

GSM Towers is a Norwegian tower supplier offering its own optimized designs for towers, capacity controls of existing structures and energy solutions. With a future oriented mentality GSM Towers emphasizes the importance of high quality, innovative thinking and engineering development. GSM Towers operate on three continents – Asia, Africa and Europe. The company has offices in Myanmar, China and Burkina Faso. In addition it is in the process of opening offices in Indonesia and Philippines. The headquarters lie in Sandefjord, Norway.

Product Introduction

The Tower Shield is a cylindrical shape structure fabricated out of a lightweight military grade material intended to cover the antennas on a tower. Through its cylindrical shape, the tower shield dramatically diminish wind forces, making it possible to add antennas without the need of welding additional steel to the tower or reinforcing its foundation. This easily installed innovative product increases the capacity of the existing towers and reduces CAPEX on new builds. The Tower Shield is a disruptive product developed by GSM to add value to towercos by making it easier to increase tenancy ratio and facilitate location sharing on existing towers at a low cost. In order to maximize the client's benefit, different solutions are offered. The product portfolio consist of the standard Tower Shield, Top Shield and Leg Shield. The optimal solution is chosen according to the specific tower it is being mounted on.

This particular installation manual

The purpose of this installation manual is to document the proper assembly of the specific Tower Shield designed for "Client X". Being considered a supplement to the design & assembly drawings, this installation manual shall provide a better understanding of this specific product. This particular trial is conducted on a 3m long x 3m diameter shield, installed just under the very top of a 4 legged angular tower.

This particular trial was performed with the intent to dismantle after completion. With this in mind, temporary bolts and U-bolts have been used in some locations. The number of nuts used per single bolt or U-bolt might vary from the quantity indicated in assemble drawings. One should keep in mind that the assembly drawings are the key document to follow since they are tower & shield specific hence providing accurate specific information, especially when looking at part numbers & material quantities. This document will indicate the complete process **giving special attention to the tower shield and antenna support structure** rather than the tower structure, RF cables, grounding, safety line systems, PPE or aviation warning lights.

It should also be noted that the Pre Assembly Stage as documented in this installation manual is extracted from another shield trial done during 2018. Non-the-less, this section is relevant and can be of great support for this specific "Client X" product.

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Lifting techniques & relevant equipment

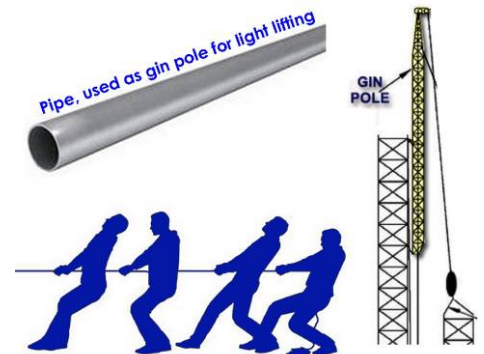
When lifting the antenna steel structure, supporting steel plates for the shield and the shield frontal panels one needs to consider several factors in determining the lift up technique to be used. Few key deciding factors are listed hereunder.

- Availability of mobile cranes, height of the tower and access with the crane itself.
- Possibility of using motorized winches
- Number of personnel available on site
- The weather condition, mostly the wind strength during the time of installation
- The dimension of the tower and the dimension of the shield.
- Availability of working space around the tower.
- Pre-installed equipment on the tower, specifically in the allocated place for the shield.

Techniques USED and relevant to this particular installation manual.

Manually lifting of individual parts and assembly on upper tower level

This manual was conducted on a Tower shield that had no item with a gross weight in excess of 60kg. It is very unlikely that in similar installation any singular item would be in excess of 100kg. In this installation manual we opted for the most economical and basic assembly solution, hence we have been using a combination of manpower, gin poles or similar, ropes and pulley systems. It is our understanding that in the majority of cases this or a variant of this technique is the most commonly used. In addition this requires added efforts compared to doing the same job with use of a crane or mechanized winches.



Other likely techniques NOT used nor relevant to this particular installation manual.

Lifting of individual part, similar to lifting each item manually but doing so by a crane or mechanical winches

One might opt using a similar lifting solution as indicated in this installation manual but making use of a crane to lift up individual parts. This is a very common system but again it all depends on availability of crane and site access.



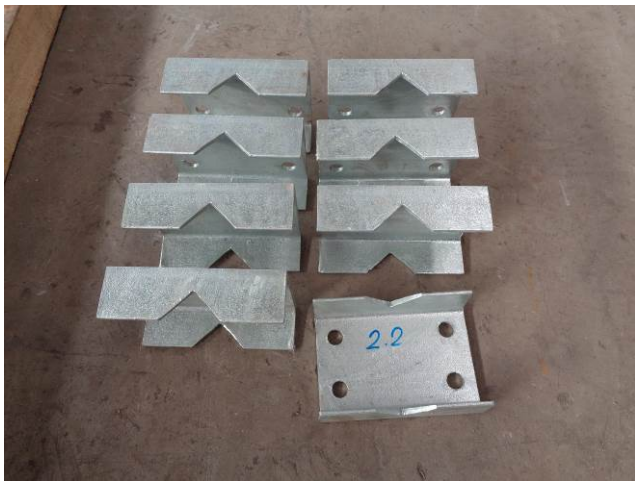
Partial completion on the ground & using a crane or mechanical winches

In a scenario where a crane can be used, one might opt to complete the shield frame on the ground and lift this as an entire structure, after the antenna structure and shield flooring have been installed

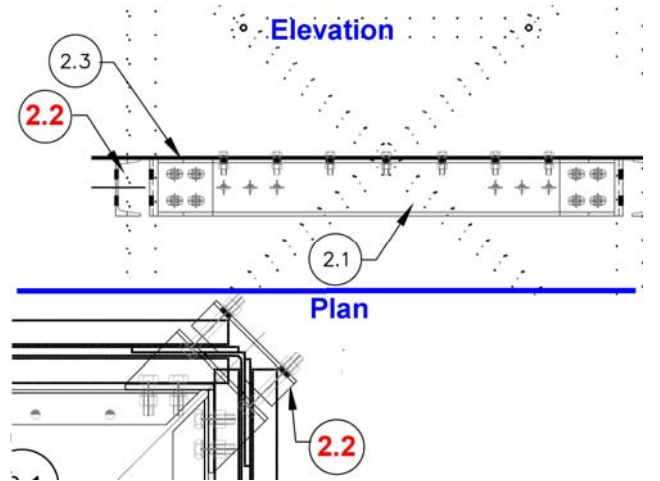
Entire completion on the ground & using a crane or mechanical winches

In other occasions, when the tower upper section is still on the ground and a crane can be used, one could opt to install the complete antenna structure and Shield structure onto the upper tower section at ground level and lift the entire completed structure with the upper tower section at one go. Again this is depending on several factors, some of which are listed above.





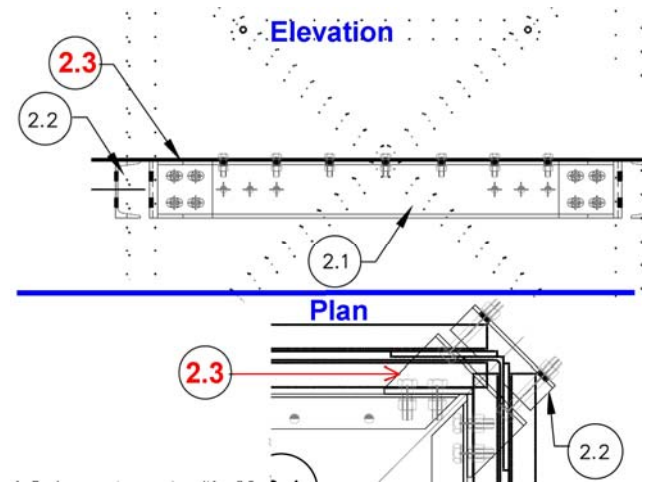
81). Item **2.2. C profile back plate**. 8 in Total on this site. Inspected & verified



Installed at top & bottom inside of the tower leg, behind part 2.3.



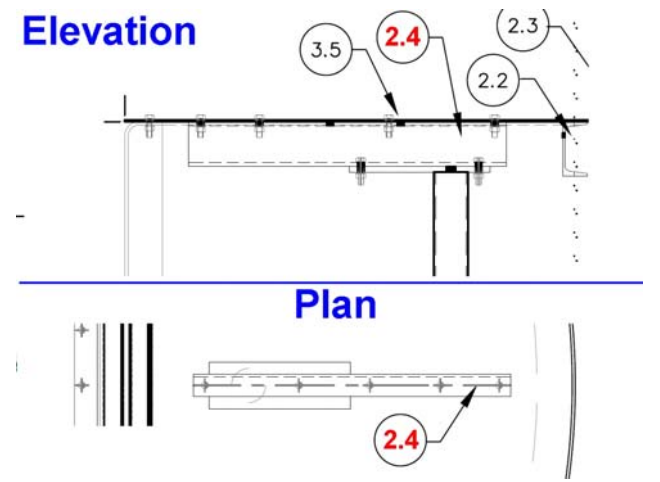
82). Item **2.3. C profile Angle Bracket**
Total of 8 on this site



Installed at top & bottom Outside of the tower leg, connected with part 2.2 & 2.1 by means of M16 bolts.



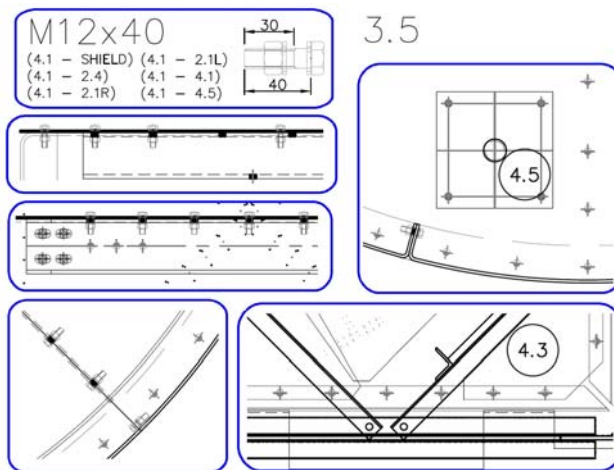
83). Item **2.4. C Profile**.
Total of 8 on this site



Installed at top & bottom of antenna pole part 2A. The roof and floor plates are connected to this bracket.



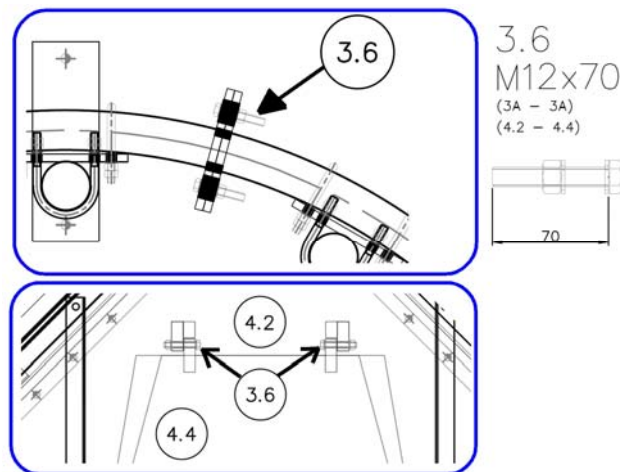
93). Items **3.5. M12x40 Bolts**
Over 300pcs supplied for this site.



M12 Bolts used in most connections. Length is supplied according to specific needs. Follow design.



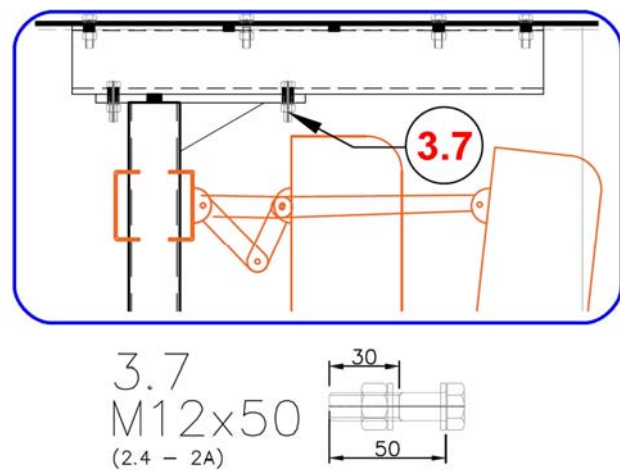
94). Items **3.6. M12x70 Bolts**
Over 20pcs supplied for this site.



M12 x 70 Bolts used in two specified connections. Follow design.



95). Items **3.7. M12x50 Bolts**
16pcs supplied for this site.



M12 x 50 Bolts used in a single location, connecting Pipe 2A to 2.4 Bracket. Follow design.

Antenna & Shield Support Structure – Installation Process

It is up to the installation team to determine the best way for installing the entire structure vis-à-vis the sequence used for installing each part. This is depending on several factors such as manpower, tools, weather condition, tower type, tower loading, wind speed and most importantly safety.

After looking at several alternatives, during the trial and as is being described in the following section of this installation manual, we opted for the under listed configuration.

Process Step	Part number for:			Process Step	Part number for:		
	Item	Bolts	U-Bolts		Item	Bolts	U-Bolts
1	3B, 3C & 3D	2.5		11	4.2 "Floor"	3.5	
2	3A	3.6	3.4	12	4.3 "Floor"	3.5	
3	2A, 2.4 & 3.1	3.7	3.2 & 3.3	13	4.1a, 4.1c & 4.6	3.5	
4	2B & 3.1		3.2 & 3.3	14	4.1a, 4.1c & 4.6 to 2.4	3.7	
5	2.2 & 2.3	2.6		15	4.1b to 4.1a	3.5	
6	2.1	2.5		16	Shield panels	2.7 "shield to shield"	
7	4.2 "Roof"	3.5		17	Shield panel to floor plates	3.5 "shield to plate"	
8	4.3 "Roof"	3.5		18	Shield panel to roof plates	3.5 "shield to plate"	
9	4.1 to 4.7 "Roof"	3.5		19	4.5 AWL bracket	3.5	
10	4.1 & 4.7 "Roof" to 2.4	3.7		20	4.4 both doors	3.6	

On the following 2 pictures you can see the status at start-up & upon completion, giving you an idea of what will be achieved by following the installation process as described in the following section of this installation manual.



117a). View of the tower ready for the shield installation.



117b) View of the complete installed tower shield.

Contact details.

We thank you for purchasing this product and hope the user manual in conjunction with provided designs can support your installation.

For further assistance, explanation or re-order, kindly contact GSM Towers team via email or phone.

Contacts are available on our web page

www.gsmtowers.com

Thankyou
GSM telecom products AS.



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