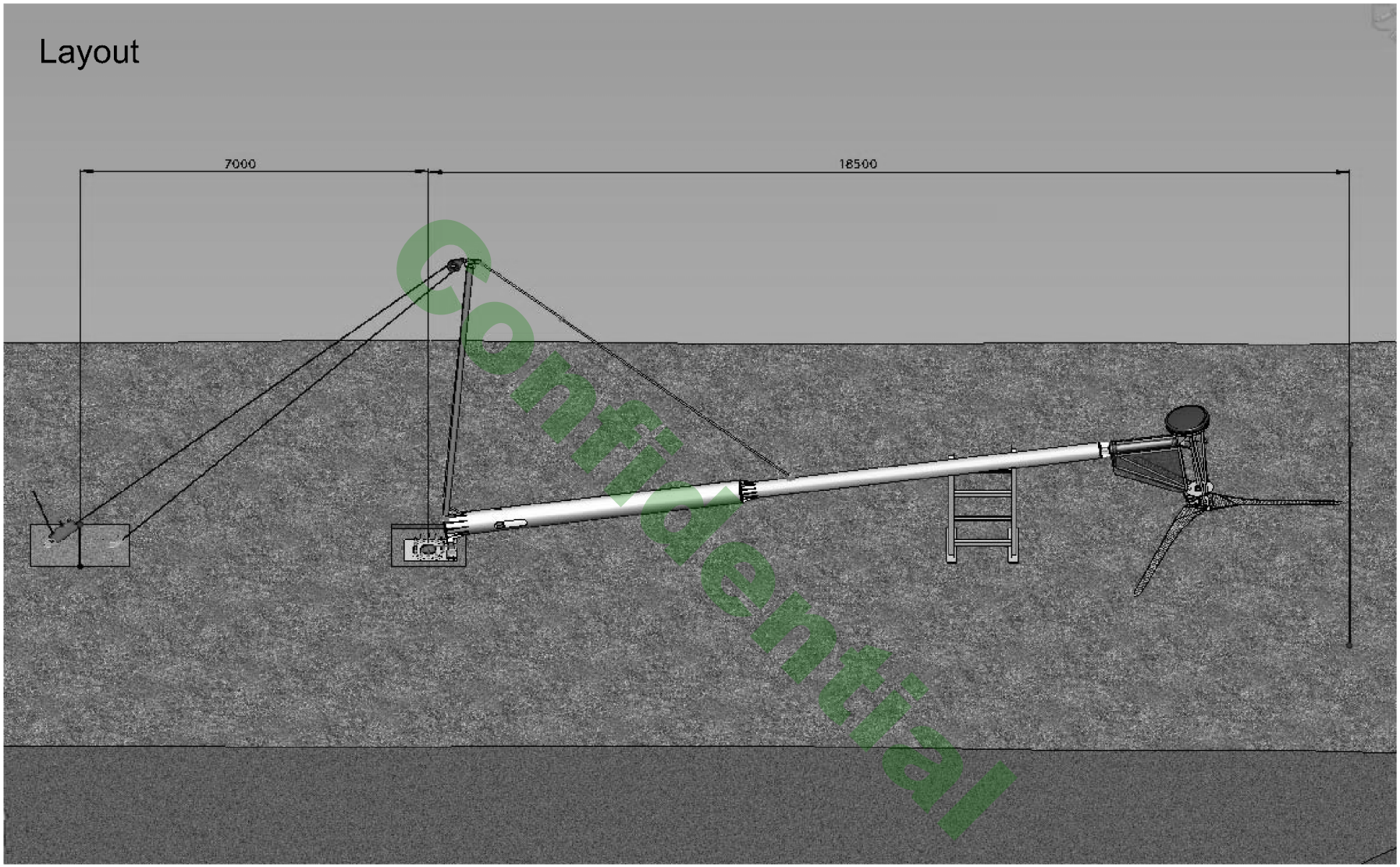
Proven 15m
6kW Wind Turbine Structure

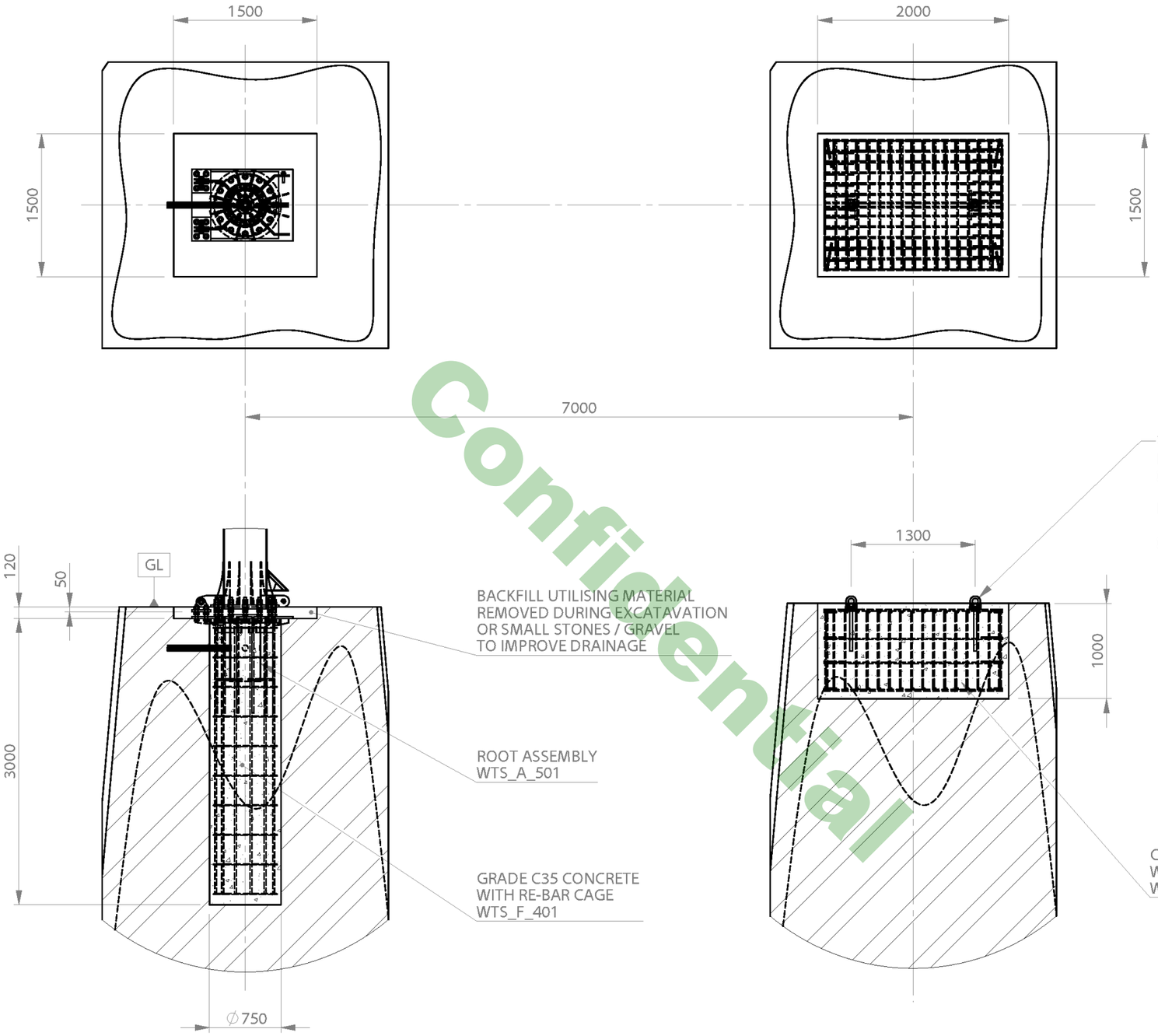
Installation Instructions

Foundation installation



Site layout : Note that with the pole folded down, the overall Length from tip of blade to root centre is 18.5m. The 2m x 1.5m x 1m anchor pad must also installed 7m from root from centre to centre. This is critical to measure out before installing the pole on site.

SITE REF. :
ABC 123



REV.	DESCRIPTION	DRAWN	APP'D	DATE
C	ANCHOR POINTS CHANGED TO FLUSH DESIGN ON 1300mm CENTRES	A.P.H	I.J.B	30/04/08
B	ROOT SHOWN WITH CABLE DUCTING	A.P.H	I.J.B	28/04/08
A	FOR MANUFACTURE	A.P.H	I.J.B	08/04/08

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL :

FINISH :

MASS (Kg.) :

Hutchinson Engineering
TEL. +44 (0)151 422 9990
FAX. +44 (0)151 420 5100
www.hutchinsonengineering.co.uk
EVERITE ROAD,
WIDNES,
CHESHIRE,
WA8 8PT

nqa. ISO 9001 Registered

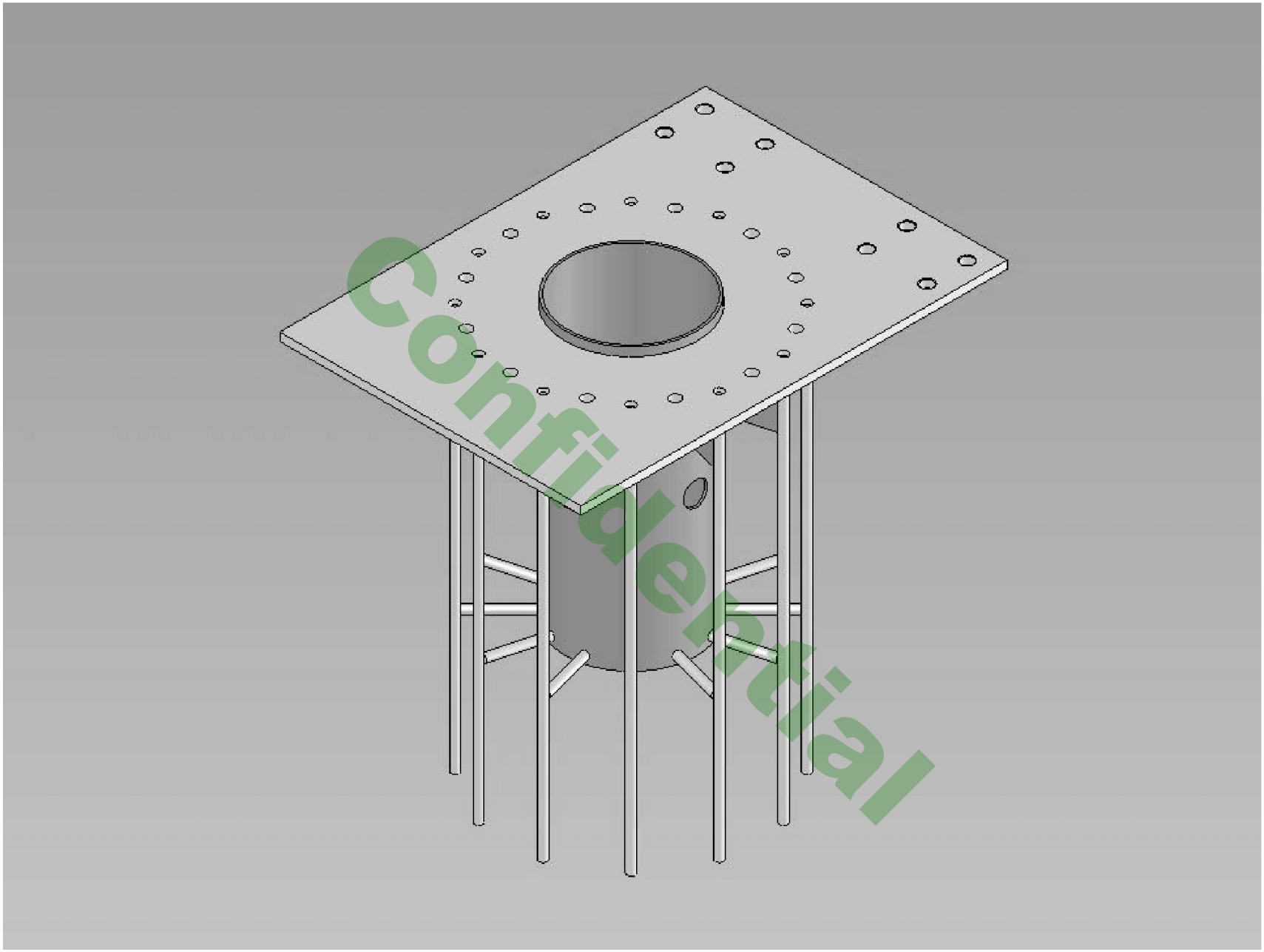
CLIENT : PROVEN
PROJECT : 15M WIND TURBINE STRUCTURE
TITLE : FOUNDATION DRAWING

A3

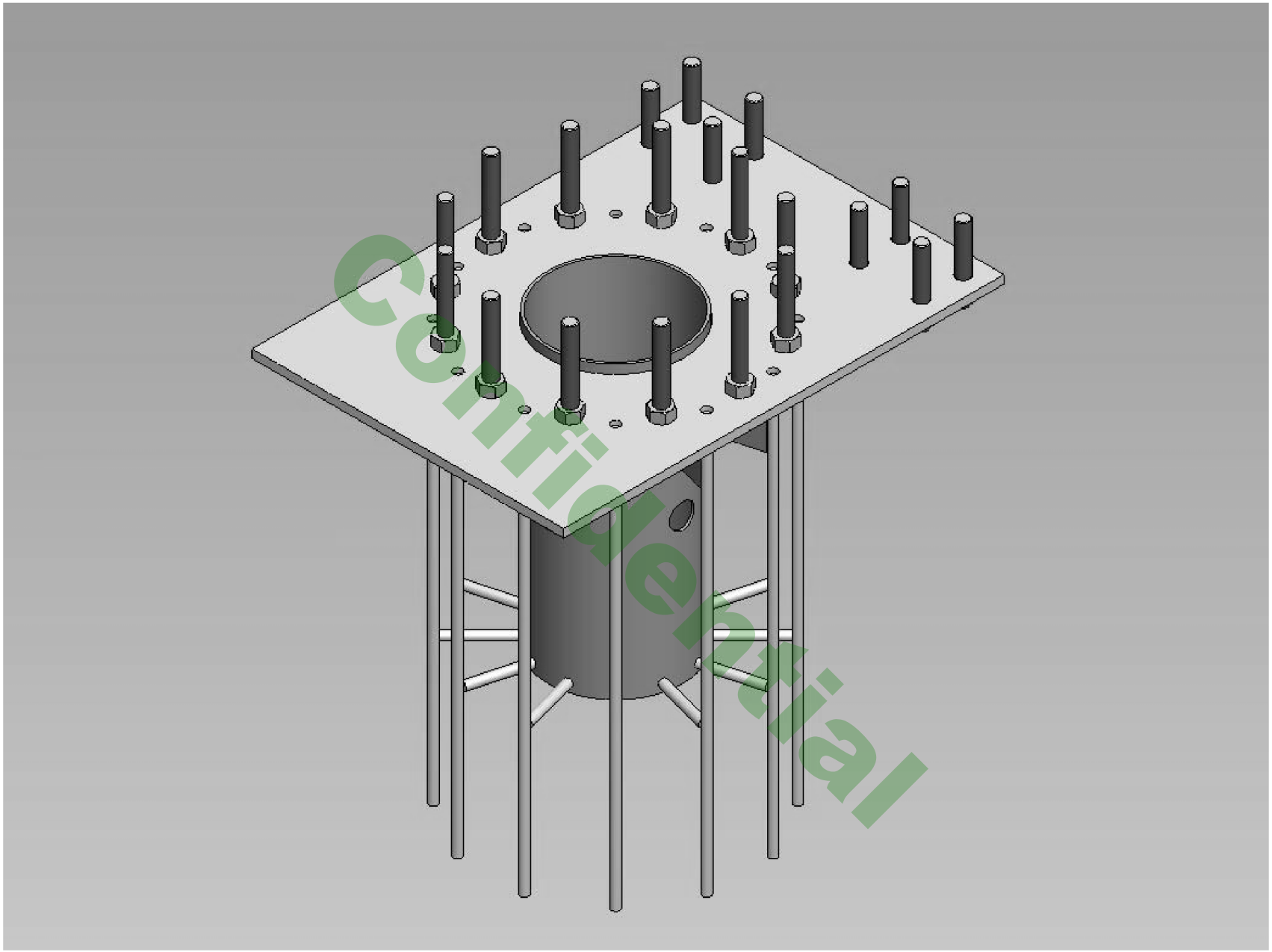
DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B	N.G	1:50	04/04/2008

DWG No. :
WTS_15M_F_001 (SHEET 1 OF 3)

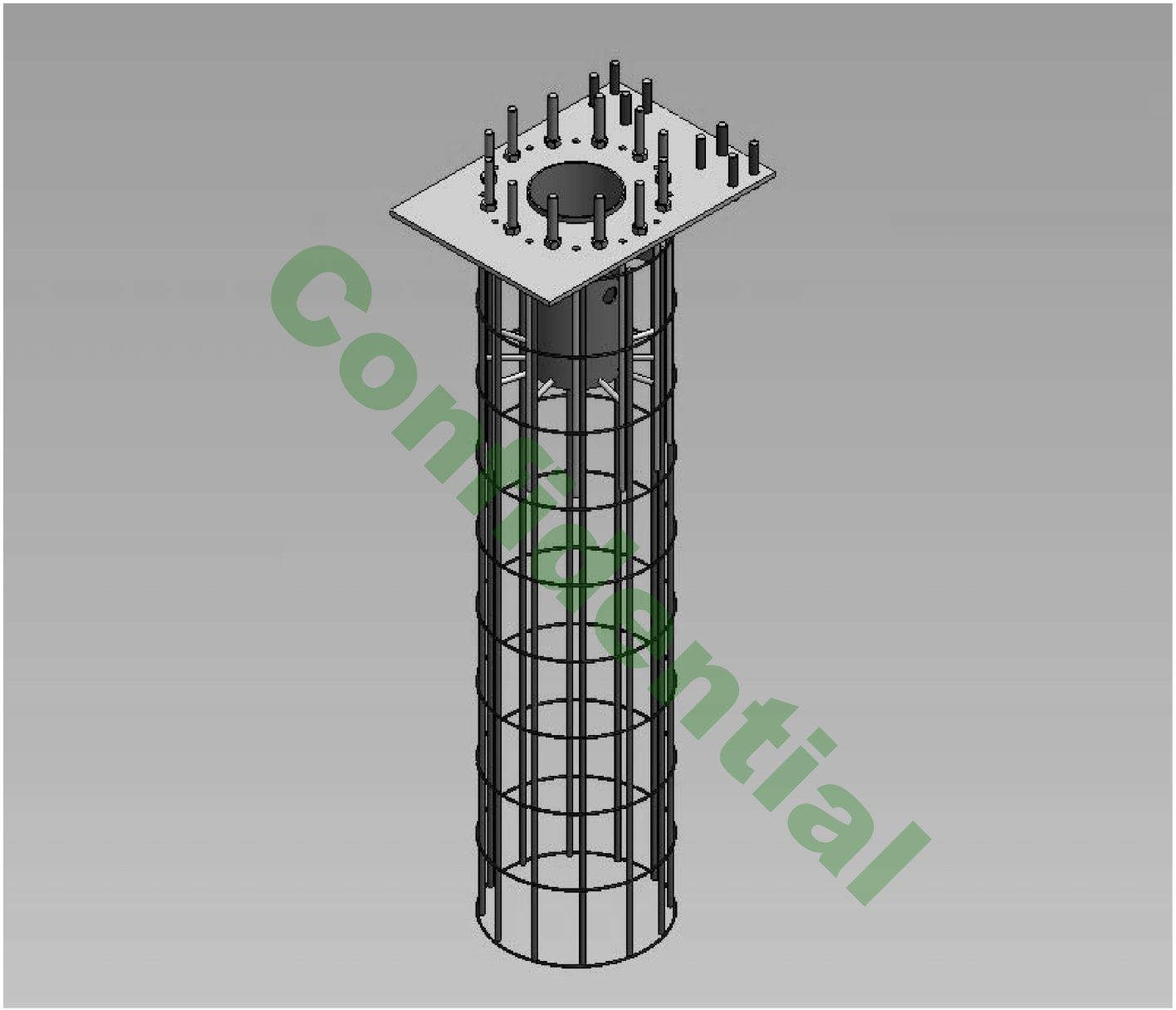
REVISION
C



Root

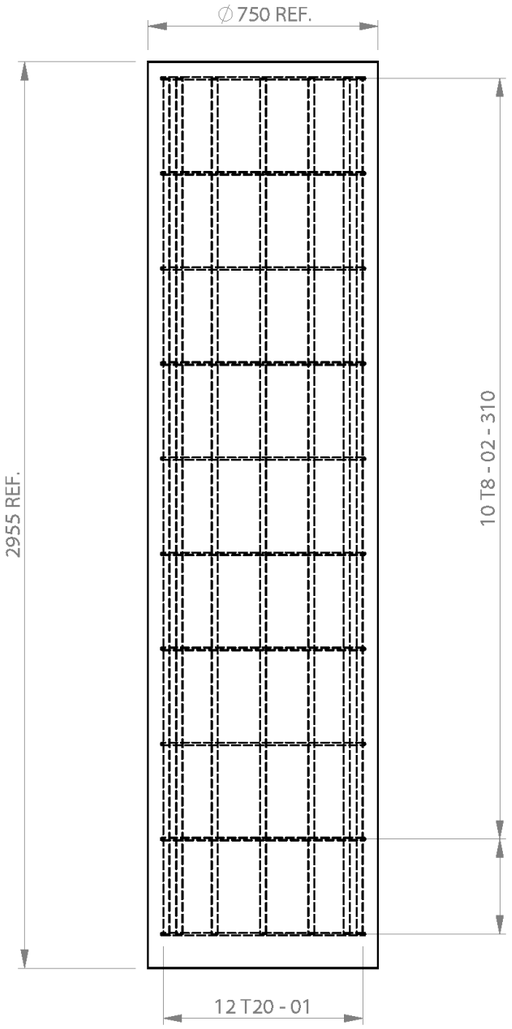


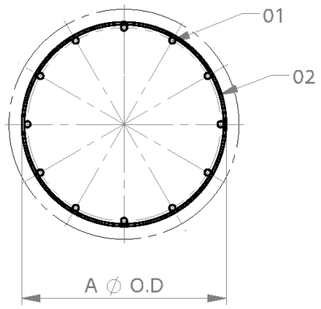
Root assembly with M30x180 hinge studs, and M30x260 pole mounting studs fitted
(See drawing for correct installation height for studs)



Root assembly shown with re-bar cage assembly wired in position

SITE REF. :





REINFORCEMENT NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH RELEVANT FOUNDATION DRAWING.

2. BARS LISTED ON BENDING SCHEDULE.

3. REINFORCING BARS TO BE TYPE 2, DEFORMED IN ACCORDANCE WITH B.S.:4449 (Fy = 460N/mm2)

4. MINIMUM COVER TO ANY BAR SHALL BE :-
   100mm TO TOP OF FOUNDATION
   50mm TO SIDES OF FOUNDATION
   75mm TO UNDERSIDE OF FOUNDATION

CONCRETE NOTES

1. ALL STRUCTURAL CONCRETE TO BE GRADE C35 WITH A MAXIMUM FREE WATER/CEMENT RATIO OF 0.5 AND A MINIMUM CEMENT CONTENT OF 300Kg/m3. NOMINAL AGGREGATE SIZE 20mm. ALL IN ACCORDANCE WITH B.S.:8110 PART 1 : 1985.

2. CONCRETE MIX WITH "VERY SEVERE EXPOSURE" CONDITIONS, AS DEFINED IN B.S.:811 PART 1 : 1997 AND CLASS 2 SULPHATE RESISTANCE IN ACCORDANCE WITH B.S.:5329 PART 1 : 1997.

3. MINIMUM COVER TO ANY BAR SHALL BE AS STATED, BUT IN NO CASE LESS THAN 50mm.

4. FOUNDATION HAS BEEN DESIGNED FOR 'POOR SOIL' CONDITIONS AS DEFINED IN SPECIFICATION EN40-2 (FORMALLY B.S. 5649 PT.2).

5. DESIGN ENGINEER TO BE CONSULTED PRIOR TO POURING OF CONCRETE, WHERE GROUND IS FOUND TO BE SOFT, RUNNY, LOOSE OR VARIES SIGNIFICANTLY ACROSS FORMATION. ALSO IN AREAS OF SEVERE CONTAMINATION, OR WHERE HIGH SULPHATE LEVELS ARE FOUND TO BE PRESENT.

6. CONTRACTOR SHALL SITE CHECK ALL RELEVANT DIMENSIONS AND LEVELS PRIOR TO CONSTRUCTION AND SHALL BE RESPONSIBLE FOR THE ACCURACY OF ALL WORK AND THE CORRECT SETTING OUT ON SITE.

MEMBER	BAR MARK	TYPE & SIZE	NO. OF MEMBERS	NO. IN EACH	LENGTH OF EACH BAR	SHAPE CODE	A (mm)
FOUNDATION	01	T20	1	12	2790	00	
FOUNDATION	02	T8	1	10	2067	99	666

REV.	DESCRIPTION	DRAWN	APP'D	DATE
A	FOR MANUFACTURE	A.P.H	I.J.B	09/04/08

NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL :

FINISH :

MASS (Kg.) :

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www.hutchinsonengineering.co.uk
EVERITE ROAD, WIDNES, CHESHIRE, WA8 8PT

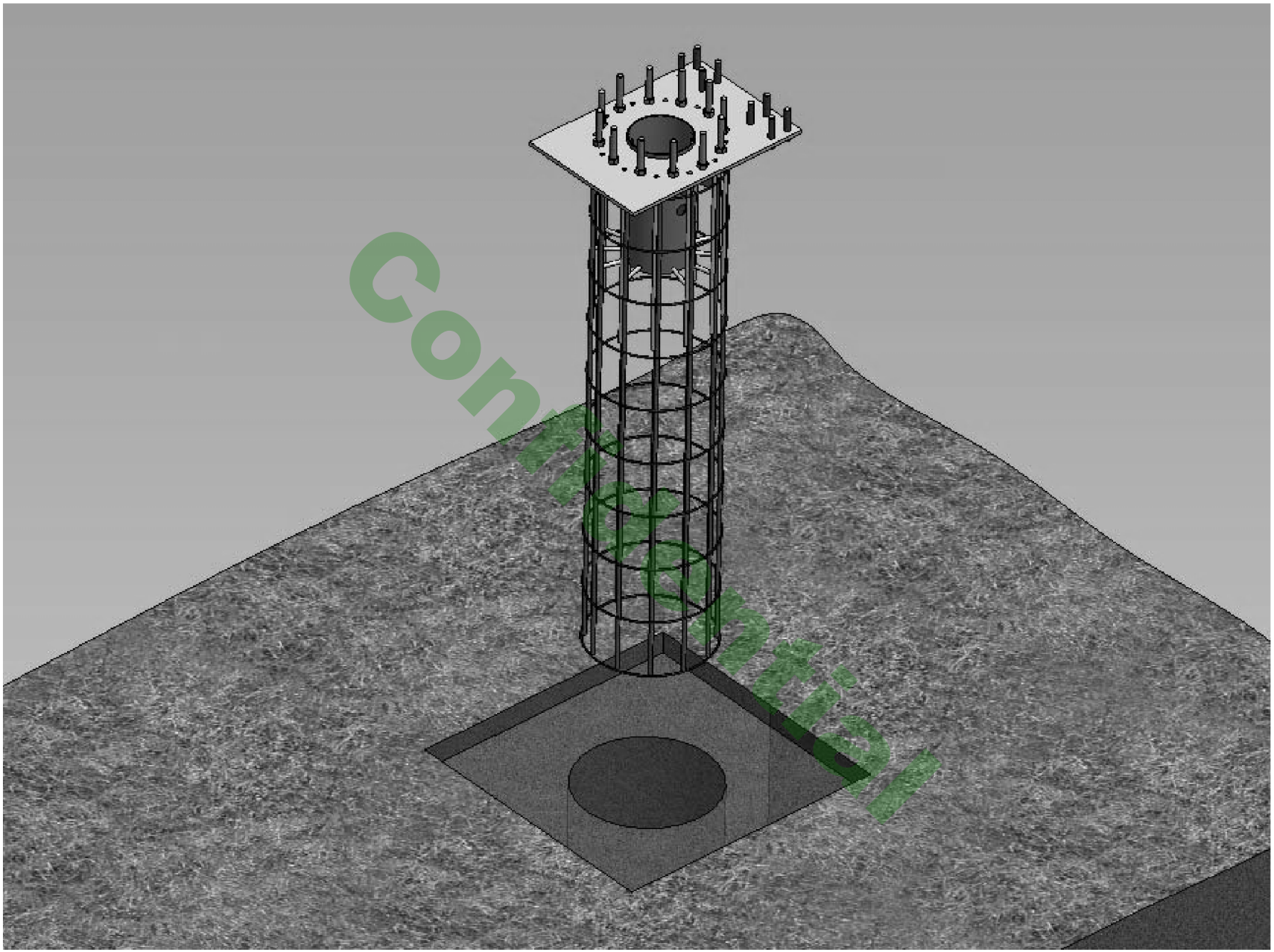
CLIENT : PROVEN
PROJECT : WIND TURBINE STRUCTURE
TITLE : ROOT FOUNDATION REBAR CAGE

A3

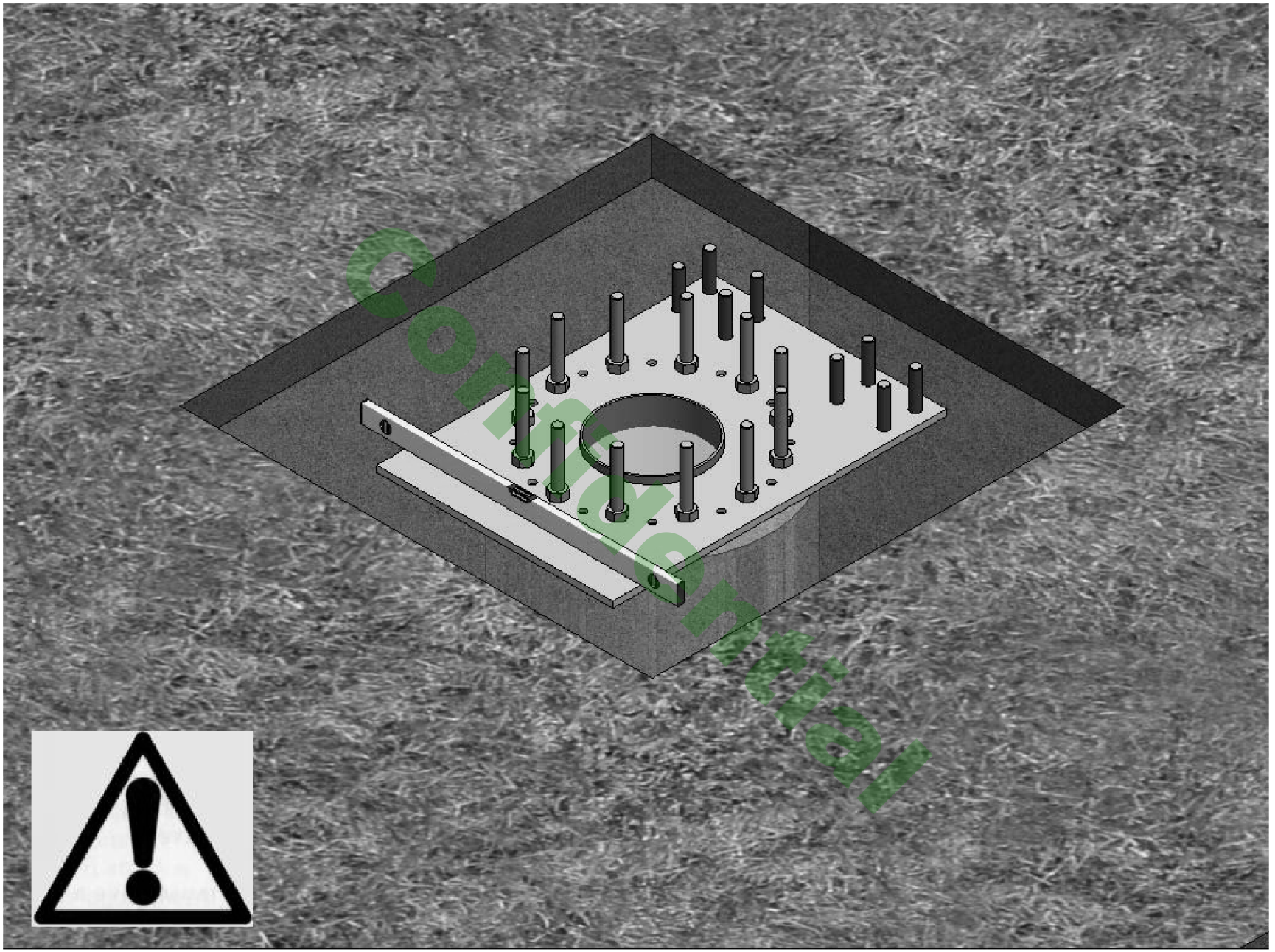
DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B.	N.G	1:20	08/04/2008

DWG No. : **WTS_F_401**

REVISION **A**



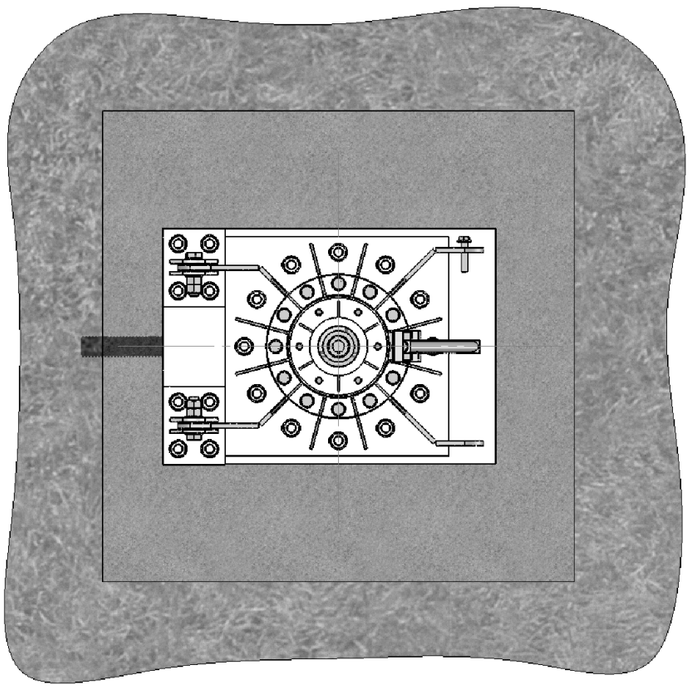
Root / re-bar cage lowered into hole, prior to levelling

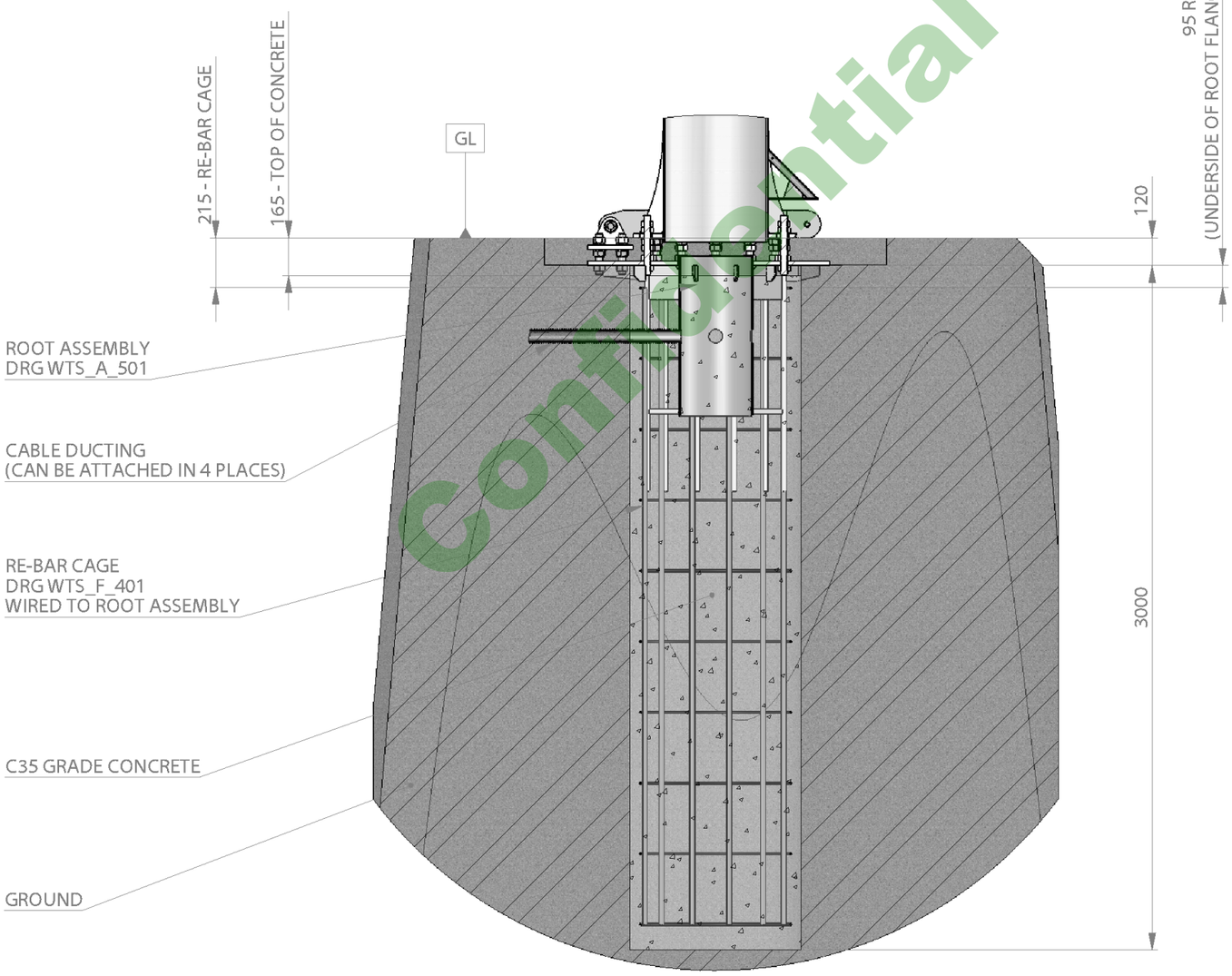


Root assembly to be levelled prior to the concrete pour

SITE REF. :
ABC 123

VIEW ON TOP OF FOUNDATION / POLE ASSEMBLY





SECTION THROUGH ROOT FOUNDATION
SEE DRAWING WTS_15M_F_001 SHEET 1 FOR FURTHER DETAIL

REV.	DESCRIPTION	DRAWN	APP'D	DATE
C	ANCHOR POINTS CHANGED TO FLUSH DESIGN ON 1300mm CENTRES	A.P.H	I.J.B	30/04/08
B	ROOT SHOWN WITH CABLE DUCTING	A.P.H	I.J.B	28/04/08
A	FOR MANUFACTURE	A.P.H	I.J.B	23/04/08

NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL :

FINISH :

MASS (Kg.) :

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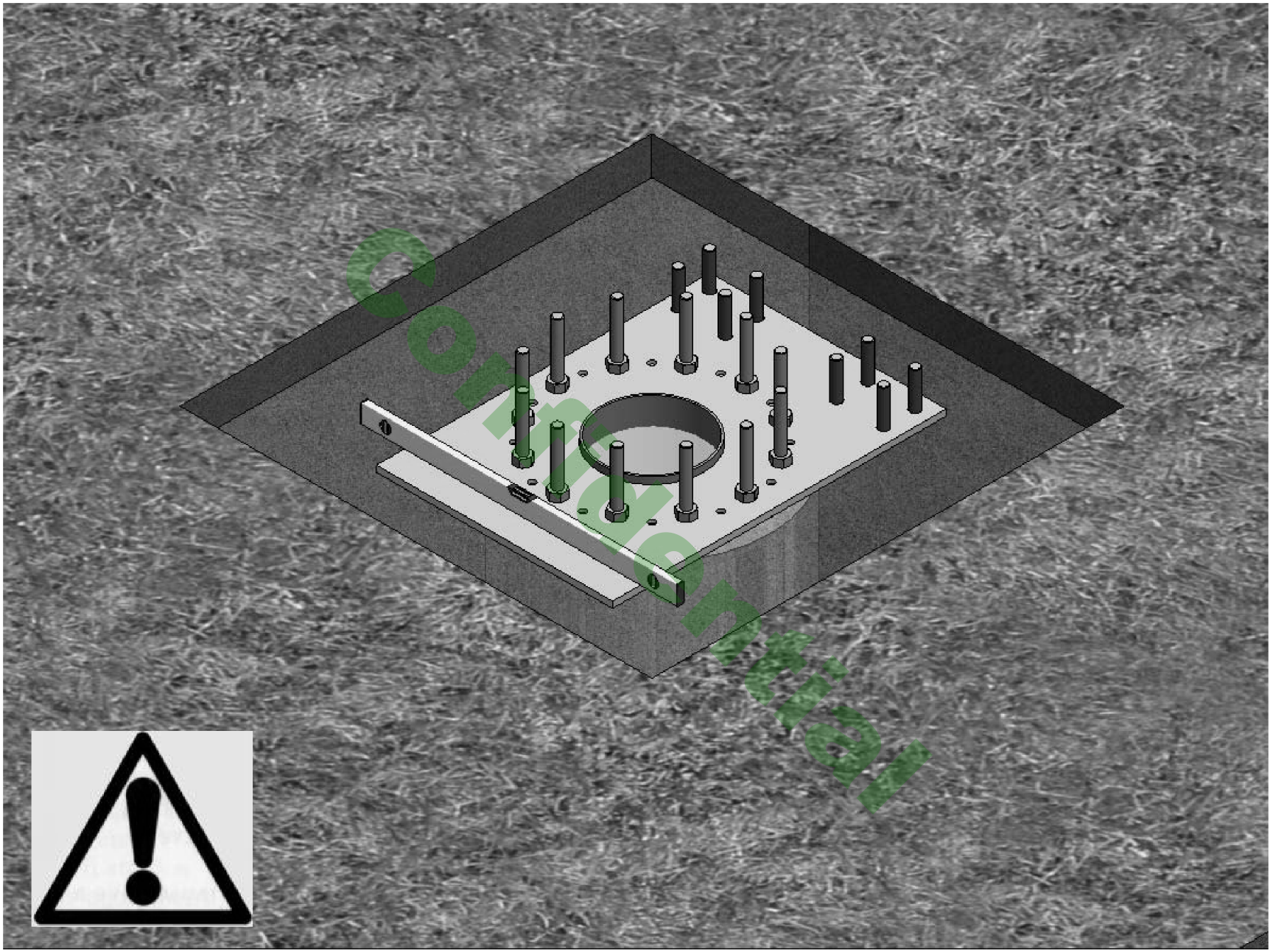
CLIENT : PROVEN
PROJECT : 15M WIND TURBINE STRUCTURE
TITLE : FOUNDATION DRAWING

A3

DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B	N.G	1:50	04/04/2008

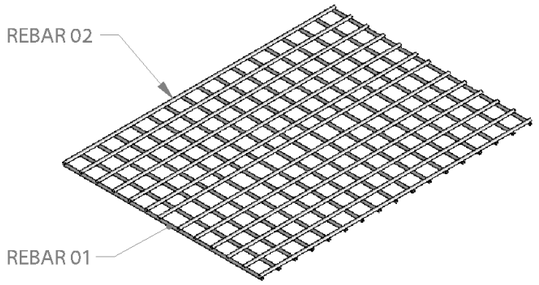
DWG No. : **WTS_15M_F_001 (SHEET 2 OF 3)**

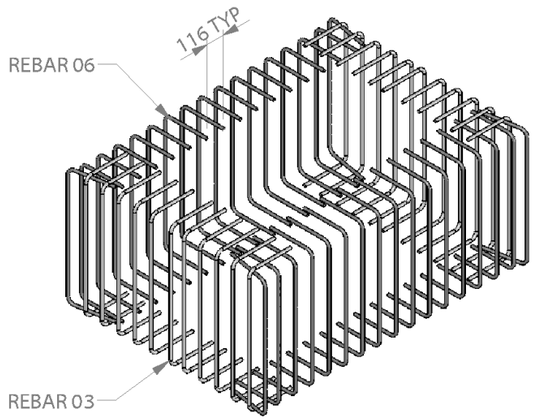
REVISION C

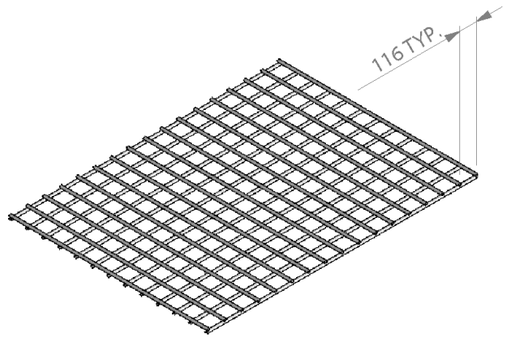


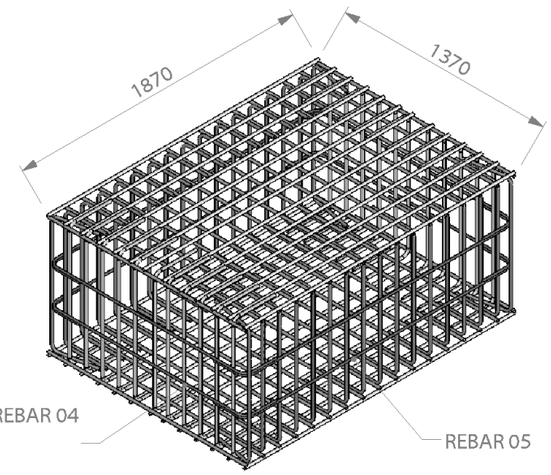
Root levels to be checked upon completion of the concrete pour

SITE REF. :









CONCRETE NOTE

1. ALL STRUCTURAL CONCRETE TO BE GRADE C35 WITH A MAXIMUM FREE WATER/CEMENT RATIO OF 0.5 AND A MINIMUM CEMENT CONTENT OF 300Kg/m3. NOMINAL AGGREGATE SIZE 20mm. ALL IN ACCORDANCE WITH B.S.:8110 PART 1 : 1985.

2. CONCRETE MIX WITH "VERY SEVERE EXPOSURE" CONDITIONS, AS DEFINED IN B.S.:811 PART 1 : 1997 AND CLASS 2 SULPHATE RESISTANCE IN ACCORDANCE WITH B.S.:5329 PART 1 : 1997.

3. MINIMUM COVER TO ANY BAR SHALL BE AS STATED, BUT IN NO CASE LESS THAN 50mm.

4. FOUNDATION SHALL BE FOUNDED ON APPROVED SUB-GRADE, CAPABLE OF WITHSTANDING A MINIMUM BEARING PRESSURE OF 100 kN/Sq.m.

5. DESIGN ENGINEER TO BE CONSULTED PRIOR TO POURING OF CONCRETE, WHERE GROUND IS FOUND TO BE SOFT, RUNNY, LOOSE OR VARIES SIGNIFICANTLY ACROSS FORMATION. ALSO IN AREAS OF SEVERE CONTAMINATION, OR WHERE HIGH SULPHATE LEVELS ARE FOUND TO BE PRESENT.

6. CONTRACTOR SHALL SITE CHECK ALL RELEVANT DIMENSIONS AND LEVELS PRIOR TO CONSTRUCTION AND SHALL BE RESPONSIBLE FOR THE ACCURACY OF ALL WORK AND THE CORRECT SETTING OUT ON SITE.

REINFORCEMENT NOTES

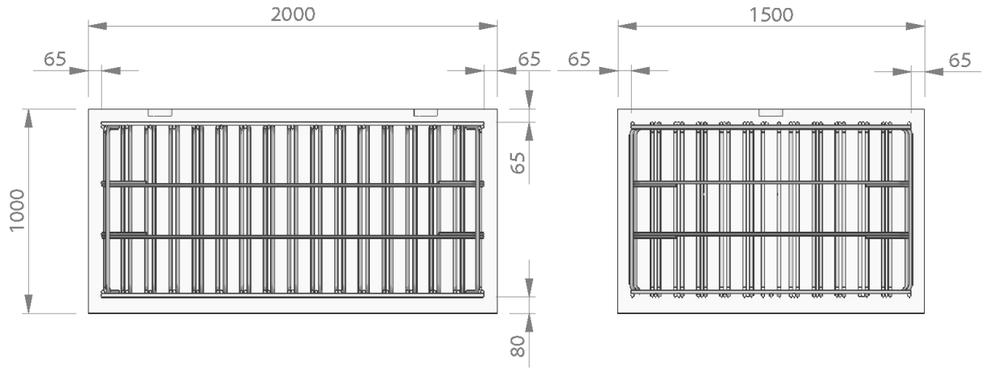
1. THIS DRAWING IS TO READ IN CONJUNCTION WITH RELEVANT FOUNDATION DRAWING.

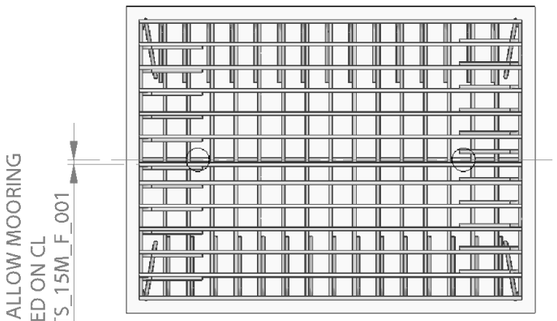
2. BARS LISTED ON BENDED SCHEDULE.

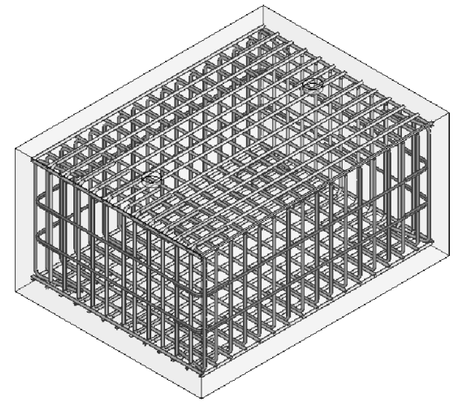
3. REINFORCING BARS TO BE TYPE 2, DEFORMED IN ACCORDANCE WITH B.S.:4449 (Fy = 460N/Sq.MM).

4. MINIMUM COVER TO ANY BAR SHALL BE:-

60mm TO TOP OF FOUNDATION
60mm TO SIDES OF FOUNDATION
75mm TO UNDERSIDE OF FOUNDATION







ITEM NO.	DIA. (mm)	MEMBER	BAR MARK	TYPE & SIZE	NO. OF MBRS.	NO. OF EACH	LENGTH EACH BAR (mm)	SHAPE CODE	A (mm)	B (mm)
REBAR 01	16	Anchor Pad	REBAR 01	T16	1	34	1370	00	1370	-
REBAR 02	16	Anchor Pad	REBAR 02	T16	1	26	1870	00	1870	-
REBAR 03	16	Anchor Pad	REBAR 03	T16	1	22	1381	21	296	855
REBAR 04	12	Anchor Pad	REBAR 04	T12	1	4	1739	21	222	1370
REBAR 05	12	Anchor Pad	REBAR 05	T12	1	4	2239	21	222	1870
REBAR 06	16	Anchor Pad	REBAR 06	T16	1	34	1349	21	296	823

REV.	DESCRIPTION	DRAWN	APP'D	DATE
A	FOR MANUFACTURE	A.P.H	I.J.B	09/04/08

NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL :

FINISH :

MASS (Kg.) :

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www.hutchinsonengineering.co.uk
EVERITE ROAD, WIDNES, CHESHIRE, WA8 8PT
ISO 9001 Registered

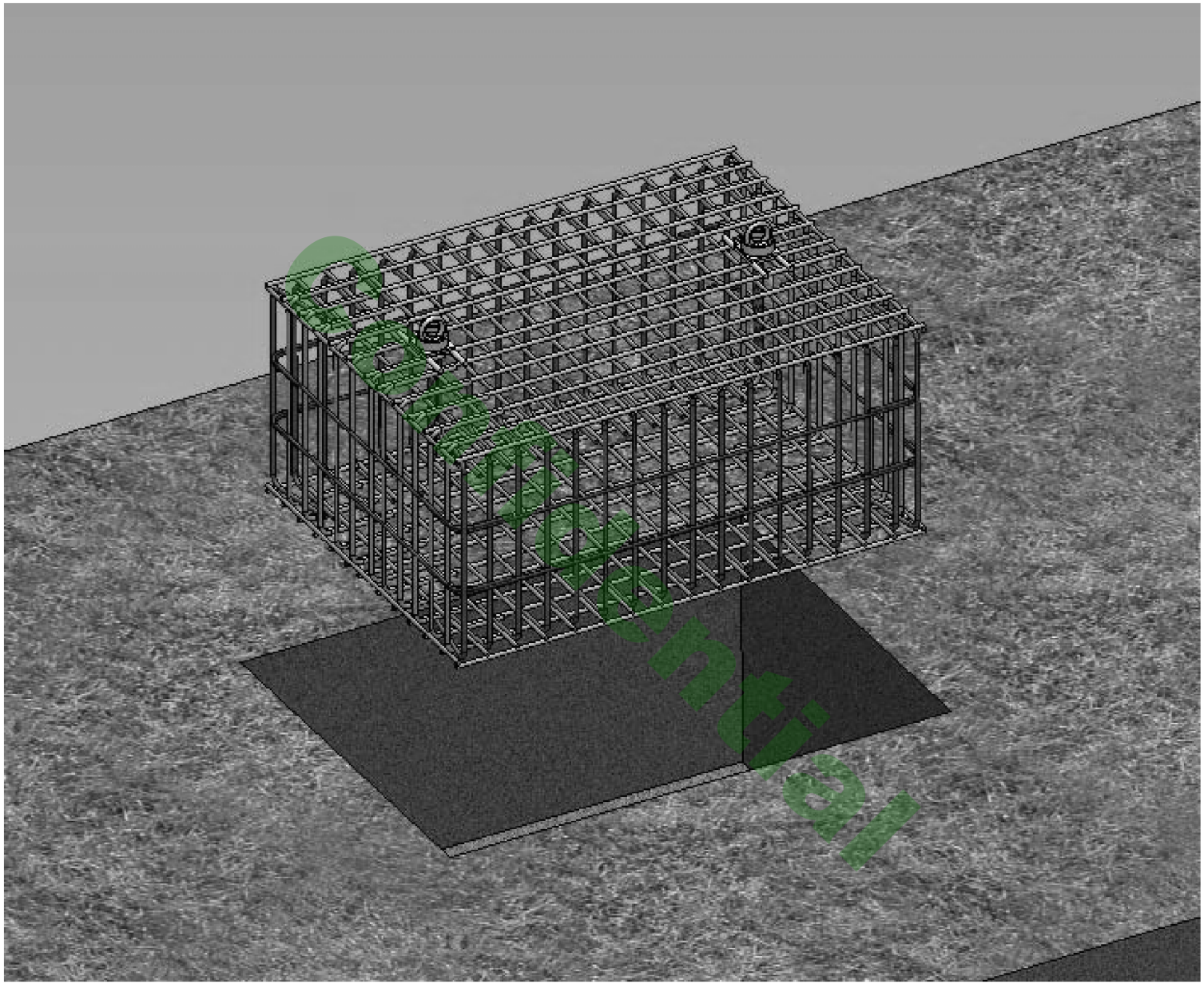
CLIENT : PROVEN
PROJECT : WIND TURBINE STRUCTURE
TITLE : ANCHOR PAD REBAR CAGE

A3

DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B.	N.G	1:30	04/04/2008

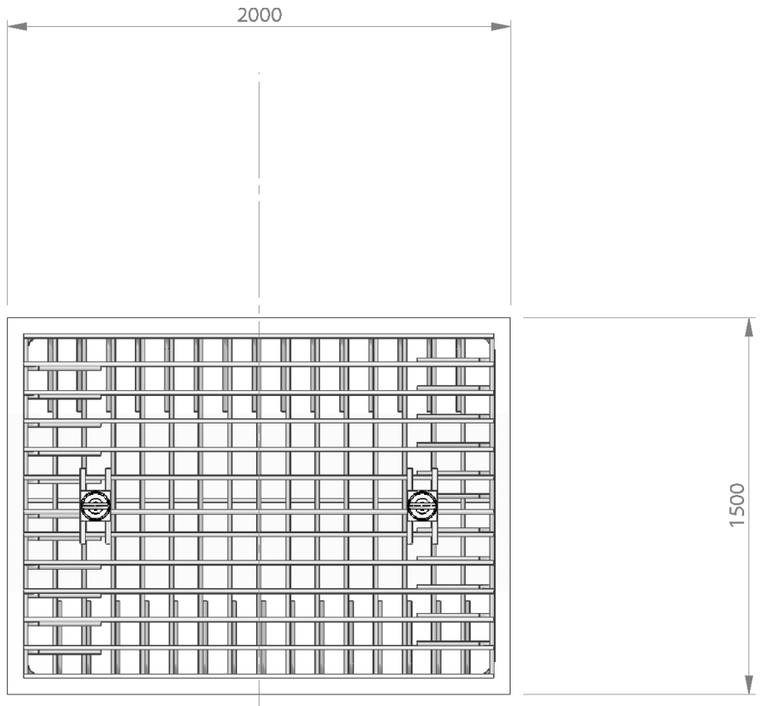
DWG No. : **WTS_F_601**

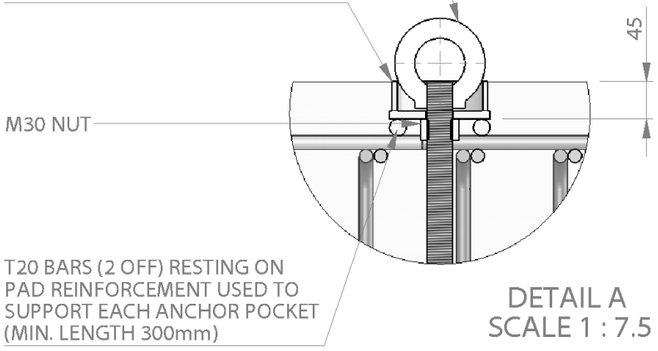
REVISION **A**



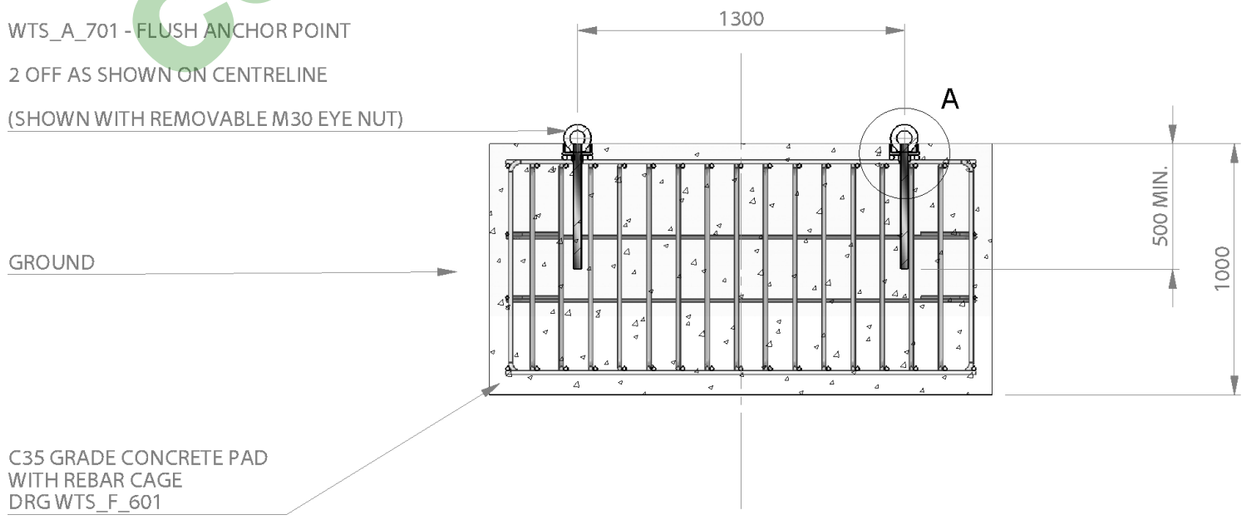
Anchor pad re-bar cage lowered into ground. Ensure anchor pad is located at the correct distance from the root (see installation drawing for details)

SITE REF. : ABC 123





DETAIL A
SCALE 1 : 7.5



SECTION THROUGH ANCHOR FOUNDATION

SEE DRAWING WTS_15M_F_001 SHEET 1 FOR FURTHER DETAIL

REV.	DESCRIPTION	DRAWN	APP'D	DATE
C	ANCHOR POINTS CHANGED TO FLUSH DESIGN ON 1300mm CENTRES	A.P.H	I.J.B	30/04/08
B	ROOT SHOWN WITH CABLE DUCTING	A.P.H	I.J.B	28/04/08
A	FOR MANUFACTURE	A.P.H	I.J.B	23/04/08

NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL :

FINISH :

MASS (Kg.) :

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nqa ISO 9001 Registered

CLIENT : PROVEN
PROJECT : 15M WIND TURBINE STRUCTURE
TITLE : FOUNDATION DRAWING

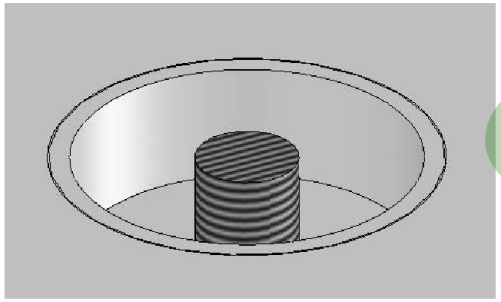
A3

DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B	N.G	1:50	04/04/2008

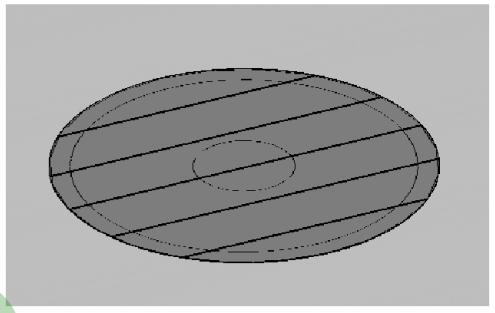
DWG No. : **WTS_15M_F_001 (SHEET 3 OF 3)**

REVISION C

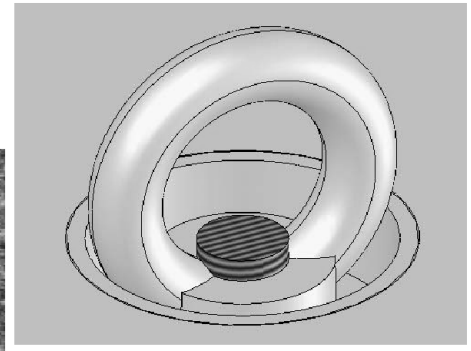
Anchor point M30 stud

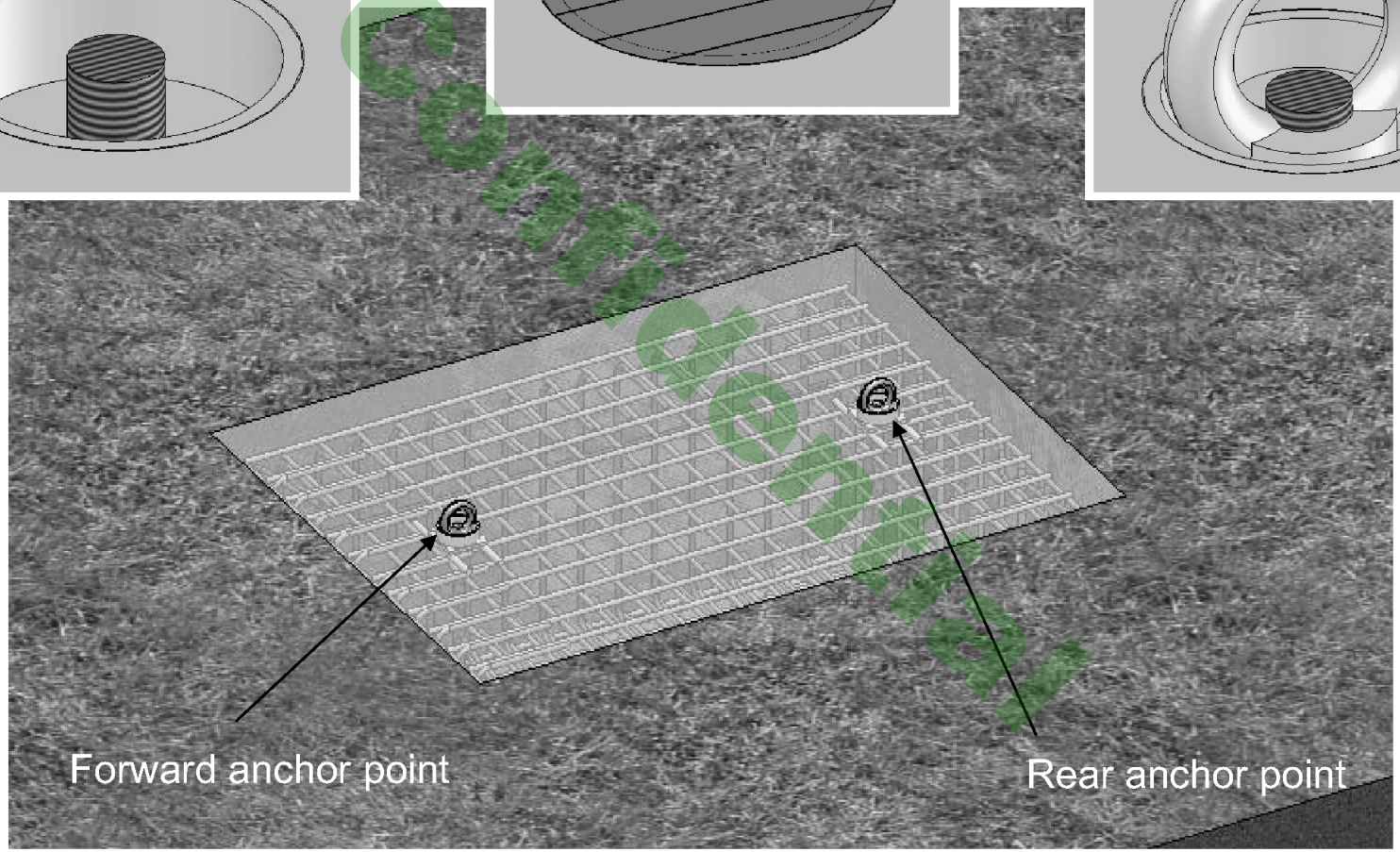


Anchor point shown taped over
in preparation for concrete pour



Anchor point shown with
M30 eye nut installed

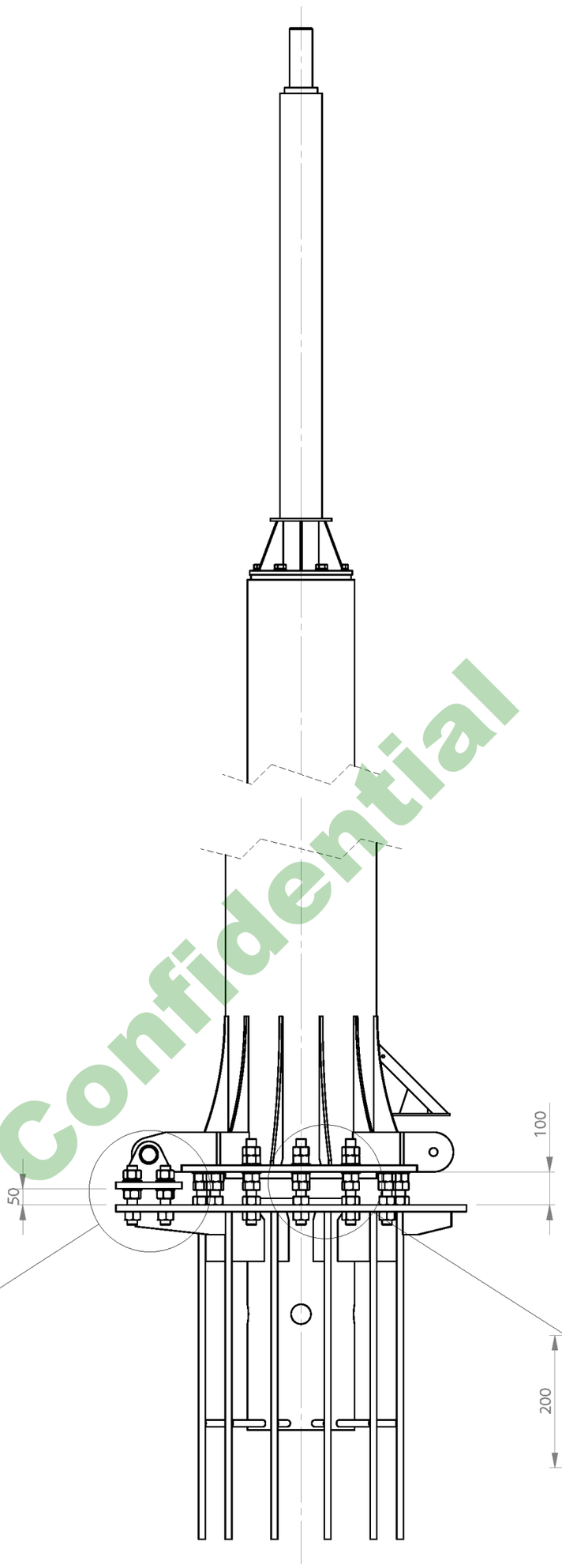




Anchor points must be masked off whilst the concrete is poured, as to not damage the threads for the removable eye nuts

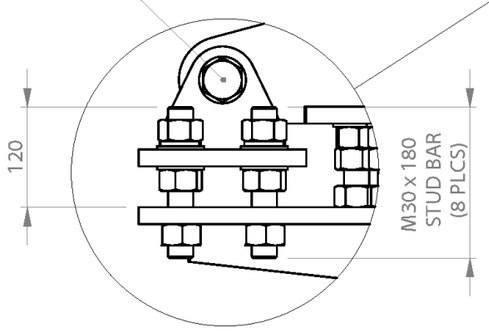
Installing pole

SITE REF. :
ABC 123



DETAIL A
SCALE 2 : 15

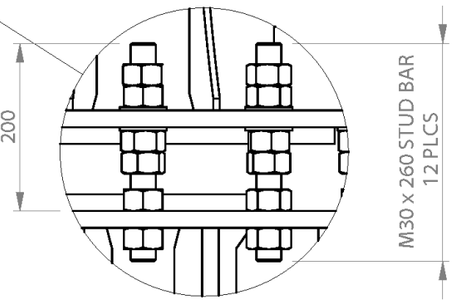
HINGE BOLTS
M30x120
2 PLCS



NOTE:

3 x FULL NUTS, 1 FLAT WASHER & 1 SPRING WASHER TO BE USED AS SHOWN PER STUD

DETAIL B
SCALE 2 : 15



NOTE:

6 x FULL NUTS & 2 PLAIN WASHERS TO BE USED AS SHOWN PER STUD

REV.	DESCRIPTION	DRAWN	APP'D	DATE
A	FOR MANUFACTURE	A.P.H	I.J.B	23/04/08

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL :

FINISH :

MASS (Kg.) :

Hutchinson Engineering
TEL. +44 (0)151 422 9990
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www.hutchinsonengineering.co.uk
nqa ISO 9001 Registered
EVERITE ROAD, WIDNES, CHESHIRE, WA8 8PT

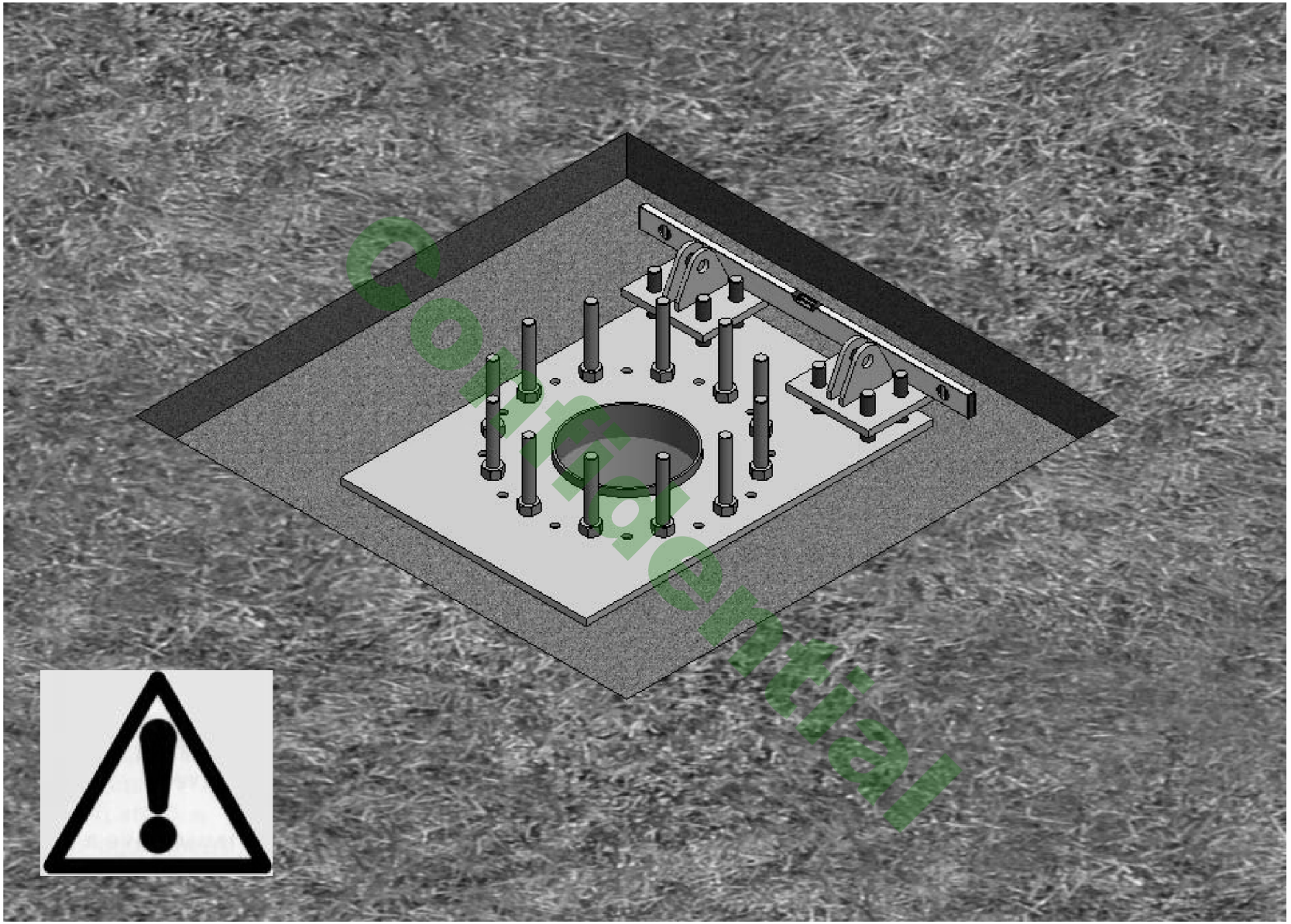
CLIENT : PROVEN
PROJECT : WIND TURBINE STRUCTURE
TITLE : POLE INSTALLATION DETAIL

A3

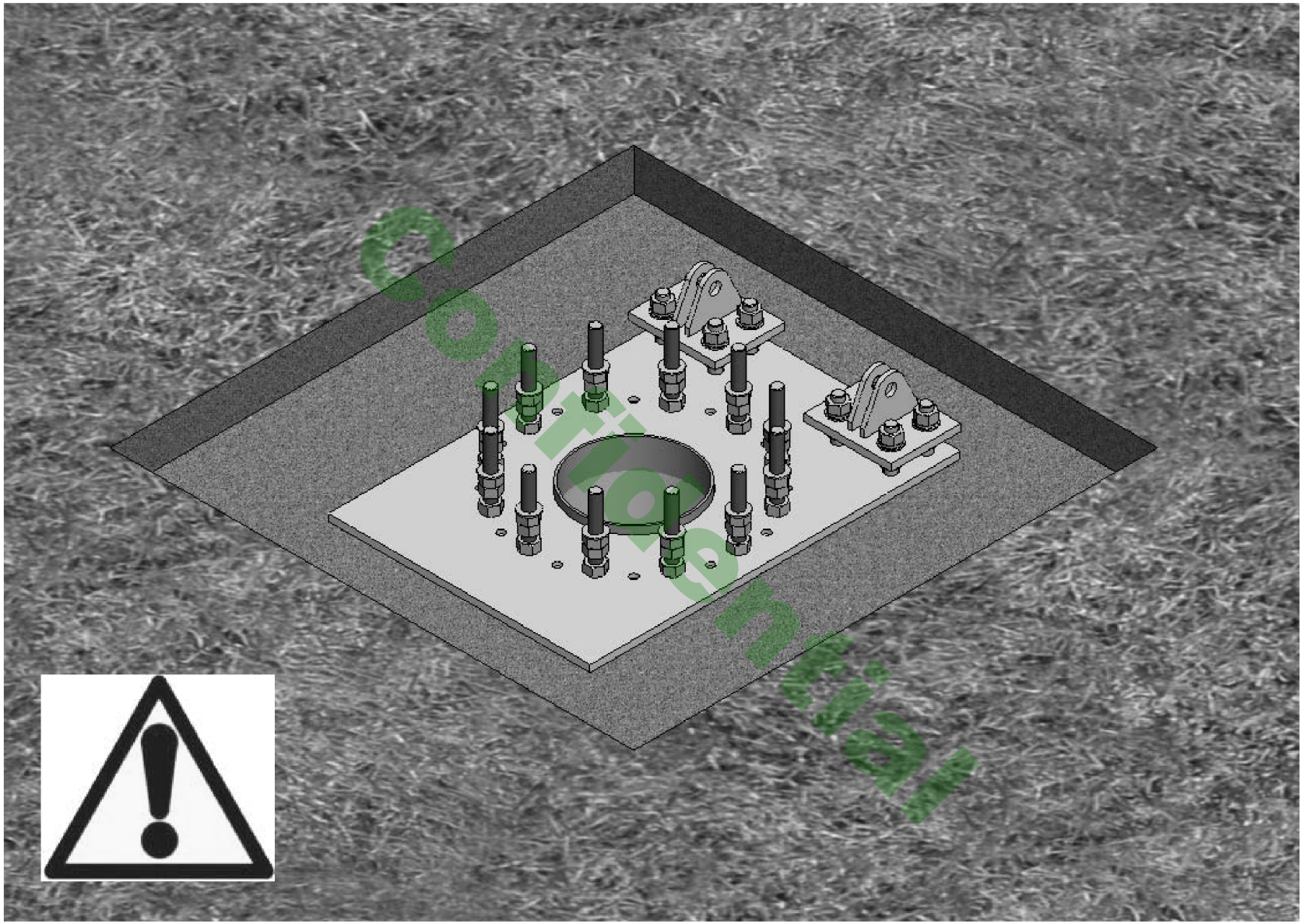
DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B	N.G	1:15	04/04/2008

DWG No. : **WTS_15M_G_003**

REVISION **A**

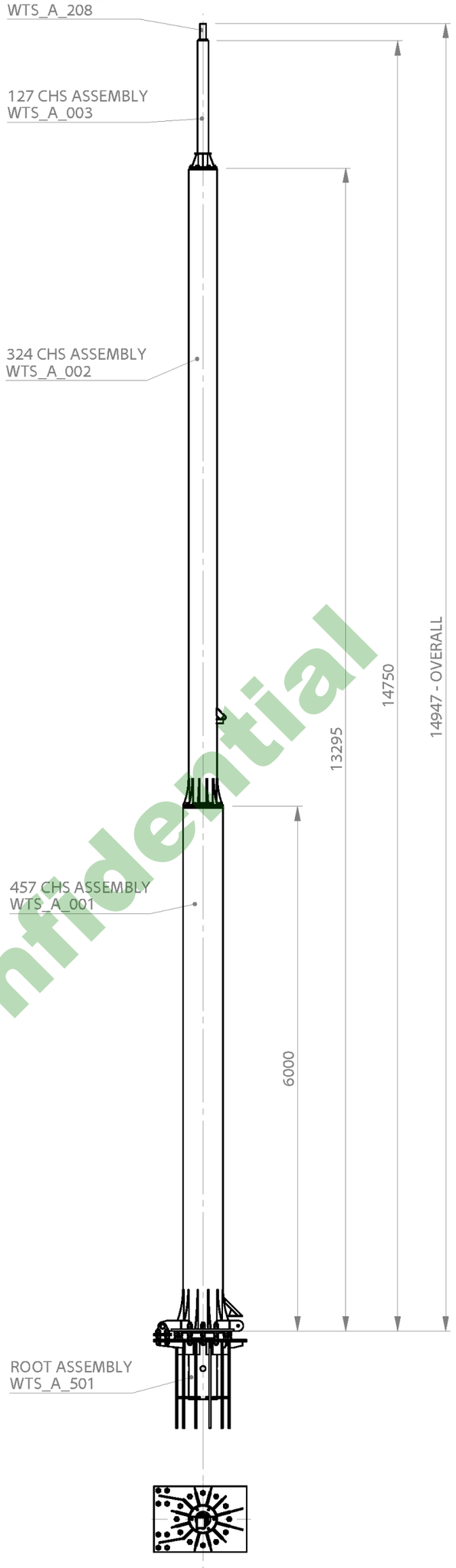


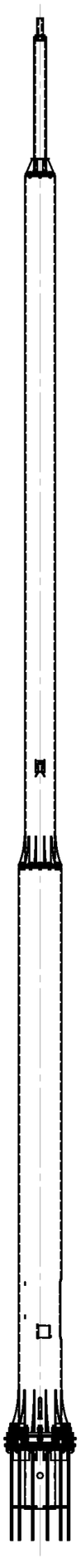
Install the hinge brackets onto the M30x180 studs, ensuring that they are set at the correct height and are level (see drawing for correct height)



Install pole levelling nuts and washers onto the M30x260 studs at the correct height

SITE REF. :





REV.	DESCRIPTION	DRAWN	APP'D	DATE
B	FOR MANUFACTURE	A.P.H	I.J.B	03/04/08
A	FOR COMMENT	A.P.H	I.J.B.	28/01/08

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL : SEE DETAILS

FINISH : GALVANISED

MASS (Kg.) : 1399.17

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EVERITE ROAD, WIDNES, CHESHIRE, WA8 8PT

CLIENT : PROVEN

PROJECT : WIND TURBINE STRUCTURE

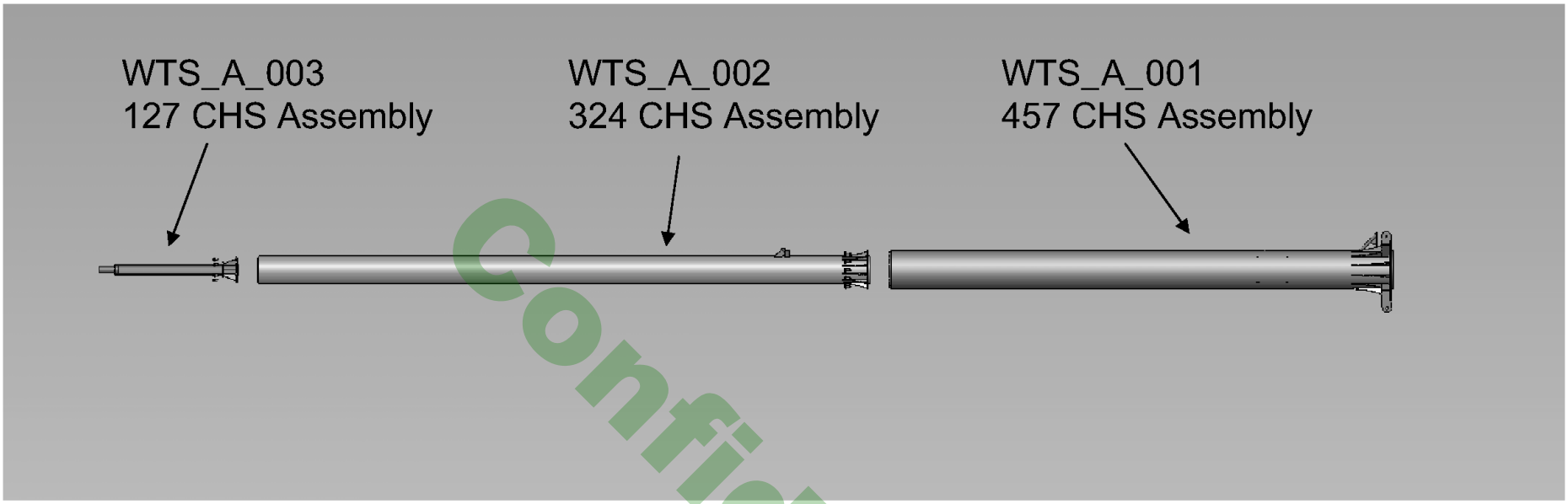
TITLE : GENERAL ARRANGEMENT DETAILS FOR 15M WIND TURBINE STRUCTURE

A3

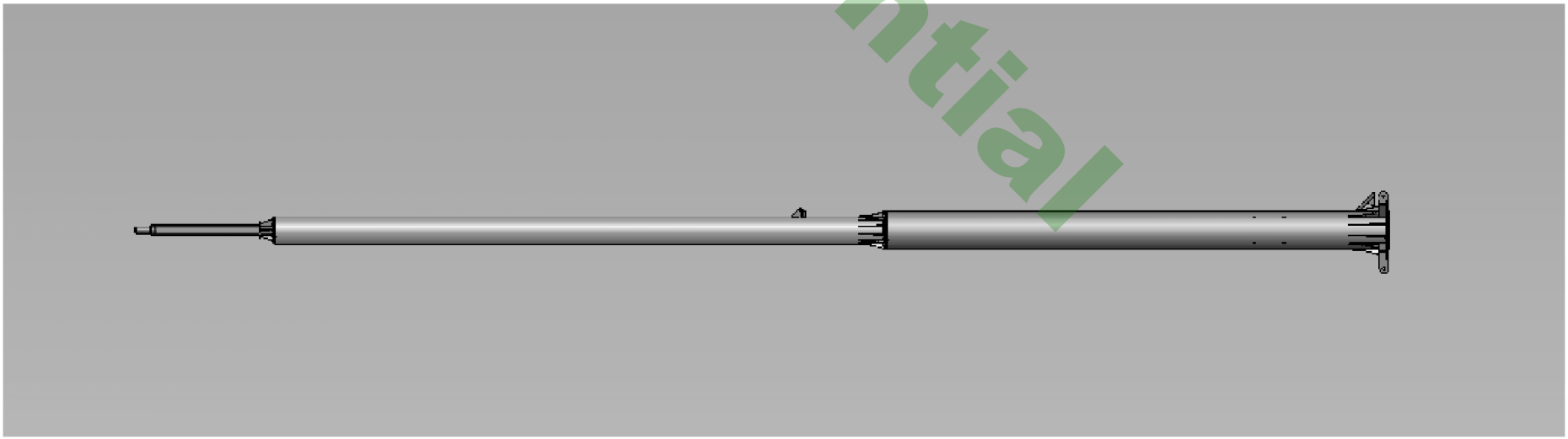
DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B	I.J.B.	1:55	28/01/2008

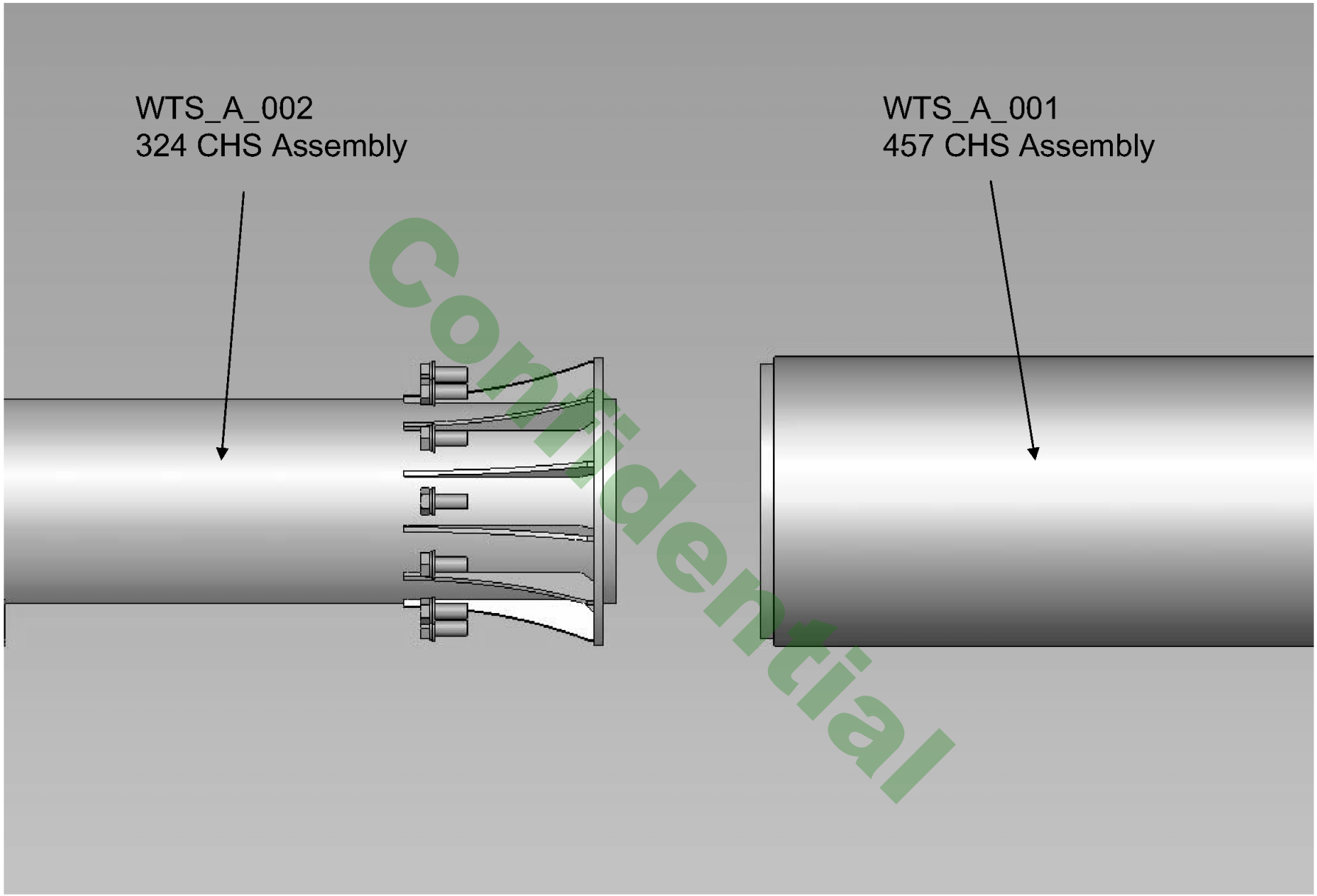
DWG No. : **WTS_15M_G_001**

REVISION **B**

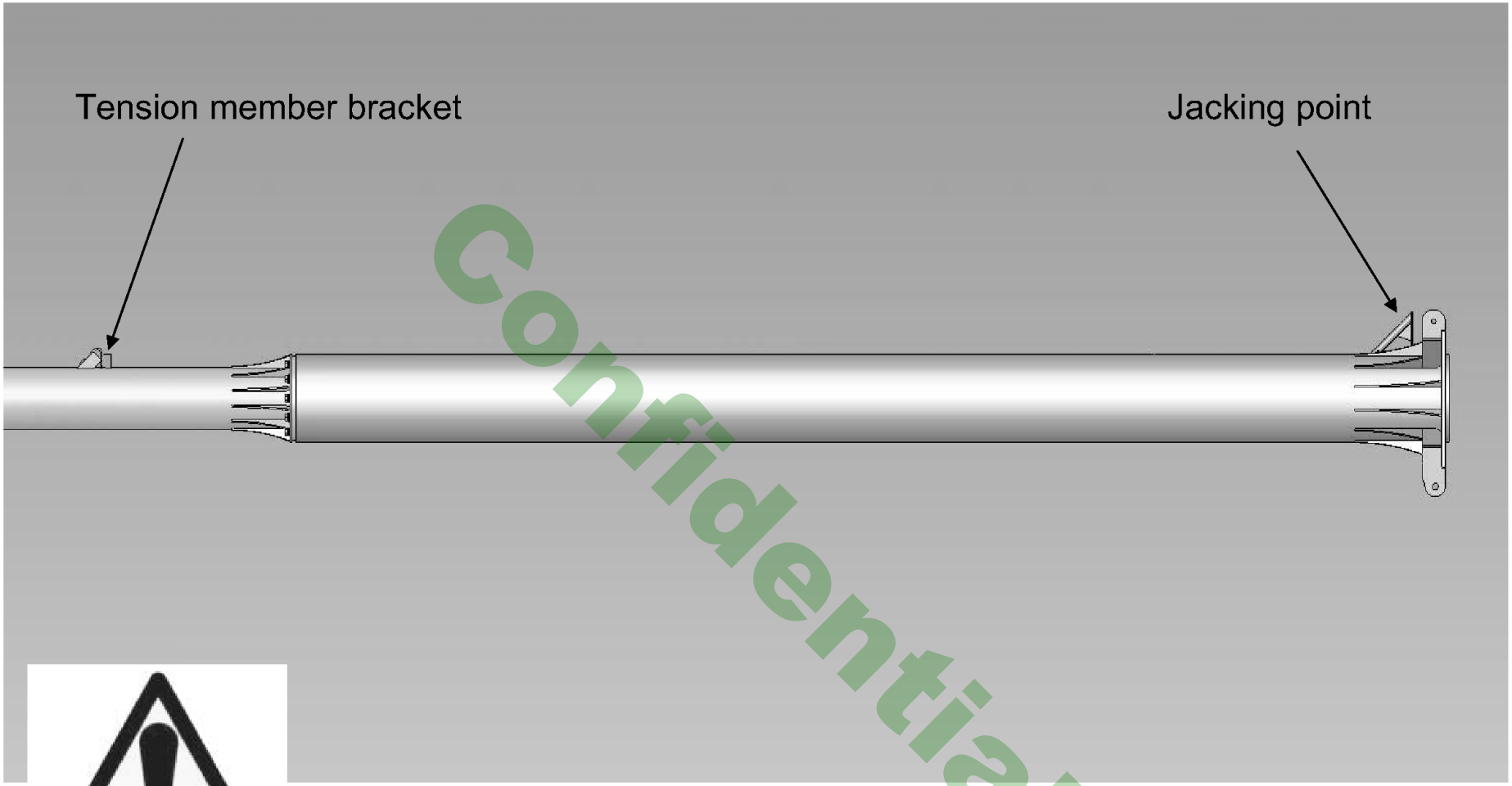


Assembled pole structure

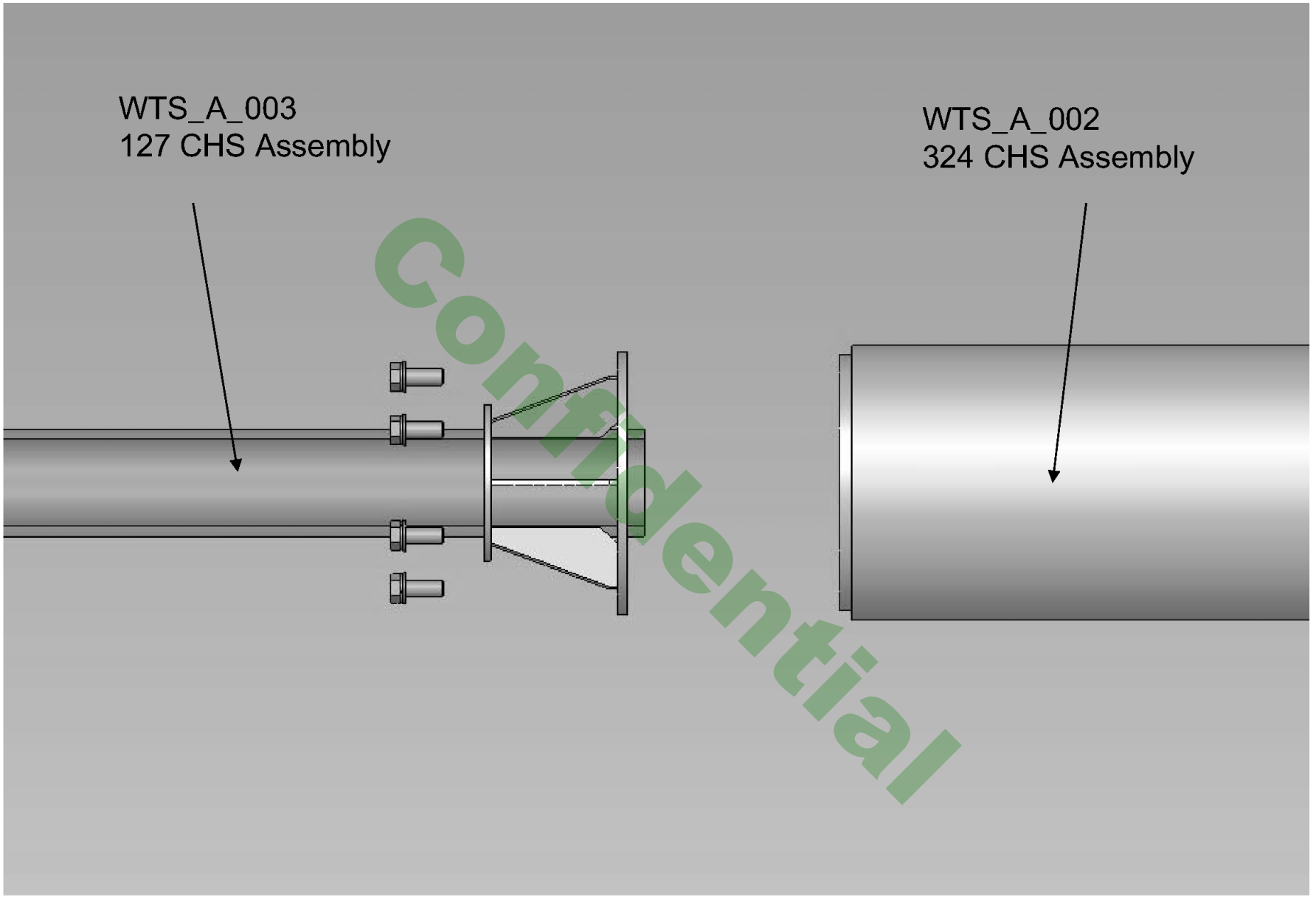




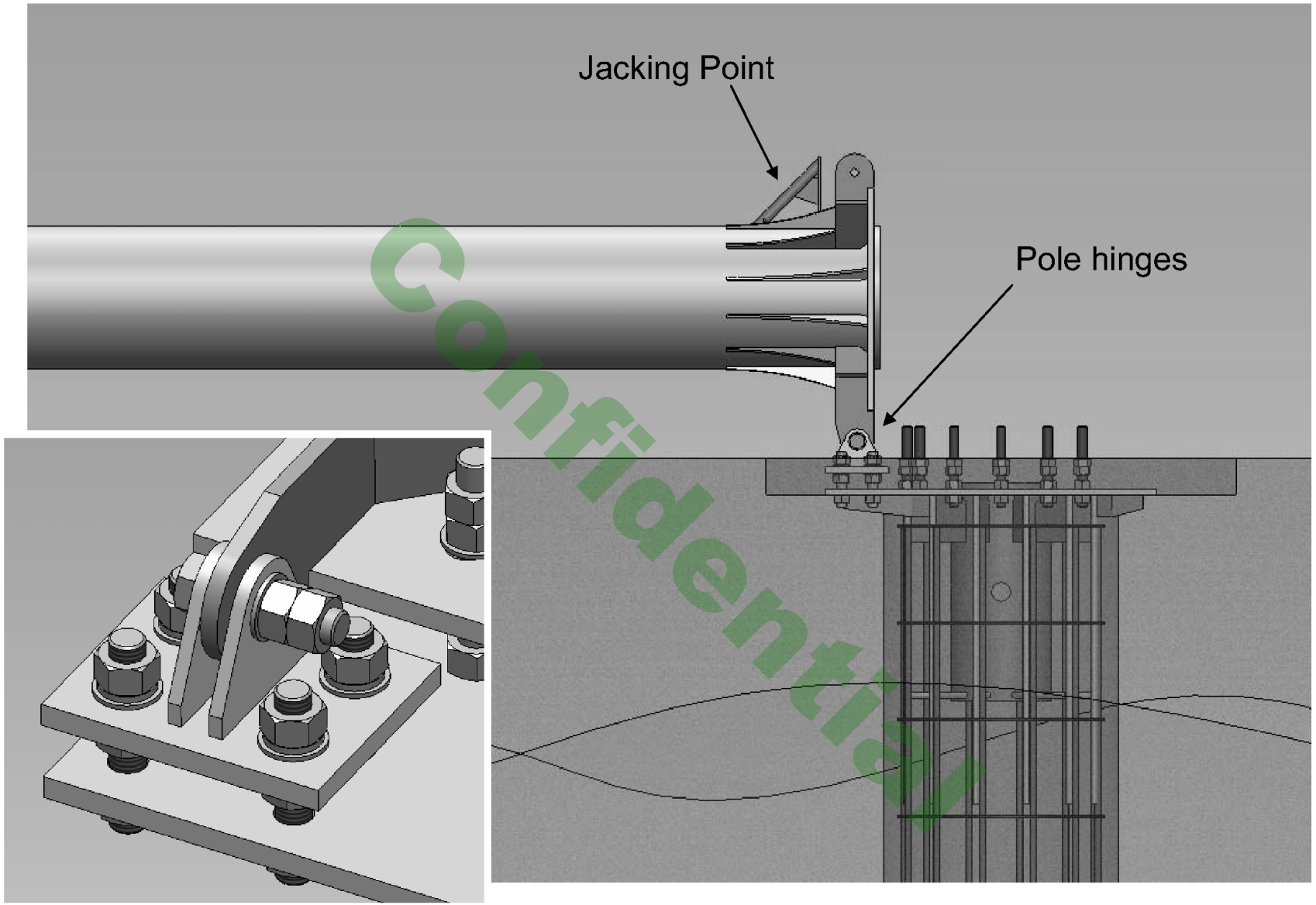
Assemble 324 CHS assembly to 457 CHS assembly using M24x60 bolts, plain washers and spring washers (12 off each). Ensure poles are straight when bolted together.



Ensure that the 324 CHS assembly is positioned in the correct orientation when bolted to the 457 CHS assembly. The attachment bracket for the tension pole on the 324 assembly must be in line with the jacking point on the 457 CHS assembly.



Assemble 127 CHS assembly to 324 CHS assembly using M20x50 bolts, plain washers and spring washers (6 off each). Ensure poles are straight when bolted together

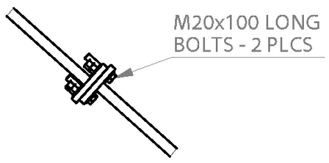


Install the assembled pole onto the hinge brackets via mechanical means. Secure with M30x120 bolt (x1) plain washers (x2) and M30 nuts (x2) per hinge. Ensure the pole is installed in the correct orientation, with the jacking point facing upwards.

Erecting the Pole Structure

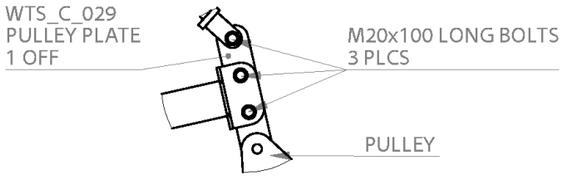
SITE REF. :

DETAIL A
SCALE 1 : 20



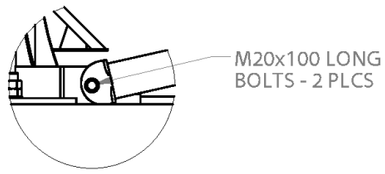
GIN POLE TIE BAR
CONNECTION

DETAIL B
SCALE 1 : 20

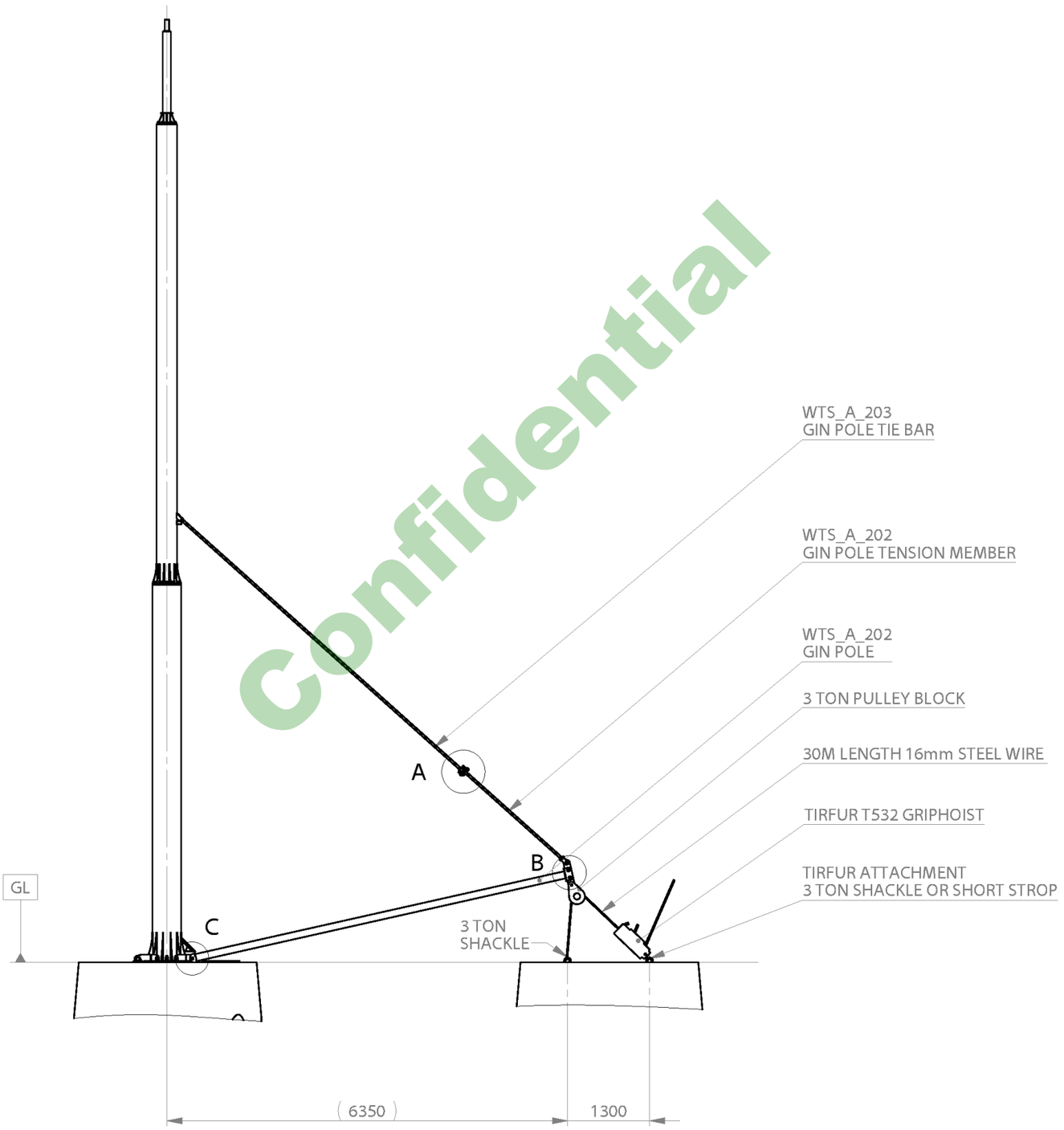


GIN POLE APEX
CONNECTION

DETAIL C
SCALE 1 : 20



GIN POLE HINGE BOLTS



REV.	DESCRIPTION	DRAWN	APP'D	DATE
C	TENSION MEMBER LENGTH SECTIONS MODIFIED	A.P.H	I.J.B	13/05/08
B	NOW SHOWN WITH FLUSH ANCHOR POINTS ON 1300mm CENTRES	A.P.H	I.J.B	12/05/08
A	FOR MANUFACTURE	A.P.H	I.J.B	22/04/08

NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETRES WITH LEVELS SHOWN IN METRES.
2. ALL DIMENSIONS NOT TOLERANCES TO BE WITHIN ±0.50mm.
3. STEELWORK TO BE TO BS 7668 OR BS EN 10113-1, GRADE S355, AND FABRICATED IN ACCORDANCE WITH BS 5950.
4. ALL BOLTS TO BE GRADE 8.8 SPUN GALVANISED TO BS 3692.
5. ALL STEELWORK TO BE PICKLED AND HOT DIP GALVANISED IN ACCORDANCE WITH BS EN ISO:1461.
6. REMOVE ALL BURRS AND SHARP EDGES.

MATERIAL :

FINISH :

MASS (Kg.) :

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www.hutchinsonengineering.co.uk
ISO 9001 Registered
EVERITE ROAD,
WIDNES,
CHESHIRE,
WA8 8PT

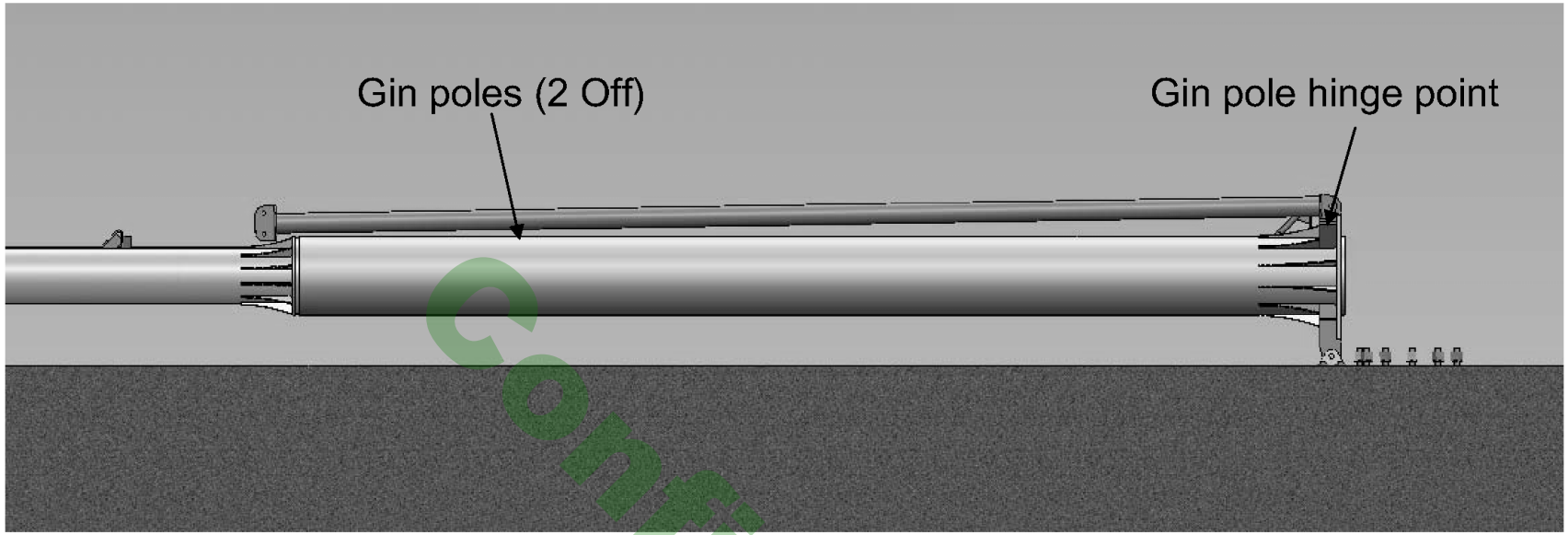
CLIENT : PROVEN
PROJECT : WIND TURBINE STRUCTURE
TITLE : GIN POLE SCHEMATIC

A3

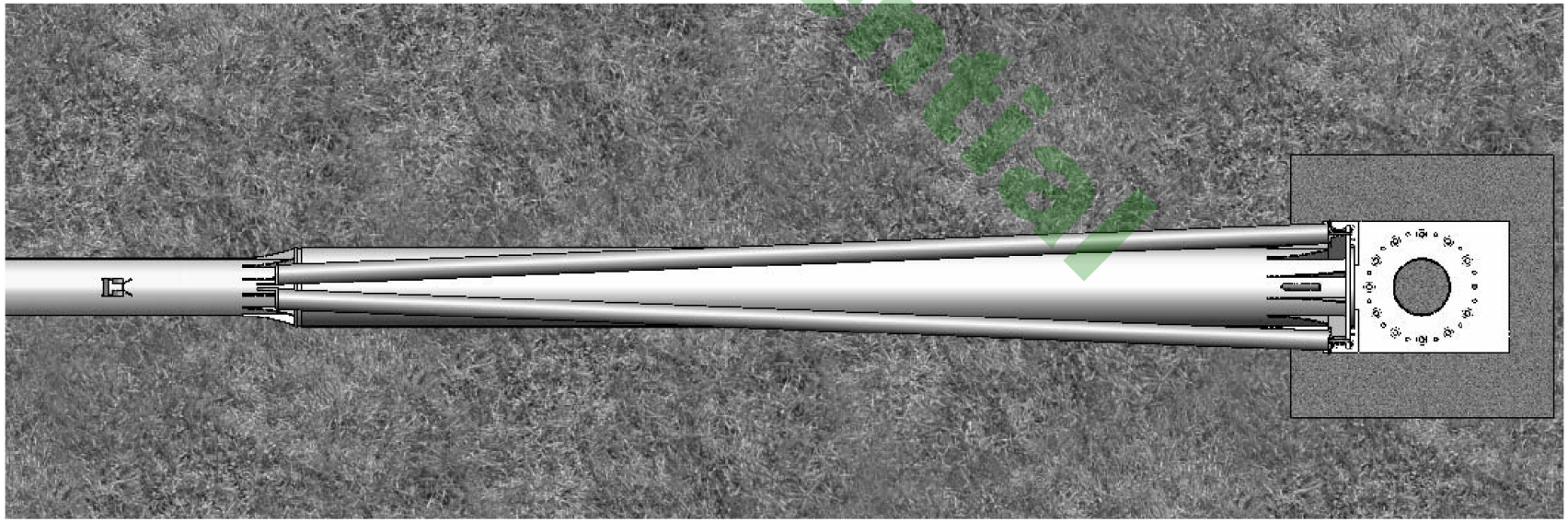
DRAWN :	APP'D :	CHK'D :	SCALE :	DATE :
A.P.H	I.J.B.	I.J.B.	1:80	22/04/2008

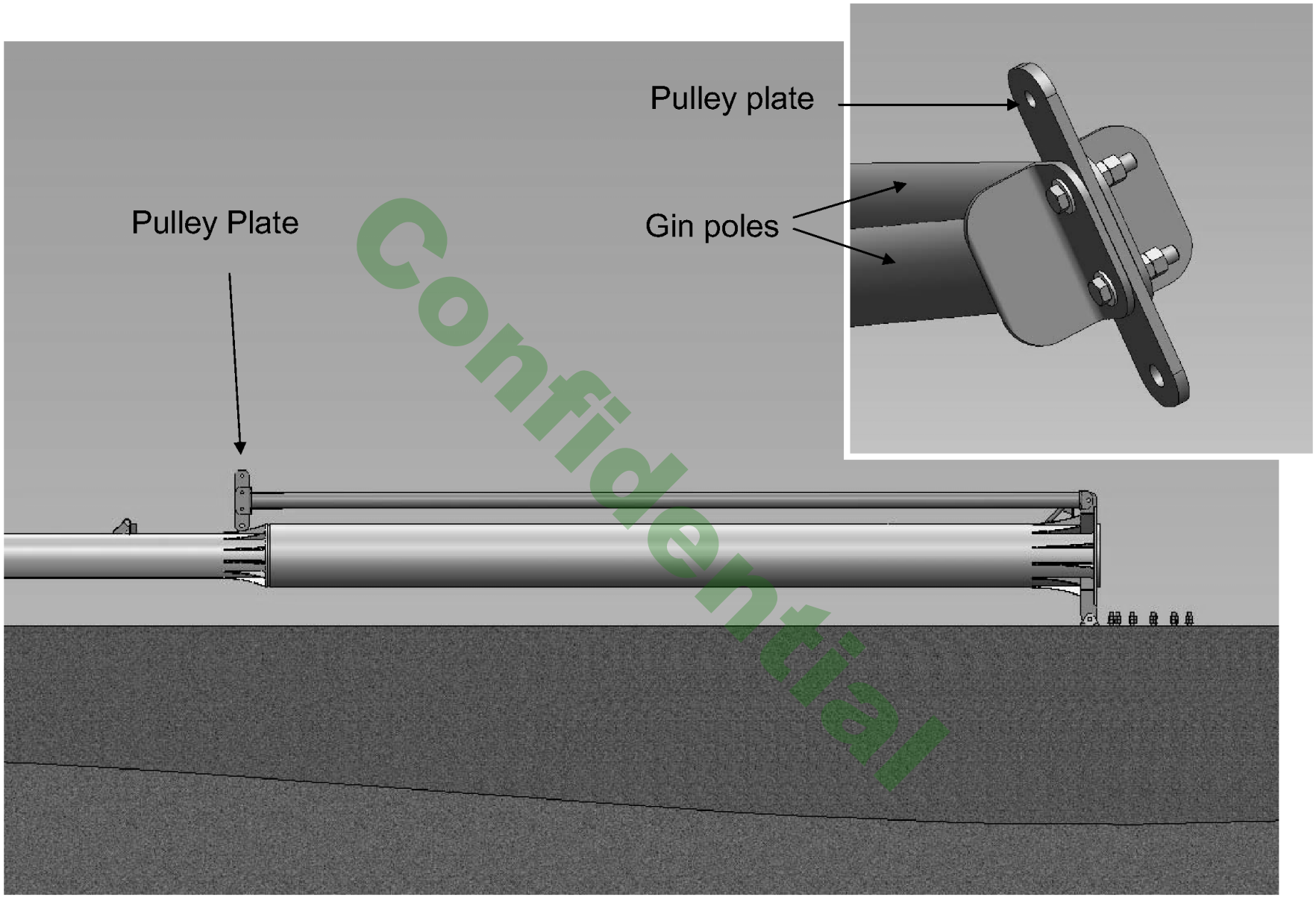
DWG No. : **WTS_15M_G_002**

REVISION **C**

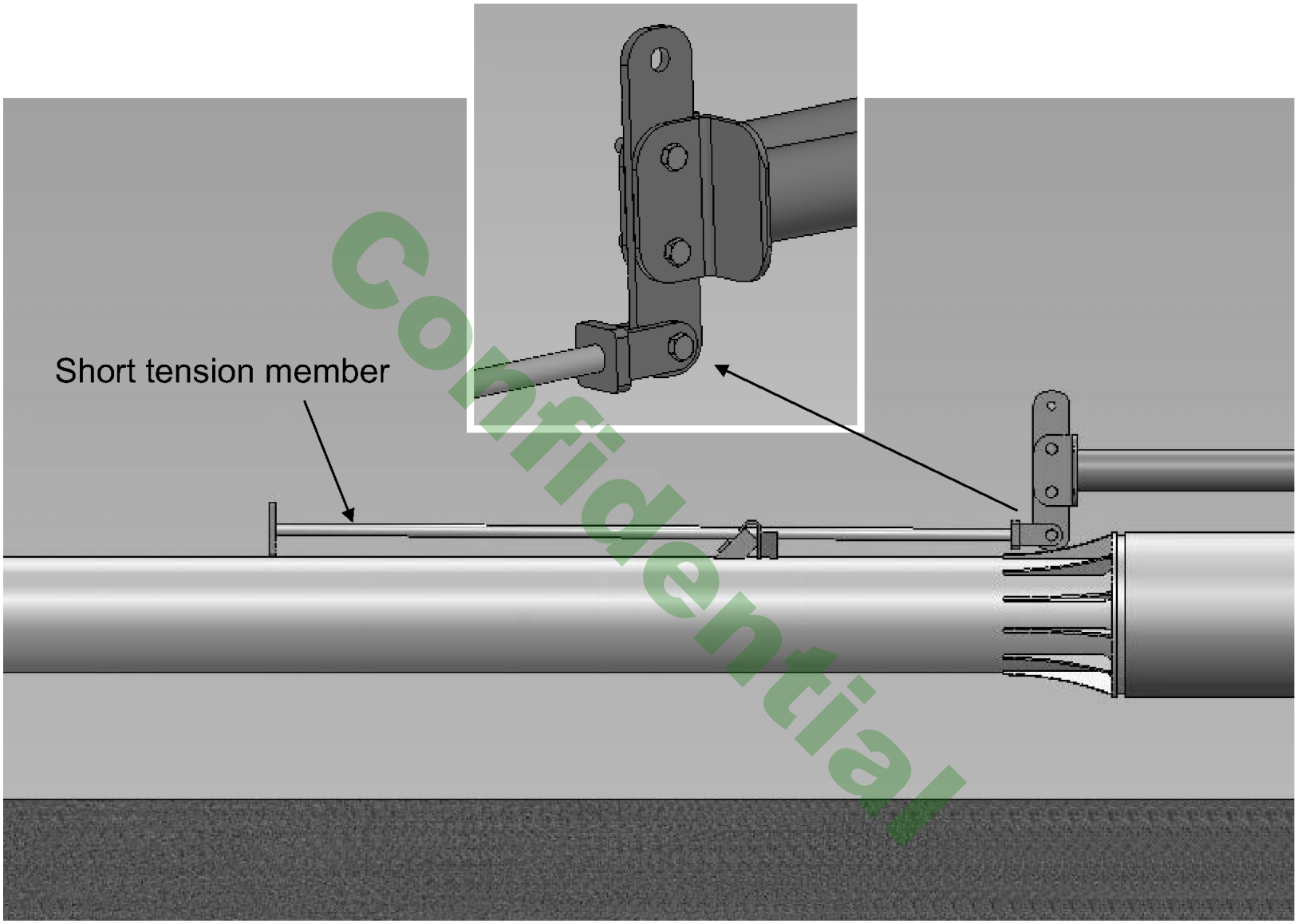


Install the gin poles in the orientation shown above. Both poles are fitted to the hinge point at the base plate using 1x M20x100 Bolt, 2 x plain washers and 2x M20 nuts per gin pole. The ends of the gin poles will meet in the middle, as shown below

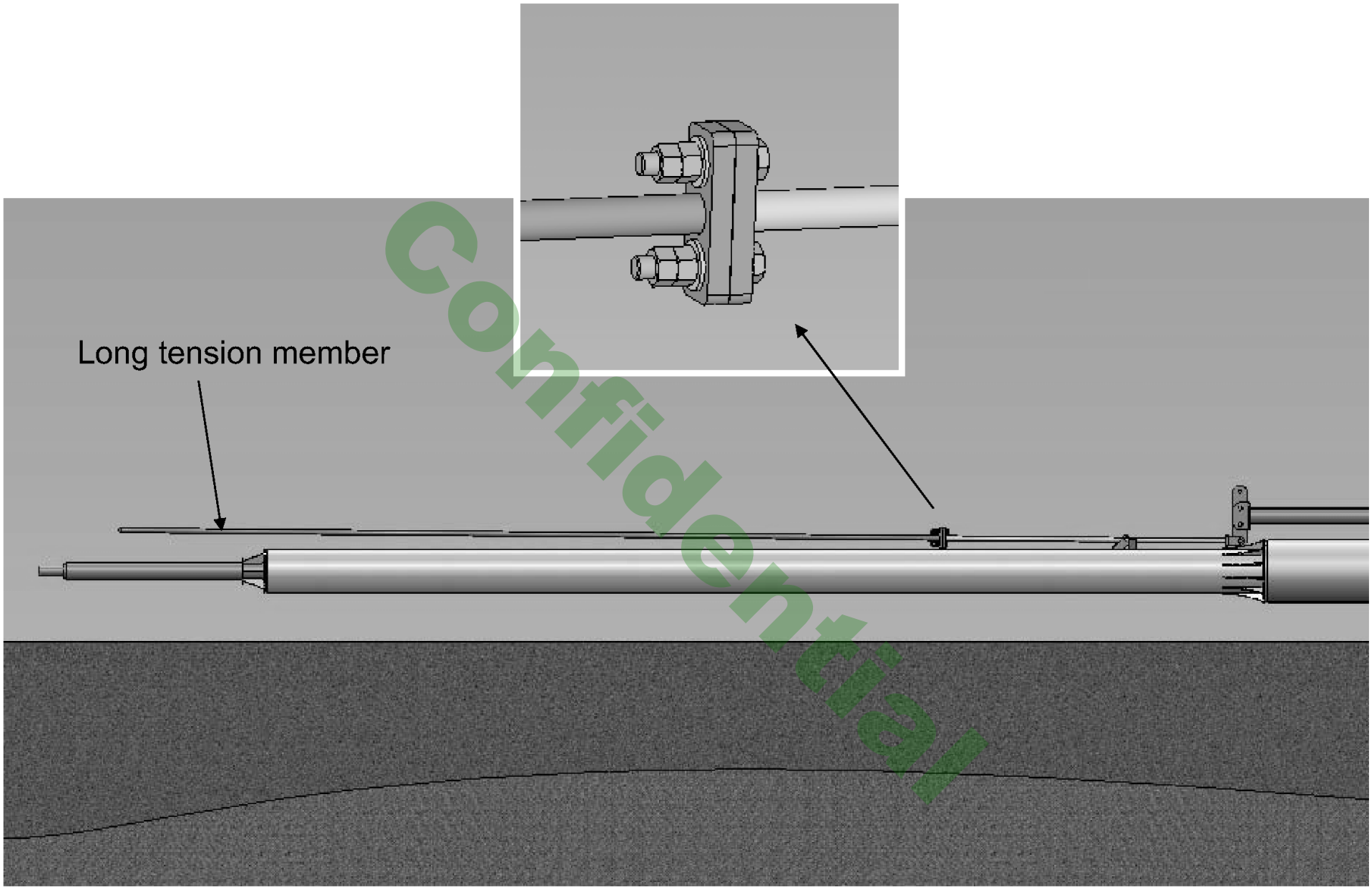




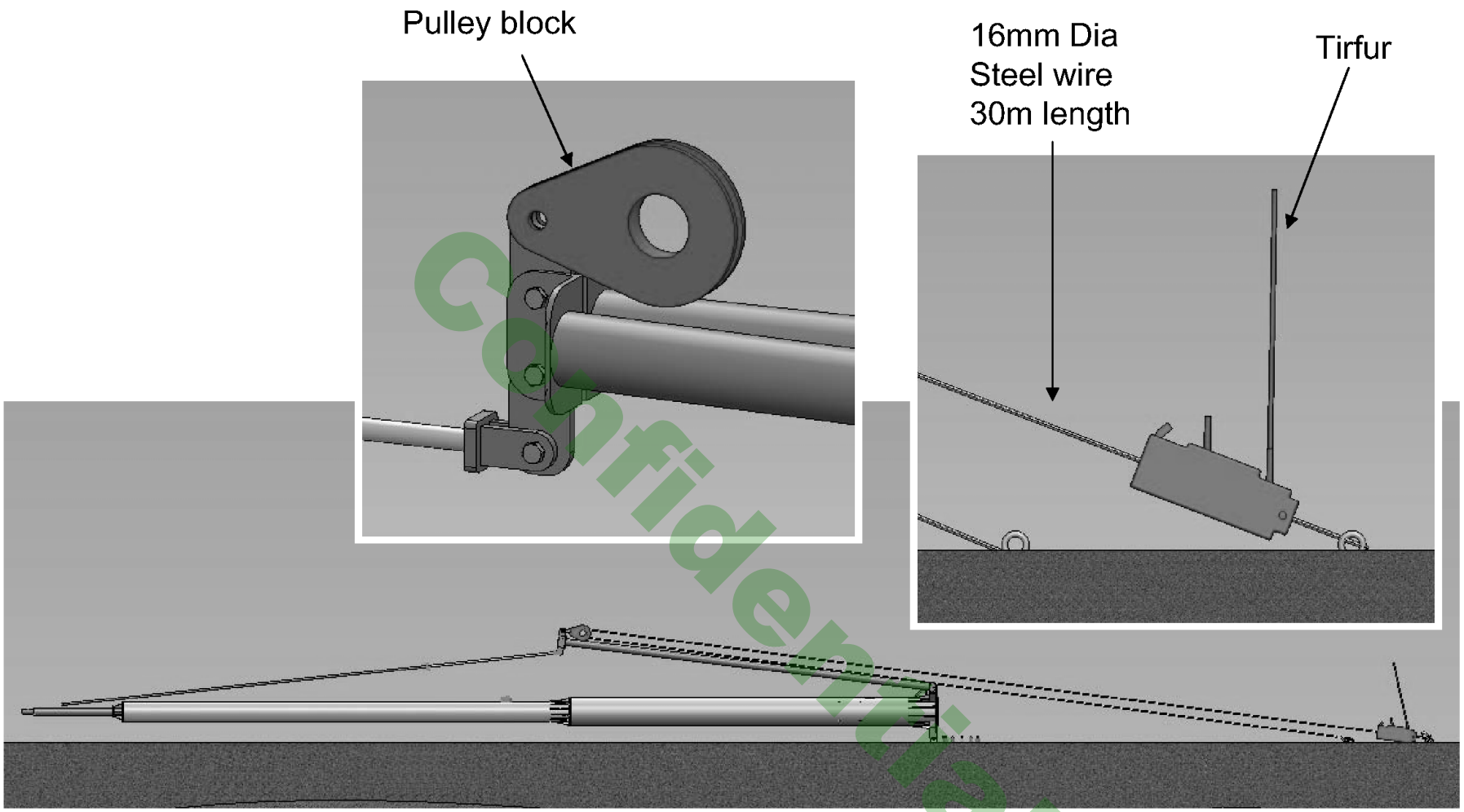
The pulley plate is now bolted in between the two gin poles as shown using M20x100 bolts plain washers and 2x M20 nuts



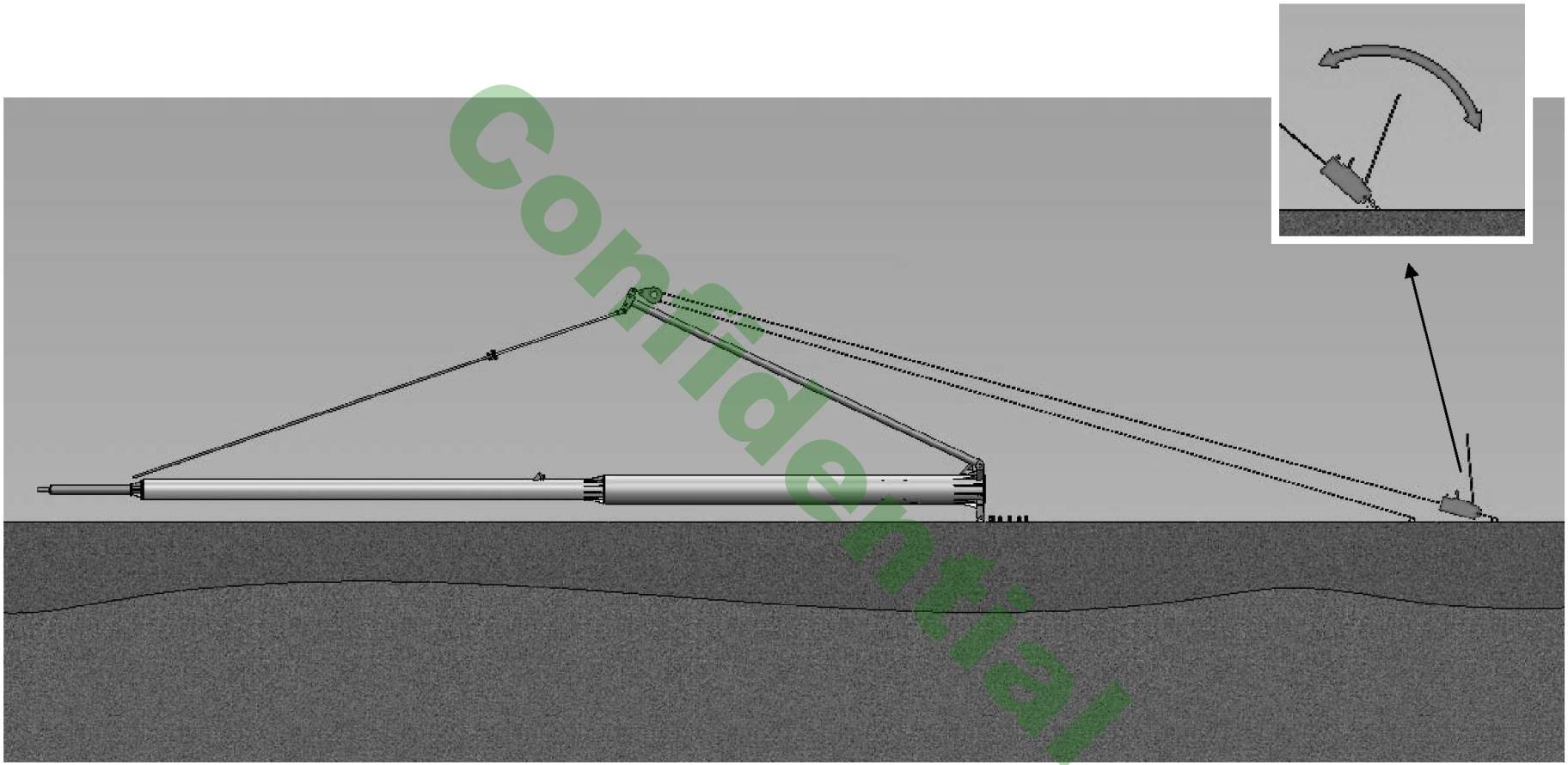
Fit the short tension member to the bottom of the pulley plate using 1x M20x100 bolt 2x plain washers and 2x M20 nuts. This connection must not be over-tightened



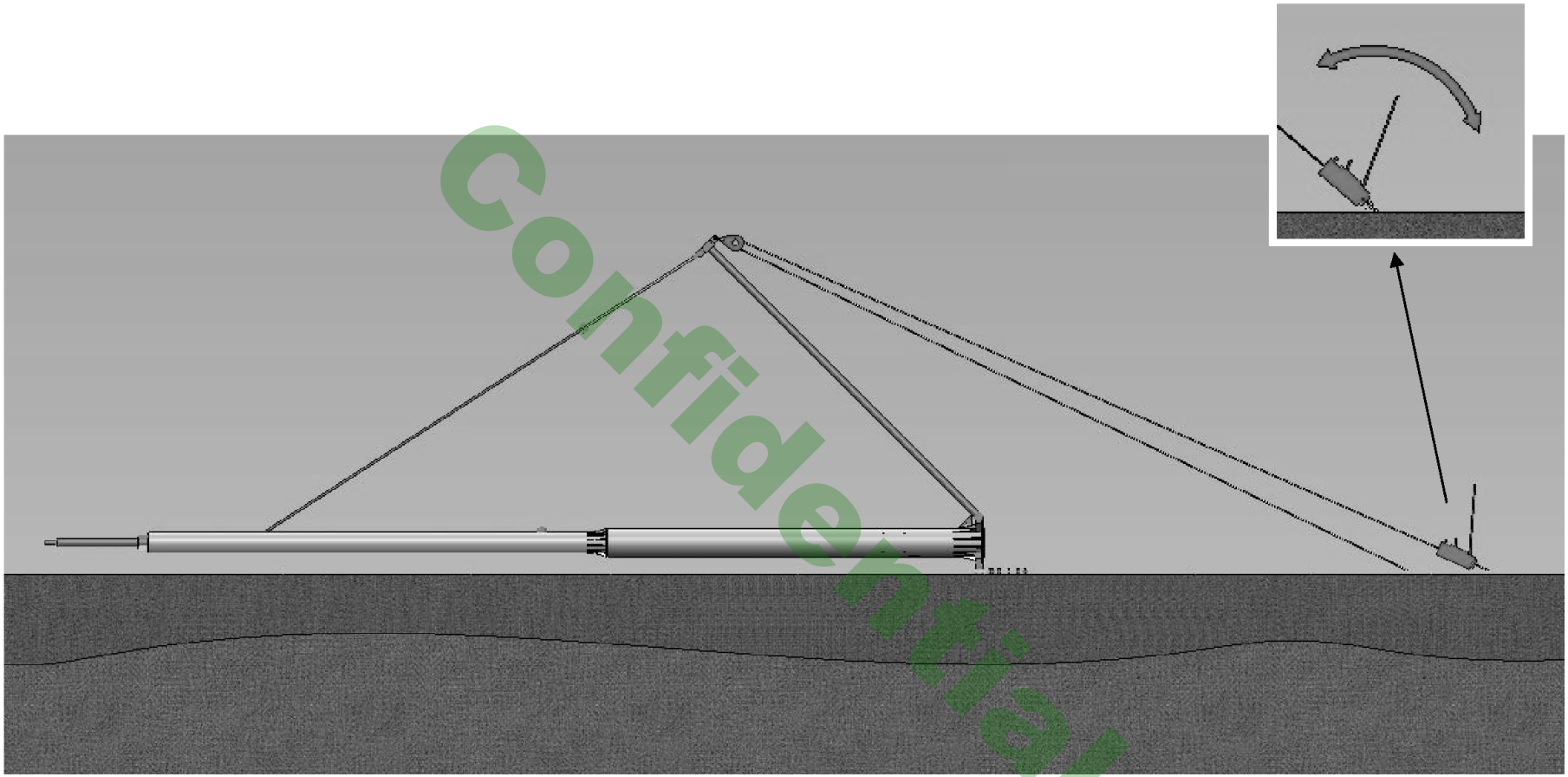
Attach the long tension member to the short tension member via the bolted connection using 2x M20x100 bolts, 4x plain washers and 4x M20 nuts.



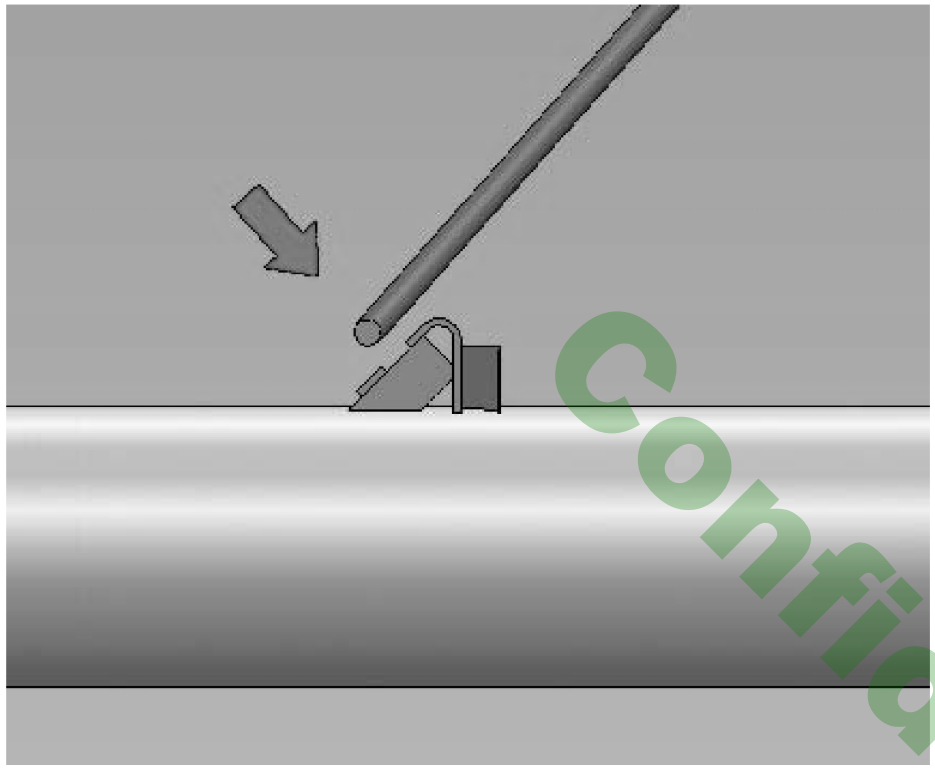
Install a suitable 5 ton pulley block on to the other end of the pulley plate (capable of handling 16mm Dia steel wire) Attach one end of 16mm steel wire to the forward anchor point using a suitable shackle. The wire is then run through the pulley, and back towards the anchor pad. The Tirfur should be attached to the rear anchor point via a short strop. The steel wire is then run Through the Tirfur and locked in (see Tirfur instructions). By moving the Tirfur handle any slack can now be taken up before beginning to lift the gin poles. The gin poles will need to be manually lifted to approximately 10 degrees before lifting with the Tirfur can begin.



Keep moving Tirfur handle backwards and forwards to lift gin poles.

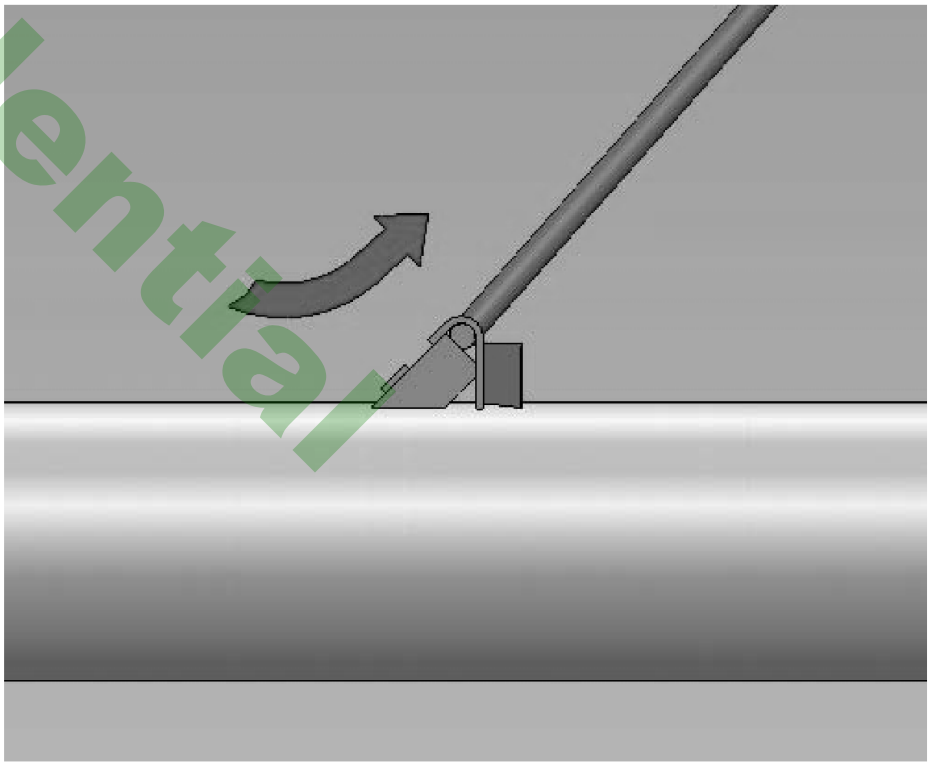


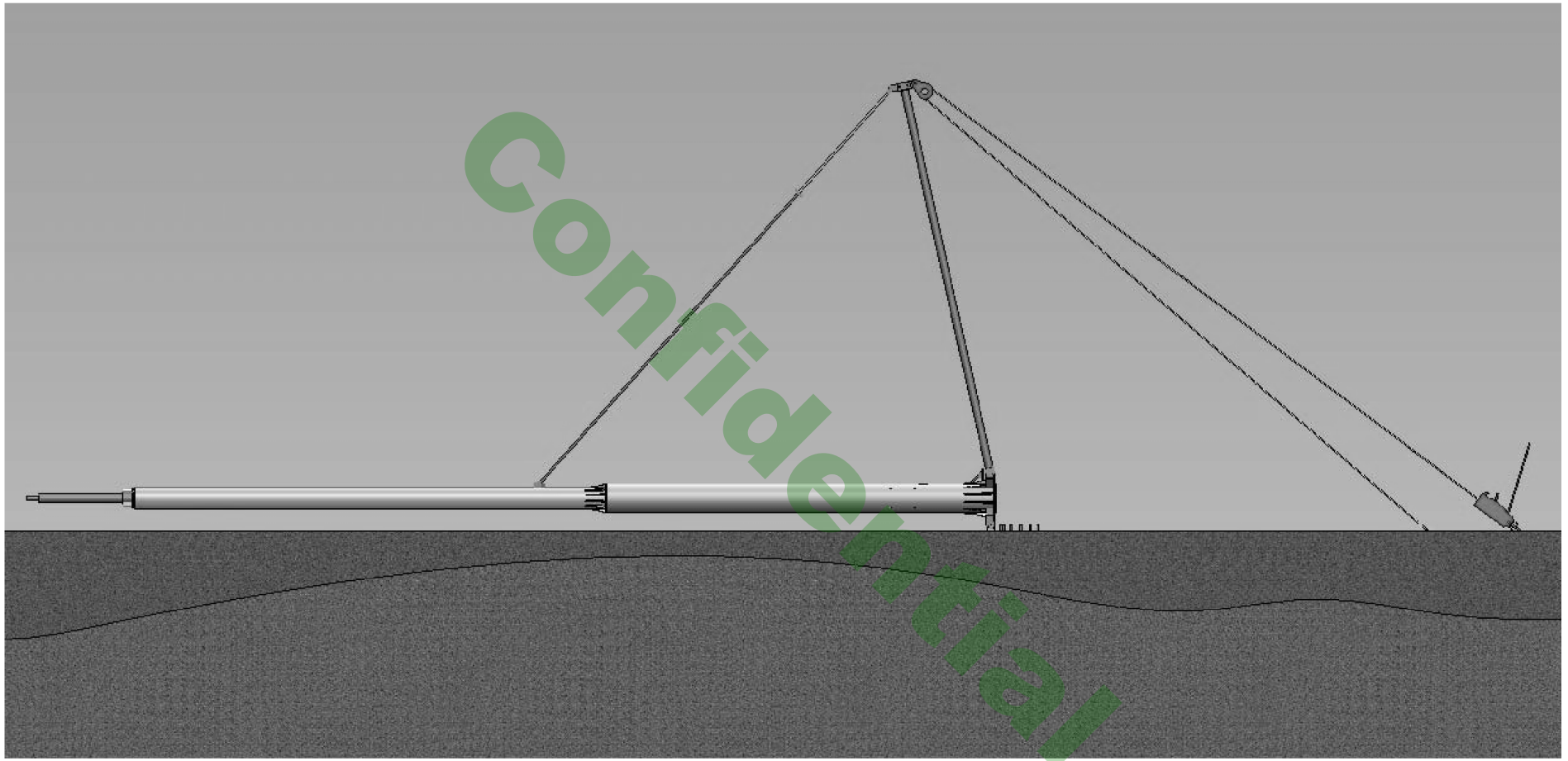
As the gin poles are being lifted, the long tension member is moving down the pole towards the tension member bracket mounted on the pole. Have someone ready to guide the end of the tension member into the bracket to allow the pole to be lifted.



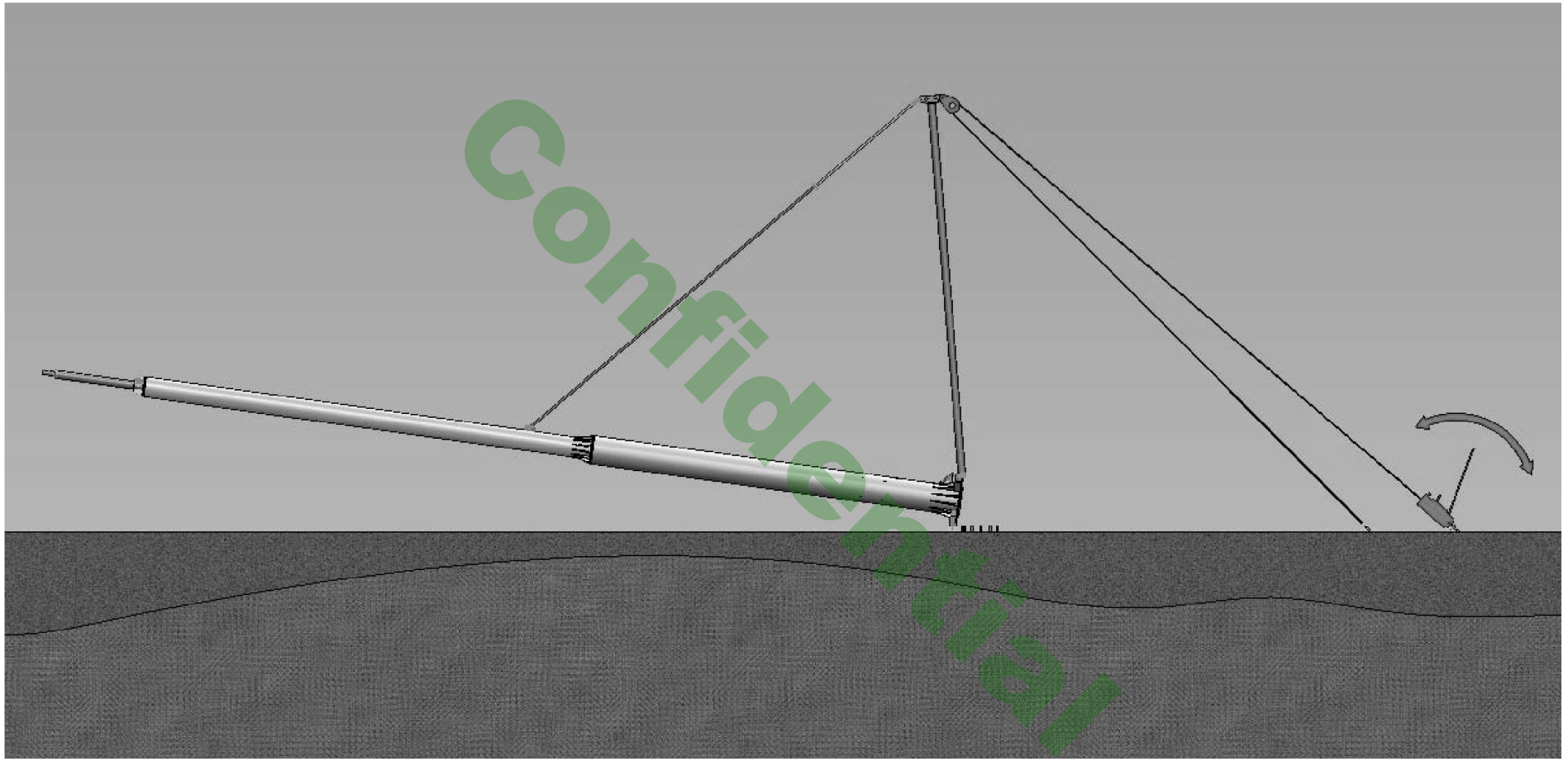
1. Tension member to be guided into fixed bracket located on the pole as the gin poles are being lifted.

2. Once the end of the tension member is in place, the pole can be lifted

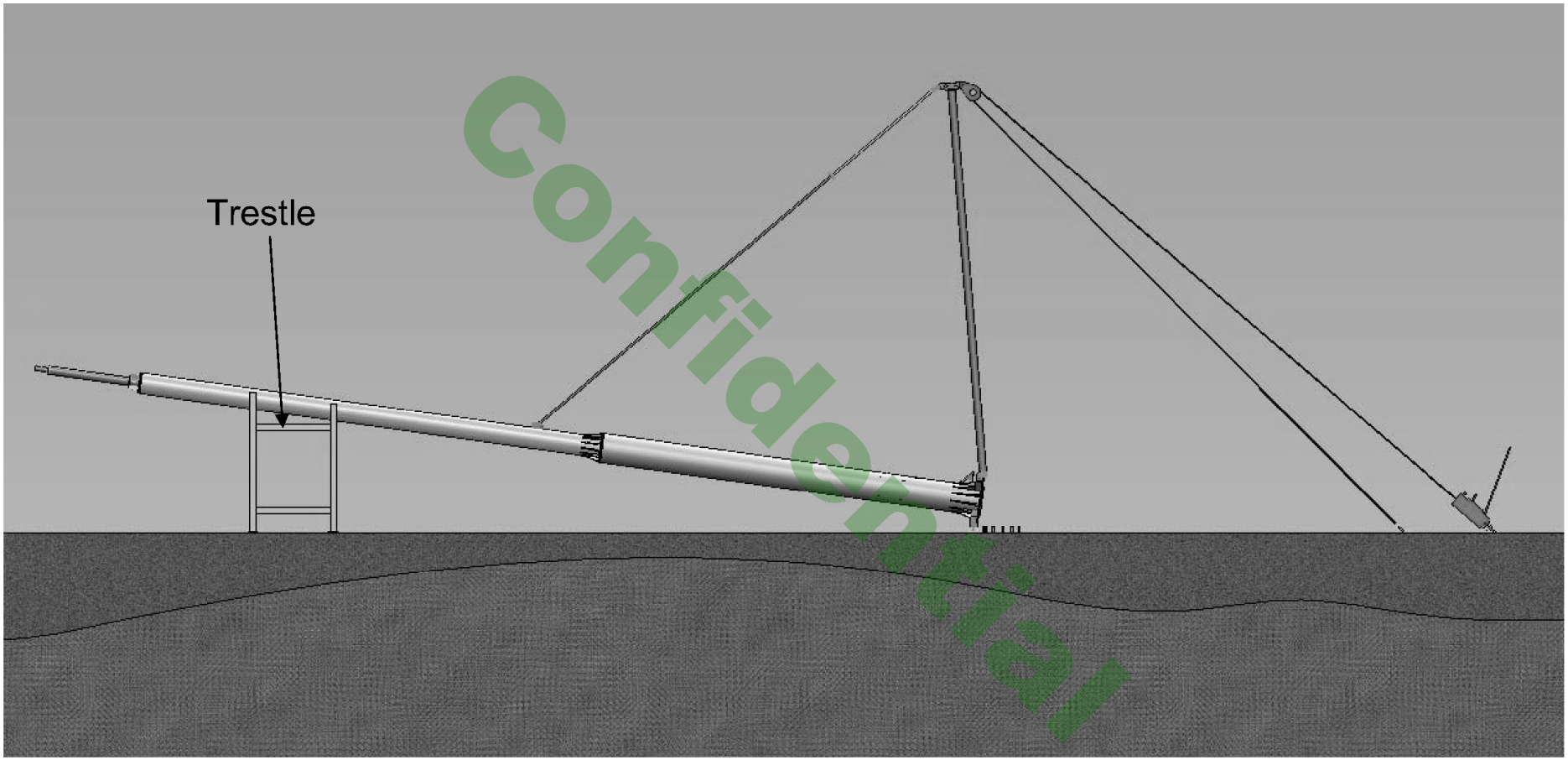




Tension member locked into bracket, the pole is now ready to be lifted

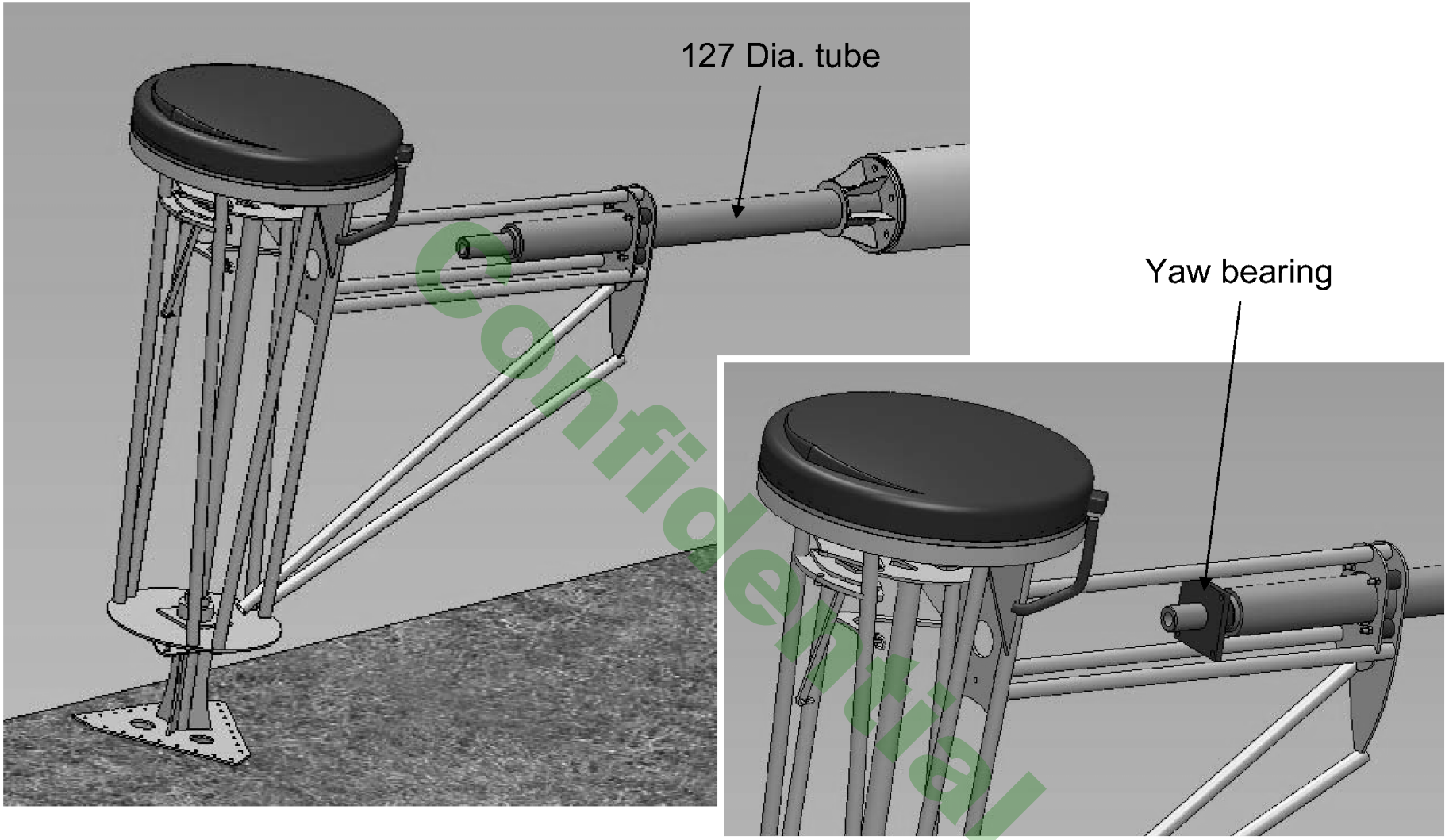


Lift the pole to approximately 10 degrees off the ground

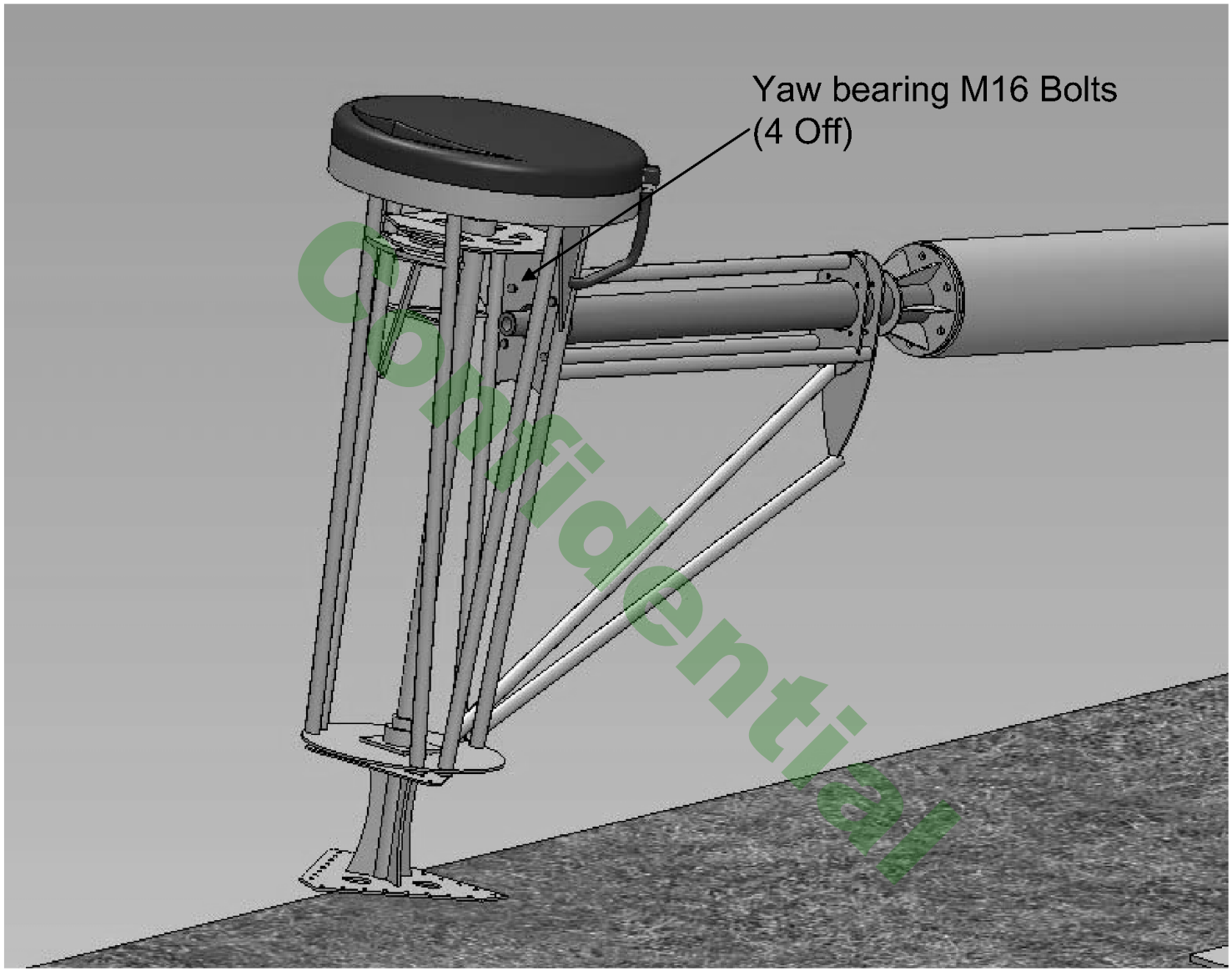


Position the trestle just over 3m from the end of the pole (in order to be clear of the blades when fitted to the turbine)

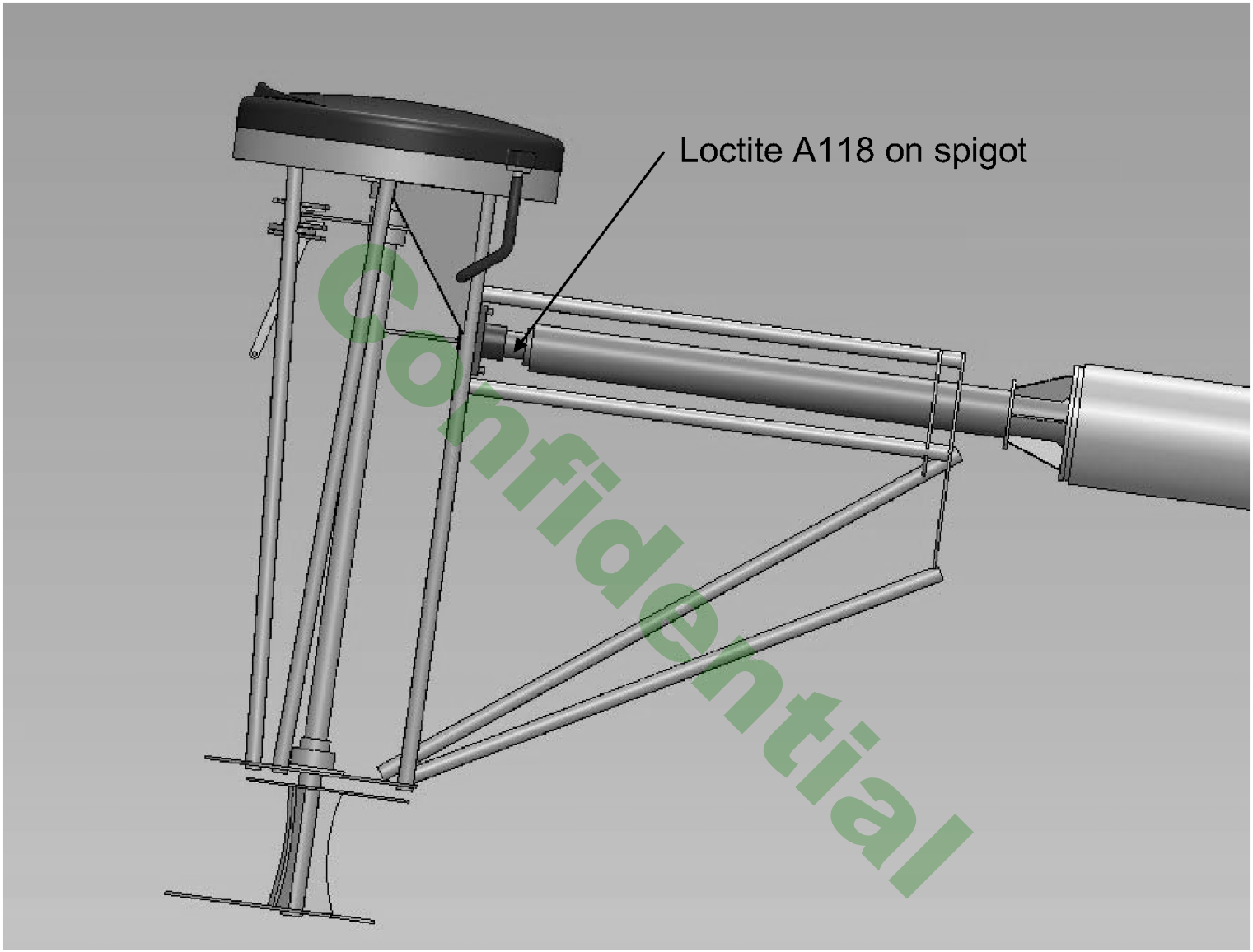
Installing the Turbine Head



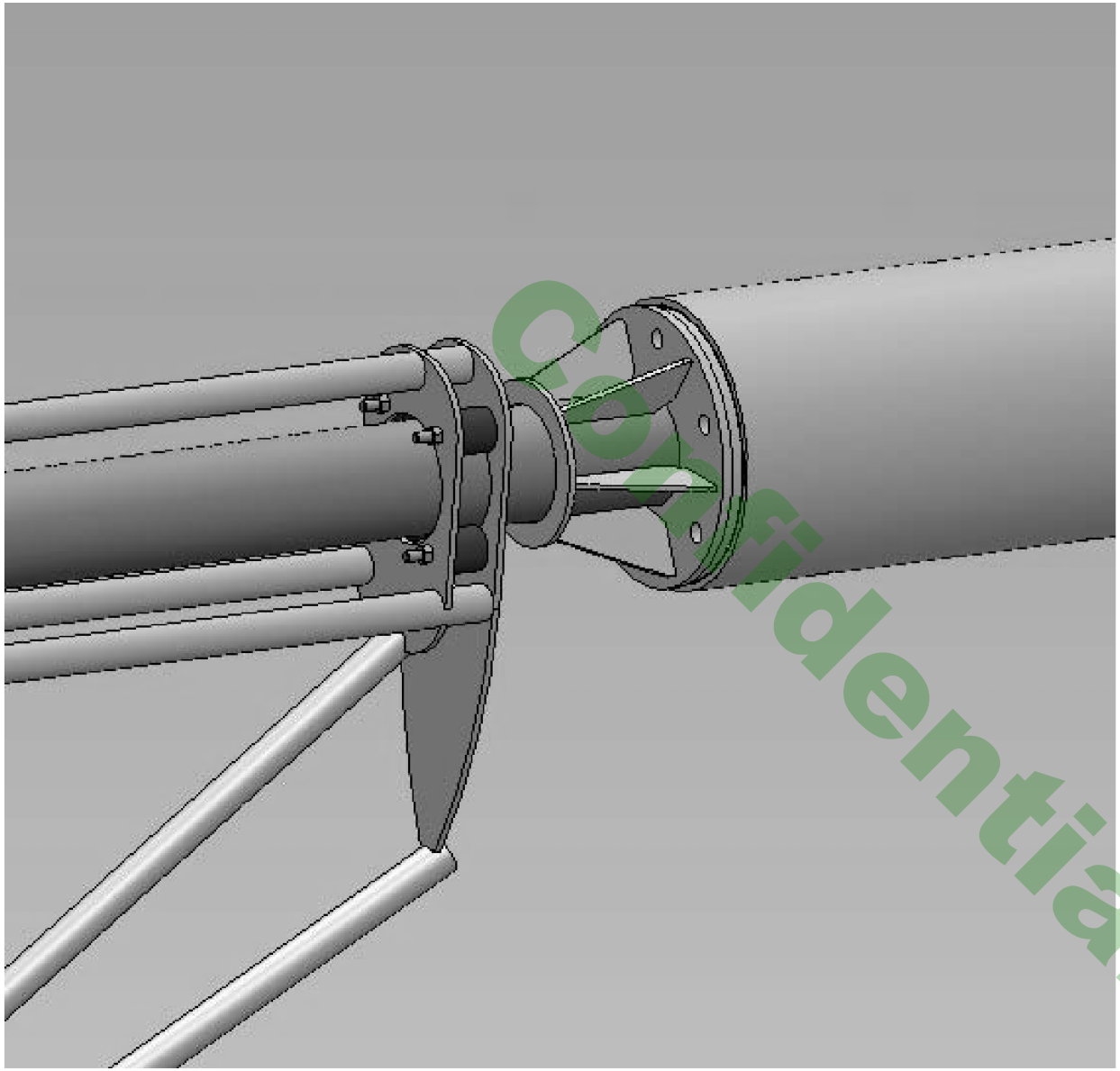
Lift the turbine and slide onto the pole. When the bottom of the turbine frame is located on the 127 Dia. tube the yaw bearing can be fitted onto the spigot. Ensure that the grease nipple on the bearing will be accessible when the turbine head is fully installed



Push the turbine head fully home and install yaw bearing M16 bolts (4 off) The Turbine Can now rotate around the tower

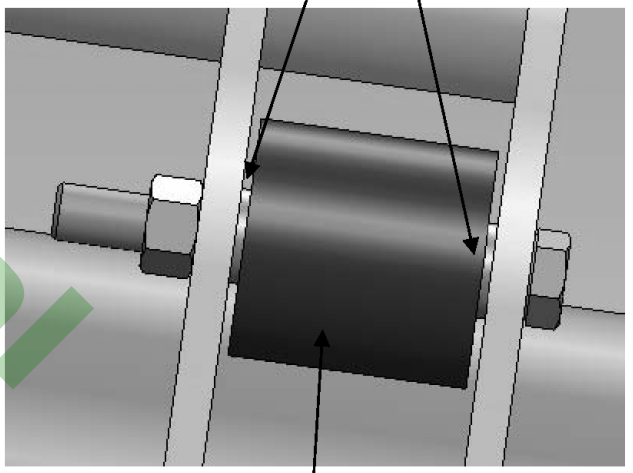


Withdraw turbine head by approximately 50mm and apply Loctite A118 Between yaw bearing and spigot. Push turbine head fully home. Tighten bearing grub screw (using 5mm Allen key) use Loctite to prevent working loose.



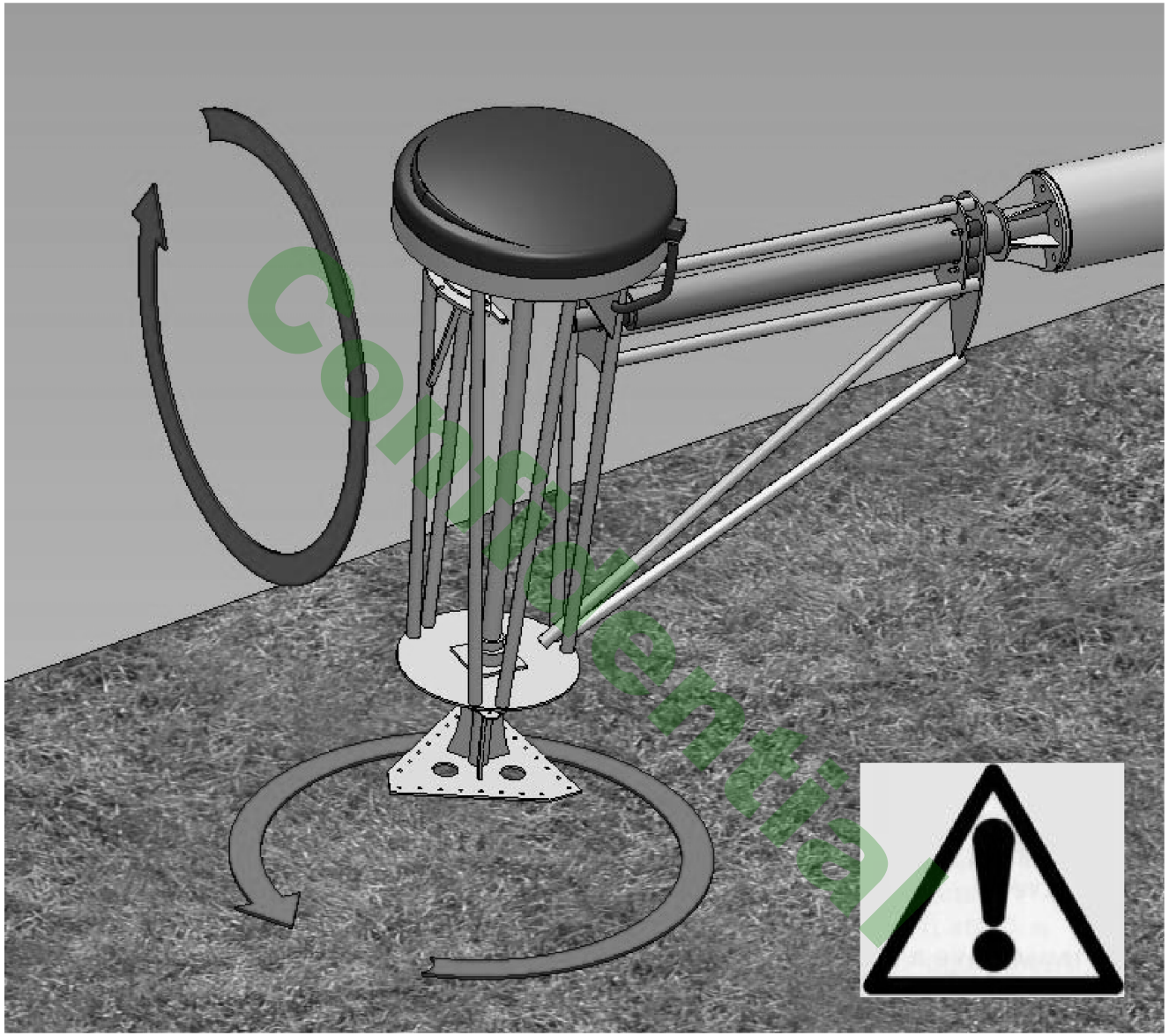
Grease bolts & Yaw Rubber ends before installation

Nylon Washers

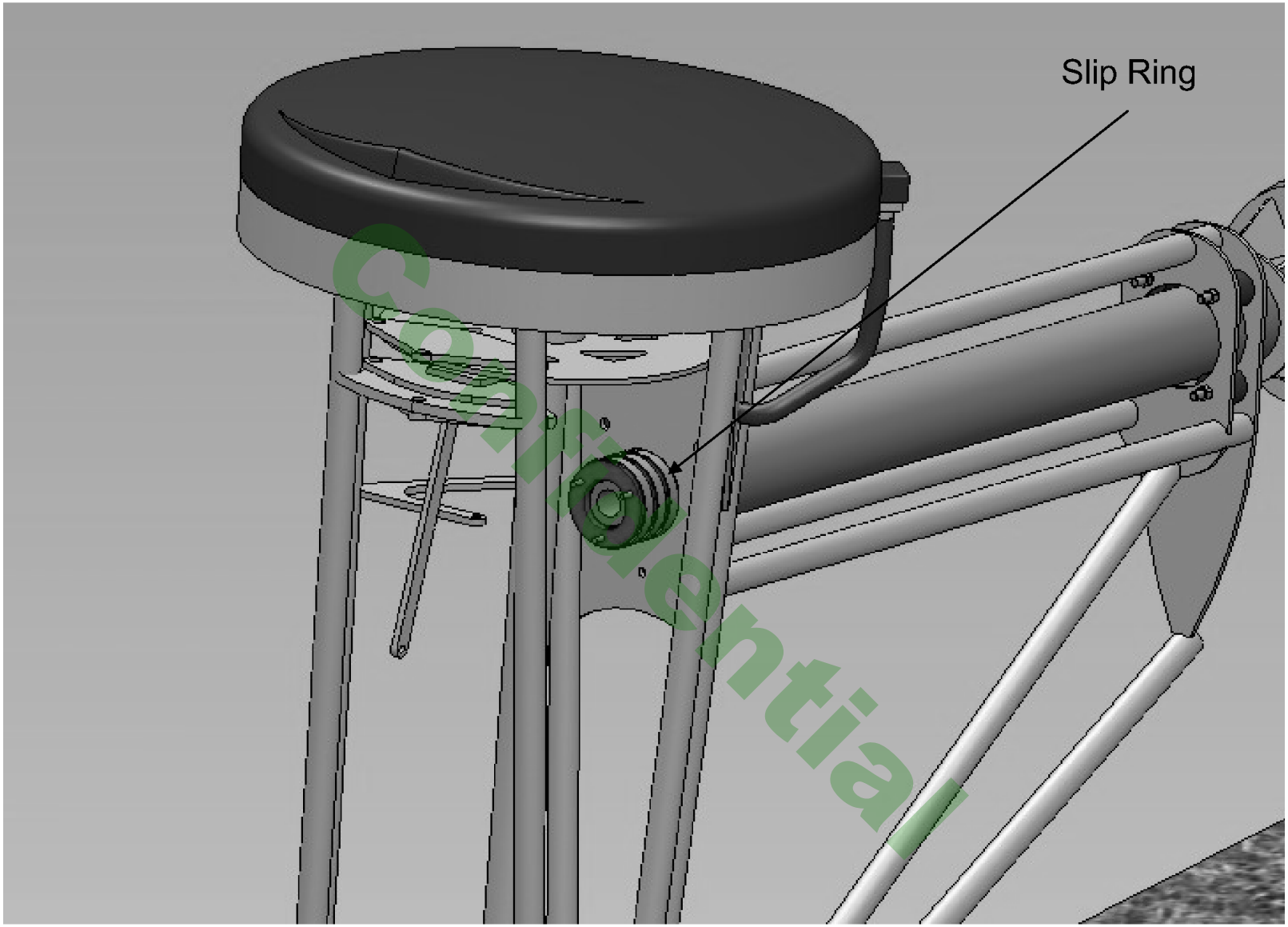


Yaw Rubber Roller

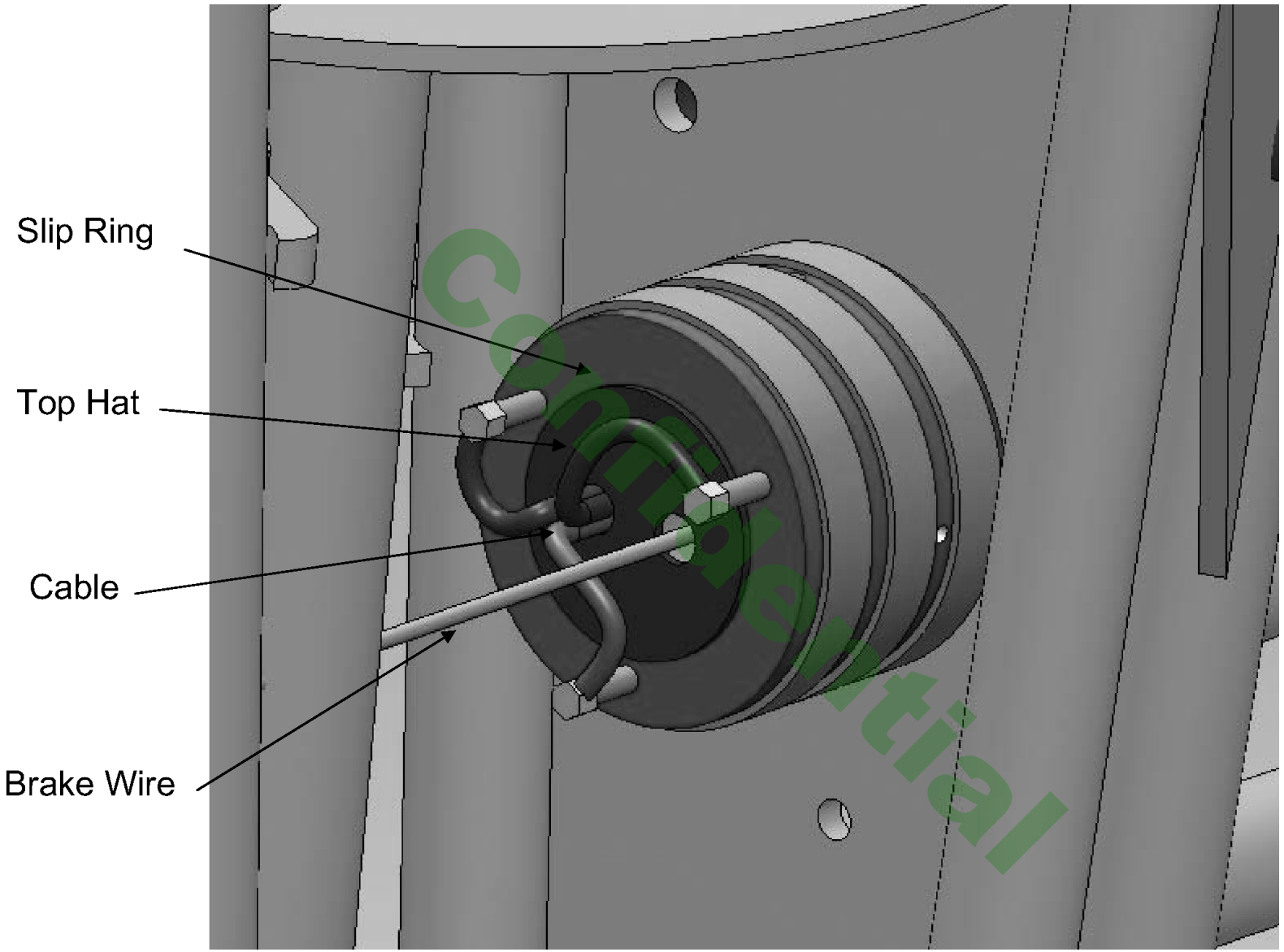
Install yaw rubber rollers (x4). Fit bolt through frame hole, guide through rubber and nylon washer and lower frame hole. DO NOT over tighten as the rubbers must be free to rotate.



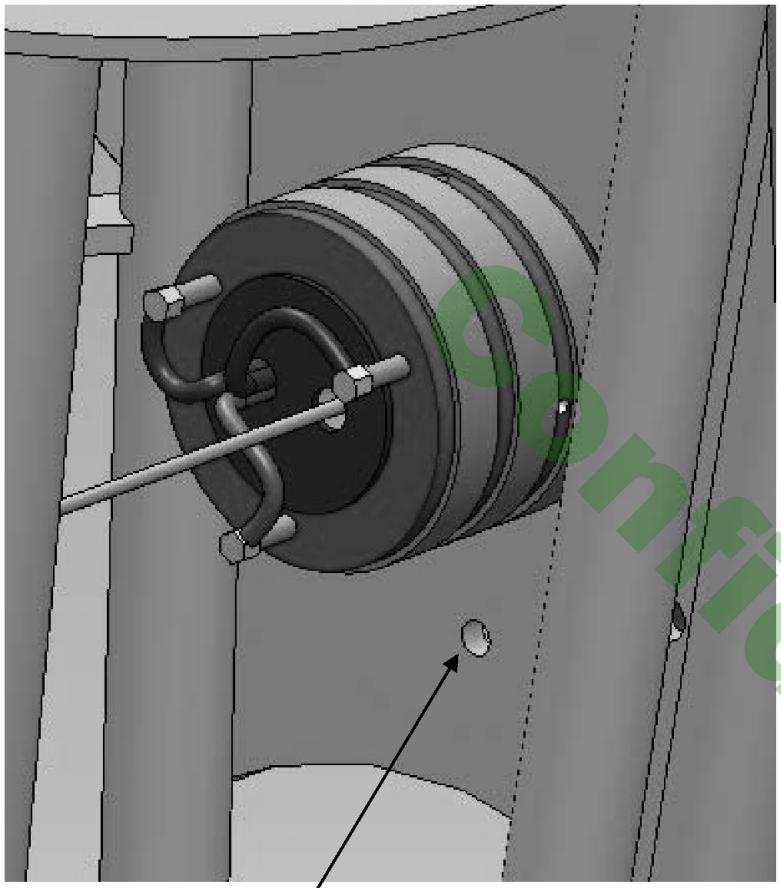
Check that everything is tight, and that the turbine freely rotates within it's yaw axis. Spin the rotor by hand checking that nothing rubs – especially the domed generator Cover. Gently tap the cover back into position and re-seal with silicon if required.



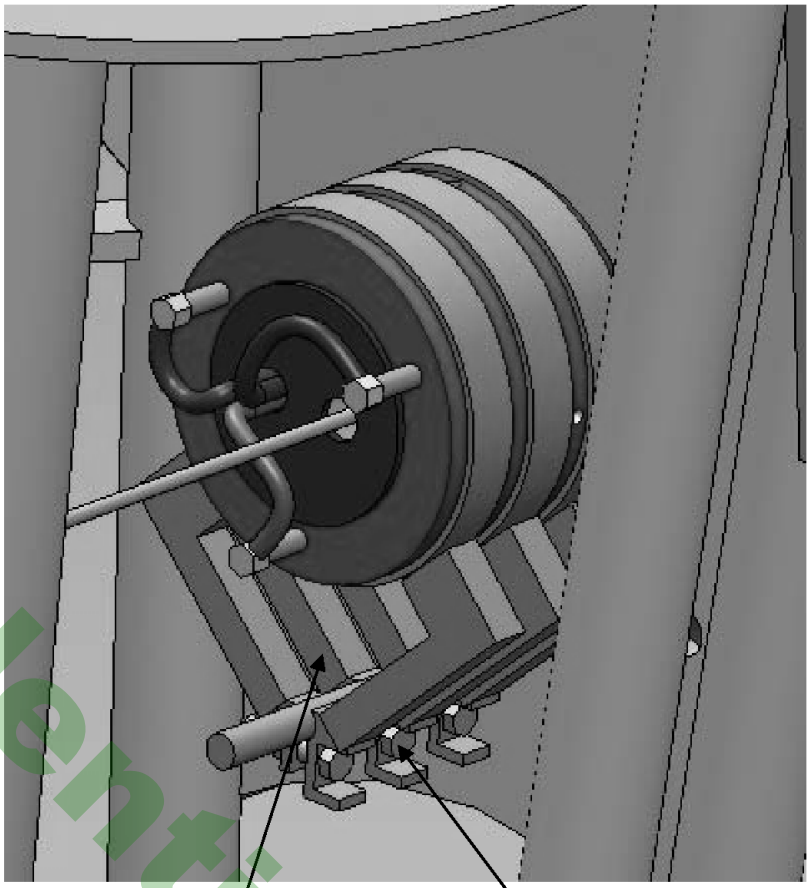
Position the slip ring so that the top-hat sits flush against the tower top. Use Loctite A118 when fitting slip ring to spigot, and on grub screws to securing in place.



Power cable & brake cable are to be installed in pole. Both the brake wire and power cable are to be pulled through the two holes in the top hat. Loosen the 3 stud nuts and connect the 3 cable ends to any of the 3 studs. Do not over tighten, vibration washers should be used for a secure fit.



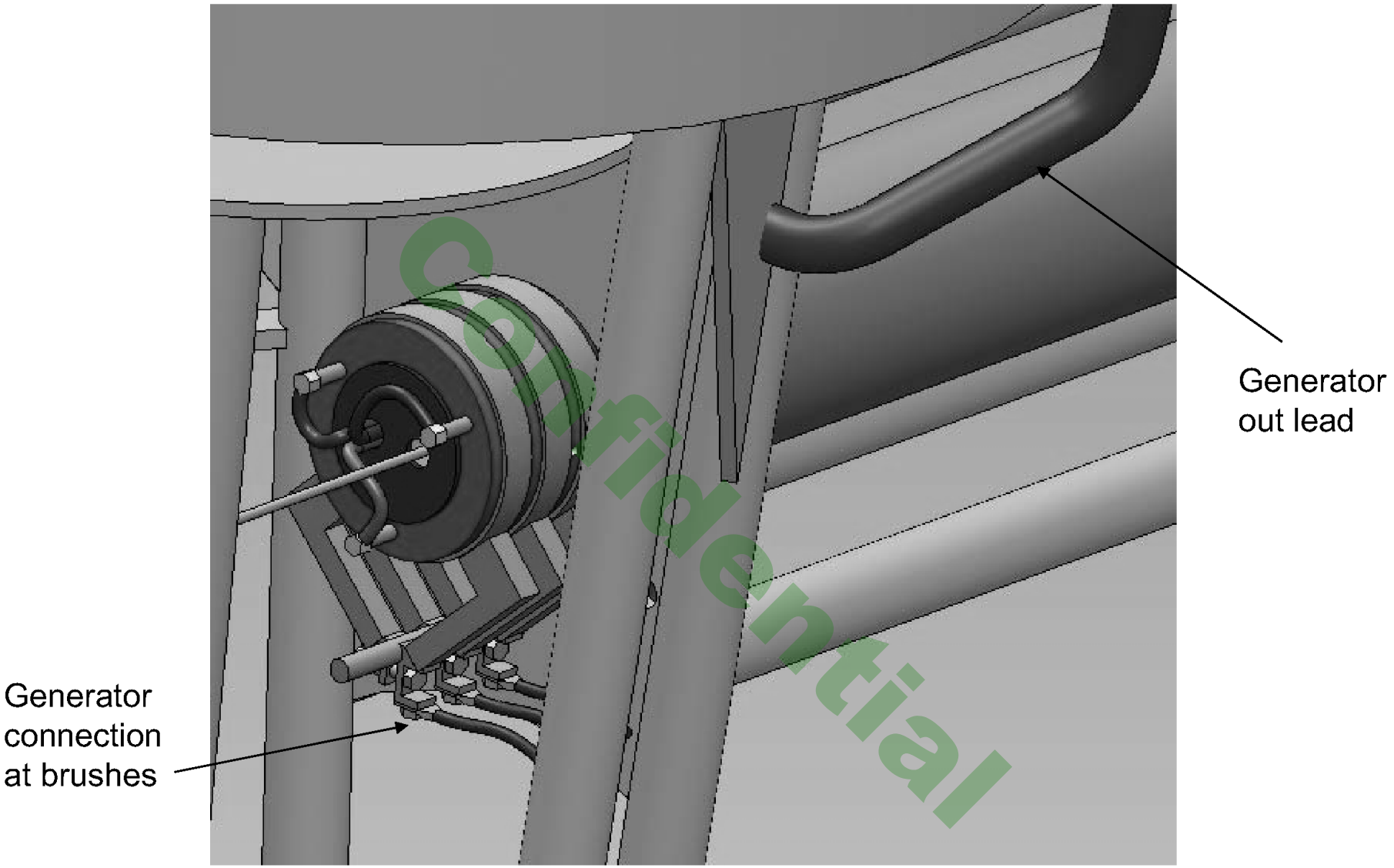
Slip Ring Brushes attachment hole



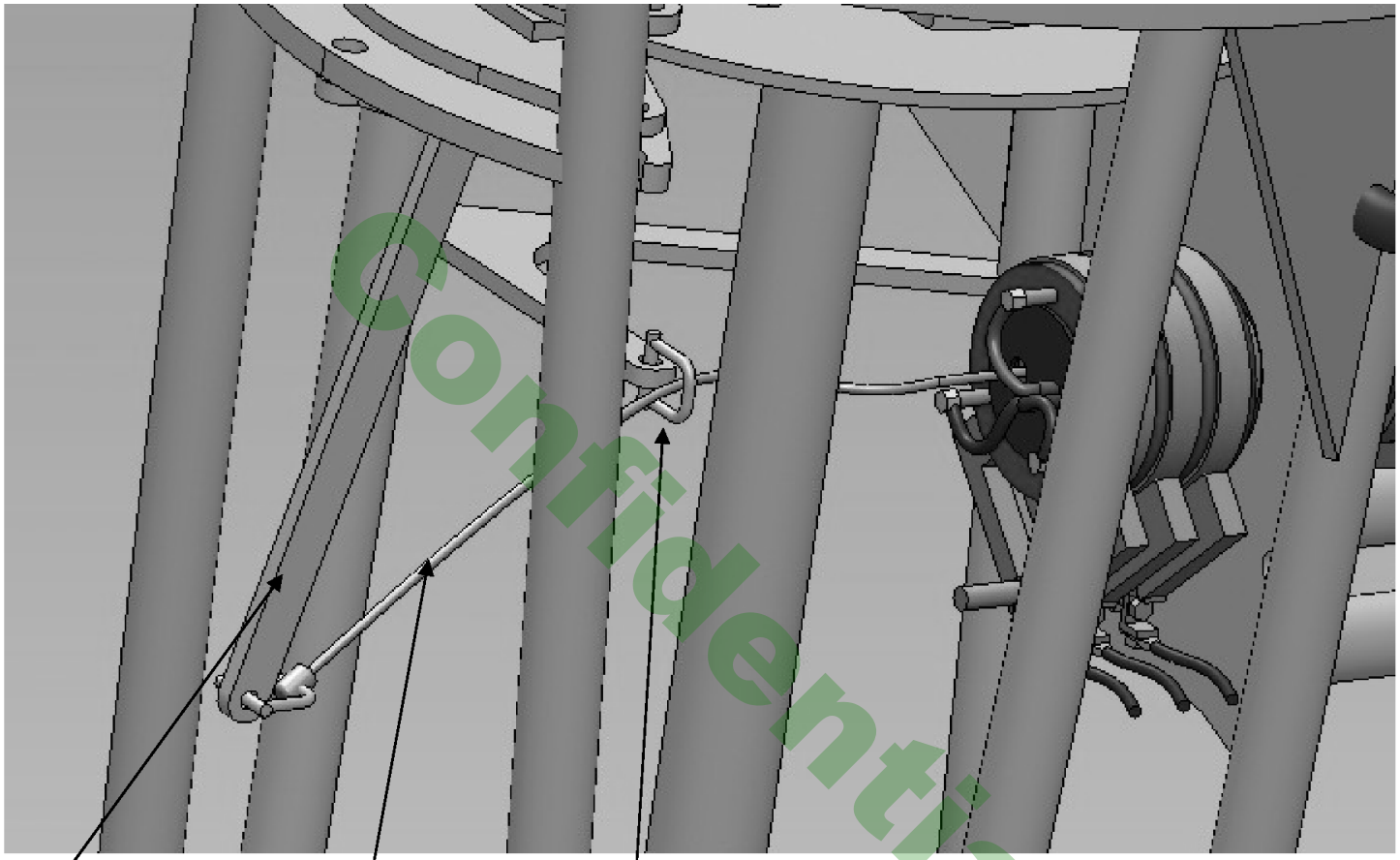
M10 brush adjustment bolts

Slip Ring Brushes in place

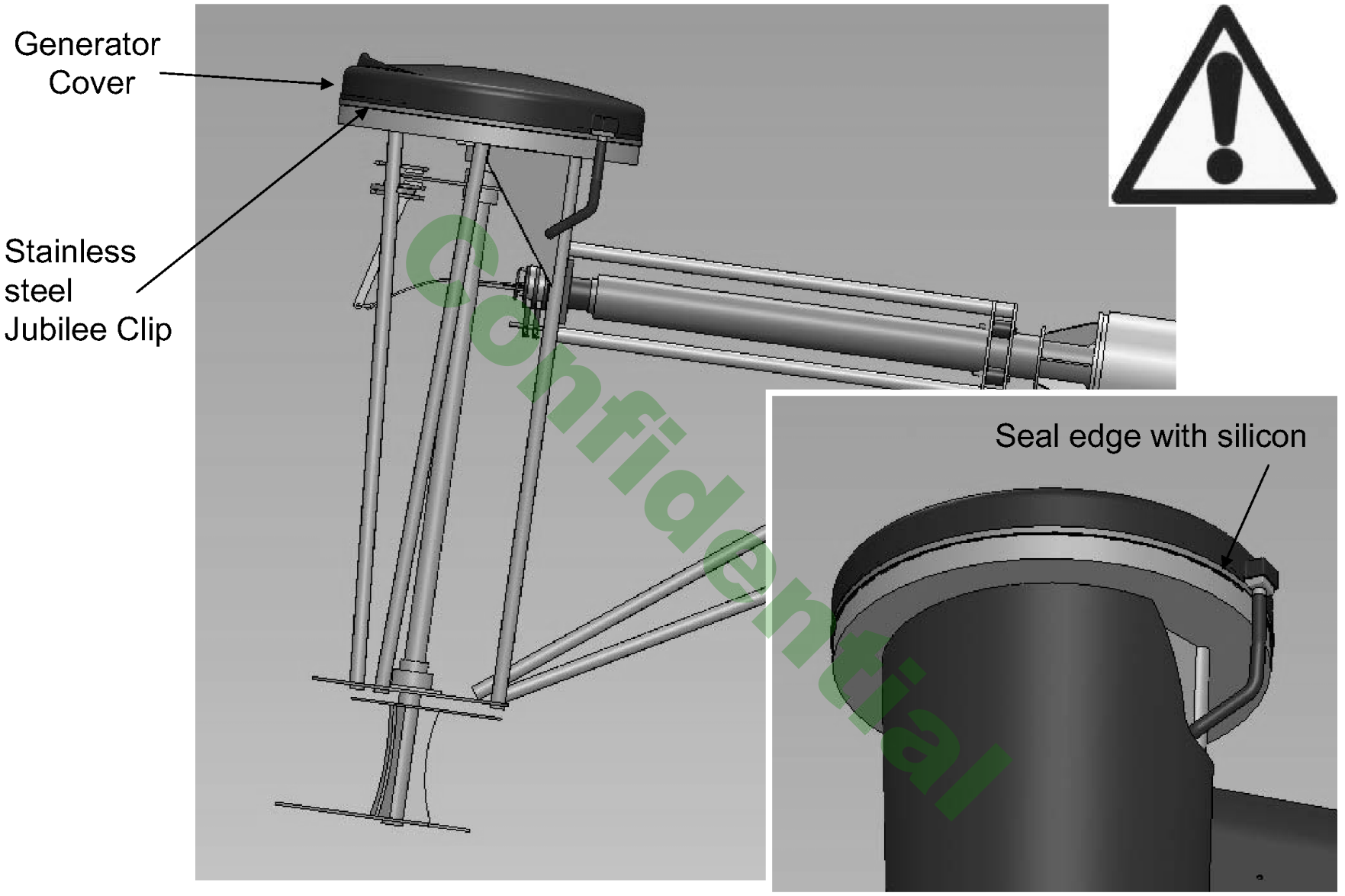
Using two 17mm spanners, attach the slip ring brushes to the turbine frame. With a 10mm socket loosen the bolts on the brushes so that they can move freely. Position the brushes In the middle of the rings, and tighten bolts. Ensure a good connection is made.



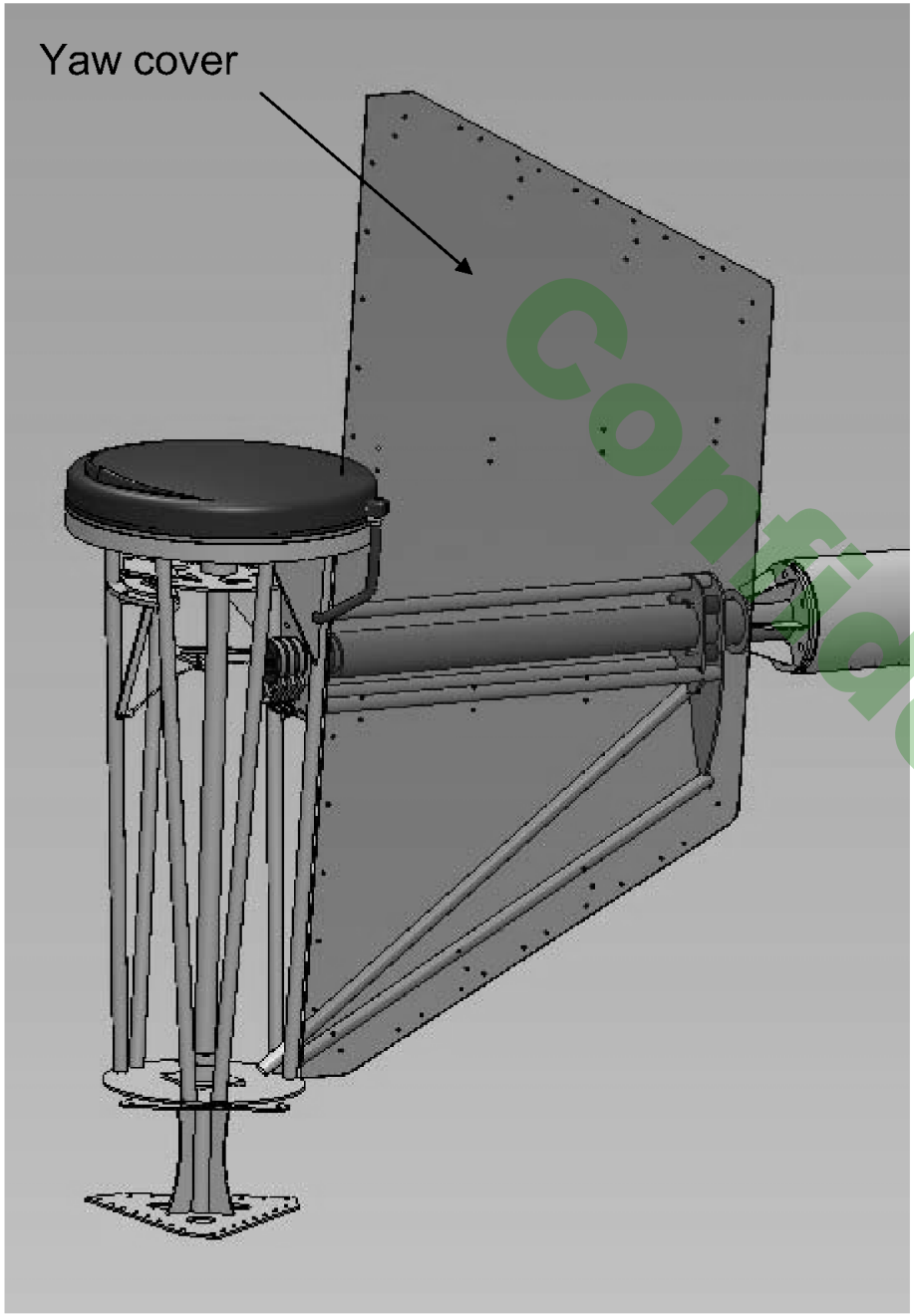
Connect the generator out lead to the brushes using a 10mm socket

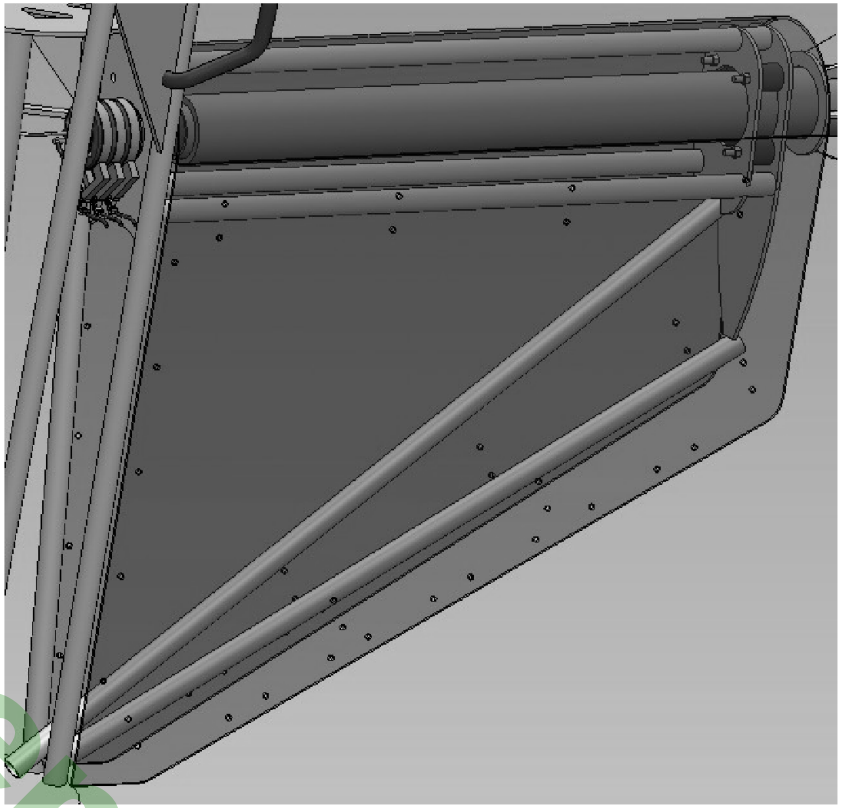


The brake wire is pulled through the second hole in the slip ring top hat. The wire must run through the guide shackle as shown, as to not rub on the generator shaft. The wire is connected to the end of the brake lever using a shackle

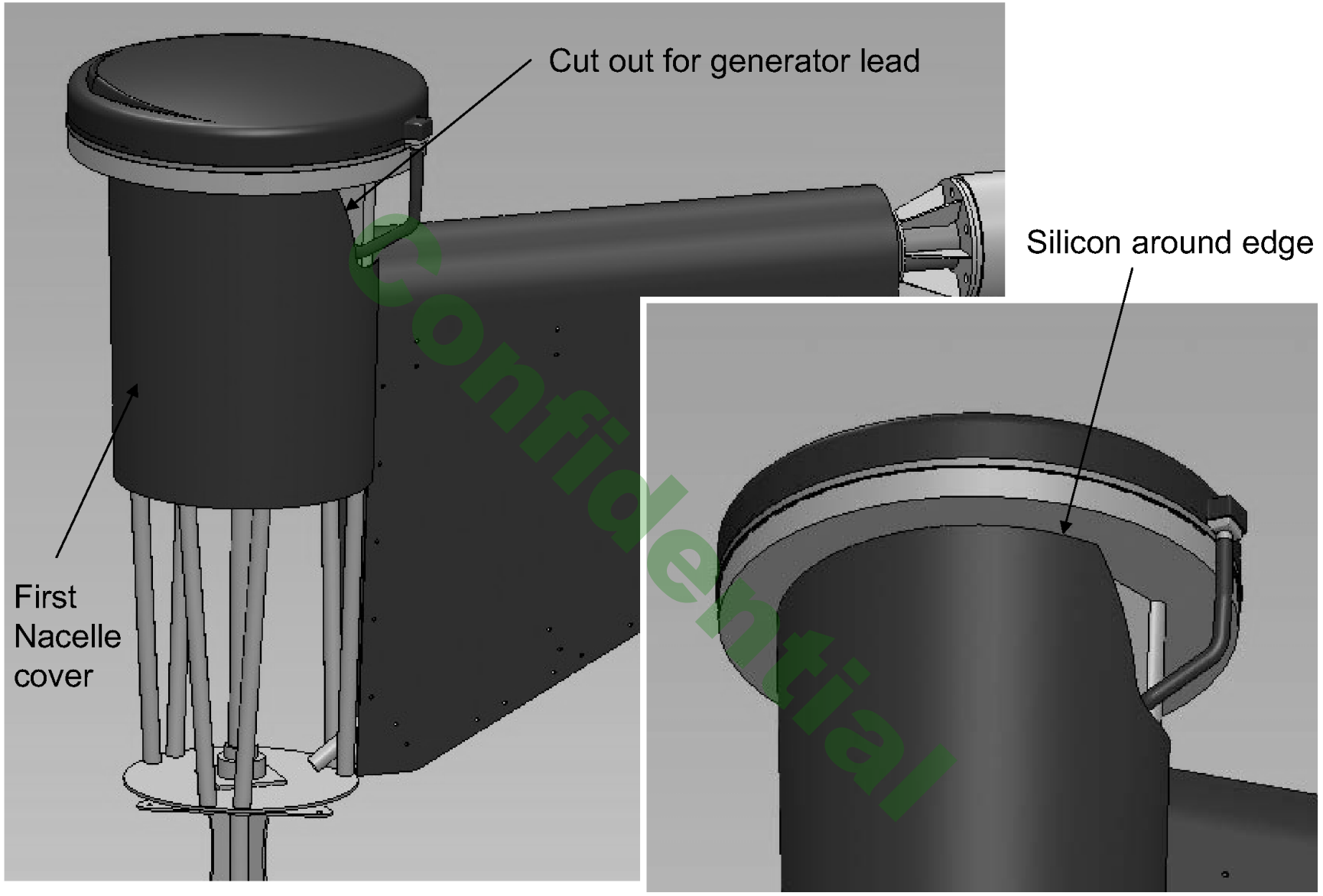


The generator cover is secured over the electrical generator by means of a stainless steel jubilee clip. This cover is supplied fitted. Check that the generator cover does not foul the moving parts of the generator. Seal edge of cover with silicon

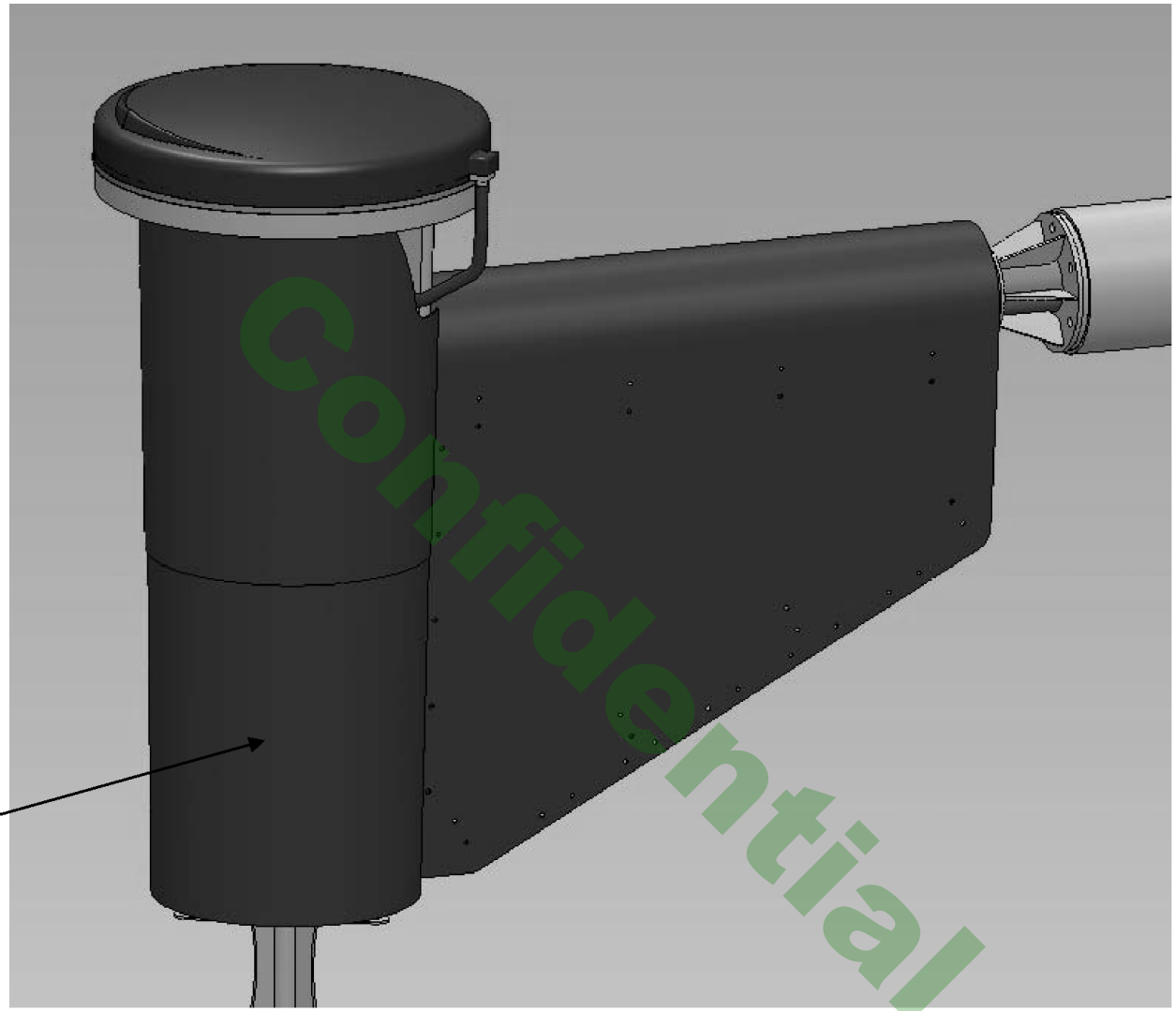




Step 1: Offer up yaw cover to one side of frame and attach using cable ties (supplied). Feed cable tie from front through cover, around steel bar and back out through the next hole. Only fasten loosely until all cable ties are in place.
Step 2: Fold the cover over the frame and attach the other side of the cover as in the previous step



Offer up the first Nacelle cover to the frame, attach using cable ties. Feed ties through cover, around steel plate and secure. Fold cover around frame and secure on other side. Ensure the cover is fitted so that the cut out for the generator lead is on the correct side.



Offer up the second nacelle cover to the frame. Fold around frame so that the cover sits Inside the first cover. Loosely stitch the two cover parts together, going around the frame also. Line up the two matching holes on either side of the both covers before securing the rest of the cover to the frame

Installing the Turbine blades

Caution:

Treat the blades with exceptional care – especially the leading
And trailing edges of the airfoil
Blades are supplied as a balanced set of three. DO NOT mix and match

Blade description

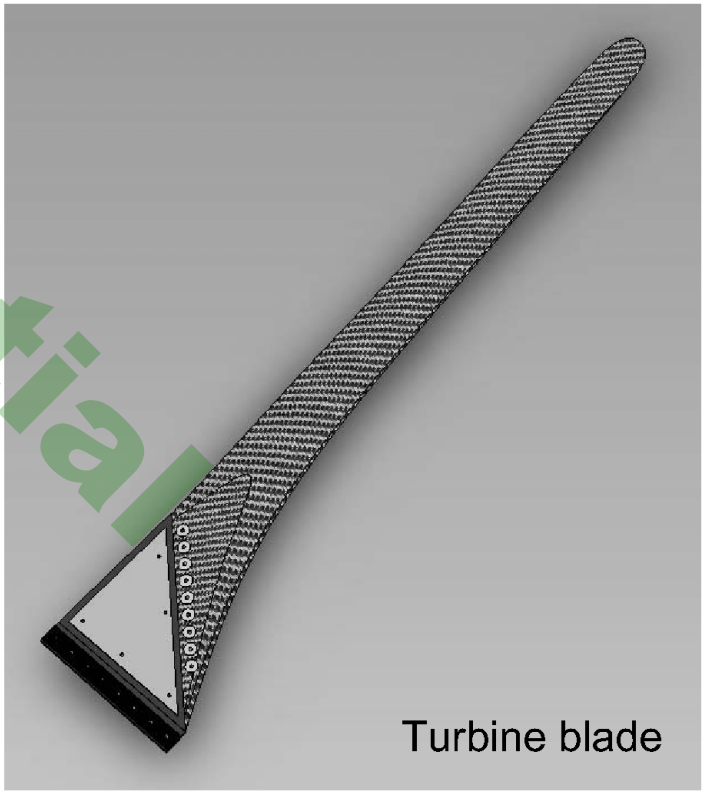
The blades are manufactured from the following parts:

1) Airfoil – glass thermoplastic
2) Zebedee hinge at blade root – polyurethane
3) Root of blade – galvanised steel

These parts are supplied already assembled

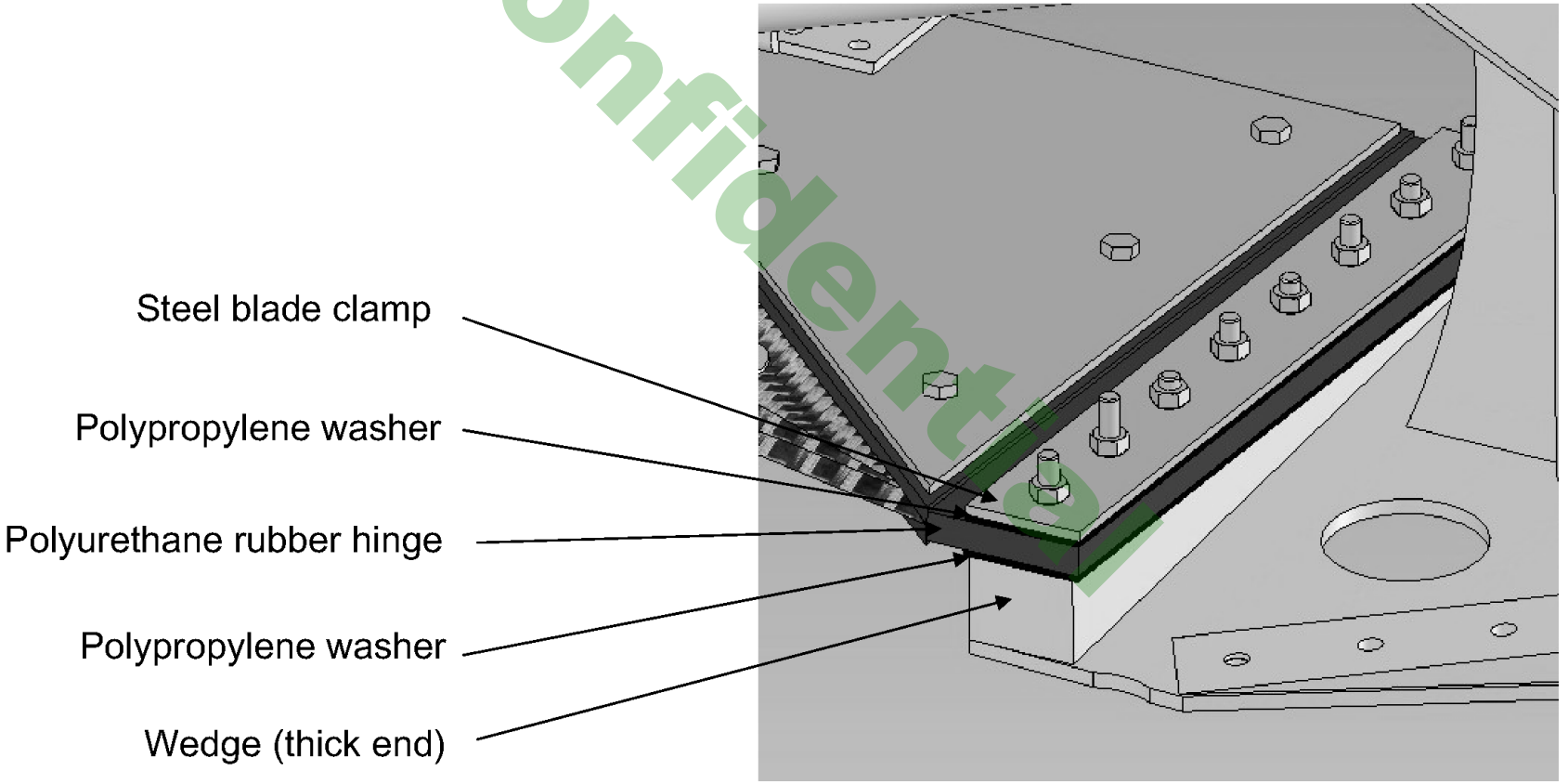
The blades are bolted to the hub plate by means of:

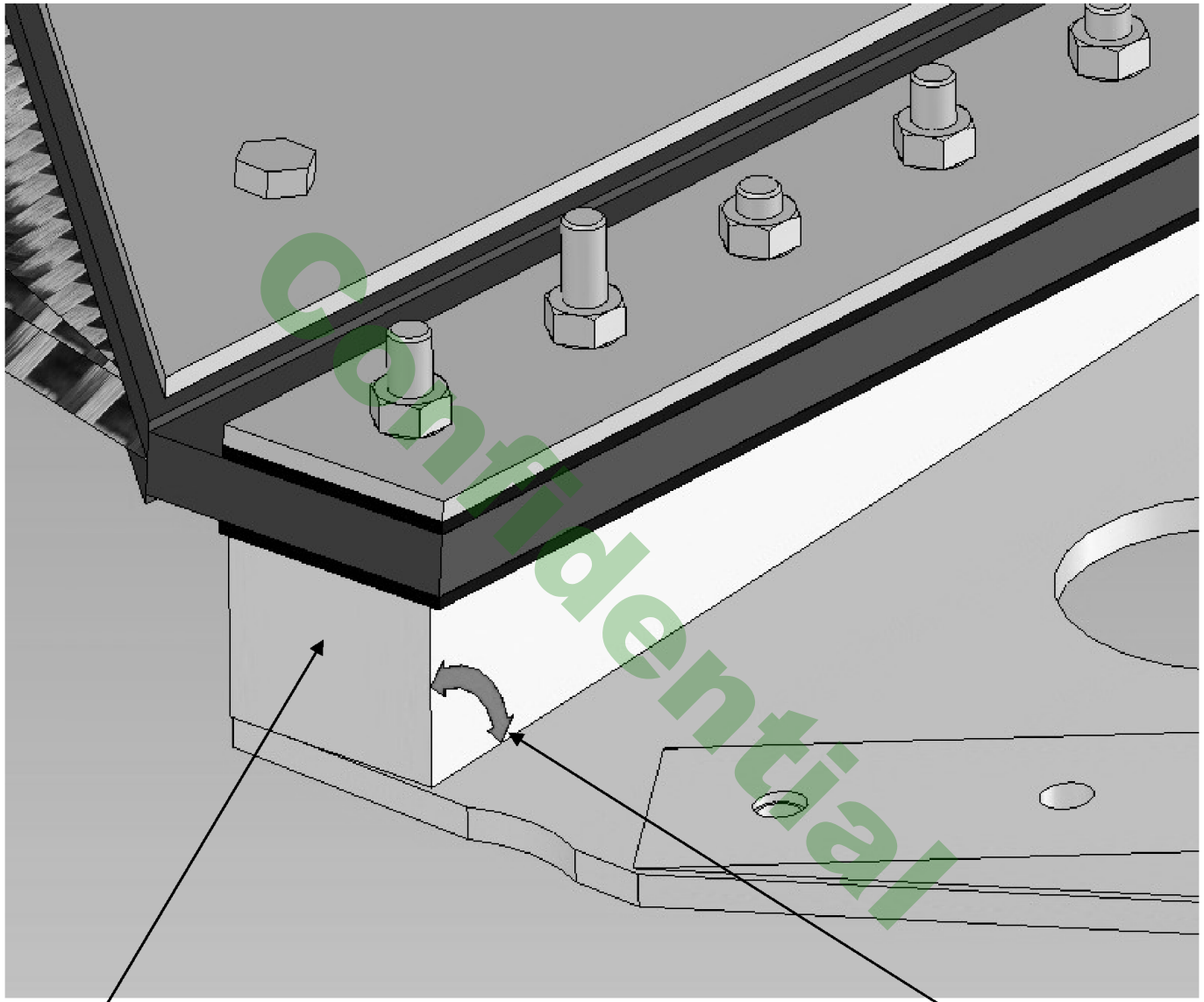
1) Stainless steel galvanised bolts
2) Galvanised steel clamp plates provided
3) Polypropylene clamp washer provided



Fitting the blades:

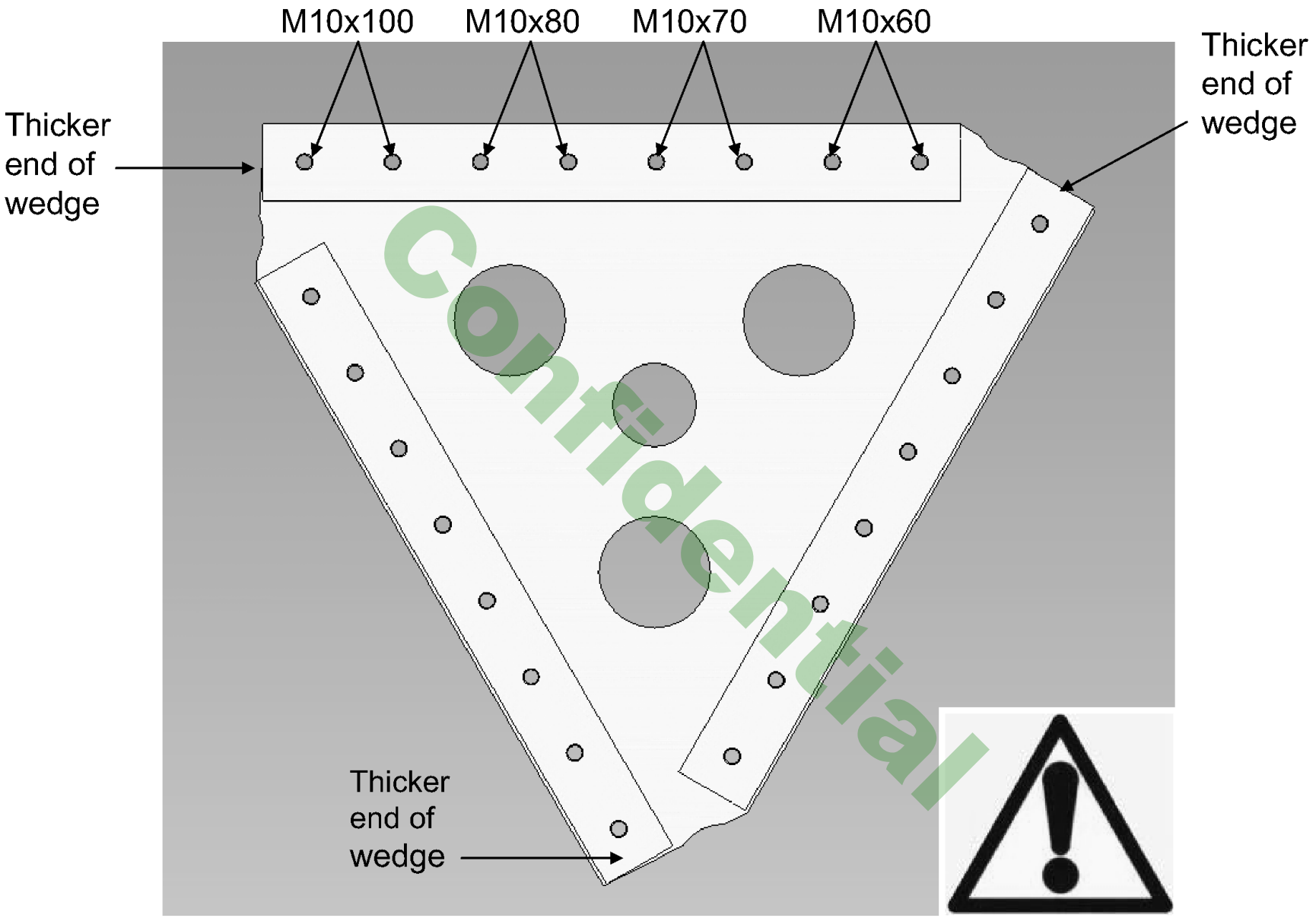
1) Place the polypropylene washer on top of the wedge
2) Place P.U rubber hinge of blade on top of polypropylene washer
3) Place further polypropylene washer on top with metal clamp plate as the final layer
4) Secure the blade using M10 bolts and lock nuts provided. (use small amount of thread locking compound on bolts)
5) Proceed to attach springs





Thicker end of wedge faces the same way as the trailing (thinner edge of the blade

End of wedge to be at 90 deg to hub



Ensure that the wedges are put the correct way or the turbine would over-speed

Zebedee springs: The Zebedee spring assembly consists of the following per blade:

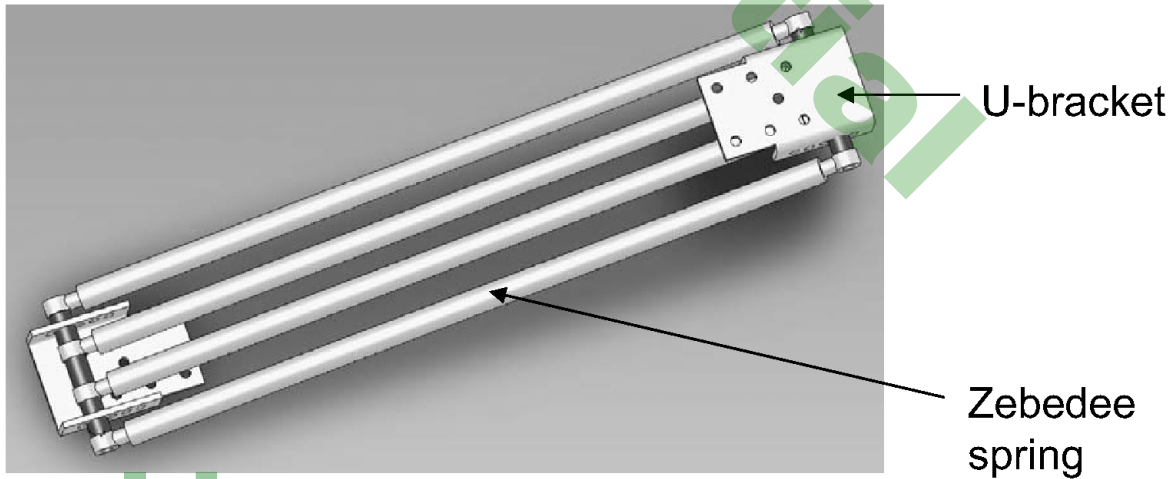
1) Zebedee spring assembly made up from four individual springs
2) U-bracket for connection to the spring hub plate
3) U-bracket for connection to the blade root

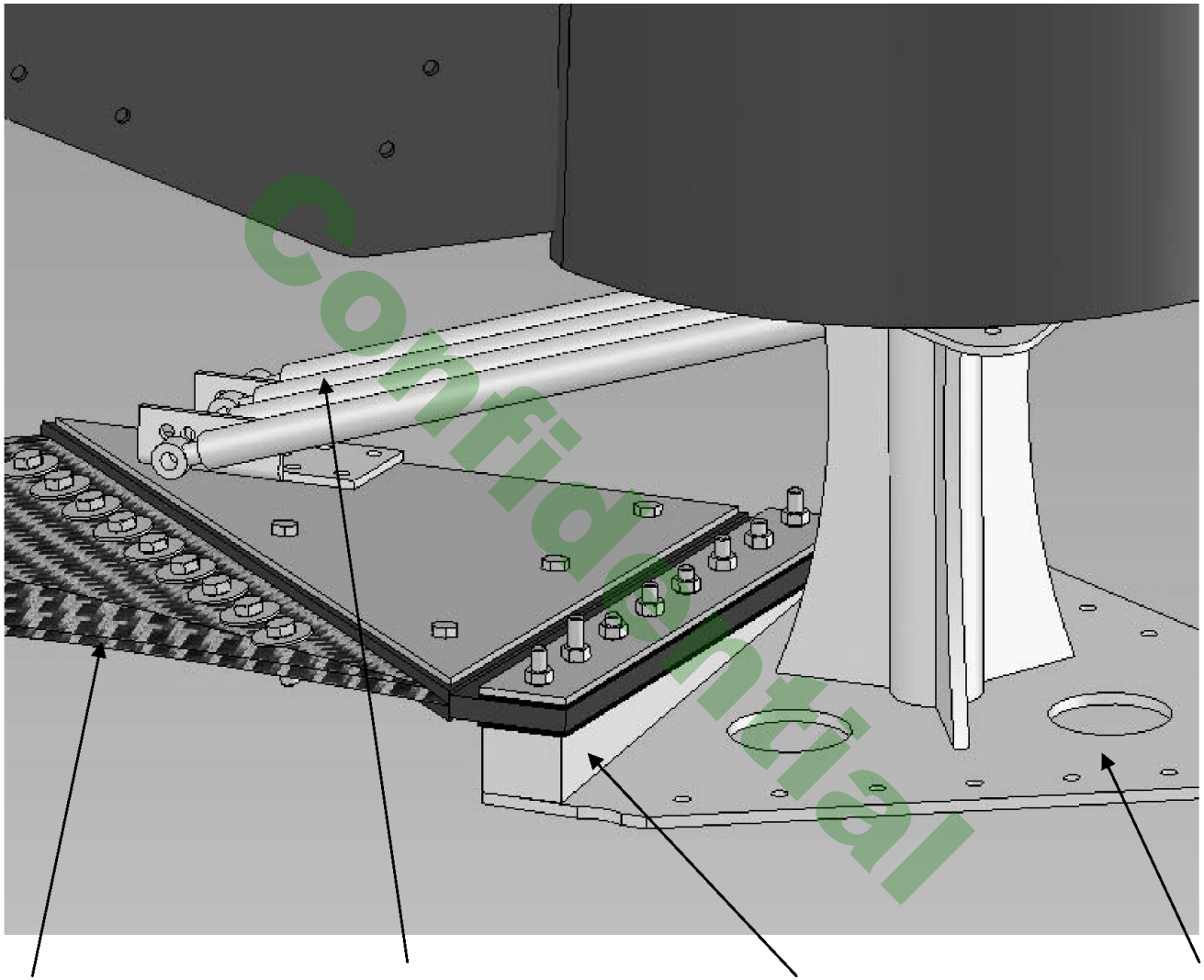
These items are supplied already assembled

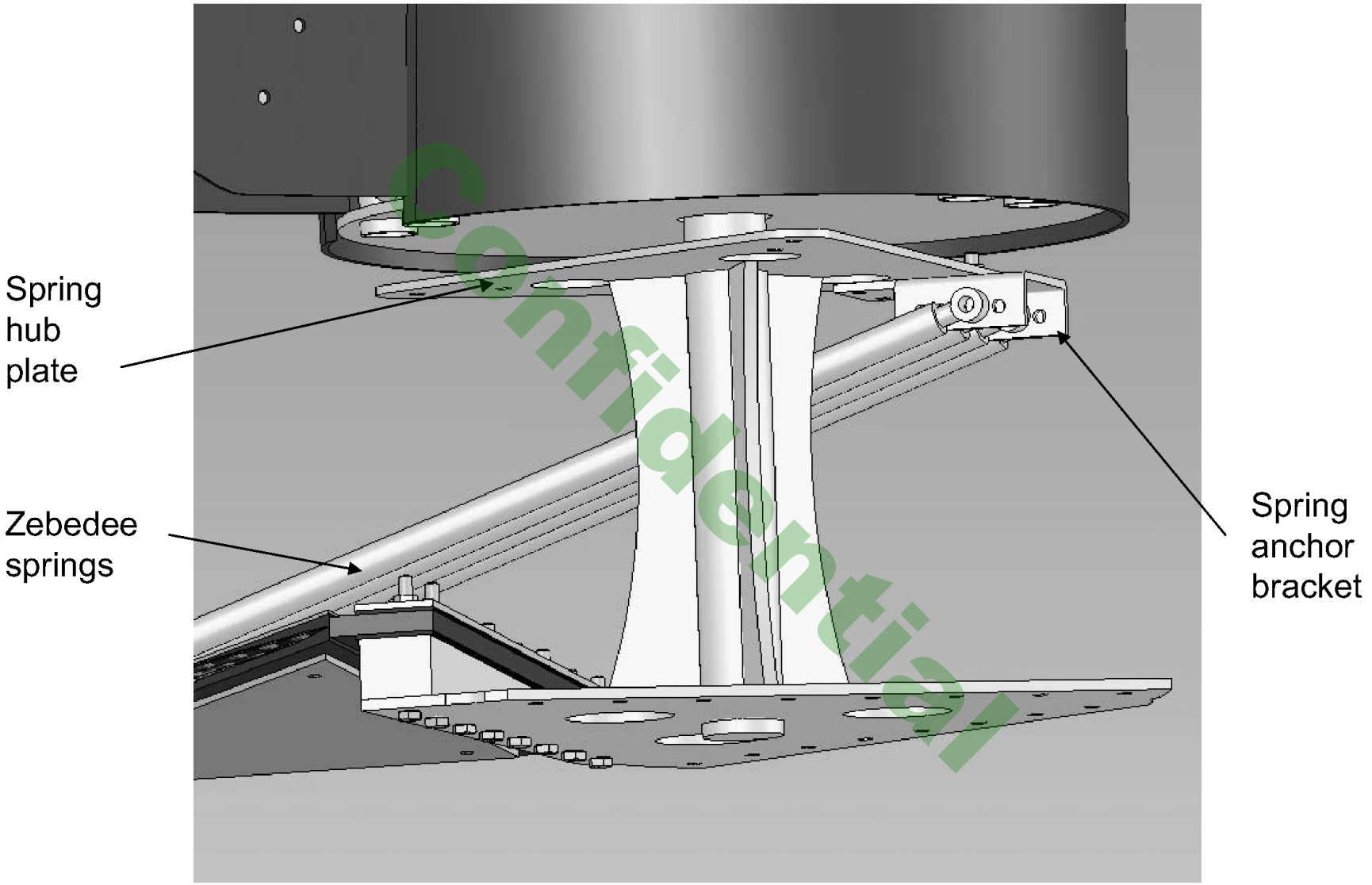
N.B – U-bracket for blade end and rotor end are marked on the U-brackets.
U-brackets are bolted using the bolt holes circled on them

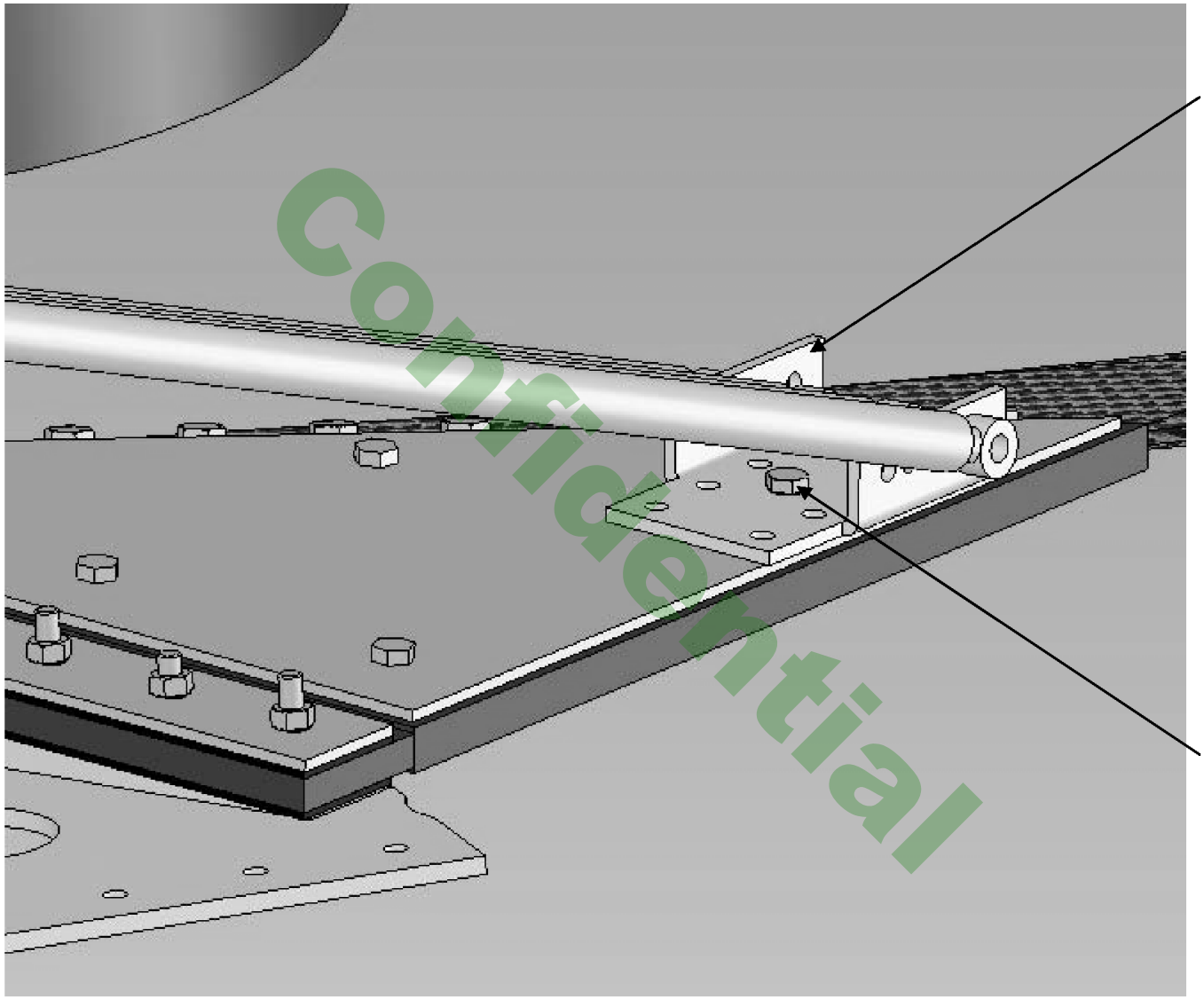
Fitting the Zebedee springs:

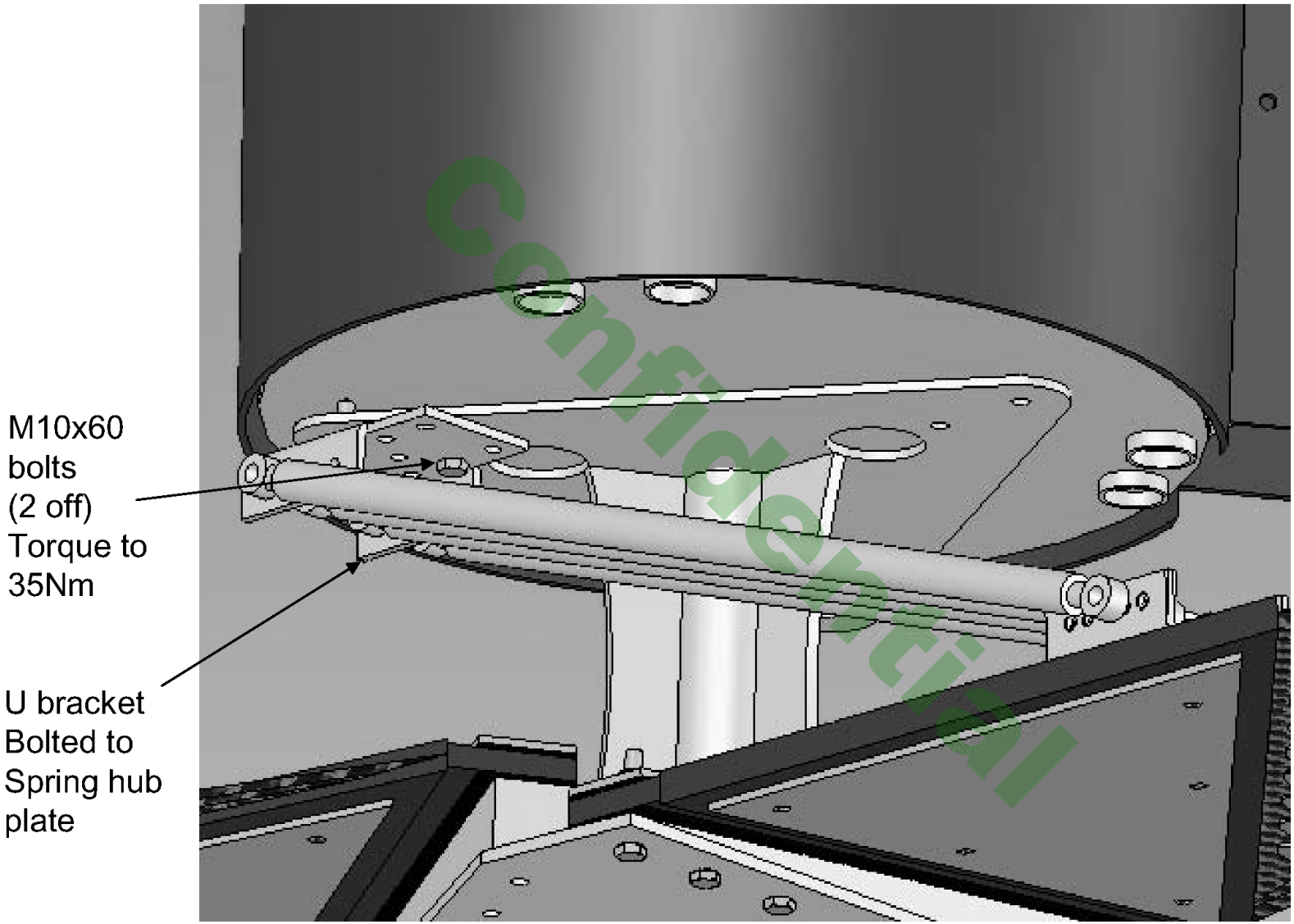
1) Apply Loctite on 2x M10x60 bolts
2) Bolt the U-bracket
3) Remove 1x M10 bolt at blade root (usually left loose)
4) Apply Loctite on 1x M10x70 bolt
5) Bolt the U-bracket (marked blade end) using the using the M10x70 bolts to the blade root (raise the blade at the tip slightly to help insert bolt through the blade root)
6) Repeat the steps above for the remaining two sets of springs







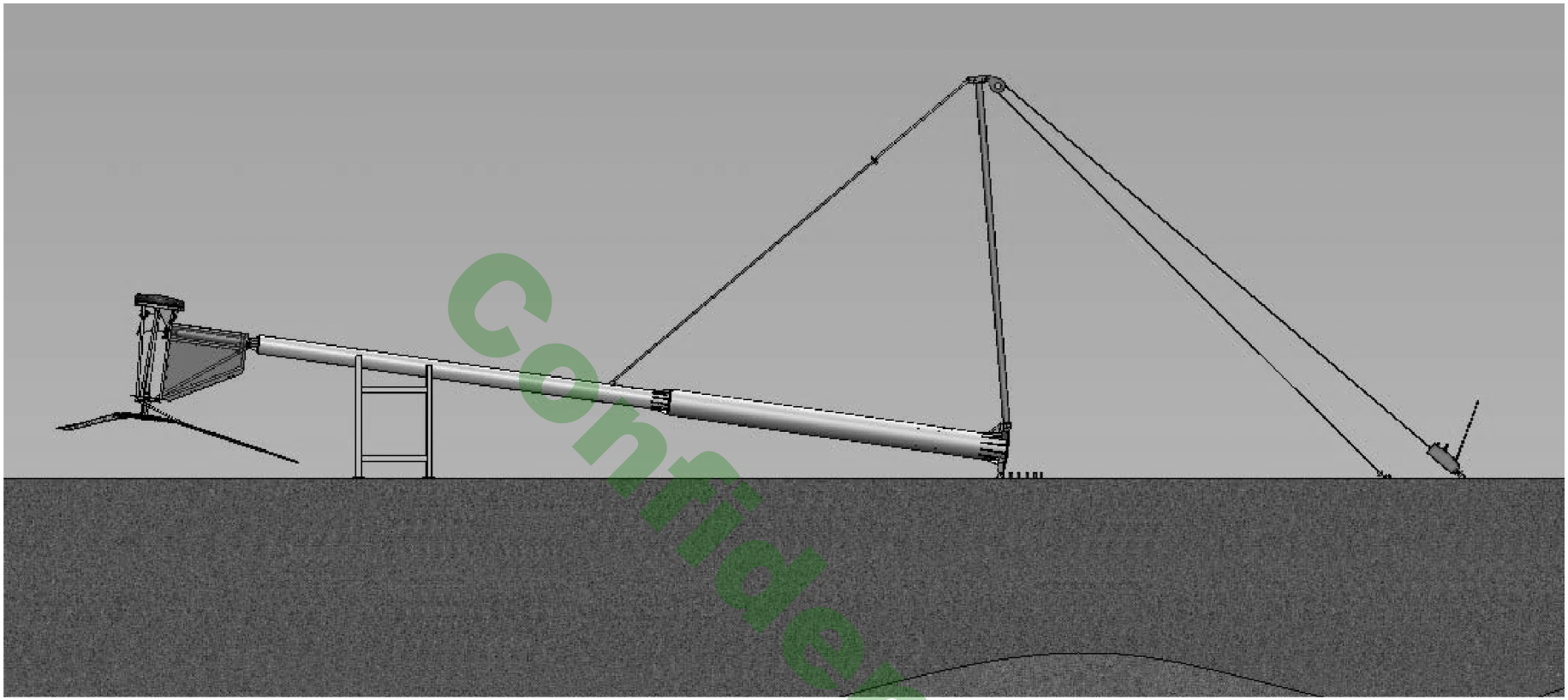




Caution!

Ensure that the blades and wedges are put the right Way or else the turbine will over-speed resulting in High voltage being transferred to the controller and inverter

Raising the turbine

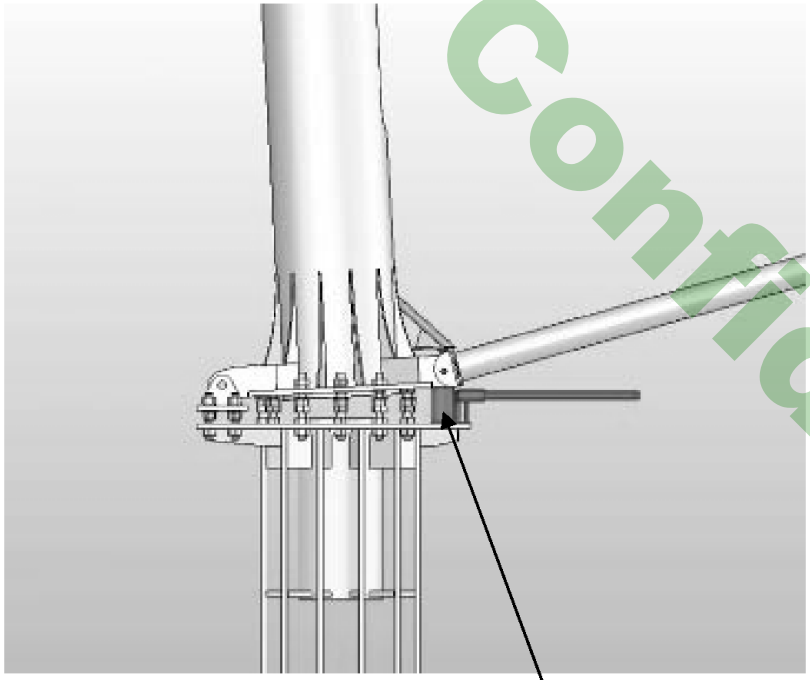


Clear the lifting area of all non essential personnel. Do not allow anyone to be in the vicinity of the wind turbine whilst raising and lowering

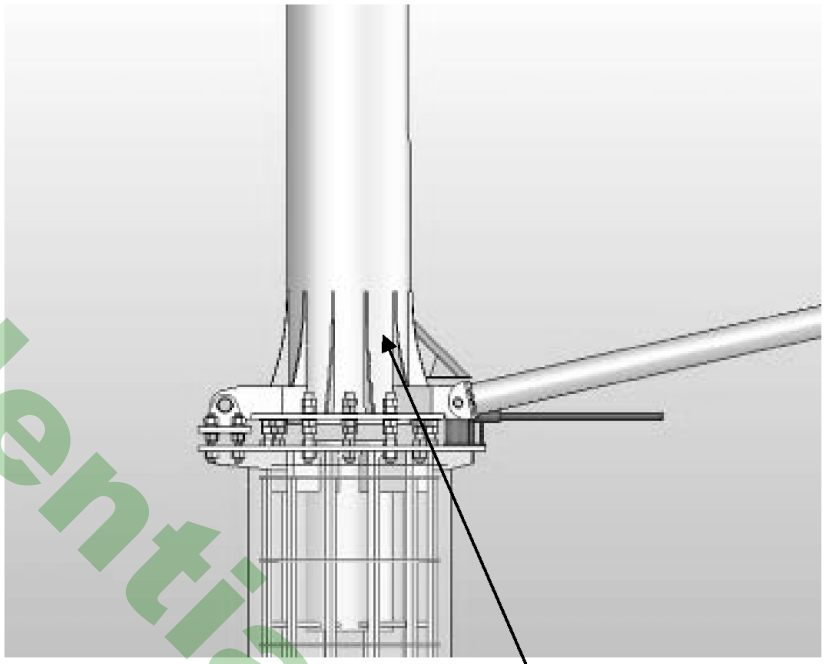
With the pole structure resting on the trestle, ensure that any slack is taken up using the Tirfur

1) Check that the cables will not be trapped under the pole base
2) Apply the wind turbine brake
3) Pull wind turbine up slowly using the Tirfur

4) As the pole is being lifted, an extended bottle jack can be placed in position under the jacking point to allow a controlled conclusion to raising the pole.



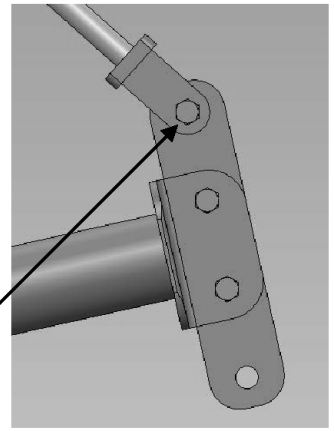
Raised bottle jack



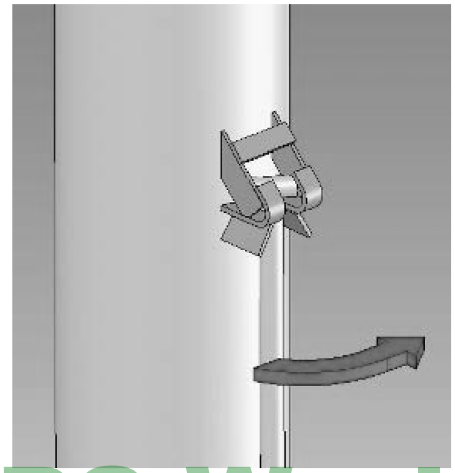
Pole upright

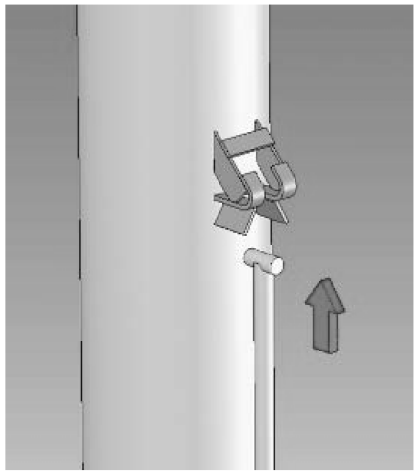
5) Slowly lower the bottle jack until the pole is upright, and the base plate is sitting on levelling nuts
6) When upright keep the tension on the rope until all of the M30 base nuts (24 off) have been levelled & tightened
7) When all bolts are tight, only now can the tension be released on the steel cable

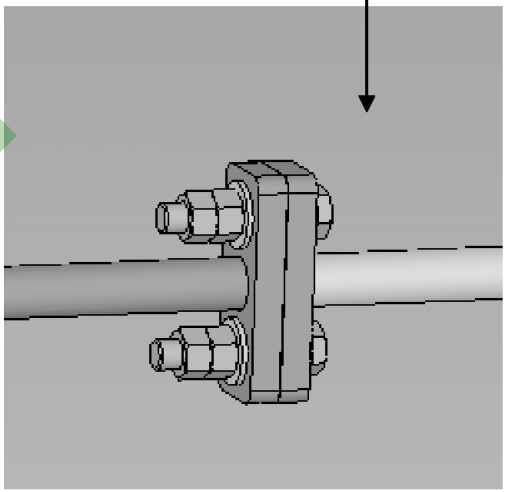
Care must be taken when dismantling the gin pole arrangement. The gin poles are heavy. Injury could result from mishandling



8) Dismantle lifting tackle (i.e. pulley, Tirfur, steel cable etc)
9) Undo the M20x100 bolt holding the end of the short tension member to the top of the pulley plate
10) The two main gin poles will now pivot down to the ground – Caution these are heavy items
11) The gin poles can now be disconnected from the base of the pole
12) Undo the two M20x100 bolts connecting the long and short tension member together
13) Release the long tension member from the bracket mounted on the pole. This is done by walking toward the pole holding the tension member until vertical lift slightly and rotate through 90 degrees. The tension member can now be withdrawn from the underside.







Lowering the turbine:

Clear the area of all non essential personnel. Do not allow anyone to be in the vicinity of the wind turbine whilst raising and lowering

1) Apply the wind turbine parking brake. Place trestle (allow clearance for turbine blades) to support tower when lowered.
2) Bolt both gin poles to base plate (fig.1)
3) Bolt pulley plate in-between gin poles (fig.2)

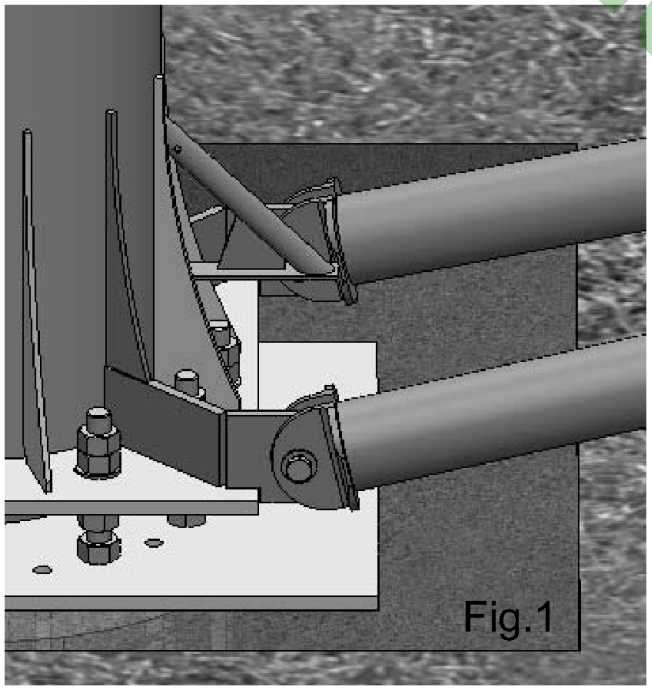


Fig.1

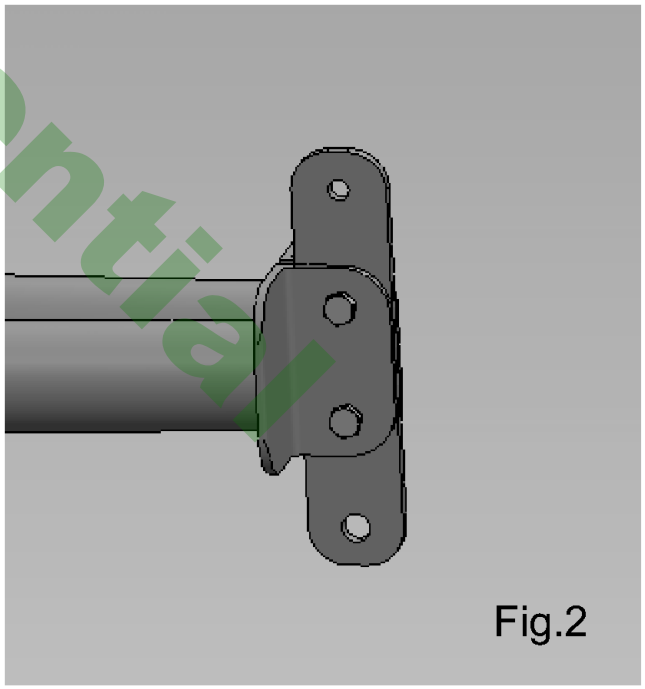


Fig.2

4) Attach the long tension member to the fixed bracket on the pole - offer up from the underside, rotate at 90 degrees and walk back towards anchor pad (fig.3)

5) Attach the short tension member to the end of the longer tension member (fig.4)

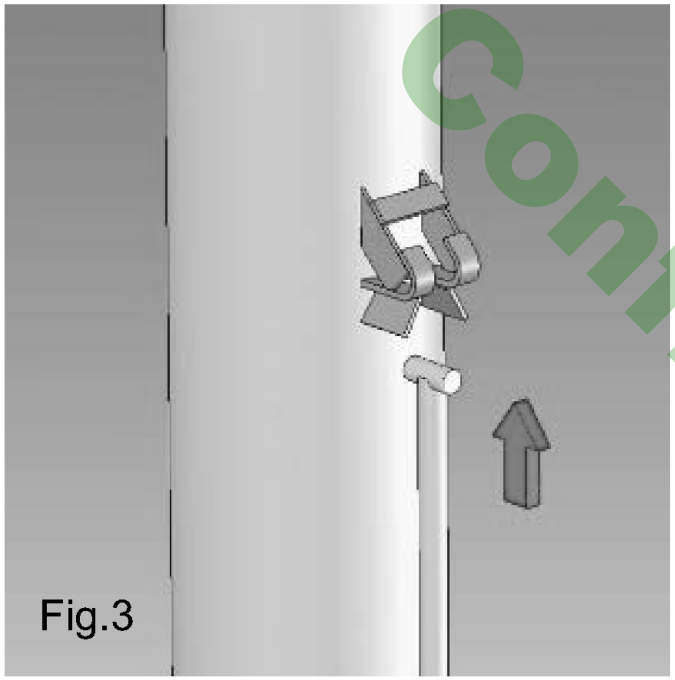


Fig.3

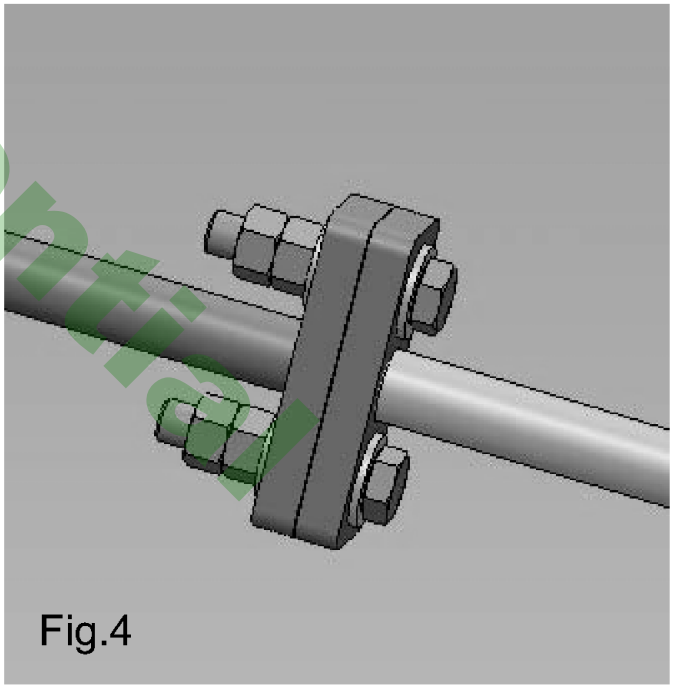


Fig.4

6) Lift the gin poles up off the ground and attach the top of the pulley plate to the end of the short tension member (fig.5)

7) Attach lifting tackle (i.e Tirfur, pulley, steel wire etc). Ensure all bolts and fasteners are tight before lowering (fig.6)

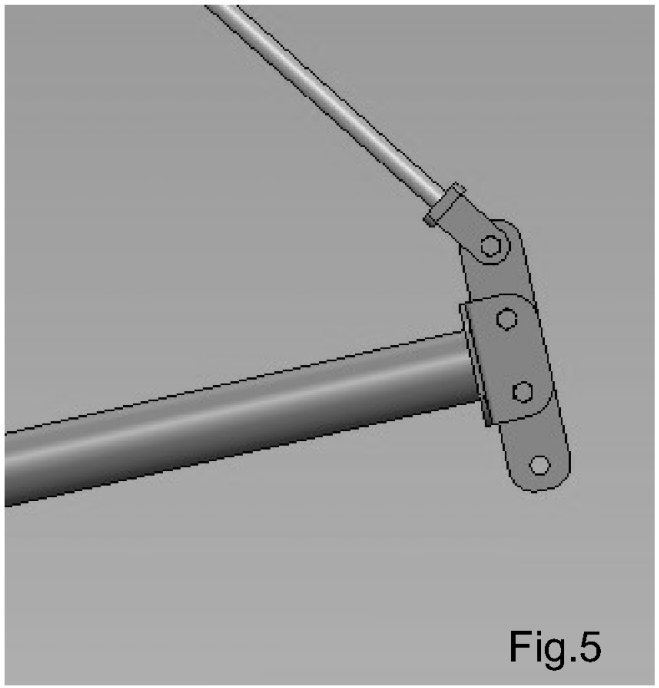


Fig.5

Fig.6

8) Take up slack in the steel wire using the Tirfur
9) Position the bottle jack under the jacking point (fig.7)
10) Remove base fixing fasteners
11) Pay out a little of the steel wire using the Tirfur (fig.8)

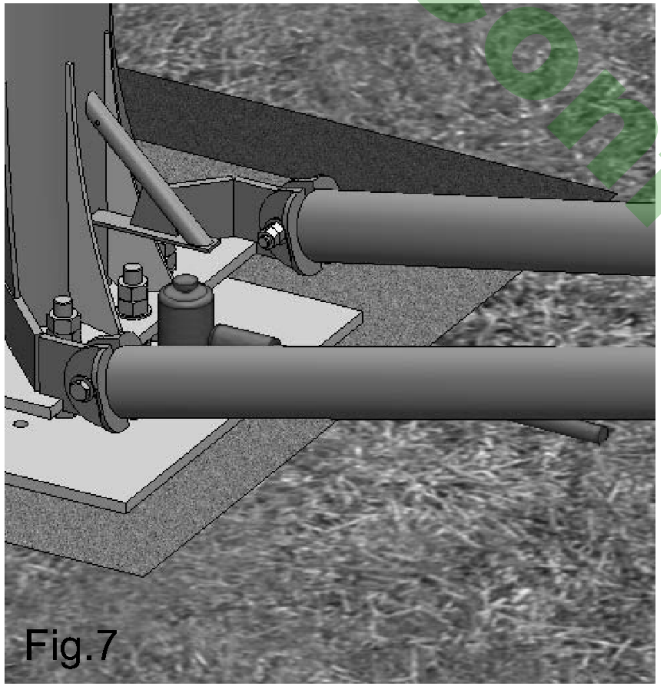


Fig.7

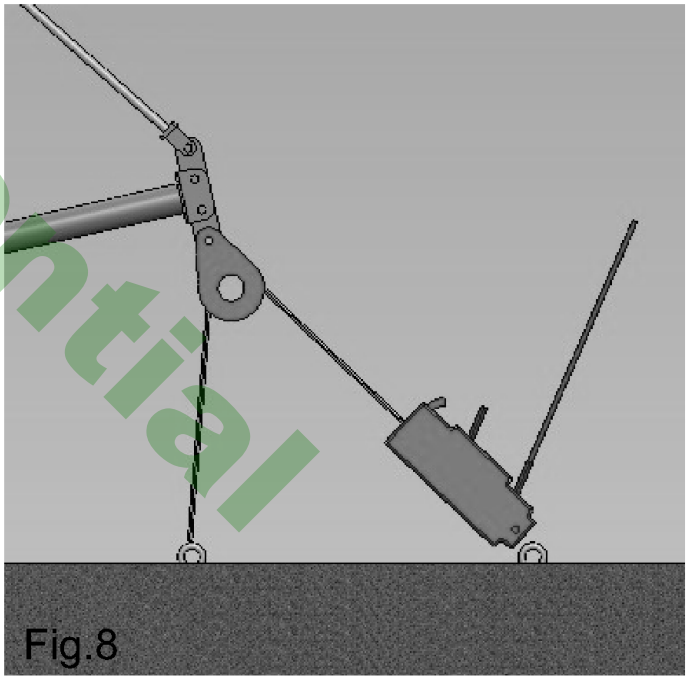


Fig.8

11) Begin to jack the tower to approximately 3 degrees, in order to tip the tower over its centre of gravity (fig.9)

12) Now lower the tower gradually using the Tirfur, so that it comes to rest on the trestle (fig.10)

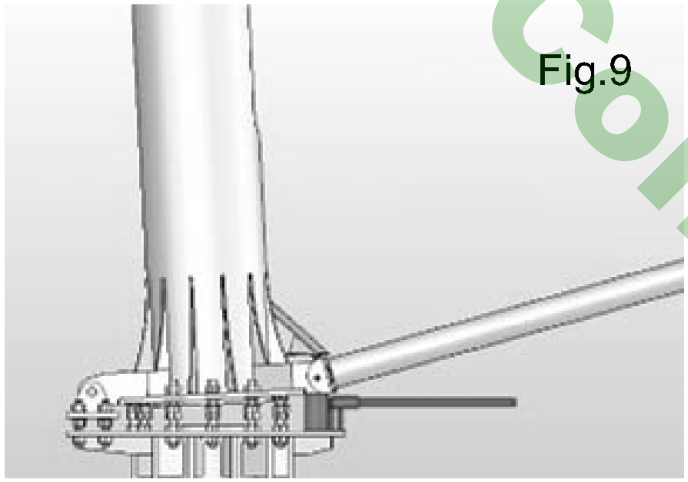


Fig.9

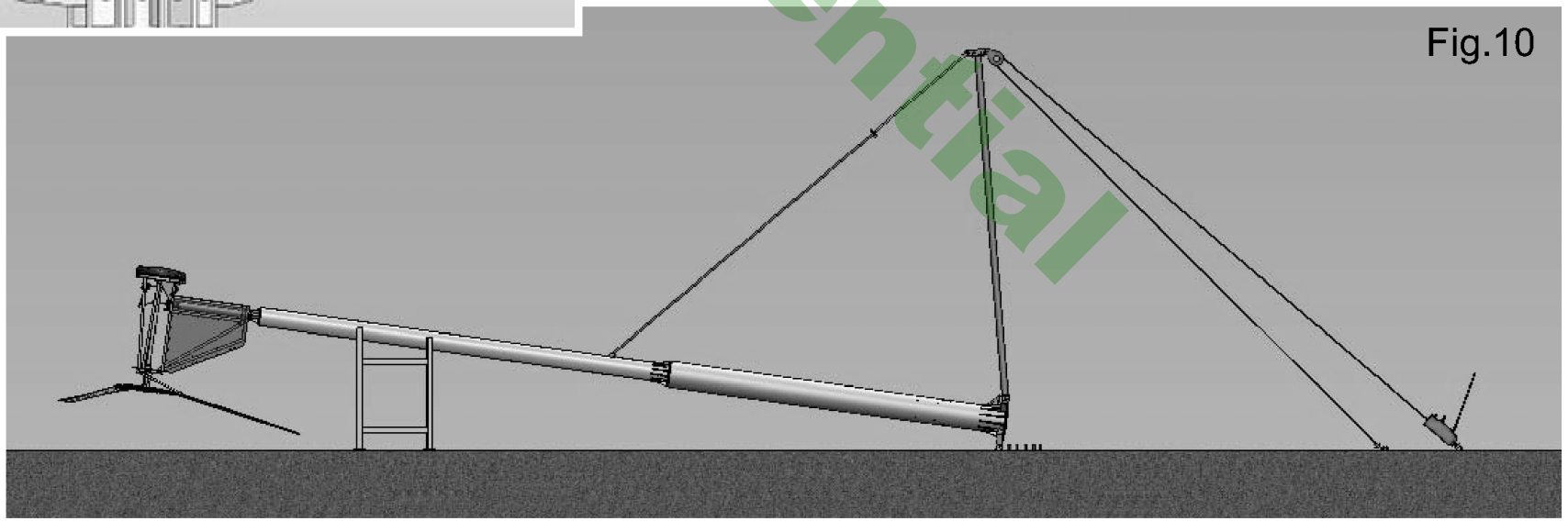


Fig.10

Turbine maintenance

Wind turbine maintenance

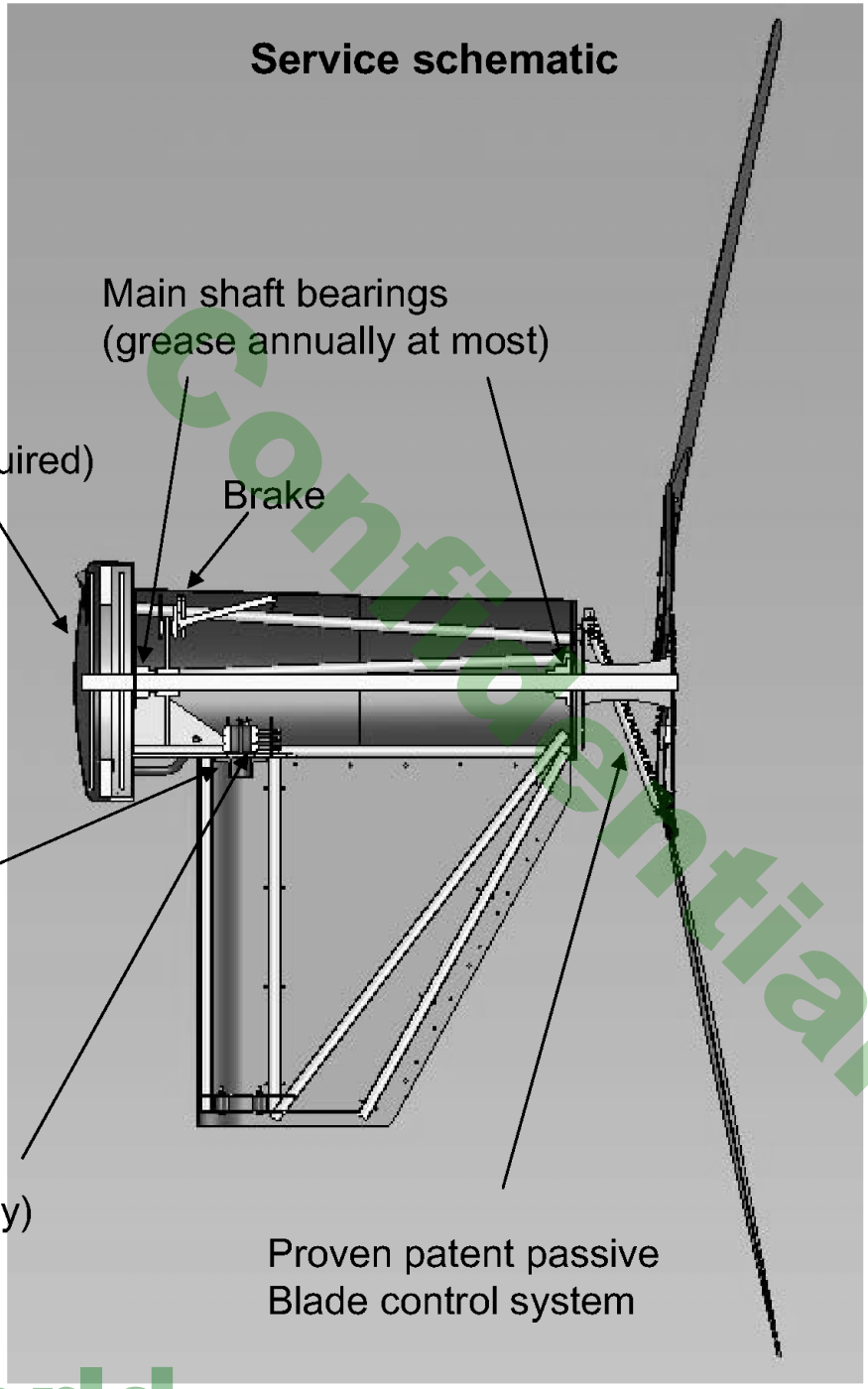
The proven 6kW wind turbine requires minimal maintenance. We recommend an annual service And regular visual inspection in order to notice any unusual occurrences.

Annual maintenance:

- Lower wind turbine as described previously
- Grease (lithium EP-2 multi purpose grease recommended) main rotor bearings and yaw bearing housing
- Clean slip ring assembly with emery cloth
- Check flange bolts and tower base bolts for tightness
- Listen for any abnormal noises or vibrations. If any exist check for loose fittings or components
- Check brake pad thickness is more than 2mm and replace if worn beyond 2mm
- Check brake operation before raising wind turbine
- Check for general wear & tear and replace any worn parts
- Pay particular attention to the blades, especially the blade root. A damaged or cracked blade should be repaired or replaced immediately.

Caution!

Any damaged or cracked blade should be repaired or replaced immediately



Maintenance Schedule:

Once per year:

•Grease he three bearings
•Clean slip rings
•Check brake pads
•Check nuts & bolts
•Check Zebedee springs

Operation:

No action is required during normal running.
The system is self regulating and automatic with passive fail-safe speed and power control.

Wind turbine maintenance schedule

TASK	TYPE OF SERVICE CHECK			
	INITIAL 3 MONTHS	QUARTERLY	ANNUALLY	AFTER 10 YEARS
Check for smooth running	Y	Y	Y	Y
Check tower bolts	Y	Y	Y	Y
Check ph-ph voltage	Y	-	Y	Y
Check brake operation	Y	-	Y	Y
Check blades	Y	-	Y	Y
Clean slip rings	-	-	Y	Y
Check slip ring brushes	-	-	Y	Y
Grease shaft bearings	-	-	Y	Y
Grease yaw bearings	-	-	Y	Y
Grease yaw rubber bolts	-	-	Y	Y
Check covers	-	-	Y	Y
Check welds	-	-	Y	Y
Change springs	-	-	Y	Y
Change blades	-	-	-	Y

Maintenance check list

- X = Check
- C = Clean
- G = Grease
- R = Replace if needed
- A = Adjust if needed

TOWER / BASE			
General Condition	X		
Foundations	X		
Nut / Bolt Tightness	X	A	
Welds / Fillets	X		
Hinge Bolts	X		
Gin Pole Assembly	X		
SLIP RING ASSEMBLY			
Slip ring assembly	X		
Slip ring body	X	C	
Slip ring brushes	X	A	R
Top-hat	X		
Nut / bolt tightness	X	A	
BLADES & SPRINGS			
Blade condition	X		
P.U Hinges	X		
Blade fixings	X		
Spring condition	X		
Nut / bolt tightness	X	A	

Wedges	X		
Washers / clamps	X		
BRAKE SYSTEM			
Brake assembly parts	X		
Brake operation	X		
Brake pads	X	R	
Shackles	X		
Brake rope condition	X	R	
Brake levers	X		
ELECTRICAL SYSTEM			
Controller operation	X		
V & I meter operation	X		
Cable connections	X	A	
Condition of wiring	X		
Inverter connections	X		
Battery connections	X		
Battery electrolyte level	X		
COVERS & OTHER CHECKS			
Generator cover condition	X		
Yaw cover condition	X		
Nacelle cover condition	X		
Cable ties	X	R	
Grease yaw rubber bolts	X		

Operation:

Once installed and commissioned the proven 6 wind turbine operates automatically. Power output will vary with the wind speed according to the power curve.

Vibration:

The turbine should run smoothly at all speeds. Any significant vibration of the turbine and tower assembly should be reported to proven energy and the turbine stopped.

Noise:

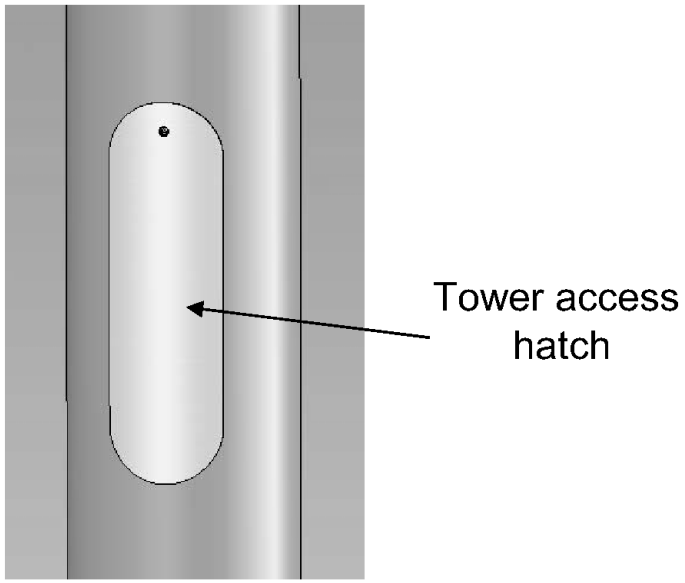
Virtually any device with moving parts makes noise and turbines are no exception. The turbine noise is produced by swishing sound from the blades as they rotate in the wind and is generally proportional to the wind speed and turbulence level. Noise is measured in decibels (dB). The noise the wind turbine creates is expressed in terms of sound per level which is a measurement of the noise power emitted by the turbine.
Proven wind turbines have low noise levels because they have no gearboxes which are a major Source of turbine noise. For example at 5m/s the emitted noise level is 45 decibels. It is perfectly Normal to stand underneath the turbine and practically have a conversation without shouting. At The rated speed however i.e. the speed where the blades cone inwards to limit power to rated, The noise level will increase slightly. Other than that any non-air noise should be reported to Proven energy.

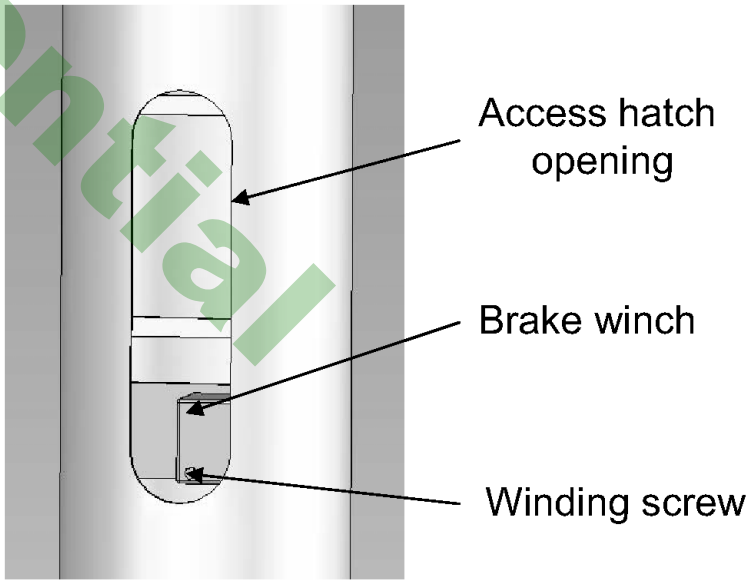
Stopping the wind turbine:

Due care & attention required

Due to the nature of the brake assembly on this type of turbine, we recommend wearing rigger gloves or similar when operating the brake lever.

1) Using the required key, remove the tower access hatch
2) With the hatch removed you will see the brake winch towards the bottom of the opening
3) Using the spanner supplied, turn the adjusting screw to wind in the webbing strap, which In turn is attached to the brake wire
4) Keep turning until the brake is engaged and the turbine blades are locked





PROBLEM	POSSIBLE CAUSE(S)	DIAGNOSIS	REMEDY
High noise level	- Loose fittings or components -Check yaw rubbers	- Check if all components are tightly fitted - Check if any bolts need grease (especially yaw rubber bolts)	- Tighten loose fittings or components - Grease bolts
Turbine fails to turn in good wind	- Shorted cables - Failed bearings - Turbine on brake	- Check connections - Check bearings - Check brake lever	- Repair short circuit - Replace bearings - Release brake
Turbine turns slowly in good wind	-Partial short in cables - Brake partially on	- Check connections - Check ph-ph voltages and resistances - Check brake lever	- Repair short circuit - Release brake
Low output	- Low wind speeds -Obstructions around turbine - High power usage - Incorrect inverter settings	- Check wind speed - Identify obstructions to wind regime - Check power usage - Check inverter settings	- Cut down nearby trees to turbine - Economise power use - Program inverters with correct settings
Turbine vibrates excessively	- Blades incorrectly fitted - Yaw rubber worn - Tower bolts not tightened	- Check blade assembly - Check yaw rubbers - Check tower bolts	- Fit blades properly - Replace yaw rubbers - Fully tighten tower bolts
No output although turbine turns at high speed	- Cables disconnected - Battery fuse blown - Controller ammeter open circuit	- Check connections	- Fix cables - replace fuse - replace meter