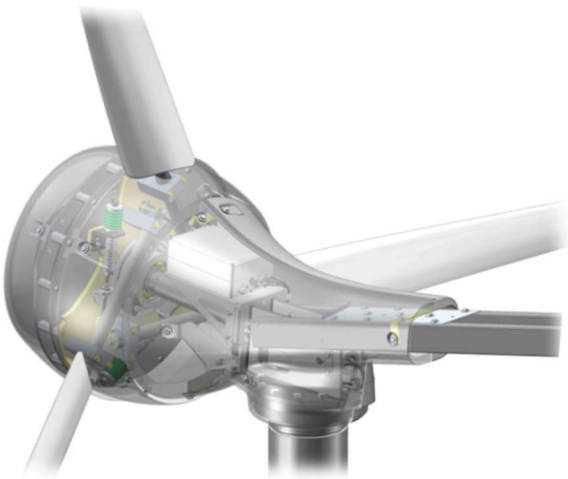




**Britwind**

## Installation Procedure

R9000 with  
Serial Numbers  
Starting 0160





Always check for the latest issue of this document on Website:- [www.britwind.co.uk](http://www.britwind.co.uk)

	Description	Author	Checked	Date
SM0302-01	Initial release for turbine serial numbers starting 0160	JB	MW	28.2.14
SM0302-02				
SM0302-03	Revised to show updated tower base slip ring arrangement and tail boom drip brackets. Dinitrol LT spec added. Layout adjusted in line with revisions	JB		



This symbol indicates a warning or care point, where instructions should be carefully followed.



This symbol indicates a safety critical item or stage. Installers should ensure these points are verified and ensured to be followed correctly. If not, the result could present a serious risk to the turbine structure.



Only personnel trained and certified by Britwind Ltd or by Britwind Ltd should install the R9000 turbines. Many aspects of installation are safety critical. Incorrect installation can lead to failures which might endanger life. Britwind will not accept any liability (product related or otherwise) for turbines which have been installed by personnel not fully certified. If you are not certified, do not install the turbine. If you are certified, and are in any doubt about any instruction contained in this document, contact Britwind before installation.




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## Packaging Contents


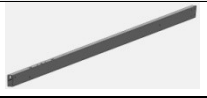

**CRATE 1** (Weight 275 Kg. Dimensions: L 126cm, W 83cm, H 117cm)

STANDARD TO BE PACKED IN CRATE 1			
Pictures	Description	Qty.	Received
	R9000 Wind Turbine - Core Unit and Middle Cover	1	
	Brake Coil	1	
	Yaw Bearing	1	
Box Containing Various Brackets, Sleeves, Bushes and Fasteners	Fasteners Box ( See Item List on page 5)	1	
	Tower Base Slip Ring	1	
	Power Cable Guide Bracket (Boxed)	1	
	H-section Seal	1	
	Front Cover Assy - Bubble Wrapped	1	
	Side cover Left - Bubble Wrapped	1	



	Side cover Right - Bubble Wrapped	1	
	Tail Vane	1	
	Rectifier Enclosure (may be larger enclosure for some versions)	1	
	Power Cables	1	
Optional Items	Twin/Single Phase Panel Meter & Inverters	1	

**CRATE 2** (Weight 100 Kg. Dimensions: L 310cm, W 46cm, H 48cm)

STANDARD TO BE PACKED IN CRATE 2			
Pictures	Description	Qty.	Received
	Assy. Single Blade Unit	3	
	Assy. Boom Left	1	
	Assy. Boom Right	1	

**Item List:** Item Numbers detailed each section of the main text of this document refer to the item descriptions listed below. They are referenced in italics e.g. (*item 1*)

Fasteners Box Contents		
Item No	Part Description	Qty

Fasteners Box Continued		
Item No	Part Description	Qty







14	Boom Fastener Support Plate	2	26	Washer EPDM	13
15	Vane Spacer Tube	3	27	Philidas Industrial Nut M8	8
16	Vane Mount	6	28	Washer M10 x 25 OD	8
17	Rear Cover Boom Bracket	1	29	Hex Set Screw M8 x 20	35
18	Rear Cover Link Plate	2	30	Hex Bolt M10 x 130	15
19	Clevis Pin	3	31	Spring Washer M8 - Din 127 B	12
20	Clevis Washer	6	32	Philidas Industrial Nut M10	3
21	Front Cover Bracket	3	33	Washer M8 x 25 OD	23
22	Vane Support Plate	2	34	Hex Set Screw M8 x 30	8
23	Cinch Washer - Boom	2	35	Set screw M16 x 60	12
24	Spring Washer M10 - Din 127 B	12	36	Spring Washer M16 - Din 127 B	15
25	Bolt End Cap - M10	3			



# Britwind R9000 Turbine Installation Procedure

## 1. Initial Conditions

This procedure covers the installation and assembly of the Britwind R9000 wind turbines with serial Numbers from 0160-xxxx-xxxx onwards onto a standard Britwind free-standing tower. Always check for the current issue of this document and other specifications and procedures on the Reseller Access website.

-  Before Installation, you must undertake a site Health and Safety Risk Assessment.
-  Before any tower movements are carried out, refer to the relevant procedure. Do not attempt to raise or lower the tower in wind speeds greater than 15m/s, or the maximum wind speed recommended by the tower manufacturer.
-  Always ensure that the tower is adequately supported so that it does not move around when work is carried out on the turbine. This can impose severe loads on the tower and raising/lowering system.
-  Always ensure that all live supplies are isolated before starting work.

**Note:** The S.W.A. underground cable should be in place in the cable trench and should be isolated at the rectifier/grid connection end.

**Note:** The area near to the wind turbine should be controlled to exclude members of the public, especially during tower raising/lowering and machine commissioning.

**Note:** All due safety precautions should be observed and best practice procedures should be followed at all times.

The Installation Checklist must be completed by the Accredited Installer and must be kept by the Installer and made available to Britwind if requested.

## 2. Yaw Bearing fitment to tower and Power Cable Installation

- Lower the tower until it is approximately horizontal to the ground and support at a point 2.8 metres from the tower top using a suitable support capable of taking the loads specified by the tower manufacturer (see figure 2.1).



Figure 2.1 Tower Support

- Thoroughly clean the M16 tapped holes in the tower top flange to remove all contaminants, if necessary use a tap or spare M16 set screw to chase out any water or debris.

Check the tower top flange for flatness and for any roughness or unevenness due to build up of zinc or other damage

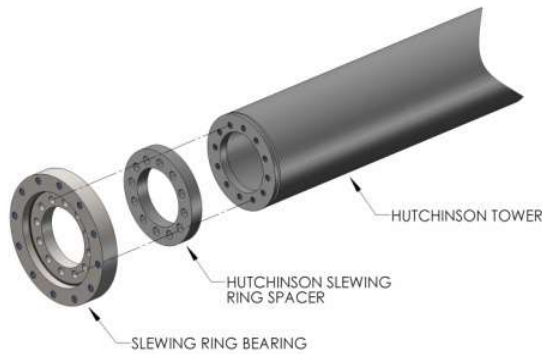


- Pass a draw-line down the tower to pull the power cable through from the top, so that the end without the crimped ferrules is at the tower base, and the prepared end as shown in Figure 2.2 is at the tower top

Figure 2.2 Power and signal cable assembly



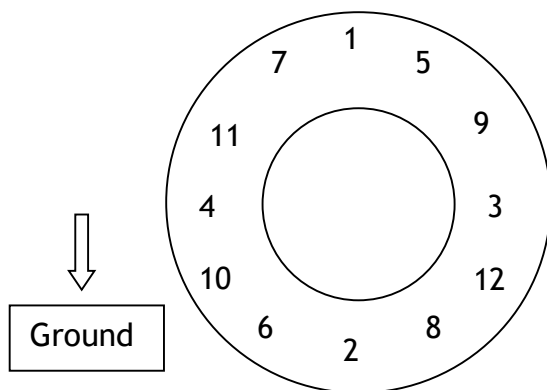
Care should be taken not to damage power cable when drawing the power cable down through tower.



- Locate the Slewing Ring spacer and the Slewing Ring Bearing at the top of the tower, in the upper-most bolt hole of the tower, using the M16 x 100 bolt and lock washer supplied with the Hutchinson Tower.
- Use grease on the bolt threads and tapped holes in the tower top flange. Initially tighten the bolt 'finger tight' only

**Figure 2.3** Fitment of Yaw Bearing to Hutchinson Tower

- Centralise the Slewing Ring bearing on the tower top before fitting the remaining M16 x 100 bolts and lock washers supplied with the Tower. Initially tighten the bolts 'finger tight' only.
- Number the 12 slewing ring bearing M16 fixing bolts in the pattern shown in figure 2.5 using a permanent marker pen or similar.



Torque tighten the slewing ring bearing bolts in the sequence (shown on figure 2.5) starting with a torque setting of 70Nm and gradually increasing in increments of 20Nm up to a final torque setting of 110Nm.

Rotate the outer race of the slewing bearing between each tightening operation, to check for free and smooth movement.

**Figure 2.5** Slewing Ring Bearing Bolt Tightening Sequence



Once the bolts are fully tightened mark the top of each bolt with a radial line, using a permanent marker pen or similar, to indicate that the appropriate torque has been reached and **complete the checkbox in section 18.**



The top end of the power cable should be left protruding a sufficient amount to allow it to be safely passed through the hole in the bottom face of the yaw box when the yaw box is offered up to the Yaw bearing.

Thoroughly coat the unprotected surfaces of the yaw bearing with grease to prevent corrosion and **complete the checkbox**.

### 3. Yaw Box Attachment

**Note:** Power cable must be fed through the hole in the base of the yaw box prior to attachment of the yaw box and turbine assembly.

**Note:** A sling can be used to lift the core unit by passing it through both apertures of the yaw box. Be very careful not to damage any of the cables when lifting the machine.

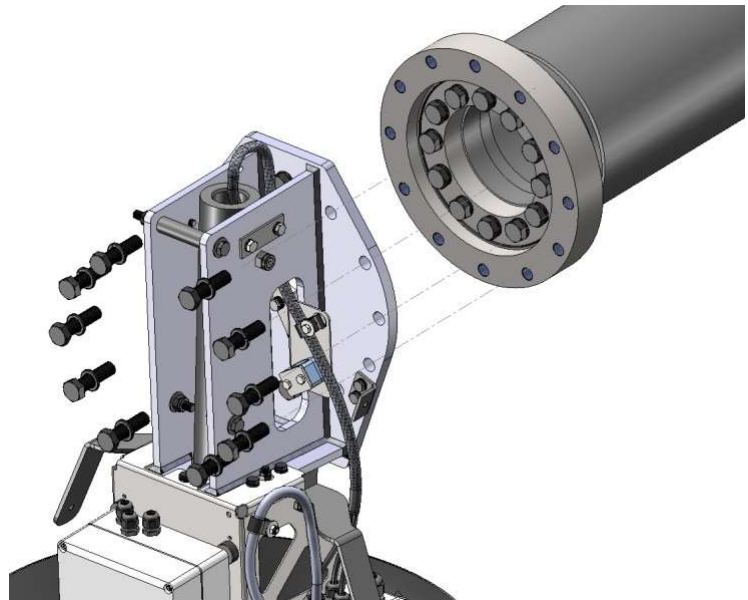


Figure 3.1 Yaw Box Attachment



**Note:-** it may be easier to undo the power cable strain relief bracket before passing the power cable through the yaw box to ensure the power cable is not damaged during the fitment of the yaw box. (see photo).

**Note:** The base of yaw box must be parallel to the outer race of the yaw bearing during assembly of the turbine to the tower, or damage may be sustained by the threads in the outer race of the yaw bearing.

- Carefully pass the power cable through the hole in the bottom of the yaw box and secure it safely out of the way to avoid accidental damage.
- Carefully bring the yaw box and the top face of the slewing ring bearing together. Take care not to damage the power cable during this process.
- Once the holes are correctly aligned, fit **12 off M16 x 60mm set screws** and spring washers (*Items 35 & 36*) to bolt the yaw box to the slewing ring bearing.
- Gently pinch up the **12 off M16 x 60mm set screws** so that they are just beginning to compress the spring washers and then torque each bolt to approx 70Nm using the same sequence as for the inner race (figure 2.5).

**Note:** A ‘crows foot’ type fitting (see figure 3.2) may be required to torque tighten the M16 x 60mm set screw at the rear of the yaw box where access is limited by the shaft.

Alternatively Britwind can supply a reduced height socket which will fit beneath the shaft with most torque wrenches and can be used to torque tighten this bolt.



**Figure 3.2** Crows foot fitting and spigot type fitting for use with a torque handle

- Continue to tighten the bolts in sequence in increments of 20 Nm up to 110 Nm, checking that the yaw bearing remains free in movement by swinging the turbine at regular intervals, to check for any unevenness or tightness.

Once fully tightened, mark each bolt with a radial line to indicate the correct torque has been applied, check for free operation of the yaw bearing and **complete the check box.**

#### 4. Connecting the Power Cable at the Tower Top



If the Strain Relief bracket was removed to fit the yaw box pass the power cable up through the central hole



..and then re-attach the Strain Relief Bracket to the yaw box using the two M8 x 20 bolts and spring washers.  
Tighten the bolts to 25Nm and **complete the checkbox.**



Position the power cable loosely in the cable clamp on the strain relief Bracket



Remove the lid of the electrical connection box on the side of the turbine



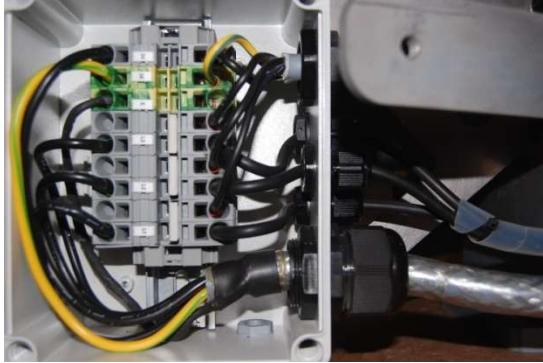
...and insert the power cable until the silver braid is just visible inside the box, then tighten the gland to secure it.



Connect the six cables into the spring cage connectors as follows:

Cable Marked	Cable Colour	Terminal Marked
1	Black	L1
2	Black	L2
3	Black	L3
4	Black	S4
	Black (heatshrink attached to braid)	E
Earth cable	Green / Yellow	SE

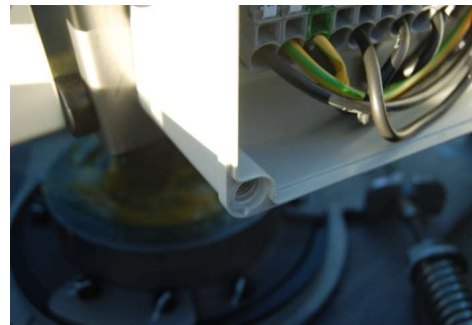
**Note:** To open the contacts on the Spring Cage Connectors insert a thin flat bladed screwdriver into the slot adjacent to the cable entry hole. Insert the cable and then remove the screwdriver to clamp the cable securely.



Arrange the cables neatly in the box and then replace the lid and complete the checkbox.



Note the tab on the corner of the lid



...and the corresponding indent in the box



---

Secure the power cable using the Strain relief clamp and cable tie the power cable and stator cable neatly together. **Complete the checkbox.**

---



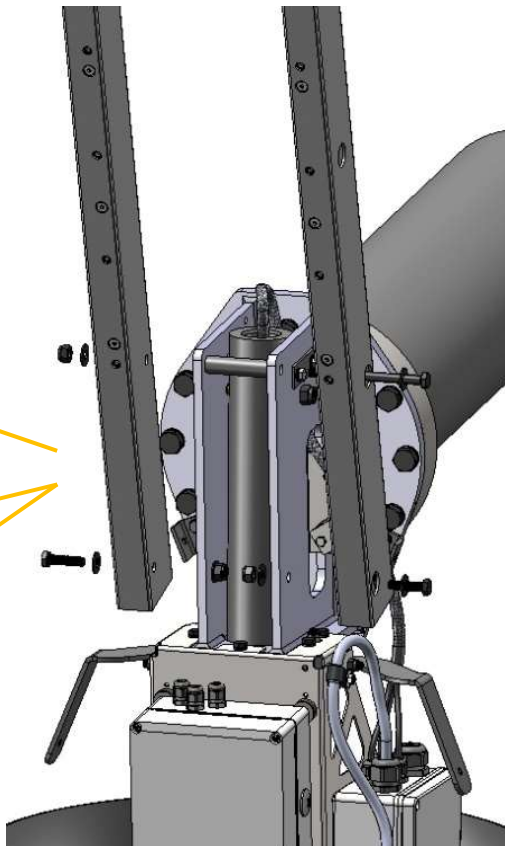
Finally, Cable tie the Stator cable at the rear of the shaft to prevent any chafing.

## 5. Tail Boom Attachment



Fit the vane support plates and boom fastener support plates using 4 off M8 x 20 bolts and spring washers (*items 29 & 31*), torque tighten to 25Nm and **complete the checkbox**. Mark fasteners to indicate torque check has been carried out.

Figure 5.1 Tail Vane Support Plates



With the outer end of the tail boom resting on the ground, offer the yaw box end of the tail boom up to the yaw box and loosely secure it with the M10 x 40 bolt (complete with two washers) and M10 Philidas nut.

---

**Note:** The tail booms are right handed and left handed - make sure that the 26mm dia. access hole is away from the yaw box, and the tapped holes along the top of the boom are uppermost.

---

**Note:** The tail booms are secured with a single M10 x 130 bolt at the rear and a pair of M10 x 40 bolts at the front. Repair washers are used underneath the bolt head and underneath the nut, it is important to ensure these are fitted correctly. The rear tail-boom securing bolt passes through a sleeve which is fitted between the yaw box side plates. See figure 5.2


---

**Note:** Washers must be fitted between the bolt head and the tail-boom and between the Philidas nut and yaw box.

Figure 5.2 Tail Boom Attachment

- Swing the tail-boom upwards, (pivoting it about the M10 x 40 bolt), until it is almost vertical and insert the M10 x 130 bolt complete with M10 washer through the tail-boom, yaw box and spacer. Pinch up the M10 x 40 bolt to secure the boom.

**Note:** That whilst the second tail boom is being fitted the M10 x 130mm bolt is not secure. It can therefore be sensible to clamp the first tail-boom in place using an F-Clamp or similar.

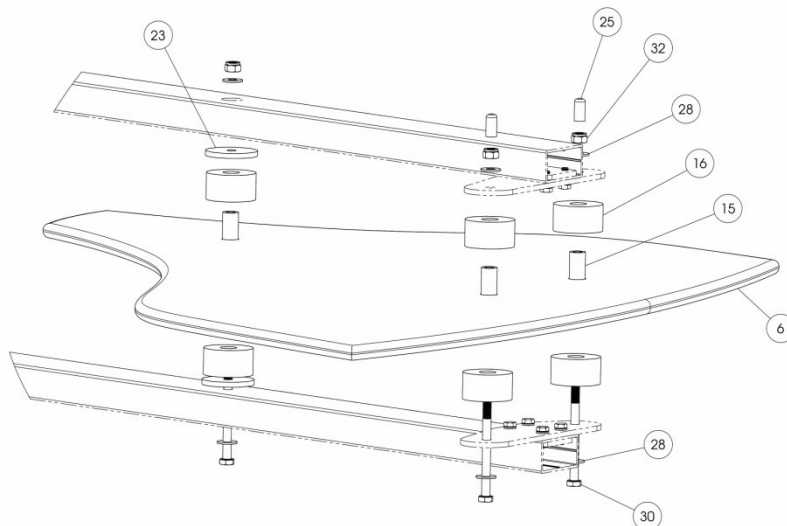
 Exercise caution when fitting fasteners to the booms through the 26mm access holes. Fingers could easily be caught if the boom were to move unexpectedly.

- Repeat for the second tail-boom once again ensuring that washers are fitted.

 Check that washers are fitted underneath all nut and bolt heads and that the spacer between the yaw box sides is correctly fitted at the rear.

- Check that the tail-booms are correctly aligned and parallel and then torque tighten the fixing bolts to 51Nm and **complete the checkbox**. Mark fasteners to indicate torque check has been carried out and that repair washers have been fitted in the correct order (see figure 5.2).
- Yaw the turbine so that the booms are horizontal.

**Note:** The tail vane is fitted with three compliant mounts on either side (see figure 5.4) with three spacer sleeves which pass through the holes in the compliant mounts (*items 16 and 15*). The front compliant mounts have large steel washers fitted between the tail booms and the compliant mounts (see figures 5.4 and 5.5 *items 16 & 23*).

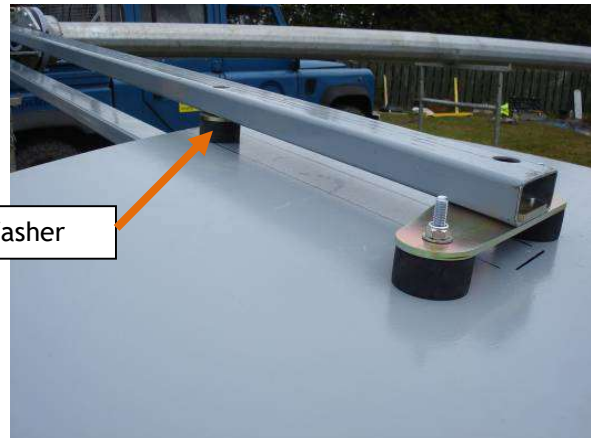


**Figure 5.4 Tail Vane Assembly**

**Note:** The rear compliant mounts are fitted between the vane support plates, (shown in figure 5.1), and the tail vane, (see figure 5.6), once again with a spacer sleeve (*Item 15*) passing through the centre of the compliant mounts.



**Figure 5.5** Front compliant mount assembly and washer



**Figure 5.6** Completed tail vane assembly

- Insert the tail vane between the tail booms so that the compliant mounts and spacer sleeves line up with the holes in the tail boom brackets.
- Pass the M10 x 130 bolts (*item 30*) complete with an M10 repair washer (*item 28*) under the bolt head through the holes in the spacer sleeves and secure using a second M10 repair washer and M10 Philidas nut (*item 32*).
- Once all three bolts are in position torque tighten to 51 Nm, add the protective caps (see figure 5.7) and **complete the checkbox.**



**Check that repair washers are fitted beneath all Philidas nuts and bolt heads. Check that the spacers are in position, and that the bolts have been correctly torque tightened.**



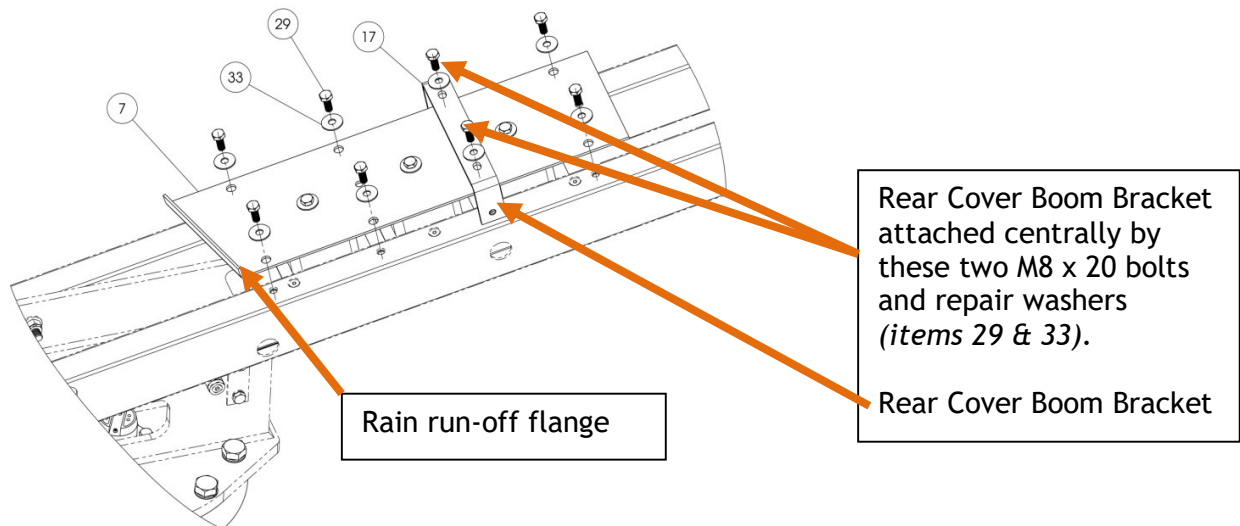
**Figure 5.7** Completed Tail Vane assembly with Protective Caps fitted

**Note:** When the tail vane is attached the machine can be allowed to swing back to a position with the tail-booms pointing upwards.


## 6. Fitting the Brake Coils


Position the Brake Coil Pack between the tail booms just behind the yaw box (see figure 6.1) and fit along with the Rear Cover Boom Bracket (*item 17*) as shown in figures 6.2 and 6.3 using the 8 off M8 x 20 bolts and repair washers (*items 29 & 33*). Ensure the rain run-off flange is positioned at the yaw box end and the cables are not pinched.

**Note:** The rear cover boom bracket should be fitted under the second from last pair of M8 bolts.



**Figure 6.1** Showing Brake coils fitted to Tail Booms and Centralised Rear Cover Boom Bracket

 The Brake Coil upper plate forms an integral part of the tail boom/tail vane structure. Ensure the Coil Pack is correctly mounted; repair washers fitted, and bolts correctly torque tightened.

 Take particular care that the cables are not trapped between the Brake Coil upper plate and the tail booms.

- Torque tighten the 8 M8 bolts to 25Nm and complete the check box.

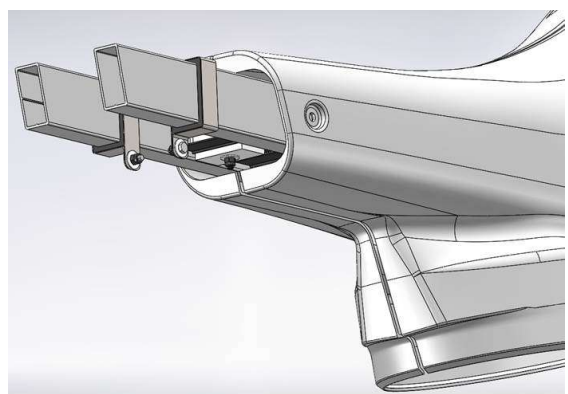
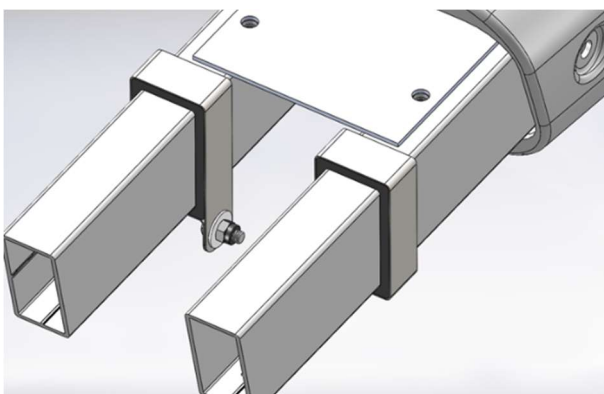


**Figure 6.2** Brake Coils and Rear Cover Boom Bracket fitted to tail booms



**Figure 6.3** View of Rear Cover Boom Bracket positioned adjacent to clearance hole in Tail Boom

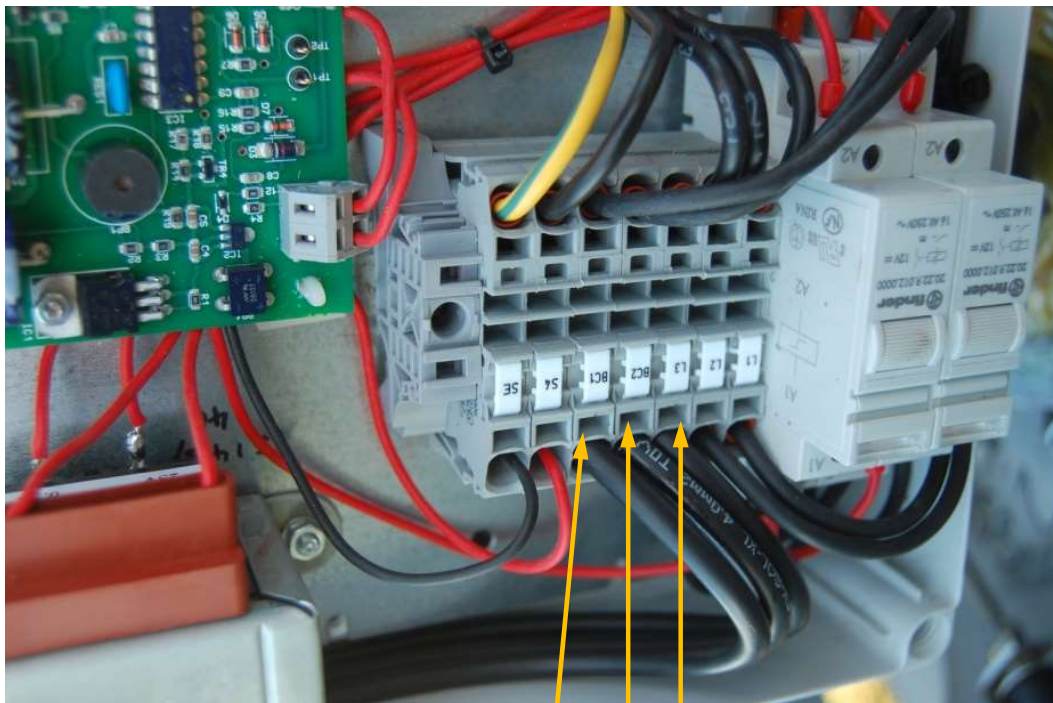
Add the two Drip Clamps to the Tailbooms as shown in figure 6.4. Note that it is easiest to stick the foam backed tape to the tail boom before fitting the clamp. Torque tighten the M8 stainless bolt and nyloc nut to 25Nm to secure the foam backed tape on to the boom and **complete the check box.**



**Figure 6.4** Showing Drip Clamp Positioning



Feed the three cables from the Brake Coils along the top of the shaft and into the three unused glands in the end face of the Brake Control Unit.



Trim the three Brake Coil cables to length, strip the ends and connect them into the spring-cage terminals marked BC1, BC2 & L3.

**Note** that it is not important which Cable goes to which terminal.



Make sure the three brake coil cables lie neatly in the Brake Control Unit and secure them with a cable around the shaft to prevent chafing.

Complete the checkbox and record the Brake Control Unit Serial Number.

- Check that the two brake relays are in synch (i.e. both either 'ON' or 'OFF') and that there is no moisture in the brake control unit.
- If the relays are not at the same state press their **reset buttons** until both are at the same state. If the relays are out of synch the turbine will not rotate smoothly.

**Note:** The orange indicators at the top of the relays show the relay state, both should be at the same state, either both with orange indicators visible or both indicators not visible. (See figure 6.6).

**Note:** The desiccant sachet attached to the box cover should be positioned at the top of the box so that it does not interfere with the two brake relays as this can cause accidental relay operation.




- Replace the cover ensuring the rubber gasket is in place. Be aware screws are soft plastic. Do not over tighten or damage the screws as this can hinder removal in the future.

- Note that it will be necessary to reopen the Brake Control Unit to check the correct operation of the brake relays once the Tower Base Slip Ring has been fitted (see Section 9).

## 7. Tower Base Slip Ring Connection

The Tower Base Slip Ring is suspended on the down tower Power cable and turns with the nacelle. It needs to be fitted so that it is suspended at a height corresponding to the opening in the tower base as shown in Figure 7.1. The Tower Base Slip Ring is supplied already connected to the Tower Base Isolator Switch which must be secured inside the tower base just below the tower base flange. Brackets are provided in the tower base to either allow direct mounting of the Tower Base Isolator or the fitment of a wooden board to be used as a mounting.

Whilst the Isolator Switch and Tower Base Slip Ring Cable are supplied already connected together, the wooden mounting board or any other fixings required will need to be provided by the installer, to suit the particular tower type being used.

 The connections between the turbine power cable and the Tower Base Slip Ring and between the underground SWA cable and the Isolator Switch are best made with the tower lowered to give easy access whilst making the connections.

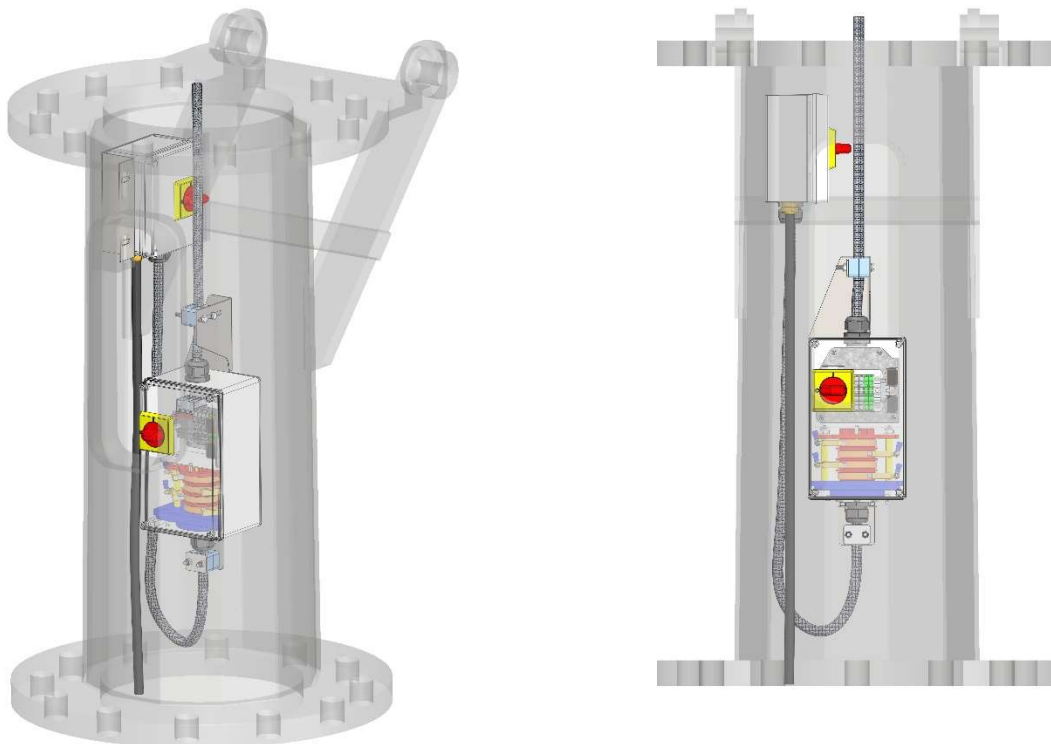
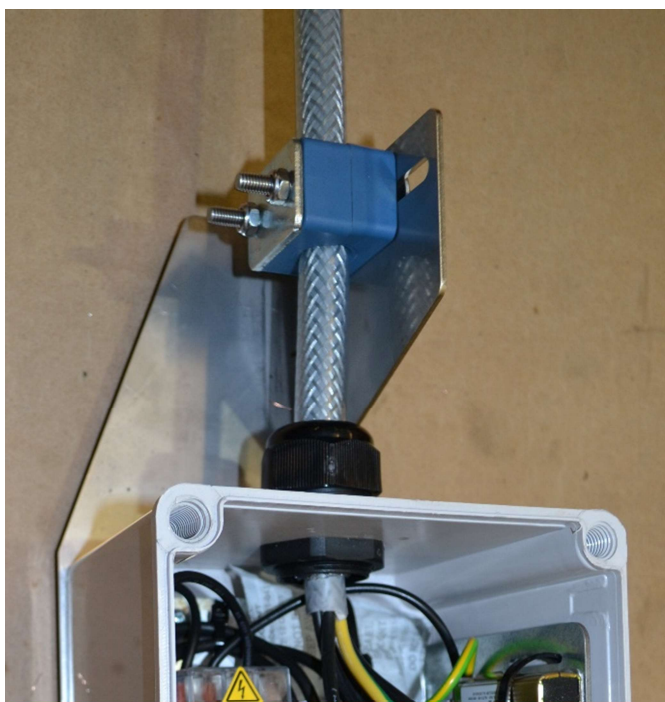


Figure 7.1 Position of the Tower Base Slip Ring and Isolator in the tower base (Note tower types may vary)



**Figure .2 Fitment of Cable Guide bracket**

Feed the cable through the grommet in the Cable Guide Bracket as shown in Figure 7.2. This needs to be fitted before the cables are connected into the slip ring



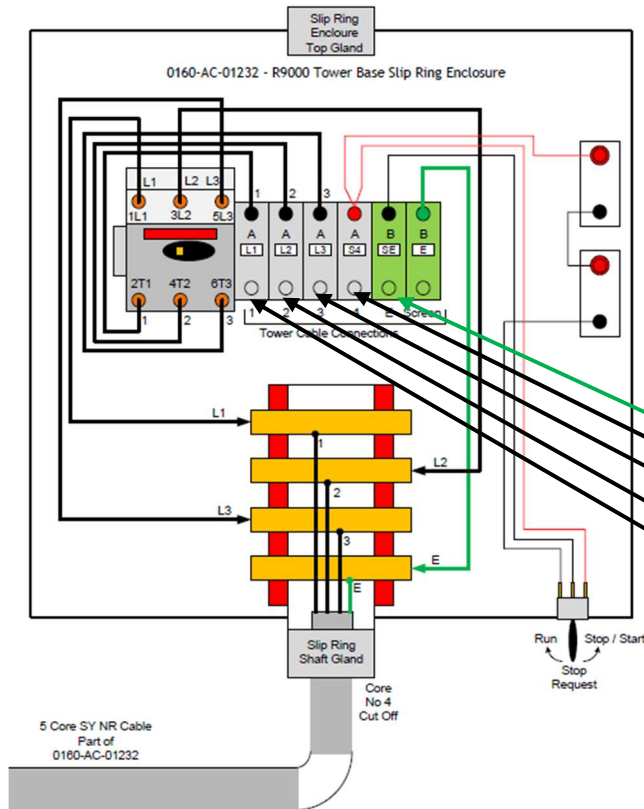
**Figure 7.3 Strain Relief Bracket**

Trim the down tower power cable to the correct length to allow the slip ring to hang opposite the tower access door as shown in Figure 7.1.

Secure the power cable in the strain relief clamp at the top of the slip ring as shown in Figure 7.3

Make sure that the cable is tightly gripped both in tension and in twisting. If the cable is not a tight fit use heatshrink or similar to increase the diameter until the cable is completely secure against twisting.

**Complete the Checklist:**



**Figure 7.4**

The Tower Base Slip Ring is supplied already connected to the Tower Base Isolator as shown in Figure 7.4.

The down tower power cable is connected into the WAGO type connectors as shown by the arrows in Figure 7.4.

Each core is numbered (1-4 + Earth) and should be connected as follows:

- EARTH
- 4 to S4
- 3 to L3
- 2 to L2
- 1 to L1

Note that the screen is left unconnected.

The Completed connections are also shown in Figure 7.5



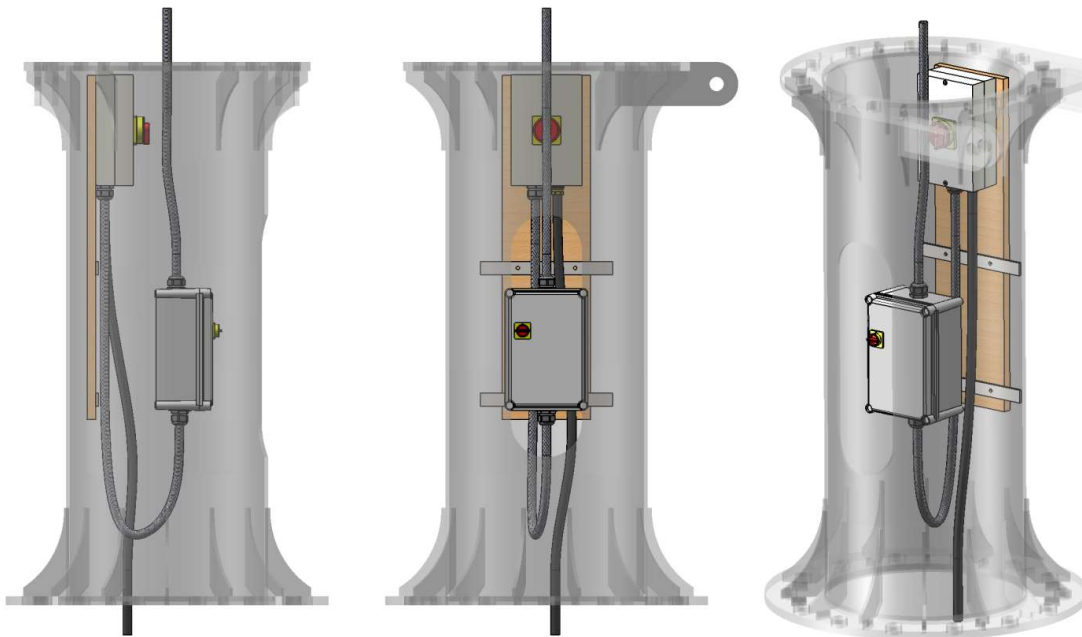
**Figure 7.5**

Figure 7.5 showing the completed connection of the power cable into the slip ring.

**Complete the Checklist:**

The underground SWA cable should be fed up along the wall of the tower base section and clipped securely in place.

Depending on the tower type used the Tower Base Isolator can either be mounted onto the angle brackets in the tower base (ARE type towers) or mounted on a wooden board placed behind the straps provided (Hutchinson type towers) - See Figure 7.6.

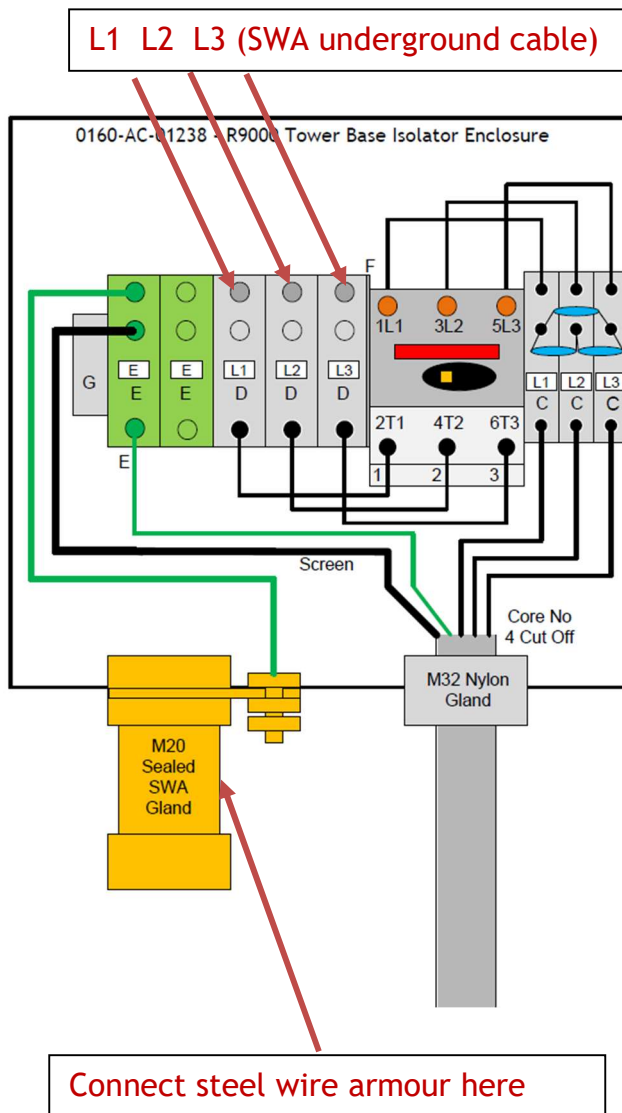


**Figure 7.6 Mounting of Tower Base Isolator using Wooden Board**

The cable connecting the slip ring to the Isolator Switch should be allowed to hang in a U shape below the slip ring and can be clipped to the SWA cable or the welded brackets using cable ties. If the cable is long enough then a complete 540 degree loop can be put into the cable and clipped with cable ties. This can give a neater arrangement and better cable path between the Tower Base Slip Ring and Isolator box.

Bear in mind that the slip ring will lower when the tower is raised, and make sure the Isolator Switch and the Slip ring do not become entangled during tower movements.

The Tower Base Slip Ring enclosure should hang roughly in the centre of the tower once the tower is vertical allowing access to the Isolator switch and the Brake Control Switch through the tower base hatch.



Connect the three cores from the underground SWA cable to L1 L2 & L3 as shown.

The steel wire armour from the underground cable is to be connected into the brass gland

**!** It is important that for UK installations the SWA Underground Cable and the Turbine Power Cable are not connected to the turbine or tower structure. This however may vary according to local regulations in other territories and the terminal attached to the brass M20 gland can then be used to make an earth connection tot the turbine or tower.

- !** • Note that it is essential that the tower structure also be earthed to its own independent lightning protection earth as per local regulations.
- Once complete, replace the lid and **complete the checkbox**



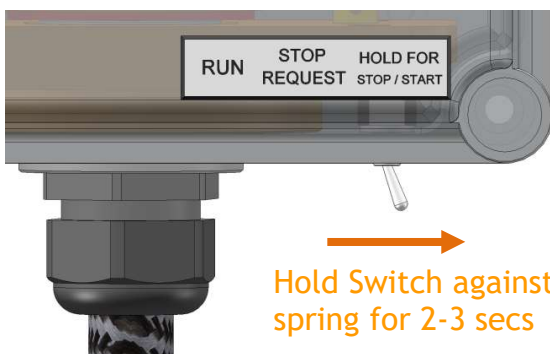
- The Cable Guide Angle Bracket is fitted to the tower using 2 x M8 x 45 bolts and 25mm washers through the two holes provided in the side of the tower lower section.
- The Bracket should then be adjusted so that the cable grommet is approximately 30mm to the left of the centre of the tower. (This is to avoid centering the cable and forcing it against the tower stiffening rib).
- The bracket can be adjusted using the four M8 x 20 bolts (each fitted with 2 repair washers and Philidas type nuts).

Tighten all the bolts to 25Nm. Once the bracket is adjusted and secured **Complete the Checkbox.**

## 8. Brake Control Checks

It is important to confirm that the brake can be controlled from the Brake Control Switch before the turbine is raised. The Brake Control Switch is integrated in the Tower Base Slip Ring enclosure.

Remove the lid to the Brake Control Unit at the tower top so that the two relays can be observed.



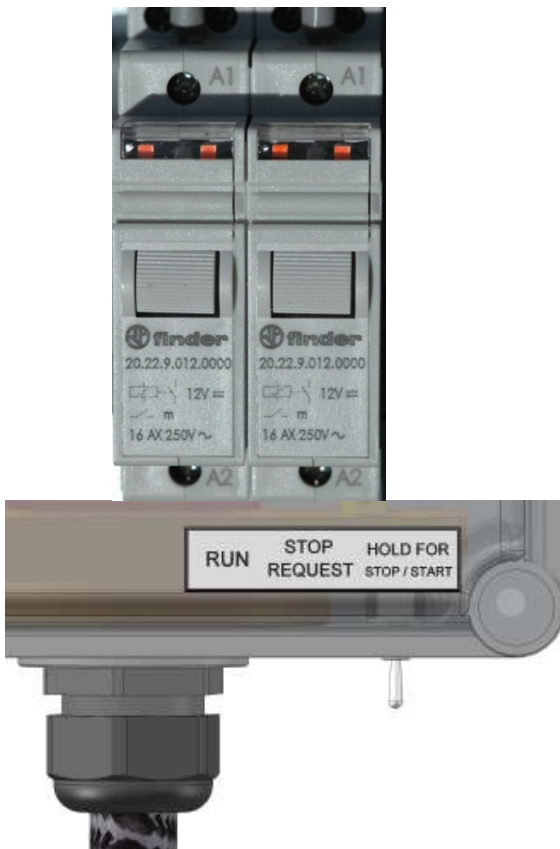
Hold the brake control switch at the 'HOLD TO STOP/START' position for 2-3 seconds or until you hear a 'beep' from the Brake control Unit. Release the switch as soon as you hear the beep.

Note that the switch is spring loaded to return to the centralised 'STOP REQUEST' position from the 'HOLD TO STOP/START' position.

Check that the two relays in the Brake Control Unit have changed state. Try to rotate the hub.


With the brake released the hub should spin completely freely. With the brake applied there should be steady resistance to rotation.


If the two relays are out of synch (ie one ON and the other OFF) then the rotor will 'cog' with uneven resistance to rotation. Make sure the two relays are always in synch (ie that the two visual indicators are both either red or blank).



Leave the brake applied and the switch at the central 'STOP REQUEST' position and **Complete the Checkbox**

## 9. Attaching the Blades

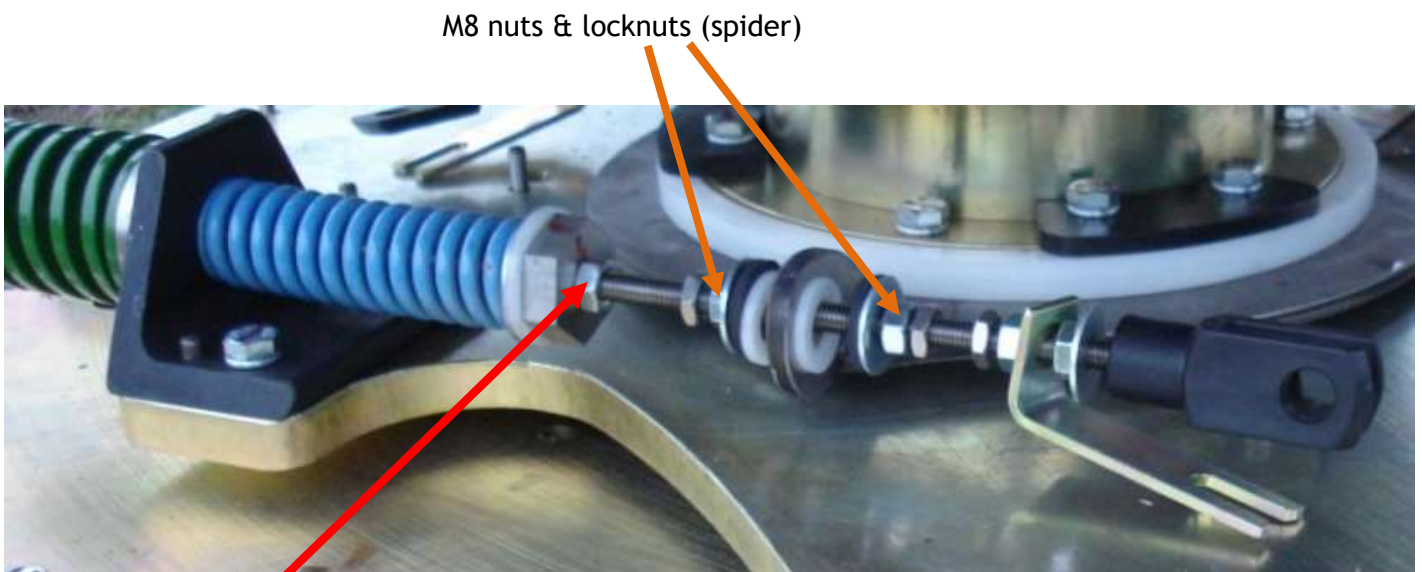
 Always check the blades prior to assembly, ensuring that there is no visible damage, especially on the leading and trailing edges. Take great care during assembly not to cause damage to blades or to blade edges.

 Never try to repair or alter a blade or any part of the blade assembly, never use blades other than in supplied sets of three. Blades are matched sets to ensure they are mass balanced. If you discover a faulty or damaged blade, return it to Britwind under warranty.

- Position the hub of the turbine at about chest height and support the tower at a point just greater than 2.8m from the yaw box base, so that when the blades are fitted they do not foul the supporting structure.

 **Note:** Working on an unsupported tower can cause damage to the tower and lifting equipment.

- Undo the three M8 x 20 bolts securing the Middle cover ring to the hub and lift the cover to give access to the hub plate and pitch system. Bungee cords or similar may be used to suspend the cover from the yaw box and tower whilst the blades are being fitted.
- Loosen the six M8 nuts and locknuts which secure the clevis and the spider on the pitch pushrod so that the Clevis Pin Retaining Clip can be moved back away from the clevis.

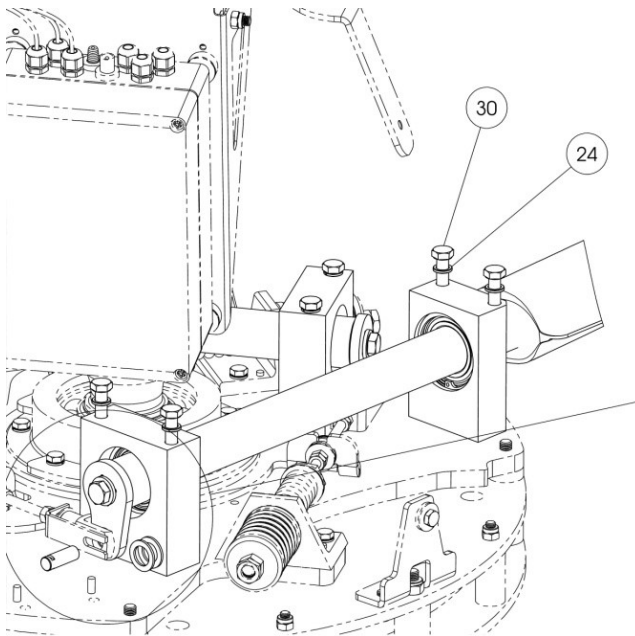


Spring Preload  
Adjustment Nut &  
Lock Nut – **DO NOT  
LOOSEN!**

M8 Clevis locknuts    Clevis Pin Retaining Clip

**Figure 9.1**

- Thoroughly clean the base of the blade bearing housings and the corresponding mating areas on the hub. Check that the distance between the inner faces of the outer and end bearing housings is approx 356mm and adjust the position of the outer bearing housing if necessary.
- Make sure that the cavities behind the radial lip oil seals on the blade bearing housings are packed with Gleitmo 585k grease



- Lightly grease the dowel pins fitted to the hub plate, the tapped holes in the hub plate and the hub plate surface onto which the bearing housings will be fitted (ie the footprint) with a general purpose grease such as Castrol LM.

- Put the 4 off M10 x 130 bolts plus spring washers (*items 30 & 24*) in the inner and outer bearing housing, and offer the blade up to the hub plate (see Figure 9.2).

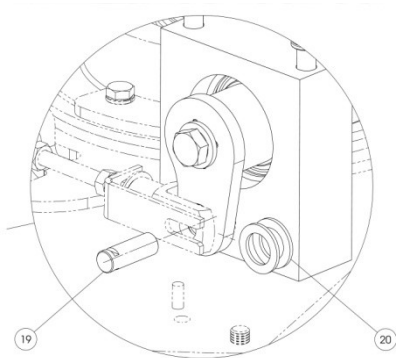
- Align the dowel holes in the base of the end bearing housing with the dowels fitted to the hub plate, and being careful not to put any bending loads onto the bearing / hub connection, adjust the outer bearing housing position so that it too is positioned on the locating dowels.

- Carefully tighten the four M10 x 130 bolts so that the inner and outer bearing housings are pulled down evenly onto the locating dowels. Take care that the blade pitch lever slots into the clevis. It may be necessary to tap the bearing housings with a soft hammer to seat them on the dowel pins.
- Ensure that the bearing housings are at the same height above the hub plate top surface throughout this procedure to avoid applying any bending loads to the dowels. Support the blade's weight during tightening of the bearing housing bolts. Ensure bearings are fully seated against the hub plate before applying torque to the bolts. Check the blade for free rotation, and **torque tighten the fixing bolts to 51Nm**. Mark each bolt head to indicate torque has been correctly applied and check that each bolt is fitted with a spring washer.

**⚠ Note:** At this point the turbine is liable to yaw freely and there is a risk of damaging blades through contact with the ground. It may be simplest to attach all three blades to balance the hub before Torque Tightening the blade bearing housing bolts

- Record the blade number (engraved on the blade root upper surface) and complete the check box.

### The Pitch Lever to Pitch Pushrod connection



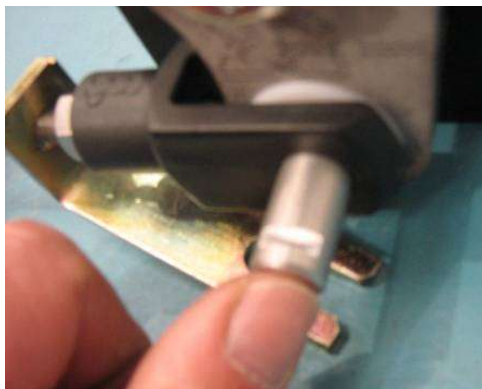
**Figure 9.3** Clevis Assembly

- Position the two nylon washers (*item 20*) over the self aligning bearing , one either side of the pitch lever (see figure 9.3 & 9.4).



**Figure 9.4** Nylon washers on pitch lever

- With an assistant holding the blade, slowly rotate the blade while holding the nylon washers in place such that the pitch lever sits between the two lugs on the clevis with the two nylon washers remaining in place, one on each side of the self aligning bearing. This can be a delicate operation and care must be taken to avoid trapping fingers.
- Insert the Clevis pin (*item 19*) into the bearing (see figure 9.5), leaving the flat grooved portion protruding.



**Figure 9.5** Inserting the clevis pin

**Note:** The Clevis pin does not require any greasing or other lubrication in the bearing.

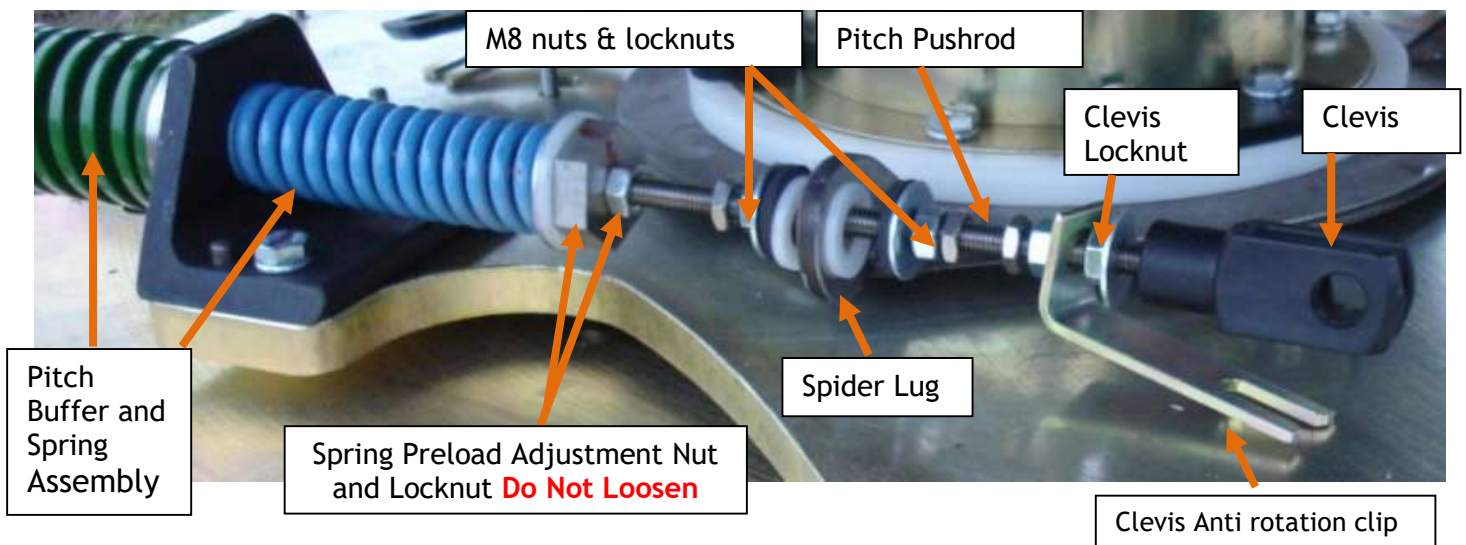
**Note:** At this stage, leave the clevis pin anti rotation clip, its locknuts and the Clevis locknut loose and well clear of the clevis.

- Repeat this process for the remaining blades, ensuring that the **turbine does not yaw and damage the blades through contact with the ground.**

**Note:** In windy conditions it may be necessary to attach a tether to the tail booms to prevent yaw motion.

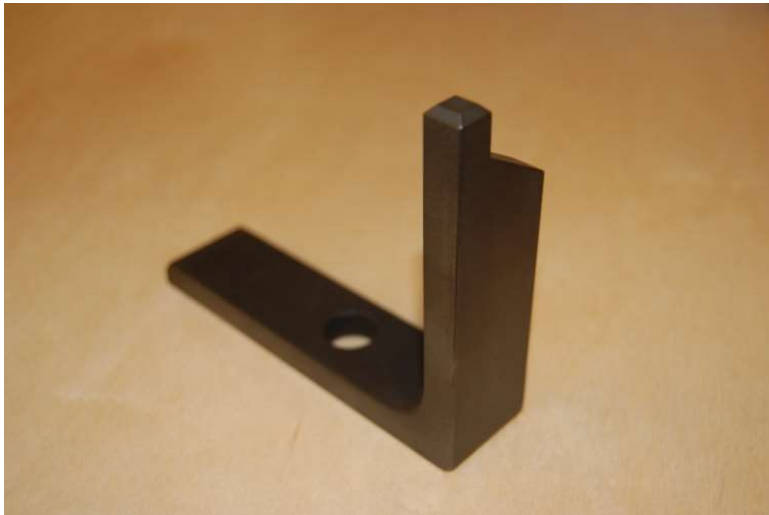
## 10. Blade Pitch Setting

Set the pitch of all three blades individually using the following process. Take care not to loosen or turn the spring preload adjustment nut or lock nut (see figure 11.1).



**Figure 10.1** Pitch Unit and Spider Connection

- Slacken the M8 nuts & locknuts on the pitch pushrod either side of the spider lug to allow 10-20mm free movement of the pushrod before the spider lug is contacted. This will allow each blade to be checked and adjusted separately. (see figure 10.1)
- Grasp each blade in turn near the blade root and carefully rotate the blade in order to manually pitch the blade through 15-20 degrees. Check for full and free movement.
- Slacken the locknut between the clevis anti rotation clip and the clevis (see figure 10.1) by several turns so that the pitch pushrod can be screwed into and out of the clevis in order to adjust the blade pitch.



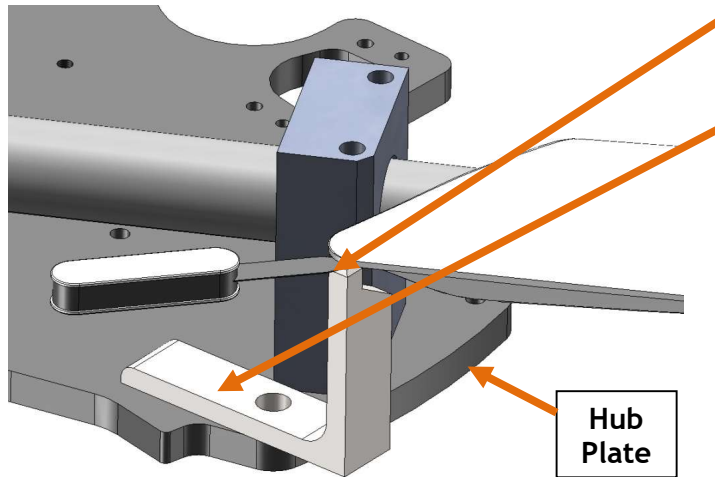
A Britwind supplied pitch setting tool (See Figure 10.2) must be used to set the pitch. It is designed to attach to the hub plate with the integral magnetic base

**Figure 10.2 Pitch Setting Tool**

- Position the magnetic pitch setting tool on the hub plate so that the top of the setting tool is directly beneath the flat surface at the very inner-most part of the lower surface of the blade's trailing edge (see figure 10.3 and 10.4).





**Figure 10.3**  
Flat surface on  
underside of blade




**Figure 10.4**  
Gap of between 0.25mm & 0.3mm  
Magnetic based pitch setting tool in position on hub plate

The gap between the top of the pitch setting tool and the flat surface on the underside of the trailing edge of the blade should be measured using a feeler gauge (see figures 10.3 & 10.4), and the blade pitch adjusted as described in the Pitch Setting Flow Chart (PTO).

- 

Note that the clearances in the threaded bar to Clevis connection tend to be taken up only when the clevis locknut is tightened. Therefore, when the clevis locknut is tightened the measured gap is likely to increase by around 0.25mm. This is why the initial setting is 0.00-0.05mm instead of the target gap of 0.25-0.3mm.
- 

Ensure that the spring preload adjustment nut and lock nut are tight at all times and are not allowed to turn relative to the pitch pushrod.
- 

Start pitch setting adjustment with the blade pitched slightly forwards (to 'run') so that there is a slight gap between the pitch setting tool and the blade and apply light pressure to the top of the trailing edge of the blade to take up any clearance in the clevis assembly.

To adjust the pitch setting, turn the entire pitch pushrod, pitch buffer and spring assembly, thereby screwing the pitch pushrod into or out of the clevis. Use a 19mm wrench on the pitch buffer end nuts to turn the pitch pushrod.

**Pitch Setting Procedure**

**1.** Ensure that the locknuts between the pitch pushrod, clevis and the anti rotation clip are fully loosened so that the spring and the adjuster nut turn with the pushrod and buffer.



**2.** Apply light pressure to the trailing edge of the blade, then measure the gap between the top of the Pitch setting tool and the lower edge of the trailing edge at the datum point with the feeler gauge. (see figure 10.5).



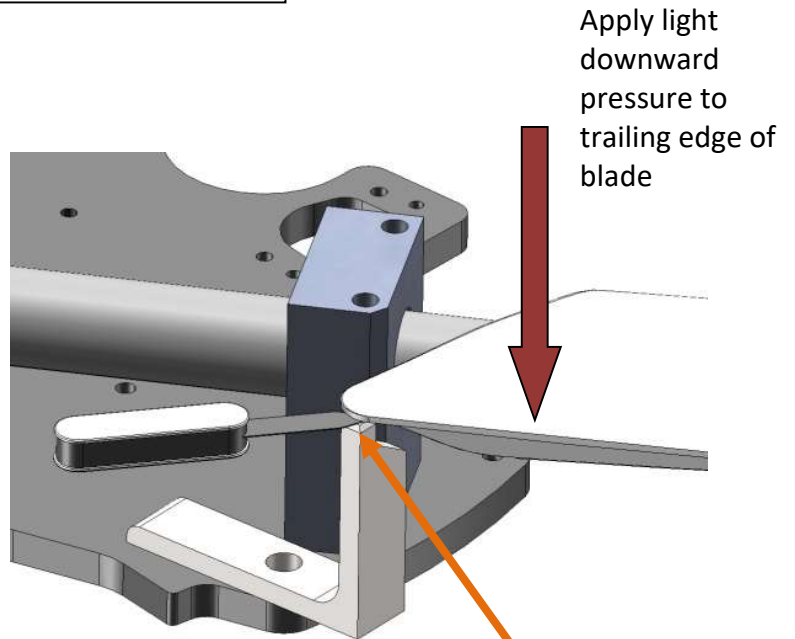
**3.** Adjust the Pitch by turning the Pitch Buffer and Spring Assembly to achieve the gap between the Blade and the Pitch Setting tool (see figure 10.5). Initially set to 0.0 - 0.05mm



**4.** Tighten the clevis locking nut to approx 20Nm and check that the 0.25-0.3mm gap has been achieved. If the gap is correct go to operation **6**. If the gap is incorrect go to operation **5**.

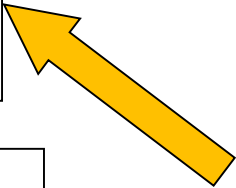


**6.** When the correct pitch has been set and confirmed at 0.25-0.3mm with the locknut on the clevis tightened, slide the Clevis anti-rotation clip fully into the groove on the clevis pin and secure it with the M8 nut and M8 locknut (see figures 10.6 & 10.7).

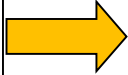


**Figure 10.5** Measuring Blade Pitch

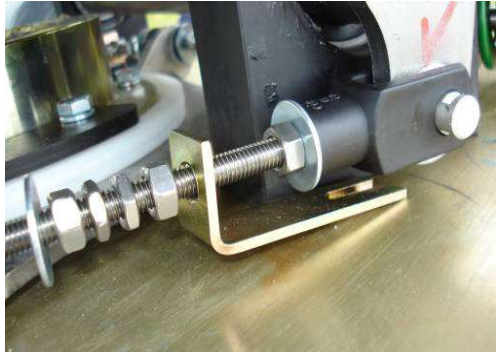
Insert Feeler gauge between datum point on lower surface of blade and top of pitch setting tool



**5.** If the 0.25-0.3mm gap has not been achieved, loosen the clevis lock nut and repeat operations **3 and 4**



**⚠ Note!** It may be necessary to repeat Steps 3, 4 and 5 several times until the correct gap is achieved **WITH THE CLEVIS LOCKNUT TIGHTENED**



**Figure 10.6** Clevis locknut tightened

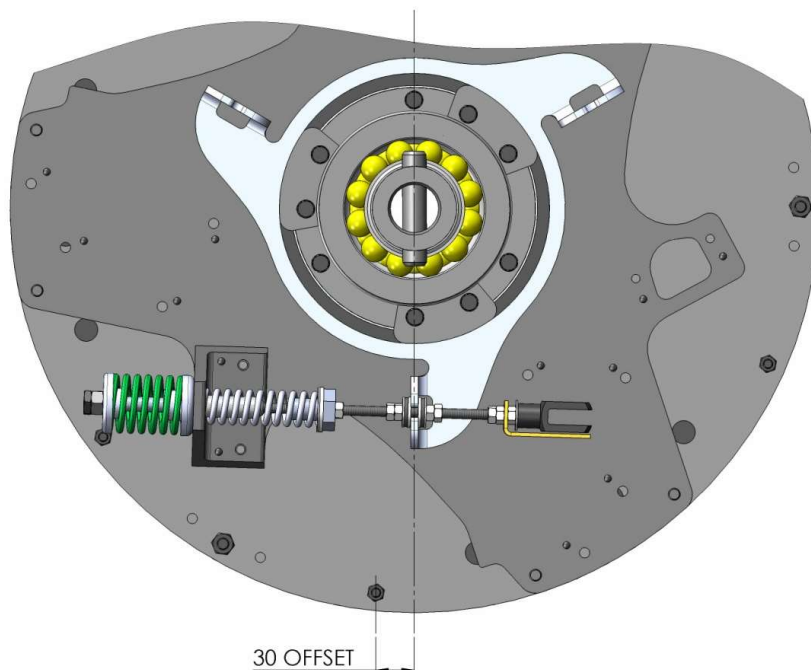


**Figure 10.7** Clevis anti rotation clip nut and locknut tightened

- **Complete the checkbox** and mark the top of the pitch buffer (spring, seat & guide) with a permanent marker or similar.
- Repeat the pitch setting procedure for the other blades and **complete the checkboxes.**

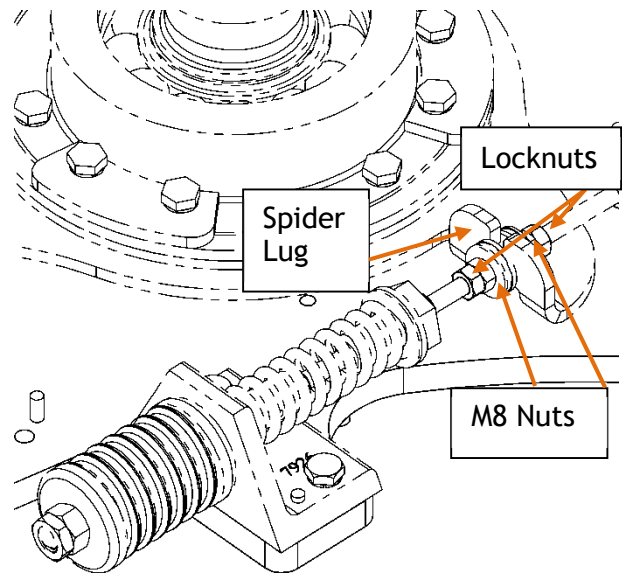
The pitch pushrod should now be connected to the spider.

- Position the spider so that the spider lug is aligned with a point approximately 30mm to the right of the M8 Philidas nut on the generator (see figure 10.8).



**Figure 10.8** Spider Lug Offset

- Gently tighten the M8 nuts on the pitch pushrod so that the spider is held closely, eliminating any play, but without compressing the rubber washers (See figure 10.9)
- Firmly tighten the locknuts onto the M8 nuts to fix their position on the pushrod and mark with a permanent marker.
- Check all the locknuts on the pitch pushrod, **complete the checkbox** and proceed to Section 11.0.



**Figure 10.9** Pitch Pushrod connection to Spider

## 11. Corrosion Protection

- Spray Dinitrol 3125 or LT copiously into the front face of the generator, onto the magnets from the outer periphery of the generator and through the gap between the front magnet ring inner diameter and the stator hub.
- Thoroughly Coat the top surface of the hub, the blade bearing housings, the shaft, electrical brackets, cover brackets, yaw box fixing bolts and yaw bearing with several applications of Dinitrol 3125 or LT allowing it to partially set between coats.
- Try not to get Dinitrol onto the stainless steel pitch pin which is fitted inside the pitch springs.

**Note:** Dinitrol 3125 & LT is supplied in aerosol or liquid form and Britwind recommend the aerosol form for site application. It is available either through Britwind or via Dinitrol’s distribution network (see [www.rejel.com](http://www.rejel.com) for a possible supplier).

- Check that the Pitch Bearing seals are in position to prevent any water ingress and that the end face of the main bearing is coated liberally with grease. Use a general purpose grease such as Castrol LM if more is required.

**Complete the checkbox.**

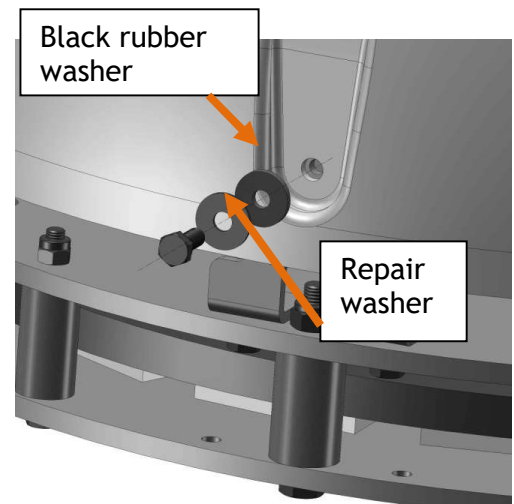
## 12. Middle Cover

**Note:** Carry out a general inspection of the turbine. Check no tools or other loose articles are left inside the machine before fitting the covers.

The Middle Cover consists of a ring mounted on the hub plate which rotates with the blades, see figure 12.2.

- Refit the Middle cover which is attached by three brackets (see figure 12.3) and M8 x 20 bolts with repair washers and rubber washers. (See figure 12.1 for the correct order of components).
- The bolts should be gently tightened until the rubber washers deform slightly (approx 15-20Nm).

**Complete the checkbox.**



**Figure 12.1** Middle Cover Attachment Bolt with repair washer and rubber washer.



Figure 12.2 Middle Cover



Figure 12.3 Middle Cover Bracket

### 13. Front Cover

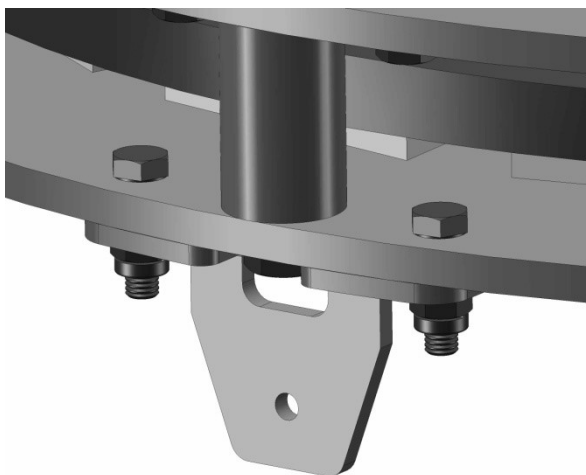


Figure 13.1 Front Cover Bracket

- Attach the three front cover brackets (*Item 21*) to the front magnet ring using M8 x 30 bolts and Philidas nuts, torque tighten to 25Nm and **complete the checkbox**. Take care that the bolts and nuts are not drawn into the generator by the magnets.

- Position the front cover over the magnet ring, align the attachment holes with the front cover brackets,

- Secure the cover with 3 off M8 x 20 bolts fitted with repair washers and 25mm rubber washers. Pinch tight to approx 15-20 Nm and **complete the checkbox**

## 14. Rear Cover

**Note:** The Rear Cover is split vertically, (see figure 14.1). Each half is attached to the turbine at three points and the two halves are joined top and bottom at the front by straps. A rubber H section seal is used between the two halves at the upper split line.



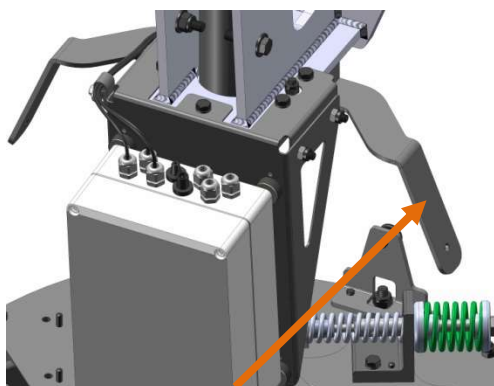
**Note:** See figures 14.2, 14.3, 14.4 & 14.5 for views of the Side Bracket, Yaw Box Bracket, Tail Boom Bracket and Top & Bottom Straps.

**Note:** The Side Bracket and Yaw Box Bracket are already fitted to the machine at delivery, and the Tail Boom Bracket will have been fitted earlier in the installation.

- Attach the Top and Bottom straps to one cover half along with the H section seal as shown in figures 14.5 & 14.6.

**Figure 14.1** Rear Cover split vertically

- Lift the first cover half (which has the top and bottom straps and the seal fitted) into position and loosely insert an M8 x 20 bolt complete with rubber washer and repair washer to locate the cover on the Side Bracket.
- Carefully position the cover and fit the bolts and washers corresponding to the Yaw Box Bracket and the Tail Boom Brackets. Leave all fixing bolts loose at this time.
- Offer up the second cover half and carefully align it so that it is in position in the rubber seal and attach it to the Side Bracket with an M8 x 20 bolt with rubber washer and repair washer (see figure 14.6).



**Figure 14.2** Rear Cover Side Bracket



**Figure 14.3** Rear Cover Yaw Box Bracket



Figure 14.4 Rear Cover Tail Boom Bracket

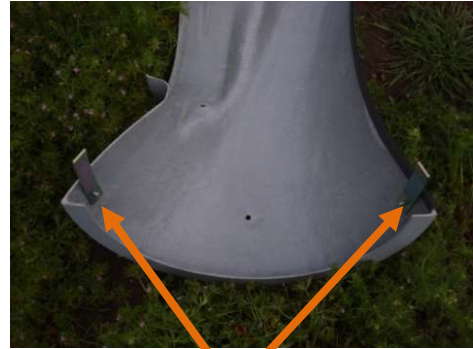


Figure 14.5 Rear Cover Top and Bottom Straps and Seal

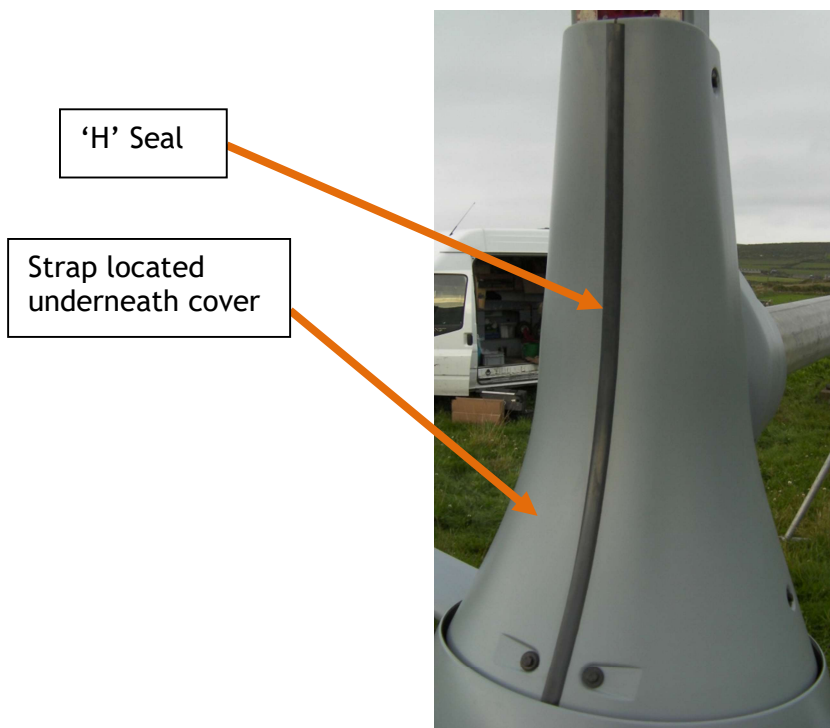


Figure 14.6 Fitting and Assembly of Rear Cover 'H' Seal and Straps



- Use a flat blunt instrument to help insert the cover into the seal, taking care not to damage the seal, and connect the top and bottom straps using M8 x 20 bolts with rubber washer & repair washer.
- When the two halves are positioned satisfactorily, tighten all bolts gently to around 15-20Nm.



- Spin the rotor to check for adequate clearance between the rear cover and middle cover and **complete the check box.**

## 15. Lightning Protection

It is essential that appropriate lightning protection system is installed and meets local regulations. UK specific guidelines state that the turbine tower is to be connected to a dedicated earth electrode. An electrode resistance to earth not exceeding 10 $\Omega$  should be achieved. If in doubt see BS EN 62305 for guidance.

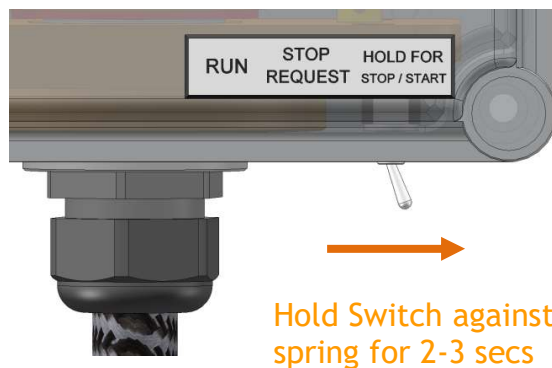
**Complete the checkbox.**

## 16. Final Checks



It is recommended that the turbine is never left unattended when the tower is lowered as there is a risk of the turbine yawing in a cross wind and the blades contacting the ground. If it is unavoidable to leave the tower lowered, securely tether the tail-booms to prevent the turbine yawing.

- Carry out a full visual check of the turbine and manually check all covers for secure fixing.
- Check that the brake can be applied and released from the tower base using the switch on the Tower Base Slip Ring.
- Release and apply the brake using the tower base switch box and check for correct operation.
- Hold the brake control switch to 'Hold for Stop Start' and wait for the whistling sound from the brake control box indicating brake release. Check that the rotor moves completely freely.
- Hold the switch to 'Hold to Stop / Start' position again to re-apply the brake and check that there is steady resistance to rotation.
- Leave the brake applied.



Note: The brake control unit will only allow a brake release/apply command to be successful 10 seconds or more after the previous release/apply command. You must therefore allow at least 10 seconds between each brake release/apply command.



**Ensure the brake is applied before the tower is raised.**

- Complete, sign and date the installation sign off sheet.
- Raise the tower according to the tower manufacturer's instructions and secure.

**Note:** The turbine must not be run or handed over to the customer until commissioning is complete.

**Refer to the relevant version of the Commissioning Procedure for details on how to commission the R9000 wind turbine.**

**Refer to the corresponding Electrical Installation Procedure for details of Rectifier box, inverter and grid connection equipment.**



## 17. Installation Checklist

(to be completed as the installation is carried out and be made available for inspection by Britwind)

**Customer:**

**Address:**

<b>Turbine Serial Number:-</b>	<b>Installation Engineer:</b>	<b>Installation Company:</b>

<b>Section</b>	<b>Check Completed</b>	<b>Initial</b>
<b>2.0</b>	<b>Yaw Bearing Fitment to Tower</b>	
	Yaw Bearing to Tower bolts tightened to 110Nm	
	Yaw Bearing coated in grease	
<b>3.0</b>	<b>Yaw Box Attachment</b>	
	Yaw Box to Yaw Bearing bolts tightened to 110Nm	
<b>4.0</b>	<b>Connecting the Power Cable at the Tower Top</b>	
	Strain Relief Bracket secured and 2 x M8 x 20 bolts tightened to 25Nm	
	Power Cable electrical connections securely made in Electrical Connection Box and lid fitted	
	Power Cable clamped in Strain Relief Bracket and Secured to avoid chafing	
<b>5.0</b>	<b>Tail Boom and Tail Vane Attachment</b>	
	Tail vane support brackets fitted and M8 x 20 bolts tightened to 25Nm	
	Tail-boom M10 x 130 bolt fitted with repair washers and tightened to 51Nm	
	Tail-boom M10 x 40 bolts fitted with repair washers & tightened to 51Nm	
	All M10 x 130 Tail-boom to Tail-vane bolts fitted with washers & tightened to 51Nm	
<b>6.0</b>	<b>Fitting the Brake Coils and Rear Cover Bracket</b>	
	Brake coils and Rear Cover Bracket attached to tail-booms and torque tightened to 25Nm	
	Tail Boom Drip Clamps fitted and torque tightened to 25Nm	



	Brake Coil cables connected to BCU and all cables secured against chafing	
	Brake Control Unit Serial Number	
<b>7.0</b>	<b>Tower Base Slip Ring Connection</b>	
	Power Cable correctly positioned in Power Cable Guide Bracket	
	Tower Base Slip Ring correctly connected to turbine Power Cable	
	SWA Cable correctly connected and Isolator secured to mounting board	
	Cable Guide Bracket fitted and correctly adjusted	
<b>8.0</b>	<b>Brake Control Checks</b>	
	Brake applies and releases when requested by Brake Control Switch	
<b>9.0</b>	<b>Attaching the Blades</b>	
		<b>Blade Number</b>
	Blade Bearing Housing bolts tightened to 51Nm (4 bolts)	
	Blade Bearing Housing bolts tightened to 51Nm (4 bolts)	
	Blade Bearing Housing bolts tightened to 51Nm (4 bolts)	
<b>10.0</b>	<b>Blade Pitch Setting</b>	
		<b>Blade Number</b>
		Blade Pitch set
	Clevis locknut tightened and clevis anti rotation clip secured	
		<b>Blade Number</b>
		Blade Pitch set
	Clevis locknut tightened and clevis anti rotation clip secured	
		<b>Blade Number</b>
		Blade Pitch set
	Clevis locknut tightened and clevis anti rotation clip secured	
	All Spider to Pushrod nuts and locknuts adjusted and tightened	
<b>11.0</b>	<b>Corrosion Protection</b>	
	Dinitrol or Grease copiously applied to all specified areas	
<b>12.0</b>	<b>Middle Cover</b>	



	Cover bolts secure, no fouls to surrounding components	
<b>13.0</b>	<b>Front Cover</b>	
	Front cover brackets fitted and M8 securing bolts tightened to 25Nm	
	Cover Bolts secure, no fouls to surrounding components	
<b>14.0</b>	<b>Rear Cover</b>	
	Cover Bolts Secure, concentric with Middle Cover & no fouls to surrounding components	
<b>15.0</b>	<b>Lightning Protection</b>	
	Lightning protection installed according to local regulations	
<b>16.0</b>	<b>Final Checks</b>	
	Visual check complete, brake check complete and brake applied	



## 18. Installation Sign-off Sheet

To be completed by the Installation Engineer and be kept available for inspection by Britwind

	<b>Name of Installation Engineer:</b>			
	<b>Organisation:</b>			
	<b>Turbine Serial Number:</b>	<b>0160-</b>		
	<b>Blade Serial Numbers:</b>			
	<b>Brake Serial Number:</b>			
	<b>Tower Type:</b>			
	<b>Customer Name:</b>			
	<b>Turbine Location:</b>			
	<b>I hereby Certify that the turbine has been installed in accordance with the above procedure:-</b>	(signature of Installation Engineer)		
	<b>Dated:</b>			
	<b>Comments:</b>  Please add all and any observations which you may have regarding the installation of the turbine including any exceptions to this procedure. These will be carefully considered by Britwind allowing us to improve and correct any problems with this procedure and the installation of the turbine itself.	If continuing on additional sheets please indicate number of sheets here:		

