

Class II
WKI 1001376-03 EN
2005-11-14

Installation Instruction

V82

Lifting and installing the nacelle

Revision

Revision scheme

Revision	Date	Description of changes
01	07-06-2004	New document
02	28-02-2005	Information added regarding the yaw system New Template – Vestas design
03	14-11-2005	Packing of transportation frame New template – Vestas design
04		

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1. Lifting and installing the nacelle

References: Installation and Service data; Assembly of lifting equipment;

PPE:



Warnings:



1.1 Preparing the nacelle on the ground

1.1.1 Entering the nacelle

The skylights on top of the nacelle are used to enter the nacelle. A ladder is placed in front of the nacelle. The ladder must be long enough to reach all the way to the top of the nacelle.

There are two skylights on top of the nacelle. They can be opened from the outside by hand. There are two handles that have to be turned to unlock the skylight. Once the skylight is unlocked, it can be tipped to open.

Arranging ladder



Open skylight with handles for opening



Sequence of work

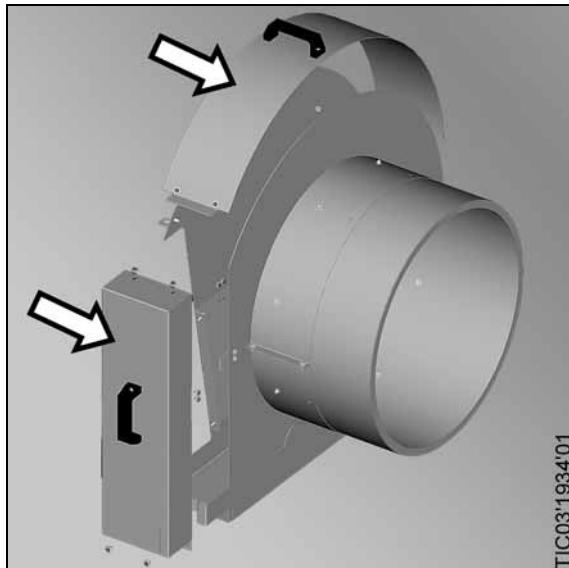
1. Put ladder into place.
2. Climb to top of nacelle.
3. Open skylight using handles.
4. Enter nacelle.

1.1.2 Store high-speed shaft cover

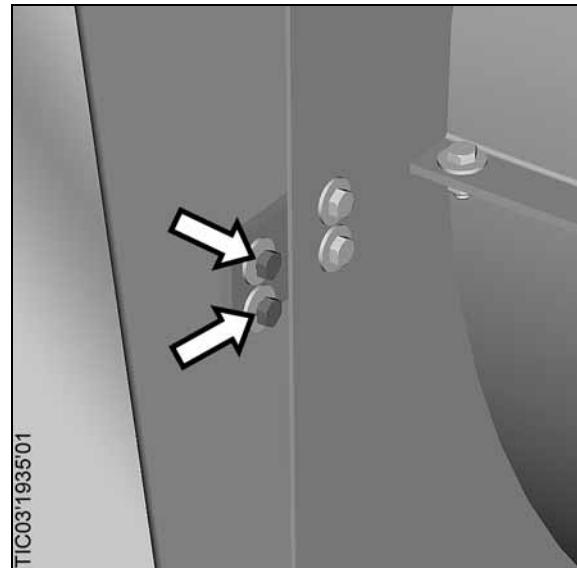
Two parts of the high-speed shaft cover, which completely encloses the disc brake calipers and the brake disc, must be removed and then stored beside the generator. This is to give access to the brake disc which is later used for turning the rotor.

Use a spanner to remove the bolts which secure the two cover parts. The two cover parts are removed and placed securely beside the generator. The bolts are refitted in the threaded holes from where they were removed so that they are not lost.

Removing cover parts



Refitting bolts in threaded holes



Sequence of work

1. Remove bolts which secure cover parts.
2. Remove cover parts.
3. Store cover parts beside the generator.
4. Re-fit bolts in threaded holes.

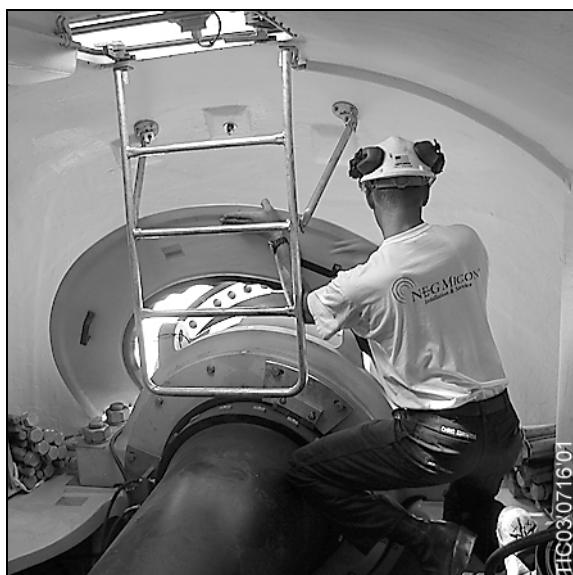
1.1.3 Store main shaft cowling

The main shaft cowling must be removed and stored at the side of the nacelle next to the main shaft. The spring locks on the cowling must be opened before removal. After opening the spring locks the cowling is removed and carried to the side nacelle. It is stored up against the nacelle cover beside the main shaft.

Opening the spring locks



Removing the cowling



Carrying the cowling to the side of the nacelle



The cowling stored against the side of the nacelle



Sequence of work

1. Open spring locks.
2. Remove cowling.
3. Carry cowling to side of nacelle.
4. Store cowling against the side of the nacelle.

1.1.4 Removing the nacelle frame bolts

The bolts that secure the nacelle to the transport frame are now released and removed. The bolts are stored together so that they can be mounted on the transport frame after the nacelle has been lifted off.

Releasing bolt with hammer and ring impact wrench



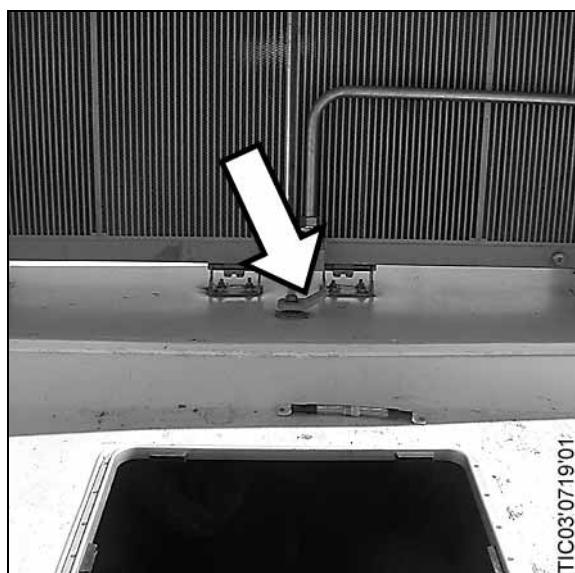
Removing bolt



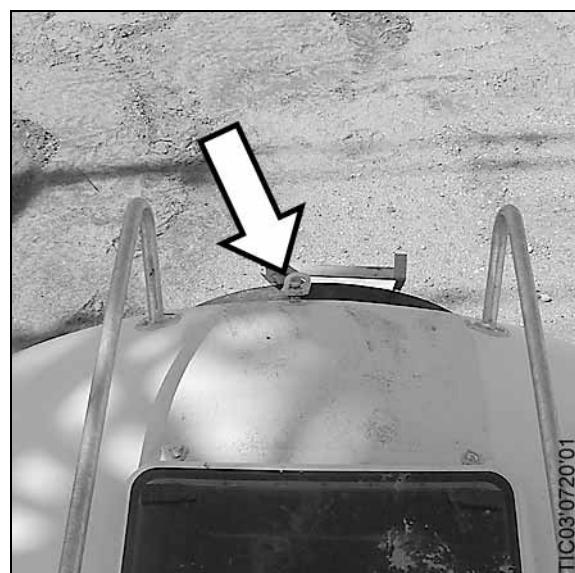
1.1.5 Attaching tag lines

Two tag lines must be attached to the nacelle, one at each end. The tag lines are used to control the position of the nacelle while it is being lifted. The tag lines must be at least 100 m. longer than the height of the hub of the turbine. The tag lines are attached to the anchor points for safety lines on top of the nacelle. After the tag lines have been attached, they are rolled out on the ground, so that they are ready to be used.

Anchor point at radiator



Anchor point on the front of the nacelle



Sequence of work

1. Climb to top of nacelle with ends of tag lines
2. Attach tag lines to anchor points

3. Roll out tag lines on the ground

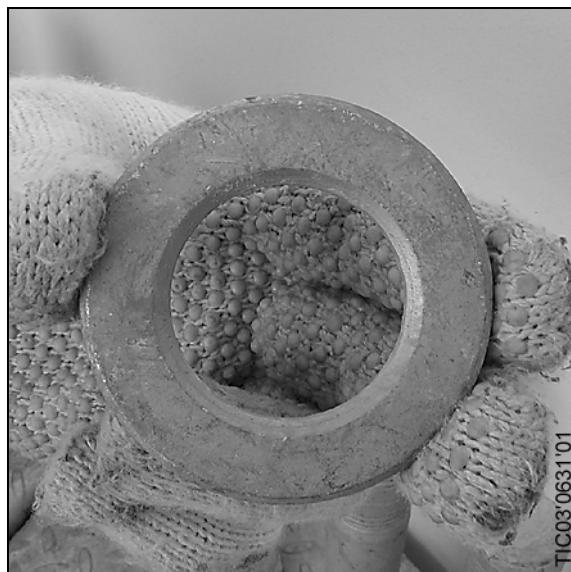
1.2 Preparing the bolts and tools

1.2.1 Preparing the bolts

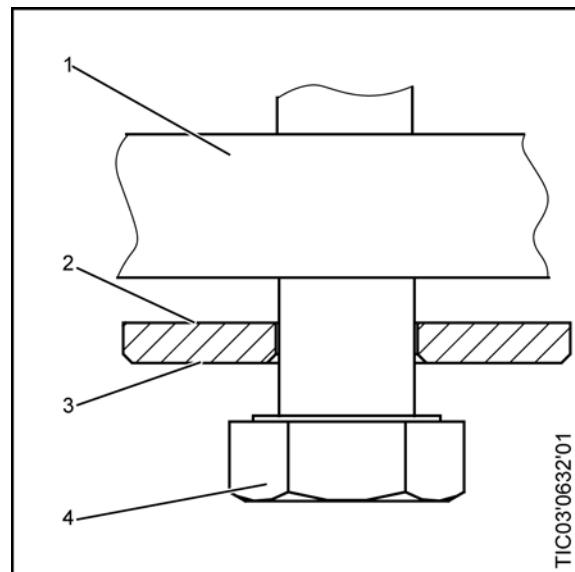
The bolts for the tower to nacelle joint as well as the bolt for the main shaft to rotor joint must be prepared and stored in the nacelle so that they are ready to be used. The bolts must be fitted with washers and lubricated with grease.

The washers must be oriented in the right direction as they are being fitting. The flat side of the washer must go against the flange, and the chamfered side must go against the bolt head. When fitting the washers onto the bolts, make sure that the chamfered side is against the bolt head, so the flat side of the washer will be against the flange when the bolts are mounted.

Chamfered side of the washer



Washer orientation

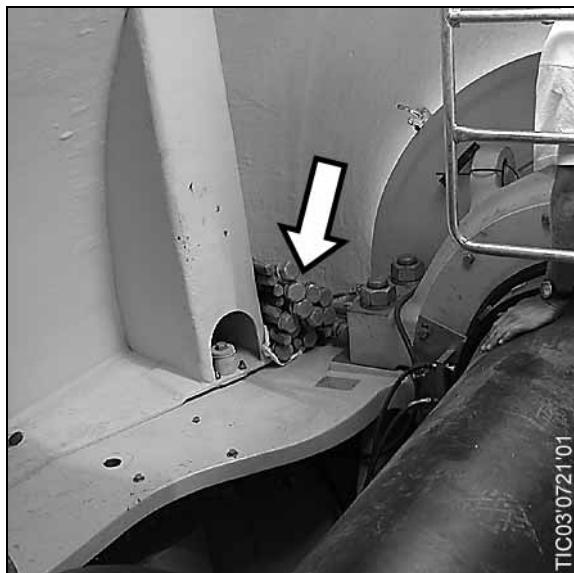


1. Flange
2. Washer flat side
3. Washer chamfered side
4. Bolt head

After the washers have been fitted, the bolts are greased. Grease is applied to the thread of the bolts.

The bolts are now stored on the base frame inside the front of the nacelle next to the main shaft. The bolts for the rotor are stored in front of the nacelle on the base frame next to the hole for the main shaft. Half of the bolts are stored on each side of the main shaft. The bolts for the nacelle are stored on the base frame next to the yaw gears.

Bolts for the rotor stored in the nacelle



Bolts for the nacelle-to-tower joint stored in the nacelle



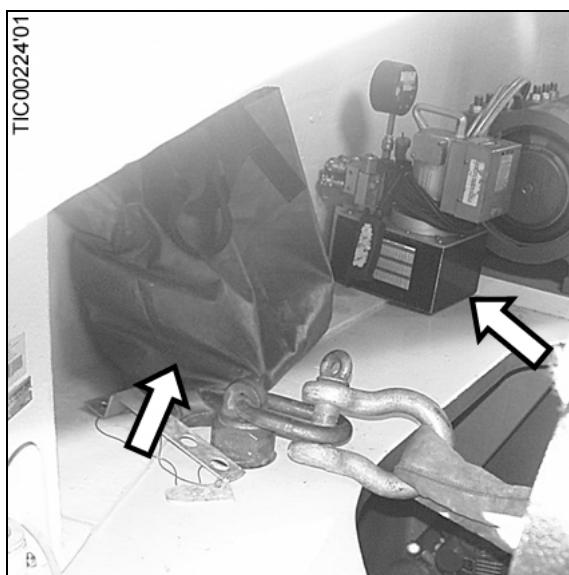
Sequence of work

1. Place washers on all nacelle-to-tower bolts.
2. Grease all nacelle-to-tower bolts.
3. Store nacelle-to-tower bolts beside yaw gears.
4. Place washers on all main shaft-to-rotor bolts.
5. Grease all main shaft-to-rotor bolts.
6. Store main shaft-to-rotor bolts beside main shaft.

1.2.2 Storing tools inside the nacelle

All the tools required for the work inside the nacelle are placed in a tool bag, which is in turn stored on the base frame inside the front of the nacelle. The hy-torq is also placed on the base frame along with the tool bag.

Tools stored inside nacelle



1.3 Mounting the lifting equipment

1.3.1 Assembling the lifting equipment

Please refer to the separate section entitled “Assembling the lifting equipment” for detailed instructions on how to assemble the lifting equipment.

1.3.2 Preparing the lifting equipment

The lifting equipment for the nacelle is placed beside the nacelle on two sets of railroad ties. A fork lift is used to transport the lifting equipment to the railroad ties. The lifting yoke must be oriented so that the end where the roundslings are fitted with eye bolts are pointing towards the rotor. The end where the roundlings are fitted with eye brackets must point towards the rear end of the nacelle. The crane hook is lowered to the lifting equipment, allowing the technicians to attach the wire ropes of the lifting equipment to the crane hook. The wire ropes are attached to the crane hook, and the crane then lifts the yoke to the top of the nacelle.

Yoke beside nacelle



Attaching yoke to crane



Sequence of work

1. Arrange rail road ties next to nacelle.
2. Place lifting equipment on railroad ties with correct orientation.
3. Attach lifting equipment to crane.
4. Lift lifting equipment to the top of nacelle.

1.3.3 Attaching the lifting equipment to the nacelle frame

Two technicians are ready on top of the nacelle. The sky lights are opened if they are not already open. The two sets of straps with the eye bolts and eye brackets are guided through the sky lights as the crane is descending. The technicians climb into the nacelle and guide the eye bolts and eye brackets to the attachment points on the base frame.

Guiding the eye bolts and eye brackets into the nacelle

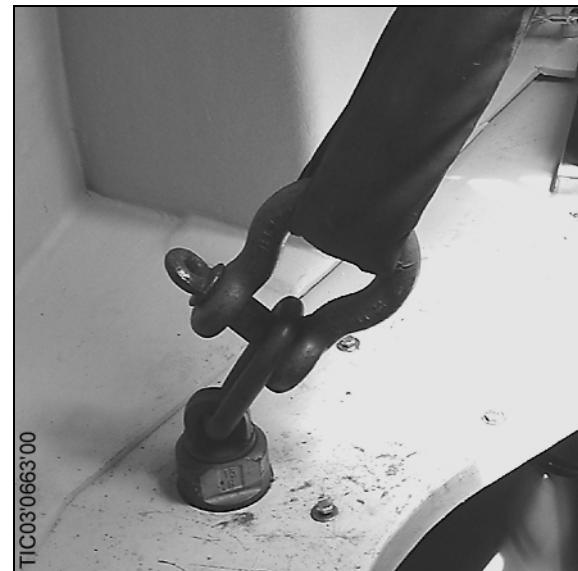


The four attachment points are located on top of the base frame, two on either side of the nacelle just under the sky lights.

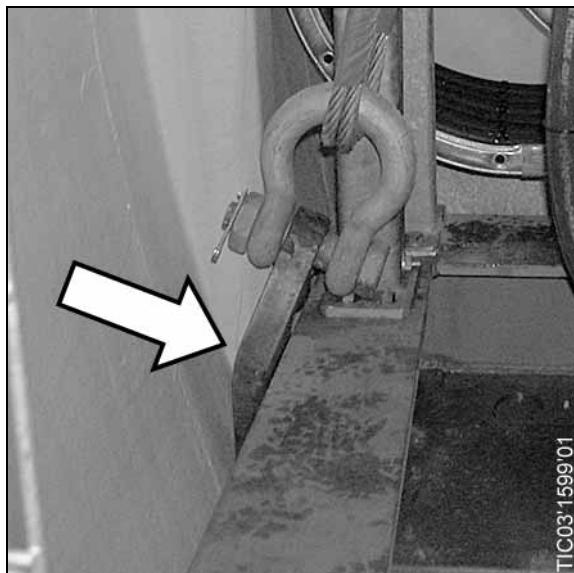
Attachment point for eye bolt on front base frame



Eye bolt on front of base frame



Eye bracket on rear end of base frame



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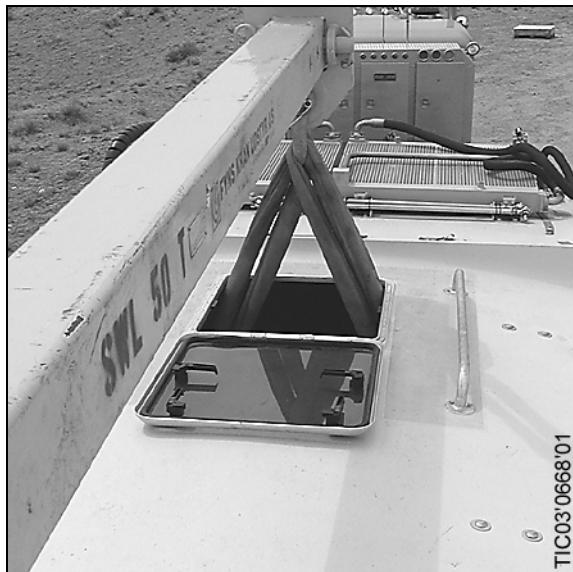
Be very careful when tightening up the straps. The lifting centre must be directly over the centre of the skylight, otherwise the straps may damage the aluminum frames. As the crane lifts the lifting yoke to tighten the straps, the straps are guided by the technicians so as to avoid all obstacles. Special attention should be drawn to the plastic locks at the skylight, since they are easily damaged by the strap.

Straps hanging free inside the nacelle



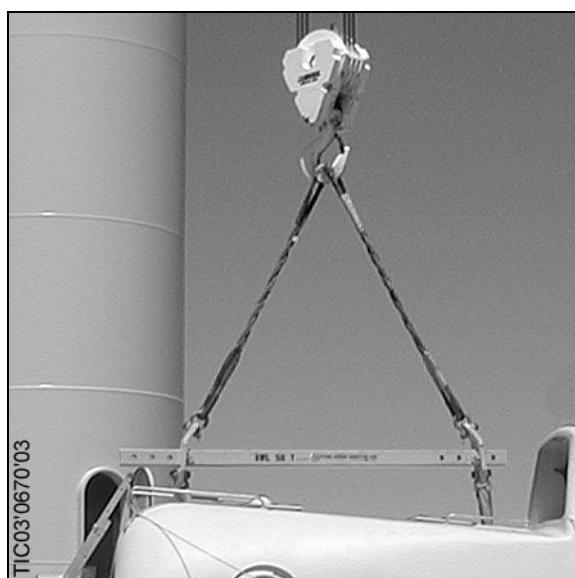
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Straps running through the skylight to the lifting yoke



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Lifting equipment finally mounted



Sequence of work

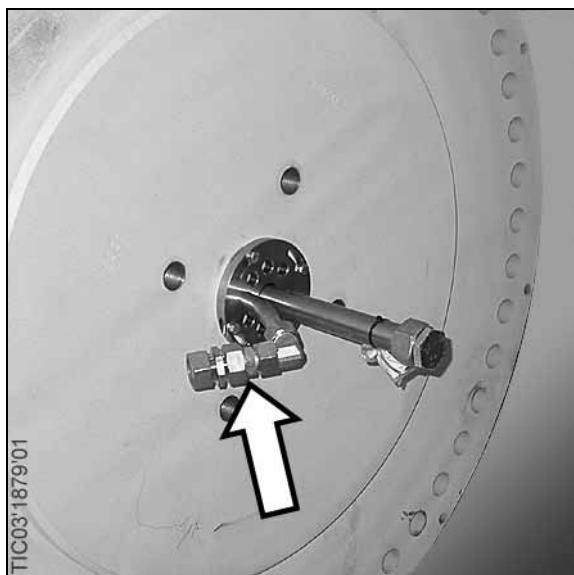
1. Open skylights if not already open.
2. Straps with eye bolts are guided into nacelle.
3. Technicians climb into nacelle.
4. Straps are guided the rest of the way into the nacelle.
5. The eye bolts and eye brackets are mounted on the base frame.
6. As the crane tightens the straps, the straps are kept free of obstacles such as the skylight's aluminum frame and the plastic locks.

1.4 Setting the hub feeder hose position

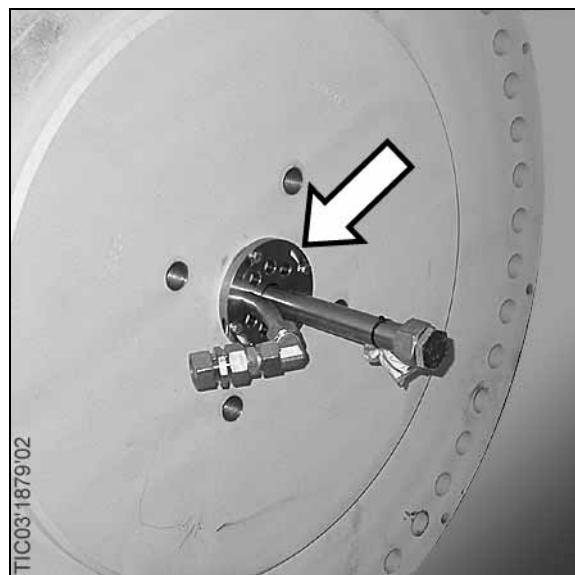
1.4.1 Angle piece alignment

The angle piece on the feed pipe which protrudes from the hole through the main shaft must be correctly positioned. Incorrect position may cause problems when installing the rotor. The tubes and wires are supported by an end flange which is split into two halves.

Angle piece

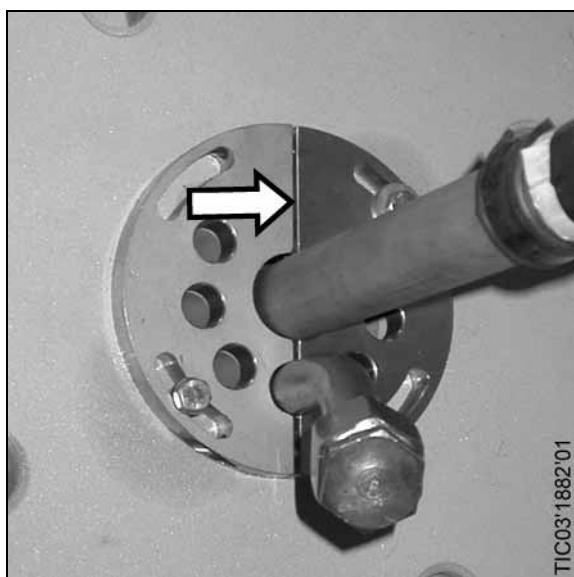


End flange

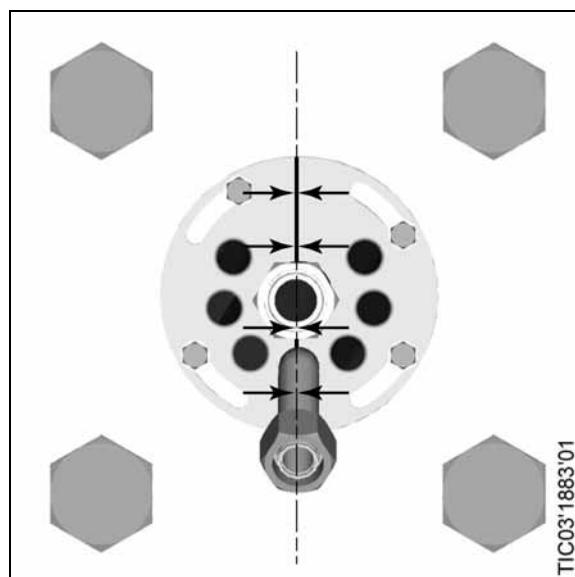


The angle piece must align with the split line in the end flange (please refer to the following drawing).

Split line in end flange



Alignment of angle piece

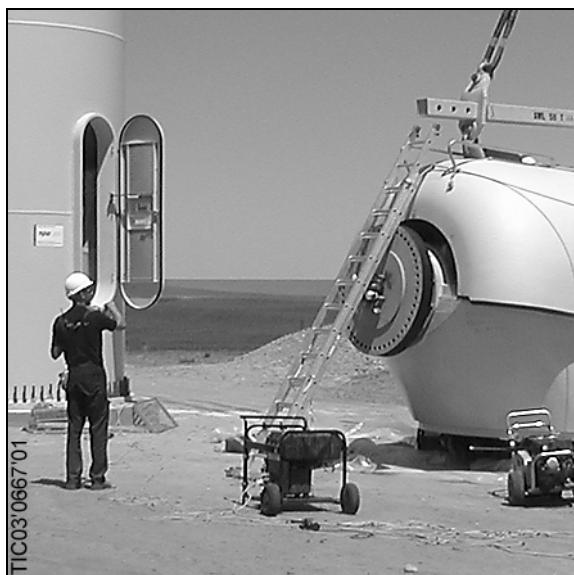


If the angle piece is out of alignment with the split line in the end flange, then it is repositioned by hand to achieve alignment.

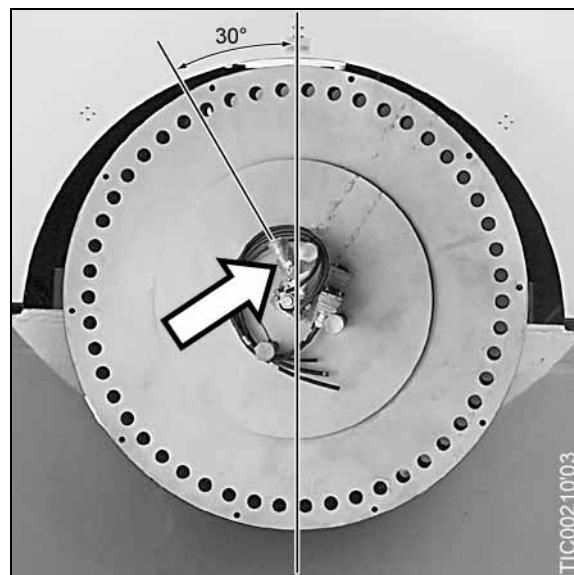
1.4.2 Angle piece position

The angle piece must be set to the 11 o'clock position (viewed from the front of the nacelle), which also can be described as 30° from the center line. The angle piece is positioned by manually rotating the main shaft at the brake disc. A technician outside gives directions to a technician inside the nacelle of which direction to rotate. The technician outside the nacelle gives a signal when the angle piece is in the correct position.

Technician giving signals to the technician in the nacelle



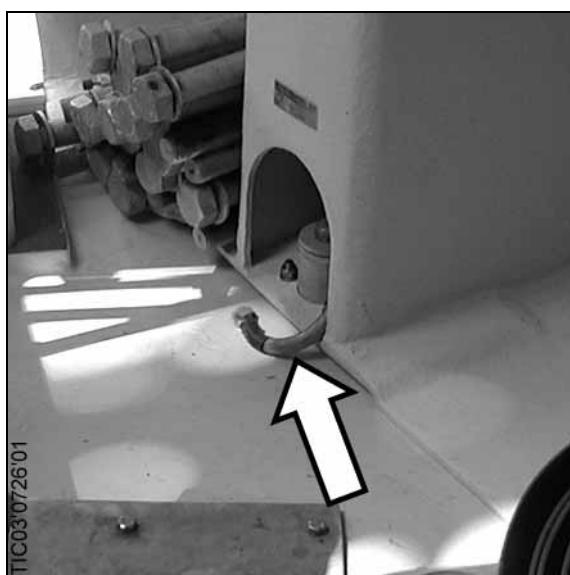
Angle piece at 11'oclock position



1.4.3 Installing the ground cable

Check to see if the ground cable has been installed. It is located on the left side in the front of the nacelle. If it has not already been installed, it should be installed now.

Ground cable installed



Sequence of work

1. Remove paint from base frame where there will be contact with cable eye.
2. Fit bolt with washer.
3. Pass bolt through eye on cable.
4. Mount bolt on base frame and tighten.

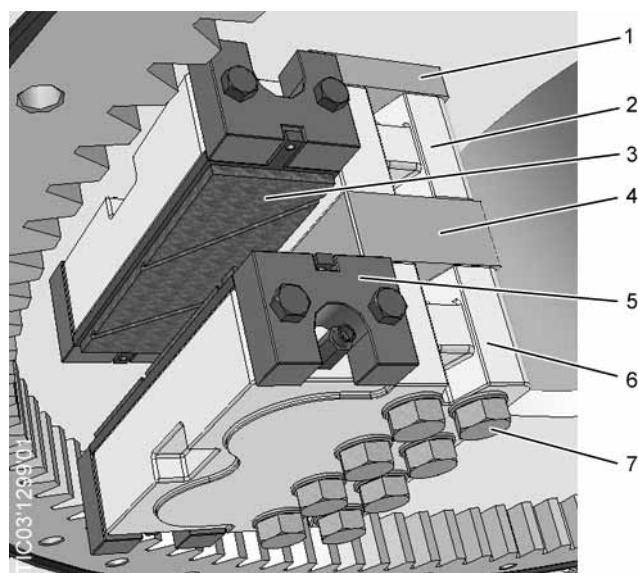
1.5 Preparing the nacelle bottom

1.5.1 Turning yaw brake calipers

Important: Two of the lower yaw brake calipers can not be turned before the nacelle is being lifted. It is important to turn the remaining two calipers and the spacers before attempting to set the nacelle on the tower since both the tower and the yaw brakes will be seriously damaged if the calipers are not turned. The two remaining yaw brake calipers are turned just before the nacelle is set on the tower top section..

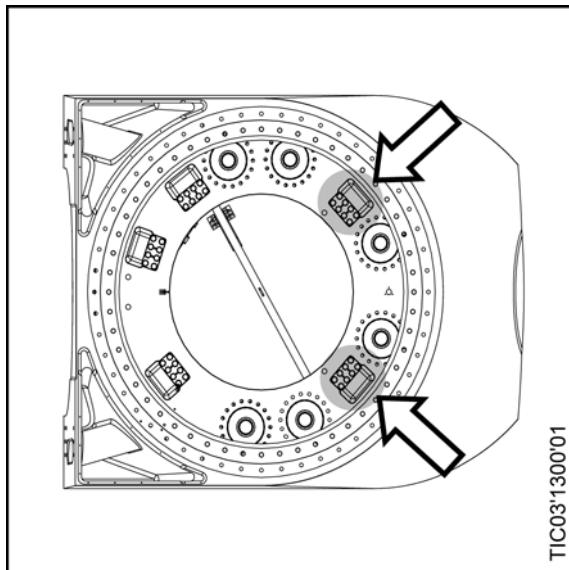
The yaw brake calipers and the spacers must be rotated 90° towards the inside of the nacelle in order to make space for the brake disc on top of the tower for when the nacelle is installed. The position of the lower yaw brake calipers, except the two calipers which are obstructed by the transport frame, must thus be checked, to ensure that they are turned 90°. Make sure that all the bolts securing the calipers and spacers are tightened to maintain the turned position.

The yaw brake



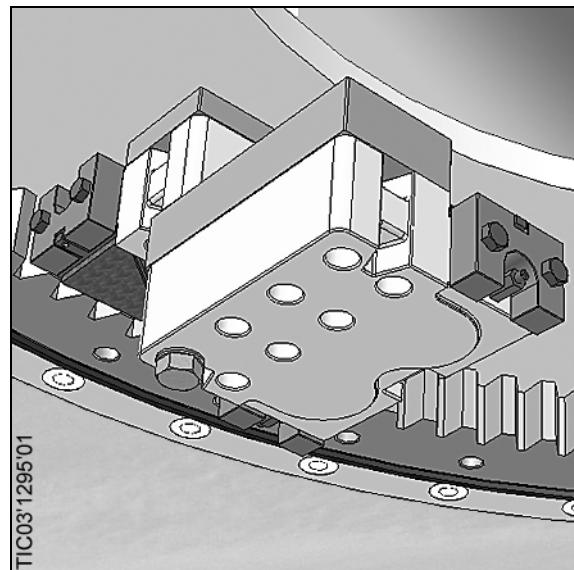
- 1. Base spacer
- 2. Upper yaw brake caliper
- 3. Brake pad
- 4. Spacer
- 5. Pad locating stop
- 6. Lower brake caliper
- 7. Mounting bolt

The two yaw brakes which are obstructed by the transport frame



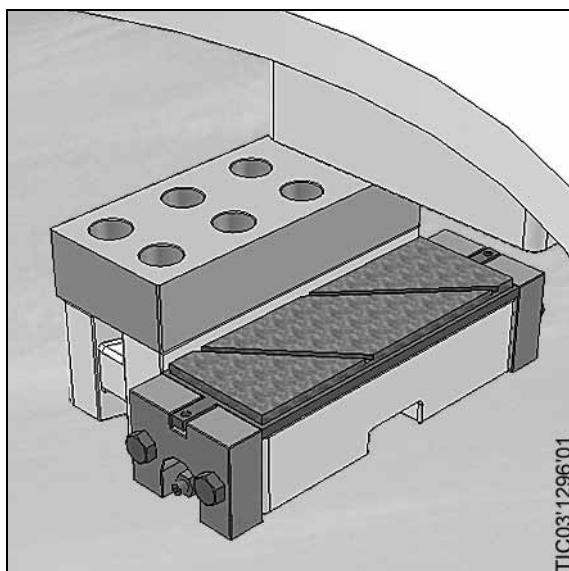
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Turned lower yaw brake caliper and spacer



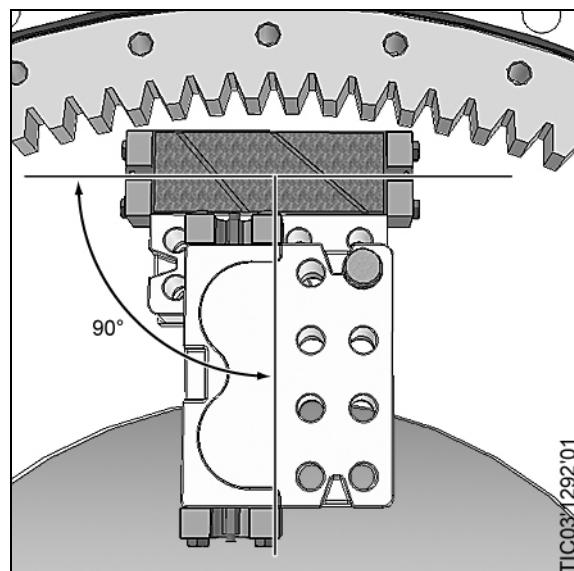
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(Seen from inside of the nacelle)



TIC03129601

(Bottom view)



TIC03129201

Sequence of work

1. Check the position of the lower yaw brake calipers.
2. Adjust position if necessary.
3. Tighten bolts if necessary.

1.5.2 Removal of bottom flange protection

The nacelle bottom flange protection must be removed and disposed of in a safe way.

1.5.3 Cleaning the outside of the nacelle

The nacelle must be cleaned on the outside before it is lifted. Cloths and industrial cleanser are used for removing dirt, stains, etc.

Cleaning the outside of nacelle



TIC031087501

1.5.4 Removing the transport frame supports

The transport frame supports are removed while the nacelle still is resting on the transport frame.
Plugging the transport frame holes

The holes from the transport frame supports are plugged while the nacelle still is standing on the transport frame. Joint filler is applied to the plugs for the holes, and the plugs are then inserted into the holes in the nacelle cover. Excess joint filler is removed with the fingers.

1.5.5 Removing the yaw brake pad transport coating

The brake pads is some times covered with some protective plastic. If this is the case this plastic protection is removed now.

1.6 Preparing the tower top flange

1.6.1 Cleaning the top flange

Before installing the middle section, the top flange of top base section must be given a final check. The flange should be clean and without burrs before the nacelle is placed upon it. Any contaminants are removed. A flat file can be used if there are any burrs that need to be leveled.

The part of the topflange which are to be used as brake disc for the yaw brakes

After using the flat file the flange must be surface treated according to the I&S data.

Filing burrs off the flange



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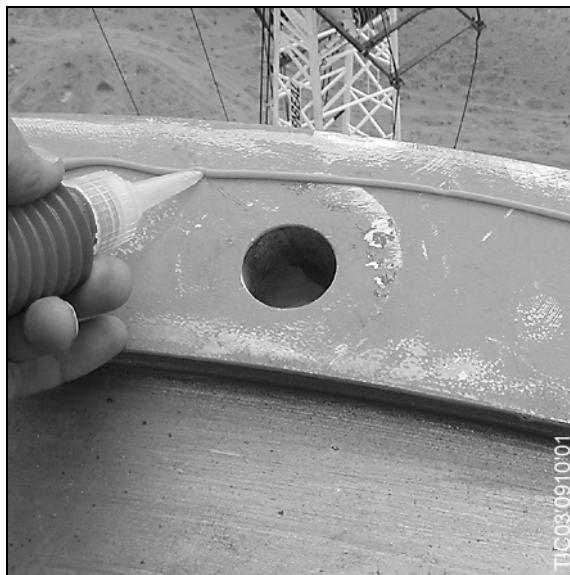
Sequence of work

1. Inspect top flange for dirt or burrs
2. Clean top flange if necessary
3. File down burrs if necessary

1.6.2 Adding sealer to the top flange

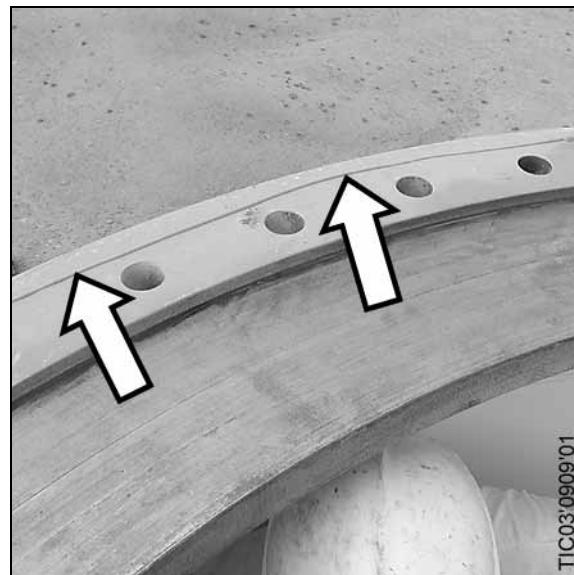
The flange joints between the tower sections must be sealed. The sealer is added to flange on the outside of the bolt holes.

Adding the sealer to the flange



TIC03'0910'01

Sealer is added outside the bolt holes



TIC03'0909'01

1.7 Lifting and installing the nacelle

1.7.1 Checking for critical wind speeds

Before lifting and installing the nacelle the wind speed must be checked. If the wind speed exceeds or it is assumed that it will exceed the critical limit within the time of the nacelle installation, the lift and installation must be put off until the wind speed is under the critical limit.

1.7.2 Lifting the nacelle

For lifting points in the nacelle check "Unloading the nacelle". Lift the nacelle and remove the transport frame. Now the crane can lift the nacelle to the top of the tower. As the nacelle is being lifted, the tag lines are used to orient the nacelle to the proper direction. Radio contact must be maintained between the team on top of the tower and the team with the tag lines on the ground. Radio contact must also be maintained between the crane operator and the top of the tower.

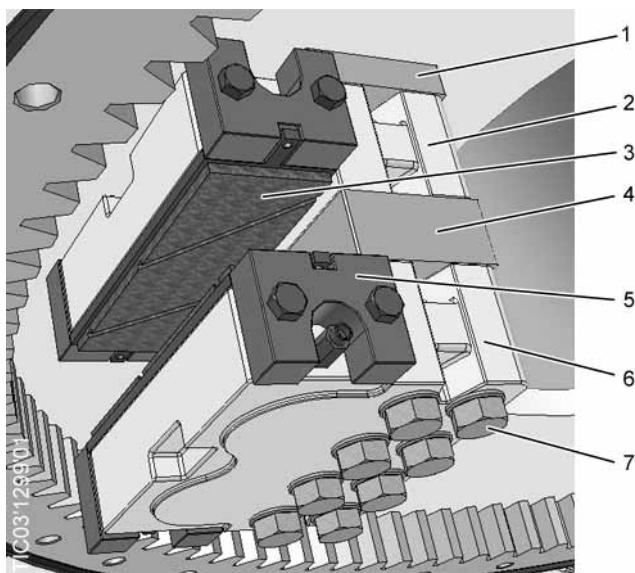
1.8 Installing the nacelle

1.8.1 Turning yaw brake calipers

Important: All the lower yaw brake calipers and the spacers must be turned 90° towards the inside of the nacelle before setting the nacelle on the tower top section.

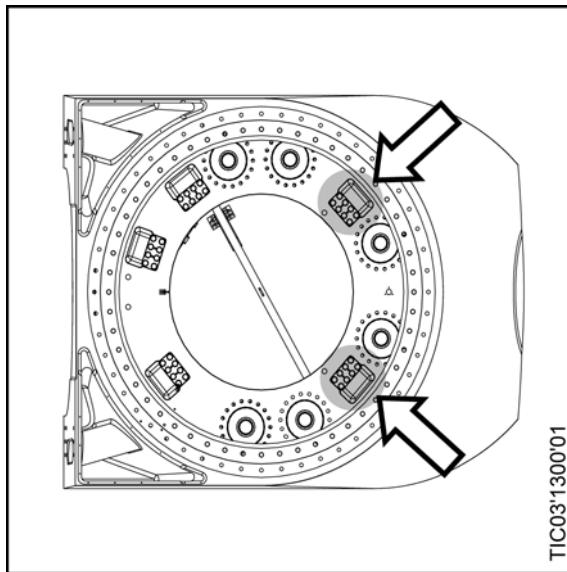
Two of the lower yaw brake calipers and spacers were impossible to turn before lifting the nacelle because they were obstructed by the transport frame. They must now be turned 90° towards the inside of the nacelle before setting the nacelle on the tower top.

The yaw brake

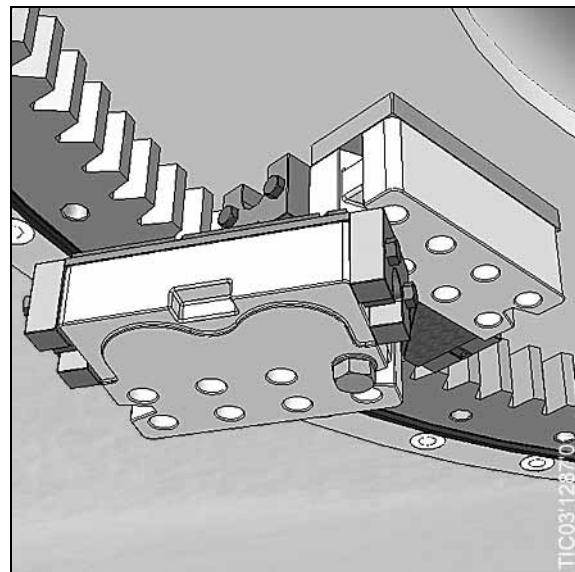


- | | |
|----------------------------|------------------------|
| 1. Base spacer | 8. Pad locating stop |
| 2. Upper yaw brake caliper | 9. Lower brake caliper |
| 3. Brake pad | 10. Mounting bolt |
| 4. Spacer | |

The two calipers which could not be turned before lifting the nacelle

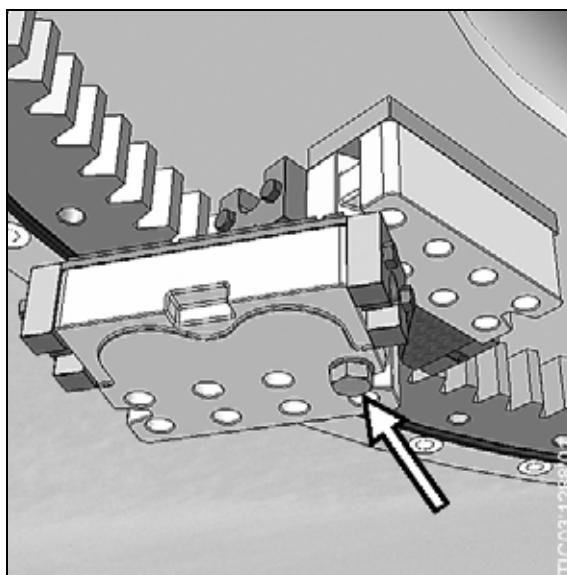


Position of the two yaw brake calipers before turning

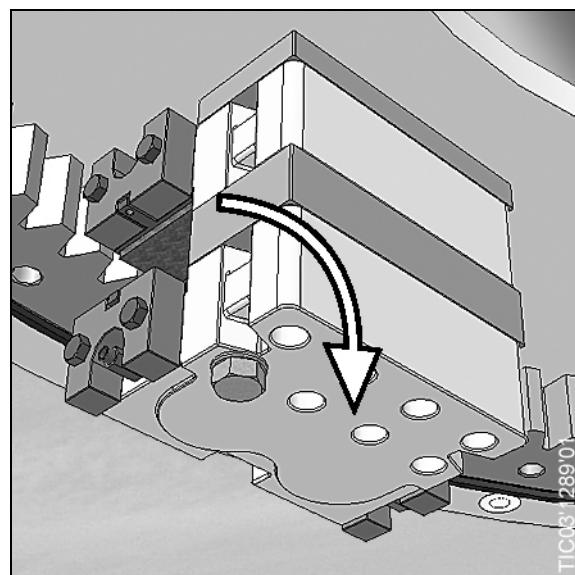


The two remaining yaw brake calipers and spacers are now turned. First the bolt which is securing the caliper is loosened just enough enable turning. Then the caliper and the spacer are turned into operation position. A bolt is now installed through the corner hole on the caliper and tightened.

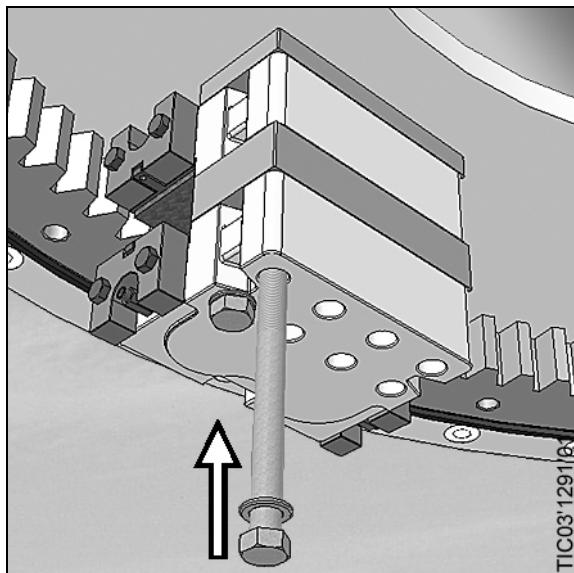
The bolt securing the caliper is loosened



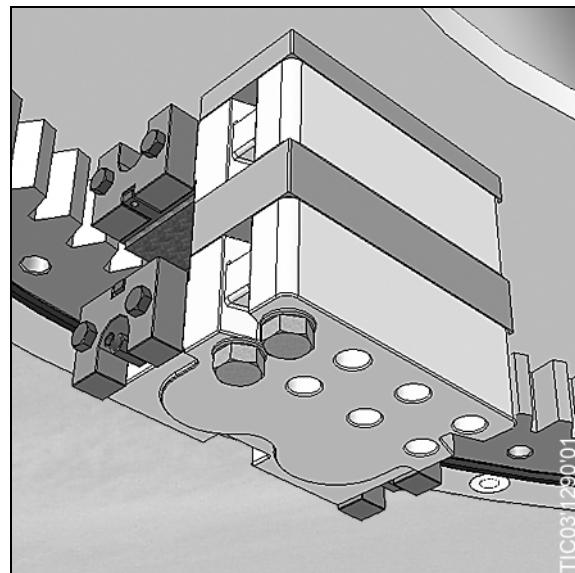
The caliper and spacer turned into operating position



Bolt installed through corner hole on caliper



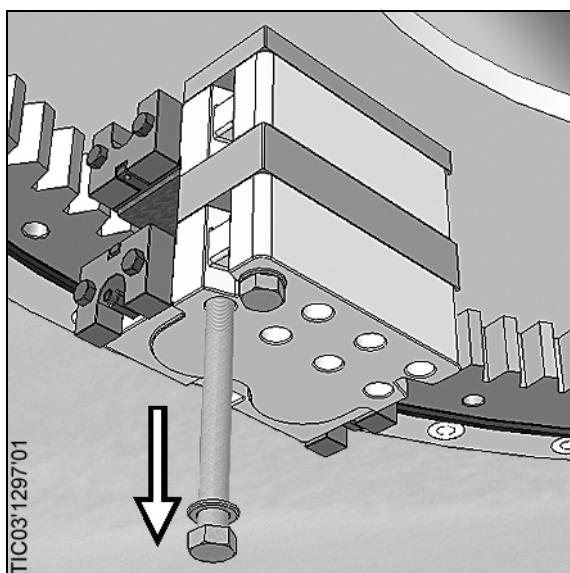
Two bolts installed on the yaw brake



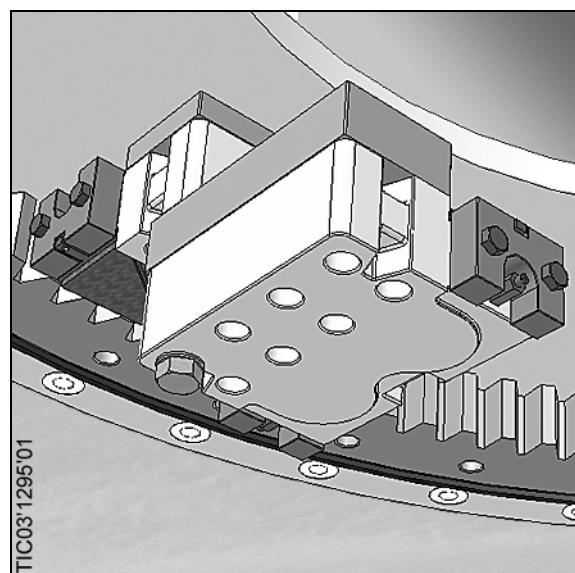
The bolt nearest to the brake pad is now removed from the yaw brake.

The yaw brake caliper and the spacer can now be turned 90° towards the inside of the nacelle. When the caliper and the spacer is in 90° position the bolt is tightened using a spanner to secure the caliper and the spacer.

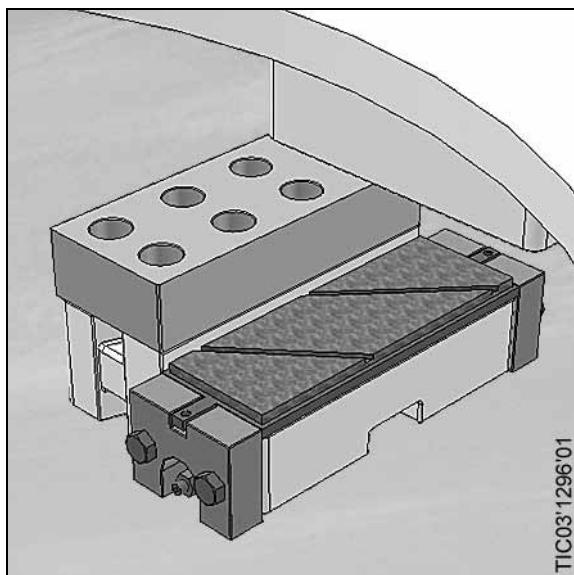
Bolt nearest the brake pad is removed



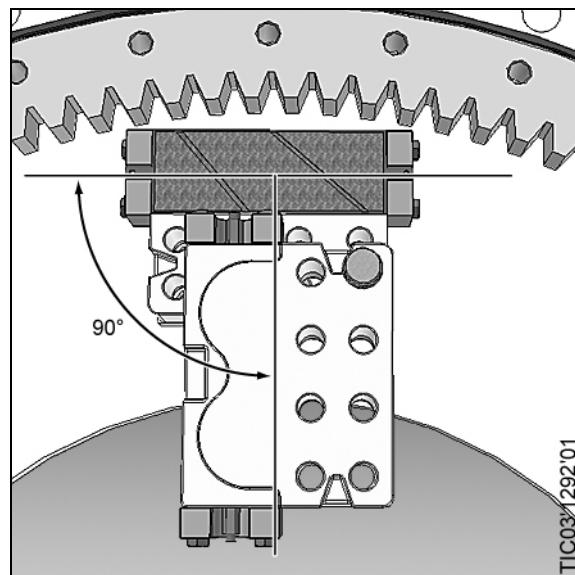
The lower yaw brake caliper and spacer turned 90° towards the inside of the nacelle



(Seen from the nacelle)



(Bottom view)



The procedure is repeated for the other lower yaw brake caliper and spacer.

The rest of the yaw brake calipers and spacers are also checked now to be sure that they are turned 90° towards the inside of the nacelle. If any of the calipers are not in the right position, they are turned now.

Sequence of work

1. Loosen the bolt which is securing the caliper and the spacer.
2. Turn caliper and spacer into operating position.
3. Install bolt in the corner hole the caliper.
4. Remove bolt nearest to the brake pad.
5. Turn caliper and spacer 90° towards the inside of the nacelle.
6. Tighten bolt.
7. Repeat procedure for the remaining caliper and spacer.
8. Check the position of all calipers and spacers.

1.8.2 Catching flanges with bolt

When the nacelle is just above the top of the tower, a bolt is used to catch the nacelle through a bolt hole on the top flange. The technician at the top of the tower directs the crane operator and the crew on the ground with the tag lines to move the nacelle in the direction that allows the bolt to catch a hole on the nacelle flange. When the bolt has caught a hole, it is screwed until the bolt-head hits the tower flange.

Now the nacelle must be turned into the proper position to allow it to catch the remaining bolts. The ground crew and the crane operator must have directions from the top of the tower as to which way to turn the nacelle. The other technicians on the top platform also help by holding onto the yaw brake calipers and pushing the nacelle in the direction desired. When the next bolt has caught the nacelle flange and has been screwed in, the remaining bolts may be installed.

Catching the nacelle with a bolt



Pushing on yaw brake calipers



Sequence of work

1. Lower nacelle to just over top flange.
2. Guide crane and ground crew to right position.
3. Catch nacelle with one bolt.
4. Swing nacelle to catch another bolt.
5. Catch nacelle with another bolt.

1.8.3 Installing the bolts

Now the bolts in the top flange to nacelle joint may be installed. All the bolts have already been fitted with washers and greased, so they are ready to be installed.

The bolts are installed using an electric impact wrench. They are screwed in only up to a point that allows the gap between the nacelle and the tower to be kept. Once all the bolts have been installed, the nacelle is lowered slowly as the bolts are tightened to follow the nacelle down. During this operation, the bolts are tightened by hand, and all technicians on the top platform help with this task. The objective is to guide the nacelle to the correct position on the top flange. The lowering of the nacelle is done gradually while as many of the bolts as possible are being tightened by hand, and the lead technician is in contact with the crane operator. When the nacelle has been set on the top flange, the bolts can be tightened with the electric impact wrench.

Installing bolts



TIC03'0725'01

Tightening bolts by hand while nacelle moves down



TIC03'0723'01

Tightening the bolts



TIC03'0724'01

Sequence of work

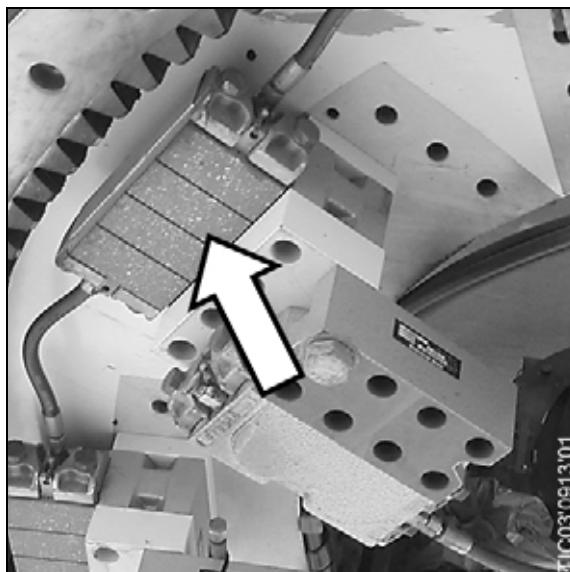
1. Install bolts to flange using an electric impact wrench.
2. Start lowering nacelle while tightening bolts by hand.
3. Set nacelle on top flange.
4. Tighten all bolts using an electric impact wrench.

1.8.4 Installing brake calipers

The removed lower brake calipers are found in the nacelle. They are now unpacked.

Before installing the brake callipers, it must be verified that the brake pads on all calipers are in place, and that the correct side of the brake pad is facing the brake disc. The brakes must not be used unless all brake pads have been mounted correctly.

Brake pad on caliper



The nacelle position bracket must be mounted with the caliper on the brake farthest to the right facing the gearbox. The nacelle position bracket is mounted with the two bolts to the right on the caliper.

The pre-mounted calipers must be turned 90° into operating position. The bolt that holds the brake caliper is loosened, and the caliper is turned into position. The remaining 7 bolts are installed by hand.

The loose calipers are mounted directly to operating position, and the bolts are installed.

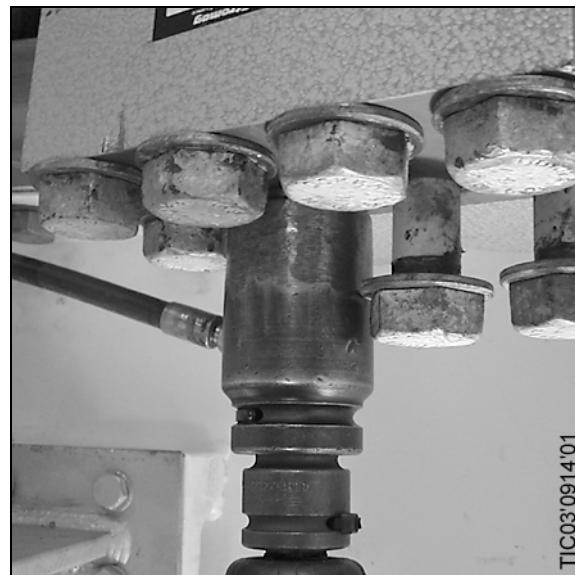
When all the bolts have been installed, they are tightened using the electric impact wrench. All the calipers are installed using this procedure.

Installing the bolts on the caliper



TIC03'0915'01

Tightening the bolts on the caliper



TIC03'0914'01

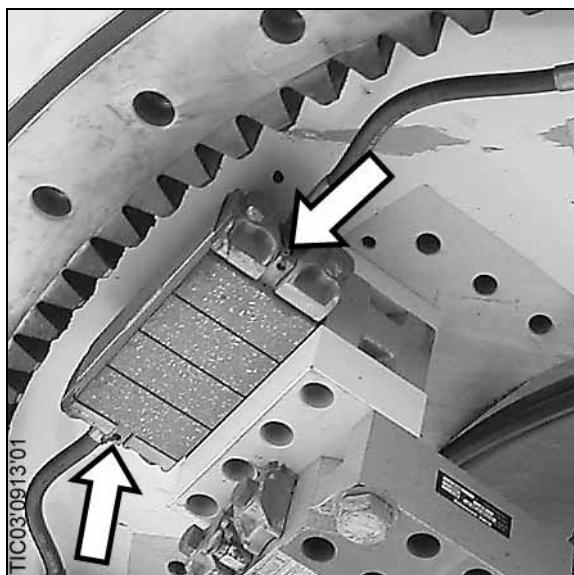
Installed caliper



TIC03'0916'01

When the brake calipers are installed the strips that are securing the brake pads are removed.

Strips securing brake pads



Sequence of work

1. Check if all brake pads are in the right place and mounted correctly.
2. Mount nacelle position bracket on the caliper farthest to the right facing the gearbox.
3. Loosen the bolt which holds the caliper.
4. Turn the caliper into operating position.
5. Install all bolts.
6. Tighten all bolts.
7. Remove the strips which are securing calipers.

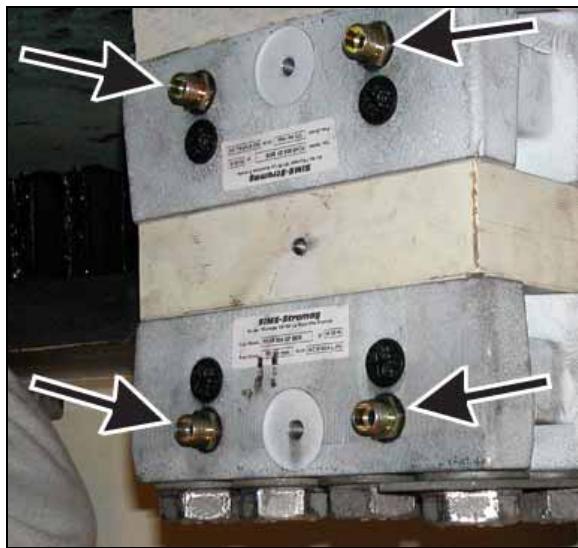
1.8.5 Installing missing hydraulic hoses on yaw system

All hydraulic hoses on the yaw system which have been removed due to the transportation frame must be installed now.

1.8.6 Installing yaw brake hoses and fittings

When the callipers are positioned and torqued and the brake pad play is correct, the brake hose system is fitted.

All four fittings ready



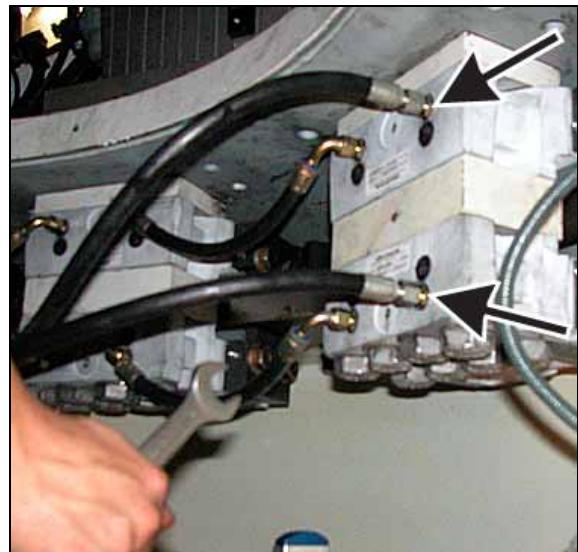
Mounting the hose connecting the upper and lower part of the last brake caliper



Hoses between two calipers mounted



Hoses from the hydraulic unit mounted

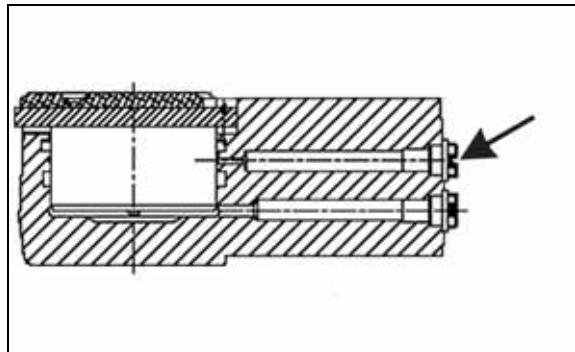


1.8.7 Mounting tubes for internal draining system (only FCHR 90)

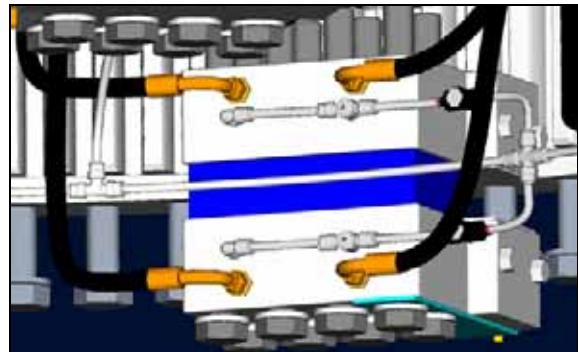
Each piston cylinder is provided with an internal drain channel that allows brake fluid to pass the inner gasket and seep without leaking through the outer gasket. Thereby the brake lining is protected against leaking brake fluid.

The caliper draining channels are connected by a system consisting of plastic tubes connected by means of quick couplings and with check valves inserted to secure the desired flow direction.

Arrow shows the plugged drain channel in the cut through caliper lower part



Caliper with white drain tubing connected by means of fittings and quick couplings and with check valves inserted



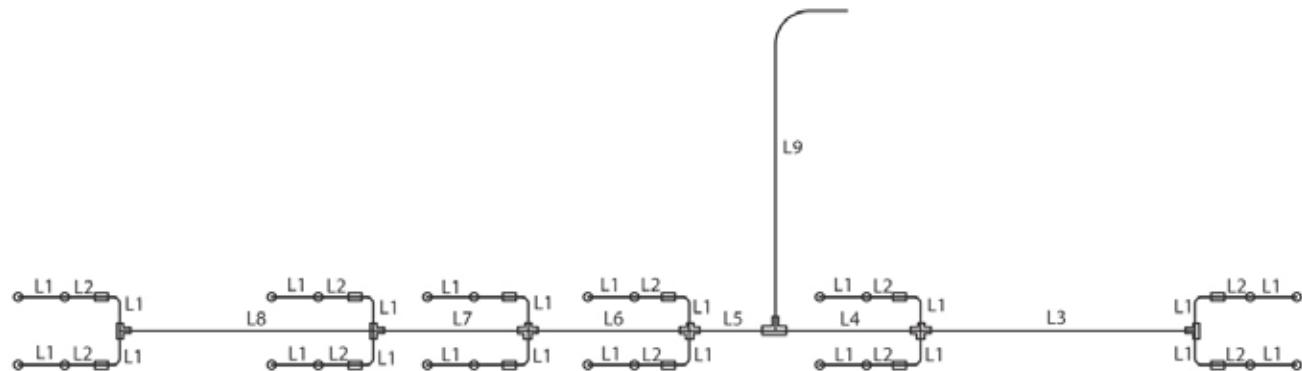
The tubing system consists of several tubes connected with quick couplings and fittings with quick couplings.

The “unfolded” tubing systems (diagrams) below show the configuration for each turbine type and is built by means of 9 different tube lengths according the below table.

NM82 /1650 v.2	
Tube type	Length [mm]
L1	100
L2	70
L3	535
L4	330
L5	90
L6	460
L7	435
L8	1035
L9	865

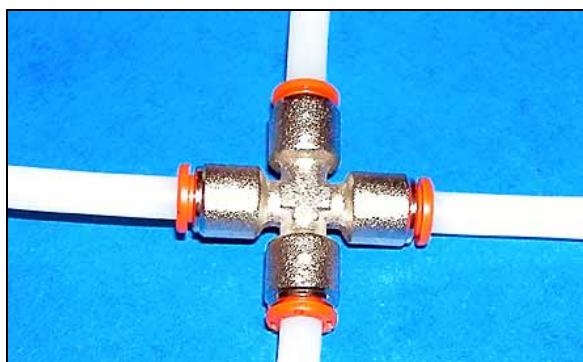
Imagine standing on the tower top platform facing the yaw brake hydraulic unit. Then the tubes must be connected just as shown in the below diagrams where right and left correspond to right and left in real life.

Drain tubing diagramme NM82/1650 v.2:



The tubes are connected by means of T quick couplings, cross quick couplings, elbow connectors, T connectors and check valves.

Equal cross coupling



T coupling



T connector (fitting)



Elbow connector (fitting)



The tubes are pressed into the quick couplings until they cannot be pulled out again.

Pressing in the last tube in the cross quick coupling



If it is necessary to dismantle a tube this is done by pressing in the outer ring and pull out the connector as shown on the below figure.

Pressing in the outer ring and pulling out the hose



Each caliper half part is fitted with an elbow fitting, a T fitting and a check valve as shown below. The caliper half parts are connected to the line using a cross coupling or a T coupling.

Drain pipe branch - T and elbow fittings and tubes - for a brake caliper half part



Drain pipe branches connected by means of T coupling



Drain pipe branches connected with of cross couplings



Pipe for hydraulic unit connected by means of T coupling



It is of vital importance that the flow through the one direction valves (check valves) is directed away from the caliper. This secures that leaking oil will flow away from the brake caliper and that the oil from one leaking can not contaminate another caliper in the system.

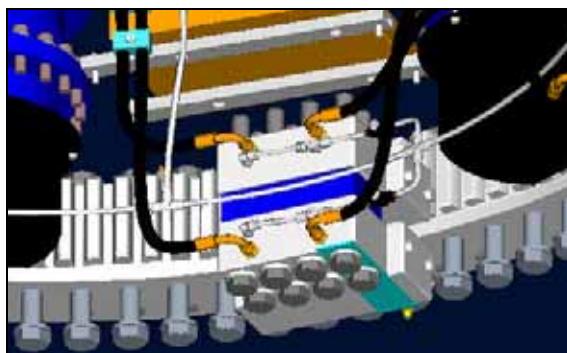
Symbol tells here that the flow direction is from left to right



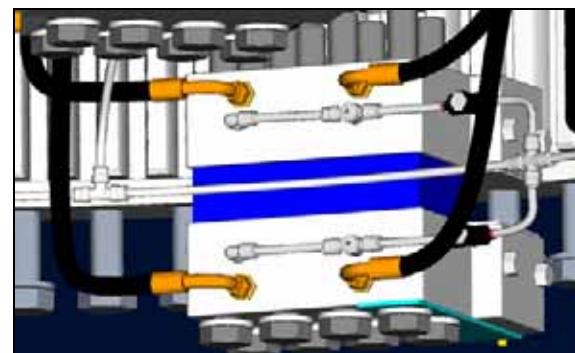
Detailed view of hydraulic symbol



The tube from the hydraulic unit entering the T-coupling



The first caliper the the right of the hydraulic unit with the drain pipes connected



The return tube is connected to the hydraulic unit into the tank of which the leaking oil is recycled. The elbow connector fits to the block of all the relevant hydraulic units. It is connected to the pressureless side of the circuit.

Hole in hydraulic unit for the return tube (Parker unit)



Elbow connector for the hydraulic unit (for all units)



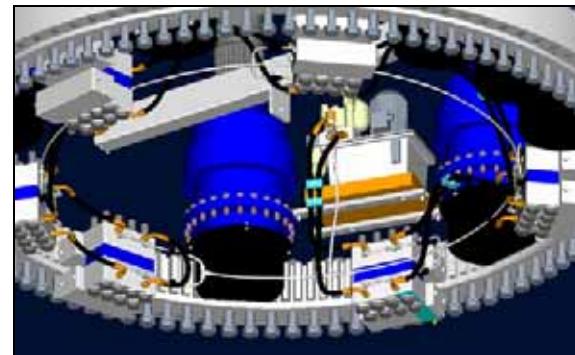
Mounting the connector fitting



Return tube entering the hydraulic unit seen from below

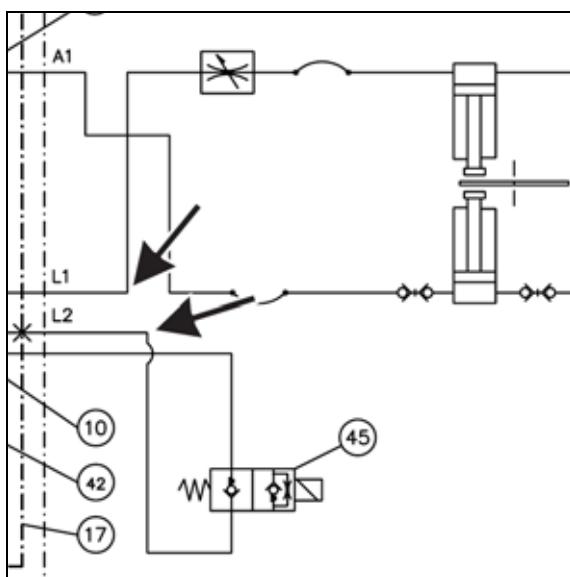


The total tubing system installed (example)

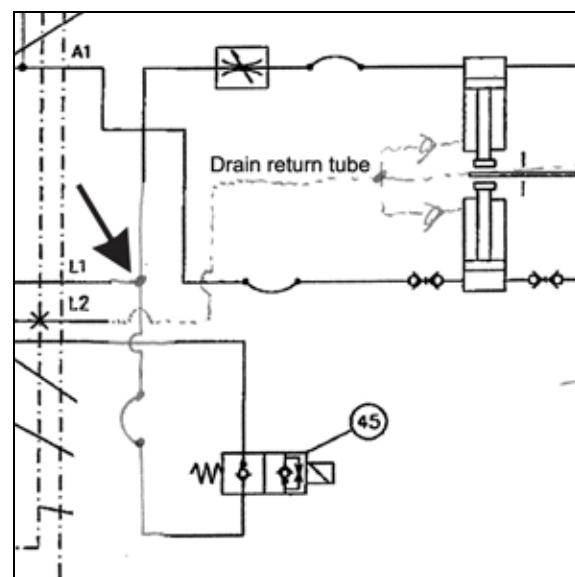


If no leak connection is available a t-fitting is used for assembling two other fittings that are returning into the leak connections. The thereby available leak connections is now available for the drain return tube fitting.

AVN K07: The two leak connections are used



AVN K07: T-connector assembles two return hoses and thereby leaves L2 available for the drain system



T-connection for assembling two leak return fittings



1.8.8 Torquing the bolts

After all the bolts have been tightened with the electric impact wrench, they can be torqued using the hydraulic torque wrench. Torque is applied as per the I&S data.

Torquing the tower to nacelle bolts



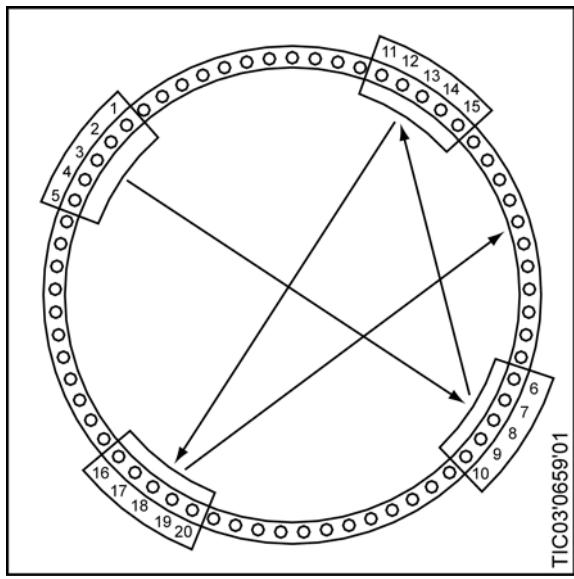
TIC03'0907'01



TIC03'0908'01

The torquing of the top flange to nacelle bolts must be performed by proceeding in a star pattern in order to pull the flanges together evenly. The illustration below shows how to torque the bolts in a star pattern. Remember to mark each bolt after torquing it.

Torquing bolts in a star pattern



Torquing bolts in a star pattern:

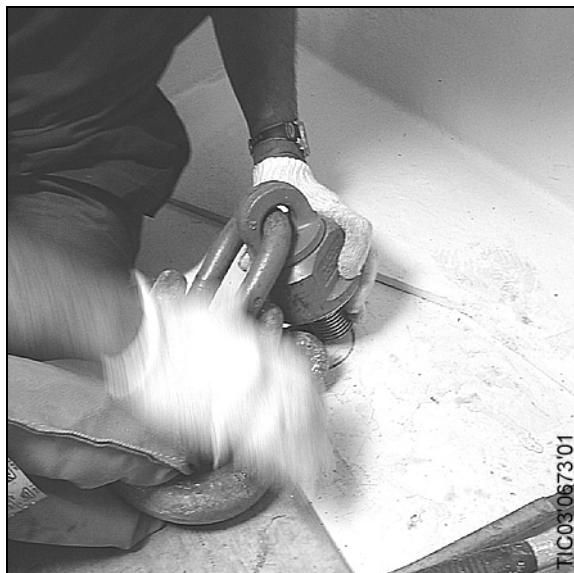
First, torque the bolts numbered 1 thru 5, and then move to the opposite side of the flange, and torque bolts 6 thru 10. Then move 90 degrees and torque bolts 11 thru 15, and move to the opposite side to torque bolts 16 thru 20. Now move to the 5 bolts between the groups numbered 11 thru 15 and 6 thru 10, and torque those. After that, move to the opposite side and continue in the same fashion until all bolts have been torqued using this star-like pattern.

1.9 Removing the lifting equipment

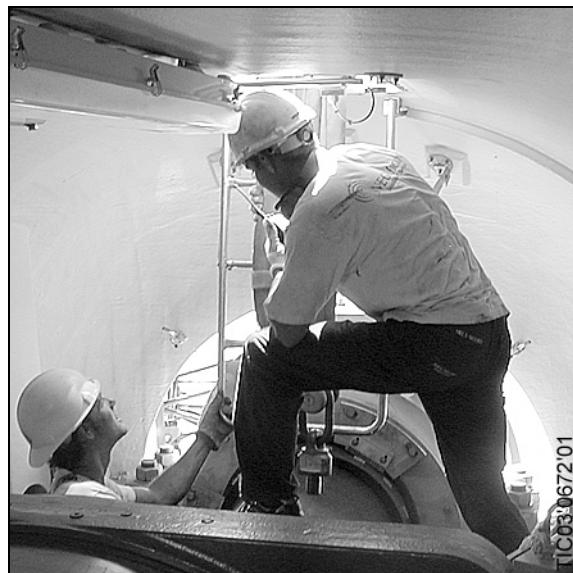
1.9.1 Removing the eye bolts and eye brackets

The eye bolts and eye brackets in the nacelle can now be removed to release the crane from the nacelle. When all eye bolts and eye brackets have been released, the crane can start lifting the eye bolts and the straps out of the nacelle. Please note that it is very important to guide the straps and the eye bolts and eye brackets out of the nacelle, so as to avoid the eye bolts causing damage on the interiors. Once the straps and eye bolts are out of the nacelle, the crane lowers the lifting equipment to the railroad ties beside the turbine. The lifting yoke is guided onto the railroad ties, and the crane is released from the lifting equipment.

Removing eye bolt from base frame



Guiding the straps and eye bolts out of the nacelle



After removing all the eye bolts the bolt holes on the nacelle base frame must be plugged to keep dirt out of the holes.

Sequence of work



1. Remove eye bolts from the base frame
2. Guide eye bolts out of the nacelle
3. Plug bolt holes on base frame

1.9.2 Removing the tag lines

The tag lines which are attached to the anchor points on the top of the nacelle can now be untied and dropped to the ground. Make sure that no one is standing near the tower when the tag lines are being dropped. After both tag lines are dropped, they are rolled together and placed in their bags.

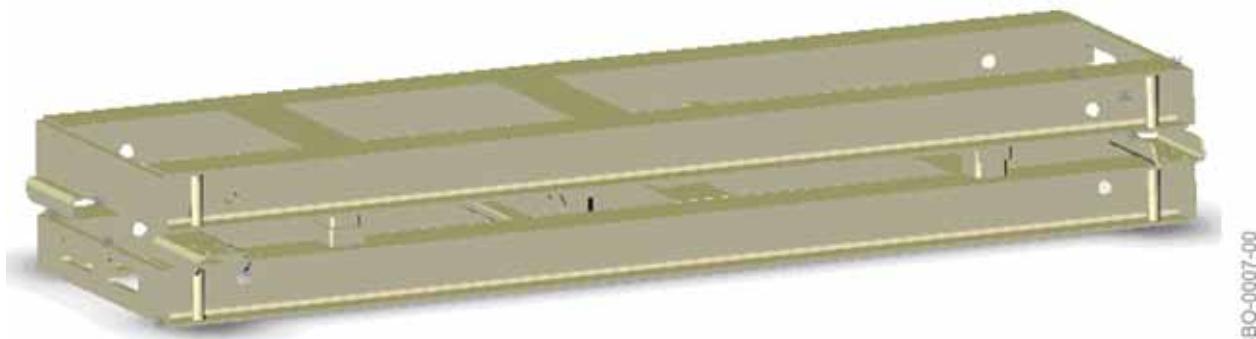
Untying the tag line



1.9.3 Packing the transport frame

After use the transport frame must be stacked and returned to Vestas Wind Systems A/S. There can be up to 6 transport frames in one stack, depending on the size of container for returning goods.

Two transport frames are stacked.



Two transport frames have the dimensions: H x B x L = 718mm x 1500mm x 5410 and the weight is 3400 kg for two frames.

All transport frame support must be returned together with the transport frame. Except the controller box, this must be packed together with the turner system. Place the controller box, so that buttons, cables and plugs cannot be damaged during transportation.