Thermal 3 Head Lifting Crane

Installation and Use on a Magnus VLF

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Revision History

Revision	Date	Author	Comments
1	30 Nov 2005	A.Blignaut/ C.Townsend	Draft release.
2	16 Dec 2005	A.Blignaut	Corrections made to some procedures.
A	24 Jan 2006	C.Townsend / A.Blignaut	Added details to overall content including safety information.

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1. SCOPE OF DOCUMENT

This document covers the installation and safe use of the Thermal 3 Head (TH3) lifting crane with the Magnus VLF output device. This document does not contain all the details necessary to install or remove a TH3. For this information, refer to the Series 2 X-Speed Upgrade document (719-00608A).

2. OVERVIEW

The lifting crane is designed to assist with the handling of a TH3 that has an approximate weight of 49 kg (108 lb). The crane uses a pneumatic cylinder and control circuit to counter-balance the weight of the head. The crane allows the service engineer to lift, swivel and lower the head as if it weighed about 4.5 kg (10 lb).

The crane is designed to reach a head resting on the floor or in the bottom of a head shipping crate. The crane will allow the user to lift the head high enough to clear hoses and brackets when the lifting boom is swiveled over the carriage. The crane allows two possible lifting angles of the TH3 for safe and convenient positioning:

1. Level lift for extracting the head from the crate and inserting a head into the crate.
2. Angled lift (10 degrees) when installing the head onto the inclined carriage and removing the head from the inclined carriage.

The lifting crane comprises of a column, a boom, and a lifting frame.

3. SAFETY ESSENTIALS

Prior to installing and using the lifting crane, read and understand all instructions contained in this document.

The crane relies on air pressure to operate and will prevent the head from falling even when the air supply is disconnected. However, the biggest factor in crane safety relies on the user verifying the following:

1) The column is correctly restrained by the column brackets.
2) The four lifting spacers and screws on the head are tight before installing the lifting frame.
3) The lifting frame is correctly aligned with the head. The **Lens Side** label is positioned on the same side as the lens tube on the head.
4) The four lifting spacers on the head are properly seated into the lifting frame slots.
5) The lifting frame is locked to the head with the hand-screw.
6) The rod-end on the lifting cable is captured between the U-shaped center beam with a fully inserted lift pin.

7) If the head is being removed from the carriage, verify the removal of all mechanical attachments between the head and the carriage. Also ensure all electrical, pneumatic, and hose connections are detached from the head. Refer to the relevant sections in document 719-00608A.

To prevent damage to the head and other equipment while using the lifting crane, the user must exercise the following precautions:

1) When switching the lifting crane between operating modes (Release and Balance), the user must be prepared to control sudden shifts and rotations of the head by holding onto a lift handle.

2) Be aware that a head suspended from the cable is free to twist and swing when left unattended. This is a potential danger for components such as the lens tube and connectors to become damaged.

3) When lowering or raising the head near the drum, be aware that a slight bounce off the main hose support bracket could drive the lens tube into the drum and cause serious damage.

4) Be aware of the flexures when lowering the head onto the carriage.

4. OPERATIONAL REQUIREMENTS

- The Magnus VLF air supply must be on for the head lifting crane to operate. The minimum required air pressure at the crane quick disconnect is 80 psi.
- The table rails must be removed before the crane can be installed.
- The carriage must be moved to location 1050 for the crane to install or remove a TH3.

5. INSTALLING THE HEAD LIFTING CRANE

5.1 Installing the Column

1. Loosen the four screws that mount the column hole cover to the upper left laser shroud.

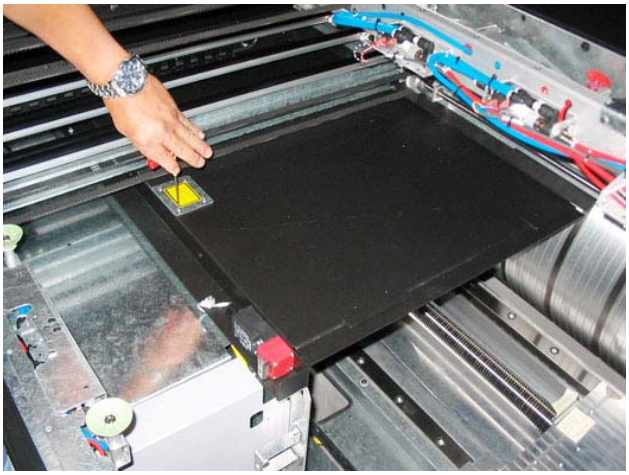


Figure 1: Removing the column hole cover

2. Slide the cover past the screw heads via the keyholes—the tether cable keeps the cover from getting lost. This cover is a critical laser safeguard and must be reinstalled after the crane and column is removed.

3. Carefully lower the column into the hole—it is a symmetrical part, so either end will do. Ensure the column seats squarely into the hole of the bottom support bracket and is held perpendicular to the laser shroud. Figure 2 shows the column properly seated in the lower support bracket. There are two sets of annular grooves on the column called witness marks. The top witness mark should be aligned with upper surface of the laser shroud. As a final check, give the top of the column a sideways push-pull. The column will only rattle around a small amount and the lower end will definitely feel restrained.

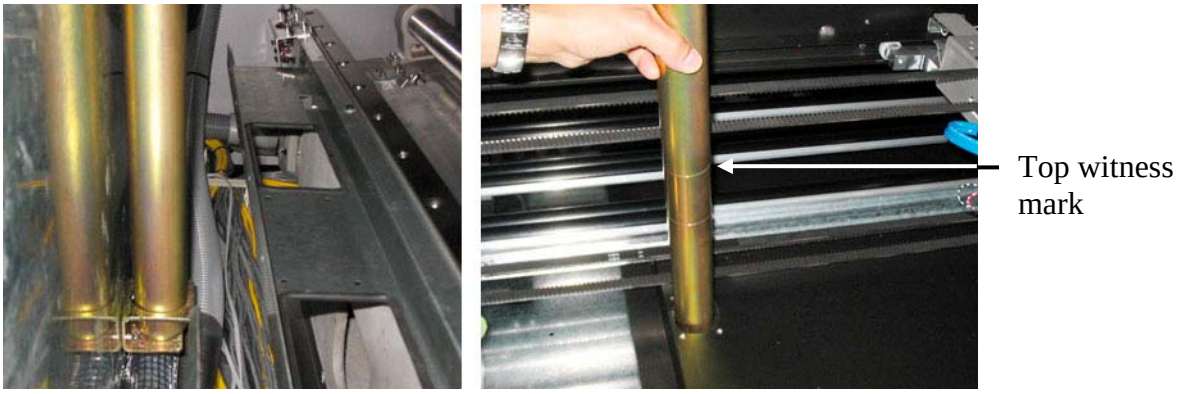


Figure 2: Installing the crane column

5.2 Installing the Lifting Boom

1. Lift the boom and place it onto the end of the column.



Figure 3: Installing the crane boom

2. Release the air line from both hose clips on the boom. Each clip has a quick-release tab that is easily released by your thumb. Attach the air line to the quick disconnect air fitting on the front of the hose tray wall.



Figure 4: Connecting the air line

3. Turn on the air supply to the Magnus VLF output device.

Note: The air will escape from the yellow tube that connects to the TH3. If this is a new installation or an upgrade, leave this tube open to allow air to flow through the tube for at least 20 minutes to flush the tube before it is connected to the TH3. This can be done while using the crane to install the head.

6. ATTACHING THE LIFTING FRAME TO THE TH3

1. The lifting frame is attached to the TH3 via four lifting spacers pre-attached to the head. If the head was supplied without pre-attached lifting spacers, locate the separate package of spacers and install them now. Kit 518-01321A contains the lifting spacers and screws and should appear in the head crate. Always verify the tightness of all four lifting spacers and screws before installing the lifting frame.

2. Align the lifting frame to the head. The **Lens Side** label must be on the same side of the head as the lens tube.

3. Attach the lifting frame to the TH3 with the four lifting spacers that fit into slots on the ends of the lifting frame. If the lifting spacers will not slip into their corresponding slots, you need to turn the hand-screw lock counter-clockwise to raise the plastic nut up inside the rear U-shaped cross-member.

4. Once you have verified all four lifting spacers are properly positioned in their slots, turn the hand-screw lock clockwise to push the lifting frame and head apart. Ensure the rear lifting spacers seat into the bottom of their vertical slots. The hand-screw lock should be only tightened enough to seat the lifting spacers and eliminate play between the head and the frame.

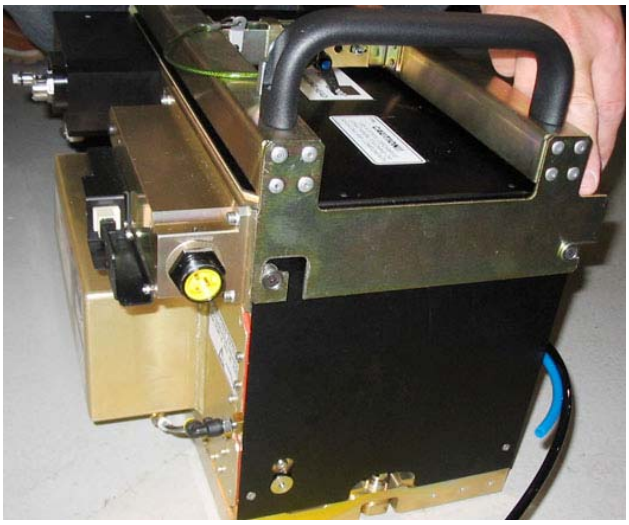


Figure 5: Attaching the lifting frame to the TH3

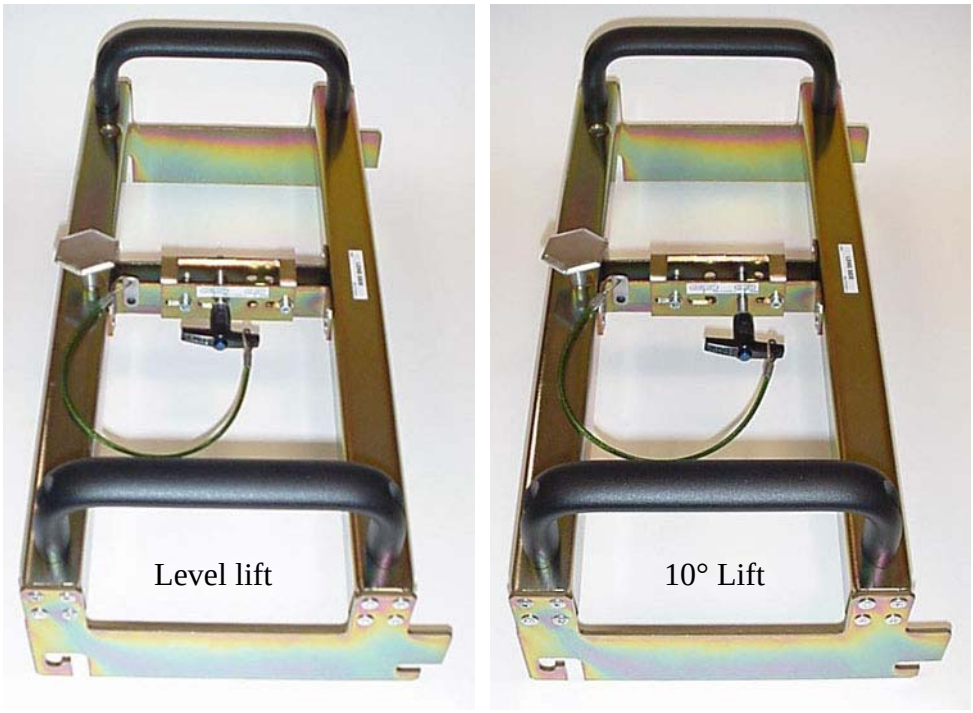


Figure 6: Lifting frame pin positions

Note: The tether is designed to keep the pin from being lost and is not intended to hold the weight of the head during a lift.

7. USING THE HEAD LIFTING CRANE

In summary, the crane is used to level-lift the head from the crate to the floor. The lift angle of the crane is changed to 10 degrees and the head is then lifted from the floor to the inclined carriage. Reverse order is used when removing and crating the head.

The operations of the crane is controlled by a labeled pneumatic toggle switch on the boom:

Release: No lifting forces are applied to the cable by the internal pneumatic cylinder. If the internal cylinder is not fully extended, the cable can be manually pulled out of the boom enclosure. If the head is suspended from the cable and this function is selected, the head will lower slowly at a pre-defined rate. If the air supply is removed from the crane while this function is selected, the head will be held stationary. Earlier beta models of the crane featured labels that described this function as **Free**.

Balance: Lifting forces are applied to the cable by retraction of the internal pneumatic cylinder. The amount of lifting force is factory set to equal the weight of the head and lifting frame. If the crane is attached to the head and this function is selected, the weight is balanced without physically moving it upward. When the user applies some lifting force via the handles, the head will rise. When the user stops lifting, the head will stop with no further up-down movements. When the user pushes down on the head via the handles, the head will lower. When the user stops pushing, the head will stop with no further up-down movements. If the air supply is removed from the crane while this function is selected, the head will be held stationary. Earlier beta models of the crane featured labels that described this function as **Lift**.

7.1 Removing the TH3 from the Shipping Crate

1. Position the TH3 with the lifting frame installed under the boom cable (the head should still be in the lower half of the head shipping crate).
2. Switch the boom toggle switch to **Release**.
3. Manually pull the boom cable rod end down to the lifting frame. If the cable will not pull out, allow a few moments for any stored air in the circuit to escape. If the cable still resists pulling, ensure that air is being supplied to the crane.



Figure 7: Pulling the lifting crane cable from inside the boom

There are two possible holes for the cable rod-end to be attached to the lifting frame via the lift pin: **Level Lift** and **10 Degree Lift**. Use the **Level Lift** position to lift the head from the shipping crate to the floor. Use the **10 Degree Lift** position to install the head onto the inclined carriage.

4. Capture the rod-end on the lifting cable inside the U-shaped centre beam with a fully inserted lift pin.

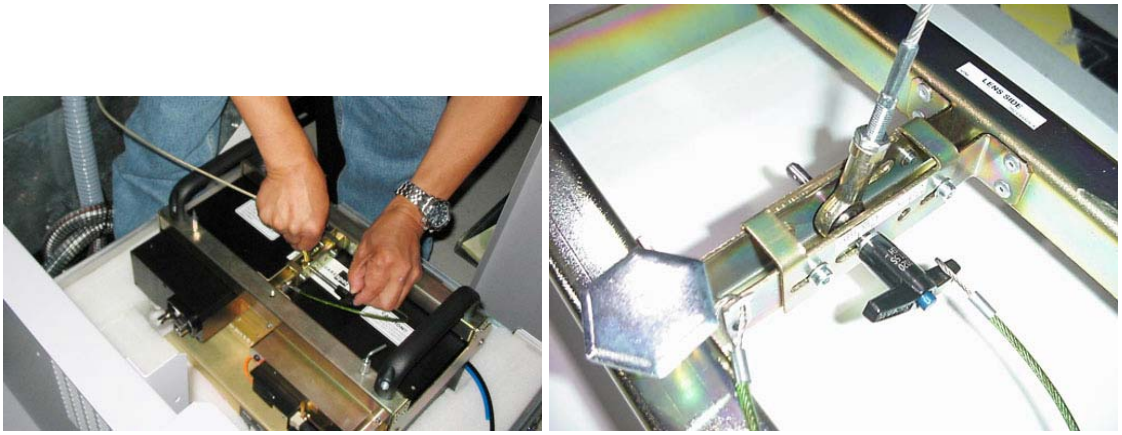


Figure 8: Attaching the cable to the lifting frame

a. The head crate packing foam has to be a tight fit for shipping. Using the **10 Degree Lift** position to move the head in and out of the crate will not work because of the interference with the foam.

5. Install the lift pin and the cable rod-end at the **Level Lift** hole of the lifting frame. Move the head crate or swing the boom until the cable is perpendicular to the lift point.

Note: If the cable is not perpendicular to the lift point when you start lifting the head, the head can swing unpredictably when it is free of the crate and could damage the head.

6. Switch the boom toggle switch to **Balance**.
   The cable will tighten and apply a lifting force equal to the weight of the head. The head should however remain stationary in the vertical direction. If the head begins to rise without any applied force by the operator, the crane lifting force is set too high and requires adjustment. Refer to Appendix A.

7. Manually raise the head until it clears the crate and move the empty crate aside.

8. Put a piece of clean protective foam on the ground to set the head on.

9. Manually push the head down until it rests on the foam.

10. Switch the boom toggle switch to **Release**.
    The lifting force is removed and the head will settle onto the foam.

11. At this point, the left and right flexure extensions must be attached to the head. For more information on installing the TH3, refer to document 719-00608A.

12. Pull downwards on the cable to provide some slack. Extract the lift pin and disconnect the cable rod-end from the lifting frame.

7.2 Installing the TH3 onto the Carriage

Before installing the head onto the carriage, the following must have been completed:

- The carriage has been prepared with the necessary parts including the flexures.
- The flexure extensions are attached to the head. For more information on installing the TH3, refer to document 719-00608A.
- The TH3 has been removed from the crate and is standing on the floor below the head crane boom.

1. Install the pin and cable rod-end at the **10 Degree Lift** hole of the lifting frame.

2. While holding onto a lift handle, flip the toggle switch to **Balance**. The cable will tighten and the head will tilt at approximately 10 degrees. Guide the head as it moves through this angle to prevent it from swinging into any objects.

3. Manually raise the head high enough to clear any obstacles and swing the boom and head into position above the carriage.

4. Manually push the head down onto the mounting points on the carriage.

CAUTION: Exercise caution when lowering the head onto the carriage-the head, drum, and hose support bracket are very close to each other. A slight bounce off of the hose support bracket could result in the lens tube contacting the drum. Also ensure the head fits between the flexures on the carriage without damaging them.

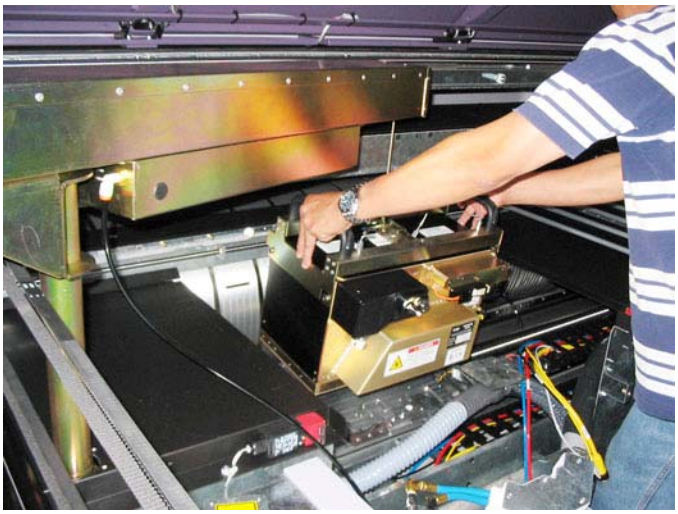


Figure 9: Installing the TH3 using the crane

5. Switch the boom toggle switch to **Release**. The head will settle onto the carriage.
6. Create some slack in the boom cable and disconnect the cable rod-end from the lifting frame.
7. Switch the boom toggle switch to **Balance** to fully retract the cable into the boom.
8. Loosen the locking hand-screw and remove the lifting frame from the head.
9. Disconnect the air supply to the lifting crane and secure the air tube in the clips on the boom.
10. Remove the boom and column from the device.
11. Install the column hole cover and tighten the screws.

7.3 Removing a TH3 from the Carriage

This procedure assumes that the TH3 has been disconnected from the device and is ready to be removed. For more information, refer to document 719-00608A.

1. Attach the lifting frame to the TH3—see Attaching the Lifting Frame to the TH3.
2. Manually pull the boom cable rod-end down to the lifting frame.
3. Install the pin and cable rod-end at the **10 degree Lift** hole of the lifting frame.
4. Switch the boom toggle switch to **Balance**—the cable will tighten. Lift the head slightly from the carriage. Carefully push the head towards the drum to clear the support bracket and lift it clear of any obstacles. Swing the boom and head so that the head can be lowered to the ground and guide the head as it lowers to prevent it from swinging into panels.
5. Put a piece of clean protective foam on the ground to set the head on.
6. Manually push the head down until it rests on the foam.
7. Switch the boom toggle switch to **Release**.
   The lifting force is removed and the head is now sitting on the foam on the floor.
8. Pull downwards on the cable to provide some slack. Disconnect the pin and cable rod-end from the lifting frame.

7.4 Putting the TH3 into the Shipping Crate

1. Remove flexure extensions (blocks) from the ends of the head.

Note: At the time of writing this document, the crate foam is not cutout to accept the head with these blocks attached. There is concern that these blocks could puncture the vacuum bag that envelopes the head during shipping.

2. Install the pin and cable rod-end at the **Level Lift** hole of the lifting frame.
3. Switch the boom toggle switch to **Balance**—the cable will tighten. Lift the head high enough to position the shipping crate underneath the head and guide the head as it rises to prevent it from swinging into panels.
4. Carefully lower and wiggle the head into the crate packaging. Use a shipping bag if applicable.
5. Once the head is properly seated inside the foam, switch the boom toggle switch to **Release**.
6. Disconnect the pin and cable rod-end from the lifting frame. Switch the boom toggle switch to **Balance** to fully retract the boom cable into the boom.
7. Remove the lifting frame from the head.
8. To install a replacement head, see Installing the TH3 onto the Carriage.

8. APPENDIX A—ADJUSTING THE HEAD LIFTING CRANE

The crane pneumatics is factory calibrated to apply enough force to hold the weight of the TH3. However, if the lifting crane cannot hold the weight of the head, or it applies too much force causing the head to rise on its own, then adjustment is necessary. To adjust the head lifting crane:

1. Remove the plastic plug on the side of the pneumatics box on the boom. This will give you access to the regulator adjusting screw and locknut.

2. Use a 5/16 in. nut driver to loosen the locknut (counterclockwise). Turn the locknut until it is a few threads from the free end. Use a flashlight to monitor progress. Do not turn the nut too far or it will fall off the screw and be lost inside the pneumatics box.

3. Adjust the crane lifting force with a small slot screw driver—turn clockwise to increase the force and counterclockwise to decrease the force. The target setpoint of this regulator screw is halfway between the point where the head just begins to rise without assistance and the point where the head just begins to lower without assistance. Once the regulator is at this setting, the head will remain stationary. The effort needed to manually lift or push down on the suspended head will be about the same.

   To find the set point for the regulator:

   a. Place a reference mark on the handle of the slotted screwdriver so this mark can be transferred to the pneumatics box at each pressure setting that initiates lifting and initiates falling. The midpoint between those marks will be our set point.

   b. Start this procedure with the head fully resting on the floor. Ensure there is some cable slack to confirm the crane is not supporting any weight. The regulator screw will have been turned out several turns (counterclockwise) to put the head in this position.

   c. Slowly turn the regulator screw clockwise. The cable slack will tighten and the crane will begin to apply a lifting force to the head. Stop turning the screw when the head begins to move very slowly (without stopping) upwards. Using a pencil, transfer the reference mark on the screw driver to the pneumatics box at the perimeter of the access hole.

   d. Allow the head to reach the top where it will stop moving. If you removed the screw driver, re-insert it into the screw slot with the reference mark on the handle lined up with the mark on the box. Slowly turn the screwdriver counterclockwise until the head begins to move very slowly (without stopping) downwards. Using a pencil, transfer the reference mark on the screw driver to the pneumatics box at the perimeter of the access hole.

   e. The midpoint between the two marks is the set point. Turn the regulator screw to this position. The head should remain stationary and the effort to push down or lift up the head should be about the same. If this is the case, the regulator has been correctly set.

4. Using the nut driver, carefully lock the screw into this position. Cover the regulator adjusting screw access hole with the plastic plug.

9. APPENDIX B—WEIGHTS OF SELECTED LIFTING CRANE COMPONENTS

1) Column = 5 kg (11 lb)
2) Boom = 13.2 kg (29 lb)
3) Lifting Frame = 2.7 kg (6 lb)