Magnus VLF MCU

MCU Drive Upgrade

Document Number
719-00703A-E

15 Jan 2008

Copyright 2008 Kodak. All rights reserved.

Revision History

Revision	Date	Author	Comments
1	07 June 2006	A.Blignaut / P.Hawes	Initial draft
2	16 June 2006	A.Blignaut / P.Hawes	Minor corrections made.
A	10 July 2006	A.Blignaut	Procedure updated after actual upgrade.
B	02 August 2006	A.Blignaut / P.Hawes	Procedure updated with travel limit clearance information.
C	17 Apr 2007	A.Blignaut / C.Bradley	Updated the motor installation procedure
D	24 July 2007	A.Blignaut / C.Bradley	Updated the lubricator setting for a six month replacement period.
E	15 Jan 2008	A.Blignaut	Changed the lubricator settings (again).

CONTENTS

Revision History i

1. Overview 1

2. Parts/tools Required 1

3. Removing Components 2

4. Installing Components 7

5. Installing the Wiring 13

6. Adjusting the Limit Switch Tabs 16
   - 6.1 Adjusting the Lower Limit Switch Tab 16
   - 6.2 Adjusting the Upper Limit Switch Tab 18

1. OVERVIEW

This procedure is to upgrade the MCU drive system. The upgrade should take approximately 6 hrs and includes the following procedures:

- Install a new, higher grade bronze nut
- Install a safety backup nut to MCU drive system
- Install a safety switch on the steel backup nut
- Install/change the lubricator and fittings

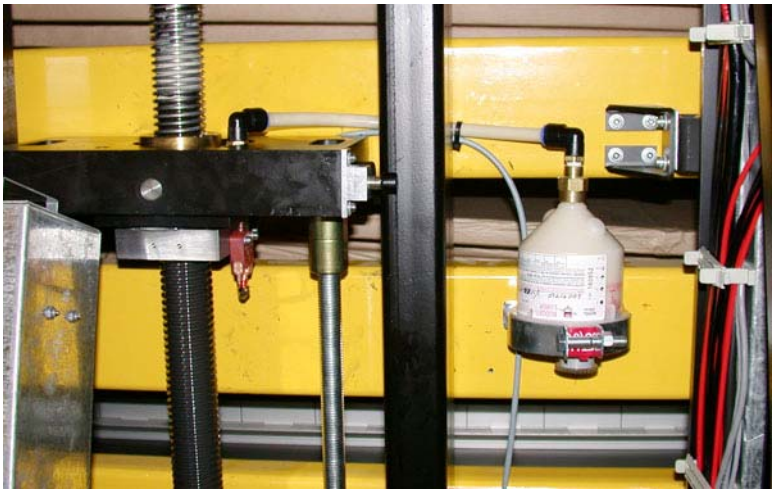


Figure 1: MCU drive system after the upgrade

2. PARTS/TOOLS REQUIRED

Parts

Kit # 512-00367A

For MCU devices that do not have a lubrication system (MM078/MT119 and later), you will also need a new upper nut plate (252-01626C) that has a cutout for the lubricator fitting.

Tools:

- Tapping fluid
- M6 tap and handle (included in the kit)
- Circlip tool (included in the kit)
- Hex key set
- Multimeter
- Two wooden blocks, approx. 10 x 10 x 20 cm
- Loctite 242

3. REMOVING COMPONENTS

1. In Service Shell, type `>>cassette move 0` to move the MCU to its bottom position.
2. Open the MCU rear doors and turn the safety interlock override switch to **Interlock Override**.
   Tip: Removing the doors will give you better access and more room to work.
3. If present, remove and discard the two M5 screws that hold the two nut plates together—these screws are no longer needed. Note that the nut plate in the photo includes a cutout for the lubricator.

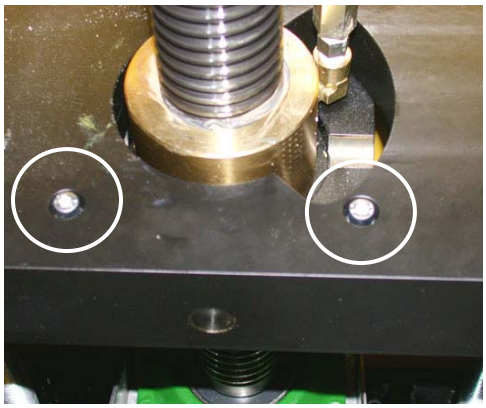


Figure 2: Upper nut plate screws

4. Use the MCU manual jog panel to raise the forks just high enough to insert the wooden blocks between the fork and frame.



Figure 3: Wooden blocks inserted under the forks

5. Use the jog panel to lower the forks onto the wooden blocks just until the two nut plates begin to separate. The weight of the forks should now be on the wooden blocks and the upper plate should be loose.

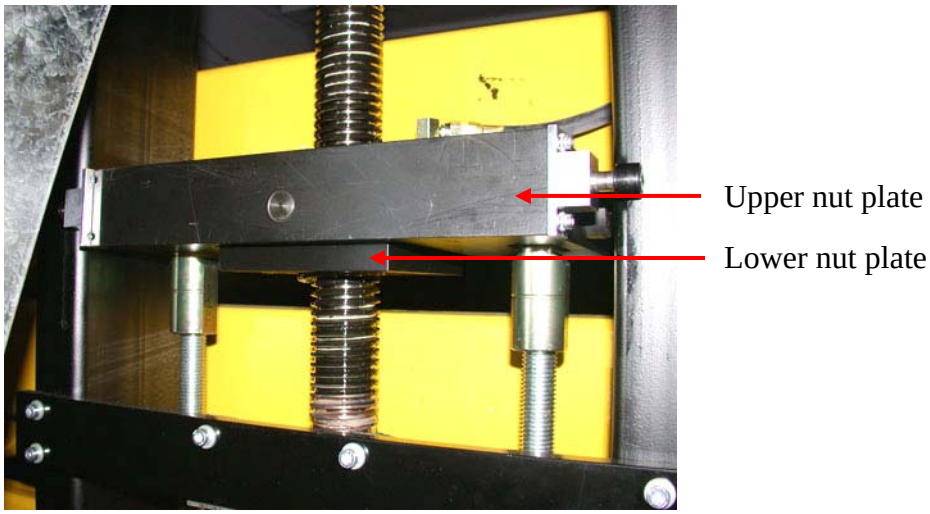


Figure 4: Nut plates separating

6. If a lubricator is present, remove the lubricator, the lubricator bracket, the hose fittings, and the hoses that connect to the jackscrew nut. Ensure that the uppermost grease fitting is removed so that the nut can pass downward through the cutout in the upper plate. Also disconnect the cable from the lubricator and from relay K6 (pins 2 and 5). The cable can be removed or left in the cable track, but mark the connectors as 'no longer used' to avoid confusion in the future. All items removed will not be used again and can be discarded.

7. Use the jog panel to drive the nut downward until it comes out of the upper plate square cutout and you can turn the nut by hand.

8. Turn the Magnus VLF device main power switch to **OFF**.

Tip: Although not necessary, removing the MCU power box will greatly improve accessibility to components during the upgrade procedure.

There are four screws securing the top of the power box and four screws securing the bottom.



Figure 5: Power box removed

9. Support the MCU motor by placing some foam or other material underneath it.

10. Remove the motor:

    a. Remove the motor cable clamp that secures the cable to the MCU frame. This will provide more slack in the cable to move the motor aside while doing the rest of the upgrade.

    b. Put a piece of foam or wood under the motor to support it when the coupling screws are loosened.

WARNING: Take care not to get your hands or fingers pinched between the motor and MCU frame when removing the motor.

c. Loosen the lower four coupling screws that attach the coupling to the motor shaft. When the shaft becomes loose in the coupling, the motor will drop under its own weight onto the foam or wood.

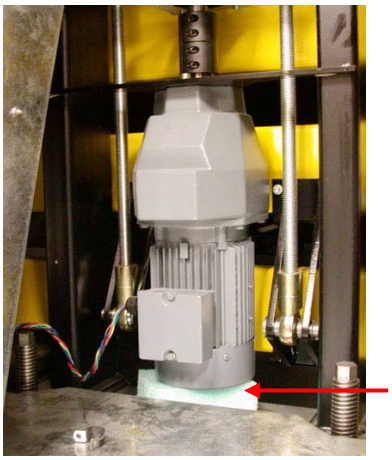


Figure 6: Removing the MCU motor

d. Remove the motor without disconnecting the wires and put it aside until it is reinstalled.



Figure 7: Jackscrew to motor coupling

11. Loosen the two setscrews in the green lower bearing (see Figure 9). The jackscrew shaft should now be loose enough to be lifted upward about a quarter inch.
12. Spin the lower nut plate and nut downward by hand until it bottoms out on the lower bearing.
13. Remove the roof panel above the jackscrew.

14. Remove the upper bearing cover plate and the screw that protrudes through it.



Figure 8: Upper bearing cover plate

15. Turn the jackscrew counter-clockwise until it comes out of the bronze nut.

16. Lift the jackscrew up and out of the MCU through the top of the frame.
    The upper nut plate should then lean towards the power box giving you access to the large shoulder bolts that secure the tie rods to the nut plate (see Figure 9).

17. Remove the lower nut.

18. Remove the upper nut plate by removing the two large shoulder bolts that hold the upper nut plate to the tie rods. Take care not to pinch your fingers while removing the upper nut plate as this plate is heavy. An extra pair of hands will help here.

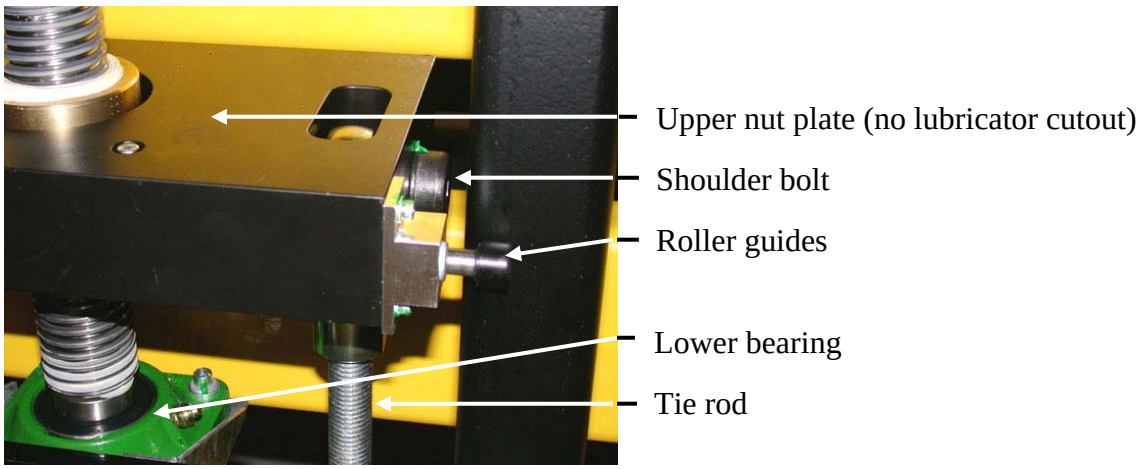


Figure 9: Jackscrew tie rod and shoulder bolt

4. INSTALLING COMPONENTS

1. Replace the two tie rods with the new longer ones. The longer tie rods will provide space under the bronze nut for the additional steel nut.

    a. Remove the circlip from the end of the tie rod pin using a circlip tool.

    b. Remove the pins in the frame hangers. Be careful not to lose the spacers as the pins come out.

    c. Remove the tie rod and install a longer one in its place. When reassembling the tie rod assemblies, be certain to insert the pins with the circlip slot towards the MCU frame and one spacer on either side of the tie rod.

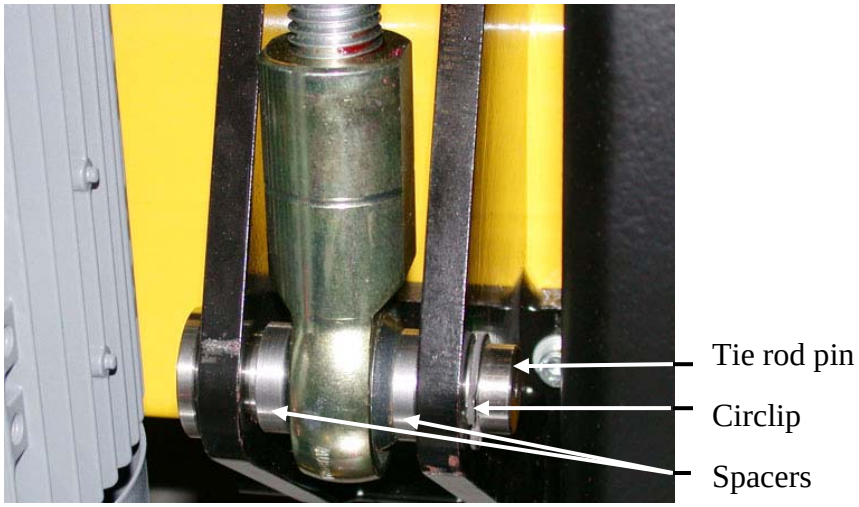


Figure 10: Tie rod lower assembly

Note: On some MCUs, the tie rod pins were incorrectly installed such that the MCU frame prevents the pins from being removed. If this is the case with your upgrade, then you must remove the two tie rod brackets from the yellow forks to replace the tie rods.

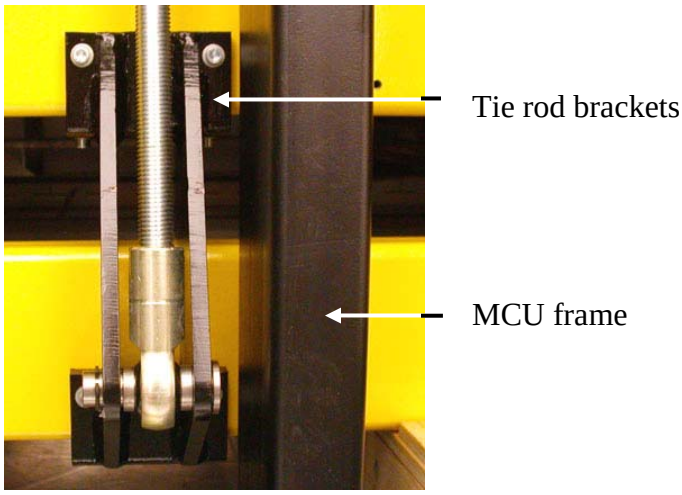


Figure 11: Tie rod pin incorrectly installed

2. If the upper nut plate that was removed does not have a cutout for the lubricator fitting, transfer the two roller guides and two nut bearing pins to a new nut plate with a lubricator cutout (part # 252-01626C).
   The roller guides will be adjusted later on in the procedure.

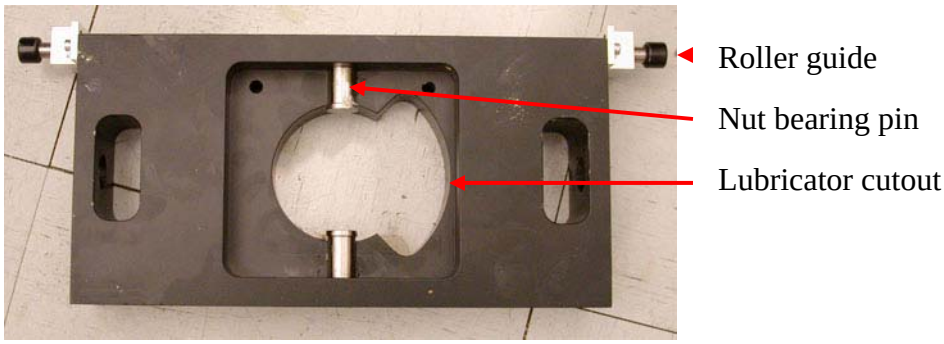


Figure 12: Upper nut plate with lubricator cutout

3. Apply Loctite 242 to the shoulder bolts and install the upper nut plate by inserting the shoulder bolts through the tie rod ends of the new tie rods. An extra pair of hands will help with this again. See Figure 1 for the orientation of the nut plate.
4. Put fresh Viperlube grease in the threads of the new bronze nut and the new steel nut.
5. Place the steel nut (counter bores facing downwards) on the green lower bearing. Place the bronze nut on top of the steel nut and align the holes of the bearing and two nuts.



Figure 13: Steel nut – counter bores downwards

6. Reinstall the jackscrew down through the top of the MCU, through the center of the upper nut plate, through the bronze nut, through the steel nut and into the lower bearing. An extra pair of hands will help to keep everything aligned.
   Note: There is no need to reinstall the two lower bearing setscrews.

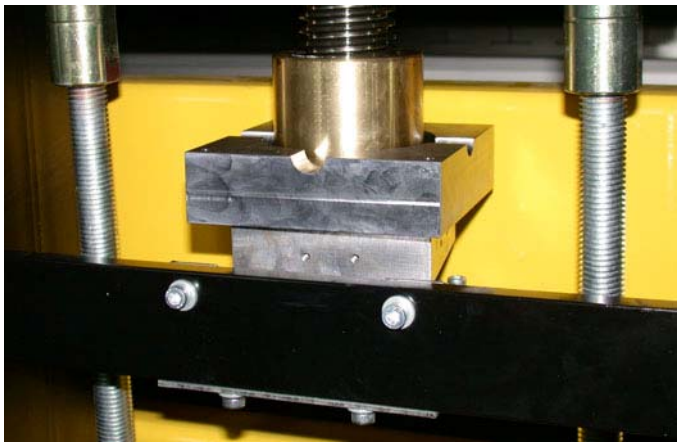


Figure 14: Bronze nut and steel nut installed

7. Turn the jackscrew so that the bronze nut is threaded onto the jackscrew. Spin the bronze nut upwards close to the upper nut plate. Be careful not to damage the threads of the bronze nut as you do this.
8. Similarly, spin the steel nut up the jackscrew—but only halfway between the lower bearing and the upper nut plate.
9. Spin the bronze nut up into the square cutout of the upper nut plate. You will need to turn the jackscrew by hand near the end. Make sure the lubricator fitting lines up with the lubricator cutout and that the two pins are still present in the upper nut plate.
10. Install the top jackscrew cover. Install the protruding screw so that the top of the screw is 20 mm above the top jackscrew cover.
11. Install the motor.
    a. Use a piece of wood and one of the old tie rods to lever the motor upwards until the bottom of the jackscrew and the top of the motor shaft are 1 mm apart inside the coupling. Use your other hand to guide the motor shaft into the coupling.



Figure 15: Installing the MCU motor

b. While holding the motor up with the lever, tighten two of the screws on the jackscrew coupling with the other hand. Rotate the jackscrew, and tighten the other two screws. The screws must be tightened to 19 N m.



Figure 16: Tightening the coupling screws

12. Adjust the upper nut plate roller guides so that they are approximately 1 mm from the MCU frame.

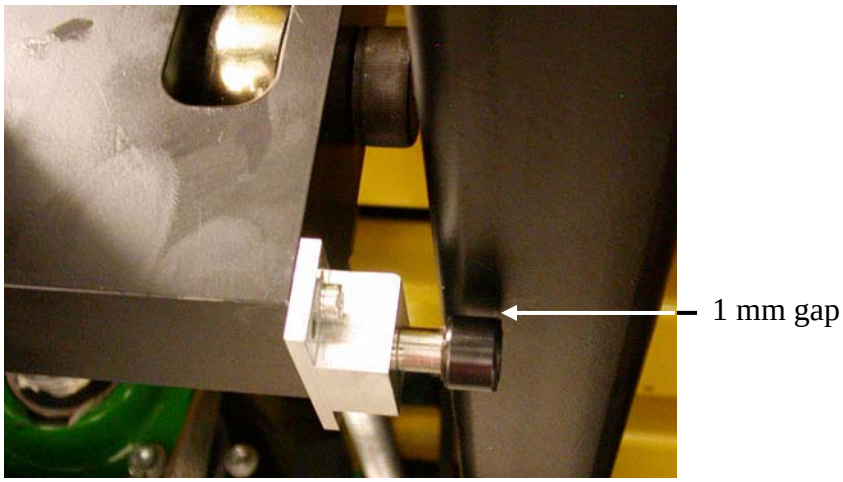


Figure 17: Roller guide gap adjustment

13. Turn the device power on and use the manual jog panel to raise the forks off the wooden blocks. Remove the blocks.

14. Spin the steel nut upward until the gap between the steel nut and the bronze nut flange is about 10 mm. Insert the shim tool (part # 690-00889A) between the steel nut and the bronze nut flange, and spin the steel nut up until it bottoms out. Back the steel nut off to the nearest ¼ turn so that its side is parallel to the bronze nut flange. Remove the shim tool.

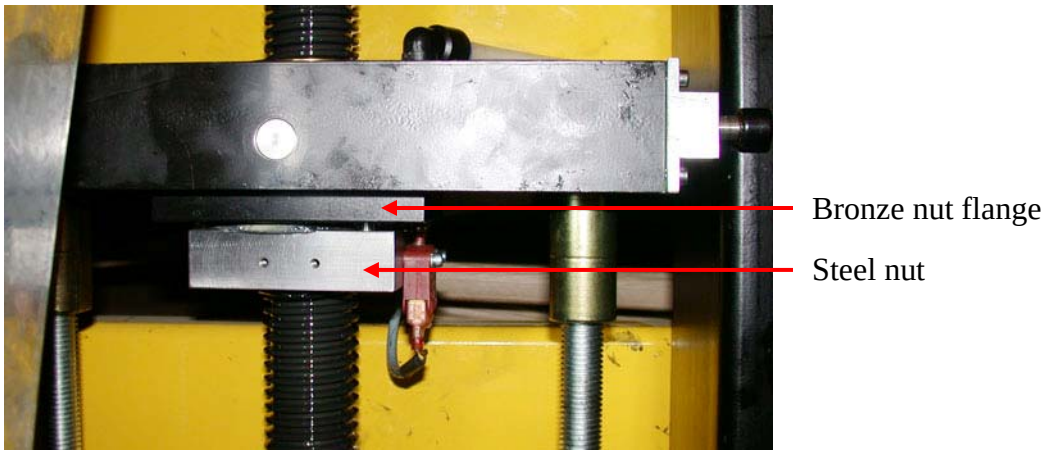


Figure 18: Steel nut adjustment

15. Apply Loctite 242 on the threads of the new bolts provided in the kit and insert bolts through the steel nut into the underside of the nut flange. Tighten the bolts.

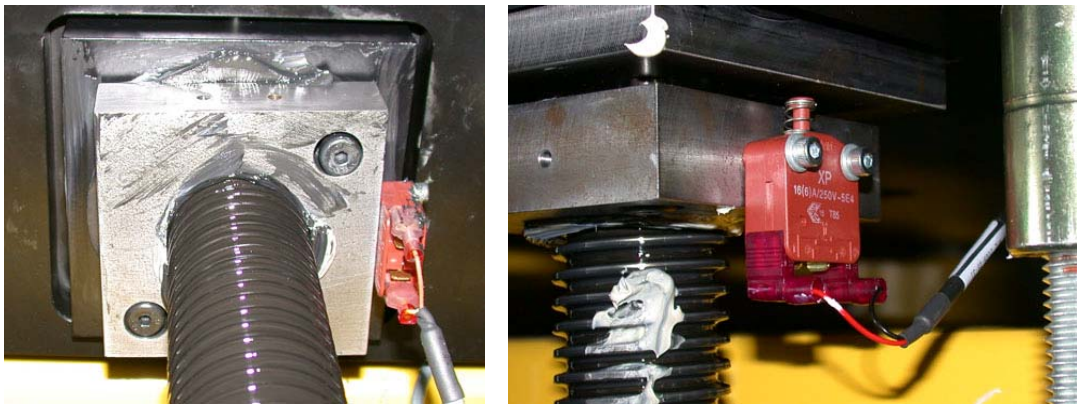


Figure 19: Steel nut bolts and safety switch

16. Install the new safety switch onto the right side of the steel nut using the screws and Bellville washers provided. Apply Loctite 242 to the screw threads. The top of the safety switch pin should be approximately 1 to 3 mm from the underside of the bronze nut flange.

17. Using Figure 20 as reference, mark, drill, and tap three M6 holes into the yellow forks to mount the new lubricator bracket and the cable mounting bracket.

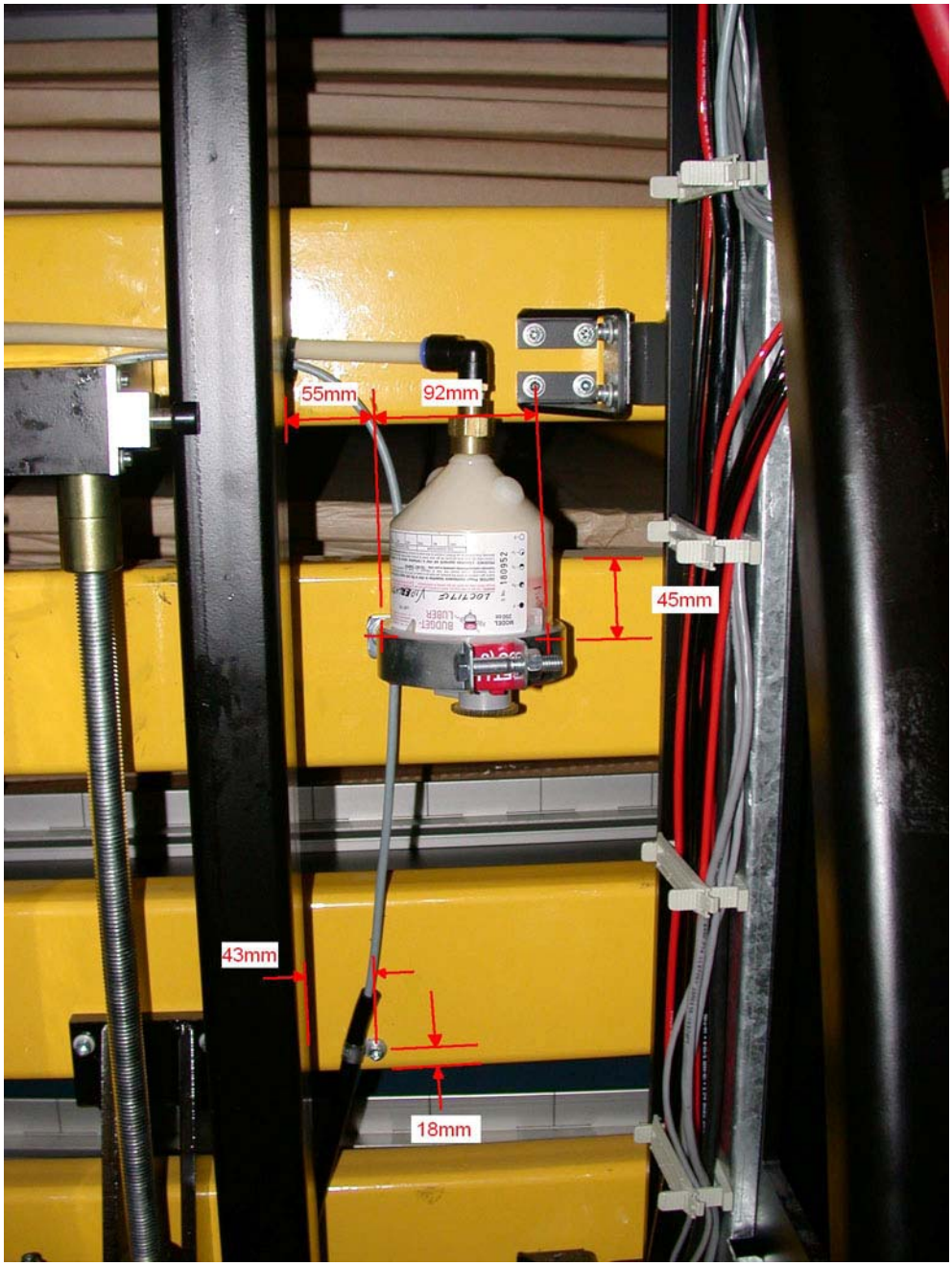


Figure 20: Drilling mounting holes for the lubricator

Note: For MCU devices that previously had a lubricator, the hole for the cable mounting bracket will already be present (lower hole).

18. Install the new lubricator:

    a. Remove the clear plastic switch cover and switch the **LITE** switch and the **12M** switch to the on position.

    b. Check that the lubricator is working by ensuring that the green LED flashes—it should flash once every 20 seconds. Replace the clear cover.
    Because of the pressure drop in the lubricator hose, the **12M** setting will push out all lubricant in approximately twelve months. However, it is recommended that the lubricator be replaced every six months. Mark the date of installation on the lubricator so that it can be replaced six months from the date of installation.

    c. Mount the lubricator bracket on the yellow fork using the new tapped holes.

    d. Install the lubricator in the bracket. See Figure 1 for lubricator orientation.

19. Connect the lubricator hose fitting to the fitting in the bronze nut—access to the nut on the hose fitting may be difficult. The pre-filled nylon hose must be cut to the exact length during installation. Make sure that the nylon hose presses against the yellow forks, and does not touch the black vertical column. See Figure 1.

20. If you removed the power box, install it now to its original position.

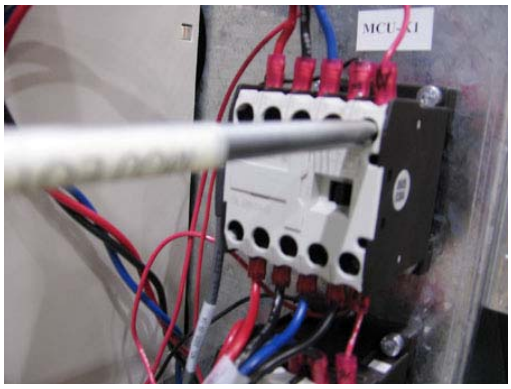
5. INSTALLING THE WIRING

1. On the MCU safety interface board (to the left of the power box), disconnect J5 of cable 220-00279A or cable 220-00279B (whichever is present). Also disconnect the wires from that cable that go to relays K1 and K2. Remove and discard the cable.

2. Install the new cable 220-00279C:

    a. Connect the common end of the cable to J5 on the MCU safety interface board.

    b. Route the black and red wires up to the contactor coils above the board and connect them as follows:
    Connect short black to contactor K2 position A2 (right photo)
    Connect long black to contactor K1 position A2
    Connect short red to contactor K2 position A1
    Connect long red to contactor K1 position A1 (left photo)



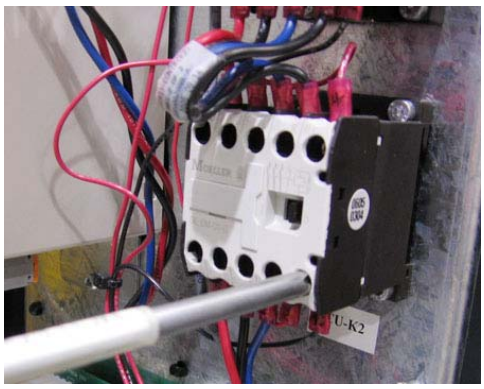


Figure 21: K1 and K2 connections

c. Route the thermistor cables down from the safety interface board, behind the MCU power box, to the bottom of the MCU motor where the thermistor will be mounted.

3. Mount the thermistor.

   a. Mount the thermistor bracket with a single screw to the bottom of the MCU motor. **Note:** the screw head must not protrude beyond the surface of the bracket or it will damage the thermistor. If necessary, drill the countersink in the bracket deeper.

   b. Mount the thermistor on the bracket with two screws provided. Using a multimeter, check that the normally closed contacts of the thermistor are closed.

   c. Connect the thermistor cables as shown below.

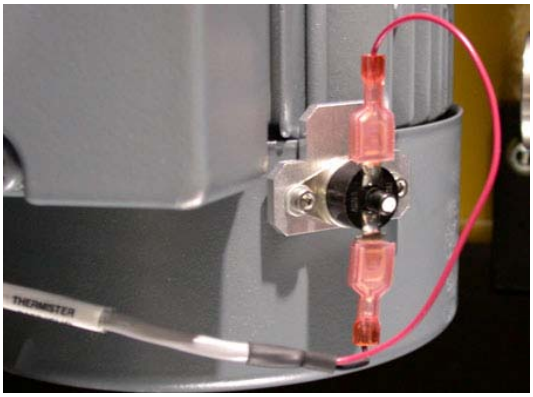


Figure 22: MCU motor thermistor

4. Route the steel nut safety switch connectors into the MCU power box through the hole near the safety interface board. Following the existing cable tray inside the power box, continue routing the cable up and out of the top hole in the power box. From there, go behind the jog panel, along the cable tray to the right, and down the cable tray to the right of the jackscrew. Slide the tube that is around this cable assembly so that begins just below the 2nd highest cable bracket on the right.

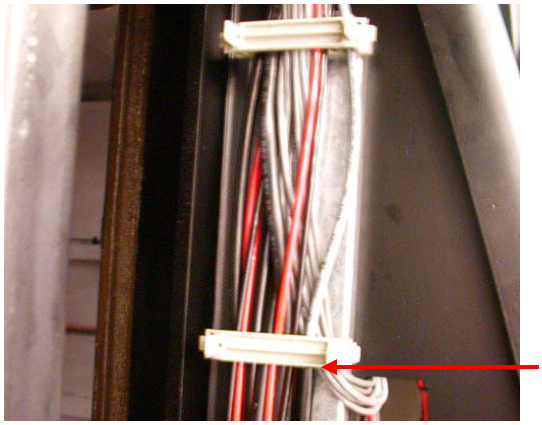


Figure 23: Right cable tray

5. Route the tube (cable inside) down inside the remainder of the right cable tray and then loop back up, fastening the other end of the tube to the forks using the cable clamp provided and a M6 screw. When the forks are at the lowest position the loop should not touch the bottom of the MCU.

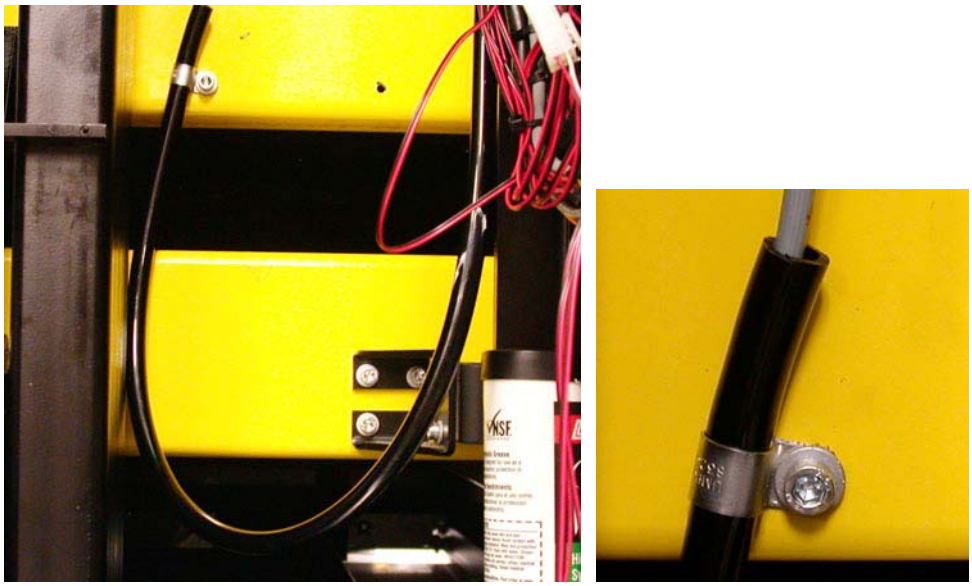


Figure 24: Cable clamp on fork

6. Route the rest of the cable up toward the lubricator and fasten the cable with a cable tie to the lubricator tube just before and just after the tube passes behind the black frame.



Figure 25: Lubricator cable routing

7. Connect the terminals of the cable to the outside (normally closed) pins of the steel nut safety switch. Make sure any slack in the cable is taken up.

8. Lubricate the jackscrew manually with Loctite Viperlube. The automatic lubricator will not begin to dispense lubricant for approximately 2 weeks after it has been turned on.

6. ADJUSTING THE LIMIT SWITCH TABS

The MCU fork limit switches must be adjusted to prevent the lubricator fitting on top of the top nut plate from being crushed when the forks are raised, and to prevent the safety switch on the new steel nut from being crushed when the forks are lowered.

6.1 Adjusting the Lower Limit Switch Tab

Since the forks are already at the lower position, check the lower limit switch tab first—this tab is the one at the top of the yellow fork.

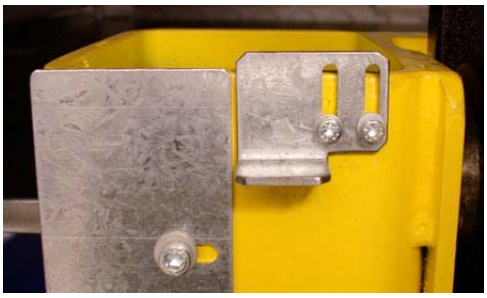


Figure 26: Lower limit switch tab

1. Turn the safety interlock override key to the **Interlock Override** position.
2. Use the MCU manual jog panel to move the forks downward. Carefully watch that the new safety switch connectors on the steel nut are not crushed by the lower bearing as the jackscrew nut assembly goes down. The limit switch tab should trigger the cutout switch when the lower bearing bracket is approximately 5 mm from the safety switch connectors as shown by the arrow in the photo on the right. There should also be a gap between the yellow fork and the MCU bottom frame.



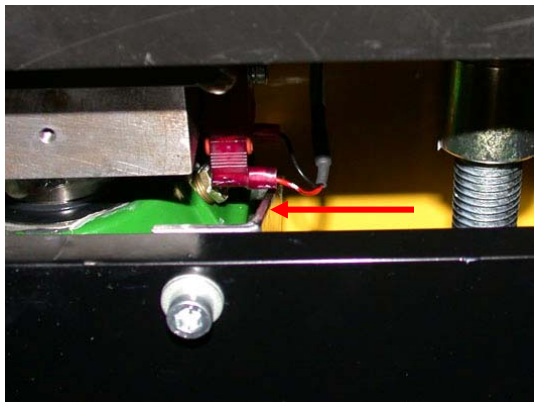


Figure 27: Lower limit switch

3. If the limit switch is not triggered in time, stop the downward movement of the forks and adjust the tab accordingly. To adjust the tab you may have to raise the MCU forks to get access to the screws. Repeat step 2.

4. Turn the safety interlock override key to the **Normal Operation** position.

5. In Service Shell, check that the forks are still able to reach the lowest pick position using the commands:
   ```
   >>cassette move 2
   >>cassette move 0
   ```

   Ensure that "**command complete**" is shown in service shell after typing the test commands. If not, the forks cannot reach their required positions, and the tabs need to be adjusted closer to the limits.

   Note: If more clearance is required to get to the lowest pick position, the switch connectors can be installed facing inwards (towards the shaft). This will give you about 10mm more clearance. If still more clearance is required, the switch must be re-installed on the back side of the steel nut (with connectors facing outward). This will give you even more clearance, but it will be difficult to access the switch in this position.

6. Type `>>cassette move 4` to raise the MCU forks most of the way before adjusting the upper limit switch tab.

6.2 Adjusting the Upper Limit Switch Tab

This tab is located midway along the MCU fork and will be replaced with a longer tab to compensate for the longer tie rods that were installed.

1. Remove the old tab and install the new longer tab in its place (right photo).

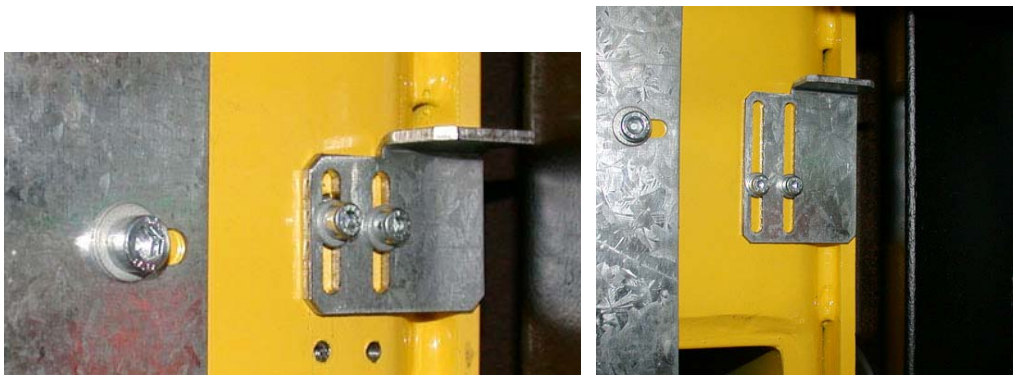


Figure 28: Upper limit switch tab

2. Turn the safety interlock override key to the **Interlock Override** position.
3. Use the MCU manual jog panel to raise the MCU forks. Closely watch that the top of the lubricator's fitting on the jackscrew nut plate is not crushed against the MCU frame. The limit switch tab should trigger the cutout switch when the top of the fitting is approximately 5 mm from the MCU frame.



Figure 29: Upper fork limit

4. If the limit switch is not triggered in time, stop the upward movement of the forks and adjust the tab accordingly. To adjust the tab you may have to lower the MCU forks to get access to the screws. Repeat step 3.
5. Turn the safety interlock override key to the **Normal Operation** position.

6. Check that the forks are still able to reach their highest position using this series of commands in service shell:
   ```
   >>cassette move 4
   >>cassette move lock up
   >>cassette move lock up
   ```
   (yes, repeat the command)

   Ensure that "**command complete**" is shown in service shell after typing the test commands. If not, the forks cannot reach their required positions, and the tabs need to be adjusted closer to the limits.

   Note: If rare instances where more clearance is required to reach the highest cassette position (the cassette eject position), you may rotate the lubricator nut fitting so that the tube lies flat on the upper nut plate. If there is still not enough clearance, it may be possible to slightly lower the cassette eject height by lowering the optical sensors that shine through the slots in the side of the fork weldment (if you do this, make sure that the cassettes can still be properly ejected). If not, the lubricator tube and fittings can be left in place and allowed to be slightly compressed, or removed completely. In this case, use the manual greasing procedures, and contact product development with the following information:

   - The exact distance between the upper nut plate and frame at the highest fork position (will be less than 25 mm if standard kit does not fit).
   - The exact distance between the bottom of the new steel nut and the top of the bearing collar when the forks are at their lowest position (cassette move 0).
   - The exact length of the exposed threads of the new tie rods (should be 406 mm +/- 0.75 mm)

7. Install the MCU panels and doors.