

The logo for Cub Cadet, featuring the brand name in a white, stylized script font on a blue rectangular background.

Professional Shop Manual



Commercial Z-Wing

NOTE: These materials are for use by trained technicians who are experienced in the service and repair of outdoor power equipment of the kind described in this publication, and are not intended for use by untrained or inexperienced individuals. These materials are intended to provide supplemental information to assist the trained technician. Untrained or inexperienced individuals should seek the assistance of an experienced and trained professional. Read, understand, and follow all instructions and use common sense when working on power equipment. This includes the contents of the product's Operators Manual, supplied with the equipment. No liability can be accepted for any inaccuracies or omission in this publication, although care has been taken to make it as complete and accurate as possible at the time of publication. However, due to the variety of outdoor power equipment and continuing product changes that occur over time, updates will be made to these instructions from time to time. Therefore, it may be necessary to obtain the latest materials before servicing or repairing a product. The company reserves the right to make changes at any time to this publication without prior notice and without incurring an obligation to make such changes to previously published versions. Instructions, photographs and illustrations used in this publication are for reference use only and may not depict actual model and component parts.

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TABLE OF CONTENTS

Introduction	1
Spindles and Blades	1
PTO Belt	3
Deck Belt	4
Spindle Service	5
Deck Belt and PTO Belt Tensioner	7
Cutting Deck Removal: Early 2005 Production	8
Cutting Deck Removal: Commencing with late 2005 Production	11
Deck Leveling: Early 2005 Production	13
Deck Wing and Hinge Lock	16
Hinge Lock: Late 2005 production	20
Deck Wing Lift Mechanism:Early 2005 Production	24
Deck Wing Lift Cable Adjustment	29
Deck Lift Mechanism	30
Lap Bars	34
Checking Neutral Adjustment	35
Linkage Neutral Adjustment	36
Hydro Neutral Adjustment	37
Tracking Adjustment	38
Steering Pivot Shafts and Bushings	40
Brake Linkage Adjustment	41
Brake Pivot Shaft Removal	46
Hydraulic Drive System: General Operation	48
Hydraulic Drive System: Diagnosis	50
Hydraulic Drive System: Pump Removal	54
Hydraulic Drive System: Wheel Motor Removal	58
Front Axle and Caster Wheels	61
Electrical: Components	66
Electrical: Starter Circuit	73
Electrical: Engine Stop Circuit	74
Electrical: Engine-Stopping Safety Circuits	75
Electrical: PTO Circuit	76
Electrical: Deck Wing Lift	77
Electrical: Charging Circuit	78
Charging System Diagnosis	78
Resistance	80

Cub Cadet Commercial Z-Wing

1. INTRODUCTION

- 1.1. **Purpose:** Heavy-duty mowing in a compact package. See Figure 1.1.



Figure 1.1

- Until now, commercial cutters needing a machine that would fit through a 36" gate had to settle for a commercial walk-behind mower or a homeowner-grade zero-turn.
- The Z-Wing's unique folding deck gives it the ability to pass through a 36" gate or opening, yet provide a 48" cutting swath, increasing productivity.
- When folded, the deck wings of the Z-Wing take up a smaller foot-print in a trailer or garage. This enables the user to make more efficient use of their trailer and garage space, and reduces the chance of damage to other equipment during loading or storage.

NOTE: When the deck of our standard TANK line encounters other objects, it is seldom the deck that gets damaged.

- 1.2. **Means:** The deck wings are lifted by an electric actuator pulling on cables.
- 1.3. **Safety:** Safety switches that sense the position of the deck wings prevent the PTO from being engaged while the wings are up.
- 1.4. **Drive System:** Hydro-gear pumps drive White Hydraulic wheel motors. These motors are new to Cub cadet, and feature a unique roller stator design.

NOTE: The information in this manual is derived from prototype equipment. Although it is accurate at the time of writing, it is subject to change without notice.

2. SPINDLES AND BLADES

- 2.1. Flail blades have been in use on "bat-wing" mowers in a variety of applications for many years. The unique thing about their use on the Z-Wing mower is that they enable just the outer portion of the deck (wing) to be raised, and the blades fold back to clear obstacles while the wings are raised. See Figure 2.1.

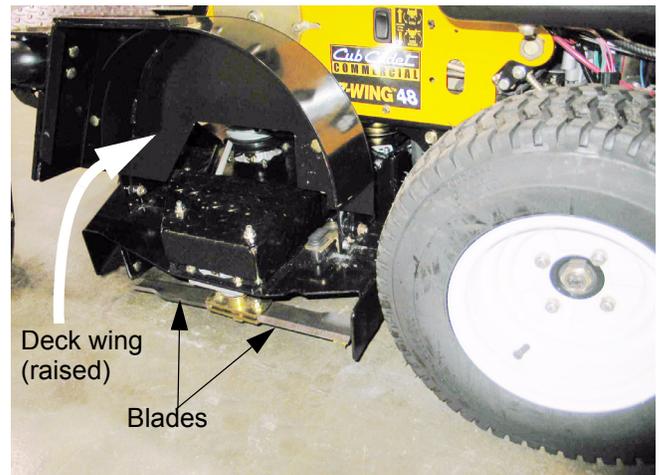


Figure 2.1

- 2.2. Things to know about flail blades:

- The individual blade elements can be removed from each of the three blade assemblies.
- If one element on a blade assembly is worn or damaged beyond a point that can be corrected with a light sharpening, replace both elements to maintain balance.
- Blade assemblies can be balanced, but not with the ease nor the accuracy of single-piece blades.
- Replace any suspect blade hardware before operating the mower.
- The operator should cease operation immediately if any unusual deck vibration or noises occur.

Cub Cadet Commercial Z-Wing

2.3. Precautions:

- Disable the engine while working on the cutting deck: Disconnect the sparkplug leads, disconnect the negative battery cable, and remove the key from the key switch.
- Allow the engine to cool thoroughly before working near the exhaust system.
- Protect hands while working on sharp objects like blades using gloves or rags.

2.4. With the wings raised the outer blades are easily accessible for service. The center blade is as accessible as it would be on a conventional deck. Lift and safely support the mower to reach the center blade. See Figure 2.4.

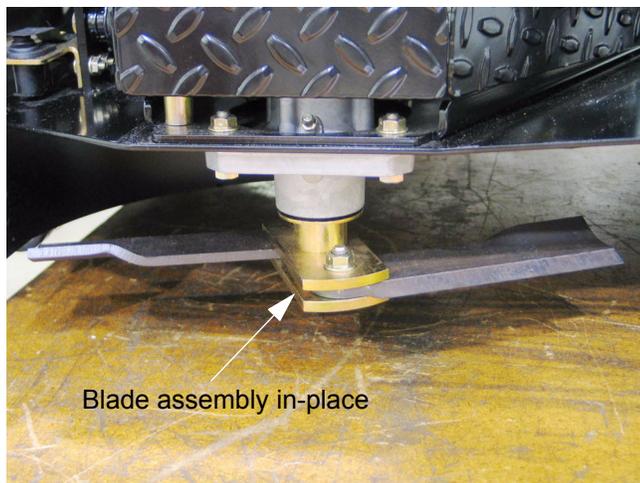


Figure 2.4

2.5. The blades can be removed from the blade mount assembly using a pair of 9/16" wrenches. See Figure 2.5.

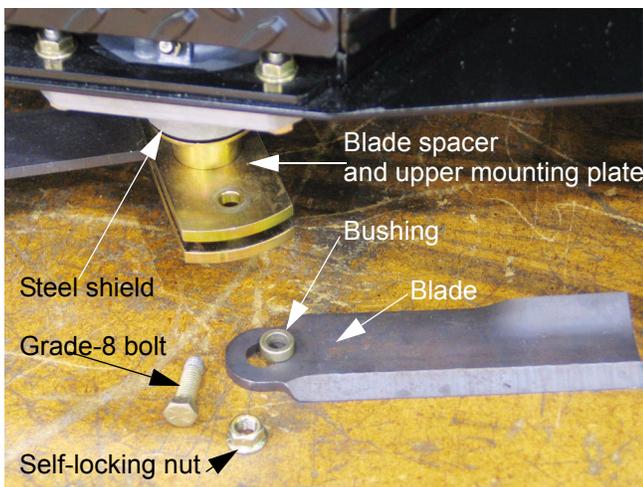


Figure 2.5

- 2.6. When performing any blade or spindle service, inspect the spindles, pulleys, and belts for wear or damage.
- 2.7. Inspect the hardware that secures the blades to the blade mount assemblies.
 - Replace the locking nut if the locking feature has degraded.
 - If the bolt is replaced, use only a grade-8 replacement from a reputable source (Cub Cadet).
 - Replace the bushing if it shows signs of wear or damage.
- 2.8. On installation, apply a small amount of thread locking compound such as Loctite 262 (red) to the threads, and tighten the nuts to a torque of 35-40 ft-lbs (47.5-54 Nm).
- 2.9. If the blade assembly is to be removed for sharpening and balancing, lower the deck to the lowest cutting position.
- 2.10. Remove the belt covers using a 9/16" wrench.
- 2.11. Hold the top of the spindle bolt using a 1 1/8" wrench and turn the nut off the bottom using a 1 1/8" wrench.
- 2.12. Slide the blade assembly off the spindle bolt. See Figure 2.12.

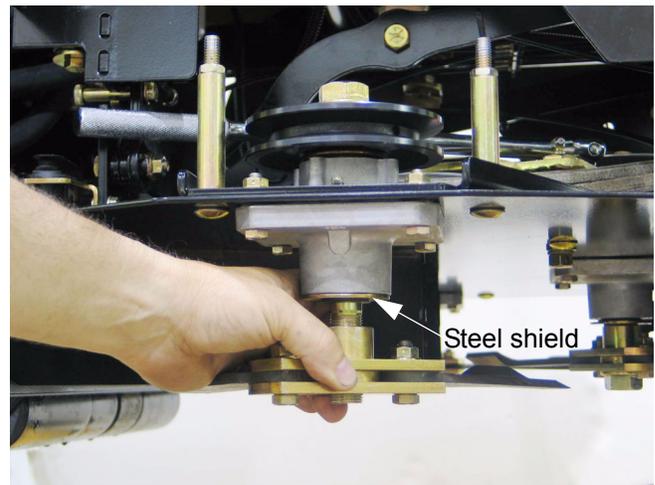


Figure 2.12

NOTE: The steel shield is part of the seal, not the blade assembly. Do not remove it unless the spindle requires service.

Cub Cadet Commercial Z-Wing

- 2.13. The blade assemblies may be sharpened and balanced similar to conventional blades, but a straight-edge should be used to confirm that the blades are straight out. If the blades are partially folded during balance checking, the results will be thrown-off.
- 2.14. On installation, apply thread locking compound such as Loctite 262 (red) to the threads, and tighten the nut to a torque of 100-120 ft-lbs (114-136 Nm).
- 2.15. Install the belt covers and reconnect the battery.
- 2.16. Test the operation of the mower and its safety features before returning it to service.

3. PTO BELT

3.1. Precautions:

- Disable the engine while working on the cutting deck: Disconnect the sparkplug leads, disconnect the negative battery cable, and/or remove the key from the key switch.
- Allow the engine to cool thoroughly before working near the exhaust system.
- Protect hands while working on sharp objects like blades using gloves or rags.
- Apply the parking brake while working on the mower.

3.2. Lower the deck wings.

- 3.3. Raise the cutting deck to the highest position. This moves the deck as far back as possible, reducing the amount of force on the PTO belt tensioner. See Figure 3.3.

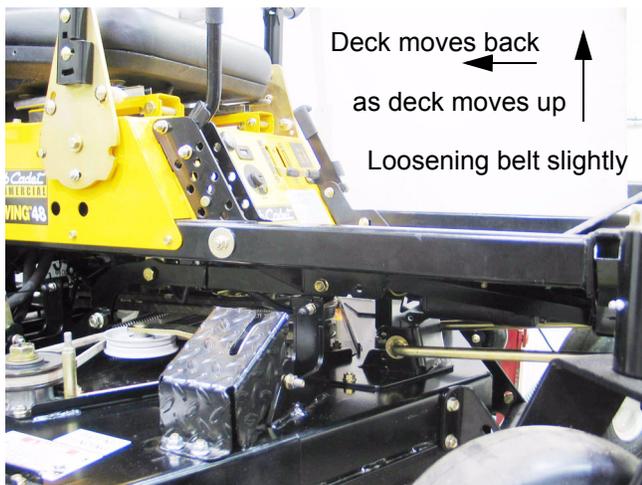


Figure 3.3

- 3.4. Remove the belt covers that protect the blade spindles using a 9/16" wrench.
- 3.5. Working from the left side of the mower, relieve tension from the belt tensioner pulley, and roll the belt off of the pulley, allowing the tensioner pulley to slip beneath the belt. See Figure 3.5.

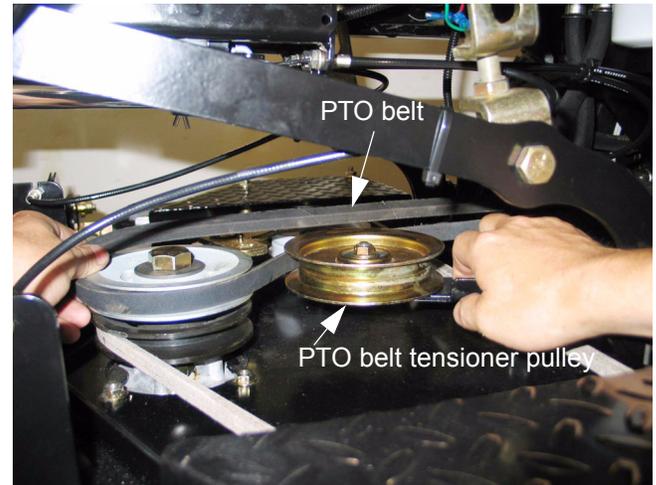


Figure 3.5

NOTE: belt routing and spring location

- 3.6. With the tension relieved, connect a 1 1/8" wrench to the bolt at the top of the stack pulley. Pass the wrench beneath the belt to reach the bolt. See Figure 3.6.

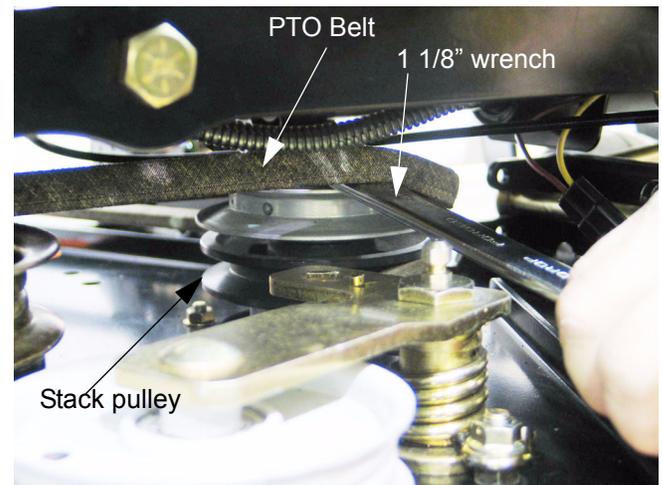


Figure 3.6

- 3.7. Draw the wrench forward to force the belt over the top of the pulley.

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- 3.8. A second 1 1/8" wrench may be applied to the top of the nearest blade spindle if more rotation is needed. See Figure 3.8.



Figure 3.8

- 3.9. Lower the deck slightly to provide belt clearance between the stack pulley and the wing lift motor, and remove the belt from the mower.
- 3.10. If the old belt exhibits any damage beyond normal wear, identify and correct the cause of the damage before returning the mower to service.
- 3.11. Inspect the condition of the deck belt, and replace it if it is suspect.
- 3.12. Position the new belt on the PTO clutch and stack pulley.
- 3.13. Pull the tensioner pulley arm out to the left, and slip the belt over the pulley.
- 3.14. Test the operation of the mower deck before returning the mower to service.

4. DECK BELT

- 4.1. Remove the PTO belt as described in the PTO Belt section of this manual, including all precautions.
- 4.2. Remove both deck belt covers using a 9/16" wrench.
- 4.3. Working from the right of the mower, use a 1/2" breaker bar to move the deck belt tensioner pulley arm, relieving tension from the deck belt. See Figure 4.3.

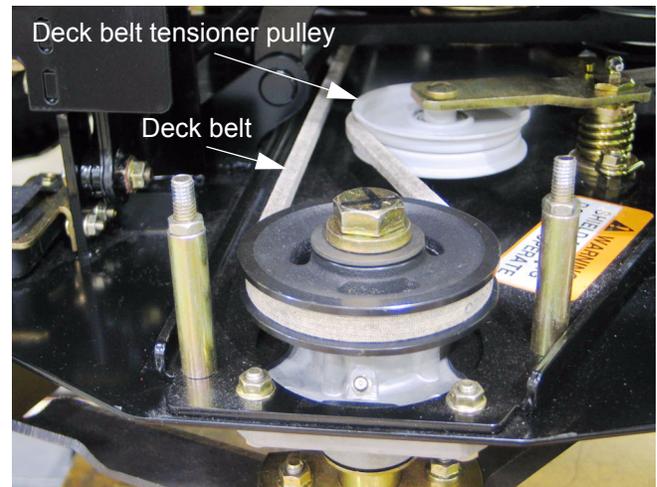


Figure 4.3

NOTE: belt routing and spring location

- 4.4. Roll the belt off of the tensioner or spindle pulley. See Figure 4.4.



Figure 4.4

- 4.5. If the old belt exhibits any damage beyond normal wear, identify and correct the cause of the damage before returning the mower to service.

Cub Cadet Commercial Z-Wing

- 4.6. Check the blade spindles for looseness while the belt is off.
- 4.7. Reverse the removal process to install a new belt or belts.
- 4.8. Test the operation of the mower and its safety features before returning the mower to service.

- 5.5. Withdraw the spindle bolt and washers, and remove the pulley. See Figure 5.5.

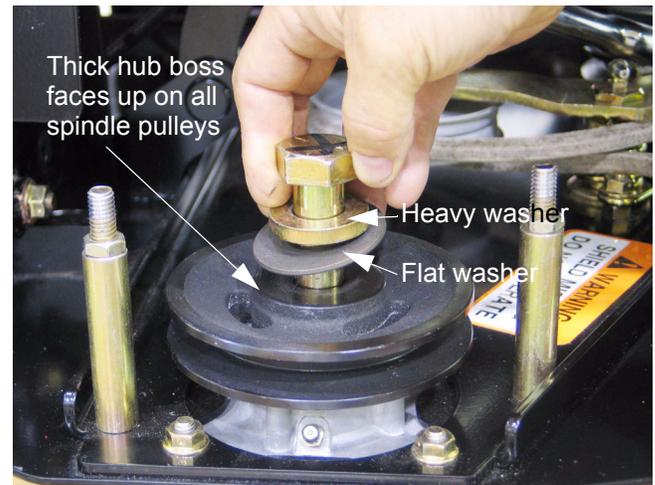


Figure 5.5

5. SPINDLE SERVICE

- 5.1. Inspect all of the spindles for wear or damage when performing regular deck belt and blade maintenance. The recommended lubrication interval for the deck spindles is 25 hrs., using No.2 Multipurpose lithium base grease.
- 5.2. If repair or removal is required, remove the deck belt as described in the Deck Belt section of this manual.
- 5.3. Hold the top of the spindle bolt using a 1 1/8" wrench and turn the nut off the bottom using a 1 1/8" wrench.
- 5.4. Slide the blade assembly off the spindle bolt. See Figure 5.4.

- 5.6. The center spindle has two pulleys, with a spacer between them, but the procedure is otherwise similar to the outer two spindles. See Figure 5.6.

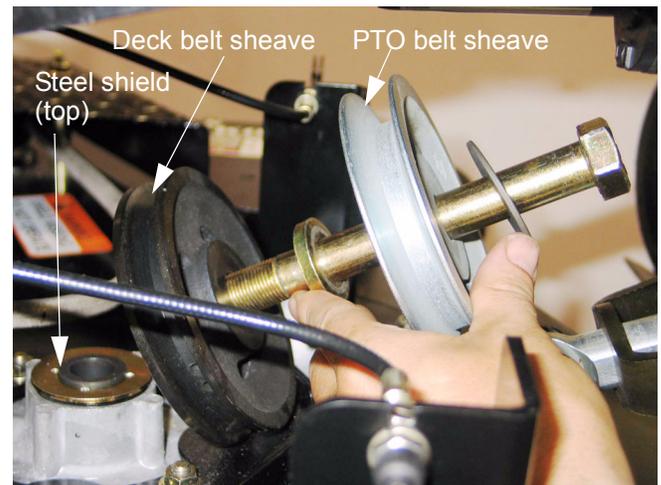


Figure 5.6

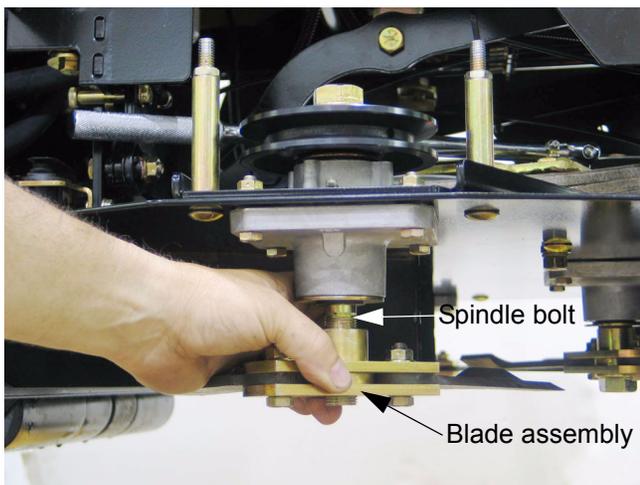


Figure 5.4

- 5.7. Once the pulley is removed, the spindle may be unbolted from the deck using a pair of 9/16" wrenches, or it may be repaired in place.

NOTE: If a warrantable repair is being made to the spindle, replace the spindle as a complete unit. Outside of warranty, the dealer may repair or replace the spindle at their own discretion. Spindle service parts may not be available during the first year of production.

Cub Cadet Commercial Z-Wing

5.8. The steel shields are identical top and bottom, and are easily removable. They do have barbed lips that may damage the seal when removed. they should not be removed unless the seals are to be replaced. See Figure 5.8.

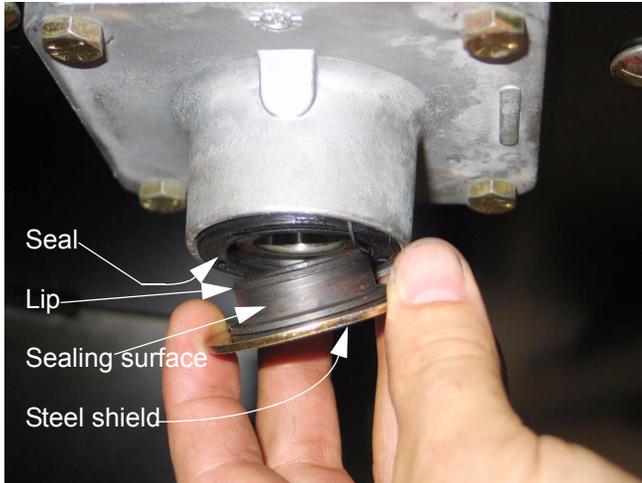


Figure 5.8

5.9. With the steel shields removed, the seals and bearings also come out easily. See Figure 5.9.

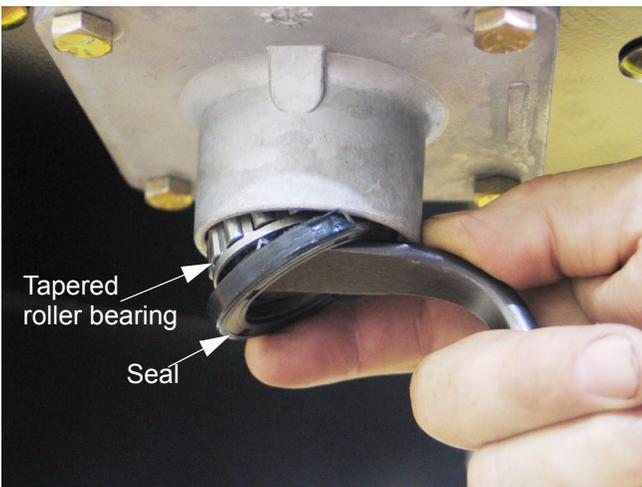


Figure 5.9

5.10. If the tapered roller bearings need to be replaced, the races need to be driven-out and replaced as well. See Figure 5.10.

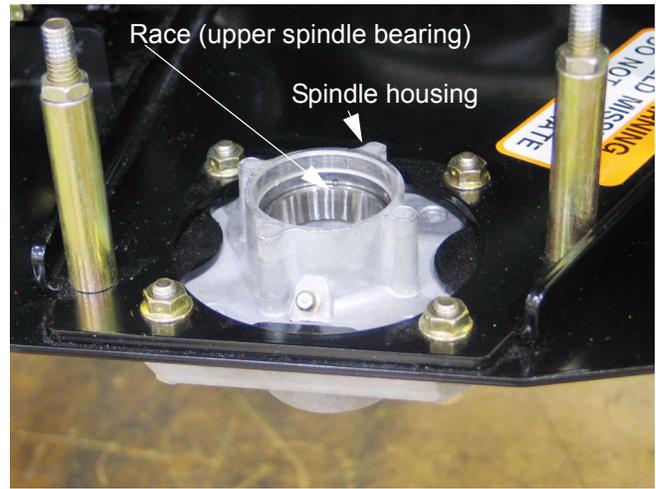


Figure 5.10

5.11. Assembly notes:

- Clean and inspect the bearings for signs of damage. Replace bearings and races if necessary.
- Pack the bearings with fresh No.2 multi-purpose lithium base grease and install them in the spindle housings using new seals.
- Replace any suspect hardware.
- On installation of the spindle nuts, apply thread locking compound such as Loctite 262 (red) to the threads, and tighten the nut to a torque of 100-120 ft-lbs (114-136 Nm).
- Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nuts if the locking feature of the nuts are in question. Tighten the spindle mounting bolts (nuts) to a torque of 20-25 ft-lbs (27-34 Nm).

Cub Cadet Commercial Z-Wing

6. DECK BELT AND PTO BELT TENSIONER

- 6.1. The deck belt tensioner idler arm can be removed using a 1" wrench on the bolt head above the deck and an 11/16" wrench to remove the nut, lock washer, and flat washer from beneath the deck. See Figure 6.1.

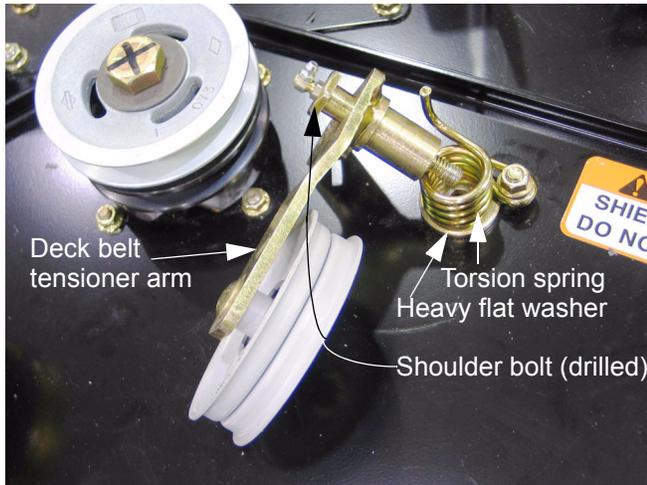


Figure 6.1

- 6.2. The bolt is rifle-drilled to provide for grease access to the bushing in the idler arm. The bushings are replaceable. See Figure 6.2.

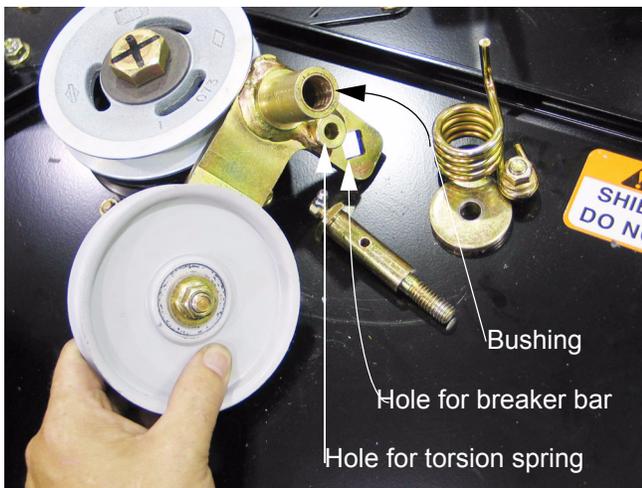


Figure 6.2

- 6.3. A heavy flat washer between the shoulder of the bolt and the deck weldment distributes the mounting load.
- 6.4. The torsion spring is mounted to a carriage bolt using a nut and jam nut that can be easily removed using a 9/16" wrench.

- 6.5. The pulley is mounted to the idler arm using a carriage bolt. It can be easily removed using a 9/16" wrench.

- 6.6. Installation notes:

- Apply a small amount of thread locking compound such as Loctite 262 (red) to the torsion spring retaining nut, or replace the nut if the locking feature of the nut is in question. Snug the nut against the spring.
- Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nuts if the locking feature of the nuts are in question. Tighten the pulley mounting nut to a torque of 20-25 ft-lbs (27-34 Nm).
- Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question. Tighten the idler arm bolt to a torque of 30-35 ft-lbs (41-48 Nm).
- Lubricate the idler arm bushings with #2 multi-purpose lithium base grease.

- 6.7. The PTO belt tensioner is a simple idler arm with an extension spring between the arm and the deck weldment.

- 6.8. The spring may be detached without removing the arm using a length of starter rope or a spring removal tool. See Figure 6.8.



Figure 6.8

- 6.9. The PTO idler arm can be removed from the deck using two 9/16" wrenches.

Cub Cadet Commercial Z-Wing

- 6.10. There are three mounting holes for the pulley on the idler arm, use the one nearest the pivot point as indicated by the “48” mark on the label. See Figure 6.10.



Figure 6.10

- 6.11. The bushings in the PTO belt tensioner idler arm are replaceable.

6.12. Assembly notes:

- Apply a small amount of threadlocking compound such as Loctite 242 (blue), or replace the nuts if the locking feature of the nuts are in question. Tighten the pulley mounting nut to a torque of 20-25 ft.-lbs (27-34 Nm).
- Apply a small amount of threadlocking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question. Tighten the pulley mounting nut to a torque of 20-25 ft.-lbs (27-34 Nm).
- Lubricate the idler arm bushings with No. 2 multipurpose lithium base grease.

7. CUTTING DECK REMOVAL: EARLY 2005 PRODUCTION

NOTE: Decks having U-shaped front lift rods were used on all Z-Wings produced after Nov. 1, 2005 (S/N: 0K015Z00001). These decks are retrofitted to earlier production. Earlier decks are easily identified by V-shaped front lift rods that connect to the deck at a single point.

- 7.1. Remove the PTO belt as described in the PTO Belt section of this manual, including all precautions.
- 7.2. Trap the deck lift in the lowest position using the clevis pin so that the cutting deck rests on the ground and the lift handle does not imitate a catapult when the weight of the deck is removed from the lift assist springs. See Figure 7.2.



Figure 7.2

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- 7.3. Remove the wing lift shield using a 9/16" wrench. See Figure 7.3.



Figure 7.3

- 7.4. Mowers produced after mid-season 2005 (2005/2) are equipped with a lateral brace between the frame and the mowing deck, similar to a panhard rod in the rear suspension of a car or truck. Disconnect or remove the lateral brace as required by the task at-hand using a 5/8" wrench and an 11/16" wrench. See Figure 7.4.

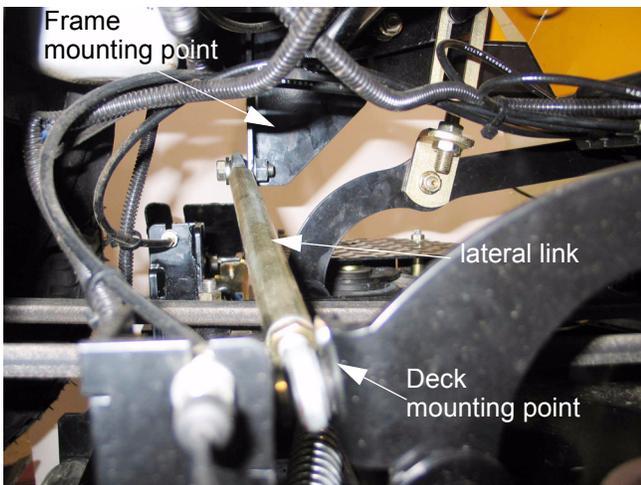


Figure 7.4

- 7.5. Block all four hinge locks into the unlatched position using extra wrenches. See Figure 7.5.

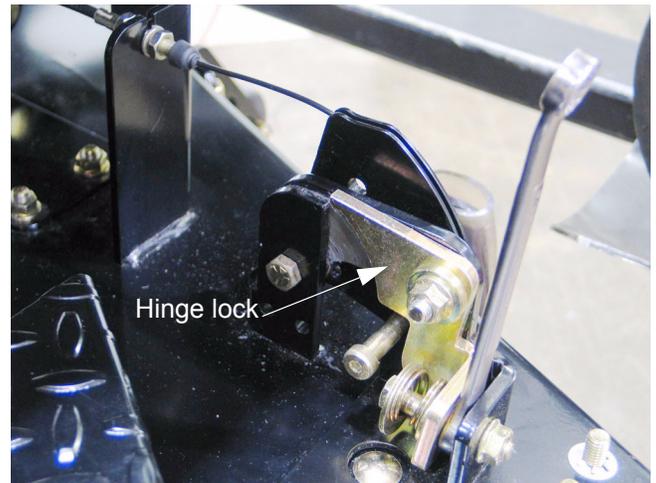


Figure 7.5

NOTE: Wrenches are handy to insert, easy to spot, and unlikely to be forgotten.

- 7.6. Slide the rubber boot back from the cable end, and remove the end jam nut on the cable using a pair of 1/2" wrenches.
- 7.7. With the wings unlatched, they can be lifted manually. Lift the wings manually to put slack in the lift cable so that the end of the cable can be slipped-out of the hole and slot in the bracket. See Figure 7.7.

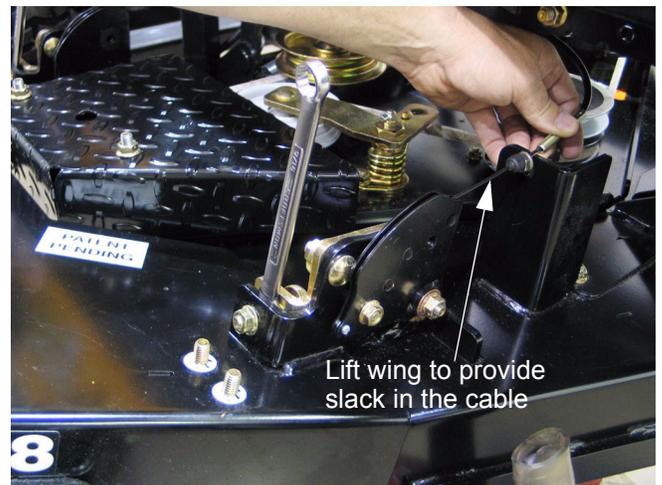


Figure 7.7

- 7.8. Once the cable housing is released from the bracket on the deck, the barrel on the end of the cable core can be maneuvered out of the hole and slot in the wing lift bracket.

Cub Cadet Commercial Z-Wing

- 7.9. Disconnect the wires from the deck wing position switches on each rear deck wing bracket. See Figure 7.9.

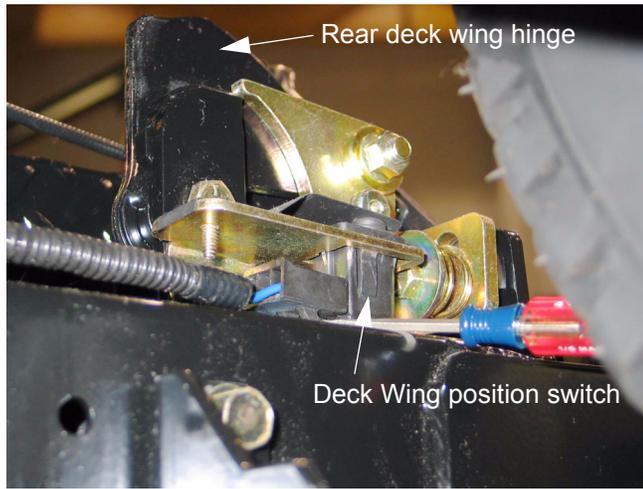


Figure 7.9

- 7.10. Cut any cable ties holding wing lift cables and wing position switch wires to the cutting deck.
- 7.11. Remove the hairpin clip and clevis pin that secure the front of the cutting deck to the spherical rod end on the front lift arm assembly. See Figure 7.11.

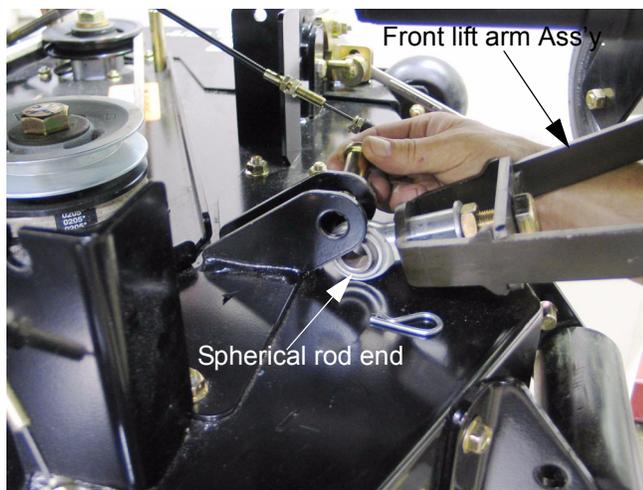


Figure 7.11

- 7.12. Remove the hairpin clips that secure the cutting deck to the lift arms.
- NOTE:** 914-0147 hairpin clips are an acceptable replacement for the originals.
- 7.13. Move the deck to the right to disengage the pins that connect the deck to the lift arms.
- 7.14. If working on the ground:

- Hold the lift handle down
 - Carefully remove the hairpin clip and clevis pin that kept the lift handle in the lowest position.
 - Carefully allow the lift handle to rise to the transport position under the force of the lift assist springs.
 - Turn the front caster wheels sideways for deck clearance.
- 7.15. Remove the cutting deck from the mower.
- 7.16. Installation is done by reversing the removal process. **Installation notes:**
- Confirm the correct operation of all safety features, including the wing-latch mechanisms before returning the mower to service.
 - Confirm that the cables are correctly adjusted after deck installation.
 - Confirm that the cables and wires are routed and fastened in such a way that they will not be damaged during operation of the mower.
 - If the locking feature of the removed lateral brace mounting nut has worn, replace the nut or apply a small amount of thread locking compound such as Loctite 242 (blue).
 - Tighten the mounting bolt to a torque of 40 ft-lbs. (54.25 Nm).

Cub Cadet Commercial Z-Wing

8. CUTTING DECK REMOVAL: COMMENCING WITH LATE 2005 PRODUCTION

NOTE: Decks having U-shaped front lift rods were used on all Z-Wings produced after Nov. 1, 2005 (S/N: 0K015Z00001). These decks are refittable to earlier production. Earlier decks are easily identified by V-shaped front lift rods that connect to the deck at a single point.

- 8.1. Remove the PTO belt as described in the PTO Belt section of this manual, including all precautions.
- 8.2. Trap the deck lift in the lowest position using the clevis pin so that the cutting deck rests on the ground or a purpose-built cart, and the lift handle does not imitate a catapult when the weight of the deck is removed from the lift assist springs. See Figure 8.2.



Figure 8.2

- 8.3. Remove the wing lift shield using a 9/16" wrench. See Figure 8.3.



Figure 8.3

- 8.4. Block all four hinge locks into the unlatched position using extra wrenches. See Figure 8.4.

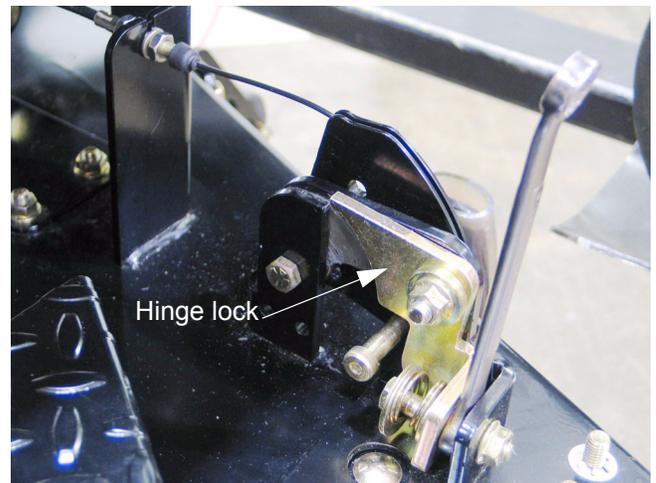


Figure 8.4

NOTE: Wrenches are handy to insert, easy to spot, and unlikely to be forgotten.

- 8.5. Slide the rubber boot back from the cable end, and remove the end jam nut on the cable using a pair of 1/2" wrenches.

Cub Cadet Commercial Z-Wing

- 8.6. With the wings unlatched, they can be lifted manually. Lift the wings manually to put slack in the lift cable so that the end of the cable can be slipped-out of the hole and slot in the bracket. See Figure 8.6.

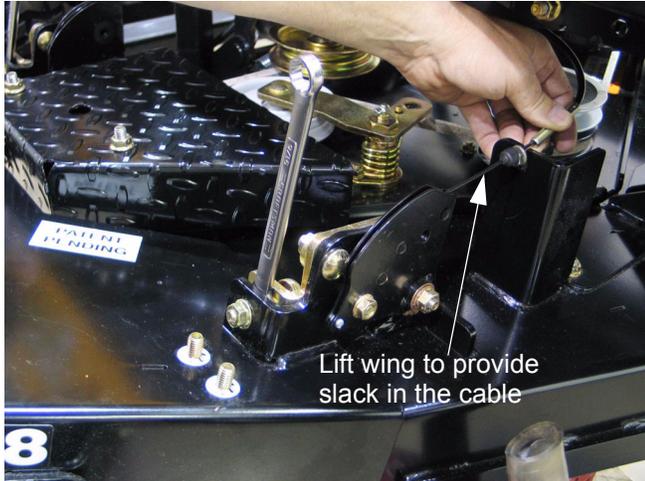


Figure 8.6

- 8.7. Once the cable housing is released from the bracket on the deck, the barrel on the end of the cable core can be maneuvered out of the hole and slot in the wing lift bracket.
- 8.8. Disconnect the wires from the deck wing position switches on each rear deck wing bracket. See Figure 8.8.

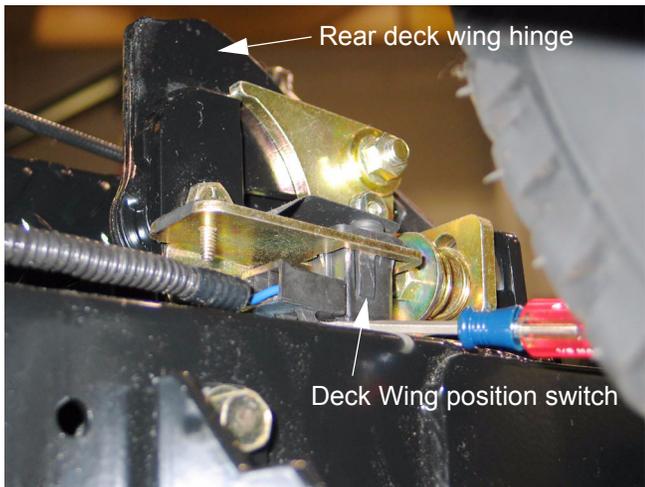


Figure 8.8

- 8.9. Cut any cable ties holding wing lift cables and wing position switch wires to the cutting deck.

- 8.10. Release the extension spring that maintains tension on the PTO belt tensioner arm and pulley. Use a length of starter rope or a spring removal tool. See Figure 8.10.

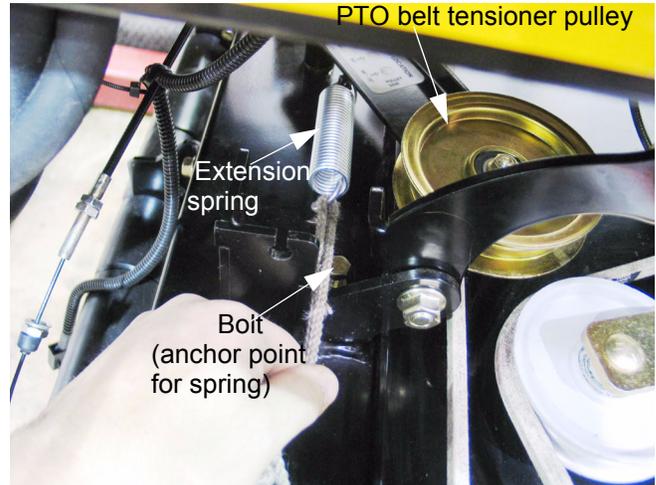


Figure 8.10

- 8.11. Remove the nuts and socket-head shoulder bolts that connect the deck to the lift arms using a 5/16" Allen wrench and a 3/4" wrench. See Figure 8.11.



Figure 8.11

Cub Cadet Commercial Z-Wing

- 8.12. Move the deck forward to disengage the front deck lift bar from the hooks on the front of the deck. See Figure 8.12.

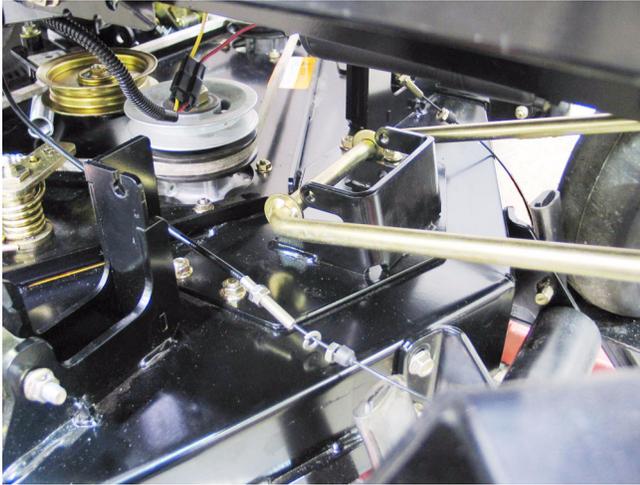


Figure 8.12

- 8.13. Raise the mower and remove the deck from beneath it.
- 8.14. If working on the ground:
- Hold the lift handle down
 - Carefully remove the hairpin clip and clevis pin that kept the lift handle in the lowest position.
 - Carefully allow the lift handle to rise to the transport position under the force of the lift assist springs.
 - Turn the front caster wheels sideways for deck clearance.
 - Remove the cutting deck from the mower.
- 8.15. If the mower is to be moved while the cutting deck is off of it:
- Secure the wires and cables that are associated with the wing lift mechanism.
 - Secure or remove the front lift bar assembly.

- 8.16. Installation is done by reversing the removal process. **Installation notes:**

- Confirm the correct operation of all safety features, including the wing-latch mechanisms before returning the mower to service.
- Confirm that the cables are correctly adjusted after deck installation.
- Confirm that the cables and wires are routed and fastened in such a way that they will not be damaged during operation of the mower.
- If the locking feature of the removed laterally brace mounting nut has worn, replace the nut or apply a small amount of thread locking compound such as Loctite 242 (blue).
- Tighten the mounting bolt to a torque of 40 ft-lbs. (54.25 Nm).

9. DECK LEVELING: EARLY 2005 PRODUCTION

NOTE: Decks having U-shaped front lift rods were used on all Z-Wings produced after Nov. 1, 2005 (S/N: 0K015Z00001). These decks are retrofittable to earlier production. Earlier decks are easily identified by V-shaped front lift rods that connect to the deck at a single point.

9.1. Preparation:

- Park the mower on a flat, level, paved surface, set the parking brake and lower the deck wings.
- **Safety:** disable the engine by removing the key from the key switch and disconnecting the high tension leads from the spark plugs.
- Setting the mower deck height to 4" provides the best combination of access above and below the deck.
- Check the rear tire pressure: they should be between 10-12 PSI (.69-.84 Bar). Be aware that adjustments to rear tire pressure will also cause a change in tracking.

Cub Cadet Commercial Z-Wing

9.2. **Side-to-side measurement:** See Figure 9.2.



Figure 9.2

- Orient the outer pair of blades fore-and-aft.
 - Check the vertical play on each element of the blade assemblies to be measured. There will be some up and down travel at the blade tips, generally between 1/8" and 1/4" (3.175mm and 6.35mm). If the amount of play significantly exceeds this range, or is not consistent between blade elements, identify the cause and correct it.
 - Aerodynamic down-force overcomes the centrifugal force that keeps the blades perpendicular to the spindle axis at mowing speeds: the blades operate at the lower end of the available play.
 - Measure the distance to the ground from the left and right rear blade tips. It should be equal.
- 9.3. If the distance from the left and right rear blade tips to the ground is equal, proceed to fore-and-aft pitch measurement. If the distance is not equal, level the deck as described under the Side-to-side leveling sub-heading.

9.4. **Side-to-side leveling:** See Figure 9.4.



Figure 9.4

- The right side deck lift link is fixed in length, while the left side link is adjustable.
 - Loosen the jam nut that locks the adjustment on the left lift link using a 3/4" wrench.
 - Move the adjustment nut up or down as necessary to level the deck, using a 3/4" wrench.
 - Tighten the jam nut, and double-check the level. Readjust if necessary.
- 9.5. **Fore-and-aft pitch measurement:**
- Measure the distance to the ground from the front and rear tips of the right side blade.
 - The front blade tip should be between 1/8" and 1/4" (3.175mm and 6.35mm) closer to the ground than the rear blade tip.
 - This measurement should be the same for the left side blade too. If it is not, identify and correct the cause.
 - If adjustment is necessary, proceed as described in the deck pitch adjustment sub-heading.

Cub Cadet Commercial Z-Wing

- 9.6. **Deck pitch adjustment:** Mowers produced before November 2005. See Figure 9.6.

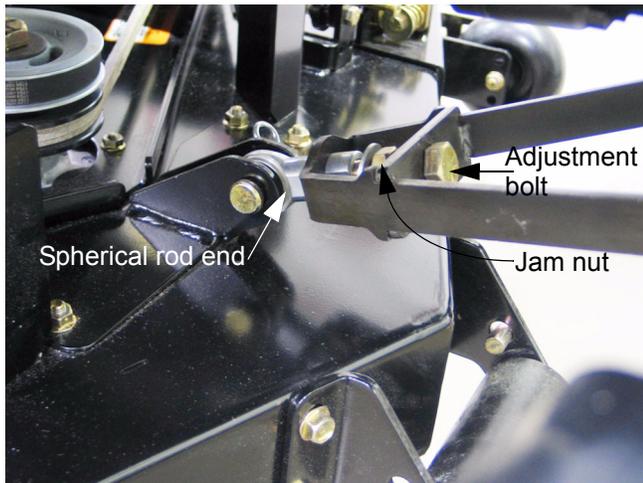


Figure 9.6

- Loosen the jam nut that locks against the spherical rod-end connecting the front of the cutting deck to the front lift arm assembly using a 15/16" wrench.
 - Tighten or loosen the pitch adjustment bolt as required to achieve a nose-down blade attitude (lower at the front of the blade than at the back) of 1/8" to 1/4" (3.175mm and 6.35mm) using a 15/16" wrench.
 - Secure the adjustment by tightening the jam nut.
- 9.7. Run and test the mower, inspecting cut quality, before returning the mower to service.
- 9.8. **Deck pitch adjustment:** Mowers produced after November 2005, or retrofitted with a new deck after November 2005: See Figure 9.8.

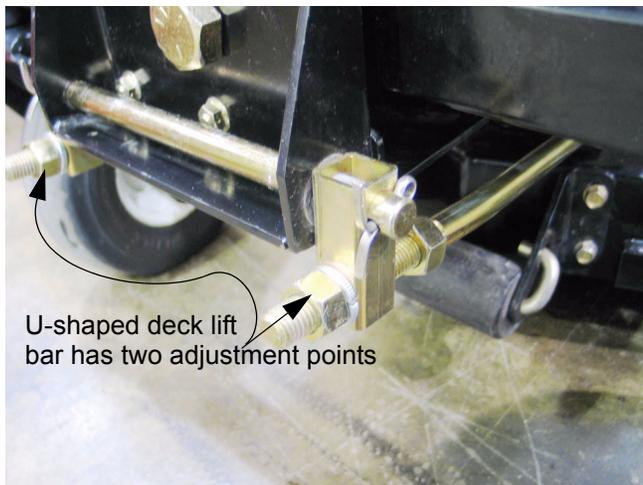


Figure 9.8

- Loosen the jam nuts that lock against the front rod lift tube using a 15/16" wrench.
- Tighten or loosen the pitch adjustment nuts as required to achieve a nose-down blade attitude (lower at the front of the blade than at the back) of 1/8" to 1/4" (3.175mm and 6.35mm) using a 15/16" wrench.
- Tension on the adjusting nuts should be even. If it is not, the looser side will amplify deck vibrations.
- Secure the adjustment by tightening the jam nut.
- The effect of adjustment is greater at lower cutting heights because the front deck lift arm is closer to horizontal at higher cutting levels. It is important to make this adjustment at the level used most frequently by the operator.

- 9.9. Run and test the mower, inspecting cut quality, before returning the mower to service.

- 9.10. **Lateral brace adjustment:** See Figure 9.10.

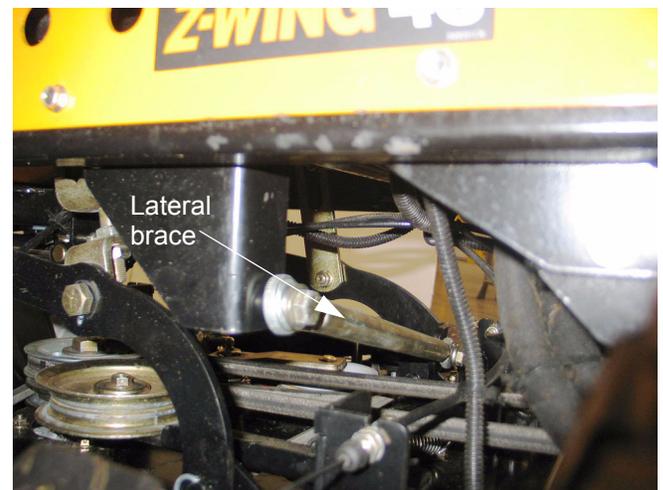


Figure 9.10

- Mowers produced after mid-season 2005, but before November of 2005 are equipped with a lateral brace between the frame and the mowing deck, similar to a panhard rod in the rear suspension of a car or truck.
- The lateral brace length should be adjusted so that at the middle of the deck's height travel it exerts no force on the deck: if one of the mounting bolts is removed it will slip back-in without force.

Cub Cadet Commercial Z-Wing

9.11. To adjust the lateral brace: See Figure 9.11.

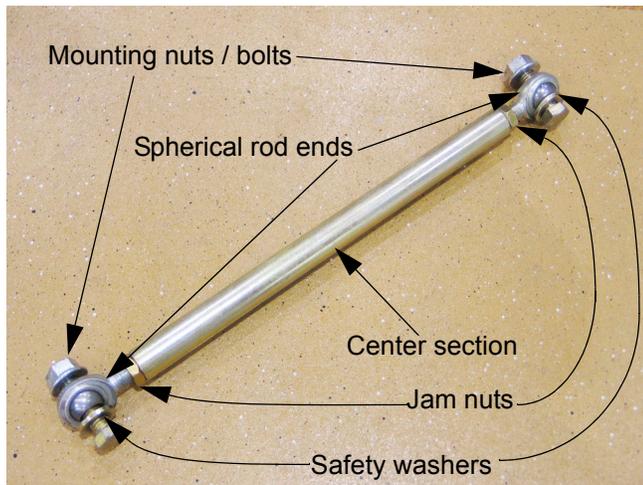


Figure 9.11

NOTE: Safety washers prevent the lateral brace from becoming disconnected if one of the spherical rod-ends fails.

- Loosen the jam nuts at each spherical rod-end using an 11/16" wrench before disconnecting the brace.
- Disconnect one end of the lateral brace, and lengthen or shorten the brace as needed by rotating the tubular center section.
- Both spherical rod ends are connected to the center section with right-hand threads, so one end must be disconnected for adjustment.
- Reconnect the end, and tighten the jam nuts.
- If the locking feature of the removed mounting nut has worn, replace the nut or apply a small amount of thread locking compound such as Loctite 242 (blue).
- Tighten the mounting bolt to a torque of 40 ft.-lbs. (54.25 Nm).

10. DECK WING AND HINGE LOCK

NOTE: Mowers produced after mid-season 2005 use a different hinge lock mechanism than the early 2005 production mowers. While the two hinge locks are similar in operation, the actual components differ substantially. The revised hinge locks will be described in a sub-section that follows the early hinge lock section.

10.1. How it works: See Figure 10.1.

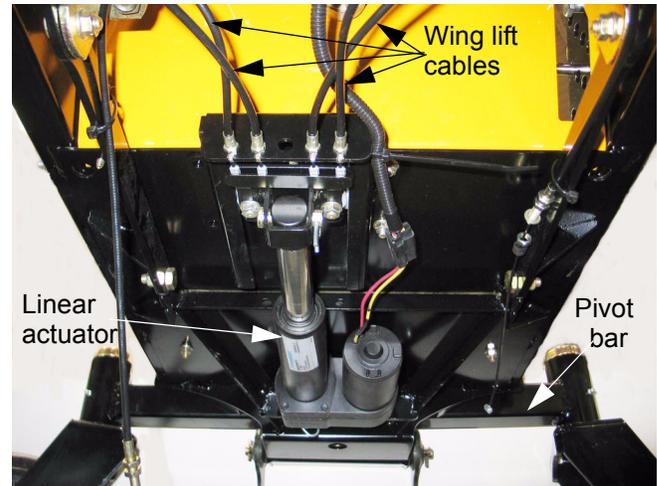


Figure 10.1

- A linear actuator mounted under the floor pulls on a brace of cables. Each pair of two cables unlatch and lift one deck wing.

10.2. Each deck wing has two hinge locks and lift cable brackets, protected by lift wing shields. See Figure 10.2.

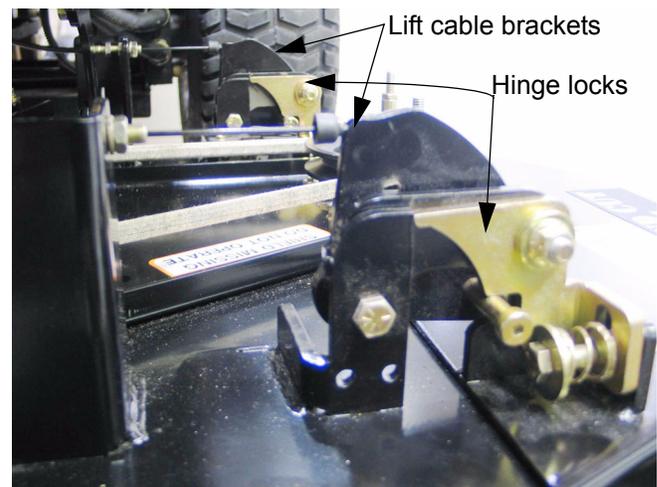


Figure 10.2

Cub Cadet Commercial Z-Wing

NOTE: All four sets of hinge locks and brackets are identical: the parts are interchangeable left-to-right and front-to-rear.

- 10.3. When the wing lift is activated, all four cables, hinge locks, and lift mechanisms should work in unison: See Figure 10.3.

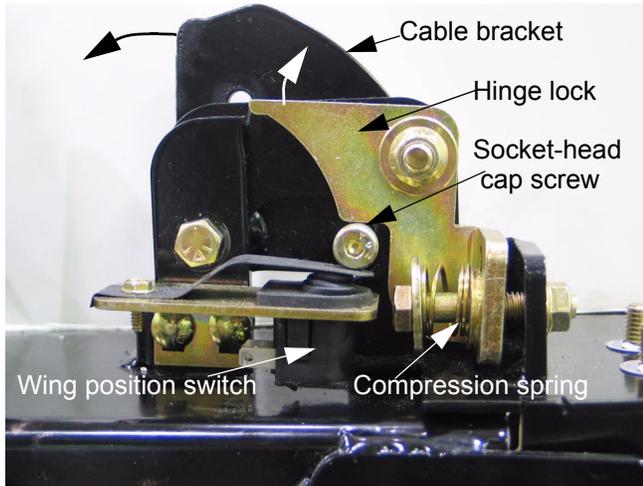


Figure 10.3

- The force applied through the cable rotates the cable bracket inward.
- The socket head cap screw attached to the cable bracket moves upward, releasing the plunger on the safety switch and rotating the hinge lock clear of the corner of the deck hinge.
- The force of a compression spring keeps the hinge lock applied when the cable is slack.
- When the spring is compressed and the hinge lock is clear of the hinge, the cable will begin to lift the deck wing.
- A clutch within the actuator prevents over-travel when the wings reach the fully raised position.
- The safety switches prevent the operation of the PTO with the deck wings raised.
- Proper adjustment is very important: refer to the DECK WING CABLE ADJUSTMENT section of this manual for the correct procedure.
- Proper hinge alignment is very important. If a hinge becomes bent or damaged, it must be repaired before the mower is used.

- 10.4. The lift mechanism can be reached by removing the lift wing shield using a 9/16" wrench. See Figure 10.4.



Figure 10.4

- 10.5. If the cable bracket is to be removed, it can be unbolted with the cable attached using two 9/16" wrenches. Once loose, the cable can be disconnected from the bracket. See Figure 10.5.

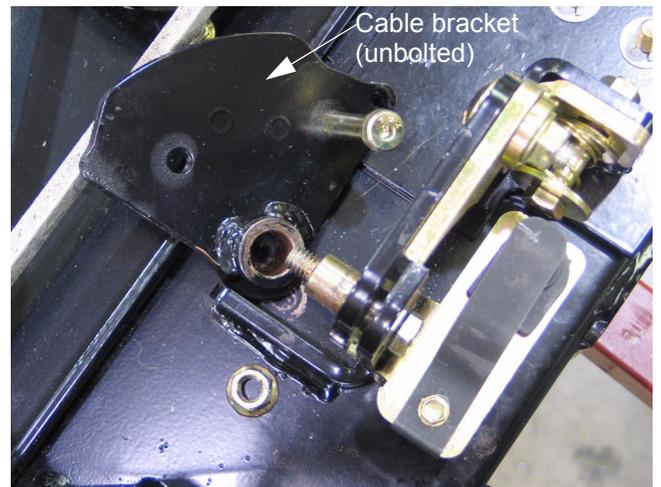


Figure 10.5

NOTE: The bolt and bushing that hold the bracket are also the pivot point for the deck wing.

Cub Cadet Commercial Z-Wing

10.6. Orientation: on all four cable brackets, one side of the bushing shoulder is thicker than the other. The socket head cap screw always goes on the side with the thicker shoulder. See Figure 10.6.

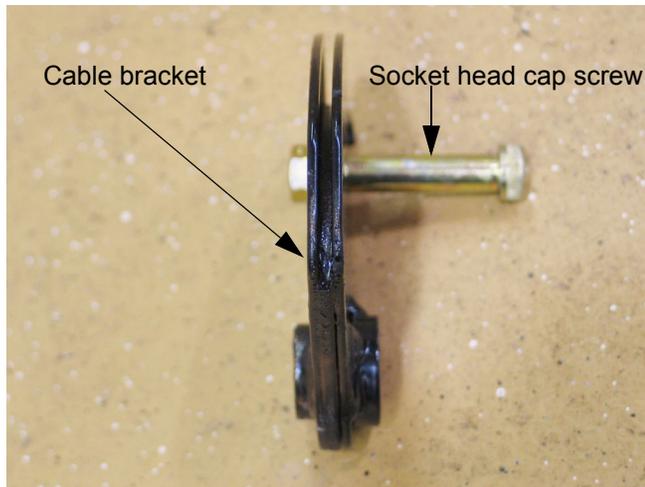


Figure 10.6

10.7. Assembly notes:

- Reverse the disassembly process to install the cable bracket.
- Lubricate the pivot point with anti-seize compound.
- Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question. Tighten the nut to a torque of 20-25 ft-lbs (27-34 Nm).
- Confirm correct operation and adjustment of the wing lift mechanism and all associated safety features before returning the mower to service.

10.8. To remove the hinge lock, the compression spring that holds the hinge lock against the bracket on the deck wing must first be disconnected.

10.9. Remove the nut that secures bolt, flat washer, and the compression spring using a pair of 9/16" wrenches. The spring will still be captive, but it can be removed when the hinge lock is unbolted from the bracket on the deck wing.

10.10. Once the spring is released, remove the nut from the carriage bolt that secures the hinge lock and its shouldered bushing to the bracket on the deck wing. See Figure 10.10.

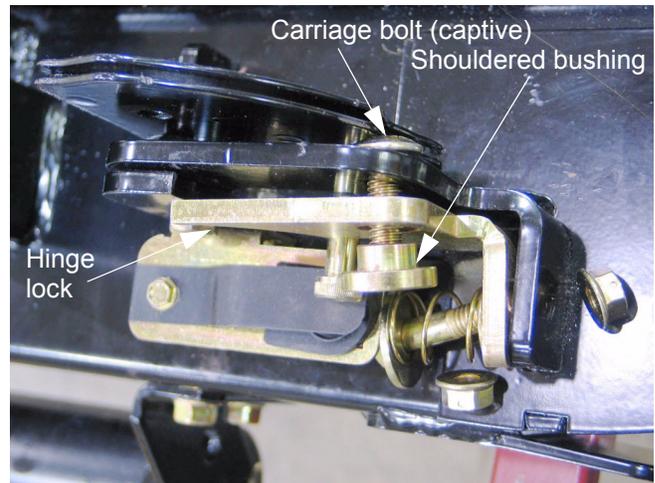


Figure 10.10

10.11. The hinge lock assembly can then be removed from the deck, except for the carriage bolt. The cable bracket must be removed to release the carriage bolt. See Figure 10.11.

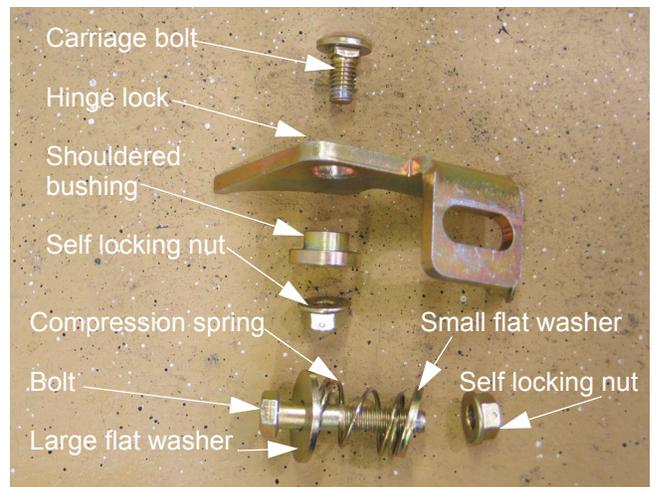


Figure 10.11

Cub Cadet Commercial Z-Wing

10.12. Assembly notes: See Figure 10.12.

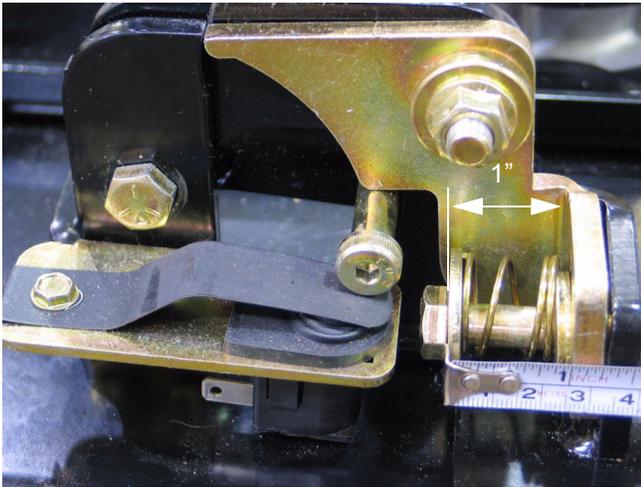


Figure 10.12

- Reverse the disassembly process to install the hinge lock.
- Lubricate the pivot point (shoulder bushing) with anti-seize compound.
- Tighten the nut on the carriage bolt to a torque of 20-25 ft-lbs (27-34 Nm). Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question.
- Tighten the nut that holds the compression spring until the distance between the head of the bolt and the near edge of the bracket on the deck wing is 1" (2.54 cm), with the hinge lock pressed firmly against the bracket. Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question.
- Confirm correct operation and adjustment of the wing lift mechanism and all associated safety features before returning the mower to service.

10.13. There is a safety switch mounted to the rear hinge on each side of the deck.

- The switch is actuated by the socket head cap screw that releases the hinge lock.
- If the switch contacts of both switches do not close, the PTO will be disabled.
- Disabled PTO may be caused by a disconnected switch, damaged wires, damaged switch, or a misadjusted switch.

10.14. The switch contacts are normally open (N.O.), meaning that the internal contacts are broken when the plunger is extended. See Figure 10.14.

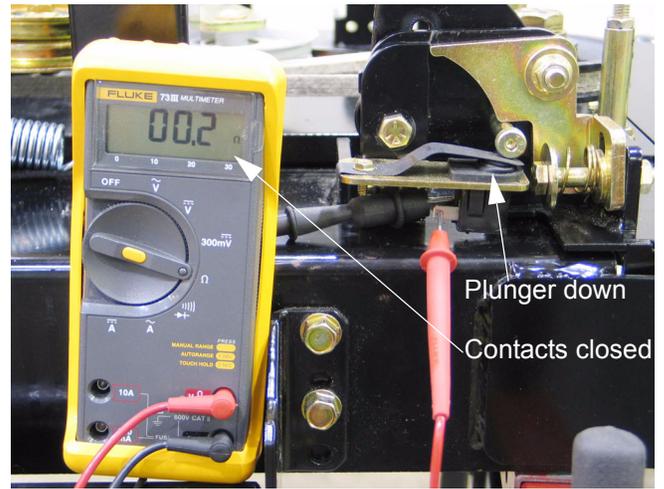


Figure 10.14

- If the contacts fail to close when the plunger is depressed, the PTO will not work.
- If the contacts fail to open when the plunger is extended, an unsafe condition will exist.
- The switches should be tested whenever mower deck maintenance is being performed.

10.15. The switches are mounted to a slotted bracket using carriage bolts: they are adjustable.

10.16. The switches are correctly adjusted when the contacts break just as the corner of the hinge lock clears the corner of the hinge. See Figure 10.16.

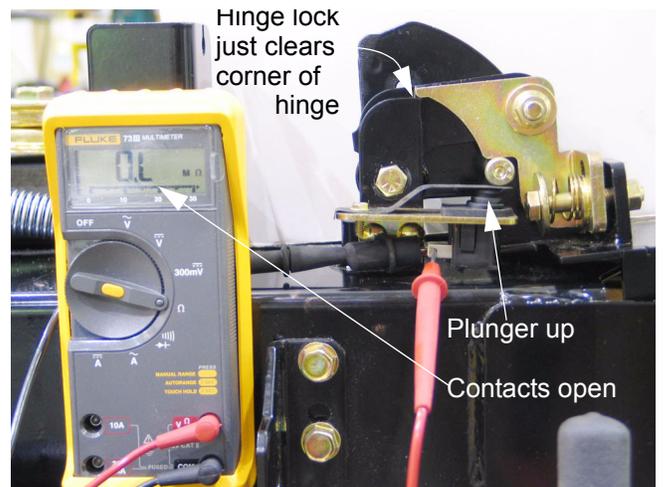


Figure 10.16

Cub Cadet Commercial Z-Wing

11. HINGE LOCK: LATE 2005 PRODUCTION

11.1. When the wing lift is activated, all four cables, hinge locks, and lift mechanisms should work in unison: See Figure 11.1.

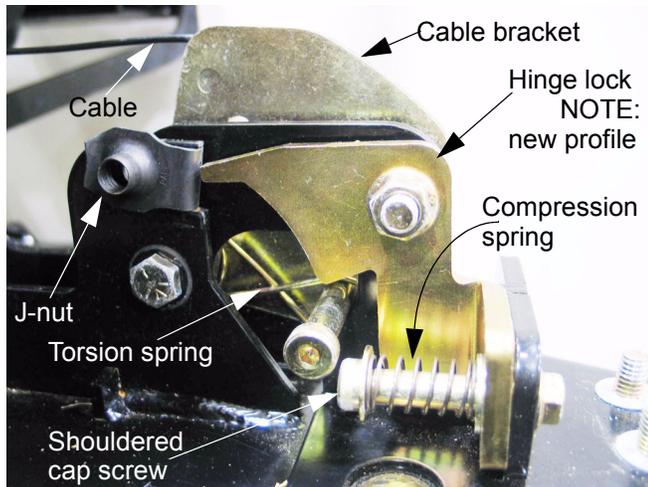


Figure 11.1

- The force applied through the cable rotates the cable bracket inward.
- The socket head cap screw attached to the cable bracket moves upward, releasing the plunger on the safety switch and rotating the hinge lock clear of the corner of the deck hinge
- The force of a compression spring keeps the hinge lock applied when the cable is slack.
- When the spring is compressed and the hinge lock is clear of the hinge, the cable will begin to lift the deck wing.
- A clutch within the actuator prevents over-travel when the wings reach the fully raised position.
- The safety switches prevent the operation of the PTO with the deck wings raised.
- Proper adjustment is very important: refer to the DECK WING CABLE ADJUSTMENT section of this manual for the correct procedure.
- Proper hinge alignment is very important. If a hinge becomes bent or damaged, it must be repaired before the mower is used.

11.2. The revised hinge lock (2005/2) differs from the original hinge lock (2005/1) in the following ways:

- There is greater range of motion between the point that the socket head cap screw releases the plunger on the safety switch and the point that it contacts the hinge lock.

- There is a torsion spring connecting the hinge to the cable bracket, giving the cable bracket more positive return action.
 - A J-nut has been positioned in a notch on the hinge. The J-nut is hardened. This provides a hard flat surface for the hinge lock to operate against. The wear resistance of the J-nut will provide more consistent locking action over time, and is easily replaced.
 - The compression spring that engages the hinge lock is mounted on shouldered socket head cap screw, eliminating the possibility of misadjustment.
- 11.3. The Safety switch that is mounted to each rear hinge lock prevents the electric PTO from engaging when the wings are not latched in the down position. See Figure 11.3.

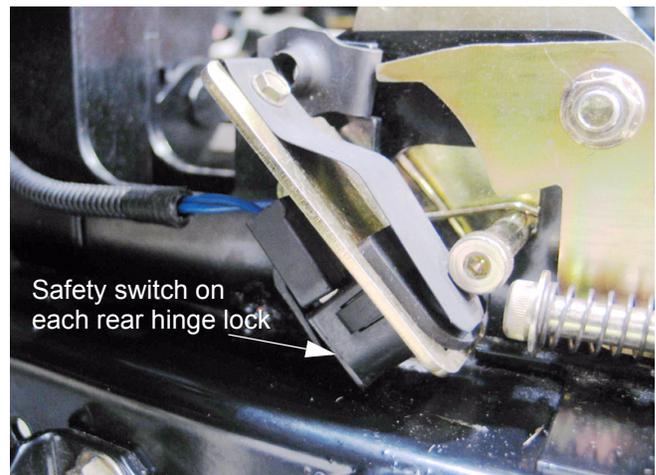


Figure 11.3

Cub Cadet Commercial Z-Wing

11.4. The lift mechanism can be reached by removing the lift wing shield using a 9/16" wrench. See Figure 11.4.



Figure 11.4

11.5. While the earlier cable brackets can simply be unbolted with the cable attached, the torsion spring on the revised cable brackets makes them easier to remove if the cable is first disconnected. See Figure 11.5.

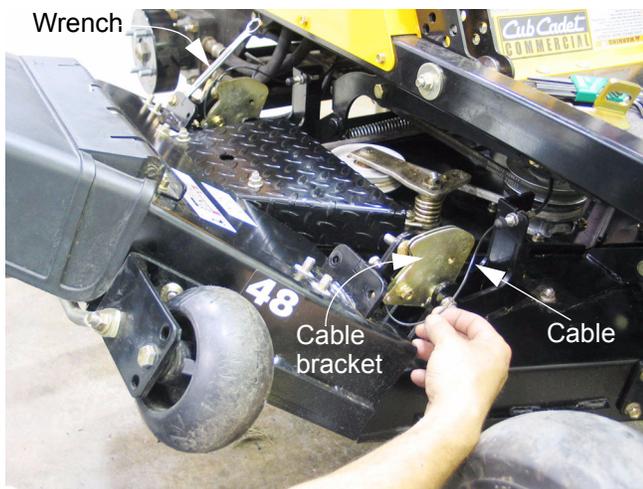


Figure 11.5

- One hinge lock on the wing to be serviced can be blocked open using an open-end wrench.
- The hinge lock nearest the cable bracket to be removed can be manually unlatched.
- With both hinge locks released, the deck wing can be lifted manually to slacken the cable.
- Slack in the cable allows the cable-end barrel to be slipped out of the key-hole opening in the cable bracket.

11.6. The cable bracket can then be removed using two 9/16" wrenches. Unbolt it and remove the bushing. See Figure 11.6.

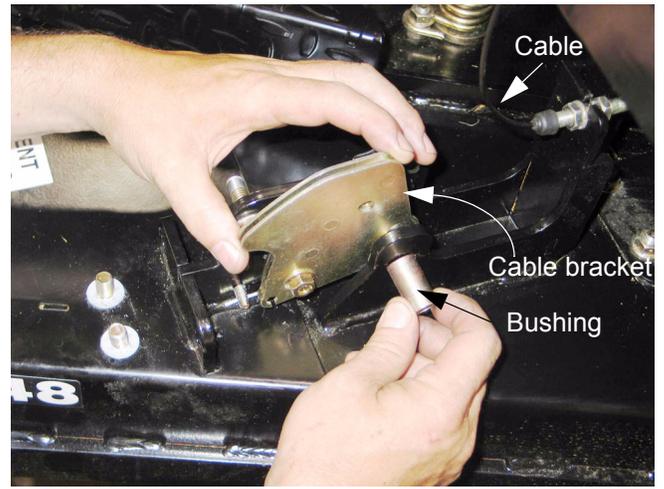


Figure 11.6

11.7. The bolt and bushing that hold the bracket are also the pivot point for the deck wing: If the deck wing is to be completely removed, taking-off both cable brackets will separate the deck wing from the rest of the deck.

11.8. Orientation: on all four cable brackets, one side of the bushing shoulder is thicker than the other. See Figure 11.8.

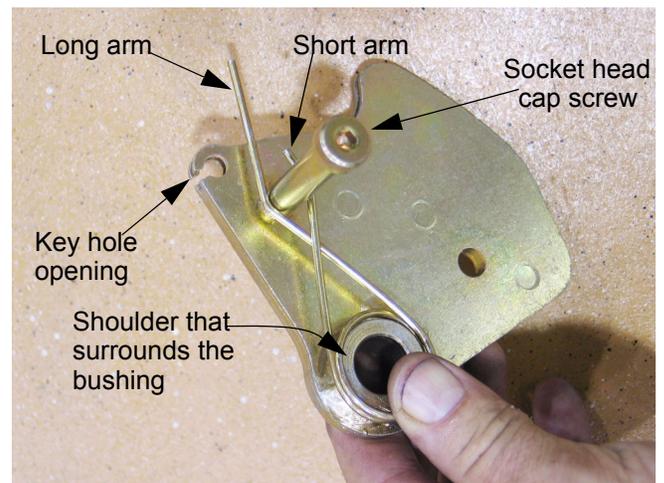


Figure 11.8

- The socket head cap screw always goes on the side with the thicker shoulder.
- The long arm of the torsion spring should be nearer the cable bracket than the short arm.
- The long arm of the torsion spring fits under the socket head cap screw.

Cub Cadet Commercial Z-Wing

11.9. Assembly notes: See Figure 11.9.



Figure 11.9

- Reverse the disassembly process to install the cable bracket: hook the long arm of the torsion spring under the machine screw on the deck wing hinge, and position the socket head cap screw under the hinge lock.
- Lubricate the pivot point with anti-size compound.
- Insert the bushing, and secure the assembly with nut and bolt.
- Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question. Tighten the nut to a torque of 20-25 ft-lbs (27-34 Nm).
- Confirm correct operation and adjustment of the wing lift mechanism and all associated safety features before returning the mower to service.

11.10. To remove the hinge lock, the compression spring that holds the hinge lock against the bracket on the deck wing must first be disconnected. See Figure 11.10.

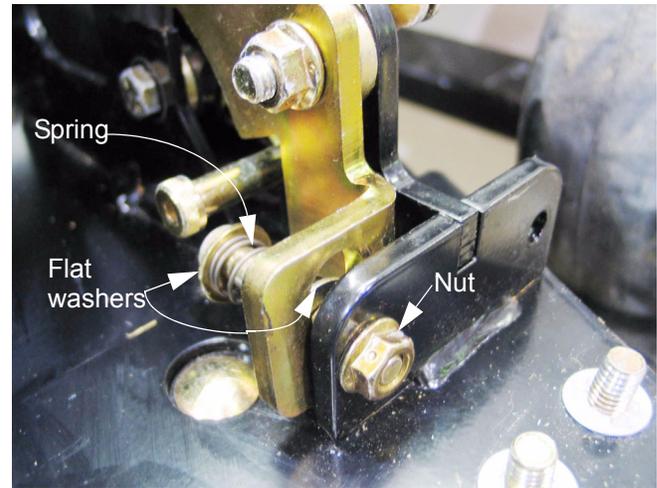


Figure 11.10

11.11. Remove the nut that secures bolt, flat washer, and the compression spring using a pair of 9/16" wrenches.

11.12. The shoulder bolt, spring, and flat washers can all be removed if the spring is compressed with finger pressure. See Figure 11.12.



Figure 11.12

11.13. The hinge lock and the bushing that it pivots on can then be removed from the deck using a 9/16" wrench. See Figure 11.13.

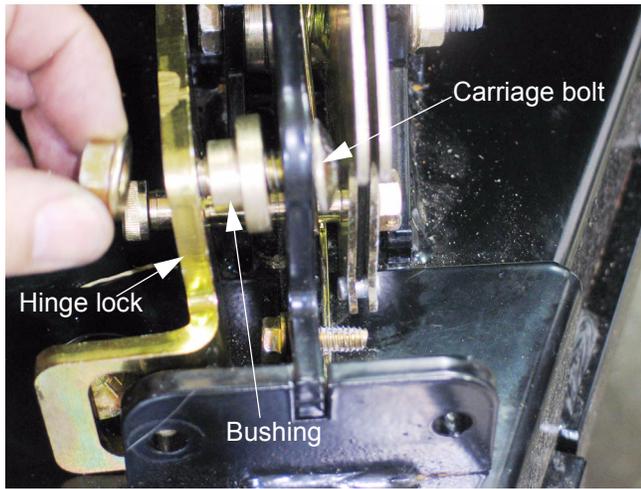


Figure 11.13

NOTE: The cable bracket must be removed to release the carriage bolt.

11.14. Assembly notes:

- Reverse the disassembly process to install the hinge lock.
- Lubricate the pivot point (shoulder bushing) with anti-seize compound.
- Tighten the nut on the carriage bolt to a torque of 20-25 ft-lbs (27-34 Nm). Apply a small amount of thread locking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question.
- Tighten the nut that holds the compression spring until the shoulder bottoms-out against the bracket. Apply thread locking compound such as Loctite 242 (blue), or replace the nut if the locking feature of the nut is in question. Tighten the nut to a torque of 20-25 ft-lbs (27-34 Nm).
- Confirm correct operation and adjustment of the wing lift mechanism and all associated safety features before returning the mower to service.

11.15. There is a safety switch mounted to the rear hinge on each side of the deck.

- The switch is actuated by the socket head cap screw that releases the hinge lock.
- If the switch contacts of both switches do not close, the PTO will be disabled.

11.16. The switch contacts are normally open (N.O.), meaning that the internal contacts are broken when the plunger is extended. See Figure 11.16.

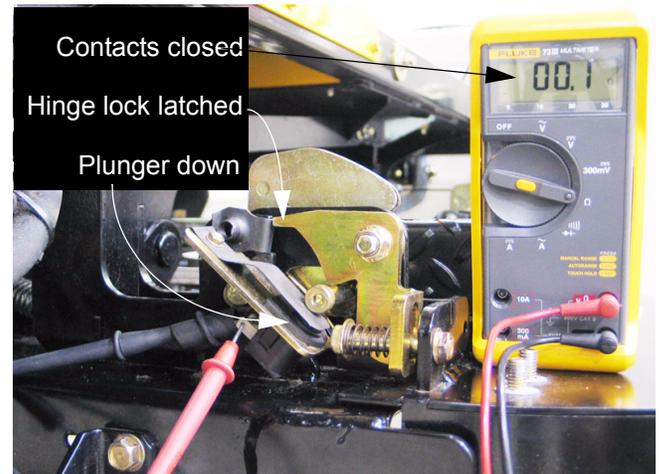


Figure 11.16

- If the contacts fail to close when the plunger is depressed, the PTO will not work.
- If the contacts fail to open when the plunger is extended, an unsafe condition will exist.
- The switches should be tested whenever mower deck maintenance is being performed.

11.17. Each switch is mounted to a bracket that can be rotated for adjustment:

- Loosen the switch bracket mounting bolt using a pair of 9/16" wrenches.
- Rotate the switch bracket until the contacts open and when the hinge lock is unlatched and close when the hinge lock latches.
- Secure the bracket by tightening the bolt.

Cub Cadet Commercial Z-Wing

- 11.18. The switches are correctly adjusted when the contacts break just as the corner of the hinge lock clears the corner of the hinge. See Figure 11.18.

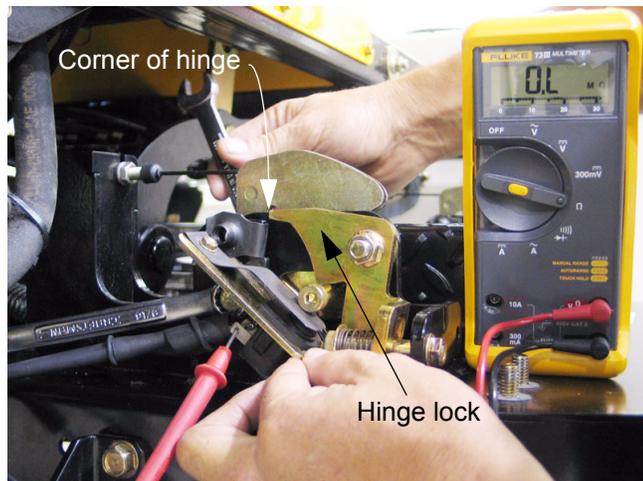


Figure 11.18

- 11.19. Test the operation of the switches after service is complete, but before the lift wing shields are reinstalled.

12. DECK WING LIFT MECHANISM: EARLY 2005 PRODUCTION

NOTE: Decks having U-shaped front lift rods were used on all Z-Wings produced after Nov. 1, 2005 (S/N: 0K015Z00001). These decks are retrofittable to earlier production. Earlier decks are easily identified by V-shaped front lift rods that connect to the deck at a single point.

- 12.1. Refer to the electrical section of this manual for electrical diagnosis of the wing lift actuator.
- 12.2. The cable cores are all nylon jacketed, and should have long service lives.
- Lubrication may be detrimental to the cables in some operating conditions, adhering grit to the cable or softening the cable core jacket.
 - If any lubricant is applied, use a dry product like graphite or dry Teflon (PTFE) such as Tri-flo brand.
- 12.3. If one cable needs replacement, and it has not suffered from some identifiable damage or cause for accelerated wear, a good case can be made for replacing all four cables.

- 12.4. To remove the wing lift actuator, remove the cutting deck as described in the CUTTING DECK REMOVAL section of this manual.

- 12.5. Retract the actuator:

- Insert the key in the key switch and turn it to ON.
- Work the rocker switch to lift the deck wings (disconnected), retracting the ram on the actuator.
- Turn the key switch OFF and remove the key.
- If the actuator has failed in the fully extended position, or if the cable bracket is to be removed, follow the steps described later in this section.

- 12.6. Disconnect the electric plug joining the actuator to the rest of the harness. See Figure 12.6.

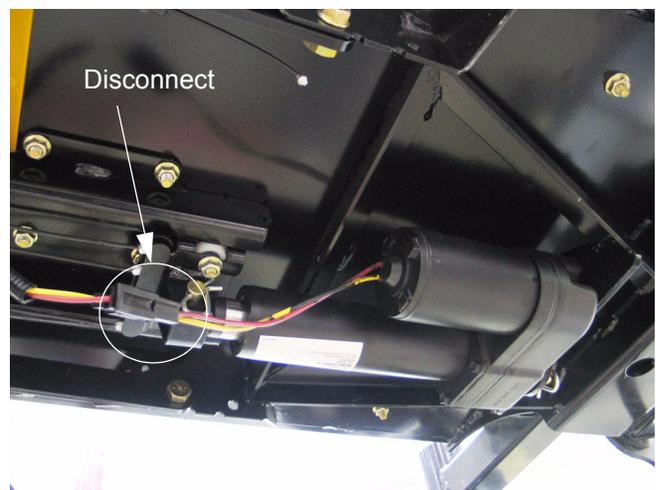


Figure 12.6

- 12.7. Remove the hairpin clip and clevis pin and connecting the rear (ram) of the actuator to the cable bracket. See Figure 12.7.

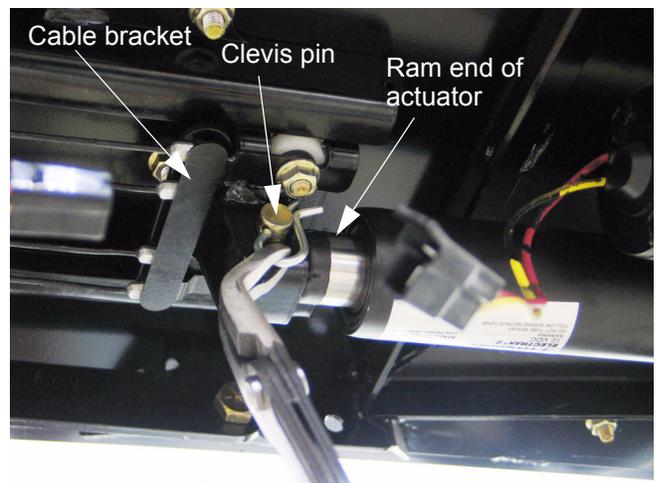


Figure 12.7

Cub Cadet Commercial Z-Wing

12.8. Disconnect the front of the actuator:

- Remove the hairpin clip from the clevis pin that secures the front of the actuator to the frame of the mower.
- Hold the actuator to keep it from rotating.
- Drive the clevis pin up, releasing the actuator.

12.9. Carefully slide the actuator toward the back of the mower to release it from the front bracket, and lower it to remove it. See Figure 12.9.

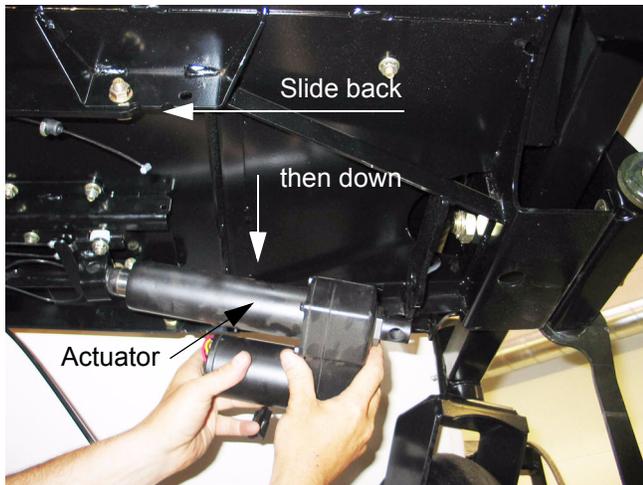


Figure 12.9

12.10. Installation notes: See Figure 12.10.

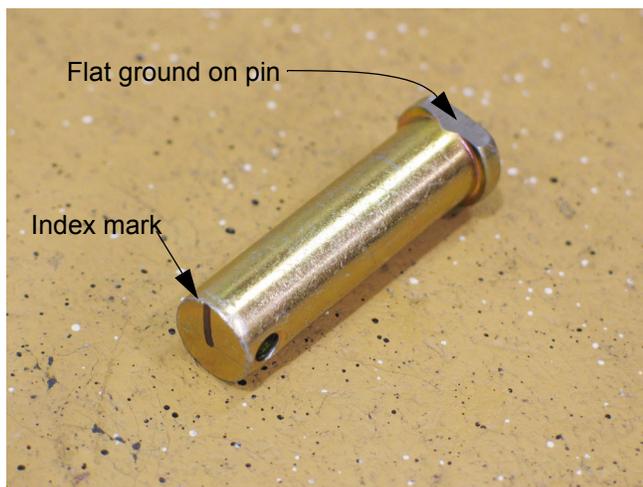


Figure 12.10

- Reverse the disassembly process to install the actuator.
- It is acceptable to grind a small flat on one side of the head of the front clevis pin, perpendicular to the bore for the hairpin clip, for ease of installation.

Installation notes, continued:

- Lubricate the pivot points (clevis pins) with anti-seize compound.
 - Confirm correct operation and adjustment of the hinge lift mechanism and associated safety features before returning the mower to service.
- 12.11. If the actuator has failed in the fully extended position, or if it is necessary to remove the cable bracket, the following sequence of instructions will be more useful.
- 12.12. To remove the wing lift actuator, remove the cutting deck as described in the CUTTING DECK REMOVAL section of this manual.
- 12.13. Disconnect the electric plug joining the actuator to the rest of the harness.
- 12.14. Remove the rear hairpin clip and clevis pin that hold the actuator to the cable bracket assembly.
- 12.15. Remove the four nuts that secure the cable bracket assembly to the frame of the mower using a 1/2" wrench. See Figure 12.15.

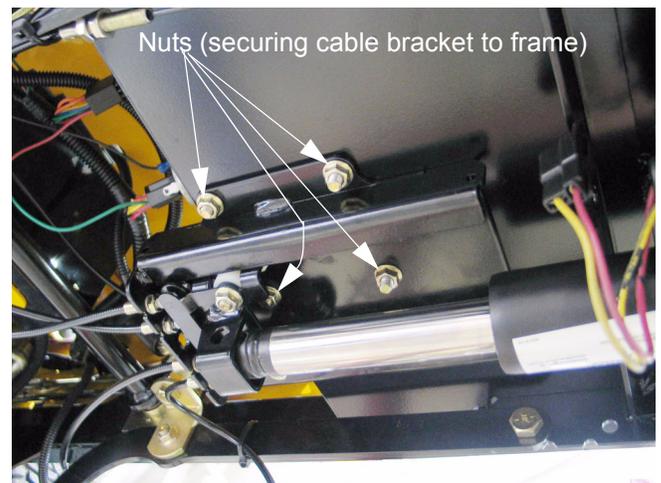


Figure 12.15

Cub Cadet Commercial Z-Wing

12.16. If the nuts are loosened from their carriage bolts in small increments and slight downward force is applied to the bracket, the square bosses on the carriage bolts will remain engaged to the frame. Tape placed over the heads of the carriage bolts will also help keep them in place. See Figure 12.16.



Figure 12.16

12.17. Cut any cable ties that secure the lift cables to the mower.

12.18. Lower the cable bracket assembly slightly to clear the bolts, draw it rearward to clear the actuator, and remove it. See Figure 12.18.

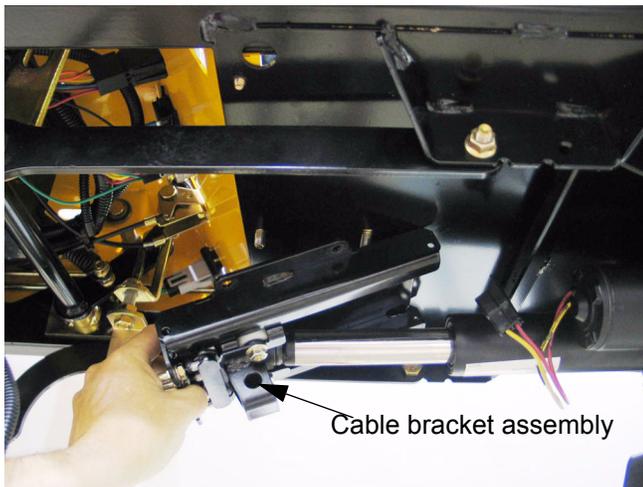


Figure 12.18

12.19. Disconnect the front of the actuator:
See Figure 12.19.

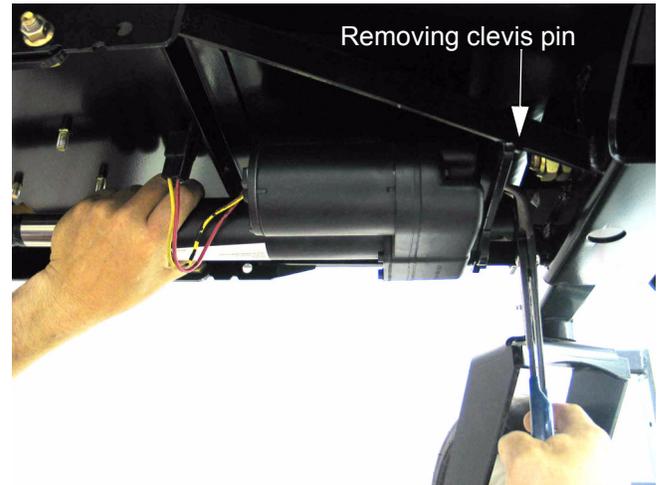


Figure 12.19

- Remove the hairpin clip from the clevis pin that secures the front of the actuator to the frame.
- Hold the actuator to keep it from rotating.
- Lift the clevis pin up, releasing the actuator.

12.20. Carefully slide the actuator toward the back of the mower to release it from the front bracket, and lower it to remove it.

12.21. If the cables need to be replaced, remove them as described in the following steps:

NOTE: Cable replacement can be accomplished without removing the cable bracket assembly.

12.22. Remove the jam nuts from the end of each cable using a 7/16" wrench and a 3/8" wrench. See Figure 12.22.

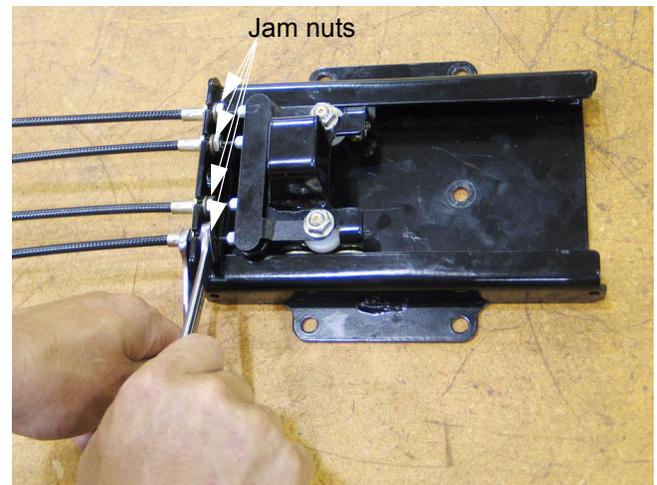


Figure 12.22

Cub Cadet Commercial Z-Wing

12.23. With the jam nuts removed, the threaded end of the cable housings will pass through the key-hole shaped slots in the end to the cable bracket.

12.24. With the cables free of the cable bracket, the actuator mounting bracket can be rolled out the end of the cable bracket. See Figure 12.24.

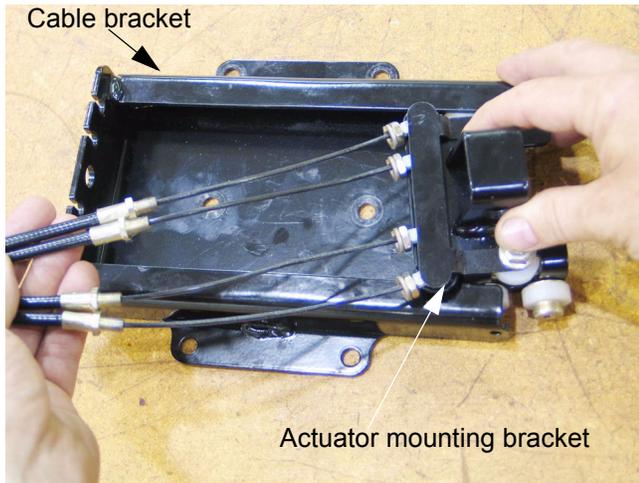


Figure 12.24

12.25. To separate Z-fittings on the end of the cables from the actuator mounting bracket, remove one of the vertical-axis rollers, and loosen the second one using a 1/2" wrench and a 3/16" allen wrench. This will allow the cable retainer to pivot, releasing the Z-fittings from the actuator mounting bracket. See Figure 12.25.

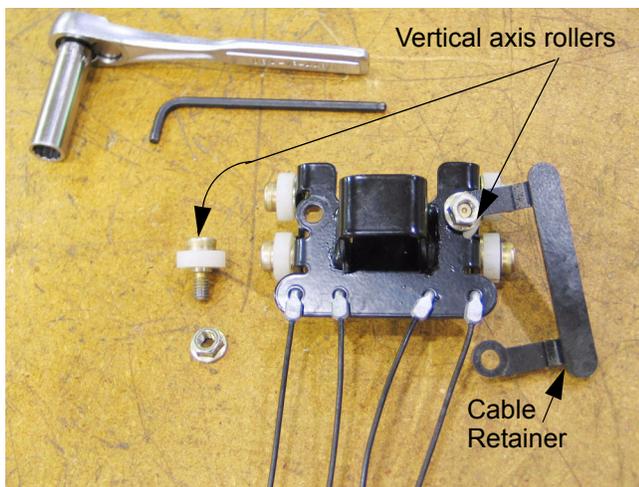


Figure 12.25

12.26. While the cable bracket and actuator mounting bracket are disassembled, inspect the rollers and their mounting hardware. See Figure 12.26.

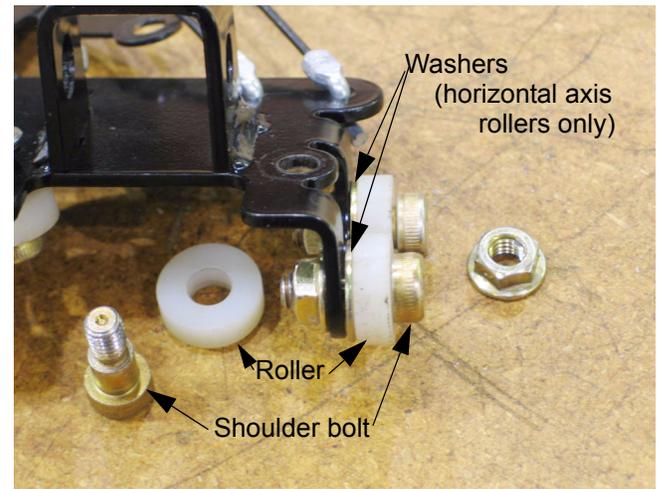


Figure 12.26

NOTE: To judge the amount of wear on the rollers, the new measurements are as follows:
O.D.= .880", I.D.= .375", Thickness= .283"
(O.D.= 2.24cm, I.D.= .95cm, Thickness= .72cm)

NOTE: The 4 horizontal-axis rollers can be removed in similar fashion, but there is a washer between each roller and the actuator bracket.

12.27. On mowers produced after November of 2005, the cable bracket assembly was changed. The bottom lip of the current brackets flares outward, while the earlier ones are bent in. See Figure 12.27.

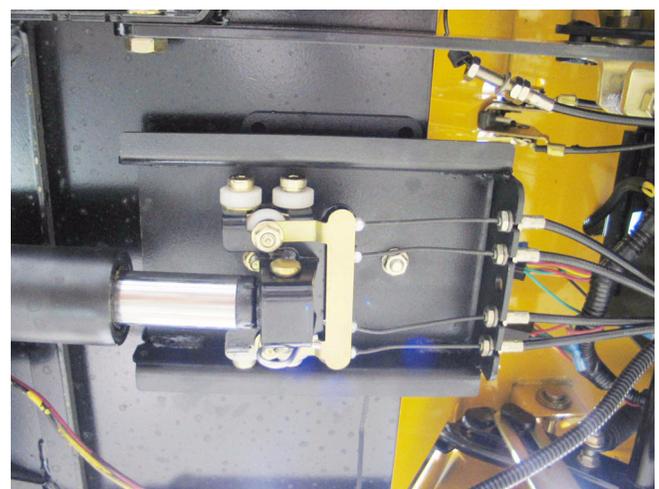


Figure 12.27

Cub Cadet Commercial Z-Wing

12.28. On the early design, the rollers of the actuator mounting bracket rode in a channel formed by the bottom lip of the cable mounting bracket, supporting the lift actuator.

12.29. The rollers on actuator mounting brackets made since November of 2005 only contact the top surface of the cable mounting bracket. See Figure 12.29.

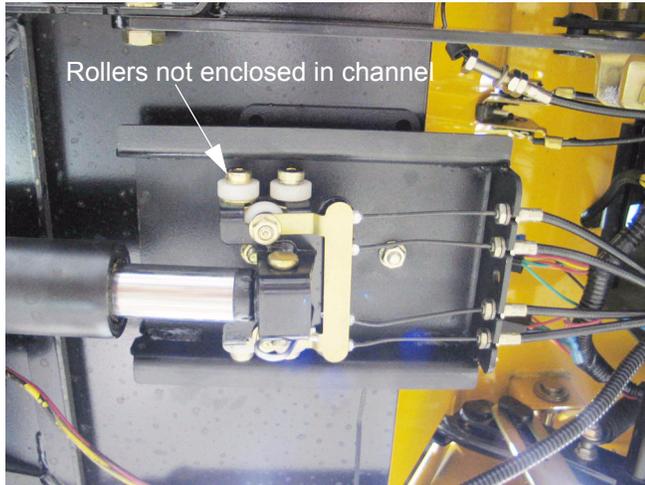


Figure 12.29

12.30. The lift actuator is supported by a separate bracket. See Figure 12.30.

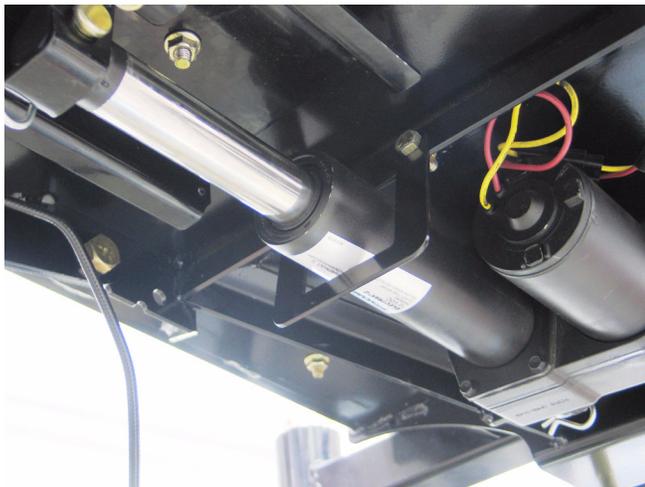


Figure 12.30

NOTE: Removal of the actuator and the actuator mounting bracket are much easier on the mowers produced after November of 2005.

12.31. Installation notes: See Figure 12.31.

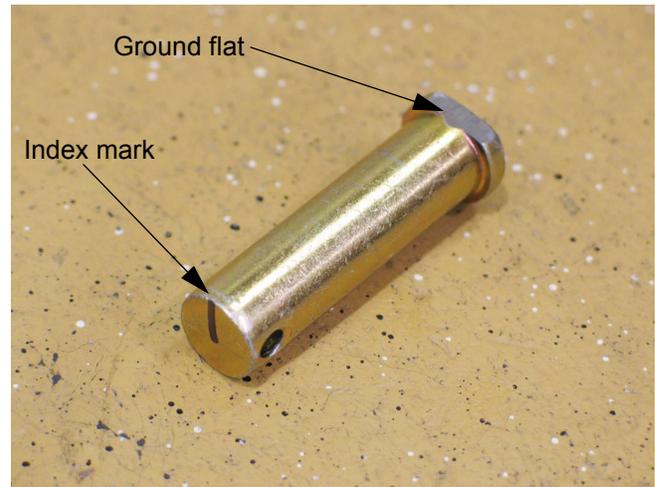


Figure 12.31

- It is acceptable to grind a small flat on one side of the head of the front clevis pin, perpendicular to the bore for the hairpin clip, for ease of installation.

12.32. Assembly notes, continued:

- Reverse the disassembly process to install the cables, brackets, and actuator.
- Lubricate the pivot points (clevis pins) with anti-seize compound.
- Test to confirm correct operation and adjustment of the hinge lift mechanism and associated safety features before returning the mower to service.

13. DECK WING LIFT CABLE ADJUSTMENT

NOTE: The bat wing feature of the Z-Wing mower is a key element in the sales of the mower. Safe and dependable operation of the feature is crucial to customer satisfaction. Correct adjustment of the cables is vitally important to the safe and dependable operation of the bat wing feature.

- 13.1. Lower the deck wings all the way.
- 13.2. Remove the shields that cover each wing lift mechanism using a 9/16" wrench. See Figure 13.2.

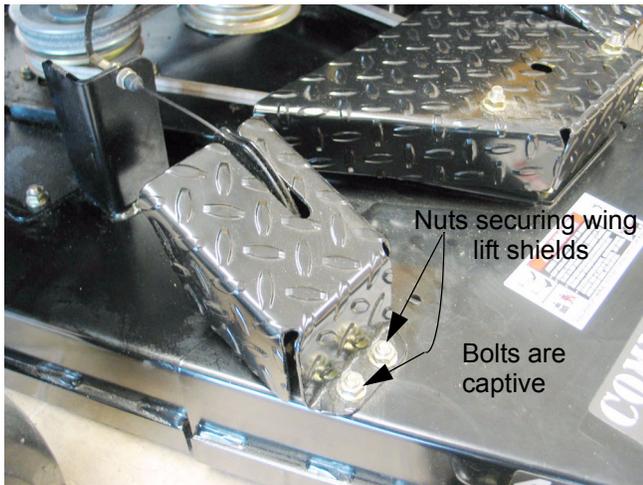


Figure 13.2

- 13.3. Turn the key switch to the RUN position, and "Blip" the wing lift switch until the tightest cable moves the hinge lock it is connected to just far enough to free that hinge. See Figure 13.3.

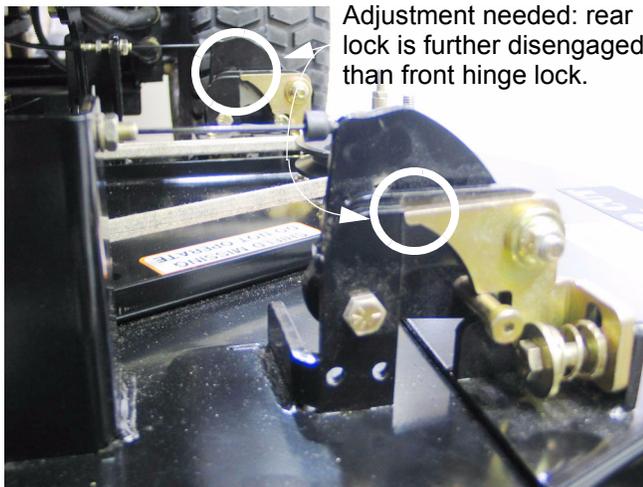


Figure 13.3

NOTE: Whether the tightest cable is on the left or right wing, front or rear hinge, does not matter.

NOTE: Usually an exposed thread length of 1/2" to 5/8" (12.7mm - 15.9mm) is a good starting point if a new cable has been installed.

- 13.4. Tighten the second cable on the same wing until the hinge lock is at the same point of disengagement as the first, using a pair of 1/2" wrenches. See Figure 13.4.

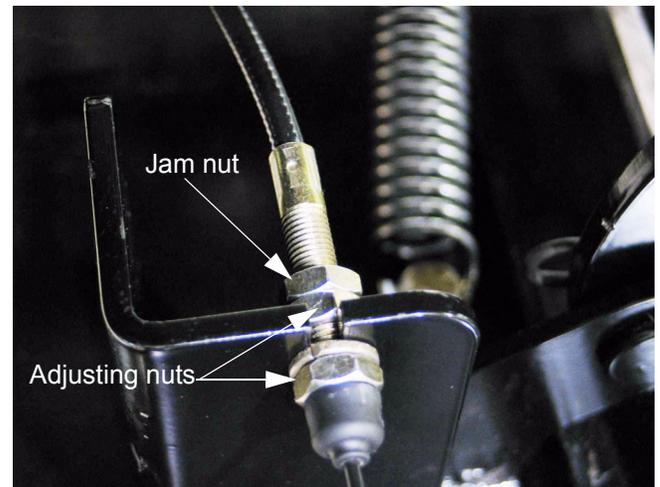


Figure 13.4

- 13.5. Lower the deck wings, then begin to raise them:
 - Watch the movement of the hinge locks to confirm that they are working at the same time.
 - If the hinge locks or hinges are binding in any way, repair them before proceeding.
 - Make any necessary adjustments if they are not.
- 13.6. Adjust the cables on the second wing so that the hinge locks both move in unison with the hinge locks on the first wing.

Cub Cadet Commercial Z-Wing

- 13.7. Operate the wings through 20 complete raise/lower cycles:
- Confirm smooth and consistent operation of the deck wings.
 - Confirm that all four hinge locks are locking and unlocking in sync. Jerky operation of 1 wing may indicate that 1 lock is unlocking later than the others.
 - Confirm that both deck wings are operating in sync.
 - Confirm that all four cables are secured in such a way that they will not be damaged by normal belt or linkage movement.
 - Make any adjustments or repairs necessary to achieve 20 trouble-free cycles.
 - Tighten the jam nuts when testing is completed.
 - Check the safety switches that are used to confirm that the wings are down. Make any repairs or adjustments necessary for the correct operation of the safety switches, as described in the DECK WING AND HINGE LOCK section of this manual.

14. DECK LIFT MECHANISM

- 14.1. If the deck lift shaft, the hubs it rides in, or any associated linkage need repair, the following procedure will provide guidance in removal and installation of those parts.
- 14.2. Begin by removing the cutting deck as described in the CUTTING DECK REMOVAL section of this manual.
- 14.3. Disconnect the front of each lift arm from the mower frame using a 9/16" wrench and a 3/4" wrench. See Figure 14.3.

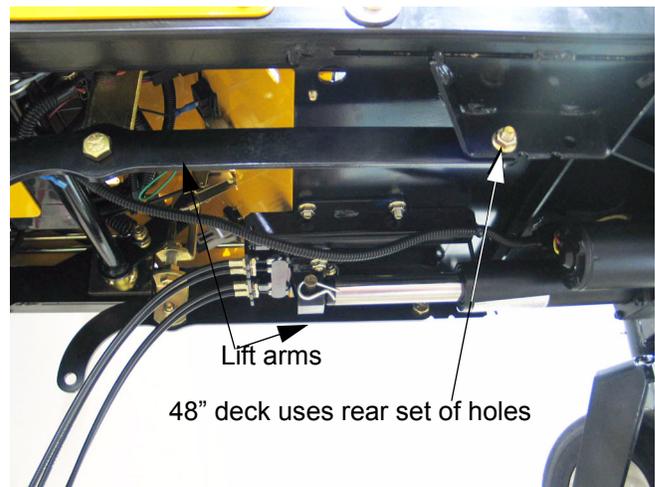


Figure 14.3

NOTE: There are two sets of holes in the bracket that the front of the lift arm mounts to. They are correctly positioned in the rear set of mounting holes.

NOTE: The lift links mount inboard of the lift arms: the left side lift link is adjustable, the right side lift link is fixed-length.

Cub Cadet Commercial Z-Wing

- 14.4. The deck lift arms and their connection points to the deck were modified in November of 2005. The new arms feature a bushing at the connection point to the cutting deck. See Figure 14.4.

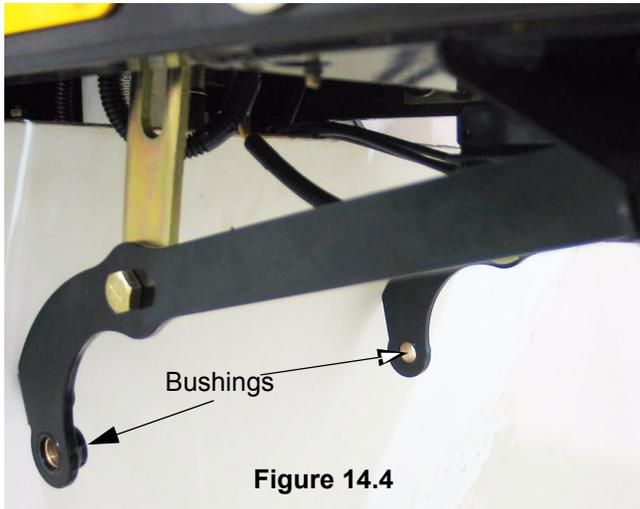


Figure 14.4

- 14.5. The bushings on both lift arms are off-set to the left. The right side arm has a tab for the connection of a lateral brace that was introduced at mid-season, 2005. The lateral brace was disused in November 2005. See Figure 14.5.

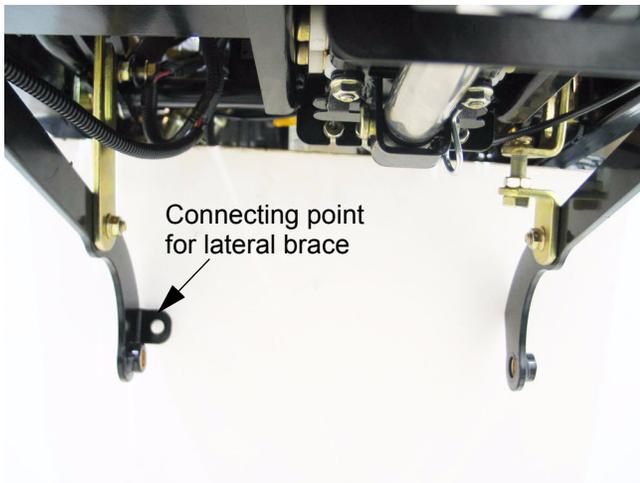


Figure 14.5

- 14.6. With the front of each lift arm disconnected from the frame, the lift links can be angled-back so that the slot in the lift link fits through the T-head weldment on the lift-shaft assembly.

- 14.7. Disconnect and remove each lift arm and lift link assembly. See Figure 14.7.

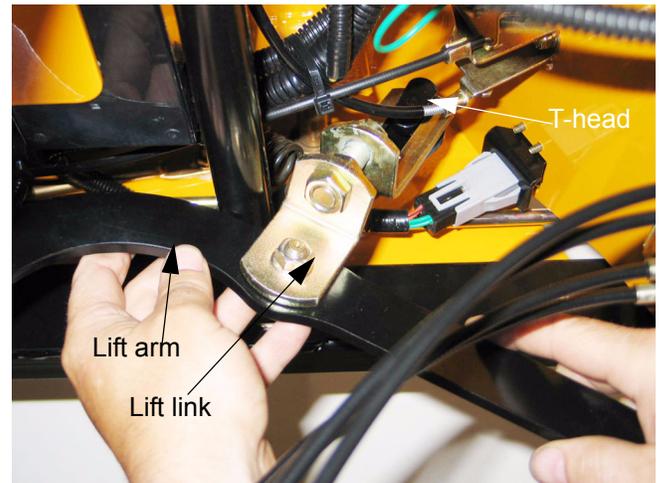


Figure 14.7

- 14.8. Confirm that the deck height control is in the highest (Transport Lock) position, minimizing tension on the lift-assist springs. When raising the deck lift handle, remove the clevis pin from above it with caution because the handle will be under tension from the lift-assist springs. See Figure 14.8.

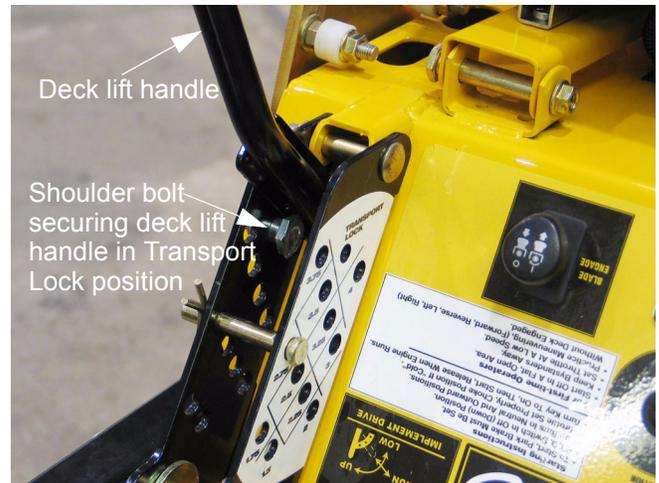


Figure 14.8

Cub Cadet Commercial Z-Wing

- 14.9. Remove the locking nuts from each bolt that connects the lift assist springs to the bellcranks on the lift shaft assembly using a 9/16" wrench.
- 14.10. Disconnect the springs from the bolts using a length of recoil rope or an appropriate hook tool. See Figure 14.10.



Figure 14.10

- 14.11. Each end of the lift shaft assembly is carried by a hub assembly. See Figure 14.11.

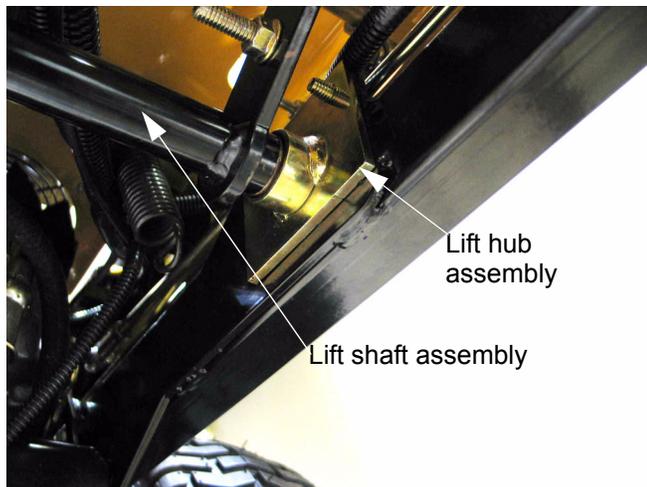


Figure 14.11

- 14.12. The bolts that hold the lift hub assemblies to the control housing are accessible through openings in the sides of the housing. See Figure 14.12.



Figure 14.12

NOTE: Have a length of bungee cord capable of maintaining light pressure across an 18" span handy before removing the lift hub bolts.

- 14.13. Loosen, then remove the pair of bolts that secures each lift hub to the control housing using a 9/16" wrench.
- 14.14. Carefully maneuver the lift shaft assembly out of the control housing, between the two frame channels. As it clears the frame, attach the shock cord between the two left hubs, holding the lift shaft assembly together. See Figure 14.14.

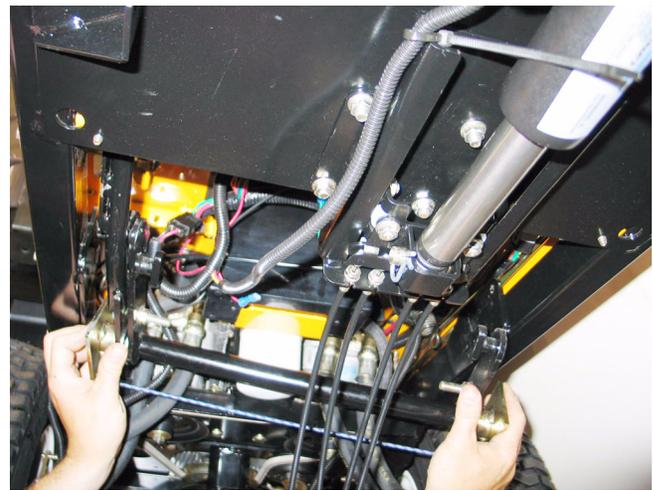


Figure 14.14

Cub Cadet Commercial Z-Wing

14.15. Rotate the left end of the lift shaft rearward to free the deck height control handle from the index assembly, and remove the assembly to a workbench. See Figure 14.15.

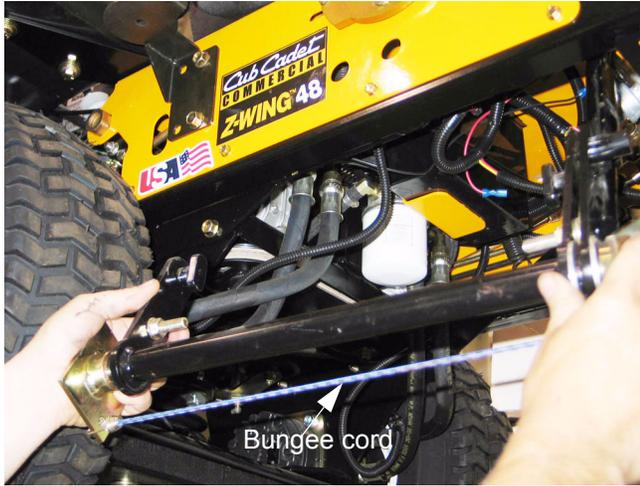


Figure 14.15

14.16. Once on the bench, the bungee cord can be removed. See Figure 14.16.

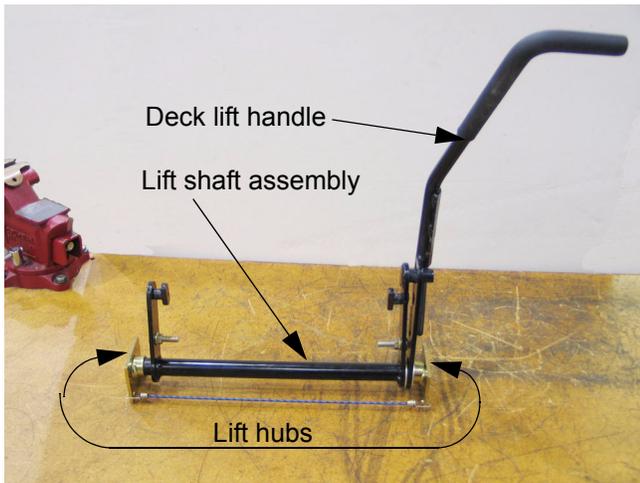


Figure 14.16

14.17. The left side hub will simply slip off of the shaft. See Figure 14.17.

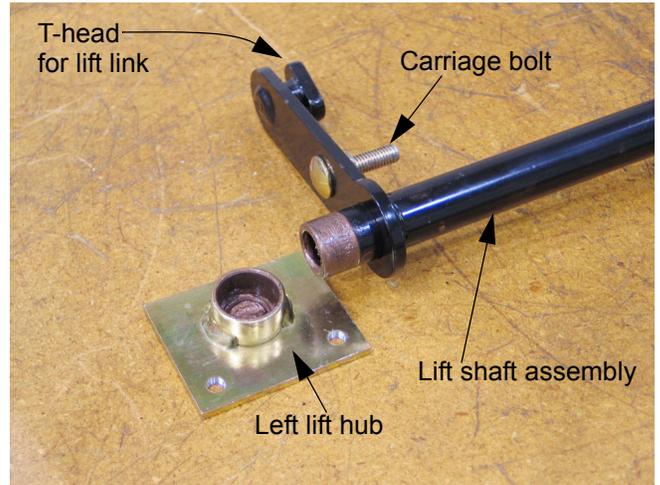


Figure 14.17

14.18. The right side hub will slip off of the shaft as well, but it also retains the deck height control lever. See Figure 14.18.

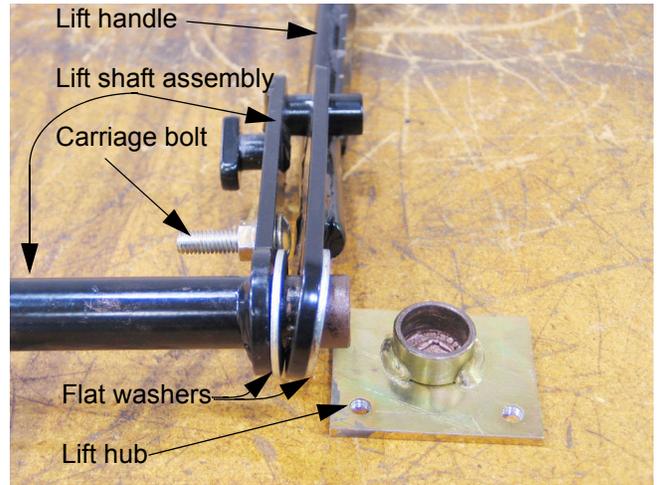


Figure 14.18

Cub Cadet Commercial Z-Wing

14.19. Assembly notes: See Figure 14.19.



Figure 14.19

- Apply anti-seize compound to the friction surfaces where the lift shaft assembly rides on the lift hubs and the lift links.
- Use the shock cord technique to hold the assembly together for installation.
- Tighten the bolt to a torque of 20-25 ft-lbs (27-34 Nm). Apply a small amount of thread locking compound such as Loctite 242 (blue).
- A magnetic socket, or the gun patch technique may be used to get the lift hub bolts started.
- Install the cutting deck as described in the CUTTING DECK REMOVAL section of this manual.
- If a lift hub should loosen, or the threads should get stripped in the field, it is possible to reinforce the installation with 3/8-16 nuts until a more permanent repair can be effected.

15. LAP BARS

15.1. The lap bars do not have room to pivot outward in the conventional manner because they would interfere with the deck wings in the raised position. For this reason, separate pivot handles articulate on the lap bar pivot brackets which fasten to the steering pivot plate. See Figure 15.1.



Figure 15.1

15.2. The pivot handles are bolted to the lap bar pivot brackets, with washer on each side of the pivot bar handle. See Figure 15.2.



Figure 15.2

- The bolts should be tight enough to eliminate play, but loose enough that they do not bind.
- Periodic tightening may be necessary using two 9/16" wrenches.
- Lubricate the joints weekly, per the Operator's Manual.

15.3. The lap bar pivot brackets are adjustable to suit individual operators. See Figure 15.3.

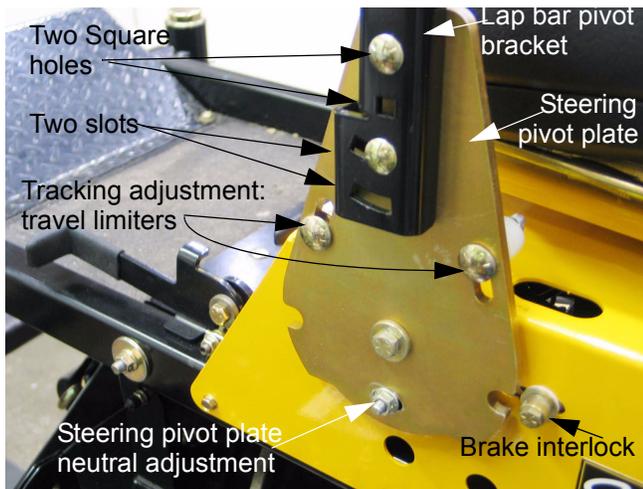


Figure 15.3

- Carriage bolts in two square holes and two slots provide adjustment for height and rake using a single 1/2" wrench.
- A mechanical interlock with the parking brake locks the steering pivot plates when the brake is applied.
- High speed tracking adjustment is done by adjusting rollers up or down on the steering pivot plate to limit travel.
- The slotted connection between the steering pivot plate and the hydrostatic pump control allows "interlock neutral" to be aligned with true neutral for the pump.

16. CHECKING NEUTRAL ADJUSTMENT

CAUTION: Releasing the parking brake with the engine at top no-load speed and loose or mis-adjusted control linkages can result in unpredictable or uncontrolled movement of the mower.

- If the drive system makes a pronounced whining sound, indicating that it may be severely out of adjustment, do not release the parking brake.
 - Perform the tests in a safe area that is free of hazards, obstacles, other personnel, or pets.
 - In cases where the misadjustment is pronounced, the tests may be performed at reduced throttle settings, to help identify the nature and location of the misadjustment.
- 16.1. With the engine warm and running at full throttle, the hydro relief valves closed, and the parking brake set: there should not be any abnormal whining noise from the drive system.
 - 16.2. With the engine warm and running at full throttle, the hydro relief valves closed, and the parking brake released: there should not be any tendency for either rear wheel to creep.
 - 16.3. If either of these issues exist, neutral adjustment is necessary.
 - 16.4. The creeping action will provide clues about the adjustment that is required:
 - If both wheels tend to creep, both neutral settings may need to be adjusted.
 - If only one wheel tends to creep, only that side may need adjustment.
 - The direction of the creepage will dictate the direction of adjustment that is required.
 - 16.5. Before adjusting the linkage, inspect it for any bent, broken, stripped, worn, or loose components. This is particularly true if a mower that was previously operating well has suddenly gone out of adjustment.

Cub Cadet Commercial Z-Wing

17. LINKAGE NEUTRAL ADJUSTMENT

17.1. Preliminary steps:

- Repair or replace any worn or damaged linkage components before attempting to adjust the steering linkage.
- Confirm that the parking brake interlock is working properly—repair it if it is not.

17.2. To isolate the problem to either the linkage or the hydro pumps, loosen the nut and bolt that secure the linkages to the steering pivot plates using two 1/2" wrenches. See Figure 17.2.

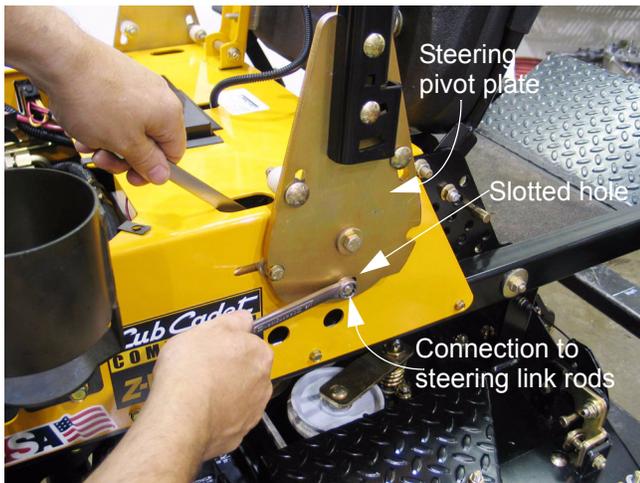


Figure 17.2

17.3. Repeat the test of neutral adjustment, as described in the CHECKING NEUTRAL ADJUSTMENT section of this manual.

- If the mower still creeps, or the drive system is working against the brakes when it should be in neutral, and the linkage is loose enough not to interfere with the return to neutral action: the adjustment must be made at the hydro.
- After adjustment at the hydro, the linkage is still likely to need adjustment.
- If the mower does not creep, and the drive system is not working against the brakes (as indicated by a whining or groaning noise), then the problem lies in the linkage.

17.4. If the problem lay in the connection between the steering link rod and the steering pivot plate, the simple act of loosening the connection and carefully re-tightening it with the parking brake applied should correct the adjustment.

17.5. If the bolt that makes the connection between the steering link rod and the steering pivot plate is against the end of the slot in the plate, then the steering link rod will need adjustment.

17.6. To reach the steering link rod adjustment point, remove the hydro service plate: See Figure 17.6.



Figure 17.6

- Disconnect the cable from the negative terminal on the battery using a 10 mm wrench.
- Remove the seven perimeter bolts from the hydro service plate using a 7/16" wrench.
- Carefully lift the plate off of the mower.

17.7. Loosen both jam nuts that lock the adjustment on the steering link rod using a 1/2" wrench (nuts) and a 7/16" wrench to hold the spherical rod end. See Figure 17.7.

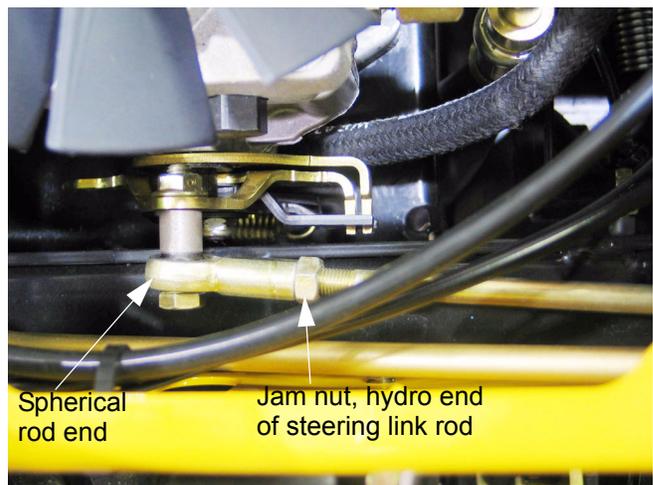


Figure 17.7

- 17.8. Loosen the bolt that joins the steering link rod to the steering pivot plate using two 1/2" wrenches.
- 17.9. Engage the parking brake, locking the steering pivot plate into the neutral position.
- 17.10. Lengthen or shorten the steering link rod as required to center the bolt that connects it to the steering pivot plate in the slot in the plate.

NOTE: The steering link rod has left-hand threads at one end and right-hand threads on the other. Its effective length may be increased or decreased by rotating the rod.

- 17.11. Tighten all of the linkage hardware.
- 17.12. Replace the hydro service cover, and secure it with two of the seven bolts.
- 17.13. Reconnect the negative battery cable.
- 17.14. Repeat the test of neutral adjustment, as described in the CHECKING NEUTRAL ADJUSTMENT section of this manual.
- 17.15. Test the operation of the mower and its safety features in a safe area that is clear of hazards, obstacles and bystanders before returning it to service.

18. HYDRO NEUTRAL ADJUSTMENT

NOTE: The neutral adjustment on the hydro is very rarely found to be out of adjustment.

- 18.1. Before proceeding with the adjustment make a careful inspection of the return-to-neutral mechanism on the hydro pump. See Figure 18.1.

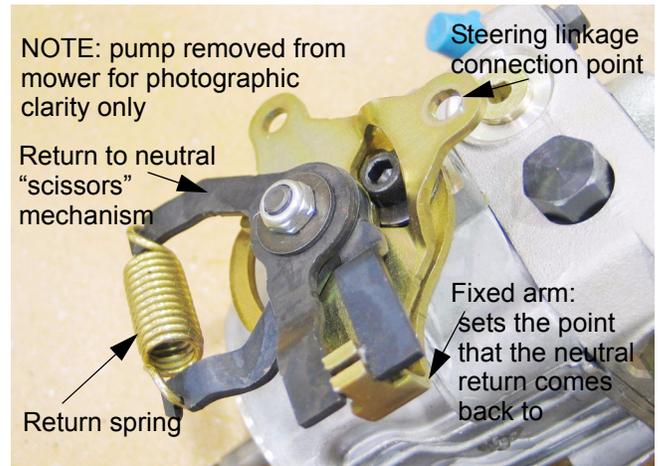


Figure 18.1

- Disconnect the steering link rod as described in the LINKAGE NEUTRAL ADJUSTMENT section of this manual.
 - Check the mechanism for binding, interference, or physical damage that might prevent it from returning to neutral.
 - Confirm that the extension spring that draws the linkage back to neutral is present and undamaged.
- 18.2. After the return-to-neutral mechanism is confirmed to be operating correctly, adjustment is the next step.

Cub Cadet Commercial Z-Wing

- 18.3. The adjustment point is easily accessible through an oval-shaped opening near the rear of the control housing. See Figure 18.3.

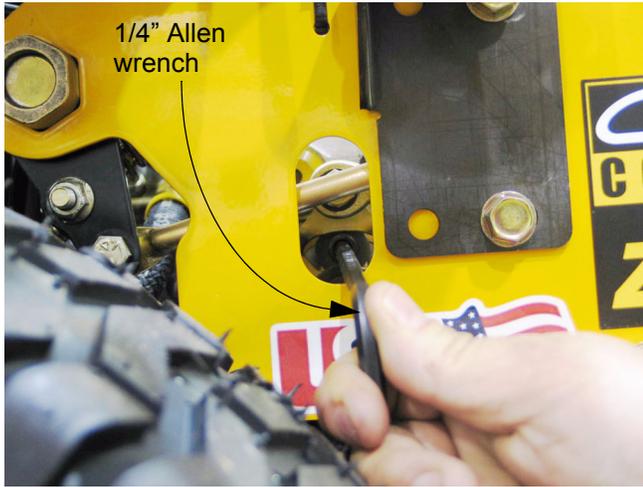


Figure 18.3

- 18.4. Loosen the socket-head cap screw that secures the return-to-neutral mechanism using a 1/4" allen wrench.
- 18.5. Confirm that no hazardous conditions will result from starting the engine.
- 18.6. Lift and safely support the rear of the mower, keeping the rear wheels off of the ground.
- 18.7. Connect the negative battery cable.
- 18.8. Start the engine, and operate it at a low throttle setting. Do not release the parking brake.
- 18.9. Reaching in from the back of the control housing, carefully rotate the entire return-to-neutral mechanism slightly forward or aft to find the point where the drive system generates the least amount of noise.
- 18.10. After the adjustment is "roughed-in" at a low throttle setting, increase the engine speed:
- The adjustment will be more sensitive at higher engine speeds.
 - Find the point where the least drive system noise is created.
 - Tighten the socket-head cap screw to secure the adjustment.
- 18.11. Turn-off the engine.
- 18.12. Lower the rear wheels to the ground.

- 18.13. Connect the steering link rods and repeat the adjustment described in the LINKAGE NEUTRAL ADJUSTMENT, which will have shifted slightly.

18.14. Disconnect the negative battery cable.

18.15. Install the hydro service plate.

18.16. Reconnect the battery.

18.17. Test the operation of the mower and its safety features in a safe area that is clear of hazards, obstacles, and other personnel before returning it to service.

19. TRACKING ADJUSTMENT

19.1. After the neutral control is properly adjusted, its appropriate to test the high speed tracking.

19.2. Loosen the rollers on the steering pivot plates that act as travel stops, using a 9/16" wrench. See Figure 19.2.

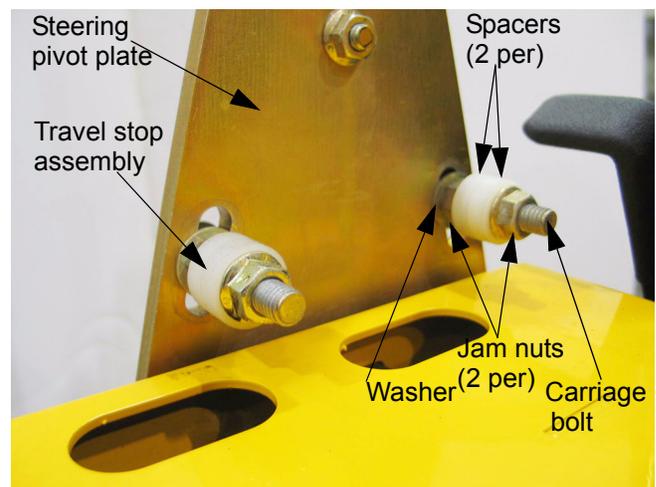


Figure 19.2

- 19.3. Make an initial adjustment of the travel stops on each steering pivot plate:
- Push the lap bar forward gently to the limit of its travel as set by the hydro control linkage.
 - Push the forward travel stop down against the top of the control housing, and tighten the nut that secures that stop.
 - Mark the position of the stops with a paint marker or magic marker; any further adjustment will be in the downward direction from these marks.
 - It is important that the travel stops on the steering pivot plate limit the movement of the steering linkage, protecting the down-stream linkage from excessive control in-put loads.
 - Repeat this process in the rearward direction to set the initial rear travel stop.
- 19.4. Make the following preliminary checks of factors that may effect tracking:
- Rear tire pressure between 10-12 PSI (.690-.828 bar.), and circumference equal to within 1/4" (6.35mm) to keep the drive wheels equal in size and firmness.
 - Front tire pressure between 20-25 PSI (1.38-1.725 bar) to prevent drag that may pull the mower off-track.
 - Relief valves closed to prevent loss of hydraulic pressure to either drive wheel.
 - No hydraulic fluid leaks to prevent loss of hydraulic pressure to either drive wheel.
 - No brake drag to pull the mower off-track. Refer to the BRAKE ADJUSTMENT section of this manual for details.
 - Hydraulic fluid reservoir full and up to operating temperature.
 - Pivot handles (lap bars) should be evenly adjusted on their steering pivot plates to prevent distorted perception of tracking issues.
 - Steering linkages are functioning correctly, as described in the LINKAGE NEUTRAL ADJUSTMENT and HYDRO NEUTRAL ADJUSTMENT sections of this manual.
- 19.5. Test the operation of the mower in a safe area that is clear of hazards, obstacles, and other personnel:
- With both lap bars pushed fully forward, the mower should travel in a straight line forward.
 - With both lap bars pulled fully rearward, the mower should travel in reverse in a straight line.
- 19.6. If adjustment is required, loosen the stop on the steering pivot plate controlling the faster wheel (opposite side from the direction of the veer). Move the stop downward to equalize the speed of the two drive wheels at full lap bar travel.
- 19.7. This procedure is similar for both forward and reverse tracking.
- NOTE:** Variations in turf will effect tracking when the mower is in use. These factors include traction, soil firmness, grass depth, and grades. It is up to the operator to compensate for these variations using the mower's controls.
- 19.8. If the mower does not respond to tracking adjustments, test the pumps and motors as described in the DRIVE SYSTEM section of this manual.

Cub Cadet Commercial Z-Wing

20. STEERING PIVOT SHAFTS AND BUSHINGS

- 20.1. If the hex flange bushings that support the steering pivot plates become worn enough to effect the precision of the steering, they are easily replaced.
- 20.2. Set the parking brake.
- 20.3. Disconnect the battery cables (negative cable first) using a 10mm wrench, and remove the battery.
- 20.4. Disconnect the steering link rod using a pair of 1/2" wrenches. See Figure 20.4.

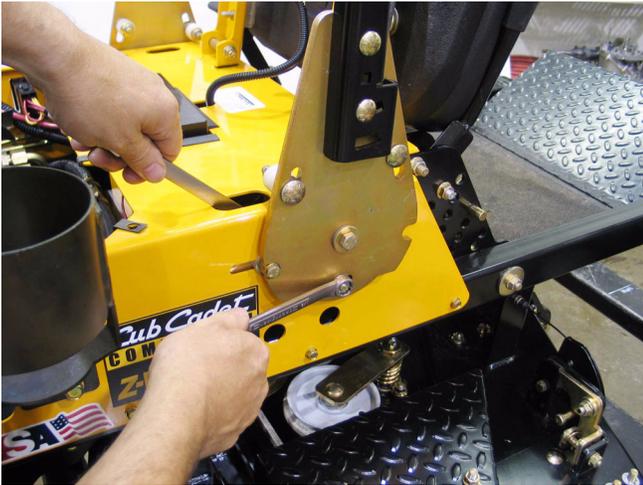


Figure 20.4

- 20.5. Unbolt the steering pivot plate from the steering pivot shaft using a 9/16" wrench, and remove the steering pivot plate. See Figure 20.5.

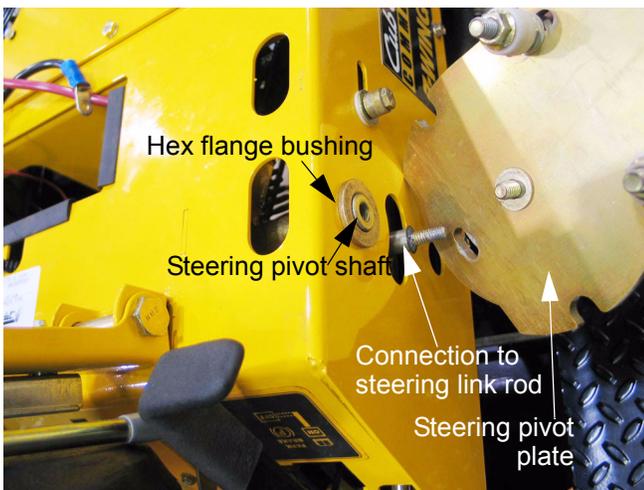


Figure 20.5

- 20.6. There are two hex flange bushings supporting each steering pivot shaft. The outer-most can simply be pried out of the control housing. See Figure 20.6.

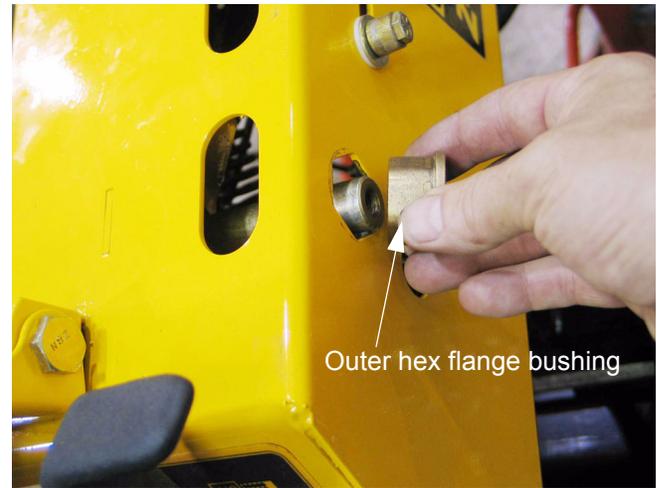


Figure 20.6

- 20.7. The shaft, together with the inner hex flange bushing can be withdrawn through the opening normally occupied by the battery. See Figure 20.7.



Figure 20.7

20.8. The steering pivot shaft.... See Figure 20.8.

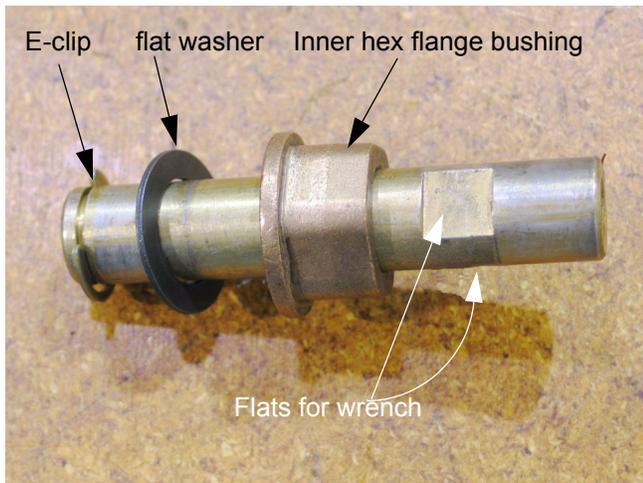


Figure 20.8

20.9. Installation notes:

- Apply lubricant to the friction surfaces of the steering pivot shaft on assembly: In regions where the mower will be in continuous duty, a dry PTFE-based lubricant such as “Tri-flow dry Teflon Lubricant” is appropriate. This will lubricate the pivot shaft without collecting abrasive grit. In regions where there is an extended dormant period anti-seize compound will help keep rust off the bearing surfaces during times of disuse.
 - Apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the bolt that connects the steering pivot plate to the steering pivot shaft. Tighten the bolt to a torque of 35 ft-lbs (47.5 Nm).
 - If the locking feature of the nut that secures the steering link rod has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the bolt that connects the steering pivot plate to the steering pivot shaft. Tighten the bolt to a torque of 250 in-lbs (28.25 Nm).
- 20.10. Test the operation of the mower and its safety features in a safe area that is clear of hazards, obstacles, and other personnel before returning it to service.

21. BRAKE LINKAGE ADJUSTMENT

21.1. Description: The brakes are cam-actuated shoe brakes:

- Because they are cam actuated, if they are mis-adjusted in either direction, the brakes may drag, or fail to hold the mower with sufficient force.
 - The brakes are generously sized. Because they are parking brakes, not service brakes, shoe wear is not likely to be a significant factor unless the brakes have been dragging.
 - There is no internal brake adjustment such as a star wheel: all adjustment is in the linkage.
 - There is a mechanical interlock between the brake linkage and the steering pivot plate. While there is interplay between the interlock and brake actuation, the interlock is covered in the next section of this manual: BRAKE / PIVOT PLATE INTERLOCK.
- 21.2. The basic premise of brake adjustment is that the brakes should keep the mower from moving when they are applied, and should not drag when they are released. This is quite simple. Brakes that drag can be referred to as too tight. Brakes that fail to hold the mower with sufficient force can be referred to as too loose.
- 21.3. Tight brakes are characterized by:
- The mower cannot be manually pushed (nor the wheels rotated) with reasonable effort, with the brake released and the relief valves open.
 - The mower has persistent tracking issues, even after the tracking adjustments have been correctly performed.
 - The wheel motor on one or both sides of the mower creates an unusual amount of noise and heat. The noise may be a “chatter”, a “whine” or a “groan”. The noise will be immediate, though it may change with use. The temperature will go up rapidly in the first 15 minutes of use.
 - Heat will be generated not only by the friction of the brake, but also by the increased loads on the hydro pumps and wheel motors. The temperature of the fluid in the drive system will climb rapidly. High temperatures will significantly shorten the service life of the pumps and motors. Damage or failure of these components that results from continued operation with a dragging brake is not warrantable. It is the customer’s responsibility to recognize when the performance of their equipment degrades, and ensure that proper repairs or maintenance are done.

Cub Cadet Commercial Z-Wing

21.4. Characteristics of brakes that are too tight, continued:

- High effort required to pull up the lever that applies the parking brake. Some “phantom” resistance may be created by the over-center action of the interlock linkage.

21.5. Brakes that are too loose are characterized by:

- Low effort required to pull up the lever that applies the parking brake. Some “phantom” resistance may be created by the over-center action of the interlock linkage.
- The mower can be pushed (or the wheels rotated) manually, with the relief valves open and the brake applied.

21.6. Before making adjustments, make a visual inspection of the brake linkage. Watch the linkage as it is being operated, and check for: See Figure 21.6.

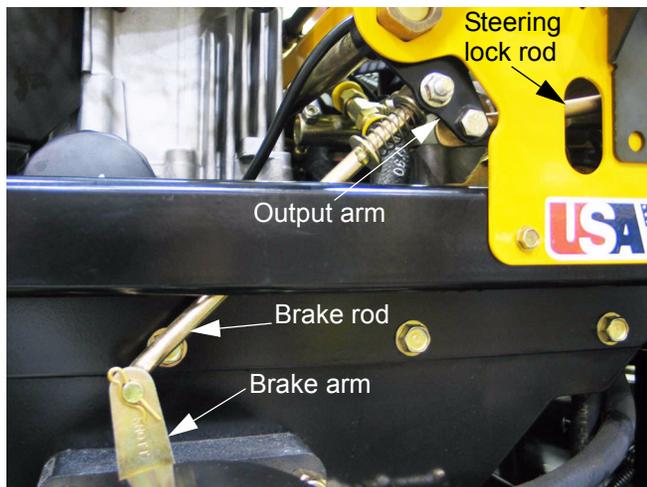


Figure 21.6

- Loose, broken, or disconnected linkage components.
- Components that are binding because of corrosion, foreign objects, or misalignment (bent links).
- Loss of travel because of worn bushings or hardware.

21.7. Each brake adjustment nut can be reached through an opening between the hydro service plate and the control housing. See Figure 21.7.



Figure 21.7

- There is one adjustment point for each side of the mower.
 - Adjustment can be made using a deep 9/16” socket.
- 21.8. The brake rod is moved by an output arm attached to the brake pivot shaft assembly. There is a compression spring on each side of the contact point. Tightening the nut puts more pressure on those springs, loosening the nut reduces the pressure on the springs. See Figure 21.8.

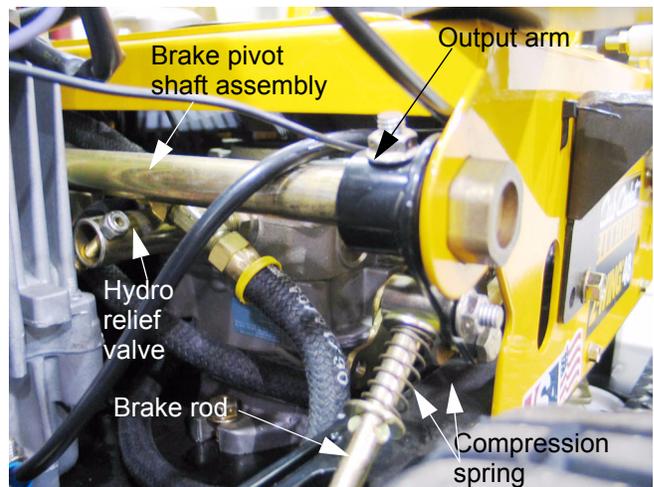


Figure 21.8

Cub Cadet Commercial Z-Wing

21.9. Park the mower on a flat, firm, level surface, the engine turned-off, and the hydro relief valves open.

NOTE: If the mower has been run recently allow the engine and drive system to cool long enough to avoid burn injuries before beginning adjustment.

NOTE: Relief valves are located on the back of each pump, immediately below the pivot brake shaft.

NOTE: This test can also be performed with the rear of the mower lifted and safely supported on jack stands. In this case the wheels would simply be rotated by hand rather than trying to push the entire mower.

21.10. Release the parking brake.

21.11. Attempt to push (rotate) the right rear wheel of the mower in either direction. There will be some motor drag on the wheel, but it should rotate with reasonable effort.

21.12. If the wheel will not rotate, or there is doubt as to whether the brake is fully released or not, loosen the adjustment nut until the wheel will rotate. See Figure 21.12.

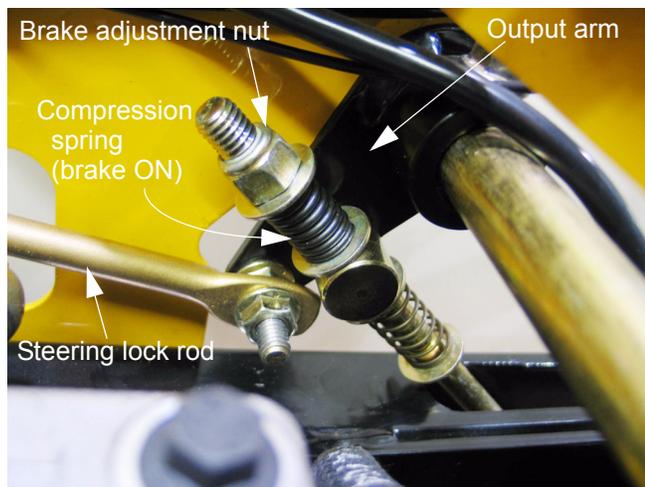


Figure 21.12

21.13. If loosening the nut does not allow the wheel to rotate as it should, check the position of the arm on the brake cam, as described later in this section of the manual.

21.14. Engage the parking brake.

21.15. Attempt to push (rotate) the right rear wheel of the mower in either direction. It should not turn.

21.16. If the wheel does rotate, tighten the adjusting nut in half-turn increments until the wheel is held firmly.

21.17. Release the parking brake, and confirm that it does not drag.

21.18. Repeat and adjust as necessary to assure correct brake operation.

21.19. Repeat the process on the left rear wheel.

21.20. When making brake adjustments, remember:

- There is about 1.5" (3.8cm) of thread length on the end of the brake rod.
- The nut is roughly 1/2" (1.27cm) tall, including the nylon locking ring.
- If 1" (2.54cm) of threaded rod is exposed above the nut, the nut is bottomed-out, and out of adjustment range.

21.21. If the nut bottoms-out or tops-out (the nylon locking ring reaches the end of the threads on the brake rod) before correct adjustment is achieved, the brake arm may be mis-indexed. See Figure 21.21.

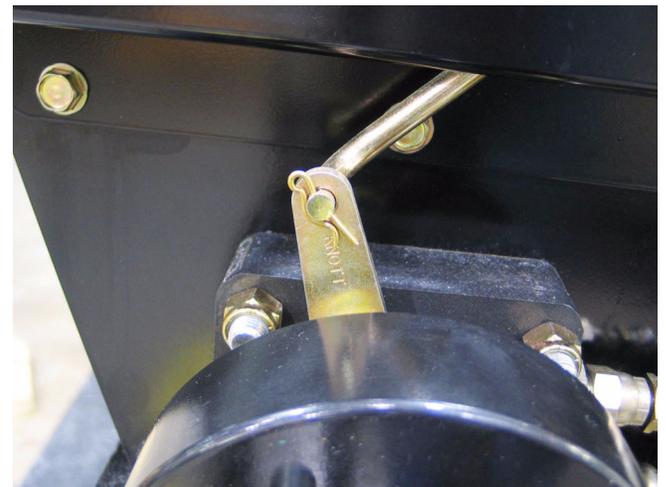


Figure 21.21

NOTE: This is not a likely occurrence unless it was improperly assembled, or someone unqualified to work on the brakes has tampered with it.

21.22. To reach the brake adjustment arm:

- Loosen the lug nuts using a 3/4" wrench.
- Lift, and safely support the back of the mower, raising the rear wheels off the ground.
- Remove the rear wheels.

Cub Cadet Commercial Z-Wing

21.23. Remove the hairpin clip that secures the brake rod to the brake arm. The brake return springs will center the brake arm. See Figure 21.23.

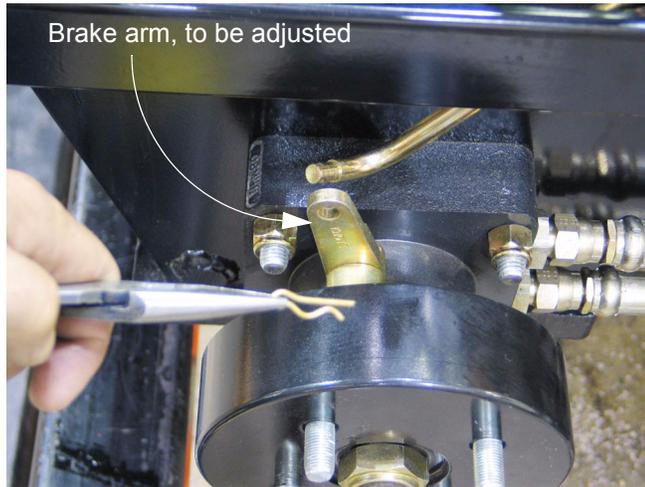


Figure 21.23

21.24. Some idea of which way the arm needs to move can be obtained by comparing the position of the arm (now centered in the "OFF" position) to the end of the brake rod that engages the arm.

21.25. Match-mark the initial position of the arm to provide a point of reference. See Figure 21.25.

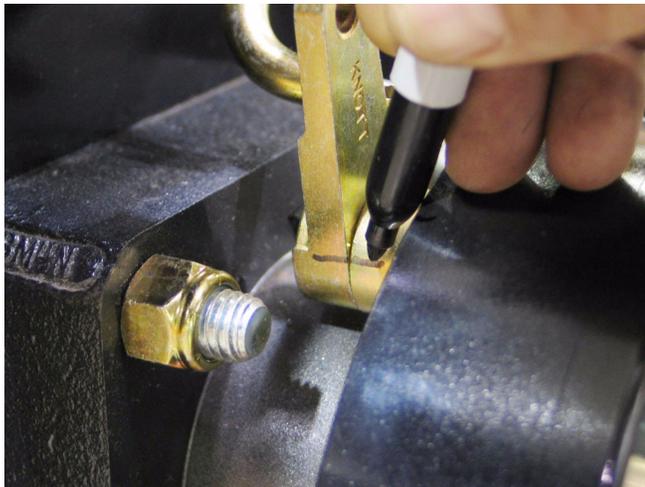


Figure 21.25

21.26. Carefully pry-off the clip that holds the brake arm onto the splined end of the brake cam shaft. See Figure 21.26.

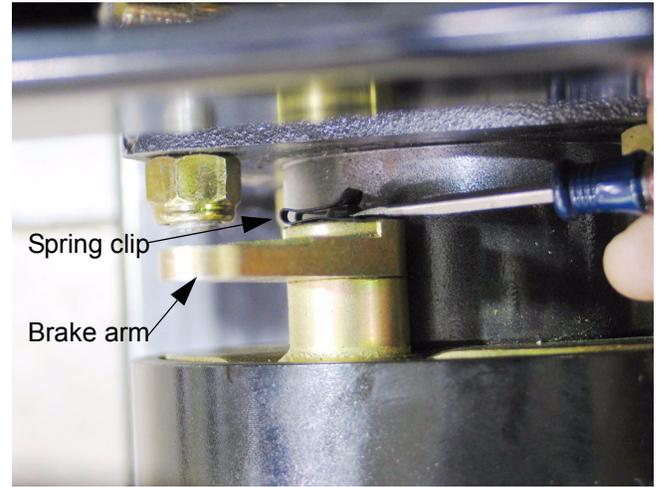


Figure 21.26

21.27. Rotate the brake arm one spline in the direction that needed to bring the adjustment nut back into its operating range. See Figure 21.27.



Figure 21.27

21.28. Re-connect the brake rod to the brake arm, and adjust as necessary to make the brakes work properly.

21.29. If further adjustments are needed to the arm position, they can be made before the final nut adjustments are made.

21.30. The final aspect of adjusting the brake linkage is to make sure the interlock between the brake and the steering pivot plates is working correctly.

Cub Cadet Commercial Z-Wing

21.31. The interlock is actuated by two steering lock rods; one for each steering pivot plate. The steering lock rods extend forward from the output arms on each end of the brake pivot shaft. See Figure 21.31.

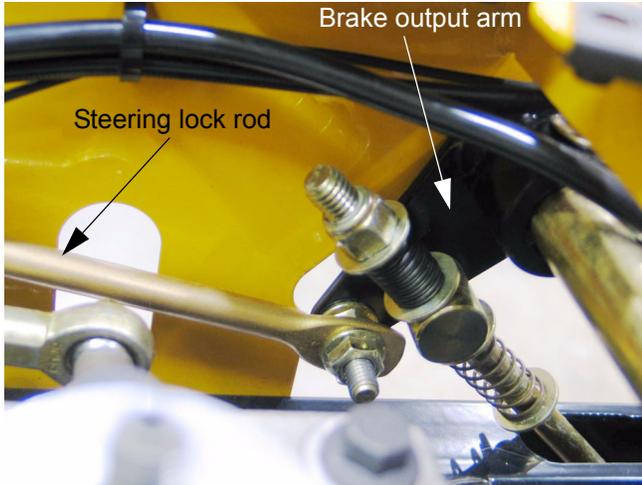


Figure 21.31

21.32. A post (consisting of a bolt, washers, and spacers) is attached to the other end of the steering lock rod, guided by a slot in the control housing. See Figure 21.32.

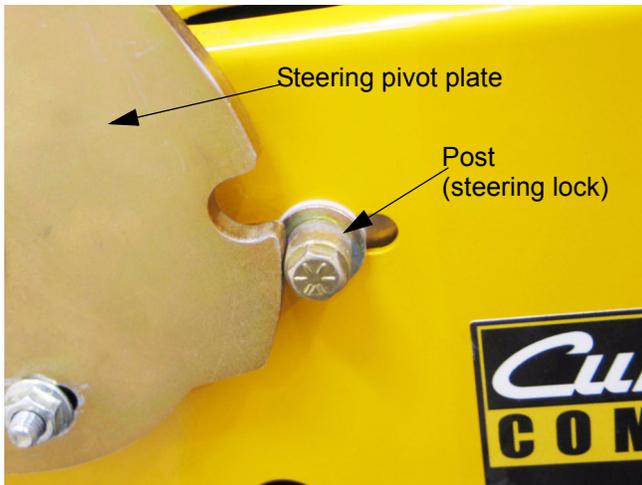


Figure 21.32

21.33. When the brake is actuated, the posts slide forward to engage the notches in the rear edges of the steering pivot plate. When the lap bars are not in neutral, they also prevent the brakes from being engaged while the mower is in motion.

21.34. The post is easily loosened for adjustment, or removal using a pair of 1/2" wrenches. See Figure 21.34.

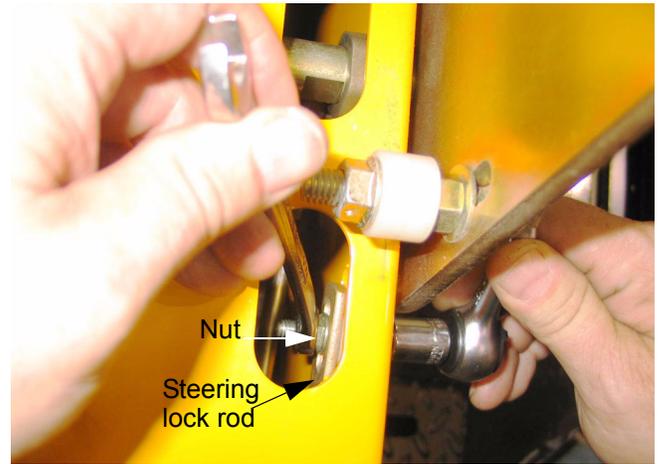


Figure 21.34

21.35. A sleeve within a sleeve creates a shoulder bushing. A steel washer rides on the shoulder to support a nylon washer that rides outside of the control housing. A second nylon washer rides between the steering lock rod and the inside surface of the control housing. See Figure 21.35.

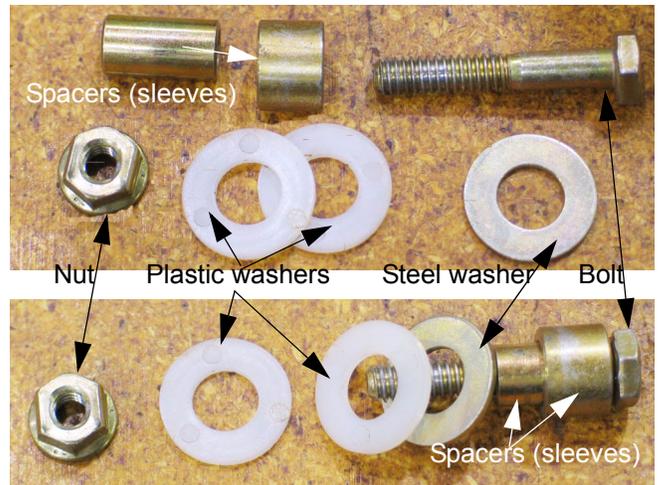


Figure 21.35

Cub Cadet Commercial Z-Wing

21.36. The steering lock post is installed on the control housing as illustrated below. See Figure 21.36.

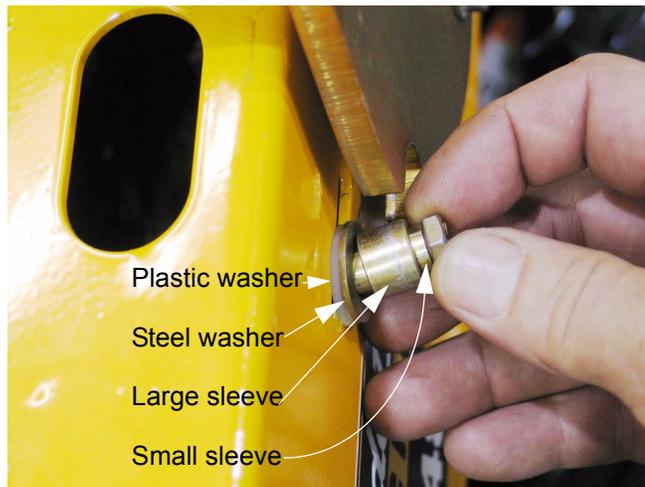


Figure 21.36

21.37. Adjustment is made by loosening the post and extending the steering lock rod to the limit of its travel. See Figure 21.37.

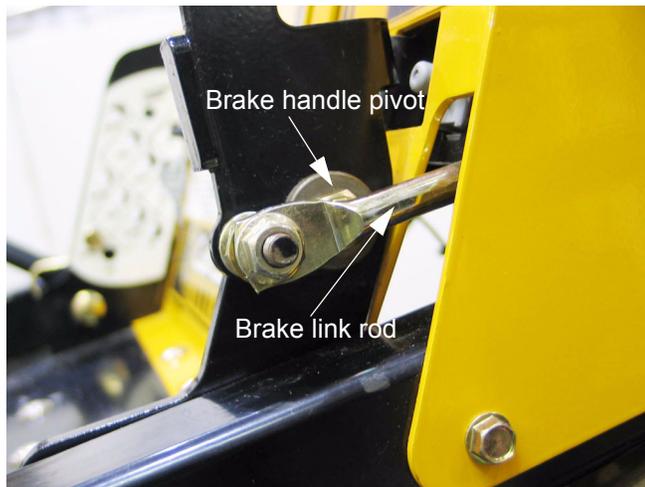


Figure 21.37

NOTE: Because of the cam-over effect that is used to lock the parking brake in whichever position it is set, the rod is at full extension at the apex of the brake link rod's travel. The brake link rod will be centered over the head of the bolt that the brake handle assembly pivots on.

21.38. When the linkage is in this fully extended position, push the post being adjusted as far as it will go in the notch in the rear edge of the steering pivot plate and tighten the nut. See Figure 21.38.

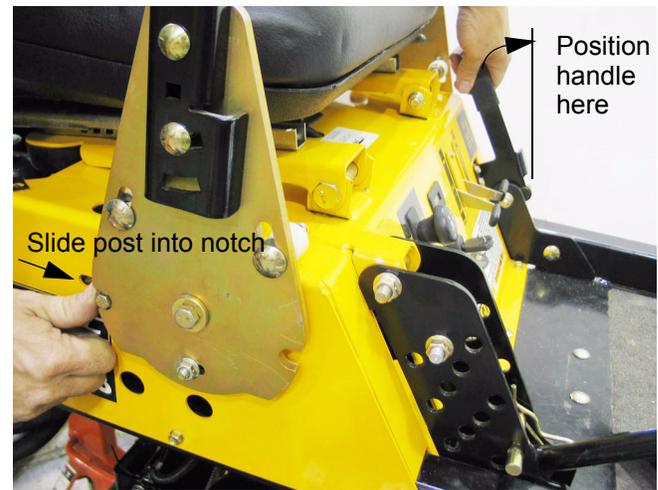


Figure 21.38

21.39. Test the operation of the steering and brake controls, and all related safety features before returning the mower to service. Tests should be done in a clear area that is free of hazards, obstructions, and other personnel.

22. BRAKE PIVOT SHAFT REMOVAL

NOTE: The brake pivot shaft itself is a 3/4" (19mm) thick solid steel shaft. As such it is not likely to require service. The bushings that support the shaft, the input arm and the output arm that transfer force through the shaft may require service.

- 22.1. Park the mower on a flat, firm, level surface.
- 22.2. Lift and safely support the mower.
- 22.3. Remove the rear wheels using a 3/4" wrench.
- 22.4. Release the parking brake to remove any tension from the brake linkages.
- 22.5. Disconnect the top ends of the brake rods from the arms on both ends of the brake pivot shaft (input arm on the left end, output arm on the right end) using a 1/2" wrench.

Cub Cadet Commercial Z-Wing

- 22.6. Disconnect the bottom ends of the brake rods from the arms on the brakes by removing the hairpin clips. See Figure 22.6.

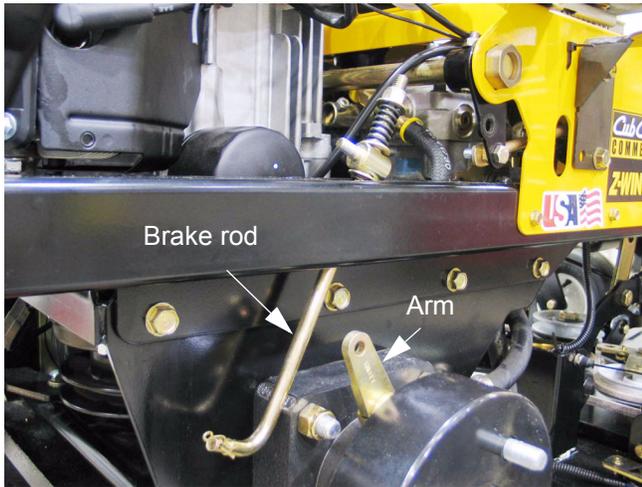


Figure 22.6

NOTE: The brake rods must be moved out of the way to gain wrench access to the socket head cap screws that hold the input and output arms to the brake pivot shaft. The brake rods may be removed entirely, at the technician's discretion.

- 22.7. If either of the arms (input or output) are to be removed, disconnect the brake link rod and steering lock rods using a pair of 1/2" wrenches.
- 22.8. Engage the parking brake to bring the nut up to an angle that it can be reached with a wrench.
- 22.9. Remove the cap screws that connect the input and output arms to the brake pivot shaft using a 1/2" wrench and a 1/4" allen wrench. See Figure 22.9.

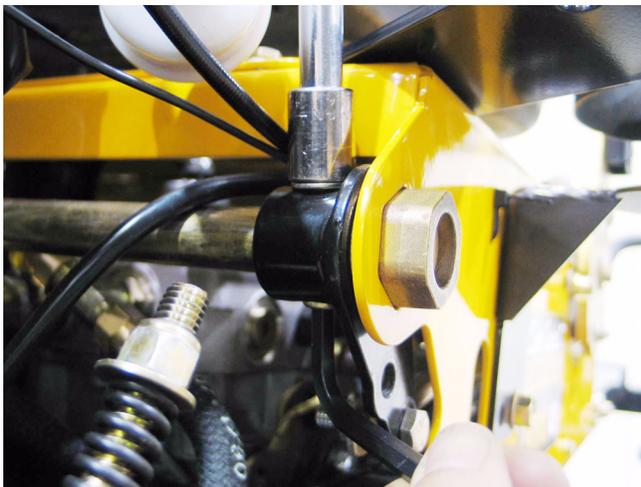


Figure 22.9

- 22.10. From this point, the brake pivot shaft can be driven far enough to achieve any necessary repairs using a soft drift. See Figure 22.10.

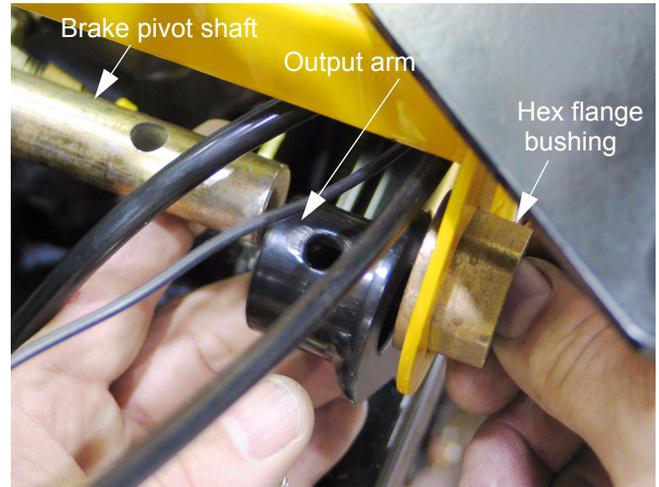


Figure 22.10

NOTE: The shaft may be removed entirely if necessary, or simply jockeyed back and forth to service the arms and bushings.

- 22.11. The bushings can be easily driven inward for removal. New bushings should be installed from the inside-out. See Figure 22.11.

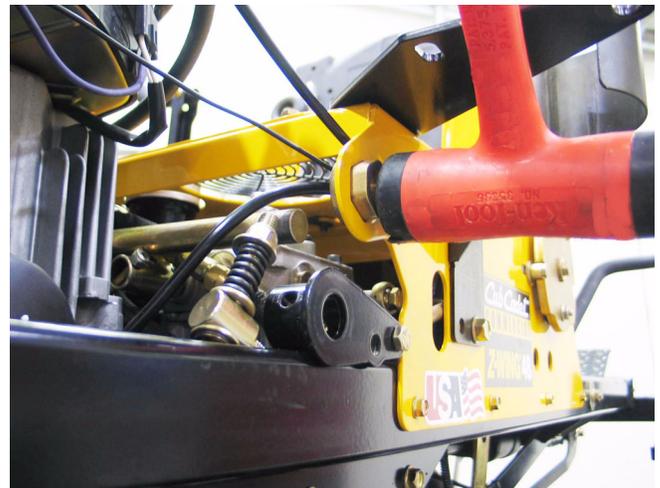


Figure 22.11

Cub Cadet Commercial Z-Wing

22.12. Installation notes:

- Apply lubricant to the friction surfaces of the steering pivot shaft on assembly: In regions where the mower will be in continuous duty, a dry PTFE-based lubricant such as “Tri-flow dry Teflon Lubricant” is appropriate. This will lubricate the pivot shaft without collecting abrasive grit. In regions where there is an extended dormant period anti-seize compound will help keep rust off the bearing surfaces during times of disuse.
- If the locking feature of the nuts that secure the steering lock rods or brake links has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the bolt that connects the steering pivot plate to the steering pivot shaft. Tighten the bolt to a torque of 250 in-lbs (28.25 Nm).
- If the locking feature of the nuts that secure the input and output arms to the brake pivot shaft has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads of the nut. Tighten the nut to a torque of 250 in-lbs (28.25 Nm).

22.13. Test the operation of the steering and brake controls, and all related safety features before returning the mower to service. Tests should be done in a clear area that is free of hazards, obstructions, and other personnel.

23. HYDRAULIC DRIVE SYSTEM: GENERAL OPERATION

23.1. System diagram: See Figure 23.1.

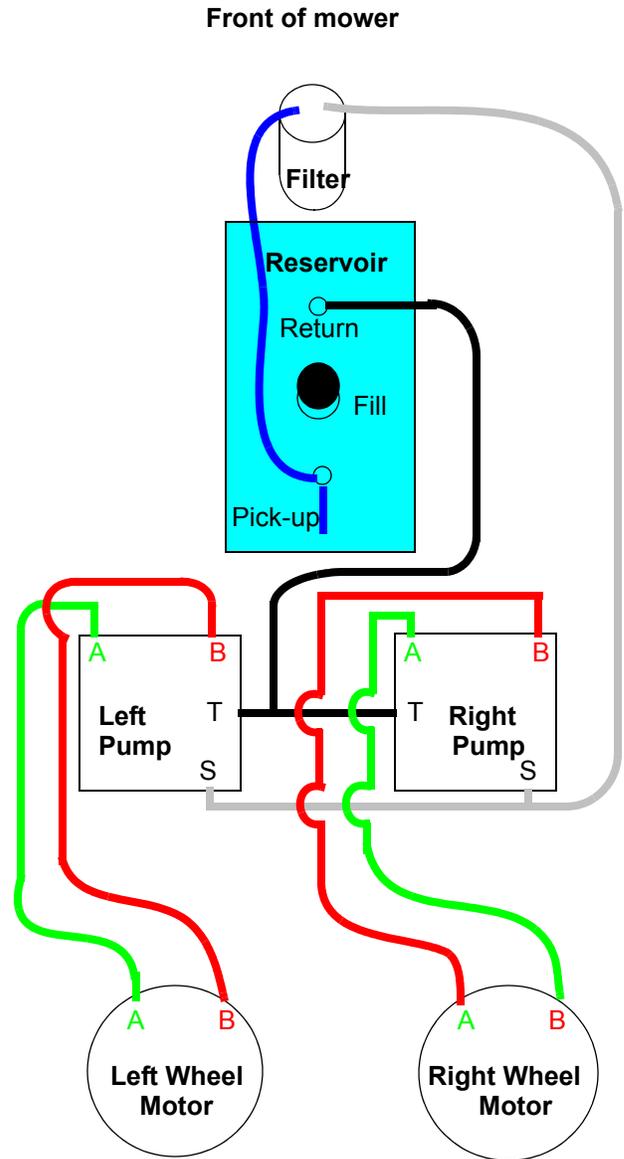


Figure 23.1

Cub Cadet Commercial Z-Wing

23.2. The hydraulic reservoir is accessible by tipping-up the seat. See Figure 23.2.



Figure 23.2

- Always clean the area surrounding the hydraulic fluid fill-cap / dipstick before removing the cap. Clean the area around any hydraulic fitting that are to be disconnected including hoses and filter.
- The reservoir contains 2 Qts. (1.89 L) of 5W40 synthetic hydraulic fluid (hydraulic drive system fluid plus p/n: 737-3121), and the filter contains roughly a pint (.47 L) of fluid. Total system capacity is more.
- The fluid and filter should be changed after the first 50 hrs. of operation, and after each 500 hrs. of operation following the initial change.

23.3. Removing the hydro service plate using a 7/16" wrench provides access to the reservoir and the hoses that connect to it. See Figure 23.3.

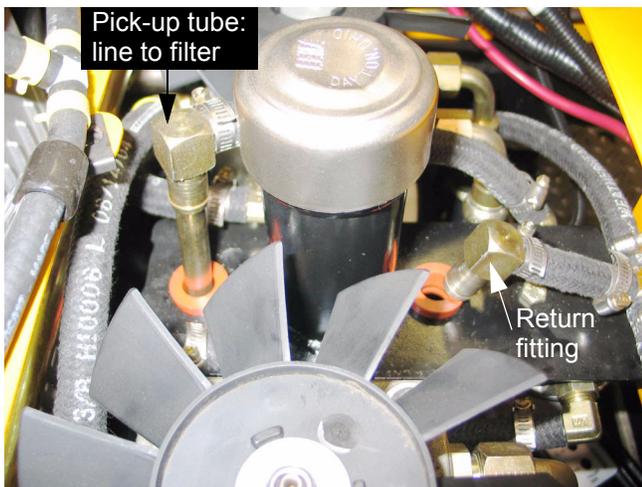


Figure 23.3

- The hose connected to the shorter tube at the front of the tank is the return line.
- The hose connected to the longer tube at the rear of the tank is the pick-up line, feeding the hydrostatic pumps via the filter.

23.4. The hydraulic filter is mounted beneath a bracket just in front of the reservoir. It is accessible for service from below the frame. See Figure 23.4.

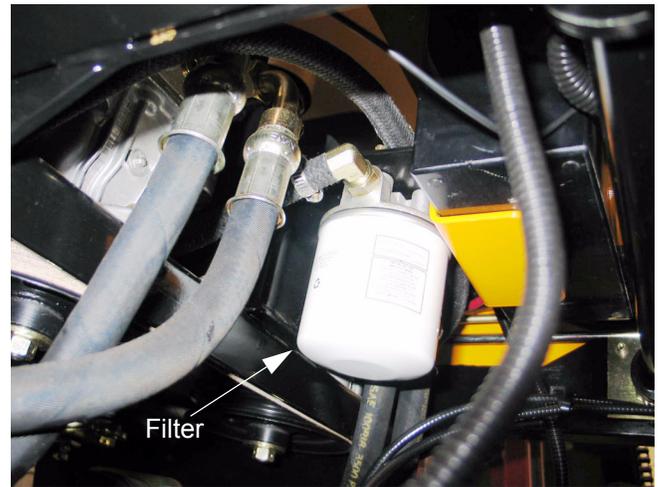


Figure 23.4

23.5. The filter and housing are direction-specific. If the hoses are disconnected for service, confirm correct reattachment before operating the mower. See Figure 23.5.

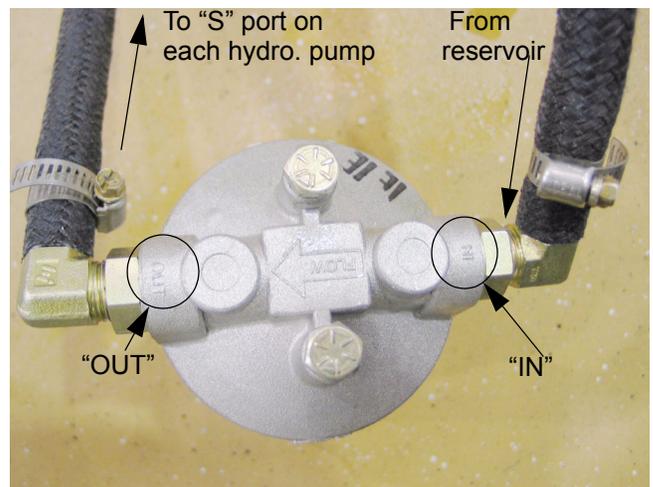


Figure 23.5

23.6. When changing hydraulic fluid, most of the reservoir will syphon out through the filter housing once the filter is removed.

23.7. Disconnect the return lines at the T fitting near the reservoir to drain them.

Cub Cadet Commercial Z-Wing

23.8. The fluid will also drain out of the lines leading to the pumps. See Figure 23.8.

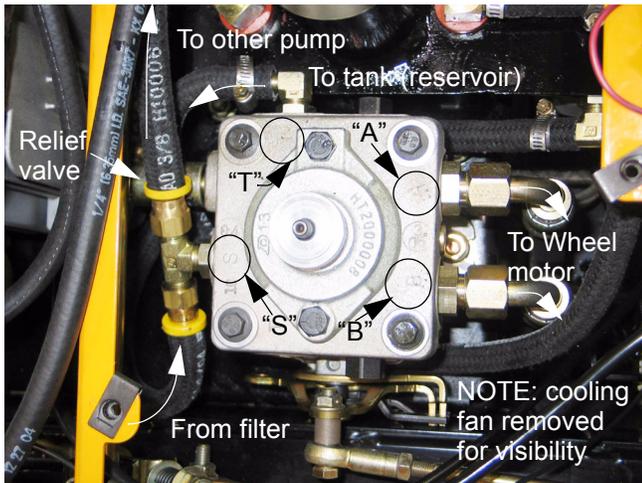


Figure 23.8

23.9. The heavier hoses carry pressurized fluid between the pumps and the wheel motors. See Figure 23.9.

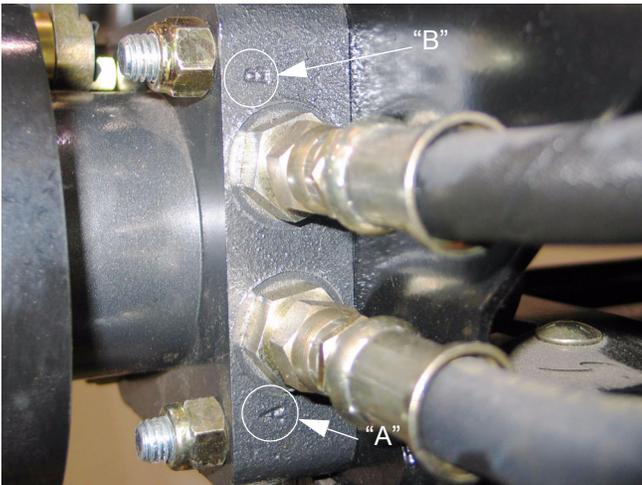


Figure 23.9

- The right side pump and wheel motor are plumbed "A" to "B" and "B" to "A".
- The left side pump and wheel motor are plumbed "A" to "A" and "B" to "B".
- This is necessary because two identical pumps are driven in the same direction, but mounted in a mirror-image relationship to one another. The mounting reverses the direction of the control inputs to one pump.

23.10. The wheel motors are manufactured by White Hydraulics. There is no financial nor managerial relationship between White Hydraulics and White Outdoor Power. They are a separate company, and Cub Cadet Commercial is simply a customer. See Figure 23.10.

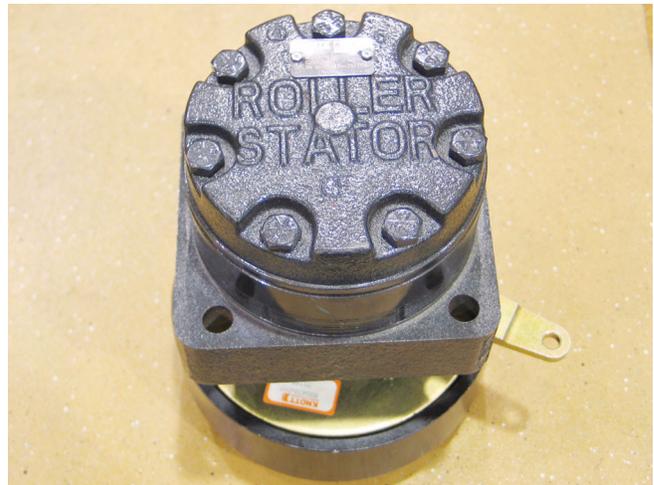


Figure 23.10

- White wheel motors feature a unique roller stator design: The rollers reduce friction directly and recover an oil film faster than a standard fixed surface.
- For more information, visit: [//WWW.Whitehydraulics.com](http://WWW.Whitehydraulics.com)
- The model used here is of the CE Series.

24. HYDRAULIC DRIVE SYSTEM: DIAGNOSIS

24.1. The method used for testing the pumps is called a "Flow Droop" test.

- The flow rate is tested at a pressure of 300 PSI, and again at 1,100 PSI. The two flow rates are compared to determine if the pump is damaged.
- If the pump is determined good, and there are no external factors hurting the performance of the drive system, then the motor can be determined to be at fault through the process of elimination.

24.2. Before condemning (or even testing) a pump or motor, a variety of external factors should be checked. These include:

- Dragging brake
- Wrong fluid or filter
- Leak or fluid starvation
- Partially open relief valve
- Belt / tensioner issues

- 24.3. If the performance of the right side drive system is suspect, pay particular attention to the belt and tensioner. There is more belt wrap on the left pump pulley than the right because the tensioner is on the left side of the frame. See Figure 24.3.

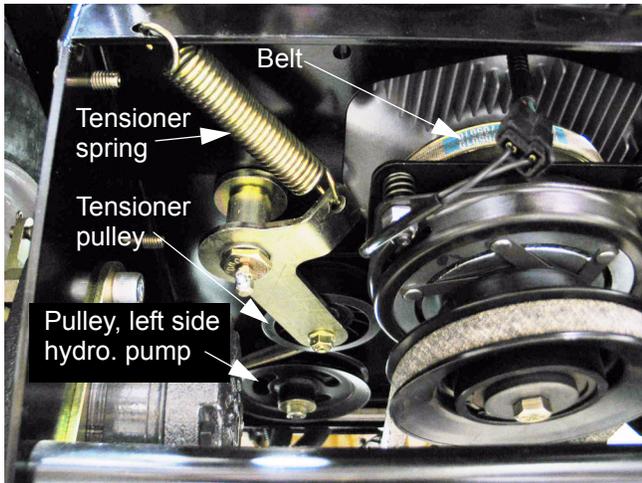


Figure 24.3

- 24.4. Observe normal hydraulic precautions:

- Allow the engine and drive system to cool before disconnecting any fittings that may expose the technician to hydraulic fluid.
- If the hydraulic system or gauge set develop any leaks in the course of operation or testing: discontinue operation immediately, identify and repair the leak.
- Relieve pressure from the system before disconnecting any components or fittings: with the engine and brake off, stroke the controls through their full range of motion.
- Clean the area surrounding any components or fittings to be disconnected to prevent contamination of the hydraulic fluid.
- Clean-up any spilled fluid promptly to prevent accidents.
- Wear eye protection while working on hydraulic systems.

- 24.5. Lift and safely support the rear of the mower.

- 24.6. Remove the wheels using a 3/4" wrench. See Figure 24.6.

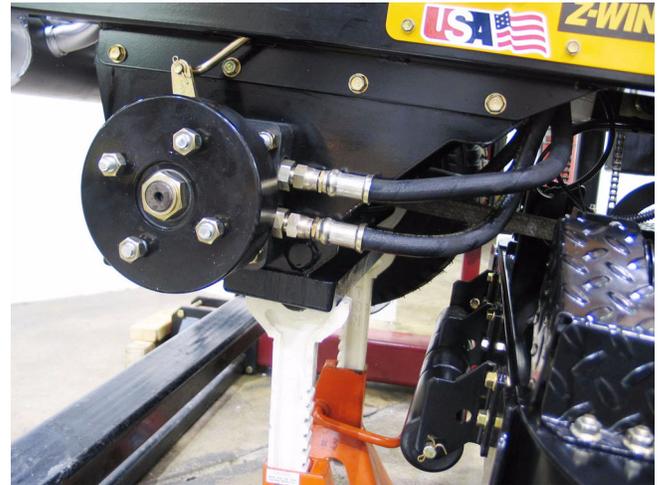


Figure 24.6

- 24.7. The gauge set should be connected so that the fluid enters the gauge set from the pressure gauge side and exits through the flow meter side. There are a variety of way to accomplish this. Bear in mind that:

- Valid tests can be made in the forward or reverse direction.
 - Valid tests can be performed with or without the wheel motor in the hydraulic circuit.
 - Disconnecting just one hydraulic line from the wheel motor, and installing the gauge set in series with the motor is slightly less work than disconnecting both lines
 - Fluid flow: In forward motion, fluid enters the wheel motor through the upper "B" port on the motor and exits through the lower "A" port.
 - Either port may be used:
The gauge set would be connected with the flow meter nearest the wheel motor if the "B" port is used and the test is made with forward wheel motion.
The gauge set would be connected with the pressure gauge nearest the wheel motor if the "A" port is used and the test is made with forward wheel motion.
- 24.8. Configure the test kit for the intended installation, with fittings finger-tight to facilitate adjustment. Keep it within arm's reach along with any wrenches needed to tighten the fittings. Set-up and wrench sizes may vary.

Cub Cadet Commercial Z-Wing

24.9. Place a catch pan beneath the wheel motor connection to be removed, and loosen the hydraulic hose using a 1" wrench and a 7/8" wrench. See Figure 24.9.

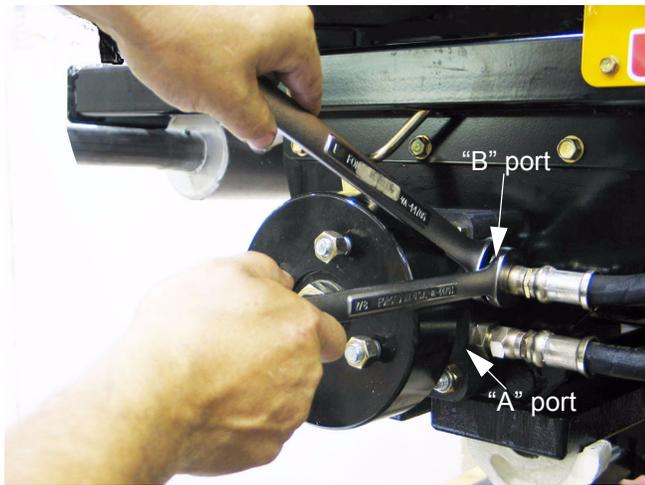


Figure 24.9

24.10. Promptly install the gauge set to minimize fluid loss. See Figure 24.10.

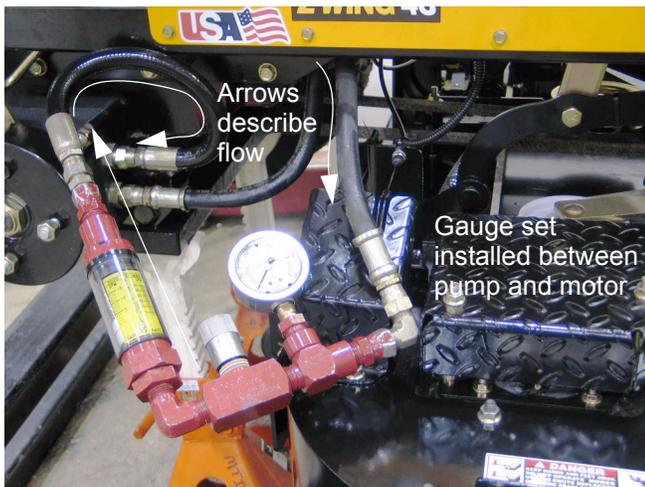


Figure 24.10

24.11. Position the gauge set so that it is visible and accessible.

24.12. Start at the wheel motor end of the gauge set connection and wrench-tighten each fitting.

24.13. If the "A" port was not chosen for the connection point of the gauge set, briefly disconnect it using a 1" wrench and a 7/8" wrench.

24.14. Catch a small quantity of fluid from the port fitting on the wheel motor, then re-connect the line.

24.15. Inspect the fluid for debris. Metal debris may indicate that the wheel motor is worn. This debris may enter the pump that is connected to the motor, causing accelerated wear on the pump.

- If the wheel motor is going bad, the pump may be a victim part. It is still (arguably, more) important to test the pump to confirm it's condition if debris is found.
- If debris is found, the fluid and filter should be replaced before the new components are installed.

24.16. Confirm that the load valve on the test kit is fully open, revealing all of the bands or marks below the knob.

24.17. Top-up the hydraulic fluid to make up for any fluid that was lost during gauge set installation. See Figure 24.17.

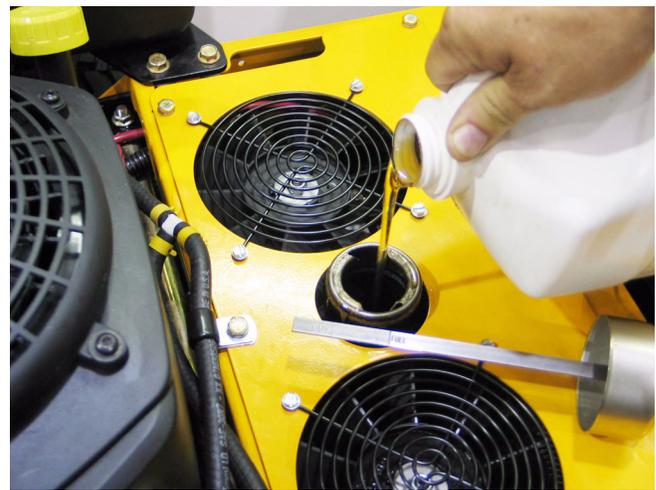


Figure 24.17

24.18. Confirm that no unsafe conditions will arise from starting the engine or operating the drive system.

24.19. Place ballast on the seat to simulate an operator's presence.

Cub Cadet Commercial Z-Wing

24.20. Match-mark, then loosen the roller used to make high-speed tracking adjustments using a 9/16" wrench. Lift it up to allow full forward motion, then snug-down the jam nut that locks the adjustment. See Figure 24.20.

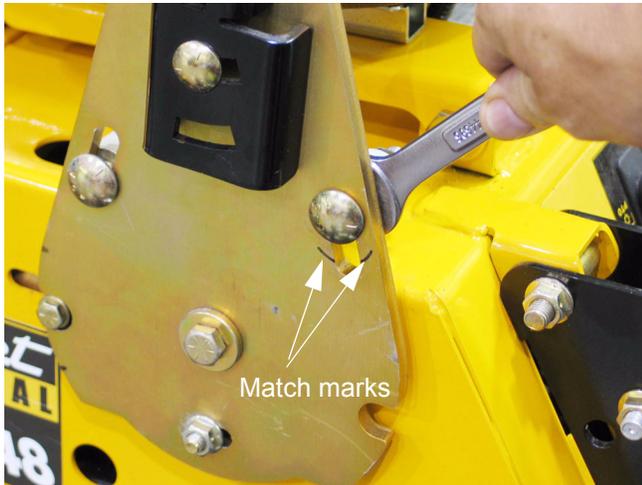


Figure 24.20

24.21. Start the engine, release the brake, and work the drive system: See Figure 24.21.



Figure 24.21

- Purge any air from the hydraulic system.
- Check for leaks
- Bring the hydraulic fluid up to operating temperature: 168 - 210 f. (71 - 99 c.).

24.22. Begin the flow droop test with the throttle set to 3,400 RPM: See Figure 24.22.



Figure 24.22

- Gently pull the lap bar that controls the pump being tested all the way forward, and hold it there for the duration of the test.
- Observe the fluid flow rate. It should be near 9 GPM (34 LPM).
- Close the load valve until the pressure gauge reads around 300 PSI (20.68 Bar.) Observe the fluid flow rate. It should be near 7GPM (26.5 LPM). See Figure 24.22a

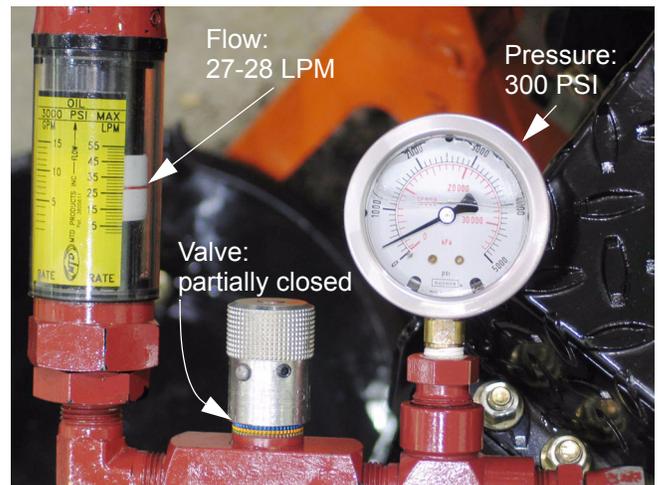


Figure 24.22a

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24.23. After the 300 PSI (20.68 Bar) flow reading is noted, close the load valve further, until the pressure gauge reaches 1,100 PSI (57.85 Bar). Note the flow rate. See Figure 24.23.

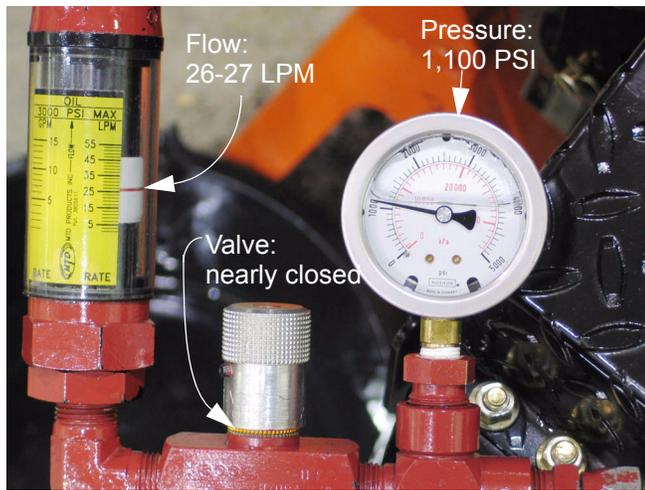


Figure 24.23

24.24. After noting the high pressure flow rate:

- Open the load valve to relieve the pressure.
- Return the lap bar to the neutral position.
- Throttle-down, then turn-off the engine.

24.25. Interpretation:

- If the difference in flow between the low pressure reading and the high pressure reading is greater than 1.5 GPM (5.61 LPM), the pump has a problem and should be replaced.
- If the difference in flow between the low pressure reading and the high pressure reading is less than 1.5 GPM (5.61 LPM), the pump is working properly.
- If the pump is working properly and other factors have been eliminated, the wheel motor has a problem and should be replaced.

25. HYDRAULIC DRIVE SYSTEM: PUMP REMOVAL

25.1. The drive system employs a pair of Hydro-Gear pumps:

- If a hydrostatic pump suffers a warrantable failure, it is to be replaced as a complete unit. The dealer will be required to return the pump to Cub Cadet for inspection and vendor recovery.
- Outside of warranty, the pumps can be feasibly rebuilt for the customer or as an exchange unit.

25.2. Observe normal hydraulic **precautions** when servicing these pumps:

- Allow the engine and drive system to cool before disconnecting any fittings that may expose the technician to hydraulic fluid.
- If the hydraulic system or gauge set develop any leaks in the course of operation or testing: discontinue operation immediately, identify and repair the leak.
- Relieve pressure from the system before disconnecting any components or fittings: with the engine and brake off, stroke the controls through their full range of motion.
- Clean the area surrounding any components or fittings to be disconnected to prevent contamination of the hydraulic fluid.
- Clean-up any spilled fluid to prevent accidents.
- Wear eye protection while servicing hydraulics.

25.3. After the engine cools sufficiently to safely work near the muffler, relieve tension from the drive belt and slip the belt off of the pulley driving the pump to be removed. See Figure 25.3.

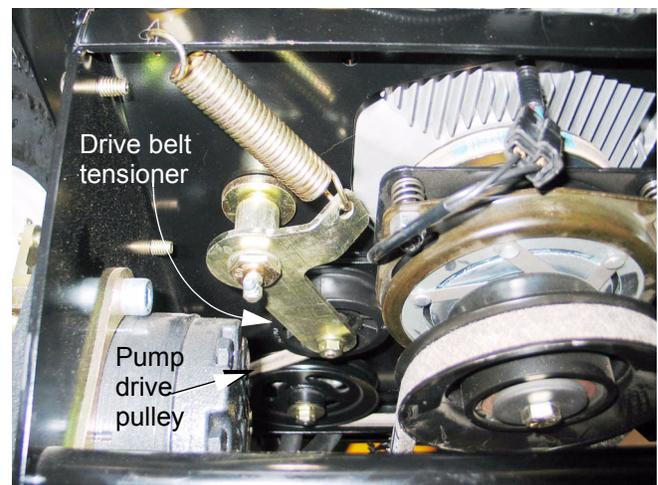


Figure 25.3

Cub Cadet Commercial Z-Wing

- 25.4. Remove the nut and flat washer that secure the pulley to the input shaft that extends out the bottom of the pump using a 9/16" wrench. See Figure 25.4.

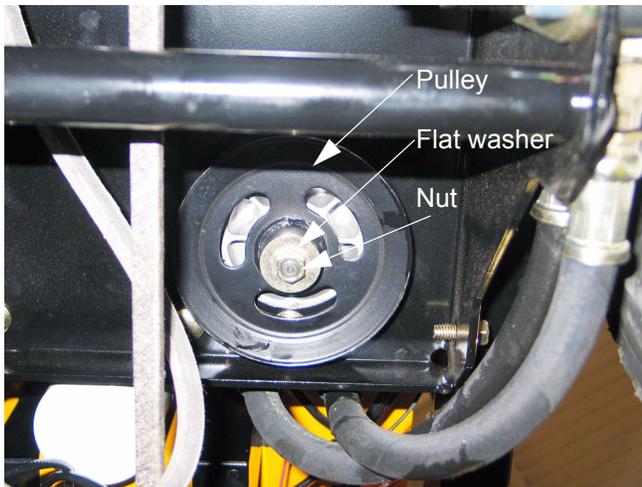


Figure 25.4

- 25.5. Install a small three-jaw puller to remove the pulley from the shaft. See Figure 25.5.

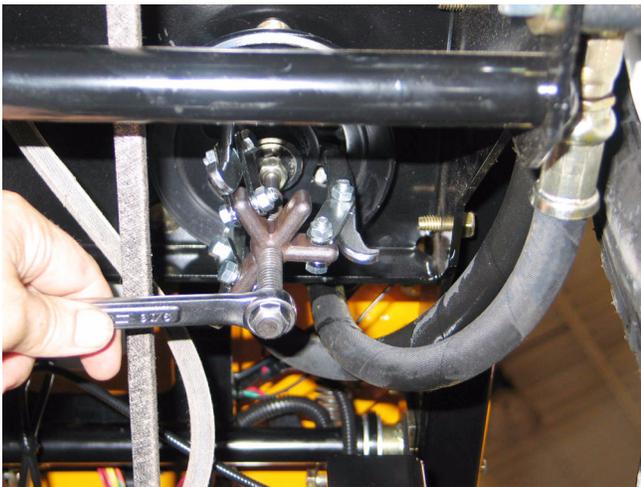


Figure 25.5

NOTE: The shaft is keyed and tapered.

- 25.6. Tilt-up the seat and disconnect the cable from the negative terminal on the battery.
- 25.7. Remove the hydro service plate using a 7/16" wrench.

- 25.8. Remove the nut that secures the cooling fan using a 9/16" wrench. See Figure 25.8.

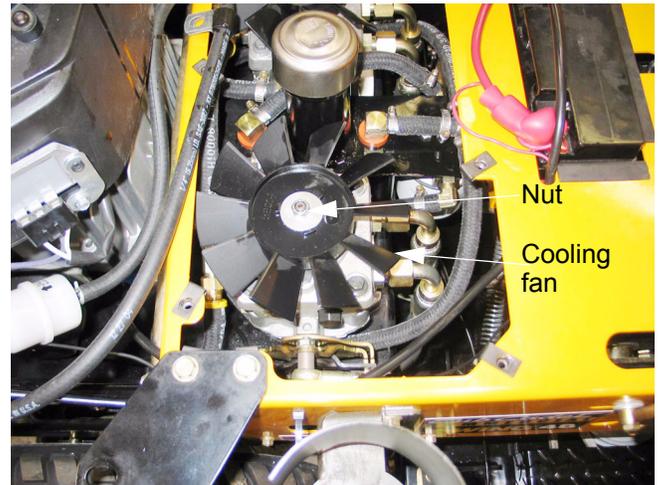


Figure 25.8

- 25.9. Lift-off the hub that the cooling fan rides on.
- 25.10. Disconnect the steering rod from the steering input arm (part of the return-to-neutral mechanism) on the hydro. pump using a pair of 1/2" wrenches.
- 25.11. The hoses at the front of the hydro. pump connect the "A" and "B" ports to the wheel motors. Mark the hoses and disconnect them using a pair of 7/8" wrenches. See Figure 25.11.

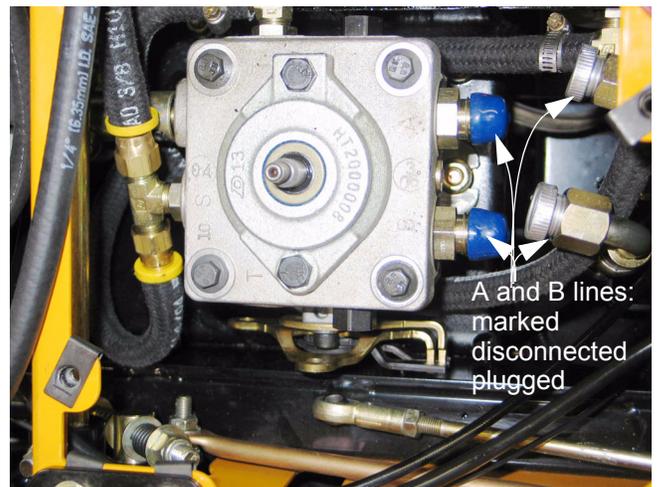


Figure 25.11

NOTE: Letters identifying the ports on the hydro. pump are embossed on the top of the pump housing.

- 25.12. Cap the fittings on the pump to prevent fluid spillage on removal, and plug the ends of the hoses to prevent fluid contamination.

Cub Cadet Commercial Z-Wing

25.13. Loosen the jam nut that secures the T-fitting to the “S” port on the right side hydro. pump or the L-fitting to the “S” port on the left side hydro. pump, depending on which pump is to be removed. Wrench size: 11/16”.

NOTE: This will allow the fitting to be rotated for better wrench access.

25.14. Disconnect the supply hose(s) from the “S” port on the pump using an 11/16” wrench.

NOTE: Because of the tight fit, it may be easier to loosen the hose(s) from the “S” port to finger-tight. After the pump is unbolted from the frame, the pump may be maneuvered into a position that allows easier removal of the hose(s).

25.15. Cap the fitting on the pump to prevent spillage during removal, and plug the fittings on the hose(s) to prevent contamination while disconnected.

25.16. Disconnect the return hose from the “T” port on the hydro. pump using a screwdriver or 1/4” hex driver to loosen the hose clamp. See Figure 25.16.

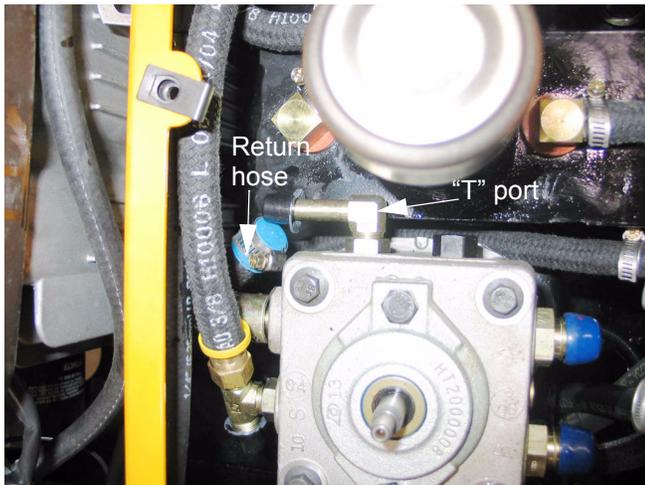


Figure 25.16

25.17. Cap the fitting on the pump to prevent spillage during removal, and plug the hose to prevent contamination while disconnected.

25.18. Remove the nuts that secure the pump to the frame using a 9/16” wrench. See Figure 25.18.

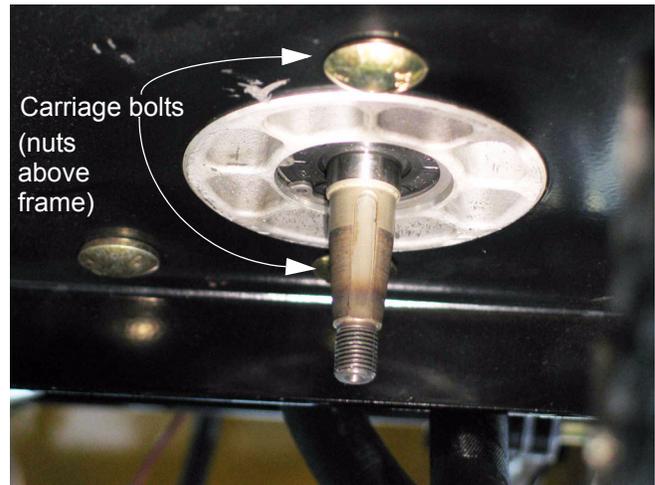


Figure 25.18

25.19. Disconnect the hose(s) from the “S” port, if not already done, and lift the pump out of the mower.

25.20. On the bench: See Figure 25.20.

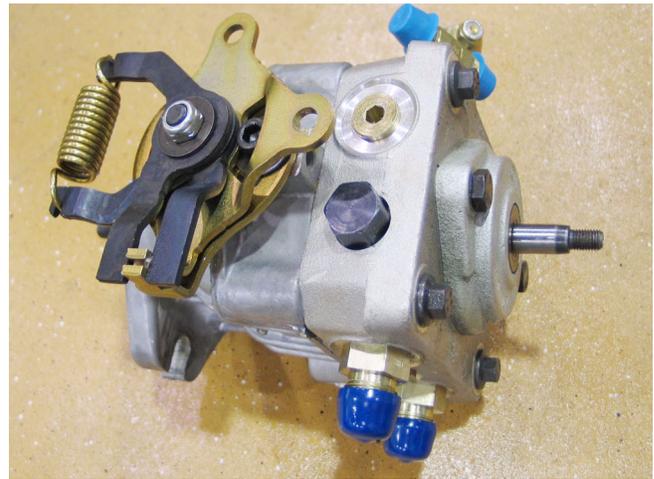


Figure 25.20

- Drain any remaining fluid from the pump.
- Make a visual comparison to confirm that the replacement pump is suitable.
- Transfer any necessary fittings or components to the new pump.
- It may be necessary to loosen the lock nut that holds the scissors arms on the new pump.
- Prime the new hydro. pump with fluid as well as possible on the bench, and cap fittings.
- Open the relief valve.

Cub Cadet Commercial Z-Wing

25.21. If there is a possibility of fluid contamination, either as a cause of or a result of the pump (or motor) failure:

- Replace the filter.
- Drain and properly dispose-of the remainder of the fluid in the system.
- Remove and clean or replace the hoses connected to the “A” and “B” ports of the pump.
- Follow break-in procedure; initial fluid change after 50 hrs. of operation.

NOTE: If hoses are cleaned with parts-washer solvent, follow-up with hot soapy water and hot water rinse. Dry thoroughly before reinstallation. The parts washer solvent is an astringent that will remove any traces of contaminated fluid. The soapy water is a surfactant that will remove any grit from the lining of the hose and flush away any remnants of solvent. Residual solvent will very effectively thin-out hydraulic drive system fluid.

25.22. Prior to installation, clean the area surrounding the pump.

25.23. Affix the carriage bolts that hold the pump using duct tape. See Figure 25.23.

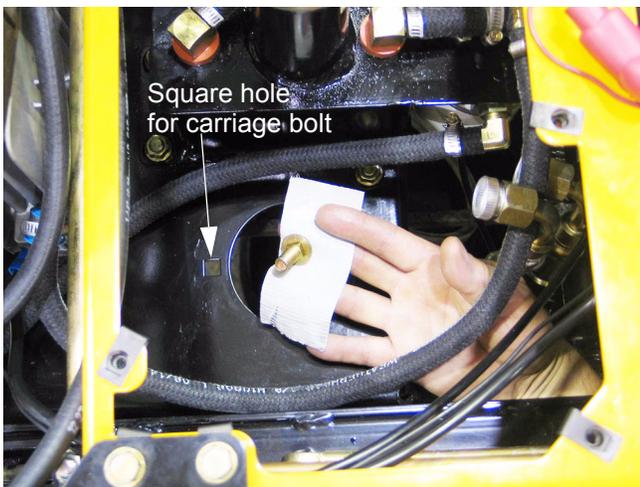


Figure 25.23

25.24. Lower the pump into position over the carriage bolts.

25.25. Prime the “S” hoses that lead from the filter, if they have lost substantial fluid. See Figure 25.25.



Figure 25.25

25.26. Connect the hose(s) to the “S” fitting on the back of the pump.

25.27. Install the nuts on the carriage bolts, and secure the pump to the frame.

- If the locking feature of the nut has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads. Tighten the bolt to a torque of 35 ft-lbs (47.46 Nm).

25.28. Connect the remaining hoses and steering linkage, then install the fan and drive pulley by reversing the removal process.

- Tighten the nut holding the pulley. If the locking feature of the nut has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads. Tighten the bolt to a torque of 35 ft-lbs (47 Nm).
- Tighten the nut that secures the cooling fan. If the locking feature of the nut has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads. Tighten the bolt to a torque of 140 in-lbs (16 Nm).
- Tighten the nut that secures the steering rod. If the locking feature of the nut has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads.

25.29. Re-fill the reservoir with Hydraulic Drive System Fluid Plus.

Cub Cadet Commercial Z-Wing

25.30. Re-connect the negative battery cable to the negative terminal of the battery.

25.31. Confirm that no hazardous conditions will be created by running the engine or operating the drive system.

25.32. Open the relief valve of the newly installed pump.

25.33. Start the engine and purge the drive system:

- Lift and safely support the rear of the mower.
- Start the engine.
- Give the lap bar ten strokes over the full distance of its travel, taking about 10 seconds to complete each stroke.
- Turn off the engine. Check the fluid level and top-up if necessary. Check for leaks. Close the relief valve.
- Start the engine.
- Give the lap bar ten strokes over the full distance of its travel.
- Turn off the engine. Check the fluid level and top-up if necessary. Check for leaks. Close the relief valve.
- Lower the rear of the mower to the ground.

25.34. Install the hydro service plate.

25.35. Adjust tracking as necessary.

25.36. Test the operation of the mower and its safety features in a safe area that is clear of hazards, obstacles, and other personnel before returning it to service. Some growling noise may come from the drive system until all the air is purged.

26. HYDRAULIC DRIVE SYSTEM: WHEEL MOTOR REMOVAL

26.1. The wheel motors used in this application are sourced from a company called White Hydraulics.

- Service parts are not available through Cub Cadet.
- If a wheel motor fails within warranty or beyond warranty, replace it as a complete unit.
- Within warranty you will be required to return the wheel motor to Cub Cadet for inspection and vendor recovery.

26.2. Observe normal hydraulic precautions:

- Allow the engine and drive system to cool before disconnecting any fittings that may expose the technician to hydraulic fluid.
- If the hydraulic system develops any leaks in the course of operation or testing: discontinue operation immediately, identify and repair the leak.
- Relieve pressure from the system before disconnecting any components or fittings: with the engine and brake off, stroke the controls through their full range of motion.
- Clean the area surrounding any components or fittings to be disconnected to prevent contamination of the hydraulic fluid.
- Clean-up any spilled fluid to prevent accidents.
- Wear eye protection while servicing hydraulic systems.

26.3. Lift and safely support the Z-Force mower.

Cub Cadet Commercial Z-Wing

26.4. Remove the wheel from the wheel motor to be replaced using a 3/4" wrench. See Figure 26.4.

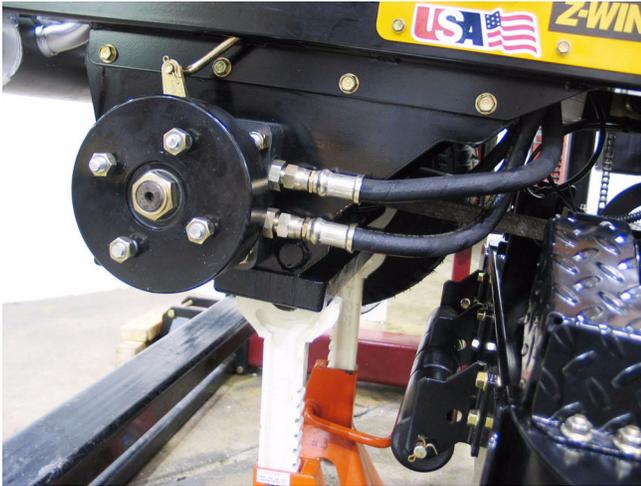


Figure 26.4

26.5. Release the parking brake.

26.6. Disconnect the brake rod from the brake arm.

26.7. Match mark and disconnect the hydraulic hoses from the wheel motor using a 7/8" wrench and a 1" wrench. See Figure 26.7.



Figure 26.7

- Catch escaping fluid in a drain pan.
- Check the fluid that comes out of the motor for debris.
- Cap the fittings on the motor to prevent fluid spillage on removal, and plug the ends of the hoses to prevent fluid contamination.

26.8. Unbolt the wheel motor from the frame using a 3/8" allen wrench and a 3/4" wrench, and carefully remove it. See Figure 26.8.

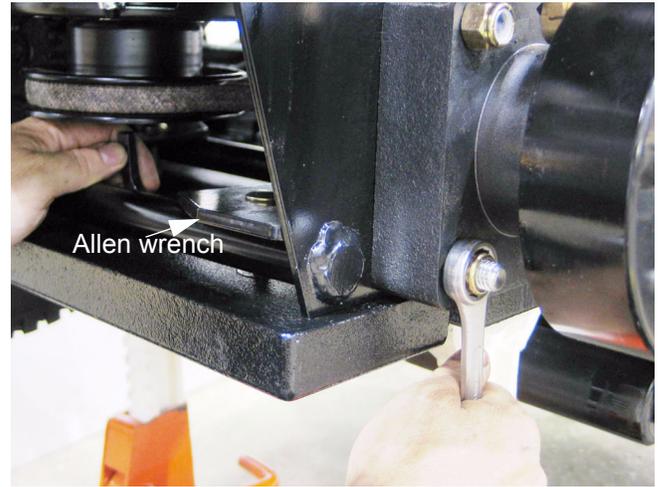


Figure 26.8

26.9. On the bench:

- Drain any remaining fluid from the motor.
- Make a visual comparison to confirm that the replacement motor is suitable.
- Transfer any necessary fittings or components to the new motor.

26.10. If there is a possibility of fluid contamination, either as a cause of or a result of the pump (or motor) failure:

- Replace the filter.
- Drain and properly dispose-of the remainder of the fluid in the system.
- Remove and clean or replace the hoses connected to the "A" and "B" ports of the pump.
- Follow break-in procedure; initial fluid change after 50 hrs. of operation.

NOTE: If hoses are cleaned with parts-washer solvent, follow-up with hot soapy water and hot water rinse. Dry thoroughly before reinstallation. The parts washer solvent is an astringent that will remove any traces of contaminated fluid. The soapy water is a surfactant that will remove any grit from the lining of the hose and flush away any remnants of solvent. Residual solvent will very effectively thin-out hydraulic drive system fluid, contributing to performance problems and premature component failure.

Cub Cadet Commercial Z-Wing

26.11. Reverse the removal process to install the wheel motor. See Figure 26.11.

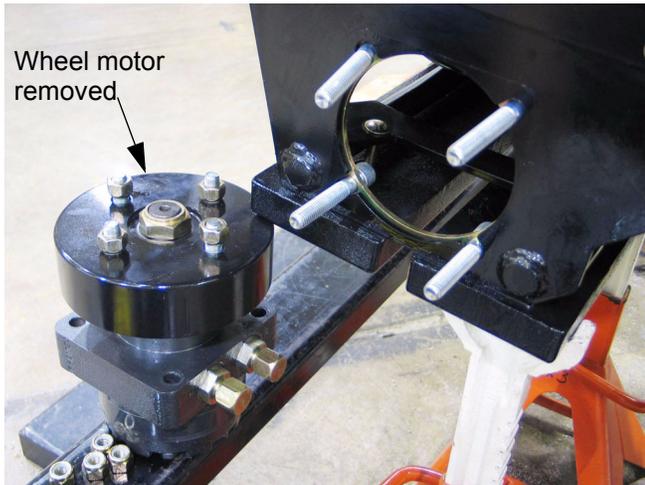


Figure 26.11

26.12. Access to the socket head cap screws around the weights is tight. Once in position, a ball drive allen wrench can be wedged against the weights to ease installation. See Figure 26.12.



Figure 26.12

- If the locking feature of the nut has worn, replace the nut, or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads. Tighten the nut to a torque of 80 ft-lbs (108.48 Nm).
- Tighten the lug nuts to a torque of 60 ±10 ft-lbs (68-95 Nm).

26.13. Re-fill the reservoir with Hydraulic Drive System Fluid Plus.

26.14. Confirm that no hazardous condition will be created by running the engine or operating the drive system.

26.15. Open the relief valve of the pump that drives the newly replaced wheel motor.

26.16. Start the engine and purge the drive system:

- Give the lap bar ten strokes over the full distance of it's travel, taking about 10 seconds to complete each stroke.
- Turn off the engine. Check the fluid level and top-up if necessary. Check for leaks. Close the relief valve.
- Start the engine.
- Give the lap bar ten strokes over the full distance of it's travel, taking about 10 seconds to complete each stroke.
- Turn off the engine. Check the fluid level and top-up if necessary. Check for leaks. Close the relief valve.
- Lower the rear of the mower to the ground.

26.17. Adjust tracking as necessary.

26.18. Test the operation of the mower and its safety features in a safe area that is clear of hazards, obstacles, and other personnel before returning it to service. Some growling noise may come from the drive system until all the air is purged.

27. FRONT AXLE AND CASTER WHEELS

27.1. The front wheels mount to the front caster yokes. See Figure 27.1.



Figure 27.1

- The wheels, bearings and tires are replaced as a complete assembly when they are worn or damaged.
 - The tires may be plugged or sealed in accordance with the instructions in the operator's manual.
 - Front tires are inflated to between 20-25 psi (1.38-1.72 Bar), with a maximum pressure of 28 psi (1.93 Bar).
- 27.2. **Lubrication:** Wheel bearings, caster yoke spindles, and the front axle pivot point are all to be lubricated at weekly intervals using #2 Multipurpose lithium-based grease, in accordance with the Operator's Manual.

27.3. The front wheels can be removed from the yokes using a pair of 3/4" wrenches. See Figure 27.3.

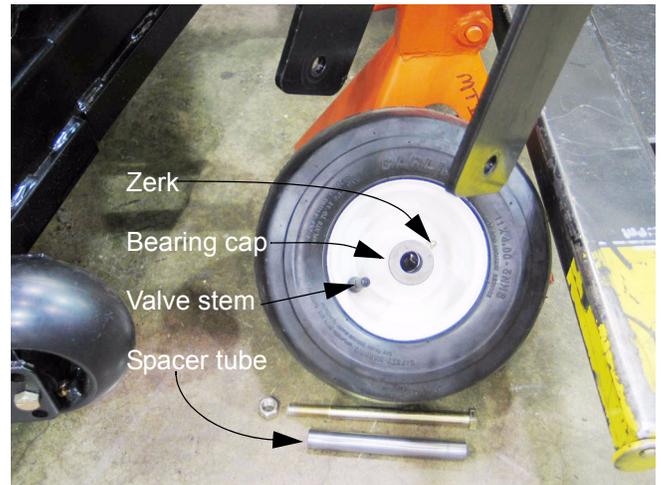


Figure 27.3

- Lift and safely support the axle before removing a wheel.
 - Grease zerks and valve stems face outward for easy access.
 - The wheels each ride on two straight roller bearings.
 - The roller bearings ride against a spacer tube.
 - The caps that hold the bearings in place act as thrust bearings within the yoke.
- 27.4. **Installation:** If the locking feature of the nut has worn, replace the nut or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads. Tighten the nut to 105 ft-lb (142 Nm).

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27.5. The **caster yokes** each pivot on a pair of Timken tapered roller bearings. They can be reached for service by removing the grease cap that covers each one. See Figure 27.5.

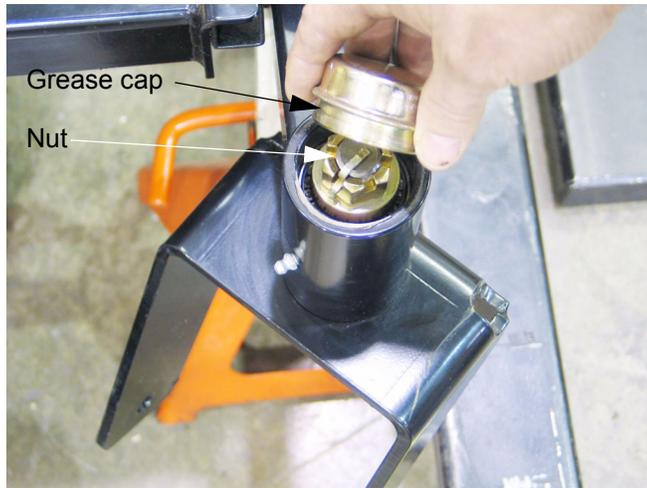


Figure 27.5

- 27.6. Remove and discard the cotter pin that secures the castle nut.
- 27.7. Remove the nut using a 1 1/8" wrench. It may be necessary to brace the yoke using a 2X4 to prevent it from rotating.
- 27.8. There is a spacer above the top of the upper bearing and below the bottom bearing.
- 27.9. The caster yoke can be pushed-out of the bearings with hand force or driven using a soft hammer or drift. See Figure 27.9.

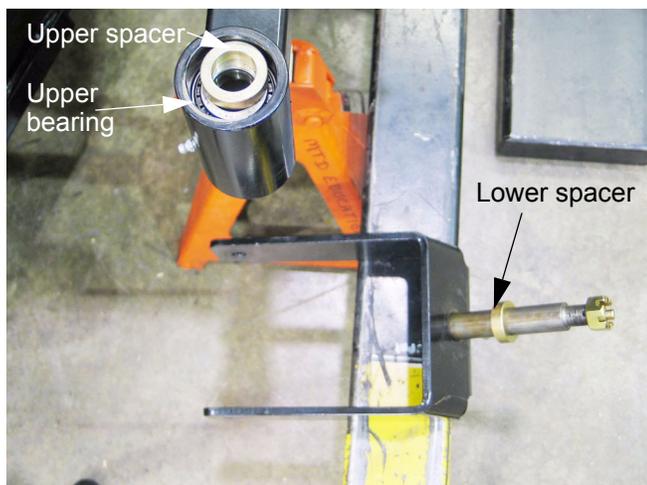


Figure 27.9

27.10. The spacer at the bottom provides a surface for the lip of the seal to ride against. See Figure 27.10.

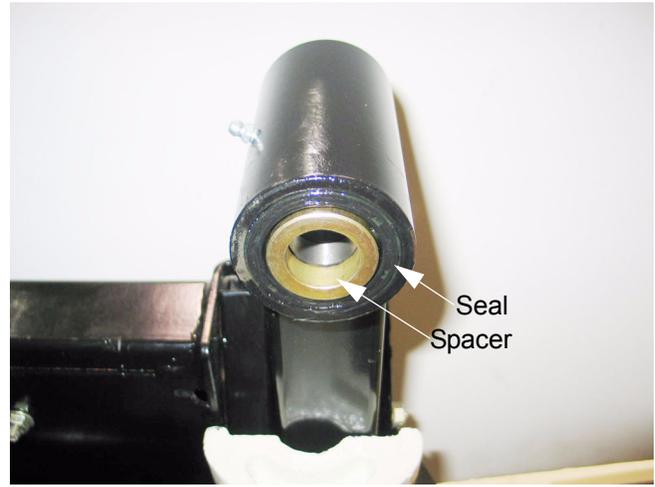


Figure 27.10

27.11. The spacer is easily removed.

NOTE: The seal is only used at the bottom, the top is taken care of by the grease cap.

27.12. The seal and lower bearing cone can be gently pushed-out together using a soft drift. See Figure 27.12.



Figure 27.12

27.13. Bearing Service:

- Bearings may be cleaned, inspected, re-packed, and reinstalled if they are undamaged.
- If bearing cones are replaced, the corresponding races should be replaced as well.
- Keep bearings associated with the races that they have been worn-into.

Cub Cadet Commercial Z-Wing

- 27.14. Inspect the yoke shaft for wear. Repair or replace it if the bearing cones have worn into the shaft, or if the yoke exhibits other signs of wear or damage.
- 27.15. To **reinstall the yoke**, after complete bearing removal, use the following steps:
- 27.16. Drive the bearing races into place against the lips on each end of the bore, using an appropriate drift or bearing driver.
- 27.17. Position the bottom bearing (cleaned, inspected, and packed) in its race, and secure it by pressing a new seal in behind it.
- 27.18. Drive the seal flush with the bottom edge of the bore using a seal driver or a 2X4.
- 27.19. Lubricate the lip of the seal with grease or oil, and position the lower spacer in the seal. If the spacer has a wear ring on the sealing surface, it may be reversed, or swapped with the upper spacer. See Figure 27.19.

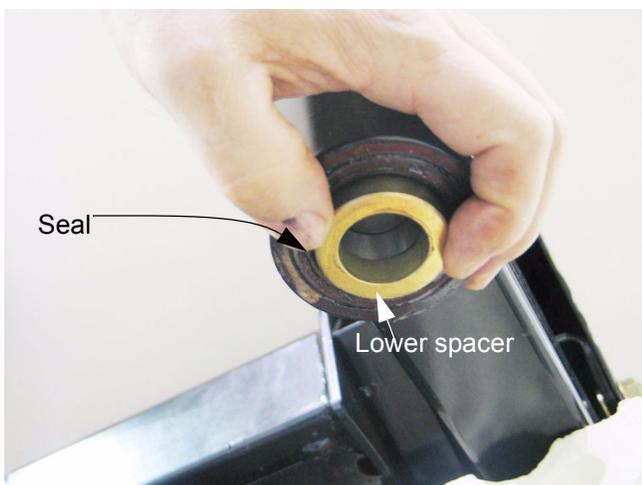


Figure 27.19

- 27.20. Insert the yoke shaft up through the lower spacer and bearing.
- 27.21. Install the cleaned, inspected and freshly packed upper bearing over the shaft, followed by the upper spacer and castle nut.
- 27.22. Support the yoke while tightening the castle nut.
- 27.23. Tighten the nut until all vertical play in the yoke shaft has just been taken-up, then align the nearest serration on the nut with the cross-bore in the yoke shaft.
- 27.24. Secure the nut with a new 5/32" X 1 1/4" cotter pin, and reinstall the grease cap.

- 27.25. **Front axle removal** can be done with the cutting deck in-place, if the mower and deck are properly supported.
- 27.26. Remove the grease caps and cotter pins from each of the front caster yokes.
- 27.27. Loosen, but do not remove the castle nuts that secure the caster yokes, using a 1 1/8" wrench.
- 27.28. Lift and safely support the mower by each side of the frame, behind the front axle.
- 27.29. Support the cutting deck by the reinforced front lip, just inside of each front deck gauge wheel. This will take the weight off of the front lift rod. See Figure 27.29.

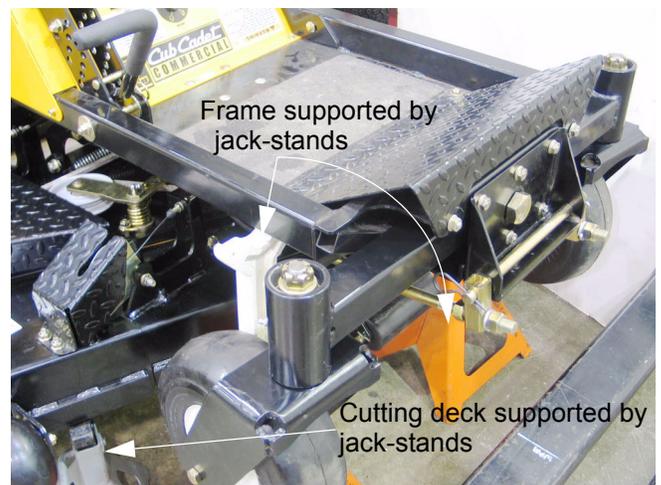


Figure 27.29

- 27.30. Remove the caster yokes to make the front axle easier to handle. See Figure 27.30.

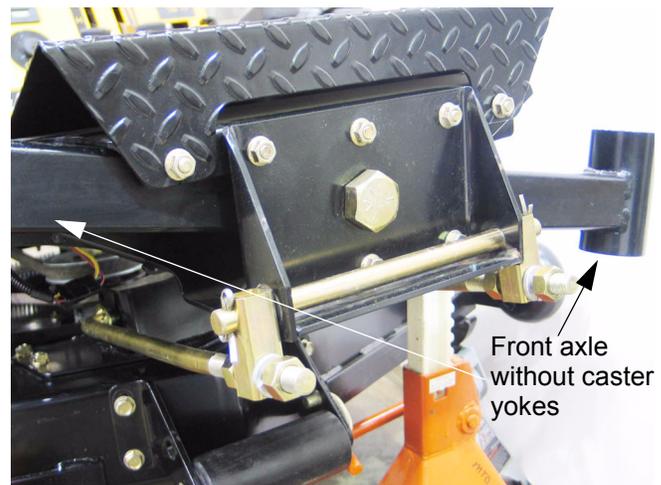


Figure 27.30

Cub Cadet Commercial Z-Wing

27.31. Remove the cotter pin that holds the front lift support rod, and withdraw the rod. See Figure 27.31.

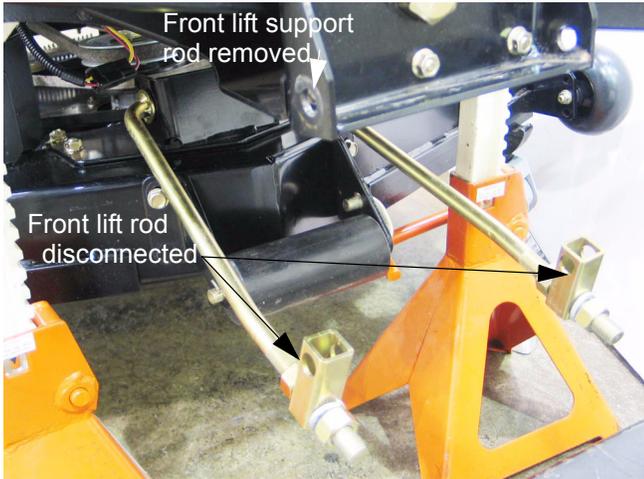


Figure 27.31

27.32. The front lift rod can then be unhooked from the deck, and removed completely.

27.33. Remove the pivot bolt using a pair of 1 1/2" wrenches. See Figure 27.33.



Figure 27.33

27.34. Once the pivot bolt is removed, the front axle bracket assembly may be taken-off using a 9/16" wrench. See Figure 27.34.

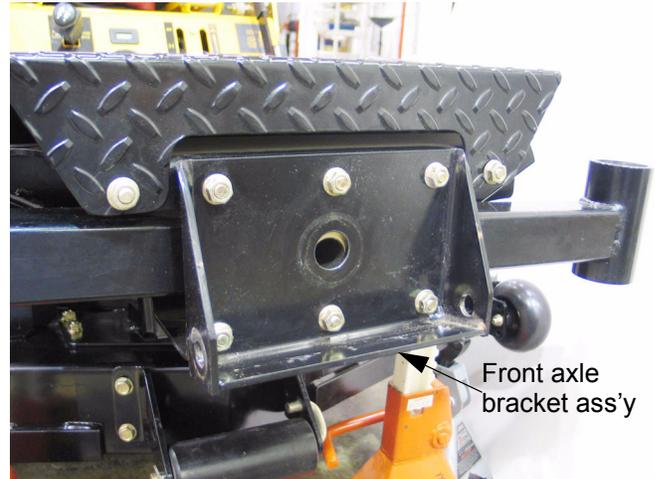


Figure 27.34

NOTE: The nuts are attached to carriage bolts that are secured to the frame with speed nuts.

27.35. With the front axle bracket removed, the flat washer and belleville washer at the front of the pivot point will be exposed. See Figure 27.35.

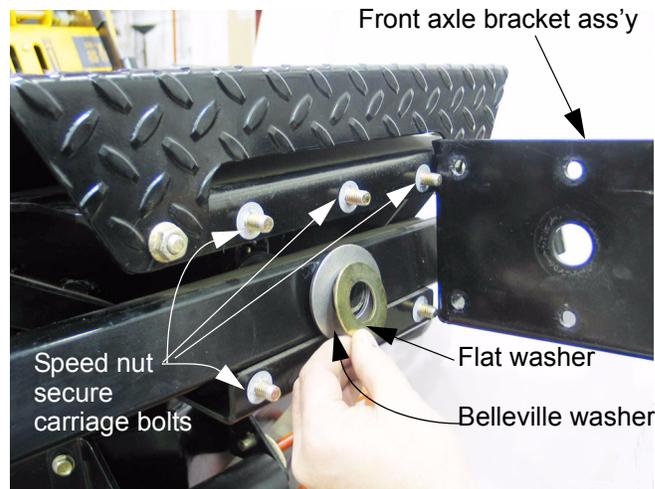


Figure 27.35

NOTE: The flat washer has a smaller I.D., and is sandwiched between the spacer tube and the front axle bracket.

NOTE: The belleville washer has a larger I.D. than the flat washer, and fits over the spacer tube. The smaller contact patch (I.D.) faces the flat washer, while the larger contact patch (O.D.) faces the axle.

Cub Cadet Commercial Z-Wing

27.36. Lift the axle and spacer tube out of the frame.
See Figure 27.36.

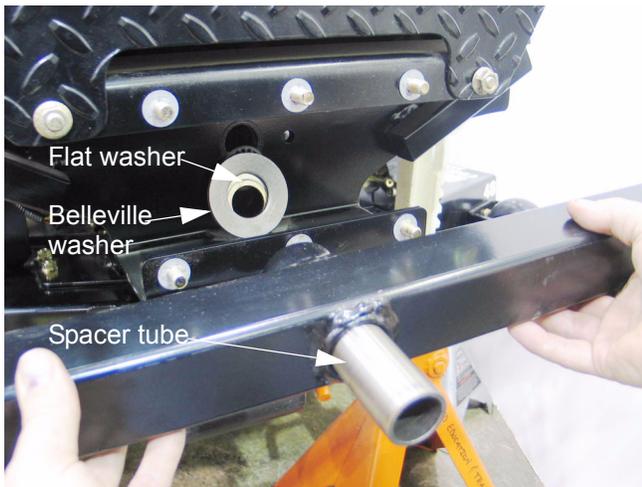


Figure 27.36

27.37. Behind the axle and tube is a second belleville washer and flat washer, positioned in mirror image to the ones in front of the axle. Behind them is a self-locking retainer.

27.38. Hardware orientation: See Figure 27.38.

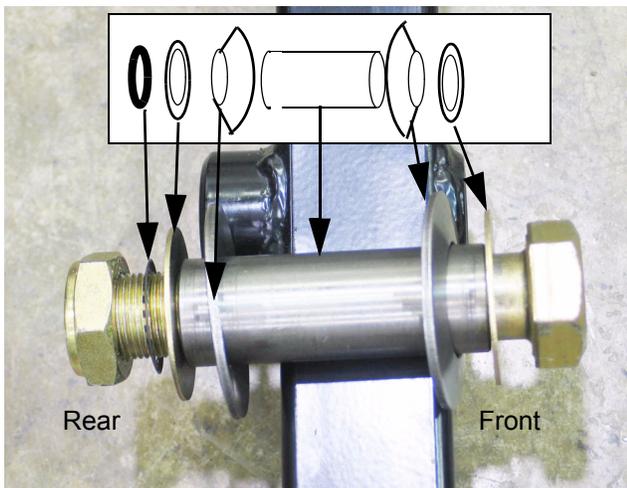


Figure 27.38

27.39. For easiest installation, the axle bracket, axle, pivot bolt, spacer tube, and washers can be lubed and pre-assembled, with the self-locking retainer holding all the parts in place.
See Figure 27.39.

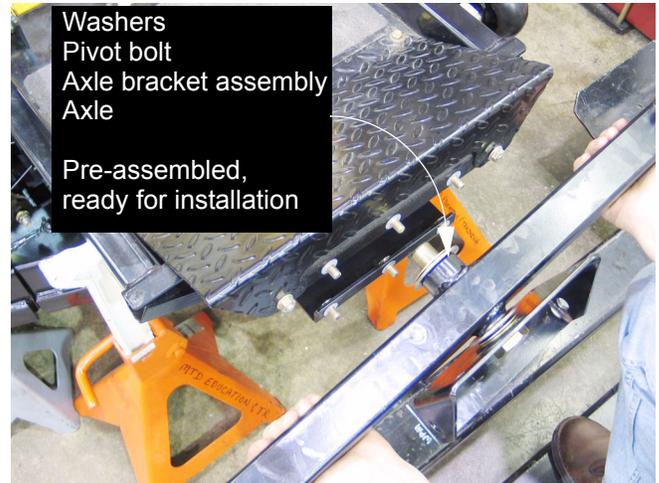


Figure 27.39

27.40. Correct axle orientation:

- The grease zerk on the pivot point faces down, and the longer boss on the axle tube goes to the rear.
- The grease zerks for the caster yoke bearings face rearward, and the tubes that the caster yoke bearings fit in are of-set upwards from the axle.

27.41. Install the nuts that secure the axle support bracket. If the locking feature of the nuts has worn, replace the nut or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads and tighten them to a torque of 35 ft-lbs (48 Nm).

27.42. Install the large locking nut that secures the pivot bolt, and tighten it using a pair of 1 1/2" wrenches. If the locking feature of the nut has worn, replace the nut or apply a small amount of thread locking compound such as Loctite 242 (blue) to the threads. Tighten the nut until all the fore-aft play in the axle is taken-up, but not so tight that friction inhibits the pivot action.

27.43. The remainder of the assembly process is to reverse the steps of disassembly.

Cub Cadet Commercial Z-Wing

28. ELECTRICAL: COMPONENTS

28.1. The **key switch** is easily removed from the front panel of the control housing for diagnosis or replacement. See Figure 28.1.



Figure 28.1

- Disconnect the ground cable from the negative battery terminal using a 5/16" wrench, or remove the fuse to disable the circuit.
- Pry-off the rubber cover.
- Remove the retainer with a 3/4" wrench.
- Unplug the electrical connection, and withdraw the key switch from within the control console.

28.2. The key switch has six spade terminals, five of which are used in this application. See Figure 28.2.

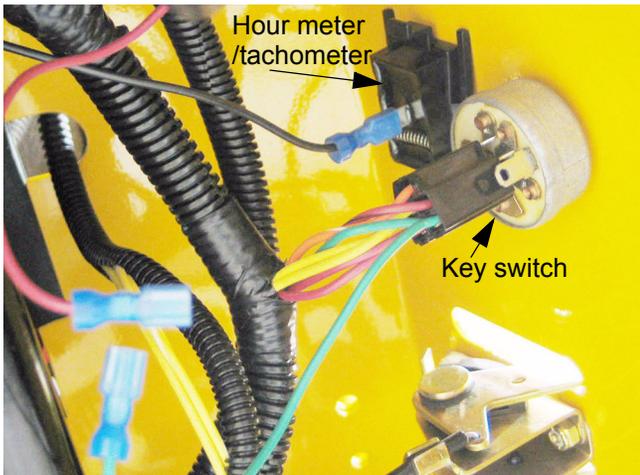


Figure 28.2

NOTE: Each spade is lettered on the inside-facing flat: M, L, B, G, S.

28.3. The key switch internal contacts are as follows: See Figure 28.3.

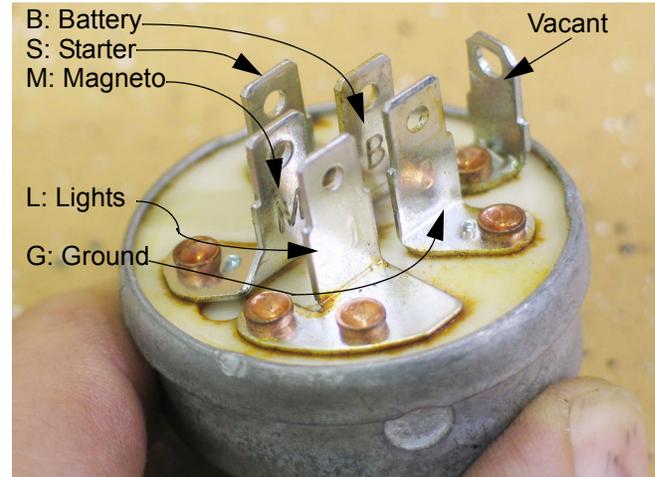


Figure 28.3

- OFF position: M+G+L
- RUN position: B+L
- Start position: B+S+L

28.4. The **PTO switch** is easily removed from the front surface of the control housing. See Figure 28.4.

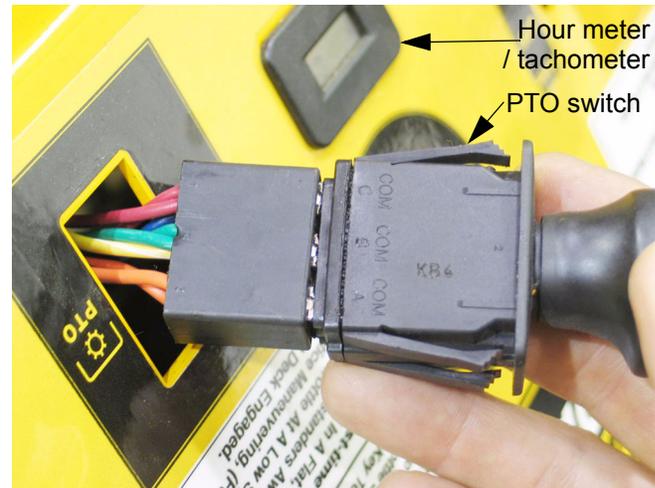


Figure 28.4

- The tabs may be reached from beneath the frame, or by removing the battery.
- Squeeze the tabs to release the switch body from the control housing.
- Unplug the electrical connector after pulling the switch out of the control housing.

Cub Cadet Commercial Z-Wing

28.5. The PTO switch has three sets of contacts: A, B, & C. See Figure 28.5.

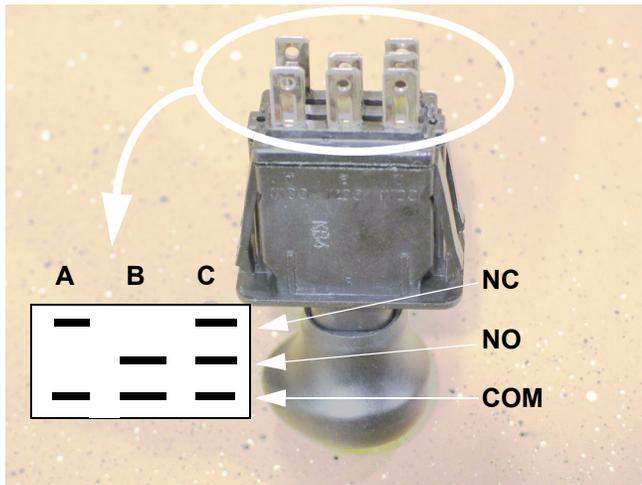


Figure 28.5

- For each set of contacts, there are three male spade terminals:
Common: (COM)
Normally Open: (N.O.)
Normally Closed: (N.C.)
- When the PTO switch is pushed-in (turned-off), each COM spade is internally connected to the N.C. spade (A, B, or C) that corresponds to it.
- When the PTO switch is pulled-out (turned-on), each COM spade is internally connected to the N.O. spade (A, B, or C) that corresponds to it.

28.6. **PTO relay:** The PTO relay can be found on the main harness conduit, near the left front corner of the engine. See Figure 28.6.

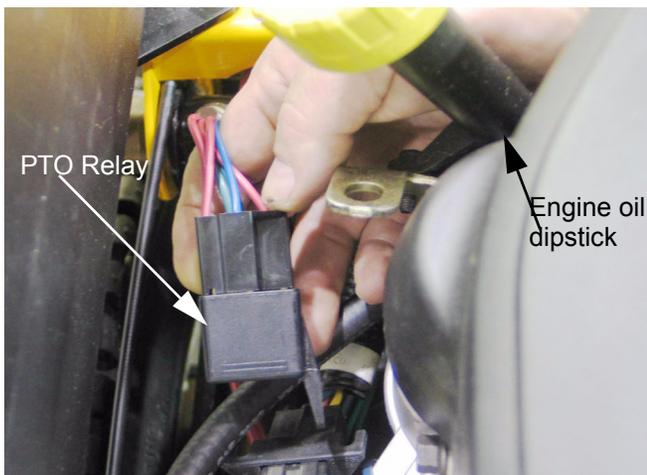


Figure 28.6

28.7. The PTO relay works as follows: See Figure 28.7.

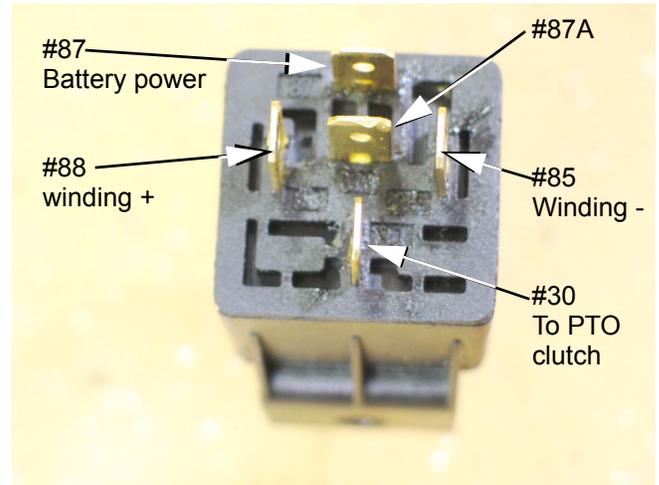


Figure 28.7

- When power (blue wire, spade #88) and ground (green wires, spade #85) are present, the windings in the relay are energized.
- When the relay is energized, battery power (red wires, spade #87) is connected to the PTO clutch (via red wire w/black trace, spade #30).

28.8. **PTO clutch:** The PTO clutch is an Ogura model JD08 with brake (BBC). See Figure 28.8.

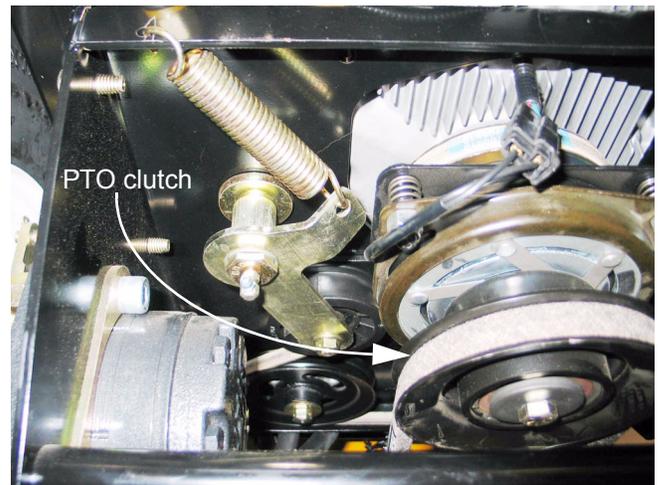


Figure 28.8

- Typical resistance in the clutch windings is 2.9 Ω . A much higher reading indicates open windings.
- A new clutch should be burnished in accordance with the Operators Manual.
- Air gap is adjustable. It should be .020"-.035" (.51mm-.90mm), checked at 100-hr. intervals.

Cub Cadet Commercial Z-Wing

28.9. **Brake safety switch:** The brake safety switch is mounted in the control console, immediately behind the parking brake lever. See Figure 28.9.



Figure 28.9

28.10. The switch is most easily reached for service by removing the two screws holding the switch bracket to the control housing using a 5/16" wrench. Once disconnected, the bracket and switch can be lowered beneath the frame for access, then unplugged. See Figure 28.10.



Figure 28.10

28.11. The brake switch contains two sets of contacts:

- One set is normally open, breaking the starter circuit when the brake is not applied (switch plunger up).
- One set is normally closed, as indicated by the letters "N.C." stamped on the spades. The N.C. contacts are part of the engine kill safety circuit.

28.12. **Seat safety switch:** See Figure 28.12.

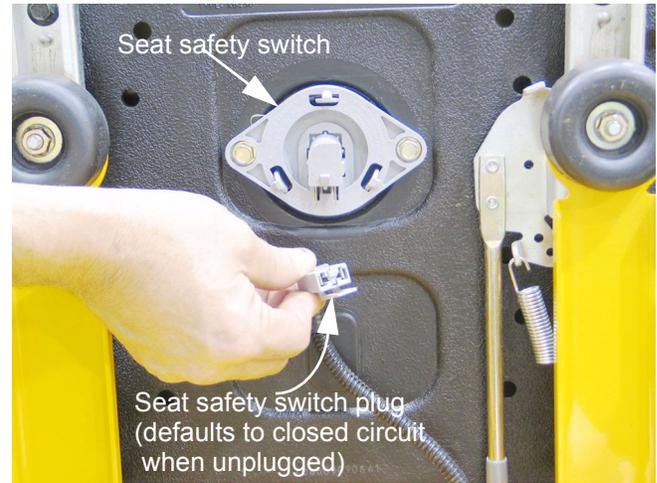


Figure 28.12

- The switch is enclosed in a housing that attaches into the bottom of the seat with two screws. They can be removed using a 3/8" wrench.
- The contacts in the switch are normally closed (N.C.).
- The switch is part of the engine kill safety circuit.
- The plug that connects to the switch contains a contact that closes the circuit if the switch is unplugged, defaulting to a closed circuit rather than an open circuit.

28.13. **Wing lift safety switch:** The wing lift safety switches are normally open (N.O.), and wired together in series. See Figure 28.13.



Figure 28.13

Cub Cadet Commercial Z-Wing

28.14. The contacts in the switches are closed when the plungers are depressed by lowering the wings.

- For adjustment procedures, refer to sub-sections 11.15 through 11.17 in the HINGE LOCK: LATE 2005 PRODUCTION section of this manual, or sub-sections 9.15 and 9.16 in the DECK WING AND HINGE LOCK section of this manual. Use whichever instructions that apply to the mower being serviced.
- Remove the lift wing shield using a 9/16" wrench to gain access to the switch.

28.15. **Wing lift control switch:** To remove the switch: See Figure 28.15.

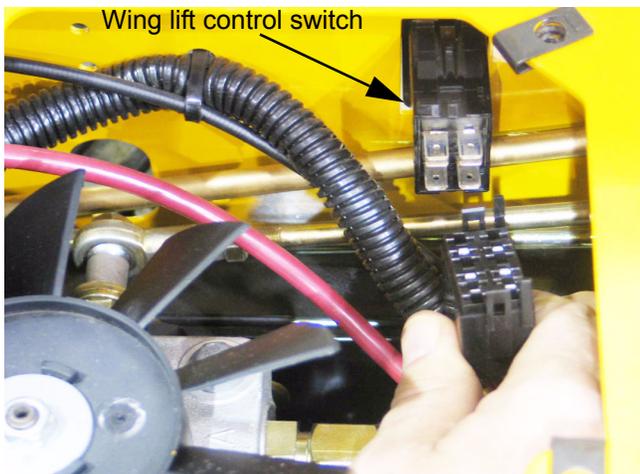


Figure 28.15

- Remove the hydro service plate using a 3/8" wrench.
- Reach forward in the left side of the control housing to disconnect and remove the wing lift control switch.

28.16. There are six spade terminals on the back of the deck wing lift control switch, oriented in two columns of three: See Figure 28.16.

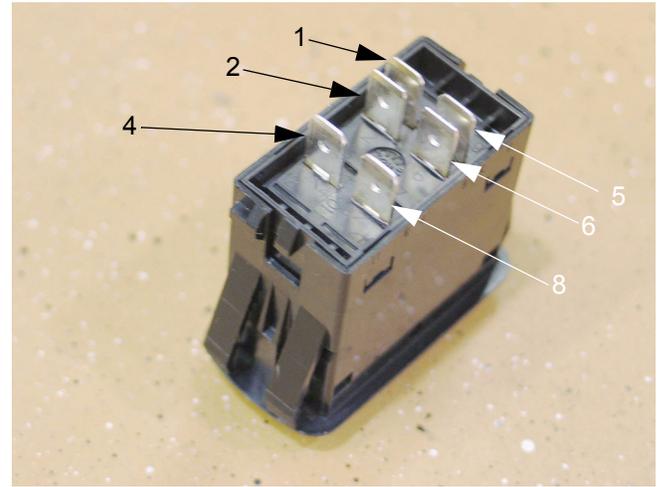


Figure 28.16

- Spades in one column are numbered: 1, 2, & 4.
- Spades in the second column are numbered: 5, 6, & 8.
- The center spade in each column (#2 and #6) are common, with #2 (red / black trace) carrying power and #6 (black) carrying ground.

28.17. Rocking the switch in one direction closes contacts joining #1 to #2 (yellow) and #5 to #6 (red), connecting power to terminal #2 and ground to terminal #5. See Figure 28.17.

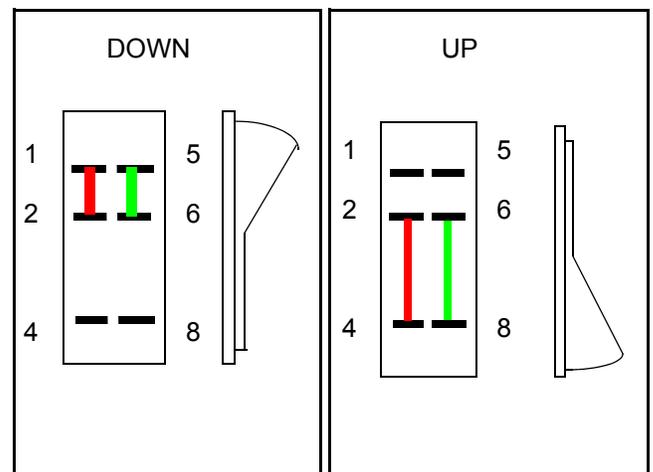


Figure 28.17

28.18. Rocking the switch in the opposite direction closes contacts joining #2 to #4 (red) and #6 to #8 (yellow), connecting power to terminal #4 and ground to terminal #8.

Cub Cadet Commercial Z-Wing

28.19. Jumper wires connect... : See Figure 28.19.

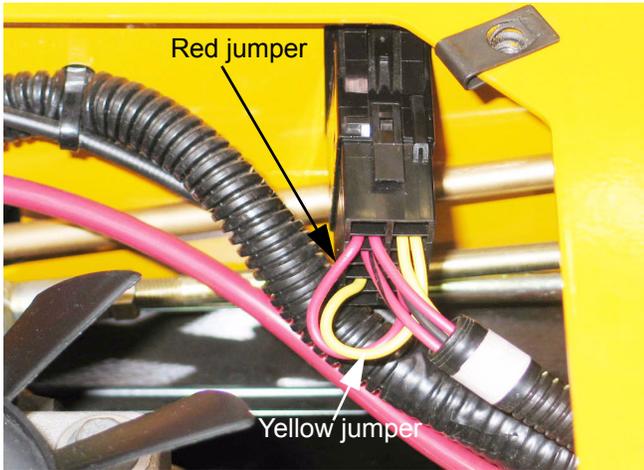


Figure 28.19

- Terminal #5 to terminal #4 (yellow jumper)
- Terminal #8 to terminal #1 (red jumper)
- Effectively reversing polarity in the two wires that lead to the wing lift actuator when the rocker switch is in the DOWN position.

28.20. **Wing lift actuator:** The wing lift actuator responds to the wing lift control switch, connected to it by the red (R) and yellow (Y) wires. See Figure 28.20.

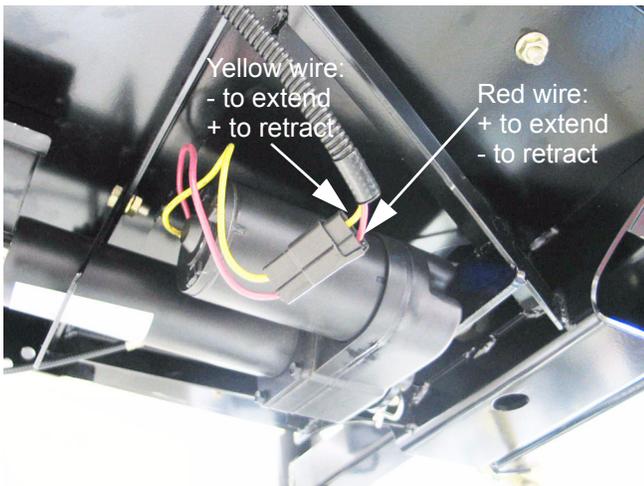


Figure 28.20

- Positive current on the red wire, with ground on the yellow wire causes the actuator to extend, lowering the wings.
- Positive current on the yellow wire, with ground on the red wire causes the actuator to retract, raising the wings.

28.21. **Fuse:** The fuse holder can be found on the main harness conduit, near the left front corner of the engine. It should contain a 20A automotive type fuse. See Figure 28.21.

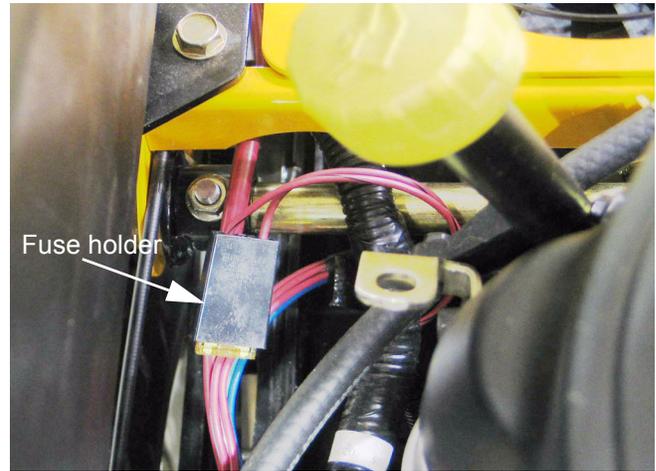


Figure 28.21

28.22. There is a second fuse holder and fuse in the harness, to the rear of the starter motor. This fuse is used for other applications of the engine, and is not of any importance in this electrical system. See Figure 28.22.

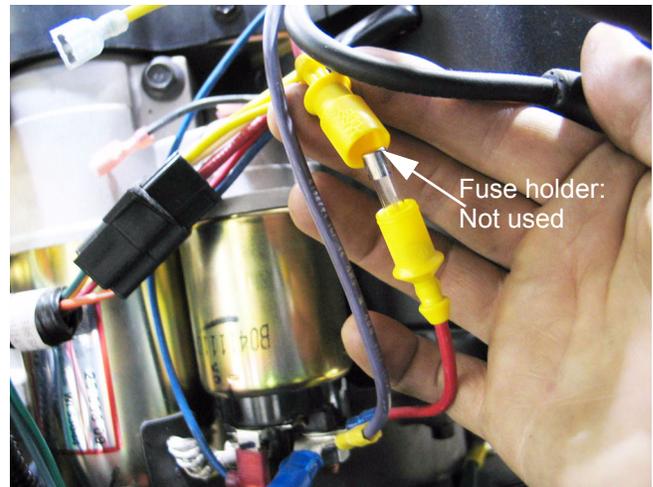


Figure 28.22

Cub Cadet Commercial Z-Wing

28.23. **Battery:** The battery is type 12CE18, which fits tightly in a cavity beneath the seat. See Figure 28.23.

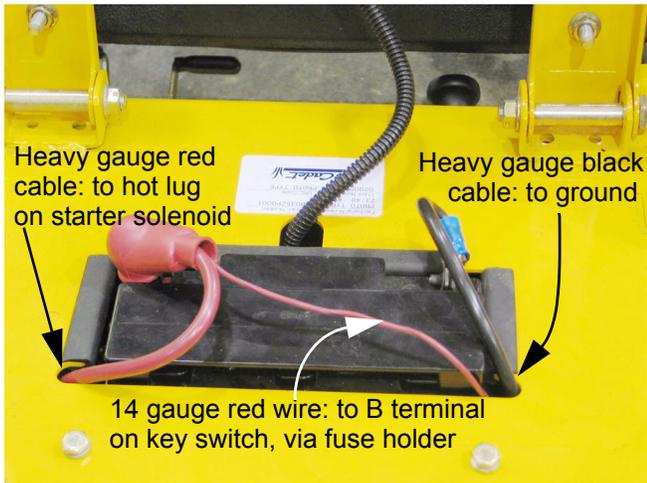


Figure 28.23

- It measures 7" wide x 3" deep x 6.5" tall (17.8cm x 7.6cm x 16.5cm), and has an 18 A/Hr. capacity.
- The posts are oriented + left and - right when viewed from the rear of the mower.

28.24. **Hour meter:** The hour meter is clipped-into the front surface of the control housing. It can be removed by unplugging the electrical connection and squeezing the clips that secure it. See Figure 28.24.

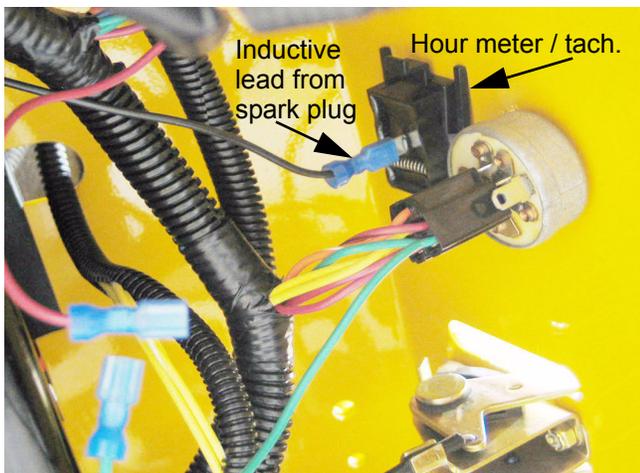


Figure 28.24

28.25. The hour meter incorporates an engine tachometer. See Figure 28.25.



Figure 28.25

- The hour meter is completely isolated from the rest of the mower's electrical system. It is driven by an inductive signal from the spark plug wire.
- The function switches automatically to tachometer when the meter is receiving a signal from the inductive pick-up, which happens when the engine is running.
- When the signal ceases (engine is turned off), the tachometer reverts to an hour meter.

28.26. Engine harness to mower harness connector: is located near the starter motor. See Figure 28.26.

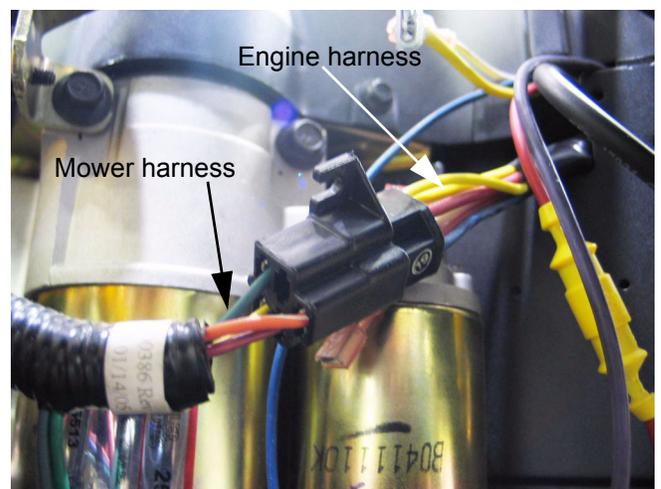


Figure 28.26

Cub Cadet Commercial Z-Wing

28.27. The harnesses are joined in the order indicated in the chart: See Figure 28.27.

Mower Harness		Engine Harness	
Circuit	Color	Color	Circuit
Starter	O/w	Bu+R (2)	Starter
Ground	Gn	Y (2X)	Ground
Key Sw. M and Safety	Y	W (2X)	Mag Kill
Key Sw. L	R	R	After-fire Sol.
Dead end		R	Fused hot
Bat. Cable	R	V	Charge*

* Connects at hot lug on starter

Figure 28.27

28.28. Engine harness - **magneto**: The white wires connect to the kill tang on each of the two ignition modules.

28.29. Engine harness - **after-fire solenoid**: The red wire connects the after-fire solenoid on the bottom of the carburetor. See Figure 28.29.

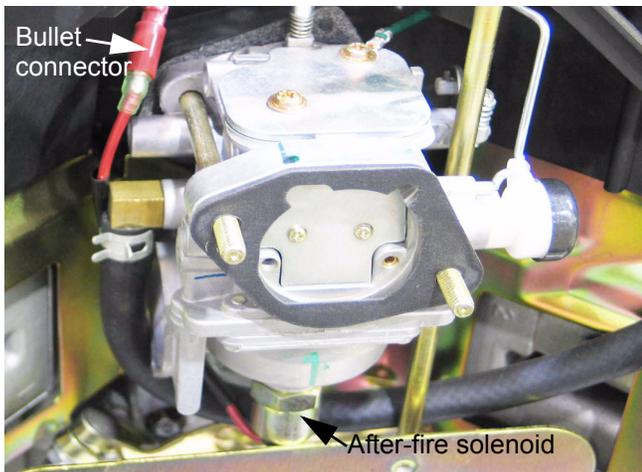


Figure 28.29

28.30. Engine harness - **alternator**: Raw output from the stator enters the regulator / rectifier through two white wires, just visible under the flywheel.

28.31. Engine harness - **regulator / rectifier**: The regulator / rectifier is mounted near the right front corner of the engine, extending into the blower shroud. See Figure 28.31.

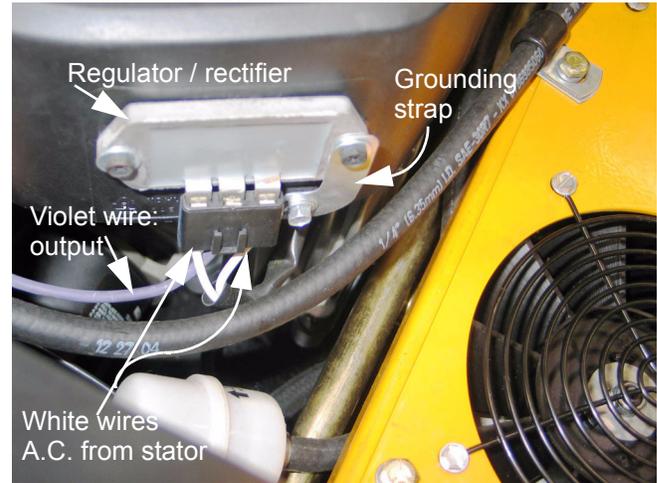


Figure 28.31

- The violet wire carries charging current to the battery, via the hot lug on the starter.
 - The L-shaped strap must maintain good ground contact with the engine block.
 - Raw stator output enters through white wires.
- 28.32. The amperage out-put of the alternator can be tested using an automotive VAT tester, a Briggs& Stratton DC shunt (P/N 19359), or a suitable amp meter.
- D.C. output should be 12.5 - 14.5 volts at 3,600 RPM with a fully charged battery.

Cub Cadet Commercial Z-Wing

29.5. Power passes from the PTO switch to the N.O. contacts on the brake switch through the orange w/black trace wire. See Figure 29.5.



Figure 29.5

- If the contacts are closed (brake applied, plunger depressed), the current continues through a plain orange wire to the engine harness connector.
 - If the contacts are open, the circuit will not complete and power will not reach the starter.
- 29.6. At the engine harness connector, the orange wire corresponds to a blue wire that connects to the trigger spade on the starter solenoid.
- 29.7. The solenoid and starter receive high-amperage current through a heavy-gauge red battery cable connected to the heavy lug on the starter solenoid.
- 29.8. The **L terminal** directs power to the after-fire solenoid and the accessory circuits (PTO and Wing lift) through a red wire when the key is in the START position.

30. ELECTRICAL: ENGINE STOP CIRCUIT

30.1. With the key in the OFF position, Terminals G, M, and L are connected within the key switch. See Figure 30.1.

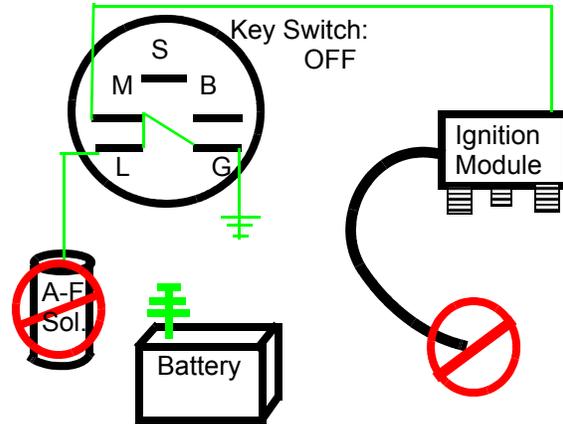


Figure 30.1

- 30.2. **Terminal G** is connected to a green wire that constitutes the ground circuit. The ground circuit is connected to the frame of the mower and the engine block.
- 30.3. The heavy gauge black cable connected to the negative post of the battery also leads to the frame of the mower.
- 30.4. **Terminal L** is connected to a red wire that provides power to the accessory circuits and to the after-fire solenoid on the carburetor.
- 30.5. When the engine is running, the after-fire solenoid draws power from the charging circuit. See Figure 30.5.

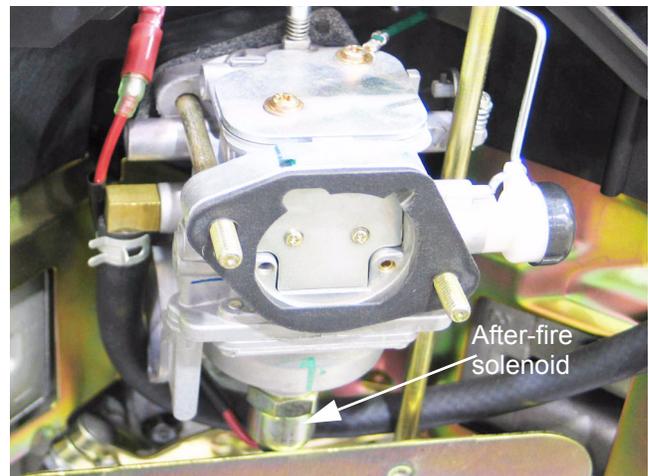


Figure 30.5

Cub Cadet Commercial Z-Wing

- 30.6. To stop the engine without an occurrence of after-fire, it is necessary to deprive the after-fire solenoid of power from the charging circuit as well as from the key switch.
- 30.7. This is done by grounding-out the charging circuit through the key switch connection to G terminal.
- 30.8. Through the **M terminal**, the magneto finds ground by its connection to the G terminal with the key in the OFF position.

31. ELECTRICAL: ENGINE-STOPPING SAFETY CIRCUITS

- 31.1. The object of the engine stopping safety circuits is to prevent the mower from running if an inherently unsafe condition exists.
- 31.2. Unsafe conditions that will cause engine shut-down include:
- Engine running with the seat unoccupied and the parking brake released.
 - Engine running with the seat unoccupied and the cutting deck engaged.
- 31.3. The seat safety switch is central to the system. See Figure 31.3.

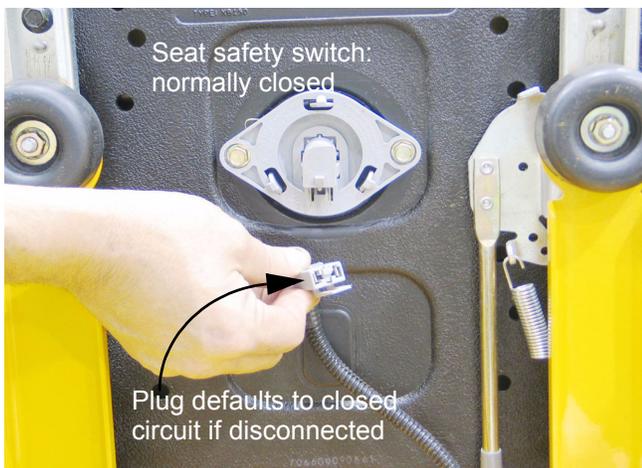


Figure 31.3

NOTE: Seat switch plug defaults to closed circuit if disconnected.

- 31.4. The yellow wire that connects the M terminal on the key switch to the ignition modules connects to the seat switch. The paired yellow w/white trace wires from the second terminal on the seat switch extend to the Brake switch and the PTO switch.
- 31.5. If the seat is empty (contacts closed) a ground path may be completed through the PTO switch. See Figure 31.5.

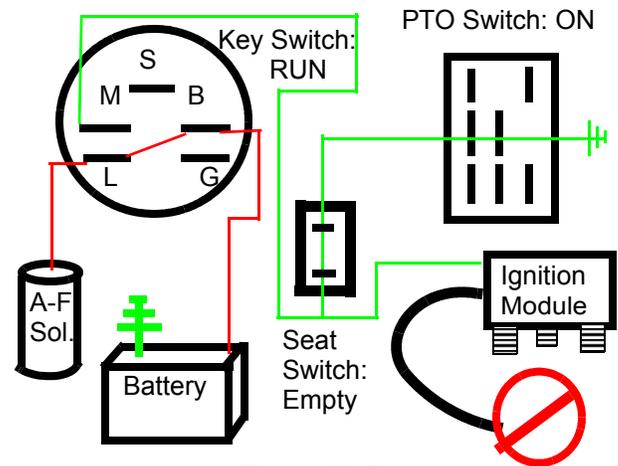


Figure 31.5

- 31.6. If the seat is empty (contacts closed) a ground path may be completed through the brake switch. See Figure 31.6.

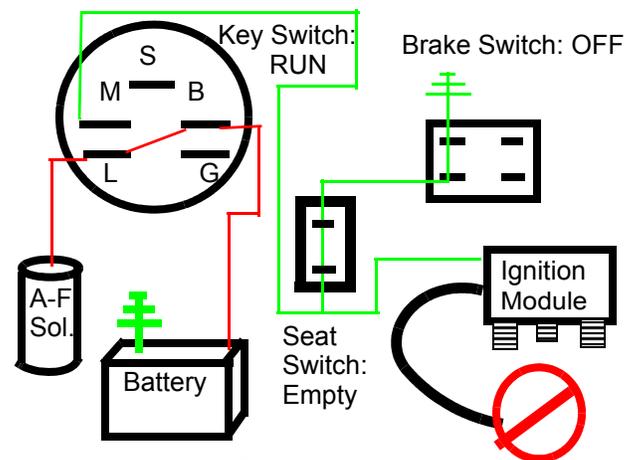


Figure 31.6

Cub Cadet Commercial Z-Wing

32. ELECTRICAL: PTO CIRCUIT

32.1. The operation of the PTO clutch is governed by the PTO relay. See Figure 32.1.

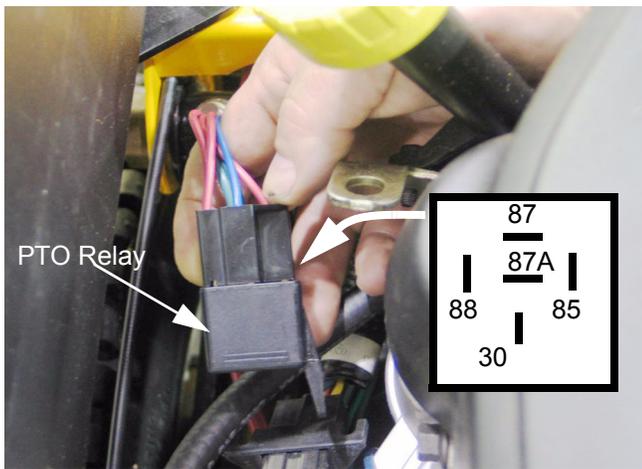


Figure 32.1

32.2. When the relay is energized it passes power to the PTO clutch (R/bk wire, #30).

- Power is present at the common terminal (red wires, #87) when the key switch is in any position other than OFF.
- The windings have a constant ground (green wires, #85).
- The windings are energized (blue wires, #88) by power from the PTO switch and both wing lift safety switches, with all three switches in series.

32.3. Power from the key switch flows to the common spade on set of contacts C of the PTO switch. See Figure 32.3.

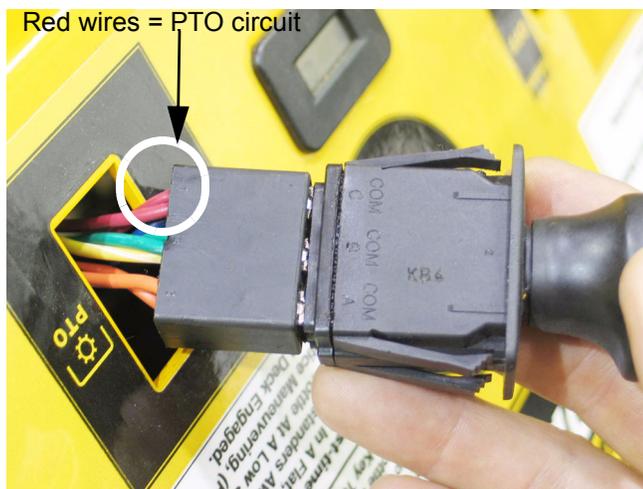


Figure 32.3

32.4. One red wire continues on to the common spade on the relay.

32.5. When the PTO switch is turned-ON, the power at C-COM spade is passed to the blue wires connected to the C-N.O. spade on the PTO switch.

32.6. The blue wires run to both wing lift safety switches in series. See Figure 32.6.



Figure 32.6

32.7. If both deck wings are down and latched, power reaches spade #88 on the relay, energizing the windings. See Figure 32.7.

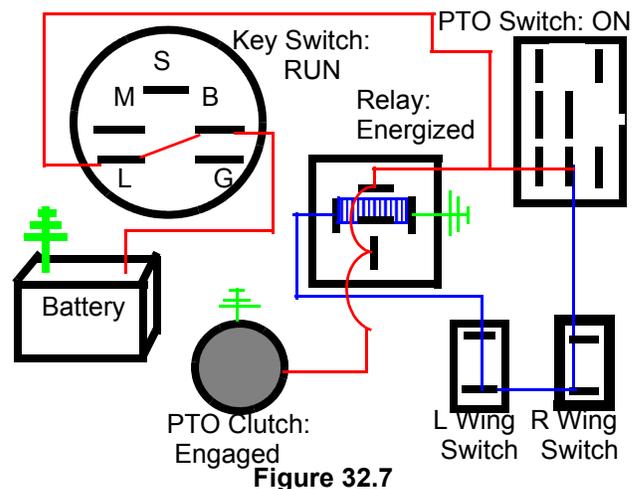


Figure 32.7

Cub Cadet Commercial Z-Wing

33. ELECTRICAL: DECK WING LIFT

33.1. The deck wing lift switch has a constant ground to spade #6 (black wire). Spade #2 (red wire/black trace) receives power whenever the key switch is in any position other than OFF. See Figure 33.1.

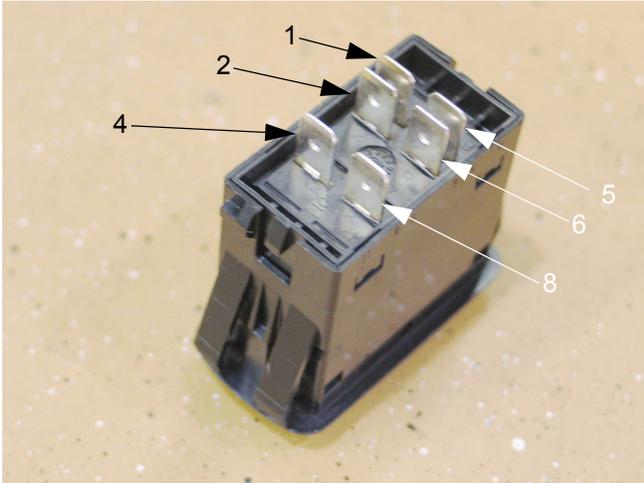


Figure 33.1

33.2. Rocking the switch in one direction closes contacts joining 1 to 2 (Y) and 5 to 6 (R), connecting power to terminal 2 and ground to terminal 5. See Figure 33.2.

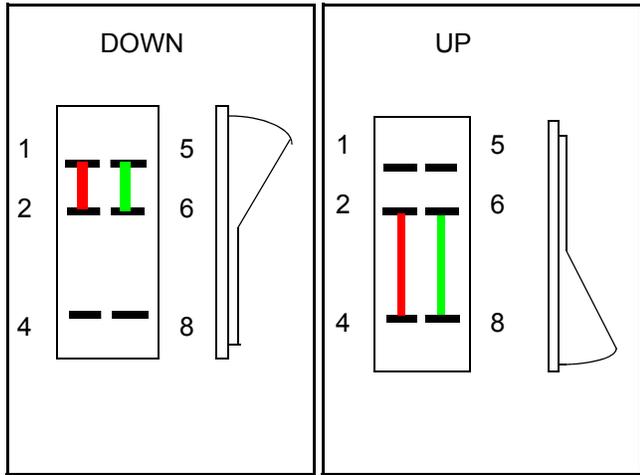


Figure 33.2

33.3. Rocking the switch in the opposite direction closes contacts joining 2 to 4 (R) and 6 to 8 (Y), connecting power to terminal 4 and ground to terminal 8. See Figure 33.3.

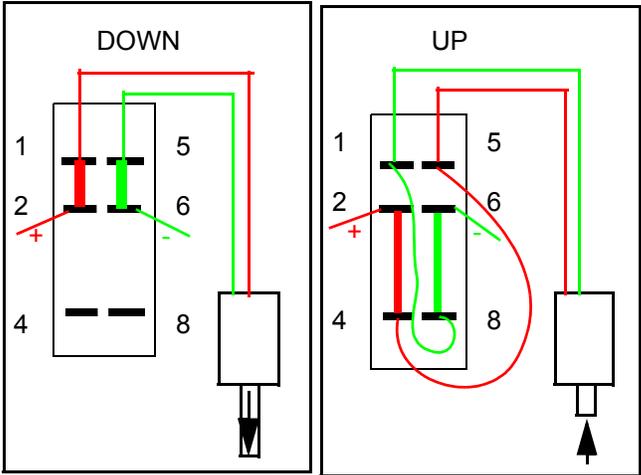


Figure 33.3

33.4. Rocking the switch in the opposite direction closes contacts joining 2 to 4 (R) and 6 to 8 (Y), connecting power to terminal 4 and ground to terminal 8.

33.5. Jumper wires between terminals 4&5 and 1&8 reverse the polarity to drive the motor the opposite direction.

33.6. The lift motor extends an actuator to lower the wings, and retracts to raise the wings. See Figure 33.6.

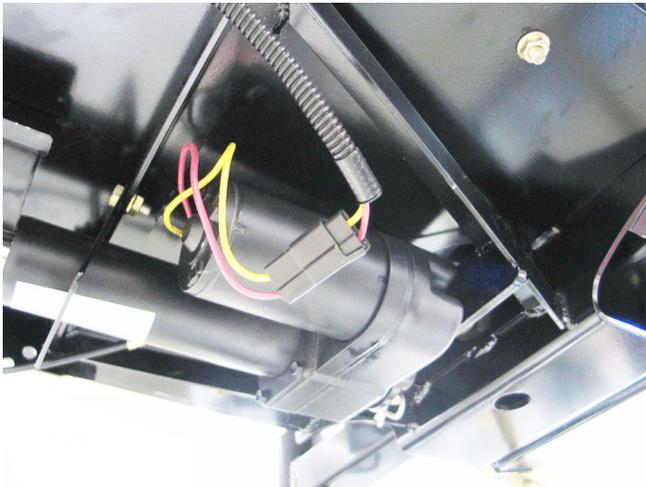


Figure 33.6

Cub Cadet Commercial Z-Wing

34. ELECTRICAL: CHARGING CIRCUIT

- 34.1. The output of the charging system reaches the “hot” lug on the starter solenoid through the violet wire from the regulator / rectifier.
See Figure 34.1.

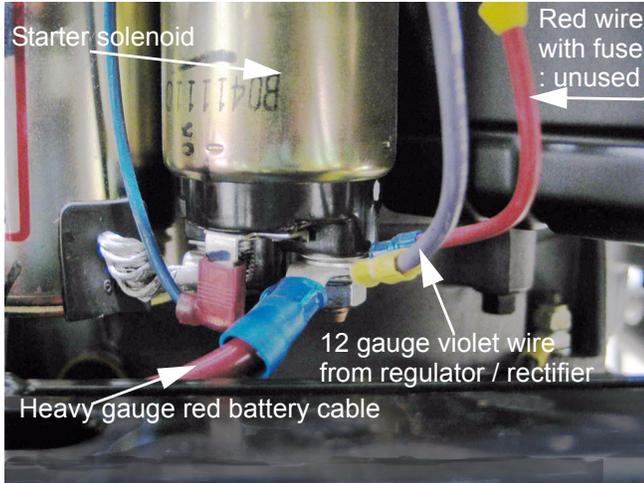


Figure 34.1

- 34.2. At this point (hot lug), charging system output is transferred directly to the heavy-gauge cable. The other end of the heavy gauge cable is connected directly to the positive post on the battery.

35. CHARGING SYSTEM DIAGNOSIS

- 35.1. D.C. voltage output of the regulator rectifier is easily checked by connecting a DVOM, set to read D.C. voltage between the violet wire and a good ground such as the negative battery post or engine block. See Figure 35.1.

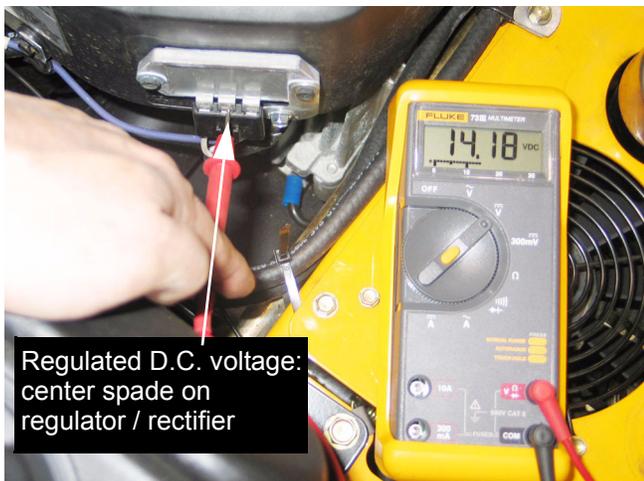


Figure 35.1

- 35.2. The voltage read at this point, with the engine running at 3,600 RPM, should be more than battery voltage, but less than 14.7 V. Higher voltage indicates a bad regulator / rectifier.
- 35.3. Voltage read at this point with the engine turned-off will be whatever is in the battery.
- 35.4. Amperage out-put of the charging system requires a Ammeter to be wired in-series with the stator circuit (white wires), or the use of an inductive ammeter. Output will vary with load. this charging system has a nominal capacity of 15 Amps.
- 35.5. The regulator / rectifier can be tested in isolation from the rest of the system using a tester manufactured by Kohler (P/N: 25 761 20). Following Kohler's instructions: See Figure 35.5.



Figure 35.5

- Unplug the harness connector from the regulator / rectifier, being careful not to short the center spade to either of the outer spades in the process.
- Connect the wire with the clip on it to a good ground. The L-shaped strap with zinc-coated screw that connects the regulator / rectifier to the engine block is an important ground, and a clean, firm connection should be maintained.
- Connect the red lead to the center, output spade on the regulator / rectifier.
- Connect the two black leads to the outer spades on the regulator rectifier.
- Plug the tester into a 110V base plug, turn-on the power, and press the test button.
- Regulator / rectifier condition is indicated by the status light.

Cub Cadet Commercial Z-Wing

35.6. With the regulator / rectifier disconnected, it is also possible to check the stator output:
See Figure 35.6.

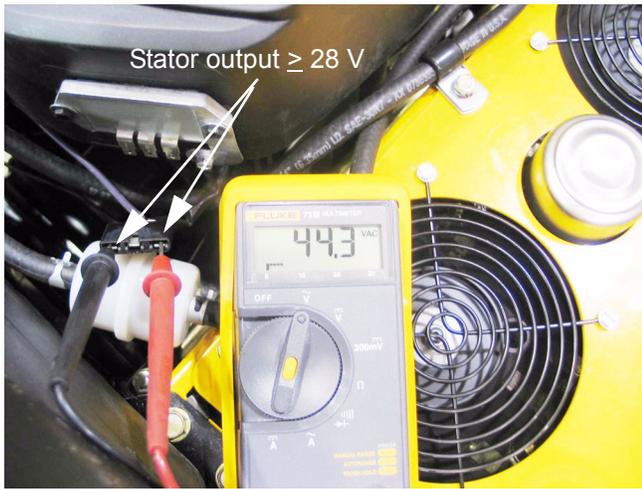


Figure 35.6

- Start the engine, and set the throttle to maintain 3,600 RPM.
- Touch the probes of a DVOM set to read A.C. voltage to the female spade terminals on the ends of the white wires in the harness plug that connects to the regulator / rectifier.
- Output of a good stator should be greater than 28 volts.

35.7. With the engine turned-off, it is possible to check the stator for an open condition:
See Figure 35.7.

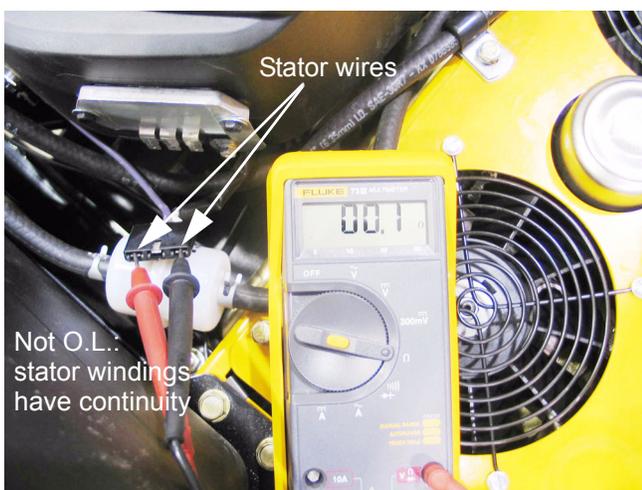


Figure 35.7

35.7 Continued...

- With the DVOM set to read Ohms, insert the probes into the female spade terminals on the ends of the white wires in the harness plug that connects to the regulator / rectifier.
- If the reading is infinity or O.L., the stator windings are open, and it should be replaced.

35.8. With the engine turned-off, it is possible to check the stator for a shorted condition:
See Figure 35.8.

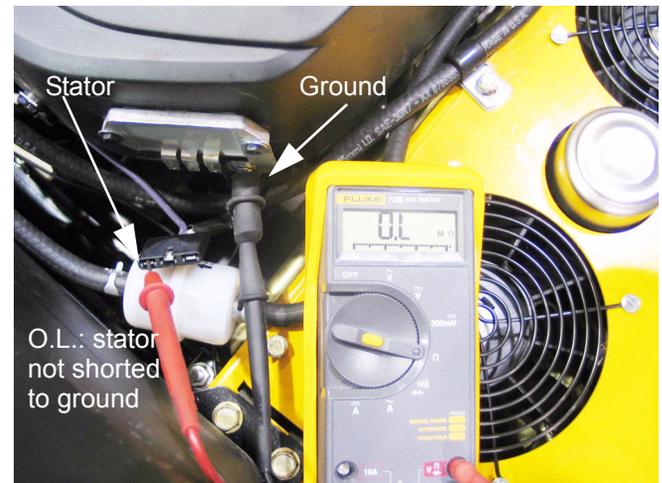


Figure 35.8

- With the DVOM set to read Ohms, insert one probe into one of the female spade terminals on the ends of the white wires in the harness plug that connects to the regulator / rectifier. Touch the other probe to ground.
 - Repeat for the second white wire.
- 35.9. If either test produces a measurement other than infinity or O.L., the stator is shorted, and it should be replaced.

Cub Cadet Commercial Z-Wing

36. RESISTANCE

36.1. Electrical resistance in the wiring harness of this mower can cause a variety of problems:

- Hard starting
- Insufficient charging of the battery
- Slow wing lift action
- PTO “fall-out”

36.2. Ohms, represented by the symbol Ω is a measure of electrical resistance. Ohm’s law defines the relationship between volts (pressure), amps (electron flow), and ohms (resistance) as:
1 volt = 1 amp X 1 ohm.

36.3. While it is typical to state resistance in terms of ohms, there is another means of measuring the actual effects of resistance that is more useful for the diagnosis of electrical problems.

36.4. To illustrate why ohm measurement can be misleading for a technician, a resistance reading on a short length of 14ga wire is 0.00.
See Figure 36.4.

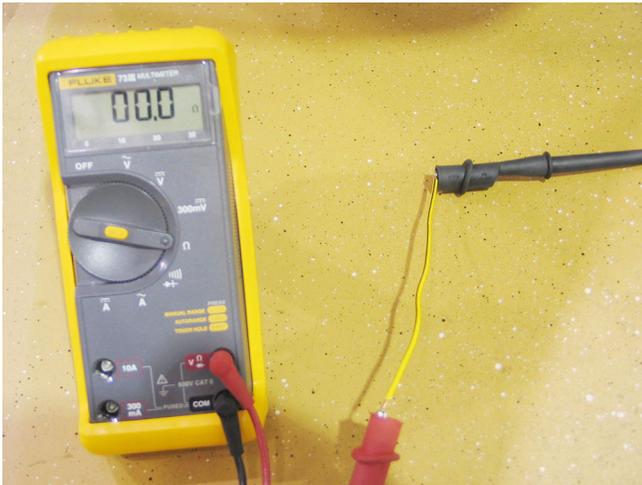


Figure 36.4

36.5. That resistance reading does not change much as the individual strands are whittled-away.
See Figure 36.5.



Figure 36.5

- In this illustration, indicated resistance in the wire did not change until all but two copper strands were cut.
 - While the indicated resistance does not change, but the current-carrying capacity of the wire does.
 - It is the current-carrying capacity that effects the electrical performance of the mower.
- 36.6. A more relevant measure of the effects of resistance is called “voltage drop”, and it is easily measured using a DVOM set to read D.C. volts.

Cub Cadet Commercial Z-Wing

36.7. As an example: See Figure 36.7.



Figure 36.7

- Connect the DVOM probes to two points on the same side of a circuit (eg. between the positive post on the battery and the trigger wire on the starter solenoid).
- Activate the circuit (crank the starter).
- Watch the reading on the meter.

36.8. Interpretation:

- A voltage reading greater than 1 indicates resistance in the circuit that deserves investigation.
- A voltage reading greater than 2 will cause performance issue with the mower, and needs to be repaired.
- Repeating the test on individual components or portions of the circuit can help identify the sources of resistance.

36.9. Voltage drop tests can also be used on the ground side of the circuit.

NOTE: Resistance on the ground side is frequently over-looked in diagnosis, but it can cause as many problems as resistance on the hot side of the circuit.

NOTE: Ground issues can manifest themselves in multiple circuits because many positive-side circuits share ground paths. In complex systems, power will even hunt for ground in near-by circuits. This is typified in the automotive field by a brake light that does not work, but the adjacent tail light dimly when the brake pedal is depressed.

36.10. To demonstrate a voltage drop test on the ground side of the system, the meter is connected between the negative terminal on the battery, and the ground strap on the regulator / rectifier. See Figure 36.10.

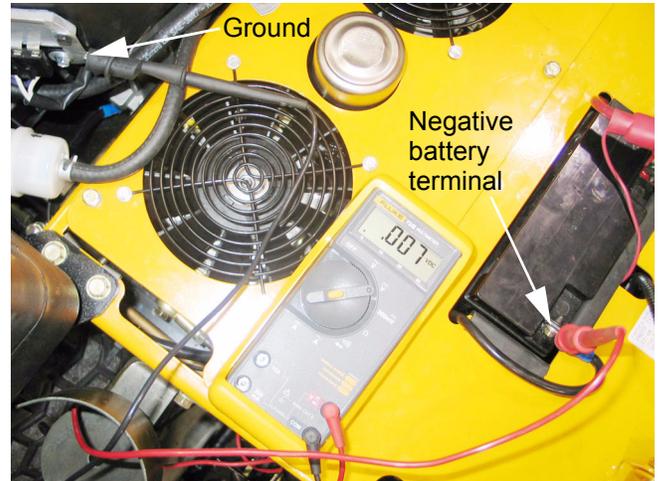


Figure 36.10

36.11. With the starter motor turning, the ground-side voltage drop measures only .007 VAC, indicating a good ground path.

36.12. Sources of resistance:

- Corroded wires or terminals
- Pinched or chafed wires
- Loose terminal connections
- Inappropriate fasteners; bright zinc or zinc-dichromate fasteners transfer voltage much better than black oxide or oil-and-phos coated fasteners.
- Insulation from paint (eg. between engine and frame).
- Burned or corroded contacts within switches or relays.

Cub Cadet Commercial Z-Wing

36.13. When testing switches on the bench, resistance beyond $.2 \Omega$ indicates a problem. See Figure 36.13.



Figure 36.13

36.14. Always test switches in all modes of operation to confirm that they work correctly. See Figure 36.14.



Figure 36.14

**- Z-WING 48
NUMBER (02000386)**

