

Product: New Holland L221/L228/C227/C232/C237 Loader Service Repair Manual

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# SERVICE MANUAL

## L221 / L228 Tier 4B (final)

### 200 Series Skid Steer Loader

*PIN NGM418237 and above; PIN NHM435463 and above*

## C227 / C232 / C237 Tier 4B (final)

### 200 Series Compact Track Loader

*PIN NGM418237 and above; PIN NHM435463 and above*

**Part number 48068128**

1<sup>st</sup> edition English

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## SERVICE MANUAL

**C227 TIER 4B (FINAL) [NGM418237 - ], C227 TIER 4B (FINAL) [NHM435463 - ],  
C232 TIER 4B (FINAL) [NGM418237 - ], C232 TIER 4B (FINAL) [NHM435463 - ],  
C237 TIER 4B (FINAL) [NHM435463 - ], L221 TIER 4B (FINAL) [NGM418237 - ],  
L221 TIER 4B (FINAL) [NHM435463 - ], L228 TIER 4B (FINAL) [NGM418237 - ],  
L228 TIER 4B (FINAL) [NHM435463 - ]**

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## Link Product / Engine

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Product	Market Product	Engine
C227 TIER 4B (FINAL) [NGM418237 - ]	North America	F5HFL463A*F001
C227 TIER 4B (FINAL) [NHM435463 - ]	North America	F5HFL463A*F001
C232 TIER 4B (FINAL) [NGM418237 - ]	North America	F5HFL463A*F001
C232 TIER 4B (FINAL) [NHM435463 - ]	North America	F5HFL463A*F001
C237 TIER 4B (FINAL) [NHM435463 - ]	North America	F5HFL463A*F001
L221 TIER 4B (FINAL) [NGM418237 - ]	North America	F5HFL463A*F001
L221 TIER 4B (FINAL) [NHM435463 - ]	North America	F5HFL463A*F001
L228 TIER 4B (FINAL) [NGM418237 - ]	North America	F5HFL463A*F001
L228 TIER 4B (FINAL) [NHM435463 - ]	North America	F5HFL463A*F001

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## INTRODUCTION

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## INTRODUCTION

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## **Foreword - Important notice regarding equipment servicing**

All repair and maintenance work listed in this manual must be carried out only by qualified dealership personnel, strictly complying with the instructions given, and using, whenever possible, the special tools.

Anyone who performs repair and maintenance operations without complying with the procedures provided herein shall be responsible for any subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional, or local dealers, reject any responsibility for damages caused by parts and/or components not approved by the manufacturer, including those used for the servicing or repair of the product manufactured or marketed by the manufacturer. In any case, no warranty is given or attributed on the product manufactured or marketed by the manufacturer in case of damages caused by parts and/or components not approved by the manufacturer.

The manufacturer reserves the right to make improvements in design and changes in specifications at any time without notice and without incurring any obligation to install them on units previously sold. Specifications, descriptions, and illustrative material herein are as accurate as known at time of publication but are subject to change without notice.

In case of questions, refer to your NEW HOLLAND CONSTRUCTION Sales and Service Networks.

## Safety rules - Ecology and the environment

Soil, air, and water quality is important for all industries and life in general. When legislation does not yet rule the treatment of some of the substances that advanced technology requires, sound judgment should govern the use and disposal of products of a chemical and petrochemical nature.

Familiarize yourself with the relative legislation applicable to your country, and make sure that you understand this legislation. Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, anti-freeze, cleaning agents, etc., with regard to the effect of these substances on man and nature and how to safely store, use, and dispose of these substances.

### Helpful hints

- Avoid the use of cans or other inappropriate pressurized fuel delivery systems to fill tanks. Such delivery systems may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of these products contain substances that may be harmful to your health.
- Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
- Avoid spillage when you drain fluids such as used engine coolant mixtures, engine oil, hydraulic fluid, brake fluid, etc. Do not mix drained brake fluids or fuels with lubricants. Store all drained fluids safely until you can dispose of the fluids in a proper way that complies with all local legislation and available resources.
- Do not allow coolant mixtures to get into the soil. Collect and dispose of coolant mixtures properly.
- The air-conditioning system contains gases that should not be released into the atmosphere. Consult an air-conditioning specialist or use a special extractor to recharge the system properly.
- Repair any leaks or defects in the engine cooling system or hydraulic system immediately.
- Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
- Protect hoses during welding. Penetrating weld splatter may burn a hole or weaken hoses, allowing the loss of oils, coolant, etc.

### Battery recycling

Batteries and electric accumulators contain several substances that can have a harmful effect on the environment if the batteries are not properly recycled after use. Improper disposal of batteries can contaminate the soil, groundwater, and waterways. NEW HOLLAND CONSTRUCTION strongly recommends that you return all used batteries to a NEW HOLLAND CONSTRUCTION dealer, who will dispose of the used batteries or recycle the used batteries properly. In some countries, this is a legal requirement.



### Mandatory battery recycling

**NOTE:** The following requirements are mandatory in Brazil.

Batteries are made of lead plates and a sulfuric acid solution. Because batteries contain heavy metals such as lead, CONAMA Resolution 401/2008 requires you to return all used batteries to the battery dealer when you replace any batteries. Do not dispose of batteries in your household garbage.

Points of sale are obliged to:

- Accept the return of your used batteries
- Store the returned batteries in a suitable location
- Send the returned batteries to the battery manufacturer for recycling

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## Safety rules

### Personal safety



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

**⚠ DANGER** indicates a hazardous situation that, if not avoided, will result in death or serious injury.

**⚠ WARNING** indicates a hazardous situation that, if not avoided, could result in death or serious injury.

**⚠ CAUTION** indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

### **FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.**

### Machine safety

**NOTICE:** *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

### Information

**NOTE:** *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

## Safety rules

### **CALIFORNIA PROPOSITION 65 WARNING**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Battery post, terminals and related accessories contain lead and lead compounds.

**Wash hands after handling**

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## Safety rules - Personal safety

**Carefully study these precautions, and those included in the external attachment operators manual, and insist that they be followed by those working with and for you.**

1. Thoroughly read and understand this manual and the attachment Operator's Manual before operating this or any other equipment.
2. Be sure all people and pets are clear of the machine before starting. Sound the horn, if equipped, three times before starting engine.
3. Only the operator should be on the machine when in operation. Never allow anyone to climb on to the machine while it is in motion. If the machine is equipped with an Instructors Seat, this must only be used for training purposes. Passengers must not be allowed to use the Instructors Seat.
4. Keep all shields in place. Never work around the machine or any of the attachments while wearing loose clothing that might catch on moving parts.
5. Observe the following precautions whenever lubricating the machine or making adjustments.
  - Disengage all clutching levers or switches.
  - Lower the attachment, if equipped, to the ground or raise the attachment completely and engage the cylinder safety locks. Completing these actions will prevent the attachment from lowering unexpectedly.
  - Engage the parking brake.
  - Shut off the engine and remove the key.
  - Wait for all machine movement to stop before leaving the operators platform.
6. Always keep the machine in gear while travelling downhill.
7. The machine should always be equipped with sufficient front or rear axle weight for safe operation.
8. Under some field conditions, more weight may be required at the front or rear axle for adequate stability. This is especially important when operating in hilly conditions or/when using heavy attachments.
9. Always lower the attachment, shut off the engine, set the parking brake, engage the transmission gears, remove the key and wait for all machine movement to stop before leaving the operators platform.
10. If the attachment or machine should become obstructed or plugged; set the parking brake, shut off the engine and remove the key, engage the transmission gears, wait for all machine or attachment motion to come to a stop, before leaving the operators platform to removing the obstruction or plug.
11. Never disconnect or make any adjustments to the hydraulic system unless the machine and/or the attachment is lowered to the ground or the safety lock(s) is in the engaged position.
12. Use of the flashing lights is highly recommended when operating on a public road.
13. When transporting on a road or highway, use accessory lights and devices for adequate warning to the operators of other vehicles. In this regard, check local government regulations. Various safety lights and devices are available from your NEW HOLLAND CONSTRUCTION dealer.
14. Practice safety 365 days a year.
15. Keep all your equipment in safe operating condition.
16. Keep all guards and safety devices in place.
17. Always set the parking brake, shut off the engine and remove the key, engage the transmission gears, wait for all machine or attachment motion to come to a stop, before leaving the operators platform to service the machine and attachment.
18. Remember: A careful operator is the best insurance against an accident.
19. Extreme care should be taken in keeping hands and clothing away from moving parts.

## Basic instructions - Loader arm lock and cab tilt procedure - radial lift machines

C227 TIER 4B (FINAL) [NGM418237 - ]	
C227 TIER 4B (FINAL) [NFM435463 - ]	
L221 TIER 4B (FINAL) [NGM418237 - ]	
L221 TIER 4B (FINAL) [NFM435463 - ]	

### ▲ DANGER

#### Crushing hazard!

Do not enter or exit the operator's compartment while the loader arms are raised or unsupported. Rest the loader arms on the ground or verify that loader arm is being supported by the loader arm strut or loader arm lock pin before entering or exiting the operator's compartment.

Failure to comply will result in death or serious injury.

D0168A

### ▲ WARNING

#### Crushing hazard! Loader arms are unsupported during support strut removal.

Do not enter or exit the operator's compartment with an unsupported loader arm. Two persons are required during storage. One person should remove and store the support strut while the operator remains in the operator's compartment.

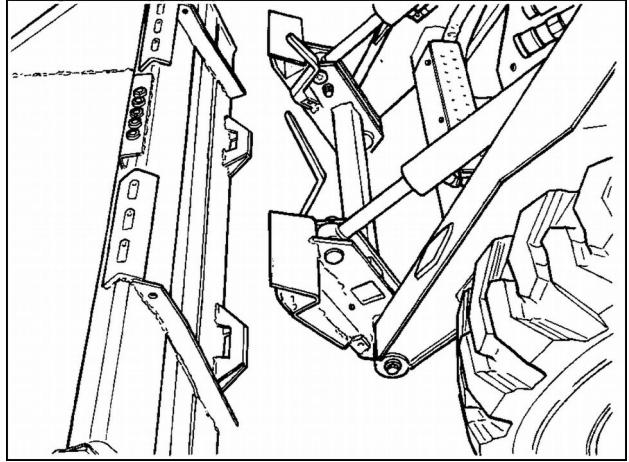
Failure to comply could result in death or serious injury.

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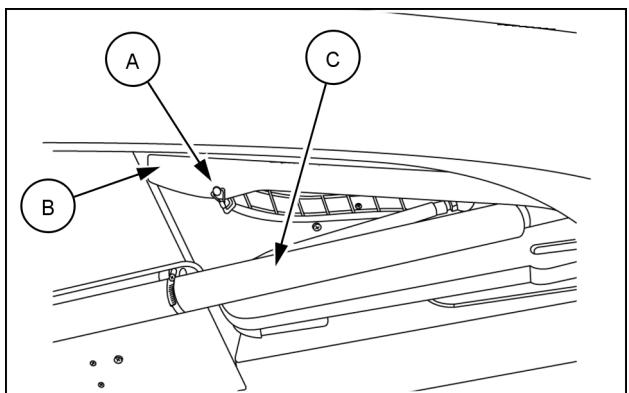
### Raise and lock the loader arm for machine service

**NOTE:** An instructional decal on the inside of the right-hand loader arm, just above the support strut is also available. Understand the loader arm lock procedure before continuing.

1. Sit in the operator's seat, fasten the seat belt, and start the engine.
2. Press the OPERATE button to enable the hydraulics.
3. Remove the bucket or attachment from the mounting plate.
4. Park the machine on firm and level surface.
5. If an assistant is not available, turn off the engine and exit the machine.
6. Remove the support strut pin (A) and let the support strut (B) rest on the lift cylinder barrel (C).

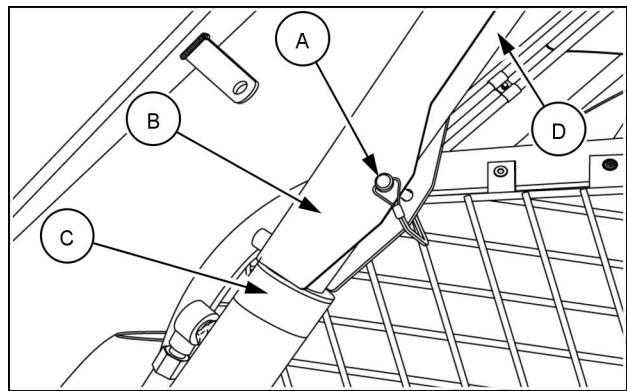


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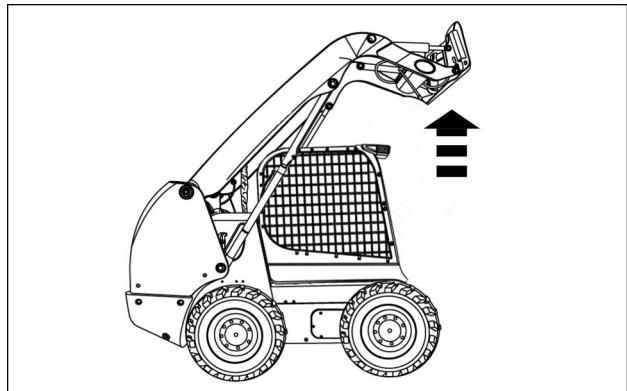


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7. Slowly raise the loader arm until the support strut (B) falls onto the cylinder rod (D).
8. Stop the engine.
9. Pull up on the override control knob (red control knob near the right-hand side of the operator's seat). The support strut (B) will brace against the top of the cylinder barrel (C)..
10. Ask an assistant to insert the pin (A) into the support strut (B). If an assistant is not available visually confirm that the support strut is braced against the top of the cylinder barrel before exiting the machine.



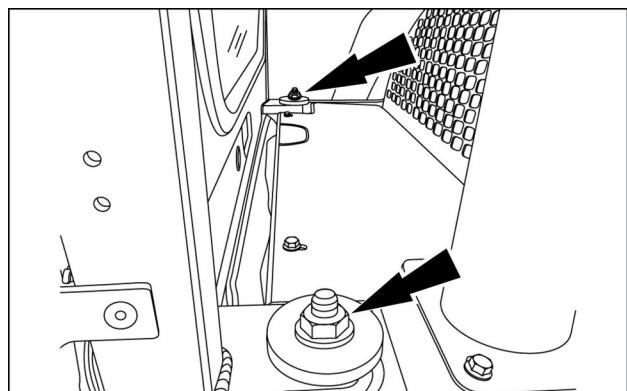
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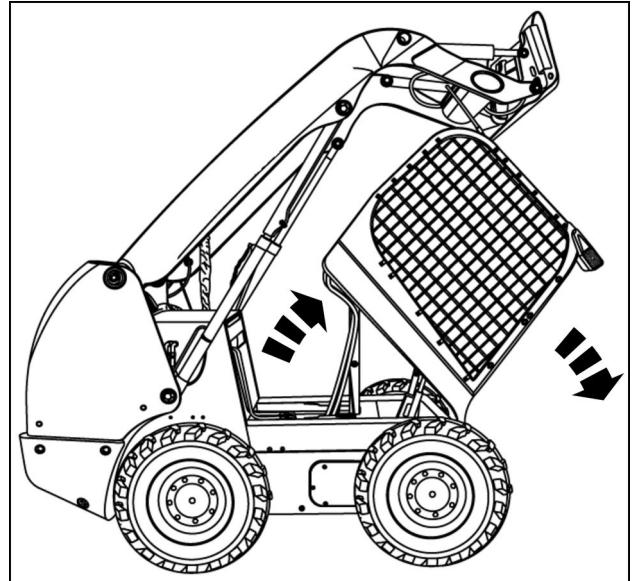
### Tilt and lock the cab forward for machine service

1. Remove the two, rear retaining nuts, located at the rear of the cab.



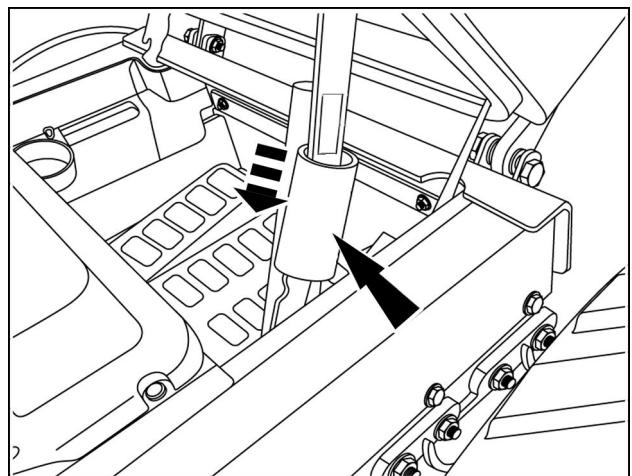
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2. Pull on the hand holds at the front of the machine until the cab is completely tilted forward.



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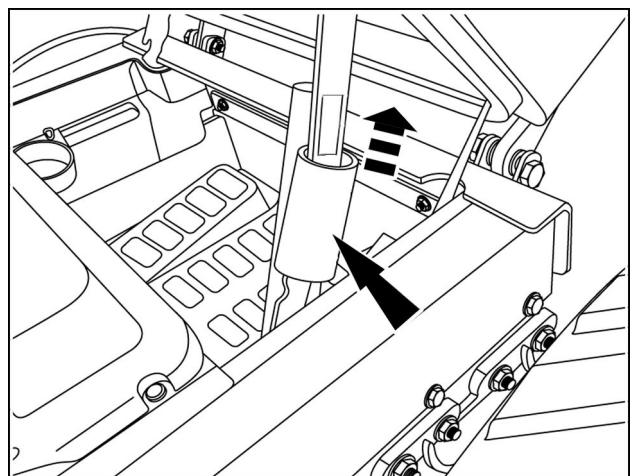
3. Confirm that the red lock tube has lowered over the cab pivot linkage. If it has the cab tilt position is now secure.



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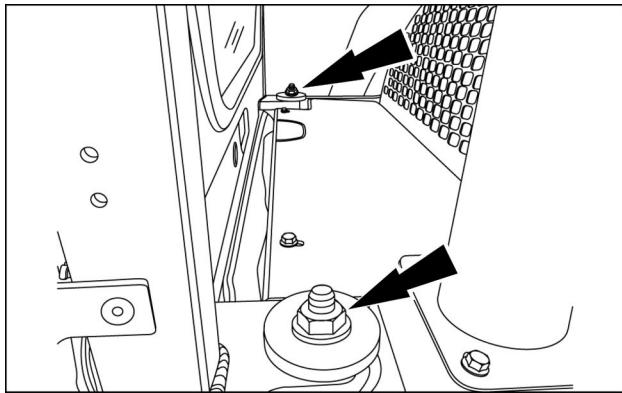
### Tilt and secure the cab for machine operation

1. Raise the red lock tube exposing the cab pivot linkage.
2. Push the cab backward into the operation position.



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3. Install the retaining nuts. Torque the nuts to **170 N·m** (125 lb ft).



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### Unlock and lower the loader arm for machine operation

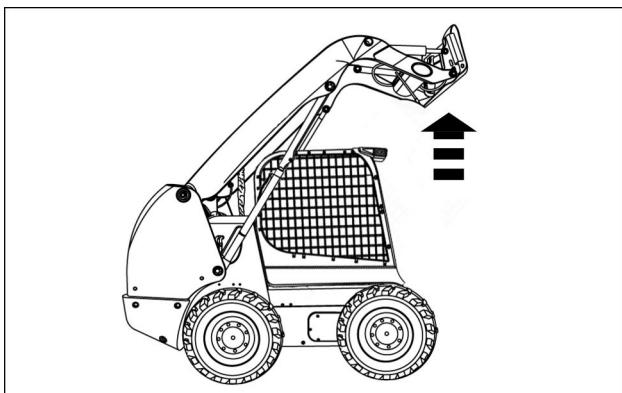
#### ⚠️ WARNING

**Crushing hazard!** Loader arms are unsupported during support strut removal.

**Do not enter or exit the operator's compartment with an unsupported loader arm.** Two persons are required during storage. One person should remove and store the support strut while the operator remains in the operator's compartment.

**Failure to comply could result in death or serious injury.**

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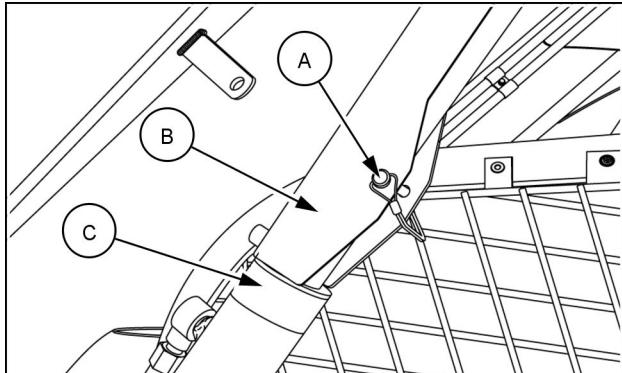


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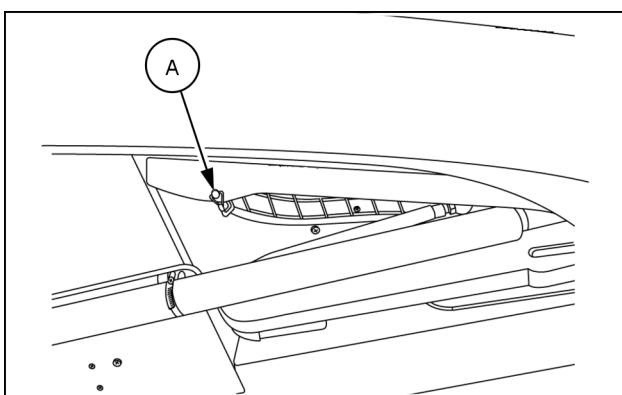
**NOTE:** An instructional decal on the inside of the right-hand loader arm, just above the support strut is also available. Understand the loader arm unlock procedure before continuing.

Placing the support strut in the storage position requires a second person. The operator must remain in the seat during this procedure.

1. Sit in the operator's seat, fasten the seat belt, and start the engine.
2. Press the operate button to enable the hydraulics.
3. Raise the loader arm until the support strut (B) is not resting on the end of the cylinder barrel (C).
4. Instruct the second person to remove the support strut pin (A) and place the support strut in the stowed position and reinstall the support strut pin (A). When the second person has cleared the area, the operator may now lower the loader arm.
5. Commence work operations or park the machine and stop the engine.



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## Basic instructions - Loader arm lock and cab tilt procedure - vertical lift machines

C232 TIER 4B (FINAL) [NGM418237 - ]	
C232 TIER 4B (FINAL) [NFM435463 - ]	
C237 TIER 4B (FINAL) [NFM435463 - ]	
L228 TIER 4B (FINAL) [NGM418237 - ]	
L228 TIER 4B (FINAL) [NFM435463 - ]	

### ⚠ WARNING

#### Crushing hazard!

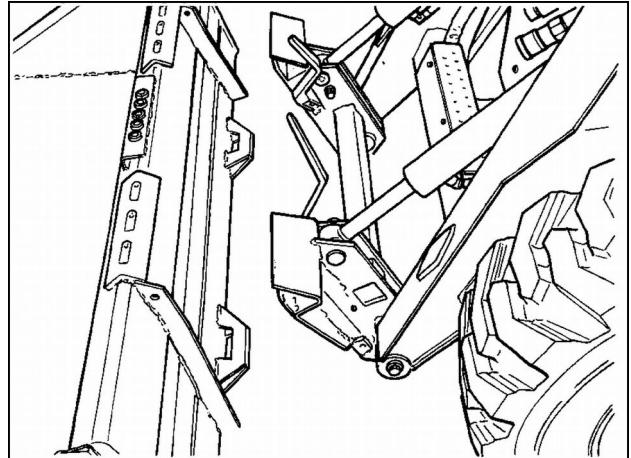
Do not enter or exit the operator's compartment while the loader arms are raised or unsupported. Rest the loader arms on the ground or verify that loader arm is being supported by the loader arm strut or loader arm lock pin before entering or exiting the operator's compartment.

Failure to comply could result in death or serious injury.

W1365A

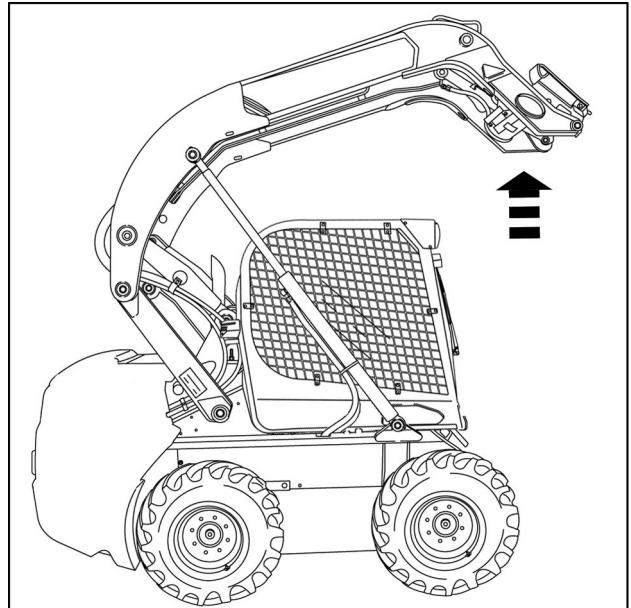
### Raise and lock the loader arm for machine service

1. Sit in the operator's seat, fasten the seat belt, and start the engine.
2. Press the operate button to enable the hydraulics.
3. Remove the bucket or attachment from the mounting plate.
4. Park the machine on a level surface.



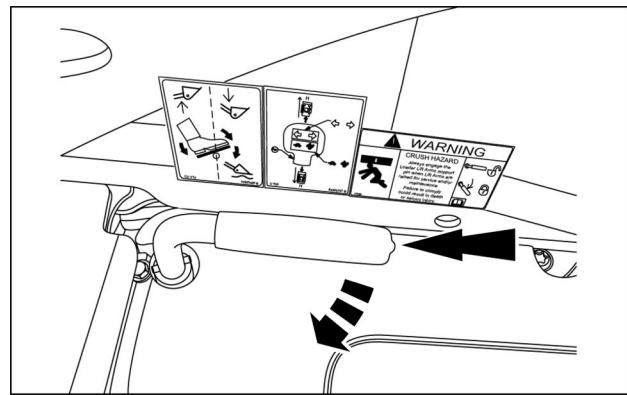
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5. Fully raise the loader arm.



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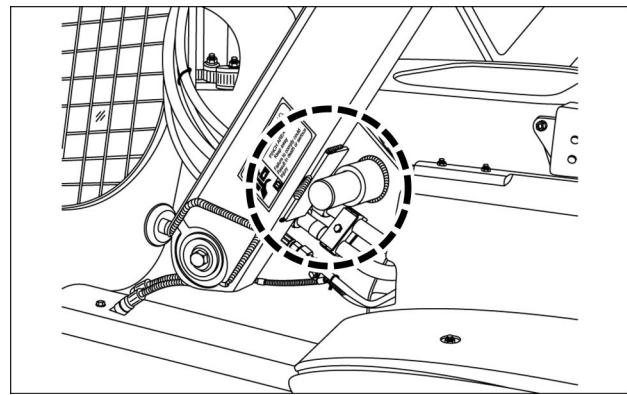
6. Locate the loader arm lock lever on the left-hand side of the operator's seat.
7. Rotate the lock lever toward the operator's seat (clockwise) to engage the lock support pin(s).
8. Stop the engine.



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9. Pull up on the override control knob (red control knob near the right-hand side of the operator's seat). The loader will brace against the lock support pin and keep the loader arm in a raised position.

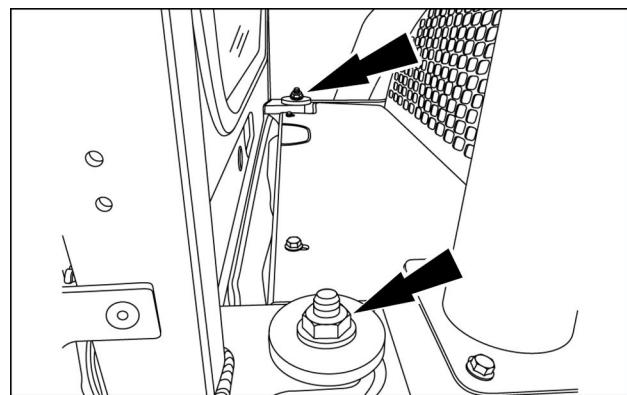
**NOTE:** Only use the override control knob to lower the loader arm in emergency situations when engine power is not available or to lower it onto the lock support pin for servicing the machine.



93107457 4

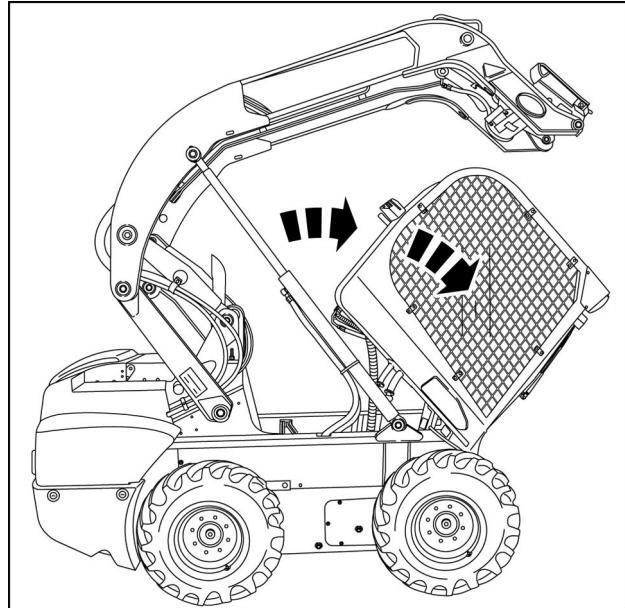
### Tilt and lock the cab forward for machine service

1. Remove the two, rear retaining nuts, located at the rear of the cab.



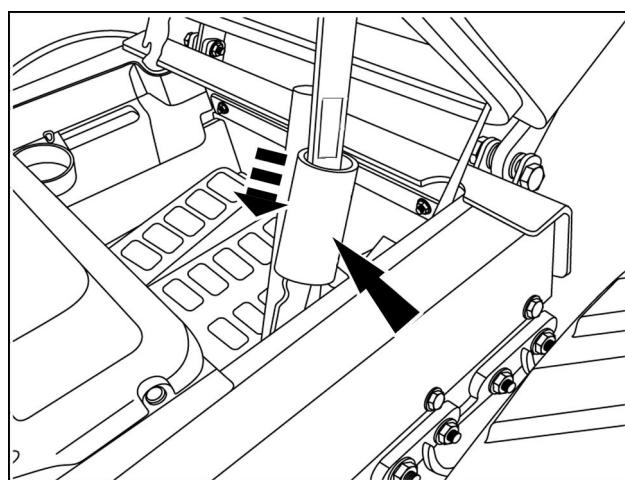
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2. Pull on the hand holds at the front of the machine until the cab is completely tilted forward.



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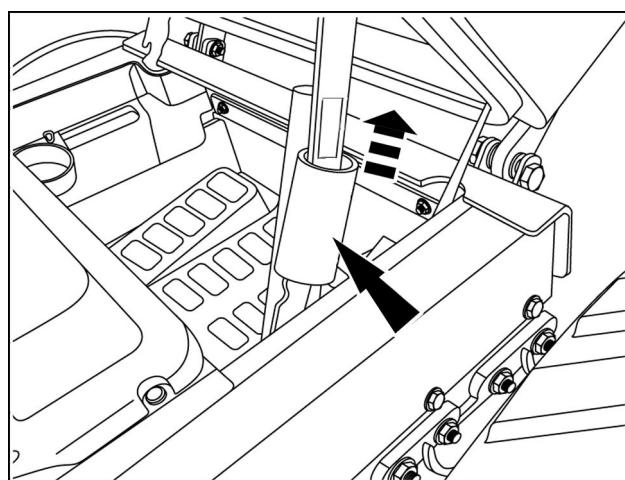
3. Confirm that the red lock tube has lowered over the cab pivot linkage. If it has the cab tilt position is now secure.



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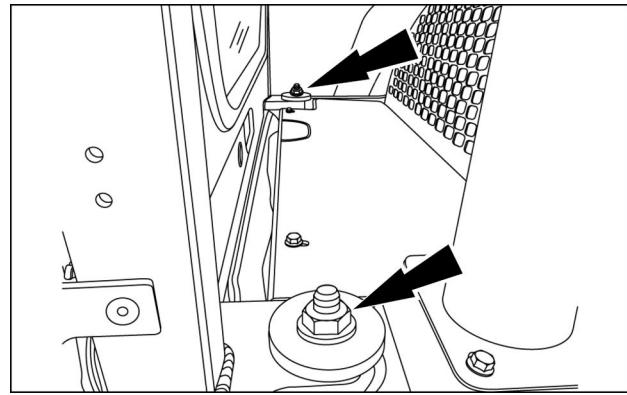
### Tilt and secure the cab for machine operation

1. Raise the red lock tube exposing the cab pivot linkage.
2. Push the cab backward into the operation position.



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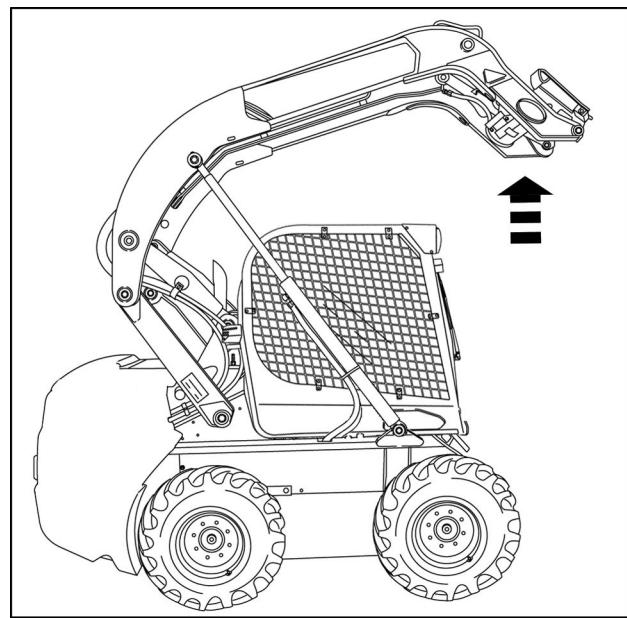
3. Install the retaining nuts. Torque the nuts to **170 N·m** (125 lb ft).



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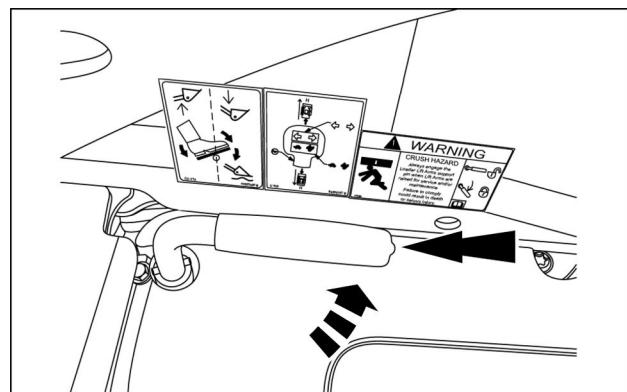
### Unlock and lower the loader arm for machine operation

1. Sit in the operator's seat, fasten the seat belt, and start the engine.
2. Press the operate button to enable the hydraulics.
3. Fully raise the loader arm.



RAPH14SSL0351BA 10

4. Rotate the lock lever away from the seat (counter clockwise) to retract the lock pin(s).
5. Lower the loader arm.
6. Commence work operations or park the machine and stop the engine.



RAIL14SSL0427AA 11

## Torque - Standard torque data for hydraulics

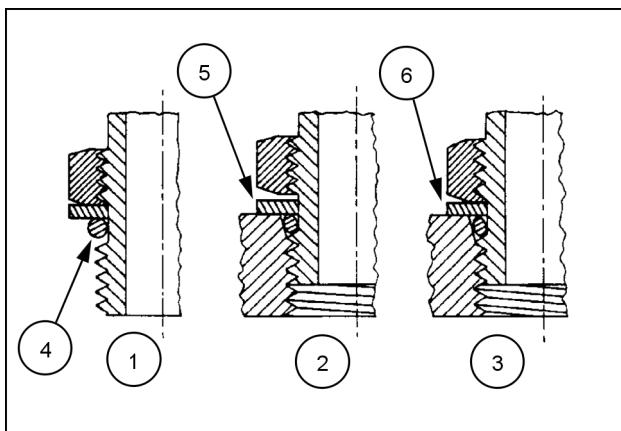
### INSTALLATION OF ADJUSTABLE FITTINGS IN STRAIGHT THREAD O RING BOSSES

1. Lubricate the O-ring by coating it with a light oil or petroleum. Install the O-ring in the groove adjacent to the metal backup washer which is assembled at the extreme end of the groove (4).

2. Install the fitting into the SAE straight thread boss until the metal backup washer contacts the face of the boss (5).

**NOTE:** Do not over tighten and distort the metal backup washer.

3. Position the fitting by turning out (counterclockwise) up to a maximum of one turn. Holding the pad of the fitting with a wrench, tighten the locknut and washer against the face of the boss (6).



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### STANDARD TORQUE DATA FOR HYDRAULIC TUBES AND FITTINGS

TUBE NUTS FOR 37° FLARED FITTINGS			O-RING BOSS PLUGS ADJUSTABLE FITTING LOCKNUTS, SWIVEL JIC- 37° SEATS
SIZE	TUBING OD	THREAD SIZE	TORQUE
4	6.4 mm (1/4 in)	7/16-20	12 – 16 N·m (9 – 12 lb ft)
5	7.9 mm (5/16 in)	1/2-20	16 – 20 N·m (12 – 15 lb ft)
6	9.5 mm (3/8 in)	9/16-18	29 – 33 N·m (21 – 24 lb ft)
8	12.7 mm (1/2 in)	3/4-16	47 – 54 N·m (35 – 40 lb ft)
10	15.9 mm (5/8 in)	7/8-14	72 – 79 N·m (53 – 58 lb ft)
12	19.1 mm (3/4 in)	1-1/16-12	104 – 111 N·m (77 – 82 lb ft)
14	22.2 mm (7/8 in)	1-3/16-12	122 – 136 N·m (90 – 100 lb ft)
16	25.4 mm (1 in)	1-5/16-12	149 – 163 N·m (110 – 120 lb ft)
20	31.8 mm (1-1/4 in)	1-5/8-12	190 – 204 N·m (140 – 150 lb ft)
24	38.1 mm (1-1/2 in)	1-7/8-12	217 – 237 N·m (160 – 175 lb ft)
32	50.8 mm (2 in)	2-1/2-12	305 – 325 N·m (225 – 240 lb ft)
			339 – 407 N·m (250 – 300 lb ft)

These torques are not recommended for tubes of 12.7 mm (1/2 in) OD and larger with wall thickness of 0.889 mm (0.035 in) or less. The torque is specified for 0.889 mm (0.035 in) wall tubes on each application individually.

Before installing and torquing 37° flared fittings, clean the face of the flare and threads with a clean solvent or Loctite cleaner and apply hydraulic sealant to the 37° flare and the threads.

Install fitting and torque to specified torque, loosen fitting and retorque to specifications.

**PIPE THREAD FITTING TORQUE**

Before installing and tightening pipe fittings, clean the threads with a clean solvent or Loctite cleaner and apply sealant for all fittings including stainless steel or for most metal fittings. For high filtration/zero contamination systems use .

PIPE THREAD FITTING	
Thread Size	Torque (Maximum)
1/8-27	13 N·m (10 lb ft)
1/4-18	16 N·m (12 lb ft)
3/8-18	22 N·m (16 lb ft)
1/2-14	41 N·m (30 lb ft)
3/4-14	54 N·m (40 lb ft)

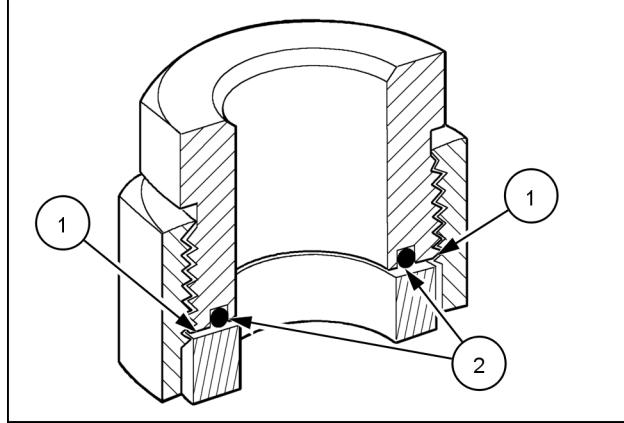
**INSTALLATION OF ORFS (O-RING FLAT FACED) FITTINGS**

When installing ORFS fittings thoroughly clean both flat surfaces of the fittings (1) and lubricate the O-ring (2) with light oil. Make sure both surfaces are aligned properly. Torque the fitting to specified torque listed throughout the repair manual.

**NOTICE:** *If the fitting surfaces are not properly cleaned, the O-ring will not seal properly. If the fitting surfaces are not properly aligned, the fittings may be damaged and will not seal properly.*

**NOTICE:** *Always use genuine factory replacement oils and filters to ensure proper lubrication and filtration of engine and hydraulic system oils.*

The use of proper oils, grease, and keeping the hydraulic system clean will extend machine and component life.



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## Basic instructions - Shop and assembly

### Shimming

For each adjustment operation, select adjusting shims and measure the adjusting shims individually using a micrometer, then add up the recorded values. Do not rely on measuring the entire shimming set, which may be incorrect, or the rated value shown on each shim.

### Rotating shaft seals

For correct rotating shaft seal installation, proceed as follows:

1. Before assembly, allow the seal to soak in the oil it will be sealing for at least thirty minutes.
2. Thoroughly clean the shaft and check that the working surface on the shaft is not damaged.
3. Position the sealing lip facing the fluid.

**NOTE:** *With hydrodynamic lips, take into consideration the shaft rotation direction and position the grooves so that they will move the fluid towards the inner side of the seal.*

4. Coat the sealing lip with a thin layer of lubricant (use oil rather than grease). Fill the gap between the sealing lip and the dust lip on double lip seals with grease.
5. Insert the seal in its seat and press down using a flat punch or seal installation tool. Do not tap the seal with a hammer or mallet.
6. While you insert the seal, check that the seal is perpendicular to the seat. When the seal settles, make sure that the seal makes contact with the thrust element, if required.
7. To prevent damage to the seal lip on the shaft, position a protective guard during installation operations.

### O-ring seals

Lubricate the O-ring seals before you insert them in the seats. This will prevent the O-ring seals from overturning and twisting, which would jeopardize sealing efficiency.

### Sealing compounds

Apply a sealing compound on the mating surfaces when specified by the procedure. Before you apply the sealing compound, prepare the surfaces as directed by the product container.

### Spare parts

Only use CNH Original Parts or NEW HOLLAND CONSTRUCTION Original Parts.

Only genuine spare parts guarantee the same quality, duration, and safety as original parts, as they are the same parts that are assembled during standard production. Only CNH Original Parts or NEW HOLLAND CONSTRUCTION Original Parts can offer this guarantee.

When ordering spare parts, always provide the following information:

- Machine model (commercial name) and Product Identification Number (PIN)
- Part number of the ordered part, which can be found in the parts catalog

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## Protecting the electronic and/or electrical systems during charging and welding

To avoid damage to the electronic and/or electrical systems, always observe the following practices:

1. Never make or break any of the charging circuit connections when the engine is running, including the battery connections.
2. Never short any of the charging components to ground.
3. Always disconnect the ground cable from the battery before arc welding on the machine or on any machine attachment.
  - Position the welder ground clamp as close to the welding area as possible.
  - If you weld in close proximity to a computer module, then you should remove the module from the machine.
  - Never allow welding cables to lie on, near, or across any electrical wiring or electronic component while you weld.
4. Always disconnect the negative cable from the battery when charging the battery in the machine with a battery charger.

**NOTICE:** *If you must weld on the unit, you must disconnect the battery ground cable from the machine battery. The electronic monitoring system and charging system will be damaged if this is not done.*

5. Remove the battery ground cable. Reconnect the cable when you complete welding.

### **WARNING**

**Battery acid causes burns. Batteries contain sulfuric acid.**

**Avoid contact with skin, eyes or clothing. Antidote (external): Flush with water. Antidote (eyes): flush with water for 15 minutes and seek medical attention immediately. Antidote (internal): Drink large quantities of water or milk. Do not induce vomiting. Seek medical attention immediately.**

**Failure to comply could result in death or serious injury.**

W0111A

## Special tools

The special tools that NEW HOLLAND CONSTRUCTION suggests and illustrate in this manual have been specifically researched and designed for use with NEW HOLLAND CONSTRUCTION machines. The special tools are essential for reliable repair operations. The special tools are accurately built and rigorously tested to offer efficient and long-lasting operation.

By using these tools, repair personnel will benefit from:

- Operating in optimal technical conditions
- Obtaining the best results
- Saving time and effort
- Working in safe conditions

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## Torque - Minimum tightening torques for normal assembly

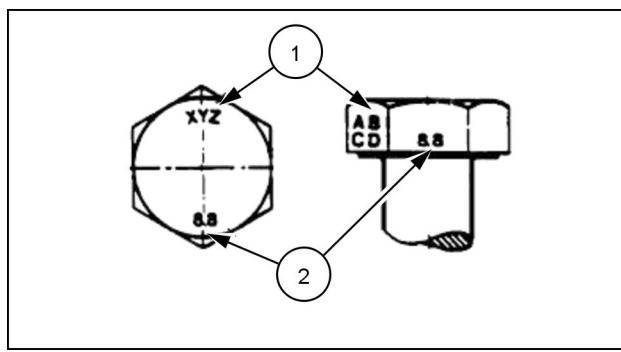
### METRIC NON-FLANGED HARDWARE

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.2 N·m (19 lb in)	2.9 N·m (26 lb in)	3.2 N·m (28 lb in)	4.2 N·m (37 lb in)	2 N·m (18 lb in)	2.9 N·m (26 lb in)
M5	4.5 N·m (40 lb in)	5.9 N·m (52 lb in)	6.4 N·m (57 lb in)	8.5 N·m (75 lb in)	4 N·m (36 lb in)	5.8 N·m (51 lb in)
M6	7.5 N·m (66 lb in)	10 N·m (89 lb in)	11 N·m (96 lb in)	15 N·m (128 lb in)	6.8 N·m (60 lb in)	10 N·m (89 lb in)
M8	18 N·m (163 lb in)	25 N·m (217 lb in)	26 N·m (234 lb in)	35 N·m (311 lb in)	17 N·m (151 lb in)	24 N·m (212 lb in)
M10	37 N·m (27 lb ft)	49 N·m (36 lb ft)	52 N·m (38 lb ft)	70 N·m (51 lb ft)	33 N·m (25 lb ft)	48 N·m (35 lb ft)
M12	64 N·m (47 lb ft)	85 N·m (63 lb ft)	91 N·m (67 lb ft)	121 N·m (90 lb ft)	58 N·m (43 lb ft)	83 N·m (61 lb ft)
M16	158 N·m (116 lb ft)	210 N·m (155 lb ft)	225 N·m (166 lb ft)	301 N·m (222 lb ft)	143 N·m (106 lb ft)	205 N·m (151 lb ft)
M20	319 N·m (235 lb ft)	425 N·m (313 lb ft)	440 N·m (325 lb ft)	587 N·m (433 lb ft)	290 N·m (214 lb ft)	400 N·m (295 lb ft)
M24	551 N·m (410 lb ft)	735 N·m (500 lb ft)	762 N·m (560 lb ft)	1016 N·m (750 lb ft)	501 N·m (370 lb ft)	693 N·m (510 lb ft)

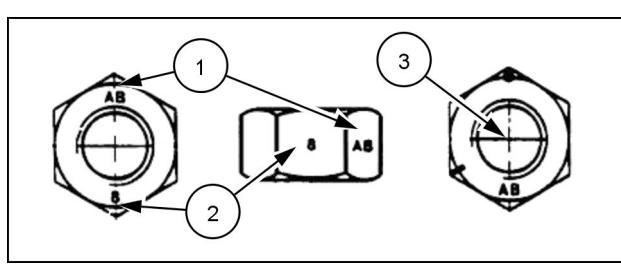
**NOTE:** M4 through M8 hardware torque specifications are shown in pound-inches. M10 through M24 hardware torque specifications are shown in pound-feet.

**METRIC FLANGED HARDWARE**

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.4 N·m (21 lb in)	3.2 N·m (28 lb in)	3.5 N·m (31 lb in)	4.6 N·m (41 lb in)	2.2 N·m (19 lb in)	3.1 N·m (27 lb in)
M5	4.9 N·m (43 lb in)	6.5 N·m (58 lb in)	7.0 N·m (62 lb in)	9.4 N·m (83 lb in)	4.4 N·m (39 lb in)	6.4 N·m (57 lb in)
M6	8.3 N·m (73 lb in)	11 N·m (96 lb in)	12 N·m (105 lb in)	16 N·m (141 lb in)	7.5 N·m (66 lb in)	11 N·m (96 lb in)
M8	20 N·m (179 lb in)	27 N·m (240 lb in)	29 N·m (257 lb in)	39 N·m (343 lb in)	18 N·m (163 lb in)	27 N·m (240 lb in)
M10	40 N·m (30 lb ft)	54 N·m (40 lb ft)	57 N·m (42 lb ft)	77 N·m (56 lb ft)	37 N·m (27 lb ft)	53 N·m (39 lb ft)
M12	70 N·m (52 lb ft)	93 N·m (69 lb ft)	100 N·m (74 lb ft)	134 N·m (98 lb ft)	63 N·m (47 lb ft)	91 N·m (67 lb ft)
M16	174 N·m (128 lb ft)	231 N·m (171 lb ft)	248 N·m (183 lb ft)	331 N·m (244 lb ft)	158 N·m (116 lb ft)	226 N·m (167 lb ft)
M20	350 N·m (259 lb ft)	467 N·m (345 lb ft)	484 N·m (357 lb ft)	645 N·m (476 lb ft)	318 N·m (235 lb ft)	440 N·m (325 lb ft)
M24	607 N·m (447 lb ft)	809 N·m (597 lb ft)	838 N·m (618 lb ft)	1118 N·m (824 lb ft)	552 N·m (407 lb ft)	

**IDENTIFICATION****Metric Hex head and carriage bolts, classes 5.6 and up**

1. Manufacturer's Identification
2. Property Class

**Metric Hex nuts and locknuts, classes 05 and up**

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1. Manufacturer's Identification
2. Property Class
3. Clock Marking of Property Class and Manufacturer's Identification (Optional), i.e. marks **60°** apart indicate Class 10 properties, and marks **120°** apart indicate Class 8.

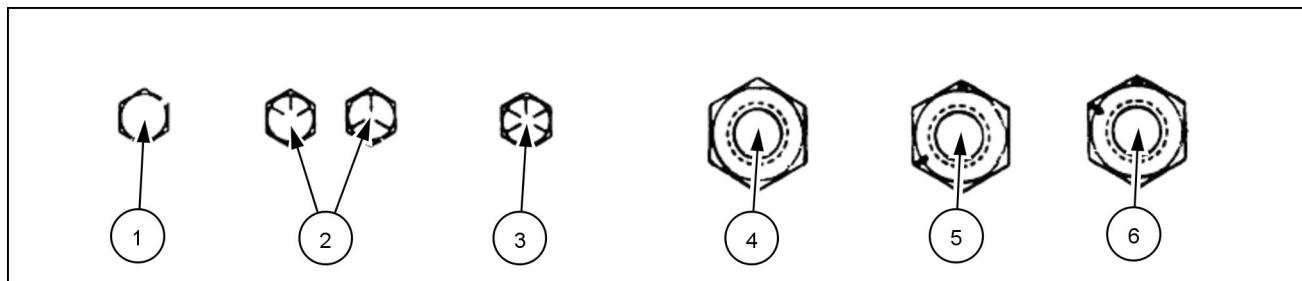
## INCH NON-FLANGED HARDWARE

NOMINAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrB W/ Gr5 BOLT	LOCKNUT GrC W/ Gr8 BOLT
	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	8 N·m (71 lb in)	11 N·m (97 lb in)	12 N·m (106 lb in)	16 N·m (142 lb in)	8.5 N·m (75 lb in)	12.2 N·m (109 lb in)
5/16	17 N·m (150 lb in)	23 N·m (204 lb in)	24 N·m (212 lb in)	32 N·m (283 lb in)	17.5 N·m (155 lb in)	25 N·m (220 lb in)
3/8	30 N·m (22 lb ft)	40 N·m (30 lb ft)	43 N·m (31 lb ft)	57 N·m (42 lb ft)	31 N·m (23 lb ft)	44 N·m (33 lb ft)
7/16	48 N·m (36 lb ft)	65 N·m (48 lb ft)	68 N·m (50 lb ft)	91 N·m (67 lb ft)	50 N·m (37 lb ft)	71 N·m (53 lb ft)
1/2	74 N·m (54 lb ft)	98 N·m (73 lb ft)	104 N·m (77 lb ft)	139 N·m (103 lb ft)	76 N·m (56 lb ft)	108 N·m (80 lb ft)
9/16	107 N·m (79 lb ft)	142 N·m (105 lb ft)	150 N·m (111 lb ft)	201 N·m (148 lb ft)	111 N·m (82 lb ft)	156 N·m (115 lb ft)
5/8	147 N·m (108 lb ft)	196 N·m (145 lb ft)	208 N·m (153 lb ft)	277 N·m (204 lb ft)	153 N·m (113 lb ft)	215 N·m (159 lb ft)
3/4	261 N·m (193 lb ft)	348 N·m (257 lb ft)	369 N·m (272 lb ft)	491 N·m (362 lb ft)	271 N·m (200 lb ft)	383 N·m (282 lb ft)
7/8	420 N·m (310 lb ft)	561 N·m (413 lb ft)	594 N·m (438 lb ft)	791 N·m (584 lb ft)	437 N·m (323 lb ft)	617 N·m (455 lb ft)
1	630 N·m (465 lb ft)	841 N·m (620 lb ft)	890 N·m (656 lb ft)	1187 N·m (875 lb ft)	654 N·m (483 lb ft)	924 N·m (681 lb ft)

**NOTE:** For Imperial Units, **1/4 in** and **5/16 in** hardware torque specifications are shown in pound-inches. **3/8 in** through **1 in** hardware torque specifications are shown in pound-feet.

**INCH FLANGED HARDWARE**

NOMINAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrF W/ Gr5 BOLT	LOCKNUT GrG W/ Gr8 BOLT
	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	9 N·m (80 lb in)	12 N·m (106 lb in)	13 N·m (115 lb in)	17 N·m (150 lb in)	8 N·m (71 lb in)	12 N·m (106 lb in)
5/16	19 N·m (168 lb in)	25 N·m (221 lb in)	26 N·m (230 lb in)	35 N·m (310 lb in)	17 N·m (150 lb in)	24 N·m (212 lb in)
3/8	33 N·m (25 lb ft)	44 N·m (33 lb ft)	47 N·m (35 lb ft)	63 N·m (46 lb ft)	30 N·m (22 lb ft)	43 N·m (32 lb ft)
7/16	53 N·m (39 lb ft)	71 N·m (52 lb ft)	75 N·m (55 lb ft)	100 N·m (74 lb ft)	48 N·m (35 lb ft)	68 N·m (50 lb ft)
1/2	81 N·m (60 lb ft)	108 N·m (80 lb ft)	115 N·m (85 lb ft)	153 N·m (113 lb ft)	74 N·m (55 lb ft)	104 N·m (77 lb ft)
9/16	117 N·m (86 lb ft)	156 N·m (115 lb ft)	165 N·m (122 lb ft)	221 N·m (163 lb ft)	106 N·m (78 lb ft)	157 N·m (116 lb ft)
5/8	162 N·m (119 lb ft)	216 N·m (159 lb ft)	228 N·m (168 lb ft)	304 N·m (225 lb ft)	147 N·m (108 lb ft)	207 N·m (153 lb ft)
3/4	287 N·m (212 lb ft)	383 N·m (282 lb ft)	405 N·m (299 lb ft)	541 N·m (399 lb ft)	261 N·m (193 lb ft)	369 N·m (272 lb ft)
7/8	462 N·m (341 lb ft)	617 N·m (455 lb ft)	653 N·m (482 lb ft)	871 N·m (642 lb ft)	421 N·m (311 lb ft)	594 N·m (438 lb ft)
1	693 N·m (512 lb ft)	925 N·m (682 lb ft)	979 N·m (722 lb ft)	1305 N·m (963 lb ft)	631 N·m (465 lb ft)	890 N·m (656 lb ft)

**IDENTIFICATION****Inch Bolts and free-spinning nuts**

20083682 3

**Grade Marking Examples**

SAE Grade Identification			
1	Grade 2 - No Marks	4	Grade 2 Nut - No Marks
2	Grade 5 - Three Marks	5	Grade 5 Nut - Marks 120° Apart
3	Grade 8 - Five Marks	6	Grade 8 Nut - Marks 60° Apart

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