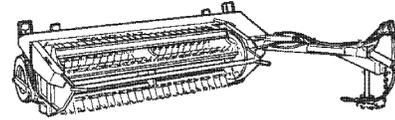


Product: New Holland 474/489/492/1465 Mower Conditioner Service Repair Manual
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NEW HOLLAND

474

489

492

1465

REPAIR MANUAL



NEW HOLLAND

SERVICE

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474, 489, 492, 1465 REPAIR MANUAL CONTENTS

SECTION 00 - GENERAL INFORMATION

SECTION 31 - IMPLEMENT POWER TAKE-OFF (PTO)

SECTION 35 - HYDRAULIC SYSTEMS

SECTION 39 - FRAMES

SECTION 55 - ELECTRICAL SYSTEMS

SECTION 58 - ATTACHMENTS/HEADERS

SECTION 90 - SAFETY DECALS

The sections used through out all New Holland product Repair manuals may not be used for each product. Each Repair manual will be made up of one or several books.

The sections listed above are the sections utilized for the 474, 489, 492, 1465 Mower-Conditioners.

SECTION 00 - GENERAL INFORMATION

Chapter 1 - General Information

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FOREWORD

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all equipment, as well as the personal safety of the individual performing the repair.

This Repair Manual provides troubleshooting and overhaul instructions using recommended procedures and equipment. Following these instructions will ensure the safe, efficient, and timely completion of the service or repair.

The manual is divided into sections which are subdivided into chapters. Each chapter contains information on general operating principles, detailed inspection, overhaul and, where applicable, specific troubleshooting, special tools, and specifications.

Any reference in this manual to right, left, rear, front, top, or bottom is determined by standing behind the machine and looking in the direction of travel.

All data and illustrations in this manual are subject to variations in build specification. This information was correct at the time of issue, but New Holland policy is one of continuous improvement, and the right to change specifications, equipment, or design at any time, without notice, is reserved.

PRECAUTIONARY STATEMENTS

PERSONAL SAFETY

Throughout this manual and on machine decals, you will find precautionary statements (“**DANGER**”, “**WARNING**”, and “**CAUTION**”) followed by specific instructions. These precautions are intended for the personal safety of you and those working with you. Please take the time to read them.



DANGER



This word “**DANGER**” indicates an immediate hazardous situation that, if not avoided, will result in death or serious injury. The color associated with Danger is **RED**.



WARNING



This word “**WARNING**” indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury. The color associated with Warning is **ORANGE**.



CAUTION



This word “**CAUTION**” indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. The color associated with Caution is **YELLOW**.

FAILURE TO FOLLOW THE “DANGER”, “WARNING”, AND “CAUTION” INSTRUCTIONS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH.

MACHINE SAFETY

The precautionary statement (“**IMPORTANT**”) is followed by specific instructions. This statement is intended for machine safety.

IMPORTANT: *The word “IMPORTANT” is used to inform the reader of something he needs to know to prevent minor machine damage if a certain procedure is not followed.*

INFORMATION

NOTE: *Instructions used to identify and present supplementary information.*

SAFETY

PRECAUTIONARY STATEMENTS

A careful operator is the best operator. Most accidents can be avoided by observing certain precautions. To help prevent accidents, read the following precautions before operating this equipment. Equipment should be operated only by those who are responsible and instructed to do so.

Carefully review the procedures given in this manual with all operators. It is important that all operators be familiar with and follow safety precautions.

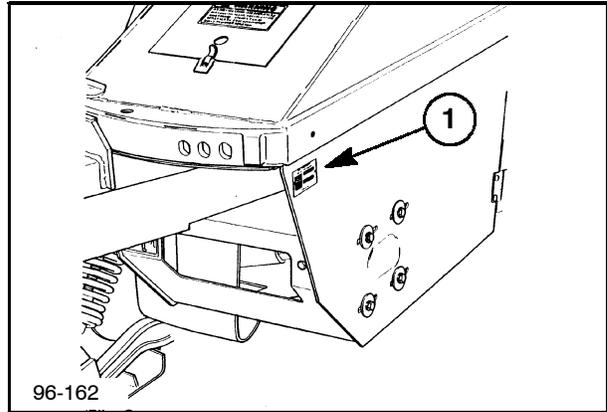
Most farm implement accidents can be avoided by the observance of a few simple safety precautions:

- 1. Do not clean, lubricate, or make any adjustments on the mower-conditioner while it is in motion.**
- 2. Do not start the mower-conditioner until you know that everyone is clear of the machine and have made sure that no tools are lying on the machine.**
- 3. Do not work around the unit in loose clothing that might catch in any of the moving parts.**
- 4. Do not attempt to pull material from any part of the mower-conditioner while it is in operation.**
- 5. Do not get off the tractor while the mower-conditioner is in operation.**
- 6. Use of the optional safety chain is recommended when operating on a public road.**

SERIAL NUMBER

This manual includes information to service all variations of the Models 474, 489, 492 and 1465. For some repairs, different procedures or adjustments may be necessary depending on the serial number of the machine.

The serial number is stamped on an identification plate, 1, on the left side of the main frame.

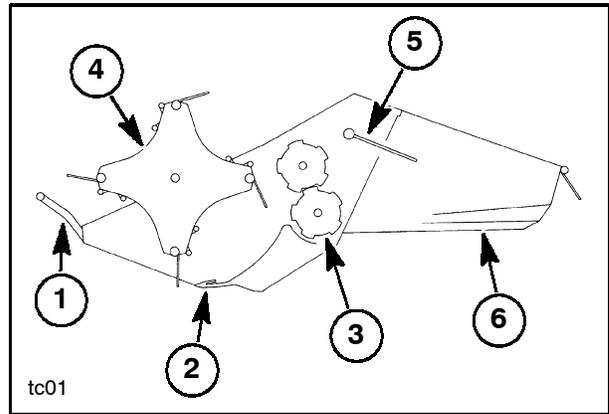


HOW THE MOWER-CONDITIONER FUNCTIONS

The mower-conditioner combines cutting and conditioning of the crop in one machine.

The push bar, 1, pushes tall crops forward so they can be cut by the cutter bar, 2, and fed cut end first into the conditioning rolls, 3.

A reel, 4, assists in picking up down crop and in moving crop from the cutter bar to the conditioning rolls. An adjustable swathgate, 5, and windrow forming shields, 6, at the rear deflect the material from the rolls to form a windrow or swath.



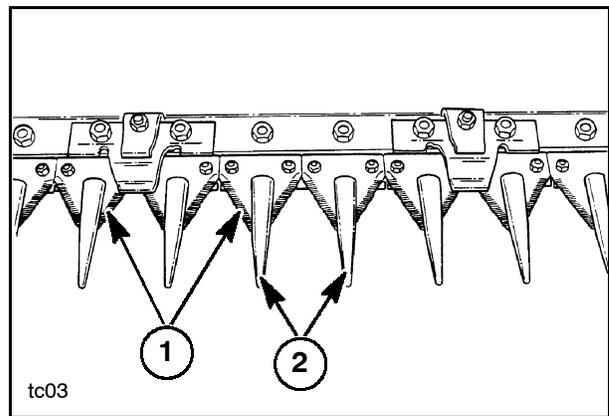
2

The cutter bar has a series of knives, 1, that move back and forth between guards, 2, that include a shear edge. The guards help lift and separate the crop so it can be cut by the knives scissors like action. The knife sections are often referred to as "sickle sections".

Standard Guards

The mower-conditioner can be ordered equipped with either the standard guards, Figure 3, or stub guards as shown in Figure 4.

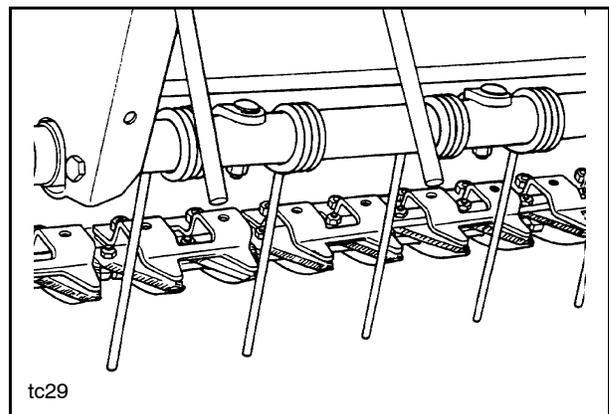
The standard guards are recommended for most conditions. The top lip helps separate and lift the crop and keeps the knife section from lifting away from the ledger surface. The tip of the guard extends ahead of the knife section to protect it from foreign objects.



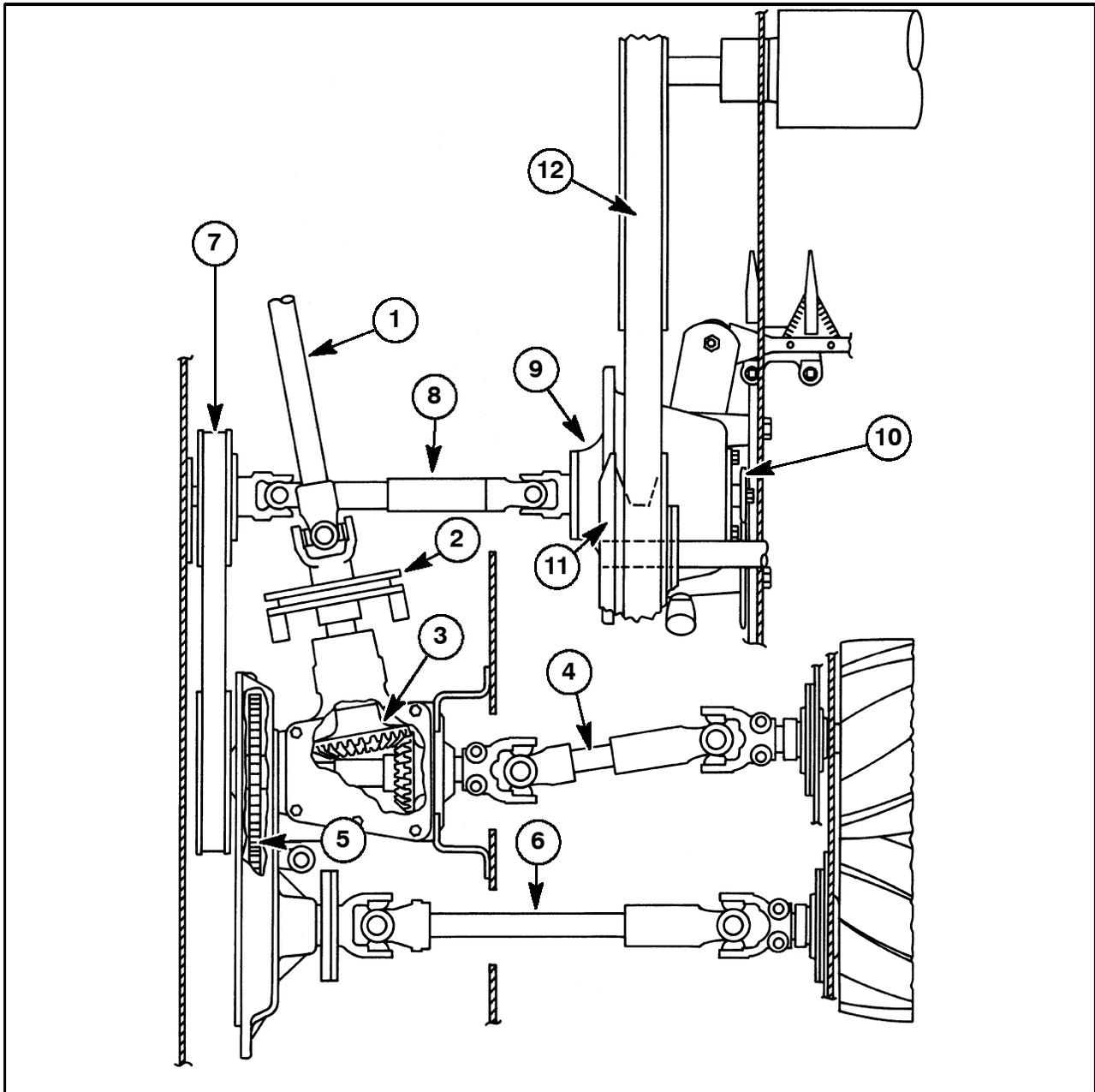
3

Stub Guards

The stub guards are recommended for use in difficult cutting conditions, such as tangled or wet undergrowth, that tend to plug the cutter bar. The stub guards do not have a top lip, instead the knife is held on the ledger surface by hold down clips at each guard. The tip of the knife extends past the end of the guard and is more susceptible to damage from foreign objects.



4



5

POWER DISTRIBUTION

The drive shaft, 1, from the PTO is connected through the slip clutch, 2, to a 100° bevel gearbox, 3.

A PTO, 4, attached to the right of the gearbox drives the upper conditioning roll.

A spur gearbox, 5, at the left of the bevel gearbox supplies power to drive a PTO, 6, for the lower conditioning roll.

A sheave at the left of the spur gearbox drives a belt, 7, that supplies power to a PTO, 8, that drives the enclosed wobble drive gearbox, 9.

A sprocket, 10, at the right of the wobble drive gearbox supplies power to a chain that drives a variable sheave, 11. A belt, 12, from the variable sheave drives the reel.

TAPERED SPLINE CONNECTIONS - HAMMER SEATING

NOTE: All tapered spline connections must be properly seated to prevent loosening.

To hammer seat a tapered spline:

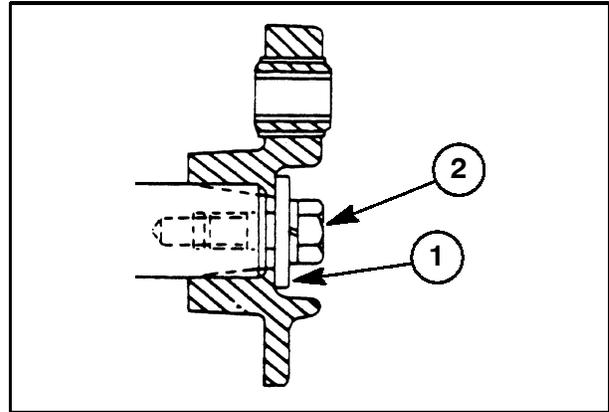
Install the part on the shaft.

Install the special washer, 1; lock washer; and cap screw, 2.

Strike the hub with a punch or driver and heavy hammer.

Retighten the center bolt.

Continue to strike the hub and retighten the cap screw until the torque does not decrease after striking.



6

HARDWARE TORQUE VALUES

Check the tightness of hardware periodically.

Use the following charts to determine the correct torque when checking, adjusting or replacing hardware on the tractor.

IMPORTANT: *DO NOT use the values listed in the charts if a different torque value or tightening procedure is specified in this manual for a specific application. Torque values listed are for general use only.*

Install a lock washer on all bolts unless a locknut or jam nut is specified.

Install a flat washer at all slotted holes unless a carriage bolt or flanged head bolt is specified.

Make sure fastener threads are clean and not damaged.

NOTE: *A torque wrench is necessary to properly torque hardware.*

MINIMUM HARDWARE TIGHTENING TORQUES IN NEWTON-METERS (FOOT POUNDS) FOR NORMAL ASSEMBLY APPLICATIONS

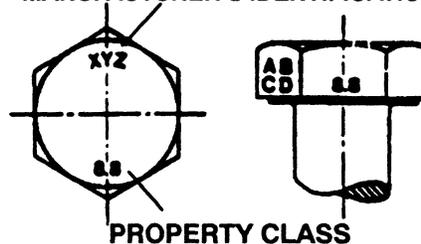
METRIC HARDWARE AND LOCKNUTS

NOMINAL SIZE	CLASS 5.8		CLASS 8.8		CLASS 10.9		LOCKNUT CL.8 w/CL8.8 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr	
M4	1.7 (15*)	2.2 (19*)	2.6 (23*)	3.4 (30*)	3.7 (33*)	4.8 (42*)	1.8 (16*)
M6	5.8 (51*)	7.6 (67*)	8.9 (79*)	12 (102*)	13 (115*)	17 (150*)	6.3 (56*)
M8	14 (124*)	18 (159*)	22 (195*)	28 (248*)	31 (274*)	40 (354*)	15 (133*)
M10	28 (21)	36 (27)	43 (32)	56 (41)	61 (45)	79 (58)	30 (22)
M12	49 (36)	63 (46)	75 (55)	97 (72)	107 (79)	138 (102)	53 (39)
M16	121 (89)	158 (117)	186 (137)	240 (177)	266 (196)	344 (254)	131 (97)
M20	237 (175)	307 (226)	375 (277)	485 (358)	519 (383)	671 (495)	265 (195)
M24	411 (303)	531 (392)	648 (478)	839 (619)	897 (662)	1160 (855)	458 (338)

NOTE: Torque values shown with * are inch pounds.

IDENTIFICATION HEX CAP SCREW AND CARRIAGE BOLTS CLASSES 5.6 AND UP

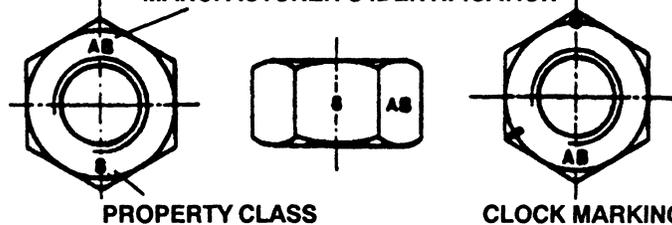
MANUFACTURER'S IDENTIFICATION



PROPERTY CLASS

HEX NUTS AND LOCKNUTS CLASSES 05 AND UP

MANUFACTURER'S IDENTIFICATION



PROPERTY CLASS

CLOCK MARKING

MINIMUM HARDWARE TIGHTENING TORQUES

IN NEWTON-METERS (FOOT POUNDS) FOR NORMAL ASSEMBLY APPLICATIONS

INCH HARDWARE AND LOCKNUTS

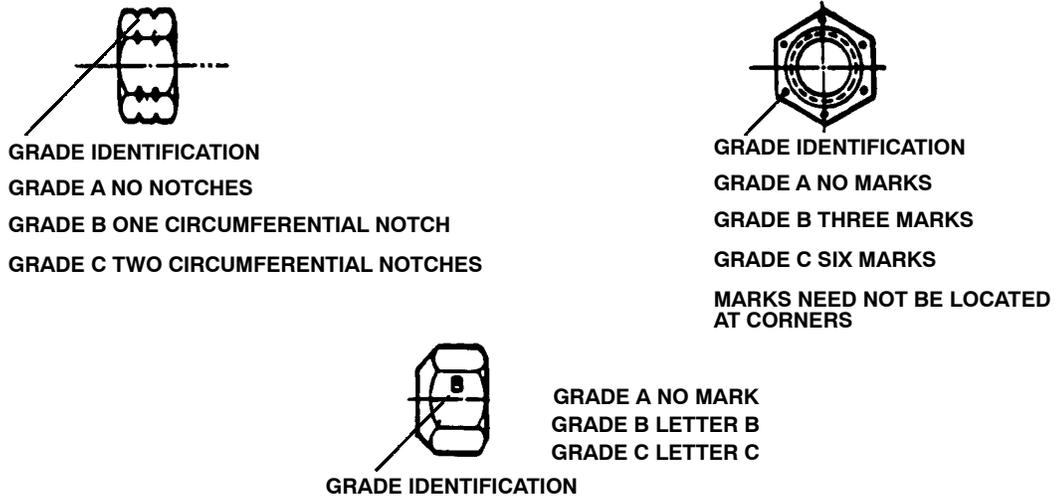
NOMINAL SIZE	SAE GRADE 2		SAE GRADE 5		SAE GRADE 8		LOCKNUTS		NOMINAL SIZE
	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	GR.B w/GR5 BOLT	GR.C w/GR8 BOLT	
1/4	6.2 (55*)	8.1 (72*)	9.7 (86*)	13 (112*)	14 (121*)	18 (157*)	6.9 (61*)	9.8 (86*)	1/4
5/16	13 (115*)	17 (149*)	20 (178*)	26 (229*)	28 (250*)	37 (324*)	14 (125*)	20 (176*)	5/16
3/8	23 (17)	30 (22)	35 (26)	46 (34)	50 (37)	65 (48)	26 (19)	35 (26)	3/8
7/16	37 (27)	47 (35)	57 (42)	73 (54)	80 (59)	104 (77)	41 (30)	57 (42)	7/16
1/2	57 (42)	73 (54)	87 (64)	113 (83)	123 (91)	159 (117)	61 (45)	88 (64)	1/2
9/16	81 (60)	104 (77)	125 (92)	163 (120)	176 (130)	229 (169)	88 (65)	125 (92)	9/16
5/8	112 (83)	145 (107)	174 (128)	224 (165)	244 (180)	316 (233)	122 (90)	172 (127)	5/8
3/4	198 (146)	256 (189)	306 (226)	397 (293)	432 (319)	560 (413)	217 (160)	306 (226)	3/4
7/8	193 (142)	248 (183)	495 (365)	641 (473)	698 (515)	904 (667)	350 (258)	494 (364)	7/8
1	289 (213)	373 (275)	742 (547)	960 (708)	1048 (773)	1356 (1000)	523 (386)	739 (545)	1

NOTE: Torque values shown with * are inch pounds.

IDENTIFICATION CAP SCREWS AND CARRIAGE BOLTS



LOCKNUTS

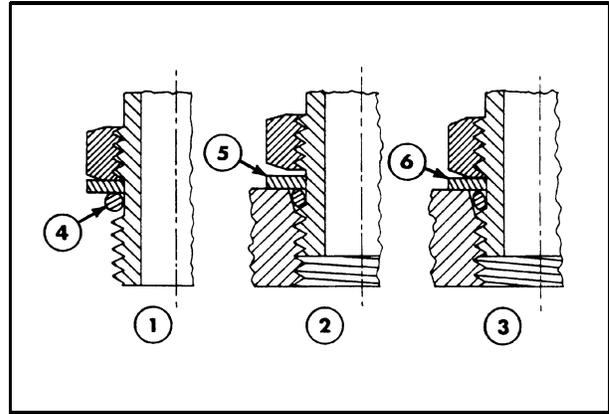


INSTALLATION OF ADJUSTABLE FITTINGS IN STRAIGHT THREAD O RING BOSSES

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.



7

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				TORQUE			
	mm	In.		NEWTON METERS Min. Max.	FOOT POUNDS Min. Max.	NEWTON METERS Min. Max.	FOOT POUNDS Min. Max.				
4	6.4	1/4	7/16-20	12	16	9	12	8	14	6	10
5	7.9	5/16	1/2-20	16	20	12	15	14	20	10	15
6	9.5	3/8	9/16-18	29	33	21	24	20	27	15	20
8	12.7	1/2	3/4-18	47	54	35	40	34	41	25	30
10	15.9	5/8	7/8-14	72	79	53	53	47	54	35	40
12	19.1	3/4	1-1/16-12	104	111	77	82	81	95	60	70
14	22.2	7/8	1-3/16-12	122	136	90	100	95	109	70	80
16	25.4	1	1-5/16-12	149	163	110	120	108	122	80	90
20	31.8	1-1/4	1-5/8-12	190	204	140	150	129	158	95	115
24	38.1	1-1/2	1-7/8-12	217	237	160	175	163	190	120	140
32	50.8	2	2-1/2-12	305	325	225	240	339	407	250	300

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

solvent or Loctite cleaner and apply hydraulic sealant Loctite no. 569 to the 37° flare and the threads.

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

Before installing and torquing 37° flared fittings, clean the face of the flare and threads with a clean

PIPE THREAD FITTING TORQUE

Before installing and tightening pipe fittings, clean the threads with a clean solvent or Loctite cleaner and apply sealant Loctite no. 567 for all fittings including stainless steel or no. 565 for most metal fittings. For high filtration/zero contamination systems use no. 545.

THREAD SIZE	TORQUE (MAXIMUM)
1/8" - 27	13 N·m (10 ft lbs)
1/4" - 18	16 N·m (12 ft lbs)
3/8" - 14	22 N·m (16 ft lbs)
1/2" - 14	41 N·m (30 ft lbs)
3/4" - 14	54 N·m (40 ft lbs)

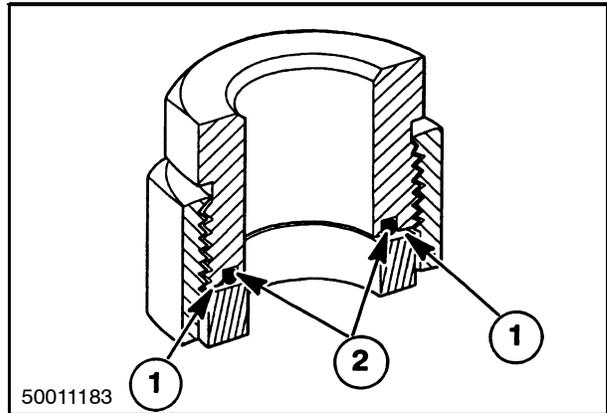
INSTALLATION OF ORFS (O RING FLAT FACED) FITTINGS

When installing ORFS fittings thoroughly clean both flat surfaces of the fitting, 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.

IMPORTANT: *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.*

IMPORTANT: *Always use genuine New Holland 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.



LUBRICATION

Adequate lubrication and maintenance on a regular schedule is vital to maintaining your equipment. To ensure long service and efficient operation, follow the lubrication and maintenance schedules outlined in this manual. The use of proper fuels, oils, grease and filters, as well as keeping the systems clean, will also extend machine and component life.

IMPORTANT: Always use genuine **New Holland** replacement parts, oils and filters to ensure proper operation, filtration of engine and hydraulic systems. See your **New Holland** dealer for additional oil quantities.

RECOMMENDED LUBRICANTS AND COOLANTS

Lubricant	Location Used	Type and Description	Part Number	Quart or Liter	Gallon or Tube		
Oil	Engine and Pivot Points without Grease Fittings, Chains	SAE 30 API CF-2SJ	9613286	1Qt.			
		SAE 30 API CF-2SJ	9613289		2.5 Gal.		
		SAE 30 API CF-2SJ	9613366*	4 L			
		5W-30 API SG/CD	9673589DS	1 Qt.			
		5W-30 API SG/CD	9624590*	4 L			
		10W-30 API SG/CD	9613313	1 Qt.			
		10W-30 API SG/CD	9613314		2.5 Gal.		
		10W-30 API SG/CD	9673508DS		5 Gal.		
		10W-30 API SG/CD	9613358*	1 L			
		10W-30 API SG/CD	9613359*	4 L			
		15W-40 API CF-4	9613290	1 Qt.			
		15W-40 API CF-4	9673730DS		1 Gal.		
		15W-40 API CF-4	9613303		2.5 Gal.		
		15W-40 API CF-4	9613292		5 Gal.		
Coolant	Engine	ESE-M97B18-D, Ethylene Glycol New Holland Spec. Coolant Concentrate	FGCC2701DS		1 Gal.		
		Propylene Glycol Concentrate	FGCC2711DS		1 Gal.		
		Hydraulic Oil	Hydraulic System, Hydrostatic System Front Axle Oil	134D – ESN-M2C134-D New Holland Spec. Hydraulic oil	9624450		2.5 Gal.
				134D – ESN-M2C134-D	9624451		5 Gal.
				134D – ESN-M2C134-D	9613367*	4 L	
				134D – ESN-M2C134-D	9624785*	10 L	
Hydraulic Oil	Optional, Multi-Seasonal Use, Recommended for Low Temperatures	F200	86523625DS	1 Qt.			
		F200	86523626DS		5 Gal.		
		F200	86509446*	20 L			
Gear Oil	Gearboxes	80W90 EP Gear Oil API GL5	9613295	1 Qt.			
		80W90 EP Gear Oil API GL5	9613294		2.5 Gal.		
		80W90 EP Gear Oil API GL5	9613375*	5 L			
		85W140 EP Gear Oil API GL5	9613297	1 Qt.			
		85W140 EP Gear Oil API GL5	9613296		2.5 Gal.		
		85W140 EP Gear Oil API GL5	9613376*	4 L			
Grease	All Grease Fittings	Lithium base EP high temperature	9861804DS		Tube		
		Lithium base EP high temperature	9861804CDS*		Tube		
Brake Fluid		Mineral Based Oil	1QM6C34A or 86541699DS	1 Qt.			

* **NOTE:** Canada Part Numbers ONLY.

SEALANTS

DESCRIPTION	NEW HOLLAND PART NUMBER	TYPICAL APPLICATIONS	STRENGTH	COLOR
THREAD LOCK	L22200 (222)	Small screws and hardware	Low	Purple
	L24231 (242)	Small screws and hardware	Medium	Blue
	L29000 (290)	Wicking Type	Medium	Green
	L26231 (262)	Nuts & Bolts	High	Red
THREAD SEALANTS	L54531 (545)	Hydraulic/Pneumatic	Non-fouling	
	L56531 (565)	Pipe Sealant	Controlled strength	
	L56747 (567)	Pipe Sealant	High Temperature	
SILICONES	L81724 (3.5 oz. tube)	Ultra Blue RTV Gasket	Non-corrosive	Blue
	L58775 (10.2 oz. cartridge)	Ultra Blue RTV Gasket	Non-corrosive	Blue
	L82180 (3.35 oz. tube)	Ultra Blue RTV Gasket	Non-corrosive	Black
	L59875 (10.2 oz. cartridge)	Ultra Blue RTV Gasket	Non-corrosive	Black
518 GASKET ELIMINATOR	L51831DS	Mating Machined Surfaces	Flexible	Red

ECOLOGY AND THE ENVIRONMENT

Soil, air, and water are vital factors of agriculture and life in general. When legislation does not yet rule the treatment of some of the substances which are required by advanced technology, common sense should govern the use and disposal of products of a chemical and petrochemical nature.

The following are recommendations which may be of assistance:

- Become acquainted with and ensure that you understand the relative legislation applicable to your country.
- Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, antifreeze, cleaning agents, etc., with regard to their effect on man and nature and how to safely store, use and dispose of these substances. Agricultural consultants will, in many cases, be able to help you as well.

HELPFUL HINTS

1. Avoid filling tanks using cans or inappropriate pressurized fuel delivery systems which may cause considerable spillage.
2. In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of them contain substances which may be harmful to your health.
3. Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
4. Avoid spillage when draining off used engine coolant mixtures, engine, gearbox and hydraulic oils, brake fluids, etc. Do not mix drained brake fluids or fuels with lubricants. Store them safely until they can be disposed of in a proper way to comply with local legislation and available resources.
5. Modern coolant mixtures, i.e. antifreeze and other additives, should be replaced every two years. They should not be allowed to get into the soil but should be collected and disposed of safely.
6. Do not open the air-conditioning system yourself. It contains gases which should not be released into the atmosphere. Your dealer or air conditioning specialist has a special extractor for this purpose and will have to recharge the system properly.
7. Repair and leaks or defects in the engine cooling or hydraulic system immediately.
8. Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
9. Protect hoses during welding as penetrating weld splatter may burn a hole or weaken them, allowing the loss of oils, coolant, etc.

INTERNATIONAL SYMBOLS

As a guide to the operation of your tractor, various universal symbols have been utilized on the instruments, controls, switches, and fuse box. The symbols are shown below with an indication of their meaning.

	Thermostart starting aid		Radio		P.T.O.		Position Control
	Alternator charge	KAM	Keep alive memory	N	Transmission in neutral		Draft Control
	Fuel level		Turn signals		Creeper gears		Accessory socket
	Automatic Fuel shut-off		Turn signals -one trailer		Slow or low setting		Implement socket
	Engine speed (rev/min x 100)		Turn signals -two trailers		Fast or high setting		%age slip
	Hours recorded		Front wind-screen wash/wipe		Ground speed		Hitch raise (rear)
	Engine oil pressure		Rear wind-screen wash/wipe		Differential lock		Hitch lower (rear)
	Engine coolant temperature		Heater temperature control		Rear axle oil temperature		Hitch height limit (rear)
	Coolant level		Heater fan		Transmission oil pressure		Hitch height limit (front)
	Tractor lights		Air conditioner		FWD engaged		Hitch disabled
	Headlamp main beam		Air filter blocked		FWD disengaged		Hydraulic and transmission filters
	Headlamp dipped beam		Parking brake		Warning!		Remote valve extend
	Work lamps		Brake fluid level		Hazard warning lights		Remote valve retract
	Stop lamps		Trailer brake		Variable control		Remote valve float
	Horn		Roof beacon		Pressurised! Open carefully		Malfunction! See Operator's Manual
			Warning! Corrosive substance				Malfunction!(alternative symbol)

SECTION 31 - IMPLEMENT POWER TAKE-OFF (PTO)

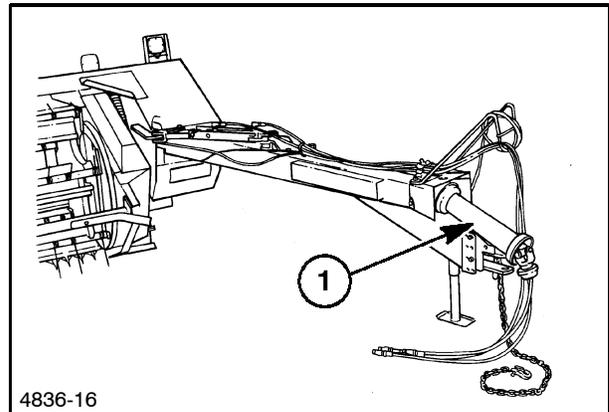
Chapter 1 - PTO

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PTO ASSEMBLY

The Models 474, 489, 492 and 1465 use a three-joint drive shaft assembly. The front telescoping PTO assembly, 1, is attached to the tractor. The rear shaft goes through the tongue and drives the universal joint that is part of the slip clutch on the gearbox.



4836-16

1

Universal Joint Operation

A universal joint assembly consists of two yokes, 1, connected by a cross and bearing assembly, 2. The bearings allow the yokes to pivot and operate when the shafts connected to the yokes are out of alignment.

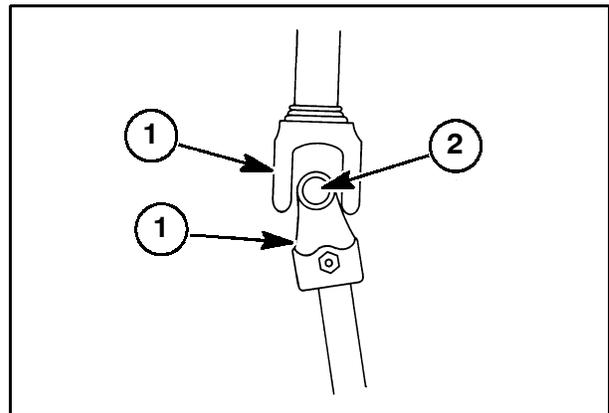
If only one joint is used, the connecting shafts must be on the same center line for uniform power flow. When the connecting shafts are not aligned, the driven yoke will alternate between leading and lagging behind the driving yoke.

Depending on the starting position of the yokes, the first 45° of rotation of the driving yoke will result in the driven yoke being accelerated so it leads the driving yoke. The greater the misalignment, the greater the difference in yoke rotation.

At 20°, the lead will be approximately 2°; at 40°, the lead will be 8°. Between 45° and 90° of rotation, the driven yoke will slow down so that when the driving yoke has rotated 90° the driven yoke has also rotated 90°. Between 90° and 135°, the driven yoke will lag behind the driving yoke. From 135° to 180°, the driven yoke will speed up until at 180° the yokes again are at the same speed.

The speed-up and slow-down cycle will repeat when the drive yoke is rotated from 180° to 360°. At a speed of 540 RPM, the driven yoke will oscillate at a speed of 18 cycles per second.

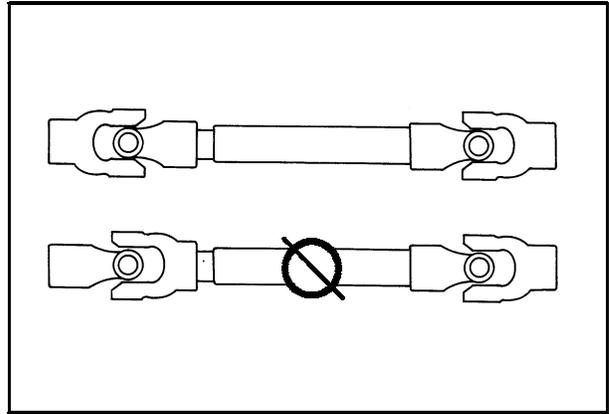
If a single joint was used to connect a tractor PTO to the mower-conditioner, the joint would be destroyed if operated at an angle over 20° as the mass of the rolls would not allow it to change speeds to match the yoke.



2

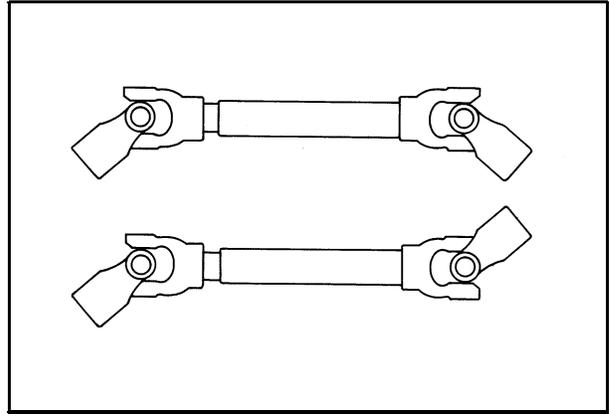
Universal Joint Phasing

The speed-up/slow-down effect on the driven shaft can be minimized by using two universal joints that are in phase and operating at the same angles. To be in phase, both yokes on the shaft between the joints must be in the same position, i.e., both vertical at the same time as shown at the top of Figure 3. If the joints are out of phase as shown at the bottom of Figure 3, excessive vibration can occur.



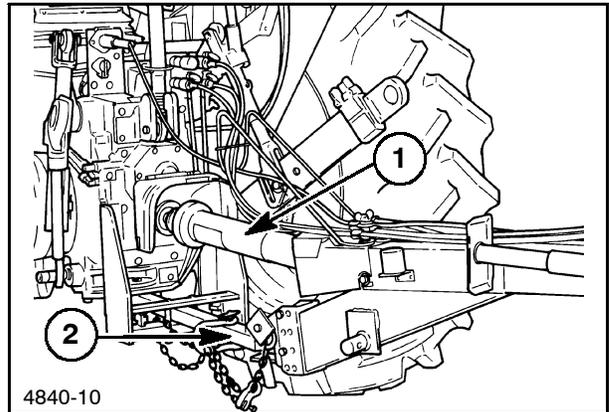
3

When the universal joints are phased correctly and the operating angles at each joint are equal, the speed changes in one joint will be offset by the changes in the other. As long as the joint angles remain equal, the end yokes can face either the same or opposite direction as shown.



4

To provide the same angle at each end of the front PTO assembly, 1, the tractor drawbar, 2, must be adjusted so the center of the hitch pin hole is 14" from the end of the PTO shaft. The hitch height of the mower-conditioner must also be adjusted so the PTO is level. When these two adjustments are correct, they produce the same distance from the hitch pin (pivot point) to the center of each joint.



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5

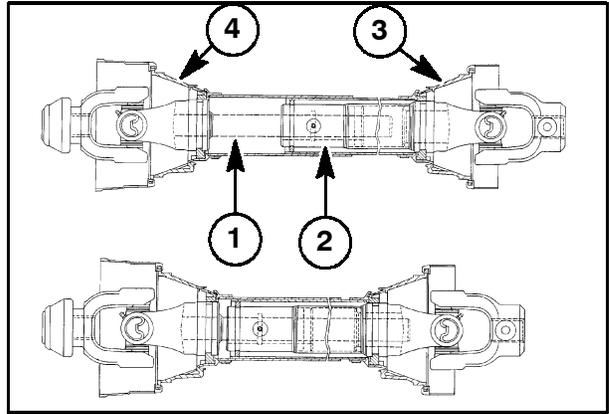
TELESCOPING SHAFT AND TUBE

When turning or operating on uneven terrain, the distance between universal joint assemblies changes. The PTO assemblies have a square shaft, 1, that telescopes inside a square hole in the hub, 2, at the end of the drive tube.

One of the sides of the square shaft has a raised area that will allow it to be installed only when the universal joints are in phase.

The telescoping sections must be kept lubricated and free of dirt or burrs so they can telescope freely when under load. If the telescoping force is too great, the universal joints will fail.

The shields, 3 and 4, over the shaft and tube must also telescope freely and be able to rotate independently of each other.



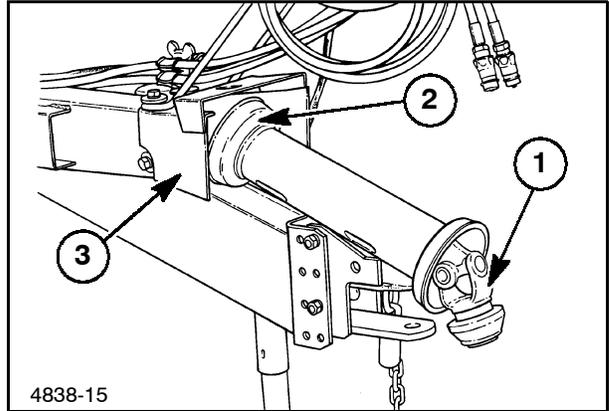
6

FRONT PTO ASSEMBLY

Removing

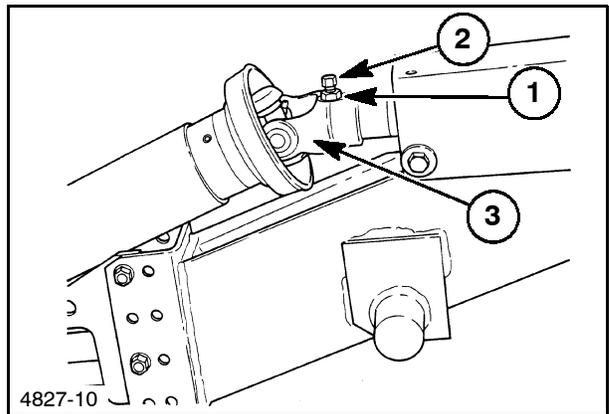
Pull the front universal joint and shaft, 1, out of the rear tube, 2.

Remove the shield, 3, and hose support from the tongue.



7

Loosen the jam nut, 1, and remove the setscrew, 2. Slide the rear yoke, 3, off the splined shaft.



8

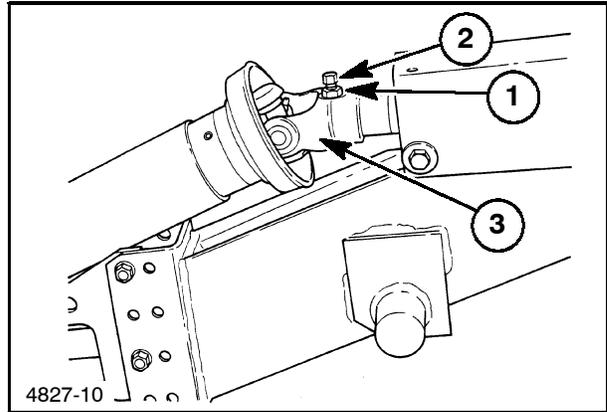
Installing

Clean the splines on the drive shaft that goes through the tongue and the inside of the yoke on the front PTO. Check for burrs or damage to the splines.

Install the splined yoke, 3, on the drive shaft with the setscrew hole in the yoke aligned with the tapered hole in the splined shaft. Install the setscrew, 2, and jam nut, 1. Tighten the setscrew.

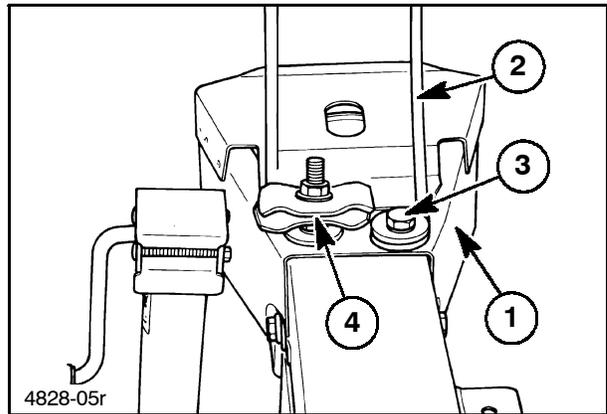
Use a hammer to seat the setscrew. Retighten the setscrew. Do this at least three times before tightening the jam nut.

IMPORTANT: If the setscrew is not hammer seated as described above, it may loosen and result in extensive damage to the PTO and/or tractor.



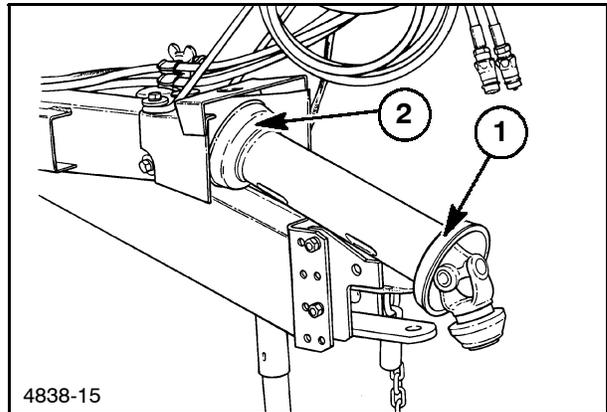
9

Install the shield, 1, and hose support, 2, on the tongue. Attach the sides of the shield to the tongue using two 1/2" x 1" cap screws and lock washers. Attach the right of the support to the tongue using a spacer, large flat washer, lock washer, and 1/2" x 1-1/2" cap screw, 3. Attach the left of the support to the tongue using a spacer, large flat washer, lock washer, and special clamp bolt, 4.



10

Grease the square shaft and install the front section, 1, in the rear section, 2, of the PTO.



11

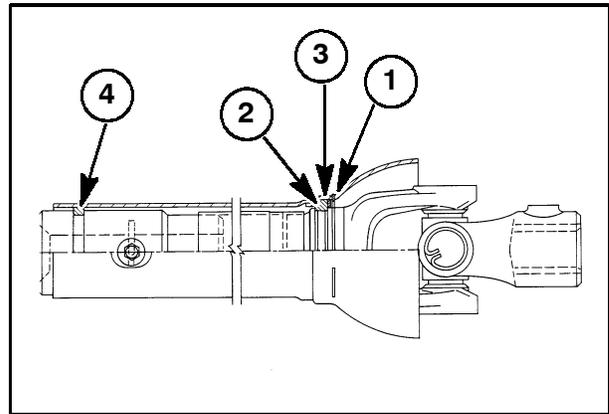
PTO SHAFT SHIELDS

Disengage the snap ring, 1, inside the bell of the shield by using a screwdriver to pry the ends of the snap ring away from the shield.

Slide the shield off the shaft.

Remove the shield bearing, 2; back-up washer, 3; and snap ring from the yoke.

If removing the inner telescoping shield, also remove the shield support bushing, 4, between the shield and drive tube.



12

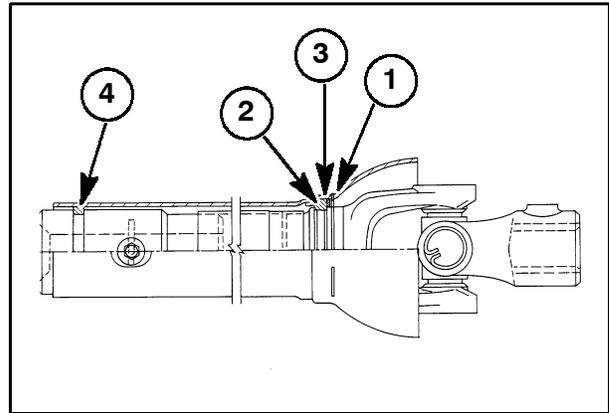
Installing

Place the snap ring, 1, in position on the yoke.

Install the shield bearing, 2, and backup washer, 3, on the yoke.

If installing an inner shield, install the shield support bushing, 4, in the notch in the drive tube.

Slide the shield into position and seat the snap ring in the notches in the shield.



13

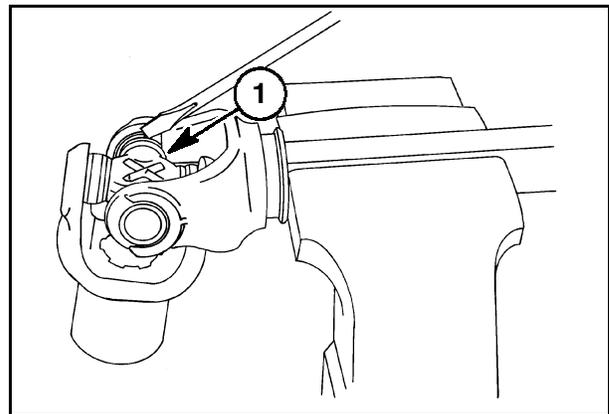
JOINT REPLACEMENT

Remove the joint and shaft assembly from the mower-conditioner.

Remove the shield from the shaft.

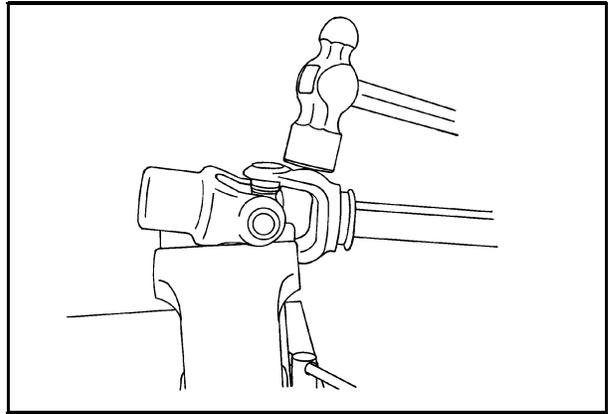
Disassembling**Method I**

Remove the snap rings, 1, from the yokes. It may be necessary to use a punch and hammer to tap the bearing cap toward the center to take pressure off the snap ring.



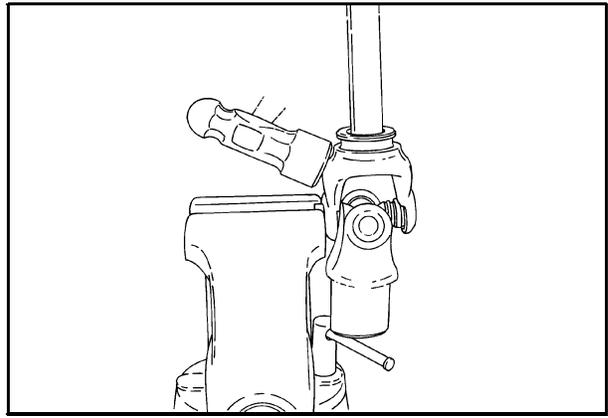
14

Place the joint in a vise so the ears of a yoke rest on the jaws. Tap the other yoke down to drive the bearing cap out of the yoke. Turn the yoke over and repeat for the other bearing cap. Remove the yoke from the spider.



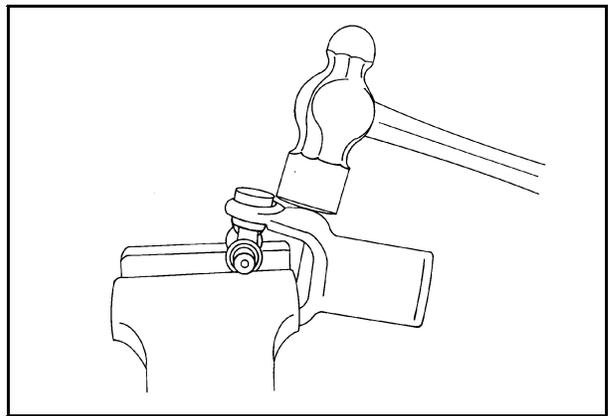
15

If the cap does not move completely out of the yoke, clamp the cap in the vise and tap on the yoke.



16

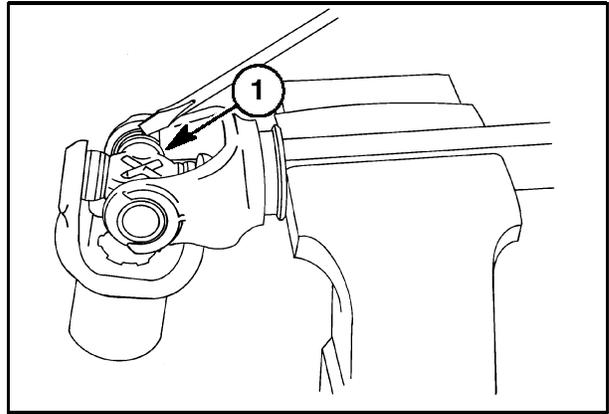
Adjust the vise so that the parts of the cross that were removed from the yoke rest on the jaws of the vise. Remove the other bearing caps the same way.



17

Method II

Remove the snap rings, 1, from the yokes. It may be necessary to use a punch and hammer to tap the bearing cap toward the center to take pressure off the snap ring.



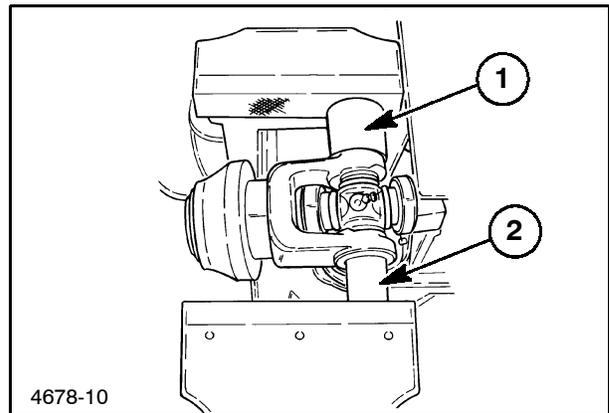
18

Locate a spacer, 1, that has an inner diameter larger than the outside diameter of the bearing cap to be removed and a second spacer, 2, that has a slightly smaller outside diameter than the bearing cap.

Place the joint assembly in a vise with the larger spacer against a vise jaw and centered over the bearing cap to be removed and the smaller spacer against the opposite bearing cap.

Tighten the vise to push the bearing cap into the larger spacer.

Reposition the joint and spacers in the vise to remove the remaining bearing caps.



19

Assembling

Carefully remove the bearing caps from the new cross and bearing assembly. Check to be sure the bearing rollers remain in position.

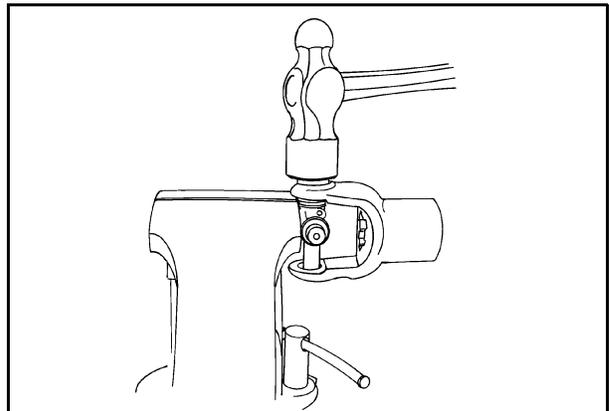
Place the cross in position in a yoke.

Support the yoke ear on the vise to prevent it from being sprung when the cap is installed.

While holding the cross inside a bearing cap, place a spacer against the bearing cap and drive or press the bearing cap into the yoke.

Support the other ear of the yoke and drive or press the bearing cap into the opposite side of the yoke.

If a bearing cap cannot be installed completely, check to be sure a needle bearing roller has not fallen out of position in the cap. If a roller is out of position, there will be extra space between the cap seal and cross.



20

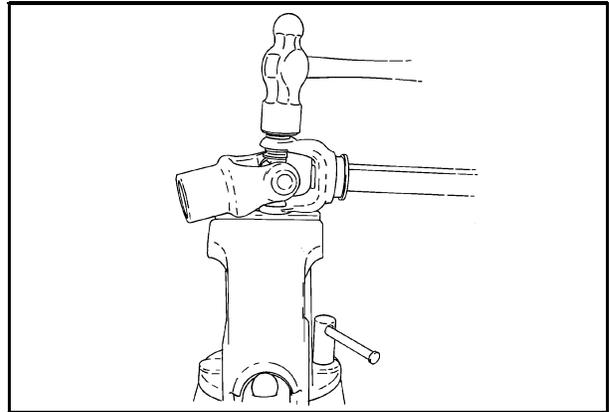
Position the cross in the vise as shown with the ears resting on the vise.

Position the second yoke so the cross is inside a bearing cap in the yoke.

Place a spacer against the bearing cap and drive or press the bearing cap into the yoke.

Turn the yokes over and install the remaining bearing cap.

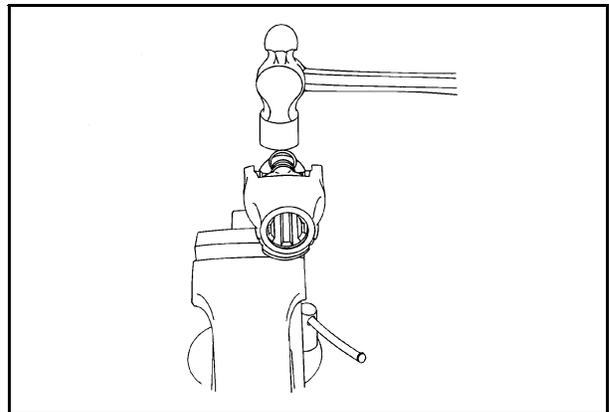
If a bearing cap cannot be installed completely, check to be sure a needle bearing roller has not fallen out of position in the cap. If a roller is out of position there will be extra space between the cap seal and cross.



21

Install a snap ring in each bearing cap bore in the yoke.

If the snap ring cannot be installed, check to be sure a needle bearing roller has not fallen out of position in the cap. If the caps are seated correctly, the ears of the yoke may be sprung so they are too close together. Place an ear of the tight yoke in a vise and tap the yoke to spread the ears.



22

After all four snap rings are installed, seat the bearing caps against the snap rings as follows:

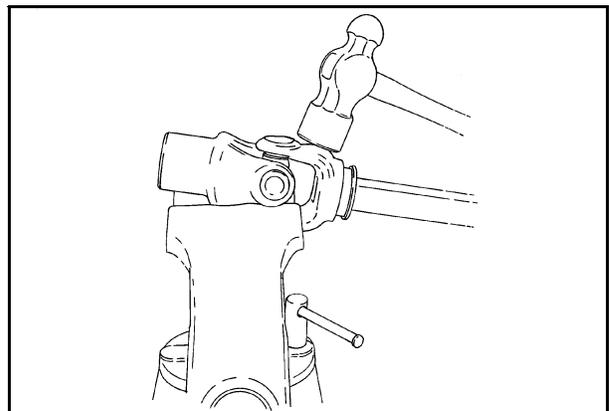
Place the joint in a vise so the ears of a yoke rest on the jaws.

Lightly tap the other yoke down to drive the bearing cap out against the snap ring.

Reposition the yoke and repeat for the other bearing caps.

Install the shield over the shaft or tube.

Reinstall the assembly on the mower- conditioner.



23

QUICK-DETACHABLE YOKE

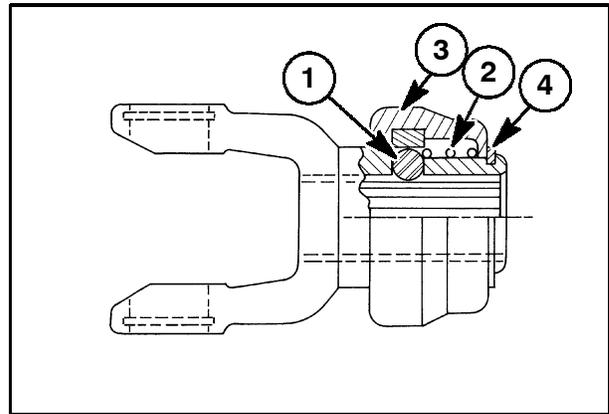
Slide Collar Type

When the PTO is installed on the tractor shaft, the retainer balls, 1, drop into the groove in the PTO shaft. A spring, 2, applies pressure to the collar, 3, to keep the balls in the groove on the shaft. When the collar is moved toward the yoke, the retainer balls can move out of the groove and toward the outside of the collar to allow the yoke to be removed from or installed on the shaft. A snap ring, 4, is used to keep the collar on the yoke.

The sliding collar and retaining balls must be kept lubricated and free of foreign material to operate properly.

The collar, spring, and balls can be removed from the yoke by first moving and holding the collar toward the yoke ears and then removing the snap ring.

NOTE: Individual components of the slide collar yoke assembly are not available separately as the collar must be matched to the yoke to ensure proper operation.



24

Pin-Type Yoke

NOTE: Replacement pins for yokes with the quick-detachable pin held in place with an "X" washer are no longer available. The new style replacement pins do not have a groove for the "X" washer and are shorter.

To install the pin:

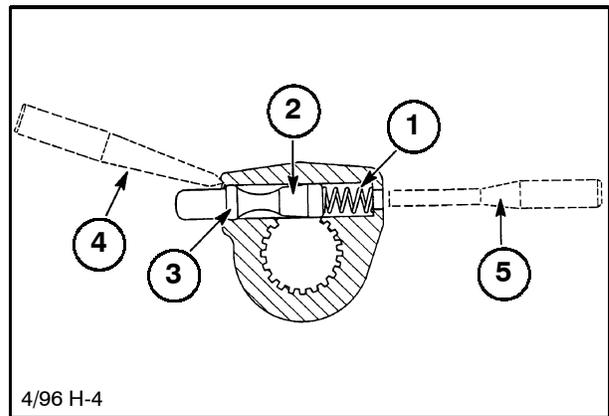
Place spring, 1, and pin, 2, in the yoke as shown.

Place the yoke on a solid surface with the pin facing up.

Press the pin into the yoke until the ridge on the pin at 3 is inside the yoke.

While still holding the pin in the yoke, use a center punch, 4, at four locations to deform the bore to retain the pin.

If this style pin must be removed, use a punch, 5, to drive it out past the center punch marks.



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